BUREAU OF WATER

ANNUAL REPORT

PHILADELPHIA

1895.

ERRATA IN ANNUAL REPORT FOR 1895.

Page	Line	
71	Last	Read Item 10. Extensions & Improvements. Estimates, $2,835,150. Appropriations, $1,000.
73	22	Read Total for Pumping and Supply Mains, $1,819,150. " " " Extensions and Improvements, $2,835,150. " Item 10. Appropriations. For purchase of Telephones, $1,000.
110	8	Read must first submit its plans for examination by the State Board of Health.
134		Folding plate should be marked Fig. 3.
140	2 & 4	For car shed read coal shed.
154	13	For $939.70, read $939.30.
155		For Amount not merging, $23,517.13, read Amount merging, $23,517.13.
276	12	For 31,000 gallons per square mile read 21,000.
277	21	For 69,359,757,440 gallons read 59,359,757,440.
278		Table IX, Neshaminy. June: For 18 read 11, and for 0.747 read 0.516.
		Neshaminy. October, average daily yield in gallons: For 6,419,336 read 6,419,386.
		Tohickon. October, average daily yield in gallons: For 530,391 read 5,303,911.
		Tohickon. December, rainfall in inches: For 2,570 read 2,510.
283		Table V. Tohickon. Area in miles: For 107.2 read 102.2.
284		Table VI. Neshaminy. Per cent. collected: For 40,040 read 49,040.
284		Table VIII. Neshaminy. For September 28, 1895, read read September 28, 1885.
290	7	For 3:1 read 1.3:1.
292	13 from foot	For Appendix A read Sub-Appendix A.
295	2	For Appendix D read Sub-Appendix D.
295	12	For Appendix B read Sub-Appendix B.
296	11	For overlaying read overlying.
297	7 from foot	For Appendix C read Sub-Appendix C.
297	13	Photographs 18 to 25 not published.
304	6	For 1.3, 1.8 and 2.1 read 1.3:1, 1.8:1 and 2:1.
304		Photographs 1 to 25 not published.

Page	Line	
304	7 from foot	For Appendices read Sub-Appendices.
308	33	Insert "r" in around.
309	3 from foot	For space read spaces.
311	13	For flags read slag.
311	16	For composed one read composed of one.
311	26	For Burnham read Burham.
311	26	For Hemnoor read Hemmoor.
313	6 from foot	For Appendix D read Sub-Appendix D.
315	Last	Photographs not published.
316	7	Photographs not published.
316	13	For track read crack.
317	6	For sprawled read spawled.
318	14 from foot	Photographs not published.
319	15	Photographs not published.
321	15	Photographs not published.
321	4 from foot	For up read *pp*.
322	4	Photographs not published.
322	11	For have read has.
325	12	For Fig. 7 read Fig. 13.
326	7	For difference read differences.

NINETY-FOURTH ANNUAL REPORT

OF THE

BUREAU OF WATER

For the year ending December 31, 1895,

AND

FIRST ANNUAL MESSAGE

OF

CHARLES F. WARWICK

Mayor of the City of Philadelphia

WITH

ANNUAL REPORT

OF

THOMAS M. THOMPSON

Director of the Department of Public Works,

ISSUED BY THE CITY OF PHILADELPHIA, 1896.

1896.

PHILADELPHIA:
DUNLAP PRINTING CO. 1306-8-10 FILBERT STREET.
1896.

OFFICE OF THE MAYOR

PHILADELPHIA.

Mayor:

CHARLES F. WARWICK.

Secretary:

JOHN K. McCARTHY.

Chief Clerk:

HARRY C. GILL.

Contract and License Clerk:

JOSEPH F. JONES.

Stenographer and Typewriter:

HENRY W. PEIRSON.

Ass't Stenographer and Typewriter:

HARRY M. FISLER.

Messenger:

WILLIAM G. LEE.

FIRST

ANNUAL MESSAGE

OFFICE OF THE MAYOR, CITY HALL.

Philadelphia, April 6, 1896.

TO THE SELECT AND COMMON COUNCILS
OF THE CITY OF PHILADELPHIA.

GENTLEMEN:—In accordance with the provisions of the Act of Assembly of June 1, 1885, I herewith transmit to your Honorable Bodies my first Annual Message upon the financial and general conditions of the Municipality. I also submit for your consideration the following annual reports of the departments immediately under my control, to wit: Department of Public Safety, Department of Public Works, and Department of Charities and Correction, and send you together therewith the annual reports of the following departments: Receiver of Taxes, City Treasurer, City Controller, Law, Education, and Sinking Fund Commission.

On Monday, the first day of April, 1895, I took the oath of office and entered upon the discharge of my duties as Mayor of the City of Philadelphia. At that time I appointed as Director of the Department of Public Safety, Hon. Abraham M. Beitler, who continued to fill that position until he resigned on the seventeenth day of February, 1896, when he retired to take a position on the bench of the Court of Common Pleas, No. 1, having been appointed by his Excellency, the Governor of the Commonwealth of Pennsylvania, to fill the vacancy occasioned by the death of the Hon. Joseph Allison.

On the seventeenth day of February, 1896, as the successor to Mr. Beitler, I named the Hon. Frank M. Riter, Director of the said Department.

I also appointed on the first day of April, 1895, as Director of the Department of Public Works, Mr. Thomas M. Thompson.

The President and members of the Department of Charities and Correction were continued in office.

FINANCES.

A careful examination of the financial affairs of the City of Philadelphia leads, in my judgment, to the conclusion that the growth, development and needs of the Municipality require an increase in the amount of her revenue.

In looking over the City Controller's report we find that the total receipts from all sources during the year were $29,838,771.88 ; that the total expenditures were $31,329,549.69 ; that the excess of expenditures over receipts was therefore, $1,490,777.81 ; that the tax levy brought into the City Treasury $13,154.942.82, and that the taxes of other years that were collected amounted to $1,418,283.93. The bulk of the balance of the revenue was derived from the receipts of the departments and their bureaus, and from loans created in 1895.

Summing the whole matter up briefly, taking into account the amount of money received and the amount of money expended, the results, as submitted by the Controller, show a difference of $1,839,726.92.

This deficit, however, is a feigned or fictitious one, and must always, when considered, be taken in connection with the large amounts non-merging, to wit., cash absolutely in the Treasury, but carried forward on the books of the Controller, principally, for the reason that provisos in the ordinances prevent the balances of certain appropriations from being available for other uses, thus necessitating the charging of all such balances as a liability. For the year ending December 31, 1895, the amounts protected in this manner, as well as by existing contracts not completed, reach the *extraordinary* figures of $3,093,941.57. If we deduct this feigned deficit of $1,839,726.32, we show instead a surplus of $1,154,214.75. If again to this there be added the amount of Personal Property tax, $929,486.29, due by the State prior to January 1, 1896, but *not* paid until afterwards, there is an actual surplus of $2,083,701.04.

In order to keep up the present pace in improvements it will be necessary for the City to obtain money to bring about the results so much desired and so much needed.

The net debt of the City is comparatively light; in fact, it is about equal to the value of the Gas Works, and is smaller in amount and per capita than the debt of any city of like size and importance in the world.

There are many matters in the way of municipal work that demand immediate attention. The improvement of the Gas Works; the filtration of the water supply; the erection of school houses; the widening of Delaware avenue and the improvement of the river front, are pressing and urgent.

These improvements cannot be effected unless sufficient money be raised to carry on the work. They may be considered necessities in so far as the advancement and progress of the City are concerned. Money must be had either by increased taxation or the creation of a loan. Unless money be raised sufficient to accomplish these purposes the City's advancement will receive a check; whereas, on the other hand, if the money be provided these improvements, permanent in their character, will induce to an increase in revenue, and add greatly to the fame and reputation of the City. False economy deceives nobody, and benefits no one.

The City's credit never stood higher than it does to-day, and the response that was made at the time of the issuance of what was termed the "Popular Loan," shows the confidence that the people have in the integrity and financial ability of the municipality.

In view of these facts and the decision of the Supreme Court filed May 31, 1894, wherein the city securities in the possession of the Sinking Fund, amounting on January 1, 1896, to $18.692,525.00, are no longer held to be a part of the funded debt of the City, thus showing a reduction from $52,900,245 to $34,207,720, I would recommend the creation of further loans to meet the growing demand for municipal improvements.

DEPARTMENT OF PUBLIC SAFETY.

The Department of Public Safety, under the direction of Hon. Abraham M. Beitler, was advanced to a high state of discipline and excellence. Every Bureau received from him attention and care, and many of the Bureaus were by him completely re-organized. A faithful, devoted and intelligent official, he gave his best efforts in a loyal service to the City. His successor, Mr. Frank M. Riter, is giving to the Department the same attention, devotion and intelligence that marked the administration of his predecessor. The annual report submitted by Mr. Beitler sets forth in detail the work accomplished in the various Bureaus under his Department during the year 1895.

Bureau of Police.

Too much praise cannot be given to the Police Bureau for the faithful and intelligent services rendered during the great railway strike, which began December 17th and lasted until December 24th, 1895. The strike affected almost the entire railway system of the City of Philadelphia, or nearly 400 miles of passenger railway track. The trouble was not confined to any one locality, but extended over the entire City. Forty-five hundred motormen and conductors left their cars, and they were sustained and supported in their action by strong public sentiment. It was during the Christmas holidays, when the streets were crowded with men, women and children; the weather was mild and pleasant, and every condition of temperature, sentiment and season combined against the authorities in their efforts to preserve the peace and good name of the City. Let it be stated to the credit of the police force that without fear and with courage, and a due appreciation of duty, they never faltered in their efforts to preserve order; they needed no urging in the application of force wherever and whenever it was required. Constantly on duty by night and day, there was not a murmur of complaint nor a resignation, and it is but fair to say that the firm stand that was taken, and the intelligence and courage that were shown, resulted in the final settlement of the strike and the restoration of law and order. They appreciated the fact that it was for them to preserve the peace at all hazards and under all circumstances; that it was not within their province to parley nor to effect agreements, but to rout disturbers of the peace and enforce obedience to law.

Nor can I fail to speak in the highest terms of the loyal and valuable services rendered by the Fire Bureau. No doubt the sympathy of all these men, both in the Police and Fire Bureaus, was in common with that of citizens generally enlisted in the cause of the strikers, and great credit should be given for the intelligence that was shown by them in distinguishing their sense of duty from their sympathies.

In this connection I desire further to join with the Director of the Department of Public Safety in thanking the Superintendent of the Park Commission, General Thayer, and Captain Chasteau for the very valuable services they rendered at that time.

It is but just to say that the almost universal compliance made with the order of the authorities for the closing of the saloons at night throughout the City is worthy of commendation, and reflects credit upon those liquor dealers who promptly and without any hesitation complied with the same, and thus did much to preserve the public peace.

Such a strike, so wide in its extent, so endorsed by public sentiment, so determined in its purpose, and so menacing in its force, never before occurred in the history of this nor any other city in America.

Now that the terror and passions of that period have subsided, let us hope never to return, we can calmly look back and consider what was done, the efforts that were made, and the conclusions that were reached.

The authorities never wavered in their purpose to maintain order at any cost, and to apply force without economy in the preservation of the public peace, and they never misunderstood nor miscalculated the conditions that surrounded and the duties that impelled them. The excitement and fear rose to such a height that the timid called for the presence of the soldiery, and many men, usually conservative and judicious, seemed, in the suggestions they made, and the advice they gave, to have lost their wisdom, often failing to bear in mind that the single duty of the authorities was to protect life and property, to uphold the law, to preserve the peace, and to repress violence.

The result shows that without loss of life, with but little destruction of property, the course pursued by the authorities was the proper one, and the results that were finally attained proved the wisdom of the methods applied.

In the history of strikes I know of no settlement having ever been reached with so little loss, not a life sacrificed, and the pecuniary damage so trifling that it is hardly worth the calculation.

Not in a single instance did the police force fail to rout any opposition it met, and never once did it quail in the presence of disorder.

In every encounter anarchy was swept away before the force of law.

Let me at this point say that the position that was then taken is notice for the future, that the authorities stand for law, and that they will never hesitate to apply any force that may be necessary to preserve the peace, the good order, and the fair name of the City.

Bureau of Fire.

This Bureau has reached a condition of great efficiency, and to-day stands second to none in this country or in any other. The improvements that have been made in the matter of fire alarms and fire apparatus, and in the discipline of the force, together with the assistance rendered by the police in the matter of transmitting alarms, have placed the Fire Bureau upon a very efficient basis.

The courage shown under the exposure and in the face of danger that the firemen undergo in the line of their duties cannot be too highly praised by the citizens of this community.

Their comfort and convenience should be provided for in every way, and especially in so far as the fire houses

2

are concerned. They are ever on duty, ready by night and by day, in frost and heat, to answer every call During the year 1895 one hundred and seventy-eight men of the force were more or less severely injured in the actual discharge of their duties.

It is to be regretted that the appropriations to the Police and Firemen's Pension Funds have not been paid. The matter still is in litigation, and it is to be hoped that the Courts may find some way that will authorize the Municipality to make the appropriations for the relief of those men who undergo such dangers and perform such heroic work. Men who are subject to constant exposure, who stand ready at all times to protect the lives and property of the citizens, must necessarily, in years of continuous service, have their health affected, and the dangers surrounding their occupation appeal strongly for the support of that fund which in time will be their foster nurse, "when service shall in their old limbs lie lame." It is to be hoped that the law will not be so contracted or narrow in its construction as to prevent the Municipality from doing that which humanity has a right to demand.

Electrical Bureau.

The Electrical Bureau has made a great advance and has introduced many improvements during the year 1895. The Director in his report says that no City in the Union can show better results accomplished in one year or boast of a more perfect Municipal Electrical plant. Its reputation is world-wide, and it has received the careful inspection and examination of scientific men from abroad as well as at home, and has been pronounced by those who are able to judge as unequaled in this or any other country.

The introduction of underground conduits is the only system that will do away with overhead wires, and appropriations should be made for the building and extension of these conduits throughout the City.

Philadelphia, without question, is the best lighted City in this country. There are in use at this time 6,361 electric light lamps, of which number the City pays for 6,228. This seems to be a great many lights, and yet it is almost impossible to reduce the number when it is borne in mind that the City extends over so vast an extent of territory. The City of Philadelphia covers about 130 square miles, and no greater protection can be given for the safety of life and property than electric lighting. Crime avoids the light, it lurks and works in darkness, and the more brilliantly a City is illuminated the safer are its people in their possessions. The electric light stands on guard for the protection of life and property.

There has been much public discussion as to whether or not an Electric Light plant should be established and owned by the City. In order that this question may be intelligently settled or decided the Director has suggested to Councils that an appropriation of $600 be made to the Department of Public Safety to secure expert estimates to guide the Electrical and Finance Committees in passing upon the question. If the test be made we will then be better able to judge as to whether or not it will be to the interest of the City to establish her own plant or to continue the present system of purchasing from individual companies. It is to be hoped that this test will be made, and under the careful and intelligent supervision of the Electrical Bureau, the proper conclusions will be easily reached.

Bureau of Health.

The work under the Bureau of Health has been of a most useful character, and the results have been satisfactory in the extreme.

In the early part of the year 1895 the Chemical and Bacteriological Laboratories were working in conjunction, and together have accomplished much good. This is set forth in detail in the report made by the Bureau of Health to the Director of the Department of Public Safety.

The health of the City has been greatly improved by the supervision of the police force in the matter of Sanitation, the police officers acting as Sanitary Inspectors, making daily reports as to the condition of the localities patrolled by them.

Philadelphia is one of the best paved cities on this continent. Not only has she improved her principal highways, but her alleys, courts, and small streets have been, in many instances, paved with asphaltum, thereby inducing to cleanliness and to the health of crowded localities. This good work should be continued.

The open air excursions given to the poor children who live in the crowded and thickly populated sections of the City have also done much in the way of giving health to thousands of little ones who otherwise would have pined away, and would not have had an opportunity to enjoy that change of air and scene that is so conducive to health. There is hardly a Charity that gives so much pleasure and accomplishes more good than this one.

Bureau of City Property.

Under this Bureau the public squares are cared for. They have been increasing very rapidly for some time past, but unfortunately in many instances appropriations have not been made for the improvement of the property after its acquirement.

These are the open breathing spots and pleasure grounds of the people, and conduce not only to the recreation but to the health of all. Appropriations should be made to improve and utilize all the land so taken by the City.

Independence Hall should at the earliest practicable moment be restored to its original condition, as it existed in 1776. Every precaution should be taken to protect this sacred property against damage by fire. It is the Mecca towards which every patriotic heart turns, and historically is the most valuable and important structure in this land, and its loss would be irreparable.

Bureau of Building Inspection.

Under the Ordinance of April 10, 1894, it is provided *inter alia* that the Director of the Department of Public Safety, with the approval of the Mayor, shall appoint two additional Inspectors, whose duty it shall be to inspect at least once in every three months all elevators used for the purpose of carrying either passengers or freight, or passengers and freight.

In May last the Director of the Department of Public Safety called the attention of Councils to the inadequate force of Elevator Inspectors. Councils as yet have taken no action in relation to the matter. We have at this time one Elevator Inspector. I am sure you will agree with me that it is utterly impossible for one inspector to discharge the duties required under said ordinance. Either the ordinance should be repealed or an appropriation made providing for the appointment of a sufficient number of Inspectors to do the work. It is important that these examinations should be made. It would be well to provide for the payment of a certain fee sufficient to pay for the cost of the service.

DEPARTMENT OF PUBLIC WORKS.

The intelligent and comprehensive report of the Director of the Department of Public Works contains much useful and important information and gives some idea of the immense amount of work required to be performed under that Department.

The present Director cannot be too highly commended for his faithful devotion to the interests of the City confided to his care.

Bureau of Gas.

The receipts of this Bureau for the year 1895 were $3,155,956.47, the current expenses were $2,985,513.85, and for permanent improvements the sum of $54,589.59 was expended, leaving a balance in the City Treasury of $115,853.03. If the City had been paid for all the gas furnished free, if sold at the present rate of $1.00 per 1,000 cubic feet, there would have been added to the City Treasury $638,494.

The Gas Works is one of the most valuable assets of the City. It has been valued, at a low calculation, at $30,000,000. It will be seen in the report of the Director of the Department of Public Works that there were expended for permanent improvements last year only $54,589.59. In order to keep these works up to a proper standard it will be necessary to make greater improvements not only in the manufacture but in the distribution of the gas, and these improvements will compel a large expenditure of money. The gas is not of the quality that it should be and there is no need of concealing the truth; it will not be, until the necessary improvements are made that will enable the Bureau to manufacture and distribute a better illuminant. Some of the improvements now in process of construction, it is thought, will, in a measure, bring about the desired results.

In my inaugural address I stated that the Gas Works should never pass from the absolute control and ownership of the City. The plant is too valuable, and history shows that whenever such a property passes into private hands it in time becomes an extortionate monopoly. During my administration I have seen nothing that tends to change my opinion as then expressed. In fact I have been strengthened in my belief that the Gas Works should never be sold.

Bureau of Highways.

The progress in paving that the City of Philadelphia has made within the past few years is unexcelled in the history of any municipality.

All of the paving on streets occupied by passenger railway companies has been done at the expense of these companies, requiring the expenditure of millions of dollars, and I think it will be admitted by those who are able to judge that no city on this continent, in so far as its streets are concerned, is in better condition. Another great improvement that has induced to the public health is the paving of the small streets, courts and alleys throughout the City. I have already referred to this matter above, under the head of Bureau of Health. This work should be continued in every direction, for the results flowing from it are of the greatest importance.

Bureau of Street Cleaning.

With improved pavements throughout the City the matter of Street Cleaning is comparatively made easy, but the Bureau cannot wholly succeed unless it has the hearty co-operation of the people. The ordinances in relation to the sweeping of refuse into the cartways must and will be enforced. If every citizen would be careful to observe the provisions of the many ordinances relating to this matter the question would be easy of solution. Papers which for some time past have littered the highways, create a great nuisance and endanger the lives of the citizens inasmuch as they provoke to accidents.

A short time since, at the request of the Civic Club, permission was given by the Director of the Department of Public Works to station receptacles in a number of blocks of the City confined within the Seventh Ward. It was stated that this plan had been adopted with success in Boston and other cities, and it is but proper to give it a fair trial. It may be said in this connection that the Director of the Department of Public Safety has given explicit instructions to the Police Lieutenants of the several districts of the City as to the duties of patrolmen in the matter of calling the attention of the citizens to violations of any of the ordinances above referred to whenever they occur.

As to the disposal of garbage, the reduction and crematory systems, although not yet perfect, will in time no doubt be entirely satisfactory.

The extension of time in contracts for the cleaning of streets and the removal of garbage, in my judgment, will do much towards effecting a better and more efficient service.

The citizens themselves can render great aid to the authorities in calling attention to any derelictions of duty, on the part of the Contractors, that may occur under their immediate notice.

Bureau of Surveys.

The plans and specifications for the building of the Subway on Pennsylvania avenue which, by reason of their detail, occupied considerable of the time of the Bureau in their preparation, have been completed, and advertisements for proposals are about to be inserted in the newspapers.

Nothing will be left undone, upon the part of the administration, to urge forward this work, which is one of the most important improvements in our City. Upon the completion of this great undertaking, the removal of dangerous grade crossings, which continually menace the lives and properties of our citizens, will be accomplished, and free and uninterrupted travel on the streets running north and south will be secured, especially on the main avenue of travel, Broad street. Its construction will increase the value of property, add greatly to the appearance of the City, and provide safer and finer avenues to the Park.

The construction of main sewers should be pushed industriously and ample provision should be made in the appropriations of Councils for the urging of this important and sanitary work.

The Aramingo, the Mill Creek, and the Wingohocking Systems, drain an immense area of territory, and need to be further extended. The Intercepting System has done much towards the improvement of the quality of the water of the Schuylkill River for drinking purposes, by diverting the sewerage from the river and carrying it to a point below the pumping stations. May I suggest that Councils should provide a further system of drainage for the Southern Section of the City. It is the wish of all that money may be found sufficient to meet these demands, and to provide for the extension of the present and the introduction of new systems. Nothing so adds to the health and cleanliness of a community as an adequate system of sewers.

Councils recently provided for the creation of a loan of $2,000,000 for the improvement of the river front, the widening of Delaware Avenue, and for the deepening of the channel of the Delaware River below the City.

This work is of vital importance for the advancement of the commercial interests of the City. If we are ever to look for a return of our commercial prosperity and for an opportunity to compete in this direction with other States we must necessarily provide every accommodation and secure a free and uninterrupted channel to the sea, so that vessels of the heaviest draught may have no hesitation and find no trouble in coming to our Port. Shoals and obstructions must be removed and every facility given for ship travel. There must be no unnecessary dangers to confront merchantmen, and a safe course to our wharves must be assured. The fair and impartial spirit that has been shown by many of our citizens owning property on the river front, in the matter of arbitration in so far as damages are concerned, incident to the widening of the street and other changes which are to be made in conjunction therewith as to bulkheads, walls, etc., is to be commended. It is our hope that the matter will be ultimately settled to the satisfaction of all concerned.

The bridges that have been contracted for under the liberal appropriations of Councils are doing much in the way of connecting sections and affording safe, convenient, and speedy means of communication and transportation.

Bureau of Water.

The Schuylkill river supplies sufficient water for the wants of this community in so far as quantity is concerned. The construction of what are called subsiding reservoirs is in a great measure effecting a change and an improvement in the quality of the water. Still it has been shown that subsidence alone does not answer the purpose, and it has been contended by scientific men, and their contention has been supported by facts, that filtration is a necessity, and that by the adoption of this process water is not only cleared but purified and made healthful.

Instances to prove these statements are numerous not only in this country but abroad. The health of the people is the first consideration, and Councils should at the earliest possible moment join their efforts with those of the Administration in providing means ample for the introduction of the best system that can be adopted. Delay in this matter may result in disaster, and if it does the people will know where to place the responsibility. It is the paramount duty of Councils to take this matter up at once for consideration and settlement.

For years the citizens have been complaining, and justly, about the character of our water. We have a generous and bounteous supply, and it is for the authorities to do all in their power to improve that supply in so far as quality is concerned, and I ask your earnest and hearty co-operation in this most important matter. The Ad ministration has been devoted and loyal in its efforts to meet this question fairly and to settle it with the best judgment that it can command. The matter is so plain that it has gone beyond the limit of argument, and now needs earnest and immediate action. The introduction of the best system based upon scientific opinion and honest experience should be had at once.

You will agree with me, I am sure, that this matter appeals to us from every point of view, especially in the interest of those who are unable to introduce into their homes individual plants, and who cannot purchase spring or mineral waters. They are deeply interested in the early introduction of a general system of filtration that will provide for their use clean, pure water for drinking, bathing and cooking purposes, and they have a right to demand our assistance and support.

In view of the increase in our population, the increase in our manufacturing industries, and the increased consumption of water resulting therefrom, the question of its careful use should be considered, and some method should be introduced which will prevent the constant waste that goes on from day to day. With economy, our supply as I have stated above, would be adequate for generations to come. It is really the waste wherein lies the danger, not the necessary, fair and economical use.

DEPARTMENT OF CHARITIES AND CORRECTION.

Too much praise cannot be given to the President and members of this Department who devote their time and thought to the work assigned to them without pay or emolument of any character. The institutions under their care and keeping in the matter of management, discipline, and cleanliness speak eloquently for the work of those who compose its Bureaus of administration. Let me suggest that I believe the time has come when it would be greatly to the advantage of the Almshouse if it could be removed to a locality further in the suburbs, or rather into the country. The matter of transportation of those consigned to its care can now so easily be provided for that it is hardly to be considered. It would be of great advantage to the institution in many ways if it could be removed from its present situation. The section of the City in which it now stands is improving rapidly and filling up with a new population, and no doubt the advancement would be much greater if the change suggested could be made. The Philadelphia Hospital, that stands second to none in reputation in this country or in any other, should remain and would be greatly benefited by the removal of its present neighbor; in fact, I have no hesitation in saying that the separation of the Almshouse and Hospital would be to the advantage of both.

The establishment of a Free Library is a matter that appeals to every intelligent citizen. Its influence spreads out in almost every direction, reaches almost every home, and in itself provides a system of liberal education.

Appropriations made for its support will bring an abundant return. There is no reason why our City should not be in the very front rank in this most important matter.

Nothing speaks more positively in proof of the culture, intelligence and liberality of a people, and nothing adds greater reputation to the name of a city than the establishment and generous support of an extensive library, free and open to the public. It is a means of education within the easy reach of all and induces to law and order and the stability of popular institutions.

Education is the safety of the Republic; it is the lamp to her feet.

The purpose of a Free Library is to carry out and distribute the information that enlightens and teaches all and, at the same time, to afford means to many who otherwise would have no opportunity for self instruction.

The City cannot too liberally support such an institution, and no one can measure the extent and usefulness of its influence. As the river Nile, with its overflow, brought fertility and wealth to Egypt, so will the Free Library, extending its influence in every direction, spreading out on all sides, bring stability, intelligence, fame and wealth (for knowledge is wealth) to our City and her people.

As to the Commercial Museum, if it be not stinted in the matter of appropriations we can hardly calculate the advantage that may accrue from its successful management. It will bring us in touch with the commercial interests of this whole continent, inducing to reciprocity between our own and foreign States; it should be made a school in which our merchants, artisans, manufacturers and importers may learn those lessons that will increase our wealth, our influence, and our reputation.

The City Hall, which has cost in the neighborhood of $16,000,000, is one of the finest buildings devoted exclusively to Municipal purposes in the world. It unfortunately is now almost surrounded by tall buildings, and it is reasonable to suppose that like improvements will continue on all its sides, so that in a few years it will be completely shut in by high structures forming a wall around it and leaving no space where its architectural beauty may be seen and studied with advantage. It would be of immense importance to open, if possible, a space on one of its sides for the making of a park or plaza. In so far as the question of expense is concerned now is the time to accomplish that result, for delay will only add to the value of adjoining property, and in a generation the increase in valuation will be so great that it will be next to impossible to secure the ground necessary for that purpose.

In conclusion, let me say that the administration stands ready to join hands with Councils in urging the progress and prosperity of the City. We should labor in common, having in view the same end—the interests of this great Municipality. At all times we should work with zeal and without jealousy. The Executive and Legislative branches of the Government, each confined within its proper limits, having but one object in view, the welfare of the City, can and should accomplish great results.

Philadelphia covers a great area of territory, its population is rapidly approaching, if it has not already reached, a million and a quarter of people; it is the best housed community in the world, the number of its private dwellings being in the neighborhood of two hundred and fifty thousand. There is no City that can so truthfully be called "The City of Homes." Its streets are well paved and well lighted, and its Park, the greatest in the world, is easy of access, and enjoys every natural advantage.

The progress made in the past ten years has been marvelous, and much of the praise due for the advancement belongs to the intelligent co-operation of Councils with the Executive Departments. It should be our purpose not to cease in well doing, for there is much yet to be accomplished.

An adequate supply of pure water, the construction of the subway, the improvement of the gas works, the further extension of paving, the widening of Delaware avenue, the deepening of the channel in the river, the opening of public parks, the generous support of a free library and a commercial museum, the providing of ample school accommodations for our children, and, if possible, the making of a plaza opposite the Public Buildings, will place our City second to none in its advantages, its conveniences and its attractiveness.

To aid this City in her progress, to promote and protect her interests, should be the duty and the honor of every man who is called upon to represent her in an official capacity. It is a great trust confided to our care. Narrow and selfish policies will only retard our growing prosperity, it is continued and general advancement that we all should seek, and I feel confident that you will give to me that aid which will redound to the City's welfare and our mutual credit.

I am, respectfully,

CHAS F. WARWICK,

Mayor.

ANNUAL REPORT

OF THE

Department of Public Works

FOR THE

Year ending December 31, 1895.

OFFICERS

OF THE

Department of Public Works.

Director,

THOMAS M. THOMPSON.

Chief Clerk,

HARRY W. QUICK.

GENERAL RECORD CLERK—WILLIS SHEBLE.
CLERK—ERNEST T. HANEFELD.
ASSISTANT CLERK—ANDREW L. TEAMER.
STENOGRAPHER AND CLERK—FRED. D. BIDDLE.
STENOGRAPHER AND TYPEWRITER—HARRY S. STOY.
MESSENGER—JOHN P. JUNIOR.

Superintendent of City Ice Boats,

H. E. MELVILLE.

Chiefs of Bureaus:

GAS—WILLIAM K. PARK.
HIGHWAYS—THOMAS L. HICKS.
LIGHTING—JOHN J. KIRK.
STREET CLEANING—SYLVESTER H. MARTIN.
SURVEYS—GEORGE S. WEBSTER.
WATER—JOHN C. TRAUTWINE, JR.

NINTH ANNUAL REPORT

OF THE

DEPARTMENT OF PUBLIC WORKS.

THOMAS M. THOMPSON, Director.

Philadelphia, January 2, 1896.

HON. CHARLES F. WARWICK,
Mayor of Philadelphia.

DEAR SIR:—In accordance with Section 1, Article 1, of the Act of Assembly, entitled "An Act to provide for the better government of cities of the first class in this Commonwealth," approved June 1, 1885, I have the honor to submit the Report of the Department of Public Works for the year ending December 31, 1895—the Ninth Annual Report of the Department.

In compliance with the following Resolution of the Finance Committee of Councils, passed November 11, 1895:

"*Resolved*, That the Mayor be requested to instruct the heads of the various Departments, in framing their reports and other printed matter, to abbreviate the same as much as possible, so as to save expense," this report will be made as brief as possible.

The work under the direction of the Department, and limited only by the appropriations made for it, progressed in a satisfactory manner, and while the amount of work done is not so great as during the previous year, yet the year closed with much accomplished.

The reports of the Chiefs of the various Bureaus of the Department herewith submitted, contain much interesting and instructive information concerning its progress, extent and condition of the improvements accomplished under their supervision.

City Ice Boats.

During the severe cold weather of January and February, 1895, the ice in the river was from twelve to twenty inches in thickness, and required all three of the boats to be in continuous service. Their constant trips and persistent work successfully kept the harbor of Philadelphia and the channel of the river below the city to the Capes, free from obstruction by ice, so that navigation was uninterrupted. From the small receipts for towage, and the total tonnage of vessels towed, it is evident that the channel of the river was kept so nearly free from packed ice, that the river tow-boats were able to care for all vessels sailing to and from this port.

During the summer, the ice boats received the usual repairs, made necessary by the winter service, at an aggregate cost of $12,550.00, and they are again ready for service, should they be required to keep the river open for navigation.

The report of Captain H. E. Melville, Superintendent, gives in detail the operations of the boats and the repairs made to them during the past summer.

The following comparative summary is an abstract of the work done by the City Ice Boats, and the receipts for towage and expense of maintenance during the years 1892–3 and 1894–5. The exceedingly mild weather during the season of 1893–4 rendered it unnecessary to place the boats in commission; hence there are no receipts for that season.

	1892 and 1893.		1893 and 1894.		1894 and 1895.	
	No.	Tonnage.	No.	Tonnage.	No.	Tonnage.
Vessels Outward	3	4,686				
Vessels Inward	10	5,639	....	....	2	1,925
Vessels assisted	1	523				
Total	14	10,848	....	....	2	1,925

	1892 and 1893.	1893 and 1894.	1894 and 1895.
Amount received for towage and assistance rendered	$2,241 38	....	437 08
Amount received for the sale of old material	178 69		
Total paid City Treasurer	$2,420 07	....	437 08

	1893.	1894.	1895.
Total amount of warrants drawn	$83,341 75	$15,634 60	$33,597 71
Deduct cash paid City Treasurer	2,420 07	....	437 08
Actual current expenditure	$80,921 68	$15,634 60	$33,160 63

Bureau of Gas.

The results of the operation of the Bureau of Gas for the past year, are of a very satisfactory character. The output of gas was 396,628,520 cubic feet more than in the previous year.

The receipts of the Bureau for the year 1895 were $3,155,956.47. The current expenses were $2,985,513.85, and there were expended for permanent improvements, $54,589.59; leaving a balance in the City Treasury of $115,853.03. This does not, however show the complete revenue of this Bureau. The amount of gas furnished free during the year in lighting the buildings used by the City, street lamps, etc., was 638,494,005 cubic feet, which, if sold to the public at the present rate (one dollar per thousand cubic feet) would have added to the City Treasury, $638,494.00.

During the year the following improvements and repairs have been made:

Point Breeze Works.—Resetting and repairing a stack of the Dudley D. Fleming Benches; putting in two turntables and two Bronder patent gas retort charging machines, with coal bins, engines and coal conveyor.

Ninth Ward Works.—The wharf along the river front has been repaired and put in thorough condition.

Ninth and Diamond Streets Holder Station.—Placing one horizontal tubular boiler with dome and stack.

There were laid 44.13 miles of mains and distributing pipes.

The introduction of the two Bronder patent gas retort charging machines at the Point Breeze Works will result in the saving to the City of about $40,000 per year for labor. The introduction of improved labor-saving machinery and modern appliances should be continued until the several works of the City are thoroughly equipped. If this is done, and the works economically managed, it will result in a large increase of profit to the City.

The amount of gas furnished free during the year was 638,494,005 cubic feet, an increase over the previous year of 15,180,254 cubic feet. This increase in the quantity of gas furnished free continues with unabated rapidity, and, I presume, will continue, until Councils provides by ordinance, that each Department of the City government using gas shall pay for the same out of the appropriation made to it. Legislation to this effect would place an indefinite account in proper business form, and give the

Bureau credit for an article for which, under the present system, it receives neither money nor credit.

The greatest consumption of gas in the City in any one day during 1895, was 19,008,000 cubic feet, and the largest amount made in any twenty-four hours, was 17,472,000 cubic feet.

The average candle-power of the gas manufactured for the year, was 19.04.

Unaccounted for gas.—While the figures in the leakage account are not quite so great as they were during the previous year, they are still of unusual proportions. That they remain so is attributable to worn out services, numerous breaks in the distributing mains incident to the continued work upon the highways, and to condensation due to friction caused by increased pressure necessary to get the gas into and through the many hundreds of miles of small mains, insufficient in size and distributed all over the City.

This matter will not be remedied to any great extent until Councils provide for replacing these small mains with others of larger size.

Improvements.—A contract has been awarded to Bartlett, Hayward and Company of Baltimore, Md., for the construction of a gas holder, with the necessary out-buildings, at the Point Breeze Works, with a capacity of 3,000,000 cubic feet; the same to be completed on or before December 1, 1896. This holder is of prime importance, and when completed will supply a long felt need of the Department.

There is also under contract with the same firm, a third lift to the holder at Germantown, which when completed will increase the capacity of the holder at this station 190,000 cubic feet, and will materially aid the Department in giving gas to a section of the City which heretofore has been short in supply.

This section, which embraces the upper portion of the

Twenty-second Ward and Chestnut Hill, cannot be sufficiently supplied with gas until a twenty-inch main is laid from the Twenty-fifth Ward Works to Chestnut Hill. The laying of this main has been repeatedly recommended and urged by my predecessor.

To enable the Department more readily to get the gas away from the Twenty-fifth Ward Works, and furnish a better supply to consumers, provision has been made for the erection of a pumping station and placing therein the necessary machinery. This work, it is expected, will be completed early in the year.

On the morning of September 24, 1895, fire broke out in the coal shed at the Twenty-fifth Ward Works, and before it was extinguished, entirely destroyed the shed and consumed about 2,600 tons of coal. The loss was promptly adjusted by the insurance companies, and the entire amount of insurance ($34,143.88) paid into the City Treasury before the close of the year. The Department immediately took action looking to the reconstruction of the building, and a contract has been awarded and executed for replacing the structure with one of a more durable character.

With the increase of improved manufacturing facilities at the Point Breeze Works arises a necessity for an enlargement of the coal shed at these works for the reception of coal by rail.

Attention has been frequently called to the necessity for additional large mains for distributing gas into particular sections of the City. Two of the most important of these are (a) A 36-inch main from the Point Breeze Works to the Ninth Ward Works, by which relief would be given to the business centre and that portion of the City east of Twenty-second street. Also by making connections with this main and carrying the gas across the Schuylkill river, a large portion of West Philadelphia could be furnished with an additional supply of gas. (b) A 20-inch main from the Twenty-fifth Ward Works to Chestnut Hill, which would not only give relief to Germantown and Chestnut Hill, but also keep the pipes now supplying the rapidly growing territory between the terminal points well filled with gas, thus giving an additional supply to Tioga, in the Twenty-eighth Ward, and Franklinville, in the Thirty-third Ward.

The manufacturing plant at the Ninth Ward Works, situated between Twenty-second and Twenty-third streets, and between Market and Filbert streets, should be transferred to the Point Breeze Works, and additional holders built on the present site of the Ninth Ward Works.

The Department has in contemplation a plan for the improvement of the gas works, which will materially increase the manufacturing capacity of the plant; and if sufficient appropriation is made to enable it to become operative, the Department will be in a position to manufacture gas at a much less cost. This plan, when completed, will be forwarded to Councils for their consideration and action.

The report of the Chief of the Bureau gives in detail the operations of this Bureau, and refers to special needs of the current business.

The following tables gives the manufacturing and holder capacities; also comparative statements of the operations of the Bureau of Gas during the years 1892, 1893, 1894, and 1895:

Manufacturing Capacity.—The following table gives in detail the capacity of the several Works:

Works.	Stacks.	Retorts per Stacks.	Total Retorts.	Grand Total.	Maximum Capacity per Works, 24 hours.	Total Maximum Capacity 24 hours.
Ninth Ward	4	150	600			
	2	194	388			
Experimental Bench	....	....	3			
				991	6,600,000	
Twenty-first Ward	1	30	30	30	200,000	
Twenty-fifth Ward	6	120	720	720	5,500,000	
Twenty-sixth Ward	6	144	864	864	8,000,000	
						20,300,000

The above does not include the plant at the Philadelphia Gas Improvement Company, which has a capacity of 11,000,000 cubic feet per day.

There are at the Ninth Ward Works, in addition to the above, eight (8) retorts used exclusively for vaporizing naphtha, for maintaining clear pipes about the works.

The following table gives in detail the date of construction, the location and capacity of all holders:

Location.	When Erected.	Dimensions.	Capacity.	Total.
		Feet.	Cubic feet.	
Ninth Ward Works	1851	140 x 70	1,000,000	
" "	1871	140 x 70	1,000,000	
" "	1844	80 x 40	300,000	
" "	1847	80 x 40	300,000	2,600,000
Twenty-fifth Ward Works	1876	140 x 70	1,500,000	
" " "	1876	140 x 70	1,000,000	
" " "	1885	140 x 70	1,500,000	
" " "	1885	140 x 70	1,000,000	
" " "	1889	140 x 70	1,000,000	6,000,000
Twenty-sixth Ward Works	1852	160 x 90	1,800,000	1,800,000
Twenty-first Ward Works	....	60 x 38	103,000	
" " "	1874	78 x 44	200,000	303,000
Frankford: Frankford avenue and Buckius street	....	50 x 16	31,000	
Frankford: Frankford avenue and Buckius street	....	45 x 16	25,000	
Frankford: Frankford avenue and Buckius street	1869	80 x 26	130,090	186,090
Bridesburg: Richmond and Bridge streets	1869	60 x 21	59,000	59,000
Ninth and Diamond streets	1869	140 x 70	1,500,000	
" " "	1874	140 x 70	1,500,000	3,000,000
Ninth and Mifflin streets	1874	115 x 62	600,000	
" " "	1890	160 x 84	1,577,000	2,177,000
Twenty-fifth and Callowhill sts	1851	100 x 50	700,000	
" " "	1888	80 x 42	203,000	903,000
Germantown: Near Wister Station, P. & R. R. R.	1870	100 x 50	390,000	390,000
Total				17,418,000

Comparative Statement of the Pipe laid during the Years 1892, 1893, 1894 and 1895.

	1892.	1893.	1894.	1895.
	Feet.	Feet.	Feet.	Feet.
2 inch	62	653	....	1,755
3 "	6,933	23,796	23,429	7,580
4 "	111,770	120,564	179,940	157,584
6 "	36,784	19,612	40,672	37,517
8 "	972	3,856	24	12,904
10 "	....	....	....	368
12 "	16,148	2,924	4,280	8,960
20 "	14,272	12,091	....	6,378
30 "	....	....	....	....
Total	‡186,941	*183,496	¶248,345	†233,046

‡ 1892 equal to 35⅜ miles.
* 1893 equal to 34¾ miles.
¶ 1894 equal to 47¼ miles.
† 1895 equal to 44.18 miles.

The following is a summary of the receipts and expenditures for the years 1892, 1893, 1894 and 1895.

Comparative Statement of Receipts.

Year.	Receipts.	Increase.	Decrease.
1892	$3,845,825 99		
1893	4,027,074 88	$181,218 89	
1894	3,143,431 29	....	$883,643 59
1895	3,155,956 47	12,525 18	

Comparative Statement of Expenditures.

	1892.	1893.	1894.	1895.
Current expenses	$2,604,432 90	$2,772,761 60	$2,929,565 69	$2,985,513 85
Extensions	207,466 64	217,870 66	350,787 20	54,589 59
Total	$2,811,899 54	$2,990,632 26	$3,280,352 89	$3,040,103 44

Total Output and Distribution of Gas.

	1892.	1893.	1894.	1895.
	Cubic feet.	Cubic feet.	Cubic feet.	Cubic feet.
Stock delivered and not paid for, and on hand January 1	522,687,800	524,671,400	560,016,800	644,294,320
Manufactured and purchased during the year	3,584,589,000	3,803,316,000	4,110,401,000	4,422,752,000
Total to be accounted for	4,107,276,800	4,327,987,400	4,670,417,800	5,067,046,320

	Manufactured.	Purchased.
1892	2,223,188,000	1,361,401,000
1893	2,339,119,000	1,464,197,000
1894	2,605,278,000	1,505,123,000
1895	2,728,065,000	1,694,687,000

	1892.		1893.		1894.		1895.	
	Cubic feet.	Per cent.	Cubic feet.	Per cent.	Cubic feet.	Per cent.	Cubic feet.	Per cent.
Delivered to private consumers, for which bills have been rendered	2,400,497,000	58.45	2,506,092,000	57.90	2,372,254,000	50.80	2,744,496,900	54.16
Delivered to consumers (bills not rendered) and in holders, December 31	524,671,400	12.77	560,016,800	12.94	644,294,320	13.80	655,074,900	12.93
Public lighting, etc.	93,043,324	02 27	98,523,114	02.28	106,763,874	02.28	117,786,899	02.32
Street lamps	501,160,281	12.21	503,869,600	11.64	516,549,877	11.06	520,707,106	10.28
Used at works, offices, stations, etc	26,254,400	00.64	26,612,700	00.61	26,698,800	00.57	26,840,200	00.53
Unaccounted for, leakage, etc	561,650,395	13.66	632,873,186	14.63	1,003,856,929	21.49	1,002,140,315	19.78
Total	4,107.276,800	100.00	4,327,987,400	100.00	4,670,417,800	100.00	5,067,046,320	100.00

Public lighting, etc.	1892.		1893.		1894.		1895.	
	Cubic feet.	Per cent.	Cubic feet.	Per cent.	Cubic feet.	Per cent.	Cubic feet.	Per cent.
Bureau of Police	15,767,600	00.38	19,753,600	00.46	21,106,400	00.45	23,261,900	00.46
Bureau of Fire	9,969,400	00.24	12,732,300	00.30	14,253,000	00.30	17,653,400	00.35
Bureau of Water	2,412,700	00.06	2,654,600	00.06	2,804,400	00.06	3,056,800	00.06
Public Buildings	27,022,100	00.66	23,575,800	00.54	24,570,200	00.52	26,895,700	00.53
Almshouse	15,944,600	00.39	17,374,400	00.40	20,521,000	00.44	20,113,500	00.40
City Property	4,134,200	00.11	3,331,200	00.08	3,230,500	00.07	3,580,300	00.07
Public Squares	7,154,024	00.17	7,302,614	00.17	7,299,074	00.16	6,621,299	00.13
Park Commission	322,800	00.01	364,600	00.01	464,100	00.01	639,900	00.01
Schools	10,315,900	00.25	11,434.000	00.26	12,515,200	00.27	15,964,100	00.31

The receipts as reported in detail by the Chief of the Bureau for 1895, are:

For gas, services, etc.	$2,784,904 07
Coke, tar, etc.	330,611 91
Miscellaneous	6,296 61
Insurance on building destroyed by fire	34,143 88
Total	$3,155,956 47

To the receipts for gas should be added the value, at $1.00 per 1,000 cubic feet, of the increased quantity of gas sold, for which payment is not due, as follows:

	Cubic Feet.	
December 31, 1895	655,074,900	
December 31, 1894	644,294,320	
	10,780,580 cu. ft.	$10,780.58

The table following gives in detail the total output of gas and its distribution during the years 1892, 1893, 1894 and 1895.

Comparative Statement of Operations of the Bureau of Gas during the Years 1892, 1893, 1894 and 1895.

	1892. Cubic Feet.	1893. Cubic Feet.	1894. Cubic Feet.	1895. Cubic Feet.
Total output	3,585,158,000	3,802,140,000	4,109,316,000	4,423,804,000
Largest production of gas in any 24 hours	* 15,332,000	† 15,421,000	‡ 16,809,000	¶ 17,478,000
Largest consumption in any 24 hours	*a* 16,328,000	*b* 16,387,000	*c* 17,506,000	*d* 19,008,000

* † ‡ ¶ On December 19th, 17th, 12th and 13th.
a b c d On December 21th, 22d, 27th and 24th.

	Bushels.	Bushels.	Bushels.	Bushels.
Quantity of coke on hand Jan. 1	110,615	148,600	21,000	117,000
Made during the year	6,712,032	7,391,471	8,115,627	8,256,889
Total	6,822,647	7,540,071	8,136,627	8,373,889
Coke sold during the year	3,389,513	3,684,193	3,691,698	4,009,378
Breeze sold during the year	807,520	1,123,445	1,300,435	1,357,480
Used under retorts	2,017,911	2,205,494	2,510,124	2,460,836
Used under boilers and lime-kilns	375,724	413,889	431,190	428,604
In offices, yards and in pipe-laying	83,379	92,050	86,180	94,591
On hand December 31	148,600	21,000	117.000	23,000
Total	6,822,647	7,540,071	8,136,627	8,373,889

	1892.	1893,	1894.	1895.
Number of meters introduced during the year	4,882	4,628	5,282	6,535
Total in use	143,637	148,265	153,547	160,082
Services introduced during the year	9,287	9,026	9,287	7,106
Total in use	178,707	187,733	197,020	204,126
Lights added during the year	111,486	104,641	107,172	131,457
Total in use	2,560,756	2,665,397	2,772,569	2,904,026
Total number of consumers	141,897	149,482	154,743	161,245
Number of public lamps	20,754	21,333	21,716	21,621

The following table gives the amount of gas consumed in the several Departments of the City, and for which the Bureau of Gas receives neither money nor credit:

Quantity of gas burned free in	**1892**	**594,203,605**	**cubic feet.**
" " " "	**1893**	**602,392,714**	" "
" " " "	**1894**	**623,313,751**	" "
" " " "	**1895**	**638,494,005**	" "

Bureau of Highways.

Mr. George A. Bullock resigned from the position of Chief of the Bureau of Highways on June 15, 1895. Mr. Thomas L. Hicks was appointed from among those having passed the Civil Service examination to succeed him, and he assumed charge of the Bureau November 1, 1895.

The report of the Chief of the Bureau shows in detail, the extent and variety of work done on the highways and upon the bridges of the City during the past year. The actual expenditures of the year amounted to $1,422,658.19, which is $662,218.05 less than in 1894.

The paved streets and roads open and in use December 31, 1895, aggregated 1,348 miles, of which 940.44 miles are paved and 407.56 miles are dirt roads.

During the past year the extent of streets repaved or newly paved by the City with improved pavements, was 40 miles 5,128.5 feet, in addition to which the passenger railway companies have laid 64 miles 4,563 linear feet. There were 311 streets graded, which required the handling of 1,114,823.88 cubic yards of earth, nearly 40 per cent. more than in the previous year. 276 streets were opened, aggregating a total length of 23 miles.

It will be noted that the number of miles of improved pavements laid during 1895, is considerably less than in 1894. This is due to the fact that the appropriation of $500,000, for repaving, with improved pavements, streets not occupied by passenger railway tracks, became available so late in the season, that it was impossible for the Department to place the necessary underground structures in the streets to be repaved, and do the work before freezing weather. This work, however, will be commenced early in the spring, and pushed to completion as rapidly as possible.

Bridges.

The Superintendent of Bridges reports general repairs to 268 of the 319 bridges belonging to the City, at a cost of $112,812.05.

The most extensive of these repairs was the strengthening of the column piers under the eastern and western fixed spans of the South street bridge with concrete and stone work, at a cost of $54,758.

He also estimates that the repairs to the City bridges during 1896 will cost about $58,000.

Repairs to Sewers.

Under the supervision of the Inspector of Sewers, a systematic inspection was made of all sewers, their condition ascertained, and, where necessary, repairs were made throughout the year at a cost of $19,795.14.

Curbing.

The Department has placed granite curved curb at the corners of all street intersections paved or repaved, to the extent of the amount appropriated for the purpose.

It is beyond question that the quality of the curbing and its alignments has much to do with the appearance of the streets, and I heartily endorse the recommendation made by my predecessor, that Councils, by legislation, should provide that a dressed granite curb be set upon all streets prior to paving or repaving.

During the year 439,458 square yards of repairs were made to paved streets, at a cost of $234,016.17.

The License Clerk reports that the collections made by the Receiver of Taxes for licenses issued by him amounted to $150,513.24, an increase of $57,263.91 over the preceding year.

The preservation of streets already improved and the improvement of new streets, is one of the most important subjects coming within the scope of this Department. Permanency in the construction of streets, means economy in repair—consequently, in all street paving, every means possible should be employed to secure the very best foundation.

In cities of the Old World, the street foundations are of firmly set concrete. Such a foundation insures permanent improvement, the pavement retains its grade, and can be kept in repair at a minimum expense.

During the years 1894 and 1895, most of the street pavements laid by the City have been put down on a concrete foundation, and the permanency of their condition is very gratifying.

The contracts for repaving during the year 1896 will require the contractor to lay the pavement with a ten years' guarantee.

The following tables gives comparative statements in detail of the work done during the years 1892, 1893, 1894 and 1895; and of the receipts and expenditures of the Bureau of Highways:

Comparative Statement of Work done.

	1892.	1893.	1894.	1895.	
New Paving	226,438.60	270,420.15	221,872.	149,515.05	Linear ft.
Macadamizing (new)	19,729.00	80,986.80	121,998.	66,813.	" "
Grading	447,475.00	743,361.00	797,227.	1,114,823.88	Cubic yds.
New footway paving	154,999.00	116,430.91	103,915.	110,086.50	Square yds
Repairs to paved streets	314,153.00	396,556.62	416,039.	329,598.14	" "
Footways repaved	18,465.00	21,985.37	17,676.	19,448.24	" "
Ditches repaved	55,772.00	66,555.37	128,529.	109,860.47	" "
Gutter stone laid	48,715.00	48,678.00	40,869.	21.462.50	Linear ft.
Crossing stone laid	42,836.00	47,480.40	48,269.	26,437,68	" "
Tramway stone laid	6,759.00	8,363.00	8,365.	4,397.41	" "
Curbstone reset	350,689.00	643,362.00	1,163,836.	356,687.	" "
Wooden trunks	8,484.00	6,278.00	7,277.	4,972.66.	" "
Brick and stone drains	872.00	889.00	1,396.	1,744.50	" "
Hand railings	1,248.00	2,716.00	1,340.5	3,125.90	" "
Broken stone used	6,668.00	24,166 27	46,601.	12,771.75	Cubic yds.
Macadamising (resurfacing)	12,033.00	71,686.00	66,138.	42,920.	Linear ft.
Footway, curb and railroad notices served	32,806.00	58,434.	91,291.	46,025.	

Summary of Work Done in Improved Pavements—New Streets.

	1892.		1893.		1894.		1895.	
	Square Yards.	Linear Feet.	Square Yards.	Linear Feet.	Square Yards.	Linear Feet.	Square Yards.	Linear Feet.
Granite blocks	134,715.38	49,219	84,655.04	30,860.00	142,420	54,088	90,090	28,293
Sheet asphalt	71,685.96	21,002	61,246.89	18,484.00	115,056	33,400	110,342	28,544
Vitrified bricks	143,953.82	48,474	119,914.93	40,350.00	75,851	21,307	131,051	68,629
Asphalt blocks	....	....	602.00	387.06	815	524	1,309	795
Macadamizing	47,503.00	19,729	148,059.23	80,986.80	228,434	121,998	146,024	66,313
Total	397,858.16	† 138,424	414,478.09	‡ 171,017.86	562,576	¶ 231,317	478,816	* 193,074

Replacing Cobblestone with Improved Pavements—Old Streets.

	1892.		1893.		1894.		1895.	
	Square Yards.	Linear Feet.	Square Yards.	Linear Feet.	Square Yards.	Linear Feet.	Square Yards.	Linear Feet.
Granite blocks	161,370.00	75,882	159,873.29	76,823.00	60,655	23,834	2,977	1,525
Sheet asphalt	133,644.75	31,861	235,989.36	68,527.34	156,233	63,282	2,834	390
Vitrified brick	....	....	25,400.00	10,344 00	33,305	11,623	6,901.03	3,795.05
Granolithic	....	....	18,143.43	24,694.75	10,536	13,814	15,722.10	16,561
Slag block	....	....	....	....	....	....	1,812	983
Total	295,014.75	† 107,743	439,406.08	‡ 180,389.09	260,729	¶ 112,553	30,246.13	* 23,254.05

† 1892. Total amount of new paving 246,167 linear feet equal 46 miles 3,287 linear feet.
‡ 1893. Total amount of new paving 351,406.95 linear feet, equal 66 miles 2,926.95 linear feet.
¶ 1894. Total amount of new paving 343,870 linear feet, equal 65 miles 670 linear feet.
* 1895. Total amount of new paving 216,328.05 linear feet, equal 40 miles 5,128.05 linear feet.

In addition to the work done by the City in paving and repaving of streets with improved pavement, the following statement shows in detail the work done by the passenger railway companies during the year 1895:

	Paving, Linear Feet.	Repaving, Linear Feet.	Total, Linear Feet.
Granite blocks	13,940	202,518	216,458
Sheet asphalt	550	73,619	74,169
Vitrified bricks	15,750	2,993	18,743
Slag blocks		10,025	10,024
Macadam	11,710	11,378	23,088
Total	41,950	300,533	342,483

Equal to 64 miles, 4,563 linear feet, at an estimated cost of $2,000,000.

Comparative Statement of Receipts.

Year.	Receipts.	Increase.	Decrease.
1892	$81,467 97	$9,652 08	
1893	97,004 85	15,536 88	
1894	93,249 33		$3,755 52
1895	150,513 24	57,263 91	

Comparative Statement of Expenditures.

	1892.	1893.	1894.	1895.
Current expenses	$315,580 94	$473,133 77	$498,372 12	$415,861 82
For extensions	856,283 09	1,839,087 40	1,586,504 12	1,006,796 37
Totals	$1,171,864 03	$2,312,221 17	$2,084,876 24	$1,422,658 19

Board of Highway Supervisors.

During the past year, the Board held twenty-four meetings, and approved of one hundred and sixty-seven plans for underground structures, vaults, conduits, sidings, and other works authorized by Ordinances of Councils and for which permits were issued.

The receipts for the past year were $10,975.90, the expenditures, $4,440.00; showing a profit paid into the City Treasury of $6,575.90.

The report of the Chief Draughtsman shows the amount of work done during the past year, and also states how inadequate the present force is to meet the demand made upon it.

Almost the entire time of the Draughting Department of this Board is consumed in making plans of iron awnings and other routine matters which must be attended to, so that many of the more important plans drawn during the past two years are incomplete; and, as the plans made of underground works are extremely valuable, adequate provision should be made to complete and maintain them.

The recommendation of the Executive Officers of the Board for an increase in the staff of draughtsmen, should receive favorable consideration.

The following is a statement of the number of permits authorized to be issued for electrical conduits during the year 1895:

Brush Electric Light Co	10
Edison Electric Light Co	18
Philadelphia Traction Co	6
Electric Traction Co	7
Burnham, Williams & Co	1
Columbia Electric Light Co	5
Bell Telephone Co	21
Diamond Electric Light Co	1
Fairmount Park and Haddington Pass. R. W. Co	1
Union Pass. R. W. Co.	9
Moyamensing ave. and Penrose Ferry Pass. R. W. Co	2
Total	81

The following is a summary of the transactions of the Board of Highway Supervisors, and of the work of the Draughting Department for the years 1892, 1893, 1894 and 1895:

Transactions of the Board of Highway Supervisors.

Permits authorized to be issued.	1892.	1893.	1894.	1895.
For vaults	4	3	3	18
For railroad tracks, curves and turnouts	106	62	197	192
For underground pipes	12	4	8	37
For electrical conduits	80	217	179	81
For erecting bridges	....	....	1	2
For tunnels	2	....	....	....
For miscellaneous	2	....	1	2
For awnings	....	....	188	360

Work done by the Draughtsmen of the Board of Highway Supervisors.

	1892.	1893.	1894.	1895.
Plans of iron awnings drawn	....	....	187	360
New street record plans prepared	74	41	148	176
Blue print plans placed on file	78	79	122	167

Receipts and Expenditures.

	1892.	1893.	1894.	1895.
Receipts	$4,521 00	$4,786 00	$3,262 25	$10,975 90
Expenditures	3,600 00	3,697 77	3,998 14	4,400 00
Profit to the City	$921 00	$1,088 23	*735 89	$6,575 90

*Excess of expenditures over receipts.

Bureau of Lighting.

The public lamps under the care of this Bureau have been well attended to, lighted and kept in good condition. On December 31, 1895, there were lighted 17,439 public gas lamps, and the consumption of gas by these lamps was 520,707,106 cubic feet during the year, an increase of 4,157,229 cubic feet over the previous year.

In addition to the gas lamps lighted, there were 4,182 gas lamps maintained and cared for by this Bureau, the lighting of which has been discontinued because of their proximity to electric lights.

Those sections of the City where gas mains are not yet laid, nor electric lights erected, are lighted by gasoline lamps of the Maloney Company Patent, furnished by the Pennsylvania Globe Gas Light Company, under a contract made by Ordinance of Councils, approved December 31, 1878. These lamps have been maintained throughout the year in a thoroughly satisfactory manner, and every condition of the contract with the City strictly complied with. The total number of lamps under the care of this company is 11,538.

The lighting with gas of that section of the City situated between the Delaware river and Sixth street, and between Vine and Poplar streets, is done by the Northern Liberties Gas Company. The total number of lamps under the care of this company on December 31, 1895, was 130.

The following comparative statement shows the number of lamps and the expenditures during the years 1894 and 1895:

	1894.		1895.	
	No.	Cost.	No.	Cost.
Gas lamps under charge of Bureau of Lighting	*21,716	$202,292 13	21,621	$202,548 33
Gasoline lamps	10,599	214,114 75	11,538	238,728 66
Gas lamps supplied by the Northern Liberty Gas Company	174	4,302 65	130	3,268 07
Electric arc lights under charge of Board of Directors of City Trusts	50	....	50	
Gas lamps under charge of Bureau of Correction	236	....	239	
Total	32,775	$420,709 53	33,578	$444,545 06

* Not lighted because of proximity to electric lights—1894, 4,882 1895, 4,182.

In addition to the 33,528 gas and gasoline lamps, there are 6,311 electric arc lights under the care of the Department of Public Safety (Electrical Bureau), (83 of which are free, being maintained by the different electric light companies for privileges granted) and 50 electric arc lights under the care of the Board of Directors of City Trusts; making the total number of lights 39,889, an increase during the year of 1,788 lights.

Bureau of Street Cleaning.

In consequence of the importance of street cleaning from a sanitary point of view, too much attention cannot be given this subject. The work of the Bureau of Street Cleaning during the year 1895 has been of a satisfactory character, and it is but fair to say that the contractors have, in the main, been prompt in their attention to the requests of the Department.

During the year, there have been cleaned 88,166 miles of streets, and 553,501 inlets; 235,866 loads of dirt and 620,065 loads of ashes removed; 136,513 loads of kitchen garbage and other waste collected and disposed of in a sanitary manner, at an aggregarte cost of $765,790.28.

While the complaints of all kinds made to the Department exceed those of the previous year, it does not indicate a neglect of duty, but rather a desire on the part of our citizens for greater cleanliness.

In all matters pertaining to the care of the streets, I have encouraged complaints from citizens, as much valuable assistance can be given the Department in this way. The Department has imposed penalties for neglect of contractors to comply with the provisions of their contracts, amounting to $17,414.00, and has expended $5,410.40 of their ten per cent. cash deposit in doing work neglected by them.

Garbage.—The proper removal and disposal of garbage is a most perplexing problem. The cremation process is open to the criticism of wastefulness and imperfect combustion at times. The reduction system commends itself because of its sanitary features; yet this method does not dispose of all the waste of a city; and I believe in the near future the larger cities will be compelled to operate a crematory in connection with the reduction system, in order to dispose of such matter as cannot be utilized.

The plants in operation in this City at present for the disposal of garbage, are:

Reduction, by the "Arnold System Improved," operated by the American Incinerating Company; and

Incineration, by the "Smith-Siemens Furnace," two plants, operated by the Philadelphia Incinerating Company.

Proposals have been asked for and received for the collection of ashes, cleaning of streets, etc., and the removal and disposal of garbage for the year 1896; and contracts will be awarded as soon as the appropriation for the year is available. In the meantime, the contractors are performing their work conditionally.

The aggregate amount of the contracts for 1896 is $781,918.00, which is $26,127.00 in excess of the contracts for 1895. There are two reasons for this increase: first, the growth of the City; second, the demand of the public for better service.

If legislation could be effected by which the City would have authority to make contracts for street cleaning, the removal and disposal of garbage, etc., for a period of three or more years, the Department would be able to obtain cheaper work and far superior service to that given under the present system of one year contracts.

The following is a statement in detail of the operations of the Bureau of Street Cleaning during the year 1895; also of the totals for the years 1892, 1893 and 1894:

Total work done during the year 1895.

DISTRICTS.	CLEANED.					REMOVED.				Number of Complaints of all kinds.
	Squares.	Inlets.	Crossings.	Market Houses.	Snow from Fire Plugs.	Number of Dead Animals.	No. of Loads.			
							Dirt.	Ashes.	Garbage.	
First	195,378	138,654	36,901	306	5,363	1,886	52,212	100,226	20,448	454
Second	271,053	94,637	115,000	1,240	1,356	1,013	61,784	96,927	21,588	1,896
Third	64,907	87,564	49,669	....	2,982	1,108	18,320	104,648	12,748	976
Fourth	194,185	83,114	118,179	....	10,406	3,609	67,699	163,474	43,079	791
Fifth	135,096	123,435	74,816	....	4,088	2,679	27,015	154,790	38,650	896
Broad street	21,045	26,097	3,173	....	330	....	8,836	....	....	15
Totals, 1895	881,664	553,501	397,738	1,546	24,525	10,295	235,866	620,065	136,513	5,028
Totals, 1894	819,892	380,872	159,489	1,650	8,692	10,119	271,660	531,643	96,523	3,888
Totals, 1893	663,250	311,565	251,596	1,856	21,041	18,906	319,543	578,859	97,536	4,950
Totals, 1892	561,608	352,788	180,578	1,872	3,776	9,956	218,213	488,833	71,929	1,963

The total expenses of the Bureau of Street Cleaning for the year 1895 were $765,790.28.

Bureau of Surveys.

The exhaustive report of the Chief Engineer of Bureau of Surveys, contains a detailed statement of the work performed by this very important branch of the City's service.

The amount of work done by the Bureau during the year was less than that of the preceding year, for the reason that the appropriations were much less, and also because of the decrease in work done by the passenger railway companies.

Councils, by Ordinance approved June 27, 1895, appropriated from a loan $250,000 for the construction of main sewers. This limited amount prevented the construction of any great length of main sewers, such as was built in each of the three previous years.

The following extensions to the main sewer system were made during the past year:

Intercepting System.—Work upon the three intercepting systems which were begun during the previous years, was completed as far as contracted for, comprising extensions along various streets in Manayunk and upon the Wissahickon System, consisting of the Lincoln Avenue and Cresheim Branches, and on Dobson's Run.

The completion of these sewers has stimulated building operations in the section of the city which they drain; and also serves to remove a large quantity of sewage from the water-shed of the Schuylkill River.

Aramingo System.—Work upon the Aramingo Canal System has been continued at several points on Allegheny avenue and at the river end of Ontario street. The Allegheny Avenue and Ontario Street Sewers have been practically completed.

The completion of this system will forever close the open and foul stream, which, for many years has been a menace to the health of the public in the northeastern section of the City.

Mill Creek System.—The early part of the year marked the completion of the Merion Creek branch of the Mill Creek system. The George's Run branch of this system is the most extensive sewer constructed during the year, and practically completes the main stem of the system. The sewer will at once be called into use, as a large tract in this section of the City has already been provided with private sewers, and will be largely built upon during the coming spring.

Wingohocking System.—Two connections to the Wingohocking System were commenced, one on Chew street, now emptying into Wingohocking creek, and another on Mill street which empties into the east branch of the Wingohocking creek. Both drain sections largely built upon, and which have been suffering through inadequate drainage facilities for a number of years.

Botanic Creek.—The Botanic creek sewer, which extends from Elmwood avenue near Fifty-seventh street to Sixty-third street and Woodland avenue, will supply a long felt need in the southwestern part of the Twenty-seventh Ward, and will furnish means of drainage to properties along the built-up portions of Woodland avenue.

Sylvan Street.—The sewer constructed on Sylvan street, from Pennypack creek to Dacatur street in the Thirty-fifth Ward, is the first main sewer constructed in that section of the City known as Holmesburg, and will form the main artery for branches draining a section badly in need of sewerage facilities.

American Street.—The extension of the American street sewer from the Connecting Railway to Sedgley avenue and Erie avenue, will furnish means of drainage to a growing section of the City, and enable the Department to construct the necessary branch sewers prior to the paving of streets in this section.

Fifty-sixth Street.—The Fifty-sixth street main sewer, from Market to Arch streets, will furnish drainage facilities in the populous section north of Fifty-sixth and Arch streets.

Fifty-seventh Street.—The main sewer in Fifty-seventh street, from Elmwood to Woodland avenues, was constructed for the purpose of relieving Woodland avenue, where the growth of population is rapid.

Jasper Street, north of Venango street, extending to Kensington avenue and Erie avenue.—This sewer is designed to furnish means of drainage along the line of Kensington avenue in advance of improvements.

Lefevre Street, from Frankford avenue to Richmond street.—The main sewer constructed in this street furnishes the principal outlet for the branch sewers to drain the built-up portions of Bridesburg.

Milnor Street Main Sewer, constructed in Tacony, Twenty-fifth Ward, connects a number of small sewers which formerly emptied into an open stream of water flowing through a populous district, and abates a nuisance by obliterating a foul stream of water.

Twentieth Street Main Sewer, constructed from Jackson to Mifflin streets, thence to Twenty-first street, and to Morris street, furnishes facilities for drainage to a large section of territory in the southern part of the City where the grades are very flat, and the water accumulates in large quantities in gutters and streets.

This sewer has been badly needed for many years, and will result in improving the sanitary conditions of the southwestern section of the City.

Woodland Avenue Main Sewer is the outlet for the drainage of a large settlement adjacent to Woodland avenue and the County line, and through its extension, drainage facilities will be given to the community in that section of the City.

In aditdion to the above-mentioned sewers, the large mains on Callowhill street, Twenty-fourth street and Pennsylvania avenue, appurtenant to the construction of Pennsylvania Avenue Subway, have been completed, and the drainage of this section of the City so arranged that the work on the contracts for the subway may be proceeded with without interfering with the sewerage system of the City.

I would call special attention to the recommendation of the Chief Engineer of the Bureau of Surveys, for the extension of the following system of main sewers: the Intercepting System, the Aramingo System, and the Wingohocking and Frankford Systems. All these drain large areas of territory that are rapidly improving and suffering through lack of adequate drainage facilities.

The drainage in the southern part of the City should receive the early attention of Councils.

This section of our City has long felt the need of drainage facilities, and the rapid advance of improvements along south Broad street, also east and west of that street, south of Wolf street, demand that some measures be taken looking towards the proper drainage of this section of the City.

Branch Sewers.

During the year three hundred and twenty-eight branch sewers, aggregating 42.55 miles, were built, and of branch sewers under private contract there were built one hundred and nine, aggregating 11.20 miles. Seven hundred and seventy-eight inlets of all kinds were built or rebuilt, which, with the laterals and appurtenances, cost $64,058.78.

Bridges.

During the past year the following important highway bridges have been completed and are ready for public service.

Falls Bridge over the Schuylkill river, Twenty-fourth and Twenty-eighth Wards.—This bridge was completed June 19, 1895, and replaces the old wooden bridge which was blown down by a severe wind-storm August 6, 1893.

The construction of this bridge furnishes direct communication between Germantown and the towns in and adjacent to the City along the main line of the Pennsylvania Railroad and between the important drives in the East and West Parks. The structure is designed to be ultimately a double decked bridge. The upper deck, when constructed, will give a thoroughfare to reach the high lands on both sides of the river, and, with its approaches, will avoid all grade crossings of steam railroads.

Sixth street and Allegheny avenue over the Richmond branch of the Philadelphia and Reading Railroad, in the Thirty-third Ward.—This bridge being at the intersection of two important highways, provides means for crossing the Philadelphia and Reading Railroad above grade, and results in the opening up of Sixth street, an important outlet to the northern part Thirty-third, Twenty-second, and Thirty-fifth Wards; and also in the opening of Allegheny avenue, which is one of the most important thoroughfares in that part of the City.

An interesting feature in the construction of this bridge was the remarkable size of the large plate girders along the south side of Allegheny avenue, supporting the skewed end of the structure, believed to be the largest in the United States, being 122 feet $10\frac{1}{4}$ inches long and 10 feet $3\frac{9}{16}$ inches wide over chord plates, and weighing 50 tons.

Sixty-third street bridge over the Philadelphia, Wilmington and Baltimore Railroad.—This bridge will be a great accommodation to the built-up section in that part of the Twenty-seventh Ward.

Girard avenue over Pennsylvania avenue.—During the year the construction of the bridge on the line of Girard avenue over Pennsylvania avenue was completed. This bridge superceded the old dilapidated structure, which for a number of years had been in an unsafe condition.

Jefferson street, under Philadelphia, Germantown and Chestnut Hill Railroad, Twenty-second Ward.—The construction of this bridge opens up an important highway, and will result in the development of a large tract of land.

Wyoming avenue viaduct over Frankford creek and Fisher's lane, Twenty-second Ward.—This bridge is part of a project for opening Wyoming avenue to connect Frankford and Germantown.

Before this bridge can be brought into full usefulness it will be necessary to construct a similar bridge over Frankford creek near "M" street. An appropriation for this structure is urgently recommended for the coming year.

Wayne avenue over, and Duval street under, Philadelphia, Germantown and Chestnut Hill Railroad, Twenty-second Ward.—The completion of these two bridges open to travel two important highways.

Forty-ninth street bridge over West Chester and Philadelphia Railroad, Twenty-seventh Ward.—This bridge is useful, as it opens up to travel a street in a section of the city which is rapidly developing.

Seventeenth street under Connecting Railway.—Many of the streets crossing the Connecting Railway west of Broad street, have been stricken from the City Plan by reason of railroad obstruction. The importance of opening Seventeenth street, one of the few remaining streets under the Connecting Railway, and over the Philadelphia, Germantown and Norristown Railroad, cannot be overestimated.

The work on this bridge under the Connecting Railroad is practically completed, and it is of very great importance that an appropriation be made for the construction of the bridge over the P. G. and N. branch of the Reading Railroad, thus opening an important highway to public travel, and connecting Tioga more directly with the centre of the City.

Torresdale avenue bridge over Pennypack creek, Thirty-fifth Ward.—This bridge, in addition to giving highway facilities to a growing section of the City, will furnish the only means of access for highway travel to the new County Prison.

Evergreen avenue bridge over the Chestnut Hill Branch of the Reading Railroad; and the Magnolia avenue foot bridge under the same railroad.—The completion of these bridges furnishes additional highway facilities in the Twenty-second Ward.

Thirty-third street bridge.—The masonry for the bridge on the line of Thirty-third street over the Connecting Railway, and the masonry for the bridge on the line of the same street over the Reading Railroad, with the exception of the north abutment, is practically finished; and it is important that an appropriation be made to complete the masonry and retaining walls of the Reading Railroad bridge, and to allow the erection of the superstructure, so that this street, which is the eastern boundary of Fairmount Park, may be thrown open to public travel.

There have also been constructed during the year, the following bridges by the Pennsylvania Railroad Company, and its branches:

On the Philadelphia and Trenton Railroad over Unruh street, in the Thirty-fifth Ward.

On the line of the Pennsylvania and New Jersey Railroad, at the following points: Wheat Sheaf lane and Sepviva street, Luzerne and Tulip streets, Aramingo street, Carbon street and Delaware avenue.

On the line of the Fairhill branch at Tioga street, Ontario street, Westmoreland street and Allegheny avenue.

Gray's Ferry bridge.—Ordinance of Councils approved

December 28, 1895, appropriated $250,000 for the erection of a new bridge at Gray's Ferry: *Provided*, The excess (if any) shall be paid by the railroad and railway companies using the same. Plans and surveys have been made for this structure and the work will be pushed forward without unnecessary delay as soon as a satisfactory conclusion is arrived at between the City and interested parties with whom negotiations are pending.

Dredging.—Ordinance of Councils approved December 28, 1894, appropriated $225,000.00 for removing obstructions to navigation and deepening the channels of the Delaware and Schuylkill rivers.

The matter received prompt attention, and surveys, soundings and contract drawings were promptly made by the Bureau of Surveys. Proposals for the work were received September 3, 1895, and contracts awarded. The work of dredging the Schuylkill river was begun, and upwards of 29,000 cubic yards of material have been removed from the channel of the river.

Ordinance of Councils approved December 28, 1895, appropriates $50,000.00 for the continuance of the work upon the Schuylkill river.

Danger of interference from ice during the winter, prevented the commencement of work upon Schooner Ledge in the Delaware river. The contractor has his plant in readiness, and operations will be begun in the spring and pushed to a speedy completion.

Delaware river front.—In accordance with the provisions of the Ordinance of Councils, approved June 23, 1893, plans have been prepared for the widening of Delaware avenue along the river front. On November 19, 1894, the lines were confirmed between Vine and South streets; and between South and Christian streets on April 15, 1895.

Ordinance of Councils approved March 11, 1895, authorizes the opening of Delaware avenue to its full width, as laid down on the City Plan, from Vine to South streets. Careful estimates of the damages have been made by the Chief Engineer of the Bureau of Surveys, and negotiations are now in progress with the owners of property affected by the opening, with a view of arriving at figures which can be used as a basis of settlement.

The proposed legislation, authorizing a loan of $2,000,000.00 for the purpose of widening Delaware avenue, constructing a bulkhead, extension of City piers and deepening the channel of the Delaware river, should receive the early consideration of Councils.

Abolishment of grade crossings.—Among the most difficult, and at the same time, most pressing municipal problems which must be met in the near future, is that of the abolishment of grade crossings along the line of Ninth street and the Philadelphia, Germantown and Norristown Branch of the Philadelphia and Reading Railroad, from Green street to Wayne Junction.

The police reports of accidents and the records of many Coroner's inquests are a frightful index of the enormity of the evil of grade crossings on the line of this railroad.

Studies have been made by the Bureau of Surveys for abolishing the dangerous grade crossings on this road. The design contemplates elevating the tracks of the railroad company, so that the streets may be carried under by bridges without any serious change in the grades. This work, if carried out, will eliminate twenty-five grade crossings of a steam railroad in a populous section of the City.

Testing Laboratory.—The work done by the testing laboratory during the year has been greater than that of any previous year, and is treated in detail by the Chief Engineer in his report. The importance of the tests made of cement has been fully demonstrated, and it would be well for the City to build and equip a laboratory for the analysis and inspection of all metals and other material used in City work.

District Surveyors.—The Board of Surveyors, consisting of the Chief Engineer and thirteen District Surveyors, held forty-three meetings during the year, seven of which were road-day meetings, at which one hundred and thirty-five plans were heard. Eight hundred and eighty-eight references from the Survey Committee were received, consisting of ordinances and petitions for the construction of main and branch sewers, building new bridges, revision of lines and grades, and placing new streets upon the City Plan, etc., all of which were acted upon and reported back to the Committee.

The report of the Chief Engineer shows that the cash receipts of the District Surveyors amounted to $151,081.45, in addition to which, work was done for the various Departments of the City to the value of $152,693.71; making the total earnings of the thirteen districts $303,775.16.

The following table is a summary of the receipts and expenses of the District Surveyors for the year 1895, and, in totals, for the years 1892, 1893 and 1894:

Summary of Receipts and Expenses of District Surveyors.

District.	Surveyors.	Cash Receipts.	Credit for work done for the City.	Total Credit.	EXPENSES. Salaries.	EXPENSES. Pay of Assistants.	EXPENSES. Miscellaneous.	EXPENSES. Total.	Balance Profit to the City.	Profit to the City in 1894.	Increase.	Decrease.
1	Thomas Daly	$11,562 56	$16,184 25	$27,746 81	$3,000 00	$7,177 96	$1,365 65	$11,543 61	$16,203 20	$22,338 40	....	$6,135 20
2	Chas. W. Close	9,613 53	8,432 98	18,046 51	3,000 00	6,442 22	1,521 39	10,963 61	7,082 90	16,375 41	....	9,292 51
3	W. C. Cranmer	11,407 47	12,903 00	24,310 47	3,000 00	10,306 26	1,788 41	15,094 67	9,215 80	35,495 58	....	26,279 78
4	Frits Bloch	8,389 00	11,605 39	19,994 39	3,000 00	9,366 51	1,658 31	14,024 82	5,969 57	16,311 46	....	10,341 89
5	Walter Brinton	11,055 86	9,316 26	20,372 12	3,000 00	7,367 96	1,532 04	11,900 00	8,472 12	5,434 31	$3,037 81	....
6	Joseph Mercer	23,155 35	25,674 37	48,829 72	3,000 00	8,390 55	2,703 95	14,094 50	34,735 22	33,038 75	1,696 47	....
7	W. K. Carlile	10,509 99	9,585 55	20,095 51	3,000 00	6,187 96	1,905 02	11,092 98	9,002 56	16,049 92	....	7,047 36
8	C. A. Sundstrom	4,971 43	11,504 92	16,476 35	3,000 00	10,699 92	2,594 79	16,294 71	181 64	307 62	....	125 98
9	Joseph C. Wagner	8,654 61	6,310 48	14,965 09	3,000 00	7,977 45	1,147 55	12,125 00	2,840 09	2,908 40	....	68 31
10	Jno. H. Webster, Jr.	13,654 73	13,471 79	27,126 52	3,000 00	11,959 92	2,720 08	17,680 00	9,446 52	6,944 04	2,502 48	....
11	Jos. Johnson	13,621 10	10,270 12	23,891 22	3,000 00	11,154 75	2,450 93	16,605 00	7,285 54	20,565 22	....	13,279 68
12	J. H. Gillingham	9,084 15	10,303 83	19,387 98	3,000 00	5,968 46	1,506 54	10,475 00	8,912 98	16,319 50	....	7,406 52
13	H. M. Fuller	15,401 67	7,130 77	22,532 44	3,000 00	9,816 61	2,137 92	14,954 53	7,577 91	10,438 56	....	2,860 65
	Total, 1895	$151,081 45	$152,693 71	$303,775 16	$39,000 00	112,816 53	$25,032 58	$176,849 11	$126,926 05	$202,527 17	$7,236 76	‡82,837 88
	Total, 1894	$177,549 20	$201,553 20	$379,102 46	$39,000 00	111,998 15	$25,577 08	$176,575 23	$202,527 17	$202,527 17	101,6.4 66	
	Total, 1893	$125,971 42	$129,960 01	$255,931 43	$38,958 33	$92,953 70	$23,096 89	$155,008 92	$100,922 51	$100,922 51	*54,850 95	$1 046 47
	Total, 1892	$108,433 42	$61,547 99	$169,981 41	$38,558 33	$64,845 13	$19,675 13	$123,078 59	$47,118 03	$47,118 03	†20,483 88	$1,726 63

* Net increase, 1893, $53,804.48. † Net increase, 1892, *18,757.25. ‡ Net decrease, 1895, $75,601.12.

Registry Division.—The work of this division increases each year with the growth of the City, and the reports of the Registrar shows that the past year was no exception. The increase in the number of persons examining the records, makes the preservation and renewal of worn out record books a work of necessity and importance.

The work of the Registry branch of the Bureau of Surveys is shown in the following summary of its operations:

	1892.	1893.	1894.	1895.
Number of certificates registered owners issued	11,053	11,188	12,860	13,620
Number issued for use of the Law Department	212	212	542	498
Receipts from certificates of registered owners	$2,765 00	$2,979 00	$3,203 00	$3,381 00
Number of original lots plotted	12,387	11,796	10,975	13,103
Number of transfers registered	22,540	24,315	22,720	26,978
Number of plans made for use of City Departments, Bureaus, etc	440	561	451	305
Number of examinations of registry plan books made by the public	23,824	21,703	26,736	30,490
Number of descriptions of property filed for registry	35,195	35,279	31,093	39,680
Number of titles perfected	2,215	2,093	1,905	2,215
Number of certificates of legal opening of streets, issued to Bureaus, etc	3,112	3,245	3,158	2,794
Number of certificates of registered owners in municipal lien cases for Law Department	5,825	4,833	3,500	2,854

The following tables give a comparative summary of the operations of the Bureau of Surveys in the active construction of work; also of receipts and expenditures during the years 1892, 1893, 1894 and 1895:

Comparative Summary of Main, Branch, and Private Sewers and Bridges built during the years 1892, 1893, 1894, and 1895.

	1892.		1893.		1894.		1895.	
	No.	Linear Feet.	No.	Linear Feet.	No.	Linear Feet.	No.	Linear Feet.
Bridges	5	....	6	....	4	....	16	
Intercepting sewer (section)	1	5,855	....	....	8	9,214	5	9,865
Intercepting sewer connections	....	....	4	10,260				
Wissahickon Valley sewer (section)	4	7,564	3	10,712	7	17,362		
Main sewers	26	31,705	40	55,743	57	75,693	22	25,012
Branch sewers	213	132,000	550	273,433	522	332,220	328	224,693
Private sewers	68	29,218	58	36,738	65	45,723	109	59,181
Subway sewers	....	....	....	....	....	....	5	13,886
Total	317	† 206,342	661	‡ 386,886	663	¶ 480,212	485	* 332,637

† 1892, equal to 39.08 miles. ‡ 1893, equal to 73.27 miles. ¶ 1894, equal to 90.95 miles. * 1895, equal to 62.97 miles.

Comparative Statement of Work upon Bridges during the Years 1892, 1893, 1894 and 1895.

	1892.	1893.	1894.	1895.
Finished	5	6	4	16
Begun	4	9	17	5
Authorized	4	13	17	....
Planned	10	18	23	8

Comparative Statement of Receipts.

Year.	Receipts of Bureau.	Receipts of District Surveyors.	Total.	Increase.	Decrease.
1892	$50,199 74	$108,433 42	$158,633 16	$15,230 90	
1893	73,073 59	125,971 42	199,045 01	40,411 85	
1894	139,626 34	177,549 20	317,175 54	118,130 53	
1895	62,585 17	151,081 45	213,666 02	....	$103,508 92

Comparative Statement of Expenditures.

	1892.	1893.	1894.	1895.
Current expenses	$174,660 77	$210,223 87	$247,492 25	$246,404 34
For Extensions	1,047,169 14	1,801,375 35	2,538,586 24	1,610,347 65
Total	$1,221,769 91	$2,011,599 22	$2,786,078 49	$1,856,751 99

Bureau of Water.

On April 22, 1895, Mr. John L. Ogden resigned as Chief of the Bureau of Water, the resignation to take effect May 10, 1895. From the list of eligibles certified by the Secretary of the Civil Service Board, Mr. John C. Trautwine, Jr. was appointed to succeed him, and he assumed charge of the office on June 3, 1895.

The importance of an ample supply of wholesome water cannot be overestimated, and the report of the Chief of the Bureau herewith submitted, furnishes interesting information on the subject.

The financial statement of this Bureau for the year shows a very gratifying increase in receipts. The total receipts were $2,829,857.17, an increase of $70,226.58 over the preceding year.

The expenditures for the same period were $1,897,225.20 showing a net revenue of $932,631.97 over all expenditures both for permanent improvements of every character and the cost of maintenance. Of this amount expended $1,509,902.97 was for maintenance and $387,322.23 for extensions.

The City at present is supplied with 30 pumping engines of various types and power, and seven turbine wheels, representing a total pumping capacity for delivering daily 352,290,000 gallons of water.

In addition to these, there will be completed early in the spring the two remaining engines for the Queen Lane Pumping Station, with a capacity of 20,000,000 gallons each, making the total pumping capacity for 1896 392,290,000 gallons daily.

From measurements obtained, there was pumped during the year 78,775,849,104 gallons. The average daily pumpage was 215,824,244 gallons, which is 61.26 per cent. of the total capacity of the pumping power of the engines now in use.

The pumping machinery is in generally good condition, but at several stations repairs are needed to the boilers, while new boilers are absolutely necessary for the demands made upon the Belmont Station.

The twenty million gallon Worthington High Duty engine, No. 4, formerly at Spring Garden Station was taken down and removed to Belmont Station, where it has been re-erected on foundations built to receive it. All work incident to the removal and re-erection of this engine, also the building of the foundation walls, was done by the employees of the Bureau of Water. The engine is temporarily protected by a rude structure.

Plans and specifications have been prepared for the erection of permanent brick buildings to contain the engine and the new boilers required at this station, and it is important that Councils should make an appropriation for the purpose of erecting this building as early as possible.

Two of the four triple expansion engines, twenty million gallons capacity each, designed for the Queen Lane Station, have been erected and put in service. The other two will be erected early in the spring.

The high service pumping station at Belmont, designed for the supply of Bala, Haddington and the high elevations in West Philadelphia, was completed and put in operation on June 27, 1895.

The Roxborough Auxiliary Station was completed and put in operation on May 17, since which date it has been in continuous service. This station supplies Chestnut Hill district and adjacent territory, and the demand upon it is such that the engine now in use cannot be shut down for a single hour, day or night. Supplementary or relief engines should immediately be placed at both the Belmont and Roxborough Auxiliary Stations, as a reserve in case of emergency, and to permit of repairs being made to the engines now in use.

An additional engine will be needed at the Frankford Pumping Station if the reservoir required for this district is constructed.

The Wentz Farm Reservoir, which supplies the Frankford District, holds but one and one-half days supply of water, and is in very bad condition and urgently in need of repairs.

The Belmont Reservoir in West Philadelphia, holds less than two days supply, and is also in need of repairs. In either case to make such repairs at the present time or before a new reservoir is provided, would involve the necessity of supplying these districts by direct pumpage.

New reservoirs are needed for both of these districts.

In my estimate of the requirements of this Department for the year 1896, made in December last, I stated to the Finance Committee of Councils that the amount of $2,835,150 would be required by the Bureau of Water for the improvement of the pumping stations and for the extension of the pumping and supply mains, so as to enable the Department to meet the growing demand and to improve the supply and pressure in districts where these are now inadequate.

These extensions and improvements are dwelt upon in detail by the Chief of the Bureau in his report, and as no provision has been made in the annual appropriation for either extensions or improvements, I cannot urge too strongly the importance of Councils making an appropriation at an early day to meet the absolute and urgent requirements of this Bureau.

At Belmont and Fairmount Stations, we have to-day valuable and costly pumping machinery, which is suffering severely for lack of proper protection from the weather.

On December 18, 1895, the 48-inch pumping main on Engine No. 5, at the Spring Garden Station broke on the east side of the Philadelphia and Reading R. R., and caused considerable damage by the wash of mud and debris into the pump-wells, fire-rooms and engine-rooms, throwing temporarily out of service all the engines at this station.

The washout caused by the breaking of this main led to the rupture of a 30-inch pumping main leading to the direct pumpage district, and deprived that district of water for about two hours. Repairs were promptly made, and to protect the pumps in case of such accidents in the future, we have constructed walls to divert the flood and carry their deposits either into the forebay or river.

Drought.—During the drought of the late summer and early fall of 1895, both the Delaware and Schuylkill rivers reached a lower point than ever known.

There were 58 days on which no turbine wheels were run, and at no time from July 7 to December 23 were all the pumps at work; but, notwithstanding the long continued drought, which caused much inconvenience and suffering in other cities, and the disadvantages under which the Department labored, there was no time during the exceptionally dry summer that we were required to restrict our citizens in the lawful use of water.

During the continuance of the drought the water in the Schuylkill river was drawn very low by steam pumpage. With the exception of the slight leakage at the dam and at the lock gates of the Schuylkill Navigation Company, and the water used in the locking in and out of boats, the whole flow of the river was pumped at the stations operated by steam.

Consumption.—The increase in the consumption of water continues. At present, the annual increase in our average daily consumption is about eighteen million gallons. According to diagrams prepared by the assistant engineer, our citizens consumed in 1885 on an average, seventy-two gallons each per day. In 1892, this quantity was doubled, and in 1895, our daily consumption per capita has reached one hundred and sixty gallons, an increase in ten years of eighty-eight gallons per capita per day.

It must be apparent to every one, that this large increase is mainly due to waste or misuse, and it is high time some measures were adopted by which the present waste of water may be stopped, or at least materially reduced

Water pipes were laid during the year equal to 39.64 miles; making a total of 1,174.77 miles of water mains laid within the City limits. 5.88 miles of mains were taken up and relaid.

Included in the work of the past year was the completion of the 48-inch pumping main from the Queen Lane Pumping Station to the Queen Lane Reservoir. Work was continued also on the following:

On the 48-inch supply main from the Queen Lane Reservoir to Broad and Dauphin streets; and 6,554 feet of this line were laid.

On the 48-inch main from the Queen Lane Reservoir to the intersection of Nicetown lane and Wissahickon avenue; and 1,915 feet were laid.

These two lines are intended to reach districts which at present are inadequately supplied with water, and sufficient appropriations should be made to enable the Department to complete them both as early as possible.

The inspection of all pipes used by this Bureau is of the most exacting character, and resulted in 1895 in the rejection of 3,669 pieces out of 37,301 pieces of water pipe inspected.

Construction and Repair Shop —The area occupied by the construction and repair shop has been increased nearly one-third by the addition of that part of the building, which was formerly occupied as a stable by the Department of Public Safety, and gives increased facilities for handling work. The amount of work done during 1895 is greater than that done in any previous year.

The operations of the shop are profitable to the City, both in the character of the work done and the greatly reduced cost at which it is supplied.

All the work of the several pumping stations was of the usual routine character incident to large operations.

During the summer the dam at Fairmount was thoroughly overhauled, necessary repairs made, and the structure placed in good condition.

The following tables give the number and types of engines, the location of reservoirs and a comparative summary of the operations of the Bureau of Water; also the receipts and expenditures for the years 1892, 1893, 1894 and 1895:

Statement of the Number and Type of Engines and their Several Aggregate Capacities at the Various Stations.

