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FOURTH ANNUAL MESSAGE

OF

CHARLES F. WARWICK

Mayor of the City of Philadelphia

WITH

ANNUAL REPORTS

OF

THOMAS M. THOMPSON

Director of the Department of Public Works

AND OF THE

CHIEFS OF BUREAUS

CONSTITUTING SAID DEPARTMENT

FOR THE

YEAR ENDING DECEMBER 31, 1898

ISSUED BY THE CITY OF PHILADELPHIA, 1899

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Messenger :

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FOURTH ANNUAL MESSAGE

OFFICE OF THE MAYOR, CITY HALL.

Philadelphia, April 3, 1899.

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 this my Fourth Annual Message, upon the financial and general conditions of the municipality. I also send the Annual Reports of the Directors of the Departments of Public Safety and Public Works and of the President of the Department of Charities and Correction, for the year 1898.

FINANCE.

The annual report of the City Controller shows that the total receipts of the City from all sources for the year 1898 were \$26,324,200.09, and the total expenditures \$27,075,013.76, shewing an excess of expenditures over receipts of \$750,813.67.

The deficit thus shown was ascertained when the books of the Controller's Department were closed, dating from December 31, 1898, and it is attributable to the absence of the personal property tax and school moneys due the

City of Philadelphia by the State authorities, for the year 1898, amounting in all to \$1,596,730.83.

This apparent deficit, however, which appears upon the face of the report, is susceptible of explanation. It is due to the fact that the personal property tax and the school moneys due the City of Philadelphia by the State authorities for the year 1898, amounting to \$1,596,730.83, have not all been paid. Since the Controller's report was submitted, there have been made small remittances, but at the time of the signing of the report there would have been a surplus of \$1,156,448.63, had all the money due been paid. This shows but a little improvement over the preceding year. The system is vicious and without excuse and the retention of this money upon the part of the State authorities cripples the Municipality in the matter of appropriations and reflects upon the business management in the financial departments of the State Government; further than this it seriously affects the credit of the City. The reason for this apparent deficit has to be constantly explained. The City Treasurer has repeatedly made demands for the payment of the money, but his appeals have met at no time with a hearty response, in fact at times not even with an explanation. The law under which the City pays this money to the State, requires that, immediately upon payment by the City to the State, of the whole amount due, the latter shall remit the proportionate share to which the Municipality is entitled. There is no good reason so far as has been ascertained why this money should be withheld. The money under no circumstances should be devoted to any purpose other than that which the law designates. If it cannot be diverted to any other purpose, then its retention is illegal and unjust. It would be a decided reform if the Act relating to this matter were amended. The money should be retained and accounted

for by the City and a credit given for the amount of the same upon the books of the State. In other words, to remedy this condition of affairs, the law should provide, that the City instead of paying all the money to the State, should retain that proportionate share to which she is entitled. The system is unbusiness-like. If the money belongs to the City, it should be in her hands, and the State officials who have it in their possession should return it at the earliest moment possible. This is not a new condition, it has been persisted in for years and public attention has been frequently called to the matter. I have taken occasion to repeatedly refer to it in the several messages I have submitted to your Honorable Bodies. In the reports of the City Controller for the past two years it will be seen that under the opinion of the City Solicitor, and a resolution of your Honorable Bodies, he has carried this money as an asset of the City, though actually in the hands of the State officials. This year, however, he refused so to do, stating in his annual report that he deemed it inadvisable to continue this method. He was therefore compelled to ask for a reduction in the appropriations for the ensuing year, which resulted in great inconvenience to the City and in delay in the transaction of her business and the meeting of her obligations. The books of the City Controller could not be opened for the current year, until the deficiency was made up by a reduction in the appropriations made by Councils.

As to the Personal Property Tax the City always makes the remittances prior to November 30th, the close of the fiscal year of the State, and the money which under the law belongs to the City should at least be returned before the 31st of December, that day marking the close of the fiscal year of the Municipality. As to the school tax the payments should be made in the same way, bearing in

mind of course the fact that the school year ends on the 30th of June. There is no excuse for the further continuance of a practice which puts the City to inconvenience affects her credit and gives rise to suspicion and scandal.

In 1896 the deficit was \$1,459,569.03; in 1897, \$828,325.61; in 1898, \$440,282.20. If the moneys due had been paid in 1896 there would have been a surplus of \$141,578.59; in 1897, of \$839,217.48, and in 1898, of \$1,156,448.63. These facts I am sure will prove to every fair minded man that the system needs immediate change and reform.

The funded debt of the City, January 1, 1899, less the City loans held by the Sinking Fund Commission and including outstanding warrants, was \$36,380,082.77; the funded debt, January 1, 1898, less the City loans held by the Sinking Fund Commission and including outstanding warrants, was \$39,174,353.75; showing a decrease of the total debt, since January 1, 1898, of \$2,794,270.98. The additions to the funded debt during 1898 were \$2,211,900, made up in the following manner: Of the \$6,000,000, Philadelphia and Reading Railroad Subway Loan of March 15, 1894, there was issued on account, \$900,000; for refunding loan, \$1,306,000, and an unclaimed Matured Loan amounting to \$5,900. The amount redeemed during the same period was \$7,843,400, making a decrease in the Gross Funded Debt for the year of \$5,631,500. Deducting the City securities held by the Sinking Fund Commission from the Gross Funded Debt leaves a Net Funded Debt of \$35,163,295.22.

The value of the real estate owned by the City as appraised by the Board of Revision of Taxes for the year 1898 is \$55,975,494, showing an increase over the appraisalment of 1897 of \$2,181,185.

Loan Bill.

The Loan Bill is an old question but it is a matter of deep interest to this community. It dates back to the beginning of this administration, and although I have heretofore often referred to it, in detail, it is of such vital importance to the future of the City, that it will not be out of place for me to again give, briefly, its history. Upon this measure depended the ability of the present administration to carry out its promises and its purposes, and it is with keen regret I am compelled to state, that because of unreasonable opposition, we were prevented from inaugurating the projects and reaching the results we so hoped for and desired.

In 1896, after most careful consideration an ordinance was passed in Councils providing for the creation of a loan of \$8,000,000 for miscellaneous purposes. Shortly afterwards another ordinance was passed, authorizing a loan of \$3,000,000 for the improvement of the water supply. When everything was in readiness for the placing of the loans, and advertisements for bids were about to be made, the question was raised in some quarters, that the City, under the law, had no right to increase her indebtedness, it being contended that she had reached the limit of her power to borrow. A doubt having thus been raised, which might seriously have affected the loan in the matter of premiums and rate of interest the City was compelled under the circumstances to wait until the question was passed upon by the Courts. A Bill in Equity was filed in the Court of Common Pleas No. 1, and it was held that the City had not reached the limit of her borrowing capacity. It was then urged that this opinion was not final and the judgment of the Supreme Court had to be secured. In May, 1897, that Court decided that before the City could in-

crease her indebtedness, the question would have to be submitted to a vote of the people. The first election at which this could be done did not take place until the following November, and in the meantime matters had to remain in abeyance.

The bill in its every item and feature was fully explained in the newspapers and discussed in public places and the people were intelligently informed as to every detail. They decided in favor of the creation of the loan by a majority of 17,475. The matter had been considered for upwards of three years and after this popular expression in its favor it was thought that opposition would cease, but the Schuylkill Valley Water Company in the meantime had appeared upon the scene and opposition was immediately organized to defeat the ordinance authorizing the creation of the loan. This was in the face of the mandate of the people.

At this point it may be in place to state that the loan provided for necessary improvements in every direction; among other things, for the completion of the Boys' High School and the erection of new school buildings; for the building of main sewers; for the completion of the Aramingo canal sewer; for the improvement of suburban roads; for the erection of an Art Gallery, and a Free Library; for a new Almshouse; for the abolition of grade crossings on the line of the Philadelphia and Trenton Railroad; for the equipment and building of the Philadelphia Museums; for the extension, improvement and filtration of the water supply; for the extension of Fairmount Park; for repaving streets, tramway streets, intersections and underground work incident thereto; for building bridges; for the improvement of public parks and squares; for the purchase of ground and the building of fire and police stations and electrical and underground construction; for grading and repairs to paved streets, curved curbing, resurfacing as-

phalt streets; repairs to bridges; repairs to sidewalks; repairs to ditches and sluices; and for repaving with improved pavement small streets, forty feet or less in width, from house line to house line, and the underground work incident thereto. It will be seen that these improvements were urgent and in every way would have resulted materially in the advancement of the City. All kinds of objections, however, were raised in opposition by the enemies of the bill. It was contended by those who knew better that the bill creating the loan carried as well an appropriation for every item. This was not so, for the bill pending provided only for the creation of the loan; every item of appropriation thereunder must be passed upon by Councils separately. After stormy contention the bill at length passed on June 17, 1898, and the same day I affixed my approval thereto. It must be borne in mind that the friends of the bill, in Councils, twice authorized the creation of the loan, but after each victory, outside parties instituted or inspired litigation for the purpose of delay. An effort was made to meet at once the most important question namely, that of the water supply, but the opposition filed a Bill in Equity praying the Court to restrain the City in the matter of the placing of the loan, and again the City was halted and prevented from carrying out those projects that would have resulted in her material development and advancement. This spirit of opposition, dead to every public sentiment, actuated and controlled by spiteful, unreasonable, factional or sordid motives is responsible for the City's failure to respond to the demands of her citizens for needed public improvements. The opponents of this bill, have for years, held the City by the throat like highwaymen and have checked her progress at every step. Their policy was delay and destruction; little cared they for the fame and reputation of the City. The New High

School Building half completed, because of their opposition, stands to-day like a ruin. Thousands of children have been deprived of proper school accommodations, public work in every direction has been delayed and the City's progress retarded. They have made unavailable the sum of \$3,700,000 for the improvement of the water supply. No appeal could reach the consciences of such men; in spite of public clamor and in the face of sickness and death they have stood unmoved.

DEPARTMENT OF PUBLIC SAFETY.

The Department of Public Safety has reached a high degree of efficiency throughout all its Bureaus. The Director has been unceasing in his efforts in the public service and as he retires from the position he has so ably and conscientiously filled, it must be to him a satisfaction to know that he has been faithful and loyal in the discharge of his duties.

Bureau of Police.

I cannot speak too highly of the police force of this City. It has, during the past year, been put to a severe test, and yet from every side it has been highly commended for its efficiency in the handling of crowds and in the preservation of order. There has been created an "esprit de corps" throughout the Bureau; the men have been carefully drilled and have been taught to be attentive and courteous to strangers as well as to citizens. The Superintendent is worthy the highest commendation.

I cannot lose this opportunity, to speak of the services rendered by the force during the summer vacation. There were 10,723 dwelling houses temporarily closed during that period, and left under the care and protection of

the police. Twenty-seven of these houses, seven less than last year, were robbed of goods valued at \$3,874, of which \$2,016 were recovered.

After the cessation of hostilities in the late war with Spain there were brought into this City between the 21st of August and the 27th of September of last year 1,575 sick soldiers. The reception and disposition of these soldiers were in the hands of the authorities of the City, and the services rendered by the police force in this delicate and patriotic work called forth from all our citizens, as well as from the army officials, the highest praise and commendation.

The duties that policemen and firemen are called upon to perform expose them to constant dangers, and there can be no greater charity, than to provide a fund for the relief of the families of those, who are left, in case of death, or for the men themselves if they be injured in the service. Some of our citizens have shown a proper public spirit, by giving handsome donations to the Pension Funds, and have thus set an example that should be followed by others.

The police force to be made more effective and to give more security should be increased, especially in the outlying districts.

Bureau of Fire.

This Bureau, under the immediate direction of its brave and efficient chief, has reached a most excellent state of discipline and efficiency. The total number of fires during the year was 2,484, being 57 more than occurred during 1897; the loss on buildings and contents was \$1,653,902, while that of the previous year was \$1,026,768.

In my last annual message, I called attention to a new danger that had arisen owing to the erection of very high buildings in the business sections of the City. For the better protection of these buildings, a greater supply of

water is required as well as greater force, and I cordially endorse the suggestion of the Director of the Department of Public Safety, when he urges that large mains should be laid from the Delaware river to Broad street, on Market, Chestnut and Arch streets, with a pumping station at the Delaware river, and a similar line of mains on the same streets from the Schuylkill eastward to Broad street, with a pumping station on the Schuylkill river. This would be a means of great safety in the business sections of the City.

During the past year there were 300 firemen injured in the performance of their duty. There were two deaths in the Bureau, which occurred when the men were in actual service. This is additional reason why our citizens should bear in mind the Fire and Police Pension Funds. There is not a more courageous or heroic body of men, in the public service, than the fire force of our City.

Electrical Bureau.

The Electrical Bureau still maintains its reputation as one of the best equipped in this, or any other country. At the close of the year there were 7,147 electric lights in the public highways of this City, providing not only illumination, but giving protection to life and property. It will be admitted by those who have examined into the matter by personal inspection, that Philadelphia is the best lighted City on this Continent.

The underground system is making gradual progress. There have been taken down and removed from the streets 119 poles and a little over 160 miles of telegraph and telephone wire belonging to the City, and 57.71 miles of wire belonging to the different corporations. The number of calls over the police signal and telephone service during the year was 5,207,553.

The rules established in this Bureau in the matter of

the introduction of underground trolley wires, have prevented damage of every kind resulting from what is called electrolytic action. The City's underground system of gas and water pipes and cables has been protected from injury. The construction has been made under the supervision of the able Chief of this Bureau, and has resulted in great saving to the City. In many cities throughout the country the leakage of currents from the trolley service, which has not by the adoption of a proper system been provided against has greatly destroyed the iron and lead pipes laid underground. Such a condition with us has been avoided by carrying out to the letter the wise rules promulgated and enforced by this Bureau.

Bureau of Health.

The General health of the City during the year was good. It will be seen by the report of this Bureau that the death rate for 1898 was 19.18 per 1,000 inhabitants, which although slightly higher than for 1897, which was 18.72, is lower than for any year since 1879. The death rate of Boston for 1898 was 20.09 per 1,000 inhabitants, for New York, 19.28.

Small-pox made its appearance, but it was stamped out by the effective measures that were immediately applied. I am glad to see that there has been an improvement in the condition of the Municipal Hospital, but still there is much work to be done in that direction. Once again, I call attention to the importance of erecting a hospital removed from all connection with the Municipal Hospital, and placed in an outlying locality, for the treatment of small-pox cases. This is a most important matter.

The Board of Health was abolished by Act of Assembly of March 22, 1899, and a Bureau created by an Act passed the same day. The members of the Board, five in number, gave at all times loyal and devoted attention to the duties

assigned them. They served most faithfully the interest of the City and without compensation.

The Bureau was immediately organized as the Act provided and Colonel J. Lewis Good was appointed chief of the same.

Bureau of City Property.

The chief of this Bureau has with marked intelligence discharged every duty. The restoration of the old State House has been completed and its rededication took place on the 28th day of October last, as a feature of the ceremonies incident to the celebration known as the "Peace Jubilee." The immediate locality has been greatly improved by reason of the restoration. This is the most sacred relic and the most interesting and historic building in this country and should ever be preserved with patriotic care and devotion. I am glad to take this opportunity to thank the committee of citizens and the Association of Architects, for their valuable suggestions and assistance during the continuance of the restoration.

The market sheds on the different thoroughfares throughout the City are in many instances dilapidated and virtually unproductive; they should be removed and the streets paved. I think, however, that the historic building at Second and Pine streets should be repaired and retained as an old land mark.

League Island Park should be improved at the earliest possible moment. It will add much toward the development of the lower section of the City. The plan for its improvement is feasible and the Park may be made attractive in every way as a pleasure ground and public resort for the people. Plans have already been agreed upon and it is to be hoped that the matter will be pushed without delay. The preliminary work should begin as soon as the weather will permit.

Bureau of Building Inspection.

The work of this Bureau is most intelligently performed under the direction of its able and experienced Chief. The ordinance of April 10, 1894, which authorized the inspection of elevators, as I have already said, in my two previous messages, cannot be carried out, because the force of Inspectors is totally inadequate. The ordinance provides that every elevator shall be inspected by the Bureau of Building Inspectors, at least, once every three months. There are over ten thousand elevators in the City of Philadelphia and only three Inspectors. This statement will prove conclusively that the ordinance is virtually a dead letter. This should not be the case as the constant and universal use of elevators is dangerous, in the extreme, unless every precaution be taken to guard against accident.

Bureau of Boiler Inspection.

The Chief of this Bureau has faithfully conducted its operations; he is one of the oldest officials in continuous service in this City. The total number of boilers inspected was 2,946. It might be well to add in this connection that the Bureau inspected the boilers of 143 locomotives that had been built for and shipped to Russia and Japan.

DEPARTMENT OF PUBLIC WORKS.

The Director of the Department of Public Works has been a loyal and devoted public servant; he has ably and conscientiously discharged his onerous duties. It will be shown by a careful examination of his report that the work under this Department has been well done and at lower figures than, in any year during its previous history. Unfortunately there has been no money available for the extension and improvement of the water system.

nor for the construction of main sewers and bridges nor for the paving of streets with improved pavement.

Bureau of Highways.

The Loan Bill contained items amounting to \$2,550,000, which could have been made available for the improvement of our highways if the matter had not been interfered with by litigation. The total paving and repaving for last year covered 31 1-3 miles and cost in the aggregate \$499,436, of which amount \$430,367 was assessed against the properties abutting on the streets paved. But little repaving was done during the year, as the only appropriation available for this work was \$20,000, for repaving small and tramway streets, and \$25,000 for repaving Christian street, from Sixteenth street to Twenty-first street, and from Twenty-second street to Gray's Ferry road.

One of the most important matters under the direction of the Bureau of Highways is the repaving with improved pavement the streets at present paved with cobble and rubble stone, but this work will have to be suspended until the money under the loan bill becomes available. The report of the Director in relation to the work done under the Bureau of Highways is most interesting, and I ask a careful examination of the same. The Chief of this Bureau has ably discharged his every duty.

Bureau of Street Cleaning.

Under this Bureau during the year 1898, there was expended for the cleaning of streets and inlets, removal of ashes, etc., \$540,474, and for the removal and disposal of garbage, \$328,600; making a total of \$869,074. There were cleaned during the year 217,389 miles of streets and 2,133,792 inlets; 588,954 cart loads of ashes were collected, and 201,958 loads of kitchen garbage. These

figures will give an idea of the amount of work done under this Bureau, and yet there were received only 1,850 complaints of all kinds, being 551 less than were received in 1897. The records show that this is the smallest number of complaints received by the Bureau during any previous year. I take pleasure in referring to these facts, and I congratulate the Chief of this important Bureau upon this showing. It is worth mentioning in this connection that for the year 1899 contracts have been awarded for cleaning streets, collecting and removing ashes, etc., for the sum of \$510,722, which is about \$30,000 less than the contract price for the year 1898. This is the result of active competition among the contractors, not because there has been any decrease in the work, nor any change in the specifications.

Questions have been raised many times, as to whether or not the contract system is better than the system adopted in New York, under which the head of the Bureau is authorized to employ men directly for the doing of the work. In this connection, I may say that the City of New York, and by this I mean Manhattan Island, not Greater New York, with an area of less than one-half of that of our City, pays in the neighborhood of \$3,000,000 for the cleaning of the streets alone, not including the removal of ashes, and after having had an opportunity of studying the features of both systems, I believe the contract system is cheaper, less liable to be affected by political influence and can be made in every way as effective as the so-called New York system. Great discretion however must be exercised by the head of the Department in awarding the contracts to the lowest responsible bidder, fully appreciating the meaning of the word "responsible." The unfortunate feature of the contract system is that competition sometimes induces contractors to make bids at too low a figure. They hope to be saved from loss by

shirking or neglecting the work. This requires greater vigilance however, upon the part of the City's inspectors, to enforce a faithful compliance with the terms of the contracts.

We have had an exceptional experience this winter in the matter of the removal of snow. We may not for years, again, have such a season, but the lesson teaches us that we should be prepared to meet all conditions and that a larger appropriation should be made annually for the removal of snow from the public highways, at least, in the business sections of the City. The appropriation last year was \$10,000, which was exhausted after the first snow fell, long before the close of the winter.

Bureau of Surveys.

I cannot praise too highly the work done by this Bureau under the direction of its able and experienced Chief Engineer. The expenditures of this Bureau during the past year were \$2,886,236.05, of which amount \$2,625,107.23 was expended for permanent improvements. All the work upon the main sewers in process of construction at the time of the last report has been completed. By ordinance approved July 20, 1898, Councils authorized the construction of fifteen main sewers including the extension of the Aramingo Canal and the Wingohocking systems. The estimated cost of this work is \$500,000. The plans, in fact all the preliminary details have been completed, but the work cannot begin until the appropriation under the loan bill is made.