Pumping Station.	Designated number of Engine or Turbine.	Type of Engine.	Designed capacity in million gallons per day.	Total.
Spring Garden. Old Station	5	Compound Rotary	20,000,000	
" "	6	Simpson Compound Rotary	10,000,000	
" "	7	Marine Compound Rotary.	20,000,000	
" "	8	Worthington Duplex	10 000,000	
" "	11	Gaskill	20,000,000	
New Station	9	Worthington Duplex	15,000,000	
" "	10	" "	15,000,000	
" "	2	Holly	30,000,000	
" "	3	"	30,000.000	170.000,000
Queen Lane	1	Southwark	20,000,000	
" "	2	"	20,000,000	40,000,000
Belmont	1	Worthington Duplex	5,000,000	
"	2	" "	5,000,000	
"	3	" "	8,000,000	
"	4	" "	20,000,000	38,000,000
Belmont Auxiliary	1	Worthington	2,000,000	
" "	2	Snow	500,000	2,500,000
Roxborough	1	Southwark	12,000.000	
"	2	Worthington Duplex	5,000,000	
"	3	" "	7,500,000	24,500,000
Roxborough Auxiliary	2	Knowles	250,000	
" "	1	Worthington	5,000,000	5,250,000
Mt. Airy	1	Davidson	1,000,000	
" "	2	"	1,000,000	
" "	3	Knowles	1,000,000	3,000,000
Chestnut Hill	1	Knowles	250,000	
" "	2	Worthington Duplex	500,000	750,000
Frankford	1	Marine Compound Rotary	10,000,000	
"	2	Corliss Compound Rotary	10,000,000	
"	3	Southwark Rotary	15,000,000	35,000,000
Fairmount. New House	1	Turbine Wheels	2,000,000	
" "	3	" "	5,330,000	
" "	4	" "	5,330,000	
" "	5	" "	5,330,000	
Old "	7	" "	5,100,000	
" "	8	" "	5,100,000	
" "	9	" "	5,100,000	33,290,000
Total				372,290,000

Statement of the Location, Date of Completion, Elevation, and Capacity of the City's Reservoirs.

	Name of Reservoir.	Location.	Date of Completion.	Height above City Datum.	Capacity in Gallons.
Fairmount.	Reservoir No. 1	East Fairmount Park	1815	94 feet.	26,350,000
	" " 2		1821		
	" " 3		1827		
	" " 4, Section 1		1835		
	" " 4 " 2		1836		
	" " 4 " 3		1836		
Lehigh	Section 1	Sixth and Lehigh avenue	1852 and 1871	114 "	28,910,000
	" 2				
	" 3				
	Spring Garden	Twenty-sixth and Master streets	1844	120 "	12,950,000
	Corinthian	Corinthian avenue and Poplar streets	1852	120 "	37,341,400
East Park.	Section 1	East Fairmount Park	1887	133 "	62,738,000
	" 2		1888		306,400,000
	" 3		1889		319,480,000
Queen Lane.	North Basin	Thirty-third street and Queen lane	1894	238 "	205,620,000
	South Basin				177,480,000
	Frankford	Oxford Turnpike and Comly street	1877	167 "	36,046,000
	Belmont	West Fairmount Prrk	1870	212 "	39,758,000
	Mount Airy	Allen's lane and Mower street, Germantown	1851	363 "	4,546,000
	Roxborough	Ridge and Shawmont avenues	1866	366 "	12,838,000
New Roxborough.	North Basin	Port Royal avenue and Ann street	1893	414 "	71,591,000
	South Basin				75,438,000
	Manatawna tanks—2	Manatawna and Ridge avenues	1878	442 "	107,000
	Chestnut Hill tank	Hartwell avenue and Chestnut Hill Railroad, Chestnut Hill	1860	481 "	52,000
	Belmont Stand Pipe	West Fairmount Park	1895	148 "	106,000
	Roxborough Stand Pipe	Port Royal avenue and Ann street	1895	490 "	106,000
	Total				1,417,860,400

A Comparative Statement of the Total Pipe Laid, and of other Work done during the Years 1892, 1893, 1894 and 1895.

YEAR.	PIPE LAID.			*PIPE RELAID.	FIRE HYDRANTS PLACED IN POSITION.			SUBSTITUTED FOR DEFECTIVE HYDRANTS.			Fire Hydrants in use.	Water Attachments in use.
	FEET.	EQUAL TO										
		Miles.	Feet.	Feet.	New Style	Old Style.	Total.	New Style	Old Style.	Total.		
1892	158,783	30	383	50,074	634	....	634	384	28	412	8,447	8,900
1893	265,911	50	1,911	96,066	1,000	....	1,000	323	10	333	8,881	11,892
1894	283,569	53	3,729	89,558	1,248	1	1,249	497	9	506	9,449	11,569
1895	209,295	39	3,375	31,063	902	....	902	379	4	383	10,038	10,410

Total pipe laid 1,174 miles 4,102 linear feet.

*Adds nothing to feet in ground.

Comparative Statement of Receipts and Expenditures for the years 1892, 1893, 1894 and 1895.

Receipts.

	1892.	1893.	1894.	1895.
Receipts from water rents....	2,147,447 98	$2,220,083 24	$2,300,158 59	$2,367,057 60
" " fractional rent	214,678 24	237,125 48	190,453 82	166,713 87
" " water pipes.....	152,916 45	114,531 78	152,163 31	161,285 14
" " City Solicitor's office..................................	58,768 25	44,265 44	41,663 04	46,994 07
Receipts from penalties.........	27,136 90	30,981 84	31,993 99	37,498 56
" " delinquentr'nt	15,422 75	13,745 58	25,103 40	28,920 75
" " Chief Engineer's office.........	10,274 24	5,836 84	8,917 46	11,676 44
Receipts from searches..........	5,718 50	5,830 25	5,571 75	5,539 25
" " delinqu'ntpenalties................................	2,092 71	1,874 79	3,605 23	4,171 49
Total................	$2,634,456 02	$2,674,275 24	$2,759,630 59	$2,829,357 17

Expenditures.

	1892.	1893.	1894.	1895.
Current expenses..................	$814,332 89	$1,121,555 91	$1,677,081 03	$1,509,902 97
For extensions........................	558,124 42	1,471,834 90	1,235,775 01	387,322 23
Total..............................	$1,372,457 31	$2,593,390 81	$2,912,856 04	$1,897,225 20

Comparative Statement of Pumpage for the years 1892, 1893, 1894 and 1895.

Pumpage.

	1892. Gallons.	1893. Gallons.	1894. Gallons.	1895. Gallons.
Pumped to reservoirs............	59,787,584,178	65,359,736,978	72,073,724,037	78,775,849,104
Equal to gallons pumped 100 feet high............................	102,443,373,631	110,590,708,479	121,199,588,387	132,040,954,195

NOTE.—The "pumped to reservoir, etc.," includes 956,835,491 gallons of repumpage to higher levels at the Mt. Airy, Roxborough and Belmont Auxiliary Stations.

This deducted from the total pumped, gives 77,819,013,610 gallons as the total consumption.

The cost of pumpage is calculated on the total pumpage, and the consumption per capita on the smaller quantity.

	1892. Gallons.	1893. Gallons.	1894. Gallons.	1895 Gallons.
Pumped by water-power........	10,401,951,806	9,911,609,325	10,632,201,689	7,587,193,211
Pumped by steam-power.......	49,385,632,372	55,441,127,653	61,441,519,348	71,188,655,893
Largest quantity pumped in 24 hours............................	199,996,713	222,518,845	234,894,075	258,838,527
Smallest quantity pumped in 24 hours............................	83,599,844	108,970,675	150,048,225	133,916,719

Year.	Average daily Consumption.	Average consumption in gallons per capita per day, estimating the population at*	Increase of	Increase per capita per day.	Cost per 1,000,000 gallons pumped 100 ft. high.
	Gallons.	Gallons.	Gallons.	Gallons.	
1892	160,371,448	140.4	4,017,033,574	....	$2 68
1893	176,895,920	148.6	5,871,060,936	8.2	3 22
1894	195,718,747	158.1	6,870,831,870	9.5	3 48
1895	213.202,777	160.3	6,381,670,823	2.2	3 69

*1892—1,142,650, City Census.
1893—1,190,493, estimated.
1894—1,238,112, estimated.
1895—1,329,957, estimated.

The cost of pumping one million gallons lifted one hundred feet high was $3.69 or 21 cents greater than in the previous year.

Nine per cent. of the total pumpage was by water-power, the turbine wheels using..227,615,796,330 gallons.
To pump... 7,587,193,211 "

The increase in the cost of pumping is accounted for principally by the advance in the average price of coal from $2.22½ per ton in 1894 to $2.42 per ton in 1895, an increase of 19½ cents per ton; also the inability to run the turbine wheels during the drought increased the cost of pumping per hundred million foot gallons at Fairmount, where the running expenses are the same, whatever the quantity of water pumped.

Director's Office.

The regular work of the office, incident to the current business, has been conducted with regularity, and all matters have received prompt attention.

The amount of labor required from the Director's Office continues to increase, requiring the Chief Clerk and his assistants to be at work early and late; and to their willingness thus to labor and the intelligent manner in which they discharge their duties, is ascribed the prompt and efficient despatch of the business of the office.

The following is a comparative statement of the expenditures of the Director's Office during the years 1892, 1893, 1894 and 1895:

Item.		1892.	1893.	1894.	1895.
1	Salaries	$15,920 00	$17,020 96	$17,737 10	$17,790 00
2	Horsekeep	500 00	500 00	500 00	487 50
3	Printing, stationery, etc.	2,099 18	2,676 43	2,578 52	2,499 74
	Total	$18,519 18	$20,197 39	$20,815 62	$20,777 24

Receipts and Expenditures.—The appropriations, expenditures and receipts of the Department for the year 1895, are set forth in the following table in detail by Bureaus; and also in totals for the years 1892, 1893 and 1894:

SUMMARY OF APPROPRIATIONS, EXPENDITURES, RECEIPTS, ETC., OF THE DEPARTMENT OF PUBLIC WORKS, DURING THE YEAR 1895, AND TOTALS FOR THE YEARS 1892, 1893, AND 1894.

Bureaus.	Appropriation for 1895.	Balance available from previous years.	Additional appropriations and transfers.	Total.	Number of Warrants Drawn.	Amount of Warrants Drawn.			Transfers From.	Balance Available 1896.	Total.	Amount merging.	Receipts.	Number of employees December 31, 1895.
						Current Expenses.	Extensions.	Total.						
Director's Office	$21,220 00	...	...	$21,220 00	155	$20,777 24	...	$20,777 24	$442 50	...	$21,219 74	$0 26	...	8
City Ice Boats	34,900 00	$2,161 00	$5,150 00	42,211 00	153	33,597 71	...	33,597 71	5,150 00	$2,161 00	40,908 71	1,302 29	$437 08	9
Gas	2,885,782 74	30,747 43	749,437 03	3,665,967 20	1,342	2,985,513 85	$54,589 59	3,040,103 44	283,858 90	289,040 81	3,613,003 15	52,964 05	3,155,956 47	1,713
Highways	907,700 93	423,431 86	979,120 00	2,310,252 79	3,655	415,861 82	1,006,796 37	1,422,658 19	86,951 96	708,982 96	2,218,593 11	91,659 68	150,513 24	86
Board of Highway Supervisors	* ...	...	...	...	...	...	...	...	...	...	...	...	10,975 90	5
Lighting	445,481 00	...	487 00	445,968 00	284	431,568 25	12,976 81	444,545 06	500 00	...	445,045 06	922 94	126 71	353
Street Cleaning	783,911 75	...	100 00	784,011 75	456	765,790 28	...	765,790 28	13,954 75	...	779,745 03	4,266 72	...	14
Surveys	759,910 00	1,602,810 29	328,275 00	2,690,995 29	4,901	216,404 34	1,610,347 65	1,856,751 99	23,775 00	800,247 86	2,680,774 85	10,220 44	62,585 17	287
District Surveyors	† ...	...	...	...	...	...	...	...	...	...	...	...	151,081 45	13
Water	1,031,804 00	663,479 57	920,793 75	2,616,077 32	2,686	1,509,902 97	387,322 23	1,897,225 20	64,170 40	599,117 15	2,560,512 75	55,564 57	2,829,857 17	1,011
Total, 1895	$6,870,710 42	$2,722,630 15	$2,983,362 78	12,576,703 35	13,632	6,409,416 46	$3,072,032 65	$9,481,449 11	$478,803 51	$2,399,549 78	12,359,802 40	$216,900 95	$6,361,533 19	3,499
Total, 1894	$7,082,435 75	$2,852,016 39	$6,058,613 00	15,993,065 14	17,620	$6,643,435 52	$5,724,838 73	12,368,274 25	$856,084 97	$2,722,630 15	15,946,989 37	$46,075 77	$6,316,922 50	4,152
Total, 1893	$7,778,759 88	$2,306,415 10	$4,902,771 01	14,987,945 99	12,110	$6,068,028 50	$5,394,157 45	11,462,185 95	$594,444 69	$2,852,016 39	14,908,647 03	$79,298 96	$7,004,756 51	3,409
Total, 1892	$7,451,639 93	$1,131,865 28	$1,742,455 81	10,325,961 02	10,373	$5,092,062 43	$2,744,380 78	$7,836,443 21	$124,235 81	$2,306,415 10	10,267,094 12	$58,866 90	$6,725,012 87	2,775

* Included in the appropriation and in the expenditures of the Bureau of Highways.

† Included in the appropriation and in the expenditures of the Bureau of Surveys.

The Department presents the following recommendations:

Gas.—That Councils provide, by legislation, for the extension of the City Gas Works; that appropriations be made for the laying of large mains in order to secure a proper distribution of gas; also to increase the holder capacity of the Ninth Ward Works, Twenty-fifth Ward Works, and the Ninth and Diamond streets and Manayunk Holder Stations; the introduction of improved labor saving machinery, that the cost of manufacturing gas may be reduced to a minimum.

Highways.—That legislation be enacted, requiring all owners of property to have set, six inch granite curbing in front of their property on the line of streets to be paved or repaved under ordinance of Councils; that more liberal appropriations be made to the Department for painting and repairing City bridges.

Street Cleaning.—That legislation be obtained authorizing the Department to make contracts for the cleaning of streets and the collection and disposal of garbage for a longer period than one year.

Surveys.—That early legislation be enacted by Councils to provide for the widening of Delaware avenue, constructing bulkheads, extending City piers, and deepening the channel of the Delaware river; thus enabling the City to lay the foundation for a new and improved harbor. Appropriations should also be made to continue the extension of the main sewer system, and the erection of bridges.

Water.—The requirements of this Bureau are urgent, and appropriations are needed:

For additional pumping engines at Belmont and Roxborough Auxiliary Pumping Stations.

For a new storage yard and coal shed at Spring Garden Station.

For new boilers at Belmont Station.

For coal shed, tunnel and electric light plant at Queen Lane Station.

New reservoirs are needed in West Philadelphia and Frankford. Both of these districts at the present time have only about one and one-half days supply of water; and to meet the demands of the rapidly increasing population in these sections, some immediate action should be taken to provide for the construction of these two reservoirs.

I would urgently recommend that additional large mains be laid in various parts of the City, as, in some sections, our citizens complain of an insufficient water supply, and which can only be remedied by the laying of larger mains.

While the Department was able to furnish a good supply of water during the past year, yet numerous complaints were received both of the quality of the water and its discoloration. The only remedy I can suggest or recommend is filtration and increased reservoir capacity.

The filtration of water is not experimental, and I know of no reason why the water supply of Philadelphia cannot be successfully filtered, and by this means, a better and purer article furnished to our citizens.

Appropriation, 1895.

The following is an abstract from the ordinance making appropriations to this Department for the year 1896, with a statement of the balances available from previous years for work ordered:

Bureaus.	Annual Appropriation for the year 1896.	Balance Available from previous years.	Total.
Director's Office	$21,220 00	.....	$21,220 00
City Ice Boats	32,400 00	$2,161 00	34,561 00
Gas	2,583,788 00	289,040 81	2,872,828 81
Highways	938,198 00	708,982 96	1,647,180 96
Lighting	446,904 00	.....	446,904 00
Street Cleaning	810,138 00	.....	810,138 00
Surveys	807,789 59	800,247 86	1,608,037 45
Water	928,154 00	599,117 15	1,527,271 15
Total	$6,568,591 59	$2,399,549 78	$8,968,141 37

For detailed information in regard to the work done by this Department, to which I have alluded in general terms only, I have the honor to refer you to the reports of the Chiefs of Bureaus, to whom I am indebted for their faithful and efficient services.

In submitting this report, it is my pleasure to express to you my appreciation and gratitude for the valuable counsel and co-operation you have always given me in all matters of public interest in this Department, resulting in the successful consummation of the year's work.

Very respectfully submitted,

THOMAS M. THOMPSON,

Director.

ANNUAL REPORT

OF THE

BUREAU OF WATER

FOR THE YEAR 1895.

OFFICERS

OF THE

BUREAU OF WATER.

Chief,

JOHN C. TRAUTWINE, Jr.

Assistants,

Allen J. Fuller, William Whitby.

Draughtsmen.

John E. Codman, William Farrell, John R. Gorman, Martin Murphy.

Chief Clerk—Job T. Hickman.
Assistant Clerk—James G. Dixon.
Correspondence Clerk—P. DeHaven.
Search Clerk—H. J. Johnson.
Assistant Search Clerk—William J. Duffy.
Clerk—Thomas Spence.
Assistant Clerk—K. McNeal.
Assistant Clerk—J. J. Barney.
Time Clerk—W. J. Innes.
Pipe Inspector—Theodore S. S. Baker.
Pipe Clerk—George G. Whitby.
Messenger—Haines Lewis.

Telephone Operators.

Frances Shields, Calvin Craner.

General Superintendent,

F. L. HAND.

Clerk to General Superintendent—John A. Hayes.
Assistant Clerk to General Superintendent—John B. Wright.

Works—General.

Foreman Machinist—Robert Bromily.

Foreman Carpenter—Henry Guest.

Foreman Bricklayer—Frank A. Mooney.

Foreman Stonemason—Michael Farrell.

Foreman Rigger—James Forrest.

Foreman Painter—Joseph Work.

Foreman Laborer—William Calhoun.

General Storekeeper—S. C. Buchanan.

Electrician—Henry P. Morgan.

Superintendent of Shop—James H. Dean.

Clerk to Superintendent of Shop—Jos. H. Laughlin.

Purveyors.

First District, John H. Holmes.

Clerk, William J. Mackey.

General Foreman, Thomas Preston. *Foreman of Repairs*, W. W. Wellington.

Office, 1120 Wharton street.

Second District, David A. Craig.

Clerk, Charles H. Green.

General Foreman, Michael Young. *Foreman of Repairs*, Edw. Homan.

Office, 918 Cherry street.

Third District, Charles J. Lowry.

Clerk, J. A. Spanagle.

General Foreman, Elias Abrams. *Foreman of Repairs*, William Magee.

Office, Beach and Susquehanna avenue.

Fourth District, John Montgomery.

Clerk, Arthur B. Cook.

General Foremen, George W. Showaker, James Hutchinson.

Foreman of Repairs, John Richards.

Office, Twenty-sixth and Master streets.

Fifth District, Henry Dawson.

Clerk, F. J Cornman, *General Foreman*, Charles Frank.

Office, Lyceum Building, Roxborough.

Sixth District, George H. Laut.

Clerk, William D. Kinsler. *General Foreman*, Samuel Loeb.

Office, Town Hall, Germantown.

ANNUAL REPORT

OF THE

BUREAU OF WATER

For the Year 1895.

Philadelphia, January 20, 1896.

MR. THOMAS M. THOMPSON,
Director of the Department of Public Works.

SIR:—I have the honor to submit, herewith, the Ninety-fourth Annual Report of operations connected with the supply of water to the City. This is the Ninth Annual Report of the Bureau of Water, and the first which it has been my duty to prepare.

General Conditions.

Upon taking charge of the Bureau on June 3d, I found the works generally in fair condition and under conscientious and intelligent management. The numerous cases of insufficient maintenance which I found in evidence appeared to be chargeable to lack of the funds necessary for the execution of proper repairs.

The total reservoir capacity is nominally over 1,400 million gallons, or about six and one-half days' supply; but the new reservoirs at Queen Lane and Roxborough, as well as some of the older and smaller reservoirs, are not yet in condition to carry their entire quota, and the actual total capacity is about 1,000 million gallons, or less than 5 days' supply, while the Belmont Reservoir carries but 2 days' supply for the West Philadelphia district, and that at Wentz Farm carries but one and one-half days' supply for the Frankford district which it serves.

During recent years the pumping machinery has been driven to its utmost, and it has been impossible to give it the advantage of that systematic and thorough repair which it so urgently needs, especially in view of the fact that the pump plungers, valves and diaphragms are subject to excessive wear by reason of the solid matter carried in suspension by the river water.

Visit of Water Committee of Councils.

On June 17th and 18th the annual visit of inspection of the water works was made by the Water Committee of Councils, Mr. J. Emory Byram, Chairman, under your escort.

Upon the first day the committee visited the shop at Twelfth and Reed streets: the yard of the purveyor of the First District, in the immediate vicinity; the works at Fairmount and Spring Garden, and the East Park and other reservoirs supplied from these works; the so-called Frankford Pumping Station, located near Tacony; the Frankford or Wentz Farm Reservoir supplied by it; and the Lehigh Reservoir at Sixth street and Lehigh avenue.

The second day was devoted to the inspection of the main and auxiliary Belmont Stations; the Belmont Reservoir; the Queen Lane Pumping Station and Reservoir; and the Roxborough main and auxiliary stations and reservoirs.

Officers and Employés.

I desire to bear testimony to the fidelity, industry and capacity of my corps of immediate assistants, comprising Messrs. Hickman, Hand, Codman, Fuller, Whitby and Ely, whose terms of service are respectively eighteen, ten, twenty-two, twenty-two, twenty-three and thirteen years. Not the least of the honors which you have conferred upon me by my appointment is that of official association with these gentlemen. I believe their official conduct to be above the influence of partisan or other unworthy considerations, and for my ability to cope with the arduous duties of my new office I am largely indebted to their loyal and efficient support.

So far as I have had opportunity for acquaintance with the other employés of the Bureau, I have found them, as a rule, sober, conscientious, intelligent men. In view of the general subordination of municipal interests to those of so-called "politics" in American cities, I believe that the City of Philadelphia has good reason to congratulate herself upon the personnel of the employés of this Bureau.

Receipts.

The Receiver of Taxes has furnished the following information in regard to the receipts from water rents and other sources properly connected with the work of this Bureau:

Total Reeeipts from the Operations of the Bureau of Water for the Year 1895.

MONTHS.	Searches.	Delinquent Rents.	Delinquent Penalties.	Rents, 1895.	Penalties, 1895.	Fractional Rents.	Water Pipe.	Miscellaneous. See Appendix A.	Totals.
January	$435 00	$4,041 25	$585 49	....	....	$23,668 85	$8,591 77	$4,350 82	$41,676 18
February	414 75	2 592 50	383 04	$208,022 77	....	10,127 39	7,827 81	244 17	229,612 46
March	530 25	890 50	132 24	223,501 76	....	10,555 05	5,630 70	137 12	241,377 62
April	512 00	1,948 00	212 71	365,534 26	....	23,613 44	11,508 12	464 02	403,822 55
May	547 50	2,394 00	347 29	1,187,506 03	....	14,772 29	11,791 05	970 06	1,218,328 22
June	482 00	2,056 50	267 38	66,239 55	$2,891 83	7,081 92	13,737 14	285 79	93,042 11
July	435 75	3,514 00	521 89	35,557 30	1,742 83	25,713 04	17,218 81	2,304 56	87,008 18
August	358 75	490 00	72 31	89,913 50	4,491 38	7,507 39	12,359 73	45 93	115,288 99
September	395 75	387 50	58 13	40,794 08	5,988 41	3,992 61	15,604 94	197 52	67,418 94
October	485 75	9,093 00	1,363 96	85,494 05	12,766 61	28,648 95	18,749 89	283 40	156,885 61
November	499 50	405 50	60 83	29,433 00	4,405 88	5,998 39	18,981 49	124 68	59,904 27
December	442 25	1,108 00	166 22	35,061 30	5,211 62	5,009 55	19,280 66	2,268 37	68,547 97
Totals	$5,539 25	$28,920 75	$4,171 49	$2,367,057 60	$37,498 56	$166,713 87	$161,285 14	$11,676 44	$2,782,863 10
Receipts through the office of the City Solicitor, 1895									46,994 07
Total receipts, 1895									$2,829,857 17
Receipts as previously estimated									$2,600,000 00
Unpaid claims sent to Law Department for collection									$62,467 31

Fractional Rents, 1895.

MONTHS.	Rents.	Ferrules.	Repairs.	Meters.	TOTALS.
January	$2,170 25	$332 00	$255 00	$20,911 60	$23,668 85
February	3,052 30	201 00	191 00	6,683 09	10,127 39
March	5,626 89	1,983 00	623 00	2,322 16	10,555 05
April	7,108 93	919 00	42 00	15,573 51	23,643 44
May	7,269 48	596 00	......	6,906 81	14,772 29
June	4,350 05	571 00	......	2,160 87	7,081 92
July	4,182 45	460 00	......	21,120 59	25,713 04
August	2,879 30	280 00	......	4,348 09	7,507 39
September	3,183 80	386 00	......	422 81	3,992 61
October	3,759 05	932 00	......	23,957 90	28,648 95
November	2,195 17	566 00	......	3,232 22	5,993 39
December	2,885 25	184 00	......	1,940 30	5,009 55
Totals	$48,612 92	$7,410 00	$1,111 00	$109,579 95	$166,713 87
Totals for 1894	$48,370 14	$39,783 00	$3,285 00	$99,015 68	$190,045 87
Increase	$242 78	......	......	$10,564 27	
Decrease	......	$32,373 00	$2,174 00	......	$23,739 95

Revenue for Ten Years—1886 to 1895, inclusive.

Years.	Delinquent Water Rents.	Delinquent Penalties.	Water Rents.	Penalties.	Fractional Rents.	Water Pipe.	Searches.	Chief's Office.	City Solicitor's Office.	Totals.
1886	$15,049 50	$1,964 42	$1,637,293 69	$21,377 89	$97,219 62	$122,743 91	$2,960 00	$10,121 36	$24,594 95	$1,933,328 34
1887	19,040 87	2,705 79	1,721,488 83	24,453 03	115,939 21	106,602 48	3,412 75	7,287 61	29,504 04	2,030,434 61
1888	13,995 04	1,948 54	1,793,432 38	23,584 86	113,550 16	123,667 85	4,158 25	7,742 45	22,846 97	2,104,926 50
1889	23,407 23	3,332 78	1,848,542 49	24,247 95	143,394 73	149,611 63	5,056 25	11,363 70	33,043 09	2,241,999 85
1890	25,472 39	3,622 69	1,958,551 95	26,270 94	171,901 15	141,884 27	5,235 75	9,730 83	38,367 73	2,381,037 70
1891	25,183 85	3,495 00	2,057,417 39	29,672 21	200,868 36	138,180 98	5,046 75	6,503 70	34,394 49	2,500,762 73
1892	15,422 75	2,092 71	2,147,447 98	27,136 90	214,678 24	152,916 45	5,718 50	10,274 24	58,768 25	2,634,456 02
1893	13,745 58	1,874 79	2,220,083 24	30,981 84	237,125 48	114,531 78	5,830 25	5,836 84	44,265 44	2,674,275 24
1894	25,103 40	3,605 23	2,300,158 59	31,993 99	190,453 82	152,163 31	5,571 75	8,917 46	41,663 04	2,759,630 59
1895	28,920 75	4,171 49	2,367,057 60	37,498 56	166,713 87	161,285 14	5,539 25	11,676 44	46,994 07	2,829,857 17
Totals	$205,341 36	$28,813 44	$20,051,477 14	$277,218 17	$1,651,844 64	$1,363,587 80	$48,529 50	$89,454 63	$374,442 07	....

Comparative Statement.

1894	$25,103 40	$3,605 23	$2,300,158 59	$31,993 99	$190,453 82	$152,163 31	$5,571 75	$8,917 46	$41,663 04	$2,759,630 59
1895	28,920 75	4,171 49	2,367,057 60	37,498 56	166,713 87	161,285 14	5,539 25	11,676 44	49,994 07	2,829,857 17
Increase	$3,817 35	$566 26	$66,899 01	$5,504 57	....	$9,121 83	....	$2,758 98	$5,331 03	$70,226 58
Decrease	....	....	....	....	$23,739 95	....	$82 50	....	....	....

Appropriations and Expenditures.

Appropriated December 28, 1894.		Amount appropria'd.	Amount expended.	Amount merging.	Amount not merging
Item 1. Salaries:					
Office, Chief of Bureau	$114,304 00				
Fairmount Pumping Station	14,310 00				
Spring Garden Pumping Station	79,300 00				
Belmont Pumping Station	21,150 00				
Belmont Auxiliary Pumping Station	3,400 00				
Queen Lane Pumping Station	16,050 00				
Roxborough Pumping Station	18,620 00				
Roxborough Auxiliary Pumping Station	3,400 00				
Mt. Airy Pumping Station	3,070 00				
Chest't Hill Pumping Station	1,500 00				
Frankford Pumping Station	16.700 00				
	$291,804 00				
Transferred from	25,000 00	$266,804 00	$265,864 70	$939 30	
Item 2. General supplies, including fuel, oil and small stores	$150,000 00				
Increased by transfer	225,000 00	375,000 00	351,482 87	23,517 13	
Item 3. Repairs to machinery, including the conveyance of workmen incident thereto	$60,000 00				
Increased by transfer	40,000 00	100,000 00	98,053 85	1,021 02	$925 1
Item 4. Maintenance and improvement to buildings, grounds and reservoirs	$75,000 00				
Increased by transfer	62,000 00	137,000 00	136,271 07	728 93	
Item 5. Repairs and improvement of the distribution, including the purchase of material in connection therewith, and expenses incident thereto	$100,000 00				
Increased by transfer	72,000 00	172,000 00	161,995 25	10,004 75	
Item 6. Supplies, Including fuel and labor at the City Construction and Repair Shop	$75,000 00				
Increased by transfer	11.300 00	86,300 00	83,849 81	2,450 19	

Appropriations and Expenditures.

Appropriated December 28, 1894.	Amount appropria'd	Amount expended.	Amount merging.	Amount not merging
Item 7. General, incidental and contingent expenses, including keep of horse for Chief of Bureau, General Superintendent and Ass't, each $400 $15,000 00 Increased by transfer 1,000 00	$16,000 00	$15,952 79	$47 21	
Item 8. For the purchase of material and cost of labor in connection with the laying of service pipe and expenses incident thereto, $225,000 00 Increased by transfer 157,032 26	382,032 26	364,475 07	13,557 19	$4,000 00
Item 9. Service pipe...... $40,000 00 Transferred from....... 4,772 64	35,227 36	31,957 56	3,269 80	
Total for current expenses.....	$1,570,363 62	$1,509,902 97	$55,535 52	$4,925 13
Item 10. Extensions, balance January 1, 1895..............................	$540,747 80	$266,905 89	$29 05	$273,812 86
Item 10½. Repairing and improving reservoirs, appropriation June 19, 1895.................. $250,000 00 Transferred from...... 34,397 76	215,602 24	59,432 75	....	156,169 49
Item 11. Construction and completion of Queen Lane Reservoir, balance January 1, 1895............	122,731 77	....	....	122,731 77
Item 11½. New water mains, appropriation June 18, 1895..............	100,000 00	60,983 59	....	39,016 41
Total for extensions.............	$979,081 81	$387,322 23	$29 05	$591,730 53
Item 12. Refunding Jos. J. Martin for excavating and refilling trench for water main, appropriation Dec. 23, 1895...............	1,688 85	....	....	1,688 85
Item 12½. Refunding certain overpaid and paid-in-error water bills, appropriation December 23, 1995..................................	772 64	....	....	772 64
	$2,461 49	....	....	$2,461 49

Summary.

Appropriations. Current expenses............$1,570,363 62 Extensions..................... 315,602 24 Refunds.......................... 2,461 49 Available bal. from 1894.. 663.479 57	$2,551,906 92			
Expenditures. Current expenses............$1,509,902 97 For extensions.............. 387,322 23	....	$1,897,225 20		
Amount merging.......................	....	....	$55,564 57	
Amount not merging.................	....	....	....	$599,117 15

The following table shows the receipts from the operations of this Bureau during several recent years, together with the estimates of requirements, the amounts rendered available by appropriations, etc., and the amounts expended. I am unable to find records of the estimates for the years 1892 and 1893:

Year	Receipts.	Estimates.	Available Appropriations, etc.	Expended.
1890	$2,381,037 70	$1,658,653 00	$1,371,028 11	$933,364 29
1891	2,500,762 73	2,000,000 00	1,880,683 48	1,530,294 04
1892	2,634,456 02	....	2,476,628 37	1,372,457 31
1893	2,674,275 24	....	3,813,973 92	2,593,390 81
1894	2,759,630 59	4,230,564 00	3,888,326 05	2,912,856 04
1895	2,829,857 17	4,335,366 00	2 616,077 32	1,897,225 20
1896	....	4,385,604 00		

Appropriations for 1896 .... $928,154 00
Balances from 1895 .... 599,117 15

Requirements and Appropriations.

The following table makes comparison between the requirements of this Bureau for the year 1896 and the amounts appropriated:

Statement showing the Estimates of the Bureau for the year 1896 and the amounts appropriated by City Councils.

Item.		Estimates.	Appropriations.
1	Salaries	$313,454	$302,154
2	General supplies	325,000	150,000
3	Repairs to machinery	80,000	50,000
4	Repairs to buildings, grounds, and reservoirs	100,000	50,000
5	Repairs to distribution	200,000	100,000
6	Material and labor at City shop	90,000	50,000
7	General, incidental, and contingent expenses	17.000	15,000
8	Service mains	300,000	200,000
9	Service pipes and meters	100,000	10,000
9½	Emergencies	25,000	
10	Extensions and improvements		

Pumping Stations.

FAIRMOUNT:		
Alterations in forebay and entrance channel	$15,000	
Repairs to dam	10,000	
		$25,000
SPRING GARDEN:		
Filling in forebay		25,000
BELMONT AUXILIARY:		
New 3-million gallon pump		10,000
ROXBOROUGH AUXILIARY:		
New 5-million gallon pump		15,000
FRANKFORD:		
New 15-million gallon pump		$60,000

Reservoirs.

Belmont: New basin		$200,000
Wentz Farm: New basin		300,000
ROXBOROUGH:		
Relining old reservoir,	$25,000	
Repairs to reservoirs	100,000	
		125,000
Filter plants		250,000
Meter testing plant		6,000
Pumping Stations, Reservoirs, etc		$1,016,000

Pumping and Supply Mains.

1.	20-inch Supply Main, Germantown avenue, from Allen's lane to Abington, and from Hartwell avenue to Spring House pike	30,000
2.	30-inch Supply Main, Cumberland street, from Twenty-ninth to Twenty-second streets	25,000
	and in Twenty-second street, from Cumberland to Norris street	32,000
3.	48-inch Supply Main, from Thirty-second street and Nicetown lane to Germantown avenue and Nicetown lane	120,000
4.	36-inch Pumping Main, from Roxborough Works to Ann street and Shawmont avenue	38,000
5.	20-inch Supply Main, Glenwood avenue, from Sixth to Ontario street, and Ontario street, from Glenwood avenue to Front street	14,000
6.	20-inch Supply Main, Front street, from Lehigh avenue to Tioga street	17,500
7.	20-inch Supply Main, Dauphin street, from Seventeenth to Glenwood avenue	10,000
8.	20-inch Supply Main, Nineteenth street, from Poplar to Jefferson street	8,000
9.	30-inch Supply Main, Jefferson street, from Ninth to Front street	33,000
10.	20-inch Supply Main, Twenty-second, from Federal street to Snyder avenue	17,400
11.	48-inch Supply Main, from Thirty-second and Nicetown lane to Broad and Dauphin streets	113,000
12.	36-inch Supply Main, Seventeenth street, from Dauphin to Jefferson street	41,000

13.	20-inch Supply Main, from Sixty-third street and Lansdowne avenue to Overbrook	21,500
14.	48-inch Pumping Main, from Queen Lane Works to Queen Lane Reservoir	88,000
15.	48-inch Supply Main, from East Park Reservoir, to supply between Vine and South streets and the Delaware and Schuylkill rivers	345,000
16.	30-inch Supply Main, from Broad and South streets to Broad street and Washington avenue	18,000
17.	36-inch Supply Main, from Fairmount Reservoir to Broad and South streets	154,000
18.	20-inch Supply Main, Frankford and Foulkrod streets to Bridesburg	40,000
19.	16-inch Supply Main, Allegheny avenue, from Kensington avenue to Richmond street	17,000
20.	20-inch Supply Main, Richmond street, from Wheatsheaf lane to Bridge street	22,000
21.	20-inch Supply Main, Richmond street, from Allegheny avenue to Tioga	8,750
22.	12-inch Supply Main, Parker avenue, from south of Ridge avenue to Washington street	6,000
23.	30-inch Supply Main, from George's Hill Reservoir to Thirty-eighth street and Lancaster avenue	150,000
24.	48-inch Supply Main, from Wentz Farm Reservoir to Front street and Lehigh avenue	450,000
		$2,835,150

Item 10. Purchase of Telephones $1,000

It may be well to note in detail, and in the order above given, a few of the most important items of extension and improvement for which appropriations were asked.

The forebay at Fairmount, and the entrance to it from the river, have long been eye-sores by reason of shoaling due to deposits of mud. These deposits are occasioned by the reduction of the velocity of the water in the angles formed in the entrance, and by the decreased demand in the forebay as the water passes through it. It is proposed to obviate this difficulty by building walls which will cut off the angles in the entrances and effect a gradual reduction of the cross section in the forebay to correspond with the progressive lessening of the demand from the turbine wheels.

I have elsewhere expatiated upon the importance of Fairmount dam as a factor in our supply. The small amount of $10,000, asked for this purpose, might suffice for such repairs as are immediately called for.

At Spring Garden the forebay is in much the same condition as at Fairmount, and it is proposed to convert it into a conduit, and fill over the space now occupied by it.

At the Belmont and Roxborough auxiliary stations, as stated in the report of the General Superintendent, it is very important that additional pumps should be provided as reserve in case of accident and to admit of repairs.

At Frankford a new pump will be needed if the reservoir required for this district is constructed.

Upon the occasion of the visit of the Water Committee of Councils to the Works, in June last, the necessity for a new basin in West Philadelphia was pointed out. The present basin holds barely a two days' supply, and such observations as the exigencies of the case have permitted indicate that it is leaking freely.

For similar reasons a new basin is needed as auxiliary to that at Wentz Farm for the supply of the Frankford district. The present basin at this point holds but one and one-half days' supply and is in a dilapidated condition and urgently in need of repairs.

To make such repairs in either case before a new basin is provided would involve the necessity of supplying the district by direct pumpage.

The amounts asked for re-lining the old reservoir at Roxborough, and for repairs to other reservoirs, are urgently needed.

I have elsewhere discussed the importance of inaugurating at once a series of adequate experiments upon filtration; and the City has just received, in the shape of a visitation of water polluted by coal dust from the anthracite regions, a striking object lesson upon this subject.

As pointed ont in the accompanying report upon the distribution system, our present facilities for the testing of meters are quite inadequate, and, in view of the necessity for an increase in the application of meters, an improvement of these facilities is a very pressing need.

The amount of nearly $2,000,000, for the extension of our pumping and supply mains, is needed in order to enable us to improve the supply and the pressure in districts where these are now inadequate and to keep pace with the growing demand. A few of our more urgent requirements are specified in the report of Mr. Fuller, Appendix D.

In addition to the amounts above mentioned as required for our operations during 1896, the following were asked for in July last for immediate requirements which should have been met during the year 1895.

IMMEDIATE REQUIREMENTS.

Pumping Stations.

Fairmount:		
Colonnade over roof of western pump-house and repairs to roof...		$20,000
Spring Garden:		
New storage yard	$20,000	
New coal shed	15,000	
		35,000
Belmont:		
Extension of engine house	$8,000	
Extension of boiler house	5,000	
Five new boilers	25,000	
New stack	7,000	
		45,000
Belmont Auxiliary:		
Coal shed or oil plant		2,000
Queen Lane Station:		
Coal shed and tunnel	$35,000	
Electric light plant	4,000	
		39,000
Roxborough Auxiliary:		
Coal shed or oil plant		2,000
		$143,000

Pumping Mains.

Lowering Frankford main to correspond with revised street grade	12,000
	$155,000

The General Superintendent in his report has called attention to the dilapidated condition of the roof on the upper or western wheel-house at Fairmount, and the attention of the Water Committee was called to this matter on the occasion of its annual visit in June last. It is proposed to reconstruct this roof and to cover it with a colonnade as a means of protection. In the meantime, the costly pumping machinery below continues to suffer severely from the rain which penetrates the roof.

At Spring Garden Station, our coal-storage capacity is now quite inadequate to the supply of the increased pumping plant, and it is impossible to provide any adequate reserve of fuel in anticipation of a coal famine, arising from strikes or from other causes.

At Belmont Pumping Station the No. 4 Worthington Engine, transferred from the Spring Garden Station, is at present housed in a rude covering of boards. It was your earnest wish that it might be properly protected by a house of its own before the end of the year, and plans and specifications for this purpose were accordingly prepared. New boilers are also immediately required at this station, in order to permit of the repair of those now in use and to provide an adequate supply of steam for the increased pumping plant.

The auxiliary stations at Belmont and Roxborough, and the large new pumping station at Queen lane, are, as yet, without any proper appliances for the storage of fuel, and an electric light plant is needed at the latter station.

The amount asked for these urgent necessities, like those asked for extensions during 1896, has not been granted.

Most of my assistants are greatly underpaid, and in my estimate for the expenses of the Bureau for 1896 I included the very small sums necessary to make provision for certain increases in their salaries ; limiting my requirements, in view of the unfavorable condition of the City Treasury, to those cases where the discrepancy between desert and recompense appeared most glaring.

Greatly to my regret, Councils have found it inexpedient to comply with these suggestions.

The table comparing the receipts from the operations of the Water Bureau with the appropriations granted it by Councils, appears, at first sight, to show a large gain from these sources, but it ought not to be necessary to point out that such a conclusion would be very misleading. Neglect to appropriate sufficient moneys to maintain the plant and to carry out much needed extensions can be only disastrous from an economical standpoint.

Col. William Ludlow, then Chief Engineer of the Water Department, in a communication to the Chairman of the Water Committee under date of January 9, 1886, in commenting upon the fact that the accounts of the Department for the thirty years preceding appeared to show a net profit of nearly $9,750,000, remarks:

"As a matter of fact, the diversion of this large sum has been no real profit whatsoever, but, on the contrary, has involved loss. It was obtained by starving the Department, robbing it of its earnings, and refusing to return them in sufficient amount to keep body and soul together. Instead of being a wholesome and vigorous stimulant to growth, the water service has been a clog and a nuisance, always behind the daily need, never ready to meet it, depressing and endangering property, imperiling health, hampering development, restricting manufactures, and dulling local enterprise. Judicious and timely expenditures by the City for the needful enlargement and extension of the water service are a municipal obligation of the highest order, and to stint or withhold them is not to save but to lose money. The profits should have been looked for in the promotion of prosperity, the development of industries, the increase of values and the accumulation of wealth. It is doubtful, even if the surplus revenue of the Department had been properly applied, whether the needs of to-day could have been adequately met; but it is perfectly safe to say that the City has lost in the last thirty years, from the deficiencies and unsatisfactoriness of her water supply, far more than the $325,000 a year she took from it, and, after all, she now finds herself confronted with the absolute necessity of restoring the misapplied millions, and, having spent them, does not in the least know how they are to be obtained."

The following tables exhibit a comparison between our conditions and operations for the years 1894 and 1895:

Rainfall and Stream Flow, 1894–1895.

Watershed.	Rainfall 1894.	Rainfall 1895.	Total annual stream flow 1894 gallons.	Total annual stream flow 1895 gallons.	Decrease Gallons.
Schuylkill river........	51.76	35.78	638,858,680,237	368,306,402,874	270,552,277,363
Perkiomen creek......	50.40	38.68	8,483,914,320	5,545,198,900	2,938,745,420
Neshaminy creek.....	53.00	36.29	8,381,171,520	5,238,482,482	3,142,689,038
Tohickon creek........	53.05	38.35	7,379,622,720	4,411,810,176	2,967,812,544

Annual Pumpage, 1894–1895.

	1894.	1895.	Increase.
From Schuylkill...............	67,158,206,339	73,106,159,093	5,947,952,754
From Delaware................	4,279,136,549	4,712,854,517	433,717,968
Total	71,437,342,888	77,819,013,610	6,381,670,722
Auxiliary.........................	636,381,450	956,835,494	20,454,044
Total annual pumpage......	72,073,724,338	78,775,849,104	6,702,124,766

DAILY PUMPAGE.

Table showing the Nominal, Maximum, Minimum, and Average Daily Pumpage for 1894 and 1895.

Name of Station.	Nominal.		Maximum.		Minimum.		Average.	
	1894	1895	1894	1895	1894	1895	1894	1895
Fairmount	33,290,000	33,290,000	41,674,914	48,407,523	604,371	434,960	29,207,895	20,786,830
Spring Garden	170,000,000	170,000,000	141,645,670	175,530,140	78,976,030	48,847,790	120,401,528	138,915,593
Belmont	18,000,000	38,000,000	22,620,780	31,756,020	11,258,422	11,528,125	19,648,370	23,116,379
Queen Lane	....	80,000,000	....	....	....	....	....	....
Roxborough	24,500,000	24,500,000	21,184,890	22,839,930	2,907,660	6,948,240	14,503,059	17,029,941
Total from Schuylkill	245,790,000	345,790,000	227,126,284	278,533,613	93,746,483	....	183,760,852	199,848,743
Increase	....	100,000,000	....	51,407,365	....	....	....	16,087,891
Frankford	20,000,000	35,000,000	15,439,746	18,493,575	4,167,615	3,244,220	11,721,177	12,911,930
Total from Delaware	20,000,000	35,000,000	15,439,746	18,493,575	4,167,615	3,244,220	11,721,177	12,911,930
Increase	....	15,000,000	....	3,053,829	....	....	....	1,190,753
Total from Schuylkill and Delaware	265,790,000	380,790,000	244,566,030	297,027,188	97,914,098	70,893,335	195,482,029	212,760,673
Increase	....	15,000,000	....	52,461,158	....	....	....	17,278,644

Nominal, Maximum, Minimum, and Average Daily Pumpage for 1894 and 1895—Continued.

Name of Station.	Nominal.		Maximum.		Minimum.		Average.	
	1894	1895	1894	1895	1894	1895	1894	1895
Belmont Auxiliary	....	2,500,000	....	499,290	....	48,060	....	160,319
Roxborough Auxiliary	....	5,000,000	86,910	2,769,920	43,200	50,400	27,081	865,322
Mt. Airy Auxiliary	3,000,000	3,000,000	2,355,000	2,175,000	1,143,750	1,057,500	1,717,104	1,595,825
Chestnut Hill Auxiliary	750,000	750,000	619,920	757,680	59,040	29,520	118,772	82,824
Total Auxiliary	3,750,000	11,250,000	3,061,860	6,201,890	1,245,990	1,185,480	1,862,960	2,704,290
Increase	....	7,500,000	....	3,140,030	....	....	....	841,330
Total daily	277,040,000	392,040,000	245,627,890	303,229,078	99,160,088	72,168,815	197,344,806	215,824,244
Increase	....	115,000,000	....	57,601,188	....	....	....	18,479,438

Total Contents of Reservoirs in Millions of Gallons, 1894–1895.

	1894.		1895.		Increase.	Decrease.
Nominal	Dec. 31...	1,418	Dec. 31...	1,418		
Maximum......................	Dec. 27...	995	Dec. 31...	980	....	15
Minimum......................	Sept. 2...	219	Aug. 31...	608	318	
Average........................	....	656	....	822	166	

DISTRIBUTION.

1894–1895.

Mains.

		1894.	1895.	Increase.	Decrease.
NEW WORK.	Service mains, 3 to 16 inch.....................	203,127	169,534	....	33,593
	Supply mains, 12 to 48 inch....................	32,552	9,022	....	23,530
	Pumping mains, 20 to 48 inch...............	14,419	4,792	....	9,627
	Connections and miscellaneous work.....	33,471	25,947	....	7,524
	Totals in feet.................................	283,569	209,295		74,274
REPAIRS.	Relaid, 4 to 36 inch...........	89,558	31,063	....	58,495
	Miscellaneous repairs, 4 to 48 inch.........	17,957	8,706	....	9,251
	Taken up, 2 to 36 inch..........................	62,371	23,959	....	38,412
	Lowered, raised, shifted, 4 to 30 inch.. ..	3,490	7,779	4,289	....
	Totals in feet.................................	173,376	71,507	4,289	106,158
Pipe cut off and abandoned, 3 to 16 inch........		33,432	10,091	....	23,341

Pipe laid by property owners under ordinance of Councils dated June 19, 1890:

	1894.	1895.	Increase.	Decrease.
6-inch pipe	8,608	12,550	3,942	
8-inch pipe	....	2,169	2,169	
Totals in feet	8,608	14,719	6,111	

Work performed in connection with construction of electric railways:

	1894.	1895.	Increase.	Decrease.
Pipe laid	99,742	17,503	....	82,239
Fire hydrants	964	119	....	845
Service connections	5,929	1,649	....	3,280

Meters.

	1894.	1895.	Increase.	Decrease.
Meters in use	1,195	1,253	58	

Number of dwellings and of principal appliances for the use of City water:

	1894.	1895.	Increase.	Decrease.
Dwellings with water	198,609	205,213	6,604	
Dwellings without water	12,742	12,579	....	163
Water closets	135,513	155,199	19,686	
Baths	134,267	138,650	4,383	
Wash paves	73,777	77,552	3,775	
Basins and sinks	71,632	74,497	2,865	
Urinals	4,491	4,564	73	

The following table shows the number of gallons pumped by water and by steam, the total pumpage, and the average daily pumpage for each month in the year 1895, and for the whole year:

Monthly Record of Pumpage During 1895.

Month.	Water Power. Gallons.	Steam Power. Gallons.	Totals. Gallons.	Average Per Day. Gallons.
January	1,157,966,088	4,889,651,217	6,047,617,305	195,084,429
February	934,861,556	5,076,524,678	6,011,386,234	214,692,365
March	1,147,356,795	5,257,187,628	6,404,544,423	206,598,207
April	1,159,346,863	4,817,672,834	5,977,019,697	199,233,989
May	1,218,441,270	5,217,864,241	6,436,305,511	207,622,758
June	635,784,008	6,056,138,689	6,691,922,697	223,064,089
July	377,350,379	6,529,032,149	6,906,382,528	222,786,533
August	82,201,595	6,981,281,098	7,063,482,693	227,887,972
September	14,048,068	7,043,053,816	7,057,101,884	235,236,729
October	107,991,968	6,883,313,233	6,991,305,201	225,525,974
November	249,180,903	6,454,092,605	6,703,273,508	223,442,450
December	502,663,718	5,982,843,705	6,485,507,423	209,209,917
Totals	7,587,193,211	71,188,655,893	78,775,849,104	215,824,244

The following table shows the pumpage, the cost per hundred million foot-gallons, the number of gallons pumped per capita per day, and the population, for each of the ten years from 1886 to 1895 inclusive:

Volume and Cost of Pumpage, etc., for the Years 1886 to 1895 Inclusive.

Year.	Number of Gallons Pumped to Reservoir.	Number of Gallons Pumped 100 Feet High.	Cost per Million Gallons Pumped 100 Feet High.	Gallons Pumped per Capita per Day.	Estimated Population.
1886.	28,658,966,569	46,255,361.203	4.13	80	975,000
1887.	32,426,779,765	51,289,948,331	3.99	89	995,000
1888.	37,068,763,428	59,483,831,199	4.49	100	1,020,000
1889.	42,518,919,781	69,031,118,434	3.87	110	1,050,000
1890.	51,698,508,699	84,501,451,686	3.05	131	*1,046.000
1891.	55,665,648,000	93,490,106,725	2.99	140	1,071.672
1892.	59,787,584,178	102,413,373,631	2.68	143	†1,142,650
1893.	65,352,736,978	110,590,708,479	3.22	150	1,190,493
1894.	72,073,724,238	121,199,588,387	3.48	159	1,238,112
1895.	78,775,849,104	132,040,954,195	3.69	162	1,329.957

*United States Census. †City Census.

My predecessor's reports have contained tables of the pumpage at the Fairmount Station. Corresponding tables will be found in the report of the General Superintendent, herewith, Appendix C.

Drought.

The most conspicuous feature of the operations of the Bureau for the year 1895 is the very exceptional drought. Such a drought operates doubly to increase the difficulty of maintaining the supply: first, by diminishing the quantity of water furnished by the rivers; and, second, by increasing the demand for water for such purposes as lawn sprinkling, etc.

For the first time, so far as our records show, the water in the Delaware river became brackish within the City limits. Articles appeared in the newspapers stating that marine crabs had been found in the river off the City wharves, but no difficulty was experienced in this respect at our pumping station, near Tacony.

From the report of Mr. John E. Codman, on the work of the hydrographic corps, embracing the valleys of the Schuylkill, Lehigh, Delaware below Easton, Perkiomen, Tohickon, and Neshaminy, it appears that the rainfall and stream-flow throughout the district covered are far less than any previously observed during the period since the work was inaugurated, in 1883.

Not only is the total rainfall in this district for the calendar year, 1895, unprecedentedly low, being from thirteen to fifteen inches less than the average for all the previous years, and about two inches lower than the lowest previously observed; but each month's precipitation is lower than that of the corresponding month in the earlier years.

The falling off in the average daily flow per square mile for the Perkiomen, Neshaminy and Tohickon is illustrated by the following table:

Average Daily Flow in Gallons per Square Mile of Watershed.

	1883–1894, Inclusive.	May to November, 1895.	September, 1895.
Perkiomen	1,170,000	250,000	98,000
Neshaminy	1,140,000	243,000	30,000
Tohickon	1,420,000	197,000	31,000

Unfortunately, reliable statistics of the flow of the Schuylkill during past years are not at my command.

From such data as we have, Mr. Codman roughly estimates the average daily flow of the Schuylkill at Fairmount, for the entire year, at about one billion gallons; but Mr. Edwin F. Smith, Superintendent and Engineer of the Schuylkill Navigation Company, from careful weir measurements at Pawling's Dam, the first below Phœnixville, the second above Norristown, and about a mile below the mouth of the Perkiomen, estimates the daily flow at Fairmount, from October 8th to 31st, at only 191,649,021 gallons. This is probably but little greater than the minimum flow.

Mr. Smith writes me:

"I am satisfied that the river, during the late summer "and early fall of 1895, reached a lower point than has "ever been known. The drought of 1869 was not nearly "so severe. There was a *very short* period in 1874 when "it was down to about 225,000,000, but my computations "for the whole drought give a flow in that year of "245,000,000 gallons. The low-water season of 1881 was "the nearest approach we have had, prior to 1895, to the "minimum flow. In that year, for a considerable period "—say three weeks—the flow may have been as low as "210,000,000 or 215,000,000 gallons. We must bear in "mind, however, that these figures do not represent the "yield or run-off of the watershed. There is so much "abstracted from the river by the cities, towns and man-"ufacturing establishments between Philadelphia and "Pottsville, that it is almost impossible to arrive at a "correct figure for the run-off. Our measurements at "Pawling's Dam simply show what is flowing in the "river after a certain quantity has been abstracted at "points farther up stream. Below Pawling's there should "be subtracted from the figures I have given you about "5,000,000 gallons a day for Norristown, and 3,000,000 "gallons a day for Conshohocken, including the pumping "stations and the manufacturing industries of those towns.

"For the whole valley the quantity abstracted daily, "excluding Philadelphia, is about 25,000,000 gallons "and is constantly increasing.

"A few years ago, in 1889, I made up some statistics "from the reports of the Philadelphia Water Department, "of the total quantity of water pumped from the river by "the various stations, Roxborough, Belmont, Spring Gar-"den and Fairmount, using only the figures of water "actually pumped into the reservoirs. I plotted this on "a diagram, the curve of which showed me that the City "of Philadelphia would probably reach, in its pumpage, "the minimum daily flow in 1893. If there had been a "drought in 1893, the same as we had last year, I think "it would have been found that the limit in pumping "had been reached. We know to a certainty that there "was not enough water in the river last year to supply "*all* the wants of the City, and that if the new Queen "Lane pumping station had been in operation it would "have been impracticable to have used it during the "summer months without shutting down to a correspond-"ing extent at one of the other stations. The natural "conclusion is that the City is dependent upon a source "of supply which, *as used at present*, cannot be depended "upon to meet all its wants during a season of drought."

Thanks to the two large engines put in operation at the Spring Garden works under the auspices of my immediate predecessor, Mr. John L. Ogden, the exceptionally dry summer of 1895 was passed without the necessity of proclaiming a water famine, although, during July and August, the demand exceeded the supply by about 6 million gallons daily, although the daily pumpage exceeded the minimum daily flow. Upon the completion of the four large engines designed under Mr. Ogden's administration, and now being placed at the Queen Lane Station, the City will, during next summer at least, have a capacity for pumpage from the Schuylkill sufficient to cope with any probable demand, *provided the flow of the stream is sufficient*, to permit the making of minor repairs and to avoid risk of a water famine in the event of accident to any one of the pumps; but the capacity, as thus increased, provides none too large a margin above the demands of the consumption.

These recent additions to our pumpage capacity appear clearly on the first of the three diagrams accompanying Mr. Fuller's report herewith, Appendix D; but it must be borne in mind that while the total pumpage is thus rendered sufficient for the present total demand, there are certain points where additions are still required, as at our auxiliary stations, where, as already remarked, reserve engines should immediately be placed.

Consumption and Waste.

I call your particular attention to the increase in the consumption of water, as illustrated by Mr. Fuller's diagrams.

On the first of these diagrams are curves representing the maximum, the minimum and the average daily consumption of water, the total daily pumpage capacity, the population, the daily consumption per capita, the number of buildings and the number of appliances in use in each year from 1874 to 1895 inclusive.

In the second diagram the curve of average daily consumption is extended beyond the year 1895 in order to indicate the probable consumption in years to come unless effective means are adopted for checking the present prodigal waste of water. On the same diagram are marked a number of points representing certain estimates of the future demand, and indicating how easy it is to under-estimate that demand.

In 1886 Col. Ludlow estimated that in 1920 the City would require an average daily supply of not less than 215,000,000 or 220,000,000 gallons. It will be seen that, judging from the figures, we have already passed this mark in 1895, or twenty-five years before the date assigned. He estimated, also, that by 1940, when the population would have reached nearly three million, our daily supply would require say 400,000,000 gallons, whereas the diagram indicates that if the present rates of increase are maintained we may expect, by that time, a population of 2,200,000, and an average daily consumption of 860,000,000 gallons.

In 1879 Mr. Charles G. Darrach, then Assistant Engineer in the Water Department, in a paper read before the Engineers' Club of Philadelphia, estimated that in seventy-one years, *i. e.*, in 1950, the City would be consuming 150,000,000 gallons daily. This limit was exceeded in 1891, or twenty years after the publication of the estimate.

These instances serve to illustrate the perils of prophecy, and especially those of conservative prophecy, when applied to the unmetred water supply of cities.

In his report for 1862, Mr. Isaac S. Cassin, then Chief Engineer of the Water Department, says:

" The quantities of water consumed by the populations " of cities in the United States are quite various. In this " City it is a fraction over forty gallons per day to every " inhabitant, and yet this quantity, large as it really is, " and apparently almost unaccountable, is one of the " smallest shown by the published reports and statistics. " The amount varies from forty to ninety gallons per day, " and in some cases reaches nearly one hundred gallons " per day to every inhabitant. In the city of Boston it is " ninety-four gallons, and in the city of New York it is " about the same quantity.

" The City of Philadelphia now requires over double "the quantity that was required when its population was "only one-third less than at present."

The report then proceeds to a serious discussion of the alarming increase in the daily per capita consumption.

It will be noticed that at that time Philadelphia was consuming less than half as much per capita as New York or Boston, while now it consumes about 60 per cent. more per capita than either of them; also, that the consumption of those cities, per capita per day, is to-day but little, if any, greater than it was then.

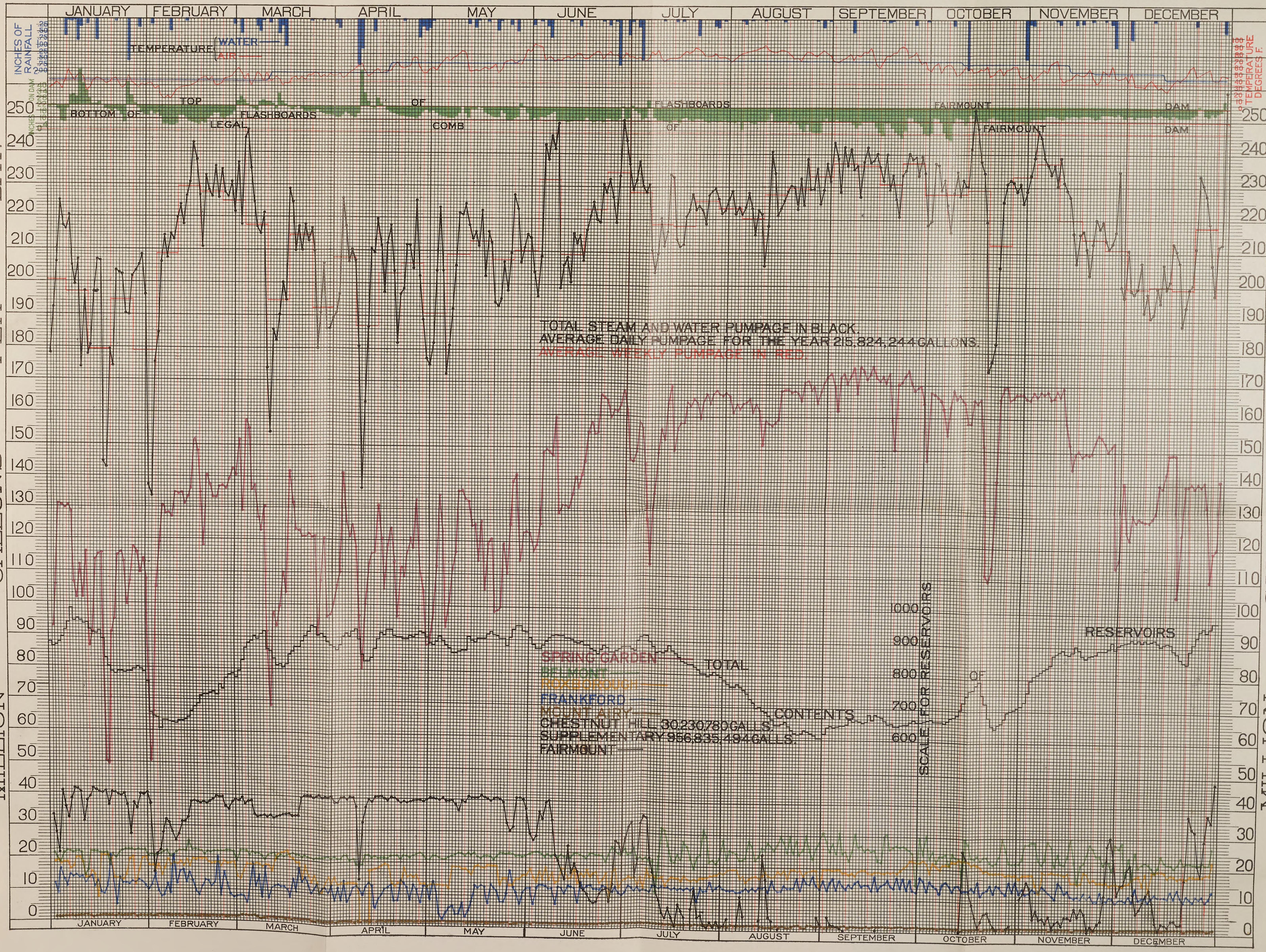
In Boston, however, the daily per capita consumption has, between these dates, been much larger, and it was reduced only by the vigorous use of the Deacon apparatus for detecting waste. In New York water meters have been largely introduced.

The third diagram shows the increase in the number of appliances of each kind.

It is quite true that the first and second diagrams are based upon an assumption liable to serious error, namely, that our consumption is properly represented by our records of pumpage as deduced from the plunger displacements of the pumps; yet, after making all due allowance for errors in this assumption, Mr. Fuller's diagrams may be taken as representing approximately the annual increase in the daily consumption.

According to these diagrams, our citizens consumed in 1885, on an average, 72 gallons each per day. In 1892 this quantity had doubled, and in 1895 our daily consumption per capita has reached the magnificent figure of 160 gallons. That this estimate is at least not absurdly in excess of the truth, is indicated by the fact that our experiments of 1892, with the Deacon apparatus, upon the locality bounded by Broad, Seventh, Chestnut, and Spruce streets, occupied chiefly by dwellings, theatres and stores, showed a consumption of 252 gallons per head per day.

PUMPAGE DIAGRAM FOR THE YEAR 1895.



It seems difficult to account for this remarkable increase otherwise than by means of the increase in the number and in the demands of water-consuming appliances required by our modern civilization.

According to a table, compiled by the Bureau of Water of Buffalo, N. Y., and recently published by one of our technical journals, the daily per capita consumption of several typical American cities is as follows:

Buffalo, N. Y.	252 gallons.
Wilkesbarre, Pa.	240 gallons.
Pittsburg, Pa.	233 gallons.
Allegheny, Pa.	224 gallons.
Camden, N. J.	220 gallons.
Albany, N. Y.	148 gallons.
Chicago, Ill.	145 gallons.
Cincinnati, O.	129 gallons.
Baltimore, Md.	100 gallons.
Boston, Mass.	99 gallons.
New York	95 gallons.
St. Louis, Mo.	79 gallons.
Providence, R. I.	60 gallons.
St. Paul, Minn	50 gallons.
Atlanta, Ga.	35 gallons.
New Orleans, La.	31 gallons.

At present, the annual increase in our average daily consumption amounts to about 18 million gallons. In other words, in order to keep pace with the ever-growing demand, even if the rate of that growth continued as at present, would require the equivalent of the annual erection of a pump raising daily 18 million gallons of water and the running of that pump continuously, day and night, the year round, with, of course, corresponding increase in reservoir and distributing capacity.

But it will be noticed that the lines representing the consumption are not straight lines, but curves, and that those curves are concave upwards. In other words, the *rate* of increase is not a constant quantity but is *itself in-*

creasing, so that while the annual erection of an 18 million gallon pump, with the accessories mentioned, might for a few years enable us to keep pace with the demand, it would not long enable us to do so.

Supply and Demand.

On the diagram representing the pumpage for each day of the year, and other important statistics, has been added a curve showing the total contents of all the reservoirs on each day of the year. An inspection of this curve shows that during the months of July and August the demand exceeded the supply by nearly 6 million gallons daily, so that during these two months the volume of water stored in the reservoirs was reduced by more than 300 million gallons.

With the advent of cooler weather at the beginning of September, and with the consequent falling off in the excessive demand, the volume of water stored in the reservoirs began, without any material increase in the volume pumped, to increase somewhat, and by the middle of October the rate of increase had reached about 20 million gallons daily.

On the 19th of October, however, an accident at the Spring Garden Works threw out of service, for about five days, the two large Holly pumps, each raising 30 million gallons daily. Our pumpage capacity was thus suddenly reduced by 60 million gallons daily, and the storage diagram therefore shows a loss of about 40 million gallons daily, which, if continued, would have emptied our reservoirs in less than 20 days, and this notwithstanding that we had in full operation every steam pump with which the City was supplied during the summer of 1894.

The consequence of a disablement of this extent, extending over a longer period and happening during the excessive demand of July and August, can readily be imagined.

These considerations show on how perilously narrow a margin our work has been conducted, and that any stoppage for considerable repairs during the summer has been out of the question. The pumps have therefore been driven to their fullest extent, night and day, and under very unfavorable circumstances.

That this is an uneconomical condition of affairs goes without saying.

As already remarked, the completion of the four new 20-million-gallon pumping engines at the Queen Lane Station, which may be looked for before the heavy demand of next summer sets in, will materially improve the situation and will place us beyond the reach of probable want for at least a year or two to come, *provided, always, that the river furnishes water in sufficient quantities.*

Improvement in Means for Measuring Flow.

In order to obviate the uncertainty which admittedly characterizes all of our estimates of pumpage and of consumption, based, as they are, solely upon plunger displacement, I have conducted experiments with the Venturi meter, a recently patented device designed especially for the purpose of measuring the flow of water in large pipes, and differing radically, in principle, in construction and in mode of operation, from all of the various water meters in common use.

For these experiments, which were conducted at our Belmont Station under the personal supervison of Mr. Fuller, assistant in charge of distribution, a 6-inch meter was obtained from the makers, the Builders' Iron Foundry, of Providence, R. I. The discharge through the meter was measured in large cylindrical tanks.

Our experiments having demonstrated the usefulness of the apparatus for the purpose intended, and the use of larger sizes having proved satisfactory elsewhere, three larger meters, for use respectively on 12-inch, 20-inch and 48-inch pipes, have been ordered.

Simultaneously with the investigation of the Venturi meter, Mr. Fuller has been carrying on, in our meter-testing shop at the Spring Garden Station, a series of experiments with the Pitot tube, an apparatus designed upon still another principle, and applicable to the flow of water, not only in pipes, but also in open channels.

It is hoped that by the use of these two instruments, so radically different, and by checking one by means of the other, we shall be able to arrive at a satisfactory method of measuring the quantities of water pumped and consumed. The possession of such means of measurement will add much, also, to the value of expert tests of our pumping engines.

Restriction of Waste; Meters.

My predecessors have repeatedly called attention to the necessity of curtailing the reckless waste of water, and have urged the use of water meters as the natural and proper means of effecting such curtailment.

In his report for 1885 Col. Ludlow said:

"Useless waste cannot be defended; it benefits no one, "injures those who are thereby deprived of a needful "supply, and adds an item of superfluous cost to the "maintenance of the Department. At a moderate esti-"mate one-third of the water now pumped and distrib-"uted is wasted, passing into the sewers without having "served any useful purpose whatever, and in most cases "having done harm in its way.

"The main argument advanced against the use of "meters is that the manufacturing interests upon which "to so large a degree the prosperity of the City depends, "must be protected against excessive charges, and that "the effect of the meter would be to increase the charges "now made. The obvious answer to this is that the "meter is a mere instrument to measure the volume of "water passing through it, and has nothing to do with "regulating the price charged for that water. If the price "is too large, nothing is simpler than to reduce it, but in "the adjustment of matters of this sort it is essential that "it be done 'in the open' and in the general interest, "not that of individuals, however influential.

"Enthusiastic people have asserted that water should "be as bountiful and free as air. This is now, in fact, the "case, if one choose to go and get it; but the important "difference between the two fluids is that air penetrates "everywhere, and delivers itself at all elevations free of "charge, while water seeks the lowest level, and has "hitherto refused to flow up hill except upon compulsion. "This involves expenditure of power and consequently "expenditure of money, which some one must pay."

The difficulty is that while we are at the bottom of the air we are, as a rule, above the surface of the water.

Mr. Ogden, in his report for 1893, says:

"If we could reduce our consumption to the same fig-"ures as those cities (New York and Boston, with ninety "and eighty-nine gallons per capita daily, respectively), "we would save half of the cost of the coal; have ample "storage reservoirs and the reservoirs full; could keep one-"half of our steam plant in reserve, and not require any "addition thereto for several years; the pressure in the "mains and supply pipes would be increased; the water "rise higher in the buildings, and low water in the river "would not cause any anxiety."

In his report for 1894, Mr. Ogden says:

"So much has been said about the cause of this (ex-"cessive consumption) in previous reports, it seems super-"fluous to repeat that a large percentage of it is due to "waste."

A sub-committee of the Water Committee of Councils, consisting of Messrs. Harry P. Crowell (*Ch'n*), J. Emory Byram, John Morrison, J. C. Collins, and Jos. F. Porter, reporting, in 1892, on the question of the future water supply of the City, says:

"Your Committee recommends that action be taken at "an early date to prevent the useless waste of water. "Unless the same is done it will be impossible to keep up "the supply. San Francisco had trouble of a similar "nature, which was overcome to a great extent by the "introduction of meters."

In dispensing water otherwise than by meter, we are simply following a precedent established in the earliest days of water supply, and wholly unfitted to present conditions. To supply water at annual rates varying with the size of the attachment is as crude and unscientific as it would be for a merchant to charge his customers an annual rate depending upon the size of the doorway through which he took his goods.

The inadvisability of continuing the present method of charging for water may be understood when we consider what would be the effect of applying such a system (or no-system) to the sale of gas.

To sell water by attachment rates is to place a premium upon the vices of prodigality and cupidity, for a person who wastes water or who uses an inordinate supply of it, pays no more than one who practices every economy and whose requirements are moderate, provided the supplies be taken through openings of the same dimensions.

The legislation by which the Bureau is now governed in this particular is embodied in a resolution of May 18, 1870, and in an Ordinance of July 25, 1892, as follows:

Resolution, 18 May, 1870.

"The Chief Engineer of the Water Department is "hereby authorized, whenever it may be deemed necessary, "to determine the quantity of water used by manufac- "turers, sugar refiners, distillers, hotels, and other large "consumers of water, to attach meters to the several pipes "supplying the premises with water; to which meters "the officers of the Water Department shall have accesss "at all times: *Provided*, That this resolution shall not be "construed to apply to the consumption of water by pri- "vate families for household purposes."

Ordinance, 25 July, 1872.

"When it shall be specially agreed upon between the "Water Department and manufacturers or other large "consumers to accurately determine the amount of water- "rent to be assessed, the Chief Engineer of the Water "Department is hereby authorized to introduce meters "into such premises, and the charge for water consumed "as indicated by any meter, shall be at the rate of sixty "cents* per thousand cubic feet, payable quarterly: *Pro- "vided*, The Chief Engineer be instructed to use the Gem "meter if it be the cheapest and best."

It will be observed that while the resolution of 1870 empowered the Chief of the Bureau to place meters upon supplies "whenever it may be deemed necessary," the ordinance of 1872 leaves it with the consumer to decide whether or not a meter shall be placed upon his supply. This ordinance works against the City in every case, for those who know that they can reduce their bills by the use of the meter will ask to have one placed, while those who intend to take more than the meter would charge them with, decline to avail themselves of its services.

There is a wide-spread impression that the use of water meters tends to restrict unduly the use of water, particu-

*So amended by ordinance 9 Feb., 1884, 13. The rate has since been reduced to thirty cents per thousand cubic feet, which is about 4 cents per 1,000 gallons.

larly on the part of the poorer members of our population, who might, under a meter system, be tempted to restrict their consumption below that which is required to maintain the public health. It would, of course, be most unwise to adopt any measure which might lead to such restriction, but other cities have overcome this difficulty by fixing a minimum rate, below which nothing can be gained by economizing.

The Department of Public Works is a socialistic or communistic organization, by means of which the entire community seeks to obtain certain results to the best advantage and at a reasonable expense.

I take it, therefore, that the aim of the Bureau should be, not to show a profit upon its transactions, but to furnish plenty of good water at the lowest possible cost to the community.

Acting upon this view, the introduction of meters should be governed, not by a desire to increase the City's revenue from water furnished, but, first, to decrease the City's expenditure by cutting off a waste which, under the present circumstances, appears little short of criminal, and thus enabling the Bureau to furnish to all a plentiful supply with the means now at hand, and, second, to substitute a just, scientific, common-sense method of doing business in place of that which we have inherited from the earliest water-works practice, a method which would be ludicrous by reason of its clumsiness, were it not for the serious injustice which it involves.

The meter rate is now, as it should be, approximately such as to supply the water to our manufacturers and other citizens at cost.

If it is objected that the use of meters discourages our manufacturers, the rate may, if the City please, be still further reduced.

I have already referred to a case, developed in 1892, which showed, in a certain down-town district, a daily per capita consumption of 252 gallons; and you will notice that in Mr. Fuller's report mention is made of another, recently developed in the upper part of the city. Here, by means of a house-to-house inspection of 142 small new houses on two intermediate streets in one block, it was found that out of 782 appliances 22 were leaking slightly and 32 running continually. The daily consumption per capita was found to be 222 gallons, and of this quantity 192 gallons were wasted and only 30 actually used.

It is for our citizens, through their representatives in Councils, to decide whether it is best, for the privilege of thus throwing water, unused, into the sewers, to forego the benefits of a pure and plentiful supply. So long as this waste continues, the city's financial resources will continue to be strained to their utmost to maintain it, and projects for genuine improvement must halt while the city treasury grapples hopelessly with the task of filling a bottomless pit.

I regard the diminution of waste as the first and most pressing duty of this Bureau.

Future Supply.

Even if no other duties had engrossed my attention, the few months that have elapsed since my appointment as Chief of this Bureau would have been all too short for the purpose of making a proper study of the various schemes which have been submitted for the extension and improvement of the city's water supply, to say nothing of the experimental investigations which should be undertaken; so that, burdened as I have been with the multitude of business incident to assuming charge of the Bureau, and with the repairs of the Queen Lane Reservoir, to which, at your request, I have given my immediate personal attention, it is quite out of the question for me to submit any definite recommendation at this time.

Previous Studies.

Four serious studies of the problem of the future supply have been made under official auspices.

H. P. M. Birkinbine, 1864.

In the spring of 1864 $3,000 were appropriated by Councils for the purpose of preliminary investigation of streams lying beyond the limits of the city, and these investigations were carried out by Mr. H. P. M. Birkinbine, then Chief Engineer of the Water Department. Chester, Ridley, Crum, Darby, and Cobb's creeks, flowing into the Delaware below the city, and Mill, Gulf, East Valley, Wissahickon, Plymouth, Saw Mill, Stony, and Perkiomen creeks, flowing into the Schuylkill above the city, were surveyed, with such thoroughness as the appropriation would warrant. Mr. Birkinbine favored the Perkiomen as a source of supply, and elaborated a plan for bringing its waters to the city. He asked for an appropriation of $12,000 for further investigations.

Fairmount Park Commission, 1867.

"In 1867 a Special Committee of the Fairmount Park "Commission, consisting of Fred. Graff, John C. Cresson, "George G. Meade, Strickland Kneass and William "Sellers, reported on the preservation of the purity of "the City's water supply, with the conclusion that the "Schuylkill river can be relied on for many years, if "proper means be taken early to guard it from pollution, "especially by building an intercepting sewer from Mana-"yunk to below the Fairmount dam, and if large retaining "compensating reservoirs are built in the upper Schuyl-"kill to supply additional water during droughts." *

* From Report of Rudolph Hering, C. E., Assistant in charge of Surveys for Future Supply, in Report of William Ludlow, Chief Engineer, for 1883, p. 266.

Commission of Experts, 1875.

In 1875 a Commission of Experts, consisting of W. Milnor Roberts, William J. McAlpine, J. W. Adams, W. E. Morris, Solomon W. Roberts and William H. McFadden, was appointed by the Mayor, and to this Commission the entire subject of the present and future supplies was referred.

The Commission, in its report, discussed the following schemes: 1. Increasing the minimum flow of the Schuylkill by the construction of impounding reservoirs for the storage of storm water. 2. Pumping by water power at Flat Rock dam. 3. Prevention of pollution of Fairmount pool. 4. A gravity supply from the Delaware Water Gap. 5. Two projects involving the taking of water from the Delaware at New Hope: one by steam pumps at that point and a high-level conduit; the other by bringing the water in the canal of the Delaware Division of the Navigation Company. 6. Taking the Delaware water at Scudder's Falls, 2½ miles above Trenton. 7. A gravity supply from the Perkiomen. 8. Artesian wells.

The Commission, owing evidently to the want of sufficient means for an adequate investigation, made no definite recommendation in favor of any of these schemes. It, however, referred to the second and seventh schemes as worthy of further investigation, and pronounced the third to be "the most effectual remedy hitherto advocated."

It recommended, further, the completion of the East Park reservoir and its connection with the Spring Garden and Fairmount pumping stations and with the Spring Garden, Corinthian and Delaware reservoirs; the improvement of the machinery at Fairmount and the building of two improved turbines; the re-arranging of the pumping mains at the Belmont works, and putting in a proper distributing main from Belmont reservoir to supply the east side of the river; the building of an intercepting sewer on the east side of Fairmount pool, or of a conduit for purer water from Flat Rock dam to the pumping works at Belmont, Spring Garden and Fairmount; and the establishment of a new pumping station at Lardner's Point, with a reservoir at or near Wentz Farm, with proper mains connecting the pumping works with the Delaware reservoir and with the new reservoir supplying Frankford, etc.; and sundry minor improvements.

Rudolph Hering, 1883–86.

By far the most thorough and elaborate investigation of this subject was that recommended, in 1882, by a Board of Experts, appointed by the Mayor, and consisting of Messrs. E. S. Chesbrough, J. Vaughan Merrick and Frederick Graff, in conjunction with the Chief Engineer.

This investigation was undertaken in 1883, under the administration of Col. Wm. Ludlow, Chief Engineer, by Mr. Rudolph Hering, whose reports I have already quoted, and extended over a period of three years. It involved a very thorough topographical and hydrographic survey of the watersheds of the Neshaminy and the Tohickon, flowing into the Delaware, above the City, and of the Perkiomen, and a careful study of the other schemes presented. The waters of the several streams considered were subjected to chemical analysis by Prof. Albert R. Leeds, and a thorough sanitary survey of the Schuylkill Valley was made by Mr. Dana C. Barber, Assistant Engineer.

Mr. Hering was at that time of the opinion that the only schemes worth considering were "those which bring to the City the water of running streams in the Schuylkill, Delaware or Lehigh watershed;" that while the streams north of the Blue Mountains were the best available for the present or future supply and must eventually form the source of supply for this and other cities, consideration of cost should give the preference to nearer sources of satisfactory water; but that in tapping these nearer sources the ultimate extension of the system to the country north of the Blue mountains should always be kept in mind.

The sources studied in detail were, therefore, the Perkiomen, the Neshaminy, the Tohickon and the Delaware above Trenton. The water of the Delaware was found to be the best of these, that of the upper Perkiomen and Tohickon next in quality, and that of the Neshaminy and the Lower Perkiomen the least desirable.

In his final report, dated July, 1886, pages 311 and 312, Mr. Hering submits the following estimates:

Cost for delivering (A) 90 million, (B) 150 million and (C) 210 million gallons daily.

A, 90,000,000 gallons daily.

Delaware river, at Lardner's Point, pumping by steam	$7,064,000 00
Neshaminy Creek, by gravity	7,875,000 00
Delaware River, at Point Pleasant, pumping by water-power	9,673,000 00
Tohickon Creek, by gravity	10,008,000 00
Perkiomen Creek, above Green Lane, by gravity	10,195,000 00
Perkiomen Creek, above Schwenksville, by gravity	11,167,000 00
Delaware River, at Point Pleasant, pumping by steam	12,775,000 00

B, 150,000,000 gallons daily.

Delaware River, at Lardner's Point, pumping by steam	10,415,000 00
Tohickon Creek, by gravity, and Delaware River, at Point Pleasant, pumping by water-power	11,215,000 00
Perkiomen Creek, above Schwenksville, by gravity	12,139,000 00
Tohickon and Neshaminy Creeks, by gravity	13,597,000 00
Tohickon Creek, by gravity, and Delaware River, at Point Pleasant, pumping by steam	14,275,000 00
Delaware River, at Point Pleasant, pumping by steam	16,355,000 00
Perkiomen Creek, above Green Lane, and Lehigh affluents, by gravity	17,675,000 00

C, 210,000,000 gallons daily.

Tohickon Creek, by gravity, and Delaware River, at Point Pleasant, pumping by water-power	12,695,941 00
Northeast Branch and Perkiomen, above Schwenksville, by gravity	13,674,493 00
Delaware River, at Lardner's Point, pumping by steam	13,766,085 00
Delaware River, at Point Pleasant, pumping by water-power and by steam	15,475,262 00
Tohickon Creek and Neshaminy Creek, by gravity, and Delaware River, at Point Pleasant, pumping by steam	17,174,998 00
Tohickon Creek, by gravity, and Delaware River, at Point Pleasant, pumping by steam	17,717,025 00
Perkiomen, above Green lane, and Lehigh affluents, by gravity	18,833,400 00
Delaware River, at Water Gap, by gravity	19,278,061 00
Delaware River, at Point Pleasant, pumping by steam	19,622,543 00

The results of his investigations are summed up as follows:

"It therefore appears with sufficient clearness, I think, "that whenever good water can no longer be obtained "from Lardner's Point by the pumps which it may be "considered advisable to place at this point, the City "should build an aqueduct to Point Pleasant, pump Del- "aware water by water power, and supplement the quan- "tity as it may become necessary by storing the water "from the Tohickon creek, first in the lower and then the "upper reservoir."

"After the aqueduct is taxed to its full capacity, at "which time it will probably be necessary to go to the "Blue Mountains for an increased supply, another aque- "duct will have to be built. It is premature, I think, to "say definitely at present whether this second aqueduct "extending to the Blue Mountains should go by way of "the Delaware or Lehigh river. If the South Mountain "region should preserve its present character, there can "be no doubt that it should extend by way of the Perkio- "men valley, and after receiving the South Mountain "water at Green Lane, follow up the Lehigh river. The "cost of this scheme, which now is relatively greater than "that of others, would then probably be less. The Point

"Pleasant aqueduct could later also be carried to the "mountains whenever the quality of the water, owing to "the pollution from the Lehigh river, becomes objection- "able. And its extension would then most economically "be to the Delaware Water Gap."

"It is better to build two separate aqueducts in this "way than only one with double the capacity, because in "the latter case the risk from accident becomes greater. "New York, Boston, Washington and Paris each have "two. London has even more."

"When the above-mentioned aqueducts are built the "City of Philadelphia will be supplied with the best "water obtainable in Eastern Pennsylvania."

Hydrographic Surveys.

The hydrographic studies of the Perkiomen, Neshaminy and Tohickon watersheds, inaugurated by Mr. Hering, have been continued under the capable charge of Mr. John E. Codman, who is most unjustly retained on the pay-roll as "Draughtsman," and the results for the past year are embodied in the report of that gentleman, transmitted herewith.

These observations, thus continued from year to year, now form an exceedingly valuable collection of data for the hydrographic study of the districts embraced, and each year adds greatly to their usefulness. This is particularly true of years of exceptional drought, such as that through which we have just passed.

Other Plans Proposed.

A few years ago the Philadelphia and Reading Railroad Company, as lessee of the works of the Schuylkill Navigation Company, submitted a plan involving the purchase of those works by the city and the construction of an aqueduct to bring the Schuylkill water from above Norristown dam to the city's existing pumping stations.

In connection with the proposed supply from the Perkiomen, Neshaminy, and Tohickon, various plans for supply from the upper Delaware and from the upper Lehigh were considered, and a company, entitled "The South Mountain Water Company," which proposed to obtain the control of these sources of supply, laid before the city, in October, 1885, a plan looking to the leasing of the city's works by the company, and the construction by the company of certain works designed to secure an ample and satisfactory supply.

This proposition was declined by the city.

In 1891 Mr. Joseph Wharton brought to the attention of the city a large tract of land in Southern New Jersey, controlled by him and furnishing water from several large streams, notably the Mullica river and its branches, whose waters flow into the Atlantic. Mr. Wharton proposed to impound the water of these streams, pump it across the dividing summit, and lead it by an open canal to a reservoir on the head waters of Cooper's creek, whence it would be taken, partly for the supply of Camden, N. J., and partly by several lines of 48-inch steel mains crossing the Delaware, under the bed of the river, and delivered to the city's pumps. He submitted a report upon the project, by Mr. C. C. Vermeule, a well-known civil engineer and hydrographer, who urged, in favor of the plan, "the great advantages of distance (Haddon reservoir being but nine miles from Philadelphia's City Hall), of uninhabited gathering grounds and complete natural filtration."

Mr. Ogden, then Chief of the Bureau, said of this plan: "It is unfortunate that such favorable conditions as these cannot be found in Pennsylvania."

In 1892 a sub-committee of the Water Committee of

Councils, under the chairmanship of Mr. Harry T. Crowell, presented a report in which are collected, generally in abstract, the various documents and reports which, prior to that time, had heen submitted with a view to throwing light upon the question of the future supply. I have already had occasion to quote from this report.

During the past year still another proposition has been brought forward, namely, that of a private company, represented by Mr. H. Birkinbine, to furnish a supply of water from the Susquehanna river, opposite Columbia, Pa., by means of an aqueduct.

From the Company's project, which is transmitted herewith, as Appendix I, it appears that the Company proposes to acquire the necessary rights, construct the necessary works, and deliver the water to the City in West Philadelphia, at an elevation of 150 feet.

There has been no opportunity for study of this proposition and the communication presented in Appendix I is evidently intended merely as preliminary, being unaccompanied by estimates of cost, but at first glance it is difficult to perceive wherein lies its superiority over that, already studied in detail by Mr. Hering, to bring to the City the waters of the Delaware above Trenton, except that the elevation of 150 feet, at which the Susquehanna Company proposes to deliver the water, would suffice for the supply of those districts now furnished with water from the East Park reservoir, the elevation of which is 133 feet.

The growth of our City is toward the higher ground to the northwest, and thus requires constant additions to our high-level services. A very large and constantly increasing proportion of our "extensive and expensive pumping plant" would therefore still have to be kept in service.

Filtration.

Since the date of Mr. Hering's final report, in 1886, it has been abundantly demonstrated, notably by the extensive and elaborate experiments made at Lawrence, Mass., and described in the reports of the Massachusetts State Board of Health, that thoroughly pure and safe water may be obtained from rivers by means of filtration. He therefore urges the advisability of experiments for the purpose of determining to what extent the waters of the lower Delaware and Schuylkill rivers, close to the upper portions of the City, may be rendered thoroughly satisfactory by means of a modern system of filtration.

One very important advantage of such a supply is that it admits of gradual and indefinite extension, as the requirements of the City increase, and does not call for any immediate outlay of large sums of money or the postponement for many years of the introduction of a supply satisfactory both in quality and quantity.

Another and a very important advantage is that, so far as the Delaware is concerned, the City in its use of the river, would not be hampered by venerable agreements, dividing its rights with other corporations. Neither does it necessarily involve the transfer of any portion of the City's functions to a private corporation.

The popular mind is readily fascinated with the idea of crystal water from mountain streams, and is apt to jump to the conclusion that a gravity supply is of necessity less expensive than one involving pumpage; but there is considerable difficulty in finding unappropriated mountain streams flowing in such volume as to furnish even 200 million gallons daily, and, when found, their watersheds, if not already contaminated, are liable to contamination in the not very distant future, so that filtration may have to be the final resort in any case short of ownership of the entire watershed.

Furthermore, the conditions may readily be such that the cost of the gravity supply shall exceed that of a supply by pumpage. In my estimate, made at the request of Colonel Goodman, and submitted herewith, the cost of a small gravity supply, with an aqueduct about 27 miles long, was found to be slightly less than that of a steam pumpage supply of equal volume; but, as rather more than half of the cost of the gravity supply was that of the aqueduct, it is plain that the total cost of such a supply must increase rapidly with the distance from which it must be brought.

While, therefore, the claims of the gravity supplies from distant sources should by all means be carefully studied, it is evident, especially in the light of modern filtration, that the boundless supplies brought to our doors by our two rivers should not be overlooked.

The Schuylkill as a Source of Supply.

The average daily flow of the Schuylkill throughout the year may, as already remarked, be taken as about one billion gallons.

This, *if it could all be rendered avaliable*, would suffice for the entire needs of the City until 1950, supposing the consumption to continue increasing at its present rate.

Much could be done in this direction by the construction of impounding dams in which to store, for use in the dry season, some of the water which now goes to waste in floods. Such a plan, it will be remembered, was under consideration by the commission of experts appointed in 1875; but the commission held that it "would be much more expensive than raising the additional water by steam at Fairmount," and did not, therefore, recommend it.

Legal Considerations.

The legal controversies in which the prosecution of such a plan would involve the City with other communities affected, suggest the advisability of placing all the streams of the State under the control of the State itself, as is now the case in Massachusetts, where a community or corporation, desiring to take water from any stream, must first obtain a permit from the State Board of Health.

Boston and the neighboring towns have already inaugurated a metropolitan water supply for their common benefit; and it would seem that the ultimate outcome of the present conditions must be the establishment of State, if not National, systems of water supply.

In the meantime, so hot is the race for the control of the streams, that State control, in some shape, appears very desirable.

The Berwyn Water Company has purchased the rights of the Tredyffrin, Whiteland, Willistown and Villa Nova Water Companies, formed for the purpose of supplying water in Radnor township, in Delaware county, and in Tredyffrin, East Whiteland, Willistown and Easttown townships, in Chester county, all in this State; and for this purpose it has selected Pickering Creek, which empties into the Schuylkill on its right or west bank about two miles below Phœnixville. The townships to be supplied lie without and to the southward of the watershed of Pickering Creek, Tredyffrin and East Whiteland being drained chiefly by Valley Creek, which reaches the Schuylkill at Valley Forge, three miles below the mouth of Pickering Creek; while Willistown and Easttown are drained by Ridley, Crum and Darby Creeks, flowing into the Delaware River.

In my respects of September 27, I called your attention to the increasing appropriation of the waters of the

Schuylkill and of streams tributary to it, for the ostensible purpose of supplying other towns and districts.

It is possible that, under cover of the demands of these communities, interested parties may be acquiring private control of waters which now form part of the City's supply, with a view of placing themselves in position to dictate terms to the City.

I submitted that the whole question of the reciprocal rights of our own and other municipalities and of corporations and individuals, upon these tributaries, should receive early attention at the hands of the City's legal advisers.

Granting that the waters of the tributaries of the Schuylkill, and those of the upper river itself, are taken in good faith for the supply of the population adjoining those waters, it cannot be long before the rapid growth of that population will become a serious menace to our supply, and, inasmuch as the waters thus taken are returned to the streams as sewage, to the public health.

In fact, the ultimate outcome of the process now going on can only be the conversion of the entire flow of the river into sewage, which will then be the only fluid supplied to our pumps on the Schuylkill.

I am now in receipt of your favor of the 17th inst., advising me that you had at once referred the matter to the City Solicitor, and enclosing a copy of his report.

That official finds:

"*First.*—That the City has the natural right to use the "waters of the Schuylkill to its fullest extent for purely "domestic purposes, irrespective of the rights of the "Schuylkill Navigation Company, and limited only by "the right of persons or municipalities higher up the "stream to use it for like purposes.

"*Second.*—Persons or municipalities higher up the "stream or on its tributaries may use as much of the "water as may be necessary for domestic purposes, with- "out reference to the amount required by the City.

"*Third.*—It follows, then, that the City has no exclu- "sive or paramount right to the water above and beyond "the City limits.

"*Fourth.*—By the agreement with the Navigation "Company the City acquired the right to use for any "purpose all the water in the pool in excess of that re- "quired for the purpose of navigation as limited and de- "fined by said agreement.

"*Fifth.*—It would appear by long use and legislative "sanction and direction that the City had acquired the "right to use and receive the waters of the Schuylkill and "its tributaries, in excess of that required by individuals "or municipalities higher up the stream.

"*Sixth.*—That while corporations organized under the "Act of 1874 are authorized to 'erect works and appro- "priate rivers, creeks, and canal water rights and ease- "ments within or without the limits of the city, borough "or place where such company was located,' compensa- "tion must be made for property rights affected by such "appropriation."

Unfortunately, the water works of this and other communities have been constructed without reference to the legal distinction between "natural" (or domestic) and "artificial" (manufacturing) requirements. Indeed, the exact difference between the two seems to be difficult of definition. The waters for both uses are ordinarily taken through a common intake and are hopelessly mingled in the pipes of the distribution, so that only by the universal application of meters could the quantity of each be satisfactorily ascertained.

Again, it would manifestly be most unwise for a growing community to begin the construction of water works of such capacity as to supply only its needs at the time of their commencement, for such works would be outgrown before their completion. Such a community must, in the construction of its works, provide for its requirements years in advance.

Hence, our neighbors, in appropriating the waters of streams which do or which might contribute to our supply, take not only what is immediately required, but also enough to provide for their future needs.

Not only the Schuylkill, but also the Delaware tributaries are being taken.

As a case in point I may mention that the Tohickon, one of the streams investigated by Mr. Hering in 1883–6, is now being tapped by a company for the supply of Quakertown.

Dual Supply.

The dual supply system, in which a limited supply of superior water is furnished through one system of pipes, and, of course, at higher rates, for purposes requiring such water, while a larger volume of inferior water is furnished, for other purposes, through another system of pipes, has long been under consideration and is in use in some places.

It is so correct, theoretically, that its manifest advantages appear at once from the mere statement of its principle. Its most serious—and at the same time its most obvious—disadvantage is the double system of piping and attachments which it requires. Another difficulty is that of deciding upon the dividing line between the two qualities of water supplied and the purposes for which they are respectively to be used. It would seem only natural that the quality of the poorer water would suffer by the distinction. The ultimate destiny of the dog branded with a bad name is proverbial, and it is altogether likely that the less desirable water would soon become unfit for such purposes as washing, either of the person or of clothing, as, indeed, the water which we are now obliged to drink too frequently is. It would also, no doubt, soon be found unfitted for many manufacturing purposes, such, for instance, as those of the brewer.

On October 1st, in reply to an inquiry from you, I submitted an estimate of the cost of laying a main on Market street from the Delaware river to Broad street, provided with fire hydrants, to be used exclusively as a fire main, and to be supplied from the City's fire boats in the river.

My estimate of the cost of laying a 12-inch pipe and providing it with the necessary hydrants, including material and labor, was $17,204.50, and that of a 10-inch pipe about $2,000 less. The hydrants contemplated in the estimate are flush hydrants opening just below the level of the street or sidewalk, thus causing no obstruction to travel. Such hydrants would cost about twice as much as those now in use, but they would have the additional advantage of offering less resistance to the flow.

I suggested also the advisability of erecting a stationary pumping engine at or near the foot of Market street for the purpose of supplying such a pipe, the use of which would then not be dependent upon the presence of a fire-boat, which might happen to be on duty elsewhere.

Without taking up, at the present time, the complicated question of the advantages and disadvantages of a dual supply, furnishing waters of different grades of purity through separate systems of pipes, I may suggest that it would appear eminently proper to make separate provision in this way for fire extinction, and also for the flushing of sewers, for which purposes manifestly a much less pure water might be used than that which is desirable for domestic and many manufacturing purposes.

The Perkiomen District.

In August last, at the request of Colonel Samuel Goodman, a member of the Water Committee of City Councils, I prepared an estimate of the cost of a gravity supply from the Perkiomen District, as compared with that of a pumpage supply of equal volume. The water, in either case, was to be delivered into Queen Lane reservoir.

The estimate was as follows:

Approximate Estimate of Comparative Cost of a Gravity Supply from the Perkiomen Creek, and a Pumpage Supply from the Schuylkill River; both Delivered into Queen Lane Reservoir. Gravity Water Supply from Perkiomen Creek.

Location of Reservoir.	Area in acres when full.	Length in Miles.	Elevation of Water Surface above city datum.	Extreme height of dam.	Extreme length of dam.	Collecting Area.		Capacity.		Total cost of dams.	Cost per one million gallons capacity.
						Square miles.	Acres.	Cubic feet.	Gallons.		
Perkiomen creek at Green lane.........	1705	7.7	300 feet	95 feet.	634 feet.	71.3	45,632	1,370,158,600	10,248,786,328	$1,118,295	$109 11
Rich Valley near Sumneytown.........	90	1.0	330 "	85 "	616 feet.	9.0	5,760	152,960,000	1,144,140,800	465,013	406 43
East Swamp creek near Millville......	1648	4.5	450 "	50 "	800 feet.	31.9	20,416	1,108,768,000	8,293,584,640	855,321	103 13
Totals	....	....	....	....	....	... .	....	2,631,886,600	19,686,511,768	$2,438,629	....

COLLECTING AREAS.

Perkiomen, above Green lane.	71.3 Sq. miles.	
Rich Valley, above Sumneytown..................................	9.0 "	"
East Swamp, above Sumneytown................	35.4 "	"
Total..	115.7 "	"

AVAILABLE FLOW.

From Perkiomen above Green lane................	40 Million Gallons Daily	
From East Swamp and Rich Valley...............	26 " " "	
Total...	66 " " "	
Cost of aqueduct from Green lane to Queen lane Reservoir with a daily capacity of...... 210,000,000 Gallons		$7,164,500a
Queen lane Reservoir with a daily capacity of 66,000,000 "		2,750,000
Cost of Storage Reservoirs..		2,450,000
Total cost of gravity supply..		$5,200,000

APPROXIMATE COST OF PUMPING PLANT.

Including buildings, machinery and piping.................................. $600,000c

COST OF PUMPAGE.

Raising one million gallons 100 feet...	$3 50
Raising one million gallons 230 feet..	8 05
Raising sixty-six million gallons 230 feet..................................	531 30
Raising sixty-six million gallons per day 230 feet for one year......	193,924 50

Capitalized cost of Pumpage.	Plant.	Total.
At 3 per cent. $6,464,150..	$600,000	$7,064,150
At 3½ per cent. 5,540,700..	600,000	6,140,700
At 4 per cent. 4,848,112..	600,000	5,448,112

NOTES: a—Taken from report of Rudolph Hering, dated March 27, 1886.
b—Taken from Annual Report of Water Bureau for 1891.
c—Deduced from cost of the Queen Lane Pumping Station Plant.

In submitting this estimate to Col. Goodman, I called his attention to the fact that while the minimum average daily flow in the Perkiomen District, as obtained by dividing the total flow of the year by 365, was about 870,000 gallons per square mile per day; the flow during long periods in each year is much less than this.

If storage reservoirs could be made of such capacity that all of the water of the streams could be impounded, the average rate might be used and the shortage, occurring during the periods referred to, would be compensated by the excess stored during the others.

But there are practical considerations which limit the dimensions of storage reservoirs, and allowances must therefore be made for the fact that much of the flow in the wet months of the year is wasted in overflow, as well as for evaporation from the large surfaces of the storage reservoirs, and for seepage through their sides, etc.

The results of careful investigation by Mr. Fitzgerald in Massachusetts, by Mr. Vermeule in New Jersey, and by Mr. Codman of our own Bureau, show that not more than 570,000 gallons per square mile per day should be relied upon as the actual available yield of such streams as those in question; and upon this quantity my estimate was based.

The abnormally low flow of these streams during the past year, as shown in the table on page 78, strikingly shows the importance of taking into calculation the possible minimum flow. As the drought still continues, it appears altogether probable that the stream flow for 1896 will show even lower figures than did that for 1895.

Pollution of the Schuylkill.

The Schuylkill is at all times subject to discoloration after rains extending over any considerable portion of its water shed. In his report for the year 1888 my predecessor, Mr. John L. Ogden, remarks: "After a general rain in the valley the Schuylkill is at first yellow from the flow of the nearer streams which run principally through cultivated land. It is afterward dark or black from the washings of the culm piles in the coal regions.

"In January the breaking of the Milldale Rolling Mill dam, one-and-a-half miles above Port Clinton, was the cause of the black appearance of the water at that time. The coal dirt and slush that had accumulated in the dam were brought down by the freshet produced by the break."

This is the earliest reference which I have as yet found to the pollution of the water by the washings of coal-dust from the anthracite region.

At this writing the City has just passed through a visitation of this kind, perhaps the worst which it has experienced, and, for the first time on record, the discoloration has appeared in the Delaware river, where for a short time the condition was as marked as in the Schuylkill. In the Delaware the trouble must undoubtedly come from the Lehigh anthracite coal regions.

I would urge that legal measures be taken to prohibit the fouling of the stream in this way. If necessary, the powers of the State Board of Health should be so extended as to give it jurisdiction in such matters.

During the summer it was the practice of the Pencoyd Iron Co. to discharge into the river, on Sundays, from their works, nearly opposite the mouth of the Wissahickon, large quantities of soot, which floated upon the surface of the river, giving it a very repulsive appearance. At my request this deposit was examined by Dr. B. M. Bolton, Chief of the Bacteriological Division of the Board of Health, and he reported that he found no reason to believe that it rendered the water injurious to health.

Notice was, however, served upon the Company, requiring them to discontinue the practice, and this request was complied with.

At the request of Mr. Abraham M. Beitler, Director of the Department of Public Safety, Dr. Bolton examined, in December last, samples of water taken by him from five of our reservoirs. His report was as follows;

"The average number of bacteria found on several "different examinations in one cubic centimeter of water "is as follows:

"In Fairmount basin, No. 1	1,205
In Fairmount basin, No 2	945
In Corinthian	1,334
In East Park, North basin	824
In East Park, South basin	843
In East Park, West basin	675
In Delaware basin (inlet)	2,913
In Delaware basin, No. 3	1,089
In Belmont basin. (This sample was taken when dredging was going on near the inlet)	5,405

"The number of bacteria is in all cases much larger "than it is desirable to have, but it is not unusually large "for an open unpurified water supply. We usually assume "that fifty bacteria to one cubic centimeter is a maximum "for water above suspicion."

The Need of Experiments in Filtration.

It is most desirable that the waters of the Delaware and Schuylkill rivers, and of the other sources of supply which are now in contemplation, should be carefully and thoroughly examined in the light of the advances recently made in bacteriological methods. The records now available, with the exception of Dr. Bolton's recent investigation of the waters in our reservoirs, refer to conditions no longer obtaining, and the experiments upon which they were based were made when our knowledge of bacteriology was much more limited than it now is.

The population upon the watersheds of our rivers, as upon those of the other streams which have been considered as possible sources of supply, has materially increased, while the available flow of the streams has been diminished by the increase of the quantities taken from them for the supply of these communities.

On the other hand, the intercepting sewer was finished and put in use in 1888, or after most of the analyses at present available had been made.

Dr. Henry Leffmann, in a recent lecture before the Academy of Natural Sciences, exhibited a map showing the distribution of cases of typhoid fever in 1895, as given by the Board of Health; and argued, from the uniform distribution of the cases over the area of the city, that the cause must be general and not local, and that it is probably to be sought in the character of the water supply.

The old pumping station at Kensington (abandoned in 1890) took its water from the Delaware just below the mouth of the Aramingo sewer; and it is significant that the gradual discontinuance of the use of this station was accompanied by a diminution in the excess of the number of typhoid cases in the district supplied from it.

It is matter of record, also, that the introduction of a system of filtration into Girard College was marked by a notable decrease in the number of typhoid cases there.

Prof. Frankland, in a paper read before the Institution of Civil Engineers (London), in April, 1886, and published in the report of the Royal Commission on Metropolitan Water Supply, September 8, 1893, states, as a result of several years' examinations of the filtered Thames and Lea river waters supplied by the London companies:

(1) That the chemical changes effected by filtration were quite insignificant.

(2) That the filters removed from 95.3 to 98.4 per cent. of the micro-organisms in the water.

(3) That this extraordinary biological efficiency of the filters depends upon the formation of a superficial gelatinous deposit or membrane upon the top of the sand, which membrane acts as an almost impervious obstacle to the passage of micro-organisms, and that it is of the greatest importance that this membranous film should not be ruptured by the application of excessive or irregular pressure in the filtration.

"The Lawrence experiments show that when filtering "at a rate of from 2,000,000 to 3,000,000 gallons per acre, "per day, which gives a velocity of 6 to 9 feet in twenty-"four hours, 99½ per cent. of the bacteria in the applied "water can be removed by filtration. At slower rates prac-"tically all can be removed. At Zurich, where the ordi-"nary velocity of filtration is 25 feet in twenty-four hours, "or more than double the London rate, the average num-"ber of bacteria per cubic centimeter in water after filtra-"tion is 20. As, however, the number in the water before "filtration is unusually low (about 200), the *percentage* of "removal is only 90, or much less than either of the other "cases."

"Fig. 1, showing the results of the working of these "filters during four years from 1887 to 1890 inclusive, is "interesting as showing the tendency of the number of "micro-organisms in the filtered water to remain constant "without regard to the fluctuations in the number in the "water before filtration, a fact already noted in the London "and in the Lawrence experiments, and strongly suggestive "of the conclusion that the bacteria in the effluent are due "to the drains of the filter itself and not to the applied "water."

"But the benefits of filtration are seen more clearly in "the mortuary records than in the records of the labora-"tory. At Zurich, for example, the typhoid mortality in "1880, before the construction of the present filters, was

"4 per 1,000 of the population. Since then it has dropped "to 0.4 per thousand, a decrease of 90 per cent. The "effects of filtration in London are shown in Fig. 2, taken "from a paper read before the American Statistical Associ- "ation in January, 1892, by Prof. Sedgwick and Mr. Allen "Hazen, which shows the typhoid mortality in London "since 1870 as compared with several American cities. It "is reproduced here with the adddition of the typhoid curve "for St. Louis since 1867. From this it will be seen that "notwithstanding the fact that London draws its water "supply from two small rivers draining a territory densely "populated, it has had for more than twenty years, a "typhoid rate continuously lower than that of any large "American city."

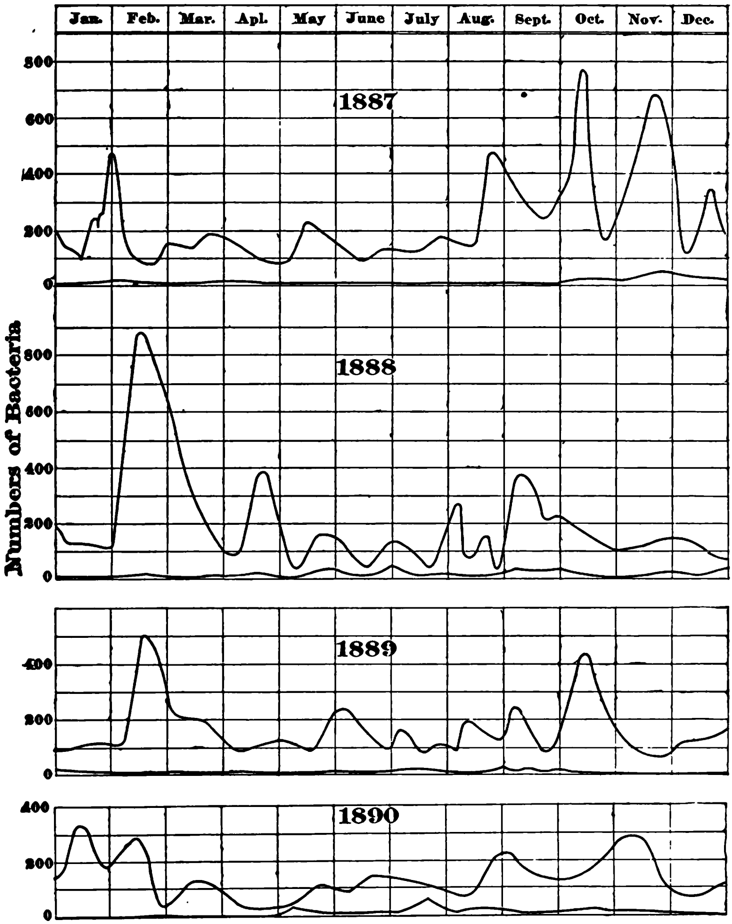


FIG. 1. NUMBERS OF BACTERIA IN FILTERED AND UNFILTERED WATER AT ZURICH, SWITZERLAND, 1887–1890.

In each of the four diagrams the upper and lower curves show respectively the conditions obtaining before and after filtration.

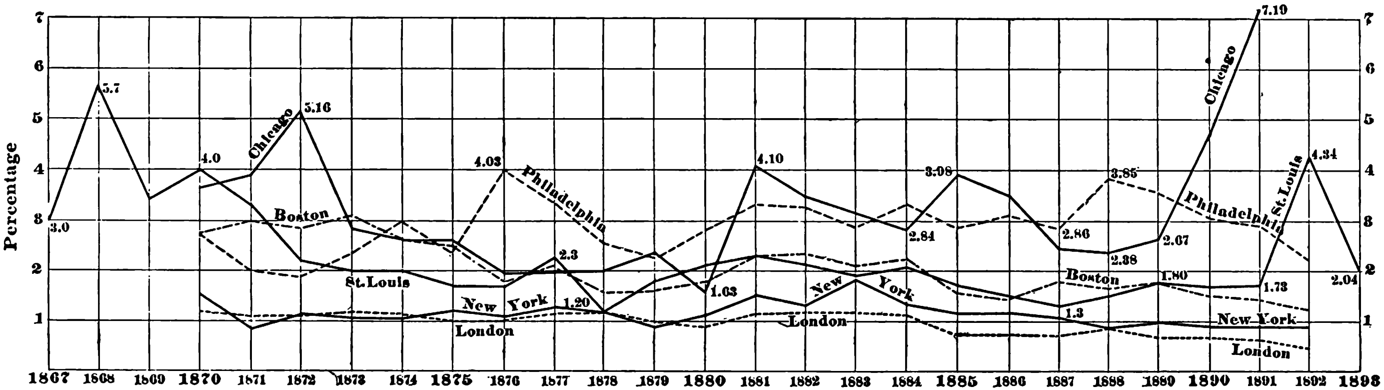


Fig. 2. Effects of Typhoid Fever (in Percentage of Total Number of Deaths) in Chicago, Philadelphia, St. Louis, Boston, New York, and London from 1867 to 1893.

"Even more significant is the report of Dr. William "Farr, Registrar General, upon the experience of London "with cholera in 1866, in which he points out that the "field of greatest fatality was almost coincident in its bound- "aries with a section of East London, which, for a time "just then, was supplied with unfiltered water—a fact to "which he attributes the deaths of nearly 4,000 persons. "Of like purport is the now familiar story of Hamburg, "which upon the advent of cholera in 1892, and in spite "of the warning given a few years before, by an epidemic "of typhoid, was found still drinking the unfiltered water "of the Elbe. As a result, nearly 8,000 persons lost their "lives from cholera in eight weeks, whereas the adjoining "city of Altona, which drank from the same stream after "it had received the sewage of Hamburg, but not until the "water had been filtered, was, except for certain imported "cases, almost wholly exempt from it."

"Indeed, no fact in sanitary science is now more firmly "established than that properly conducted sand filtration "is an almost perfect defense against the dangers of pol- "luted water."*

Fig. 2 shows that the typhoid mortality of Philadelphia is high as compared with those of the other American cities represented, and much higher than that of London, which uses filtered water from the rivers Thames and Lea.

Projects for Filtration.

In 1892 an ordinance was passed by Councils, authorizing the Department of Public Works to advertise for proposals and award a contract for the erection of a sand filter plant at Belmont Pumping Station. The filter bed

*From a paper by Mr. Robert Moore on "The Filtration of City Water Supplies in the Light of Recent Researches," read before the Engineers' Club of St. Louis, May 2, 1894, and published in the Journal of the Association of Engineering Societies, Vol. XIV, No. 1, January, 1895.

was to be capable of filtering 20,000,000 gallons in twenty-four hours. Its depth was to be not less than four feet, the rate of filtration was not to exceed two and one-half gallons per square foot per minute, and the average quantity of filtered water required for washing the filter was not to exceed three per cent. of the water filtered. The conditions stipulated that all odor, color and suspended impurities should be removed, that the albuminoid ammonia in the filtered water should not exceed 0.10 parts, or the free ammonia 0.015 parts in one million, that not more than one hundred colonies of microbes per cubic centimeter, and none of the coagulent or other purifying agent used, should be left in the water.

The contractor was to build the plant for a net sum, to operate it for one year under the supervision of this Bureau, for a net sum, and to guarantee a maximum cost of operation for three years.

No appropriation has been made for carrying into effect the provisions of this ordinance.

The Woman's Health Protective Association, under the presidency of Mrs. John H. Scribner, has laid before the Department a report prepared, at its request, by Mr. Joseph B. Rider, Civil Engineer, of New York, urging the adoption of upward sand filtration, the filtering apparatus to be placed in the bed of the reservoir.

Mr. Rider estimates that the cost of such filter beds, sufficient for the treatment of the entire supply of the city, together with the capitalized value of the operating expenses, would be between $2,000,000 and $2,700,000. The cost of the Hamburg filter plant, supplying about 600,000 persons, was $2,350,000.

A committee of residents of Germantown, with Mr. Frank J. Firth as chairman, desirous of improving the quality of water furnished to the City in general and to that district in particular, has been in conference with a experimenting with four different styles of mechanical filters and is about to add a fifth. He has at his command a laboratory fully equipped with modern appliances and under the charge of an experienced chemist and bacteriologist.

Wilmington, Del., and Danville, Royersford, and Wilkes Barre, Pa., have installed mechanical filters, and the results there and elsewhere recorded, as well as those obtained with natural sand filters, fully justify the relatively trifling expenditure now asked for the purpose of experiment. They do not, however, render it unnecessary for our city to make its own experiments under its own auspices.

Fairmount Dam.

There is no single structure connected with the water supply of the city of such immediate and vital importance as the dam at Fairmount. The failure of this dam would involve the draining of the Fairmount pool, and that would leave 84 per cent. of our pumpage system without water.

The present structure consists, properly speaking, of two dams, one constructed in 1819–21 and enlarged in 1842–43, the other built in 1872, a few feet below the first. The space between the two is filled with concrete.

The face timbers of the new dam may be easily inspected from the apron below, and many of them are already seen to be honeycombed. It is true that the stone filling and the great width of the combined structure go far to quiet any apprehension as to its security, but the consequence of any failure here would be so serious that constant watchfulness is required, and all means should be employed to prevent material leakage, not only in order to avoid waste but also for the security of the structure.

In the agreement between the Navigation Company and the City, under date of June 14, 1824, it is provided that the City "will have and take charge of the locks and canal aforesaid at Fairmount, and at all times hereafter forever, cause the same to be well and faithfully attended and kept in good order and repair, at the proper expense of the said Mayor, aldermen, and citizens of Philadelphia." The locks are now in a dilapidated condition, and should be so far repaired as to avoid danger to the pool.

Flat Rock Dam.

Flat Rock Dam is in bad condition and has already given out in places. This dam was built and is owned by the Schuylkill Navigation Company, but inasmuch as the supply of the higher levels fed from the Roxborough Pumping Station is dependent upon its integrity, I would suggest that negotiations be opened with the company looking to the repair or reconstruction of the dam.

Fairmount Pool.

The head of slack water in Fairmount pool is about one-third of a mile above the mouth of the Wissahickon, or say four and one-half miles above the dam. As measured by planimeter on the topographical map of the park, 200 feet to the inch, prepared by the Park Commission, the area of the pool is about 15,700,000 square feet. One inch of depth on this surface gives a volume of over 1,300,000 cubic feet, or say 9,724,000 gallons; and our daily pumpage from the pool, which averages about 200,000,000 gallons, takes from the pool, therefore, a quantity equivalent to about twenty and one-half inches in depth.

Fairmount Works.

A comparison of the present pumpage diagram with those of twenty years ago shows the interesting fact that, at that time, the main dependence of the City was upon the turbine wheels at Fairmount, the steam pumps at Spring Garden and elsewhere being used only as auxiliary and during the summer months, when the reduction of the flow of the river and the increase of consumption rendered it difficult for the turbines to keep pace with the demand.

To-day the conditions are exactly reversed. The Spring Garden works, even before the addition of the two 30,000,000-gallons Holly engines, raised more water than all the other stations combined, and our total nominal steam pumpage capacity now amounts to 347,000,000 gallons, while the nominal water-pumpage capacity amounts to only 33,000,000 gallons, or 9.3 per cent. of the total.

During the past summer the wheels at Fairmount have been almost entirely idle, and the plant there can now be looked upon as merely an auxiliary to the steam pumpage. It forms, however, a very important factor in our pumpage capacity, raising, when running full, over 40,000,000 gallons daily.

In the report of the General Superintendent you will find mention of the unwholesome condition of the river immediately below the dam, brought about by the discharge into it of the intercepting and other sewers on both sides of the river below the dam, a feature to which I called your attention in my letter of September 11th. During the summer the offensiveness of this state of things became well nigh unbearable. Little or no water passed over the dam or through our wheel houses, and the basin below this became a stagnant pool, merely rising and falling with the tide, so that the water became filthy and foul in the extreme, rendering the occupancy of our pumping station exceedingly unpleasant if not absolutely dangerous.

The Schuylkill Navigation Company.

As in former years, the Bureau has been subjected to considerable annoyance by objections on the part of the Philadelphia and Reading Railroad Co., Lessee of the Schuylkill Navigation Company, to the drawing down of the level in Fairmount Pool below that which the company now considers necessary for its purposes. Suit was entered by the company in May last to restrain the City from such use of the water and to define the rights of the company in the premises, and a claim has recently been made on behalf of a boatman for damages arising from detention of his boat by reason of low water in Fairmount Pool.

These claims are based upon three agreements bearing date June 3, 1819, July 20, 1820, and June 14, 1824, respectively, between the President, Managers and Company of the Schuylkill Navigation Company on the one hand, and the Mayor, Aldermen and citizens of Philadelphia on the other.

These agreements give to the City the unrestricted use of all the water remaining in the river after the company has drawn off so much as may be needed for the operation of the canal and locks, provided such use should not reduce the level below the top of the dam then built; but the Railroad Company proceeds upon the assumption that it was the intention of the parties to compel the City to maintain throughout the entire pool such depth as the company might at any time require, a depth which it could easily establish and maintain by dredging.

Furthermore, in his letter of September 23, 1895, Mr. Edwin F. Smith, Engineer and Superintendent of the Navigation Company, wrote me as follows:

"There is no scarcity of water whatever for navigation "purposes anywhere on the river. Our dams are all brim "full, and there is scarcity at Fairmount only because "the Department insists upon doing the wrong thing."

While it may be true, as Mr. Smith remarked in his letter of September 27th, that "the City certainly has no "right to expect that the company shall use its storage "water to keep the pumping stations on Fairmount dam "going," it seems to me equally certain, on the other hand, that it was not the intention of the parties to these several agreements that the company should restrain the City from pumping water while it (the company) was holding back the storage water of the river in its upper dams.

The business of the Schuylkill Navigation Company has admittedly dwindled almost to zero, and the chief value of the canal property now seems to reside in its function as a thorn in the flesh of the City.

By virtue of the ancient agreements above cited, made while the canal was the chief means of communication in this part of the State, and at a time when the water supply of the City can scarcely be said to have reached even its infancy, the company now seeks to cripple the vital operations of the City for the supposed benefit of a navigation which is nearly, if not quite, a thing of the past.

The company has also, by virtue of these agreements, certain water rights from which it derives revenue from the mill owners at Manayunk, and by virtue of these rights the City is prevented from increasing the height of its flash boards on the dam.

The railroad company thus seeks to restrain the City, on the one hand, from drawing the water down below what the company now claims as its boating limit, which is the bottom of the flash boards, and on the other hand, from replacing the flash boards by a permanent structure or increasing their height beyond its present one of twelve inches. These twelve inches, therefore, embrace the limits which the company now seeks to establish as those between which the City is to be permitted to take water.

I have referred, elsewhere, to the proposition made by the company a few years ago, looking to the purchase of its works by the City.

As stated in the report of the General Superintendent, every effort has been made to comply with the requests of the Navigation Company. The turbine wheels at Fairmount are extremely wasteful of water, consuming, according to our estimate, thirty gallons in water power for each gallon raised into the reservoir, and the engineers at the station were therefore instructed not to run these wheels unless the water was above the boating level required by the Navigation Company.

It will be noticed, also, that notwithstanding our forced encroachments upon the alleged rights of the Navigation Company by the use of our steam pumps, we were unable to keep pace with the demand during July and August, but lost daily about 6,000,000 gallons from our reservoirs.

Queen Lane Reservoir.

Immediately after my appointment as Chief of the Bureau in June last, you directed my attention to the condition of the Queen Lane Reservoir, and urged that it be given my immediate personal attention. You placed at my disposal the services of Mr. Rudolph Hering and Major C. W. Raymond as consulting engineers, and, in concert with these gentlemen, I immediately proceeded to a careful study of the problem.

The results of this study are embodied in the reports made by us and appended hereto as Appendix II.

Unfortunately, the investigation was not begun until the summer had well commenced, and the best working season of the year was unavoidably consumed in our examination and study of the structure, in the preparation of specifications and in the awarding of the contract, so that active operations could not be put under way until fall.

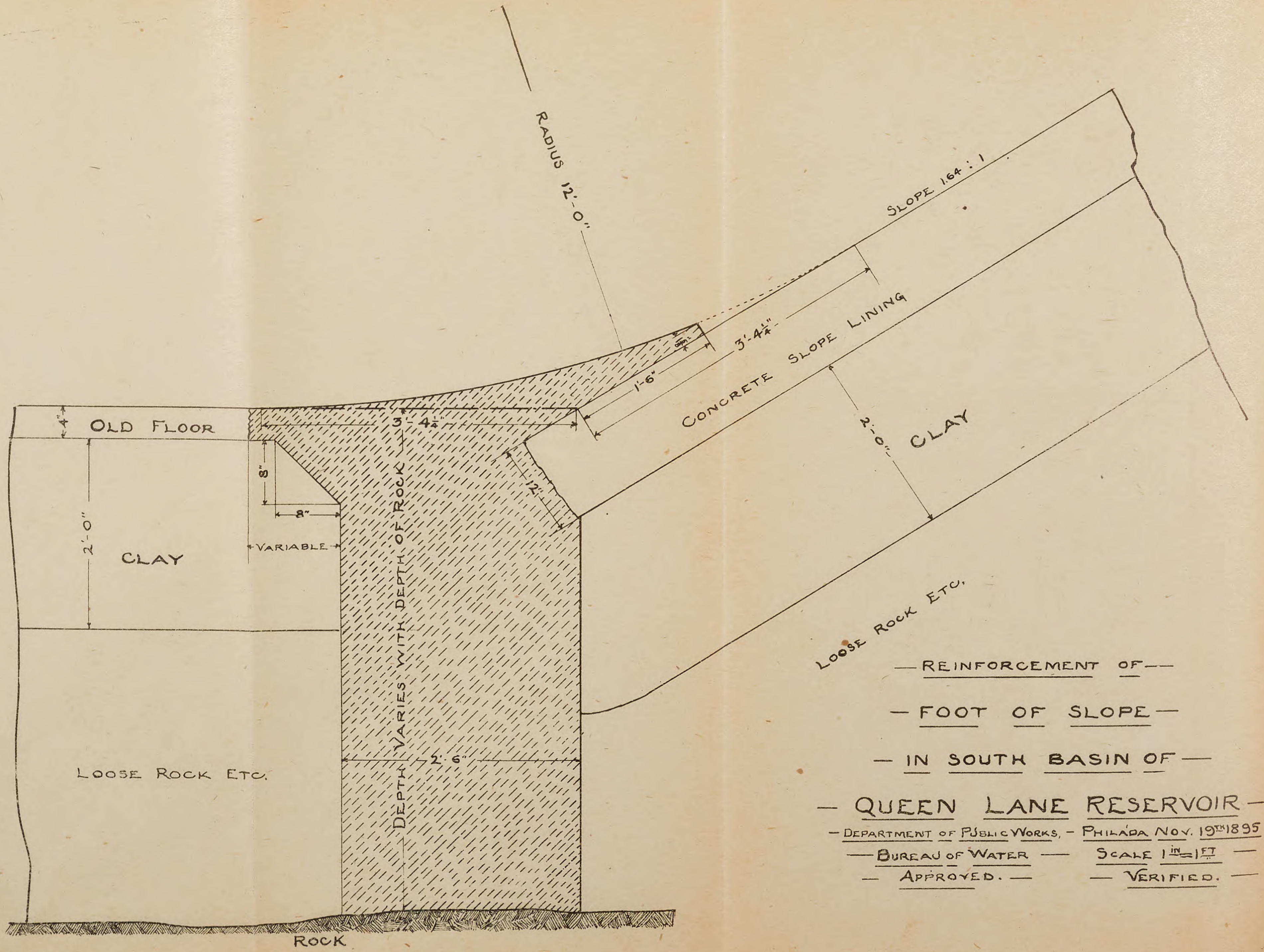
The report suggested that precautions be taken to increase the support under the feet of the concrete slabs covering the inner slopes of the reservoir, and that this treatment be applied, first, in but one of the two basins, in order that at least so much of the structure might be put in service this winter. It recommended, also, the lining of the slopes with a coating of asphalt and the construction of a drain around the reservoir site. The banks were found to be of sufficient dimensions, but it was suggested that the outer slopes might be flattened as a means of preventing undue wear of their surfaces.

Although the report suggested the north basin as the one to be first improved in the manner suggested, it was afterward decided to begin operations in the south basin, inasmuch as this had shown itself to be in a worse condition than its neighbor.

Operations were accordingly begun in the south basin on October 18th, under contract with the Pennsylvania Asphalt Paving Company. This contract covered the excavation of a trench under the foot of the inner slope around the entire circumference of the south basin, and the filling of this trench with a concrete wall, as indicated in Fig. 3.

The clay taken out in excavating the trench was, in accordance with the recommendation of the report, spread upon the floor of the south basin, in order that any water percolating through that floor might carry particles of this clay with it, and thus gradually close any pores which afforded them passage.

The footing wall is, in general, 2 feet 6 inches in thickness, and its depth is such as to reach, in all cases, to rock of a more or less satisfactory character. As stated



Radius 12'-0"
Slope 164 : 1
3'-4¼"
1'-6"
Concrete Slope Lining
2'-0"
Clay
12"
4"
Old Floor
3'-4¼"
8"
8"
Variable
2'-0"
Clay
Depth Varies with Depth of Rock
2'-6"
Loose Rock Etc.
Loose Rock Etc.
Rock
Reinforcement of
Foot of Slope
in South Basin of
Queen Lane Reservoir
Department of Public Works, Phila'da Nov. 19th 1895
Bureau of Water
Scale 1 in = 1 ft
Approved.
Verified.

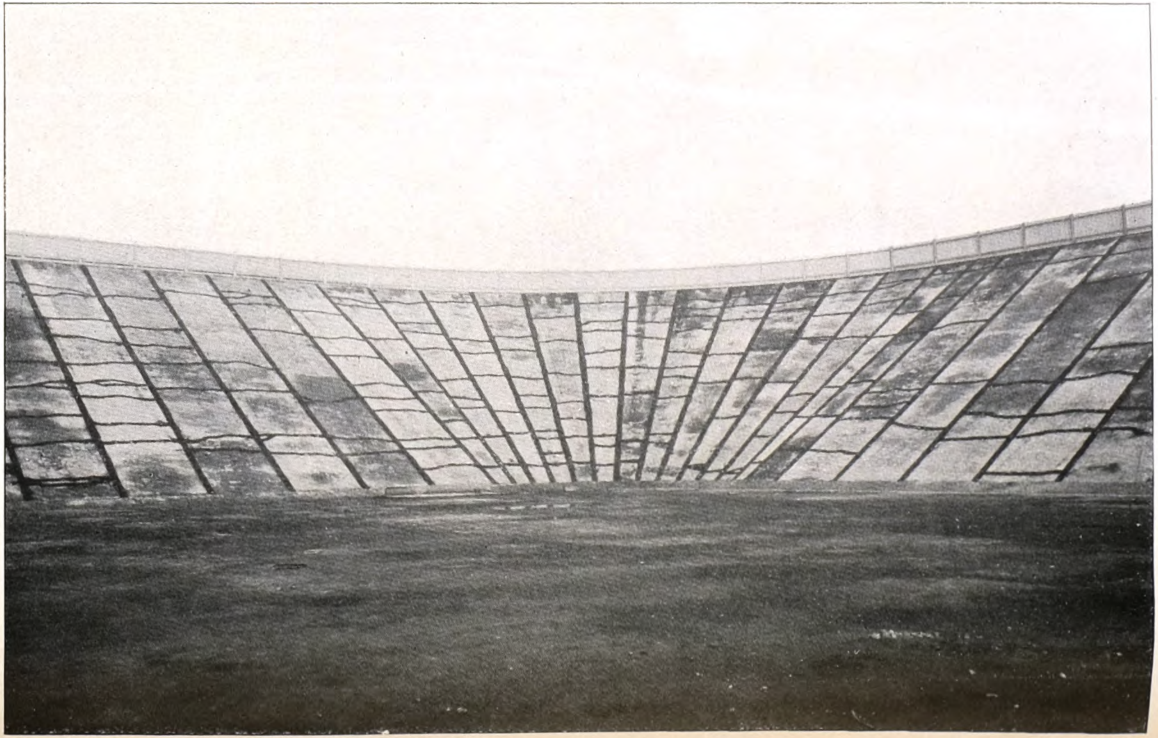


FIG. 4.—QUEEN LANE RESERVOIR.
Northeast Corner of South Basin, Showing Application of Asphalt on Slopes, November 18, 1895.

in our report, the rock underlying the site is micaceous and subject to decomposition near the surface, and in some places it was found impossible to reach a thoroughly satisfactory foundation without sinking the wall to inordinate depths.

As shown in Fig. 3, advantage was taken of this reconstruction to strengthen the joint between the floor and the slopes, by giving to the former a curved contour, tangent with the surfaces both of the floor and of the slopes.

The narrow triangle, between the top of this finish and the surface of the slopes, was filled out with a mixture of asphalt and sand, and the entire curved upper surface of the footing wall, together with the triangle mentioned, was covered with a coating of melted asphalt applied as a paint.

The construction of the footing wall was completed by November 14th.

Before the use of asphalt could be begun, the season had advanced so far that it became manifestly impossible to line the inner surfaces before the advent of cold and wet weather, during which it is inadvisable to conduct such operations. The task of lining the basins with asphalt was therefore postponed until 1896; but the subsequent behavior of the structure, under the action of the rains which set in during the construction of the footing wall, showed beyond question the advisability of taking immediate precautions to protect the structure from the effect of the winter storms.

It was found that rain, falling upon the surfaces of the slopes, found its way along the horizontal cracks which had appeared in the surfaces of the slabs to the open joints between them, and, passing through these joints to the clay beneath, flowed down between the clay and the concrete slabs, softening and, in some cases, washing out portions of the clay in the lower part of the slope, thus leaving the lower portions of the concrete slabs relatively unsupported. This appeared to have been a principal cause of the leakage of the reservoir, much of which evidently passed through the joint between the floor and the slopes, and it was accordingly decided to seal at once, with melted asphalt, the joints between the slabs and the horizontal cracks in them.

Arrangements were accordingly made with the Pennsylvania Asphalt Paving Company for the supply of this material and of the necessary labor. The work began on November 7, while the construction of the concrete footing wall was still in progress and was finished by December 6.

This treatment with asphalt was applied to both basins. As already stated, the top of the footing wall in the south basin received a coat of asphalt over its entire surface, and special pains were taken, also, to close the joint between the floor and the slopes in the north basin. Two or three of the most conspicuous cracks in the floor of each basin were also repaired with asphalt.

In all cases, the concrete surface, before the application of the melted asphalt, was first treated with a solution of about 30 per cent. California asphalt in 70 per cent. of gasoline. This solution penetrated the pores of the concrete, and was allowed to dry thoroughly before the melted asphalt was applied to it. Melted asphalt, applied directly to a concrete surface, has little or no adhesion to the latter, but the solution of asphalt and gasoline acts as a priming coat or binder, and secures a very satisfactory degree of adhesion.

Inasmuch as a thorough treatment of the slopes with asphalt had to be deferred until 1896, it was intended to introduce only sufficient water to cover the floors of the basins to a depth of a few feet and thus protect them from the frost. The slopes would thus have been left exposed to the full severity of the winter storms, and the use of asphalt in sealing the cracks in the slabs and the joints between them, as shown in the photograph, Fig. 4, was intended merely as a protection against this.

The result has, however, shown a very considerable improvement in the capacity of the reservoir for retaining water.

Both operations have been under the efficient care of Mr. Amasa Ely, under whose supervision the original work of construction was performed.

On November 29, water was introduced into the north basin from one of the pumps at the Queen Lane Pumping Station, and on December 7, when this had reached a depth of 4 feet 2 inches, the lower pass-pipes between the two basins were opened and the water was allowed to flow into the south basin.

On December 17 and 18, when the water in both basins had reached a depth of 5 feet, the elevation of the water surface was measured, and showed a loss of $\frac{1}{8}$ inch in the north and $\frac{1}{4}$ inch in the south basin.

At a depth of 6 feet these observations were resumed, and showed a daily loss of from $\frac{1}{8}$ to $\frac{1}{4}$ inch in each basin, that in the south basin slightly exceeding that in the north.

Under the same head of 6 feet, before the repairs, the north basin lost about half an inch daily, and the south basin about one inch. In this case, however, the water had previously reached a depth of 10 feet.

At this writing the water stands about 10 feet in each basin, and the loss from the north and the south basins is about $\frac{3}{8}$ inch and $\frac{3}{4}$ inch respectively.

The losses stated include evaporation in all cases.

It will be remembered that no contract has yet been let for a thorough treatment for the purpose of rendering the basin water-tight.

The cost of the footing wall was as follows:

1,681 square yards of floor concrete removed, at 10 cents	$168 10
21 cubic yards of slope concrete removed, at $1.00	21 00
2,286 cubic yards of excavation, at 40 cents	914 40
2,575 cubic yards of concrete foot-wall, at $5.50	14,162 50
Total	$15,266 00

The cost of the asphalt work was as follows:

Bermudez Asphalt, Alcatraz Asphalt, F. Grade, } 60.46 tons, at $60 per ton	$3,627 60
Gasoline, 1,723 gallons, at 12 cents	206 76
Implements	533 45
Total for materials	$4,367 81
Labor	3756 87
Total	$8,124 68

With a view to a thorough and permanent lining of the inner slopes alternative specifications have been prepared for:

1st. A lining of melted asphalt.

2d. A double lining of melted asphalt with burlap between the two coats.

3d. A three-inch lining of asphalt concrete.

4th. A water-tight lining, the method of treatment to be submitted by the bidder.

Similar specifications, with the exception of the third, have been prepared for the new reservoir at Roxborough. The slopes of this reservoir, being of brick, have the advantage of flexibility, and are free from many of the disadvantages of a cement concrete lining. Hence it was thought unnecessary to apply a lining of asphalt concrete there.

During the progress of our investigation of Queen Lane reservoir several firms and companies were invited to place upon the concrete slopes of the reservoir samples of such linings as they would propose to apply in the event of the award of a contract to them for such repairs, and, in pursuance of these invitations, samples of Alcatraz, Bermudez, and Seyssel asphalt were applied, as were also samples of an asphaltic material called ruberoid, prepared by the Standard Paint Company of Bound Brook, N. J.

It was, of course, out of the question to test in this way the imperviousness of the several linings, and the samples were intended simply to give a working acquaintance with the different materials.

A considerable number of concrete slabs, one foot square, are now being prepared with a view to experimenting with various water-proofing applications.

Queen Lane Pumping Station

The new Queen lane pumping station, on the left or east bank of the Schuylkill just below the mouth of the Wissahickon, owes its somewhat misleading name to the fact that it was designed for the supply of the Queen lane reservoir.

It will have four triple-expansion, vertical, fly-wheel engines, each with a capacity of 20-million gallons daily, lifted about 235 feet. The engines will be supplied with steam by twenty-four furnace-flue tubular boilers.

The boilers, built by Riter and Conley, of Pittsburg, Pa., are all in place and ready for use. The engines are being erected by the Southwark Foundry and Machine Company of this City, and two of them have already been in service.

No arrangements have as yet been completed for the supply or storage of fuel for this station, and no appropriation is available for the purpose. The coal thus far used has been brought by carts from the Wissahickon station of the Philadelphia and Reading Railroad, a distance of about half a mile. This is, of course, uneconomical, and, as will be seen, it accounts in part for the increase in the cost of pumpage during 1895.

The original design of the station involved the construction of a turnout from the railroad to a car shed to be built on the brow of the hill overlooking the station, and of a tunnel from a point under the car shed, passing under Ridge avenue to the basement of the boiler house. From the tracks in the shed the coal was to be fed, by means of chutes and hoppers, into cars in the tunnel and by them conveyed to the basement, whence it was to be raised to the boiler-hoom by hydraulic lifts. The estimated cost of this arrangement, exclusive of land, which has not yet been condemned, was about $35,000.

Investigations are now being made with a view to determining whether liquid or gaseous fuel can be economically substituted for coal at this station. If it can, the construction and operation of the costly appliances for handling coal, and the necessity of disposing of ashes, can be avoided.

The use of oil or gas is being studied, also, in connection with the Belmont and Roxborough high-service stations. Here the location necessitates a long haul, of both coal and ashes, and in the case of the Belmont station these materials must be hauled through the park.

Tapping Mains Under Pressure.

In the report of Mr. Fuller on the Distribution System, Appendix D, mention is made of the purchase of apparatus for tapping mains while they are full of water under pressure.

This device is a very important addition to our facilities, obviating, as it does, the necessity of shutting off the water, from mains and from the districts supplied, during the time while large connections are being made.

Mains Supplying Fire Hydrants.

During October and November there appeared, in the New York Journal of Commerce and Commercial Bulletin, a series of articles commenting unfavorably upon our means for distribution in certain localities, particularly as viewed from the standpoint of the underwriter.

In these articles it was stated, with Hexamer's maps as authority, that in a large portion of Market street the hydrants are supplied by 6-inch mains laid in 1822, that Chestnut street is supplied by a 10-inch main laid in 1823, that all of the lateral streets have 6-inch mains laid in 1822, and that on a portion of Broad street, where there are modern pipes 20 and 30 inches in diameter, the 6-inch pipes of 1823 are still retained for hydrant use.

It seems proper, in this connection, to state the following facts:

On Market street west of Broad street we have two lines of 6-inch main, one on each side, laid at dates ranging from 1834 to 1876.

On Market street east of Broad street we have one 20-inch main in the centre of the street, laid in 1882, and two 6-inch mains, one on each side, laid mostly in 1822 and 1823.

At each street crossing the 20-inch central main is connected with the 6-inch side mains through the mains on the lateral streets, and the fire hydrants, nearly all of which are located at the street intersections, are thus practically supplied directly from the 20-inch main.

Futhermore, on Arch street, from Second to Twenty-second, we have a 6-inch main and a 30-inch supply main (the latter laid in 1850) both of which are connected, through the mains on the lateral streets, with the Market street system. No attachments other than fire hydrants are allowed on supply mains.

On Chestnut street we have, west of Broad street, one 10-inch main; and, east of Broad street, two 10-inch mains, laid mostly in the '20's and '30's.

On Walnut street we have a 12-inch main from Front

10

to Twenty-second streets. This also feeds the Market and Chestnut street systems.

On Broad street the 20-inch and 30-inch mains are connected at each crossing with the 6-inch side mains, and thus, practically, with the hydrants.

On the other north and south streets we have pipes as follows:

Delaware avenue, 6-inch pipe, laid	1861.
Water street, 6-inch pipe, laid	1846.
Front street, 8-inch pipe, laid	1822–1823.
Second street, 6-inch pipe, laid	1823–1824.
Third street, 6-inch pipe, laid	1824–1827.
Fourth street, 6-inch pipe, laid	1823–1826.
Fourth street, 16-inch pipe, laid	1885.
Fifth street, 10-inch pipe, laid	1824–1826.
Sixth street, 6-inch pipe, laid	1822–1827.
Seventh street, 6-inch pipe, laid	1822–1827.
Eighth street, 10-inch pipe, laid	1827–1828.
Ninth street, 6-inch pipe, laid	1823–1826.
Tenth street, 6-inch pipe, laid	1823–1830.
Eleventh street, 10-inch pipe, laid	1830–1831.
Twelfth street, 6-inch pipe, laid	1826–1848.
Thirteenth street, 6-inch pipe, laid	1828–1846.
Juniper street, 10-inch pipe, laid	1879.

A portion of the 6-inch pipe laid on Market street, near Tenth, in 1822, was taken up October 22, 1895, and it was found that the incrustations which had formed in it during these 73 years, had reduced its area only about one-fifth.

Advertisements.

In my letter of September 27 I invited your attention to the disadvantage under which the City in general, and this Bureau in particular, labors by reason of the provision that advertisements of our requirements shall be inserted only in three local newspapers, one of them German.

In many cases, no doubt, our local mechanics and manufacturers are abundantly able to supply the City's needs, and certainly in many it would be absurdly inconvenient to place our contracts outside of the City; but, on the other hand, there are very many and very important cases where the City ought to have the benefit of the competition of outside parties, and many where only such parties can furnish the work on terms advantageous to the City. It is a great pity, therefore, if a mis-called local patriotism is to be allowed to cripple the City's facilities of doing work.

The daily papers of any city or cities are by no means, in all cases, the best means of advertisement for engineering work; and I would not, therefore, urge that our advertisements be placed in the daily papers of other cities; but I do urge that permission be given this Bureau to advertise its engineering requirements in those journals, such as the "Engineering News" and "Engineering Record," of New York, which are regularly consulted by engineering contractors in search of just such advertisements. The two journals named are weekly technical papers of recognized high standing, and are very largely used by municipal officers for the purpose of advertising their requirements.

Report of the General Superintendent.

I call attention to three important suggestions made by Mr. Hand, General Superintendent, in his report, viz: for the laying of a main across the Schuylkill River, to connect the eastern and western portions of our system; for the construction of a high-level bridge across the Wissahickon; and for the improvement of our telephone service.

Needed Improvement of the Telephone Service.

All of these are important improvements; but the last named is, in my judgment, the first in importance, and it is certainly by far the least in cost. Mr. Hand is well within bounds in saying that "there are times, principally during the night, when it is almost impossible to transmit messages," and "that an error in transmission or inability to communicate might, in a critical case, result in very serious damage."

With your approval, I propose to proceed at once to improve the condition of our lines, and, in order to secure the best possible result at a minimum cost, to secure the services of an expert to design the work and to supervise its execution.

Councils have appropriated $1,000 for the purchase of telephone instruments and bids have been received for their supply. I recommend that the matter of the selection of an instrument be referred to the expert who shall superintend the improvement of the lines, in order that the two parts of the system may be so co-ordinated as to secure the best results.

Increase in Cost of Pumpage.

Mr. Hand, in his report, shows and explains an increase of twenty-one cents per hundred million foot-gallons in the cost of pumpage. This is due chiefly to an increase of seventeen cents per ton in the average price of the coal consumed and partly to the drought, which forbade the usual employment of the turbines at Fairmount, and partly to starting up of Queen Lane and auxiliary stations.

Construction and Repair Shop.

The Superintendent of the Construction and Repair Shop, in his annual report, submitted herewith (Appendix E), states that the amount of work done there in the repair of machinery and boilers, in 1895, greatly exceeds that done in any previous year.

The area occupied by the shop has been increased nearly one-third by the addition of that part of the building which was formerly occupied as a stable by the Police Bureau. This gives an increase of facility in handling work, and provides space for additional tools, as these may be required.

Water Meters on Fire Connections.

Several insurance companies and firms of underwriters have objected to the placing of meters upon the fire connections of manufacturing establishments, claiming that, inasmuch as such meters must necessarily remain idle during long periods, they are liable, when called upon, to refuse to operate, and that they might thus cut off the flow entirely at the critical moment. Mr. Fuller, Assistant in Charge of Distribution, has accordingly, as stated in his report, devised an apparatus, there illustrated, in which the meter is placed upon a by-pass of relatively small diameter, thus avoiding any possible interference with the flow through the pipe.

Such a device could hardly be depended upon to give an accurate measurement of any water actually taken through the fire connection; but, inasmuch as any such taking, in however small quantity, would be a violation of the manufacturer's bond, the office of the device is not to measure the quantity taken, but simply to give evidence of the fact that any had been taken, and Mr. Fuller's experiments upon this device show that it will detect the appropriation of any considerable amount of water.

Electrolysis of Water Pipes.

Notwithstanding that there are now in operation in the city over 400 miles of electric railway operated by the trolley system, we have yet to learn of any well-authenticated case of injury to our water pipes by reason of electrolysis. It is believed that this immunity is due largely to the effective bonding between the rails, upon which the Electrical Bureau insists.

Abbreviation of Report.

The voluminous lists of new fire hydrants and renewals of fire hydrants, which have hitherto accompanied the report of the Assistant in Charge of Distribution, and which occupied 130 pages in the report for the year 1894, are omitted from the present report, as involving an expense for their printing entirely incommensurate with any value resulting from their publication. It is but proper to remark that this omission was decided upon before the receipt of the request of the Finance Committee of Councils that the Department reports be curtailed as much as possible.

The table of service and supply pipes is transmitted as heretofore. These pipes, unlike the fire hydrants, being, of course, underground, it is desirable that a permanent record be kept of their laying, and in no way can this be so satisfactorily accomplished as by putting them in print. The few dollars required for this will be well invested.

Accompanying the report of Mr. Allen J. Fuller, Assistant in Charge of Distribution, will be found a table showing the number of properties of each kind served, and the number of appliances of each kind in use, on January 1, 1896, and another showing the number of permits granted for each purpose during the year 1895.

Heretofore these tables have appeared in the report of the Chief of the Bureau, and it has been customary to itemize these tables by wards, as well as by the nature of the appliances; but, believing that the considerable expense of printing the tables by wards is not warranted by any corresponding advantage, I have discontinued the practice and have given simply the totals for the entire city.

List of Water Pipes in Ground.

The alphabetical list of all water pipe "in the ground," compiled and printed in 1877, and showing the location, size, date of laying and length, of the pipe in each street, is now being revised, and I strongly recommend that it be printed.

New Quarters in City Hall.

At your suggestion, I have examined, in company with my assistants, such apartments in the City Hall as appeared to be available for the uses of this Bureau, with a view to an early escape from our present incommodious, unsightly and malodorous quarters in the old La Salle College building, at the northeast corner of Juniper and Filbert streets.

As a result of this examination, I have recommended that application be made for rooms Nos. 177, 178, 178A, 180, 181, 182, 183, 184, 186 and 188, in the northwestern part of the first story, for those of our offices to which the public requires easy access, and for two large rooms and the intervening hall in the ninth story of the western pavilion for the rest of our office work. These rooms are all, as yet, unfinished.

I am under obligations to many persons for aid kindly rendered me in the prosecution of my duties; notably to the Chairman and members of the Water Committee of Councils for advice and encouragement, to engineers in charge of water works in reply to numerous inquiries, and to my predecessors, Dr. Wm. H. McFadden and Mr. John L. Ogden for data in connection with the water service in the past and for their obliging willingness to offer any assistance in their power.

To you, sir, I am indebted for that courteous consideration which has done so much to facilitate my labors.

I remain,

Very respectfully yours,

JOHN C. TRAUTWINE, JR.,

Chief of Bureau.

APPENDICES.

The following appendices accompany this report:

A. List of Miscellaneous Receipts.

B. Report of Chief Clerk.

C. Report of General Superintendent.

D. Report of Assistant in Charge of Distribution.

E. Report of Superintendent of Construction and Repair Shop.

F. Report of Assistant in Charge of Hydrographic Work.

G. Report of Chief Draftsman.

H. Reports on Queen Lane Reservoir.

I. Project of the Philadelphia Water Supply Company.

APPENDIX A.

List of Miscellaneous Receipts for the year 1895.

January	2	Philadelphia Traction Co	Removing fire hydrant	$37 61
	3	Franklin Sugar Refining Co	Laying pipe	142 07
	4	Bureau of Water	Overpaid warrants	841 14
	5	Penna. R. R. Co	Supply connection	70 03
	5	Bureau of Water	Overdrawn warrants	297 02
	7	Charles Land	Shut off to redrive ferrule	16 50
	8	Peoples' Traction Co	Shifting stop	25 61
	8	Peoples' Traction Co	Shifting stop	26 89
	8	Peoples' Traction Co	Shifting stop	25 49
	9	Bureau of Water	Overdrawn warrants	493 50
	15	Electric Traction Co	Shifting stop	33 11
	17	Bureau of Water	Overdrawn warrants	123 00
	21	People's Traction Co	Renewing stop	28 10
	21	Quaker City Croquet Club	Rent of ground	10 00
	28	John Kerrigan	Repairing main	80 33
	29	McCann & Lafferty	Repairing main	37 21
	30	Phila. & Reading R. R. Co	Relaying pipe	2,063 19
February	1	John Grim	Repairing and relaying pipe	244 17
March	9	Southern Electric Light Co	Repairing stop	4 08
	12	John F. Pugh	Shut off and redriving ferrule	3 00
	15	Philadelphia Traction Co	Renewing stops	48 54
	28	D. McMahon	Shut off to repair pipe	3 00
	30	John Hevener	Six months rent of farm No. 3	78 50
April	4	Henry Snyder	Rent of saloon	200 00
	5	J. Sellers Kite	Repairing main	81 34
	17	David McMahon	Repairing main	33 88
	17	David McMahon	Repairing main	15 87
	17	David McMahon	Repairing	10 17
	22	Germantown Ice Co	Supply connection	10 09
	23	T. P. Smart	Repairing main	32 87

List of Miscellaneous Receipts for the year 1895—Continued.

April	27	Jos. Ladly	Stone	$79 80
May	6	John H. Harris	Rent of farm No. 2	100 00
	8	H. M. Harris	Rent of farm No. 1	100 00
	8	Bureau of Water	Overdrawn warrants	72 00
	8	Bureau of Water	Overdrawn warrants	211 72
	14	Philadelphia Traction Co	Moving stop	75 41
	20	J. A. Mundy	Repairing main	342 46
	21	J. A. Mundy	Shut off to redrive ferrule	6 00
	21	J. A. Mundy	Shut off to redrive ferrule	3 00
	21	J. A. Mundy	Plugging main	3 00
	21	J. A. Mundy	Shut off to redrive ferrule	3 00
	21	J. A. Mundy	Repairing main	8 40
	21	J. A. Mundy	Shut off	12 25
	21	J. A. Mundy	Shut off	3 00
	31	H. H. Houston	Supply connection	14 39
	31	Hestonville P. R. R Co	Renewing stop	15 43
June	4	D. McMahon	Shut off to redrive ferrule	10 50
	5	Frank McCullogh	Repairing pipe	6 08
	17	Peoples' Traction Co	Putting in stop	23 38
	17	Philadelphia Traction Co	Shifting stop	22 66
	19	Hestonville P. R. R. Co	Changing stop	43 78
	19	Hestonville P. R. R. Co	Renewing stop	26 89
	22	M. Ehret & Co	Shifting fire hydrant	10 45
	29	John McCann & Co	Repairing main	131 99
	29	McCann & Lafferty	Repairing main	10 06
July	2	Powers & Weightman	Repairing stop	3 42
	18	Peoples' Traction Co	Supply connection	26 39
	25	Peoples' Traction Co	Fire hydrant	93 33
	26	Philadelphia Traction Co	Shifting stop	25 63
	26	Philadelphia Traction Co	Shifting stop	22 90
	27	Bussenius & Cunliffe	Old material	2,132 89
August	1	Bureau of Water	Overdrawn warrants	9 00
	15	D. McMahon	Shut off to drive ferrule	1 00
	20	Philadelphia Traction Co	Shifting stop	24 64
	21	Hestonville P. R. R. Co	Moving stop	11 29
September	2	Philadelphia Traction Co	Shifting stop	27 05

List of Miscellaneous Receipts for the year 1895—Continued.

September 13	Wallace & Jones	Shut off to redrive ferrule	$3 50
13	Wallace & Jones	Shut off to redrive ferrule	12 66
13	Wallace & Jones	Shut off to repair main	6 91
13	Wallace & Jones	Shut off to repair main	18 81
13	Wallace & Jones	Shut off to repair main	27 93
13	Wallace & Jones	Shut off to repair main	29 65
13	Wallace & Jones	Shut off to redrive ferrule	6 00
13	Wallace & Jones	Shut off to make attachment	7 25
13	Wallace & Jones	Shut off to repair main	15 06
13	Wallace & Jones	Shut off to repair main	3 00
24	Wallace & Jones	Shut off to repair main	3 00
24	Harrison Bro. & Co	Laying pipe	36 70
29	John Hevener	Rent of farm No. 3	78 50
October 14	Electric Traction Co	Removing stop	29 21
21	Allison Mfg. Co	Repairing leak	10 55
18	Oak Lane Water Co	Stops, etc	25 50
23	Electric Traction Co	Shifting stops	26 30
23	Philadelphia Traction Co	Shifting stops	73 94
23	Philadelphia Traction Co	Shifting stops	39 40
November 1	Philadelphia Traction Co	Shifting stop	34 90
4	Oak Lane Water Co	Stops, etc	25 50
13	Morse, Williams & Co	Extending connection	29 42
19	Philadelphia Traction Co	Removing stop	25 96
25	Philadelphia Traction Co	Shifting stop	8 90
December 2	J. C. & G. W. Arnold	Repairing main	10 81
7	Electric Traction Co	Shifting stop	38 05
13	D. E. Dallam	Removing fire hydrant	16 69
14	H. Hitner & Son	Scrap iron and lead dross	1,667 90
16	Girard Iron & M. Co	Scrap iron and lead dross	89 10
20	Valentine Skipton	Empty oil barrels	139 65
20	A. B. Harrison	Ch'g location of fire hydrant	36 20
20	D. McMahon	Shut offs	3 38
21	D. McMahon	Repairing main	25 84
27	Philadelphia R. R. Co	Repairing stop	5 75
31	Henry Snyder	Rent of saloon, Fairmount	200 00
31	W. P. Clements	Shut offs, etc	35 00
	Total		$11,676 41

APPENDIX B.

REPORT OF CHIEF CLERK.

BUREAU OF WATER.

Philadelphia, January 24, 1896.

MR. JOHN C. TRAUTWINE, JR.,

Chief, Bureau of Water.

DEAR SIR:—I have the honor to transmit herewith detailed statement of the expenditures of the Bureau for the year 1895.

Yours truly,

J. T. HICKMAN,

Chief Clerk.

Detailed Expenditures of the Bureau for 1895.

General Appropriation.	Amount appropria'd.	Amount expended.	Amount merging.	Amount not merging
An Ordinance to make an appropriation to the Bureau of Water, approved Dec. 28, 1894.				
Amonnt appropriated......$1,031,804 00				
Balance from books of 1894 .... 663,479 57				
Increased by additional appropriations and transfers.......... 920,793 75				
$2,616,077 32				
Diminished by transfers.. 64,170 40				
Net appropriation..........	$2,551,906 92			
Item 1. Salaries.......... $291,804 00				
Diminished by transfer... 25,000 00				
Net appropriation to Item..........	266,804 00			
For Salary Chief of Bureau..........	6,000 00	$6,000 00		
Chief Clerk..........	2,000 00	2,000 00		
Assistant clerk..........	1,200 00	1,200 00		
Correspondence clerk..........	900 00	900 00		
Time clerk..........	1,000 00	1,000 00		
Messenger..........	720 00	720 00		
Draughtsmen..........	4,700 00	4,700 00		
General superintendent....	3,500 00	3,282 98		
Clerks to general superintendent..........	2,000 00	2,000 00		
Assistants to chief..........	3,600 00	3,600 00		
Pipe inspector and clerks..	2,200 00	2,200 00		
Search clerks..........	2,200 00	2,200 00		
Assistant clerks..........	2,750 00	2,750 00		
Chief inspector..........	1,200 00	1,200 00		
Inspectors..........	19,000 00	19,000 00		
Permit clerk.s..........	2,300 00	2,300 00		
Purveyors..........	9,200 00	9,200 00		
Clerks to purveyors..........	4,800 00	4,800 00		
Assistant clerks to purveyors..........	4,500 00	4,464 22		
Hydrant inspectors..........	7,050 00	6,326 05		
General foremen..........	6,634 00	6,164 50		
Foremen of repairs..........	3,900 00	3,900 00		
Superintendent of shop....	1,500 00	1,500 00		
Clerk to superintendent of shop..........	900 00	825 00		
Watchmen (offices and yards)..........	6,075 00	5,893 10		
Storekeepers..........	1,400 00	1,290 36		
Foreman machinist..........	1,500 00	1,500 00		
" bricklayer..........	1,100 00	1,100 00		
" carpenter..........	1,000 00	1,000 00		
" stonemason..........	900 00	900 00		
" painter..........	900 00	774 20		
" riggers..........	900 00	900 00		
" laborers..........	840 00	840 00		
Janitor (main office)..........	720 00	720 00		
Lineman..........	1,000 00	973 12		
Telephone operators..........	1,100 00	1,100 00		
Electrician..........	1,200 00	1,200 00		
General storekeeper..........	1,000 00	1,000 00		
Yardkeeper (Fourth District)..........	915 00	915 00		

Detailed Expenditures of the Bureau for 1895.

General Appropriation.	Amount appropria'd	Amount expended.	Amount merging.	Amount not merging
SALARIES AT PUMPING STATIONS.				
Fairmount engineers, oilers, etc.........	$14,310 00	$13,944 37		
Spring Garden engineers, oilers, etc...	79,300 00	75,817 09		
Belmont engineers, oilers, etc............	21,150 00	20,069 26		
Belmont auxiliary engin's, oilers, etc..	3,400 00	2,625 43		
Queen lane engineers, oilers, etc.........	16,050 00	143 34		
Roxborough engineers, oilers, etc.......	18,620 00	17,398 96		
Roxbo'h auxiliary engin'rs, oilers, etc.	3,400 00	2,621 40		
Mt. Airy engineers, oilers, etc...........	3,070 00	3,070 00		
Chestnut Hill engineers, oilers, etc....	1,500 00	1,500 00		
Frankford engineers, oilers, etc.........	16,700 00	16,341 32		
Total..	....	$265,864 70	$939 70	
Item 2. For general supplies, including fuel, oil, and small stores....... ....$150,000 00				
Increased by transfer from Bureau of Gas............... 225,000 00				
Net appropriation to Item................	$375,000 00			
Deficiencies of 1894:				
Coal for stations.......... $61,216 30				
Hauling....................... 318 11				
Oil 68 42				
		$61,602 83		
Belting..	....	150 51		
Brushes	....	45 35		
Chandlery....................................	....	311 96		
Coke...	....	2,104 10		
COAL FOR OFFICES AND SHOPS.				
2 tons nut, at $5.50....................$11 00				
4 tons stove, at $4.15................. 20 60				
10 tons stove, at $5.15................ 51 50				
9 tons stove, at $6 00................. 54 00				
66 tons bituminous, at $3.44......227 04				
61 tons nut, at $4.65..................283 65				
332.06 tons pea, at $2.95...........996 30				
		1,641 09		
COAL FOR STATIONS.				
Fairmount, 226 tons egg, at $4.49............................ $1,010 25				
Chestnut Hill, 213.09 tons buck, at $3.02.................. 644 62				
Mt. Airy, 1,369.17 tons buck, at $2.25................. 3,079 91				
Queen Lane, 805.10 tons pea, at $2.65.................. 2,134 58				
Roxborough, 290.13 tons buck, at $1.97................. 572 58				
Roxborough, 19,256.02 tons pea, at $2.72.................. 53,845 39				
Frankford, 7,172.16 tons buck, at $2.05................. 14,704 26				
Belmont, 5,974.00 tons buck, at $1.96.......................... 11,708 06				
Belmont, 13,176.14 tons pea, at $2.71.......................... 35,708 90				

Detailed Expenditures of the Bureau for 1895.

General Appropriation.		Amount appropria'd	Amount expended.	Amount merging.	Amount not merging
Item 2—Continued.					
Spring Garden, 28,846.04 tons buck, at $1.97..........	56,827 02				
Spring Garden, 32,657.14 tons pea, at $2.68............	98,242 62				
			$278,478 19		
Grease		....	5 00		
Hauling ashes, Roxborough Station, 4,622.09 tons, at 20c..............................		....	924 49		
Hauling coal, Roxborough to Roxborough auxiliary, 522.16 tons, at 35c			182 89		
Lime..		....	26 40		
OIL.					
51 gallons paraffine, at 9c...	$4 59				
51½ gallons Arctic, at 13c...	6 70				
102½ gallons gasoline, at 8c.	8 20				
264 gallons gasoline, at 7½c.	19 80				
263½ gallons black, at 7c....	18 45				
56 gallons linseed, at 53c....	29 65				
53½ gallons castor, at 92c...	49 22				
57 gallons castor, at 93c......	53 61				
4,753½ gallons headlight, at 6¾c................................	314 22				
827 gallons lard, at 58c.......	479 66				
7,655 gallons engine, at 25c.	1,913 76				
8,075½ gals. cylinder, at 28c.	2,261 28				
			$5,159 14		
Paints..		....	363 26		
Tallow..		....	193 28		
Waste (cotton)..		....	210 88		
Wood		....	77 50		
Total..		....	$321,482 87	....	$23,517 13
Item 3. For repairs to machinery, including the conveyance of workmen incident thereto..............	$60,000 00				
Increased by additional appropriations	40,000 00				
Net appropriation..		$100,000 00			
Deficiencies of 1894:					
Iron fittings................	$88 87				
Repairs to boilers.........	360 44				
Repairs to pipe cover'g	183 71				
			$633 02		
Belting..		....	74 00		
Boiler tubes..		....	1,000 00		
Brass fittings..		....	1,419 35		
Chandlery...		....	1,066 71		
Centrifugal pump..		....	500 00		
Donkey pumps..		....	1,310 00		
Fire brick..		....	701 68		
Gum goods..		....	1,787 76		
Hardware		....	1,505 00		
Hauling..		....	2,000 00		
Hoisting engines...		....	1,157 00		
Iron castings..		....	659 41		
Iron fittings..		....	1,551 74		
Jet heads...		....	90 50		
Lumber..		....	1,000 00		
Packing..		....	64 50		
Paints..		....	70 00		

Detailed Expenditures of the Bureau for 1895.

General Appropriation.		Amount appropri'd.	Amount expended.	Amount merging.	Amount not merging
Repairs to boilers:					
Fairmount Station	$18 50				
Belmont Station	80 34				
Mt. Airy Station	157 10				
Fire engine	379 34				
Roxborough Station	1,054 19				
Frankford Station	891 00				
Spring Garden Station	4,271 83				
		....	$6,852 30		
Repairs to hoisting engine		....	345 59		
Repairs to jack		....	23 70		
Repairs to pipe covering:					
Roxborough Station	$25 00				
Belmont Auxiliary St'n	100 20				
Frankford Station	396 81				
Belmont Station	630 90				
Spring Garden Station	1,558 25				
		....	2,711 16		
Repairs to pumps:					
Roxborough	$1,300 62				
Spring Garden	1,526 61				
Frankford	6,178 03				
		....	9,005 26		
Repairs to scales		....	270 25		
Separators, Queen Lane Station		....	1,425 00		
Steel rails		....	379 80		
Transportation		....	2,604 45		
Wages:					
Bricklayers	$13,883 31				
Carpenters	1,483 20				
Helpers	436 82				
Laborers	8,919 16				
Machinists	21,557 67				
Stonemasons	11,785 51				
		....	58,065 67		
Total		....	$98,053 85	$1,021 02	$925 13
Item 4. Maintenance to buildings, grounds and reservoirs	$75,000 00				
Increased by additional appropriation	62,000 00				
Net appropriation to Item		$137,000 00			
Deficiencies of 1894:					
Repairs to harness		....	$7 75		
Benches		....	30 00		
Bricks		....	5,557 4[illegible]		
Brushes		....	59 18		
Carts and wheels		....	167 00		
Cement		....	3,000 00		
Chandlery		....	1,673 79		
Clay		....	10 00		
Cleaning wells		....	79 00		
Disinfector rental		....	108 00		
Disinfectant supplies		....	98 00		
Electric supplies		....	1,116 18		
Fire brick		....	32 12		
Forage		....	1,350 17		
Furnishing light		....	986 75		
Glass window		....	58 80		
Granite coping		....	844 25		
Gum goods		....	377 03		

Detailed Expenditures of the Bureau for 1895.

General Appropriation.		Amount appropria'd.	Amount expended.	Amount merging.	Amount not merging
Hauling			1,000 00		
Hardware			1,739 75		
Horses, 2 at $123.50			247 00		
Horse shoeing			210 58		
Ice			141 89		
Iron			109 07		
Lumber			4,000 00		
Oil			72 55		
Paints			722 18		
Professional services, V. S.			19 75		
Repairs to harness	$27 55				
Repairs to pavement	52 10				
Repairs to roadway	568 00				
Repairs to roofs	1,869 09				
Repairs to siding	124 81				
Repairs to wagons	94 55				
			2,736 10		
Sand			477 40		
Scales			655 76		
Services as diver			100 00		
Slag			155 25		
Stable supplies			23 60		
Stone			1,009 21		
Telephone rental			1,305 00		
Telephone supplies			698 21		
Window shades			24 00		
Wages:					
Engineer corps	$10,663 69				
Bricklayers	1,662 72				
Carpenters	12,405 05				
Helpers	11,864 01				
Horses and carts	5,609 50				
Laborers	56,080 91				
Painters	5,318 00				
Stonemasons	1,664 44		105,268 32		
Total			136,271 07	728 93	
Item 5. For repairs and improvement of the distribution, including the purchase of material and cost of labor in connection therewith and expenses incident thereto	$100,000 00				
Increased by additional appropriation	72,000 00				
Net appropriation to Item		172,000 00			
Deficiencies of 1894:					
Gum goods			136 10		
Ashes			2 90		
Boiler tubes			747 11		
Brass fittings			794 84		
Bricks			713 30		
Cement			230 91		
Chandlery			517 88		
Corporation cocks:					
64 ½-inch, at 32 cts	20 48				
100 ¾-inch, at 42 cts	42 00				
			62 48		
Disinfectant			14 00		
Flagstone			17 19		
Forage			1,127 82		
Gauge			16 00		
Granite coping			230 87		

Detailed Expenditures of the Bureau for 1895.

General Appropriation.		Amount appropria'd.	Amount expended.	Amount merging.	Amount not merging
Gum goods			336 25		
Hardware			1,507 61		
Harness			93 71		
Hauling			1,000 00		
Iron fittings			1,502 89		
Iron pipe:					
3,030 6 in., 1,107,143 lbs., at .886 cent	$9,809 28				
1,102 6 in., 406,578 lbs., at .87 cent	3,538 68				
500 8 in., 244,531 lbs., at .87 cent	2,127 42				
416 10 in., 287,491 lbs., at .884 cent	2,440 73				
380 12 in., 347,502 lbs., at .864 cent	3,002 41				
			20,918 52		
Iron specials:					
228,914 lbs. at 1.85 cents	4,234 90				
302,301 lbs. at 1.75 cents	5,290 29				
			9,525 19		
Lumber			2,000 00		
Machine work			179 40		
Paints			52 23		
Plumbing			65 52		
Professional services V. S.			4 00		
Repairs:					
To conduit	10 00				
To pavement	88 20				
To wagons	36 35				
			134 55		
Shop castings:					
6,195 lbs. at 1.465 cents	91 04				
4,190 lbs. at 3 cents	125 70				
33,120 lbs. at 2⅜ cents	786 60				
175,760 lbs. at 1.07 cents	1,874 21				
			2,877 55		
Slag			71 10		
Transportation	230 95				
Traveling expenses	153 60				
			384 55		
Water meters, 3 4 in., at $198			594 00		
Wages:					
Improvement	$4,104 50				
First District	12,736 46				
Second District	12,777 76				
Third District	33,987 41				
Fourth District	20,142 58				
Fifth District	14,061 44				
Sixth District	18,026 63				
			115,836 78		
Total			161,995 25	10,004 75	
Item 6. For supplies, including fuel, and labor at City construction and repair shop	$75,000 00				
Increased by additional appropriation	11,300 00				
Net appropriation to Item		86,300 00			
Deficiencies of 1894:					
Iron castings	48 51				
Transportation	9 30				
			57 81		
Belting			19 92		

Detailed Expenditures of the Bureau for 1895.

General Appropriation.		Amount appropria'd	Amount expended.	Amount merging.	Amount not merging
Item 6—Continued.					
Brass castings, etc.:					
21,204 lbs. lead coating at 4 cts	848 16				
4,960 lbs. expansion metal at 24½ cents	1,220 10				
16,221 lbs. red brass at 11.09 cents	1,930 16				
13,372 lbs. Ajax metal at 22 cents	2,941 84				
38,513 lbs. yellow brass at 9⅞ cents	3,799 26				
	$10,739 52				
CR.					
34 lbs. red brass returned, at 11.9 cents	$4 04				
58 lbs. Ajax m't'l returned at 22 cents	12 76				
400 lbs. yellow brass returned at 9⅞ cents	39 50				
4,525 lbs. scrap brass at 5 cents	226 25				
11,975 lbs. turnings at 4 ct.	479 00				
	$761 55	....	$9,977 97		
Chandlery		....	159 10		
Forage		....	200 00		
Gum goods		....	665 23		
Hardware		....	1,434 84		
Horse shoeing		....	20 00		
Ice		....	59 24		
Iron		....	2,601 85		
Iron fittings		....	80 66		
Lathes		....	3,155 25		
Listing		....	15 00		
Lumber		....	3,500 00		
Machine work		....	80 15		
Shop castings:					
7,155 lbs. at 2¾ cts	$196 76				
6,565 lbs. at 3 cts	196 95				
8,655 lbs. at 2⅜ cts	205 56				
24,850 lbs. at 3¼ cts	807 63				
154,868 lbs at 1.07 cts	1,674 81				
169,430 lbs. at 1.585 cts	2,693 38				
575,912 lbs. at 1.465 cts	8,438 14				
597,374 lbs. at 1.64 cts	9,796 94				
		....	$24,010 17		
Transportation		....	18 10		
Water meters:					
2 4 in. at $198	$396 00				
3 3 in. at $150	450 00				
		....	$846 00		
Wages		....	36,948 52		
Total		....	$83,849 81	$2,450 19	
Item 7. For general, incidental and contingent expenses, including keep of horse for Chief of Bureau, General Superintendent and Assistant,					

Detailed Expenditures of the Bureau for 1895.

General Appropriation.	Amount appropria'd.	Amount expended.	Amount merging.	Amount not merg'g.
each four hundred (400) dollars....... .... $15,000 00				
Increased by additional appropriation 1,000 00				
Net appropriation to item.............	$16,000 00			
Advertising....................................	....	$327 00		
Current meter..................................	....	121 20		
Desks and chairs..............................	....	139 50		
Daily papers.....................................	....	30 16		
Expenses of Committee on Water upon tours of inspection................	....	601 50		
Fire insurance................................	....	242 00		
Incidentals	....	372 88		
Keep of horse..................................	....	944 07		
Maps...	....	292 00		
"Photo" supplies............................	....	161 94		
Services of experts...........................	....	152 50		
Services of typewriters....................	....	83 50		
Stationery	....	8,011 83		
Subscription (periodicals)................	....	26 50		
Transportation................................	....	279 05		
Traveling expenses (hydrographic)....	....	173 89		
Telephone supplies..........................	....	22 50		
Text books......................................	....	87 08		
Typewriter supplies.........................	....	98 55		
Washing towels................................	....	84 00		
Window awnings..............................	....	88 55		
Writing up duplicates......................	....	2,102 59		
Wages, Hydrographic Corps.............	....	1,560 00		
Total..	....	$15,952 79	$47 21	
Item 8. For the purchase of material and cost of labor in connection with the laying of water pipes and expenses incident thereto.............. .... $225,000 00				
Increased by additional appropriation.............. 157,032 26				
Net appropriation to item	$382,032 26			
Deficiencies of 1894:				
Hardware.......................... $17 68				
Harness................. .... 36 50				
Horse................................ 126 60				
Horse shoeing..................... 69 00	....	$249 18		
Belting..	....	65 53		
Boiler	....	291 00		
Brass fittings..................................	....	1,599 66		
Brushes	....	22 22		
Bricks...	....	216 00		
Cement...	....	7,779 60		
Chandlery	....	1,636 47		
Coping stone..................................	....	38 83		
Compound	....	50 00		
Disinfectant....................................	....	56 00		
Dynamite..	....	1,019 80		
Electric supplies.............................	....	209 00		
Forage	....	1,677 54		
Freight	....	9 60		
Gum goods.....................................	....	5,188 05		
Hardware	....	2,399 54		

Detailed Expenditures of the Bureau for 1895.

General Appropriation.	Amount appropria'd	Amount expended.	Amount merging.	Amount not merging
Harness		$308 07		
Hauling		2,897 93		
Horses, 2 at $123.50		247 00		
Horse shoeing		616 90		
Ice		219 64		
Iron and steel		1,693 43		
Iron filings		1,000 00		
Iron pipe:				
1651=6", 598,442 lbs., @ $\frac{908}{100000}$ $5,433 85				
2869=6", 1,065,267 " @ $\frac{87}{100}$ 9,283 75				
6970=6", 2,514,729 " @ $\frac{886}{1000}$ 22,283 16				
1500=8", 741,649 " @ $\frac{87}{100}$ 6,365 36				
1584=10", 1,076,271 " @ $\frac{864}{1000}$ 9,299 00				
2620=12", 2,381,712 " @ $\frac{864}{1000}$ 20,577 29				
		73,242 41		
Iron special castings:				
47,472 lbs., at 1.35 $640 87				
162,057 lbs., at 3.25 5,266 87				
448,156 lbs., at 1.85 8,290 89				
684,350 lbs., at 1.75 11,976 14				
		26,174 77		
Lead, 50,192 lbs., at 3.19		1,601 12		
Lumber		3,946 58		
Machine work		520 80		
Meters, 6—6-in., at $450		2,700 00		
Paints		250 62		
Professional services (V. S.)		143 15		
Red clay		14 40		
Rent of shop (Fifth District)		100 00		
Repairs to gauge $2 50				
Repairs to meters 762 85				
Repairs to wagons 1,107 60				
		1,872 95		
Sand		420 00		
Services of assistant pipe inspector		133 00		
Stable supplies		190 91		
Steam hammer		650 00		
Stone		1,000 00		
Shop castings:				
12,331 lbs., at 1 $\frac{885}{1000}$ $195 45				
14,000 lbs., at 2¾ 385 01				
13,240 lbs., at 3 397 20				
51,600 lbs., at 1.07 552 23				
142,689 lbs., at 1.64 2,340 10				
165,865 lbs., at 2⅜ 4,115 48				
		7,985 47		
Tapping machines		4,403 80		
Tolls		5 66		
Transportation		13 50		
Traveling expenses		1,751 05		
Tube meter		44 00		
Viney's stop valves:				
5—6-in., 2-way, at $15 $75 00				
7—6-in., 3-way, at $28 50 199 50				
109—6-in., 6-way, at $2.00 6,200 00				
		6,474 50		
Wagon		185 00		
Window awning		6 00		
Wages:				
Improvement $4,879 20				
First District 11,300 98				
Second District 34,086 27				
Third District 48,231 22				
Fourth District 28,309 76				
Fifth District 39,422 27				
Sixth District 34,926 19				
		201,155 89		
		$364,475 07	$13,557 19	$4,000 00

Detailed Expenditures of the Bureau for 1895.

General Appropriation.		Amount appropria'd	Amount expended.	Amount merging.	Amount not merging
Item 9.					
For service pipe............	$40,000 00				
Diminished by transfer	4,772 64				
Net appropriation to item.................		$35,227 36			
Brass fittings....................................		....	$5,350 91		
Corporation cocks:					
1,500—3/8-in., at c.26.........	$390 00				
17,500—1/2-in., at c.28.........	4,900 00				
486—5/8-in., at c.32.........	155 52				
300—3/4-in., at c.42.........	126 00				
50—1-in., at c.64..........	32 00				
25—1½-in., at $1.16.......	29 00				
25—2-in., at $1.74..........	43 50				
		....	5,676 02		
Iron...		....	141 78		
Iron fittings....................................		....	868 39		
Lead pipe, 252,800 lbs., at c.4⅛............		....	10,614 16		
Wages—Improvement..........................		....	9,306 30		
Total....................................		....	$31,957 56	3,269 80	
Item 10. For extensions, balance Jan. 1, 1895..		540,747 80			
Air chambers (Queen Lane Station)...		....	$316 00		
Boilers " " "		....	56,466 72		
Cement......................................		....	2,486 85		
Engine-house (addition at Sp.Garden)		....	7,844 40		
Hauling..		....	1,991 05		
Lead, 303,448 lbs., at c.3-18375............		....	9,661 03		
Pumping engines (Queen Lane)........		....	67,551 20		
Pumping station " "		....	68,532 10		
Services as diver..............................		....	320 00		
Standpipes George's Hill, Rox. Aux...		....	15,430 00		
Traveling crane (Queen Lane)..........		....	7,460 00		
Wages:					
Fourth District..............	$3,445 76				
Fifth District.................	14,518 74				
Sixth District................	10,882 04				
		....	28,846 54		
Total....................................		....	$266,905 89	$29 05	$273,812 86
Item 10½. For repairing and improving reservoirs:					
Appropriation June 19, 1895	$250,000 00				
Diminished by transfer.....	34,397 76				
Net appropriation to item.................		$215,602 24			
Concrete wall (Queen Lane)		....	$23,390 68		
Repairs to walks (East Park).............		....	28,851 25		
Services of experts............................		....	2,456 37		
Wages (engineer corps)........		....	4,734 45		
Total....................................		....	$59,432 75	....	$156,169 49
Item 11. For the construction and completion of Queen Lane reservoir:					
Balance January 1, 1895......................		$122,731 77	....	....	$122,731 77

Detailed Expenditures of the Bureau for 1895.

General Appropriation.		Amount appropria'd.	Amount expended.	Amount merging.	Amount not merging
Item 11½. For new water mains:					
Appropriation July 3, 1895		$100,000 00			
Excavating pipe trench:					
2,797.6 cub. yds., at 21 cts.	$587 50				
Less 20 per cent	117 50				
			$470 00		
Iron pipe:					
23 lengths 30 in., 106,218 lbs., at $\frac{95}{100}$ cts	$1,009 07				
737 lengths 48 in., 5,474,152 lbs., at $\frac{95}{100}$ cts	52,551 49				
			53,560 56		
Iron special castings: 42,366 lbs., at $2\frac{1}{4}$ cts			953 24		
Lead: 163,482 lbs., at $3\frac{67}{100}$ cts			5,999 79		
Total			$60,983 59		$39,016 41
Item 12. For the purpose of refunding to Mr. Joseph J. Martin, for excavating and refilling twelve-(12) inch trench for water main in Thirtieth street, from Spring Garden street to the Zoological Garden: Appropriation December 23, 1895		$1,688 85			$1,688 85
Item 12½. For the purpose of refunding certain overpaid and paid-in-error water bills: Transferred from Item 9, December 23, 1895		$772 64			$772 64

RECAPITULATION.

General Appropriation.			
Balance from books of 1894	$663,479 57		
Special appropriations and transfers	920,793 75		
		$1,584,273 32	
Annual appropriation		1,031,804 00	
			$2,616,077 82
Transferred to other Bureaus	64,170 40		
Expended for deficiencies	62,686 69		
Expended for maintenance	1,447,216 28		
Expended for extensions	387,322 23		
		1,961,395 60	
Amount merging	55,564 57		
Amount not merging	599,117 15	654,681 72	2,616,077 82

APPENDIX C

REPORT

OF THE

GENERAL SUPERINTENDENT

OF

Work done during 1895 on Buildings, Grounds and Reservoirs, and on Boilers and Machinery at the Pumping Stations.

OFFICE OF THE GENERAL SUPERINTENDENT,

BUREAU OF WATER.

Philadelphia, January 15, 1896.

MR. JOHN C. TRAUTWINE, JR.,
Chief, Bureau of Water.

DEAR SIR:—I have the honor to submit the following report of work performed under my direction during the year 1895:

The total quantity of water pumped during the year amounted to 78,775,849,104 gallons, which represents an increase of 6,702,124,866 gallons over the pumpage of 1894.

The maximum daily pumpage was 258,838,527 gallons, an increase of 23,944,452 gallons over the maximum daily pumpage of the preceding year.

The average daily pumpage was 215,824,244 gallons, an increase of 18,479,438 gallons over the average of 1894.

The average daily pumpage per capita was 162 gallons, or 3 gallons more than in 1894.

The pumpage, as in previous years, is estimated from the plunger displacement, making what is believed to be a proper allowance for slip, but it is hoped that in the near future a more reliable estimate may be had by means of the Venturi meter. Experiments with this apparatus are now being made.

On December 1, 1894, as stated in my report of January 19, 1895, the first of the two thirty-million-gallon pumping engines, of the triple-expansion type, built by the Holly Manufacturing Company, of Lockport, N. Y., was put in operation. The second one was started on February 11, 1895, and both engines have since been run by the builders almost continuously and, thus far, to my entire satisfaction. Arrangements are now being made for an official test of these engines, as provided in the contract.

The twenty-million-gallon Worthington high-duty engine No. 4, at Spring Garden, has been taken down and removed to the Belmont station, where it has been re-erected on foundations built to receive it. The work of taking down and re-erecting the engine, as also that of building the foundations, was done by employes of this Bureau. The engine has been in operation at Belmont since June 27th, and has rendered it an easy matter to keep the Belmont reservoir supplied, and has enabled us to begin repairs of the older engines there. The plungers in the high duty attachment having become scored by grit in the water taken at Spring Garden, the attachment was thrown out of service before the removal of the engine. The plungers have since been repaired by the builders, and the high duty attachment will be put in operation as soon as sufficient boiler capacity is provided.

The engine has been temporarily protected by a rude structure of boards, and plans and specifications have been prepared for the erection of permanent brick buildings to contain the engine and the five new boilers required at this station.

At the Queen Lane station two of the four triple-expansion engines, of twenty-million-gallons capacity each, designed for this station by the Southwark Foundry and Machine Company, have been erected and put in service, the first having been started on October 23d and the second on November 20th.

Twenty-four (24) boilers of the marine type, designed by this Bureau and built by Riter & Conley, of Pittsburg, Pa., were also placed at this station. These boilers were fired on September 26th for the first time, and they are now all ready for service. They will furnish steam for the four engines when the latter are completed. The work of building the foundations, flues, settings, etc., was done by this Bureau.

At the Belmont Auxiliary works a two-million-gallon engine, of the Worthington type, was started on June 27th, to pump from the Belmont reservoir into a standpipe 150 feet high, finished during 1895, for the supply of the high-level district embracing Bala, Haddington. etc. The standpipe is not yet encased.

At the Roxborough Auxiliary station the five-million-gallon Worthington engine, originally erected at the old Delaware works (since abandoned)and afterward erected and used for about three years at Spring Garden, began supplying water through the standpipe to the Chestnut Hill and Mount Airy district on May 17th, since which date it has been working continuously. The standpipe was finished during 1895.

Supplementary or relief engines should immediately be placed at both the Belmont and Roxborough auxiliary stations, as provision in case of emergency and to permit repairs. At Roxborough the demand is such that the engine now in use cannot be shut down for a single hour, night or day.

The fifteen-million-gallon engine erected by the Southwark Foundry and Machine Company, at Frankford station, is in much the same condition as at the date of my last report. It has been running at intervals during the year, but the City has not yet accepted it. The makers, with the consent of the Director of the Department of Public Works, have been endeavoring to secure satisfactory operation of the automatic, sliding pump valves introduced by them with a view to increasing the capacity to twenty-two (22) million gallons daily. They have at present in operation, for this purpose, a hydraulic attachment operated by pressure taken from the pumping main.

At Queen Lane pumping station the contractor for the erection of the buildings finished the stack on March 25th; the engine and boiler house on September 30th; the concrete foundations for the pump beds on January 14th; the steel structure supporting the engine beds on February 23d, and the boiler foundations on February 24th. All of the boilers were set on saddles by June 29th, and the steam pipes and boiler domes were in place by August 3d.

The electric crane, of twenty-ton capacity, built by William Sellers & Company, was completed on June 1st and was used in erecting the engines.

The entire flue system was finished by September 15.