The work of making connections with the Intercepting Sewer is being steadily pushed forward, but the appropriation for the extension of this most important system during the past year was only \$20,000, an amount totally inadequate to do the work required. This is a most important feature in relation to the improvement of the water

supply and should receive the early and favorable consideration of Councils; during the year 1898 this sewer and its branches were carefully inspected and wherever necessary were thoroughly cleaned; to-day they are in perfect condition and fully meeting the purposes of their original construction.

The building of main sewers in the outlying districts is also a matter of great moment and should receive early attention.

The work on the Pennsylvania Avenue Subway has been industriously continued and it is now rapidly approaching completion. No greater piece of engineering work has been done by the City during this generation. It has resulted in vastly improving property in its immediate locality, has removed many very dangerous grade crossings; has opened travel upon the streets without interruption; has provided a more imposing entrance to Fairmount Park and has made Broad street one of the finest avenues in the world. During the Peace Jubilee the processions, miles in length, were enabled to keep up their line of march without a break.

The grade crossings on Ninth street should be removed at the earliest moment practicable. Provision has been made under the Loan Bill for the abolishing of grade crossings on the line of the Philadelphia and Trenton Railroad.

Great improvement to the channels of the Delaware and Schuylkill rivers, has been effected under the several contracts for dredging said rivers which were in force at the beginning of the year. In a short time, the Delaware river will have a channel 600 feet in width and 26 feet in depth at mean low tide, from the City to a point below Chester, and the Schuylkill river will have a channel 250 feet in width and 22 feet in depth at mean low tide, from Penrose Ferry bridge to a point near Fifty-eighth street,

and 150 feet in width and 20 feet in depth at mean low tide, from Fifty-eighth street to a point near the Baltimore and Ohio Railroad bridge.

The City should make every effort to secure from the National Government an appropriation sufficient to provide a channel in the Delaware river, 30 feet in depth, from the harbor to the sea. This will not only benefit the City but will be of great advantage, to the West, in that it will provide an additional outlet for the products of that great section, to the markets beyond the Atlantic. This is a national development and upon this ground the assistance of the National Government should be invoked.

For the widening of Delaware avenue the City appropriated under the loan of January 13, 1896, \$1,500,000, and the Board of Directors of City Trusts, Trustees of the estate of Stephen Girard, joined with the City in the work and set aside the sum of \$650,000, making a total amount available of \$2,150,000. The improved and changed condition of affairs in that locality, between Vine and South streets, gives now every opportunity to, and provides every convenience for, our commercial interests. These improvements ought to mark the opening of a new era in Philadelphia commerce. An ordinance is now pending in Councils for the widening of Delaware avenue, from Vine street to Green street; this will be of great advantage to the business interests of the City.

The foundation piers and abutments of Gray's Ferry bridge are all completed and the metal superstructure is being erected. It will require about \$100,000 for the completion of the work. Negotiations for some time past have been pending with two railroad corporations to provide this amount, but unfortunately an agreement has not yet been concluded.

Bureau of Water.

The Chief of this Bureau has conducted it with intelligence and fidelity. The total number of gallons of water pumped during the year was 102,241,835,372. The average daily pumpage was 274,670,777, an increase of 17,152,103 gallons daily over that of the preceding year. The average daily consumption during the year 1898, estimating the population of the City at 1,400,000, was 196.2 gallons per capita per day, an increase over the year 1897 of 10.4 gallons per capita per day, and an increase over 1895, the first year of this administration of 35.9 gallons per capita per day. This tremendous increase must impress every intelligent citizen with the necessity of providing some means to prevent excessive waste. In my previous messages, I have always contended, that the Schuylkill river supply was sufficient and would be sufficient for generations to come, provided it was economically used. I think it will be admitted by every one that the use of 196.2 gallons per capita per day is both excessive and extravagant. A system of metering properly introduced would tend to make the people careful of the use of the water, but would not in any wise deprive them of all that was necessary. It would simply prevent waste. The Schuylkill river as I have already said is sufficient so far as quantity is concerned and the water good as to quality, if it were made clean and wholesome. Scientific men everywhere have pronounced in favor of filtration and it is claimed that a proper system will answer every purpose in this City.

The past year shows an increase of \$94,308.34 over the previous year in the matter of receipts and a net revenue of \$1,569,669.02 over all expenditures for permanent improvements of every character and cost of maintenance.

The total receipts of Bureau of Water during years 1895, 1896, 1897 and 1898 were		\$11,746,013 81
Current expenses during the same period,	\$5,532,462 46	
Paid for extensions during the same period	1,351,523 68	
	<hr/>	
Total..		\$,883,986 14
		<hr/>
Net profit in four years.....		\$4,862,027 67

A Bureau of the City Government that shows such returns should receive support in the matter of sufficient appropriations for permanent improvements, but unfortunately our requests have not been complied with.

If a fair portion of the net profits of this Bureau, nearly \$5,000,000.00, during the past four years, had, in answer to our appeals, been appropriated for the improvement of the water works, they would not be in the deplorable condition they are to-day, but these profits were diverted to other purposes and the works neglected and starved.

At the Roxborough Pumping Station we require four 5,000,000 gallon pumping engines. The largest engine at this station of 12,000,000 gallons capacity is continually breaking down, the work it has to perform is too hard and continuous, it requires frequent repair and in the near future will collapse, unless relieved. Such an accident would be disastrous to the people in Germantown, Chestnut Hill, Mt. Airy, Roxborough and Manayunk. At the Belmont Pumping Station two 10,000,000 gallon pumping engines are needed. A 5,000,000 gallon pumping engine at the Roxborough High Service Station is needed and another of like capacity for the Belmont High Service Station. There are other improvements required which are referred to in detail in the report of the Bureau, such as engine houses, pumping mains, etc.

Nothing in my judgment is of greater need in the matter of the improvement of our water than subsiding reser-

voirs, and in this connection I desire to say that the Queen Lane Reservoir has been of great benefit and would fully answer the purpose of its original construction if the demand upon our supply were not so great. The water, unfortunately, so soon as it is pumped into the basin is withdrawn for consumption, before it is given time to subside.

The great pity is that we have not more reservoirs of like capacity distributed throughout the City.

The most important matter for our consideration at this time is the water question. The conditions are such to-day that the fame and reputation of the City are at stake and something must be done.

We must bear in mind, however, that no one to-day possesses the miraculous rod of Moses with which to strike the rock and have the waters gush forth in abundance.

No matter what plan may be adopted it will take some time for its introduction, and in the meantime it behooves us to act with wisdom and judgment. The reports that have gone abroad, many of them, no doubt, greatly exaggerated, have had a bad effect and in time will seriously injure the business interests of this community and result in having strangers avoid this city as they would a pest-house.

There are two plans for the solution of this question, one is to improve our present system and the other is to bring a supply from another source.

If a pure and adequate supply could be brought from the northern counties of the State or the upper Delaware this unquestionably would be the plan to adopt. I think it will be admitted, however, that this plan at present, is not practicable, in view of the expense incident to its adoption. If this plan then be not feasible, we are driven to the first proposition, that is, the adoption of a system of filtration and the construction of subsiding reservoirs.

From the very beginning of this controversy, I have

urged this plan as the immediate solution of the question.

In my first annual message for the year ending December 31, 1895, I said that "the administration has been devoted and loyal in its efforts to meet this question fairly and to settle it with the best judgment 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." I further added that "all are deeply interested in the early introduction of a general system of filtration that will provide for the use of the people clean, pure water for drinking, bathing and cooking purposes."

In my second annual message for the year ending December 31, 1896, I said "a supply of pure potable water is the greatest need of our City at this time. The supply has been very much improved by the construction of subsiding basins and it remains alone for us to introduce a system of filtration that will make that supply pure and healthful. The people are interested in this question and so soon as it is decided that the City can create a loan the matter should be undertaken with an eye single to the introduction of the best plant or system that can be obtained." In this same message I urged that "provision should be made for the construction of a reservoir to supply the people of West Philadelphia. The administration has ever bent its efforts in the direction of the improvement of the water supply." In my third annual message for the year ending December 31, 1897, I said, "the improvement of the water supply is a crying need. It is a matter that affects the health of every man, woman and child in this community, and should receive immediate attention, for unless something be done to furnish a pure, healthful supply of water, not alone will the

City be affected in so far as its inhabitants are concerned, but the result will be to keep from our midst strangers and visitors who at all times add to the wealth of a community. The fame and reputation of the City depend upon the intelligent settlement of this question. The typhoid fever prevalent here a short time since, brought us all to a realizing sense of the danger that confronts us. If the City had the money in hand a wise solution of the question would be to bring the water from a pure source in large aqueducts to this City, but that would require so vast an expenditure of money that such a plan at present is practically beyond our reach. Fortunately, we have at this time a plentiful supply of water, which no doubt will meet the requirements for many years to come provided we do not draw upon it too extravagantly. The only question to be settled is as to its quality. Inasmuch as we cannot bring our supply from a distance it is a duty incumbent upon us to make pure and healthful by a system of filtration that which we have at hand, and I cannot too strongly nor earnestly appeal to your Honorable Bodies to immediately authorize the creation of a loan, so that an appropriation may be made providing for the construction and maintenance of filtration plants. So soon as the loan is authorized the City will be ready, through her officials having charge of the matter, to submit, as I have already stated in a special message sent to Councils last February, a comprehensive plan looking towards the accomplishment of this object. All that we now need to make our water wholesome is the construction of filtration plants. Subsiding reservoirs go far towards the improvement of the water supply and we have accomplished much in that direction, but we must go a step further. We should unite our efforts to meet this great question intelligently and give relief at the earliest possible moment. Any unnecessary delay is a crime against humanity.

A loan should be authorized and an appropriation should be made, plans should be submitted and contracts immediately awarded for the doing of the work required. The very moment two or three districts are supplied with wholesome water the question will be settled."

After four years of careful study of this matter I have seen no reason to change my mind. This plan I have constantly persistently urged from the very beginning. I believe it will meet every requirement of the case.

My purpose has been clearly defined, the inauguration of the system depended only upon an appropriation and that appropriation could not be made because of the unreasonable and spiteful opposition to the loan bill, an opposition that set at defiance the will of the people, and was dead to every sentiment of civic pride and to all demands of public necessity. If the \$3,700,000, provided for in said bill, for the improvement of the water supply had been made available we, to-day, would be on the way towards the solution of the problem and no doubt there would be in course of construction, at two points, at least, natural sand filtration plants as well as a subsiding reservoir in West Philadelphia.

Of course it was never contended for a moment that the amount under the loan bill was sufficient to establish a complete system, but it would have provided enough for a beginning, and with a good start the work would have proceeded to the end.

I sincerely hope the coming administration, for the sake of the City's future, will not be so hampered and that the results of the labors of the friends of the loan bill will be reaped by a successful solution of this all important question. The opinion of the Supreme Court will be handed down in a short time and if in favor of the City nearly \$4,000,000 will at once be made available. It has been a long struggle, but it will soon end.

Let me summarize the matter by saying that the City should put her plant in the best condition possible, appropriations should be made to increase the pumping capacity, to build additional subsiding reservoirs, and to construct at those points wherever practicable natural sand filtration beds and at those points where such plants because of the expense cannot be provided, the best mechanical process known. This plan will secure for a generation or more an adequate system and a sufficient supply for all purposes, provided at the same time we adopt a plan that will prevent excessive waste. It will be seen, as above stated, that last year the City supplied 196.2 gallons per capita per day, an increase over the year 1897 of 10.4 gallons per capita per day, and over 1895, the first year of this administration of 35.9 gallons per capita per day. I think it must be apparent to every mind that this increase cannot continue from year to year with an increase, at the same time, in population, without danger of exhausting our supply. A system of metering that will in no wise prevent a necessary and sufficient use, but will provide against excessive and extravagant waste, must sooner or later be adopted, if we are to depend upon our present supply.

The water works of Philadelphia are pumping twice as much water as is required. It is asserted, by those who know, that one-half the water pumped is wasted. If this waste were stopped the capacity of our works would practically be doubled. This excessive demand overtaxes the works, strains them at every point, and prevents the reservoirs answering their purpose, in that there is not given time for the sediment to subside. If the consumption, to-day, were reduced one-half, there still would be an abundant supply, and the quality of the water would at once improve. Time and again we have called public attention to this matter but our requests have been unheeded. In a great measure, the solution of the question

is with the people, and if the waste be stopped, an improvement in the quality of the water will be the immediate result.

With an improved plant and the water made clear and wholesome by filtration the City would be in a position to provide for the distant future. It might under these circumstances be advisable to contract with a company for the furnishing of a supply from the head waters of the Delaware, or as has been suggested in some quarters by impounding the waters or streams in the northern part of the State. Under what terms such an arrangement could be made is hard at this time to state, but in my judgment the City should not negotiate for such a supply, until she is in an independent position, and able to depend upon her own resources, in case of failure on the part of the company to carry out the specifications. Of course, it would be better, if the City could raise the money and provide such a system under her own direction and control, but I think it goes without the chance of contradiction that, at this time, it is not, and so far as we can see into the future, it will not be within her financial ability so to do.

Let me add just here, that the Legislature should enact a law which should be most stringently enforced, providing for the protection of all rivers and streams throughout the State, which supply any community with water. Every settlement upon the banks of these rivers or their branches, should be compelled to filter every drop of sewage discharged into said streams, or else divert the sewage in another direction. The pollution of any stream whose water is drawn upon for public consumption is a crime. Power, clearly defined, should be vested in an executive officer, to enforce obedience to the law; he should be authorized to institute summary proceedings against individuals or communities and the Attorney-General should represent

the State in every action brought. This would go far towards the settlement of the water question. It is the duty and the province of the State, to control this matter and to protect in every way possible, the health of the people by saving from pollution the rivers of the Commonwealth.

Under the Agreement between the City and the United Gas Improvement Company it was provided that "the said The United Gas Improvement Company, its successors and assigns, shall at the expiration of two years from the date of the lease, surrender, release and deliver to the City of Philadelphia full and absolute possession of all that part or portion of the property known as the Ninth Ward Station, described as follows, to wit: All that certain lot or piece of ground with the buildings thereon erected, bounded on the south by Chestnut street, on the east by Twenty-fourth street, on the north by Market street, and on the west by the Schuylkill river; and also all that certain lot or piece of ground with buildings thereon erected, bounded on the south by Market street, on the west by the Schuylkill river, on the north by the Pennsylvania Railroad, and on the east by Twenty-third street."

On March 15, 1899, the President of the said company addressed a letter to me in which he said that "although by Agreement it is provided that the surrender of this property shall take place at the expiration of two years from the date of the lease we are ready to make the transfer immediately or as soon as you designate the person to whom the transfer and delivery of possession shall be made." Having made arrangements for the transfer, the United Gas Improvement Company on the 25th day of March, 1899, surrendered possession of the said property to the City of Philadelphia, and delivered into the hands of the Chief of the Bureau of City Property the keys of

all the buildings thereon. The assessed valuation of this property is \$1,200,000. It is now in the possession of the City for any disposition that Councils may deem proper to make of it. On the 30th of March, 1899, I transmitted to Councils a message in relation to the matter.

DEPARTMENT OF CHARITIES AND CORRECTION.

The President and Directors of this Department have given most loyal service to the duties assigned them. It is with regret that I am compelled to refer to the death of Mr. Joseph H. Mann, a Director of this Department, who served faithfully and well the interests committed to his care. He died on Sunday the 8th day of January, 1899. As his successor I named Dr. Joseph S. Neff. On March 24, 1899, Mr. Henry B. Gross resigned as Director of this Department.

Again I urge, in the increased belief for the necessity thereof, the removal of the Almshouse from its present location. Such an institution should be in the suburbs or in the farming districts. The institution would be more healthful and it could be kept in a cleaner condition. From every aspect of the case the necessity of the removal is apparent. In suggesting this removal, I refer to the Almshouse alone, and not to the Philadelphia Hospital, for the latter should remain where it is at present. Both institutions would be greatly benefited by the separation. The new Loan Bill will make an appropriation available for the erection of a new Almshouse.

I have not changed my mind as to the suggestion I have heretofore made in relation to the consolidation of all the poor districts in this County. They should all be under the direct management of the Department of Charities and Correction. The Almshouse is at all times crowded:

its accommodations are not sufficient to meet the constant demands while some of the poor houses in the outlying districts have comparatively but very few inmates. There is no reason why a bill should not be passed in the Legislature providing for such a consolidation. Such a bill was presented in the last Session but failed of passage.

The building of a Free Public Library so soon as funds are at hand should be done. An institution of this character is a necessity; it becomes a centre of education and refining influence. It is false economy to avoid spending money for such a purpose. The Free Library in this City although its quarters are not sufficient for its needs and though it lacks those conveniences that such an institution should enjoy has already made marvelous progress; it shows what could be done with a larger building and increased accommodations. The Boston Free Library has added immensely to the fame and reputation of that City. The same may be said of the Congressional Library in Washington, in fact we hear these two institutions referred to whenever the names of those cities are mentioned. Philadelphia should have such an institution and it is to be hoped that when the money under the Loan Bill becomes available, appropriations will be made for the purchase of ground and the erection of a suitable and artistic building, and that too, as close to the centre of the City as possible.

The following table for the years 1895, 1896 and 1897 speaks for itself; it will be seen that Philadelphia loses nothing in the comparison:

	1895.	1896.	1897.
Boston Public Library.....	847,321	1,005,019	1,119,658
New York Free Circulating.....	654,451	752,329	922,709
Free Library of Philadelphia.....	1,053,745	1,354,002	1,672,684

The reports from Boston and New York for 1898 have not yet been received, but the circulation for that year in

this City was 1,738,950, an increase of 66,266 volumes over the previous year. It, too, must be borne in mind in this connection that the total number of books in our library is only 184,687. If these figures do not prove that a greater library is needed then all argument fails.

Some time since, one of our prominent and public spirited citizens gave to the City his handsome residence on North Broad street to be used as a branch of the Free Library, and besides donated a large sum of money for the purchase of pictures of American artists to adorn the walls of the building. Last year the same generous donor presented to the City a most valuable collection of books printed before the year 1501, consisting of about five hundred works, they are of special value, as illustrating the progress and the early history of printing; the collection contains many choice specimens and is a very valuable acquisition.

If we had a new and larger Free Public Library, it would no doubt induce to further contributions from many of our wealthy citizens who are interested in the welfare and progress of the City.

The Commercial Museum is now firmly established and has brought us in touch with the commercial interests of the whole country, in truth, we may say, of the world. Its influence has perceptibly grown within the past year. Its purposes are better understood and its uses more fully appreciated than ever. It stands as a monument to the energy, the broad and civic spirit of Dr. William Pepper, whose death was an irreparable loss to Philadelphia. The best tribute that can be paid to the memory of so useful a citizen is to continue to successful completion the work inaugurated by him. The usefulness of the Commercial Museum will increase as time runs on, especially in view of the recent war with Spain. Our

accession of territory in the East as well as in the South will open up new markets for our merchants and manufacturers and such an institution has become a necessity. To-day we are entering upon a new future with a broader scope and with greater possibilities in commerce than we have ever enjoyed.

The Commercial Museum, a short time since, inaugurated a movement providing for the holding of a National Exposition in this city in September of this year. It will exhibit the manufactured products of America and give opportunities to our manufacturers to study the character and quality of the goods that hold the markets of the world, in which we are to compete. The work in this direction has already advanced far enough to insure the success of the movement. Congress has made an appropriation of \$350,000, the State an appropriation of \$50,000, and the City one of \$200,000, while private subscriptions are being sought. A bill is now pending in the Legislature of the State providing for an increased appropriation in view of the importance of the undertaking. The success of the Exposition will add greatly to the fame of our City; to-day it is receiving the cordial support of all the business interests of this community and should be encouraged in every direction.

The Civil Service Bureau under the charge and direction of its able Secretary is well organized and the merits of the system have been given a thorough test. The examiners are representative men of integrity; they were selected with care and they have devoted time and attention to the duties assigned them. During the past four years there have been filed 15,000 applications for appointments, and 1,200 examinations have been held.

In my annual message for the year ending December 31,

1897, I wrote the following: "At the time of the destruction by fire of the State Capitol at Harrisburg, I appointed a Committee of Citizens to secure, if possible, the assent of the State authorities to the removal of the Capital from Dauphin to Philadelphia County. Many meetings were held and an effort was made to arouse public sentiment, but unfortunately success was not reached." A resolution of Councils was passed a few days since which was subsequently transmitted to the Legislature urging the removal of the Capital. Before such a removal could be effected the question would have to be, under the Constitution, submitted to a vote of the people and approved by them. Every effort should be made to reach this result. It would be of great advantage to the City, and I believe benefit legislation if such a change could be made. In the matter of convenience and accommodations the City offers every advantage, far beyond that which the present location or any other in the State can afford. So far as railway facilities and communication are concerned the distance is not to be considered. That was a serious matter in the past, but to-day it need not be weighed. The Capitol Building, as has been suggested, might be placed in Fairmount Park, or better than that, in the neighborhood of Washington Square. If our people would interest themselves in this matter they might create a public sentiment throughout the Commonwealth in favor of the removal. It is surely, an effort worth making, and if an act were passed submitting it to a vote of the people a favorable result might be reached.

In the face of the water question and other urgent improvements it may not, in the opinion of some people, be the time to consider the matter of a "boulevard," but I cannot retire from office without saying that it is to be hoped that in the near future, there may be money available to begin

work in that direction. A broad avenue, which, in time, would be lined with handsome buildings, running from the City Hall to Fairmount Park, would make Philadelphia in beauty second to no other city on the continent. It would be wise, for now is the time, if it ever is to be done, to place upon the plan of the City, such an avenue, thus giving notice that the City contemplates making ultimately such an improvement. If, under all the circumstances, it is not deemed advisable to start from City Hall because of the cost, there is another plan that has been suggested, which is feasible and should be adopted.

The defect in our municipal government is in its legislative branch and this is due more to the system than to anything else. When Councils were originally organized the features of the National or Federal Government were copied or followed almost to the very letter. All the wards, whether large or small, were given, in the upper chamber, like representation. There was a reason for the adoption of such a system in the Federal Constitution, because the smaller States would not surrender to the larger their independence as sovereign powers. The question was a matter of compromise as between sovereignties, but in a municipal corporation there is absolutely no reason for the adoption of such a plan, and, in fact, upon every principle of representation it is unfair. The City as a whole, in so far as her interests are concerned, is without representation. Members in the upper chamber, as well as in the lower, consider themselves responsible directly and immediately to their wards, and necessarily their influence is circumscribed by these narrow boundaries. Their loyalty is to a locality rather than to the whole City. They feel themselves answerable to particular constituencies. This quite recently has been shown and has been advanced as a reason by certain Councilmen, who opposed a measure for the gen-

eral good, because to use their own language, they "saw nothing in it for their own wards." This may be a very flimsy excuse, and is not a very broad view to take, but it unquestionably controls the actions of some Councilmen. I believe it would be a decided advantage to the City, and in the interest of wise and proper legislation, if Select Council was reduced in number to 21 or 23 members, to be chosen by the entire vote of the people and elected as the representatives of the whole City—holding an allegiance to the interests of the municipality rather than to any particular district, ward or locality. This would dignify the office and increase its responsibility.

The Common Council should be reduced at least one-third in number, or it would be better to have one Councilman for every 4,000 taxables rather than for every 2,000. The lower chamber would give sufficient representation to the wards and it would be a fair representation based upon population. When we consider that Common Council is composed of 140 members and upwards, we can then appreciate how unwieldy and cumbersome such a body becomes in the conduct of municipal legislation; it is too bulky to be efficient.

I believe, too, it would be proper to pay salaries to the President of the two chambers, and to the Chairman of the Finance Committee, and perhaps to the Chairmen of other important committees. No one not familiar with the duties of Councils can have an idea of the work required from these officials.

There is one very important matter that should receive attention and the time is ripe for its settlement. The legislative and executive functions should be clearly defined. Councils to-day are exercising in many directions and without authority of law executive power. Unless this matter be definitely settled and the distinctions clearly drawn there will ultimately be trouble and confusion.

The purpose of the Act of June 1, 1885, is to centre executive power and responsibility in the Mayor and Heads of the Departments and whenever Councils attempt to exercise any executive function it is a clear violation of the provisions of the said Act. There should be a full interpretation of the law in relation to this matter and the distinctions clearly drawn before the question becomes further involved.

A number of events of great importance have taken place at different times during the period covered by this administration.

In October, 1895, the Liberty Bell, under a resolution of Councils, was sent to the Atlanta Exposition. The Committee having the Bell in charge traveled through many of the Southern States and the people with enthusiasm and patriotism extended a welcome every step of the way. The Bell seemed, with its associations, to arouse the ardor of the whole people. Men, women and children assembled in all the large cities and towns through which we passed to tender a cordial greeting. The school children covered it with flowers and old men kissed and blessed it. The event has done much to unite in one sentiment the people of this great country. It has unquestionably brought closer together in bonds of friendship the two cities, Atlanta and Philadelphia.

On May 30, 1896, the Garfield monument in Fairmount Park was unveiled. The celebration took place at night and was most imposing.

In September, 1896, Li Hung Chang was the guest of the City, and the reception given him was simple and impressive. It was a strange sight, indeed, witnessed by no other age, when this prominent and distinguished Chinaman sat in Independence Hall and received the welcome of our City.

On May 15, 1897, the Society of the Cincinnati of the State of Pennsylvania unveiled and dedicated the Washington Monument in Fairmount Park. It was a day long to be remembered, for it was most historic in character. The President of the United States and the members of his Cabinet were present to take part in the ceremonies. The weather was all that could be desired and the affair passed off with signal success. It was only another proof of what Philadelphia can do when she rises to meet an occasion.

On the 20th of May, 1897, the statue of Stephen Girard which stands on the west side of the City Hall was unveiled and dedicated.

In June of 1897 an event of national interest took place when the Commercial Museums were opened. The President of the United States and several members of his Cabinet were present.

On June 21, 22 and 23, 1897, the Eighteenth National Saengerfest was held in this City. A large building had been erected for the purpose at Eleventh and York streets, capable of seating 15,000 persons. The grand chorus consisted of between five and six thousand singers; visiting Societies from all over the country were here to compete for prizes. It was one of the most successful festivals ever held in this country.

During the continuance of the war with Spain no City gave more aid to the sick and wounded soldiers who were brought North from the seat of war than Philadelphia.

After the war the returning Philadelphia troops were received and welcomed at the expense of the City. The receptions were of such a character that they proved the real loyalty and patriotism of our people.

On October 25, 26, 27 and 28, 1898, a Peace Jubilee was held in this City in commemoration of the return of Peace as well as in celebration of the triumph of our arms on land and sea in the war with Spain.

On the first day there was a Naval Review on the Delaware, and Hon. John D. Long, Secretary of the Navy, was present upon that occasion; the battleships and cruisers were anchored in the river. The second day was Military Day and 25,000 soldiers and sailors under command of General Miles, marched in review before the President of the United States and the members of his Cabinet. The third day it rained and the Civic procession in consequence was postponed until the following day. The Jubilee passed off with great success; the City was crowded with strangers; such an event has never been witnessed in this City. The President and his Cabinet, the Generals of the Army, the Commodores and Captains of the Navy, were guests of the City during the continuance of the festivities. It was the most successful event of its character in this country since the war with Spain.

In December last, at the Peace Jubilee held in Atlanta, Georgia, the President of the United States gave utterance to the following: "The time has now come in the evolution of sentiment and feeling under the providence of God, when in the spirit of fraternity we should share with you in the care of the graves of the Confederate Soldiers." No more patriotic expression has been uttered since the Civil War. The Confederate Veterans Annual Convention is to be held this year in Charleston, S. C. The Grand Army of the Republic is to have a National Convention here this year. Would it not be a great opportunity for Philadelphia to extend an invitation to the Confederate Veterans to meet here in 1900? An invitation of the City endorsed at the next Convention of the Grand Army of the Republic could not but result in great benefit and a further cementing in sentiment of the whole nation.

In conclusion let me express my appreciation of the

loyal support given to me at all times by the heads of the several Departments, the Chiefs of the various Bureaus, as well as their subordinates, and the Secretary and assistants of my immediate official staff. I shall ever bear in grateful remembrance the devotion and aid I received from my friends in and out of Councils who in the face of violent opposition were ever loyal. I am sure that time will prove that our efforts were always devoted to the public welfare, and to the interests and advancement of the municipality.

Yours very truly,

CHAS. F. WARWICK,
Mayor.

ANNUAL REPORT

OF THE

Department of Public Works

FOR THE

Year Ending December 31, 1898.

OFFICERS
OF THE
Department of Public Works.

Director,
THOMAS M. THOMPSON.

Assistant Director,
HARRY W. QUICK.

CHIEF CLERK—WILLIS SHEBLE.
CLERK—ERNEST T. HANEFELD.
ASSISTANT CLERK—ANDREW L. TEAMER.
STENOGRAPHER AND CLERK—HARRY A. STOY.
STENOGRAPHER AND TYPEWRITER—JOSEPH MARCUS.
GENERAL INSPECTOR—ROBERT C. HICKS.
MESSENGER—JOHN P. JUNIOR.

Superintendent of City Ice Boats,
H. E. MELVILLE.

Chiefs of Bureaus,
HIGHWAYS—WILLIAM H. BROOKS.
LIGHTING—JOHN J. KIRK.
STREET CLEANING—SYLVESTER H. MARTIN.
SURVEYS—GEORGE S. WEBSTER.
WATER—JOHN C. TRAUTWINE, JR.

TWELFTH ANNUAL REPORT
OF THE
DEPARTMENT OF PUBLIC WORKS

THOMAS M. THOMPSON, Director.

Philadelphia, January 3, 1899.

HON. CHARLES F. WARWICK,
Mayor of Philadelphia.

DEAR SIR:—As required by the Act of Assembly, creating the Department of Public Works, I have the honor to present the Twelfth Annual Report of this Department, covering the year ending December 31, 1898.

For details of the large amount of work that has been undertaken and accomplished in the Department of Public Works during the past year, I must refer you to the exhaustive reports of the Chiefs of the several Bureaus herewith submitted, and confine myself to a general statement.

It would be well to state at the beginning of this report that during the year, no money has been available for the extension or improvement of the water system, for the construction of main sewers and bridges, nor for repaving streets with improved pavements, consequently, along these lines, no permanent improvements have been made.

The work on the Pennsylvania Avenue Subway and the

widening of Delaware avenue, and construction of new bulkheads and piers, has been energetically prosecuted and these works are nearing completion. This matter is referred to, however, under the head of the Bureau of Surveys.

The prices paid for paving and the construction of branch sewers were, in many instances, remarkably low—in fact, the margin to contractors must have been of the smallest, even if some did not lose money. Nevertheless, the Department, as in duty bound, compelled as good work as though higher prices had been paid and in all instances required the work to be done in strict accordance with the specifications governing the same. The fact is, however, that parties obtain contracts at low prices to whom contracts should never be awarded—men who will slight their work at every opportunity, as well as cause great and unnecessary trouble in settling accounts.

A review of the year's work of the Department limited only by the appropriation made for it, shows good results and was done in an efficient manner.

City Ice Boats.

With the first appearance of ice in the Delaware River the shipping community turn their attention to the Ice Boats and look to them to keep the Harbor of Philadelphia and the channel of the Delaware River below the City to the capes free from obstruction by ice.

On account of the open winter in the month of January and February but little service was required of the Ice Boats. They were in commission at intervals from January 2, 1898, to February 14, 1898, when, all ice having disappeared, the three boats were put out of commission and returned to their dock at the House of Correction.

By reason of the opening of hostilities between the United States and Spain City Councils, on May 9, 1898,

passed a joint resolution authorizing the Mayor to lease to the Government of the United States City Ice Boat No. 3, for use in the Coast Defence System of the Delaware River.

On May 16, 1898, in compliance with said resolution, City Ice Boat No. 3 was towed to League Island and turned over to Commodore Silas P. Casey, commandant. The boat was fitted up by the United States Government and renamed "Arctic," and, had occasion demanded, I have no doubt that the "Arctic," manned by our gallant jackies, would have given a good account of herself.

On September 13, 1898, the United States Government returned the boat to the City, after placing her in her original condition.

Important service was rendered by the Ice Boats on October 25, 1898, upon the occasion of the naval review in connection with the Peace Jubilee. All three boats took part in the review; Nos. 1 and 2 were assigned to the committee having charge of the naval parade and their guests, and boat No. 3 to the representatives of the press. At the conclusion of the ceremonies boat No. 3 returned to her dock and Nos. 1 and 2 were held in service for the purpose of transferring the marines from the several warships in the harbor to Washington street wharf and back again. These services having been performed they returned to their dock on October 28, 1898.

The repairs made during the year were of the usual character and the boats are now in good condition and will be put in commission immediately their services are required.

The following summary is an abstract of the work done by the City Ice Boats, and of the receipts and expenses of maintenance during the year 1894-95, 1895-96, 1896-97, 1897-98:

	1894 and 1895.		1895 and 1896.		1896 and 1897.		1897 and 1898.	
	No.	Tonnage.	No.	Tonnage.	No.	Tonnage.	No.	Tonnage.
Vessels Outward.....			1	190				
Vessels Inward.....	2	1,925			1	648		
Vessels Assisted.....					1	2,511	2	2,561
Totals.....	2	1,925	1	190	2	3,159	2	2,561

	1894 and 1895.	1895 and 1896.	1896 and 1897.	1897 and 1898.
Amount received for towage and assistance rendered.....	\$437 08	\$10 00	\$321 28	\$765 00
Amount received for the sale of old material.....		28 12	4 40	16 00
Total paid City Treasurer.....	\$437 08	\$38 12	\$325 68	\$781 00

	1895.	1896.	1897.	1898.
Total amount of warrants drawn	\$33,597 71	\$22,767 49	\$24,991 41	\$19,153 08
Deduct cash paid City Treasurer.....	437 08	68 12	325 68	781 00
Actual current expenditure.....	\$33,160 63	\$22,699 37	\$24,665 73	\$18,372 08

Bureau of Highways.

A fair amount of work in the way of improving streets was done during the past year, although not quite as much as in the preceding year.

The total paving and repaving done covered thirty-one and one-third (31 1-3) miles, and cost in the aggregate \$499,436, of which amount the sum of \$430,367 was assessed against the property abutting on the streets paved.

The following is a classification of the street pavements laid during the year and their mileage, also the total mile-

age of the various kinds of street pavements, December 31, 1898:

General Pavement Statistics.

Kinds of Pavements.	LAID DURING 1898.		MAKING TOTAL IN CITY DEC. 31, 1898.	
	Sq. Yards.	Miles.	Sq. Yards.	Miles.
Sheet Asphalt.....	149,774	8.58	3,120,902	190.72
Asphalt Block.....			178,900	19.17
Granite Block.....	28,287	1.77	5,760,509	351.13
Cobble or Rubble.....			2,920,664	158.71
Vitrified Brick.....	167,092	11.63	1,777,123	109.34
Granolithic.....			72,726	12.77
Slag Block.....	1,236	.32	17,882	3.02
Macadam.....	90,938	9.01	1,946,774	185.36

In addition to the paved and macadam streets there are 424 miles of unpaved streets or dirt roads.

It is to be regretted that frequently many of the ordinances authorizing the paving of streets are not passed by Councils until late in the season, making it impossible to place the work under contract until late in the summer or even in the early fall, thus crowding the work into a few weeks' time and in a season of the year when the weather is not only changeable but often severe. Concrete is now required as a foundation under many of our street pavements, and, as it will not set readily in cold weather, the paving should be ordered early enough to permit of its being completed before the first of November.

But little repaving was done during the year, as the only appropriation available for this character of work was \$20,000, set aside from Item 16, for repaving small and tramway streets; and \$25,000 for repaving Christian street, from Sixteenth street to Twenty-first street, and from Twenty-second street to Gray's Ferry Road.

No matter in the care of the Bureau of Highways is of more public interest than repaving with improved pavements the streets at present paved with cobble and rubble stone, but work of this character cannot be continued to any great extent until the City is able to negotiate the loan provided for by ordinance approved June 17, 1898.

The grading of streets continues to be a special feature of work in this Bureau. Two hundred and twenty-four (224) contracts were made and 1,447,876 cubic yards of grading was done during the year. While this amount is not as great as that done in the previous year, yet it exceeds the grading done during either 1895 or 1896, showing that extensive building operations requiring the opening of new streets continued throughout the year.

The appropriation for repairs to paved streets during the year included the resurfacing of asphalt streets where the surface was so worn that repair was impracticable. Work was done to the full extent of the amount appropriated for it as follows:

Resurfacing with sheet asphalt.....	4.5 miles.
Repairs to paved streets:	
Cobble and rubble, 263,229 sq. yds., based on an average width of 12 feet, equals..	38 "
Granite block, 64,770 sq. yds., based on an average width of 18 feet, equals.....	6 "
Asphalt block, 30,000 sq. yds., based on an average width of 12 feet, equals.....	4 "
Vitrified brick, 44,000 sq. yds., based on an average width of 15 feet, equals.....	4 "
Repairs to asphalt paved streets, 16,364 sq. yds., based on an average width of 15 feet, equals	1.9 "
Total	<u>58.4</u> "

Repairs to paved streets heretofore were paid for at so much per square yard, but the liberal appropriation made by Councils for this work during the ensuing year has en-

abled the Department to award the contract for repairing streets except those paved with asphaltum for a lump sum for each class of pavement, the contractor to keep the streets in repair for the entire year.

We believe this system will work to great advantage for the City, as it will be to the interest of the contractor to repair holes before they become enlarged and the City will thus secure greater permanency in repair and saving in expense, for it seems reasonable to expect a large reduction in the cost of such repairs for the year 1900, as the pavements will be in good order at the time new contracts will be made instead of being full of holes from the winter wear as has heretofore been the case. No change has been made in the system of repairing streets paved with sheet asphalt; therefore, they will be repaired as heretofore, at so much per square yard.

The tearing up of the streets of the City by the various corporations for the purpose of connections, repairs and extensions to their underground service, becomes, with the laying of improved pavements, a very serious problem, requiring, if we hope to keep our street pavements in good condition, stringent rules and regulations.

The United Gas Improvement Company opened, for the purpose of laying mains, services, etc., one hundred and thirty-seven (137) miles of street pavements. These openings were all reinstated by said company in a satisfactory manner and under the direct supervision of the Inspectors of the Bureau of Highways. This extra work added greatly to the labors of the officials of this Bureau.

The unprecedented heavy rainfalls of the past summer and fall, caused numerous washouts and did a large amount of damage to our unpaved and macadamized roads, but in every instance repairs were promptly made and the roads placed in first class condition.

During the year 39,104 tons of broken stone were placed

upon roads requiring resurfacing and all other roads cared for under the annual contract for the maintenance of unpaved and macadamized highways, received the constant attention of the contractor, and I am glad to state that so satisfactory has been the service that complaints have been less than usual.

Upon all macadamized highways sprinkling was continued during the entire heated term. The importance and desirability of this work has been fully recognized and provision is now made annually by Councils for its continuance.

There are three hundred and thirty-two (332) City bridges under the care and supervision of the Bureau of Highways, and during the year, repairs have been made as far as the appropriation for the work would permit. There are, at present, several of our bridges which are in bad condition, and others which are deteriorating for the want of painting, but the appropriation made for the repair and maintenance of bridges is totally inadequate to do all the work required. It is poor economy to permit these important structures to depreciate because of neglect in making repairs, which, if promptly made, would prevent the necessity for larger outlays for renewals.

Here should be recorded the death of Mr. Carl A. Trik, who, at the time of his decease, held the position of Superintendent of Bridges.

Mr. Trik entered the employ of the City in the year 1881, acting in the capacity of Assistant Engineer in the Bureau of Surveys. On January 7, 1891, he was transferred to the Bureau of Highways to fill the position of Superintendent of Bridges, made vacant by the death of the former incumbent, and this position Mr. Trik held until his demise, which occurred on July 10, 1898.

Mr. Trik was in the fifty-seventh year of his age, an efficient and painstaking officer, earnest and ambitious in the

discharge of his duties and highly respected by his associates. The City, by his death, was deprived of the services of an earnest and experienced officer.

Under the supervision of the Inspector of Sewers a careful examination of all City sewers was made, and wherever breaks were discovered they were promptly repaired.

The rainfall readings show an accumulated excess of more than nine inches over the annual amount of precipitation for the centre of the City. Several downpours were abnormally severe, especially the one occurring on August 3. This storm began at 10.47 o'clock A. M. and ended at 1.20 o'clock P. M. During that time 5.48 inches of rain fell, as recorded at the United States Weather Bureau office, located at Ninth and Market streets. Notwithstanding these unusual heavy rainfalls, the number of breaks in sewers was fewer than expected, and, when breaks did occur, the emergencies were promptly met and repairs immediately made.