At Queen Lane Reservoir, a concrete footing wall has been placed under the foot of the slope around the entire circumference of the south basin. The joint between floor and slope in each basin has been thoroughly covered with asphalt, and asphalt has also been used for closing the cracks in the concrete slabs forming the slopes and in the joints between them, and several of the largest cracks in the concrete floor. This application of asphalt was designed rather as a protection against rain, and to permit the carrying of a few feet of water to avoid injury to the floor by frost, than as a means of rendering the basin watertight.

Before the repairs, the north and south basins lost respectively, under 6 feet head, $\frac{1}{2}$ inch and 1 inch in depth daily Since the repairs, the loss in any one day from either basin, under 6 feet head, has not exceeded $\frac{1}{4}$ inch, while the average loss has been about $\frac{1}{8}$ inch. Evaporation is included in these figures in both cases.

On November 29, the water from the new pumping station was turned into the reservoir through the fountain provided for the purpose at the western end of the division bank. Prior to that date, the water pumped was carried directly into the distribution through a connection established between the pumping and the supply mains around the northeast corner of the reservoir.

On one or two occasions the water from this basin has been turned into the district hitherto supplied by direct pumpage from the Spring Garden station, but experiments are now in progress for determining the extent of leakage at different depths, and for the purpose of these experiments it is of course necessary to cease pumping into the reservoir and to cut it off from the distribution.

Specifications have been prepared for a thorough repair of the basin.

The work begun in the north basin at the New Roxborough reservoir in the fall of 1894, for the purpose of locating and repairing the leaks, was suspended, on account of freezing weather, from January to the following

April. In order to prevent frost from penetrating the bottom lining of the north section, water to the depth of about two feet was admitted to the basin. When work was resumed, the concrete and brick lining was replaced, over the area previously uncovered, and all joints that had been opened, either by frost or by settlement in the embankment, were cut out and repaired. The work was completed by May 1, and the water was again turned in to a depth of about 12 feet.

Evidences of leakage still being apparent, the water was lowered to about two feet, and it has since remained at that depth. The leakage, under this head, is inconsiderable.

In the south basin water has been carried to an average depth of about 16 feet. Considerable leakage takes place here also, but, as the basin has been kept constantly in use, there has been no opportunity for examination or repairs.

Specifications have been prepared for the thorough repair of this reservoir.

The top of the banks at East Park reservoir being greatly in need of repair, the old asphalt paving has been taken up and replaced with Neufchatel, six feet in width, with a concrete base, and extending nearly the entire distance around the outside bank. The division banks were all resurfaced, and in all three sections the inside slopes were also repaired.

The building of a face wall at Lehigh reservoir, on the Sixth street front, from Lehigh avenue to Somerset street, has been completed, and new stone steps have been erected at the northeast, southeast and southwest corners.

On October 19, the copper expansion-bend in the steam pipe running from the boilers in the new boiler-house, Spring Garden pumping station, to the Holly engines, gave away in the brazing, breaking the steam pipe and blowing out the wall in the end of the boiler house. No one was injured by the explosion. Temporary repairs were made and the engines put into operation again on October 23. Permanent repairs are now in progress. When these are completed we shall be in position to make an official test of the two new 30-million gallon Holly pumping engines.

The Bureau is under heavy expense owing to the lack of sufficient facilities for electric lighting at this station, being obliged to take current from the West End Electric Company.

On the morning of December 18, the 48-inch pumping main of No. 5 engine, at this station, broke on the east side of the Reading Railroad, washing mud and debris over the railroad tracks and into the pump wells, fire rooms, engine rooms and forebay. The wash-out led to the rupture of a 30-inch pumping main leading to the direct pumpage, and deprived that district of water for about two hours.

The pump wells at Spring Garden have thus been filled up by wash-outs, on previous occasions, and I am therefore constructing walls for the purpose of diverting such floods in future and carrying their deposits either into the forebay or into the river.

Owing to the drought during the months from August to December, very little water was pumped at Fairmount. There were fifty-eight (58) days on which no wheels were run, and at no time from July 7 to December 23 were all the pumps at work. During the greater part of this time the water in the river was drawn very low by the steam pumpage. Advantage was taken of the extreme low water to repair the dam, and loss of water from leakage was thus almost entirely stopped, so that very little afterward escaped in that way. The Schuylkill Navigation Company afterward made repairs to its lock gates, considerably reducing the leakage there. The whole flow of the river, with the exception of the leaks mentioned and the water used in the locking in and out of boats, was, during the dry season, pumped at the stations operated by steam.

There were 265 days on which no water passed over the flash boards.

To the extent of our ability, we have endeavored to comply with the requirements of the Schuylkill Navigation Company in the matter of keeping up the level in Fairmount pool.

The buildings at this station have long been in need of repairs, and this necessity has repeatedly been urged. The wall on the lower side of the forebay was repaired during the past year, but it is absolutely imperative that the roof of the upper wheel-house be at once reconstructed, in order to protect the pumping engines there from speedy deterioration. For some years the roof of this structure has been in such a condition that this portion of the works has had to remain closed to visitors.

The forebay at Fairmount and the entrance to it from the river have always been subject to shoaling, on account of the progressive diminution in the velocity of the water as it passes the entrances of the flumes to the several wheels, and by reason of two corners in which the water loses its velocity and deposits its sediment. It is propsed, if the necessary means are provided, to construct walls reducing these channels to such dimensions as will obviate this difficulty in the future.

The condition of the river below the dam has constituted a most offensive nuisance at these works, especially during the hot and dry weather of last summer. The intercepting sewer discharges into the river just below the dam and directly off from the Water Works grounds, and two sewers from West Philadelphia empty their contents directly opposite our works. Further defilement occurs all along the river on both sides below our works, so that its condition is little better than that of an open sewer. During the summer little or no water passes over the dam or through our turbines, and there is therefore practically no current in the river below the dam, the surface merely rising and falling with the flow and ebb of the tide. At low water a sand bar, formed on the lower side of the mound dam by the over-wash during the freshet of May 22, is left bare, and the filth deposited upon it by the receding tide adds greatly to the offensiveness of the surroundings.

The forebay at the Spring Garden Works is unsightly and unnecessary. In February, 1893, it was twice partially filled in with earth and gravel by breaks in the adjacent mains. A considerable amount was washed in also by the breaking of the 48-inch main in December, 1895, and it is of course liable to this at any time, especially now that precautions have been taken to divert such washings from the pump wells.

The engines at the Spring Garden and Belmont Pumping Stations have been, with but slight intermission, worked to their full capacity during the year, and, although kept in running order within that period, they are now undergoing extensive and much needed repairs.

There is, at present, no connection between the east and west sides of the Schuylkill river, except the 12-inch pipe crossing Market street bridge for the supply of the City Hall, and this, of course, does not serve to connect our two systems. Should the pumps at Belmont station shut down for forty-eight hours, all of West Philadelphia would therefore be without water. I deem it important that our entire system be connected, as far as possible, so that any station which may be compelled to shut down can receive assistance from one or more of the others, and

I therefore urge the laying of a main to connect the existing systems on the east and west sides of the river. Such connection might normally remain empty and be held solely for use in case of emergency.

Communication by team between our works at Roxborough and those at Mount Airy and Chestnut Hill is seriously hampered by the absence of a high-level bridge across the upper Wissahickon. This renders it necessary to descend into and climb up from the deep intervening valley in order to pass from one station to the other.

I invite your attention to the defective character of our present telephone system. Most of the wires have been in service for many years and are badly rusted so that every storm breaks one or more of them, and the return circuit is in all cases by the ground, and the lines are therefore subject to so great an induction, from electric light and other currents that there are times, principally during the night, when it is almost impossible to transmit messages.

It is easy to see that an error in transmission, or inability to communicate, might, in a critical case, result in very serious damage.

I advise, therefore, that the lines be rebuilt with metallic circuits, and that such other modern improvements be introduced as will put the telephone service in the best possible condition.

A detailed report on additions made to boilers and machinery will be found in the description of boilers and machinery accompanying this report.

Recapitulation, expense account and pumpage at the several stations will be found in the accompanying tables.

It will be noticed that the cost of pumping 1,000,000 gallons of water to a height of 100 feet has increased from $3.48 in 1894 to $3.69 in 1895, an increase of 21 cents, which, on the 132,040,000 gallons lifted 100 feet, amounts to $27,728.

Of this, $22,020, or 17 cents per 100,000,000 foot-gallons, is accounted for by the advance from $2.22½ to $2.42, or 19½ cents, in the average price of the 112,925 tons of coal consumed. The remainder may be accounted for by the fact that the cheaper pumpage by water power, at Fairmount, was, in 1895, only 9.63 per cent. of the total, while in 1894 it was 14.75 per cent. of the total. This not only increased the cost per 100,000,000 foot-gallons at Fairmount, where the running expenses are practically constant, whatever the quantity pumped, and and the quantity of coal consumed at the other stations relatively to the total quantity of water pumped; but, by requiring higher duty of the steam engines, necessitated the use of a greater proportion of the larger and more expensive pea coal, as indicated in the following table. (See next page.) This table is based upon the coal *paid for* during each year, and its figures therefore do not exactly agree with those already given, which are based upon coal *consumed.*

Furthermore, the cost per 100,000,000 foot-gallons at the new Queen Lane station, at the new auxiliary stations at Roxborough and Belmont, and at Chestnut Hill, has been relatively high, as shown in the following table:

	Cost of Raising One Million Gallons 100 feet. 1894.	1895.
Fairmount	$1 35	$1 71
Spring Garden	3 30	3 47
Belmont	4 15	3 99
Belmont Auxiliary		71 11
Queen Lane		31 72
Roxborough	3 88	3 34
Roxborough Auxiliary		11 99
Mount Airy	9 07	8 54
Chestnut Hill	46 45	61 00
Frankford	4 44	5 09
Average	$3 48	$3 69

	Pea.			Buckwheat.			Total.		
	Tons.	Cost.	Average price per ton.	Tons.	Cost.	Average price per ton.	Tons.	Cost.	Average price per ton.
1894	40,419	$104,380	$2.58	40,158	$76,525	$1.91	80,577	$180,905	$2.25
1895	65,896	189,931	2.88	43,866	87,536	2.00	109,762	277,467	2.53

At the small auxiliary stations the expenditure for labor is at all times necessarily high in relation to the quantity raised, and at Belmont and Queen Lane, which began pumping May 16th and October 14th respectively, a force was employed for several months in making ready, and coal was consumed at Queen Lane in testing boilers before actual pumping began.

Respectfully submitted,

F. L. HAND,

General Superintendent.

Total Capacity 38,000,000 gallons per day from June 25, 1895.

BELMONT PUMPING STATION.

No. 1 Worthington Duplex. Capacity 5,000,000 gallons per day.
No. 2 Worthington Duplex. Capacity 5,000,000 gallons per day.
No. 3 Worthington Duplex. Capacity 8,000,000 gallons per day.
*No. 4 Worthington Duplex. Capacity 20,000,000 gallons per day.

1895	Running time for each engine in hours.				Gallons Pumped by each Engine.				Total pumpage of each month.	Average pumpage per day.	Coal.		Percentage of Ashes.	Oils.		Mean water pressure and mean suction lift in pounds per sq. inch.				Gallons raised 100 ft. per pound of coal.
														Cylinder.	Engine.					
	No. 1.	No. 2.	No. 3.	No. 4.	No. 1.	No. 2.	No. 3.	No. 4.	Gallons.	Gallons.	Tons.	Lbs.		Qts.	Qts.	No. 1	No. 2	No. 3	No. 4	
January	744	744	680	....	192,073,800	201,606,268	248,063.435	....	641,743,503	20,701,403	1,741	1,930	20	217	62	88	88	88	......	364.4
February	672	670	664	....	168,843,600	181,574,910	257,476,315	....	607,894,825	21,710,529	1,525	1,760	20	196	56	88	88	88	......	362.0
March	735	738	742	....	187,561,800	196,120,603	281,645,805	....	665,328,208	21,462,200	1,739	380	20	217	62	88	88	88	......	378.4
April	718	714	718	....	185,800,500	192,272,312	266,449,785	....	644,522,597	21,484,086	1,665	346	20	210	60	88	88	88	......	382.9
May	738	731	744	....	194,268,600	201,243,869	293,191,930	....	688,704,399	22,216,270	1,675	1,123	20	217	62	88	88	88	......	406.6
June	685	696	712	24	184,568,400	191,614,568	296,335,123	19,480,300	691,998,391	23,066,613	1,993	1,075	20	210	60	88	88	88	90	343.4
July	280	212	390	502	66,918,800	57,966,508	149,412,230	452,847,150	727,144,688	23,456,280	1,405	2,076	20	239	102	88	88	88	90	516.5
August	121	143	233	725	29,263,000	35,485,855	86,120,300	644,962,000	795,831,155	25,671,972	1,413	1,025	20	293	131	88	88	88	90	557.0
September	62	63	433	651	16,469,900	16,932,391	169,507,225	581,200,450	784,109,9[illegible]6	26,136,998	1,428	2,000	20	270	114	88	88	88	90	544.7
October	180	260	357	570	46,352,400	69,372,273	141,349,180	4[illegible]6,128,890	753,202,743	24,296,862	1,434	460	20	285	112	88	88	88	90	515.5
November	347	367	621	366	90,755,100	95,722,200	244,275,100	299,326,990	730,079,390	24,335,979	1,510	1,574	20	254	95	88	88	88	90	478.0
December	46	....	310	703	11,481,600	....	122,829,160	572,607,900	706,918,660	22,803,827	1,412	417	20	283	99	88	......	88	90	495.2
Totals and averages.	5,328	5,338	6,604	8,541	1,3[illegible]4,357,500	1,439,911,757	2,556,65[illegible],588	3,066,553,680	8,437,478,525	23,116,379	18,941	726	20	2,889	1,015	88	88	88	90	440.6

* No. 4 Engine transferred from Spring Garden Station during March 1895, and was erected June, 1895, at Belmont Station.

Jonval Turbines—Double-acting horizontal plunger pumps.
Total capacity, 33,290,000 gallons per day.

FAIRMOUNT PUMPING STATION.

Capacity, No. 1.—2,000,000 gallons per day.
Capacity, Nos. 3, 4, and 5.—5,330,000 gallons per day.
Capacity, Nos. 7, 8, and 9.—5,100,000 gallons per day.

1895.	Running time of each turbine in hours.							Gallons Pumped by each Turbine.							Total Gallons Pumped each Month.	Average Pumpage per Day.	Oils.	
	No. 1.	No. 3.	No. 4.	No. 5.	No. 7.	No. 8.	No. 9.	No. 1.	No. 3.	No. 4.	No. 5.	No. 7.	No. 8.	No. 9,			Castor. Qts.	Engine. Qts.
January	713	717	718	669	613	680	677	71,276,912	199,751,300	200,808,834	179,558,117	155,529,075	176,005,375	175,036,475	1,157,966,088	37,353,744	35	228
February	386	672	672	620	515	397	554	37,398,912	182,130,958	181,308 534	166,229,827	125,737,225	101,262,425	140,793,675	934,861,556	33,387,912	13	181
March	736	736	737	741	386	742	729	71,203,298	195,687,603	203,061,923	196,539,923	97,667,925	193,835,098	189,361,025	1,147,356,795	37,011,509	36	242
April	690	691	6[illegible]0	693	711	703	713	64,808,960	188,226,292	189,016,915	185,788,071	175,322,875	176,533,175	179,650,575	1,159,346,863	38,644,895	30	210
May	679	744	744	738	678	736	737	69,584,640	204,684,461	205,451,281	193,277,938	168,757,875	189,866,300	186,818,775	1,218,441,270	39,304,557	38	243
June	80	623	626	402	205	310	279	8,269,508	166,470,788	169,040,863	94,338,419	50,173,925	78,652,925	68,837,580	635,784,008	21,192,800	14	164
July	....	541	354	173	180	177	110	....	143,680,792	70,568,432	45,065,055	41.433,600	47,472,100	29,130,400	377,350,379	12,172,592	10	110
August	....	122	58	73	14	23	21	....	31,519,953	15,703,504	19,872,788	3,425,175	6,180,525	5,499,650	82,201,595	2,651,664	9	37
Septemb'r	....	....	....	56	1	....	....	....	....	....	13,789,693	258,375	....	....	14,048,068	468,268	....	12
October	73	217	81	22	31	34	9	7,140,991	56,609,808	20,490,989	6,179,705	6,973,850	8,303,425	2,293,200	107,991,968	3,483,611	5	35
Novemb'r	134	444	147	117	110	28	21	13,852,672	122,517,204	40,136,043	33,505,009	26,693,225	6,643,000	5,853,750	249,180,903	8,306,030	13	112
Decemb'r	189	612	372	206	264	262	218	19,295,515	167,120,337	73,707,676	53,083,228	66,429,025	66,656,687	56,371,250	502,663,718	16,214,958	17	141
Totals and averages	3,680	6,119	5,199	4,510	3,708	4,092	4,068	362,831,408	1,658,399,496	1,369,294,994	1,187,227,773	918,402,150	1,051,411,035	1,039,626,355	7,587,193,211	20,786,830	210	1,715

Total Capacity, 90,000,000 Gallons per day.

NEW SPRING GARDEN STATION.

No. 2.—Vertical Triple Expansion—Capacity, 30,000,000 gallons per day.
No. 3.—Vertical Triple Expansion—Capacity, 30,000,000 gallons per day.
No. 9.—Worthington Duplex—Capacity, 15,000,000 gallons per day.
No. 10.—Worthington Duplex—Capacity, 15,000,000 gallons per day.

1895.	Running time of each Engine in hours.				Gallons Pumped by each Engine.				Total Pumpage of each Month.	Average Pumpage per day.	Coal.		Percentage of Ashes.	Oils. Cylinder.	Oils. Engine.	Mean Water Pressure and Mean Suction Lift in Pounds per Square Inch.				Gallons Raised 100 Feet per Pound of Coal.
	No. 2.	No. 3	No. 9.	No. 10.	No. 2.	No. 3.	No. 9.	No. 10.	Gallons.	Gallons.	Tons.	Pounds.		Qts.	Qts.	No. 2.	No. 3.	No. 9.	No. 10.	
January	....	577	164	740	....	572,005,850	112,483,750	476,983,750	1,161,473,350	37,466,882	947	1,621	.25	616	70	......	52	68	68	793.3
February	228	403	360	313	223,901,500	419,866,530	254,856,640	217,859,300	1,116,483,970	39,874,427	1,896	1,833	.25	534	63	50	50	65	68	381.2
March	351	539	723	741	332,609,500	541,585,800	514,591,080	484,694,071	1,873,480,451	60,434,853	2,827	1,659	.25	1,016	75	50	50	72	72	429.1
April	602	629	696	563	590,168,500	616,527,000	485,334,696	366,154,340	2,088,184,536	69,606,151	2,488	184	.25	1,157	60	50	50	69	70	543.6
May	648	628	728	712	691,382,000	683,789,500	528,193,630	488,190,290	2,391,555,420	77,146,949	2,789	423	.25	1,263	63	50	50	65	65	555.4
June	707	744	700	719	788,972,100	799,900,500	506,004,470	503,777,430	2,598,654,500	86,621,816	3,021	1,383	.25	1,350	60	50	50	65	65	557.0
July	733	724	662	743	835,567,000	827,805,000	483,617,050	505,946,000	2,652,935,050	85,578,550	3,163	510	.25	1,344	62	50	50	67	67	543.2
August	740	738	742	742	854,353,500	868,518,000	539,687,350	498,057,020	2,760,615,870	89,052,124	3,259	440	.25	1,364	62	50	50	64	64	548.6
September	714	717	704	686	848,862,000	873,463,500	512,766,110	468,998,680	2,704,090,290	90,136,343	3,192	115	.25	1,320	60	50	50	63	65	548.7
October	632	660	739	742	752,556,000	759,589,500	519,613,220	473,853,010	2,535,611,760	81,793,927	3,236	734	.25	1,334	62	50	50	68	68	507.5
November	717	701	716	720	816,793,500	815,157,000	526,902,300	465,266,430	2,654,119,230	88,470,641	3,044	633	.25	1,243	60	50	50	63	63	564.7
December	738	731	744	744	868,113,750	861,010,500	540,199,530	481,947,665	2,751,271,445	88,750,691	3,148	645	.25	1,375	63	50	50	63	63	566.0
Totals and averages	6,810	7,791	7,678	8,165	7,633,279,350	8,699,218,680	5,524,249,826	5,431,728,016	27,288,475,872	74,762.947	33,014	1,218	.25	13,916	760	50	50	66	66	535.4

er

Tons

18	4,0[illegible]
[illegible]	[illegible],09[illegible]
[illegible]0	2,[illegible]1[illegible]
23	1,[illegible]
2[illegible]	1,[illegible]
26	2,[illegible]09
[illegible]8	2,51[illegible]
[illegible]	2,[illegible]
[illegible]	2,[illegible]
7[illegible]	2,79[illegible]
8[illegible]	2,[illegible]47
[illegible]	2,[illegible]42
46	31,123

Station.

Total Capacity, 100,000,000 gallons per day up to March 11, 1895.

OLD SPRING GARDEN STATION.

No. 4.—Worthington Duplex, Capacity, 20,000,000 gallons per day.
No. 5.—Vertical Compound, Capacity, 20,000,000 gallons per day.
No. 6.—Simpson Rotary Compound, Capacity, 10.000,000 gallons per day.
No. 7.—Marine Rotary Compound, Capacity, 20,000,000 gallons per day.
No. 8.—Worthington Duplex, Capacity, 10,000,000 gallons per day.
No. 11.—Gaskill Compound, Capacity, 20,000,000 gallons per day.

1895.	Running Time of each Engine in Hours.					
	No. 4.	No. 5.	No. 6.	No. 7.	No. 8.	No. 11.
January	724	693	....	....	738	584
February	672	623	274	517	646	529
March	203	374	606	707	723	68
April	....	436	167	597	688	....
May	....	533	....	616	648	18
June	....	669	175	659	651	500
July	....	703	534	743	741	628
August	....	738	520	743	742	742
September	....	711	683	713	716	705
October	....	733	711	744	738	72
November	....	607	524	720	716	507
December	....	604	383	737	68	160
Totals and averages	1,599	7,424	4,577	7,496	7,815	5,168

1895.	Gallons Pumped by each Engine.					
	No. 4.	No. 5.	No. 6.	No. 7.	No. 8.	No. 11.
January	655,215,010	631,929,300	....	....	371,957,000	483,552,000
February	632,408,900	537,862,300	144,515,420	387,281,220	325,584,100	433,855,500
March	190,001,000	306,037,660	254,070,000	556,813,800	364,649,600	91,712,000
April	....	382,281,400	68,686,000	482,072,300	346,752,000	....
May	....	452,152,300	....	490,501,200	326,592,000	12,376,000
June	....	559,602,600	72,870,000	502,943,200	327,348,000	366,346,000
July	....	603,516,800	223,960,000	506 324,900	374,976,000	470,098,800
August	....	626,442,500	219,250,000	492,986,800	373,968,000	623,100,000
September	....	620,217,500	287,175,000	542,205 800	359,452,800	585,248,000
October	....	628,144,000	298,830,000	525,444,100	372,316,000	537,304,000
November	....	521,738,000	220,500,000	525,233,960	361,149,600	373,320,000
December	....	530,891,200	163,170,000	586,128,400	34,524,000	70,132,000
Totals and averages	1,477,624,910	6,400,815,560	1,953,026,420	5,597,935,680	3,939,269,100	4,047,044,300

1895.	Total Pumpage of each Month.	Average Pumpage per Day.	Coal.		Percentage of Ashes.	Oils. Cylinder.	Oils. Engine.	Mean Water Pressure and Mean Suction Lift in Pounds per Square Inch.						Gallons Raised 100 ft. per Pound of Coal.
	Gallons.	Gallons.	Tons.	Lbs.		Qts.	Q's.	No. 4.	No. 5.	No. 6.	No. 7.	No. 8.	No. 11.	
January	2,142,653,310	69,117,848	4,063	691	.25	655	676	70	50	....	....	70	50	341.5
February	2,461,507,440	87,910,980	3,098	1,905	.25	894	845	65	50	50	54	63	50	514.5
March	1,763,284,060	56,880,130	2,316	1,722	.25	666	560	50	50	50	54	63	50	493.0
April	1,279,791,700	42,659.723	1,905	19	.25	578	412	....	50	50	54	64	....	435.1
May	1,281,621,500	41,342,629	1,953	286	.25	455	409	....	50	....	54	64	50	422.5
June	1,829,109,800	60,970,326	2,309	2,124	.25	655	612	....	50	50	54	52	50	510.9
July	2,178,876,500	70,286,338	2,515	1,285	.25	689	751	....	50	50	62	62	50	561.0
August	2,335,747,300	75,346,687	2,669	2,138	.25	842	830	....	50	50	63	64	50	566.6
September	2,394,299,100	79,809,970	2,703	210	.25	864	894	....	50	50	62	62	50	573.7
October	2,362,038,100	76,194,777	2,798	482	.25	892	918	....	50	50	65	66	50	546.7
November	2,001,941,560	66,731,385	2,747	888	.25	759	781	....	50	50	65	65	50	472.0
December	1,384,845,600	44,672,438	2,042	1,209	.25	554	525	....	50	50	63	62	50	439.1
Totals and averages	23,415,715,970	64,152,646	31,123	1,759	.25	8,503	8,213	61	50	50	59	63	50	487.4

* No. 4 engine was transferred from Spring Garden Station during March, 1895, and was erected June, 1895, at Belmont Station.

Total Capacity—2,500,000 gallons per day.

BELMONT AUXILIARY STATION.

No. 1—Worthington Duplex.—Capacity, 2,000,000 gallons per day.
No. 2—Snow.—Capacity, 500,000 gallons per day.

1895.	Running Time of each Engine in Hours.	Gallons Pumped by each Engine.	Total Pumpage of each Month.	Average Pumpage per Day.	Coal.		Percentage of Ashes.	Oil.		Mean Water Pressure.
								Cylinder.	Engine.	
	No. 1.	No. 1.	Gallons.	Gallons.	Tons.	Lbs.		Qts.	Qts.	No. 1.
January										
February										
March										
April										
May	69	2,962,642	2,962,642	95,569	24	1,740	.20	8	4	43
June	150	7,669,046	7,669,046	255,634	37	610	.20	28	4	53
July	186	9,311,970	9,311,970	300,386	50	....	.20	30	10	57
August	212	9,960,840	9,960,840	321,317	52	514	.20	31	8	58
September	496	8,313,001	8,313,001	277,100	39	1,140	.20	30	8	58
October	181	7,842,617	7,842,617	252,987	45	1,500	.20	31	16	60
November	160	6,587,485	6,587,485	219,582	40	400	.20	30	8	61
December	137	5,869,015	5,869,015	189,323	33	2,044	.20	30	8	60
Totals and averages	1,591	58,516,616	58,516,616	160,319	323	1,228	.20	202	63	56

Total Capacity—40,000,000 Gallons per day.

QUEEN LANE PUMPING STATION.

No. 1.—Vertical Triple Expansion.—20,000,000 per day.
No. 2.—Vertical Triple Expansion.—20,000,000 per day.

1895.	Running Time of each Engine in Hours.		Gallons Pumped by each Engine.		Total Pumpage of each Month.	Average Pumpage per day.	Coal.		Percentage of Ashes.	Oil. Cylinder.	Oil. Engine.	Mean Water Pressure and Mean Suction Lift in Lbs. per sq. in.		Gallons Raised 100 ft. per lb. of Coal.
	No. 1.	No. 2.	No. 1.	No. 2.	Gallons.	Gallons.	Tons.	Lbs.		Qts.	Qts.	No. 1.	No. 2.	
January														
February														
March														
April														
May														
June														
July														
August														
September														
October	8		6,912,578		6,912,578	222,986	143	260	.25	166	296	89		254.3
November	29	18	25,172,960	11,208,360	36,381,820	1,212,710	175	800	.25	174	500	95	88	223.1
December	88	15	76,129,340	11,712,710	87,842,050	2,833,614	354	1,940	.25	80	450	103	100	269.6
Totals and averages	125	33	108,214,878	22,921,070	131,135,948	359,276	673	760	.25	420	1,246	96	94	249.0

Total Capacity — 24,500,000 gallons per day.

ROXBOROUGH PUMPING STATION.

No. 1—Vertical Compound.—Capacity, 12,000,000 gallons per day.
No 2—Worthington Duplex.—Capacity, 5,000,000 gallons per day.
No. 3—Worthington Duplex —Capacity, 7,500,000 gallons per day.

1895.	Running time of each engine in hours.			Gallons Pumped by each Engine.			Total Pumpage of each Month.	Average Pumpage per day.	Coal.		Percentage of Ashes.	Oils. Cylinder.	Oils. Engine.	Mean water pressure and mean suction lift in lbs. per square inch.			Gallons raised 100 feet per pound of coal.
	No. 1.	No. 2.	No. 3.	No. 1.	No. 2.	No. 3.	Gallons.	Gallons.	Tons.	Lbs.		Qts.	Qts.	No. 1.	No. 2.	No. 3.	
January	703	246	485	333,944,650	34,972,250	140,231,000	509,147,900	16,424,125	1,832	2,114	.25	375	600	160	160	160	483.1
February	657	....	578	348,418,180	....	158,129,910	501,548,090	17,912,431	1,799	1,556	.25	351	554	160	....	160	484.7
March	699	414	479	310,381,740	93,116,750	121,049,270	524,547,760	16,920,895	1,896	480	.25	388	651	160	160	160	481.1
April	654	251	3	350,852,240	61,591,250	986,400	413,429,890	13,780,996	1,199	1,852	.25	329	604	160	160	160	598.7
May	730	406	14	389,879,160	100,007,034	4,791,270	494,677,464	15,957,337	1,408	2,224	.25	269	616	160	160	160	610.6
June	667	497	32	350,142,020	120,268,015	10,122,930	480,532,965	16,017,765	1,417	1,120	.25	348	649	160	160	160	589.6
July	722	334	68	382,733,040	82,477,575	21,242,535	486,453,150	15.692,037	1,392	880	.25	343	610	160	160	160	607.6
August	728	515	70	390,668,760	129,316,105	20,326,000	540,310,865	17,429,350	1,606	1,320	.25	359	666	160	160	160	584.9
September	707	711	94	372,309,480	171,260,155	24,939,480	568,509,115	18,950,303	1,691	680	.25	331	650	160	160	160	584.6
October	726	722	391	369,899,760	170,014,958	93,086,890	633,001,608	20,419,406	2,047	1,280	.25	305	594	160	160	160	537.6
November	679	572	42	362,371,320	139,350,150	12,708,120	514,429,590	17,147,653	1,569	960	.25	310	554	160	160	160	570.1
December	706	663	160	339,169,080	162,347,050	47,824,260	549,340,390	17,720,657	1,711	1,710	.25	528	508	160	160	160	558.1
Totals and averages	8,378	5,361	2,416	4,300,769,430	1,264,721,292	650,438,065	6,215,928,787	17,029,941	19,574	496	.25	4,236	7,256	160	160	160	529.5

Total Capacity — 5,250,000 gallons per day.

ROXBOROUGH AUXILIARY PUMPING STATION.

No. 1—Worthington Duplex.—Capacity, 5,000,000 gallons per day.
No. 2—Knowles. — Capacity, 250,000 gallons per day. (Not in use since October, 1895.)

1895.	Running time of each engine in hours.		Gallons pumped by each engine.		Total pumpage of each month.	Average pumpage per day.	Coal.		Percentage of Ashes.	Oils.		Mean Water Pressure.	
										Cylinder.	Engine.		
	No. 1.	No. 2.	No. 1.	No. 2.	Gallons.	Gallons.	Tons.	Lbs.		Qts.	Qts.	No. 1.	No. 2.
January	....	60	....	562,980	562,980	18,160	5	325	.25	2	....	....	36
February	....	75	....	699,050	699,050	24,966	6	1,010	.25	3	....	....	36
March	....	68	....	739,440	739,440	23,852	5	....	.25	3	....	....	36
April	....	62	....	629,980	629,980	20,999	4	760	.25	3	....	....	36
May	....	77	....	785,450	785,450	25,337	4	345	.25	3	....	....	36
June	....	93	....	932,040	932,040	31,068	3	1,030	.25	3	....	....	38
July	....	96	....	991,120	991,120	31,971	4	1,790	.25	3	....	....	37
August	406	96	38,285,199	1,041,440	39,329,639	1,268,698	80	890	.25	70	3	56	37
September	690	20	63,537,520	374,918	63,912,438	2,130,414	123	280	.25	142	14	56	37
October	744	....	69,771,497	....	69,771,497	2,250,693	104	1,140	.25	155	15	56	....
November	720	....	67,359,587	....	67,359,587	2,245,319	90	....	.25	150	15	56	....
December	744	....	70,129,407	....	70,129,407	2,262,233	87	578	.25	156	16	56	....
Totals and averages	3,304	647	309,083,210	6,759,418	315,842,628	865,322	518	1,428	.25	693	63	56	36

Total Capacity, 3,000,000 gallons per day.

MOUNT AIRY PUMPING STATION.

No. 1.—Davidson Rotary, Capacity 1,000,000 gallons per day.
No. 2.—Davidson Rotary, Capacity 1,000,000 gallons per day.
No. 3.—Knowles Rotary, Capacity 1,000,000 gallons per day.

1895.	Running time of each engine in housr.			Gallons pumped by each engine.			Total Pumpage each month	Average pumpage per day.	Coal.		Percentage of Ashes.	Oils. Cylinder.	Oils. Engine.	Mean Water Pressure and Mean Suction lift in lbs. per Sq in.			Gallons raised 100 ft. per pound of coal.
	No. 1.	No. 2.	No. 3.	No. 1.	No. 2.	No. 3.	Gallons.	Gallons.	Tons.	Lbs.		Qts.	Qts.	No. 1.	No. 2.	No. 3.	
January	723	394	....	31,641,250	14,828,750	....	46,470,000	1,499,032	117	1,420	25	62	62	70	70	....	268.7
February	634	393	....	27,892,500	11,835,000	....	42,727,500	1,525,982	110	600	25	56	56	70	70	....	263.6
March	698	460	....	31,476,500	17,711,000	....	49,187,500	1,586,693	122	720	25	62	62	70	70	....	275.0
April	720	351	....	31,767,500	13,262,500	....	45,030,000	1,501,000	113	....	25	60	60	70	70	....	271.2
May	729	442	....	32,638,750	17,326,250	....	49,965,000	1,611,774	120	200	25	62	62	70	70	....	283.7
June	705	497	....	32,805,000	20,793,750	....	53,598,750	1,786,625	131	2,060	25	60	60	70	70	....	276.4
July	733	469	....	34,051,250	19,500,000	....	53,551,250	1,727,459	148	880	25	62	62	70	70	....	214.7
August	736	346	....	34,721,250	14,738,750	....	49,460,000	1,595,483	144	940	25	55	55	65	65	....	233.0
September	676	466	....	32,651,250	21,369,750	....	54,021,000	1,800,700	143	2,180	25	60	60	60	60	....	254.4
October	742	364	....	33,913,750	15,985,000	....	49,898,750	1,609,637	131	2,060	25	62	62	60	60	....	257.3
November	710	285	....	32,149,000	12,335,000	....	44,484,000	1,482,800	117	920	25	60	60	60	60	....	257.7
December	744	297	....	32,271,250	11,811,250	....	44,082,500	1,422,016	119	1,190	25	43	43	60	60	....	250.9
Totals & averages	8,550	4,764	....	387,979,250	194, 000	....	582,476,250	1,595,825	1,520	1,970	25	704	704	66	66	....	257.7

Total Capacity, 750,000 gallons per day.

CHESTNUT HILL STATION.

No. 2—Knowles—Capacity, 250,000 gallons per day.
No. 3—Worthington Duplex—500,000 gallons per day.

1895.	Running time of each Engine in hours.		Gallons Pumped by each Engine.		Total Pumpage of each Month.	Average Pumpage per Day.	Coal.		Percentage of Ashes.	Oils. Cylinder.	Oils. Engine.	Mean Water Pressure and Mean Suction Lift in Pounds per sq. in.		Gallons Raised 100 feet per Pound of Coal.
	No. 2.	No. 3.	No. 2.	No. 3.	Gallons.	Gallons.	Tons.	Lbs.		Qts.	Qts.	No. 2.	No. 3.	
January	7	....	147,600	....	147,600	4,761	10	920	.22	1	....	53	....	7.7
February	....	....	....	....	....	....	10	2,070	22	....	....	53	....	
March	117	....	3,859,740	....	3,859,740	124,507	18	1,643	.36	11	....	53	....	291.7
April	31	....	1,003,680	....	1,003,680	33,456	12	523	.34	4	....	53	....	44.8
May	150	....	5,244,720	....	5,244,720	169,184	19	2,045	.82	16	....	53	....	143.9
June	156	....	5,777,000	....	5,777,000	192,566	21	1,435	.32	18	....	53	....	145.8
July	142	....	5,266,860	....	5,266,860	169,898	22	864	.30	13	....	53	....	128.5
August	162	....	5,696,280	....	5,696,280	183,750	22	1,105	.25	15	....	53	....	138.3
September	46	....	1,751,520	....	1,751,520	58,384	13	315	.25	5	....	53	....	72.8
October	2	....	73,800	....	73,800	2,380	9	1,966	.26	1	....	53	....	4.1
November	29	....	1,094,700	....	1,094,700	36,490	10	1,040	.26	3	....	53	....	55.2
December	9	....	314,880	....	314,880	10,157	10	54	.25	1	....	53	....	17.1
Totals and averages	851	....	30,230,780	....	30,230,780	82,824	182	540	.28	88	....	53	....	90.7

Total capacity, 35,000,000 gallons per day.

FRANKFORD PUMPING STATION.

No. 1.—Marine Compound Rotary—10,000,000 gallons per day.
No. 2.—Corliss Compound Rotary—10,000,000 gallons per day.
No. 3.—Vertical Compound Rotary—15,000,000 gallons per day.

1895.	Running Time of each Engine in Hours.			Gallons Pumped by each Engine.			Total Pumpage each Month.	Average Pumpage Per Day.	Coal.		Percentage of Ashes.	Oils. Cylinder.	Oils. Engine.	Mean Water Pressure & Mean Suction Lift in Lbs. per Sq. Inch.			Gallons Raised 100 Feet per Pound of Coal.
	No. 1.	No. 2.	No 3.	No. 1.	No. 2.	No. 3.	Gallons.	Gallons.	Tons.	Lbs.		Qts.	Qts.	No. 1.	No. 2.	No. 3.	
January	....	479	542	....	169,111,430	218,341,144	387,452,574	12,498,470	663	1.080	.25	420	538	......	77	63	399.8
February	....	491	307	....	169,652,450	176,011,853	345,663,803	12,345,135	499	1.640	.25	372	462	......	78	65	473.0
March	....	338	483	....	110,122,530	266,637,939	376,760,469	12,153,563	545	1.700	.25	446	584	......	78	65	472.9
April	543	84	258	190,367,093	18,086,790	136,676,568	34[illegible],080,451	11,502,681	544	.760	.25	398	494	76	75	65	433.5
May	629	....	140	228,881,944	....	78,465,702	302,347,646	9,753,149	509	1.940	.25	294	345	75	......	65	405.5
June	703	12	219	252,484,205	4,165,260	131,216,732	387,866,197	12,928,873	614	1.640	.25	288	384	75	75	65	431.5
July	703	111	216	250,766,194	39,062,800	124,672,567	414,501,561	13,371,018	641	.560	.25	324	452	75	77	65	442.0
August	621	283	200	224,337,453	105,693,800	114,297,896	444,329,149	14,333,198	613	1.180	.25	336	452	70	70	68	495.0
September	699	444	45	270,566,719	164,680,325	28,800,342	464 047,386	15,468.246	609	2.040	.25	341	460	68	68	68	520.3
October	727	451	49	280,751,041	162,921,160	21,287,579	464,959,780	14,998,702	661	1.360	.25	332	443	69	69	69	480.6
November	691	367	27	253,825,709	183,631,920	10,158,114	397,615,743	13,253,858	568	.80	.25	336	466	70	70	70	478.7
December	736	184	84	259,959,351	67,508,333	54,762,071	382,229,758	12,329,992	581	.61	.25	339	457	68	68	68	453 7
Totals and Averages.	6,052	3,244	2,570	2,211,939,712	1,144,586,798	1,356,828,007	4,712,854,517	12,911,930	7,053	.601	.25	4,226	5,537	72	73	66	456.8

FAIRMOUNT PUMPING STATION, 1895.

Wheels.	Total Pumpage.	Hours pumped.	Hours shut down. High water.	Hours shut down. Low water.	Hours shut down. Muddy water.	Hours shut down. Full basin.	Hours shut down. Repairs.
1	362,831,408	3,680	57	2,061	2	....	2,960
3	1,658,399,496	6,119	52	2,415	....	....	174
4	1,369,294,994	5,199	52	3,209	....	....	300
5	1,187,227,773	4,510	41	3,995	....	4	210
7	918,402,150	3,708	25	4,095	....	4	928
8	1,051,411,035	4,092	25	4,094	....	5	544
9	1,039,626,355	4,068	25	4,482	91	5	89
Totals......	7,587,193,211	31,376	277	24,351	93	18	5,205

The following table shows the quantity of water pumped at Fairmount, from 1886 to 1895, inclusive:

Year.	Gallons per 100 Feet.	Repairs.	Cost per Million Gallons.
1886................................	7,282,553,795	$9,895 87	$2 23
1887................................	10,105,736,663	5,582 83	1 18
1888................................	11,241,113,108	6,958 00	1 44
1889................................	11,413,836,469	4,800 44	1 24
1890................................	12,352,987,139	4,900 00	91
1891................................	11,380,824,730	5,900 00	1 14
1892................................	10,401,951,806	4,750 85	1 14
1893................................	9,911,609,325	5,675 46	1 44
1894................................	10,632,204,689	4,013 23	1 35
1895................................	7,857,193,211	3,983 15	1 71

CURRENT EXPENSES AND WORK OF THE PUMPING STATIONS FOR THE YEAR 1895.

Stations.	Pay of Employees at the Station.	Coal.			Lubricating Oils.		Lighting.		Repairs to Boilers and Machinery.	Small Stores.	Total Expenses.	Total Gallons Pumped.	Lift in Feet, including Suction and Friction.	Gallons Pumped 100 Feet High, Suction and Friction Included.	Cost of Raising One Million Gallons 100 Feet.	Percentage of Work Done at each Station.	Height of Surface of Basins Above Pumps in Feet.
		Tons.	Price per Ton.	Cost.	Gallons.	Cost.	Oil.	Electri'ty.									
Fairmount	$8,634 37	....	....	....	482	$168 88	$22 00	....	$3,983 15	$185 00	$12,993 40	7,587,193,211	100.0	7,587,193,211	$1 71	4.00	90.00 115 00 120.00
Spring Garden	66,309 11	64,138	B'k, $1.97 Pea, 2.68	$151,409 18	7,848	2,130 15	62 00	$1,611 25	33,212 89	839 00	255,574 08	50,704,191,842	145.1	73,598,348,090	3 47	52.15	102.00 179.00 *114.00 †215.00
Belmont	20,119 12	18,944	B'ck, 1.96 Pea, 2.71	46,857 74	976	265 66	19 85	435 00	6,755 62	208 00	74,660 99	8,437,478,525	221.6	18,697,086,937	3 99	13.00	198.08
Belmont Auxiliary	2,625 57	323	Pea, 3.00	969 00	67	18 28	11 00	....	1,657 39	52 00	5,333 24	58,516,616	129.3	75,697,094	71 11	.57	‡160.00
Queen Lane	568 32	673	Pea, 2.90	1,951 70	417	107 40	10 50	328 00	6,895 49	133 00	9,994 41	131,135,948	240.9	315,975,314	31 72	2.00	231.00
Roxborough	15,274 81	19,574	Pea, 2.72	53,241 28	2,873	750 02	13 00	465 00	7,755 36	215 00	77,714 47	6,215,928,787	389.6	23,217,258,553	3 34	16.00	317.00 366.00
Roxborough Auxiliary	1,469 58	518	Pea, 3.07	1,590 26	189	52 72	13 50	....	1,683 15	48 00	4,857 21	315,842,628	128.3	405,451,172	11 99	3.00	§140.00
Mount Airy	3,070 00	1,520	B'ck, 2.25	3,420 00	352	103 28	9 00	....	939 18	43 29	7,584 75	582,476,250	152.4	888,243,176	8 54	5.00	‖128.00
Chestnut Hill	1,500 00	182	B'ck, 2.27	413 14	22	6 16	11 00	....	316 00	21 00	2,267 30	30,230,780	122.4	37,011,543	61 00	.28	128.00
Frankford	13,041 32	7,053	B'ck, 2.05	14,458 65	2,441	641 96	13 75	563 00	7,855 62	211 06	36,785 30	4,712,854,517	153.2	7,218,689,105	5 09	4.00	108.53
Totals and averages deducted from totals.	$131,612 32	112,925	$2.42	$274,310 95	15,667	$4,244 51	$185 60	$3,402 75	$71,053 85	$1,955 29	$487,765 15	78,775,849,104	167.6	132,040,954,195	$3 69	100.00	....

* Repumpage from East Park. † Spring Garden to Queen Lane. ‡ Repumpage from Roxborough. § Repumpage from Mt. Airy. ‖ Repumpage from Belmont.

TOTAL PUMPAGE 1895.

1895.	Fairmount.	Spring Garden.	Belmont.	Queen Lane.	Roxborough.	Chestnut Hill.	Frankford.	Consumption.	Supplementary Pumpage				Total Pumpage.	Average per day	Percentage of Ashes.	Maximum Gallons for One Day.	Minimum Gallons for One Day.	Total Steam Pumpage.	Total Water Pumpage.
									Bel. Auxiliary.	Rox. Auxiliary.	Mt. Airy.	Total.							
January	1,157,966,088	3,304,126,660	641,743,503	....	509,147,900	147,600	387,452,574	6,000,584,825	....	562,980	46,470,000	47,032,980	6,047,617,805	195,084.429	7.67	224,879,732	142,863,402	4,889,651,217	1,157,966,088
February	934,861,556	3,577,991,410	607,894,825	....	501,548,090	....	345,663,803	5,967,959,684	....	699,050	42,727,500	43,426,550	6,011,386,234	214,692,365	7.64	242,809,942	138,916,719	5,076,524,678	934,861,556
March	1,147,356,795	3,636,764,511	665,328,208	....	524,547,760	3,859,740	376,760,469	6,354,617,483	....	739,440	49,187,500	49,926,940	6,404,544,423	206,598,207	8.14	246,789,309	153,791,599	5,257,187,628	1,147,356,795
April	1,159,346,863	3,367,976,236	614,522,597	....	413,429,890	1,003,680	345,080,451	5,931,359,717	....	629,980	45,030,000	45,659,980	5,977,019,697	199,233,989	7.58	225,755,909	136,956,347	4,817,672,834	1,159,346,863
May	1,218,441,270	3,673,176,920	688,704,399	....	494,677,464	5,244,720	302,347,646	6,382,592,419	2,962,642	785,450	49,965,000	53,713,092	6,436,305,511	207,622,758	8.18	226,115,562	172,441,993	5,217,864,241	1,218,441,270
June	635,784,008	4,427,764,300	691,998,391	....	480,532,965	5,777,000	387,866,197	6,629,722,861	7,669,046	932,040	53,598,750	62,199,836	6,691,922,697	223,064,089	8.49	250,0[illegible]9,972	196,435,884	6,056,138,689	635,784,008
July	377,350,379	4,831,811,550	727,144,688	....	486,453,150	5,266,860	414,501,561	6,842,528,188	9,311,970	991,120	53,551,250	63,854,340	6,906,382,528	222,786,533	8.77	237,500,064	203,827,783	6,529,032,149	377,350,379
August	82,201,595	5,096,363,170	795,831,155	....	540,310,865	5,696,280	444,329,149	6,964,732,214	9,960,840	39,329,639	49,460,000	98,750,479	7,063,482,693	227,887,972	8.96	240,608,474	205,994,538	6,981,281,098	82,201,505
September	14,048,068	5,098,389,390	784,109,966	....	568,509,115	1,751,520	464,047,386	6,930,855,445	8,313,001	63,912,438	54,021,000	126,246,439	7,057,101,884	235,236,729	8.95	243,628,077	218,405,548	7,043,053,816	14,048,068
October	107,991,968	4,897,649,860	753,202,743	6,912,578	633,001,608	73,800	464,965,780	6,863,792,337	7,842,617	69,771,497	49,898,750	127,512,864	6,991,305,201	225,525,974	8.88	253,013,940	174,350,707	6,883,313,233	107,991,968
November	249,180,903	4,656, 60,790	730,079,390	36,381,320	514,429,590	1,094,700	397,615,743	6,584,842,436	6,587,485	67,359,587	44,484,000	118,431,072	6,703,273,508	223,442,450	8.50	247,275,489	197,377,130	6,454,092,605	249,180,903
December	502,663,718	4,136,117,045	706,918,660	87,812,050	519,340,390	314,880	382,229,758	6,365,426,501	5,869,015	70,129,407	44,082,500	120,080,922	6,485,507,423	209,209,917	8.24	258,838,527	178,598,442	5,982,843,705	502,663,718
Total	7,587,193,211	50,704,191,842	8,437,178,525	131,135,948	6,215,928,787	30,930,780	4,712,854,517	77,819,013,610	58,516,616	315,842,628	582,476,250	956,835,494	78,775,849,104	215,824,244	100.00	....	....	71,188,655,893	7,587,193,211
Increase over 1894	....	6,702,106,233	1,266,497,291	No Pumpage.	910,499,980	....	433,717,968	6,381,670,822	No Pumpage.	305,952,178	....	320,454,044	6,702,124,866	18,479,438	....	23,944,452	3,868,494	9,747,136,344	
Decrease over 1894	3,015,011,478	....	....	....	....	13,276,120	....	....	....	....	44,014,750	....	....	....	....	....	....	....	3,045,011,478

DESCRIPTION OF PUMPING MACHINERY OF THE BUREAU OF WATER, PHILADELPHIA, 1895.

STEAM ENGINES AND PUMPS.

Pumping Station.	Designated Number of Engine or Turbine.	Types of Engines.	Designated Capacity—Million Gallons per Day.	High Pressure Cylinder: Number of Cylinders.	Bore (inches).	Stroke (feet).	Number of Revolutions.	Speed (feet per minute).	Diameter of Rod (inches).	Int. Pressure Cylinder: Number of Cylinders.	Bore (inches).	Stroke (feet).	Number of Revolutions.	Speed (feet per minute).	Diameter of Rod (inches).	Low Pressure Cylinder: Number of Cylinders.	Bore (inches).	Stroke (feet).	Number of Revolutions.	Speed (feet per minute).	Diameter of Rod (inches).	Air Pumps: Number of Air Pumps.	Bore (inches).	Stroke (feet).	Number of Revolutions.	Diameter of Rod (inches).	Type—Single [S] or Double [D].
Spring Garden: (Old Station)	5	Southwark Foundry Quarter-Crank Fly Wheel Pump	20	2	44	4	16⅔	133⅓	8	...	...	...	...	...	...	2	88	4	16⅔	133⅓	8	4	24	2	16⅔	...	S.
	6	Simpson Compound Rotary	8	1	36	5.2	11	133⅔	4	...	...	...	...	...	...	1	57	8	11	176	5	1	30	4	11	...	S.
	7	Marine Compound Rotary	20	1	45	6	17	204	8	...	...	...	...	...	...	1	80	6	17	204	8	1	40	3	17	...	S.
	8	Worthington Duplex	10	2	38	4	12½	100	4½	...	...	...	...	...	...	2	66 3/16	4	12½	100	{2 rods 4}	2 2	{29¾ 27}	2	12½	...	S.
	11	Gaskill Compound	20	2	33	4	17½	140	4½	...	...	...	...	...	...	2	66	4	17½	140	5	2	24	2¼	17½	...	S.
(New Station)	2	Holly Ver. Triple Expansion	30	1	36	5	20	200	7½	1	62½	5	20	200	7½	1	92	5	20	200	8	1	26	5	20	...	S.
	3	Holly Ver. Triple Expansion	30	1	36	5	20	200	7½	1	62½	5	20	200	7½	1	92	5	20	200	8	1	26	5	20	...	S.
	9	Worthington Duplex	15	2	38	4	12½	100	4½	...	...	...	...	...	...	2	66	4	12½	100	{2 rods 4}	2 2	{29½ 27}	2	12½	...	S.
	10	Worthington Duplex	15	2	38	4	12½	100	4½	...	...	...	...	...	...	2	66	4	12½	100	{2 rods}	2 2	{29¾ 27}	2	12⅓	...	S.
Belmont	1	Worthington Duplex	5	2	29	4	12	96	4	...	...	...	...	...	...	2	50¼	4	12	96	4	{2 2}	...	2	12	...	S.
	2	Worthington Duplex	5	2	29	4	12	96	4	...	...	...	...	...	...	2	50¼	4	12	96	4	{2 2}	...	2	12	...	S.
	3	Worthington Duplex	8	2	33¾	4	12	96	4½	...	...	...	...	...	...	2	58¼	4	12	96	4½	{2 2}	{29¾ 29¾}	2	12	...	S.
	4	Worthington Duplex	20	2	41	4	16¼	180	7	...	...	...	...	...	...	2	82	4	16¼	130	{2 rods 5}	2	...	...	...	...	...
Belmont Auxiliary	1	Worthington Duplex	2	...	...	...	...	...	...	...	...	...	...	...	...	2	...	2.6									
	2	Snow	½	2	12	1	35	...	1½																		
Queen Lane Station	1	Southwark Foundry Vert. Triple Expansion	20	1	37	4.5	22	198	5¼	1	62	4.5	21.84	198	5¼	1	96	5.4	22	198	5¼	1	28	3	...	2¾	T.
	2	Southwark Foundry Vert. Triple Expansion	20	1	37	4.5	22	198	5¼	1	62	4.5	21.84	198	5¼	1	96	5.4	22	198	5¼	1	28	3	...	2¾	T.
Roxborough	1	Southwark Foundry Quarter-Crank Fly Wheel Pump	12	2	44	4	15½	124	8	...	...	...	...	...	...	2	88	4	15½	124	8	2	24	...	...	...	S.
	2	Worthington Duplex	5	2	36	4	12	96	4½	...	...	...	...	...	...	2	58	4	12	96	4½	{2 2}	29¾ 29¾	{2 2}	12	...	S.
	3	Worthington Duplex	7½	2	38	4	12½	100	4½	...	...	...	...	...	...	2	66	4	12½	100	2 of 4	{2 2}	29¾ 27	{2 2}	12½	...	S.
Roxborough Auxiliary	1	Worthington Duplex	6	2	21	4	12	96	3½	...	...	...	...	...	...	2	36	4	12	96	3½	4	18	1.59	12	...	S.
	2	Knowles' Pump	¼	1	14	1⅓	18	48	1 11/16	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Mount Airy	1	Davidson Pump	1	1	20	1⅔	60	200	2¼	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	2	Davidson Pump	1	1	20	1⅔	60	200	2¼	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	3	Knowles' Pump	1	1	24	2	20	80	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Chestnut Hill	1	Knowles' Pump	¼	1	24	1¾	11	38.5	3⅝	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	2	Worthington Duplex	½	2	14	⅞	...	...	1¾	...	...	...	...	...	...	2	10	10¼	...	...	1¾	...	...	...	...	...	...
Frankford	1	Marine Compound Rotary	10	1	40	5	21	210	6¾	...	...	...	...	...	...	1	69	5	21	210	6¾	1	24	2½	21	3¾	S.
	2	Corliss Compound Rotary	10	1	28	3	37	222	3 15/16	...	...	...	...	...	...	1	56	3	37	222	4 15/16	1	30	1⅙	37	{Trunk 6}	S.
	3	Southwark Foundry Quarter-Crank Compound Pump	15	1	44	3½	24	168	{2 rods 5}	...	...	...	...	...	...	1	88	3½	24	168	{2 rods 5}	1	28	1¾	24	...	S.
Fairmount: (New House)	1	Turbine Wheels	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	3	...	5⅓	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	4	...	5⅓	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	5	...	5⅓	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
(Old House)	7	...	5 1/10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	8	...	5 1/10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	9	...	5 1/10	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Forcing Pumps.

Pumping Station.	No.	Type—Single [S], Double [D], Bucket [B], Plunger [P].	Number of pumps.	Bore (inches).	Area (square inches), A.	Stroke (feet).	Number of single strokes per minute.	Diameter of Pump Rod (inches).	Displacement per Stroke, Theoretical (Gallons).	Displacement per Stroke, Actual (Gallons).	Diameter Suction Pipe (inches).	Diameter Discharge Pipe (inches).	Number of Suction Valves (on each end).	Lift of Suction Valves (inches).	Area of Suction Valves (square inches).	Number of Discharge Valves.	Lift of Discharge Valves (inches).	Total Area, B (square inches).	Relative Speed of Water, A, B (through valves).	Speed (feet per second) through Valves.	Mean Pressure on Pumps at Pressure Gauge (pounds per square inch).	Corresponding Head (feet).	Lift (feet) from Surface of Water to Centre of Gauge.	Total lift (feet).
Spring Garden: (Old Station)	5	{D. P.}	2	36½	1,021	4	66⅔	8	212⅙	208	2 x 36	48	78	½	554	78	½	554	1.84	4.05	110	250	...	...
	6	{R. P.}	2	{B. 28½ P. 20⅛}	{638 818}	8	22	...	125⅝	125	None	36	16	1½	421	Check	...	...	1.50	4.4	45	104.6	22	126.6
	7	{D. P.}	2	30	707	6	34	8	218½	207½	{2 of 30}	48	18	1	631	18	1	631	1.12	3.8	{66 45}	{153.5 104.6}	20	{173.5 124.6}
	8	{D. P.}	2	30	707	4	25	4½	147½	140	30	30	8	1	280½	8	1	280½	2.50	4.2	{86 45}	{200 104.6}	16.5	{216.6 121.2}
	11	P	2	36	1,017.9	4	35	6	208½	200	36	36	306	5/16	414	288	5/16	390	2.61	6.09	71	163.9	25	188.9
(New Station)	2	D. Plunger.	3	20	706.8	5	40	6	539.8	...	48	30	8	1	248	72	½	546	1.29	4.22				
	3	D. Plunger.	3	30	706.8	5	40	6	539.8	...	48	30	8	1	248	72	½	546	1.29	4.22				
	9	{D. P.}	2	37	1,075	4	25	5	221¼	210¼	36	36	12	1	300¾	12	1	300¾	3.58	5.97	{66 45}	{153.5 104.6}	16.4	{169.9 121}
	10	{D. P.}	2	37	1,075	4	25	5	221¼	210¼	36	36	12	1	300¾	12	1	300¾	3.58	5.97	{86 45}	{200 104.6}	16.4	{216.4 121}
Belmont	1	{D. P.}	2	22 1/16	382	4	24	4	78	75	30	30	8	1	...	8	1	...	...	...	88	204.6	14.6	219.2
	2	{D. P.}	2	22½	397	4	24	4	81¼	78	30	30	8	1	...	8	1	...	...	...	88	204.6	14.6	219.2
	3	{D. P.}	2	28	615	4	24	4½	126½	121¼	30	30	8	1	248	8	1	248	2.47	3.96	88	204.6	14.6	219.2
	4	{D. P.}	2	36½	1,025	4	65	6 15/16	221½	215	36	36	36	½	302	36	½	302						
Belmont Auxiliary	1																							
	2																							
Queen Lane Station	1	{D. P.}	3	34½	934.8	5.4	22	5	655.5	...	48	48	89	½	801.5	89	½	801	1.16	3.6	100	231	32	246
	2	{D. P.}	3	34½	934.8	5.4	22	5	655.5	...	48	48	89	½	801.5	89	½	801	1.16	3.6	100	231	32	246
Roxborough	1	{D. P.}	2	29	635	4	31	8	137½	133½	27	36	60	½	465	60	½	465	...	2.6				
	2	{D. P.}	2	22	380	4	24	4½	77½	73¾	30	30	8	1	...	8	1	...	...	...	...	...	21	365.4
	3	{D. P.}	2	26	531	4	25	5	108	102¾	30	30	8	1	280	8	1	280	2.50	4.2	148	344	21.4	365.4
Roxborough Auxiliary	1	{D. P.}	2	24	452	4	21	3½	93½	89¼	30	48	72	½	546	8	1	248	1.82	2.91	52	121	14.5	135.5
	2	Piston	...	10	785	1⅓	36	1 11/16	68	5½	6	6	2	...	...	2	...	...	...	...	36	83.7		
Mount Airy	1	{D. Piston}	1	10	78.5	1⅔	120	2¼	6⅝	6¼	12	10	6	⅝	87	6	⅝	87	0.90	3.00	60	140		
	2	{D. Piston}	1	10	78.5	1⅔	120	2¼	6⅝	6¼	12	10	6	⅝	87	6	⅝	87	0.90	3.00	60	140		
	3	Piston	...	...	...	2	40	3 15/16	...	25	42	40	2	...	...	2	...	...	...	...	36	83.7		
Chestnut Hill	1	Piston	1	18	254.5	1¾	22	3⅜	26	25	10	8	2	⅝	34	2	...	34	7.4	4.74	56	123.2		
	2	...	...	...	...	...	...	1¾	6.9	6.5	...	...	...	...	...	...	...	...	...	...	53	123.2		
Frankford	1	{D. P.}	2	21	346	5	42	6¾	85¼	81¾	{2 of 20}	30	10	1	350⅝	10	1	350⅝	9.98	3.45	73	170	17.4	187.5
	2	{D. P.}	2	20	314	3	74	3 11/16	48	45¾	30	30	12	¾	420¾	12	¾	420¾	0.75	2.77	73	172	15.4	187.5
	3	{D. P.}	2	28	615	3½	96	5½	109¾	...	42	40	1	...	290	1	...	290	2.12	.47				
Fairmount: (New House)	1	Piston	2	16	201	6	24	3⅝	61 1/20	61 1/20	18	16	2	...	240	2	...	240	0.88	2.11				
	3	Piston	2	22⅜	394.3	6	16	5	119 13/16	115⅝	22½	36	6	...	528	1	2	441	0.90	1.44				
	4	Piston	2	22	380.1	6	16	5	115⅝	115⅝	22½	36	6	...	528	1	2	441	0.86	1.37	56	130	...	130
	5	Piston	2	22	380.1	6	16	5	115⅝	115⅝	22½	36	6	...	528	1	2	441	0.86	1.37	56	130	...	130
(Old House)	7	Piston	2	18 11/16	274.3	6	22	4	83½	80 97/100	20	30	1	2	264	1	2	264	1.04	2.29	56	130	...	130
	8	Piston	2	18⅝	272.4	6	22	4	82 9/10	80 97/100	20	30	1	2	264	1	2	264	1.04	2.29	56	130	...	130
	9	Piston	2	18 11/16	274.3	6	22	4	83½	80 97/100	20	30	1	2	264	1	2	261	1.04	2.29	56	130	...	130

STEAM BOILERS.

Pumping Station.	Type of Boilers.	Number of Boilers.	Diameter of Shell (inches).	Length of Shell (feet).	Thickness of Shell (inches).	Number of Flues.	Diameter of Flues (inches).	Thickness of Flues (inches).	Length of Flues (feet).	Number of Tubes.	Length of Tubes (feet).	Diameter of Tubes (inches).	Diameter of Steam Drum (inches).	Length of Steam Drum (feet).	Length of Grate (feet).	Area of Grate (square feet).	Area of Heating Surface (square feet).	Estimated Horse-power, at 10 square feet for Shell and Fire Flues, 15 square feet for Tubes and 12 square feet for Drums.	Height of Stack (feet).	Section of Stack (square feet).
Spring Garden	Marine, Steel	24	138	10⅝	{1⅛ 15/16 9/16}	Fo 2	x corr 43	uga ⅜	ted. 8	188	8	3	42	12½	6⅙	42	1,551	113	100	49
	Furnace Flue, Tubular	10	102	20	⅝	2	37	⅜	8	90	10	4	...	...	6⅙	42	1,116	100	150	27
Belmont	Tubular	7	72	12	½	...	...	...	...	92	12	4	48	14	5½	36	1,371	95.9	100	25
	Furnace Flue, Tubular	5	102	20	⅝	2	42	⅜	8	90	10	4	...	...	6⅙	42	1,116	100	100	25
Belmont Aux.	Furnace Flue	4	102	20	⅝	2	42	⅜	7½	90	10	4	...	...	6⅙	42	1,116	80	125	20
Queen Lane	Furnace Flue, Tubular	24	102	20	⅝	2	42	⅜	8	90	10	4	...	...	6⅙	42	1,116	100	202	113
Roxborough	Tubular	3	72	15	⅜	...	...	...	...	67	15	4	{1 dome 36}	4	5	33¾	1,215	87	100	20¼
	Marine	6	{oval 11½ 9½}	9⅝	9/16	2	37½	⅜	7	138	7	3	42	11½	6⅙	37½	...	...	100	28
	Furnace Flue, Tubular	4	102	20	⅜	2	42	⅝	7½	90	10	4	...	...	6 1/7	42	1,116	80	100	25
New Roxborough Aux.	Furnace Flue	4	102	20	⅝	2	42	⅜	7½	90	10	4	...	...	6⅙	42	1,116	80	125	20
Mount Airy	Tubular	3	48	10	5/16	...	...	...	...	48	10	3	{1 dome ...}	...	4	16⅔	4·5	33	50	7 9/16
	Scotch Boiler	1	6	10	⅝	1	36	⅜	74	38	7 6	3	...	...	5	1	293	25	50	1½
			Connecte	d by 1	drum	in	the	flue	and 1	on top										
Chestnut Hill	Cylinder	2	30	30	...	...	...	...	...	...	...	...	30	7½	5	13¾	175	16½		
	Tubular	1	48	14	5/16	...	...	...	...	44	14	3	21	24	5	22½	...	44		
Frankford	Marine, Steel	12	138	10⅝	{15/16 13/16 ¾}	Fo 2	x corr 43	uga ⅜	ted. 8	188	8	3	42	12½	...	42	1,551	113	{150 100}	{38 33}

APPENDIX D.

REPORT

OF

Assistant in Charge of Distribution.

BUREAU OF WATER.

Philadelphia, January, 1896.

MR JOHN C. TRAUTWINE, JR.,
Chief, Bureau of Water.

DEAR SIR :—The following report on work done during the year 1895 in connection with the Distribution System, is respectfully submitted :

The water supply throughout the City, owing to increased pumping facilities which enabled us to maintain the reservoirs to nearer their full capacity, has been far more abundant than in may years previous, there having been a marked decrease in the number of complaints of inadequacy due to low pressure on the mains.

During the latter part of the year the City, with the exception of the District east of Fifth street, between the Pennsylvania Railroad and the Richmond Branch of the Reading Railroad, was fairly well supplied. In the locality named there is but one six-inch pipe for the supply of the entire section, and, as it is largely a manufacturing District, the danger from shortage of water in the event of fire is very great. In order to meet an emergency of this nature, as well as for the general improvement of the water supply to this District, a sixteen-inch main should be laid as soon as possible.

The boundaries of the Water Districts, as now supplied from the several reservoirs and by direct pumpage, remain, practically, the same as they were during 1894.

No new supply or feeding mains have been laid and put into permanent use except for the improvement of small areas, as follows:

A six-inch pipe was laid in Clearfield street, from Twenty-third to Twenty-seventh street, for the purpose of connecting the Roxborough supply from Ridge avenue to the Germantown supply at Twenty-third and Clearfield streets. This pipe, which is one thousand seven hundred and fifty (1,750) feet in length, was first laid on the surface, and was put into actual service within forty-eight (48) hours from the time it was ordered. Afterwards, while still in use, it was lowered to the proper depth into a trench. By means of this pipe the pressure in the northern part of the Twenty-eighth Ward was increased from twenty (20) to thirty-seven (37) pounds.

A twelve-inch pipe was laid in Torresdale avenue, southeast from Devereaux street, increasing the pressure in the lower portion of the Thirty-fifth Ward from six (6) to sixty-four (64) pounds.

The supply in the easternmost end of the Twenty-fourth Ward was also greatly improved by laying a twelve-inch main from Thirty-fifth street, north of the Pennsylvania Railroad, to Thirtieth and Spring Garden streets, which increased the pressure from twenty-one (21) to fifty (50) pounds.

Notwithstanding that there has been considerable improvement in the supply as compared with former years, it is by no means as efficient as it should be. New supply mains are greatly needed for the sections below South street, between South and Vine streets, and for the manufacturing districts in the northeastern portion of the City. For the northwestern section, now supplied by direct pumpage, ample provision will be made by the completion of the pumping and supply mains of the Queen Lane System.

A thirty-six inch pumping main is also needed for the new pump at the Shawmont Works. This engine is dependent upon the old mains for Nos. 2 and 3 Worthington pumps, and it is therefore run at a disadvantage in economy of fuel and safety to the mains.

Pumping and supply mains have been laid as follows:

The work of laying the 48-inch supply main from Queen Lane reservoir to Broad and Douphin streets was continued, and six thousand five hundred and fifty-four (6,554) feet of the line were laid, leaving a balance of eleven thousand five hundred (11,500) feet to complete the main.

One thousand nine hundred and fifteen (1,915) feet of 48-inch main, to extend eventually from Queen Lane reservoir to the intersection of Nicetown lane and Wissahickon avenue, were laid, and, inasmuch as there is no prospect of the immediate completion of this line, a 12-inch main was laid in Nicetown lane between Thirty-second street and Wissahickon avenue for the purpose of conveying, when the Queen Lane reservoir is put into service, a much needed supply to the Tioga district.

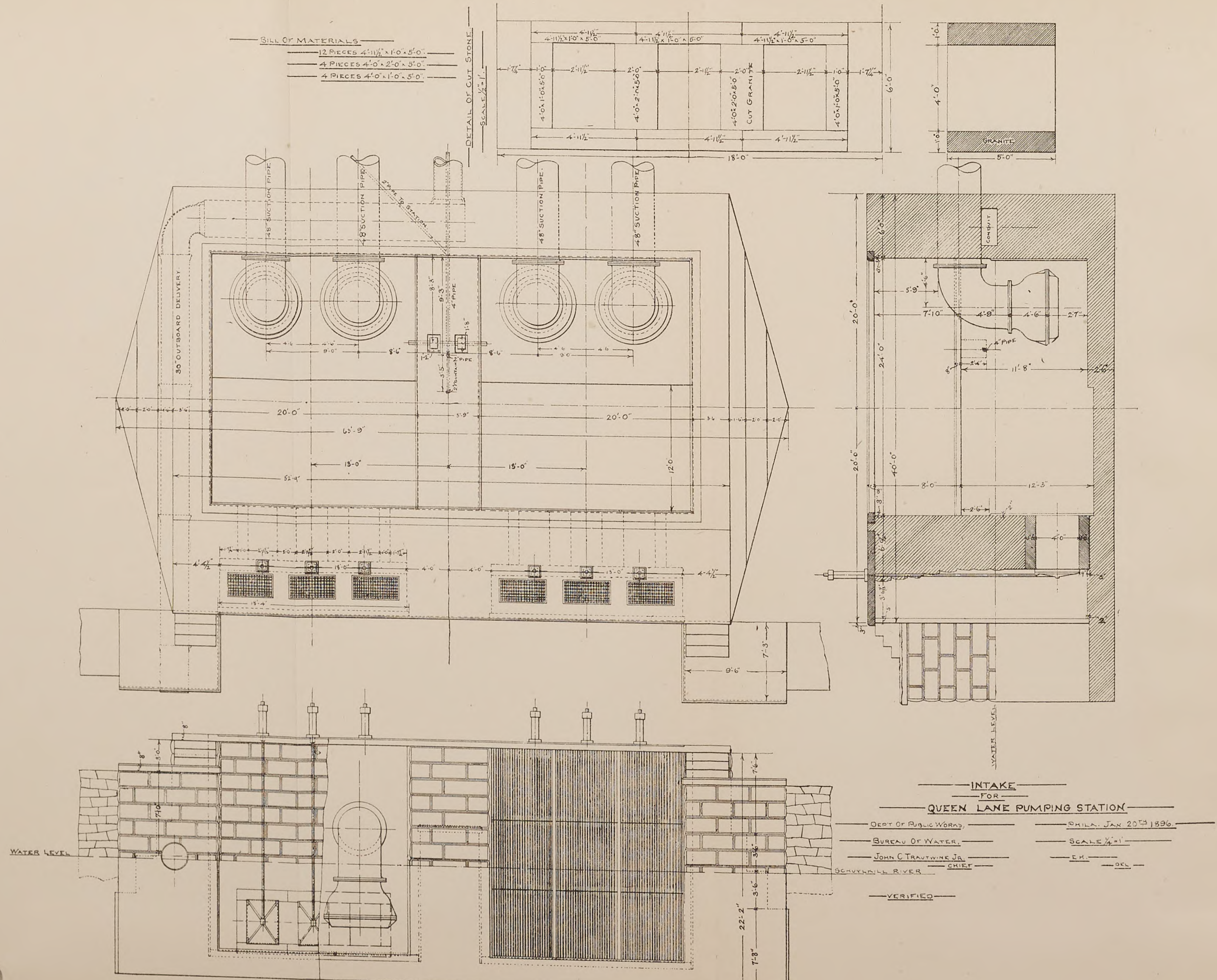
A 48-inch pumping main and connections for Nos. 1 and 2 engines at Queen Lane pumping station (the greater portion of which were laid during 1894) have been completed, and water was let in on October 14, 1895. • There was, at first, considerable leakage at the joints on this line, but since the latter have been recaulked the leakage has ceased and the main is now in a satisfactory condition.

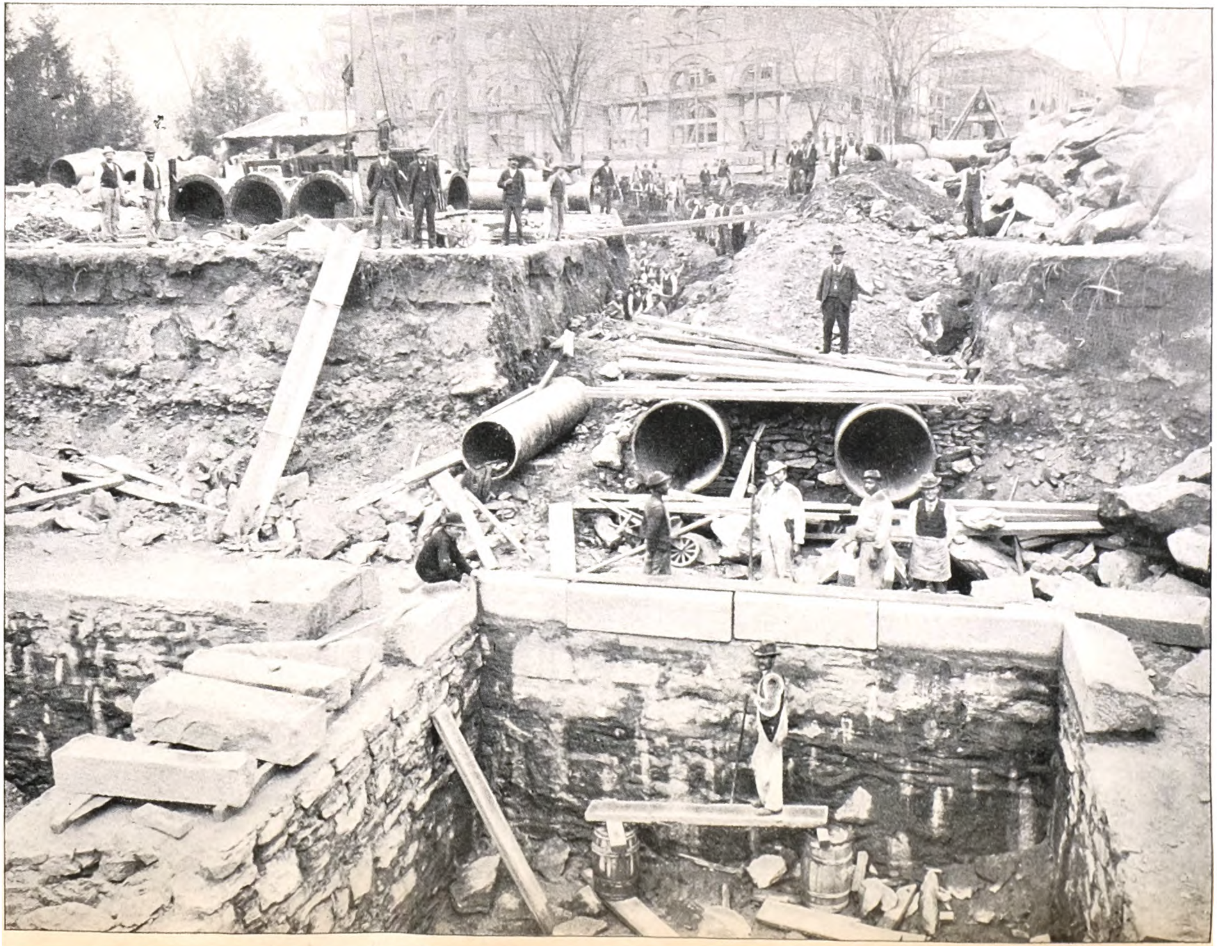
Owing to the fact that Queen Lane reservoir, at the time No. 1 engine was completed, was not in condition to use, it was considered expedient to lay a 48-inch connection from the pumping main at Thirty-third street and New Queen lane to the supply main from the north stop house on Thirty-first street. This connection, which is two thousand and eight (2,008) feet long, was, accordingly, put in, and pumpage was started through it (experimentally) to the Spring Garden direct pumpage district, on October 23, 1895.

No. 2 engine, at Spring Garden pumping station, was connected to the 48-inch pumping main (laid in 1893), and a connection was also made between this main and No. 11 main at East Park reservoir. Considerable trouble was experienced at first from leaks at the joints, caused by the ram on the pipe, but this difficulty has been remedied, and no trouble has lately been experienced.

A connection was also made near the Spring Garden pumping station, between the 36-inch supply main from East Park reservoir (formerly connected to Nos. 8 and 11 engines to pump subsided water from the reservoir into the direct pumpage district, but since discontinued) and the 48-inch Fairmount main. The object of this is to supply Fairmount reservoir at times when the water in the river is too low to permit the running of the turbine wheels. Formerly, on such occasions, water was drawn from the mains supplying the locality between Vine and South streets and the Delaware and Schuylkill rivers, but this lowered the pressure on the mains in that section to so great an extent as to seriously affect the supply, and to add, in case of fire, increased danger from shortage of water.

Pumping main connections between the auxiliary pumping station at Roxborough and the Chestnut Hill 30-inch main in Shawmont avenue, and also a connection from this main to the new standpipe at Roxborough, were completed and put into service, since which there


INTAKE
FOR
QUEEN LANE PUMPING STATION
DEPT OF PUBLIC WORKS.
BUREAU OF WATER.
JOHN C TRAUTWINE JR.
CHIEF
PHILA. JAN 20TH 1896.
SCALE ¼"=1'
E.H.
DEL
VERIFIED
SCHUYLKILL RIVER
WATER LEVEL
BILL OF MATERIALS
12 PIECES 4'-11½" x 1'-0" x 5'-0"
4 PIECES 4'-0" x 2'-0" x 5'-0"
4 PIECES 4'-0" x 1'-0" x 5'-0"
DETAIL OF CUT STONE
SCALE ½"=1'
CUT GRANITE
GRANITE
48" SUCTION PIPE
30" OUTBOARD DELIVERY
2" PIPE TO STATION
4" PIPE
CONDUIT



INTAKE UNDER CONSTRUCTION AT QUEEN LANE PUMPING STATION. VIEW OF DAM.

has been an ample supply throughout the Chestnut Hill section.

The total quantity of new mains laid during 1895 was as follows:

2-inch	59 feet.
3-inch	117 feet.
4-inch	9,875 feet.
6-inch	155,184 feet.
8-inoh	9,854 feet.
10-inch	3,931 feet.
12-inch	15,696 feet.
16-inch	391 feet.
20-inch	405 feet.
30-inch	449 feet.
36-inch	182 feet.
48-inch	13,152 feet.
	209,295 feet.

A new intake was built at Belmont Works for the No. 4 engine removed from Spring Garden pumping station, and a 36-inch suction pipe, 107 feet long, composed of "bead" and "bell" pipes and with lead joints was put in for this engine, with an air chamber placed about 25 feet from the pump. It was afteward found necessary, owing to the excessive "ram," to move the air chamber closer to the pump, and since making this change no trouble has been experienced.

Queen Lane Intake.

The work of constructing the intake at Queen Lane Pumping Station was begun early in the year, and is now nearly complete.

This structure is built of masonry, and is rectangular in form, with a well 46 feet long by 24 feeet wide and 21 feet deep, divided into two equal sections, of 20 x 24 feet, by a wall, the top of which is 8.66 feet below that of the main structure.

The front, or river wall, is pierced with three openings or sluice ways for each section, Each opening is 2.96 feet wide and 4 feet high, and controlled by vertical sliding gates at the outer end.

Masonry piers project 5 feet from the face of the wall at the centre and at each end, thus leaving two spaces 18 feet wide and 19.5 feet high, in which are placed the heavy iron screens.

The two end piers are further extended a distance of 7 feet to form a break-water, or means of protection for the screens. A heavy dry-laid wall also extends up and down stream from the piers for a distanch of 60 feet.

The masonry fronting the river is of rock-faced Pennsylvania granite, laid in 19½ inch courses. The rough work is of Conshohocken stone ; the floor in the bottom of the well, and between the screens and the river wall is of concrete, and the walls of the well above the water surface are lined with buff brick, and finished at the top with a dressed granite coping 8 inches thick.

The excavation for this work was about 50 by 65 feet, and averaged 22 feet in depth, two-thirds of it being rock.

In order to do this work, which extended part way into the river, it was necessary to construct a coffer-dam. This was made in the form of a triangle, with the apex in the river and the two legs resting on the bank. Three-inch pine, tongue and grooved sheathing, was used on the outside of the framing, and the latter was heavily weighted with stone to hold the dam in place. Very little trouble, considering the rocky nature of the bed of the river, was experienced from leakage, and none whatever with the additional dam that was afterward constructed in front of the first one, in order to make a channel, 45 feet long. to deep water, and thus insure the free flow to the intake,

From each of the wells two lines of cast-iron 48-inch suction pipes, with bell and bead joints, were laid to the engine house, one for each of the four 20-million gallon engines. Each pipe is provided with a foot valve in the well and an air chamber at the pump.

No trouble was experienced from "ram," but, owing to defective caulking, the leakage at the joints was excessive, and it became necessary to uncover all the pipes in order to have them repaired. As an additional precaution against leakage, several coatings of asphalt were put on the outside of the joints with satisfactory results.

Broken Mains.

Breaks, for which no special reason could be assigned, occurred in the following-named mains:

Districts.	Size in Inches.									Total.
	3	4	6	8	10	12	20	30	48	
First	1	1	9	......	......	......	1	......	......	12
Second	2	......	14	8	......	3	......	......	......	27
Third	......	5	7	1	2	1	1	......	......	17
Fourth	......	9	25	......	1	......	......	1	1	37
Fifth	......	......	2	......	1	......	......	4	......	7
Sixth	......	3	15	......	2	2	1	1	......	24
Total	3	18	72	9	6	6	3	6	1	124

The following-named breaks were caused by sewer contractors, by street cleaners in their rough usage of fire hydrants, by water freezing in the pipes, and various other causes:

Districts.	Size in Inches.							Total.
	4	6	10	12	20	30	48	
First	....	1	....	....	....	....	....	1
Second	1	8	....	2	....	....	....	11
Third	....	11	....	....	....	....	....	11
Fourth	....	8	2	....	....	....	....	10
Fifth	....	17	3	....	1	1	1	23
Sixth	4	11	....	....	....	....	....	15
Total	5	56	5	2	1	1	1	71

July 22d, the thirty-inch supply main between Roxborough and Chestnut Hill broke immediately west of Wissahickon creek, at a point where the main deflects at a right angle through a branch or " T." The entire top of the branch was displaced, and the water ran through the opening under a head of 338 feet. Fortunately, this occurred near the creek, and the water took its course, doing little damage.

On December 18, a similar break occurred on No. 5 pumping main, at a point about 400 feet north of Spring Garden Pumping Station. At the time this occurred, No. 5 engine was pumping to East Park reservoir, and the pressure on the main was less than half of that on former occasions when pumping to Queen Lane reservoir. The washout was about 110 feet long, 18 feet wide and 11 feet deep. The Reading Railroad tracks were obstructed with debris, and the well of the Cramp engine No. 7 was partially and that of No. 11 was completely filled with gravel. No. 8 thirty-inch pumping main was undermined and broke of its own weight, and considerable other damage was done.

The character of the fractures in the 30-inch and the 48-inch branches was relatively the same; but in the first instance the casting was somewhat honey-combed and dirty, defects that were not visible at the time of inspection, but which probably caused the breakage. No reason can be assigned, however, for the breaking of the 48-inch branch. In this case the iron was apparently sound, of good quality, even in thickness and of true proportions, and, furthermore, it had formerly withstood fully twice the pressure under which it broke.

The turning off of water for the purpose of making new connections to water mains is a cause of considerable annoyance to consumers, particularly in the manufacturing districts, and the inconvenience is especially noticeable when the main which is shut off is a supply main or feeder, as, in such cases, large areas are affected.

In order to avoid this annoyance and inconvenience, the plan of making such connections without drawing water from the mains, by means of a tapping machine especially constructed for this class of work and extensively used throughout the country, was adopted. Five tapping machines (Smith's patent) were purchased, viz: Three No. 1 machines, with 2-inch, 3-inch, 4-inch and 6-inch cutters: one No. 2 machine, with 8-inch, 10-inch and 12-inch cutters, and one No. 3 machine, with 16-inch and 20-inch cutters. These machines can be used to make connections to mains of any diameter. Six, ten and twelve-inch connections have been satisfactorily made by their use, in the Third District, without interfering with the supply and at a cost less than would have been required by the old method.

The distribution system has been extended considerably during the past few years in the outer sections of the City, and the duties pertaining to its supervision, care and maintenance, owing to increased distance from the district offices, have increased accordingly. One of the principal difficulties experienced is the time required to inspect complaints in the extreme limits of the districts, and a bicycle was used, experimentally, to facilitate this class of work. The experiment worked quite successfully, and I therefore recommend that the use of the bicycle for this purpose be extended to all the districts.

Meters.

The following table shows the number of meters in use, the consumption, and a comparison with the year 1894:

Meters in use; Consumption not charged for at Meter Rates.

	1894.	1895.	Increase.
Number of meters on supply connections............	225	223	
Number of meters on fire connections................	149	152	
Total..	374	375	1

Meters in use; Consumption charged for at Meter Rates.

	1894.	1895.	Increase.
Number of meters on supply connections............	821	878	57
Consumption in gallons	1,672,487,811	2,372,135 400	699,648,019
Meter charges..	$102,826 34	$132,988 69	$30,162 35

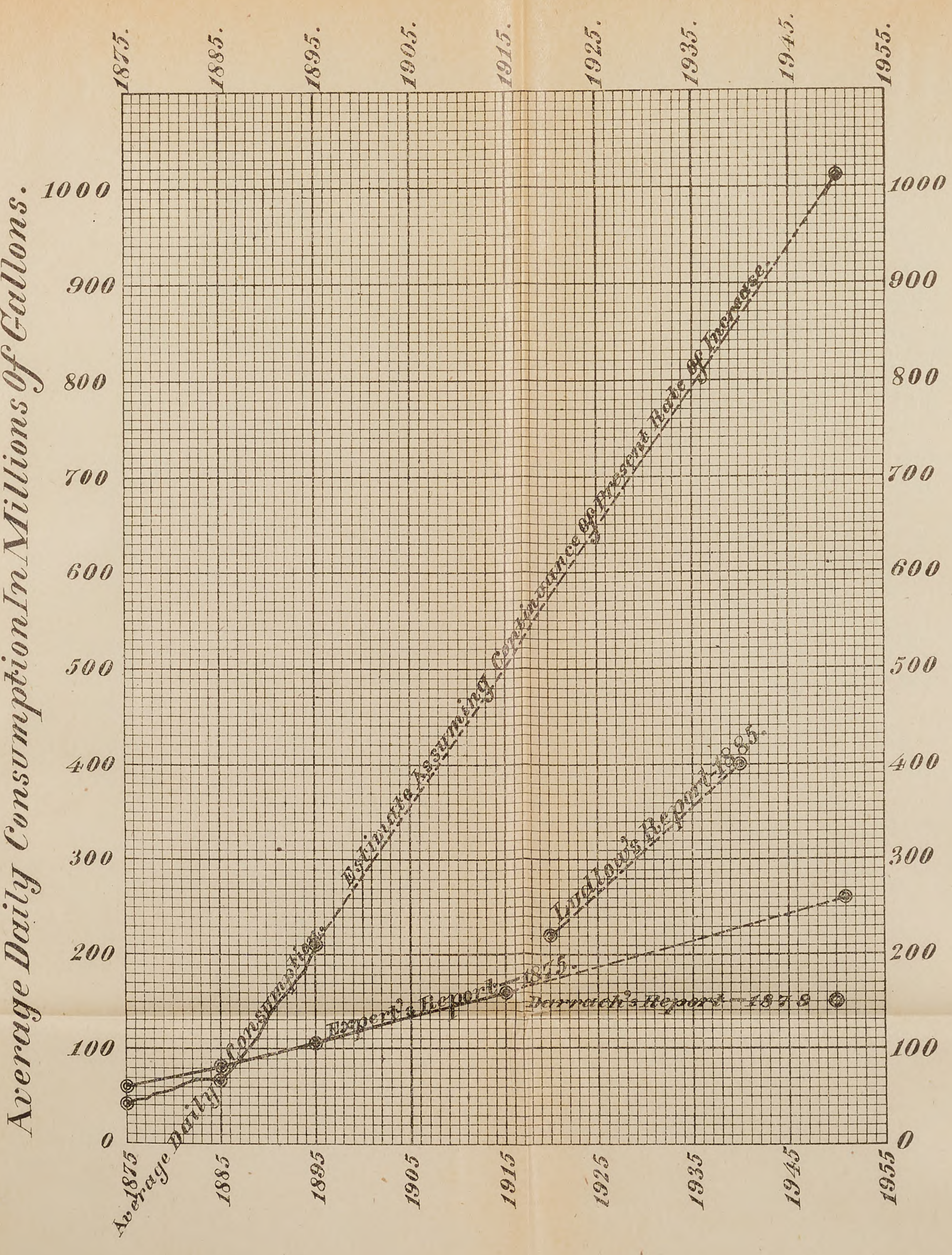
The increase in the number of meters was fifty-eight, and these were placed chiefly at the request of consumers who found it to their advantage to pay water rent by "meter" rather than by "schedule" rates. It is a noticeable feature that no complaint of waste of water has ever been made where meters are used.

DIAGRAM

OF

PUMPING CAPACITY, CONSUMPTION, POPULATION, APPLIANCES AND BUILDINGS.

1874 — 1895.



COMPARISON OF ESTIMATES

OF

FUTURE CONSUMPTION.

The use of meters is discredited to a great extent in this City, but it is evident that there is no method so just for regulating the water rent charges, and there is certainly no other method by which excessive waste of water can be so effectually stopped.

In view of the vast increase in the consumption of water during late years, and the still greater quantity required in the near future, as indicated by diagrams 1, 2, and 3, it is evident that either meters must soon be adopted, or immediate additions must be made to the large distributing mains, to provide a supply sufficient to keep pace with the rapidly increasing use and waste of water. If the mains are extended there must also be a corresponding increase in the pumping and reservoir capacities, involving expenditures so large that there will be little opportunity for improving the *quality* of the supply. Of the two expedients, the meter system would be the cheapest, most effective, and in line with that which of necessity will eventually *have to be done*, for there is certainly a limit to the financial ability of any community to pump water that it may simply run to waste through the sewers.

An experimental effort was made some time ago to restrain the excessive waste of water in the locality bounded by Broad, Seventh, Chestnut and Spruce streets, but the results were the same as they have been in all other cities—the waste cannot be controlled except by using meters.

The Deacon meter, especially constructed for detecting waste of water, was used in the above-mentioned inspection, and it developed the fact that 63 per cent. of the water was wasted by 17 per cent. of the properties.

An examination was also made to ascertain the quantity of water consumed in small modern houses.

The locality selected for this purpose was on two intermediate streets in the northwestern part of the City, where 142 seven-roomed houses built in 1893 were inspected with the following results;

Number of appliances	782
" " " leaking slightly	22
" " " turned on continually	32
" " inhabitants	539
Consumption during 24 hours	119,800 gals.
" per capita	222 gals.
Waste of water during 24 hours	103,680 gals.