The work of placing curved granite curbing at the intersections of streets has been continued to the full extent of the amount appropriated for the purpose.

The following tables give comparative statements in detail of the work done in the years 1895, 1896, 1897, and 1898, and of the receipts and expenditures of the Bureau of Highways for the same period.

Comparative Statement of Work done.

	1895.	1896.	1897.	1898.	
New paving.....	149,515.05	169,832.14	126,864.38	117,779	Linear ft.
Macadamizing (new).....	66,813.	47,199.	78,029.	47,568	" "
Grading	1,114,823.88	1,138,778.93	2,373,510.84	1,447,876	Cubic yds.
New footway paving.....	110,086.50	115,478.27	71,657.01	93,197	Square yds.
Repairs to paved streets.	329,598.14	304,481.97	472,322.35	418,363	" "
Footways repaved.....	19,448.24	23,071.67	12,651.25	19,053	" "
Ditches repaved.....	109,800.47	113,658.18	104,675.78	57,024	" "
Gutter stone laid.....	21,462.50	20,252.	34,731.30	20,656	Linear ft.
Crossing stone laid.....	26,137.68	24,090.55	9,330.	8,616	" "
Tramway stone laid.....	4,397.41	2,825.	585.	959	" "
Curbstone reset.. ..	356,687.	250,411.29	130,374.	140,052	" "
Wooden trunks.....	4,972.66	7,263.40	5,225.	9,467	" "
Brick and stone drains..	1,744.50	1,104.	2,098.	2,827	" "
Hand railings.....	3,125.90	3,029.90	1,583.50	7,053	" "
Broken stone used.....	15,964.68	20,708.75	30,720.	39,104	Tons.
Macadamizing (resurfacing).....	42,920.	81,641.	110,485.	141,990	Linear ft.
Curved curb corners	28,329.39	23,806.65	19,300.11	18,432	" "
Footway, curb and rail-road notices served.....	46,025.	28,755.	17,830.	19,474	

Summary of Work done in Improved Pavements—New Streets.

	1895.		1896.		1897.		1898.	
	Square Yds.	Linear Ft.	Square Yds.	Linear Ft.	Square Yds.	Linear Ft.	Square Yds.	Linear Ft.
Granite blocks.....	90,090	28,293	29,244.75	8,384.50	21,231	7,218	26,154	8,354
Sheet asphalt.....	110,342	28,544	133,995.77	39,236.87	135,848.74	36,209	125,260	32,917
Vitrified bricks.....	131,051	68,629	119,011.17	46,484.05	168,852.21	58,933.26	163,188	58,282
Asphalt blocks.....	1,309	795						
Macadamizing.....	146,024	66,813	93,773	47,199	162,102.72	78,029	90,938	47,568
Totals.....	478,816	*193,074	375,024.69	†141,304.42	488,034.67	†180,439.26	405,540	‡147,121

Replacing Cobblestone with Improved Pavements—Old Streets.

	1895.		1896.		1897.		1898.	
	Square Yds.	Linear Ft.	Square Yds.	Linear Ft.	Square Yds.	Linear Ft.	Square Yds.	Linear Ft.
Granite blocks.....	2,977	1,525	70,600.16	18,608.29	12,147	1,694	2,133	1,018
Sheet asphalt.....	2,834	390	116,054.18	43,674.90	13,228.92	10,147	21,514	12,360
Vitrified bricks.....	6,901.03	3,795.95	17,153.30	5,208	5,013.70	5,119	3,904	3,143
Granolithic.....	15,722.10	16,561	6,553.44	7,449.96	3,652.69	4,971.12		
Slag Block.....	1,812	983	1,477.82	785.67	2,688	2,523	1,236	1,765
Totals.....	30,246.13	*23,251.05	211,838.90	†75,726.72	36,730.31	†24,454.12	31,787	‡18,226

* 1895, Total amount of new paving 216,328.05 linear feet, equal 40 miles 5,128.05 linear feet.
 † 1896, Total amount of new paving 217,631.14 linear feet, equal 41 miles 551 linear feet.
 ‡ 1897, Total amount of new paving 204,893.58 linear feet, equal 38 miles 4,253 linear feet.
 § 1898, Total amount of new paving 165,347 linear feet, equal 31 miles 1,667 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 1898:

	Repaving, Linear Feet.
Granite blocks	23,220
Granite blocks (old blocks relaid).....	12,144
Sheet asphalt	465
Vitrified bricks	874
Total	36,703

Equal to 6 miles, 5,023 linear feet, at an estimated cost of \$200,000.

Comparative Statement of Receipts.

Years.	Receipts.	Increase.	Decrease.
1895.....	\$150,513 24		
1896.....	155,054 06	\$4,540 82	
1897.....	135,439 35		\$19,614 71
1898.....	129,467 24		5,972 11

Comparative Statement of Expenditures.

	1895	1896	1897	1898
Current expenses.....	\$415 861 82	\$546,931 82	\$579,195 64	\$608,763 41
For extensions.....	1,006,796 37	984,787 23	745,578 64	529,776 34
Total.....	\$1,422,658 19	\$1,531,719 05	\$1,324,769 28	\$1,138,529 75

Board of Highway Supervisors.

The reports of the officers of this Board show that, notwithstanding a reduction in the rates charged for plans, the gross receipts have been greater than any previous year. The total receipts were \$18,081.57 and the expendi-

tures \$9,224.46, showing a net profit to the City of \$8,857.11. This sum is not large when compared with the receipts and expenditures of other branches of the City service, but it is a satisfaction to know that additions to valuable records are being made by the Board of Highway Supervisors without cost to the City.

During the year 43.3 miles of underground plans have been added to the valuable records of this Board, and these additions to the records already on file are more valuable than the monies paid into the City Treasury by the individuals and corporations for whose accommodation the work has been done by the draughtsmen of the Board.

The following is a statement of the number of permits authorized to be issued to the several companies maintaining underground structures during the year 1898:

Edison Electric Light Company.....	24
Columbia Electric Light Company.....	1
Penna. Heat, Light and Power Company.....	6
Pneumatic Transit Company.....	1
Powelton Electric Light Company.....	1
Diamond Electric Light Company.....	1
Burnham, Williams & Company.....	1
Union Traction Company.....	1
Bell Telephone Company	330
Total	366

In addition to the above nine hundred and seventy-six (976) permits were issued to The United Gas Improvement Company to open street pavements for the improvement of their system of distribution.

Applications from the various corporations—gas, electric light, telephone companies, etc.—for permits to open street pavements, continue unabated in number and, as a result, our streets are continually torn up, causing not only great inconvenience to business and our citizens generally, but destroying the permanency of the street pavement.

This question of openings on street pavements for various purposes has always been important and will require much study and, perhaps, legislation, before a satisfactory plan for protecting our street pavements can be evolved.

This leads me to again refer to a suggestion made in previous reports for the construction of a system of subways, within which pipes for all underground services could be placed. With a system such as this with proper house connections carried to the curb line, there would be but little excuse for breaking the street pavements and, at the same time, it could be made a source of large revenue to the City.

The following is a summary of the transactions of the Board and of the work of the draughting department; also of the receipts and expenditures for the year 1895, 1896, 1897, and 1898:

Transactions of the Board of Highway Supervisors.

Permits authorized to be issued.	1895	1896	1897	1898
For vaults.....	18	16	15	15
For railroad tracks, curves and turn-outs.....	192	113	66	66
For underground pipes.....	37	17	8	10
For electrical conduits.....	81	278	38	366
For erecting bridges.....	2		1	
For tunnels.....		1		
For miscellaneous.....	2		2	2
For awnings.....	369	345	283	329

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

	1895	1896	1897	1898
Plans of iron awnings furnished.....	369	341	271	296
New street record plans prepared.....	176	43	92	210
Blue print plans placed on file.....	167	190	186	148

Receipts and Expenditures.

	1895	1896	1897	1898
Receipts.....	\$1,975 90	\$14,354 36	\$2,380 80	\$18,081 57
Expenditures.....	4,400 00	5,198 93	7,328 28	9,224 46
Profit to the City.....	\$6,575 90	\$9,155 43	*\$4,947 48	\$8,857 11

* Deficit.

Bureau of Lighting.

The City gas lamps are lighted and maintained by The United Gas Improvement Company in accordance with the terms of the lease between the City and said company.

The gasoline lamps are lighted and maintained by the Pennsylvania Globe Gas Light Company, under contract with the City, at \$21.00 per lamp per year.

The gas lamps in the Northern Liberties district are lighted and maintained by the Northern Liberties Gas Company, under contract with the City, at \$20.20 per lamp per year.

The work of the Bureau of Lighting is a general supervision of the work to be performed by these several companies, and this arduous duty during the past year, devolved entirely upon the Chief of the Bureau. The addition of one clerk and two inspectors already granted, will somewhat lighten his labors during the year 1899.

The total number of lamps lighted and under the supervision of the Bureau of Lighting on December 31, 1898, was 32,793, divided as follows:

Gas lamps maintained by The United Gas Improvement Company	19,417
Gasoline lamps	13,156
Gas lamps supplied by Northern Liberties Gas Company	92
Gas lamps maintained by the Department of Charities and Correction.....	128
Total	32,793

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In addition to the gas and gasoline lamps there are 7,147 electric arc lights under the care of the Department of Public Safety, Electrical Bureau.

The contract of the City with The United Gas Improvement Company provides that it shall in each succeeding year supply gas, without charge, to three hundred (300) street lamps or lamps in public squares in each year, along the lines of its mains, in addition to the number supplied in the preceding year when directed so to do by Ordinance of Councils, which shall also specify the location of the same.

In accordance with this provision two hundred and ninety-nine (299) new street lamps were located by the Department during the year, on streets under contract to be paved and the locations of the lamps were approved by Councils Committee on Gas. Of this number, two hundred and sixteen (216) have been erected during the year and the balance will be erected in the early part of the coming year.

Owing to the many new building operations and the opening of new streets, the demand from operative builders for gas lamps was so great, it became apparent in the early part of the year that the three hundred (300) new gas lamps to be furnished by The United Gas Improvement Company would not be sufficient to meet the requirements. To meet this demand arrangements were made with The United Gas Improvement Company to move certain gas lamps because of their proximity to electric lights and re-erect them in other places on streets where there were no lamps. Under this arrangement, six hundred and seven (607) gas lamps were discontinued, and of this number five hundred and eighty-nine (589) have been re-erected in other places.

In view of the above facts it is evident that the three hundred (300) additional gas lamps which The United

Gas Improvement Company are required to erect annually will not be sufficient to meet the rapid development of the City and it will be necessary for Councils to make provision for an additional number of new gas lamps annually.

In this connection I would suggest that all public lamps should be located under general, instead of special, ordinance.

The following statement shows the number of gas and gasoline lamps and the expenditures of the Bureau of Lighting during the year 1898:

	Number of Lamps.	Cost during the year 1898.
Gas lamps maintained by the United Gas Improvement Co.....	20,930	
Gasoline lamps.....	13,156	\$270,214 13
Gas lamps supplied by the Northern Liberties Gas Co.....	92	1,858 44
Gas lamps maintained by the Bureau of Correction.....	239	
Salaries and office expenses.....		2,326 37
Total	34,417	\$274,598 94

Of the above number, one thousand five hundred and thirteen (1,513) gas lamps under the care of The United Gas Improvement Company and one hundred and eleven (111) gas lamps of those maintained by the Department of Charities and Correction are not lighted because of their proximity to electric lights.

Bureau of Street Cleaning.

There was expended by this Bureau during the year 1898, for the cleaning of streets and inlets, removal of ashes, etc., \$540,474; and for the removal and disposal of garbage, \$328,600, a total of \$869,074. While this seems a large amount of money, it is comparatively small when compared with the magnitude of the work performed.

There were cleaned during the year 217,389 miles of streets and 2,133,792 inlets: 588,954 cart loads of ashes and dry refuse were collected and removed from business establishments and dwellings. There were also collected and disposed of in a sanitary manner, 201,958 loads of kitchen garbage and 8,769 dead animals.

The collection of ashes during the past year involved the handling of about 28,380,000 vessels and the collection of garbage about 82,945,000 vessels. Notwithstanding the magnitude of all this work there were received only 1850 complaints of all kinds, which is 551 less than the preceding year. This is the smallest number of complaints received by the Department during any previous year and attests to the efficiency of the Bureau of Street Cleaning and the satisfactory manner in which the work was performed.

Health and City cleanliness are closely allied and it is a self evident fact that much disease is removed from a city by proper cleaning of streets; therefore, this branch of the City service has been given constant study and vigilance and the results obtained have been extremely satisfactory. We believe that Philadelphia is the cleanest city on this continent.

The garbage has been collected daily and this branch of the service has been kept up so efficiently during the year that very few complaints have been received.

For removing snow from the streets surrounding the City Hall and the bridges spanning the Schuylkill River and such other streets, including small streets in the business centre of the City, Councils appropriated \$10,000, an amount totally inadequate to do the work required.

On all business and small streets, known as tramway streets, the surplus snow should be removed, for it is a continuous nuisance while it lasts. Shovelled from the sidewalks and swept from between the car tracks it forms piles

of from three to four times the depth of the average snow fall, and, when beaten down and covered by the unsightly street dirt, guarded from the direct rays of the sun by the buildings which tower on either side of our narrow streets, it remains a long time to be a hindrance and obstruction to business and travel, a source of danger to public health and a discomfort to the majority of citizens generally.

The health and convenience of the public demand that Councils should provide sufficient appropriation for the removal of snow from streets in the business centre of the City and, as far as possible, from our small and narrow streets.

This Department is constantly in receipt of communications from our citizens, complaining of the dirty condition of back alleys, but as the power and duties of the Bureau of Street Cleaning are limited to the cleaning of streets, we can do nothing to improve the condition of alleys. When the accumulations of dirt and filth become unbearable a complaint to the Bureau of Health will result in a temporary removal of the offensive collection, thus abating the nuisance; but with the limited means at its command it cannot undertake to keep the alleys clean. Therefore, the sooner legislation is enacted to include the cost of cleaning alleys under the regulations governing the cleaning of streets, it will be better for all concerned.

Contracts have been awarded for cleaning streets, collecting and removing ashes, etc., for the year 1899, for the sum of \$510,722, which is \$34,729 less than the contract price for the year 1898. This is not owing to any decrease in the amount of work to be done, but to active competition among the bidders.

The contract price for the collection and disposal of garbage during the year 1899 is \$358,000, which is \$28,000 more than the contract price for 1898. This increase is due mainly to the increased number of houses from which

the garbage is to be removed, and, judging from the efficient manner in which this work was performed during the past year, we believe it is money well and wisely expended. However, I am still of the opinion expressed in previous reports that if contracts for the cleaning of streets, etc., and the collection and disposal of garbage, could be made for a period of not less than three years, the work could be done better and at much less aggregate cost than under the present one year system.

The following is a statement in detail of the operations of the Bureau of Street Cleaning during the year 1898; also the totals for the years 1895, 1896, and 1897:

Total Work During the Year 1898.

DISTRICTS.	CLEANED.						REMOVED.			Number of Complaints of all kinds.
	Squares.	Inlets.	Crossings.	Market Houses.	Snow from Fire Plugs.	Number of Dead Animals.	NUMBER OF LOADS.			
							Dirt.	Ashes.	Garbage.	
First.....	513,698	215,264	60,310	622	3,916	1,643	37,742	110,020	34,650	225
Second.....	390,536	491,524	48,726	1,226	1,500	2,244	50,919	99,403	34,982	664
Third.....	210,360	97,197	33,240	.....	1,822	1,482	16,924	58,948	31,242	286
Fourth.....	640,203	670,188	51,050	.....	390	1,919	83,599	135,018	59,436	391
Fifth.....	327,583	583,089	4,800	.....	918	1,481	17,116	126, 65	46,654	280
Sixth.....	21,415	73,530	1,960	.....	2,236	.....	1,168	.....	.....	4
Totals, 1898.....	2,173,895	2,133,792	236,062	1,848	10,772	8,769	222,468	588,974	201,958	1,850
Totals, 1897.....	1,313,770	446,232	196,267	1,920	7,983	9,796	228,276	668,358	162,874	2,401
Totals, 1896.....	1,178,757	476,351	163,152	1,536	10,034	10,315	235,681	623,228	152,729	3,213
Totals, 1895.....	881,661	553,501	397,738	1,546	21,723	10,295	235,866	620,065	131,513	5,928

The total expenses of the Bureau of Street Cleaning for the year 1898 were \$895,427.01.

Bureau of Surveys.

The important work of this Bureau, under the direction of its able Chief Engineer, has been conducted in a very satisfactory manner.

The expenditures of the Bureau of Surveys during the past year were \$2,886,236.05. Of this amount, \$2,625,107.23 was expended for permanent improvements. The receipts of the Bureau from all sources were \$128,753.08.

Main Sewers.—Work was continued upon all main sewers in process of construction at the time of the report for 1897, and all have been completed. They are as follows.

Brown street, from Fiftieth street to Fifty-first street, and on Fifty-first street, from Brown street to Haverford street, and on Aspen street, from Fifty-first street to Haverford street.

Mascher street, from north of Ontario street to Tioga street.

Twenty-ninth street, from Susquehanna avenue to Herman street, and on Herman street, from Twenty-ninth street to Thirtieth street, and on Thirtieth street, from Herman street to Cumberland street.

Wingohocking Sewer, from present sewer on Chew street, near Duval street, to Johnson street, to Bellfield avenue, to Sharpnack street.

The only appropriation made by Councils during the past year for main sewers was \$20,000, for the construction of a main sewer on Fifty-fifth street, from Thomas avenue to South street. Proposals have been received for its construction and contract for the work executed.

By ordinance approved July 20, 1898, City Councils authorized the construction of fifteen main sewers, including the extension of the Aramingo canal and Wingohocking systems. The estimated cost of the work is

\$500,000. The general and detailed drawings of these sewers have been completed, but the work cannot be proceeded with until the City is able to negotiate the loan provided for by ordinance approved June 17, 1898, and which is now in litigation.

Intercepting System.—The building of connections with the intercepting sewer is being steadily pushed to the extent of the limited appropriations for the work. The appropriation for the extension of this system during the past year was only \$20,000, an amount totally inadequate to do the work required.

Owing to the agitation of the pollution of the water supply taken from the Schuylkill river, the extension of this system is more important than ever and should receive early and favorable consideration of Councils and liberal appropriation for the work should be made.

During the year \$2,700 were expended in cleaning the main intercepting sewer between Fairmount dam and the upper Manayunk terminus. The work was done under the joint supervision of the Bureaus of Highways and Surveys, and was very effective in increasing the capacity of the sewer by reason of the removal of a large amount of deposits which had accumulated in past years.

Three hundred and seventy (370) drains were connected with the intercepting sewer and its branches, all of which were properly inspected by the Supervisor of the Sewer and Inspector of Drain Connections.

Cohocksink System.—During the past year, but one serious break occurred in the Cohocksink sewer, at Girard avenue and Germantown avenue. Owing to the continuous and heavy rainfalls, repairs were made under great difficulties, the entire section across Girard avenue being rebuilt.

In compliance with a resolution of Councils, passed October 6 1898, we prepared and forwarded to Councils, plans providing additional sewerage, with direct outlets for the relief of the territory drained by the Cohocksink sewer, in the Sixteenth, Seventeenth, and Twentieth Wards. The estimated cost of the new sewer and the section to be reconstructed is \$225,000, which amount should be appropriated for the work as early as practicable.

My recommendations made in previous reports for the construction of main sewers in various sections of the City, in order to provide better drainage facilities, apply to this year as well.

In the southern part of the City, below Shunk street, and between the Delaware and Schuylkill rivers, the development of territory is practically at a stand-still, because of insufficient drainage facilities.

The importance of providing a proper drainage system for the district of Frankford, becomes more urgent each year. Frankford creek, which is a tidal stream, foul at all times, but more so when the tide recedes, receives the sewage from a large and densely populated territory, and is yearly becoming more contaminated by reason of the extension of the branch sewer system.

Plans for a comprehensive drainage system for this district have been designed and funds should be provided to begin this important work.

There are many and pressing demands for main sewers in all outlying sections of the City, but their construction must be held in abeyance until funds are placed at our disposal.