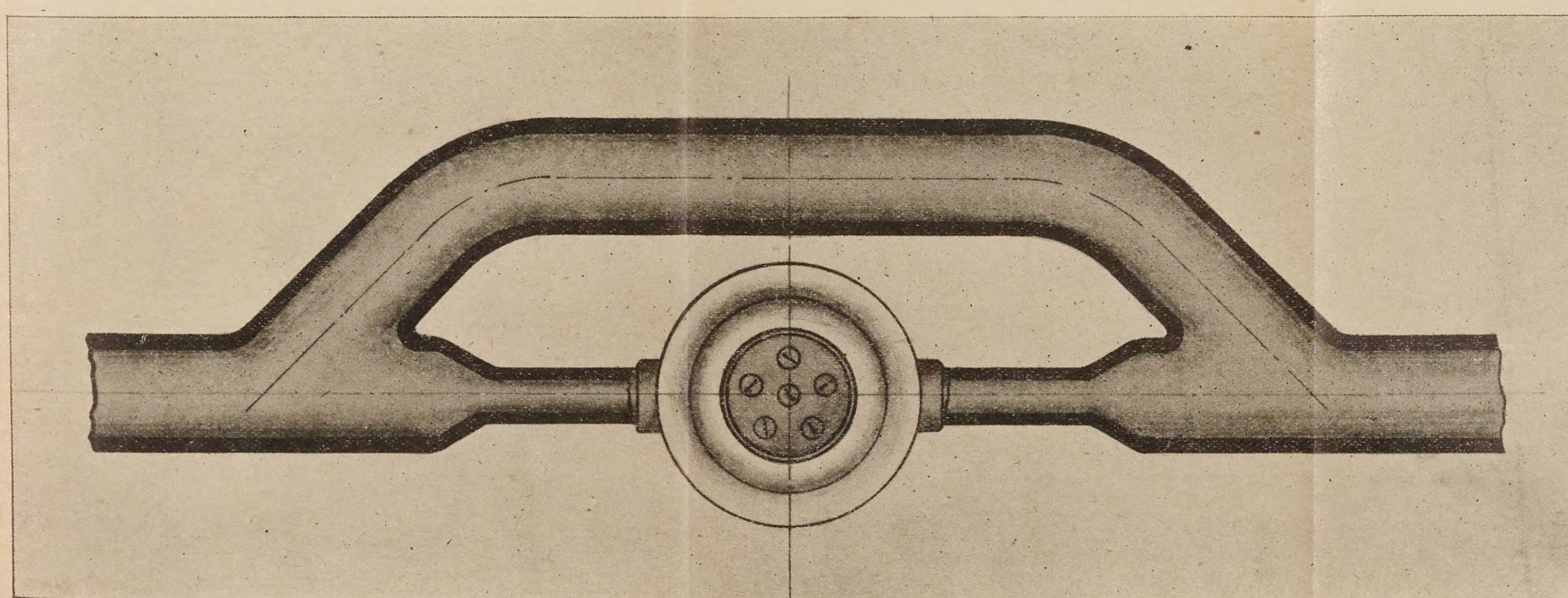
The quantity running during the night, as detected by the Deacon meter, was considered as wasted and it was assumed that during the day the waste went on at the same rate.

In this way it is estimated that of the 222 gallons per capita, 192 gallons are wasted and 30 gallons are actually used.

These experiments show clearly that 60 to 65 per cent. of the water is wasted through leaky fixtures and by householders permitting water to flow continuously through appliances in a manner and for purposes not intended by the ordinances of Councils. The effect of allowing water to run from hydrants and spigots to prevent the pipes from freezing, was clearly demonstrated during the recent cold weather, at which time the pressure on the mains was reduced eight (8) pounds in the Germantown district, and many people were, in consequence, deprived of their water supply; and it is a well ascertained fact that the same practice is indulged in during the summer months, for the purpose of keeping the water cool.

Proportional Meters.

There appear to be objections on the part of both the insurance companies and the insured to the placing of meters on fire connections. It is claimed that the meter obstructs the flow of water through the pipes, particularly at high velocities, which occur when the water is most



Proportional Meters.

needed. All mechanical devices for measuring water by means of rotating or oscillating pistons or discs obstruct the velocity to a more or less extent when placed immediately in the line of flow; but it has been the practice in the Water Bureau to avoid this objectionable feature, as much as possible, by using a meter larger than the pipe to which it is attached, and under these conditions the friction is very slight. Nevertheless, objections are made.

In order to avoid this difficulty, experiments were made with a proportional meter, which, under the circumstances, appear to give results sufficiently satisfactory to warrant its adoption.

This device is constructed by reducing the supply pipe to one-tenth its area by means of two cone-shaped reducers, between which an ordinary meter is placed. A by-pass, extending from above to below the meter, is connected to the supply pipe, and insures the unobstructed flow of water at all times. Experiments show, however, that there is a proportional flow through the meter, upon which a sufficiently accurate estimate can be made to permit the use of these meters on fire connections until such time as a better method may be devised.

Venturi and Pitot Meters.

The measurement of the flow of water in large mains for the purpose of testing the pumps, and in order to ascertain the quantity supplied to districts, etc., is a desirable feature, and experimental tests have been made with the Venturi and the Pitot meters for this purpose.

One 12-inch, one 20-inch and one 48-inch Venturi meter have been ordered, and two Pitot meters have been purchased and will be put into service as soon as it can be conveniently done.

A suitable meter shop is urgently needed. At present the office and repair shop for this branch of the service is at 918 Cherry street, which is also the headquarters for the Second Purveyor's District. The apparatus for testing the meters is at Spring Garden pumping station, three miles distant, and various materials are stored at the South street yard, equally inaccessible from the office. This condition of affairs is annoying as well as expensive, and I would earnestly recommend that a meter shop be constructed at Fairmount, on the site of the one destroyed by fire May 23, 1892, as this location is the most central, and the conveniences for obtaining water and the conditions necessary for properly testing meters are better than elsewhere.

Mains.

The following shows the quantity of mains laid, relaid, taken up, etc.:

New Work.

Service mains laid		169,534 feet.
Supply mains laid		9,022 feet.
Pumping mains laid		4,792 feet.
Connections, etc		25,947 feet.
Total		209,295 feet.

Repairs.

Mains relaid	31,063 feet.	
Repairs and connections	8,769 feet.	
		39,832 feet.
Old pipes taken up	23,959 feet.	
Pipes lowered, raised and shifted	7,779 feet.	
		31,738 feet.
Total		71,570 feet.

Abandoned.

Three-inch	1,737 feet.
Four-inch	7,370 feet.
Six-inch	859 feet.
Twelve-inch	125 feet.
Total	10,091 feet.

The total quantity of pipe handled for all purposes throughout the year was 280,802 feet, weighing 17,768,997 pounds.

The total quantity of new pipe laid was 209,295 feet or 39.6 miles, making, in addition to that previously laid, 1,174.8 miles now in use.

Fire Hydrants.

New style fire hydrants in new locations	902
New style fire hydrants in place of old style	379
Old style fire hydrants in place of others of the old style	4
Total	1,285
New style fire hydrants taken out	93
Old style fire hydrants taken out	215
Total	308

The total number of new style fire hydrants added to the Distribution System was 594, and the total number in use December 31, 1895, was 10,038; of which 1,400 are of the old style and 8,558, or 85.25 per cent. are of the new pattern.

Drills for Attachment.

The following-named new attachments were made to the mains:

½-inch	9,464;	area of openings,	1,859 sq. ins.
⅝-inch	497;	" "	153 "
¾-inch	187;	" "	83 "
1-inch	133;	" "	104 "
1½-inch	37;	" "	65 "
2-inch	63;	" "	198 "
3-inch	10;	" "	71 "
4-inch	17;	" "	214 "
6-inch	2;	" "	57 "
Total	10,410.	Area of openings,	2,804 sq. ins.

Attachments, including the ferrules, service pipes and curb stops, were put in from the street mains to the curbs, by employes of this Bureau, in order to provide for, without the breaking of street pavements, water supplies if needed in the future.

½-inch	2,727
¾-inch	1
1-inch	6
Total	2,734

Mr. Theodore S. S. Baker, Chief Pipe Inspector, reports as follows:

"In conjunction with two regular, and one temporary, assistant pipe inspectors, cast iron water pipe and special castings have been inspected at the following pipe foundries, viz:

Donaldson Iron Company, Emaus, Pa.

Reading Foundry Company, Reading, Pa.

McNeal Pipe & Foundry Company, Burlington, N. J.

Camden Iron Company, Camden, N. J.

Gray's Ferry Foundry & Boiler Company, Twenty-ninth and Gray's Ferry road, Philadelphia.

In addition to the above, quite a number of pipes and special castings, as enumerated on schedule attached hereto, were inspected for private parties and builders to whom the Director of the Department of Public Works gave permission to purchase and lay, subject to such inspection.

I would also state, in conclusion, that I personally inspected all large specials and machine work, such as facing and drilling of flange pipes and other castings, breeches pipe, and machine castings for the several pumping stations.

Tabulations of the work performed are herewith submitted.

Respectfully,

ALLEN J. FULLER,

Assistant in charge of Distribution.

Schedule of pipe and special castings inspected, rejected, and accepted, during the year 1895:

Pipe and Special Castings.	Ordered.	Inspected	Rejected.	Accepted.	Cancelled.
Six-inch pipe	15,647	17,930	2,283	15,647	
Eight-inch pipe	2,000	2,295	295	2,000	
Ten-inch pipe	2,000	2,108	108	2,000	
Twelve-inch pipe	3,000	3,189	189	3,000	
Thirty-inch pipe	25	27	2	25	1 } McNeal Pipe
Forty-eight-inch pipe	765	802	37	765	1 } & Fdr'y Co.
Small specials	7,079	7,551	472	7,079	
Large specials	412	450	38	412	
*Private					
Three-inch pipe	24	24	....	24	
Four-inch pipe	110	125	15	110	
Six-inch pipe	2,358	2,551	193	2,358	
Eight-inch pipe	181	217	36	181	
Small specials	31	32	1	31	
Totals	33,632	37,301	3,669	33,632	2

* Pipe inspected for builders and property owners under ordinance of Councils, dated June 19, 1890.

IRON SERVICE AND SUPPLY MAINS LAID IN 1895.

First District.

Comprising the First, Second, Third, Fourth, Twenty-sixth, Thirtieth and Thirty-sixth Wards.

Street. Location.	Size in inches.	Distance in feet.
Service Mains.		
Alder street, from north curb line of Porter to dead end south house line of Wolf street	6	415
Bambrey street, from north curb line of Tasker to centre of Dickinson street	6	437
Bancroft street, from dead end north house line of Ritner to dead end south house line of Wolf street	6	400
Bancroft street, from north curb line of McKean to dead end south house line of Mifflin street	6	412
Bonsall street, from centre of Wharton to 12 feet north of south house line of Oakford street	6	396
Carlisle street, from dead end north house line of Porter to dead end south house line of Jackson street	6	1,200
Chadwick street, from north house line of Porter to dead end south house line of Wolf street	6	800
Chubb street, from dead end north house line of Kneu street, north	6	105
Clarion street, from centre of Moyamensing avenue, northwest	6	25
Clarion street, from dead end north house line of Porter to dead end south house line of Ritner street	6	400
Daly street, from dead end west house line of Eleventh to dead end east house line of Twelfth street	6	396
Daly street, from dead end west house line of Twelfth street, west to connect dead end	6	273
Dean street, from dead end north house line of Porter to dead end south house line of Ritner street	6	400
Devon street, from centre of Wharton to South curb line of Oakford street	6	396
Dickinson street, from dead end west house line of Twenty-third to west house line of Twenty-sixth street	6	1,430
Dudley street, from dead end east curb line of Twentieth street, west	6	13
Durfor street, from dead end west house line of Twelfth to dead end east house line of Thirteenth street	6	396
Earp street, from west house line of Twenty-sixth to centre of Twenty-eighth street	6	842
Eighteenth street, from south house line of Porter street, north	6	60
Eleventh street, from southeast to northwest house line of Moyamensing avenue	6	60
Farrell street, from north curb line of Ritner to dead end south house line of Wolf street	6	415

Street. Location.	Size in inches.	Distance in feet.
Service Mains—Continued.		
Fifth street, from 3 feet south of north house line of Old Second to 1 foot north of south house line of Durfor street	6	1,133
Fitzgerald street, from dead end west house line of Twelfth to dead end east house line of Thirteenth street	6	396
Gerhard street, from centre of Moyamensing avenue, north	6	30
Getz street, from centre of Moyamensing avenue, north	6	30
Guenther street, from dead end north house line of Wharton to 12 feet north of south house line of Oakford street	6	372
Hicks street, from 12 feet south of north house line of Shunk to Porter street	6	412
Hicks street, from dead end north house line of Ritner to centre of Jackson street	6	882
Hoffman street, from dead end east curb line of Twentieth street, west	6	13
Hollywood street, from north curb line of Reed to dead end 2 feet north of south house line of Wharton street	6	414
Jackson street, from dead end, west house line of Fifteenth street, to dead end, east house line of Sixteenth street	6	397
Jackson street, from west house line of Sixteenth street to centre of Seibold street	6	580
Jackson street, from east to west house line of Twentieth street	6	50
Juniper street, from dead end, north curb line of Shunk street, north	6	15
Juniper street, from dead end, north house line of Porter street, to dead end, south house line of Ritner street	6	400
Juniper street, from north house line of Jackson street to dead end, south house line of Snyder avenue	6	388
Juniper street, from dead end, north house line of McKean street, to dead end, 2 feet south of southeast house lide of Passyunk avenue	6	117
Lawrence street, from Morris to Tasker streets	6	450
Lingo street, from south curb line to centre of Mifflin street	6	13
McClellan street, from dead end, west house line of Seventeenth street, to dead end, east curb line of Eighteenth street	6	408
Mifflin street, from dead end, west house line of Seventeenth street to dead end, east house line of Eighteenth street	6	409
Mole street, from dead end, 12 feet south of north house line of Shunk street, to dead end, south house line of Porter street	6	412
Mole street, from Ritner street to Wolf street	6	400
Mole street, from south house line of Jackson street to 6-inch main 6 feet north of south curb line of Snyder avenue	6	468

Street. Location.	Size in inches.	Distance in feet.
Service Mains—Continued.		
Moore street, from dead end, 12 feet west of east house line of Twenty-second street, west	8	48
Moyamensing avenue, from dead end, east house line of Broad street to south house line of Porter street	6	1,131
Moyamensing avenue, from east house line of Twelfth street to east house line of Eleventh street	6	500
Mount Holly street, from south curb line to centre of Mifflin street	6	13
Newkirk street, from dead end, north house line of Wharton street to south curb line of Oakford street	6	373
Nicholas street, from north curb line of Reed street to dead end, south house line of Wharton street	6	416
Oakford street, from east house line of Thirty-fourth street, west	6	35
Pallas street, from dead end, north house line of Porter street, to dead end, south house line of Ritner street	6	400
Pierce street, from dead end, 12 feet west of east house line of Twenty-second street, west	6	50
Porter street, from east house line of Fifth street, west	6	50
Porter street, from dead end, west house line of Seventeenth street, to west house line of Eighteenth street	6	446
Reed street, from Eleventh to Twelfth streets	6	571
Ritner street, from east house line of Fifth street, west	6	50
Rosewood street, from dead end, north house line of Porter street, to dead end, south house line of Ritner street	6	400
Rosewood street, from dead end, north house line of Ritner street to south house line of Wolf street	6	400
Sears street, from west house line of Twenty-sixth street to centre of Twenty-seventh street	6	421
Sears street, from dead end, west house line of Twenty-seventh street, to centre of Twenty-eighth street	6	421
Seigel street, from dead end, west house line of Seventeenth street, to dead end, east curb line of Eighteenth street	6	408
Seventeenth street, from north house line of Porter street to dead end, south house line of Ritner street	10	400
Seventeenth street, from dead end, north house line of Ritner street, to dead end, south house line of Wolf street	10	400
Seventeenth street, from dead end, north house line of Wolf street, to Passyunk avenue	10	738
Seventeenth street, from dead end, north house line of McKean street, to dead end, south house line of Mifflin street	6	400
Shunk street, from southeast house line of Moyamensing avenue, west	6	72
Snyder avenue, south side, from east house line of Twentieth street, west	6	50
Snyder avenue north side, from east house line of Twentieth street, west	6	50

Street. Location.	Size in inches.	Distance in feet.
Service Mains—Continued.		
Stillman street, from north curb line of Tasker street to centre of Dickinson street....	6	437
Thirteenth street, from southeast house line of Moyamensing avenue north	6	56
Thirty-fourth street, from dead end, 115 feet north of north house line of Wharton street, to 3 feet south of south curb line of Gray's Ferry road	6	384
Thirty-fifth street, from 394 feet north of north house line of Wharton street, to dead end, 2 feet south of south curb line of Gray's Ferry road	6	99
Thirty-fifth street, in yard of Harrison Bros. & Co., from 3 feet north of building No. 12 to building No. 42, north of Gray's Ferry road	8	240
Tree street, from 12 feet east of west house line of Second street, to dead end, east house line of Old Second street	6	374
Twentieth street, from southeast house line of Passyunk avenue to south house line of McKean street	6	1,156
Twentieth street, from dead end north house line of McKean street, to dead end, south house line of Mifflin street	6	400
Twenty-second street, from south house line of Moore street, to dead end, south house line of Morris street...	12	450
Twenty-fourth street from south house line of Dickinson street, north	6	50
Twenty-fifth street, east side, from south house line of Dickinson street, north	6	50
Twenty-fifth street, west side, from south house line of Dickinson street, north	6	50
Tweuty-sixth street, from south house line of Dickinson street, north	6	50
Twenty-ninth street, from dead end, north house line of Wharton street, to south curb line of Oakford street...	6	371
Ward street, from dead end, north house line of Snyder avenue, to dead end, south house line of McKean street	6	400
Watt street, from dead end, north house line of Porter street, to dead end, south house line of Kitner street...	6	400
Watkins street, from 2 feet east of east house line of Twenty-second street, west...	6	50
Total	....	30,720

Street. Location.	Size in inches.	Distance in feet.
Service Supply Connections.		
Fifteenth street, east side, 6 feet north of north house line of McKean street	4	15
Fifteenth street, west side, 6 feet north of north house line of McKean street	4	15

14

Street. Location.	Size in inches.	Distance in feet.
Service Supply Connections—Continued.		
Fifteenth street, east side, 6 feet south of south house line of Mifflin street	4	15
Fifteenth street, west side, 6 feet south of south house line of Mifflin street	4	15
Fifth street, east side, 3 feet north of north house line of Porter street	4	15
Fifth street, west side, 4 feet south of south house line of Porter street	4	15
Fifth street, west side, 9 feet north of north house line of Porter street	4	15
Fifth street, east side, 4 feet south of south house line of Ritner street	4	15
Jackson street, south side, 6 feet west of west house line of Sixteenth street	4	18
Jackson street, north side, 6 feet west of west house line of Sixteenth street	4	18
Jackson street, south side, 6 feet east of east house line of Seventeenth street	4	18
Jackson street, north side, 6 feet east of east house line of Seventeenth street	4	18
Juniper street, east side, 6 feet north of north house line of Jackson street	4	15
Juniper street, west side, 6 feet north of north house line of Jackson street	4	15
Juniper street, east side, 6 feet south of south house line of Snyder avenue	4	15
Juniper street, west side, 6 feet south of south house line of Snyder avenue	4	15
Moyamensing avenue, southeast side, 9 feet west of west house line of Eleventh street	4	17
Moyamensing avenue, southeast side, 18 feet east of east curb line of Twelfth street	4	17
Moyamensing avenue south east side, 19 feet west of west curb line of Twelfth street	4	17
Moyamensing avenue, southeast side, 28 feet east of east curb line line of Thirteenth street	4	17
Moyamensing avenue, southeast side, 9 feet north of east house line of Broad street	4	17
Moyamensing avenue, northwest side, 85 feet northeast of east house line of Broad street	4	17
Moyamensing avenue, southeast side, 22 feet southwest of south curb line of Shunk street	4	17
Moyamensing avenue, northwest side, 22 feet southwest of south curb line of Shunk street	4	17
Porter street, south side, 6 feet west of west house line of Seventeenth street	4	19
Porter street, north side, 6 feet west of west house line of Seventeenth street	4	19
Porter street, south side, 6 feet east of east house line of Eighteenth street	4	19

Street. Location.	Size in inches.	Distance in feet
Service Supply Connections—Continued.		
Porter street, north side, 6 feet east of east house line of Eighteenth street	4	19
Seventeenth street, east side, 6 feet north of north house line of Porter street	4	15
Seventeenth street, west side, 6 feet north of north house line of Porter street	4	15
Seventeenth street, east side, 6 feet south of south house line of Ritner street	4	15
Seventeenth street, west side, 6 feet south of south house line of Ritner street	4	15
Seventeenth street, east side, 9 feet north of north house line of Ritner street	4	15
Seventeenth street, west side, 9 feet north of north house line of Ritner street	4	15
Seventeenth street, east side, 6 feet south of south house line of Wolf street	4	15
Seventeenth street, west side, 6 feet south of south house line of Wolf street	4	15
Seventeenth street, east side, 6 feet north of north house line of Wolf street	4	15
Seventeenth street, west side, 6 feet north of north house line of Wolf street	4	15
Seventeenth street, east side, 6 feet south of south house line of Jackson street	4	15
Seventeenth street, west side, 6 feet south of south house line of Jackson street	4	15
Seventeenth street, east side, 6 feet north of north house line of Jackson street	4	15
Seventeenth street, west side, 6 feet north of north house line of Jackson street	4	15
Seventeenth street, east side, 13 feet south of southeast house line of Passyunk avenue	4	15
Seventeenth street, west side, 4 feet south of southeast house line of Passyunk avenue	4	15
Seventeenth street, east side, 6 feet north of north house line of Snyder avenue	4	15
Seventeenth street, east side, 6 feet south of south house line of McKean street	4	15
Seventeenth street, west side, 6 feet south of south house line of McKean street	4	15
Thirty-fifth street, east side, 6 feet south of south house line of Gray's Ferry road	4	15
Thirty-fifth street, east side, 6 feet north of north house line of Wharton street	4	15
Twenty-second street, west side, 8 feet south of south house line of Tasker street	4	18
Twenty-second street, west side, 6 feet north of north house line of Morris street	4	18
Total		815
Fire hydrant connections	6	899

Street. Location.	Size in inches.	Distance in feet.
Fire Connections (Private).		
South street, north side, 121 feet west of west house line of Twenty-fourth street, for Philadelphia Rubber Works	6	16
Supply Connections (Private).		
Carpenter street, from ceutre of Burnett street, west, for Southern Electric Light Company	3	11
Catharine street, south side, 220 feet east of east house line of Eighth street, for Artificial Ice Company	4	17
Total	....	28
Repairs, general	3	2
Repairs, general	4	5
Repairs, general	6	318
Repairs, general	10	3
Repairs, general	12	8
Repairs, general	20	9
Total	....	345
Pipe Relaid.		
Cross street, from west houseline of Eighth street to east house line of Ninth street	6	396
Cross street, from 3 feet west of west houseline of Ninth street to east houseline of Tenth street	6	393
Cross street, from west houseline of Tenth street to east houseline of Passyunk avenue	6	385
Fernon street, from west houseline of Eighth street to east houseline of Ninth street	6	396
Fernon street, from west houseline of Ninth street to east houseline of Tenth street	6	396
Fernon street, from west houseline of Tenth street to east houseline of Eleventh street	6	396
Fisher street, from west houseline of Sixth street to east houseline of Seventh street	6	396
Hoffman street, from west houseline of Fourth street to east houseline of Fifth street	6	400
Hoffman street, from west houseline of Fifth street to 5 feet east of east houseline of Sixth street	6	391
Hoffman street, from west houseline of Sixth street to east houseline of Seventh street	6	396
Hoffman street, from west houseline of Seventh street to east houseline of Eighth street	6	389

Street. Location.	Size in inches.	Distance in feet.
Pipe Relaid—Continued.		
Latona street, from west houseline of Eighteenth street to east houseline of Nineteenth street	6	396
McClellan street, from west houseline of Sixth street to east houseline of Seventh street	6	395
McClellan street, from west houseline of Seventh street to east houseline of Eighth street	6	388
Seigel street, from west houseline of Sixth street to east houseline of Seventh street	6	396
Seigel street, from west houseline of Seventh street to east houseline of Eighth street	6	389
Seventeenth street, from south houseline of Porter street north	10	60
Sylvester street, from west houseline of Sixth street to east houseline of Seventh street	6	396
Total		6,754
Fire hydrant connections relaid	6	201
Pipe Taken Up.		
Cross street, from west houseline of Eighth street to east houseline of Ninth street	4	396
Cross street, from 3 feet west of west houseline of Ninth street to east houseline of Tenth street	4	393
Cross street, from west houseline of Tenth street to east houseline of Passyunk avenue	4	385
Fernon street, from west houseline of Eighth street to east houseline of Ninth street	4	396
Fernon street, from west houseline of Ninth street to east houseline of Tenth street	4	396
Fernon street, from west houseline of Tenth street to east houseline of Eleventh street	4	396
Fisher street, from west houseline of Sixth street to east houseline of Seventh street	4	396
Hoffman street, from west houseline of Fourth street to east houseline of Fifth street	4	400
Hoffman street, from west houseline of Fifth street to 5 feet east of east houseline of Sixth street	4	391
Hoffman street, from west house line of Sixth street to east house line of Seventh street	4	396
Hoffman street, from west house line of Seventh street to east house line of Eighth street	4	389
Latona street, from west house line of Eighteenth street to east house line of Nineteenth street	4	396
Latona street, from centre of Twenty-third street, west	6	13
Mole street, from south house line of Jackson street, north	6	30

Street. Location.	Size in inches.	Distance in feet.
Pipe Taken Up—Continued		
McClellan street, from west house line of Sixth street to east house line of Seventh street	4	395
McClellan street, from west house line of Seventh street to east house line of Eighth street	4	388
Seigel street, from west house line of Sixth street to east house line of Seventh street	4	310
Seigel street, from west house line of Seventh street to east house line of Eighth street	4	389
Seventeenth street, from south house line of Porter street, north	6	60
Sylvester street, from west house line of Sixth street to east house line of Seventh street	4	396
Titan street, from centre of Twenty-third street, west	6	13
Total	....	6,724
Fire hydrant connections taken up	3	8
Fire hydrant connections taken up	4	198
Fire hydrant connections taken up	6	13
Total	....	219
Pipe Lowered.		
Broad street, intersection of Moyamensing avenue	6	7
Pipe Cut Off and Abandoned.		
Latona street, from west curb line of Twenty-third street, west	6	12
Myrtlewood street, from 4 feet north of centre of Wharton street, north	6	21
Prime street, north side, 4 feet west of Swanson street	4	9
Seigel street, from 136 feet east of Seventh street, west	4	86
Sutherland street, east side, 54 feet 6 inches south of Kansas street (connection)	4	32
Titan street, from west curb line of Twenty-third street, west	6	12
Washington avenue, north side, 110 feet west of Twenty-first street (connection)	4	5
Total	....	177
Fire hydrant connections cut off and abandoned	4	59
Fire hydrant connections cut off and abandoned	6	42
Total	....	101

Recapitulation of First District.

Purposes for which Used.	Sizes in Inches. 3	4	6	8	10	12	20	Total in feet and pounds.
New pipe or feet added:								
Service mains	......	......	28,444	288	1,538	450	......	30,720
Service supply connections	......	815	......	......	......	......	......	815
Fire hydrant connections	......	......	899	......	......	......	......	899
Fire connection (private)	......	......	16	......	......	......	......	16
Supply connection (private)	11	17	......	......	......	......	......	28
Total { Feet	11	832	29,359	288	1,538	450	......	32,478
Total { Pounds	165	15,808	968,847	12,096	84,590	32,400	......	1,113,906
Pipe used but adding nothing to feet in ground.								
Repairs general	2	5	318	......	3	8	9	345
Pipe relaid	......	......	6,895	......	60	......	......	6,955
Pipe taken up	8	6,410	525	......	......	......	......	6,943
Pipe lowered	......	......	7	......	......	......	......	7
Total { Feet	10	6,415	7,745	......	63	8	9	14,250
Total { Pounds	150	121,885	255,585	......	3,465	576	1,431	383,092
Total handled { Feet	21	7,247	37,104	288	1,601	458	9	46,728
Total handled { Pounds	315	137,693	1,224,432	12,096	88,055	32,976	1,431	1,496,998
Pipe cut off and abandoned	......	191	87	......	......	......	......	278

Second District.

Comprising the Fifth, Sixth, Seventh, Eighth, Ninth, Tenth, Twenty-fourth, Twenty-seventh and Thirty-fourth Wards.

Street. Location.	Size in inches.	Distance in feet.
Service Mains.		
Adeline street, from centre of Fiftieth street, west	6	440
Albion street, from centre of Walnut street, to dead end, south house line of Sansom street	6	260
Allison street, from 10 feet south of centre of Market street, north	6	60
Ameseka street, from centre of Forty-eighth street, to 2 feet west of east house line of Forty-ninth street	6	442
Ameseka street, from 2 feet west of east house line of Forty-ninth street, west	8	33
Arch street, from east house line of Sixty-third street, west	6	96
Ashland avenue, from centre of Fifty-seventh street, west, to connect dead end	6	158
Aurora street, from east house line of Vandeveer, west	6	10
Bryn Mawr avenue, from 290 feet south of south house line of Wynnefield avenue, north	6	402
Buist avenue, from 12 feet east of west house line of Sixty-second street, to west house line of Sixty-fifth street	6	1,522
Callowhill street, from dead end, 13 feet west of centre of Sixtieth street to Sixty-first street	6	546
Cedar (or South) street, from centre of Forty-sixth street, to west house line of Forty-seventh street	6	597
Cemetery avenue, from east house line of Sixty-third street, west	6	72
Chelwynde avenue, from east house line of Sixty-third street, west	6	70
Chester avenue, from east house line of Sixtieth street, west	6	60
Columbia avenue, from 8 feet south of south curb line of Elm avenue, north	6	13
Conestoga street, from centre of Master street, north	6	30
Conestoga street, from south house line of Media street, north	6	60
Cowley street, from dead end, west house line of Thirteenth street, to dead end, east house line of Perry street	6	113
Dicks avenue, from east house line of Sixty-third street, west	6	70
Elm avenue, from Fifty-second street to 5 feet east of west curb line of Columbia avenue	6	649
Elmwood avenue, from east curb line of Sixty-seventh street to dead end, 2 feet west of east house line of Seventy-second street	6	2,831
Elmwood avenue, from dead end, 150 feet west of west house line of Seventy-second street to Island road	6	915

Street. Location.	Size in inches.	Distance in feet.
Service Mains—Continued.		
Florence avenue, from dead end, west house line of Forty-ninth street, to dead end, east house line of Fiftieth street	6	410
Fiftieth street, from dead end, 5 feet south of south house line of Kingsessing avenue, north	6	85
Fiftieth street, from 3 feet north of south house line of Market street, to 2 feet south of centre of Arch street	6	623
Fiftieth street, from dead end, north house line of Parrish street, to dead end, south house line of Hoopes	6	311
Fiftieth street, from 2 feet south of south house line of Elm avenue, north	6	37
Fifty-and-one-half street, from Woodland avenue to Greenway avenue	6	523
Fifty-and-one-half street, from 9 feet south of centre of Market street, north	6	59
Fifty-and-one-half street, from Thompson street to dead end, south house line of Kershaw street	6	225
Fifty-first street, from southeast house line of Woodland avenue, northwest	6	80
Fifty-first street, from south house line of Market street, north	6	90
Fifty-first street, from centre of Girard avenue, north	6	35
Fifty-first street, from centre of Thompson street to dead end south house line of Kershaw street	6	224
Fifty-first street, from south house line of Merion avenue, north	6	25
Fifty-first street, from 12 feet south of north house line of Susquehanna avenue to north house line of Wynnefield avenve	6	634
Fifty-one-and-one-half street, from centre of Westminster avenue, north	6	20
Fifty-second street, from Woodland avenue, northwest	6	80
Fifty-second street, from north house line of Whitby avenue to south curb line of Hadfield street	8	356
Fifty-second street, from 24 feet south of north house line of Susquehanna avenue to 239 feet north of north house line of Wynnefield avenue	8	999
Fifty-two-and-one-half street, from centre of Media street to south house line of Warren street	6	257
Fifty-third street, from southeast house line of Woodland avenue, northwest	6	80
Fifty-third street, from south house line of Market street, north	6	100
Fifty-third street, from dead end, north house line of Haverford avenue to south house line of Seneca street	6	298
Fifty-third street, from south house line of Wynnefield avenue, north	6	100
Fifty-three-and-one-half street, from south house line of Wynnefield avenue, north	6	50

Street. Location.	Size in inches.	Distance in feet.
Service Mains—Continued.		
Fifty-fourth street, from southeast house line of Woodland avenue, northwest	6	80
Fifty-fourth street, from south house line of Market ssreet, north	6	100
Fifty-fifth street, from southeast house line of Woodland avenue, northwest	6	72
Fifty-fifth street, from south house line of Market street, north	6	100
Fifty-fifth street, from south house line of Media street, north	6	60
Fifty-fifth street, from south house line of Master street, north	6	60
Ftfty-five-and-one-half street, from south house line of Media street, north	6	60
Fifty-sixth street, from centre of Woodland avenue, north	6	40
Fifty-sixth street, from 3 feet south of centre of Market street, north	6	42
Fifty-sixth street, from 6 feet north of south house line of Media street, north	6	48
Fifty-seventh street, from southeast house line of Woodland avenue, northwest	6	80
Fifty-seventh street, from south honse line of Thomas avenue to Hoffman avenue	12	633
Fifty-seventh street, from Market street, north	6	52
Fifty-seventh street, from dead end, north house line of Vine street, to north house line of Melrose	6	220
Fifty-eighth street, from 5 feet north of south house line of Market street north	6	95
Fifty-eighth street, from dead end, north house line of Vine street, north	6	310
Fifty-ninth street, from centre of Woodland aveuue, northwest	6	32
Fifty-ninth street, from 6 feet north of south house line of Market street, north	6	94
Fifty-ninth street, from dead end 2 feet south of north house line of Haverford street to north house line of Girard avenue	6	419
Fitzwater street, from Forty-eighth to Forty-ninth streets	6	550
Fifty-nine-and-one-half street, from centre of Girard avenue, north	6	35
Forty-sixth street, from dead end north house line of Baltimore avenue to north house line of Cedar (or South) street	6	56
Forty-six-and-one-half street, from dead end, northwest house line of Linmore street to dead end southeast house line of Woodland avenue	6	509
Forty-seventh street, from south house line of Cedar (or South) street, north	6	80
Forty-seventh street, from 6 feet north of south house line of Market street, north	6	35

Street. Location.	Size in inches.	Distance in feet.
Service Mains—Continued.		
Forty-eighth street, from centre of Paschall avenue, north	6	40
Forty-eighth street, from dead end, 5 feet south of north house line of Baltimore avenue to north house line of South street	6	405
Forty-eighth street, from south house line of Market street, north	6	41
Forty-ninth street, from dead end, south house line of Kingsessing avenue to Regent street	6	250
Forty-ninth street, from Springfield avenue to south house line of Florence street	8	1,076
Forty-ninth street, from dead end, north house line of Florence street to dead end south house line of Pentridge street	8	131
Forty-ninth street, from dead end, north house line of Pentridge street to dead end 6 feet north of south house line of Baltimore avenue	8	114
Forty-ninth street, from dead end, 4 feet south of north house line of Baltimore avenue to north house line of South street	6	564
Forty-ninth street, from south house line of Market street, north	6	100
Forty-ninth street, from south house line of Elm avenue, north	6	36
Forty-nine-and-one-half street, from 9 feet south of centre of Market street, north	6	59
Gibson avenue, from east house line of Sixty-third street, west	6	70
Girard avenue, from east house line of Fifty-ninth street to centre of Sixtieth street	10	499
Greenway avenue, from east house line of Seventy-first street, west	6	35
Hadfield street, from Fifty-first to Fifty-second streets	6	430
Hampton street, from dead end, 6 feet west of west house line of Twentieth street to Twenty-first street	6	514
Hazel avenue, from 13 feet east of centre of Sixtieth street, west	6	26
Hoffman avenue, from east house line of Fifty-seventh street, west	6	70
Jefferson street, from west house line of Fifty-one-and-one-half street to centre of Fifty-second street	6	270
Kingsessing avenue, from dead end, 5 feet east of west house line of Forty-eighth street, west	6	105
Kingsessing avenue, from 25 feet east of centre of Forty-ninth street, west	6	50
Kingsessing ave, from east house line of Fiftieth street, west	6	70
Lancaster road, from 2 feet south of south house line of Wynnefield avenue, north		104
Lebanon avenue, from 6 feet west of east house line of Sixty-second street, to dead end, east house line of Sixty-third street	6	503

Street. Location.	Size in inches.	Distance in feet.
Service Mains—Continued.		
Lewis street, from dead end, 97 feet west of west house line of Thirty-sixth street, west	9	55
Locust street, from centre of Forty-fourth street to dead end, 4 feet east of east house line of Forty-fifth street.	12	427
Ludlow street, from dead end, west house line of Forty-fourth street, to centre of Forty-fifth street	6	431
Malcolm street, from Fifty-first to Fifty-second streets	6	430
Marston street, from east house line of Meadland street, west to dead end	6	48
Master street, from dead end, 55 feet east of east house line of Fifty-fifth street, west	6	115
Meadland street, from centre of Marston street, north	6	25
Meadow street, from south house line of Market street, north	6	82
Media street, from dead end, 240 feet west of west house line of Fifty-fourth street, to west house line of Fifty-sixth street	6	843
Melrose street, from centre of Fifty-seventh street, west	6	340
Melrose street, from 5 feet west of east house line of Fifty-eighth street, west	6	50
Merion avenue, from dead end, 269 feet west of west house line of Fiftieth street, to Fifty-second street	6	1,148
Moravian street, from dead end, west house line of Nineteenth street to dead end, east house line of Twentieth street	6	397
Ogden street, from dead end, west house line of Forty-ninth street to centre of Fiftieth street	6	480
Osborne court, from centre of Duponceau street, west 106 feet, thence south 91 feet	6	197
Palo Alto street, from centre of Hampton street, west	6	10
Paschall avenue, from dead end, west house line of Seventy-second street, to dead end, east house line of Island road	6	905
Pearl street, from 3 feet east of east house line of Thirty-fifth street, west	6	53
Pentridge street, from west house line of Fifty-first street, west	6	240
Poplar street, from dead end, west house line of Forty-first street, to dead end, east house line of Eaglesfield street	6	554
Race street, from east house line of Sixty-third street, west	6	49
Rhinehart street from dead end, west house line of Forty-seventh street, west	6	275
Seventy-first street, from 11 feet north of centre of Elmwood avenue, north	6	27
Seventy-third street, from centre of Elmwood avenue, north	6	30
Sixtieth street, from dead end, north house line of King-		

Street. Location.	Size in inches.	Distance in feet.
Service Mains—Continued.		
sessing avenue, to 343 feet north of centre of Springfield avenue.	6	1,329
Sixtieth street, from 23 feet north of centre of Haverford avenue to north house line of Girard avenue	10	68
Sixty-and-one-half street, from south house line of Callowhill street, north	6	60
Sixty-and-one-half street, from centre of Master street, north	6	30
Sixty-first street, from centre of Woodland avenue, northwest	6	40
Sixty-first street, from south house line of Callowhill street, north	6	60
Sixty-first street, from south house line of Hamilton street, north	6	60
Sixty-second street, from 6 feet south of south house line of Hamilton street, north	6	66
Sixty-second street, from centre of Lebanon avenue to south house line of Lancaster avenue	6	910
Sixty-two-and-one-half street, from 6 feet south of south house line of Hamilton street, north	6	36
Sixty-third street, from 2 feet south of south house line of Gibson avenue to north house line of Elmwood ave.	10	1,571
Sixty-third street, from 6 feet north of north abutment of P. W. and B. R. R. bridge to dead end, 2 feet south of south house line of Paschall avenue	10	193
Sixty-third street, from dead end, north house line of Woodland avenue to centre of Cemetery avenue	6	466
Sixty-fourth street, from 6 feet south of south curb line of Buist avenue, north	6	65
Sixty-fifth street, from 4 feet north of north house line of Buist avenue, north	6	72
Sixty-eighth street, from centre of Woodland avenue, northwest	6	40
South street, from east house line of Forty-eighth street to west house line of Forty-ninth street	6	620
Springfield ave., from east house line of Sixtieth st., west	6	60
Stiles street, from Forty-second street to dead end, east house line of Belmont avenue	6	642
Thirtieth street, from 314 feet south of south house line of Marston street, north	6	314
Thirtieth (or Bridgewater) street, from centre of Spring Garden street, north	6	45
Thirtieth (or Bridgewater) street, from 15 feet south of north house line of Spring Garden street to Thirty-fifth street	12	3,308
Thirtieth (or Bridgewater) street, from 15 feet south of north house line of Spring Garden street, southeast	12	18
Thomas avenue, from east house line of Fifty-seventh street to dead end, east house line of Fifty-eighth street	6	455

Street. Location.	Size in inches.	Distance in feet.
Service Mains—Continued.		
Thompson street, from 3 feet east of east house line of Sixty-first street, west	6	28
Warrington avenue, from dead end, west house line of Forty-eighth street to 4 feet west of east house line of Forty-ninth street	6	407
Warrington avenue, from 4 feet west of east house line of Forty-ninth street, west	8	59
Whitby avenue, from dead end, southwest house line of Baltimore avenue to west house line of Fifty-second street	8	278
Windsor avenue, from dead end, 10 feet east of centre of Forty-ninth street, west	6	45
Wynnefield avenue, from Elm avenue to 36 feet west of Lancaster avenue	8	3,837
Yocum street, from east house line of Seventy-first street, west	6	70
Zenobia street. from east house line of Quince street, west	6	10
Total	....	47,047
Supply Mains.		
George's Hill, Fairmount Park, from 20-inch supply main connection. west side of stand pipe, northeast to connect with 12-inch main laid in 1894	12	86
Pumping Mains.		
Belmont Pumping Station on River road, from No. 4 Engine to 36-inch main laid in 1870, north-east corner of engine house	36	125
Belmont Pumping Station, from No. 4 Engine, east to fore-bay (suction pipe)	36	107
George's Hill, Fairmount Park, from 34 feet 6 inches west of west house line of No. 1 Engine house north to connect with dead end of 20-inch main laid in 1894	20	153
George's Hill, Fairmount Park, from 36-inch main 2 feet south of south house line of Engine House, north to condenser (suction pipe)	30	32
George's Hill, Fairmount Park, from stand pipe to top of bank north side of Belmont Reservoir (overflow)	12	109
Total	....	526

Street. Location.	Size in inches.	Distance in feet.
Supply Main Connections.		
George's Hill, Fairmount Park, from stand pipe north side of Belmont Reservoir, north	20	20
George's Hill, Fairmount Park, from 20-inch outlet, north side of Belmont Reservoir, north to stand pipe	20	44
Total	....	64
Pumping Main Connections.		
George's Hill, Fairmount Park, from 12-inch main inside of Engine House, west to connect with 20-inch main from No. 1 Engine	20	34
By-pass Connections.		
George's Hill, Fairmount Park, from 30-inch main, south side of Belmont Reservoir, to 36-inch overflow at south-east corner	30	45
Service Supply Connections.		
Arch street, south side, 4 feet east of east curb line of Sixty-third street	4	20
Conestoga street, west side, 7 feet north of north curb line of Media street	4	12
Conestoga street, east side, 7 feet north of north curb line of Media street	4	12
Conestoga street, west side, 7 feet south of south curb line of Media street	4	12
Elm avenue, south side, 3 feet west of west house line of Forty-ninth street	4	15
Elm avenue, south side, 3 feet east of east house line of Fiftieth street	4	15
Elm avenue, south side, 23 feet west of west curb line of Fiftieth street	4	17
Elm avenue, south side, 3 feet east of east house line of Fifty-first street	4	15
Elm avenue, south side, 3 feet west of west house line of Fifty-first street	4	17
Elm avenue, south side, 60 feet east of east house line of Fifty-second street	4	15
Florence avenue, north side, 10 feet west of west house line of Forty-ninth street	4	24
Florence avenue, south side, 10 feet west of west house line of Forty-ninth street	4	24

Street. Location.	Size in inches.	Distance in feet.
Service Supply Connections—Continued.		
Florence avenue, north side, 9 feet east of east house line of Fiftieth street	4	24
Florence avenue, south side, 9 feet east of east house line of Fiftieth street	4	24
Fifty-first street, west side, 9 feet south of north house line of Woodland avenue	4	21
Fifty-first street, east side, 9 feet south of north house line of Woodland avenue	4	21
Fifty-first street, west side, 9 feet north of south house line of Woodland avenue	4	21
Fifty-second street, west side, 12 feet north of south house line of Woodland avenue	4	25
Fifty-second street, east side, 12 feet north of south house line of Woodland avenue	4	25
Fifty-second street, west side, 9 feet south of north house line of Woodland avenue	4	25
Fifty-second street, east side, 9 feet south of north house line of Woodland avenue	4	25
Fifty-third street, west side, 9 feet north of south house line of Woodland avenue	4	21
Fifty-third street, east side, 9 feet north of south house line of Woodland avenue	4	21
Fifty-third street, west side, 9 feet south of north house line of Woodland avenue	4	21
Fifty-third street, east side, 9 feet south of north house line of Woodland avenue	4	21
Fifty-fourth street, west side, 9 feet north of south house line of Woodland avenue	4	21
Fifty-fourth street, east side, 9 feet north of south house line of Woodland avenue	4	21
Fifty-fourth street, west side, 9 feet south of north house line of Woodland avenue	4	21
Fifty-fourth street, east side, 9 feet south of north house line of Woodland avenue	4	21
Fifty-fifth street, west side, 9 feet north of south house line of Woodland avenue	4	22
Fifty-fifth street, east side, 9 feet north of south house line of Woodland avenue	4	22
Fifty-fifth street, 10 feet south of north house line of Woodland avenue	4	21
Fifty-fifth street, west side, 7 feet south of south curb line of Media street	4	19
Fifty-fifth street, east side, 7 feet south of south curb line of Media street	4	19
Fifty-fifth street, west side, 7 feet north of north house line of Media street	4	19
Fifty-fifth street, east side, 7 feet north of north curb line of Media street	4	19
Fifty-five-and-one-half street, west side, 7 feet south of south curb line of Media street	4	13

Street. Location.	Size in inches.	Distance in feet
Service Supply Connections—Continued.		
Fifty-five-and-one-half street, east side, 7 feet south of south curb line of Media street	4	13
Fifty-five-and-one-half street, west side, 7 feet north of north curb line of Media street	4	13
Fifty-five-and-one-half street, east side, 7 feet north of north curb line of Media street	4	13
Fifty-sixth street, west side, 10 feet south of north house line of Woodland avenue	4	21
Fifty-sixth street, east side, 10 feet south of north house line of Woodland avenue	4	21
Fifty-sixth street, west side, 9 feet north of south house line of Woodland avenue	4	21
Fifty-sixth street, west side, 7 feet south of south curb line of Media street	4	19
Fifty-sixth street, east side, 7 feet south of south curb line of Media street	4	19
Fifty-sixth street, west side, 7 feet north of north curb line of Media street	4	19
Fifty-seventh street, west side, 10 feet north of south house line of Woodland avenue	4	21
Fifty-seventh street, east side, 10 feet north of south house line of Woodland avenne	4	21
Fifty-seventh street, west side, 10 feet south of north house line of Woodland avenue	4	21
Fifty-seventh street, east side. 10 feet south of north house line of Woodland avenue	4	21
Fifty-eighth street, west side, 9 feet south of north house line of Woodland avenue	4	21
Fifty eighth street, east side, 9 feet south of north house line of Woodland avenue	4	21
Fifty-eighth street, west side, 9 feet north of south house line of Woodland avenue	4	21
Fifty-eighth street, east side, 9 feet north of south house line of Woodland avenue	4	21
Fifty-ninth street, west side, 9 feet south of north house line of Woodland avenue	4	21
Forty-ninth street, east side, 9 feet north of south house line of Woodland avenue	4	21
Forty-ninth street, west side, 3 feet north of south house line of Florence avenue	4	25
Forty-ninth street, west side, 3 feet south of north house line of Warrington avenue	4	25
Locust street, north side, 5 feet west of west house line of Forty-fourth street	4	19
Locust street, north side, 10 feet east of east house line of Forty-fifth street	4	19
Market street, north side, 2 feet west of west house line of Forty-ninth street	4	40
Market street, south side, 65 feet west of west house line of Forty-ninth street	4	6

Street. Location.	Size in inches.	Distance in feet.
Service Supply Connections—Continued.		
Market street, south side, 1 foot east of east house line of Forty-ninth street	4	24
Master street, south side, 4 feet east of east house line of Sixty-first street	4	19
Master street, south side, 68 feet west of west house line of Sixtieth street	4	19
Merion avenue, south side, 5 feet west of west house line of Fifty-first street	4	13
Merion avenue, south side, 95 feet east of east house line of Fifty-second street	4	13
Poplar street, north side, 125 feet west of west house line of Forty-first street	4	20
Poplar street, south side, 142 feet west of west house line of Forty-first street	4	20
Poplar street, north side, 28 feet east of east house line of Eaglesfield street	4	20
Poplar street, south side, 21 feet east of east house line of Eaglesfield street	4	20
Sixty-first street, west side, 10 feet south of north house line of Woodland avenue	4	21
Sixty-first street, east side, 10 feet south of north house line of Woodland avenue	4	21
Sixty-third street, west side, 5 feet north of north house line of Market street	4	34
Sixty-third street, east side, 5 feet north of north house line of Market street	4	30
Sixty-third street, west side, 8 feet south of south house line of Arch street	4	35
Sixty-third street, east side, 3 feet south of north house line of Hamilton street	4	33
Sixty-third street, west side, 144 feet north of north house line of Hamilton street	4	33
Sixty-third street, west side, 5 feet south of south house line of Haverford	4	30
Sixty-third street, east side, south house line of Haverford	4	33
Stiles street, north side, 132 feet east of east house line of Belmont avenue	4	16
Stiles street north side, 95 feet west of west house line of Forty-second street	4	16
Total		1,723
Fire hydrant connections	6	3,972
Fire hydrant connections	8	63
Total		4,035

Street. Location.	Size in inches.	Distance in feet.
Fire Connections (Private)		
Broad street, west side 133 feet south of south house line of Chestnut street, for Lafayette Hotel	6	6
Duponceau street, west side. 121 feet north of north house line of Locust street, for Sharpless Bros.' stables......	4	15
Fifteenth street, west side 37 feet south of south house line of Market street, for Harrison Building............	6	11
Forty-fourth street, east side, 134 feet south of south house line of Parrish street, for Hestonville, Mantua and F. P. Railway Company..	4	22
Fourth street, west side, 76 feet south of south house line of Merchant street, for Philadelphia Bourse............	6	33
Woodland avenue, northwest side, 176 feet southwest of south house line of Chestnut street, for Bartram Apartment House..	6	20
Total..	....	97
Supply Connections (Private)		
Fifth street, east side, 57 feet south of south house line of Merchant street, for Philadelphia Bourse................	6	33
Fifth street, east side, 59 feet south of south house line of Merchant street, for Philadelphia Bourse...............	6	33
Sansom street, north side, 202 feet west of west house line of Fifteenth street, for H. R. Baker......................	3	12
Spruce street, north side, 366 feet west of west house line of Thirty-fourth street, for Student's Hall, University of Pennsylvania	4	22
Thirtieth street, west side, 332 feet south of south house line of Locust street, for Ice Manufacturing Company..	4	15
Woodland avenue, northwest side, 174 feet southwest of south house line of Chestnut street, for Bartram Apartment House...	4	20
Total...		135
Meter Inspection Connections.		
Belmont Pumping Station (rear of coal sheds), from 12 feet east of 36-inch stop, east to tank in rear of engine house..	6	137

Street. Location.	Size in inches.	Distance in feet.
Drains.		
Belmont Pumping Station, from No. 4 Engine House, east across River Drive	6	93
Belmont Pumping Station, from condenser in No. 4 Engine House, east across River Drive	12	144
Belmont Pumping Station, from Boiler House, east across River Drive (blow-off)	6 12	209 30
Belmont Pumping Station, from 6-inch drain, south side of Boiler House, southeast	6	56
Belmont Pumping Station, from spout, southwest corner of Boiler House, to 12-inch drain pipe	4 6	33 13
Belmont Pumping Station, from spout, southeast corner of Boiler House, to 6-inch drain pipe	6	15
Belmont Pumping Station, north side of Engine House, from meter tanks in rear of Engine House, east across River Drive	8	324
Belmont Pumping Station, on River Drive, from 36-inch main northeast corner of Engine House, east	6	15
Belmont Auxiliary Pumping Station, 68 feet north of north house line of Engine House, east	6	110
Lansdowne avenue, from 30 feet west of west house line of Fifty-second street, west from 20-inch main	6	14
Total	....	1,056
Repairs, general	4	24
" "	6	1,343
" "	8	168
" "	10	180
" "	12	159
Total	....	1,874
Pipe Relaid.		
Aurora street, from 5 feet east of west curb line of Ninth street, west	6	20
Bond street, from 7 feet east of west house line of Ninth street, west	6	10
Brogan street, from 3 feet west of west house line of Raspberry street to Vandeveer street	6	74
Cowley street, from west house line of Perry street to east house line of Juniper street	6	112
Essex street, from 4 feet east of east house line of Quince street, west	6	14
Goodwater street, from 4 feet west of centre of Seventh street, west	6	22

Street.	Location.	Size in inches.	Distance in feet.
	Pipe Relaid—Continued.		
Grace street, from west house line of Sixteenth street, to east house line of Seventeenth street		6	396
Harmstead street, from west house line of Nineteenth street, to east house line of Twentieth street		6	396
Harmstead street, from west house line of Twentieth street to 9 feet west of east house line of Twenty-first street		6	505
Iseminger street, from north house line of Heins street to south house line of Budd street		6	233
Johnson street, from west house line of Twentieth street to 9 feet east of centre of Twenty-first street		6	512
Locust street, from east Seventh street to west Seventh street		10	127
Market street, south side, from 9 feet east of west house line of Twenty-third street, west		6	365
Melon street, from 2 feet east of east house line of Thirty-seventh street, west		6	64
Naudain street, from west house line of Twentieth street, to east curb line of Twenty-first street		6	507
Pryor's court, from 3 feet east of west house line of Ninth street, west		6	10
Quince street, from north house line of Spruce street to Walnut street		6	844
Ranstead street, from 4 feet east of west curb line of Fourth street to east house line of Fifth street		6	422
Seventh street, from Locust to Walnut street		10	551
Sloan street, from 2 feet south of south house line of Baring street, north		6	64
South Pearl street, from 3 feet east of east house line of Quince street, west		6	13
Steadman street, from centre of Quince street, west		6	13
Thirty-sixth street, from centre of Spring Garden street to 2 feet south of south house line of Haverford street		6	383
Truxton street, from north house line of Heins street to south house line of Budd street		6	234
Vandeveer street, from Brogan to Locust street		6	263
Vollum street, from north house line of Steadman street to centre of Arizona street		6	168
Warren street, from centre of Baring street, north		6	32
Wiota street, from south house line of Baring street, north		6	30
Total		....	6,384
Fire hydrant connections relaid		6	436

Street. Location.	Size in inches.	Distance in feet.
Pipe Taken Up.		
Aurora street, from 5 feet east of west curb line of Ninth street, west	3	20
Bond street, from 7 feet east of west house line of Ninth street, west	3	10
Brogan street, from 3 feet west of west house line of Raspberry street to centre of Vandeveer street	3	74
Cowley street. from west house line of Perry street to east house line of Juniper street	3	112
Essex street, from 4 feet east of east house line of Quince street, west	3	14
Goodwater street, from 4 feet west of centre of Seventh street, west	3	22
Harmstead street, from west house line of Nineteenth street, west	3	10
Harmstead street, from 10 feet east of east house line of Twentieth street west	3	10
Iseminger street from 20 feet south of south house line of Budd street, north	3	20
Iseminger street, from north house line of Heins street, north	3	13
Johnson street, from west house line of Twentieth street, west	4	390
Locust street, from 9 feet east of east house line of Forty-fifth street, west	16	5
Market street, south side, from 9 feet east of west house line of Twenty-third street, west	4	65
Melon street, from 2 feet east of east house line of Thirty-seventh street, west	4	64
Naudain street, from west house line of Twentieth street to east curb line of Twenty-first street	3	507
Pryor's court. from 3 feet east of west curb line of Ninth street, west	3	18
Quince street, from north house line of Spruce street to 126 feet north of centre of Locust street	3	552
Quince street, from 38 feet south of south house line of Walnut street. north	3	59
Ranstead street, from 4 feet east of west curb line of Fourth street west	4	137
Ranstead street, from 180 feet east of east house line of Fifth street, west	4	180
Seventh street, from 91 feet south of south house line of Walnut street, north	4	100
Sloan street, from 2 feet south of south house line of Baring street, north	4	64
South Pearl street, from 3 feet east of east house line of Quince street, west	3	13
Steadman street, from centre of Quince street, west	3	13
Truxton street, from north house line of Heins street to south house line of Budd street	3	234
Vandeveer street, from Brogan street to Locust street	3	263

Street. Location.	Size in inches.	Distance in feet.
Pipe Taken Up—Continued.		
Vollum street, from north house line of Steadman street to centre of Arizona street	3	168
Warren street, from centre of Baring street, north	4	32
Wiota street, from south house line of Baring street, north	4	30
Total	....	3,199
Fire hydrant connections taken up	3	22
Fire hydrant connections taken up	4	557
Fire hydrant connections taken up	6	190
Total	....	769
Pipe Lowered.		
Chester avenue, from 24 feet west of west house line of Forty-first street to east house line of Forty-second street	6	296
Fifty-second street, from 9 feet north of centre of Market street, north	36	90
Forty-second street, from 117 feet north of north house line of Girard avenue, north	6	192
George's Hill, Fairmount Park, south side of Belmont Reservoir	30	152
Market street, from 8 feet east of east curb line of Fifty-second street, west	20	30
Paschall avenue, from 12 feet west of west house line of Gray's Ferry road, to 10 feet east of east house line of Forty-eighth street	6	182
Total	....	942
Pipe Raised.		
George's Hill, Fairmount Park, south side of Belmont Reservoir	30	58
	36	110
Total	....	168

Street. Location.	Size in inches.	Distance in feet.
Pipe Cut off and Abandoned.		
Filbert street, from west house line of Twenty-second street, west	6	19
Filbert street, from 19 feet west of west house line of Twenty-second street to east house line of Twenty-third street	4	254
Grace street, from west house line of Sixteenth street to east house line of Seventeenth street	3	396
Harmstead street, from 10 feet west of west house line of Nineteenth street to 10 feet east of east house line of Twentieth street	3	376
Harmstead street, from west house line of Twentieth street to 9 feet west of east house line of Twenty-first street	3	505
Iseminger street, from 13 feet north of north house line of Heins street to 20 feet south of south house line of Budd street	3	200
Johnson street, from 101 feet east of east house line of Twenty-first street, west	4	122
Locust street, from east Seventh street to west Seventh street	4	127
Market street, south side, from 56 feet west of west house line of Twenty-third street, west	4	300
Quince street, from 101 feet north of north house line of Locust street, north	3	233
Ranstead street, from 120 feet west of west house line of Fourth street, west	4	105
Seventh street, from centre of Locust street, north	4	451
Thirty-sixth street, from centre of Spring Garden street to 2 feet south of south house line of Haverford street	4	383
Total	....	3,471
Fire hydrant connections cut off and abandoned	3	27
Fire hydrant connections cut off and abandoned	4	752
Fire hydrant connections cut off and abandoned	6	290
Total	....	1,069

Recapitulation of Second District.

	Purposes for which used.	Sizes in inches. 3	4	6	8	10	12	16	20	30	36	Total in feet and pounds.
New pipe or feet added.	Service mains			33,447	6,883	2,331	4,386					47,047
	Supply mains						86					86
	Pumping mains			125			109		153	32	107	526
	Supply main connections								64			64
	Pumping main connections								34			34
	Bye Pass connections									45		45
	Meter inspection connections			137								137
	Service supply connections		1,723									1,723
	Fire hydrant connections			3,972	63							4,035
	Fire connections (private)		27	70								97
	Supply connections (private)	12	57	66								135
	Drains		33	525	324		174					1,056
	Total { Feet	12	1,840	38,342	7,270	2,331	4,755		251	77	107	54,985
	Total { Pounds	180	34,960	1,265,286	305,340	128,205	342,360		39,909	25,564	45,154	2,186,958
Pipe used but adding nothing to feet in ground.	Repairs, general		24	1,343	168	180	159					1,874
	Pipe relaid			6,140		678						6,818
	Pipe taken up	2,154	1,619	190				5				3,968
	Pipe lowered			670					30	152	90	942
	Pipe raised									58	110	168
	Total { Feet	2,154	1,643	8,343	168	858	159	5	30	210	200	13,770
	Total { Pounds	32,310	31,217	275,319	7,056	47,190	11,448	550	4,770	69,720	84,400	563,980
	Total handled { Feet	2,166	3,483	46,685	7,438	3,189	4,914	5	281	287	307	68,755
	Total handled { Pounds	32,490	66,177	1,540,605	312,396	175,395	353,808	550	44,679	95,284	129,554	2,750,938
	Pipe cut off and abandoned	1,737	2,494	309								4,540

Third District.

Comprising the Eleventh Twelfth, Sixteenth, Seventeenth. Eighteenth, Nineteenth, Twenty-third, Twenty-fifth, Thirty-fifth, and part of the Thirty-third Wards.

Street. Location.	Size in inches.	Distance in feet.
Service Mains.		
Adrian street, from dead end, 3 feet south of north house line of Jefferson street. north	6	157
Agate street, from centre of Ann street, northeast	6	25
Agate street, from southwest house line of Allegheny avenue, northeast	6	38
Airdrie street. from centre of Lawrence street, west to connect dead end	6	13
Allegheny avenue, south side, from dead end 1 foot east of east house line of Trenton avenue, west to connect	6	81
Allegheny avenue, south side, from dead end, west house line of Kensington avenue, to dead end, west house line of Potter street	6	192
Allegheny avenue, south side, from dead end, west house line of "G" street to centre of "E" street	6	1,075
Allegheny avenue, south side, from centre of Front street, west	6	30
Allegheny avenue, north side, from centre of Front street, west	6	30
Allegheny avenue, south side, from centre of Sixth street. at a point 23 feet north of south house line of Allegheny avenue, west	6	25
Allegheny avenue, south side, from centre of Sixth street, at a point 45 feet 6 inches north of south house line of Allegheny avenue east 25 feet; thence across bridge of P. and R. R. R.	6	157
Allegheny avenue, south side, from centre of Sixth street, at a point 50 feet 6 inches north of south house line of Allegheny avenue, east 25 feet; thence southeast 43 feet 6 inches; thence northeast 77 feet 6 inches across bridge over P. and R. R. R. (second line)	6	146
Allegheny avenue, south side. from southeast house line of Glenwood avenue, northwest	6	42
Allegheny avenue, southwest side, from centre of Glenwood avenue, northwest	6	30
Allegheny avenue, north side, from west house line of Kensington avenue to west curb line of "E" street	6	1,712
Allegheny avenue, north side. from 23 feet 9 inches east of west house line of Sixth street, west	6	20
Allegheny avenue, northeast side, from southeast house line of Glenwood avenue, northwest	6	60
Almond street, from southwest house line of Orthodox st., northeast	6	60

Street. Location.	Size in inches.	Distance in feet.
Service Mains—Continued.		
Amber street, from Allegheny avenue to centre of Westmoreland street	6	806
Ann street, from centre of Chatham street to northwest curb line of Trenton avenue	6	1,608
Ann street, from southeast house line of Frankford avenue, northwest	6	35
Aramingo avenue, east side, from south house line of Somerset street, north	6	61
Aramingo avenue, west side, from south house line of Somerset street, north	6	62
Aramingo avenue, from southwest house line of Ann st., northeast	6	50
Baldwin street, from 22 feet southeast of centre of Tacony street, northwest	6	22
Belgrade street, from 7 feet 6 inches northeast of southwest house line of Orthodox street, northeast	6	51
Benners street, from 19 feet southeast of centre of Tacony street, northwest	6	19
Benners street, from southeast house line of Torresdale avenue, northwest	6	80
Berges street, from Trenton avenue to dead end, east house line of Amber street	6	351
Berkshire street, from 293 feet southeast of southeast house line of Tackawanna street, northwest	6	300
Bellmore street, from east curb line of Amber street, west to dead end	6	26
Bermuda street, from southwest house line of Orthodox street, northeast	6	25
Bodine street, from centre of Cumberland street, north.	8	28
Boudinot street, from dead end, north house line of Indiana avenue, to dead end, south house line of Rush street.	6	367
Boudinot street, from dead end, north house line of Rush street, to dead end, south house line of Clearfield street	6	103
Bridge street, from dead end, 33 feet southeast of centre of Frankford avenue, northwest to connect.	6	33
Bristol street, from southeast house line of Richmond street northwest	6	31
Buckius street, from 26 feet southeast of centre of Richmond street, northwest	6	25
Butler street, from 1 foot east of east house line of Richmond street, west	6	58
Butler street, from centre of Lawrence street to dead end west house line of Fifth street	6	236
"C" street, from dead end, north house line of Indiana avenue, to dead end, south house line Clearfield street	6	502
Cambridge street, from southwest house line of Orthodox street, northeast	6	50
Carey street, from centre of Lawrence street, west to connect dead end	6	17

Street. Location.	Size in inches	Distance in feet.
Service Mains—Continued.		
Cedar street, from dead end, 78 feet south of north house line of Lehigh avenue to dead end, south house line of Somerset street	12	821
Cedar street, from southwest house line of Ann street, northeast	6	50
Cedar street, from northeast house line of Margaret to centre of Foulkrod street	6	474
Cedar street, from 3 feet southwest of southwest house line of Bridge street, northeast	6	53
Chatham street, from southwest house line of Ann street, northeast	6	25
Charles street, from southwest house line of Bridge street, northeast	6	46
Cherry street, from southeast house line of Bridge street, northeast	6	42
Clearfield street, from 5 feet east of east house line of Hartville street, west	12	39
Clearfield street, from 1 foot 6 inches west of east house line of Gransback street, west	12	27
Clearfield street, from east house line of Front street, west	12	60
Clearfield street, from dead end, 19 feet east of west house line of Second street, west	6	19
Clearfield street, from dead end, west house line of Leithgow street to east house line of Fifth street	12	353
Clementine street, from 18 feet southeast of northwest house line of Trenton avenue, northwest	6	18
Court street, from dead end, west house line of Beach street, to dead end, south house line of Brown street	6	225
Cook street, from centre of Memphis street, west	6	23
Commerce street, from north house line of Huntingdon street, north	6	132
Commerce street, from dead end, 162 feet north of north house line of Huntingdon street to centre of Cedar street	6	645
Cornwall street, from 460 feet southeast of southeast house line of Kensington avenue, northwest	6	460
Courtland street, from east house line of Second street, west	6	25
Cottage street, from southwest house line of Bridge street, northeast	6	50
Culvert (or Kennedy) street, from dead end 10 feet southeast of northwest house line of Trenton avenue to dead end, southeast house line of Frankford avenue	6	750
Custer street, from south house line of Allegheny avenue, north	6	22
Devereaux street, from east house line of Torresdale avenue, west	6	80
Dillwyn street, from south house line of Wood street, north	6	15
Dittman street, from centre of Frankford street, northeast	6	25

Street. Location.	Size in inches.	Distance in feet.
Service Mains—Continued.		
Dittman street, from southwest house line of Bridge street, northeast	6	50
Duncan street, from southeast house line of Tacony street, northwest	6	48
Dyre street, from southeast house line of Franklin street, northwest	6	50
Dyre street, from east house line of Penn street, north	6	25
"E" street, from dead end, north house line of Indiana avenue, to dead end south house line of Clearfield street	6	502
"E" street, from south house line of Allegheny avenue, north	6	110
Edgemont street, from southwest house line of Orthodox street to centre of Buckius street	6	1,565
Edmund street, from southwest house line of Margaret street, north	6	50
Edmund street, from southwest house line of Bridge street, northeast	6	48
Eighth street, from dead end, 39 feet 6 inches south of north house line of Clearfield street, north	6	40
Emma street, from centre of Berges street, north	6	13
Erdrick street, from southeast house line of Van Kirk street, northeast	6	60
Erie avenue, south side, from east house line of Lawrence street, west	12	50
Erie avenue, south side, from east to west abutment of bridge over N. P. R. R.	12	125
Erie avenue, south side, from 2 feet east of east house line of Richmond street, west	12	66
Erie avenue, north side, from east house line of Lawrence street, west	12	50
Erie avenue, north side, from 3 feet east of east abutment of bridge over N. P. R. R. west	6	122
Erie avenue, north side, from east house line of Richmond street, west	6	60
"F" street, from dead end 2 feet south of south curb line of Allegheny avenue, north	6	94
Factory street, from centre of Adams street, northeast	6	414
Fairhill street, from south house line of Willard street, north	6	15
Fillmore street, from southeast house line of Thompson street, northwest	6	50
Fillmore street, from centre of Willow street, northwest	6	25
Firth street, from dead end, 60 feet east of east house line of Ninth street, west to connect	6	85
Five-and-a-half street, from centre of Montgomery avenue to centre of Klouder street	6	164
Foulkrod street, from southeast house line of Frankford avenue, northwest	20	37

Street. Location.	Size in inches.	Distance in feet.
Service Mains—Continued.		
Foulkrod street, from centre of Frankford street northeast to connect dead end	6	20
Fox street, from centre of Tioga street, north	6	391
Fraley street, from centre of Tacony street, northwest	6	25
Frankford avenue, from dead end northeast house line of Dyre street to northeast house line of Bridge street	12	991
Frankford street, from northeast house line of Torresdale avenue to centre of Foulkrod street	6	828
Frankford street, from 2 feet southeast of southeast house line of Tacony street, northwest	12	23
Franklin street, from dead end 38 feet south of south house line of Clearfield street, north	6	38
Franklin street, from centre of Garden street to centre of Richmond street	6	440
Franklin street, from Bridge street, northeast	6	21
Freemont street, from southeast house line of Edgemont street, northwest	6	50
"G" street, from dead end south curb line of Allegheny avenue to north house line of Hilton street	6	227
Garden street, from southwest house line of Franklin street, northeast	6	33
Geisler street, from centre of Thompson street, northwest	6	17
Geisler street, from southeast house line of Edgemont street, northwest	6	26
Gillingham street, from east house line of Tackawanna street, to centre of Mulberry street	6	404
Glenwood avenue, from southwest house line of Pacific avenue, northeast	10	50
Glenwood avenue, from 2 feet west of east house line of Second street, west	6	30
Glenwood avenue, from 5 feet southwest of west house line of Seventh street to northeast house line of Allegheny avenue	6	360
Glenwood avenue, from northeast house line of Allegheny avenue to centre of Clearfield street	12	1,209
Glenwood avenue, northwest side, from southwest to northeast abutment of bridge over N. P. R. R.	12	48
Godfrey avenue, from north house line of Jefferson street north 390 feet, thence east on Godfrey avenue 90 feet to west house line of Fourth street	6	480
Gordon street, from southeast house line of Belgrade street, northwest	6	20
Gransback street, from centre of Cambria street to south house line of Indiana avenue	6	525
Gransback street, from north house line of Indiana avenue to centre of Clearfield street	6	525
Green lane, from centre of Richmond street, west	6	30
Griffith street, from southeast curb line of Thompson street, northwest	6	6
Gurney street, from centre of Second street, northwest	6	23

Street. Location.	Size in inches.	Distance in feet.
Service Mains—Continued.		
Hagerman street, from centre of Howell street, north......	6	21
Harrison street, from southeast house line of Richmond street, northwest...	6	60
Harrowgate lane, from east house line of Joyce street, west..	6	40
Hartville street, from centre of Cambria street to dead end, south house line of Indiana avenue..................	6	527
Hartville street, from dead end north house line of Indiana avenue to centre of Clearfield street...............	6	527
Hedley street, from southeast house line of Richmond street, northwest...	6	30
Herbert street, from east house line of School street, west..	6	30
Higbee street, from southeast line of Torresdale avenue, northwest..	6	80
Hilton street, from centre of Sundgard street to centre of "G" street...	6	471
Howell street, from 25 feet southeast of centre of Tacony street, northwest...	6	25
Howell street, from centre of Tulip street to dead end east house line of Torresdale avenue....................	6	845
Hunter street, from centre of Richmond street, west........	6	32
Indiana avenue, from centre of Front street, west...........	6	30
Jackson street, from centre of Bridge street, northeast.....	6	27
James street, from centre of Margaret street, northeast.....	6	25
Janney street, from centre of Ann street, northeast..........	6	25
Jasper street, from centre of Hart lane to centre of Cambria street...	6	465
Jasper street, from south line of Pacific street, north......	6	40
Josephine street, from southwest house line of Orthodox street, northeast...	6	30
Juniatta street, from 4 feet southeast of southeast house line of Richmond street, northwest......................	6	51
Joyce street, from centre of Harrowgate lane to dead end south house line of Venango street.......................	6	394
Kettlewell street, from east house line of Richmond street, west..	6	30
Keystone street, northwest side, from Howell street to dead end southwest house line of Comly street........ ..	6	421
Kingston street, from east house line of Richmond street, west..	6	30
Klouder street, from Montgomery avenue to Germantown avenue..	6	562
Lawrence street, from south curb line of Clearfield street, north...	6	13
Lawrence street, from Sedgely avenue, north to connect dead end..	6	92
Lawrence street, from dead end west house line of Venango street to north curb line of Butler street.....	6	1,159
Lefevre street, from southeast house line of Richmond street, northeast...	6	60

Street. Location.	Size in inches.	Distance in feet.
Service Mains—Continued.		
Lefevre street, from southeast house line of Edgemont street, northwest	6	50
Lefevre street, from southeast house line of Thompson street, northwest	6	50
Lehigh avenue, southwest side, from centre of Amber street to dead end southeast house line of Frankford avenue	6	356
Lewis street, from 35 feet northwest of southeast house line of Richmond street, northwest	6	54
Lewis street, from east house line of Tacony street, west	6	28
Lindley street, from centre of Penn street, northwest	6	38
Lippincott street, from 5 feet west of east house line of Front street, west	6	55
Luzerne street, from 2 feet 3 inches northwest of southeast house line of Richmond street, northwest	6	54
Margaret street, from east house line of Edmund street to 84 feet west of west house line of Torresdale avenue	12	460
Margaret street, from southeast house line of Tacony street to dead end southeast house line of James street	6	247
Margaret street, from dead end northwest house line of James street to centre of Worth street	6	534
Margaret street, from east house line of Tackawanna street, to west house line of Mulberry street	12	451
Mayfield street, from centre of Marshall street to centre of Seventh street	6	234
Memphis street, from southwest house line of Ann street, northeast	6	50
Memphis street, from southwest house line of Somerset street, northeast	6	64
Memphis street, from 8 feet south of north curb line of Allegheny avenue, north	6	13
Monmouth street, from east house line of Ruth street, west	6	227
Mulberry street, from southwest house line of Bridge street, northeast	6	47
Mutter street, from north curb line Montgomery avenue to centre of Wilt street	6	297
New street, from centre of Tackawanna street to dead end east house line of Cherry street	6	619
Ninth street, from east house line of Glenwood avenue, north	6	35
Oakland street from centre of Unity street to dead end southwest house line of Ridge street	6	750
Oakland street, from dead end northeast house line of Ridge street to dead end southwest house line of Orthodox street	6	119
Old Front street, from south house line of Rush street, north	6	39
Old Front street, from southwest house line of Boudinot street, northeast	6	77

Street. Location.	Size in inches.	Distance in feet.
Service Mains—Continued.		
Olivia street, from southeast house line of Richmond street, northwest	6	30
Ontario street, from east house line of Richmond street, west	6	60
Ontario street, from east house line of Front street, west	12 16	30 56
Orange street, from centre of Belgrade street, northwest	6	20
Orchard street, from centre of George street north to dead end	6	252
Orchard street, from Bridge street to southeast house line of Franklin street	6	237
Orchard street, from centre of Culvert street, north	6	270
Orkney street, from south house line of Clearfield street, north	6	50
Orthodox street, from dead end 14 feet west of east house line of Adams road, west	6	28
Overbrook street, from centre of Bridge street, northeast	6	25
Pacific street, from Jasper street to dead end northeast house line of Kensington avenue	6	636
Penn street, from centre of Dyre street, north	6	15
Pierce street, from southwest house line of Orthodox street, northeast	6	50
Pike street, from east house line of Richmond street, west	6	30
Potter street, from 10 feet 6 inches south of south house line of Allegheny avenue, north	6	33
Pratt street, from southeast house line of Frankford avenue, northwest	6	70
Pratt street, from southeast house line of Tacony street, northwest	6	53
Reese street, from dead end south house line of Williard street, north	6	15
Roxborough street, from 3 feet southeast of east house line of Richmond street, northwest	6	53
Roxborough street, from southeast curb line of Tacony street, northwest	6	19
Ruan street, from southeast curb line of Tacony street, northwest	6	13
Rush street, from centre of Boudinot street, west	6	16
Ruth street, from centre of Cambria street to 101 feet 6 inches north of north house line of Monmouth st	6	332
Salmon street, from southwest house line of Orthodox street, northeast	6	30
Sanger street, from southeast house line of Tacony street, northwest	6	50
School street, from centre of Ash street to dead end south house line of Church street	6	531
Sedgley avenue, northwest side, from southwest abutment of bridge over N. P. R. R. northeast to centre of Venango street	6 8	4 96

Street. Location.	Size in inches.	Distance in feet.
Service Mains—Continued.		
Sedgley avenue, north side, from centre of Lawrence street, northeast	8	31
Sellers street, from dead end southeast curb line of Oakland street, northwest	6	38
Silver street, from dead end northwest house line of Frankford avenue to centre of Emerald street	6	249
Spangler street, from west house line of Commerce street northeast	6	45
Stiles street, from southwest house line of Orthodox street, northeast	6	50
Street (no name), southeast side of Thompson street, between Ash and Norris streets, from 12 feet southeast of southeast house line of Thompson street, northwest	4	12
Street (no name), southwest side of Lehigh avenue, southeast of Frankford avenue, from 28 feet northeast of southwest house line of Lehigh avenue, southwest	4	30
Summer street, from southwest curb line of Orthodox street, northeast	6	39
Sundgard street, from 22 feet south of north house line of Allegheny avenue, north	6	24
Sundgard street, from south house line of Hilton st., north	6	30
Tenth street, from southeast house line of Glenwood avenue, north	6	34
Thompson street, from southwest house line of Orthodox street, northeast	6	60
Thompson street, from dead end southwest house line of Lefevre street to centre of Buckius street	6	676
Tioga street, from east house line of Fox street, west	6	20
Torresdale avenue, from southwest house line of Orthodox street, northeast	12	30
Torresdale avenue, from south house line of Margaret street, north	12	58
Torresdale avenue, from southwest house line of Bridge street, northeast	6	50
Torresdale avenue, from dead end north house line of Comly street to north house line of Devereaux street	12	1,263
Townsend street, from centre of Belgrade street, northwest	6	18
Trenton avenue, southeast side, from centre of Somerset street, northeast	6	30
Trenton avenue, southeast side, from southwest house line of Ann street, northeast	6	50
Trenton avenue, northwest side, from southwest house line of Clementine street, northeast	6	40
Trenton avenue, from southwest house line of Margaret street, northeast	6	25
Tulip street, from southwest house line of Somerset street, northeast	6	33
Tulip street, from southwest house line of Ann street, northeast	6	38
Tulip street, from 38 feet north of south house line of Allegheny avenue, north	6	45

Street. Location.	Size in inches.	Distance in feet.
Service Mains—Continued.		
Tulip street, from centre of Howell street, north	6	21
Tucker street, from southeast house line of Tacony street, northwest	6	53
Turner street, from south house line of Willard st., north	6	15
Tusculum street, from centre of Front street, west	6	33
Vankirk street, from dead end, southeast house line of Erdrick street to dead end, northwest house line of Walker street	6	425
Vankirk street, from 25 feet southeast of centre of Tacony street, northwest	6	25
Walker street, from southwest house line of Bridge street, northeast	6	24
Washington street, from southwest line of Orthodox street, northeast	6	46
Water street, from centre of Bridge street, west	6	27
Waterloo street, from southwest house line of Culvert street, northeast	6	50
Wakeling street, from southeast house line of Penn street, northwest	6	50
Weikel street, from centre of Ann street, northeast	6	25
Wensley street, from east house line of Richmond st., west	6	30
Westmoreland street, from east house line of Front st., west.	6	12
Westmoreland street, from dead end, 5 feet east of west house line of Front street, west	6	5
Westmoreland street, from east house line of Richmond street, west	6	60
Wheat Sheaf lane, from east house line of Richmond street, west	6	30
Willard street, from west house line of Reese street to east house line of Sixth street	6	506
Willow street, from dead end, northeast house line of Meadow street, to dead end, southwest house line of Margaret street	6	318
Willow street, from dead end, northeast house line of Margaret street to centre of Foulkrod street	6	459
Willow street, from 3 feet southwest of southwest house line of Fillmore street to Harrison street	6	264
Willow street, from 3 feet southwest of southwest house line of Bridge street, northeast	6	53
Wilt street, from centre of Mascher street to centre of Hancock street	6	260
Windrim street, from dead end, 12 feet north of south house line of Allegheny avenue, north	6	18
Wishart street, from centre of Emerald street, northwest	6	279
Witte street, from centre of Ann street, northeast	6	25
Young street, from centre of Bridge street to east house line of Church street	6	399
Total		44,795

Street. Location.	Size in inches.	Distance in feet.
Supply Mains.		
Clearfield street, from 4 feet 3 inches east of east house line of Franklin street, west.	20	58
Clearfield street, from 5 feet east of east house line of Eighth street, west	20	59
Total	....	117
By-pass Connection.		
Deveraux street and Torresdale avenue, between 6-inch main on Deveraux street and 12-inch main on Torresdale avenue	12	11
Service Supply Connections.		
Amber street, east side, 24 feet north of north house line of Allegheny avenue	4	15
Amber street, east side, 72 feet south of south house line of Allegheny avenue	4	15
Ann street, southwest side, 15 feet northwest of Chatham street	4	15
Ann street, southwest side, 10 feet southeast of Cedar street	4	15
Ann street, southwest side, 14 feet northwest of Cedar street	4	15
Ann street, northeast side, 14 feet northwest of Cedar street	4	15
Ann street, southwest side, 16 feet southeast of Aramingo avenue	4	15
Ann street, northeast side, 16 feet southeast of Aramingo avenue	4	15
Ann street, southwest side, 14 feet northwest of northwest house line of Aramingo avenue	4	15
Ann street, northeast side, 14 feet northwest of northwest house line of Aramingo avenue	4	15
Ann street, southwest side, 17 feet southeast of southeast house line of Memphis street	4	15
Ann street, northeast side, 17 feet southeast of southeast house line of Memphis street	4	15
Ann street, southwest side, 11 feet northwest of northwest house line of Memphis street	4	15
Ann street, northeast side 11 feet northwest of northwest house line of Memphis street	4	15
Ann street, northeast side, 7 feet southeast of southeast house line of Agate street	4	15

Street. Location.	Size in inches.	Distance in feet.
Service Supply Connections—Continued.		
Ann street, northeast side, 5 feet northwest of northwest house line of Agate street	4	15
Ann street, southwest side, 14 feet southeast of southeast house line of Tulip street	4	15
Ann street, northeast side, 14 feet southeast of southeast line of Tulip street	4	15
Ann street, southwest side, 15 feet southeast of southeast house line of Trenton avenue	4	15
Bridge street, northeast side, 24 feet southeast of southeast house line of Edmund street	4	15
Bridge street, northeast side, 395 feet southeast of southeast house line of Edmund street	4	15
Bridge street, southwest side 24 feet northwest of northwest house line Edmund street	4	15
Bridge street, southwest side, 22 feet southeast of southeast house line of Torresdale avenue	4	15
Bridge street, southwest side, 24 feet northwest of northwest house line of Torresdale avenue	4	15
Bridge street. northeast side, 24 feet northwest of northwest house line of Dittman street	4	15
Bridge street, southwest side, 24 feet northwest of northwest house line of Dittman street	4	15
Bridge street, southwest side, 24 feet southeast of southeast house line of Dittman street	4	15
Bridge street, northeast side, 24 feet southeast of southeast house line of Foulkrod street	4	15
Bridge street, southwest side, 116 feet southeast of southeast house line of Jackson street	4	15
Bridge street, northeast side, 26 feet southeast of southeast house line of Charles street	4	15
Bridge street, northeast side, 321 feet southeast of southeast house line of Charles street	4	15
Bridge street, northeast side, 24 feet northwest of northwest house line of Charles street	4	15
Bridge street, northeast side, 24 feet southeast of southeast house line of Cherry street	4	15
Bridge street, northeast side, 25 feet northwest of northwest house line of Cherry street	4	15
Bridge street, northeast side, 24 feet southeast of southeast house line of Mulberry street	4	15
Bridge street, northeast side, 24 feet northwest of northwest house line of Mulberry street	4	15
Bridge street, northeast side, 286 feet southeast of southeast house line of Willow street	4	15
Bridge street, northeast side, 24 feet northwest of northwest house line of Willow street	4	15
Bridge street, northeast side, 24 feet southeast of southeast house line of Cedar street	4	15
Boudinot street, west side, 24 feet north of north house line of Old Front street	4	15

Street. Location.	Size in inches.	Distance in feet.
Service Supply Connections—Continued.		
Bodine street, east side, 24 feet north of north house line of York street	4	10
Bodine street, east side, 24 feet south of south house line of Cumberland street	4	10
"C" street, west side, 24 feet north of north house line of Indiana avenue	4	15
"C" street, west side, 24 feet south of south house line of Clearfield street	4	15
Cedar street, southeast side, 13 feet northeast of northeast house line of Margaret street	4	15
Cedar street, northwest side, 13 feet northeast of northeast house line of Margaret street	4	15
Cedar street, southeast side, 24 feet southwest of southwest house line of Foulkrod street	4	14
Cedar street, northwest side, 24 feet southwest of southwest house line of Foulkrod street	4	14
Clearfield street, south side, 248 feet 6 inches east of east house line of "E" street	4	14
Commerce street, east side, 26 feet 10 inches south of south house line of Cedar street	4	6
Commerce street, east side, 24 feet 6 inches north of north house line of Huntingdon street	4	6
Commerce street, east side, 146 feet north of north house line of Huntingdon street	4	6
Culvert street, southwest side, 25 feet 5 inches southeast of southeast house line of Frankford avenue	4	14
Culvert street, southwest side, 21 feet northwest of northwest house line of Amber street	4	14
Edgemont street, southeast side, 24 feet northeast of northeast house line of Division street	4	15
Edgemont street, southeast side, 199 feet 4 inches southwest of southwest house line of Allegheny avenue	4	15
Front street, east side, 24 feet north of north house line of Indiana avenue	4	19
Front street, west side, 24 feet north of north house line of Indiana avenue	4	19
Front street, east side, 24 feet south of south house line of Clearfield street	4	18
Front street, west side, 24 feet south of south house line of Clearfield street	4	21
Front street, east side, 24 feet south of north house line of Lippincott street	4	19
Front street, west side, 24 feet south of north house line of Lippincott street	4	19
Front street, east side, 24 feet south of south house line of Allegheny avenue	4	19
Front street, west side, 24 feet south of south house line of Allegheny avenue	4	19
Frankford avenue, west side, 19 feet north of north house line of Wakeling street	4	26

Street. Location.	Size in inches.	Distance in feet.
Service Supply Connections—Continued.		
Frankford avenue, southeast side, 30 feet northeast of northeast house line of Dyre street	4	25
Frankford avenue, west side, 26 feet south of south house line of Dyre street	4	25
Frankford avenue, northwest side, 30 feet northeast of north house line of Dyre street	4	25
Frankford avenue, southeast side, 16 feet 6 inches southwest of southwest house line of Pratt street	4	25
Frankford avenue, northwest side, 16 feet 6 inches southwest of southwest house line of Pratt street	4	25
Frankford avenue, northwest side, 16 feet 6 inches northeast of northeast house line of Pratt street	4	25
Frankford avenue, southeast side, 16 feet southwest of southwest house line of Ann street	4	25
Frankford avenue, southeast side, 8 feet northeast of northeast house line of Ann street	4	25
Frankford avenue, southeast side, 14 feet southwest of southwest house line of Bridge street	4	25
Frankford avenue, northwest side, 14 feet southwest of southwest house line of Bridge street	4	25
Hope street, west side, 192 feet 8 inches south of south house line of Tioga street	4	8
Hope street, west side, 24 feet north of north house line of Orthodox street	4	8
Jasper street, southeast side, 24 feet southwest of southwest house line of Cambria street	4	15
Jasper street northwest side, 24 feet southwest of southwest house line of Cambria street	4	15
Jasper street, southeast side, 73 feet northeast of northeast house line of Hart lane	4	15
Jasper street, northwest side, 73 feet northeast of northeast house line of Hart lane	4	15
Lawrence street, east side, 24 feet north of north house line of Erie avenue	4	15
Lawrence street, east side, 24 feet south of south house line of Butler street	4	15
Orthodox street, northeast side, 24 feet northwest of northwest house line of Thompson street	4	20
Orthodox street, northeast side, 24 feet southeast of southeast house line of Almond street	4	20
Orthodox street, northeast side 24 feet northwest of northwest house line of Almond street	4	21
Orthodox street, southwest side, 24 feet northwest of northwest house line of Almond street	4	15
Orthodox street, northeast side, 24 feet southeast of southeast house line of Belgrade street	4	18
Orthodox street, southwest side, 24 feet southeast of southeast house line of Belgrade street	4	18
Orthodox street, south side, 24 feet west of west house line of Richmond street	4	18

Street. Location.	Size in inches.	Distance in feet.
Service Supply Connections—Continued.		
Orthodox street, north side, 24 feet west of west house line of Richmond street	4	18
Oakland street, northwest side, 17 feet northeast of northeast house line of Unity street	4	15
Oakland street, northwest side, 18 feet southwest of southwest house line of Sellers street	4	15
Oakland street, northwest side, 17 feet northeast of northeast house line of Sellers street	4	15
Oakland street, northwest side, 22 feet southwest of southwest house line of Orthodox street	4	15
Philip street, west side 24 feet north of north house line of Westmoreland street	4	9
Philip street, west side, 24 feet south of south house line of Ontario street	4	9
Richmond street, southeast side, 24 feet northeast of northeast house line of Orthodox street	4	18
Richmond street, northwest side, 24 feet northeast of northeast house line of Orthodox street	4	18
Richmond street, northwest side, 227 feet 6 inches northeast of northeast house line of Orthodox street	4	18
Richmond street, northwest side, 166 feet southwest of southwest house line of Orthodox street	4	18
Richmond street, southeast side, 166 feet southwest of southwest house line of Orthodox street	4	18
Richmond street, northwest side, 24 feet southwest of southwest house line of Orthodox street	4	18
Richmond street, southeast side, 24 feet southwest of southwest house line of Lefevre street	4	18
Richmond street, southeast side, 24 feet northeast of southwest house line of Buckius street	4	19
Richmond street, southeast side, 24 feet southwest of southwest house line of Buckius street	4	19
Richmond street, southeast side, 384 feet 4 inches southwest of southwest house line of Jenks street	4	19
Richmond street, southeast side, 272 feet northeast of northeast house line of Bristol street	4	18
Richmond street, northwest side, 272 feet northeast of northeast house line of Bristol street	4	18
Richmond street, northwest side, 24 feet southwest of southwest house line of Hedley street	4	18
Richmond street, southeast side, 24 feet southwest of southwest house line of Hedley street	4	18
Richmond street, southeast side, 24 feet southwest of southwest house line of Juniatta street	4	19
Richmond street, northwest side, 24 feet southwest of southwest house line of Juniatta street	4	18
Richmond street, southeast side, 24 feet northeast of northeast house line of Juniatta street	4	18
Richmond street, southeast side, 24 feet northeast of northeast house line of Harrison street	4	19

Street. Location.	Size in inches.	Distance in feet.
Service Supply Connections—Continued.		
Richmond street, northwest side, 24 feet southwest of southwest house line of Harrison street	4	18
Richmond street, southeast side, 24 feet southwest of southwest house line of Harrison street	4	18
Richmond street, northwest side, 24 feet northeast of northeast house line of Roxborough street	4	18
Richmond street, southeast side, 24 feet northeast of northeast house line of Roxborough street	4	18
Richmond street, northwest side, 24 feet southwest of southwest house line of Roxborough street	4	18
Richmond street, southeast side, 24 feet southwest of southwest house line of Roxborough street	4	18
Richmond street, northwest side, 124 feet northeast of northeast house line of Lewis street	4	18
Richmond street, southeast side, 119 feet northeast of northeast house line of Lewis street	4	18
Richmond street, southeast side, 24 feet southwest of southwest house line of Lewis street	4	19
Richmond street, southeast side, 24 feet northeast of northeast house line of Luzerne street	4	19
Richmond street, southeast side, 109 feet south of south house line of Luzerne street	4	20
Richmond street, east side, 58 feet north of north house line of Pike street	4	18
Richmond street, east side, 124 feet south of south house line of Wheatsheaf lane	4	18
Richmond street, east side, 67 feet north of north house line of Butler street	4	18
Richmond street, east side, 24 feet south of south house line of Butler street	4	18
Richmond street, west side, 24 feet south of south house line of Butler street	4	19
Richmond street, east side, 60 feet north of north house line of Olivia street	4	19
Richmond street, east side, 24 feet north of north house line of Erie avenue	4	18
Richmond street, west side, 24 feet north of north house line of Erie avenue	4	18
Richmond street, east side, 24 feet south of south house line of Erie avenue	4	18
Richmond street, west side, 24 feet south of south house line of Erie avenue	4	18
Richmond street, east side, 24 feet north of north house line of Tioga street	4	18
Richmond street, west side, 24 feet north of north house line of Tioga street	4	19
Richmond street, west side, 64 feet north of north house line of Tioga street	4	20
Richmond street, 72 feet south of south house line of Venango street	4	19