In addition to the main sewers authorized by Ordinance of Councils of July 20, 1898, the Chief Engineer of Bureau of Surveys has prepared a list of thirty (30) main sewers, all of which are absolutely needed for the proper health and expansion of the City, and Councils should,

by liberal appropriations, provide for their construction. They are as follows:

Montgomery street, relief sewer, near Sydenham, to Twentieth streets, etc.

Relief sewer, in Sepviva street, from Huntingdon to Sergeant streets, etc.

Oxford street, relief sewer, on Oxford street, from Thirtieth to Twenty-sixth street.

Chestnut street, from Fifty-sixth to Fifty-ninth street, and on Fifty-ninth street to Arch street.

Fifty-fifth street, from Thomas avenue to South street, and on South street.

Shunk street, sewer, from Oregon avenue, near Weccacoe avenue, to Weccacoe avenue, etc.

Wingohocking main sewer, from terminus, near Ninth street, to Fifth street.

West branch of Wingohocking main sewer, from Bellfield and Sharpnack streets to Mt. Pleasant avenue.

Extension of Wissahickon high level intercepting sewer from terminus to Rex avenue.

Rosehill street, from Allegheny avenue to Tioga street, and on Tioga street to "B" street, etc.

Extension of Snyder avenue sewer to low water line.

Fifteenth street, from Bellfield avenue to Rockland street, and on Rockland street, etc.

East branch Wingohocking main sewer, from Fisher's lane to Olney street.

Extension of Fifty-second street sewer, from P. W. and B. R. R. to Chester branch of P. and R. R. R.

Magee street, from Delaware River to Milnor street.

Frankford intercepting sewer, on Frankford avenue.

Extension of Thomas Run sewer, on Fifty-sixth-and-one-half street.

Extension of branch of Merion Creek, from near Over-

brook avenue and Upland way to Fifty-ninth street, and on Fifty-ninth street to City avenue.

Devereaux street, from Delaware River to State road.

Extension of Lincoln avenue sewer, from Sedgwick avenue to Cresheim road, etc.

Relief sewer, on Twelfth street, from Lombard to Walnut street.

Pratt street, from Frankford avenue to Willow street.

York and Coral streets, relief.

Craig street, from Welsh road to Solly street, to Bristol pike to creek.

Tioga street, from Delaware River to Richmond street.

Princeton street, from Tulip to Wisconsin streets, to Cottman street.

Cottman street, from Delaware River to Tulip street.

Elmwood avenue, from Sixty-ninth to Sixty-sixth streets, to P. W. and B. R. R.

Janney street, from Allegheny avenue to Westmoreland street.

Wissahickon high level intercepting sewer, extension to Twenty-fourth street and Indiana avenue.

To construct the sewers enumerated above will require an appropriation estimated at \$2,250,000.

Branch Sewers and Inlets.—21.61 miles of branch sewers were constructed by the City during the past year, and 1.47 miles of sewers were built in connection with the widening of Delaware avenue, payment being made from the Girard Estate fund; 563 inlets, not included in sewer contracts, were built or rebuilt, and 5,396.03 feet of curbed granite curb placed in connection therewith; 17,542 feet of lateral sewer connections were built in streets to be paved. Upon streets paved with asphalt 250 asphaltum-filled manhole covers were substituted for the old iron covers.

In addition to the branch sewers constructed by the City 8.28 miles of branch sewers were built at private expense.

The total length of the City sewers is as follows:

Main sewers	133.44 miles.
Branch sewers	668.76 "
	<hr/>
Total	802.20 "

Revision of City Plans.—The Bureau is engaged in the revision of lines and grades in many of the rural sections of the City, where numerous building and land operations call for City improvements. The studies and plans for street revision, with a view to abolishing grade crossings, have been continued along the lines of the following railroads: Philadelphia and Bustleton, Philadelphia and Frankford, Chestnut Hill branches of the Philadelphia and Reading Railway and the Pennsylvania Railroad. Also for the elevation of the tracks of the Philadelphia and Trenton Railroad, from Norris street to Butler street, and the Philadelphia, Germantown and Norristown Railroad, on Ninth street, from Spring Garden street to Broad street.

Bridges.—The only new bridge authorized during the year 1898 was a footway bridge on the line of Wheatsheaf lane, over the tracks of the Connecting Railway and the Philadelphia and Trenton Railroad. This bridge is for pedestrian travel only, vehicle traffic having been diverted to another crossing, due to the closing of Wheatsheaf lane over the railroad. Proposals have been received and contract awarded, but owing to the fact that the appropriation for its construction not being available until late in the season, the work has not been commenced.

Gray's Ferry Bridge.—The contract for the masonry sub-structure of this bridge, work upon which was commenced in 1897, was completed November 12, 1898, the cost being \$250,000. The appropriation for the construction of this bridge was \$400,000. An additional appropriation of \$7,000 was made December 31, 1898, which, added to the unexpended balance from the previous appropriation, will admit of placing the metal structure in place, exclusive of the paving, railings and final painting.

Bids were received December 13, 1898, for the metal superstructure and the contract awarded to the lowest bidder, the Phoenix Bridge Company.

The report of the Chief Engineer gives detailed and interesting description of the work planned and of its progress.

While the proposed loan carries an appropriation of \$600,000 for new bridges, we have a list of numerous bridges, all of which should be built, and which will cost, approximately, in the aggregate, \$2,425,000. The bridges needed are as follows:

Retaining walls, abutments and superstructure for Thirty-third street bridge over the Philadelphia and Reading Railway and over Connecting Railway.

Lehigh avenue, under Connecting Railway.

Wyoming avenue, over Frankford Creek.

Seventeenth street, over Philadelphia, Germantown and Norristown Railroad.

Seventy-first street, over Philadelphia, Wilmington and Baltimore Railroad.

Sedgley avenue, over Richmond Branch Philadelphia and Reading Railway.

Allegheny avenue, under North Pennsylvania Railroad.

Fifty-seventh street, over West Chester and Philadelphia Railroad.

Draw bridge across Schuylkill River at or near line of Passyunk avenue.

Fifty-second street, under Pennsylvania Railroad.

Sixty-sixth avenue, north over North Pennsylvania Railroad.

Gray's Ferry Bridge over Schuylkill River (to complete).

Gibson avenue, under Baltimore & Philadelphia Railroad.

Graver's lane, over Chestnut Hill Branch Philadelphia and Reading Railway.

Erie avenue, over Richmond Branch Philadelphia and Reading Railway.

Montgomery avenue, over Connecting Railway.

"D" street, over Connecting Railway.

Glenwood avenue, over Richmond Branch Philadelphia and Reading Railway.

Allegheny avenue, under Connecting Railway.

Armat street, under Germantown and Chestnut Hill Branch Philadelphia and Reading Railway (two bridges).

Dauphin street, under Connecting Railway.

Frankford avenue, over Frankford Creek (two bridges).

Large street, under Frankford Branch Philadelphia and Reading Railway.

Sixtieth street, over Philadelphia, Wilmington and Baltimore Railroad.

Byberry Road, over creek in Thirty-fifth Ward.

Hunting Park avenue, over Richmond Branch Philadelphia and Reading Railway.

Sixty-fifth street and Baltimore & Ohio Railroad.

Centre street, under Philadelphia, Germantown and Norristown Railroad.

Fifty-eighth street, over Philadelphia and West Chester Railroad.

Over Wissahickon Creek near Walnut lane.

Twelfth street, under Connecting Railway.

Footbridge over Pennsylvania Railroad at Thirty-eighth street and Mantua avenue.

Footbridge under Philadelphia and Germantown Railroad at Collum street.

Woodbine avenue, north of Haverford avenue (two bridges).

Upper deck, Falls Bridge.

School lane, approach to Falls Bridge over Philadelphia and Norristown Railroad.

Rhawn street, over Pennypack Creek (two bridges).

The City is rapidly growing, and each year there is an increasing demand for better facilities of communication between built up sections and between the East and West sides of the Schuylkill River. While the amount set aside in the loan will complete important bridges, there are many other urgent bridges for which additional funds should be provided, in order to keep pace with the requirements of the City's development.

The necessity of liberal appropriations for bridge construction is scarcely less important than the appropriation for main sewers.

Pennsylvania Avenue Subway.—The work on this improvement has been steadily pushed during the past year and the magnitude of the work is shown and can best be realized by reference to the following statistics:

	1898.	Total Dec. 31, 1898.
Earth and rock excavation..	463,609 cu. yds.	902,084 cu. yds.
Masonry laid exclusive of sewers	60,196 cu. yds.	171,328 cu. yds.
Temporary track laid.....	2½ miles.	10 miles.
Permanent track laid.....	2½ miles.	2½ miles.
Sewers constructed.....	.26 miles.	4.2 miles.
Bridges constructed	9	11
Structural steel work erected	7,237,126 lbs.	7,358,940 lbs.

	1898.	Total Dec. 31, 1898.
Number of approved drawings prepared	170	1,213
Number of shop drawings checked	360	790
Average number of men employed by contractors.....	600	

The following work has been completed during the year:

Temporary tracks completed; permanent tracks laid in yard between Fifteenth street and a point midway between Broad and Thirteenth streets; masonry in retaining walls practically completed; underpinning completed; side walls of the tunnel and brick masonry of arch completed; bridge abutments completed; bridges at Twelfth, Thirteenth, Broad, Fifteenth, Seventeenth, Eighteenth, Nineteenth and Twentieth streets completed, except the extensions on Pennsylvania avenue at Fifteenth and Eighteenth streets; the core removed partially from Thirtieth street to the West portal of the tunnel, entirely beneath the tunnel; partially from the East portal of the tunnel to Fifteenth street, entirely from Fifteenth street to a point midway between Broad and Thirteenth streets.

The importance of this improvement and the benefit to be derived from it have been set forth in previous reports and to mention them again in this report would be repeating what has already been stated. Detailed and interesting descriptions of the work and of its progress under the numerous contracts, will be found in the full and descriptive report of the Chief Engineer.

Improvement of Channels, Delaware and Schuylkill Rivers.—Active work under the several contracts for improving the channels of the Delaware and Schuylkill Rivers, and which were in force at the beginning of the year, was resumed early in the season as soon as the weather would permit and steadily pushed throughout the year.

The dredging already completed and that which remains to be done under contracts now in force will provide a channel in the Delaware River 600 feet wide and 26 feet deep at mean low tide from the City to a point below Chester, Pennsylvania; and in the Schuylkill River, 250 feet wide and 22 feet deep, at mean low tide, from Penrose Ferry Bridge to a point near Fifty-eighth street; and 150 feet wide and 20 feet deep, at mean low tide, from Fifty-eighth street to a point near the Baltimore & Ohio Railroad Bridge.

The following contracts for dredging in these two rivers have been completed:

Contract No. 3, Schuylkill River:—From a point about half a mile above Penrose Ferry Bridge to Fifty-eighth street, completed July 19, 1898.

Contract No. 5, Delaware River:—Removal of the remaining portions of Schooner Ledge not covered by previous contracts, completed June 2, 1898.

Contract No. 6, Delaware River:—Work under this contract embraced three locations—Section 1, from Avenue 38 South to Morris street (a continuation of the Philadelphia harbor improvement and covered the removal of the Greenwich Point bar or middleground), completed July 11, 1898. Section 2: On Fort Mifflin bar, between Fort Mifflin and Lincoln Park, completed September 1, 1898. Section 3: Along Schooner Ledge, between South Chester and Marcus Hook, completed September 15, 1898.

Work under the following contracts is still in progress:

Contract No. 1, Delaware River:—Removal of overlying materials and ledge rock at Schooner Ledge, opposite South Chester.

Contract No. 4, Schuylkill River:—From Fifty-eighth street to Walnut Street Bridge.

Contract No. 7, Schuylkill River:—From near Yankee Point to Fifty-eighth street and from a point South of the Baltimore and Philadelphia Railroad Bridge to Walnut street.

The work performed under these several contracts in improving the channels of the two rivers has been of great benefit to navigation and of immediate relief to commercial interests; especially is this noticeable in the increased traffic on the Schuylkill River, where larger vessels than heretofore, have been chartered to take on oil cargoes.

From statistics obtainable it is evident that the extensive harbor improvements made by the City during the past three years have resulted in largely increasing the commerce of the port.

The appropriation of \$50,000 made by Councils on December 31, 1898, for continuing the work in the Schuylkill River, will be placed under contract in the early part of the coming year.

Widening of Delaware Avenue and Extension of City Piers.—The City appropriated for this improvement from loan of January 13, 1896, \$1,500,000 and the Board of Directors of City Trusts, Trustees of the Estate of Stephen Girard, deceased, have co-operated with the City of Philadelphia in the work and set aside the sum of \$650,000, making the total amount available \$2,150,000. The construction work is divided into two classes, sewers and bulkhead, with work incident thereto.

Contracts Nos. 5 and 6, sewers, and contract No. 7, bulkhead construction, which were in force at the beginning of the year, were proceeded with and the work energetically pushed. The work under contracts Nos. 5 and 6 is practically completed. Contract No. 7 is being steadily pushed and will be finished during the coming year; and, when completed, will provide an avenue 150 feet wide be-

tween Vine and South streets and will greatly facilitate the commerce and business interests of the City centered on the river front between these points.

City Piers.—Contract No. 8, construction of wooden pier at the foot of Chestnut street and contract No. 9, for the construction of a similar pier at the foot of Arch street, have both been completed at a cost of \$84,979.15.

On September 6, 1898, proposals were received and contract awarded to the lowest bidder for an enclosing building for the deck of Arch street pier. Contract was promptly executed and work is in progress.

Proposals for an enclosing building on the deck of the pier at the foot of Chestnut street, with a pavilion over a portion of the upper deck, were received December 13, 1898. Contract has been awarded and is now in course of preparation. Work upon this building will be commenced in the early part of the coming year.

District Surveyors.—The Board of Surveyors and Regulators, consisting of the Chief Engineer and the thirteen district surveyors, held twenty-four stated meetings and twelve special meetings during the year. One hundred and eighteen (118) plans of new streets were confirmed and forty-four (44) relocations of curves and street railway tracks were passed upon and approved. Five hundred and seventeen (517) references of bills and petitions for new streets, revision of City plans and new sewers were received and acted upon and reported back to the Committee on Surveys.

The cash receipts and work performed for City departments during the year aggregates in value \$214,588.94, exceeding the expenditures of the thirteen districts, \$50,968.11.

The following is a summary of the receipts and expenditures of the District Surveyors for the year 1898, and in totals for the years 1895, 1896, and 1897:

Summary of Receipts and Expenses of District Surveyors.

Districts.	Surveyors.	Cash receipts.	Credit for work done for the City.	Total credit.	EXPENSES.				Balance profit to the City.	Profit to the City in 1897.	Increase.	Decrease.
					Salaries.	Pay of assistants.	Miscellaneous.	Total.				
1	Thomas Daly.....	\$6,708 42	\$6,936 69	\$13,675 11	\$3,000 00	\$5,489 28	\$1,489 41	\$9,978 69	\$3,696 42	\$2,245 63	\$1,450 79	
2	Chas. W. Close.....	3,867 90	6,540 14	10,408 04	3,000 00	5,936 66	1,646 49	10,583 15	*	1,396 63	.....	\$1,396 63
3	Wm. C. Cranner....	5,198 44	6,898 70	12,087 14	3,000 00	6,459 96	1,303 30	10,763 26	1,323 88	1,399 57	.....	75 69
4	Frits Bloch.....	3,032 76	8,926 68	11,959 39	3,000 00	5,619 96	1,497 67	10,117 63	1,841 76	1,905 64	.....	63 88
5	Walter Brinton.....	10,031 56	8,678 94	18,710 50	3,000 00	6,600 00	2,174 89	11,774 89	6,935 61	7,047 70	.....	112 09
6	Jos. Mercer.....	9,396 56	13,851 96	23,248 52	3,000 00	5,339 91	1,960 09	13,300 00	9,948 52	5,995 69	3,952 83	
7	Wm. K. Carlile.....	3,518 83	6,049 25	9,568 08	3,000 00	4,559 96	1,685 60	9,045 56	522 52	2,220 69	.....	1,698 17
8	C. A. Sundstrom....	3,364 51	12,921 03	16,285 54	3,000 00	9,859 92	2,638 32	15,498 24	787 30	1,365 15	.....	577 86
9	Jos. C. Wagner.....	11,850 15	9,656 62	21,506 77	3,000 00	11,316 00	1,773 02	16,089 02	5,417 75	4,129 70	1,288 05	
10	Jno. H. Webster, Jr.	7,782 87	7,313 93	15,096 80	3,000 00	7,559 92	2,201 69	12,761 61	2,335 19	3,414 15	.....	1,078 97
11	Jos. Johnson.....	13,847 13	9,529 50	23,376 63	3,000 00	9,722 32	2,620 81	15,243 13	8,133 50	12,256 79	.....	4,123 29
12	J. H. Gillingham....	10,464 69	12,605 68	23,070 37	3,000 00	9,772 14	2,292 61	15,064 75	8,005 62	10,241 28	.....	2,235 66
13	H. M. Fuller.....	10,061 43	5,534 62	15,596 05	3,000 00	8,129 97	2,270 93	13,400 90	2,195 15	3,482 83	.....	1,287 68
	Total.....	\$99,120 25	\$115,468 69	\$214,588 94	\$39,000 00	\$99,166 00	\$25,454 83	\$168,620 83	\$51,143 22	\$57,101 47	\$6,691 67	\$12,649 92
	Total, 1897.....	107,510 98	119,764 64	227,275 62	39,000 00	104,297 75	26,876 40	170,174 15	57,101 47	85,006 32	7,129 63	35,084 48
	Total, 1896.....	122,839 79	132,830 47	255,670 26	39,000 00	108,633 98	23,029 96	170,663 94	85,006 32	126,926 05	4,894 03	46,813 76
	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	\$1,837 88

* Deficiency, \$175.11.

Registry Division.—The work of renewing worn out registry plan books has been carried forward to the extent of the limited assistance given the Registrar for this purpose. There has been a large falling off in the number of searches issued during the year, due to the fact that title and trust companies, which issue searches for profit to their clients, make them from the registry plan books themselves. This was never intended in the Act creating the registry division of the Bureau of Surveys.

These plan books are valuable records and of great importance to the public. Fifty-three of them, because of their dilapidated condition, have been withdrawn from the public use until such time as they can be renewed.

It is but just that a reasonable charge should be made for each examination, sufficient, at least, to pay for keeping the books in fit condition to be used.

This is a matter which should receive the consideration of Councils, and such legislation should be enacted as will remedy the evil.

The following is a comparative summary of the operations of the Registry Division of the Bureau of Surveys during the years 1895, 1896, 1897 and 1898:

	1895.	1896.	1897.	1898.
Number of certificates registered owners issued.....	13,620	13,770	12,700	10,205
Number issued for use of the Law Department.....	498	569	732	1,416
Receipts from certificates of registered owners.....	\$3,381 00	\$3,432 50	\$3,173 00	\$2,573 00
Receipts from miscellaneous sources.....	\$252 00	\$326 70	\$370 50	\$397 41
Number of original lots plotted.....	13,103	13,269	14,319	12,763
Number of transfers registered.....	26,978	29,026	30,848	28,565
Number of plans made for use of City Departments, Bureaus, etc.....	305	494	481	458
Number of examinations of registry plan books made by the public.....	33,970	35,673	36,737	39,121
Number of descriptions of property filed for registry.....	39,680	42,690	43,108	41,328
Number of titles perfected.....	2,215	2,560	2,516	2,420
Number of certificates of legal opening of streets issued to Bureaus, etc.....	2,794	3,141	2,945	2,210
Number of certificates of registered owners in municipal lien cases for Law Department.....	2,854	2,177	2,356	1,782

The following tables give a comparative summary of the operations of the Bureau of Surveys in the active construction of work; also the receipts and expenditures during the years 1895, 1896, 1897 and 1898:

Comparative Summary of Main, Branch and Private Sewers, and Bridges built During the years 1895, 1896, 1897 and 1898.

	1895.		1896.		1897.		1898.	
	No.	Linear Feet.	No.	Linear Feet.	No.	Linear Feet.	No.	Linear Feet.
Bridges.....	16		6		2			
Subway bridges.....							11	
Intercepting sewer (section).....	5	9,865						
Intercepting sewer connections.....			2	5,990	1	413		
Main sewers.....	22	25,012	2	12,671			4	6,129
Branch sewers.....	328	224,693	294	116,633	200	133,072	152	114,101
Private sewers.....	109	59,181	94	44,611	96	32,576	90	43,697
Subway sewers.....	5	13,886			4	2,328	6	1,453
Delaware avenue sewers.....					1	360	8	7,759
Total.....	485	*832,637	398	†179,905	304	‡168,749	271	§178,189

* 1895 equal to 62.97 miles.

† 1896 equal to 34.07 miles.

‡ 1897 equal to 81.94 miles.

§ 1898 equal to 32.79 miles.

Comparative Statement of Work upon Bridges during the Years 1895, 1896, 1897 and 1898.

	1895.	1896.	1897.	1898.
Finished.....	16	6	2	
Begun.....	5	1	3	1
Authorized.....		1	1	2
Planned.....	8	8	11	7

Comparative Statement of Receipts.

Year.	Receipts of Bureau.	Receipts of District Surveyors,	Total.	Decrease.
1895.....	\$62,585 17	\$151,081 45	\$213,666 62	
1896.....	58,558 70	122,839 79	181,398 49	\$32,268 13
1897.....	37,574 60	107,510 98	145,085 58	36,312 91
1898.....	29,832 83	99,120 25	128,753 08	16,332 50

Comparative Statement of Expenditures.

	1895.	1896.	1897.	1898.
Current expenses.....	\$246,404 34	\$245,951 48	\$245,270 66	\$261,128 82
For extensions.....	1,610,347 65	896,641 45	2,582,519 61	2,625,107 23
Total.....	\$1,856,751 99	\$1,142,592 93	\$2,827,790 27	2,886,236 05

Bureau of Water.

In the absence of any serious accident to the pumping machinery the service has been well maintained throughout the year, and no restriction on legitimate use of water was necessary.

The engines and boilers at the several pumping stations have been driven to their maximum capacities, and yet we were scarcely able to meet the demands made upon us. That is not to be wondered at when we consider the large increase annually in the consumption of water and the small amount of money appropriated to enable the Department to meet the increasing demands made upon this branch of the City service.

Comparing the consumption of water during the first year of this administration with that of the fourth year, we find the consumption has increased 22,435,820,932 gallons, while not a single dollar has been available for the purchase of additional pumping engines or for laying

large distributing mains. Therefore, is it any wonder that in some sections of the City the water supply is not equal to the demands?

I have, in previous reports, presented the needs of the Bureau of Water and made recommendations for improving its efficiency; communications have been repeatedly forwarded to Councils, calling their attention to this matter, but, with the exception of three small appropriations made last summer, to wit, \$40,700 for boilers and boiler house at the Belmont Pumping Station, \$80,000 for new pumping main at the Queen Lane Pumping Station and \$30,000 for boilers, etc., at the Roxborough Pumping Station, nothing further has been done, and our system, as a whole, has been completely neglected.

I shall again, in this report, call attention to the urgent needs of this Bureau. We can make known our wants, which are the wants of the people, but it belongs to the good judgment of the tax-levying authorities to say how these wants are to be satisfied. If Councils will furnish the money, the Department will supply the water.

The financial statement of the Bureau of Water for the past year shows an increase in receipts of \$94,308.34 over the preceding year, and a net revenue of \$1,569,669.02 over all expenditures both for permanent improvements of every character and cost of maintenance. The following statistics will be interesting:

Total receipts of Bureau of Water during years 1895, 1896, 1897 and 1898, were.....		\$11,746,013.81
Current expenses during the same period	\$5,532,462.46	
Paid for extensions during the same period	1,351,523.68	
Total		<u>\$6,883,986.14</u>
Net profit in four years.....		<u>\$4,862,027.67</u>

Surely a branch of the City service that can show such results as this is deserving of more funds for new work of such vital importance to the people of Philadelphia.

The reservoirs, buildings and grounds have been kept in as good order as the means at our command would permit, and repairs have been made to the hard-worked machinery at the several pumping stations to the full extent of the amount available for the purpose. This work is referred to in detail in the report of Mr. Frank L. Hand, General Superintendent (Appendix B), which accompanies the report of the Chief of the Bureau.

The total number of gallons of water pumped during the year was 102,241,835,372. The average daily pumpage was 274,670,777 gallons, an increase of 17,152,103 gallons daily over that of the preceding year.

The average daily consumption of water during the year 1898, calculating 1,400,000 as the estimated population of our City, is 196.2 gallons per capita per day, an increase over the year 1897 of 10.4 gallons per capita per day, and over 1895, the first year of this administration, of 35.9 gallons per capita per day.

It must be apparent to anyone that very much of the immense quantity of water distributed daily is criminally wasted, and unless City Councils adopt some measures by which the present extravagant waste of water may be stopped, or, at least, materially reduced, it will be necessary to provide large appropriations for additions to our pumping machinery, or the Department will not be able to meet the increasing demands upon its already inadequate and overtaxed pumping facilities.

At the Belmont Pumping Station a new chimney and flue were built, and a new boiler house of sufficient dimensions to accommodate eight boilers constructed. Owing to the insufficient appropriation, but seven boilers have been contracted for. These have been built and are now

being placed in position, and will be ready for service early in 1899.

No provision having been made for the construction of an engine house at this station, the 20,000,000-gallon high duty Worthington pump is still without shelter, save that furnished by a rude structure of boards hastily put up by the employes of the Bureau of Water in the year 1895. It is a discredit to the City that such a valuable piece of machinery should stand for four years without a proper house to protect it from the elements.

The small appropriation of \$30,000 for improvements at the Roxborough Pumping Station has enabled us to contract for a new chimney and six new boilers for this station. They will be ready for service during the spring of 1899.

On December 31, 1898, Councils appropriated \$100,000 for further improvements at this station. This amount will provide two 5,000,000-gallon engines and a new intake. Proposals for these engines will be asked for at once and contract promptly awarded, but they cannot be erected and put in service before the latter part of 1899.

The condition of affairs at the Roxborough Station, upon which depend for their supply, by the constant and direct action of the pumps, the large and increasing population of Germantown, Chestnut Hill, Mt. Airy, Roxborough and Manayunk, is too dangerous to be permitted to continue. The largest engine at this station (12,000,000 gallons capacity) is continually breaking, and requires the greatest care to keep it in operation. It is only a question of time, and a very short time at that, when it will collapse entirely, which will throw it out of service. It is very expensive to keep this engine in repair, and it is practically useless, and should be removed and replaced with more serviceable machinery.

The other two engines at this station have a total ca-

capacity of 12,500,000 gallons per day. These, with the two new 5,000,000-gallon engines which will be installed during 1899, will give a capacity of 22,500,000 gallons every twenty-four hours. The daily consumption of water in the district supplied by this station is 20,000,000 gallons per day, almost the entire pumpage. Therefore, it can readily be seen how difficult it is to maintain any reserve in the reservoir, and, with all the engines running and nothing in reserve, it is clearly apparent how serious the stoppage for any reason of any one of these engines would be to the section depending upon them.

Contract has been made for a new 48-inch pumping main for the Queen Lane system and the pipe will be laid the early part of 1899, as soon as the weather will permit of the work being done.

Thirty-four miles of service mains from three to twelve inches in size were added to the distribution system during the year, making an aggregate of 1,278.02 miles of water pipe now in use.

The operations of the Construction and Repair Shop are carried on in the same satisfactory manner as has heretofore characterized this branch of the Bureau. The output of material is of better quality and more readily secured than from private establishments.

Notwithstanding the fact that the pumping machinery at the several stations, excepting that at the Frankford Station, has been forced to its maximum capacity, many sections of the City have been short of water, and it is imperative that action be taken at once to relieve this over-taxed machinery and also give our citizens an ample supply of water.

The crippled condition of several of our pumping stations has been mentioned in previous reports, and the subject is again referred to in detail in the reports of the

Chief of Bureau of Water and the General Superintendent.

The following is a summary of the extensions and improvements urgently needed in the Bureau of Water at this time:

Roxborough Pumping Station.

Two 5,000,000-gallon pumping engines.
 New engine house.
 Extension to boiler house.
 New 36-inch pumping main from the station to new reservoir.

Belmont Pumping Station.

Two 10,000,000-gallon pumping engines.
 New engine house.
 New 48-inch pumping main to reservoir.

Roxborough High Service Station.

One 5,000,000-gallon pumping engine.

Belmont High Service Station.

One 5,000,000-gallon pumping engine.

Queen Lane Pumping Station.

Lowering suction mains.
 Coal shed and tunnel.

Spring Garden Pumping Station.

Additional storage capacity for coal.

Reservoir.

A reservoir of 100,000,000 gallons capacity to connect with the Wentz Farm Reservoir to supply that portion of the City comprising the Thirty-fifth, Twenty-third, Twenty-fifth, Thirty-first and portions of the Sixteenth.

Seventeenth, Eighteenth, Nineteenth and Thirty-third Wards.

These extensions and improvements are absolutely necessary to place our pumping stations in proper shape to meet the demands made upon them. The estimated cost of the improvements is \$915,000, and, unless it is desired to cripple our water plant, funds for this work must be supplied.

The system of distribution is defective to a considerable extent by reason of the age and small dimensions of many of the mains, but principally by reason of the insufficient number of large distributing mains to conduct the water from the reservoirs to the service mains.

Because of no appropriation for the purpose the Department has been compelled to omit the laying of large distributing mains needful to keep the service mains charged at the proper pressure when water is drawn from them, and, with the extension annually of service mains, the result is that the pressure and flow are largely reduced below what the elevations of our reservoirs call for, and, at times, fail entirely in some sections of the City.

I, therefore, suggest that Councils give this matter immediate consideration and make an appropriation for new mains. We recommend the following:

Forty-eight-inch main from Wentz Farm Reservoir to Lehigh avenue.

Supply Mains.

Belmont System.—Thirty-inch main, from Belmont Reservoir to Thirty-eighth street and Lancaster avenue.

Twenty-inch main, from Sixty-third street and Lansdowne avenue to Overbrook.

Corinthian System.—Thirty-six-inch main, from Corinthian Reservoir to Eleventh and Poplar streets.

Thirty-inch main, from Eleventh and Poplar streets to Eleventh and Green streets.

Twenty-inch main, from Eleventh and Green streets to Eleventh and Vine streets.

Sixteen-inch main, from Broad and Green streets to Sixth and Green streets.

Fairmount System.—Thirty-six-inch main, from Fairmount Reservoir to Broad and South streets.

Thirty-inch main, from Broad and South streets to Broad street and Washington avenue.

East Park System.—Forty-eight-inch main, from East Park Reservoir to supply old City.

Queen Lane System.—Forty-eight-inch main, from Nicetown lane and Thirty-second street to Germantown avenue.

To lay the above mains will cost approximately \$1,475,000, and Councils should provide for this work as early as practicable.

Favored beyond measure with copious and timely rains during the past summer, the flow of water in the Schuylkill River was sufficient to meet the pumping capacities of the several pumping stations which draw from it; but because there was an abundant supply from the river during the past summer, we should not allow ourselves to be lulled into a false security as regards the future, for past experience (years 1895 and 1896) has taught us that during seasons of drought the entire flow of this river is not sufficient to meet the demands of our pumping stations.

Our present water supply is extremely precarious, and, although a kind Providence has been on our side during the past year, it is presumptuous to depend on chance or a constant succession of favorable circumstances rather than

take such vigorous and reasonable measures as will insure certainty and permanence in such an important matter as the water supply.

The necessity for intelligent and prompt action towards securing an adequate supply of water for the City cannot be too strongly urged.

The following tables give the number and types of engines, the locations and capacities of reservoirs and a comparative summary of the operations of the Bureau of Water; also receipts and expenditures for the years 1895, 1896, 1897 and 1898:

*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.	Designated capacity in million gallons per day.	TOTAL.	
Spring Garden.	Old Station.....	5	Compound Rotary.....	20,000,000	170,000,000	
	" ".....	6	Simpson's 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			
Queen Lane.....	1	Southwark.....	20,000,000	80,000,000		
" ".....	2	" ".....	20,000,000			
" ".....	3	" ".....	20,000,000			
" ".....	4	" ".....	20,000,000			
Belmont.....	1	Worthington Duplex.....	5,000,000	38,000,000		
" ".....	2	" ".....	5,000,000			
" ".....	3	" ".....	5,000,000			
" ".....	4	" ".....	20,000,000			
Belmont Auxiliary.....	1	Worthington.....	2,000,000	2,500,000		
" ".....	2	Snow.....	500,000			
Roxborough.....	1	Southwark.....	12,000,000	24,500,000		
" ".....	2	Worthington Duplex.....	5,000,000			
" ".....	3	" ".....	7,500,000			
Roxborough Auxiliary.....	1	Worthington.....	5,000,000	5,000,000		
Mt. Atry.....	1	Davidson.....	1,000,000	3,000,000		
" ".....	2	" ".....	1,000,000			
" ".....	3	Knowles.....	1,000,000			
Chestnut Hill.....	1	Knowles.....	250,000	750,000		
" ".....	2	Worthington Duplex.....	500,000			
Frankford.....	1	Marine Compound Rotary.....	10,000,000	42,000,000		
" ".....	2	Corliss Compound Rotary.....	10,000,000			
" ".....	3	Southwark Rotary.....	22,000,000			
Fairmount.	New House.....	1	Turbine Wheels.....	2,000,000	38,290,000	
	" ".....	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		
	Total.....					399,040,000

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	114 "	28,910,000
" " 2.....		{ and		
" " 3.....		{ 1871		
Spring Garden.....	Twenty-sixth and Master streets.....	1844	120 "	12,900,000
Corinthian.....	Corinthian avenue and Poplar street.....	1852	120 "	37,341,400
East Park... { Section 1.....	East Fairmount Park.....	{ 1887	133 "	306,400,000
" " 2.....		{ 1888		
" " 3.....		{ 1889		
Queen Lane { North Basin.....	Thirty-third street and Queen lane.....	1894	238 "	205,620,000
" " South Basin.....				
Frankford.....	Oxford Turnpike and Comly street.....	1877	167 "	36,046,000
Belmont.....	West Fairmount Park.....	1830	212 "	39,778,000
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 "	71,594,000
" " South Basin.....				
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	394 "	106,000
Roxborough Stand Pipe.....	Port Royal avenue and Ann street.....	1895	490 "	106,000
Total.....				1,417,860,400

52

*Comparative Statement of Pumpage for the Years 1895,
1896, 1897 and 1898.*

	1895. Gallons.	1896. Gallons.	1897. Gallons.	1898. Gallons.
Pumped to reservoirs.	78,775,849,104	87,693,642,529	95,667,466,871	102,241,835,372
Equal to gaug. pumped 100 feet high.....	132,040,934,195	161,776,711,718	187,371,927,277	210,828,621,625

NOTE.—The “pumped to reservoir,” etc., includes 1,987,000,830 gallons of repumpage to higher levels at Mt. Airy, Roxborough, Belmont and Chestnut Hill Auxiliary Stations. This, deducted from the total pumped, gives 100,254,834,542 gallons as the total consumption.

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

	1895. Gallons.	1896. Gallons.	1897. Gallons.	1898. Gallons.
Pumped by water- power.....	7,537,193,211	8,959,846,128	7,590,276,532	8,914,409,227
Pumped by steam- power.....	71,188,655,893	78,733,796,401	88,077,190,339	93,327,426,145
Largest quantity pumped in 24 hours.	258,838,527	286,965,648	319,214,876	339,675,336
Smallest quantity pumped in 24 hours.	133,916,719	72,143,883	108,286,152	119,308,896

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.	
1895	213,202,777	160.3	6,381,670,823	2.2	3.69
1896	235,696,614	172.5	8,409,847,849	12.2	3.43
1897	267,532,080	185.8	7,770,830,162	13.3	3.16
1898	274,670,779	196.2	6,255,643,421	10.4	2.97

* 1895—1,329,957 estimated.

1896—1,367,815 estimated.

1897—1,385,734 estimated.

1898—1,400,000 estimated.

The cost of pumping one million gallons lifted one hundred feet high was \$2.97, or 19 cents less than in the previous year.

About eight per cent. of the total pumpage was by water-power, the turbine wheels using 267,432,276,810 gallons.
To pump..... 8,914,409,227 "

A Comparative Statement of the Total Pipe Laid and of other Work done during the Years 1895, 1896, 1897 and 1898.

YEAR.	PIPE LAID.			*PIPE RELAID. Feet.	FIRE HYDRANTS PLACED IN POSITION.			SUBSTITUTED FOR DEFECTIVE HYDRANTS.			Fire Hydrants In use.	New Water At- tachments.
	Feet.	EQUAL TO			New Style.	Old Style.	Total.	New Style.	Old Style.	Total.		
		Miles.	Feet.									
1895.....	209,295	39	3,375	31,063	902	.....	902	379	4	383	10,038	10,410
1896.....	196,839	37	1,479	71,189	732	1	733	384	6	390	10,624	7,860
1897.....	161,810	30	3,410	45,902	566	.....	566	256	4	260	11,101	7,618
1898.....	182,828	35	1,675	38,555	618	.....	618	267	1	268	11,621	7,152

Total pipe laid, 1,278.02 miles.

* Adds nothing to feet in ground.

THE HISTORY OF THE UNITED STATES OF AMERICA
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SUMMARY OF APPROPRIATIONS
DURING THE

Bureaus.	Appropriation for 1898.	Balance available from previous years.	Number of employees Dec. 31, 1898.
Director's Office.....	\$24,707 00		9
City Ice Boats.....	32,400 00		9
Gas.....	*		
Highways.....	1,090,474 62	\$294,329 06	100
Board of Highway Supervisors.....	†		12
Lighting.....	275,980 00		1
Street Cleaning.....	909,533 00		14
Surveys.....	621,260 00	4,298,682 69	297
District Surveyors.....	‡		13
Water.....	1,068,843 40	69,588 52	1,012
Total, 1898.....	\$4,023,198 02	\$4,662,600 27	1,467
Total, 1897.....	\$7,691,281 71	\$2,499,400 24	3,107
Total, 1896.....	\$6,568,591 59	\$2,399,549 78	3,366
Total, 1895.....	\$6,870,710 42	\$2,722,680 15	3,499

* Bureau of Gas abolished. Philadelphia Gas Works leased to Highways.

*Comparative Statement of Receipts and Expenditures for the
Years 1895, 1896 1897 and 1898.*

Receipts.

	1895.	1896.	1897.	1898.
Receipts from water rents.....	\$2,367,057 60	\$2,441,683 95	\$2,628,008 69	\$2,605,449 06
“ “ fractional rent...	166,713 87	193,684 88	181,248 87	197,691 65
“ “ water pipes.....	161,285 14	131,602 69	142,217 77	180,877 96
“ “ City Solicitor's Office.....	46,994 07	43,806 52	53,517 84	47,883 58
Receipts from penalties.....	37,498 56	36,417 98	35,184 08	38,148 64
“ “ delinquent rent.	28,920 75	19,132 75	19,559 00	30,887 00
“ “ Chief Engineer's Office.....	11,676 44	4,875 91	3,564 08	5,861 41
Receipts from searches.....	5,539 25	5,633 50	5,243 25	4,929 75
“ “ delinquent pen- alties.....	4,171 49	2,295 58	2,813 94	4,436 81
Total.....	\$2,829,867 17	\$2,879,133 26	\$2,971,357 52	\$3,065,665 86

Expenditures.

	1895.	1896.	1897.	1898.
Current expenses.....	\$1,509,902 97	\$1,307,696 40	\$1,354,642 90	\$1,360,220 19
For extensions.....	387,322 23	517,914 49	310,510 31	135,776 65
Total.....	\$1,897,225 20	\$1,825,610 89	\$1,665,153 21	\$1,495,996 84

Director's Office.

The regular work of the Director's office, incident to the current business and to the extensions planned and prosecuted during the year, was promptly met and the work discharged in a most satisfactory manner.

In my resume of the operations of the several Bureaus of this Department, I have made suggestions and recommendations, which I deem it unnecessary to again repeat.

The following is a comparative statement of the expenditures of the Director's office during the years 1895, 1896, 1897 and 1898:

Item.	1895	1896	1897	1898
1 Salaries.....	\$17,790 00	\$18,890 00	\$20,195 00	\$20,420 00
2 Keep of horses.....	487 50	750 00	1,400 00	1,400 00
3 Printing, stationery, etc.....	2,499 74	2,318 38	2,543 84	2,399 04
4 Expenses attending Investigation of Filtration.....			421 50	
4 Refunding Jas. B. England money paid for gas pipe.....				887 00
Total.....	\$20,777 24	\$21,758 38	\$24,60 34	\$24,606 04

Receipts and Expenditures.—The appropriations, expenditures and receipts of the Department for the year 1898 are set forth in the following table in detail by Bureaus, and also in totals for the years 1895, 1896 and 1897:

Appropriations, 1899.