Street. Location.	Size in inches.	Distance in feet.
Service Supply Connections—Continued.		
Richmond street, west side, 43 feet north of north house line of Venango street	4	20
Richmond street, east side, 24 feet south of south house line of Kingston street	4	20
Richmond street, west side, 367 feet north of north house line of Ontario street	4	20
Richmond street, west side, 197 feet south of south house line of Ontario street	4	21
Richmond street, east side, 24 feet south of south house line of Ontario street	4	19
Richmond street, east side, 107 feet north of north house line of Westmoreland street	4	18
Richmond street, west side, 107 feet north of north house line of Westmoreland street	4	20
Richmond street, east side, 24 feet south of south house line of Westmoreland street	4	19
Richmond street, east side, 24 feet north of north house line of Wensley street	4	18
Richmond street, east side, 24 feet south of south house line of Wensley street	4	19
Richmond street, east side, 24 feet north of north house line of Allegheny avenue	4	18
Sixth street, east side, 24 feet north of north house line of Clearfield street	4	14
Sixth street, west side, 24 feet north of north house line of Clearfield street	4	15
Sixth street, east side, 24 feet south of south house line of Allegheny avenue	4	14
Sixth street, west side, 24 feet south of south house line of Allegheny avenue	4	15
Sixth street, west side, 24 feet south of south house line of Westmoreland street	4	15
Sixth street, west side, 24 feet north of north abutment of bridge over P. and R. R. R	4	15
Sixth street, east side, 55 feet north of north abutment of bridge over P. and R. R. R	4	15
Sixth street, east side, 24 feet south of south house line of Willard street	4	15
Thompson street, southeast side, 109 feet northeast of northeast house line of Geisler street	4	15
Thompson street, northwest side, 158 feet northeast of northeast house line of Geisler street	4	15
Thompson street, southeast side, 24 feet southwest of southwest house line of Clearfield street	4	15
Thompson street northwest side, 115 feet 6 inches southwest of southwest house line of Clearfield street	4	15
Tacony street, northwest side, 23 feet 6 inches northeast of northeast house line of Church street	4	15
Tacony street, northwest side, 377 feet 6 inches northeast of northeast house line of Church street	4	15

Street. Location	Size in inches.	Distance in feet.
Service Supply Connections—Continued.		
Tacony street, southeast side, 27 feet northeast of northeast house line of Church street	4	15
Tacony street, southeast side, 24 feet southwest of southwest house line of Duncan street	4	15
Wright street, west side, 24 feet north of north house line of Ontario street	4	9
Wright street, west side, 24 feet south of south house line of Tioga street	4	9
York street, northeast side, 24 feet northwest of northwest house line of Thompson street	4	9
York street, northeast side, 73 feet southeast of southeast house line of Almond street	4	9
York street, northeast side, 24 feet northwest of northwest house line of Almond street	4	9
York street, northeast side, 173 feet 4 inches southeast of southeast house line of Gaul street	4	9
York street, northeast side, 24 feet northwest of northwest house line of Gaul street	4	9
York street, northeast side, 109 feet 3 inches southeast of southeast house line of Cedar street	4	10
Total		2,871
Fire hydrant connections	6	569
Supply Connections (*Private*).		
Amber street, northwest side, 218 feet southwest of southwest house line of Lehigh avenue, for Electric Traction Company	4	18
Cumberland street, north side, 1 foot 6 inches east of west house line of American street, for Jefferson Manufacturing Company	4	18
Fairhill street, west side, 26 feet north of north house line of Susquehanna avenue, for Feil's brewery	3	16
Fourth street, east side, 103 feet south of south house line of Brown street, for Gallivan Brewing Company	4	17
Huntingdon street, northeast side, 10 feet southeast of southeast house line of Trenton avenue, for Hygeia Ice Manufacturing Company	3	24
Noble street, south side, 8 feet east of east house line of Glenwood street, for Knox Pipe Factory	4	18
Toronto street, northeast side, 18 feet southeast of northwest house line of Bath street, for Philadelphia and Reading R. R	4	16
Total		127

Street.	Location.	Size in inches.	Distance in feet.
	Drains.		
Susquehanna avenue, southwest side, 58 feet 6 inches northwest of northwest house line of Cedar street, from 18-inch main		6	4
	Pipe Re-laid.		
Adrian street, from centre of Otter street to 11 feet north of south house line of Girard avenue		6	560
Allegheny avenue, north side, from 186 feet northwest of northwest house line of Frankford avenue, northwest.		6	90
Buckius street, from centre to northwest house line of Richmond street		6	33
Bodine street, from north house line of York street, north.		6	350
Capewell street, from centre of Belgrade street, northwest.		6	22
Cedar street, from south house line of Somerset street, north		12	60
China street, from north house line of Buttonwood street to south house line of Green street		6	574
Cook street, from east house line of Memphis street, west.		6	25
Crease street, frem southeast house line of Belgrade street, northwest		6	20
Deal street, from centre of Memphis street, northwest		6	26
Dillwyn street, from centre of Wood street north		6	15
Earl street, from southeast house line of Belgrade street, northwest		6	21
Fairhill street, from Cambria street to Indiana avenue		6	550
Fox street, from centre of Memphis street, northwest		6	26
Geisler street, from centre of Edgemont street, northwest.		6	29
Geisler street, from southeast house line of Thompson street, northwest		6	26
Germantown avenue, from 1 4 feet southeast of southeast house line of Girard avenue, northwest		6	166
Glenwood avenue, southeast side, from 28 feet 6 inches southwest of southwest abutment of bridge over N. P. R. R. to 45 feet northeast of northeast abutment		6	132
Gordon street, from centre of Belgrade stroet, northwest		6	21
Gordon street, from southeast to northwest house line of Memphis street		6	50
Hewson street, from southeast house line of Belgrade street, northwest		6	40
Hewson street, from centre of Memphis street, west		6	26
Holman street, from northeast house line of Adams street to 4 feet northeast of southwest house line of Cumberland street		6	346
Hope street, from centre of Hancock street to south house line of Girard avenue		6	516
Hope street, from north house line of Huntingdon street to Lehigh avenue		6	524

Street. Location.	Size in inches.	Distance in feet.
Pipe Relaid—Continued.		
Jackson street, from centre of Memphis street, northwest.	6	26
Julianna street, from south house line of Wood st., north..	6	50
Leithgow street, from centre of Poplar street to centre of George street	6	771
Leithgow street, from north house line of Girard avenue to south house line of Thompson street	6	391
Lucy street, from centre of Almond street to centre of Belgrade street	6	339
Marshall street, from Dauphin to York street	6	550
Memphis street, from centre of Deal street, north	6	13
Monmouth street, from 3 feet northwest of southeast house line of Edgemont street, northwest	6	47
Monmouth street, from southeast house line of Thompson street, northwest	6	51
Ocean street, from centre of Dana street, north	6	13
Orkney street, from south house line of York street, north	6	19
Pepper street, from centre of Cedar street, northwest	6	26
Pepper street, from southeast house line of Memphis street, northwest	6	52
Ritter street, from centre of Norris street, north	6	26
Savery street, from southeast house to northwest house line of Belgrade street	6	41
Seltzer street, from east house line of Front street, west	6	30
Sewell street, from centre of Tucker street to centre of Jackson street	6	259
Silver street, from east house line of Front street, west	6	30
Sixth street, from north house line of Clearfield street, north 565 feet; thence northwest 51 feet 6 inches; thence northeast 91 feet; thence north 457 feet to south house line of Westmoreland street	10	1,165
Slossman street, from centre of Canal street to east house line of Third street	6	266
Taggart street, from centre of Norris street, north	6	27
Thompson street, from 1 foot southwest of northeast house line of Susquehanna avenue to southwest house line of York street	6	1,440
Thompson street, from northeast house line of Somerset street to Williams street	6	586
Tucker street, from centre of Cedar street, northwest	6	27
Tucker street, from southeast house line of Memphis street, northwest	6	52
Townsend street, from southeast to northwest house line of Memphis street	6	50
Vienna street, from centre of Belgrade street, northwest	6	21
Vienna street, from east house line of Memphis street, west	6	27
Wood street, from west house line of Second street to east house line of St. John street	6	200
Wood street, from west house line of St. John street to east house line of Third street	6	210

Street. Location.	Size in inches.	Distance in feet.
Pipe Relaid—Continued.		
Wood street, from west house line of Third street to east house line of Fourth street	6	401
Wood street, from 53 feet east of west house line of York avenue to east house line of Crown street	6	184
Wood street, from west house line of Crown street to east house line of Fifth street	6	126
Wood street, from west house line of Fifth street to east house line of Sixth street	6	378
Wreckin street, from centre of Cedar street, northwest	6	25
Wreckin street, from southeast house line of Memphis street, northwest	6	26
York avenue, from Wood street, north	6	33
Total	....	12,326
Fire hydrant connections relaid	6	994
Repairs, general	4	25
" "	6	3,743
" "	8	14
" "	10	314
" "	12	73
" "	18	6
" "	30	28
Total	....	4,203
Pipe taken up.		
Adrian street, from centre of Otter street to 11 feet north of south house line of Girard avenue	4	560
Buckius street, from centre to northwest house line of Richmond street	4	32
Bodine street, from north house line of York street, north	4	350
Capewell street, from centre of Belgrade street, northwest	4	22
Cedar street, from south house line of Somerset street, north	6	60
China street, from north house line of Buttonwood street, to south house line of Green street	4	574
Cook street, from east house line of Memphis street, west	4	25
Crease street, from southeast house line of Belgrade street, northwest	4	20
Deal street, from centre of Memphis street, northwest	4	24
Dillwyn street, from centre of Wood street, north	3	15
Earl street, from southeast house line of Belgrade street northwest	4	20
Geisler street, from centre of Edgemont street, northwest	4	28

Street. Location.	Size in inches.	Distance in feet.
Pipe taken up—Continued.		
Geisler street, from southeast house line of Thompson street, northwest	4	26
Germantown avenue, from 154 feet southeast of southeast house line of Girard avenue, northwest	6	166
Glenwood avenue, southeast side from 28 feet 6 inches southwest of southwest abutment of bridge over N. P. R. R. to 45 feet northeast of northeast abutment	6	121
Gordon street, from centre of Belgrade street, northwest	4	21
Gordon street, from southeast house line of Memphis street, northwest	4	50
Hewson street, from southeast to northwest house line of Belgrade street	4	40
Hewson street, from centre of Memphis street, west	4	25
Holman street, from 41 feet south of south house line of Cumberland avenue, north	4	45
Holman street, from north house line of Adams st., north	4	60
Hope street, from centre of Hancock street, to south house line of Girard avenue	4	516
Hope street, from north house line of Huntingdon street to Lehigh avenue	4	524
Jackson street, from centre of Memphis street, northwest	6	25
Julianna street, from south house line of Wood street, north	4	50
Leithgow street, from Poplar street, north	4	70
Leithgow street, from centre of Culvert to centre of George street	4	432
Leithgow street, from north house line of Girard avenue to south house line of Thompson street	4	392
Lucy street, from centre of Almond street to centre of Belgrade street	4	339
Memphis street, from centre of Deal street, north	4	13
Monmouth street, from 3 feet northwest of southeast house line of Edgemont street, northwest	4	47
Monmouth street, from southeast to northwest house line of Thompson street	4	49
Ocean street, from centre of Dana street, north	4	13
Orkney street, from south house line of York street, north	4	19
Pepper street, from centre of Cedar street, northwest	4	26
Pepper street, from southeast house line of Memphis street, northwest	4	50
Ritter street, from centre of Norris street, north	4	26
Savery street, from southeast house line of Belgrade street, northwest	4	40
Seltzer street, from east house line of Front street, west	4	30
Sewell street, from centre of Tucker street to centre of Jackson street	4	259
Silver street, from east house line of Front street, west	4	30
Sixth street, from north house line of Clearfield street to south house line of Westmoreland street	10	1,124

Street. Location.	Size in inches.	Distance in feet.
Pipe taken up—Continued.		
Slossman street, from centre of Canal street to east house line of Third street	4	265
Taggart street, from centre of Norris street, north	4	26
Tucker street, from centre of Cedar street, northwest	4	27
Tucker street, from southeast house line of Memphis street, northwest	4	51
Townsend street, from southeast house line of Memphis street, northwest	4	50
Venango street, from 28 feet northwest of northwest house line of Tulip street, northwest	6	56
Vienna street, from centre of Belgrade street, northwest	4	21
Vienna street, from east house line of Memphis street, west	4	26
Wood street, from west house line of Second street to east house line of St. John street	4	200
Wood street, from west house line of St. John street to east house line of Third street	4	210
Wood street, from west house line of Third street to east house line of Fourth street	4	401
Wood street, from 53 feet east of west house line of York avenue to east house line of Crown street	4	184
Wood street, from west house line of Crown street to east house line of Fifth street	4	126
Wood street, from west house line of Fifth street to east house line of Sixth street	4	198
Wreckin street, from south east house line of Memphis street, northwest	4	25
York avenue, from centre of Wood street, north	4	33
Total		8,465
Fire hydrant connections taken up	4	1,152
Fire hydrant connections taken up	6	240
Total		1,392
Pipe Lowered.		
Allegheny avenue, south side, from east to west house line of Second street	6	68
Allegheny avenue, north side, from east to west house line of Second street	6	68
Belgrade street, from 71 feet 7 inche north of north house line of Wellington street to south house line of Westmoreland street	6	277
Bridge street, from 20 feet northwest of northwest house line of Cottage street to 32 feet northwest of northwest house line of Walker street	6	400

Street. Location.	Size in inches.	Distance in feet.
Pipe Lowered—Continued.		
Buckius street, from west curb line of Thompson street, west	6	148
Butler street, from 200 feet east of east house line of Turner street, west	6	235
Cedar street, from southwest house line to centre of Fillmore street	6	15
Deveraux street, from 69 feet east of east house line of Torresdale avenue, west	30	240
Fillmore street, from centre of Cedar street, northwest	6	90
Front street, from 56 feet 6 inches north of north house line of Indiana avenue to south house line of Clearfield street	6	50
Orthodox street, from 37 feet southeast of southeast house line of Thompson street, northwest	6	290
Second street, from 80 feet south of south house line of Allegheny avenue, north	6	250
Second street, west side, south house line of Allegheny avenue (on fire hydrant connection)	6	18
Total	....	2,539
Pipe Raised.		
Allegheny avenue, southwest side, from 78 feet southeast of southeast house line of Agate street to southeast house line of Tulip street	6	218
Allegheny avenue, north side, from 181 feet southeast of northwest house line of Memphis street, northwest	6	181
Allegheny avenue, north side, from northwest house line of Memphis street, to southeast house line of Agate street	6	108
Allegheny avenue, northeast side, from 11 feet southeast of northwest house line of Memphis street to southeast house line of Witte street	6	745
Front street, from 40 feet north of north house line of Allegheny avenue, north	4	406
Tulip street, from 38 feet southwest of northeast house line of Allegheny avenue, northeast	6	98
Tulip street, from southwest house line of Allegheny avenue, northeast	6	38
Venango street, from east house line of Lawrence street, east	6	106
Total	....	1,900

Street. Location.	Size in inches.	Distance in feet.
Pipe Cut off and Abandoned.		
Allegheny avenue, northeast side, from 186 feet northwest of northwest house line of Frankford ave., northwest..	6	30
Holman street, from 60 feet north of north house line of Adams street, north...	4	241
Leithgow street, from 70 feet north of centre of Poplar street to centre of Culvert street..........................	4	268
Marshall street, from Dauphin street to York street........	4	550
Fairhill street, from Cambria street to Indiana avenue.....	4	550
Thompson street, from northeast house line of Somerset street to centre of Williams street..	4	586
Thompson street, southeast side, from centre of Norris street to centre of Dauphin street......	4	250
Thompson street, southeast side, from centre of Ash street to centre of Norris street................	4	421
Total..	....	2,896
Fire hydrant connections cut off and abandoned............	4	785
Fire hydrant connections cut off and abandoned............	6	184
Total..	....	929

Recapitulation of Third District.

	Purposes for which used.	Sizes in Inches.										Total in feet and pounds.
		3	4	6	8	10	12	16	18	20	30	
New pipe or feet added	Service mains	....	42	38,306	155	50	6,119	56	....	37	....	44,795
	Supply mains	....	....	....	....	....	....	....	....	117	....	117
	Bye-pass connections	....	....	....	....	....	11	....	....	....	....	11
	Service supply connections	....	2,871	....	....	....	....	....	....	....	....	2,871
	Fire hydrant connections	....	....	4,569	....	....	....	....	....	....	....	4,569
	Supply connections (private)	40	87	....	....	....	....	....	....	....	....	127
	Drains	....	....	4	....	....	....	....	....	....	....	4
	Total { Feet	40	3,000	42,879	155	50	6,160	56	....	154	....	52,494
	Total { Pounds	600	57,000	1,415,007	6,510	2,750	443,520	6,160	....	24,486	....	1,956,033
Pipe used but adding nothing to feet in ground.	Pipe relaid	....	....	12,095	....	1,165	60	....	....	....	....	13,320
	Repairs general	....	25	3,743	14	314	73	....	6	....	28	4,203
	Pipe taken up	15	8,075	643	....	1,124	....	....	....	....	....	9,857
	Pipe lowered	....	....	2,299	....	....	....	....	....	....	240	2,539
	Pipe raised	....	....	1,900	....	....	....	....	....	....	....	1,900
	Total { Feet	15	8,100	20,680	14	2,603	133	....	6	....	268	31,819
	Total { Pounds	225	153,900	682,410	588	113,165	9,576	....	840	....	88,976	1,079,710
Total handled	{ Feet	55	11,100	63,559	169	2,653	6,293	56	6	154	268	84,313
	{ Pounds	825	210,900	2,097,447	7,098	145,915	453,096	6,160	840	24,186	88,976	3,035,713
Pipe cut off and abandoned		....	3,651	174	....	....	....	....	....	....	....	3,825

Fourth District.

Comprising the Thirteenth, Fourteenth, Fifteenth, Twentieth Twenty-ninth, Thirty-second and part of the Twenty-eighth Wards.

Street. Location.	Size in inches	Distance in feet.
Service Mains.		
Allegheny avenue, north side, from dead end west house line of Broad street to dead end 9 feet east of east house line of Fifteenth street	6	388
Arlington street, from dead end west house line of Thirty-second street to 20 feet east of east house line of Thirty third street	6 6	420 420
Berks street, from east house line of Willington street, west	6	61
Camac street, from Thompson street to 21 feet north of south house line of Seybert street	6	233
Camac street, from dead end north house line of Susquehanna avenue, north	6	295
Carlisle street, from 6 feet 8 inches north of north curb line of Allegheny avenue, north	6	9
Carlton street, from dead end west house line of Thirteenth street to 22 feet west of east house line of Broad street	6	550
Carlton street, from dead end 238 feet east of east house line of Twenty-third street, west	6	238
Carlton street, from east house line of Twenty-fourth street, west	6	16
Clearfield street, from dead end west house line of Twenty-third street to east house line of Twenty-seventh street	6	1,750
Cumberland street, from dead end west house line of Thirty-first street to dead end east house line of Thirty-third street	6	790
Cumberland street, from dead end 5 feet 6 inches west of west house line of Thirty-third street to intersection of Woodford street and Ridge avenue	6	371
Dacota street, from Twenty-fifth to Twenty-sixth streets	6	451
Dauphin street, from dead end 47 feet 11 inches east of southeast house line of Glenwood avenue, west	6	114
Dauphin street from 1 foot east of east house line of Thirty-third street, west	6	21
Dover street, from 34 feet 6 inches south of south house line of Oxford street, north	6	28
Edwin street, from dead end east house line of Geary street, west to connect	6	10
Euclid street, from dead end west house line of Thirty-first street to dead end east house line of Thirty-second street	6	400
Fowler street, from Oliver street, north	6	14
Garnet street, from 27 feet south of north house line of Cumberland street, north	6	27
Geary street, from Wylie street to dead end south house line of Vineyard street	6	334

Street. Location.	Size in inches.	Distance in feet.
Service Mains—Continued.		
Geary street, from dead end north house line of Vineyard street to dead end south house line of Poplar street...	6	86
Glenwood avenue, from south house line of Dauphin street, northeast	8	76
Glenwood avenue, from east house line of Broad street, northeast	6	76
Glenwood avenue, from dead end west house line of Eleventh street to west house line of Twelfth street...	6	620
Grove street, from centre of Geary street, west to connect dead end	6	10
Harold street, from east house line of Twenty-third street, west	6	35
Hagert street, from Thirty-third street to Ridge avenue...	6	276
Herman street, from dead end northwest house line of Sedgeley avenue to Twenty-sixth street	6	835
Huntingdon street, from centre of Sedgeley avenue. west..	6	35
Indiana avenue, from dead end, east house line of Twelfth street west to connect	6	21
Lawson street, from centre of Pearl street, north	6	13
Lehigh avenue, south side, from 18 feet west of west wall of bridge over P. & R. R. R. east to Fifteenth street	6	459
Lehigh avenue, north side, from east house line of Fifteenth street, west	6	35
Lehigh avenue, south side, from dead end, west house line of Twenty-eight street to dead end, east house line of Twenty-ninth street	6	400
Lehigh avenue, south side, from west house line of Twenty-ninth street to 240 feet west of west house line of Thirtieth street	6	690
Lehigh avenue, north side, from east house line of Thirtieth street, west	6	50
Morse street, from dead end, west house line of Thirty-first street to dead end, 2 feet east of east house line of Thirty-second street	6	398
Morse street, from dead end, west house line of Thirty-second street, to 17 feet west of east house line of Thirty-third street	6	429
Monument avenue, from dead end, east house line of Thirty-third street, west	6	19
Natrona street, from 141 feet south of south house line of Oxford street, north	6	141
Newkirk street, from centre of Oxford street, north	6	26
Nineteen-and-three-quarter street, from centre of Cumberland street, north	6	26
Opal street, from 26 feet 6 inches south of north house line of Cumberland street, north	6	27
Park avenue, from north house line of Dauphin street to south house line of York street	6	500
Park avenue, from centre of Cambria street, north	6	25

Street. Location.	Size in inches.	Distance in feet.
Service Mains—Continued.		
Pearl street, from dead end, west house line of Tenth street to dead end, east house line of Twelfth street..........	6	796
Pearl street, from 193 feet east of east house line of Fifteenth street, west......	6	193
Pearl street, from west house line of Sixteenth street, to dead end, 2 feet west of east house line of Seventeenth street	6	400
Percy street, from south house line of Berks street, north	6	25
Saulnier street, from centre of Twenty-seventh street, west	6	15
Sedgeley avenue, from 607 feet east of east house line of Twenty-first street to Twenty-second street...............	8	1215
Seybert street, from Twelfth to Thirteenth streets.	6	447
Sheridan street, from dead end, 3 feet south of south house line of Berks street, north......................................	6	30
Showaker street, from east house line of Twenty-third street to east house line of Twenty-fourth street........	6	450
Showaker street, from dead end, 189 feet 6 inches east of east house line of Twenty-sixth street, west............	6	214
Showaker street, from dead end, 12 feet east of west house line of Twenty-eighth street to 17 feet west of east house line of Twenth-ninth street..........................	6	429
Thirteenth street, from Cambria street, north................	6	25
Thirtieth street, from south house line of Lehigh avenue, north...	12	17
Thirtieth street, from 16 feet north of south house line of Lehigh avenue, north...	12	64
Thirty-and-three-quarter street, from dead end, north house line of York street, north.............................	6	65
Thirty-and-one-half street, from south house line of Cumberland street, north..............................	6	53
Thirty-one-and-three-quarters street, from north house line of York street to north house line of Cumberland street	6	553
Thirty-two-and-one-half street, from dead end 8 feet south of north house line of York street to north house line of Cumberland street..................................	6	560
Thirty-two-and-three-quarter street, from dead end 7 feet north of south house line of Cumberland street, north...	6	44
Thirty-third street, east side, 149 feet south of south house line of Oxford street, north..............................	12	152
Thirty-third street, east side, from Susquehanna avenue to 61 feet west of southwest house line of Ridge avenue	12	780
Thirty-third street, west side, from dead end north house line of York street to dead end south house line of Cumberland street............	6	500
Thirty-three-and-one-half street, from Cumberland to south house line of Firth street..................................	6	257
Thirty-fourth street, from centre of Cumberland street, north..	6	28
Thompson street, from 124 feet 6 inches east of east house line of Twenty-seventh street, west............................	6	156

Street. Location.	Size in inches.	Distance in feet.
Service Mains—Continued.		
Twelfth street, from Cambria to southeast house line of Glenwood avenue	6	677
Twenty-first street, from southeast house line of Sedgley avenue, northwest	6	72
Twenty-third street, from Huntingdon street to dead end south house line of Lehigh avenue	6	545
Twenty-fourth street, from dead end north house line of Huntingdon street to dead end south house line of Lehigh avenue	6	442
Twenty-fourth street, from southeast house line of Clearfield street, north	6	50
Twenty-fifth street, from dead end 130 feet south of south house line of Diamond street, north	6	140
Twenty-fifth street, from Huntingdon street to dead end south house line of Harold street	6	176
Twenty-fifth street, from dead end north house line of Showaker street to dead end south house line of Lehigh avenue	6	170
Twenty-fifth street, from south house line of Clearfield street, north	6	50
Twenty-sixth street, from south house line of Showaker street, north	6	40
Twenty-sixth street, from 12 feet 10 inches south of centre of Clearfield street, north	6	26
Twenty-eighth street, from dead end north house line of Montgomery avenue, to dead end 8 feet 10 inches north of south house line of Berks street	6	509
Wilcox street, from 250 feet east of east house line of Twentieth street, west	6	250
Willington street, from dead end 220 feet south of south house line of Berks street, north	6	270
Wilt street, from centre of Thirty-first street to dead end east house line of Thirty-second street	6	426
Total		23,138
Supply Mains.		
Master street, from 36 feet 10 inches west of east house line of Thirty-third street, west	48	26
Twenty-ninth street, from north house line of Huntingdon street to dead end 6 feet 5 inches south of south house line of Lehigh avenue	48	514
Twenty-ninth street, from dead end 10 feet north of north house line of Lehigh avenue to north house line of Cambria street	48	1,110
Twenty-ninth street, from south house line of Allegheny avenue, north	48	120
Total		1,170

Street. Location.	Size in inches.	Distance in feet.
Pumping Mains.		
East Park Drive, from dead end laid 1893, 152 feet 6 inches northwest of forebay to Engine No. 2, Spring Garden Works	48	57
East Park Drive, from dead end, laid 1893, 152 feet 6 inches northwest of forebay to Engine No. 3, Spring Garden Works	48	124
Spring Garden Pumping Station, west front of new engine house from No. 2 Engine; suction pipe	48	183
Spring Garden Pumping Station, west front of new engine house, from No. 3 Engine; suction pipe	48	179
Total		543
Service Main Connections.		
Clearfield street and Ridge avenue, south side, between 6-inch main on Clearfield street and 12-inch main on Ridge avenue	6	34
Supply Main Connections.		
Master street, 42 feet west of east house line of Thirty-third street, between 30-inch main from Belmont and 48-inch main from Queen Lane Reservoir	30	11
Pumping Main Connections.		
Master street, from connection between 36-inch main on Thirty-third street and 48-inch main from Queen lane Reservoir, at a point 40 feet west of east house line of Thirty-third street, and 15 feet north of south house line of Master street east to connect with 36-inch main on Master street	36	48
Thirty-third street, from 36-inch main at a point 11 feet south of south house line of Master street, and 21 feet 6 inches west of east house line of Thirty-third street, northwest, connecting with 48-inch main from Queen lane Reservoir	36	27
Total	48	23
		98

Street. Location.	Size in inches.	Distance in feet.
Service Supply Connections.		
Berks street, north side, 12 feet west of west house line of Marshall street	4	14
Berks street, north side, 12 feet east of east house line of Seventh street	4	13
Berks street, north side, 12 feet west of west house line of Ninth street	4	14
Berks street, north side, 12 feet east of east house line of Tenth street	4	14
Callowhill street, north side, 14 feet 9 inches west of west house line of Broad street	4	20
Callowhill street, north side, 12 feet east of east house line of Fifteenth street	4	21
Callowhill street, north side, 12 feet west of west house line of Fifteenth street	4	20
Callowhill street, north side, 12 feet east of east house line of Sixteenth street	4	20
Callowhill street, north side, 12 feet west of west house line of Seventeenth street	4	23
Callowhill street, north side, 12 feet east of east house line of Eighteenth street	4	22
Cambria street, north side, 14 feet west of west house line of Twelfth street	4	14
Cambria street, north side, 12 feet east of east house line of Thirteenth street	4	14
Cambria street, north side, 14 feet west of west house line of Thirteenth street	4	15
Cambria street, north side, 12 feet east of east house line of Park avenue	4	15
Cumberland street, south side, 12 feet west of west house line of Twenty-ninth street	4	14
Cumberland street, north side, 12 feet west of west house line of Twenty-ninth street	4	14
Cumberland street, south side, 12 feet east of east house line of Thirtieth street	4	13
Cumberland street, north side, 12 feet east of east house line of Thirtieth street	4	15
Cumberland street, north side, 12 feet west of west house line of Thirtieth street	4	15
Cumberland street, north side, 12 feet east of east house line of Thirty-first street	4	14
Cumberland street, south side, 12 feet west of west house line of Thirty-third street	4	14
Cumberland street, south side, 12 feet east of northeast house line of Ridge avenue	4	14
Dauphin street, south side, 12 feet east of southeast house line of Glenwood avenue	4	15
Glenwood avenue, southeast side, 25 feet southwest of west house line of Eleventh street	4	18
Glenwood avenue, northwest side, 25 feet southwest of west house line of Eleventh street	4	18

Street. Location.	Size in inches.	Distance in feet.
Service Supply Connections—Conttnued.		
Glenwood avenue, southeast side, 12 feet northeast of east house line of Twelfth street	4	18
Glenwood avenue, northwest side, 12 feet northeast of east house line of Twelfth street	4	18
Harold street, south side, 12 feet west of west house line of Twenty-third street	4	11
Harold street, north side, 12 feet west of west house line of Twenty-third street	4	11
Harold street, north side, 198 feet west of west house line of Twenty-third street	4	12
Harold street south side, 12 feet east of east house line of Twenty-fourth street	4	13
Morse street, south side, 90 feet west of west house line of Thirty-first street	4	9
Morse street, north side, 90 feet west of west house line of Thirty-first street	4	9
Morse street, south side, 12 feet east of east house line of Thirty-second street	4	9
Morse street, north side, 12 feet east of east house line of Thirty-second street	4	9
Morse street, south side 12 feet west of west house line of Thirty-second street	4	9
Morse street, north side, 12 feet west of west house line of Thirty-second street	4	9
Morse street, south side, 17 feet east of east house line of Thirty-third street	4	9
Morse street, north side, 17 feet east of east house line of Thirty-third street	4	9
Norris street, south side, 12 feet west of west house line of Twenty-ninth street	4	15
Norris street, south side, 12 feet east of east house line of Thirtieth street	4	15
Norris street, north side, 12 feet west of west house line of Thirty-second street	4	15
Ridge avenue, northeast side, from Cumberland street, southeast	6	29
Sedgely avenue, southeast side, 16 feet northeast of east house line of Twenty-second street	4	18
Sedgley avenue, northwest side, 10 feet northeast of east house line of Twenty-second street	4	18
Sedgley avenue, southeast side, 12 feet southwest of west house line of Twenty-first street	4	18
Sedgley avenue, southeast side, 12 feet northeast of east house line of Twenty-first street	4	18
Sedgley avenue, northwest side, 12 feet southwest of west house line of Twenty-first street	4	18
Sedgley avenue, northwest side, 12 feet northeast of north house line of Huntingdon street	4	18
Sedgley avenue, southeast side, 36 feet southwest of west house line of Margie street	4	19

Street. Location.	Size in inches.	Distance in feet.
Service Supply Connections—Continued.		
Sedgley avenue, northwest side, 36 feet southwest of west house line of Margie street	4	19
Showaker street, south side, 12 feet east of east house line of Twenty-third street	4	11
Showaker street, north side, 12 feet east of east house line of Twenty-third street	4	11
Showaker street, south side, 12 feet west of west house line of Twenty-third street	4	11
Showaker street, north side, 12 feet west of west house line of Twenty-third street	4	11
Twelfth street, east side, 150 feet north of north house line of Cambria street	4	15
Twelfth street, east side, 12 feet south of south house line of Indiana avenue	4	15
Twenty-third street, east side, 12 feet north of north house line of Huntingdon street	4	15
Twenty-third street, west side, 12 feet north of north house line of Huntingdon street	4	15
Twenty-third street, east side, from centre of Harold street, south	4	12
Twenty-third street, east side, from centre of Harold street, north	4	13
Twenty-third street, west side, from centre of Harold street, south	4	13
Twenty-third street, west side from centre of Harold street, north	4	13
Twenty-third street, east side, from centre of Showaker street, south	4	12
Twenty-third street, east side, from centre of Showaker street, north	4	12
Twenty-third street, west side, from centre of Showaker street, south	4	12
Twenty-third street, west side, from centre of Showaker street. north	4	12
Twenty-fifth street, east side, 187 feet south of south house line of Diamond street	4	14
Twenty-eighth street, west side, 12 feet north of north house line of Montgomery avenue	4	14
Twenty-eighth street, west side, 15 feeth south of south house line of Berks street	4	14
Total		1,023
Fire hydrant connections	6	1,086
Fire Connections (Private).		
Cambria street north side, 189 feet west of west house line of Eleventh street, Dunlap Carpet Mills	4	17

Street. Location.	Size in inches.	Distance in feet.
Fire Connections (Private)—Continued.		
Colona street, south side, 159 feet 8 inches west of west house line of Eleventh street, Electric Traction Co...	4	12
Huntingdon street, north side, 24 feet east of east house line of Fifteenth street, Philadelphia Base Ball Club..	6	15
Indiana avenue, north side, 89 feet east of east house line of Sixteenth street, Philadelphia Knitting Mills.......	4	14
Susquehanna avenue, north side, 251 feet 4 inches west of west house line of Eleventh street, Electric Tractric Co..........	4	20
Twenty-fourth street, west side, 83 feet south of south house line of Hamilton street, Godschalk Mills........	4	23
Total..........		101
Supply Connections (Private).		
Clearfield street, south side, from a point 627 feet east of east house line of Twenty-ninth street, south to supply tenants on site of proposed Cambria Reservoir, Bureau of Water..........	4	1,835
Diamond street, north side, 86 feet east of east house line of Broad street, Bethlehem Presbyterian Church......	3	15
Girard avenue, north side, 27 feet east of east house line of Ninth street, Swift Brothers..........	3	9
Master street, south side, 106 feet 6 inches east of east house line of Thirty-third street, Kellar Brothers.............	3	16
Oxford street, west side, 74 feet 6 inches west of west house line of Eleventh street, Prospect Brewing Co..........	3	14
Total..........	....	1,889
Drains.		
Master street, 209 feet 6 inches west of east house line of Thirty-third street, from 36-inch and 48-inch mains southwest to sewer..........	6	240
Spring Garden Pumping Station, from west front of new engine house, west (from No. 2 Engine)..........	16	117
Spring Garden Pumping Station, from west front of new engine house, west (from No. 3, Engine)..........	16	163
Spring Garden Station, from west front of No. 2 Engine House, west (for exhaust)..........	16	55
Spring Garden Pumping Station, west front, from No. 2 and No. 3 48-inch pumping mains to East Park Reservoir, into No. 9 and No. 10 engine well..........	4 6 8	20 116 67
Thirty-third street, from 36-inch main on Master street, southwest..........	6	17

Street. Location.	Size in inches.	Distance in feet.
Drains—Continued.		
Thirty-third street, from 36-inch main to 48-inch pumping main connection, northeast	6	10
Total	....	805
Pipe Relaid.		
Darien street, from 24 feet 6 inches north of south house line of Montgomery avenue, north	6	35
Darien street, from 1 foot 4 inches south of south house line of Berks street, north	6	31
Ogden street, from 11 feet east of west house line of Ninth street to east house line of Tenth street	6	401
Ogden street, from west house line of Tenth street to east house line of Eleventh street	6	400
Olive street, from west house line of Sixteenth street to 3 feet east of east house line of Seventeenth street	6	396
Park avenue, west side, from 13 feet south of north house line of Dauphin street, northeast to centre	6	24
Park avenue, centre, from south house line of York street, northwest to connect	6	25
Pearl street, from west house line of Fifteenth street to east house line of Sixteenth street	6	396
Pearl street, from west house line of Seventeenth street to east house line of Eighteenth street	6	396
Pearl street, from west house line of Eighteenth street to east house line of Nineteenth street	6	396
Sisty street, from 1 foot 10 inches south of south house line of Montgomery avenue, north	6	28
Spring Garden Pumping Station, northeast front of engine house, 211 feet northwest of east house line of Thirty-third street; connection between 48-inch Fairmount main and 36-inch supplementary lift	36	61
Twenty-fourth street, from 150 feet north of north house line of Wood street, north	6	156
Total	....	2,745
Fire hydrant connections relaid	6	81
Repairs, general	4	158
" "	6	863
" "	8	22
" "	10	47
" "	12	31
" "	30	100
Total	....	1,221

Street. Location.	Size in inches.	Distance in feet.
Pipe Taken Up.		
Callowhill street, intersection of Twenty-first street.........	10	17
Darien street, from 24 feet 6 inches north of south house line of Montgomery avenue, north.........................	4	35
Darien street, from 1 foot 4 inches south of south house line of Berks street, north..................................	4	31
Ogden street, from 11 feet east of west house line of Ninth street to east house line of Tenth street..................	4	401
Ogden street, from west house line of Tenth street to east house line of Eleventh street................................	4	400
Olive street, from west house line of Sixteenth street to 3 feet east of east house line of Seventeenth street........	4	396
Pearl street, from west house line of Fifteenth street to east house line of Sixteenth street..............................	4	396
Pearl street, from west house line of Seventeenth street to east house line of Eighteenth street......	4	395
Pearl street, from west house line of Eighteenth street to east house line of Nineteenth street.......................	4	396
Sisty street, from 1 foot 10 inches south of south house line of Montgomery avenue, north.........................	4	28
Spring Garden Pumping Station, from 36-inch connection to supplementary lift...	36	58
Twenty-fourth street, from 150 feet north of north house line of Wood street, north	6	145
Total..	....	2,698
Fire hydrant connections taken up.............................	4	90
Pipe Raised.		
Harold st., from west curb line of Twenty-third st., west..	6	215
Pipe Shifted.		
Thirty-third street, intersection of Master street............	48	208
Pipe Cut off and Abandoned.		
Park avenue, from 13 feet south of north house line of Dauphin street, north...	6	13
Park avenue, from south house line of York street, north	6	14
Thirty-third street, east side, from 61 feet south of south house line of Ridge avenue, west..........................	12	24
Thirty-third street, from 180 feet east of west house line of Thirty-third street, west..................	6	125
Total..	....	176
Fire hydrant connections cut off and abandoned...........	4	142
Fire hydrant connections cut off and abandoned.....	6	101
Total.............	....	243

Recapitulation of Fourth District.

Purposes for which used.		Sizes in inches. 3	4	6	8	10	12	16	30	36	48	Total in feet and pounds.
New pipe or feet added.	Service mains			20,211	1,914		1,013					23,138
	Supply mains										1,770	1,770
	Pumping main										543	543
	Service main connection			34								34
	Supply main connection								11			11
	Pumping main connection									75	23	98
	Service supply connection		994	29								1,023
	Fire hydrant connection			1,086								1,086
	Fire connections (private)		86	15								101
	Supply connections (private)	54	1,835									1,889
	Drains		20	383	67			335				805
	Total — Feet	54	2,935	21,758	1,981		1,013	335	11	75	2,336	30,498
	Total — Pounds	810	55,765	718,014	83,202		72,936	36,850	3,652	31,650	1,366,560	2,369,439
Pipe used but adding nothing to feet in ground.	Pipe relaid			2,765						61		2,826
	Repairs general		158	863	22	47	31		100			1,221
	Pipe taken up		2,568	145		17				58		2,788
	Pipe raised			215								215
	Pipe shifted										208	208
	Total — Feet		2,726	3,988	22	64	31		100	119	208	7,258
	Total — Pounds		51,794	131,604	924	3,520	2,232		33,200	50,218	121,680	395,172
Total handled	Feet	54	5,661	25,746	2,003	64	1,044	335	111	194	2,544	37,756
	Pounds	810	107,559	849,618	84,126	3,520	75,168	36,850	36,852	81,868	1,488,240	2,764,611
Pipe cut off and abandoned			142	152			125					419

Fifth District.

Comprising the Twenty-first and part of the Twenty-eighth Ward.

Street. Location.	Size in inches.	Distance in feet.
Service Mains.		
Boone street, from northwest house line of Mechanic street, to Grape street	6	395
Cemetery avenue, from Ridge avenue, northeast	6	242
Eveline street, from dead end 11 feet southwest of northeast house line of Ridge avenue to centre of Frederick street	6	349
Frederick street, from Midvale street to Eveline street	6	243
Kram's avenue, from northeast house line of Pechin street to Mitchell street	6	509
Maiden street, from northeast house line of Latch avenue to Wood street	6	280
Nicetown lane, northwest side, from northeast house line of Thirty-second street to Wissahickon avenue	12	2,350
Osborne street, from centre of Manayunk avenue, northeast	6	25
Pechin street, from dead end northwest house line of Lyceum avenue to centre of Connaroe street	6	250
Walnut street, from Chestnut street to Hamilton street	6	677
Total	....	5,320
Supply Mains.		
48-*inch supply main, from Queen Lane Reservoir to Broad and Dauphin streets.*		
Nicetown lane, from 214 feet southwest of southwest house line of Thirty-second street, northeast	48	254
Thirty-second street, from Nicetown lane northwest to dead end, laid 1894, a distance of 324 feet, thence from dead end, laid 1894, centre of Juniatta street to Abbotsford avenue, thence north along southerly side of Queen Lane Reservoir to southwest side of Thirty-first street, thence north to north stop house Queen Lane Reservoir, a distance of 4,171 feet.	48	4,495
Twenty-ninth street, from north house line of Allegheny avenue, north	48	385
Total	....	5,134

Street. Location.	Size in inches.	Distance in feet.
Supply Mains—Continued.		
48-*inch supply main, from Queen Lane Reservoir to Nicetown lane and Germantown avenue.*		
Nicetown lane, from 37 feet southwest of northeast house line of Thirty-second street, northeast	48	119
Thirty-second street, from Nicetown lane, northwest	48	758
Abbotsford avenue, from Thirty-second street, northeast	48	184
Thirty-first street, from 141 feet south of centre of south stop house, Queen Lane Reservoir, to a point opposite centre of north stop house	48	854
Total	....	1,915
Pumping Mains.		
48-*inch pumping main, from Thirty-third and New Queen streets, connecting with* 48-*inch main to Broad and Dauphin streets, opposite north stop house Queen Lane Reservoir.*		
New Queen street, from Thirty-third street to Thirty-first street	48	1,486
Thirty-first street, from New Queen street southeast to north stop house, Queen Lane Reservoir	48	522
Total	....	2,008
48-*inch pumping main, from Queen Lane Pumping Station to Queen Lane Reservoir.*		
Ridge avenue, from dead end, laid 1894, 1,027 feet 6 inches southeast of engine house to dead end 658 feet northwest of northwest curb line of Midvale avenue	48	789
Thirty-third street, from dead end laid 1894, 403 feet southeast of southeast house line of Fairview avenue, southeast to overflow, Queen Lane Reservoir	48	83
Total	....	872
48-*inch suction pipes, Queen Lane Pumping Station.*		
Queen Lane Pumping Station, from fore-bay to engine house, No. 1 main	48	253
No. 2 main	48	253
No. 3 main	48	169
No. 4 main	48	168
Total	....	843

Street. Location.	Size in inches.	Distance in feet.
Supply Main Connection.		
Nicetown lane, northeast house line of Thirty-second street, between 48-inch supply and 12-inch service mains.....	12	
Thirty-first street, southwest side, between 48-inch supply main (second line) opposite centre of south stop house, northwest, connecting with 48-inch supply main (third line)........	48	44
Ridge avenue and Shawmont avenue, northeast side, between 30-inch main on Shawmont avenue and 10-inch main on Ridge avenue........	10	12
Total........	....	70
Pumping Main Connections.		
Roxborough Pumping Station, from dead end 30 feet southeast of Shawmont ave. southeast to connect stand pipe..	30	38
Roxborough Pumping Station, from stand pipe, southeast..	30	15
Total........	....	53
Fire hydrant connections........	6	142
Fire Connections (private).		
School lane, southeast side, 106 feet southwest of southwest house line of Cresson street, for Powers & Weightman	4	11
Supply Connections (private).		
Main street, northeast side, 500 feet southeast of southeast house line of Shur's lane, for Manayunk Gas Works	4	20
Queen lane Pumping Station, between boiler and engine houses from 11 feet northwest of northwest wall of boiler house, southeast, for Bureau of Water........	6	159
Total........	....	179
Drains.		
Ann street, from 184 feet southeast of southeast house line of Shawmont avenue (from 30-inch main)........	6	53
Queen Lane Pumping Station from centre of engine house to northwest side of forebay for out board delivery...	30	3[illegible]8
Queen Lane Pumping Station, around boiler and engine houses, storm water drain........	6	852

Street. Location.	Size in inches.	Distance in feet.
Drains—Continued.		
	6	852
Roxborough Pumping Station, from 30-inch connection to stand pipe, southwest	2	59
Roxborough Pumping Station, from stand pipe, southwest to 30-inch main in Ann street	12	42
Shawmont Pumping Station, from 122 feet southeast of northwest wall of boiler house to Schuylkill river	6	51
Shawmont Pumping Station, from 96 feet southeast of northwest wall of engine house to Schuylkill river	6	35
Shawmont Pumping Station, from 75 feet southeast of northwest wall of engine house to Schuylkill river	4	17
Shawmont Pumping Station, from 49 feet southeast of northwest wall of engine house to Schuylkill river	6	19
Total	....	1,436
Repairs, general	4	5
Repairs, general	6	325
Repairs, general	10	25
Repairs, general	12	34
Repairs, general	20	36
Repairs, general	30	51
Repairs, general	48	17
Total		493
Pipe Taken Up.		
Markle street, from 10 feet southwest of centre of Terrace street, northeast	6	35
Terrace street, from 14 feet southeast of centre of Markle street, northwest	6	20
Total		55
Fire Hydrant Connections Taken Up.		
Manayunk avenue, southwest side, northwest house line of Osborne street	6	29
Pipe Lowered.		
Bowman street, from 215 feet northeast of northeast house line of Thirty-fifth street north east	6	36
Levering street, from northeast house line of Fleming street, northeast	6	45
Total	....	81

Recapitulation of Fifth District.

Puposes for which used.		Sizes in Inches. 2	4	6	10	12	20	30	48	Total in feet and pounds.
New pipe or feet added.	Service mains			2,970		2,350				5,320
	Supply mains								7,049	7,049
	Pumping mains								3,723	3,723
	Supply main connections				12	14			44	70
	Pumping main connections							53		53
	Fire hydrant connections			142						142
	Fire connections (private)		11							11
	Supply connections (private)		20	159						179
	Drains	59	17	1,010		42		308		1,436
	Total ... Feet	59	48	4,281	12	2,406		361	10,816	17,983
	Total ... Pounds	590	912	141,273	660	172,232		119,852	6,327,360	6,763,879
Pipe used but adding nothing to feet in the ground.	Repairs, general		5	325	25	34	36	51	17	493
	Pipe taken up			70						70
	Pipe lowered			81						81
	Total ... Feet		5	476	25	34	36	51	17	644
	Total ... Pounds		95	15,608	1,375	2,448	5,724	16,932	9,915	52,227
Total handled...	Feet	59	53	4,757	37	2,140	36	412	10,833	18,627
	Pounds	590	1,007	156,981	2,085	175,680	5,724	136,784	6,337,305	6,816,106

Sixth District.

Comprising the Twenty-second and part of the Twenty-eighth and Thirty-third Wards.

Street. Location.	Size in inches.	Distance in feet.
Service Mains.		
Atlantic street, from Twenty-first to Twenty-second streets	6	455
Barr street, from southwest house line of Nice street, northeast	6	13
Barr street, from 12 feet southwest of northeast house line of Nice street, northeast	6	12
Brewster street, from Nineteenth to Twentieth streets	6	446
Broad street, east side, from 185 feet north of north house line of McFerran street to north house line of Franklin street	6	465
Broad street, west side, from south house line of Wingohocking street, north	6	50
Broad street, west side, from south house line of Rockland street, north	6	50
Butler street, from dead end west house line of Sixteenth street to west house line of Seventeenth street	6	446
Camac street, from south house line of Venango street, north	6	50
Carlisle street, from south house line of Rockland street, north	6	50
Cedar lane, from Locust avenue to Woodbine avenue	6	378
Cedar lane, (Nash) from southeast house line of Mechanic street, northwest	6	40
Centre street, from dead end northeast house line of Wilson street, northeast	6	380
Coulter street, from northeast house line of Wissahickon avenue to Morris street	6	1,177
Cherry street, from south house line of Erie avenue, north	6	21
Eleventh street, from south house line of Ontario street, north	6	25
Eleventh street, from south house line of Venango street, north	6	50
Emlen street, from Carpenter street, northwest	6	25
Engle street, from dead end 12 feet southeast of northwest house line of Price street to Centre street	6	318
Erie avenue, from east house line of Twelfth street, to dead end 19 feet west of northeast house line of Germantown avenue	12	912
Fifteenth street, from south house line of Rockland street, north	6	50
Frank street, from 31 feet southwest of northeast house line of Green street to 12 feet northeast of northeast house line of Lincoln avenue	6	1,157

Street Location.	Size in inches.	Distance in feet.
Service Mains—Continued.		
Goodman street, from 3 feet south of south house line of Ontario street, north	6	56
Green street, from Phil-Ellena street to Frank street	6	382
Heiskell street, from 39 feet southeast of northwest house line of Armat street to dead end southeast house line of Chelten avenue	6	744
Heiskell street, from southeast house line of Walnut lane, northwest	6	60
Henry street, from 25 feet southeast of northwest house line of Logan street to dead end southeast house line of Seymour street	6	491
Itschner street, from dead end 85 feet east of east house line of Twentieth street, west	6	100
Laurens street, from southeast house line of Coulter street, northwest	6	50
Lincoln avenue, from southwest house line of McCallum street to northwest house line of Carpenter street	6	1,156
Locust street, from dead end northeast house line of Bockius street to Sprague street	6	221
Logan street, from dead end southwest house line of Henry street, northeast	6	40
McCallum street, from southeast house line of Lincoln avenue, northwest	6	102
McCallum street, from southeast house line of Frank street, northwest	6	195
Mather street, from dead end north house line of Westmoreland street to Ontario street	6	525
Mechanic street, from southwest house line of Cedar street, northeast	6	50
Nice street, from 14 feet southeast of northwest house line of Barr street, northwest	6	484
Ontario street, from Eleventh to Twelfth street	6	492
Ontario street, from 160 feet east of east house line of Broad street, west	8	160
Park avenue, from south house line of Rising Sun lane, north	6	70
Physic street (northeast), from Hancock street, northeast	6	25
Price street, from dead end northeast house line of Willow avenue to northeast house line of Wilson street	6	515
Rising Sun lane, from northwest house line of Germantown avenue to Broad street	6	870
Rockland street, from 83 feet east of west house line of Broad street to west house line of Fifteenth street	6	530
Rubicam avenue, from Wister street to Jefferson street	6	348
Seventeenth street, ftom south house line of Butler street, north	6	50
Smedley street, from south house line of Westmoreland street, north	6	25
Sprague street, from southeast house line of Locust street, northwest	6	50

Street. Location.	Size in inches.	Distance in feet.
Service Mains—Continued.		
Thirteenth street, from south house line of Venango street, north	6	50
Thirteenth street, from south house line of Erie avenue, north	6	21
Tioga street, from Twelfth street to dead end northeast house line of Germantown avenue	6	395
Tulpehocken street, from southwest house line of Hancock street, northeast	6	50
Twelfth street, from south house line of Erie avenue, north	6	21
Twentieth street, from 354 feet southeast of southeast house line of Ruscomb street, northwest	6	204
Twenty-seventh street, from dead end 19 feet southeast of northwest house line of Hartwell avenue, northwest	6	19
Utah street, from Armat street to Heiskell street	6	451
Venango street, from west house line of Twelfth street to dead end 11 feet west of northeast house line of Germantown avenue	6	618
Wayne street, from northwest house line of Washington lane, northwest across bridge over Philadelphia and C. H. R. R	6	382
Westmoreland street, from dead end west house line of Smedley street to Seventeenth street	6	200
Wilson street, from southeast house line of Price street to Centre street	6	221
Wingohocking street, from 30 feet west of east house line of Broad street, west	6	87
Woodbine avenue, from Magnolia avenue to dead end 295 feet southwest of southwest house line of Chew street	6	1,434
Total	....	18,514
Service Supply Connections.		
Butler street, south side, 17 feet west of west house line of Sixteenth street	4	15
Butler street, north side, 17 feet west of west house line of Sixteenth street	4	15
Butler street, south side, 17 feet east of east house line of Seventeenth street	4	15
Butler street, north side, 17 feet east of east house line of Seventeenth street	4	15
Coulter street, northwest side, 378 feet northeast of northeast house line of Laurens street	4	17
Coulter street, southeast side, 339 feet northeast of northeast house line of Laurens street	4	17
Coulter street, southeast side, 14 feet southwest of southwest house line of Laurens street	4	17
Coulter street, northwest side, 14 feet southwest of southwest house line of Laurens street	4	17

Street. Location.	Size in inches.	Distance in feet.
Service Supply Connections.—Continued.		
Coulter street, southeast side, 12 feet northeast of northeast house line of Laurens street	4	17
Coulter street, northwest side, 12 feet northeast of northeast house line of Laurens street	4	17
Coulter street, southeast side, 16 feet northeast of northeast house line of Wissahickon avenue	4	17
Coulter street, northwest side, 16 feet northeast of northeast house line of Wissahickon avenue	4	17
Engle street northwest side, 55 feet northwest of northwest house line of Price street	4	12
Engle street, southwest side, 71 feet northwest of northwest house line of Price street	4	12
Engle street, southwest side, 53 feet southeast of southeast house line of Centre street	4	12
Engle street, northeast side, 53 feet southeast of southeast house line of Centre street	4	12
Hancock street, northeast side, 175 feet northwest of northwest house line of Pastorius street	4	17
Hancock street, southwest side, 236 feet southeast of southeast house line of Washington lane	4	17
Hancock street, north side, 12 feet southeast of southeast house line of Washington lane	4	17
Hancock street, south side, 12 feet southeast of southeast house line of Washington lane	4	17
Heiskell street, southwest side, 17 feet northwest of northwest house line of Armat street	4	10
Heiskell street, northeast side 103 feet northwest of northwest house line of Armat street	4	18
Heiskell street, southwest side 13 feet southeast of southeast house line of Utah street	4	10
Heiskell street, southwest side 15 feet northwest of northwest house line of Utah street	4	10
Heiskell street, southwest side 25 feet southeast of southeast house line of Chelten avenue	4	10
Heiskell street, northeast side 25 feet southeast of southeast house line of Chelten avenue	4	10
Henry street, southwest side 65 feet northwest of northwest house line of Logan street	4	15
Henry street, northeast side 65 feet northwest of northwest house line of Logan street	4	15
Henry street, southwest side, 13 feet southeast of southeast house line of Seymour street	4	15
Henry street, northeast side, 13 feet southeast of southeast house line of Seymour street	4	12
Mechanic street, northwest side, 14 feet southwest of southwest house line of Morton street	4	14
Mechanic street, northwest side, 265 feet northeast of northeast house line of Carswell street	4	8
Morris street, southwest side, 408 feet southeast of southeast house line of Hansberry street	4	17

Street. Location.	Size in inches.	Distance in feet.
Service Supply Connections—Continued.		
Morris street, southwest side, 12 feet southeast of southeast house line of Hansberry street	4	17
Ontario street, north side, 33 feet west of west house line of Goodman street	4	15
Ontario street, south side 33 feet west of west house line of Goodman street	4	15
Ontario street, south side, 16 feet east of east house line of Twelfth street	4	15
Ontario street north side, 68 feet east of east house line of Twelfth street	4	15
Rubicam avenue, southwest side, 12 feet northwest of northwest house line of Wistar street	4	13
Rubicam avenue, northeast side, 12 feet northwest of northwest house line of Wistar street	4	17
Rubicam avenue, southwest side, 12 feet southeast of southeast house line of Jefferson street	4	13
Rubicam avenue, northeast side, 12 feet southeast of southeast house line of Jefferson street	4	17
Tioga street, south side, 27 feet east of northeast house line of Germantown avenue	4	15
Tioga street, north side, 27 feet east of northeast house line of Germantown avenue	4	15
Tioga street, south side, 36 feet west of west house line of Twelfth street	4	15
Tioga street, north side, 36 feet west of west house line of Twelfth street	4	15
Venango street, south side, 12 feet west of west house line of Eleventh street	4	16
Venango street, south side, 12 feet east of east house line of Twelfth street	4	16
Venango street, south side, 15 feet west of west house line of Twelfth street	4	15
Venango street, north side, 15 feet west of west house line of Twelfth street	4	15
Venango street, south side, 15 feet east of east house line of Camac street	4	15
Venango street, north side, 15 feet east of east house line of Camac street	4	15
Venango street, south side, 18 feet west of west house line of Camac street	4	15
Venango street, north side, 18 feet west of west house line of Camac street	4	15
Venango street, south side, 15 feet east of east house line of Thirteenth street	4	15
Venango street, north side, 15 feet east of east house line of Thirteenth street	4	15
Venango street, south side, 21 feet west of west house line of Thirteenth street	4	13
Venango street, north side, 21 feet west of west house line of Thirteenth street	4	18

Street. Location.	Size in inches.	Distance in feet.
Service Supply Connections—Continued.		
Venango street, south side, 17 feet east of northeast house line of Germantown avenue	4	16
Venango street, north side, 17 feet east of northeast house line of Germantown avenue	4	18
Walnut lane, northwest side, 39 feet southwest of southwest house line of Chew street	4	19
Walnut lane, southeast side, 39 feet southwest of southwest house line of Chew street	4	19
Walnut lane, southeast side, 12 feet southwest of southwest house line of Heiskell street	4	19
Walnut lane, northwest side, 12 feet southwest of southwest house line of Heiskell street	4	19
Walnut lane, southeast side, 12 feet northeast of northeast house line of Heiskell street	4	19
Walnut lane, northwest side, 12 feet northeast of northeast house line of Heiskell street	4	19
Walnut lane, southeast side, 12 feet northeast of northeast house line of Musgrove street	4	19
Walnut lane, northwest side, 97 feet northeast of northeast house line of Musgrove street	4	19
Woodbine avenue, southeast side, 24 feet southwest of southwest house line of Chew street	4	13
Woodbine avenue, northwest side, 402 feet southwest of southwest house line of Chew street	4	17
Woodbine avenue, southeast side, 16 feet northeast of northeast house line of Cedar lane	4	13
Woodbine avenue, northwest side, 16 feet northeast of northeast house line of Cedar lane	4	17
Woodbine avenue, southeast side, 15 feet southwest of southwest house line of Cedar lane	4	15
Woodbine avenue, northwest side, 15 feet northwest of northwest house line of Cedar lane	4	15
Woodbine avenue, southeast side, 15 feet northeast of northeast house line of Magnolia street	4	15
Woodbine avenue, southwest side, 15 feet northeast of northeast house line of Magnolia street	4	15
Total	....	1,144
Fire hydrant connections,	6	1,080
Fire Connections (Private).		
Berkley street, southeast side, 130 feet southwest of southwest house line of Green street, for McCallum and McCallum	6	15

Street. Location.	Size in inches.	Distance in feet.
Fire Connections (Private)—Continued.		
Ruffner street, northwest side, northeast house line of Logan street, for David S. Cresswell	4	16
Pulaski avenue, southwest side, 172 feet northwest of southeast house line of Roberts avenue, for Philadelphia and Reading Railroad Company	4	60
Total	....	91
Trolley Sprinkling Connections (Private),		
Twelfth street, west side, 149 feet south of south house line of Ontario street, for People's Traction Company	6	19
Twelfth street, 187 feet southeast of southeast house line of Olney road, for People's Traction Company	6	9
Total	....	28
Pipe Relaid.		
Mechanic street, from Carswell to Morton	6	769
Pulaski avenue, from southeaft house line of Roberts avenue, northwest; street since abandoned	12	375
Total	....	1,144
Repairs, general	4	35
Repairs, general	6	369
Repairs, general	8	4
Repairs, general	10	5
Repairs, general	12	107
Repairs general	20	6
Repairs, general	30	44
Total		570
Pipe taken up.		
Pulaski avenue, from southeast house line of Roberts avenue, northwest	12	316
Fire hydrant connections taken up	4	17

Street. Location.	Size in inches.	Distance in feet.
Pipe lowered.		
Evergreen street, from 367 feet northeast of northeast house line of Twenty-fifth street	6	84
McCallum street, from 427 feet northwest of northwest house line of Franklin street, northwest	6	73
Winona street, from 288 feet southwest of southwest house line of Morris street	6	112
Total	....	269
Pipe raised.		
Broad street, from 386 feet north of north house line of Cayuga street	12	738
Musgrove street, from southeast house line of Upsal street, northwest	6	66
Upsal street, from 294 feet southwest of southwest house line of Musgrove street, northeast	6	566
Upsal street, southeast side, 12 feet southwest of southwest house line of Musgrove street	4	20
Upsal street, northwest side, 12 feet southwest of southwest house line of Musgrove street	4	20
Upsal street, southeast side, 12 feet northeast of northeast house line of Musgrove street	4	20
Upsal street, northwest side, 12 feet northeast of northeast house line of Musgrove street	4	20
Total	....	1,450
Pipe cut off and abandoned.		
Mechanic street, from Carswell street to Morton street	4	769
Fire hydrants connections cut off and abandoned	4	123
Fire hydrant connections cut off and abandoned	6	137
Total	....	260

Recapitulation of Sixth District.

Purposes for which used.	Sizes in inches. 4	6	8	10	12	20	30	Total in feet and pounds.
New pipe or feet added.								
Service mains		17,412	160		912			18,514
Service supply connections	1,144							1,144
Fire hydrant connections		1,080						1,080
Fire connections (private)	76	15						91
Trolley sprinkling connections		28						28
Total — Feet	1,220	18,565	160		912			20,857
Total — Pounds	23,180	612,645	6,720		65,664			708,209
Pipe used but adding nothing to feet in the ground.								
Repairs, general		769			375			1,144
Pipe relaid	35	369	4	5	107	6	44	570
Pipe taken up	17				316			333
Pipe lowered		269						269
Pipe raised	80	632			738			1,450
Total — Feet	132	2,039	4	5	1,536	6	44	3,766
Total — Pounds	2,508	67,287	168	275	110,592	954	14,608	196,392
Total handled — Feet	1,352	20,604	164	5	2,448	6	44	24,623
Total handled — Pounds	25,688	679,932	6,888	275	176,256	954	14,608	904,601
Pipe cut off and abandoned	892	137						1,029

Recapitulation of Work on Water Pipes.

Purposes for which used.	Size in Inches. 2	3	4	6	8	10	12	16	18	20	30	36	48	Total in feet and pounds.
New pipe or feet added.														
Service mains	...	...	42	148,820	9,400	3,919	15,260	56	...	37	...	...	...	169,534
Supply mains	...	...	...	...	...	...	86	...	...	117	...	...	8,819	9,022
Pumping mains	...	...	...	125	...	...	109	...	...	153	32	107	4,266	4,792
Service main connections	...	...	...	34	...	...	...	...	...	...	...	...	...	34
Supply main connections	...	...	...	...	...	12	14	...	...	64	11	...	44	145
Pumping main connections	...	...	...	...	...	...	...	...	...	34	53	75	23	185
Bye-pass connections	...	...	...	...	...	...	11	...	...	...	45	...	...	56
Meter inspection connections	...	...	...	137	...	...	...	...	...	...	...	...	...	137
Service supply connections	...	...	7,547	29	...	...	...	...	...	...	...	...	...	7,576
Fire hydrant connections	...	...	...	11,748	63	...	...	...	...	...	...	...	...	11,811
Fire connections (private)	...	...	200	116	...	...	...	...	...	...	...	...	...	316
Supply connection (private)	...	117	2,016	225	...	...	...	...	...	...	...	...	...	2,358
Trolley sprinkling connect'ns.	...	...	...	28	...	...	...	...	...	...	...	...	...	28
Drains	59	...	...	1,922	391	...	216	335	...	...	308	...	...	3,301
Total { Feet	59	117	9,875	155,181	9,854	3,931	15.696	391	...	405	449	182	13,152	209,295
Total { Pounds	590	1,755	187,625	5,121,072	418,868	216,205	1,130,112	43,010	...	64,395	149,068	76,804	7,693,920	15,093,424
Pipe used but adding nothing to feet in ground.														
Pipe relaid	...	...	...	21,661	...	1,903	435	...	...	...	...	61	...	31,063
Repairs general	...	2	252	6,961	208	574	412	...	6	51	223	...	17	8,706
Pipe taken up	...	2,177	18,689	1,573	...	1,141	316	5	...	...	...	58	...	23,959
Pipe lowered	...	...	...	3,326	...	...	...	...	...	30	392	90	...	3,838
Pipe raised	...	...	80	2,747	...	...	738	...	...	...	58	110	...	3,733
Pipe shifted	...	...	...	...	...	...	...	...	...	...	...	...	208	208
Total { Feet	...	2,179	19,021	43,271	208	3,618	1,901	5	6	81	673	319	225	71,507
Total { Pounds	...	32,685	361,899	1,427,943	8,736	198,990	136,872	550	840	12,879	223,436	134,618	131,625	2,670,578
Total handled { Feet	59	2,296	28,896	198,455	10,062	7,549	17,597	396	6	486	1,122	501	13,377	280,802
Total handled { Pounds	590	34,440	549,024	6,549,015	422,604	415,195	1,266,984	43,560	840	77,274	372,504	211,422	7,825,545	17,768,997
Pipe cut off and abandoned	...	1,737	7,370	859	...	...	125	...	...	...	...	...	...	10,091

Recapitulation by Districts.

District.		2	3	4	6	8	10	12	16	18	20	30	36	48	Feet.	Pounds.
		Size in Inches.														
New pipe or feet added.	First	....	11	832	29,359	288	1,538	450	....	....	....	....	....	....	32,478	1,113,906
	Second	....	12	1,840	38,342	7,270	2,331	4,755	....	....	251	77	107	....	54,985	2,186,958
	Third	....	40	3,000	42,879	155	50	6,160	56	....	154	....	....	....	52,494	1,956,033
	Fourth	....	54	2,935	21,759	1,981	....	1,013	335	....	....	11	75	2,336	30,498	2,[illegible]69,139
	Fifth	59	....	48	4,281	....	12	2,406	....	....	....	361	....	10,816	17 983	6,763,879
	Sixth	....	....	1,220	18,565	160	....	912	....	....	....	....	....	....	20,857	708,209
	Total { Feet	59	117	9,875	155,184	9,851	3,931	15,696	391	....	405	449	182	13,152	209,295	15,098,424
	Total { Pounds	590	1,755	187,625	5,121,072	413,868	216,205	1,130,112	43,010	....	64,395	149,068	76,804	7,693,920		
Pipe used but adding nothing to feet in ground.	First	....	10	6,415	7,745	....	63	8	....	....	9	....	....	....	14,250	383,092
	Second	....	2,154	1,643	8,343	168	858	159	5	....	30	210	200	....	13,770	563,980
	Third	....	15	8,100	20,680	14	2,603	133	....	6	....	268	....	....	31,819	1,079,710
	Fourth	....	....	2,726	3,988	22	64	31	....	....	....	100	119	208	7,258	395,172
	Fifth	....	....	5	476	....	25	34	....	....	36	51	....	17	644	52,227
	Sixth	....	....	132	2,039	4	5	1,536	....	....	6	44	....	....	3,766	196,392
	Total { Feet	....	2,179	19,021	43,271	208	3,618	1,901	5	6	81	673	319	225	71,507	2,670,513
	Total { Pounds	....	32,685	361,399	1,427,943	8,736	198,990	136,872	550	840	12,879	223,436	134,618	131,625		
Total handled { Feet		59	2,296	28,896	198,455	10,062	7,549	17,597	396	6	486	1,122	501	13,377	280,802	17,768,997
Total handled { Pounds		590	34,440	549,024	6,549,015	422,604	415,195	1,266,984	43,560	840	77,274	372,504	211,422	7,825,545		
Pipe cut off and abandoned		....	1,737	7,370	859	....	....	125	....	....	....	....	....	....	....	10,091

Recapitulation of Fire Hydrants Set, Renewed and Removed.

	Districts.	Style. O. S.	No. 1.	No. 2.	No. 3.	No. 5.	Total.
Set.	First	....	95	1	....	....	96
	Second	....	259	4	5	....	268
	Third	....	343	2	....	....	345
	Fourth	....	97	6	....	....	103
	Fifth	....	11	1	....	....	12
	Sixth	....	77	1	....	....	78
	Total	....	882	15	5	....	902
Renewed.	First	....	20	....	....	....	20
	Second	2	126	8	....	....	136
	Third	....	118	6	....	....	124
	Fourth	....	8	1	....	....	9
	Fifth	2	56	....	....	....	58
	Sixth	....	35	1	....	....	36
	Total	4	363	16	....	....	383
	Total new hydrants	....	....	....	....	....	1,285
Removed.	First	9	1	1	1	....	12
	Second	68	4	15	22	2	111
	Third	104	1	2	20	....	127
	Fourth	22	4	3	7	....	36
	Fifth	....	....	1	....	....	1
	Sixth	12	5	2	2	....	21
	Total	215	15	24	52	2	308
	Total added during 1895	....	....	....	....	....	594

Fire Hydrants by Wards.

Wards.	Style.						Total.
	O. S.	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	
First	75	231	157	18	....	....	481
Second	17	94	86	16	....	....	213
Third	14	59	41	7	....	....	121
Fourth	8	58	32	14	....	....	112
Fifth	30	78	55	12	....	1	176
Sixth	11	62	45	18	....	....	136
Seventh	16	85	82	12	....	1	196
Eighth	23	78	101	6	....	1	209
Ninth	....	107	65	9	....	3	184
Tenth	2	72	66	3	....	5	148
Eleventh	21	39	32	1	....	....	93
Twelfth	11	43	30	8	....	....	92
Thirteenth	36	41	55	11	....	....	143
Fourteenth	....	67	83	....	....	....	150
Fifteenth	21	155	172	12	1	2	363
Sixteenth	8	49	39	6	1	....	103
Seventeenth	23	60	31	2	....	....	116
Eighteenth	53	76	65	11	....	....	205
Nineteenth	61	187	120	13	....	....	381
Twentieth	40	99	122	2	....	....	263
Twenty-first	149	120	91	7	....	....	367
Twenty-second	204	417	234	68	....	....	923
Twenty-third	42	210	94	9	....	....	355
Twenty-fourth	106	154	126	21	....	....	407
Twenty-fifth	82	243	138	4	....	....	467
Twenty-sixth	23	146	120	16	....	....	305
Twenty-seventh	94	237	131	16	....	1	479
Twenty-eighth	46	205	218	41	....	....	510
Twenty-ninth	43	135	165	20	....	1	364
Thirtieth	22	85	111	6	....	....	224
Thirty-first	23	122	71	14	....	....	230
Thirty-second	20	90	87	12	....	1	210
Thirty-third	54	225	185	27	1	....	492
Thirty-fourth	53	187	74	23	....	1	338
Thirty-fifth	....	41	8	1	....	....	50
Thirty-sixth	38	122	97	31	....	....	288
Thirty-seventh	11	61	65	7	....	....	144
Total	1,480	4,540	3,494	504	3	17	10,038

Statement of the number of Fire Hydrants by Districts and Wards during 1895 and total previous thereto.

	First District. Wards. 1	2	26	30	36	Total.	Second District. Wards. 5	6	7	8	9	10	11	13	24	27	34	Total.
Prior to 1895	...	...	...	...	...	1,701	...	...	...	...	...	...	...	...	...	...	...	2,083
During 1895	36	3	24	2	31	96	4	31	4	14	41	6	1	2	35	74	53	268
Total	..	..	...	...	...	1,797	...	...	...	...	...	...	...	...	...	...	...	2,351
Taken out 1895	8	2	1	1	...	12	3	26	...	2	16	6	1	2	23	19	13	111
Total in City	...	...	...	...	...	1,785	...	...	...	...	...	...	...	...	...	...	...	2,240

	Third District. Wards. 11	12	16	17	18	19	20	23	25	31	33	35	Total.	Fourth District. Wards. ...	13	14	15	20	28	29	32	37	Total.
Prior to 1895	...	...	...	...	...	...	...	...	...	...	...	...	2,275	...	...	...	...	...	...	...	...	...	1,819
During 1895	4	4	6	4	10	44	...	84	89	43	42	15	345	...	4	1	13	15	32	10	17	11	103
Total	...	...	...	...	...	...	...	...	...	...	...	...	2,620	...	...	...	...	...	...	...	...	...	1,922
Taken out 1895	...	2	3	1	7	24	...	27	32	24	7	...	127	...	3	...	5	13	4	4	7	...	36
Total in City	...	...	...	...	...	...	...	...	...	...	...	...	2,493	...	...	...	...	...	...	...	...	—	1,886

	Fifth District. Wds. 21	28	Total.	Sixth District. Wards. 22	28	33	37	Total.	Total.
Prior to 1895	...	...	419	...	...	...	...	1,147	9,414
During 1895	7	5	12	56	9	10	3	78	902
Total	...	...	431	...	...	...	...	1,225	10,346
Taken out 1895	1	...	1	18	3	...	...	21	308
Total in City	...	...	430	...	...	...	...	1,204	10,038

Number of Attachments for Fire purposes previously reported			429
Made during 1895	First District		1
	Second District		6
	Third District		...
	Fourth District		6
	Fifth District		1
	Sixth District		2
	Total		445

Attachments, etc., made by the Purveyors in accordance with Permits issued by the Bureau of Water. Arranged by Months.

Months.	NEW ATTACHMENTS. Size. ½ inch.	⅝ inch.	¾ inch.	1 inch.	1½ inch.	2 inch.	3 inch.	4 inch.	6 inch.	Total.	SHUT OFF BY PERMIT. Reamed for larger attachments.	Re-drive.	Discontinued.	Transfer.	Repairs. Not drawn.	Repairs. Drawn and re-driven.	Totals.	WORK DONE WITHOUT PERMIT. Drawn. Discontinued and abandoned.	Drawn. Duplicate.	Drawn. Delinquent.	Drawn. Leak.	Drawn. Total.	Drawn & re-driven.
January	123	3	1	5	......	3	......	......	......	135	2	22	4	.....	6	14	48	2	......	......	34	36	5
February	24	1	1	....	......	......	......	1	......	27	1	12	1	......	4	13	31	1	......	......	21	22	3
March	630	13	22	8	4	2	2	5	......	686	....	31	47	3	9	83	173	11	......	......	78	89	111
April	811	61	13	12	2	2	3	3	1	908	5	18	30	8	3	17	81	2	......	1	53	56	145
May	851	47	16	17	5	13	1	4	1	955	7	35	9	1	2	22	76	21	......	......	39	60	101
June	1,060	44	20	14	6	6	1	......	......	1,151	12	20	31	......	3	27	93	8	......	......	33	41	159
July	1,132	40	14	18	1	6	2	......	......	1,213	3	20	26	1	10	19	79	3	2	1	22	28	40
August	751	38	20	13	2	3	......	......	......	827	8	80	31	2	10	24	155	4	......	3	39	46	77
September	1,062	39	10	16	2	12	......	1	......	1,142	15	27	24	......	......	35	101	18	......	1	31	50	115
October	1,046	105	11	6	6	4	......	......	......	1,178	17	31	31	3	2	57	141	4	......	2	60	66	139
November	1,416	96	18	19	8	9	1	3	......	1,570	12	31	51	......	17	37	148	23	......	......	35	58	22
December	558	10	41	5	1	3	......	......	......	618	1	13	43	......	11	24	92	14	20	4	48	86	27
Totals	9,464	497	187	133	37	63	10	17	2	10,410	83	340	328	18	77	372	1,218	111	22	12	493	638	944

Attachments, etc., made by the Purveyors in accordance with Permits issued by the Bureau of Water. Arranged by Districts.

Districts.	NEW ATTACHMENTS.										SHUT OFF BY PERMIT.							WORK DONE WITHOUT PERMIT.					
	Size.														Repairs.			Drawn.					
	½ inch.	⅝ inch.	¾ inch.	1 inch.	1½ inches.	2 inches.	3 inches.	4 inches.	6 inches.	Total.	Reamed for larger attachments.	Redriven.	Discontinued.	Transfer.	Not drawn.	Drawn and re-driven.	Totals.	Discontinued and abandoned.	Duplicate.	Delinquent.	Leak.	Total.	Drawn and re-driven.
First	2,600	39	21	16	3	6	3	1	1	2,690	....	52	54	.....	2	63	171	7	.....	1	73	81	
Second	1,542	226	94	40	7	18	.....	2	.....	1,929	41	58	166	3	3	105	376	17	20	3	83	123	327
Third	2,095	28	31	41	18	24	3	13	.....	2,258	....	120	75	10	41	96	342	68	.....	2	236	306	489
Fourth	2,025	155	27	22	4	9	4	1	1	2,248	38	81	12	1	25	51	208	16	2	6	100	124	62
Fifth	202	5	....	....	2	3	.....	.....	.....	212	2	....	9	4	3	36	54	....	.....	.....	1	1	35
Sixth	1,000	44	14	14	3	3	.....	.....	.....	1,078	2	29	12	.....	3	21	67	3	.....	.....	....	3	81
Total	9,464	497	187	133	37	63	10	17	2	10,410	83	340	328	18	77	372	1,218	111	22	12	493	638	944

PERMITS ISSUED DURING THE YEAR 1895.

Aquaria	2
Bakeries	45
Barber shops	100
Bars	64
Brick-yards	3
Basins and sinks in dwellings	3,028
Basins and sinks in offices and stores	575
Baths in dwellings	7,068
Baths in hotels, etc	55
Baths, shower	4
Bidets	4
Boats, etc., supply of	142
Bottling establishments	23
Building purposes	688
Carriages and wagons	350
Cellar drainers	4
Dwellings, half	6
Drug stores	29
Dye houses	7
Factories	4
Ferrules, number	10,895
Filters	2
Fire hydrants, for use of	163
Fish troughs and stands	10
Forges	26
Fountains, counter	29
Fountains, garden	8
Green houses	26
Grindstones	2
Hatter's planks	2
Heating boilers	31
Hydrants in new buildings	7,141
Hydraulic elevators	22
Ice cream saloons	4
Ice machines	1
Lawn sprinklers	6
Laundries	40
Laboratories	1
Machines, scouring, rinsing, etc	27
Milk houses	31
Motors, beer	63
Motors, organ	10
Photograph galleries	3

Pools in churches	2
Restaurants and eating saloons	33
Screw nozzles	21
Slaughter houses	6
Stables	151
Stalls in stables	1,063
Steam boilers, number	128
Steam boilers, horse power	4,526
Steam engines, number	39
Steam engines, horse power	380
Street sprinklers	238
Tubs, vats and tanks	44
Urinals in dwellings	2
Urinals in stores, offices, etc	103
Urinal troughs	59
Wash paves	3,590
Wash paves for watering horses	45
Wash tubs, stationary	1,291
Water-closets in dwellings	13,504
Water-closets in stores, etc	590

PREMISES SUPPLIED AND APPLIANCES IN USE.

January 1, 1896.

Aquaria	6
Arsenals	2
Asylums	8
Bakeries	1,373
Barber shops	1,306
Bars	1,605
Basins and sinks in dwellings	49,740
Basins and sinks in offices and stores	24,757
Baths in dwellings	137,027
Baths, public	1,092
Baths, shower	134
Baths, foot	101
Beam houses and tanneries	18
Bidets	440
Bottling establishments	599
Brick-yards	23
Brick-yards, gangs of men	96
Breweries	88
Barrels brewed	1,446,284

Cars, steam and horse	1,189
Carriages and wagons	8,291
Cellar drainers	12
Cemeteries	26
Churches	488
Coal-yards	251
Coloring rooms	152
Condensers	14
Depots and railroad stations	111
Dwellings with water	205,213
Dwellings without water	3 097
Dwellings half without water	9,482
Dyers	683
Drug stores	273
Dye houses	628
Engines on railroads	269
Factories, foundries and mills	1,596
Filters	12
Fire stations	42
Fountains, counter	452
Fountains, garden	30
Forges	1,122
Furnaces	23
Gas-works and holders	6
Glass-works	14
Greenhouses	866
Grindstones	138
Halls and club-houses	201
Hatters' planks, per set	16
Hydrants	216,862
Hospitals	40
Hotels	46
Hydraulic elevators	215
Ice cream saloons	278
Institutions, charitable	68
Ice machines	135
Laundries	576
Lawn sprinklers	262
Laboratories	38
Machines for washing, scouring, etc	2,503
Marble-yards	81
Malt houses	17
Market houses	70
Milk houses	388
Mint	1

Motors, beer	1,530
Motors, organ	150
Photograph galleries	121
Photograph galleries, operators	67
Police stations and patrols	39
Polishing wheels	19
Pools, swimming	17
Pools in churches	65
Printing establishments	158
Prisons	2
Rectifying establishments	9
Restaurants and oyster saloons	938
Screw nozzles	4,536
Shot towers	1
Slaughter houses	463
Soap boiling establishments	19
Stand pipes for watering engines	26
Stables	7,196
Stalls in stables	47,244
Stalls in market	6,900
Stalls, fish, and troughs	79
Steam boilers, number	2,888
Steam boilers, horse power	96,827
Steam boilers, heating, number	714
Steam boilers, heating, horse power	4,574
Steam engines, number	1,803
Steam engines, horse power	32,247
Steam saws	58
Steam presses and hammers	48
Shops and stores with water	4,726
Shops without water	1,092
School houses	290
Theatres	18
Tubs, vats and tanks	1,770
Turbine wheels	26
Urinals in dwellings	171
Urinals in stores, offices, etc	3,979
Urinal troughs	414
Vinegar establishments	8
Wash-paves	77,552
Wash-paves for watering horses	526
Wash tubs, stationary	17,292
Water closets in dwellings	131,407
Water closets in stores, etc	23,792
Wool washers	79

Service Attachments Laid to the Curb (on Streets to be Paved or Repaved) by the Bureau of Water.

DISTRICTS.	SIZE. ½-inch.	SIZE. ¾-inch.	SIZE. 1-inch.	TOTAL.
First	404	....	....	404
Second	212	....	1	213
Third	1,786	1	5	1,792
Fourth	111	....	....	111
Fifth	49	....	....	49
Sixth	165	....	....	165
Totals	2,727	1	6	2,734

Account of New Stops and Check Valves for 1895.

Districts.	Bureau of Water.		Viney.			Smith's Patent.	Ely's Patent	Check Valves	Total.
	2-Way.	Butterfly.	2-Way.	3-Way.	4-Way.				
First	167	....	....	....	....	....	....	....	167
Second	338	2	....	1	11	1	....	....	353
Third	381	....	....	2	8	5	1	....	397
Fourth	120	2	....	29	12	....	....	1	164
Fifth	35	5	....	....	....	....	....	4	44
Sixth	90	....	....	....	1	....	....	....	91
Total	1,131	9	....	32	32	6	1	5	1,216

Repairs to Mains, Stops and Fire Hydrants; also Stops and Fire Hydrants Removed during 1895.

Districts.	Repairs to Mains.	Stops.			Fire Hydrants.		
		Repaired.	Renewed.	Removed.	Repaired.	Renewed.	Removed.
First	56	224	23	1	173	20	12
Second	273	132	33	8	187	136	111
Third	251	377	310	15	294	124	127
Fourth	207	522	5	14	1,343	9	33
Fifth	31	11	11	2	39	58	1
Sixth	75	6	20	1	5	36	21
Total	893	1,272	402	41	2,041	383	305

Location of Check Valves.

Street.	Location.	Ward.	Size.
Spring Garden Pumping Station	West front of new engine house, 66 ft. north of northeast forebay	29	48
Midvale avenue	100 ft. northeast of Phila. and Reading R. R.	28	48
Midvale avenue	114 ft. northeast of Phila. and Reading R. R.	28	48
Thirty-third	Intersection of Bowman street, on 48-inch connection to overflow of Queen Lane Reservoir (2 valves)	28	48

Total Number of Stop Valves in the City—Arranged by Districts.

Pattern.	Size.	Outlets.	Districts. 1st.	2d.	3rd.	4th.	5th.	6th.	Total.
Single Gate, Bureau of Water.	3	2 Way.	1	211	....	7	1	10	230
	4	"	111	213	244	165	35	103	871
	6	"	3,220	3,252	3,331	2,945	496	1,612	14,856
	8	"	108	262	30	62	7	31	500
	10	"	119	230	192	235	25	120	921
	12	"	62	315	144	106	37	113	777
	16	"	30	37	22	21	....	38	148
	18	"	....	....	5	....	....	1	6
	20	"	24	40	13	45	9	13	144
	30	"	8	9	21	38	10	3	89
	36	"	3	4	8	11	6	....	32
	48	"	....	....	3	10	....	....	13
	Totals..........		3,686	4,573	4,013	3,645	626	2,044	18,587
Butterfly, Bureau of Water.	20	2 Way.	....	3	....	5	2	2	12
	30	"	2	1	1	6	8	1	19
	36	"	....	....	....	16	1	....	17
	48	"	....	....	1	21	12	....	34
	Totals..........		2	4	2	48	23	3	82
Barton.	6	3 Way.	....	1	....	....	....	....	1
	6	4 Way.	3	2	1	12	....	....	18
	8	4 Way.	....	....	....	5	....	....	5
	6	5 Way.	12	25	....	....	....	....	37
	6	6 Way.	....	5	....	....	....	....	5
	Totals..........		15	33	1	17	....	....	66

Total Number of Stop Valves, etc.—Continued.

Pattern.	Size	Outlets.	Districts. 1st.	2d.	3rd.	4th.	5th.	6th.	Total.
Viney.	6	2 Way.	8	....	4	3	....	....	15
	6	2 Way.	42	66	34	198	6	11	357
	10	3 Way.	....	2	....	3	....	....	5
	12	3 Way.	....	1	....	3	....	....	4
	6	4 Way.	12	28	13	87	....	2	142
	6	5 Way.	26	10	2	31	....	....	69
	Total.........		88	107	53	325	6	13	592
Smith Patent.	6	2 Way.	....	1	6	....	....	....	7
Total number of Stops...............			3,791	4,718	4,075	4,035	655	2,060	19,334
Check Valves.	30		....	....	1	....	2	2	5
Bureau of Water.	48		....	....	4	4	4	....	12
	Totals.........		....	....	5	4	6	2	17

Number of Valves raised in the several Districts during the year 1895, also in each year since 1873.

District.	4-way Barton.	5-way Barton.	6-inch Barton.	8-inch Barton.	3-way Viney.	4-way Viney.	5-way Viney.	6-inch Viney.	3-inch.	4-inch.	6-inch.	8-inch.	10-inch.	12-inch.	16-inch.	20-inch.	30-inch.	36-inch.	Total.
First......	......	......	......	......	......	......	......	4	......	......	......	......	......	......	......	......	......	......	4
Second......	......	9	2	......	1	1	......	......	1	1	8	......	......	......	......	2	1	......	26
Third......	1	......	......	......	......	......	1	......	......	1	16	......	4	......	......	......	......	......	23
Fourth......	......	1	......	1	1	1	1	......	......	......	14	......	1	......	......	......	3	......	23
Total for 1895......	1	10	2	1	2	2	2	4	1	2	38	......	5	......	......	2	4	......	76
" 1894......	......	4	......	......	......	......	1	......	2	2	10	......	......	1	1	1	......	......	22
" 1893......	......	......	......	......	......	......	......	1	5	8	17	......	......	1	2	1	......	......	35
" 1892......	......	......	6	......	......	......	......	1	3	7	32	......	3	1	2	......	......	......	55
" 1891......	......	......	2	2	......	......	......	1	6	10	37	......	3	1	......	1	2	......	65
" 1890......	......	......	8	3	......	......	......	......	3	23	68	......	7	1	1	......	......	......	114
" 1889......	......	......	15	......	......	......	......	2	4	23	73	......	4	1	1	......	1	......	124
" 1888......	......	......	6	......	......	......	......	......	8	26	74	......	10	1	2	......	1	......	128
" 1887......	......	......	11	......	......	......	......	......	11	16	61	......	10	3	4	2	1	1	120
" 1886......	......	......	12	......	......	......	......	......	13	18	57	1	3	......	......	......	1	......	105
" 1885......	......	......	......	......	......	......	......	......	11	24	97	1	9	......	2	......	1	......	145
" 1884......	......	......	......	......	......	......	......	......	7	13	71	1	4	2	1	3	6	1	109
" 1883......	......	......	......	......	......	......	......	......	4	27	88	......	8	......	1	......	1	1	130
" 1882......	......	......	......	1	......	......	......	......	14	25	58	1	5	1	......	......	1	......	106
" 1881......	......	......	......	......	......	......	......	......	15	44	90	......	5	7	......	......	......	......	161
" 1880......	......	......	......	......	......	......	......	......	7	23	47	......	8	1	......	......	1	......	87
" 1879......	......	......	......	......	......	......	......	......	9	16	60	1	3	2	......	......	1	1	93
" 1878......	......	......	......	......	......	......	......	......	27	22	100	......	3	1	......	1	1	......	155
" 1877......	......	......	......	......	......	......	......	......	12	60	50	......	1	......	......	1	......	......	70
" 1876......	......	......	......	......	......	......	......	......	3	17	49	......	3	......	......	1	......	......	73
" 1875......	......	......	......	......	......	......	......	......	17	55	120	4	12	2	4	1	2	......	217
" 1874......	......	......	......	......	......	......	......	......	13	32	111	6	......	3	3	......	......	......	174
Total for 22 years...	1	14	62	7	2	2	3	9	195	439	1,408	15	112	29	24	14	24	4	2,364

Number of Complaints and Examinations during 1894 and 1895.

Months.	Hydrants.		Service Pipes.		Wash Paves.		Spigots.		Water Closets.		Horse Troughs.		No. Leaks.		Total.	
	1894	1895	1894	1895	1894	1895	1894	1895	1894	1895	1894	1895	1894	1895	1894	1895
January........	106	135	74	120	6	13	5	3	2	9	2	2	10	16	205	298
February......	48	224	73	208	4	29	2	7	4	17	1	5	8	30	140	520
March	71	115	76	157	3	8	3	1	6	8	....	3	6	10	165	302
April............	65	97	64	99	4	7	....	....	1	8	....	....	14	11	148	222
May	68	113	60	63	....	....	2	5	5	5	....	1	10	13	145	200
June............	67	95	93	69	3	2	5	4	10	5	....	1	24	6	202	182
July.............	99	126	85	78	3	6	7	3	3	12	1	1	16	18	214	244
August..........	71	66	61	69	2	1	3	2	8	5	2	....	22	11	169	154
September.....	87	94	45	71	1	3	1	2	3	6	3	3	10	11	150	190
October.........	96	91	83	63	2	4	3	6	9	1	2	....	14	5	209	170
November. ...	74	98	66	88	1	1	2	2	13	9	8	1	7	9	171	208
December......	86	136	79	111	2	6	2	4	17	14	4	1	20	10	210	282
Total......	938	1,390	859	1,196	31	80	35	39	81	99	23	18	161	150	2,128	2,972

New Meters Set.

Ward.	Occupant.	Location.	Business.	Date when Set.	Name of Meter.	SIZE. ½ inch.	¾ inch.	1 inch.	1½ inch.	2 inch.	3 inch.	4 inch.	6 inch.	Total.	Gallons Consumed.	Remarks.
1	Burt Bros	2000–12 South Ninth street	Furniture factory	Feb. 13	Gem							1		1	2,767,500	Charged by meter.
1	Burt Bros	2000–12 South Ninth street	Furniture factory	Feb. 14	Crown					1				1		
2	Jeffords, J. E	712–718 Enue street	Pottery	Aug. 16	Crown			1						1	352,477	Charged by meter.
2	Mitchell & Pierson	1012 Passyunk avenue	Morocco factory	July 31	Crown					1				1	432,750	Charged by meter.
2	Wyeth, J. & Bro	S.W. c. 11th & Wash'g'n av. & rear	Laboratory	Oct. 1	Crown						1			1	763,500	Charged by meter.
3	McCarthy, D	8 and 10 Mead street	Blacksmith shop	Oct. 31	Crown			1						1	No water used	Charged by meter.
3	Segal, A	727 Christian street	Ice factory	March 19	Crown							1		1	16,104,000	Charged by meter.
3	Segal, A	727 Christian street	Ice factory	May 7	Crown		2							2		
4	Chorkisky	240 Monroe street	Bath-house	Nov. 1	Crown					1				1	120,750	Charged by meter.
4	Quigley Estate	315 Monroe street	Bath-house	July 10	Gem					1				1	153,900	Charged by meter.
5	Edson Bros	263 S. Second st. & 110 Dock st.	Cold storage	Aug. 21	Crown				1					1	551,250	Charged by meter.
5	Pardee, A	237 South Third street	Offices	Oct. 29	Crown				1					1	16,875	Charged by meter.
5	Philadelphia Demokrat	612–14 Chestnut street	Newspaper office	Dec. 22	Crown					1				1	260,250	Charged by meter.
5	Wiler, William	233 South Fifth street	Miscellaneous	Nov. 29	Crown				1					1	57,000	Charged by meter.
6	Chorley, Henry F	304 Cherry street	Shoe factory	Oct. 23	Crown			1						1	20,250	Charged by meter.

New Meters Set.—Continued.

Ward.	Occupant.	Location.	Business.	Date when Set.	Name of Meter.	Size. ½-inch.	¾-inch.	1-inch.	1½-inch.	2-inch.	3-inch.	4-inch.	6-inch.	Total.	Gallons Consumed.	Remarks.
6	Philadelphia Bourse	S. E. c. 5th and Merchant sts	Office building	May 14	Gem								1	1	5,733,000	Charged by meter.
8	Continental Hotel	S. E. c. 9th and Chestnut sts	Hotel	Feb. 25	Gem						1			1	9,707,250	Charged by meter.
8	Frazier, W. W	S. E. c. 12th and Lawson sts	Offices	Aug. 14	Gem						1			1	827,250	Charged by meter.
8	Horticultural Hall	N. W. c. Broad and Lardner sts	Hall	Dec. 30	Crown						1			1	No water used.	Charged by meter.
8	Linnard, Emily	1318 Chestnut st	Bath house	Jan. 18	Crown				1					1	8,250	Charged by meter.
8	Wanamaker, John	818-20 Chestnut st	Clothing store	June 3	Crown		1		1					2	1,170,000	Charged by meter.
9	Allen, Edmund, Trustee	1211-13 Clover st. N. W. c. Leiper	Printing office	Aug. 27	Crown						1			1	708,000	Charged by meter.
9	Gendle, D	35 South 23d st	Stone yard	March 20	Crown			1						1	299,250	Charged by meter.
9	Harrison, A. C	1500 Market st., S. W. c. 15th	Offices	Sept. 6	Gem					1				1	349,500	Charged by meter.
9	P. & R. Terminal Co	Market st., N. E. c. 12th	Power house	Nov. 19	Gem							1		1	4,070,200	Charged by meter.
10	Marks Bros	801-11 Arch st., N. W. c. 8th	Store	July 11	Crown						1			1	1,596,000	Charged by meter.
10	Marks Bros	801-11 Arch st., N. W. c. 8th	Store	Dec 22	Crown					1				1		
11	Powdermaker & Bro	215 Callowhill st., c. St. John	Cold storage	Dec. 17	Gem					1				1	21,750	Charged by meter.
12	Power, M	326 North 3d st	Currier	Nov. 12	Crown					1				1	40,500	Charged by meter.
15	Clark, J. S	1631-33 North st	Soap works	Feb. 28	Crown					1				1	20,250	Charged by meter.

New Meters Set—Continued.

Wards.	Occupant.	Location.	Business.	Date when Set	Name of Meter.	Size.								Total.	Gallons Consumed.	Remarks.
						½-inch.	¾-inch.	1-inch.	1½-inch.	2-inch.	3-inch.	4-inch.	6-inch.			
15	Newton, C. C.	N. E. 24th and Vine streets	Machine Shop	July 23	Gem					1				1	224,250	Charged by meter.
19	Boidler & Fink	2305–13 Marshall street	Stables	Oct. 2	Crown				1					1	75,000	Charged by meter.
19	Church of St. Simeon	S. S. Lehigh ave., from 9th to Hutchinson	Church	May 7	Crown					1				1	364,500	Charged by meter.
19	Columbia Singing Soc'y	2007–09 North Second street	Music Hall	Sept. 19	Crown					1				1	1,507,500	Charged by meter.
19	Feile, F.	2200–16 Fairhill street and 2205–07 North Sixth street	Brewery	Dec. 12	Crown			1						1	No water used.	Charged by meter.
19	Finkenaur, T.	1715 North Fifth street	Brewery	Nov. 26	Crown						3			3	135,750	Charged by meter.
19	Gleason, C. F.	N. W. c. American street and Susquehanna avenue	Miscellaneous	June 7	Crown					1				1	1,158,000	Charged by meter.
19	Jefferson Ice Co.	N. W. cor. Cumberland and American streets	Ice Plant	Mar. 18	Crown		1							1	72,000	Charged by meter.
19	Loughridge	2309–13 North Seventh street	Terra Cotta Works	May 23	Crown		1							1	182,250	Charged by meter.
19	McMillan, Henry	S. W. c Montgomery avenue and Warder street	Box Factory	June 27	Crown					1				1	411,700	Charged by meter.
20	Bradley, L., & Co.	N. E. c. Ninth & Girard ave.	Meat Market	May 6	Crown				1		1			2	940,500	Charged by meter.
20	Prospect Brewing Co.	1600–04 N. Eleventh street, N. W. cor. Oxford	Brewery	April 24	Gem						1			1	162,000	Charged by meter.
21	Canton Mills Co.	N. E. c. High & Walnut sts.	Woolen Mill	Mar. 6	Gem						1			1	8,578,750	Charged by meter.
21	Dixon, Wm. F.	N. S. Leverington ave., 1st H. E. of Chestnut street	Shoddy Mill	July 15	Crown		1							1	24,750	Charged by meter.
21	Queen Lane Station	Queen lane	Pumping Station	Dec. 13	Crown	1								1	106,500	

New Meters Set—Continued

Ward.	Occupant.	Location.	Business.	Date when set.	Name of meter.	Size.								Total.	Gallons consumed.	Remarks.
						½-inch.	¾-inch.	1 inch.	1½-inch.	2 inch.	3 inch.	4 inch.	6 inch.			
21	Wilde, John & Bro	W.s. Cresson st., 2d h. N. Ridge av	Woolen Mill	March 27	Crown			1						1	120,750	Charged by meter.
22	Ballantine, J	Rear of 161 Ashmead st	Hosiery Mill	October 22	Crown		1							1	39,750	Charged by meter.
22	Collins, J	S. E. c. Wayne and Berkley st	Chemicals	March 27.	Crown			1						1	52,500	Charged by meter.
22	Houston, H. H	S.W.c. Willowgrove av. & 33d st.	Hotel	May 24	Crown				1					1	2,976,000	Charged by meter.
22	Houston, H. H	S.W. c. Willowgrove av. & 33d st.	Hotel	May 29	Gem							1		1	2,976,000	Charged by meter.
22	Houston, H. H	S.s. Willowg've av., 50 ft. N.E. 35th	Stable	May 29	Crown					1				1	729,000	Charged by meter.
22	Phila. Horse Show Ass'n	W.s. Willowgrove av. & 35th st.	Horse Show Associat'n	Dec. 6	Crown				1					1	12,240	Charged by meter.
23	Jackson, Milton	4523 Tacony st	Lock Works	Sept. 3	Crown		1							1	23,250	Charged by meter.
23	Jackson, Milton	4523 Tacony ss		Sept. 3	Gem					1				1	23,250	On fire attachment.
23	Shaw, M. A	4651 Paul st., N. E. c. Meadow st.	Ice Factory	March 13	Crown							1		1	12,390,000	Charged by meter.
25	Brophy, P.	3102 Jasper st	Dye Works	Jan. 12	Crown					1				1	261,750	Charged by meter.
25	Brophy, D.	N. W. c. Trenton av. & Somerset	Coal Yard	Dec. 4	Crown		1							1	1,500	Charged by meter.
25	P. and R. R. Co	N.s. Toronto st., fr. Bath to Elm.	Coal Yard	Aug. 4	Gem							1		1	836,750	Charged by meter.
26	Bond, James	2500 S. Broad st	Brick Works	Dec. 23	Crown			1						1	No water used	Charged by meter.
26	Cresswell & Washburn	S. E. c. 18th & Washington av	Paper Factory	Nov. 28	Crown					1				1	6,750	Charged by meter.

New Meters Set.—Continued.

Ward.	Occupant.	Location.	Business.	Date when set.	Name of Meter.	Size. ½-inch.	¾-inch.	1-inch.	1½-inch.	2-inch.	3-inch.	4-inch.	6-inch.	Total.	Gallons Consumed.	Remarks.
26	Harrison Bros	N.W. Gray's Ferry road & 35th st. and 2d and 1st h. on 35th st. N of Gray's F'ry r.	Chemicals	Sept. 12	Gem							1		1	16,023,750	Charged by meter.
26	St. Thomas' School	S. E. 18th and Fernon sts	School	Nov. 18	Crown				1					1	95,250	Charged by meter.
27	Bartram Apart. House	N. S. Woodland ave. 120 ft. W. of 32d st	Apartment house	Jan. 22	Crown							1		1	No water used	
27	Bartram Apart. House	N. S. Woodland ave. 120 ft. W. of 33d st	Apartment house	March 8	Gem								1	1		On fire attachment.
27	Galloway, Wm	3216–24 Walnut st	Terra Cotta Works	Nov. 14	Crown				1					1	28,500	Charged by meter.
27	Levering & Garrigues	3302 Ludlow st	Machine Shop	Dec. 3	Crown				1					1	196,500	On fire attachment.
27	Segal, A	W. S. 30th st. 317 ft. S. Locust st	Ice Plant	March 4	Crown							1		1	41,535,000	Charged by meter.
28	Dingee Brick Works	N. E. 26th and Hagert sts	Brick Works	Oct. 9	Crown					1				1	51,750	Charged by meter.
28	Electric Magnetic R. W. Co.	S. E. S. Sedgley ave. E of 24th st.	Machine Shop	June 12	Crown				1					1	159,750	Charged by meter.
28	Fehlen, M	4148 Germantown ave	Packing House	April 22	Crown				1					1	2,242,238	Charged by meter.
28	Kohnle, J	E. S. 15th st. 104 ft. N. of Susquehanna ave	Brewery	Aug. 22	Crown				1					1	701,250	Charged by meter.
28	Leon, W	3190-92 Ridge ave	Hotel	Nov. 21	Crown			1		1				2	359,250	Charged by meter.
28	Philada. Traction Co	Ridge ave. E.S. from N.E.c. Susq. ave. to S.E. c. 32d st.	Power House	March 5	Gem								1	1	15,486,000	Charged by meter.
28	Philada. Traction Co	Ridge ave. E.S. from N.E.c. Susq. ave to S E. c. 32d st.	Power House	Nov. 21	Crown		2							2		
28	Philada. Base Ball Club	N.W.c. Broad to N.E.c. 15th and Huntingdon sts	Base Ball Grounds	May 9	Crown		2		2					4	1,875,250	Charged by meter.

New Meters Set—Continued.

Ward.	Occupant.	Location.	Business.	Date when Set.	Name of Meter.	Size. ½-inch.	¾-inch.	1-inch.	1½-inch.	2-inch.	3-inch.	4-inch.	6-inch.	Total.	Gallons Consumed.	Remarks.
28	Stafflet & Atkinson	E. s. 22d st., 161 ft. S. Indiana av	Planing mill	July 9	Crown		1							1	99,750	Charged by meter.
28	Warden, W. G.	S. E. 19th and Allegheny ave	Machine shop	Dec. 4	Crown						1			1	723,750	Charged by meter.
29	Keller, George	E. s. 33d st., 2d h. N. Thompson	Brewery	June 26	Crown						1			1	812,250	Charged by meter.
29	Mercantile Lib. Soc. Club.	1412–26 N. Broad street	Club house	March 25	Gem							1		1	4,692,750	Charged by meter.
29	Poth, F. A., Brewing Co.	N. W. 31st and Jefferson streets	Brewery	March 26	Gem					1				1	826,500	Charged by meter.
29	Serrill, John	W. s. Croskey street, 175 ft. S. Montgomery avenue	Market house & stables	July 12	Crown					2				2	78,750	Charged by meter.
30	Electric Traction Co.	W. s. Sutherland avenue, 95 ft. 10 in. S. South street	Power house	April 26	Gem						1			1	5,728,500	Charged by meter.
30	Southern Electric Lt. Co.	S. s. Carpenter st., op. Barnett	Electric light plant	Sept. 18	Crown						1			1	1,575,000	Charged by meter.
31	Electric Traction Co	E. s. Kens'ton av., from N. E. Cumb'd to S. E. c. Sergeant.	Power house	July 31	Gem							1		1	6,382,500	Charged by meter.
31	Getty & Spratt	2414 E. Huntingdon street	Shoddy mill	Nov. 6	Crown					1				1	26,250	Charged by meter.
31	Kensington Hyg. Ice Co.	N. E. Trenton av. & Hunt'don st.	Ice plant	March 22	Gem						1			1	13,099,500	Charged by meter.
31	Rumpf, Fred	2206–8 Fox street	Hosiery mill	Oct. 23	Crown		1							1	193,500	Charged by meter.
31	Straubmuller, J.	2143–45 E. York st., N. E c. Trenton av. & N. s. Emlen st., 70 ft. E. Trenton ave	Brewery	Dec. 17	Gem							1		1	750	Charged by meter.
33	Albro-Clem Elevator Co.	N. W. s. Glenwood ave., 200 ft. N. E. Allegheny	Elevator works	Dec. 11	Crown					1				1	No water used.	Charged by meter.
33	Pfund, G. F.	3854–58 Nice street	Packing house	Nov. 11	Crown				1					1	320,250	Charged by meter.

New Meters Set—Continued.

Ward.	Occupant.	Location.	Business.	Date when set.	Name of Meter.	Size.								Total.	Gallons Consumed.	Remarks.
						½-inch.	¾-inch.	1-inch.	1½-inch.	2-inch.	3-inch.	4-inch.	6-inch.			
33	Penna. R. R. Co.	W. s. 6th st. 237 ft. n. Glenw'd av	Stand Pipe	May 27	Gem								1	1	5,066,250	Charged by meter.
34	Cook, J.	4709–11 Lancaster ave	Dairy	January 18.	Crown				1					1	1,410,000	Charged by meter.
34	Cook, J.	4709–11 Lancaster ave	Dairy	June 24	Crown		1							1		
34	Dunlap, James	N. E. 55th and Hunter's ave	Carpet Factory	June 10	Crown					1				1	355,000	Charged by meter.
34	Miller, Alex	N. s. Aspen st. 41 ft. e. of 46th st	Bath House	July 13	Crown			1						1	435,000	Charged by meter.
36	Atlantic Refining Co.	W. Passyunk av. n s., c. River rd	Oil Works	Dec. 24	Crown			1						1	5,250	Charged by meter.
36	Philada. Brick Works	Rear S. E. cor. 26th and Earp sts	Brick Works	July 11	Crown					1				1	150	Charged by meter.
37	Batley, Thomas	2744–50 Germantown avenue	Market and Hall	Nov. 5	Crown				1					1	187,000	Charged by meter.
37	Hummel, J. M.	2433 North Broad street	Brewery	July 30	Crown					1				1	2,757,000	Charged by meter.
37	Peoples' Pass. R. W. Co.	Dauphin st., S. W. cor. 8th, and N. W. 8th and Susquehanna av	Depot	March 8	Crown		1							1	1,530,750	Charged by meter.
37	Peoples' Pass. R. W. Co.	Dauphin st., S. W. cor. 8th, and N. W. 8th and Susquehanna av	Depot	June 10	Crown						1			1		
37	Spaeth, Krauter & Hess	2701–07 Germantown avenue	Brewery	April 3	Gem					1				1	4,827,000	Charged by meter.
	Totals					4	17	11	20	30	18	12	4	113	206,933,280	

General Summary of Meter Operations for the year 1895.

Size of Meters.	In Use January 1, 1895.							Set During 1895.			Renewed. Taken Out.				Renewed. Put In.			Discontinued. Taken Out.					In Use December 31, 1895.							Stock on Hand December 31, 1895.					
	Crown.	Gem.	Nash.	Deacon.	Worthington.	Union.	Total.	Crown.	Gem.	Total.	Crown.	Gem.	Nash.	Total.	Crown.	Gem.	Total.	Crown.	Gem.	Nash.	Deacon.	Total.	Crown.	Gem.	Nash.	Deacon.	Worthington.	Union.	Total.	Crown.	Gem.	Nash.	Deacon.	Total.	Totals.
½-inch	26	......	8	...	...	...	34	1	......	1	1	......	2	3	......	......	......	2	...	...	...	2	24	......	6	...	...	...	30	13	......	7	...	20	50
¾-inch	209	......	26	...	...	...	235	17	......	17	19	......	3	22	25	......	25	10	...	2	...	12	222	.....	21	...	...	...	243	23	......	13	...	36	279
1-inch	202	......	23	...	1	...	226	11	......	11	18	......	3	21	17	......	17	8	...	4	...	12	204	.....	16	...	1	...	221	67	......	16	...	83	304
1½-inch	102	......	22	...	2	1	127	20	......	20	7	......	4	11	7	.....	7	5	...	3	...	8	117	......	15	...	2	1	135	10	......	13	...	28	158
2-inch	129	85	......	...	...	...	214	23	7	30	11	13	......	24	14	10	24	7	3	...	...	10	148	86	......	...	...	...	234	19	10	......	...	29	263
3-inch	49	79	......	...	...	...	128	12	6	18	5	3	......	8	5	4	9	1	2	...	...	3	61	84	......	...	...	...	145	1	2	......	...	3	148
4-inch	40	162	......	2	...	...	204	4	8	12	......	6	......	6	2	7	9	1	2	...	1	4	44	169	......	1	...	...	214	1	1	......	1	3	217
6-inch	4	19	......	4	...	...	27	.....	4	4	......	1	......	1	......	1	1	......	...	...	...	......	4	23	......	4	...	...	31	1	2	......	6	9	40
Totals	761	345	79	6	3	1	1,195	88	25	113	61	23	12	96	70	22	92	34	7	9	1	51	824	362	58	5	3	1	1,258	135	15	49	7	206	1,459

Note.—One 1-inch Crown; three 1½-inch Crown; eight 2-inch Crown, and two 4-inch Crown meters in use are dismantled, and do not show in above table.

Note.—One 3-inch Crown meter was omitted in stock, December 31, 1894.

Miscellaneous Work.

Months.	Examinations.					Miscellaneous.						Statements.
	Attachments.	Short Supply.	Leaks.	Meters.	Total.	New Boxes.	Boxes Repaired.	New iron covers set.	Fish-traps.	Service pipes repaired.	Total.	
January	107	......	3	107	217	2	......	1	6	....	9	2,298
February	118	......	15	107	240	......	......	......	9	74	83	1,534
March	134	......	2	69	205	7	......	8	18	27	60	2,221
April	133	......	3	77	213	5	......	5	7	174	191	2,059
May	127	......	4	51	185	10	......	7	16	81	114	1,904
June	127	......	7	143	277	13	......	5	10	65	93	2,089
July	127	......	1	80	208	6	3	4	15	20	48	2,105
August	131	......	4	39	174	2	......	2	9	80	93	2,022
September	125	2	2	53	182	2	1	2	5	1	11	2,163
October	127	......	6	49	182	3	1	5	10	46	65	2,012
November	125	......	4	50	179	7	1	7	17	17	49	1,893
December	125	6	4	64	199	7	......	......	6	4	17	2,272
Totals	1,506	8	55	892	2,461	64	6	46	128	589	883	24,572

Meters.																
Style.	Repaired.				Used in Service.			Purchased			Tested.					
	Crown.	Gem.	Nash.	Total.	Crown.	Gem.	Total.	Crown.	Gem.	Total.	Crown.	Gem.	Nash.	W'rthi'gt'n	Union.	Total.
½-inch	2	......	1	3	1	......	1	......	......	......	1	......	......	......	......	1
¾-inch	14	......	1	15	2	......	2	......	......	......	35	......	......	......	......	35
1-inch	10	......	......	10	2	......	2	......	......	......	25	......	1	1	1	28
1½-inch	7	......	1	8	......	......	......	......	......	......	24	......	......	......	1	25
2-inch	24	10	......	34	1	2	3	......	......	......	37	......	......	......	1	38
3-inch	14	19	......	33	1	1	2	6	......	6	4	......	......	......	......	4
4-inch	11	30	......	41	......	......	......	......	5	5	......	4	......	......	......	4
6-inch	2	8	......	10	......	......	......	......	6	6	......	......	......	......	......	......
....	84	67	3	154	7	3	10	6	11	17	126	4	1	1	8	135

Work done and Material furnished by Meter Department at Purveyors' Districts, Pumping Stations and Buildings and Grounds.

	Cost of material.	Cost of Labor.	Total.
First District	$ 50	$12 75	$13 25
Second District	95	30 60	31 55
Third District	6 95	41 20	48 15
Fourth District	27 50	41 00	68 50
Spring Garden Pumping Station	122 07	149 95	272 02
Belmont Pumping Station	70 09	285 25	355 34
Fairmount Pumping Station	11 25	121 00	132 25
Frankford Pumping Station	198 30	78 50	276 80
George's Hill Pumping Station	73 00	60 65	133 65
Roxborough Auxiliary Pumping Station	121 03	47 50	168 53
Queen Lane Station	343 77	896 45	1,240 22
East Park Reservoir	....	17 00	17 00
Repair shop	123 96	180 25	304 21
Main office	27 62	27 45	55 07
Independence Square	....	8 50	8 50
Totals	$1,126 99	$1,998 05	$3,125 04

DISTRIBUTION EXPENSES.

DURING THE YEAR 1895.

Including Expenses at Main Office, Purveyors' Districts and Meter Shops.

Material and Labor.	First District.	Second District.	Third District.	Fourth District.	Fifth District.	Sixth District.	Distribution.	Meter shop.	Main office.	Totals.
Lead	$1,593 53	$2,206 15	$3,428 87	$5,182 05	$1,592 77	$1,592 77				$15,596 14
Gasket		40 15	112 70	41 40	17 70					211 95
Coke	55 60	71 00	105 75	202 70	392 20	1,003 50				1,830 75
Wood	15 50		15 50		15 50	31 00				77 50
Pipes							149,407 95			149,407 95
Breeches pipes and ¼ turns							10,652 96			10,652 96
Small specials							17,266 43			17,266 43
Large specials							15,213 61			15,213 61
Frames and covers	1,079 81	1,300 00	1,259 62	170 90	104 86	228 60		1,034 52		5,178 31
Viney stops	248 00	218 00	248 00	5,234 50	248 00	248 00				6,474 50
Excavating by contract				470 00						470 00
Hauling, trans. and hotel		46 50		5 66		9 60	8,723 53	330 30		9,115 59
Supplies, tools, small stores, etc	578 71	1,410 34	646 10	1,365 14	3,381 16	1,934 12	4,012 66	3,584 50	434 90	17,347 63
Plumbing and plumbers supplies		56 16	16 05	3 00	10 35	4 65		14,035 67		14,125 88
Meters, etc								5,382 85		5,382 85
Repairs to buildings, etc		10 60								10 60

Distribution Expenses—Continued.

Material and Labor.	First District.	Second District.	Third District.	Fourth District.	Fifth District.	Sixth District.	Distribution.	Meter shop.	Main office.	Total.
Brick, stone, lime and cement	30 40	2,741 84	30 45	705 64	2,534 54	2,387 10		13 30		8,443 27
Lumber	1,384 20	714 60	548 74	135 30	1,196 16	468 25		183 91		4,631 16
Hay, feed, etc	500 32	758 36	920 81	695 57	113 81	106 92				3,095 79
Stable supplies	34 50	156 27	251 35	184 28		42 87				669 27
Stable repairs	511 52	298 78	285 50	162 10	121 55	100 32				1,479 77
Stable medicines	12 00	33 40	102 75	18 00						166 15
Stable shoeing	120 25	136 00	201 00	157 00	29 90	16 00				660 15
Shop work	9,706 08	17,203 06	24,672 44	11,278 19	994 53	5,618 28	209 21	471 54	13 16	70,166 49
Supplies, stationery	217 59	184 49	370 16	291 91	59 45	198 94	896 57	500 53	996 37	3,666 01
Wages { Per diem	24,037 44	31,977 00	77,501 13	50,479 49	64,791 62	63,593 50	6,387 25	9,307 25	2,733 00	330,807 68
Wages { Salary	4,738 73	5,389 17	6,216 25	7,838 10	1,719 00	3,974 00				29,875 25
Total cost of labor and material on account of distribution	41,864 18	64,931 87	116,933 17	84,620 93	77,323 10	81,558 42	212,902 17	34,844 37	4,177 43	722,155 64
Buildings and grounds		14,774 41	4,717,50	1,418 63	3,210 83	241 36				24,862 78
Construction and repair shops		703 50								703 50
Total labor and material	44,864 18	80,409 78	121,650 67	86,039 56	80,533 93	81,799 78	212,902 17	34,844 37	4,177 43	747,221 87

Tabular Statement of Work Connected with the Distribution for the years 1880 to 1895 inclusive.

Years.	Pipe.										Additional Stops.	Additional Fire Hydrants.	Fire Hydrants in Use.	Meters in Use.	Service Attachments.									
	Extensions.		Repairs and Relays.		Total Pipe Handled.		Total Amount in Use.		Total Amount Handled.															
	Feet.	Pounds.	Feet.	Pounds.	Feet.	Pounds.	Feet.	Pounds.	Feet.	Pounds.					½ in.	⅝ in.	¾ in.	1 in.	1½ in.	2 in.	3 in.	4 in.	6 in.	Total.
1880...	23,085	884,946	9,557	262,826	32,642	1,107,772	3,927,623	192,816,906	4,164,768	200,136,708	138	70	5,358	34	2,687	118	49	89	....	......	......	......	......	2,913
1881...	56,616	2,832,623	3,832	199,649	60,448	3,032,272	3,981 239	195,649,529	4,225,216	203,168,980	249	144	5,562	42	3,160	137	59	121	....	......	......	......	......	3,483
1882...	56,860	5,396,165	7,740	484,092	64,600	5,880,257	4,081,180	202,202,522	4,289,816	209,019,237	312	120	5,622	45	3,169	110	76	129	....	......	......	......	......	3,481
1883...	63,215	8,048,645	12,605	675,420	75,880	3,724,065	4,144,395	205,251,167	4,365,696	212,773,301	281	130	5,752	63	4,576	97	71	133	....	......	......	......	......	4,877
1884...	84,451	7,155,385	18,079	1,380,271	102,530	8,535,656	4,228,846	212,406,552	4,468,226	221,308,957	324	147	5,887	560	5,529	185	84	140	....	7	......	......	......	5,945
1885...	137,967	12,234,074	93,783	3,265,537	231,850	15,499,611	4,366,813	224,640,526	4,700,076	236,808,568	539	307	6,195	305	6,734	254	121	160	....	16	......	......	......	7,285
1886...	136,831	18,238,457	121,210	4,883,826	258,011	23,122,283	4,503,644	242,879,083	4,958,117	259,930,851	736	295	6,490	284	7,482	258	104	133	....	32	.....	......	......	8,009
1887...	122,790	14,780,082	34,098	1,329,083	156,888	16,109,165	4,626,434	257,659,165	5,115,005	276,040,016	546	429	6,715	253	7,892	317	124	143	2	54	......	......	......	8,532
1888...	133,552	6,356,379	45,943	1,486,631	179,495	7,843,010	4,759,986	264,015,544	5,294,500	283,883,026	772	214	6,929	267	8,260	193	139	118	23	55	......	......	......	8,788
1889...	147,171	12,270,311	57,836	2,410,677	205,007	14,680,988	4,907,157	276,285,855	5,499,507	298,514,014	601	247	7,433	304	8,950	263	149	119	17	46	......	......	......	9,544
1890...	159,176	14,164,305	70,546	3,058,294	229,722	17,222,599	5,066,333	290,450,160	5,729,229	315,736,613	840	316	7,749	552	9,248	426	167	164	30	46	......	......	......	10,081
1891...	218,931	21,319,926	64,491	2,051,782	283,422	23,371,708	5,285,264	310,770,086	6,012,651	339,108,321	1,136	356	8,105	697	7,607	213	130	152	13	33	......	......	.. ...	8,178
1892...	158,783	9,713,961	104,996	5,352,355	263,779	15 066,816	5,444,047	320,484,047	6,276,430	354,174,637	1,025	342	8,447	789	8,093	289	198	218	41	61	......	......	......	8,900
1893...	265,911	35,684,877	192,770	6,045,495	458,681	41,730,372	5,709,958	356,168,924	6,735,111	395,905,009	1,834	437	8,884	1,115	11,010	413	181	198	44	4[illegible]	......	......	......	11,892
1894...	283,569	34,690,341	173,376	5,778,809	456,945	40,469,150	5,993,527	390,859,265	7,192,036	436,374.159	2,362	560	9,444	1,196	10,891	307	147	134	42	48	......	......	......	11,569
1895...	209,295	15,098 424	71,507	2,670,573	280,802	17,768,997	6,202,824	405,957,689	7,472,858	454,143,156	1,216	594	10,038	1,253	9,464	497	187	133	37	63	10	17	2	10,410

APPENDIX E.

REPORT

OF THE

Superintendent of the Construction and Repair Shop,

TWELFTH AND REED STREETS,

FOR THE YEAR 1895.

Philadelphia, January 15, 1895.

MR. JOHN C. TRAUTWINE, JR.,
Chief of Bureau.

SIR:—The shop has been able to meet all demands for work during the past year. One (1) 36-inch and one (1) 20-inch lathe were added to the stock of tools; two (2) hydraulic lifts, with turntable attachments, were made for the Queen Lane Pumping Station; four (4) 48-inch Foote valves and all the necessary grates and screens were made for the intake at the same station; one (1) 36-inch Foote valve and screens were made for the intake at Belmont station.

Fifteen (15) 48-inch, five (5) 30-inch and four (4) 20-inch butterfly stop valves, and two (2) 30-inch check valves were made during the year, in addition to keeping up the supply of smaller stop valves and fire hydrants required by the districts.

The amount of work done at the shop for repairs to the machinery and boilers at the different stations is greatly in excess of any preceding year.

The expansion joint steam pipe and fittings for boilers at Spring Garden will be completed in a short time.

Extensive repairs to No. 8 and No. 11 pumping engines at Spring Garden station are under way at the present time.

The shop has been enlarged by the addition of the part of the building which was formerly occupied by the Police Bureau for a stable, which gives greater facilities for handling work, and relieves the heretofore cramped condition of the shop, also giving ample space to place more tools when necessary. The partition has been taken down; truss girders have been placed overhead, tying the whole of the building together, and the pattern shop extended the whole length of the front of building. The water closets and wash room have been removed to a more suitable place and other alterations are being made to suit the requirements of the shop.

I respectfully submit the following report in detail of the operations of the shop for the year ending December 31, 1895.

Respectfully,

JAMES H. DEAN,

Superintendent of Shop.

MERCHANDISE.	DR.	
To stock per inventory January 1, 1895	$21,116 64	
Bolts and nuts	1,606 63	
Hardware	279 79	
Wrought-iron	2,938 10	
Steel	450 99	
Iron castings	28,068 18	
Brass castings	9,497 57	
Lead coatings	477 20	
Lumber	4,440 73	
Paints and brushes	244 67	
Oils and tallows	256 34	
Chandlery	75 73	
Machinery	4,616 31	
Miscellaneous	219 70	
Coal	1,207 70	
Coke	35 70	
Gum goods	626 46	
Brass fittings	125 48	
Packing	15 68	
Plug valves	3,660 00	
Cements	149 91	
Wages	36,948 52	
		$112,058 03

MERCHANDISE.	CR.	
First District	$9,706 08	
Second District	17,203 06	
Third District	24,672 44	
Fourth District	11,278 19	
Fifth District	9,934 53	
Sixth District	5,618 28	
		$78,412 58
Queen Lane, boilers	$143 50	
Queen Lane, machinery	724 60	
Queen Lane, buildings and grounds	2,604 17	
		$3,472 27
Fairmount, machinery	$285 36	
Fairmount, buildings and grounds	59 62	
		344 98
Spring Garden, machinery	$2,330 29	
Spring Garden, boilers	2,498 16	
Spring Garden, buildings and grounds	122 05	
		4,950 50
Belmont, machinery	$1,865 63	
Belmont, boilers	52 17	
Belmont, buildings and grounds	142 87	
		2,060 67

Frankford, machinery	$568 85	
Frankford, boilers	325 94	
Frankford, buildings and grounds	78 21	
		$973 00
Mt. Airy, machinery	$108 82	
		108 82
Roxborough, machinery	$664 36	
Roxborough, boilers	178 96	
Roxborough, buildings and grounds	24 80	
		$868 12
General buildings and grounds	543 61	
		543 61
Shawmont, machinery	13 28	
		13 28
Construction and repair shop	294 93	
		294 93
Main office	13 16	
		13 16
Meter Department	471 54	
		471 54
Old metals	969 05	
		969 05
Fixed patterns	48 55	
		48 55
Distribution	209 21	
		209 21
Total Cr		$93,754 27
Inventory January 1, 1896		25,561 34
		$119,315 61
Total Dr		112,058 03
Balance		$7,257 58

INVENTORY JANUARY 1, 1896.

45 No. 1 fire hydrants, at $25 00	$1,125 00	
8 4-inch stop valves, at 11 00	88 00	
28 6-inch stop valves, at 12 00	336 00	
21 8-inch stop valves, at 22 00	462 00	
11 10-inch stop valves, at 30 00	330 00	
6 12-inch stop valves, at 35 00	210 00	
7 16-inch stop valves, at 58 00	406 00	
		$2,957 00
Finished parts of fire hydrants	$690 00	
Finished parts of stop valves	1,300 00	
Finished parts of rotary valves	1,497 00	
		$3,487 00
5 Unfinished 36-inch check valves, at $90 00	$450 00	
3 Unfinished bell cranks, at 15 00	45 00	
1 Unfinished air pump barrel, at 15 00	15 00	
1 Unfinished pump rod, at 25 00	25 00	
		$535 00

3	10-inch old style stop screws, at	$4 50	$13 50	
15	12-inch old style stop screws, at	5 00	75 00	
11	16-inch old style stop screws, at	6 50	71 50	
12	20-inch old style stop screws, at	8 50	102 00	
1	30-inch old style stop screws, at	10 50	10 50	
14	Viney stop screws, at	2 00	28 00	
29	Barton stop screws, at	4 00	116 00	
14	Barton stop bonnets, at	8 00	112 00	
				$528 50
27	4-inch new style stop screws, at	$1 25	$33 75	
50	6-inch new style stop screws, at	1 75	87 50	
17	8-inch new style stop screws, at	3 25	55 25	
40	10-inch new style stop screws, at	5 00	200 00	
22	12-inch new style stop screws, at	5 25	115 50	
16	16-inch new style stop screws, at	6 50	104 00	
9	20-inch new style stop screws, at	8 50	76 50	
7	30-inch new style stop screws, at	10 25	71 75	
1	36-inch new style stop screws, at	12 00	12 00	
1	48-inch new style stop screws, at	15 00	15 00	
				$771 25
130	Socket screws, at	$1 75	$227 50	
68	Spindles, at	1 50	102 00	
57	4-inch fire hydrant valves, at	1 50	85 50	
26	6-inch fire hydrant valves, at	1 60	41 60	
				$456 60
52	4-inch iron bands, at	75	$39 00	
45	6-inch iron bands, at	$1 00	45 00	
5	8-inch iron bands, at	4 00	20 00	
30	10-inch iron bands, at	5 00	150 00	
5	12-inch iron bands, at	6 00	30 00	
16	16-inch iron bands, at	7 50	120 00	
6	20-inch iron bands, at	9 50	57 00	
1	30-inch iron bands, at	15 00	15 00	
2	36-inch iron bands, at	20 00	40 00	
				$516 00
400	4-inch frost valve rods, at	30	$120 00	
114	Fire hoe heads, at	$1 00	114 00	
5	24-inch furnaces, at	17 00	85 00	
1	20-inch furnace, at	15 00	15 00	
3	24-inch furnace grates, at	5 00	15 00	
				$349 00
1	20-inch furnace grate, at	$4 00	$4 00	
21	Small lead pots, at	1 35	28 35	
9	Medium lead pots, at	1 35	22 50	
6	Large lead pots, at	4 00	24 00	
				$78 85
270	Wooden plugs, at	50	$135 00	
96	Cast-iron plugs, at	$1 00	96 00	
15	Cast-iron risers, at	2 00	30 00	
675	Brass plugs, at	25	168 75	

17	Air-pump rod straps, at	8 50	$144 50	
96	Frost valves, at	30	28 80	
40	Pair wr't-iron monkey legs, at	3 50	140 00	
18	Pair cast-iron monkey legs, at	1 50	27 00	
339	4-inch fire hydrant valves, at	2 50	897 50	
7	6-inch fire hydrant valves, at	4 00	28 00	
				$1,695 55
12	Pressure caps, at	$2 00	$24 00	
67	Ferrule mandrils, at	1 00	67 00	
14	Taper reamers at	3 50	49 00	
5	Drill sockets, at	35	2 50	
71	Drills, at	35	24 85	
178	Bursting wedges, at	25	44 50	
				$211 85
10	Handle gouges, at	$ .60	6 00	
18	Hand gouges, at	.40	7 20	
161	Handle diamond points, at	.60	96 60	
80	Hand diamond points, at	.40	32 00	
60	Pipe cutters, at	.60	36 00	
15	Plug wrenches, at	.50	7 50	
				185 30
29	Setts of handle caulking tools, at	$4.50	130 50	
46	Setts of hand caulking tools, at	2.50	115 00	
518	Flat chisels, at	.35	181 30	
162	Cape chisels, at	.35	56 70	
22	Gasket irons, at	.60	13 20	
24	Gate cutters, at	.40	9 60	
				506 30
3	Stop keys, at	$5.25	15 75	
18	Hydrant keys, at	2.25	40 50	
157	Pounds rolled brass, at	.16	25 12	
70	Pounds brass wire, at	.14	9 80	
45	Pounds copper wire, at	.16	7 20	
40	Pounds sheet brass, at	.14	5 60	
				103 97
250	Pounds iron forgings, at	$ .08	20 00	
92,452	Pounds wrought iron, at	$.01\frac{1}{2}$	1,386 78	
6,860	Pounds machinery steel, at	.02	137 20	
5,962	Pounds cast steel, at	$.05\frac{1}{2}$	327 91	
784	Pounds tool steel, at	.15	117 60	
1,050	Pounds self-hardening steel, at	.35	367 50	
				2,356 99
3,036	Pounds expansion metal, at	$.24\frac{1}{2}$	743 82	
18,160	Pounds lead, at	$.03\frac{1}{5}$	581 12	
				1,324 94
78,750	Pounds stop valve castings, at	$ $.01\frac{465}{1000}$	1,153 68	
227,019	Pounds fire hyd'nt castings, at	$.01\frac{64}{100}$	3,723 11	
25,413	Pounds m'ch'n'ry and mis., at	$.01\frac{585}{1000}$	402 79	

6,440 Pounds brass castings, at......	.10½......	$966 00	
3,175 Pounds ajax metal, at..........	.22........	1,138 50	
			$7,384 08
Hardware..		76 00	
Bolts, nuts and washers..................................		628 20	
Oils and tallows..		105 00	
Paints, oils and brushes..................................		36 00	
Chandlery...		45 60	
Gum goods...		375 00	
Lumber..		847 36	
			2,113 16
			$25,561 34

Articles Delivered to Purveyors' Districts, etc.

Districts.	Stop-cocks.									Rotary Valves.				Check Valves.				Stop-screws.				
	4-inch.	6-inch.	8-inch.	10-inch.	12-inch.	16-inch.	20-inch.	30-inch.	36-inch.	20-inch.	30-inch.	36-inch.	48-inch.	20-inch.	30-inch.	36-inch.	48-inch.	4-inch.	6-inch.	8-inch.	30-inch.	36-inch.
First........................	6	156	12	14	4	....	....	....	....	....	....	....	....	....	....	....	....	....	6	....	....	....
Second........................	....	228	50	54	31	....	....	1	....	4	....	....	....	1	....	1	....	18	12	12	2	1
Third........................	13	644	4	22	27	....	....	....	....	....	....	....	....	....	....	....	....	....	18	....	....	....
Fourth........................	16	129	....	....	2	4	....	1	....	....	5	....	5	....	1	....	....	....	12	....	1	....
Fifth........................	4	43	....	....	7	....	....	1	....	....	....	....	10	....	....	....	4	....	6	....	....	....
Sixth........................	4	124	....	....	6	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Total..................	43	1,324	66	90	77	4	....	3	....	4	5	....	15	1	1	1	4	18	54	12	3	1

Articles delivered to Purveyors' Districts, etc.

Districts.	Stop Boxes and Risers.			Iron Bands.																	
	Boxes.	Unfinished boxes.	Risers.	4-inch.	6-inch.	8-inch.	10-inch.	12-inch.	16-inch.	20-inch.	30-inch.	36-inch.	48-inch.	6-inch socket screws.	Cast iron monkey legs.	Wrought iron monkey legs.	Spindles.	Long brass nuts.	Cross heads.	Barton stop screws.	Stop nuts.
First..........	92	1,499	92	....	....	....	30	....	....	....	....	....	....	....	....	....	....	....	....	1	
Second........	52	....	463	12	12	....	12	7	6	10	6	3	....	....	....	12	....	40	....	1	
Third..........	303	....	541	24	192	12	6	8	....	....	....	....	....	....	....	....	....	24	....	1	
Fourth........	63	....	107	12	48	42	....	....	....	....	....	....	11	26	....	....	12	12	....	2	
Fifth	31	....	....	....	48	....	....	....	....	....	....	....	....	....	....	....	....	36	....	....	5
Sixth	80	....	143	48	36	....	....	4	....	....	19	....	....	....	....	....	....	24			
Works........	....	....	....	....	....	....	....	....	1												
Total.	621	1,499	1,346	96	336	54	48	19	7	10	25	3	11	26		12	12	136		5	5

Articles Delivered to Purveyors' Districts, etc.

Districts.	Gum Rings for Nozzles.	Glands.	Brass Screw.	Cast Steel Wrenches.	Bushings Wedges.	Caulking Irons.	Reamers.	Viney Stop Screw.	Outlet Sleeve.	Tail Clamps.	Eye Bolts.	T-Gland Bolts.	Brass Collars.	Furnace Grates.	Gasket Irons.	Fish Traps.				Fish Trap Screens.
																1¼-inch.	2-inch.	3-inch.	4-inch.	
First	148	108	108	12	12	......	3	......	6	......	......	150								
Second	......	......	......	12	......	......	......	20	......	....	72	250								
Third	......	12	......	......	......	......	......	6	21	......	150	72	7							
Fourth	......	12	......	18	......	......	......	27	......	......	72	156	3	1						
Fifth	......	......	......	......	......	15	......	......	......	......	......	......	3	1	15					
Sixth	......	......	......	12	......	6	......	......	......	50	96	48	......	3						
Meter Department	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	13	14	13	19
Total	148	132	108	54	12	21	3	53	27	50	390	676	13	5	15	......	13	14	13	19

Articles Delivered to Purveyors' Districts, etc.

Districts.	No. 1 Fire Hydrant.	Keys. Hydrant.	Keys. Stop.	Keys. Plug Monkey.	Chisels. Flat.	Chisels. Hand Diamond Points.	Chisels. Handle Diamond Points.	Chisels. Pipe Cutters.	Chisels. Caps.	Chisels. Hand Gouges.	Chisels. Handle Gouges.	Chisels. Handle Caulking Tools.	Plugs. Wood.	Plugs. Iron.	Plugs. Brass.	Reducing Caps.	Pressure Caps.	Lead Pot.	Lead Furnaces.	Gum Joints, Fire Hydrants.	Fire Hoe Heads.	Mandrils.
First	65	4	......	36	48	......	......	......	......	......	......	......	146	......	193	......	......	......	......	56	......	......
Second	109	......	24	36	......	......	......	......	......	......	......	......	224	......	408	......	......	......	......	53	......	......
Third	463	......	......	......	......	......	......	......	......	......	......	......	560	144	606	4	......	6	......	48	......	6
Fourth	283	......	6	......	......	......	......	......	......	......	......	......	112	......	319	......	9	10	4	38	......	9
Fifth	104	......	3	......	......	......	12	......	......	......	......	5	......	......	54	......	......	4	......	2	......	......
Sixth	90	......	8	......	......	36	......	36	......	......	......	4	192	......	84	......	......	7	3	......	......	......
Meter Department	......	......	......	......	24	12	......	6	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Works	......	......	......	......	78	6	......	......	......	......	......	......	......	......	......	......	......	......	......	......	56	......
Total	1,114	4	41	72	150	54	12	42	......	......	......	9	1,234	144	1,664	4	9	27	7	197	56	15

ARTICLES MANUFACTURED DURING 1895.

1,138	No. 1 fire hydrants, at $25.00	$28,450 00
50	4-inch stop valves, at $11.00	550 00
1,340	6-inch stop valves, at $12.00	16,080 00
87	8-inch stop valves, at $24.00	2,088 00
98	10-inch stop valves, at $31.00	2,883 00
80	12-inch stop valves, at $37.00	2,960 00
11	16-inch stop valves, at $60.00	660 00
3	30-inch stop valves, at $190.00	570 00
4	20-inch rotary stop valves, at $265.00	1,060 00
4	30-inch rotary stop valves, at $325.00	1,300 00
11	48-inch rotary stop valves, at $500.00	5,500 00
4	48-inch rotary stop valves, flanged, at $550.00	2,200 00
1	20-inch check valve, at $120.00	120 00
1	30-inch check valve, at $200.00	200 00
1	36-inch foot valve, at $250.00	250 00
13	2-inch fish traps, at $2.50	32 50
14	3-inch fish traps, at $4.50	63 00
13	4-inch fish traps, at $6.00	78 00
21	Barton stop screws, at $4.00	84 00
61	Viney stop screws, at $2.00	122 00
80	socket screws, at $1.75	140 00
56	fire hoe heads, at $1.50	84 00
37	lead pots, at $2.50	92 50
136	long brass nuts, at 75 cents	102 00
457	flat chisels, at 35 cents	159 95
38	pipe cutters, at 60 cents	22 80
54	4-inch iron bands, at $1.00	54 00
371	6-inch Iron bands, at $1.00	371 00
22	8-inch iron bands, at $3.50	77 00
76	10-inch iron bands, at $5.00	380 00
23	16 inch iron bands, at $7.50	172 50
16	20-inch iron bands, at $9.50	152 00
17	30-inch iron bands, at $15.00	255 00
6	48-inch iron bands, at $20.00	120 00
1,373	wooden plugs, at 50 cents	686 50
190	iron plugs, at $1.00	190 00
1,339	brass plugs, at 25 cents	334 75
621	stop boxes, at $2.50	1,552 50
1,499	unfinished stop boxes, at $1.75	2,623 25
1,346	stop box risers, at 35 cents	471 10
22	hydrant keys, at $2.25	49 50
72	plug monkey keys, at 75 cents a dozen	4 50
12	wrought iron monkey legs, at $3.50	42 00
134	hand diamond points, at 35 cents	46 90
173	handle diamond points, at 60 cents	103 80
4	reducing caps, at 50 cents	2 00
21	pressure caps, at $2.00	42 00
34	handle calking tools, at $4.50	153 00
10	gasket irons, at 60 cents	6 00
390	eye bolts, at 25 cents	9 75
70	wrenches, at 50 cents	35 00
	Total	$73,785 80

APPENDIX F.

Report of Assistant in Charge of Hydrographic Work.

BUREAU OF WATER.

Philadelphia, January 15, 1896.

MR. JOHN C. TRAUTWINE, JR.,
Chief of Bureau.

SIR:—The following report on hydrographic work and data collected during the year 1895 in connection with the investigations of the sources for a future water supply, is respectfully submitted.

Rainfall observations at twenty-two stations, three of which are provided with automatic rain gauges, have been continued, completing thirteen years continuous records of data relating to the precipitation.

Streamflow observations by the automatic stream gauges on the Perkiomen, Neshaminy and Tohickon streams have also been continued, completing twelve years of continuous records.

The amount of rainfall for the year ending September 30, 1895, on the area comprising the watershed of the three streams was 42.17 inches, being 6.34 inches less than the average for the past twelve years, and 7.15 inches less than the amount for 1894.

The amount of rainfall for the year ending September 30, 1895, for the twenty-two stations situated in the counties of Philadelphia, Bucks, Montgomery, Berks, Chester and Lehigh, covering an area considerably larger than the watersheds of the three streams, was 37.60 inches, being 8.90 inches less than the average annual rainfall for the preceding thirteen years.

From December 31, 1894 to January 1, 1896, the amount of rainfall over the same area was 11.20 inches less than the preceding thirteen years average.

The greatest monthly rainfall during the year, 5.50 inches, occurred in April, and the least, 0.61 inches, in September. There was a deficiency in the average rainfall for nine months in the year.

The total precipitation registered by the automatic gauge at Thirty-second and Spruce streets, for the year ending December 31, 1895, was 32.26 inches. This is collected at a point 13 feet above ground. The total amount registered by the ground gauge was 34.57 inches. The automatic gauge recorded thirteen storms in which the rate exceeded one quarter of an inch per hour, and one hundred and ten days on which one hundredth of an inch, or more, of rain fell.

No very heavy rainfalls occurred during the year. The greatest amount recorded in a single storm was on April 9, when 2.41 inches fell in twenty-five hours and fifteen minutes. The maximum fall was 0.51 of an inch in thirty-five minutes, or at the rate of 0.86 of an inch per hour. The amount of rain recorded at stations outside of the City exceeded that recorded by the U. S. Weather Bureau by from twelve to thirty-six per cent. The greatest amount recorded was 40.49 inches at Seisholtzville.

The automatic gauge at Spring Mount (or Frederick) recorded sixteen storms in which the rate exceeded one quarter of an inch per hour. The greatest amount in a single storm was on April 9, when 2.68 inches fell in twenty-three hours and forty minutes. The maximum fall was .40 of an inch per hour. The greatest amount for a short period of time was on May 27, when 0.87 of an inch fell in fifteen minutes, or at the rate of 3.48 inches per hour.

The automatic gauge at the Forks of the Neshaminy recorded sixteen storms in which the rate exceeded one quarter of an inch per hour. The greatest amount recorded in a single storm was on August 4, when 2.89 inches fell in six hours and thirty minutes, the maximum rate being 1.61 inches per hour.

The following tables, compiled as in previous years, accompany this report:

I. Monthly precipitation on sundry water sheds.
II., III., IV. Rain storms exceeding ¼ inch per hour. — Philadelphia, Forks of Neshaminy. Frederick, (Perkiomen Valley.)
V. Inches of rainfall flowing in the Perkiomen, Neshaminy and Tohickon.
VI. Average annual yield of streams.
VII. Maximum stream flow., VIII. Minimum stream flow. — Perkiomen, Neshaminy and Tohickon.
IX. Monthly and daily yield of Perkiomen, Frederick and Tohickon.

The observations on the amount of rainfall collected at different elevations above the ground surface extending over the period from 1890 to 1895, and heretofore published as Table V, have shown that difference of elevation, between the limits used (from O to 50 feet) produces no effect upon the gauge readings, and the observations have, therefore, been discontinued.

In Table V, showing the rainfall flowing off monthly in the Perkiomen, Neshaminy and Tohickon, the flow is now stated in inches, instead of percentage of rainfall, as heretofore.

In the report of this Bureau for 1894, tables X and XI gave data covering, to a considerable extent, the same ground, thus involving a certain amount of repetition. In the present report, these two tables are merged in Table IX.

It may be well to call particular attention to the following important facts which appear in the foregoing tables.

The average daily flow of the Perkiomen for the past twelve years (the year ending Sept. 30), was 177,917,837 gallons. The daily flow for 1895 was 148,509,861 gallons, being 11,620,628 gallons less than the flow of 1894, and 29,417,976 gallons less than the average for the past twelve years. The rain fall on the watershed was 4.18 inches less than the average. The average inches of rainfall flowing in the stream for the past twelve years was 24.59. The number of inches flowing during 1895 was 20.52.

The average daily flow of the Neshaminy for the past twelve years was 157,570,700 gallons. The daily flow for the year 1895 was 144,346,886 gallons, being 24,790,818 gallons less than in 1894, and 13,223,814 gallons less than the average for the past twelve years.

The rainfall on the watershed was 7.03 inches less than the average. The average inches of rainfall flowing in the stream for the past twelve years was 23.76. The number of inches flowing during 1895 was 21.76.

The average daily flow of the Tohickon for the past twelve years was 145,790,428 gallons. The daily flow for the year 1895 was 127,264,600 gallons, being 18,525,828 gallons less than the average for twelve years, and 14,405,400 gallons less than 1894.

The rainfall on the watershed was 7.84 inches less than the average. The average inches of rainfall flowing in the stream for the past twelve years was 30.06. The number of inches flowing in 1895 was 26.15.

The year ending December 31st shows for eight consecutive months the lowest stream flow on record. The average daily flow, per square mile, of the Perkiomen for the past twelve years was 1,170,000 gallons; that of the Neshaminy 1,140,000, and that of the Tohickon 1,420,000 gallons. The average daily flow per square mile of these streams for eight consecutive months, beginning with May was, for the Perkiomen, 250,000 gallons; for the Neshaminy, 243,000 gallons, and for the Tohickon, 197,000 gallons. The daily flow of the Perkiomen for the month of September was 98,000 gallons per square mile, or about 15,000,000 gallons total; of the Neshaminy 30,000 per square mile, or about 4,000,000 gallons total; of the Tohickon, 31,000 gallons per square mile, or about 2,000,000 gallons total.

The rainfall on the surface area taken as the watershed of these streams was from four to eight inches below the average.

This does not seem to be sufficient to account for the extremely low flow of these streams.

The tables of rainfall submitted with this report show that the rainfall over the country immediately surrounding and including the watersheds of these streams was 11 inches less than the normal. Similar discrepancy between the rainfall on the three watersheds in question, and that on the larger district embracing them has been observed in previous years, and it would seem to indicate that the flow of the streams is more or less affected by an area much larger than that taken from the contours of the surface.

Mr. Thomas J. Beans, of Moorestown, N. J., who, for a number of years, has voluntarily furnished the Bureau with valuable rainfall data, says in his report for the year 1895, "The rainfall for 1895, 35.90 inches, was the least annual fall in our 32 years records, that for 1879 having been 36.035 inches, for 1880, 36.04 inches, and that for 1881, 36,285 inches. The mean for 32 years is 44 inches.

The greatest rainfall was in 1894, and amounted to 55.48 inches."

The sum of the daily records of inches of water wasted over the top of the flash-boards at Fairmount Dam during 1895 amounted to a total of twenty-three feet five inches. This is by far the lowest total flow recorded. For comparison the totals for the following years are given:.

Total wasted over flash-boards in 1888,.........	40 feet	8 inches.
" " " " " 1889,.........	195 feet	10 inches.
" " " " " 1890,.........	88 feet	5 inches.
" " " " " 1891,.........	64 feet	10 inches.
" " " " " 1892,.........	71 feet	6 inches.
" " " " " 1893,.........	53 feet	
" " " " " 1894,.........	86 feet	7 inches.
" " " " " 1895,.........	23 feet	5 inches.

The computed flow of the Schuylkill for 1895 was 368,306,402,874 gallons, giving a daily average of 1,010,000,000 gallons.

The total flow, as thus stated, is made up as follows:

Total flow over flash-boards..................	69,359,757,440 gallons.
Total steam pumpage...................... ...	71,188,655,893 gallons.
Total water pumpage..........................	7,587,193,211 gallons.
Water power....................................	227,615,796,330 gallons.
Leakage at dam and locks...................	2,555,000,000 gallons.
Total..	368,306,402,874 gallons.

The flow over the flash-boards was computed by Francis' weir formula from the daily reported head over the flash-boards.

The steam and water pumpages are taken from the report of the General Superintendent, where they are given as deduced from plunger displacements.

The water power used at Fairmount is based upon the assumption that 30 gallons of water pass through the turbines for each gallon raised into the reservoir.

The leakage given comprises the lockage through the locks of the Schuylkill Navigation Company on the west side of the river and the quantity which escapes through the gates while the turbines are not running, and through the locks of the Schuylkill Navigation Company.

All of these items are subject to grave uncertainty, more particularly the first and the last, the last being little better than guess-work. We may, however, take one billion gallons per day as the average flow at Fairmount, yet in October last, Mr. Edwin F. Smith, Superintendent of the Schuylkill Navigation Company, found by weir measurement, less than 200,000,000 gallons.

The average rainfall at eighteen stations in the valley was 35.78 inches, of which about 11 inches are computed as flowing in the stream. The greatest monthly flow occurred in January and the least in September. The greatest daily flow was on January 11th, when 33 inches were recorded as wasting over the flash-boards for 24 hours.

The following named persons have been engaged as observers and rodmen during the entire year:

John G. Hilsman, rodman and gauge observer, Rush Valley P. O.

George W. Wood, rodman and gauge observer, Spring Mount, Pa.

A. F. Stover, gauge observer, Point Pleasant, Pa.

Dr. George M. Grim, gauge observer, Ottsville.

George Lowder, gauge observer, Smith's Corner.

Dr. J. A. Roth, gauge observer, Seisholtzville.

A. W. Walton, gauge observer, Doylestown.

H. L. Shull, gauge observer, Lansdale.

The Bureau is indebted to the following-named persons who have kindly furnished rainfall records:

Mr. Thomas MacKellar, Germantown, Philadelphia.

Mr. J. L. Heacock, Quakertown, Pa.

L. M. Dey, U. S. Weather Bureau.

TABLE IX.—PRECIPITATION AND STREAM FLOW ON PERKIOMEN, NESHAMINY AND TOHICKON WATERSHEDS, FROM OCTOBER, 1894, TO DECEMBER, 1895.

Date, 1894.	PERKIOMEN, AT FREDERICK. Area of Watershed, 152 Square Miles.						
	Rainfall in inches.	Percentage flowing off.	Inches of rainfall flowing off.	Monthly yield of stream. Cubic feet.	Average daily yield of stream. Cubic feet.	Gallons.	Average yield in cubic feet per second per square mile.
October	6.235	26	1.660	585,869,760	18,900,000	141,381,990	1.440
November	2.800	66	1.852	654,168,960	21,805,632	163,117,453	1.660
December	4.810	58	2.834	1,000,900,800	32,287,123	241,524,437	2.458
1895.							
January	4.295	71	3.063	1,081,779,840	34,896,114	261,041,056	2.657
February	1.580	80	1.248	440,916,480	15,747,017	117,795,860	1.201
March	2.960	132	3.914	1,381,242,240	44,556,200	333,303,520	3.392
April	6.120	57	3.484	1,230,327,360	41,010,912	306,782,925	3.122
May	3.455	28	0.983	346,006,080	11,161,500	83,493,817	0.850
June	3.560	12	0.431	152,340,480	5,078,016	37,986,195	0.387
July	3.965	15	0.611	215,861,760	6,963,282	52,089,936	0.530
August	3.365	8	0.278	98,029,440	3,162,240	23,655,196	0.241
September	0.925	20	0.168	59,348,160	1,978,272	14,799,502	0.151
Totals	44.070	46	20.521	7,246,791,360	19,854,223	....	1.511
October	3.460	7	0.231	84,269,600	2,272,600	20,358,981	0.207
November	1.875	20	0.337	132,960,960	4,432,032	33,153,899	0.337
December	3.125	29	0.912	322,116,480	10,390,854	77,728,985	0.791
Totals for 1895	....	....	....	5,545,198,900	15,192,326	113,646,484	....

Date, 1894.	NESHAMINY, BELOW FORKS. Area of Watershed, 139.3 Square Miles.						
	Rainfall in inches.	Percentage flowing off.	Inches of rainfall flowing off.	Monthly yield of stream. Cubic feet.	Average daily yield of stream. Cubic feet.	Gallons.	Average yield in cubic feet per second per square mile.
October	5.253	28	1.488	481,541,760	15,533,600	116,199,390	1.296
November	3.020	78	2.372	767,854,080	25,595,136	191,464,901	2.125
December	4.143	55	2.311	747,826,560	24,123,430	180,455,784	2.004
1895.							
January	4.683	74	3,457	1,102,161,600	35,553,600	265,959,393	2.953
February	1.123	158	1,773	573,868,800	20,495,314	153,315,594	1.703
March	3.173	134	4.262	1,379.280,960	44,493,934	332,830,258	3.697
April	5.316	63	3.336	1,079,654,400	35,988,480	269,213,521	2.990
May	2.540	27	0.695	225,011,520	7,258,436	54,296,872	0.603
June	4.300	18	0.747	167,114,880	5,570,496	41,670,201	0.462
July	3.736	23	0.880	284,281,920	9,170,384	68,599,146	0.762
August	3.366	20	0.673	217,831,680	7,026,828	52,564,323	0.584
September	0.736	7	0.053	17,236,800	574,560	4,297,007	0.047
Totals	41.389	52	21,765	7,043,664,960	19,297,712	....	1.603
October	3.256	3	0.082	26,602,560	858,147	6,419,336	0.071
November	2.206	5	0.110	35,562,240	1,185,408	8,867,468	0.100
December	1.853	22	0.401	129,885,120	4,189,842	31,342,193	0.348
Totals for 1895	....	....	....	5,238,492,480	14,352,040	107,360,712	....

Date, 1894.	TOHICKON. Area of Watershed, 102.2 Square Miles.						
	Rainfall in inches.	Percentage flowing off.	Inches of rainfall flowing off.	Monthly yield of stream. Cubic feet.	Average daily yield of stream. Cubic feet.	Gallons.	Average yield in cubic feet per second per square mile.
October	5.182	40	2.101	498,899,520	16,093,533	120,387,980	1.822
November	3.005	89	2.673	634,512,960	21,150,432	158,216,217	2.400
December	4.602	77	3.570	847,488,960	27,338,353	204,505,069	3.096
1895.							
January	4.190	94	3.956	939,306,240	30,300,200	226,661,234	3.432
February	0.958	178	1.698	403,142,400	14,405,090	107,757,554	1.635
March	3.110	172	5.371	1,275,307,200	41,138,942	307,740,624	4.659
April	5.497	84	4.654	1,104,865,920	36,828,864	275,490,031	4.171
May	2.990	22	0.656	155,727,360	5,023,463	37,578,090	0.569
June	4.492	6	0.271	64,411,200	2,147,040	16,060,974	0.243
July	3.528	23	0.806	191,479,680	6,176,764	46,205.402	0.700
August	4.430	8	0.365	86,209,920	2,780,970	20,803,099	0.315
September	0.677	5	0.037	8,752,320	291,744	2,182,397	0.033
Totals	42.661	61	26.155	6,210,103,680	17,014,000	....	1.927
October	3.855	2	0.093	21,980,160	709,037	530,391	0.080
November	2.110	5	0.135	51,986,880	1,732,896	12,962,962	0.196
December	2.570	26	0.667	158,423,040	5,110,420	38,228,594	0.579
Totals for 1895	....	....	....	4,411,810,176	12,087,151	90,418,167	....

Mr. Benjamin Shoemaker, Pennsylvania Hospital, Philadelphia.

Mr. E. F. Smith, Chief Engineer of Canals, Reading, Pa.

Mr. Thomas J. Beans, Moorestown, N. J.

Dr. Charles Moore, Pottstown, Pa.

During 1895 all observations on rainfall were taken uniformly in accordance with the instructions given at the beginning of the year.

Respectfully,

JOHN E. CODMAN,

In charge of Hydrographic Work.

TABLE II.

Rain Storms exceeding in rate 0.25 inches per hour as recorded by the Automatic Rain Gauge at Philadelphia for the year 1895.

Date of Observation, 1895.	AUTOMATIC RAIN GAUGE.				
	TOTAL FALL.		MAXIMUM FALL.		
	Amount in inches.	Duration, Hr. Mn.	Amount in inches.	Duration in minutes.	Rate per hour during maximum fall.
January 26th, snow and rain.........	1.61	10—00	melted	snow and	rain
April 8th, rain storm....................	....	....	.40	60	.40
April 9th, rain storm....................	2.41	25—15	.51	35	.86
April 9th, shower..........................	.39	0—40	.35	12	1.75
May 27th shower............................	.44	3—30	.21	15	.80
June 5th, shower...........................	.89	9—10	.30	20	.90
June 15th, shower..........................	.25	0—40	.15	10	.90
June 27th, shower..........................	.99	3—20	.75	30	1.50
July 5th, shower............................	1.40	7—40	.30	15	1.20
July 21st, shower...........................	.59	1—00	.55	25	1.32
October 31st, rain storm...............	1.58	11—25	.30	60	.30
November 26th, rain storm...........	.88	19—50	.35	15	1.40
December 22d, rain storm............	.43	3—45	.33	20	.99

TABLE III.

Rain Storms exceeding in rate 0.25. inches per hour as recorded by the Automatic Rain Gauge at Forks of Neshaminy for the year 1895.

Date of observation, 1895.	AUTOMATIC RAIN GAUGE.					
	TOTAL FALL.		MAXIMUM FALL.			
	Amount in inches	Duration. H. Min.	Amount in inches.	Duration in minutes.	Rate per hour during maximum fall.	
Jan. 26, snow and rain.....	1.83	8—30	.40	60	.40	Melted Snow & Rain.
April 8, rain storm..........	....	....	.50	30	1.00	
April 9, rain storm..........	2.21	15—50	.20	12	1.02	
May 27, shower...............	1.00	6—40	.65	32	1.22	
June 5, shower................	.95	7—40	.40	20	1.20	
June 12, shower...............	.73	1—30	.30	15	1.20	
June 27, shower..............	.74	2—25	.35	20	1.05	
July 1, shower..................	.93	9—40	.83	40	1.25	
July 5 and 6, rain storm..	1.70	35—00	.25	60	.25	
August 4, showers...........	2.89	6—30	1.22	48	1.52	
August 4, showers...........	....	....	1.61	60	1.61	
August 7, shower............	.30	0—30	.30	30	.60	
August 11, shower...........	.67	11—00	.37	15	1.48	
October 13, rain storm.....	1.77	34—15	.25	60	.25	
October 31, rain storm.....	1.36	9—00	.60	15	2.40	
November 26, rain storm.	.79	9—00	.25	60	.25	
December 22, rain storm..	,49	4—30	.45	45	1.00	

TABLE IV.

Rain Storms exceeding in rate 0.25 inches per hour as recorded by the Automatic Rain Gauge at Frederick, for the year 1895.

Date of observation, 1895.	AUTOMATIC RAIN GAUGE.				
	TOTAL FALL.		MAXIMUM FALL.		
	Amount in inches.	Duration. Hrs. Min.	Amount in Inches.	Duration in Minutes.	Rate per Hour during Maximum Fall.
January 6, rain storm	.73	10—10	.40	20	1.20
January 26, snow and rain	1.43	7—45	.60	60	.60
April 8th and 9th, rain storm	2.68	23—40	.40	60	.40
May 27th, shower	1.87	6—00	.87	15	3.48
June 5th, shower	.70	10—35	.20	10	1.20
June 22d, shower	.80	5—20	.20	10	1.20
June 27th, shower	1.79	1—50	1.75	55	1.91
July 1st, shower	.73	11—10	.35	60	.35
July 5th and 6th, shower	1.76	27—35	.35	60	.35
August 4th, shower	1.00	2—50	.55	28	1.18
August 11th, shower	2.10	14—20	.60	32	1.12
			.70	44	.95
August 27th, shower	.78	9—45	.25	12	1.25
October 13th, rain storm	2.02	34—40	.25	60	.25
October 31, rain storm	.94	10—00	.25	60	.25
November 26, rain storm	.61	8—50	.35	25	.84
December 22d, rain storm	.96	5—20	.90	45	1.20

TABLE V.

Inches of Rainfall Flowing in the Perkiomen, Neshaminy and Tohickon.

Watersheds.	Area in Miles.	Statistics of Watersheds in Percentage of Total Area.				Average for Twelve Years (1883–1895).												
		Woodland.	Cultivated.	Flats.	Roads.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.
Perkiomen at Frederick, 12 years	152.	25	71	2	2	3.33	3.69	3.89	2.36	2.05	0.96	1.24	1.09	1.10	1.02	1.83	2.16	
Neshaminy, below Forks, 12 years	139.3	6	92	¼	2	3.83	4.15	3.77	2.19	1.66	0.72	0.99	6.94	0.95	0.80	1.64	2.32	
Tohickon, 12 years	107.2	24	72	2	2	4.48	4.95	4.71	2.76	2.18	0.95	1.28	1.36	1.33	1.02	2 30	2.62	
Perkiomen at Frederick — Maximum in 12 years						5.40	9.73	5.58	3.48	6.66	2.65	4.89	2.48	3.68	2.36	6.67	3.77	
Perkiomen at Frederick — Minimum in 12 years						0.70	1.25	2 38	1.16	0.7[illegible]	0.28	0.17	0.28	0.16	0.20	0.60	1.04	
Neshaminy, below Forks — Maximum in 12 years						6.77	10.44	5.55	3.57	7.41	1.67	5.47	3.37	3.51	2.55	6.31	4.56	
Neshaminy, below Forks — Minimum in 12 years						1 60	0.90	1.84	1.03	0.35	0.08	0.04	0.14	0.03	0.06	0.33	0.85	
Tohickon — Maximum in 12 years						7.34	10.41	6.37	4.76	8.58	3.43	6.41	3.75	5.49	3.54	7.97	4.28	
Tohickon — Minimum in 12 years						0.80	1.19	2.98	0.84	0.50	0.08	0.11	0.10	0.04	0.05	0.57	0.97	

Table VI.—*Average Annual Yield of Sundry Watersheds to October 1, 1895.*

Watersheds.	Area in miles.	Average rainfall in inches.	Average rainfall flowing off in inches.	Per cent. collected.	Average annual yield in gallons.	Average daily yield in gallons.	Average yield in cubic feet per second per square mile of drainage area.	Average yield in cubic feet per second per square mile of drainage area for each inch of rainfall.
Perkiomen at Frederick, twelve years	152.0	48.255	24.590	50.960	64,951,404,612	177,917,837	1.811	0.0375
Neshaminy, below Forks, twelve years	139.3	48.428	23.761	40.040	57,519,230,238	157,570,700	1.752	0.0360
Tohickon, twelve years	102.2	50.495	30.066	59.530	53,291,210,160	145,790,428	2.207	0.0436
Sudbury, Mass., twenty years	75.2	45.606	22.234	48.750	28,681,957,000	79,562,000	1.637	0.0359
Croton, N. Y., seventeen years	338 0	45.970	22.760	49.5[illegible]0	135,400,000,000	371,600,000	1.680	0.0365

Table VII.—*Minimum Stream Flow.*

Stream.	Minimum Flow Previous to 1895. Cubic feet per 24 hours.	Date.	Minimum Flow, 1895. Cubic feet per 24 hours.	Date.
Perkiomen at Frederick	653,184	September 5, 1885.	518,400	September 15.
Neshaminy, below Forks	108,864	September 28, 1895.	371,500	September 28.
Tohickon	17,280	July 23, 1885.	181,440	September 5.

Table VIII.—*Maximum Stream Flow.*

Stream.	Maximum Flow Previous to 1895. Cubic feet per 24 hours.	Date.	Maximum Flow, 1895. Cubic feet per 24 hours.	Date.
Perkiomen at Frederick	**458,352,000**	**September 18, 1888.**	**363,113,280**	**April 9.**
Neshaminy, below Forks	**498,268,800**	**February 11, 1886.**	**279,426,240**	**April 9.**
Tohickon	**479,174,400**	**September 18, 1888.**	**333,262,080**	**April 9.**

TABLE I.

MONTHLY PRECIPITATION ON SUNDRY WATERSHEDS,

Compared with U. S. Weather Bureau Observations, at Philadelphia, 1895.

ELEVATIONS ARE IN FEET ABOVE SEA LEVEL.

PHILADELPHIA SERIES.

	U. S. Weather Bureau.	Water Bureau, Automatic.		Water Bureau, Ground Gauge.		Pennsylvania Hospital.		Germantown.	
Elevation	207	66		49		25		368	
1895.	Precipitation in inches.	Precipitation in inches.	Difference.	Precipitation in inches.	Difference.	Precipitation in inches.	Difference.	Precipitation in inches.	Difference.
January	4.52	5.11	+0.59	5.55	+1.03	4.72	+0.20	4.85	+0.33
February	1.39	1.02	—0.37	1.03	—0.36	1.73	+0.34	1.44	+0.05
March	2 61	3.29	+0.68	3.31	+0.70	2.82	+0.21	3.44	+0.83
April	6.14	5.50	—0.64	6.25	+0.11	6.17	+0.03	5.69	—0.45
May	1.72	2.04	+0.32	2.11	+0.39	2.10	+0.38	2.10	+0.38
June	3.15	3.76	+0.61	3.83	+0.68	2.78	—0.37	3.93	+0.78
July	3.23	3.09	—0.14	3.21	— 0.02	4.01	+0.78	2.80	—0.43
August	0.59	0.58	—0.01	0.58	—0.01	0.55	—0.04	1.43	+0.84
September	0.61	0.82	+0.21	0.81	+0.20	0.70	+0.09	6.65	+0.04
October	2.97	3.01	+0.04	3.46	+0.49	1.85	—1.12	3.56	+0.59
November	2.32	2.18	—0 14	2.34	+0.02	3.68	+1.36	2.44	+0.12
December	1 76	1.86	+0.10	2.09	+0.33	1.89	+0.13	2.53	+0.77
Total	31.01	32.26	+1.25	34.57	+3.56	32.70	+1.69	34.86	+3.85
Percentage	1.00	1.04	....	1.11	....	1.05	....	1.12	....
13 years yearly averages. Inches	38.60	39.70	....	42.49	....	44.31	....	47.78	....
13 years yearly averages. Percentages	1.00	1.03	....	1.10	....	1.15	....	1.24	....
13 years average, 1895	7.59	7.44	....	7.92	....	11.61	....	12.92	....
Percentage Deficiency	19.7	18.7	....	18.6	....	26.2	....	27.0	....

SCHUYLKILL SERIES. / **PERKIOMEN SERIES.**

	Lebanon.		Reading.		Pottstown.		Browers.		Hamburg.		Seisholtzville.		Frederick.	
Elevation	480		207		150		86		365		870		300	
1895.	Precipitation in inches.	Difference.	Precipitation in inches.	Difference.	Precipitation in inches.	Difference.	Precipitation in inches.	Difference.	Precipitation in inches.	Difference.	Precipitation in inches.	Difference.	Precipitation in inches.	Difference.
January	4.70	+0.18	3.90	—0.62	5.50	+0.98	4.82	+0.30	5.82	+1.30	4.40	—0.12	4.19	—0 33
February	0.87	— 0.52	1.16	—0.23	1.48	+0.09	1.08	—0 31	0.71	—0.68	2.18	+0.79	0.88	—0.51
March	3.02	+0.41	2.19	—0.42	3.50	+0.89	3.42	+0 81	2.05	—0.56	2.76	+0.15	3.16	+0 55
April	5 10	—1.04	4.28	—1.86	5.13	—1.01	4.94	—1.20	6.85	+0.71	7.09	+0.95	5.15	—0.99
May	1.85	+0.13	2.41	+0.69	3.89	+2.17	3.17	+1.45	3.25	+1.53	3.15	+1.43	3.76	+2.04
June	2.05	—1.10	3.25	+0.10	3.46	+0.31	3.78	+0.63	2.56	—0.59	2.87	—0.28	4.25	+1.10
July	2.10	—1.13	4.40	+1.17	2.53	—0.70	2.83	—0.40	3.51	+0.28	4.88	+1.65	3 05	—0.18
August	1.97	+1.38	3.44	+2.85	4.42	+3.83	2.29	+1.70	2.42	+1 83	2.88	+2.29	3.85	+3.26
September	1.32	+0.71	0.37	—0.24	1.01	+0.40	0.47	—0.14	1.62	+1.01	1.01	+0.40	0.84	+0.23
October	2.31	—0.66	3.15	+0.18	3.64	+0.67	2.48	—0.49	3.14	+0.17	3.75	+0.78	3.17	+0.20
November	1.95	—0.37	1.20	—1.12	2.20	—0.12	3.00	+0.68	1.60	—0.72	1.93	—0.39	1.84	—0.48
December	4.14	+2.38	3.59	+1.83	3.20	+1.44	2.94	+1.18	3.78	+2.02	3.59	+1.83	2.66	+0.90
Total	31.38	+0.37	33.34	+2.33	39.96	+8.95	35.22	+4.21	37.31	+6.30	40.49	+9.48	36.80	+3.79
Percentage	1.01	....	1.07	....	1.29	....	1.13	....	1.20	....	1.30	....	1.19	....
13 years yearly averages. Inches	45.71	....	43.76	....	49.12	....	43.17	....	43.35	....	50.14	....	46.80	....
13 years yearly averages. Percentages	1.18	....	1.13	....	1.27	....	1.12	....	1.12	....	1.30	....	1.21	....
13 years average, 1895	14.33	....	10.42	....	9.16	....	7.95	....	6.04	....	9.65	....	10.00	....
Percentage Deficiency	31.3	....	23.7	....	18.6	....	18 3	....	13.9	....	19.2	....	21.3	....

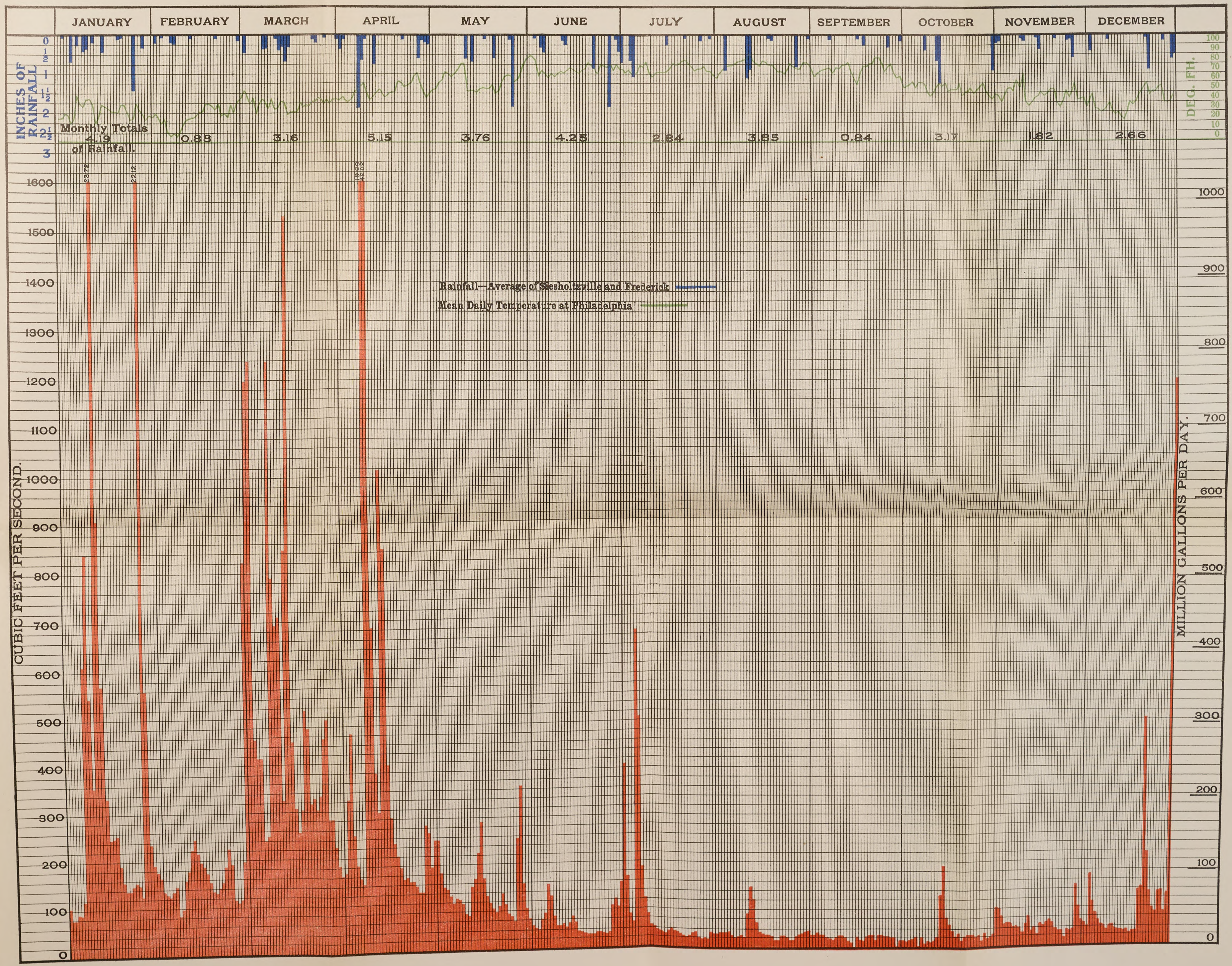
DELAWARE SERIES. / **TOHICKON SERIES.**

	Easton.		Moorestown.		West Chester.		Ottsville.		Quakertown.		Smith's Corner.		Point Pleasant.	
Elevation	340		65		455		390		536		480		119	
1895.	Precipitation in inches.	Difference.	Precipitation in inches.	Difference.	Precipitation in inches.	Difference.	Precipitation in inches.	Difference.	Precipitation in inches.	Difference.	Precipitation in inches.	Difference.	Precipitation in inches.	Difference.
January	3.56	—0.96	4.80	+0.28	4.95	+0.43	3.93	—0.59	3.73	—0.79	4.47	—0.05	4.63	+0.11
February	1.55	+0.16	0.94	—0.45	1.61	+0.22	0.88	—0.51	1.45	+0.06	0.77	—0.62	0.73	—0.66
March	2.16	—0.45	3.97	+1.36	3.44	+0.83	3.30	+0.69	2.70	+0.09	3.02	+0.41	3.42	+0.81
April	3.91	—2.23	5.12	—1.02	5.37	—0.77	4.99	—1.15	5.41	—0.73	5.60	—0.54	5.99	—0.15
May	2.58	+0.86	2.64	+0.92	3.30	+1.58	2.73	+1.01	3.60	+1.88	2.85	+1.13	2.78	+1.06
June	3.10	—0.05	5.05	+1.90	2.47	—0.68	3.58	+0.43	3 47	+0.32	5.51	+2.36	5.41	+2.26
July	5.02	+1.79	2 94	—0.29	1.73	—1.50	3.61	+0.38	4.63	+1.40	3.51	+0.28	2.36	—0.87
August	2.29	+1.70	0.63	+0 04	2.28	+1.69	3.98	+3.39	2.13	+1.54	4.94	+4.35	6.67	+6.08
September	0.74	+0.13	0.47	—0.14	0.62	+0.01	0.59	—0.02	0.87	+0.26	0.70	+0.09	0.55	—0.06
October	4.62	+1.65	4.27	+1.30	2.58	—0.39	4.10	+1.13	3.38	+0.41	3.99	+1.02	3.95	+0.98
November	2.23	—0.09	2.87	+0.55	1.55	—0.77	2.03	—0.29	2.60	+0.28	1.88	—0.44	1.93	+0.17
December	2.47	+0.71	2.20	+0.44	3.13	+1.37	3.53	+1 77	3.19	+1.43	2.56	+0.80	1.76	0.00
Total	34.23	+3.22	35.90	+4.89	33.03	+2.02	37.25	+6.24	37.16	+6.15	39.80	+8.79	40.18	+9.17
Percentage	1.10	....	1.17	....	1.06	....	1.20	....	1.20	....	1.28	....	1.29	....
13 years yearly averages. Inches	46.81	....	45.97	....	52.63	....	49.65	....	49.91	....	50.59	....	50.79	....
13 years yearly averages. Percentages	1.21	....	1.19	....	1.36	....	1.28	....	1.29	....	1.31	....	1.31	....
13 years average, 1895	12.58	....	10.07	....	9.60	....	12.40	....	12.75	....	10.79	....	10.61	....
Percentage Deficiency	27.0	....	21.9	....	18.2	....	24.9	....	25.5	....	21.3	....	20.8	....

NESHAMINY SERIES.

	Lansdale.		Forks of Neshaminy.		Doylestown.	
Elevation	350		143		405	
1895.	Precipitation in inches.	Difference.	Precipitation in inches.	Difference.	Precipitation in inches.	Difference.
January	5.09	+0.57	4.98	+0.46	3.98	—0.54
February	1.34	—0.05	0.74	—0.65	1.29	—0.10
March	3.24	+0.63	3.51	+0.90	2.77	+0.16
April	4.88	—1.26	6.04	—0.10	5.03	—1.11
May	2.28	+0.56	2.70	+0.98	2.64	+0.92
June	5.25	+2.10	4.68	+1.53	2.97	—0 18
July	4.34	+1.11	3.76	+0.53	3.11	—0.12
August	2.95	+2.36	4.26	+3.67	2.89	+2.30
September	0.71	+0.10	0.77	+0.16	0.73	+0.12
October	3.27	+0.30	3.33	+0.36	3.17	+0.20
November	2.68	+0.36	2.05	—0.27	1.89	—0.43
December	1.60	—0.16	2.56	+0.80	1.40	—0.36
Total	37.63	+6.62	39.38	+8.37	31.87	+0.86
Percentage	1.21	....	1.27	....	1.02	....
13 years yearly averages. Inches	46.32	....	47.64	....	47.78	....
13 years yearly averages. Percentages	1.20	....	1.23	....	1.24	....
13 years average, 1895	8.69	....	8.26	....	15.91	....
Percentage Deficiency	18.7	....	17.3	....	33.2	....

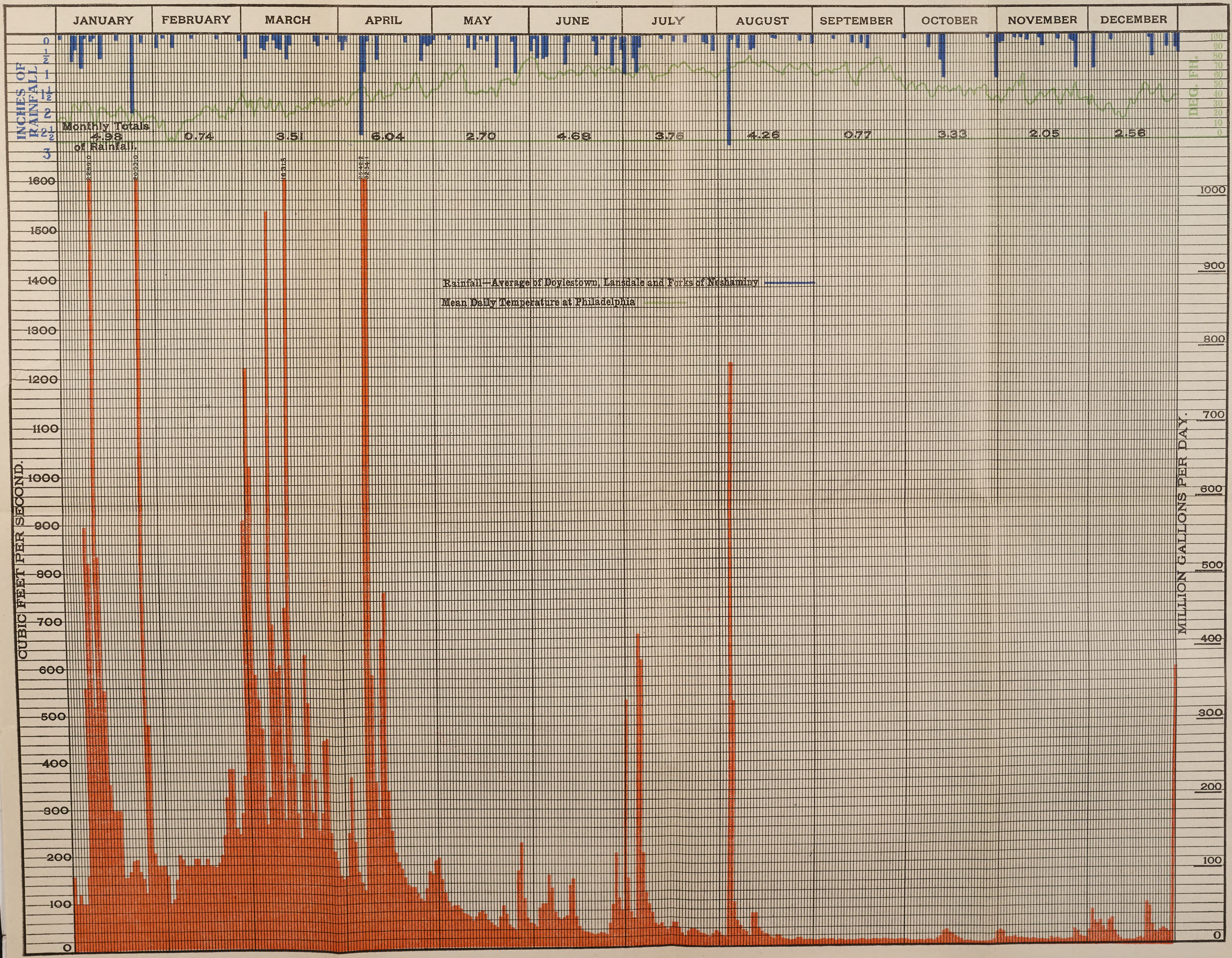
STREAM FLOW
1895.
PERKIOMEN CREEK AT FREDERICK.



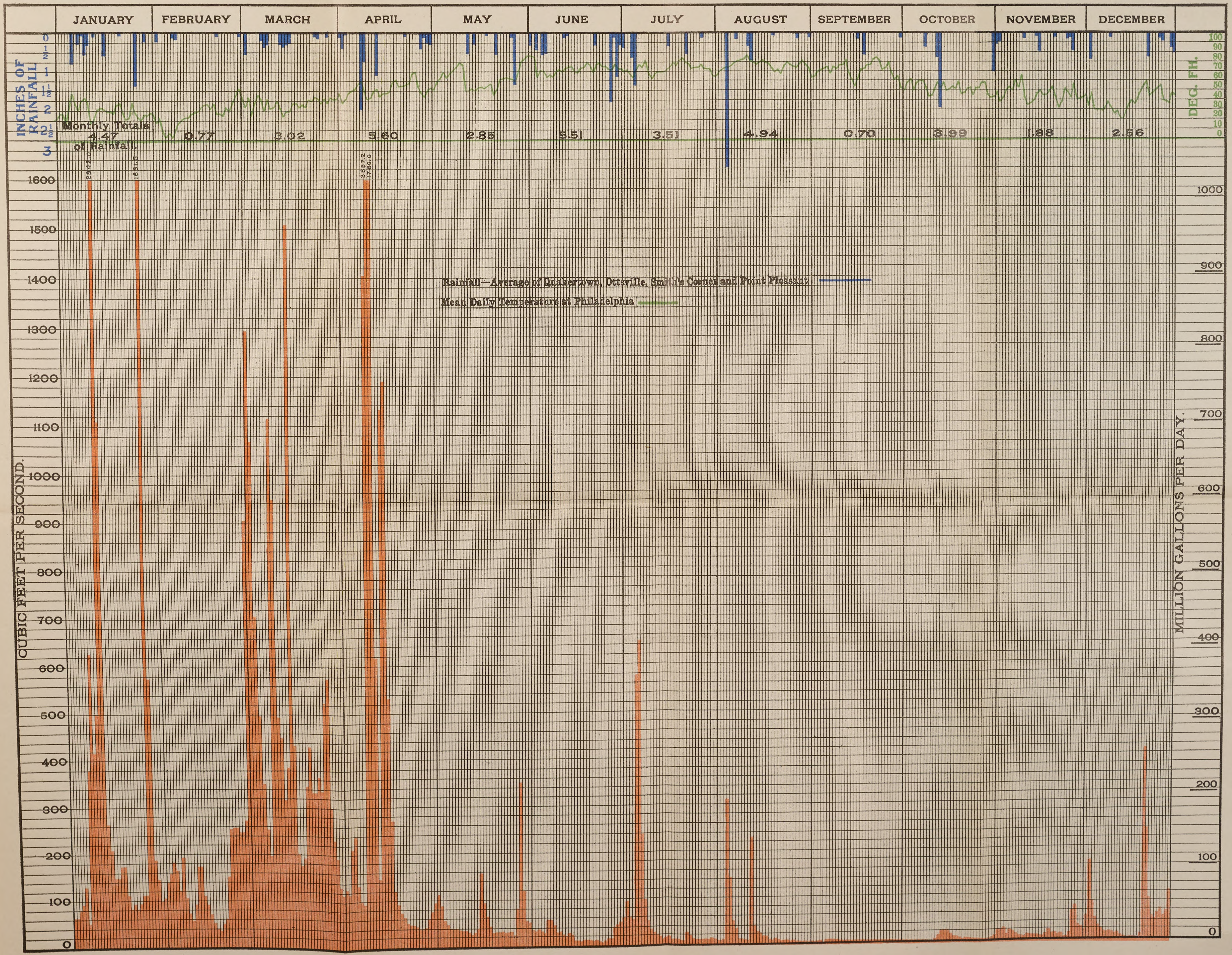
STREAM FLOW

1895.

NESHAMINY CREEK BELOW FORKS.



STREAM FLOW
1895.
TOHICKON CREEK.



APPENDIX G.

REPORT OF CHIEF DRAFTSMAN.

BUREAU OF WATER.

Philadelphia, January 15, 1896.

MR. JOHN C. TRAUTWINE, JR.,
Chief of Bureau.

SIR:—The following report of work under my charge in the drafting room, for the year 1895, is respectfully submitted.

One hundred and sixty-five drawings relating to the design and construction of buildings, boilers, engines, reservoirs, intakes and conduits have been made and recorded. Many of these drawings require much time and labor.

SUBJECTS.	NO. OF DRAWINGS.
New Engine House at Belmont Pumping Station, and additions to buildings at Frankford and Roxborongh	18
Intakes, conduits, etc.	5
Details of Pumping Engines and Boilers	34
Details of work at Reservoirs	29
Miscellaneous castings for special work	19
Illustrating various Reports	60
Total	165

Specifications were prepared for buildings and special steam connections and parts of machinery which required to be advertised.

From data furnished by the boiler inspectors about two hundred and twenty calculations of boiler horse power were made.

Nearly all the work of making blue prints, formerly done by the draftsman, was transferred to the photographer. About 2,500 blue prints were made.

For plans requiring frequent revision, or coloring, such as those employed as studies for contemplated changes, considerable use has been made of the LeClere process, by which black lines on white drawing paper are obtained from tracings.

During the year the photographer employed by the Bureau and detailed to this department made about three hundred and fifty photographs, including views of all the pumping stations, progress of work at conduits, intakes, buildings, reservoirs, etc.; of Queen Lane Reservoir before, during and after repairs; of the leaks in the dams at Fairmount and Flat Rock and through the head gates and locks at Fairmount; of sewers emptying into the Fairmount and Flat Rock pools, and of the low stage of the river at Flat Rock and Conshohocken dams in September last.