The following is an abstract from the ordinance making an appropriation to this Department for the year 1899, with a statement of balances available from previous years for work ordered, and for which contracts are executed:

Bureaus.	Annual Appropriation for the year 1899.	Balance available from previous years.	Total.
Director's Office.....	\$27,525 79		\$27,525 79
City Ice Boats.....	32,400 00		32,400 00
Highways.....	1,586,768 50	\$354,149 60	1,940,918 10
Lighting.....	289,190 00		289,190 00
Street Cleaning.....	908,850 00		908,820 00
Surveys.....	614,560 00	3,037,948 36	3,652,508 36
Water.....	1,261,439 00	90,345 81	1,354,784 81
Total.....	\$4,718,708 29	\$3,482,443 77	\$8,201,147 06

After three years and nine months of service as Director of the Department of Public Works, I have the satisfaction of knowing that my very best effort and most persistent labors have been given to the office. To my Chiefs of Bureaus and others I am deeply grateful for the support they have given me in my efforts to secure for the City satisfactory service.

To you, sir, are due my heartfelt thanks for the assistance and support you have given me in the performance of the duties of my office.

Very respectfully submitted,

THOMAS M. THOMPSON,

Director.

ANNUAL REPORT

OF THE

BUREAU OF WATER

For the Year 1898.

OFFICERS
OF THE
BUREAU OF WATER.

Chief,
JOHN C. TRAUTWINE, JR.

Assistants,
ALLEN J. FULLER, WILLIAM WHITBY.

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

Chief Clerk—Job T. Hickman.
Assistant Clerk—James G. Dixon.
Correspondence Clerk—P. deHaven.
Search Clerk—H. J. Johnson.
Assistant Search Clerk—Wm. 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—Morris P. Getz.

Purveyors.

First District, John H. Holmes.
Clerk—William J. Mackey.
General Foreman—Thos. 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 street 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, 4377 Manayunk avenue.
Sixth District, George H. Laut.
Clerk—Wm. D. Kinsler.
General Foreman—Samuel Loeb. *Foreman of Repairs*—James W. DeHart
Office, Town Hall, Germantown.

ANNUAL REPORT
OF THE
Bureau of Water

For the Year 1898.

TWELFTH ANNUAL REPORT OF THE
BUREAU OF WATER.

Ninety-seventh Annual Report of Operations
Connected with the City Water Supply.

Philadelphia, January 20, 1899.

THOMAS M. THOMPSON, Esq.,
Director, Department of Public Works.

DEAR SIR:—In my annual report for 1897 I said:
“The water service of this City is in critical condition.”

“In its efforts to grapple with the rapidly increasing
“consumption of water, the Bureau, although earning an-
“nually, for the City, about a million dollars above its ex-
“penses, has been and still is handicapped by the refusal
“of all appropriations for extensions. As a consequenc
“of this, and of the increasing waste of water, the consump-
“tion has again overtaken our pumpage capacity, and there
“will, almost certainly, be a shortage of water at many
“points during the coming year.”

This prediction, foreshadowed in each of my preceding annual reports, was abundantly fulfilled. During the summer of 1898 the condition was well-nigh intolerable. During that of 1899 it must be much worse.

Continued Starvation.

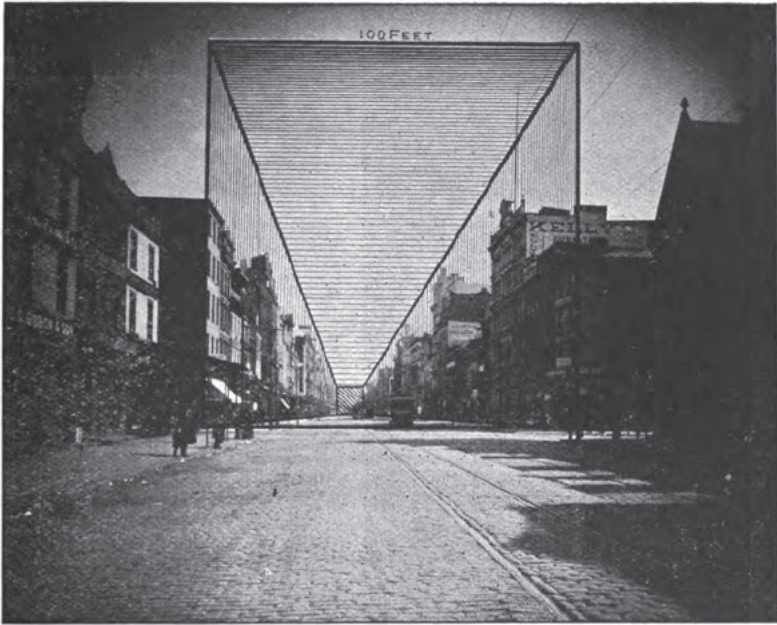
Year after year, through you, I have warned Councils of the condition of our works and have appealed for the means necessary to avert disaster. Year after year, my warnings and appeals have been disregarded.

During my administration, not one cent has been appropriated for extensions of the works, until, within the past year, a few trifling amounts have been granted, barely sufficient to prevent absolute water famine in one or two cases, but leaving entirely untouched the great and urgent needs of our system as a whole.

Every effort has been made to meet the conditions with the inadequate means provided. Our boilers and engines are strained to the utmost night and day, and in some cases disabled; there is no opportunity for thorough repairs; we dare not stop pumping during seasons of muddy water; in spite of all manner of pitiful expedients we are compelled to cut off our reservoirs from the distribution in order to keep them from being entirely emptied; and from all sides come loud and well-grounded complaints from citizens who pay for a water supply but do not get it.

Immediate Needs. Waste of Water.

As shown in my annual estimate for 1899, about five million dollars are needed immediately, apart from filtration, to put our works into condition to supply the enormous quantities of water now being used and the still larger quantities wasted. On the other hand, if mere waste were stopped, those works, even as they stand, would be superabundantly able to furnish all the water used,



250 MILLION GALLONS.
(100 feet square, 3,300 feet long.)

MARKET STREET, LOOKING EAST FROM SEVENTH STREET TO DELAWARE RIVER.

AVERAGE CONSUMPTION, PHILADELPHIA, 1898, 275 million gallons per day.

while about one million dollars would put them in fair condition and develop their full capacity. The difference between the two sums would pay for the installation of filter plants and for the means of restricting the waste, and the reduction in our present operating expenses would cover the cost of operating both. In other words, the City may have filtration, and an abundant supply, for nothing.

Magnitude of System.

Our water works are among the largest in the world. The estimated cost of the existing plant is about \$35,000,000. Our average daily pumpage of 275 million gallons would fill Market street (100 feet wide) 100 feet deep, from the Delaware river to near Ninth street, or nearly $\frac{3}{4}$ of a mile. This is more than twice as much water as our people can possibly use and enjoy.

Water Meters.

It is of the first importance that our citizens should be encouraged to use water not only freely but lavishly, whatever the cost to the City. No system of waste-restriction that would restrict the lavish use of water should be considered for a moment. It is far better to have a gallon wasted than to discourage the proper use of a pint. For this reason and to avoid unnecessary expense, the water meter should not be applied to dwellings except where waste of water is found to be going on or where a meter is requested; and, even there, only the water wasted should be charged by meter, not the water used. Councils have wisely so arranged our schedule as to provide for this. Indeed, a consumer would draw all the water he could possibly use and enjoy, and would do a fair amount of wasting besides, long before his meter began to register against him. It is only against scandalous waste that the meter is aimed.

A few of our people are wasting more water than the whole population uses. The water wasted by this small minority does no good whatever, even to those who waste it; and yet, for the privilege of having it wasted, our careful consumers, who are in a large majority, pay double what they should and get but a poor supply, and our whole system is being hurried into physical bankruptcy. Our preposterously enormous consumption is the sole excuse for propositions to deprive the City of the control of her water supply.

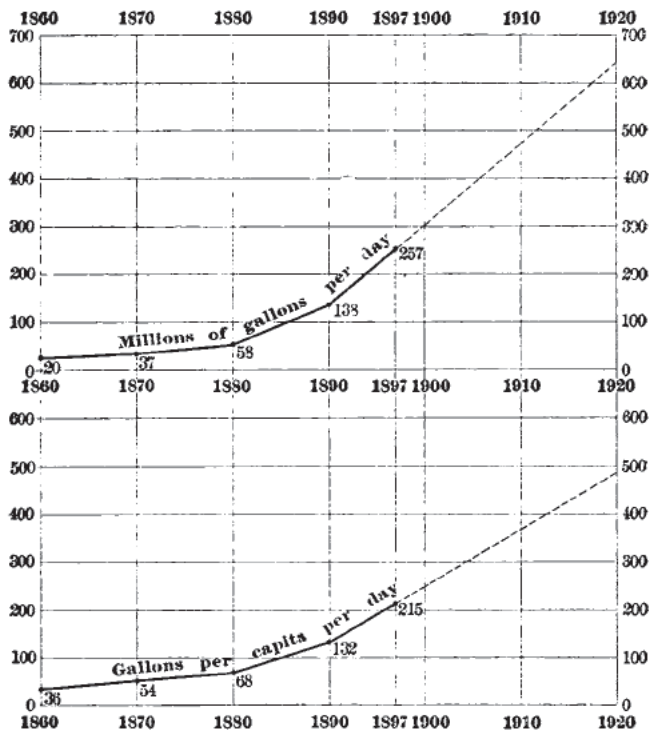
There is a popular impression to the effect that restriction of waste of water means restriction of its use, oppression of manufacturers and residents, and the promotion of uncleanly habits, especially among poor people. This is utterly erroneous. The testimony of Atlanta, of Atlantic City, of Poughkeepsie, of Providence, of Milwaukee, of Richmond, of Harrisburg, and of many other cities and towns, shows that the very reverse is the case; both residents and manufacturers uniting in commendation of the meter system, by which the waste alone is restricted and the water saved for use and enjoyment.

The water meter is unpopular only where it is unknown.

It is most lamentable that, in spite of my efforts and of those of my predecessors, our citizens are deprived of the supplies they pay for, and the City's control of her works is jeopardized, solely through lack of general information as to the functions of the water meter and the results of its use.

No Outside Assistance Needed.

I have repeatedly shown that the City holds in her own hands the key to the solution of her water problem, that she is abundantly able to make the necessary improvements, and that she needs no assistance from benevolent corporations or individuals.



CONSUMPTION OF WATER,
 TOTAL AND PER CAPITA,
 IN PHILADELPHIA.

As stated in my annual report for 1897, "all we need "is means for preventing waste, and means for filtering "the water."

Schuylkill Valley Water Company.

In my annual report for 1897, after long and careful study of the scheme of the Schuylkill Valley Water Company, I said, "This scheme is equally unnecessary with that "of the Philadelphia Water Supply Co. (bringing Delaware water from Yardley), and scarcely less costly. The "defects of the proposed storage system would alone suffice "to condemn the scheme, even if the City required any "thing of the sort."

This report was published in the daily newspapers on February 24th. On March 2d the company's ordinance passed Select Council by a vote of 22 to 14, after motions to refer the matter to your Department had been voted down. In Common Council the progress of the ordinance was stopped by charges of bribery.

Insufficiency of Engineering Force.

The City of New York, before the recent consolidation, although furnishing considerably less water than Philadelphia furnishes to-day, employed, in the operation and ordinary extension of her water works, a corps of thirty-six engineers and engineering assistants, with a total salary of about \$75,000 per annum, besides a corps of fifty-four additional engineers and assistants engaged in completing the works in connection with the new Croton aqueduct.

Philadelphia has a total engineering force of nine persons, including the Chief, at a total salary of about \$15,000 per annum.

I make this comparison because some dissatisfaction has been expressed in Councils at what has been called the slowness of our force in responding to demands upon it.

Our engineering force is weaker than in 1885, when only one-fourth of the present supply was being pumped, and is ill equipped even for the ordinary routine of the service; yet we have been required, in addition, to submit detailed reservoir plans within three weeks from notice, a plan for the filtration of the entire supply, with estimates of cost, within two summer months, and "at the earliest possible time," a report on a gravity supply, with estimates of cost, "together with any other information bearing on the subject."

Some fifteen years ago, Mr. Rudolph Hering, with a force of about twenty assistants, very properly devoted three years of time, at an expenditure of about \$80,000, to a problem of this nature but of less magnitude.

What the Engineering Force Should Be.

The proper development of a large water supply requires that it be placed in the hands of a sufficient force of intelligent, well-informed and skilled persons, capable of understanding the present and estimating the future conditions and needs of the service. This force must be given every possible facility for investigation and experiment, and must not only be unhampered by capricious legislative interference, but must be assured of intelligent, hearty and loyal legislative support. Under these auspices a harmonious plan for the development of the system, for many years in advance, should be mapped out, adopted and followed; and every proposition for extension or other change should be carefully studied in the light of this plan and made to conform to it.

Supply from a Distant Source.

On October 13th, Select Council passed a resolution requesting a report "at the earliest possible time, as to "whether there is, within a radius of one hundred miles

“from the City, a supply of good water capable of furnishing this City with a sufficient storage capacity for one hundred and fifty days, and whether the same can be stored and brought down by gravity and deposited in the City reservoirs for distribution. Also, report on the estimated cost of procuring such supply, together with any other information bearing upon the subject.”

In the absence of all facilities for the proper study of such a question, I reported to you, November 15th, after correspondence with the Chief Engineer of Department of Water Supply of New York, and study of the Manchester and Liverpool supplies, that, judging from Mr. Hering's report and from the experience of New York, Manchester and Liverpool, and allowing for our present rate of increase of consumption, it would be extremely hazardous to estimate the cost of installation of a sufficient gravity supply for Philadelphia, from the sources indicated in the resolution, at less than \$100,000,000, and that the annual charge for interest and operation would probably reach or exceed \$5,000,000 or \$6,000,000.

Besides, it would almost certainly be five or ten years before such a supply could be put in service, and we must, at any cost, have immediate protection against impending water famine.

The New York works, not yet completed, have already cost \$87,000,000. The aqueduct is very much shorter than that contemplated in the resolution and is designed for a supply much less than will be necessary in our case, if waste is to continue unchecked. The annual expenditure, for operation alone, is nearly one million dollars in addition to interest on cost of plant.

Ample Supply at Our Doors.

I have repeatedly shown, but it cannot be too often or too forcibly repeated:

(1) That our present works are abundantly able to supply, from the sources at our doors, all the water our people can possibly use and enjoy.

(2) That one million dollars expended upon those works would bring them to a proper condition of uniform efficiency and give a large surplus of capacity.

(3) That one million dollars more would install the meters necessary for cutting off the waste, which, in the absence of means to supply it, is wrecking the system.

(4) That two and a half millions more would install filtration plants sufficient for all the water used.

(5) That thus a total of less than five million dollars will put the City in the possession of works furnishing an abundance of excellent water, probably quite as good as that which could be brought from any source within the State.

(6) That these five million dollars are only the sum which must be immediately appropriated and expended, merely to avert water famine and apart from filtration, if we are to keep up the farce of wasting more water than we use and enjoy, and

(7) That the annual expense of supplying plenty of filtered water for all our needs and luxuries would be no greater than that of keeping up our present supply of impure water for use and waste.

Filtration.

In order that any system of filtration may be made effective, it must of course be supplied with water sufficient for the demand and with that required for cleaning the filters. Our works are incapable of supplying even the present demand, more than half of which is for water wasted. To make them equal to the emergency, we must spend either \$500,000 to \$1,000,000 in restricting the present waste of water, or \$5,000,000 for its perpetuation.

In the latter case the filter plants will cost about \$7,500,000, as against \$2,500,000 in the former case.

Uninformed persons are apt to suppose that it is a simple matter to design and construct a system of filtration plants sufficient for our needs. Nothing could be further from the fact.

The problem is not only a most complex one in itself. It is intimately involved with that of the future expansion of the entire system, and the two must be deliberately studied in conjunction, by a sufficient force of competent persons properly equipped and in the interest of the City alone.

Even though a hastily designed system of filtration, based upon our insufficient present knowledge, might, by a happy chance, result in something short of dismal failure (if we had the means for supplying it with water), it is practically certain that it would be very far indeed from being the best obtainable and still further from being the most economical.

Still more certainly ruinous would it be, for the sake of some alleged economy in first cost, to rush blindly into a contract with outside interested parties for the construction of unknown or untried systems designed often in appalling ignorance of the requirements of the problem.

Slow Sand Filtration.

It is popularly supposed that because slow sand filtration has given unqualified success at many places in Europe and in this country, and because it has been styled "God's method," it must necessarily be perfectly successful for purifying the water supplied to Philadelphia.

Although we have been denied the means of acquiring the necessary knowledge respecting our own case, we learn, from Louisville, Ky., that slow sand filtration was there found unsuitable for the Ohio river water,

and that the so-called "mechanical" system has been adopted there instead. These results give added weight to the opinion of Dr. A. C. Abbott, Chief of the Bacteriological Division of the Bureau of Health, of this City, who had already said: "I do not believe slow sand filtration would be at all times best suited to the direct filtration of the Schuylkill river water."

While these considerations by no means bar out the slow sand filter, which has accomplished such admirable results elsewhere, they show the absolute necessity of obtaining practical knowledge before deciding upon the general adoption of that or any other system for our works.

Philadelphia's Exceptional Opportunity.

Philadelphia is singularly fortunate in having her supply furnished by six distinct systems, some of them relatively quite small. She thus has exceptional opportunity for the construction of initial plants where the problem may be thoroughly worked out before the stupendous work of installing filtration plants for the entire supply is undertaken.

Initial Plant Recommended.

In my first annual report, that for 1895, I recommended and urged the inauguration of the filtration of our water supply by the immediate construction of a plant for the filtration of the water furnished to some one of our smaller districts, in order that we might be gaining, from practical experience, the knowledge absolutely required for the proper solution of this problem; and an ordinance to this effect then received the approval of the Water and Finance Committees, and of a majority in Common Council, but fell for want of the necessary two-thirds vote. Since then I have uniformly advocated this course.

The speediest way, and the only certain way, of reach-

ing a satisfactory solution of the problem, is to take up the lines where they were dropped three years ago. Any attempt to make up the lost time by rushing blind-fold into the design and construction of works for the filtration of the entire supply (or, still worse, by accepting designs hastily prepared by ignorant or interested outside parties) would almost certainly result in failure, and therefore in the loss of many more years of time, to say nothing of millions of dollars.

Reports on Filtration.

During my administration I have seized every available opportunity for extending our knowledge in this matter. I have corresponded with all the communities in this country employing filtration, and have visited many of the more important plants. These investigations have strengthened my original conviction.

I have submitted to Councils, through you, numerous reports upon filtration. In these reports I have set forth, to the best of my ability, and with the utmost fulness, the results of my studies of the subject. Among these reports I may mention the following:

March 13, 1897. An estimate of the cost of construction, maintenance and operation of a plant or plants sufficient for the filtration of the entire water supply of the City. The preparation of this report, submitted in response to a resolution of Councils, involved correspondence with over eighty cities and towns employing filtration, and a laborious compilation and study of the results and of other sources of information.

August 30, 1897. A review of the entire subject, occupying 78 foolscap pages, submitted at your request, and transmitted by you to Councils with your report of October 7, 1897, in response to a request for information on the subject.

February 16, 1898. A report of 14 pages, in response to a request for information as to what could be done, with \$3,700,000, toward installing a plant sufficient for the filtration of the entire water supply of the City.

September 9, 1898. A report of 44 foolscap pages, in response to a resolution of Councils, adopted July 1st, and requesting your Department "to prepare plans and drawings and estimated cost of filtration of all the water used by the City, and transmit the same to Councils not later than October 1, 1898." This report was accompanied by six large plans, showing five suggested filtration plants, and contained estimates of the cost of each. In this report I showed that filtration plants for all the water used in the City could be constructed for about two and a half million dollars, while corresponding plants for the filtration of the water wasted, in addition to that used, would cost about three times as much.

This report, and the accompanying plans, were submitted merely as a suggestion and in obedience to the resolution of Councils, and not as a recommendation, except as to reduction of waste, which, of course, is at the very foundation of the problem of our water supply, and about which there are no two opinions where the facts are known.

This report was transmitted by you to the Water Committee at its meeting of October 11th, and a printed abstract of it was laid before each member present. The report was not mentioned at the meeting, and the Committee adopted a resolution "that the Department of Public Works be requested to place in proper form the results of its researches on the question of Slow Sand Filtration for the entire City."

Basin No. 3, Belmont Reservoir.