The daily pumpage chart for the report of the Chief of Bureau and the daily stream flow charts for the Hydrographic Work have been prepared as in former years.

To the pumping chart has been added a diagram showing the total contents of all the reservoirs on each day of the year.

Respectfully,

JOHN E. CODMAN,
Chief Draftsman.

APPENDIX H.

REPORTS

ON

QUEEN LANE RESERVOIR.

DEPARTMENT OF PUBLIC WORKS,

BUREAU OF WATER.

Philadelphia, June 17, 1895.

MR. THOMAS M. THOMPSON,
Director, Department of Public Works.

DEAR SIR:—At your request we visited the reservoir recently constructed at Queen lane and Thirty-third street, with a view to determining what steps may be necessary to place it in such condition that it may safely be entrusted with its intended depth of water. We have paid several visits to the site, examining carefully not only the reservoir itself externally and internally, but also the adjacent country surrounding it, in order to form an idea as to the extent and probable course of the leakage. Upon most of these occasions we were accompanied by Mr. Amasa Ely, who was in charge of the work from first to last.

The study of the condition of the reservoir divides itself naturally into three parts; first, the stability of the embankment, or its ability to resist tendency to rupture due to the pressure of water; second, the resistance of the exterior slopes of the embankment against the action of storms; and third, the ability of the reservoir to resist leakage.

The *stability* of the embankment depends upon its form and weight; and its resistance to the destructive *action of storms* depends upon the inclination of its exterior slopes and the character of the material of which they and the banks are formed. The effectiveness of the entire reservoir to resist *leakage* depends upon the stability and imperviousness not only of the embankment but also of the bottom.

In the short time thus far devoted to this subject it has of course been impossible for us to arrive at definite conclusions with reference to all these questions. We are not at present prepared to submit any recommendations with reference to the prevention of leakage—a subject which will require further careful investigation. The observations we have already made upon this point, as well as our conclusions, will therefore be reserved for presentation in a later report.

Since, however, you have requested us to make, as soon as possible, recommendations with reference to any part of the problem without waiting for a complete solution of all the questions involved, and since certain operations might be commenced immediately, we now present facts and conclusions respecting the first two points under consideration, viz.: the stability of the embankment and its resistance to the action of storms.

I.

Stability of the Embankments.

As already stated, the stability of the embankment depends upon its cross section and upon its weight. We find the cross section to be as follows: The normal top width is 18 feet; along the north side this increases from

18 feet at the east end to 22 feet at the west end; the height of the bank increasing at the same time from 17 to 35 feet. At the northwest corner, where the height of the bank becomes 40 feet, the top width increases to 27 feet, and from this point it again decreases until it becomes 21 feet opposite the west end of the division bank; the height of the bank at the same time decreasing to 31 feet. Opposite the west end of the division bank the width decreases abruptly to 18 feet. At the southwest corner, where the carriageway encroaches upon the banks, the top width is reduced to 16 feet, and at a few places along the east bank it increases to 19 or 19½ feet.

The inner slope, including that of the division bank, is uniform at 1.64 horizontal to 1 vertical. The outer slopes vary from 1.3 : 1 to 1.8 : 1. Generally speaking, the flattest slope is found along the northern half of the west bank, where the height of the bank is greatest.

The height of the embankment varies from 17 feet at the northeast corner, where the natural surface is highest, to about 40 feet at the northwest corner, where the natural surface is lowest.

From Mr. Ely we learned that the main body of the embankment is formed of the decomposed micaceous rock found upon the site, while the core-wall is composed principally of sandy clay found in places upon the site of the reservoir. An examination of the specific gravity of these materials made during the construction gave the following results:

Broken micaceous rock, loose....................	76 lbs. per cubic ft.
Broken micaceous rock, shaken..	91 lbs. per cubic ft.
Broken micaceous rock, well rammed.........	121 lbs. per cubic ft.
Core-wall material, loose..........................	75 lbs. per cubic ft.
Core-wall material, shaken.......................	84 lbs. per cubic ft.
Core-wall material, well rammed..............	124 lbs. per cubic ft.

We are of the opinion that so long as the present dimensions are maintained by protecting the banks from erosion, and so long as leakage into or through them is prevented, the banks are abundantly strong to withstand the pressure of the water behind them when the reservoir is filled to its intended depth of 30 feet.

II.

Permanence of Outer Slopes.

As already stated, the outer slopes vary from 3 : 1 to 1.8 : 1. That they are undesirably steep for the material employed is evident from the fact that slides or washes have already occurred, notably on the north bank opposite Thirty-second street, and on the east bank just north of its juncture with the division wall.

The liability of the banks to such washing and sliding would call for constant watchfulness and repairs, and if the latter were neglected the erosion would undoubtedly in time proceed sufficiently to impair the safety of the banks.

We, therefore, recommend that the steepness of the outer slopes, except where their height is less than 10 feet, be diminished so that they shall not be steeper than 2 horizontal to 1 vertical. We recommend, further, that where it is practicable this flattening be accomplished by extending the base of the banks over a portion of the adjoining sidewalk. This will render it unnecessary to surround the entire embankment with a retaining wall, and will answer the purpose fully as well. Where this treatment is not practicable, as for instance where the sidewalk would be made too narrow or where the carriage-way upon the bank interferes, resort to a retaining wall will be necessary.

Plans for this improvement are now being prepared by the Bureau of Water.

We beg to repeat that the treatment here suggested for the outer slopes, has nothing whatever to do with the imperviousness of the reservoir, but is here suggested merely as an improvement which may be carried out while the question of leakage is under consideration.

The reservoir, therefore, should not be filled after this improvement is made, until the interiors of the basins have been further considered and attended to.

The recommendations here made for the flattening of the outer slopes and the construction of a retaining wall where necessary, could be carried into effect without interfering with any recommendations we may hereafter make with regard to the prevention of leakage through the banks, the two matters being wholly independent of each other.

Respectfully presented,

(Signed.) JOHN C. TRAUTWINE, Jr.

Chief of Bureau.

(Signed.) RUDOLPH HERING,

C. W. RAYMOND,

Consulting Engineers.

DEPARTMENT OF PUBLIC WORKS.

Bureau of Water.

Philadelphia, August 5, 1895

Mr. Thomas M. Thompson,
Director, Department of Public Works.

Dear Sir:—We present herewith the result of our investigation of the condition of the Queen lane reservoir, together with our recommendations for its repair and improvement.

Site, Dimensions and Construction.

A detailed statement of the site, dimensions and construction of this reservoir, prepared, at our request, by Mr. Amasa Ely, the inspecting engineer in charge of the work from its commencement to its completion, will be found in Appendix "A." We present below a brief abstract of this statement.

The rock underlying the site, Fig. 1, is gneiss and mica schist, the upper portion of which is more or less disintegrated. Nearly continuous over this is a layer of sandy clay, and on this rests the top soil.

The material on the space enclosed by the site of the embankments was excavated, generally, to sub-grade. When in rock, it was excavated to a depth of several inches below sub-grade, and afterward leveled up to sub-grade with disintegrated rock, which was then compacted by a steam roller. The few projections left above sub-grade were removed by pick or by blasting.

The total length of the foot of the inner slopes, in both basins, is 7,210 feet. Of this about 6,200 feet are in excavation below the natural surface. On this portion, therefore, the base of the artificial embankment is higher than the floor of the reservoir. On the other portion, the level of the floor was brought up with material of the same character as the best used in the banks, and this was rolled in layers continuously with those in the banks.

The sandy clay found in place was broken up and rolled. It extends, as a rule, across the width of the bank. Its thickness varies, in general, from 18 to 30 inches.

The main body of the banks, Fig. 2, is built chiefly of the disintegrated micaceous rock. The core wall was formed of clay taken principally from the site. For that portion of the banks between the core wall and the inner slope, material containing but few large stones was selected.

The lower pass pipes, Fig. 4, are supported by brick piers, and the trenches, which are rammed with clay, are provided with numerous offsets in order to reduce the tendency to leakage.

The inlet pipes, Fig. 5, are brought up on the outer slope of the embankment. They discharge through a fountain into a basin, from which the water flows down two aprons lined with blue-stone flags.

The spaces between the stop-houses, Fig. 6, and the sides of the excavations and embankments adjoining them, are thoroughly rammed with clay.

The inner slopes and the bottom are covered with a layer, 2 feet thick, of clay, brought chiefly from a field south of the reservoir.

On the slopes, this clay is covered with concrete slabs, 10 feet wide, and diminishing in thickness from 12 inches at foot to 6 inches at top. On the bottom it is covered with 4 inches of concrete, which overlaps the foot of the slope lining.

From Mr. Ely's report it appears that the materials were well selected and the work properly done in accordance with the instructions of the Department.

The reservoir was practically completed on October 1, 1894.

Examinations by Experts.

During November, 1894, the reservoir was examined at the request of his Honor, Mayor Edwin S. Stuart, by Messrs. John A Wilson, A. Feldpauche and J. J. de Kinder, Engineers. At several places they cut through the concrete lining, and found the clay of good quality, of full thickness and properly packed, and the concrete well made and of good materials. No evidence of defective work was discovered, and all damage by rain storms had been properly repaired. There were no signs of unequal settlement. Mr. de Kinder refers to cracks found in the bottom and slope linings, and he considers them due to shrinkage.

At the request of the Citizens' Municipal Association, an examination and report upon the reservoir were made by Prof. Lewis M. Haupt. This report we have carefully examined and considered.

Rate of Leakage.

After the examination of these experts, water was pumped into the basins to a depth of 10 feet. Under this head, water issuing from the reservoir was discovered at five points in the vicinity, A, B, C, F and G, Fig. 1. Of these the one nearest the reservoir was that at F, about 9 inches above the level of the floor, and 123 feet from the foot of the inner slope.

As shown by the observations plotted in Fig. 7, and explained in Appendix D, leakage occurred at the following rates, as the water was gradually drawn off:

Leakage per Day.

HEAD.	NORTH BASIN.		SOUTH BASIN.	
In Feet.	Inches in Depth.	Gallons.	Inches in Depth.	Gallons.
10	0.70	386,100	1.25	592,292
4	0.35	184,885	0.35	303,473
2	0.32	166,550	0.41	181,860

Results of our Investigation.

A detailed account of our investigations will be found in Appendix B. The following is a brief abstract of this account:

At the time of our first examination the basins contained about two feet of water. Under this head we found distinct evidence of leakage in but one place, viz: in the meadow at A, Fig. 1, which is about 13 feet below the level of the floor, and distant horizontally about 330 feet from the foot of the inner slope. This meadow was saturated with water, but it has dried since the emptying of the reservoir.

The disintegrated micaceous rock of which the banks are composed is apparently as well compacted as its nature would permit. A settlement, of probably less than an inch, appears to have taken place in the division bank, and a crack about ¼ inch wide has opened between the northern end of the eastern pass pipe and the concrete slope lining above it.

The slabs forming the inner slope lining do not appear to have settled vertically as a whole, or to have slid in the direction of their lengths. Their edges, adjoining the steps at the stop houses, are badly cracked.

We find no other indication of unequal settlement in the banks.

Soon after the admission of water, it undoubtedly began to pass through the joints between the slope and bottom linings, between the slabs forming the lining of the slopes, and possibly also through the body of the concrete, saturating and softening the clay lining and washing out some of it, thus permitting the lower parts of the slabs forming the slope lining to settle into the clay, as shown in an exaggerated manner in Fig. 8, leaving, between them and the overlaying bottom lining, a space, Fig. 10, through which more water entered, causing further saturation and washing out of the clay and further settlement of the slope linings. This opening reached, in places, a width of perhaps half an inch, and when there was scarcely half an inch of water over it the water escaped through it so freely that we are satisfied that by far the greater portion, if not all, of the observed leakage occurred in this way.

This deformation is clearly indicated by two series of cracks which appear quite generally throughout the slopes, one at a height of about 5 feet and the other at a height of 10 or 12 feet above the floor, or approximately at the levels of the two angles shown in Fig. 8.

Except as indicating this feature, these cracks are of but little importance, as are also numerous other horizontal cracks, mostly very narrow, in other portions of the slabs, for the concrete lining is provided as a protection to the clay lining rather than for watertightness.

In some of these places the concrete floor lining also has settled, and has cracked at a distance of a few feet from the foot of the slope. Since the emptying of the reservoir this floor lining, owing, no doubt, to the action of the sun's rays, has in some places warped considerably along these cracks, as indicated in Fig. 11.

Cracks have appeared in the floor along the seams formed between the portions laid on successive days, and the concrete adjoining some of them is quite disintegrated and can easily be removed by the hand.

With these exceptions the concrete, so far as examined, is of good quality.

In each basin we find depressions, two of which are from 1 to 2 inches deep, and from 50 to 100 feet in circumference. A slight crack can be traced around one of these in the south basin. These deformations may be attributed to inequalities in the filling under the clay lining, or to imperfect compacting of the latter.

The four brick piers (pp. Fig. 1; see also photographs 18 to 25) supporting the ends of the two lower pass-pipes have been damaged by ice which formed when there were about 4 feet of water in the basins, the upper portions having been driven about an inch toward the division bank and slightly tipped over in the same direction.

The clay lining, which was intended to assure the imperviousness of the reservoir, has, wherever examined, been found of full thickness and well compacted. The clay contains a considerable proportion of mica, and, upon a casual examination, appears to be scarcely a suitable material, by itself, for the formation of a water-tight lining. Nevertheless, when properly confined, it has considerable power of self-puddling, as shown by our examinations, and particularly by the experiments of Mr. Hand, the General Superintendent, described in Appendix C. That it is not sufficiently impervious is evident from the fact that the water which escaped through the opening between the slope and floor linings made its way to the exterior of the reservoir.

In many places small quantities of clay had washed into the basin through the seams and cracks on the slope and on the floor.

The core wall evidently adds but little to the water-tightness of the reservoir. It is formed of material of doubtful quality, and its base is in general higher than the floor of the basin.

Proposed Improvements and Repairs.

In our report of June 17, 1895, we remarked: "The "study of the condition of the reservoir divides itself "naturally into three parts; first, the stability of the "embankment, or its ability to resist tendency to rupture "due to the pressure of the water; second, the resistance "of the exterior slopes of the embankment against the "action of storms; and, third, the ability of the reservoir "to resist leakage."

As regards the stability of the embankment we expressed the opinion that so long as the present dimensions are maintained by protecting the banks from surface erosion, and so long as leakage into or through them is prevented, the banks are abundantly strong to withstand the pressure of the water behind them when the reservoir is filled to its intended depth of 30 feet.

To prevent the washing and sliding of the exterior slopes, we recommend that their inclinations be diminished to a slope of 2 horizontal to 1 vertical, extending the base of the embankment over a portion of the sidewalk where this is practicable, and elsewhere resorting to a retaining wall.

We now report our views regarding the best method of permanently preventing dangerous leakage from the reservoir.

While it is of course desirable to prevent all leakage, the mere loss of water due to such slight and harmless percolation as occurs in nearly all reservoirs is of little importance.

There are two ways in which this reservoir may be made practically watertight. One of these is to reconstruct either the core wall or the interior lining, deepening the former or reinforcing the latter. The other is to leave the structure undisturbed and utilize the present lining as a foundation for a coating which will prevent the penetration of water.

The first of these methods is expensive and unnecessary.

The second method is practicable and reliable, and, if asphalt is used as a coating, it offers the most economical way known to us of rendering the reservoir watertight and serviceable.

Asphalt, properly prepared and applied, is impervious to water. Its toughness and flexibility enable it to conform, without rupture, to slight cracks and settlements in the underlying material, thus indicating where repairs may be necessary. Any repairs required in the asphalt itself are easily made.

Reservoirs in various parts of the world have been lined with asphalt, and the resulting experience has been fully recorded. Where properly applied these linings have proved successful, even under trying conditions.

We therefore recommend that, in order to render the reservoir watertight, the present lining be covered, as far as necessary, with a coating of asphalt.

Before applying the asphalt, the concrete should be carefully repaired wherever it is seriously broken.

The wider cracks in the slope lining and those around the pass-pipes may be repaired by grouting with neat cement; but wherever the surface is seriously impaired, it should be taken out and replaced with sound material.

Where the floor lining, at the foot of the slopes, requires repair, advantage should be taken of this fact to underpin the slabs with a substantial footing, as indicated in Fig. 12.

We believe it to be a wise precaution, where the original surface of the rock is lower than the clay lining, to extend this footing downward to the rock as a core wall, in order to prevent any percolation which may occur through the floor of the reservoir, from washing out the underlying material.

The footing course or wall should be of the best Portland cement concrete, and of such dimensions as may be determined by the Chief of the Bureau of Water.

Where the clay lining is found to be impaired, it should be properly restored.

For the floor we recommend, from the experience recorded, the use of either the natural bitumen from California (Alcatraz) or Venezuela (Bermudez), with an admixture of sand and carbonate of lime, or the rock asphalts from Europe (Neuchatel or Seyssel). In either case the material should be applied in a manner similar to that employed with sheet asphalt for street paving.

For the slopes, we think the material should be natural bitumen, with a less proportion of foreign matter than for the floor, and should be spread as a thick paint.

Before the application of the first coat the surface of the slabs should be roughened, as, for instance, by a thin wash of strong Portland cement, upon which, while still fresh, coarse sand or crushed quartz is sprinkled.

As a further precaution against sliding or crawling of the asphalt in hot weather, we recommend that a layer of heavy burlap, suitably anchored in a groove at the top of the slopes, be stretched tight upon the first coat of asphalt and pressed into it. Upon this burlap the second coat of asphalt, made somewhat harder than the first, should be spread.

Similar applications of burlap to the Linda Vista reservoir, in Oakland, California, 35 feet deep, side slopes 1 : 1, and to another California reservoir, with nearly vertical sides, have been perfectly successful in preventing creeping of the asphalt; in the former case for three years.

The application of the asphalt should be made while the prepared surface of the concrete is thoroughly dry, clean and warm. If the weather should be such as to render it desirable the surface should be artificially heated prior to the spreading of the asphalt.

We are satisfied that this lining will prove effective if sufficient care is taken in its preparation and application.

The proper composition of asphalt, the best proportions of sand and pulverized carbonate of lime, and the modes of application under different conditions, are as yet matters of special expert knowledge. We therefore advise that the specifications for this part of the work be prepared by one or more engineers who have given special observation and study to the lining of reservoirs with asphalt, and who have had facilities for forming proper conclusions therefrom.

The inner slopes of the reservoir should be lined with the asphalt coating from top to botton, but we consider it unnecessary, at the present time, to coat the entire floor with asphalt. Leakage of such a character as to involve danger can hardly occur except near the banks; and any leakage through the rest of the floor will probably cease in time, owing to the tendency of the clay to become more perfectly puddled under the action of any escaping water.

We therefore advise that the asphalt lining on the floor be confined to a strip 50 feet wide, extending entirely around the foot of the banks of both basins.

After the repairs are made the floor may be advantageously covered with a thin layer of loose clay. If water is then admitted and mingled with this clay, and left standing for a sufficient time, we believe that in percolating through any pores in the concrete and clay lining it will increase the imperviousness of the bottom of the reservoir.

If, notwithstanding this precaution, it should be found in time that a considerable amount of leakage takes place through the floor, the asphalt lining can then be extended toward the centre with facility and economy.

In applying the asphalt lining, special care should be taken that the joints between the concrete lining and the stop-houses and pass-pipes are thoroughly covered.

We are confident that if the repairs and improvements herein recommended are properly carried out, and if the reservoir is kept under observation, it will safely carry its full contents.

In order that its behavior may be closely observed at all times, we recommend the construction of a drain completely around the reservoir, as indicated in Fig. 1, and in the profile, Fig. 14.

We recommend that the treatment here suggested be applied first to the north basin, in order that so much of the reservoir may be put in use at the earliest possible moment.

Estimate of Cost.

The following is an approximate estimate of the cost of the repairs and improvements herein recommended, as applied to both basins. We believe this estimate to be ample, but, inasmuch as the quantities required in several of the items can be determined only as the work proceeds, we can attempt no closer estimate at this time.

Interior

(1) Concrete footing, cleaning and repairing floor, repairing cracks at stop-houses and at pass-pipes...	$15,000 00	
(2) Asphalt lining of slopes..........................	70,000 00	
(3) Asphalt lining of floor............................	60,000 00	
		$145,000 .00

Exterior.

(1) Reconstruction of slopes and building retaining walls	$75,000 00	
(2) Drain	12,000 00	
		87,000 00
Total		$232,000 00

Respectfully presented.

[Signed] JOHN C. TRAUTWINE, Jr.,
Chief of Bureau.

[Signed] RUDOLPH HERING,
C. W. RAYMOND,
Consulting Engineers.

The following Drawings and Appendices accompany this report :

Figures.

1. Topographical plan of site and surroundings, with location of proposed drain.
2. Cross sections of bank, showing outer slopes 1.3, 1.8 and 2.1.
3. Rollers.
   Large, for bottom and banks.
   Small, for clay on slopes.
4. Pass-pipes.
5. Inlet.
6. Stop-houses.
7. Diagram of leakage from N. and S. basins.
8. Normal deflection of slope slabs.
9. Deflection of slabs in N. basin.
10. Joint at foot of slope, with opening.
11. Hump.
12. Footing.
13. Diagram of Fairmount experiments.
14. Profile of drain.

Photographs.

1 2. Cracks in west bank, S. basin.
3 8. Cracks between slope and floor linings.
9 11. Cracks in floor, S. basin.
14 17. Crater-like mound of clay.
18 25. Pass-pipes.
12 13. Steps.

Appendices.

A. Account of site, dimensions and construction.
B. Results of investigation.
C. Experiments on the permeability of different linings.
   Explanation of Fig. 13.
D. Observations on rate of leakage from reservoir.
   Explanation of Fig. 7.

SUB-APPENDIX A.

Site, Dimensions and Construction of Reservoir.

Site.

The Queen Lane Reservoir is located midway between the Falls of Schuylkill and Germantown, upon a plateau sloping toward the south, its boundaries being Thirty-third, Queen and Thirty-first streets and Abbottsford avenue. (Fig. 1.)

Geological Formation.

Underlying the top soil on this tract are the gneiss rock and mica-schist, so common in and about Philadelphia. Near the surface these rocks are more or less decomposed. Thus we have immediately over the solid rock the same rock in a partly disintegrated condition, while higher up it has become reduced to a nearly sandy condition, and consists chiefly of mica and quartz. Overlying this, and nearly continuous over the site, is a layer varying from 18 to 30 inches in thickness of a sandy clay, and upon this rests the top soil.

Embankments.

The embankments of the reservoir are composed chiefly of the decomposed macaceous rock found upon its site. The outer slopes vary from 1.3 : 1 to 1.8 : 1 (Fig. 2), while the inner slope is uniformly 1.64 : 1. The normal top width of the bank is 18 feet. At the southwest corner, where the carriage way encroaches upon the banks, the top width is reduced to 16 feet, but at all other points it is at least 18 feet. The height of the embankment varies from 17 feet at the northeast corner, where the natural surface is highest, to about 40 feet at the northwest corner, where the natural surface is lowest.

Core Wall.

Near the centre of the embankment is a core wall, composed principally of the sandy clay found upon the site of the reservoir.

Construction.

Work on the construction of the reservoir was begun October 10, 1892, by stripping off the timber and brush and removing the top soil. After the removal of the top soil, the puddle trench was dug to a depth of three to five feet, or half the width of the puddle wall at its starting point. The foot of this wall is in all cases in the decomposed micaceous rock.

The contractors were authorized to use in the puddle wall, and on the bottom of the bank, between the puddle wall and the inner lining (See Fig. 2), the clay found on the reservoir property, and this material was used throughout the entire length of the puddle wall, except across the railroad openings and over the low ground near the north end of the west bank, and east of the southwest corner. At the latter places clay from the outside clay pits was used from the bottom of the puddle wall to about half way up the embankment, above which point clay from the reservoir ground was used. The entire puddle wall across the railroad openings was built up with clay from the outside pits. The material for the puddle wall was placed and rolled at the same time with that for the banks.

The clay found in place on the site of the bank between the core wall and the inner slopes was broken up with plows and shovels and afterward rolled and left in place. It was not reinforced with clay from the outside pits.

The top soil was completely stripped from the base of the bank, and, where the natural surface had a slope toward the outside of the bank, as near the northwest and southwest corners, steps were cut into the original surface to break the slope, as shown in Fig. 2.

All around the outside of the embankment a toe about 18 inches deep was cut to receive the foot of the outside bank.

Across the low ground already mentioned, this toe was made about 2 feet to 2 feet 6 inches deep.

The work of building the banks was begun October 31, 1892. The material for the embankment was brought to place by wheel and drag-scrapers, carts, and trains from the steam-shovels. That delivered by the trains was dragged out in layers with drag-scrapers.

The material of the bank on the inner side of the puddle-wall contained comparatively few large stones, while in the outside filling the number of large stones is considerably greater.

The material under the concourse and roadways, and beyond the outer slopes of the typical bank, is the poorest taken from the excavation, and contains stones varying in size from a few inches to 18 or 20 cubic feet. The concourse, having been used also as a waste dump, contains refuse building material, top-soil and stumps. The material under the concourse and roadways was not rolled.

The contractors were authorized to make the fill, above the water line, from the rotten rock stratum, and, although this portion was rolled with the steam-roller, there are a number of unbroken large stones above that level.

The embankment was rolled in layers of from 6 to 9 inches with 2 grooved steam-rollers (Fig. 3.), each weighing 12 tons. Sprinklers were used to moisten the material, except after a rain.

Within the enclosure formed by the embankments the material immediately under the top soil was removed by wheeled and drag scrapers and carts. The lower strata were removed by drag scrapers (on the part next to the banks), by wheeled scrapers (nearer the center), and by steam shovels (in the central portion).

Where the sub-grade was in rock, the excavation was made from four to eight inches deeper than sub-grade, in order to leave as few points as possible projecting above sub-grade.

The bottom was then staked off in squares of .50 feet on a side, and the ground was carefully leveled between these stakes, the hollows being filled with decomposed rock, which was then rolled with a 12-ton grooved steam roller (Fig. 3).

Any small projections still remaining above sub-grade were removed with rock wedges and picks; larger projections were removed by blasting.

Where the surface under the top soil was lower than sub-grade, viz: in the northwest corner of the north basin (See Fig. 1) and (to a very small extent) along the south bank of the south basin, the surface was brought up to sub-grade by filling in with "best filling material" deposited in layers, as in the banks, and rolled with the grooved steam roller, shown in Fig. 3.

Pass-pipes, Fig. 4.

Where the lower pass-pipes are laid through the division bank (Fig. 4) the trenches are thoroughly rammed with clay from the bottom to 18 inches above the pipe, and for 18 inches a ound the well.

The piers A. A. supporting these pass-pipes are built T shape in plan, the arm indicated by the dotted line running out about $2\frac{1}{2}$ feet from the pier, thus giving about $4\frac{1}{2}$ feet support to every joint.

The sides of the trenches are grooved vertically between every two piers, as shown, so as to give a broken surface to the clay puddle along the side. On each side of the well the clay puddle is counter-sunk in the bottom of the trench about 15 inches.

The upper pass-pipes were laid upon T shaped piers in the same manner as the lower ones, and the space between the pipe and surrounding piers was rammed with clay. The clay was also continued around the stop-well in the centre of the bank.

Inlet Pipes. Fig. 5.

The two 48-inch inlet pipes are laid up the outer slope of the bank, from its foot at Thirty-third and Bowman streets, to the vault under the inlet pool. They have about two feet of earth covering on the slope and within the vault they are laid upon a series of brick piers which rest on a foundation consisting of rubble masonry 2 feet in thickness, over a layer of concrete 4 feet thick.

At the rear end of the vault the two 48-inch pipes converge into a 72-inch pipe which makes a quarter turn into a vertical position, emerging from the embankment at the centre of the inlet pool, from which the water flows into the two basins over aprons lined with blue-stone slabs set on edge.

Stop-Houses. Fig. 6.

The space between the stop-houses and the sides of the excavations and embankments adjoining them, are thoroughly rammed with clay, as indicated in Fig. 6.

Clay Lining.

The bottom and the inner slopes of the reservoir (Fig. 2), are lined throughout with two feet of clay taken principally from a field in the low ground just south of the hill on which the reservoir is built. Some clay was brought, also, from other localities within the City limits.

The clay lining of the slopes was put on during the season of 1893, starting with the west bank in the north basin.

After the completion of each bank the addition of its clay lining was begun.

The clay was spread thinly, in horizontal layers, 2 or 3 inches thick, and kept moist by sprinkling with a hose. A line of one inch pipe was run around the entire bank with hose connections spaced a short distance apart, to provide water for sprinkling purposes, and afterward for mixing the concrete.

The clay was rolled with an iron-grooved roller (Fig. 3), weighing about one ton, and drawn by two mules harnessed tandem.

The clay for the bottom lining was delivered during the fall of 1893, and the winter following, and but a small portion of it was rolled in place before the spring of 1894. It was rolled in five or six layers parallel to the bottom of the reservoir, with a steam roller weighing 12 tons (Fig. 3), and, except where moistened by rain, was sprinkled by sprinkling carts and wagons. Upon the slopes this clay is overlaid with concrete slabs 10 feet wide, 66½ feet long, and varying in thickness from 6 inches at the top to 12 inches at the foot. (Fig. 2.)

Concrete Lining.

These slabs are supported entirely by the clay lying underneath them. The bottom of the reservoir is covered by a concrete lining 4 inches in thickness which rests upon the clay lining.

The edges of this bottom lining of concrete overlap the foot of the concrete slabs on the slopes as indicated in the figure.

The concrete for the bottom and slope lining was mixed as follows: Two parts of sand and one part of cement were spread evenly upon the mixing board, and turned and raked until well mixed, when enough water was added to make a thin mortar, after which four parts of broken stone were spread evenly over the mortar and mixed with it. In a portion of the bottom lining of the south basin, blast furnace flags was substituted for the stone.

After the bottom concrete was rammed in place until the mortar appeared on the surface, a dryer composed one part cement and two parts sand was thrown over the surface, which was then floated until all stones appearing on top were covered, and a comparatively smooth finish obtained.

On the slope concrete a separate finish, composed of one part cement and two parts sand, was used.

The slope concrete and finish is of the same character as that placed as a sample in East Park Reservoir.

The cement used on the lining was all imported, and of the Hilton, Burnham and Hemnoor brands.

With the exception of shaping up the outer slopes in a few places, and a few square yards of sodding, the work was finished by October 1st, 1894.

SUB-APPENDIX B.

Results of Investigation.

(a) Leakage.

At the time of our first visits the depth of water in the basins was less than 2 feet. Under these conditions the only important leakage appearing outside of the reservoir was that in the square bounded by Thirty-third and Thirty-fourth, Fairview and Queen streets, near the point marked "A," Fig. 1. The meadow here lies from 20 to 30 feet below the finished bottom of the basin, and we found it saturated with water over a space of perhaps a tenth of an acre. We are informed that the ground here was quite dry before water was let into the reservoir, that when the reservoir contained 10 feet of water the flow of the stream was much greater than at the time of our visit, and that the meadow itself was covered with ice in winter. The meadow has dried since the emptying of the reservoir.

Under the 10 feet of water, leaks appeared also in the rocky sides of the pipe trenches on the eastern and southern sides of the reservoir near the points marked B and C respectively, Fig. 1. That at B appeared to be about 10 feet and that at C about 14 feet below the bottom of the reservoir. The water from these leaks flowed along the pipe trenches to a point near D, and was thence carried through a trough D E to a measuring weir at E, which indicated that under a head of 10 feet the combined leakage of B and C, with perhaps some leakage from intermediate points, amounted to about 142,000 gallons per day. At the time of our visits, when there were less than 2 feet of water in the basins, little or no water seemed to be escaping through the trough D E.

The leak at C first appeared in the rock on the western side of the trench, and after disappearing there, it appeared upon the eastern side nearly opposite.

We are informed by Mr. Ely that when the reservoir held its maximum quantity of water a leak appeared in the curbing of the carriage drive near the point marked F, near Thirty-third street and Indian Queen lane, at an elevation of 9 inches above the floor of the basin, and at a distance of 123 feet from the foot of the inner slope. This leak first appeared on the western side of the drive near the point marked a, but, after flowing there for two days, it ceased, and immediately reappeared on the eastern side of the drive near b. In both cases the water issued in a stream about $\frac{3}{8}$ of an inch in diameter.

We are also informed by Mr. Ely that under a head of 10 feet a slight leak appeared near the point G, on Queen street east of Thirty-third street, near the western end of the north bank. This leak manifested itself in an accumulation of water in the rut on the north side of the street.

Both F and G were entirely dry when we visited the location.

We submit herewith diagrams, Fig. 7, showing the rate of leakage from the north and south basins, respectively, plotted from the diary of Mr. Ely. His account of these investigations is given in Appendix D.

(*b*) *Concrete lining.*

In order to inform ourselves as to the character of the lining of the reservoir we entered both basins, and made a careful inspection of each. At our request the water had been drawn off until it was about level with the foot of the slope in the north basin, and perhaps half an inch lower than this in the south basin. As the bottom of each basin slopes from the level foot of the embankment toward the outlet chamber or stop house in its eastern bank, the bottom was still covered with water, varying in depth from say nothing at the sides to about one foot near the stop houses. Our inspection, on the occasion of this visit, was therefore confined chiefly to the condition of the slopes and to that of the edges of the bottom at the foot of the slopes.

In many of the concrete slabs which form the lining of the slopes of both basins we find a tendency to the formation of two series of horizontal cracks, one at a height of about 5 feet and the other at a height of about 10 or 12 feet from the bottom, measured vertically. These cracks, while they are more or less irregular, are distinctly horizontal in their general direction, and they appear so generally throughout the construction, and so nearly at the same heights, as evidently to indicate some peculiarity in the behavior of the slope lining. We, therefore, examined carefully, by means of a large straight-edge, a considerable number of the slabs in which these cracks appear, and of those in which they are absent. In the former we found, almost universally, a deformation which we have indicated in an exaggerated manner in Fig. 8, showing that the portion of the slab below the upper crack, appears to have sunken, rotating about an axis in the upper crack, while that portion below the lower crack has settled still further, rotating about an axis in the lower crack.

The greatest deformation of this kind noticed, was in the twenty-third slab from the division bank in the western embankment of the south basin, near the point where the crater-like mound appeared. Here the total deviation at the foot of the slope amounted to $1\frac{3}{4}$ inches, as will be seen from the following table, in which are given the results of measurements for a few cases. The letters correspond with those in Fig. 8, and the measurements are given in inches.

	No. of Slab.*	No. 23.	No. 25.	No. 27.
Offset	a	$\frac{5}{8}$	$\frac{5}{8}$	$\frac{7}{16}$
"	b	$1\frac{3}{4}$	$1\frac{5}{8}$	$\frac{7}{8}$
"	c	$\frac{7}{8}$	$\frac{7}{8}$	$\frac{7}{16}$
"	d	$1\frac{3}{8}$	$1\frac{1}{8}$	trace.
"	e	67	48	
"	f	98	92	

*Counting southward from the division bank.

In other slabs examined, the settlement was less, but the presence of this particular kind of deformation was so general and so marked, that, taken in connection with the two cracks already mentioned it led irresistibly to the conclusion that there was, throughout the entire slope, a tendency for the foot to settle inward in a direction at right angles to the slope.

Along the north bank of the north basin are several contiguous slabs, in which, while the upper crack is conspicuous, the lower one is less so, and, in some cases entirely wanting. Here, by applying the straight-edge, we found, at the upper crack the distortion shown in Fig. 8, while the portion below that crack showed distinctly a deformation in the opposite direction, Fig. 9. In other words, the upper surface of the slab below the upper crack was concave, instead of being convex as in the slabs already described.

In order to ascertain whether the cracks in the slope lining extended entirely through its thickness, we drilled two holes, about two inches in diameter, through the twenty-third slab from the division bank in the west bank of the south section. This is the slab in which the greatest deformation was found and in which the lower crack, photographs 1 and 2, was wider than in any other place, reaching a width of $\frac{3}{8}$ of an inch or more. The holes were both drilled in this lower crack at a distance of about 7 inches from each other, and at such points that one of the holes was about two inches higher than the other. When the upper hole was filled with water, the water flowed through the crack into the lower hole, but the flow appeared to be confined to the upper 4 inches of the thickness of the slab. When the water in the upper hole had subsided an inch or an inch and a half, the flow nearly ceased.

The concrete between the two holes was afterwards cut out, but, owing to the roughness of the exposed surface of the concrete, we were unable to follow the track more than about four inches, and water, poured into the crack above the opening, seemed to be confined in its flow, as before, to these upper four inches. Water, poured into the cavity excavated, ran off very slowly, if at all, showing at least a satisfactory degree of contact between the concrete and the clay lining beneath it.

After careful examination we have been unable to find any evidence that the slabs forming the slopes have settled as a whole, either vertically or in the direction of their lengths.

Where the foot of the slope has settled, as indicated in Fig. 8, and where this settlement has not been followed up by a settlement of the bottom lining which overlaps the foot of the slope, we have, of course, an opening of greater or less extent between the two, as indicated in Fig. 10. See also Photographs 3 to 8.

Through many of these openings it was easy to insert a bar of iron one inch by one-quarter inch, and, by springing up and down upon the bottom lining near them, the lining could be moved up and down, as shown by the pumping action thus exerted upon the water in the opening. Furthermore, in the north basin, where sufficient depth of water remained to cover the joint between the slope and the bottom linings, the water could be seen rapidly escaping through these openings.

As shown in Fig. 10, the bottom lining finishes off to a sharp edge having an angle of about 31 degrees, and in many places we found these edges sprawled off, and in others so friable that they could easily be broken off.

The opportunity for leakage from the space opened between the bottom and the slope linings by the settlement of the latter, indicate that by far the greater portion of the leakage thus far observed has taken place through these spaces.

In many cases, however, the portion of the bottom lining near the foot of the slope has settled, forming cracks running parallel to the foot of the slope and distant from it a few feet.

This settlement in the concrete bottom lining closes, more or less completely, the opening between it and the slope lining, left by the subsidence of the latter.

Since the emptying of the reservoir there has been, at many points near the foot of the slopes, a marked increase in the deformation of the bottom lining.

This deformation takes the shape of a rise of the lining along the cracks already referred to as being caused by settlement, and seems to be due to the action of the summer sun in heating the upper surface of the lining, while the lower surface, in contact with the moist clay below, remains comparatively cool. The action of the sun in warping the concrete has probably contributed also to the deformation of the slope lining to which we have already referred.

The warping of the bottom lining is particularly noticeable in the south basin at several points along the south embankment near its eastern end. At one of these points (Fig. 11) the upper surface of the bottom lining, along the crack, which was here about 3 feet from the foot of the slope, was found to be 3 inches higher than the foot of the slope and $3\frac{1}{2}$ inches higher than the general level of the bottom lining as observed at a distance of 24 feet out from the foot of the slope. At this point we cut through the bottom lining and found the thickness of the concrete was about $\frac{1}{4}$ inch less than the stipulated thickness of 4 inches, while close to the foot of the slope it measured about 7 inches.

The lower surface of the bottom lining, which at this point had been for some weeks separated from the clay below, felt as warm as the upper surface. The clay here was of full thickness and well compacted, but that immediately adjoining the foot of the slope, although compacted, was found more or less saturated with water.

At the joints left between portions of the bottom lining laid on successive days there is a tendency to open, and the thin layer of cement, used in patching these seams, is generally more or less broken, and very imperfectly, if at all, connected with the lining proper.

Extending eastward from the west slope of the south basin opposite the eighteenth slab from the division bank (Photographs 9 to 11) a crack of this kind extends about 100 feet out into the basin; and here the crack in the bottom lining is in worse condition than at any other point, the material, for a width of 6 inches between the two portions of the bottom lining proper, and for a depth of about 2 inches in places, being quite disintegrated, so that it can be easily removed by the hand. The surface of the bottom lining on the north side of the crack is about $\frac{5}{8}$ of an inch lower than on the south side, which latter emits a hollow sound when struck.

We find two notable depressions in the concrete floor, —one in each basin. That in the north basin is distant 150 feet south of the north bank and about 30 feet east of the slab marked "2." It is of irregular shape, and measures about 6 by 20 feet. As measured by the hand-level it is $1\frac{1}{4}$ inches deep. The depression in the south basin is 150 feet east of the west bank, opposite to the twenty-third slab from the division bank, which is the slab in which the two holes were drilled for the purpose of ascertaining whether the low crack extended entirely through the slab. This depression is of oval shape, about 20 by 30 feet, and, as measured by the hand-level, is from $1\frac{1}{2}$ to $1\frac{3}{4}$ inches deep. A slight crack is traceable around the greater part of this depression.

Similar depressions, of less depth, were noticed in other portions of the floor.

The edges of the concrete slabs adjoining the steps leading into the reservoir near each stop-house are badly cracked, as shown in photographs 12 and 13.

(c) *Clay Lining.*

The clay lining has, wherever examined, been found of full thickness and well compacted, but the fact that leaks have appeared in the neighborhood of the reservoir, and that we found the water (under a head of scarcely half an inch) running out freely between the slope and the bottom linings, show that it is not perfectly fulfilling its functions.

We have examined several samples of the clay taken from this lining, and we find that it contains a considerable proportion of micaceous material, which renders it difficult to make a water-tight lining with it. A piece of this clay, about the size of an egg, placed in water when dry, immediately began to go to pieces, and in about ten minutes it had resolved itself into a broad low pile of loose flaky particles, without the least power to resist pressure. On the other hand, cups made of it exhibited a considerable power of retention.

Another sample of the clay was thoroughly compacted in the end of a cylindrical lamp chimney. The interior diameter of the tube was $1\frac{7}{8}$ inches, and its length 7 inches. The depth of the clay in the tube was $2\frac{3}{4}$ inches, leaving $4\frac{1}{4}$ inches to be filled with water. A fine wire was imbedded in the clay in the axis of the cylinder. The clay was allowed to dry for five days and the wire was then withdrawn, leaving a small hole. Water was then poured into the tube, and the following phenomena were noted.

July 16.

1. The clay was still damp. The tube was filled with water at 1.30 A. M. All the water ran through into a tumbler beneath it in $2\frac{1}{2}$ minutes.

2. Filled again at 2.46 P. M. Emptied in three minutes. (A small portion of bottom flaked off and fell into tumbler.)

3. Filled again at 2.59 P. M. Emptied in 4 minutes.

4. Filled again at $3.04\frac{1}{2}$ P. M. Emptied in 8 minutes.

5. Filled again at $3.13\frac{1}{2}$ P. M. Emptied in 30 minutes.

6. Filled again at 3.45 P. M. Left all night.

July 17.

At 10 A. M. about $\frac{1}{4}$ inch remained in tube, and no leakage was apparent.

7. Filled at 10.05 A. M. No leakage at 3 P. M.

These experiments indicate that, at least under low heads, the clay used in the linings of the slopes and bottom has considerable power of self puddling; that is, that water, passing through a very small opening in the clay will carry with it from above a sufficient quantity of the clay to close the opening.

At the south wall of each outlet chamber, Fig 1, and at many other points, we found evidences that the clay from behind the slope's lining had been washed outward through the joints between the slabs which form that lining, and down the slopes to the bottom. The accumulations thus formed at the north and south stop-houses amounted to about one-sixth and one-third of a cubic foot respectively.

At the point marked H, Fig. 1, at the foot of the twenty-seventh slab from the division bank, in the west bank of the south basin, we found evidence that the clay, instead of washing through the joint between the slabs of the slope lining, had been carried down behind the slab under the foot of that lining and washed upward through the opening between that and the bottom lining. The clay thus washed into the basin was deposited in the form of a mound, having a central funnel-shaped opening or depression resembling that of a crater. See photographs 14 to 17. The mass was about 8 feet long by 2 feet wide, and 12 or 15 inches high, and measured about 7 cubic feet. It extended in a direction parallel with the foot of the slope.

A thin layer of clay extended from this mound over a space reaching perhaps 20 feet from the foot of the slope.

Since the emptying of the reservoir it has been noticed that during a smart shower a jet of water about half an inch in diameter and three inches high springs up into the basin at this point.

A tendency to the formation of similar mounds has been observed in other parts of the basin.

At many places in the bottom, air bubbles were found escaping through the concrete lining. This we noticed chiefly in the vicinity of the edges of the slope lining.

(*d*) *Pass-pipes.*

An inspection of the two lower pass-pipes up through the division bank indicated that some settlement, probably less than an inch, had taken place in the bank at these points, and the northern opening of the eastern pass-pipe had settled about a quarter of an inch, leaving an opening between it and the concrete slope lining above it.

We find that all four of the brick piers, p, Fig. 1, and photographs |18 to 25, surrounding the outer ends of the two lower pass-pipes have been damaged by ice which formed when there were about four feet of water in each of the basins. This ice was said to have been about 15 inches thick, and its pressure against the upper portions of the piers has sheared off these portions along a plane corresponding approximately with the axis of the pipes and have driven the upper portions of the piers an inch or so inward toward the division wall, besides tipping them over slightly in the same direction.

(e) *Core Wall.*

It was practically impossible for us to examine the core wall itself, and, as a matter of fact, we felt that such examination was scarcely called for. Mr. Ely pointed out to us in two places, one near each end of the division bank, the natural stratum from which was taken the greater part of the material for this wall, and we found it to be a decidedly sandy and inferior clay, so that the wall at best could have added but little, if any, to the water tightness of the banks.

Furthermore, in a number of places where the elevation of the natural surface was high, the foot of the core wall was higher than the bottom of the reservoir, so that the wall, even if impervious, could not have intercepted any leak having its origin at the level of the bottom of the reservoir.

The core wall, Mr. Ely informs us, averaged full thickness, varying, possibly, as much as 6 inches either in excess or in deficiency. The thickness at foot, however, is proportional to the actual depth, as will be seen upon comparing the two diagrams of Fig. 2.

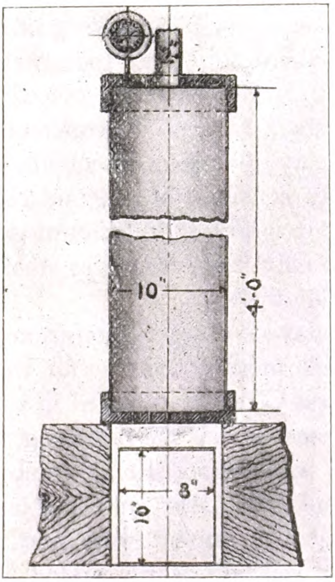
SUB-APPENDIX C.

Experiments at Fairmount on Permeability.

Explanation of Diagram, Fig. 13.

These tests were made to determine the rate of percolation through various materials under a head of 30 feet.

A number of iron cylinders were prepared of the dimensions here shown.



These cylinders were fitted with a cap at each end, that on top being provided with a 2-inch pipe running vertically 30 feet above it and a pressure gauge attachment, while that on the bottom was perforated with 27 holes of about $\frac{1}{8}$-inch diameter. Each cylinder was set up on blocks 1 foot above the floor, so that a drip pan 10 inches high and 8 inches wide could be placed under it. The holes in the bottom cap were drilled within a radius of 3 inches from the center, so that all the water passing through them was collected in the drip pan. As the surface of the cylinders was comparatively smooth they were coated inside with a thin plaster of cement, which was roughened with a brush that the clay and concrete might knit better with the sides and thus reduce leakage around the material placed therein.

The cylinders were packed with various materials, as follows: Each had a bottom layer one foot thick, of decomposed micaceous rock, consisting of mica sand and small pieces of the decomposed rock, well rammed in a moist condition. Upon this was placed—in No. 1, two feet of yellow clay, 4 inches of concrete; in No. 2, two feet of yellow clay, 6 inches of concrete, of which the upper $1\frac{1}{2}$ inches consisted of a stone chip and cement finish; in No. 3, two feet of Fairmount gravel; in No. 4, two feet of blue clay, from Rancocas creek, N. J.; in No. 5, two feet of yellow clay.

This yellow clay used was taken from the edge of the tract from which most of the clay for the reservoir was obtained, and was carefully rammed in the cylinders and properly moistened during the ramming.

The concrete was composed of $1\frac{1}{2}$ inch broken stones, four parts; sand, two parts; and Portland cement, one part. The sand and cement were first mixed dry, and sufficient water was afterwards added to make a soft mortar. After the stone had been added and all thoroughly mixed together, the concrete was packed in the cylinder until the mortar came to the surface, which was then troweled smooth.

The $1\frac{1}{2}$ inch finish in No. 2 cylinder was composed of three parts stone chips, not larger than $\frac{1}{4}$ inch, and one part Portland cement. Tests Nos. 1 and 2 were begun March 26, 1895, and Nos. 3, 4 and 5, July 2, 1895. The water was introduced at the top of the two-inch pipe, and the loss was measured at the end of each day, at which time the pipe was also refilled, so that a relatively constant head was maintained. The amount of water lost in the 2-inch pipe was checked by measuring the water collected in the drip pan under the cylinder.

Each test was continued 16 days, and the results were computed and plotted in Fig. 7, which shows the rate of leakage through the various materials for each day during the test.

These rates show the actual depth of water found to have passed through the various materials in 24 hours time.

Test No. 3, which is that of the Fairmount gravel, showed no appreciable leakage from July 2d to July 8th.

The diagram for this case begins, therefore, with July 9th, the first day on which the leakage was observed.

SUB-APPENDIX D.

LEAKAGE FROM NORTH AND SOUTH BASINS.

Explanation of Diagram, Fig. 7.

The gauge in each basin was read carefully from day to day, and with the exception of the time from January 9 to January 31, 1895, when the water was being used, the difference in these readings represent the actual loss of water for each day. These readings are plotted in Fig. 7, in full lines. The broken lines indicate the fall that would have taken place in the water surface of each basin during the same time had there been no rainfall, the difference between the full and broken lines representing the rainfall during this period. Of course, the basins lost a certain amount from evaporation, but owing to the freezing of the water in the test-bucket, no accurate measurements could be made of this. Two tests were made, however: 1st, from May 1st to May 11th, when an evaporation of $2\frac{3}{8}$ inches was observed; 2d, from May 28th to June 5th, during which period an evaporation of $2\frac{5}{8}$ inches took place.

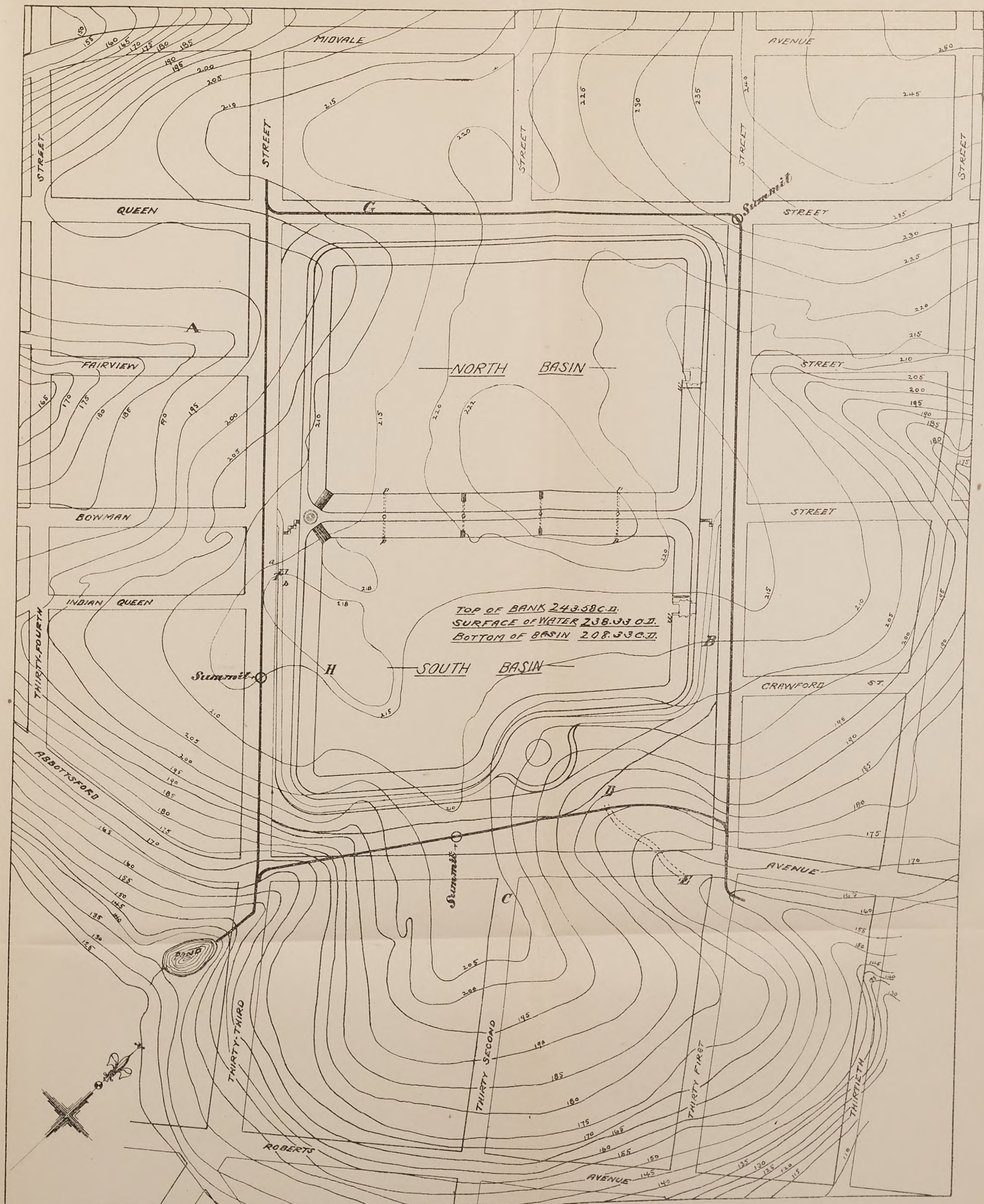


Fig 1 Queen Lane Reservoir,

Topographical Plan showing location of Proposed Drain.

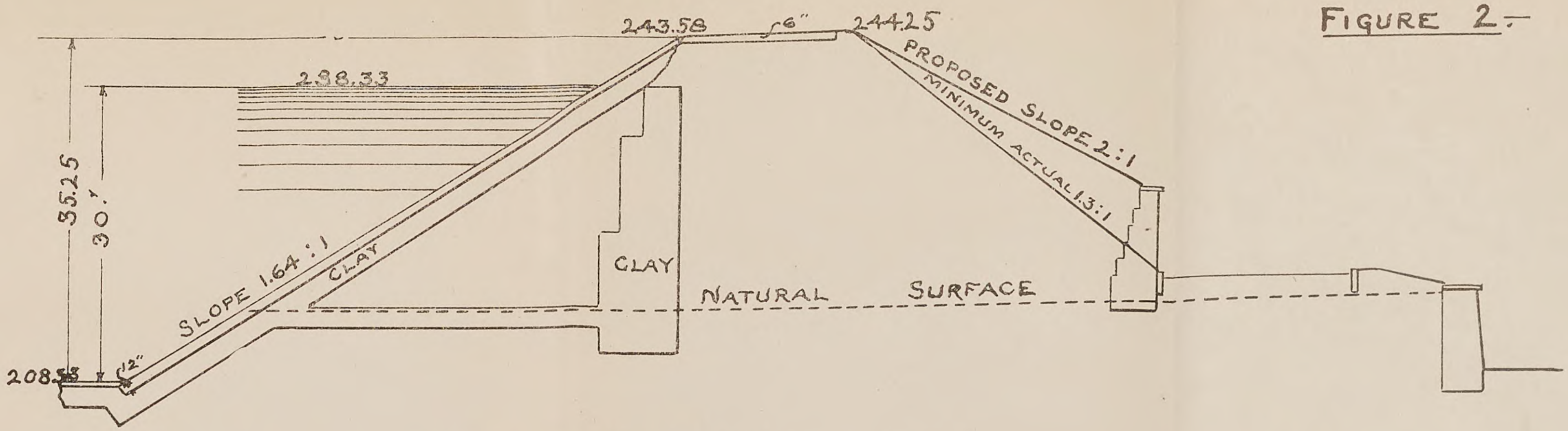
Scale 1 inch = 200 Feet.

Approved, John C. Trautwine, Jr. Chief.

16E4

TO ACCOMPANY REPORT OF JOHN C. TRAUTWINE JR. CHIEF OF BUREAU OF WATER, RUDOLPH HERING, AND C.W. RAYMOND, CONSULTING ENGINEERS, DATED AUGUST 5th 1895.

FIGURE 2.-

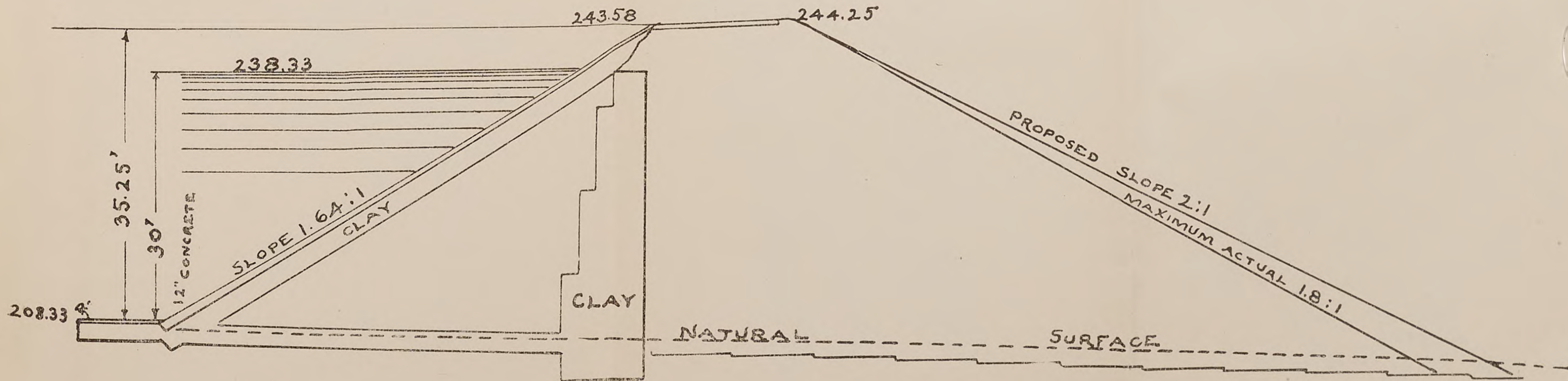


SECTIONS OF

– QUEEN LANE RESERVOIR EMBANKMENT. –

SHOWING

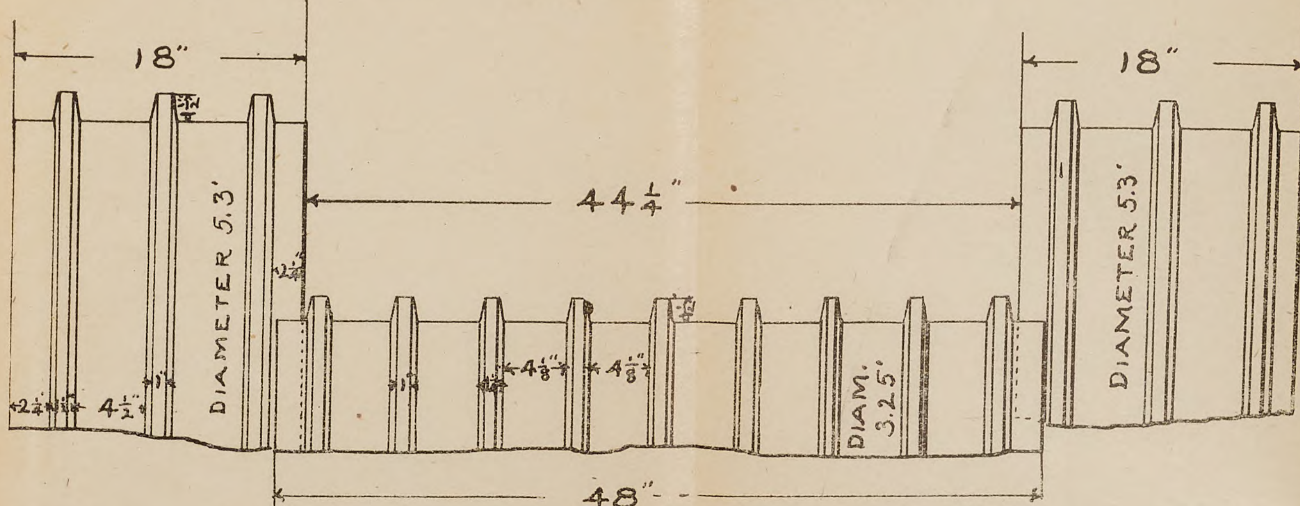
– MAXIMUM, MINIMUM AND PROPOSED SLOPES. –



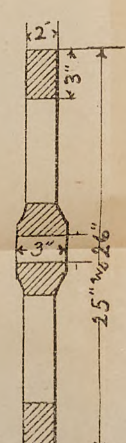
— FIGURE 3. —

ARRANGEMENT OF ROLLS ON 12 TON STEAM ROLLER. USED AT

QUEEN LANE RESERVOIR.



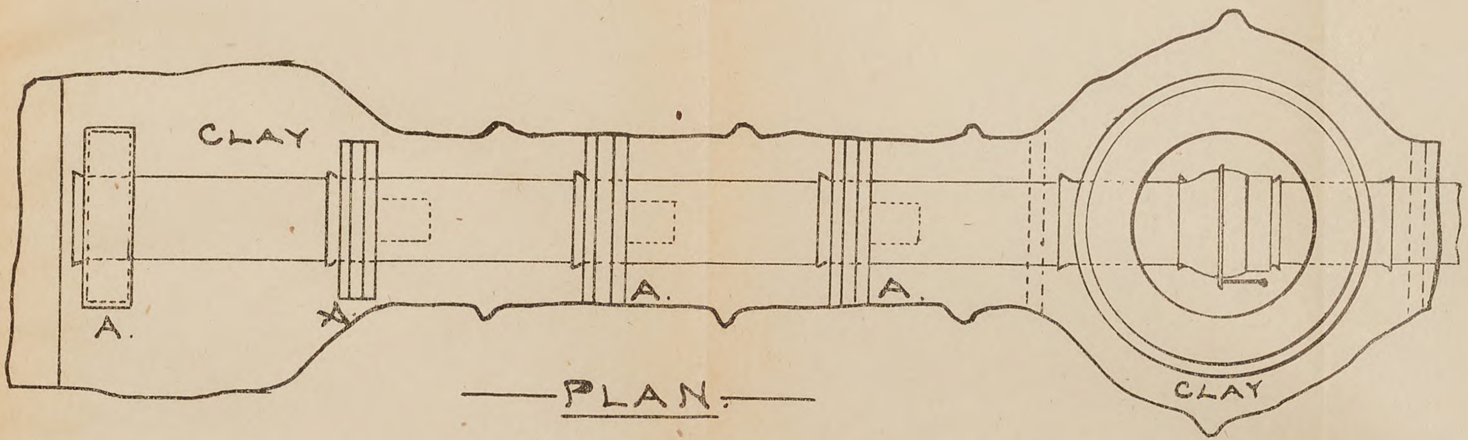
WHEELS FOR SMALL HORSE-ROLLER USED AT QUEEN LANE RESERVOIR.
EACH ROLLER HAS 9 WHEELS MAKING TREAD ABOUT 22 INCHES
ALTERNATE WHEELS ARE 25" AND 26" IN DIAMETER.



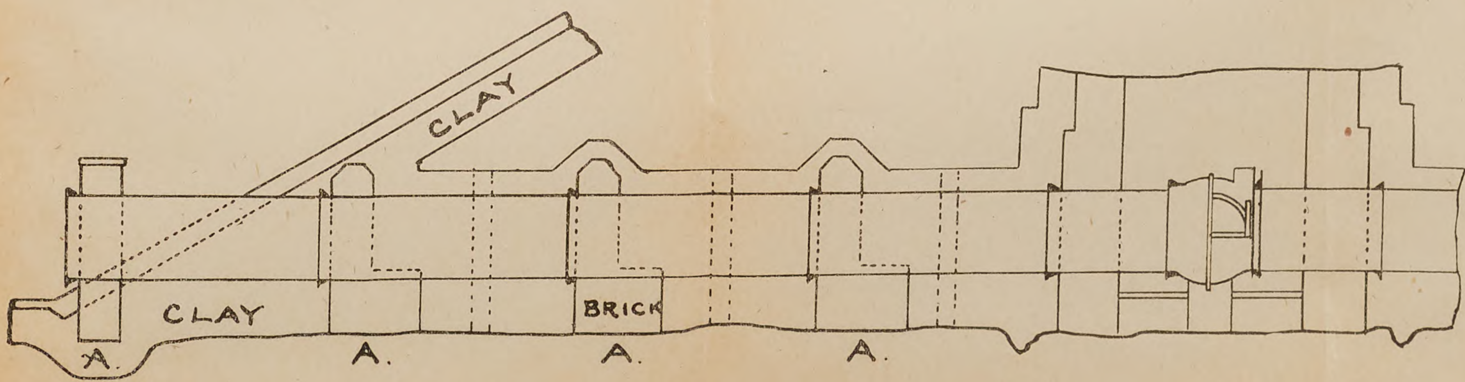
ONE WHEEL WEIGHS	170 LBS.
	9
	1530 "
FRAMES	150 "
AXLE	68 "
SHAFTS AND IRONS	100 "
TOTAL	1848 "

Figure 4.

Pass Pipes

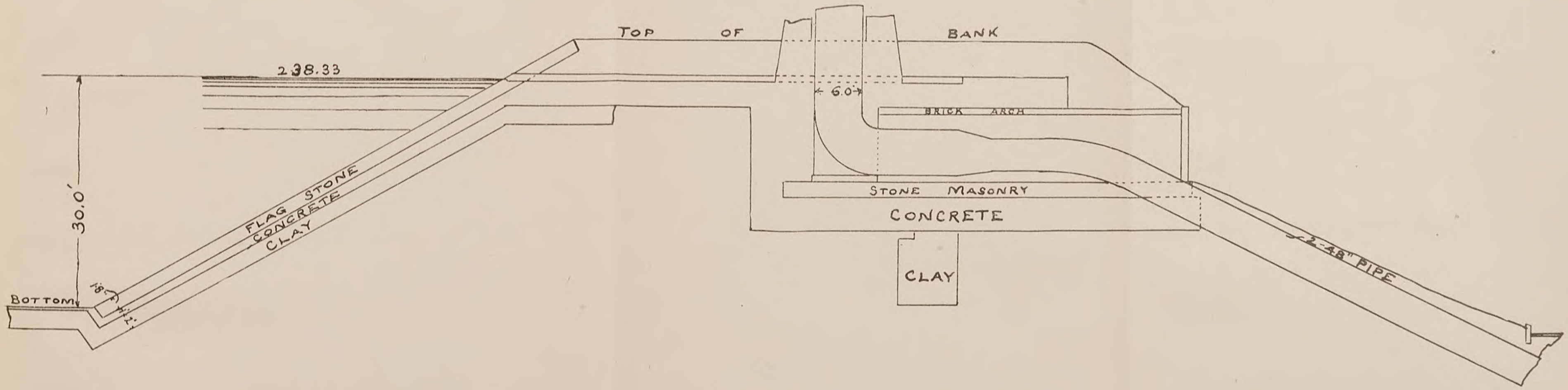


Plan.



Vertical Section.

— FIGURE 5. —



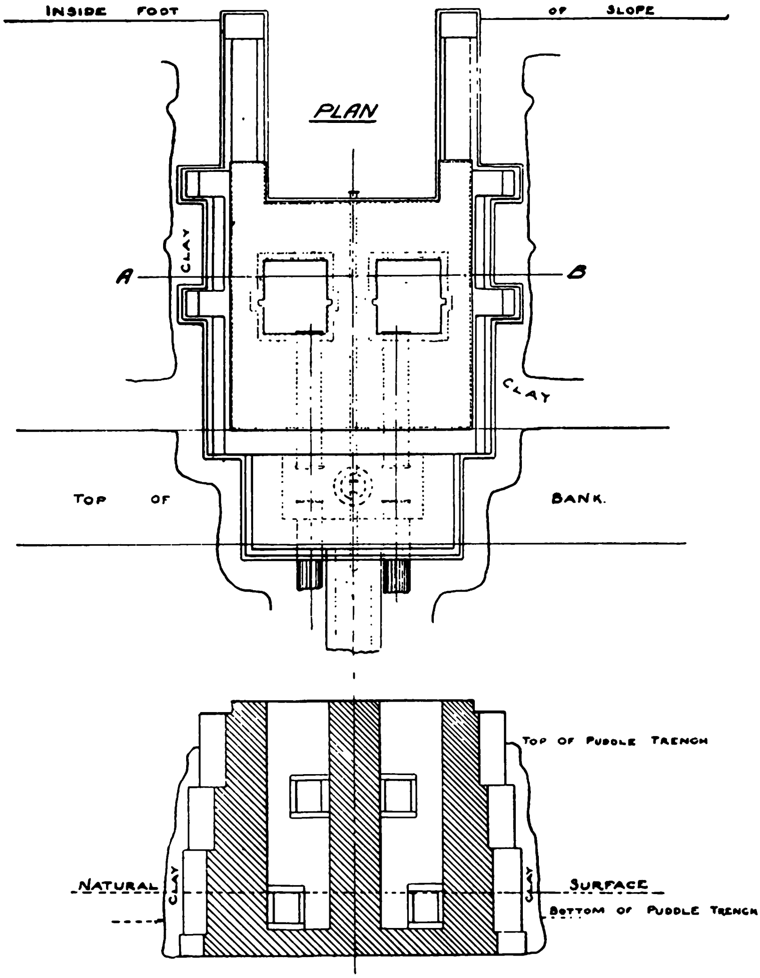
— SECTION OF BANK —

— AT —

— INLET POOL —

— SECTION TAKEN ON BROKEN LINE M-N FIG.-1. —

FIGURE 6. -
STOPHOUSE



SECTION A-B

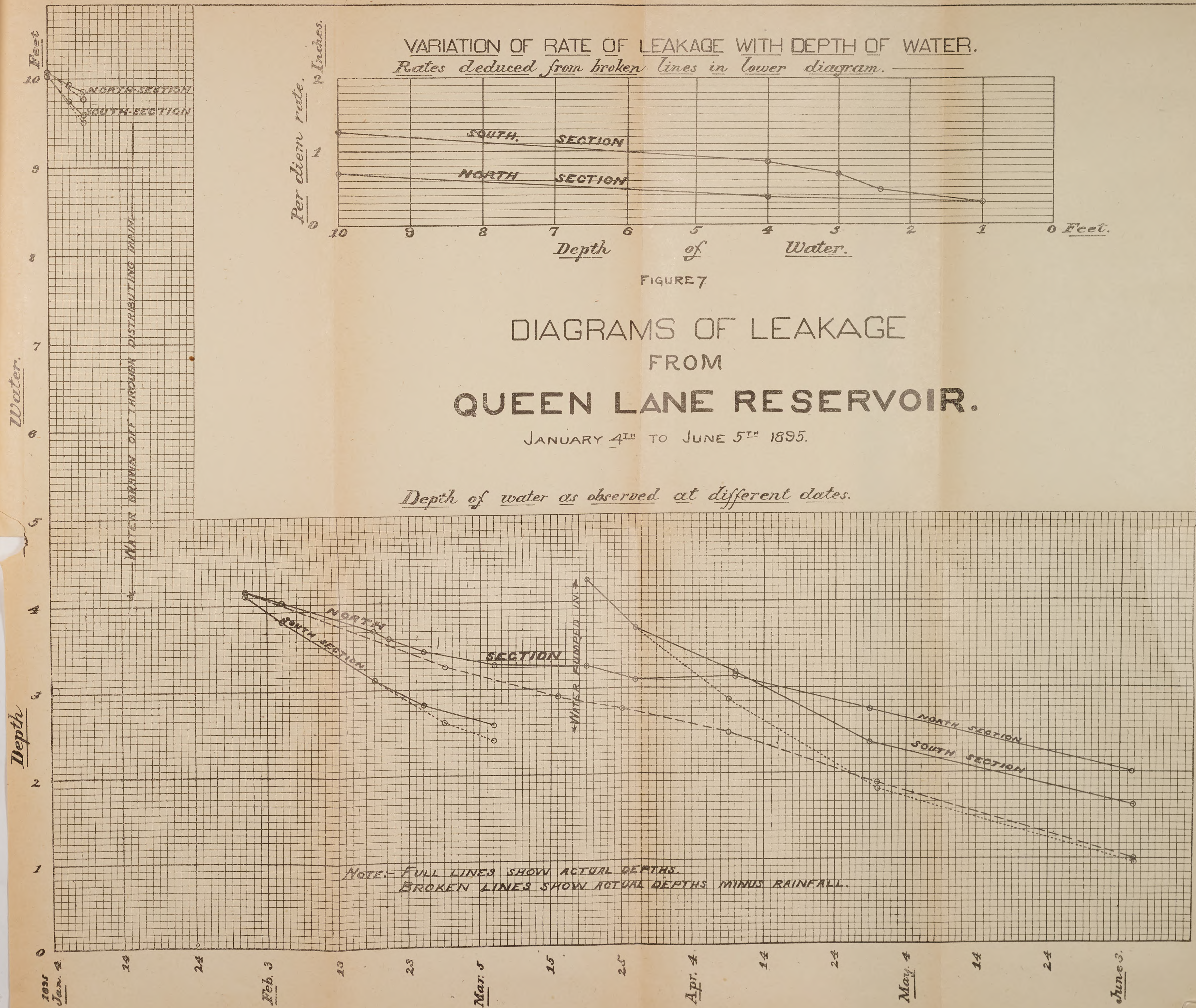
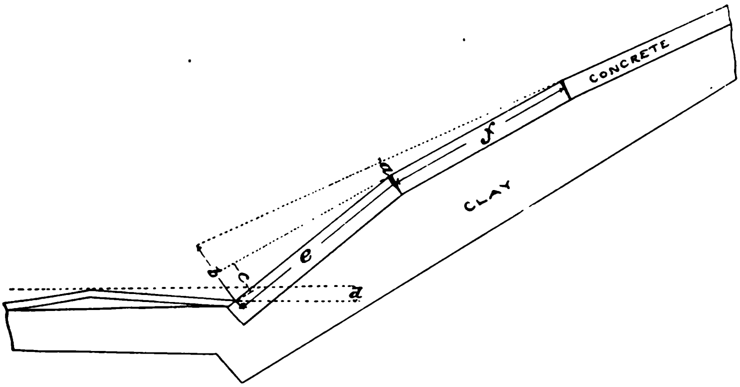


FIGURE 7

DIAGRAMS OF LEAKAGE FROM QUEEN LANE RESERVOIR.

JANUARY 4TH TO JUNE 5TH 1895.

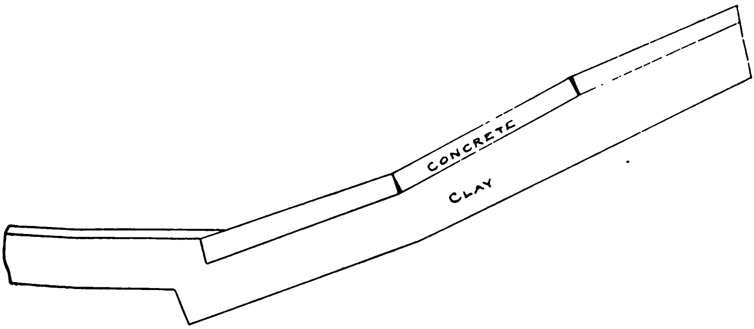
— FIGURE 8. —



— FIGURE 9 —

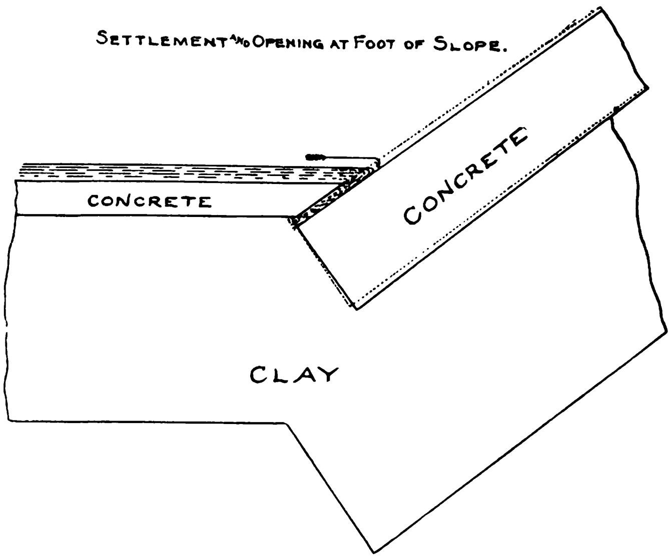
— DEFORMATION OF CONCRETE SLOPE SLABS —

— (EXAGGERATED) —



— FIGURE 10 —

SETTLEMENT AND OPENING AT FOOT OF SLOPE.



— FIGURE 11. —

WARPING OF BOTTOM LINING.

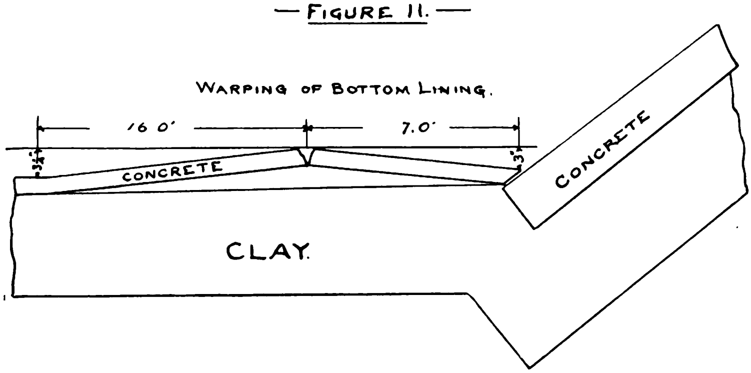
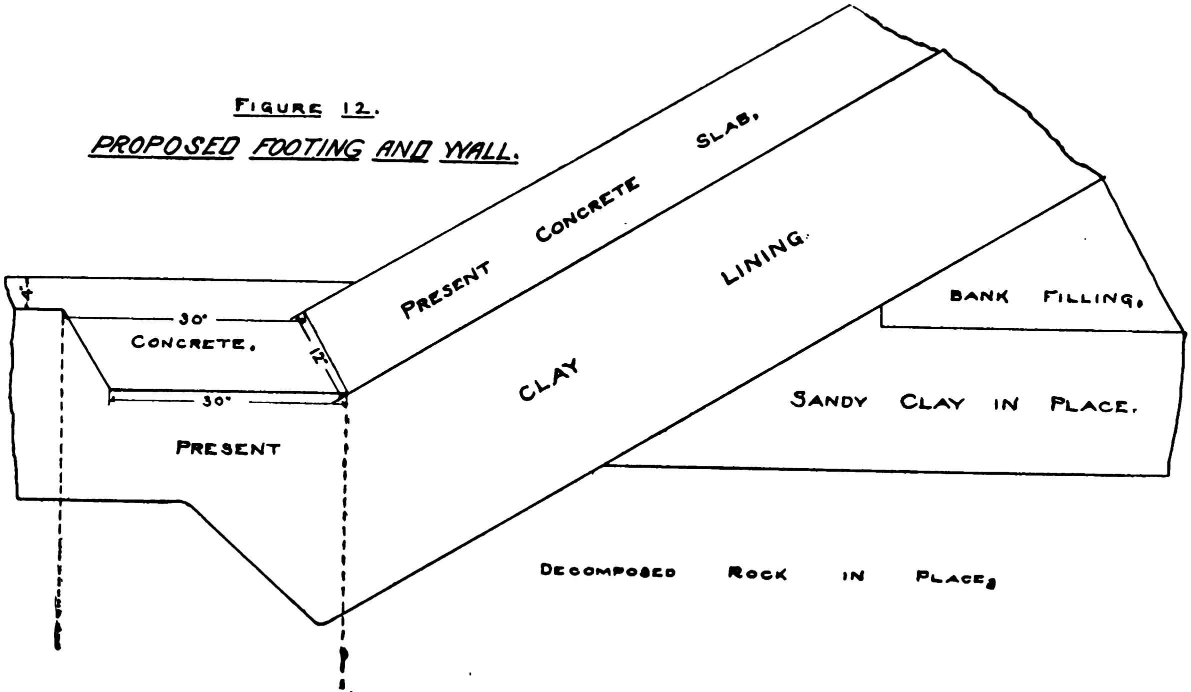
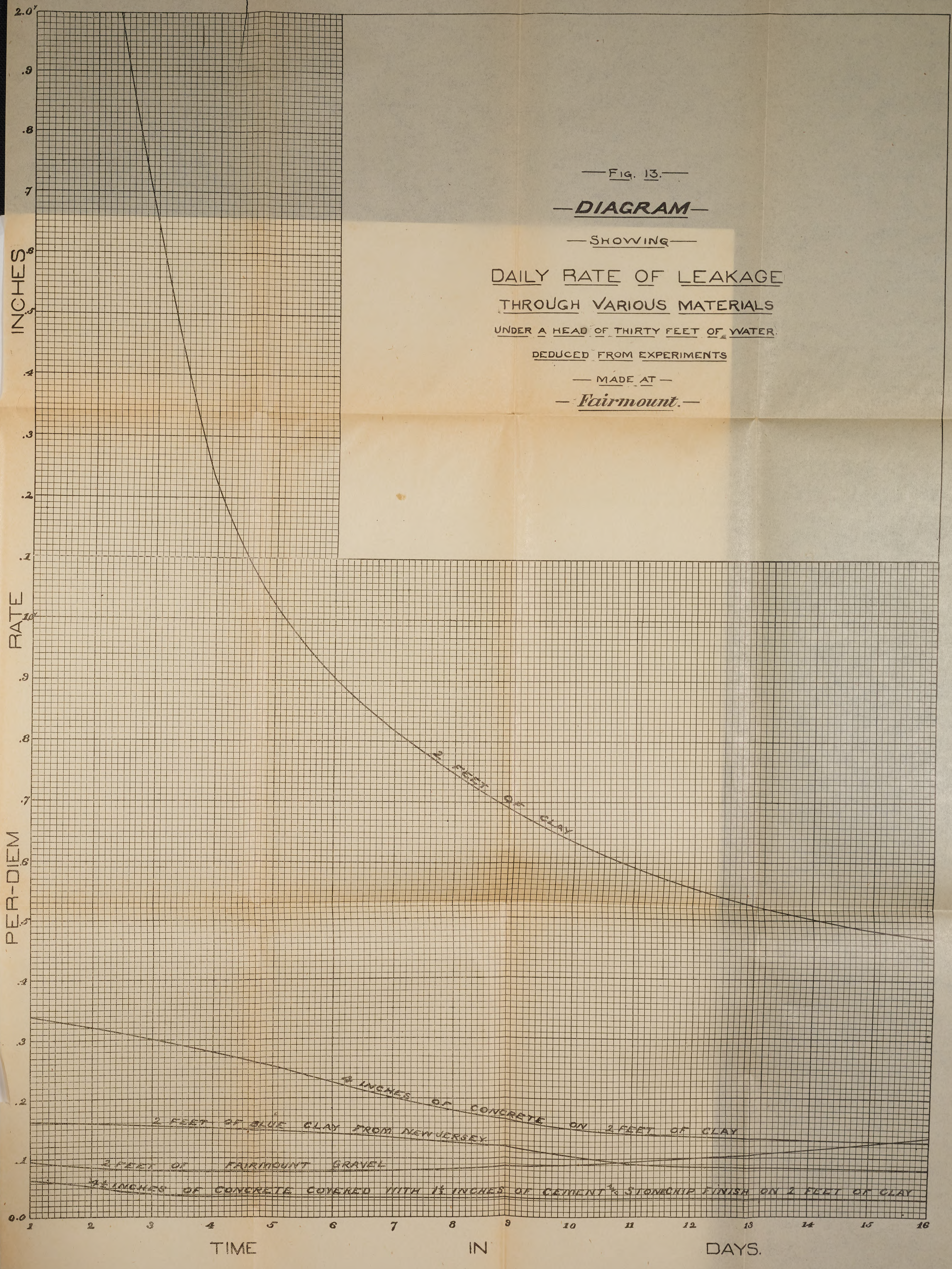


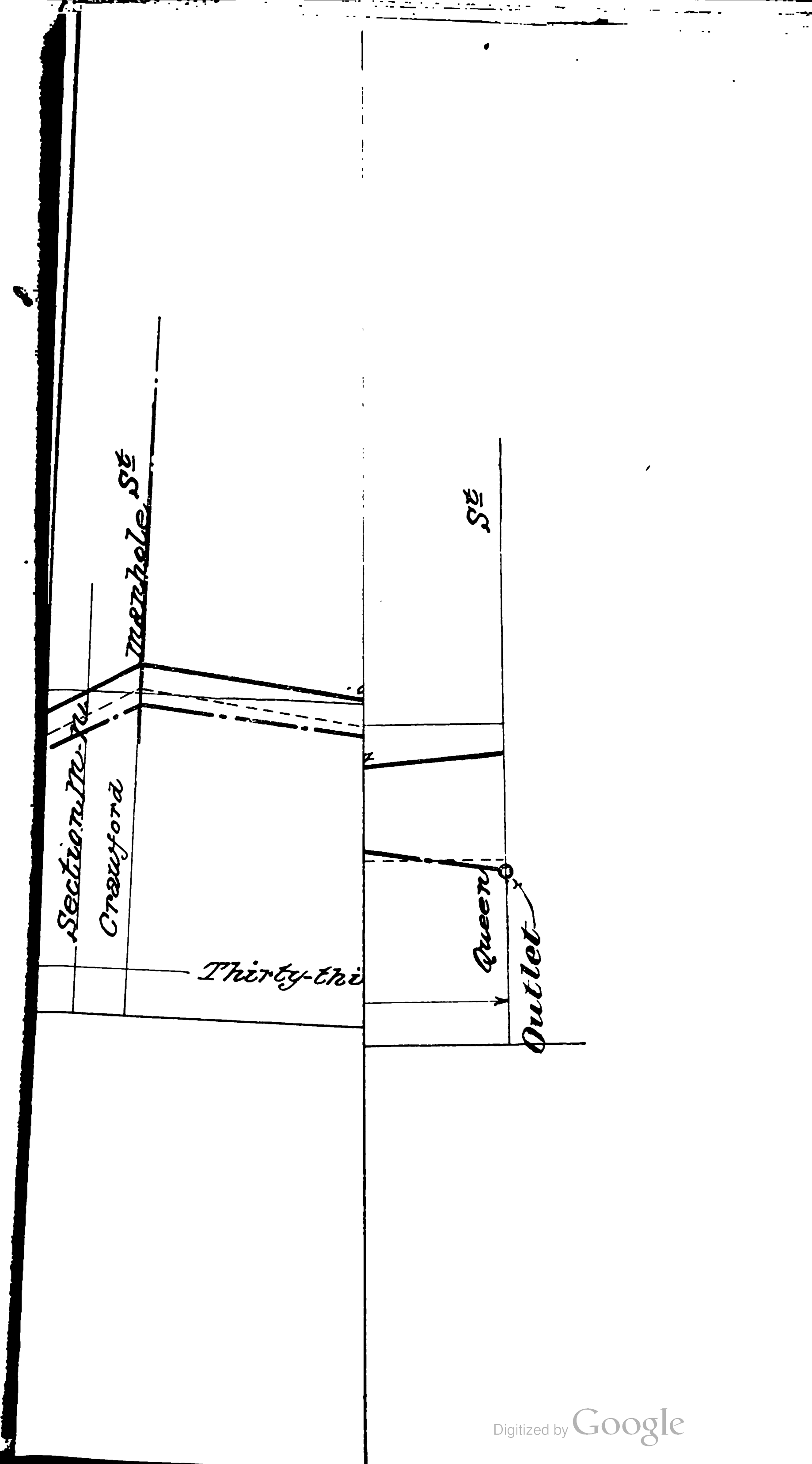
FIGURE 12.

PROPOSED FOOTING AND WALL.





—Fig. 13.—
—DIAGRAM—
—Showing—
DAILY RATE OF LEAKAGE
THROUGH VARIOUS MATERIALS
UNDER A HEAD OF THIRTY FEET OF WATER.
DEDUCED FROM EXPERIMENTS
— MADE AT —
— Fairmount. —
INCHES
RATE
PER-DIEM
2.0"
.9
.8
.7
.6
.5
.4
.3
.2
.1
1.0"
.9
.8
.7
.6
.5
.4
.3
.2
.1
0.0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
2 FEET OF CLAY
4 INCHES OF CONCRETE ON 2 FEET OF CLAY
2 FEET OF BLUE CLAY FROM NEW JERSEY.
2 FEET OF FAIRMOUNT GRAVEL
4½ INCHES OF CONCRETE COVERED WITH 1½ INCHES OF CEMENT & STONECHIP FINISH ON 2 FEET OF CLAY
TIME
IN
DAYS.


Section M-N
Crawford
manhole
St
Thirty-thi
Queen
St
Outlet

APPENDIX I.

PROJECT OF THE "PHILADELPHIA WATER SUPPLY COMPANY" TO SUPPLY THE CITY OF PHILADELPHIA WITH WATER.

The water to be taken from the Susquehanna river, about one mile above Wrightsville, York County, Pennsylvania. The river being three-quarters of a mile in width, the point of location being well protected by natural rock formations, the elevation being sufficient to permit of a genuine all gravity supply to the City of Philadelphia, and capable of extensions to meet the requirements of a city of five millions population.

The aqueducts to be carried down upon the York County side of the river until the Susquehanna Canal is reached at Wrightsville, thence by bed of Canal to a location near Conowingo where the river will be crossed by bridge or siphon lines. The line of the Aqueducts then run almost due east skirting the country north of the line of the Baltimore & Ohio R. R., encountering but two elevations the entire distance that would necessitate heavy cuts or tunnels. The streams en-route would either be crossed by masonry bridges or siphoned, and the water delivered into Philadelphia, in the West Park, at about 150 feet elevation. On the line of the aqueduct there are two valleys which can be used for storage reservoirs. The Pennsylvania Canal follows the entire east line of the river from Harrisburg, 40 miles above, to Columbia, below the point of our influent, and all drainage on the east side of the river is received into the canal and discharged into the river near the dam at Columbia.

The aqueducts are to be made of plate steel, of ample strength, and properly protected in every necessary manner.

The distance of the aqueduct line is about ninety miles. The elevation at the influent is 240 feet, with a proposed grade of about ten inches per mile to give a service at about 150 feet elevation in Philadelphia. The Roxborough and Chestnut Hill high service is to be supplied by supplemental pumpage from the gravity supply elevation, saving at least 125 feet lift over present pumpage, incurring a large saving in cost of operation. When it is considered that Chestnut Hill is over 80 feet higher than Harrisburg, it can be readily understood why a gravity supply for the entire city is impossible without going so great a distance as to make the cost prohibitory.

Drainage Area.

The drainage area of the Susquehanna embraces within its limits in this State all or part of 28 Counties, and a large portion of the drainage area being in the wilderness portion of Pennsylvania and northern New York. The total drainage area is 18,000 square miles. The flow of the stream would therefore be as follows:

Minimum daily flow	2,000,000,000 gallons.
Mean daily flow when free from storm water	6,500,000,000 gallons.
Maximum daily flow	16,650,000,000 gallons.

Right of Way.

It is proposed to construct aqueducts capable of delivering two hundred and fifty (250) million gallons daily at Philadelphia. The right of way will be sixty (60) feet wide the entire length of the aqueduct, so that additional pipe lines can be laid at any time increased service may be required.

The entire line of the aqueduct will be readily accessible by both railroad and water facilities, permitting prompt access for any contingency that could happen, a most important consideration.

The projectors have taken into consideration the construction of a large area of filter beds at the influent through which the water would flow before entering the aqueduct, always insuring a good potable water in times of high water when the river is in a disturbed condition.

This is the only genuine all-gravity system possible for the City of Philadelphia, whereby an inexhaustible supply of good potable water is obtainable, and it is also entirely within the limits of the State, thereby permitting a constant supervision and control of its water under the laws of the State, and is free from the impounding of large bodies of water incident to either of the plans heretofore submitted to the public, thereby doing away with the danger, as also the expense in money and time in construction and maintenance of dams and reservoirs of great size, for the impounding and storage of water to meet anything like the present daily and future requirements of the City. Hundreds of millions gallons daily can readily be supplied from this location. To warrant the great cost of such new system of water supply, the source should be capable of permitting almost indefinite extensions of the system ; this is demonstrated in the fact that the rapid growth of the City and consumption of water has actually outgrown the supposed ample estimates and plans of nine years ago, made at large cost, which only provided for a maximum of 210 millions gallons daily, the actual consumption the past summer exceeding that amount daily.

The ideal source of supply of water for this great City, both present and future, is from a living stream, of great volume, a good potable water, where the quantity desired may be added to from time to time as the demands of the City increase. A source within the boundaries of the State, permitting supervision and legal control over it; an elevation, sufficient to flow the water by gravity to the desired point at the receiving basins; the avoidance of impounding dams and impounding of waters, all of which this proposed system offers.

Among the benefits to the City to be derived by this new project will be—

First. A first-class water supply by gravity, doing away with the present extensive and expensive pumping plant.

Second. The assurance of the completion of the system within three years.

Third. A source of supply capable of indefinite extensions and of enormous volume and good quality.

Fourth. Rapid construction of the new system, of which the City stands in urgent need.

Fifth. The City to be at no cost whatever in its construction, yet receiving the benefits of a new supply at moderate cost, with the right of acquiring ownership at a future time, on terms to be mutually agreed upon.

The sole purpose of the project is to construct the system and deliver the water at a point designated. The Company merely sells its water at a price to be agreed upon, and has nothing whatever to do with the distribution.

(Signed) HENRY BIRKINBINE,

Engineer.