In my annual report for 1897, I stated that the construction of a new reservoir for West Philadelphia would

involve merely an expenditure of money without adequate return, that the money required for a new reservoir would, if properly expended, give to West Philadelphia an ample supply of excellent water, while such a reservoir as could be built for any reasonable proportion of the funds available would make little or no appreciable improvement in the supply, and that it would be two or three years before a new reservoir could be put in service.

In your report for 1897 you recommended the construction of this reservoir.

An Ordinance approved July 12, 1898, appropriates, "out of the loan authorized by ordinance of Councils, "approved June 17, 1898," five hundred thousand dollars "for the purpose of constructing a reservoir, furnishing "pumping machinery and mains for that portion of the "City lying west of the Schuylkill river."

On July 12, in company with myself, you selected, for this basin, a site adjoining the present reservoir on the north. In September this site was approved by the Committee on Plans and Improvements of the Commissioners of Fairmount Park, with the provision that the design be approved by the Committee.

As pointed out in my letter to you of 6th December last, the new basin will probably consume the entire appropriation, leaving nothing for the pumping engine and the needed mains, which will cost nearly as much more; and the new basin will effect no material improvement until the engine and mains are provided. During the past summer, the demand exceeding our pumping facilities, we were obliged (as at Roxborough) to cut off the present Belmont reservoir from the distribution in order to keep it from being entirely emptied. The new basin, of course, would have been in the same plight.

In obedience to resolutions of Councils, the preparation of the plans and specification for the new basin has been

given precedence over matters of real urgency, including the pumping engines and mains for the same district, and has been pushed diligently by our slender force.

On October 13th, having made every possible effort, I succeeded in handing you a set of plans of this basin, in anticipation of a joint resolution of Councils requiring the plans by October 20th.

On October 20th both branches of Councils passed preambles and resolutions requesting the submission of the plans not later than the first regular meeting of Councils in November (November 3d). In obedience to this, a second set of plans was submitted to you on November 2d. At your request, it was accompanied by a specification.

The plans and the specification are now being perfected as rapidly as possible, consistently with proper care.

The appropriation for this basin is not yet available.

Recognizing the desirability of making the new basin an ornament to the Park, and of obtaining the largest possible storage on the site allotted, the basin was designed with inner walls of masonry, instead of the usual sloping banks. The outer banks were to exhibit easy slopes, sodded.

The Park Commission, however, preferred a construction with gently sloping inner banks, resembling those of a natural lake, and, after considerable discussion and a visit to Boston for the inspection of reservoirs there, the Commission (through its Committee on Plans and Improvements) accepted a plan, submitted at your suggestion, involving a sloping bank on one side and masonry walls on the other two sides. The external appearance of the basin, under this plan, will be exactly as intended in our original design, and the change in the appearance of the interior will scarcely be noticeable to the average observer.

Appropriations Granted.

During 1898 the following small appropriations for extensions and improvements were granted:

Date of Ordinance.	Purpose.	Amount.
June 22.	Belmont Pumping Station. Chimney, flue, boiler house and boilers.....	\$40,700
July 12.	Roxborough Pumping Station. Boiler house and boilers.....	30,000
July 12.	Queen Lane system. New Pumping main...	80,000
		<hr/> \$150,700

With these appropriations, a new chimney, flue and boiler house have been erected at the Belmont Pumping Station, and seven new boilers (the appropriation being insufficient for the eight boilers required) are being installed there; six new boilers (the appropriation being insufficient for the eight boilers required) and a new chimney and flue, are being built for the Roxborough station; and the very badly needed second pumping main for the Queen lane supply is being laid.

Plans and specifications are being rapidly prepared for new engines and a new intake at the Roxborough station, an item of \$100,000 for that purpose having been granted in the appropriation bill for 1899. It will probably be late in the current year before the new engines can be started, and complete break-down of the present plant may occur at any moment.

The new chimney and flue at Belmont have already enabled us to improve the supply in so far that we can now keep the present reservoir in service most of the time; and the new boilers will effect a further improvement. With additional engines we might even be able to keep the new basin filled after it is completed, for a season or two at least; but, as already explained, the money appropriated for engines will be absorbed by the basin itself.

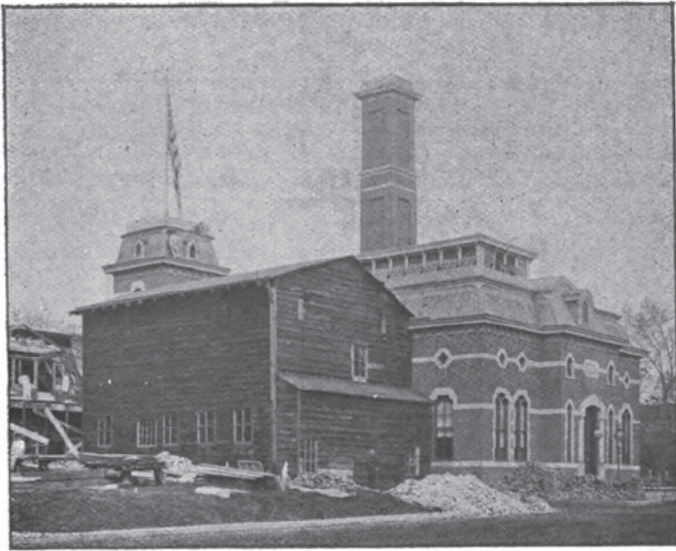
The appropriation of \$30,000 for boilers and boiler house at Roxborough station, was insufficient for the purpose. The boilers, with the chimney and flue, being the most urgently needed, were therefore ordered, and the boiler house left in abeyance.

For the Roxborough station and a pumping main from it, we require \$338,000, as set forth in my estimate for 1899. In reply to a request for information, we stated, later in the year, that the most pressing of the needs of the station were:

Two boilers.....	\$7,000
Two 5-million gallon pumping engines	75,000
Boiler house and engine house.....	45,000
Intake.....	10,000
Pumping main.....	40,000
	<hr/>
	\$177,000

Councils having appropriated only \$100,000 to meet these requirements, we are forced to omit the engine house, the boiler house and the main. The engines and boilers will, therefore, have to be protected by a frame house, erected by employees of the Bureau, as at Belmont; and the supply of the district, in spite of the additional pumps, will be restricted by insufficiency of the mains. It seemed, however, better to have pumps, with their capacity limited by insufficient mains, than to have mains lying empty for want of pumps. It is a grave question whether the present pumps can hold out until the new ones are installed.

The new Roxborough reservoir, built 1892-3, relined with asphalt 1896-7, and now evidently water-tight, has never yet been filled, owing to the insufficiency of our pumping capacity to supply the water used and wasted in the district; and during 1898 we have been forced to cut this reservoir off from the distribution in order to keep it from being entirely emptied, as was the case also with the West Philadelphia reservoir.



FRAME HOUSE OVER PUMP NO. 4, AT BELMONT STATION,
PHILADELPHIA.

Erected, 1895.

Photographed, 1898.

The second Queen Lane pumping main will obviate a part of the extreme risk under which that system has been laboring, but no provision is made for relaying the suction mains. We have resorted to every conceivable expedient to avoid the resulting damage, but without avail, and the four pumping engines, costing \$300,000, have all been fractured in consequence, and are daily suffering further and more serious damage.

The large high-duty pumping engine at Belmont station still remains protected only by a rude frame house erected over it by employees of the Bureau in 1895, our appeals (repeated in 1895, 1896, 1897 and 1898), for the few thousand dollars required for its proper protection, having been refused.

One of the largest engines at Spring Garden station has been crippled by the fracture of a pump chamber, which has thrown out of service one of its three pumps, reducing its capacity by one-third; and the other two pump chambers of this engine and the three in its sister engine are also fractured and liable to give out at any moment. Such an accident would precipitate dire calamity upon our largest system. Yet our drafting force is so hard pressed with other matters, including the plans for the new West Philadelphia basin, that it cannot now undertake the preparation of the plans for the repairs of these pumps.

In each of my four annual estimates I have asked for \$35,000 for the construction of proper coaling facilities for the Queen Lane pumping station. The appropriation having been annually refused, we are compelled to haul the coal through the park in carts, at an annual additional expense of about \$9,000.

Appropriations Out.

Hitherto Councils, while refusing all appropriations for extensions, have generally conceded the major portions of

the amounts asked for our current necessities; but for 1899 a large number of these items have been scaled down, generally one-half or more.

In the hope of saving our water works system from collapse, I asked that \$500,000 be appropriated to the item of "service pipes and meters," intending that about \$400,000 of this should be used for meters. The appropriation bill gives us \$5,000 for lead pipe and \$1,000 for meters.

The items for wages in connection with the maintenance and repair of buildings, grounds and reservoirs, improvement of distribution, repair shop and engineer corps, for the purchase of water pipe and lead, covering for boilers and steam pipes, lumber, cement, electric supplies, stationery, etc, tapping machines, harness, etc., all based upon the requirements of previous years, have been reduced about one-half.

The item for "the purchase of meters to measure the flow of water through large pipes," has been cut down from \$9,000 to \$2,500, apparently under the impression that the meters here mentioned are water-meters in the usual and unpopular acceptation of the term.

The item of emergencies, one of the most vitally important of the list, has been cut from \$25,000 to \$5,000. This is the only item from which we can by contract make repairs to engines, boilers or reservoirs in cases of accident.

Appropriation for Hydrographic Survey Disallowed.

The annual appropriation of \$1,600 for the continuance of the hydrographic survey, has been disallowed. This survey, inaugurated in connection with the elaborate investigation carried on by Mr. Rudolph Hering in 1883-6, has been continued ever since, furnishing to the City exceedingly valuable information respecting the behavior of all the streams in eastern Pennsylvania, especially as to the volume of water which may be expected from them.

The value of such investigations depends very largely upon the length of time covered by them; for, the longer the time, the greater is the probability that the series includes all the extremes of flood and of drought which can reasonably be expected to occur.

Similar studies have been carried on by New York for twenty-eight years, and by Boston for eighteen years.

It was with the help of the results of this survey that I was enabled to demonstrate to you, about a year ago, the insufficiency of the proposed storage system of the Schuylkill Valley Water Company, whose very disastrous scheme was then under consideration; and I should not have been able to show this if these investigations had been discontinued a few years earlier, or before the dry spell through which this section has been passing during the last few years. The effect of this spell upon the behavior of the streams has not yet passed off, and it is most desirable that the observations should be continued at least until this effect has been fully recorded.

In reply to inquiries, I endeavored to explain to the Finance Committee the value of this survey to the City.

Queen Lane and Roxborough Reservoirs.

During the last four years the only sums granted for improvements were those appropriated for the relining of the Queen Lane and new Roxborough reservoirs, and these sums have been expended with highly satisfactory results. Queen Lane has repeatedly held its full capacity, and Roxborough is evidently in condition to be similarly used, but the draft upon our pumping facilities there is such that we have never been able to fill it. For some time, and for the same reason, we have been unable to fill Queen Lane.

Sanitary Investigations.

Notwithstanding the insufficiency of our small engineering force, every effort has been made, during the year, as heretofore, to extend our knowledge of the two rivers from which we draw our supplies, and to co-operate with the Board of Health and the Law Department in the suppression of nuisances polluting these streams and particularly the Schuylkill.

In May, after consultation with Mr. J. W. Catharine, Assistant in the Law Department, I detailed two assistants to patrol the Schuylkill in a boat, observing the shores and reporting nuisances. This party submitted reports of its observations and a large number of photographs, which were transmitted, through you, to the Law Department.

During May and June, members of the State and City Boards of Health made a number of trips up the Schuylkill river, as far as Reading, investigating sources of pollution. For the purposes of this investigation I prepared printed copies of existing reports upon the sanitary condition of the river, photographs taken by my assistants, and a plan of Manayunk, showing the locations of the several mill properties there. I was able to attend only the first two trips of this party, but one of my assistants attended each of them.

I undertook also a series of examinations of the waters of both rivers, in the hope of obtaining information as to their relative purity, before and after filtration, as affected by location.

For this purpose, small experimental filters, kindly loaned by the Loomis-Manning Filter Company, were placed at Royersford and at our Spring Garden pumping station, on the Schuylkill, and at Yardley and at our Lardner's Point pumping station, on the Delaware. Several series of samples of the Delaware water were taken

at different points between Yardley and Lardner's Point, and at various points opposite the pumping station.

Owing to pressure of other work, and the smallness of the force, these investigations had to be discontinued without arriving at entirely definite results.

Semi-weekly chemical and bacteriological observations of the water taken at our largest (Spring Garden) pumping station, begun in 1897, have been continued throughout the year. I submit, as Appendix G, the report of Dr. A. C. Abbott, Chief of the Bacteriological Division, Bureau of Health, based upon these and other investigations.

Fire-Pipe Lines.

During the year I have been in correspondence with the engineers at Buffalo, Cleveland, Detroit, Milwaukee and Boston in regard to the fire-pipe lines in use in those cities, and have seen the Buffalo system in operation. Through these pipes, fire boats, lying in the river or harbor, may send very powerful streams of water upon fires in the business district. I respectfully recommend that the consideration of this subject be suggested to the Department of Public Safety. This is the more important, as the values exposed in our business district become greater, and as the consumption of water in that district increases without any provision for keeping pace with the demand.

Additional Fire Hydrants.

At the request of the Department of Public Safety, arrangements are being made to set a large number of new fire hydrants in the central business portion of the City as soon as the season opens; and one of our draftsmen is now engaged in designing, for this work, a fire hydrant to be placed below the sidewalk, so as not to interfere with traffic.

New Offices in City Hall.

On August 30, 1888, the headquarters of the Bureau of Water were removed from the old Commissioners' Hall, northwest corner of Thirteenth and Spring Garden streets, to the second and third floors of a rented building, No. 1321 Filbert street, northeast corner of Juniper street. The enormous growth of the business of the Bureau during the subsequent years rendered these quarters extremely inconvenient. During the past year our headquarters have been removed to commodious and admirable rooms in the City Hall.

In the latter part of January, the Chief Inspector of Distribution and the Permit Clerk, with their assistants, removed to the large room, No. 196, on the ground floor on the north front of the City Hall and adjoining the north entrance on the west, and the assistant in charge of pipe frontage removed to the three smaller rooms, Nos. 194, 192 and 190, adjoining No. 196 on the west. The basements under these three rooms are also at our disposal.

On October 1st the remainder of our headquarters, including the Chief's office, the drafting room, and the offices of the Chief Clerk, General Superintendent and Assistant in Charge of Distribution, was removed to rooms on the seventh or mansard floor of the City Hall, occupying nearly all of the north front and the northern half of the west front. These rooms, as a rule, have fine skylights and all are admirably adapted to our uses.

The Public Buildings Commission furnished a fine new blue-printing frame, upon our design, but afterward objected to our allowing it to project from any of the windows and refused our request to be allowed to use it upon the roof. We are thus compelled to send our tracings a distance of $1\frac{1}{2}$ miles, to the repair shop, Twelfth and Wharton streets, for printing, or place them in the hands of outside parties for the purpose.

At the request of the Director of the Department of Public Safety, and after considerable effort, we succeeded in finding, within the new quarters allotted to us in the City Hall, a room suitable for the uses of Mr Eastwick, Chemist of the Bureau of Health, whose services are devoted chiefly to analyses of water, and whose present quarters are most unsuitable for the purpose; but upon the presentation of Mr. Eastwick's requisition for furniture to the Building Commissioners, one of the Commissioners objected to making any provision for so dangerous a person, it being his conviction that all of our troubles in connection with water supply were due to chemists and other water experts. No provision has yet been made for furnishing Mr. Eastwick's room.

Conclusion.

In this, as in each of my three preceding annual reports, I have shown how easily and at how small expense the supply may be made superabundant in quantity and unexceptionable in quality, and have appealed for the necessary means; and every conceivable effort has been made to give the best possible results with the inadequate facilities under our control.

Out of the \$3,700,000 set apart for the improvement of the water supply, from the proceeds of the loan bill, \$500,000 will be consumed by the new basin for Belmont reservoir. If the remainder becomes available, I recommend and urge the following disposition of the amount:

(1) The expenditure of from \$500,000 to \$1,000,000 in the application of water meters to properties where reckless waste of water is going on without benefit to anyone.

(2) The expenditure of about \$1,000,000 upon the existing works in order to remedy defects and develop the full efficiency of the works, in accordance with one of my two alternative estimates for the current year.

The investment of these two sums, amounting, together, to probably less than \$2,000,000, would insure an abundant supply of water from our present sources and with our present works, with a surplus capacity such as would obviate the necessity of further extensions for some years to come, and would at once enable us to effect a marked improvement in the quality of the water furnished, even without the installation of any special works for its purification.

(3) The investment of the remainder (say \$1,200,000) in the installation of filtration plants, in accordance with plans to be prepared by the Department of Public Works, which must be authorized to employ the expert assistance necessary for their preparation.

This amount will install plants sufficient for the filtration of about one-half of the total supply by methods already well known and approved.

The \$3,200,000 expected from the loan bill will thus, if properly applied, not only put the works in excellent condition and insure an ample supply (and this must be done before filtration can be made efficient), but will provide an ample fund for the inauguration of measures for the purification of the supply.

If the waste of water is allowed to proceed unchecked, the entire \$3,200,000, with \$1,800,000 additional, must be immediately expended solely for supplying the present enormous demand, without provision for the rapid growth of that demand, and without provision for the purification of the water.

Very respectfully yours,

JOHN C. TRAUTWINE, JR.,

Chief of Bureau.

The following appendices accompany this report:

- A. Report of Chief Clerk.
- B. Report of General Superintendent.
- C. Report of Assistant in Charge of Distribution.
- D. Report of Superintendent of Construction and Repair Shop.
- E. Report of Assistant in Charge of Hydrographic Work.
- F. Report of Chief Draftsman.
- G. Letter of Dr. A. C. Abbott, Chief of Bacteriological Division, Bureau of Health.

APPENDIX A.

REPORT OF CHIEF CLERK.

Philadelphia, February 3, 1899.

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

DEAR SIR :—I have the honor to transmit herewith tables showing the appropriations and expenditures, receipts from the operations of the Bureau; receipts, estimates, requirements and amounts rendered available by appropriation, etc.; comparison of requirements and appropriations; and the detailed expenditures of the Bureau for the year 1898.

Yours respectfully,

J. T. HICKMAN,
Chief Clerk.

List of Miscellaneous Receipts for the year 1898.

Jan. 17	D. P. S. Nichols.....	Sale of horses	\$22 50
26	W. H. Russell.....	Repairing main.....	6 18
Mar. 4	F. A. Alfreri.....	Repairing main.....	10 50
11	Bachelor Pneumatic Tube Co.....	Shifting pipe.....	32 13
16	J. W. Harris.....	Rent of farm No. 2.....	100 00
16	H. M. Harris.....	Rent of farm No. 1.....	100 00
16	W. Root.....	Rent of farm No. 4.....	150 00
21	Daniel J. McNichol.....	Removing pipe.....	7 80
21	Daniel J. McNichol.....	Removing pipe.....	8 35
21	Daniel J. McNichol.....	Relaying pipe.....	47 32
21	Daniel J. McNichol.....	Watching pipe.....	8 50
25	Loos & Dilworth.....	Empty oil barrels.....	227 50
26	United Gas Improvement Co.....	Replacing fire hydrant.....	68 66
26	United Gas Improvement Co.....	Lowering pipe.....	32 32
Apr. 15	J. G. Mellvaine & Co.....	Repairing stop.....	5 75
20	United Gas Improvement Co.....	Repairing main.....	12 50
20	Philadelphia Traction Co.....	shifting stop.....	30 21
21	United Gas Improvement Co.....	Lowering pipe.....	18 38
25	Allison Manufacturing Co.....	Repairing stop boxes.....	5 83
25	Allison Manufacturing Co.....	Repairing stop boxes.....	7 27
May 2	John Hevener.....	Rent of farm No. 3.....	78 50
5	United Gas Improvement Co.....	Changing service pipe.....	3 00
17	Girard College.....	Stop-box covers.....	18 00
19	United Gas Improvement Co.....	Raising pipe.....	6 05
20	John Dobson.....	Laying 10-inch main.....	1,456 00
25	Philadelphia and R. R. Co.....	Fire hydrant.....	31 13
25	United Gas Improvement Co.....	Raising pipe.....	16 92
31	United Gas Improvement Co.....	Repairing fire hydrant, &c.....	59 30
June 10	Pneumatic Transit Co.....	Repairing tube.....	10 35
21	Bureau of Water.....	Overdrawn warrant.....	4 00
June 29	United Gas Improvement Co.....	Drawing and redriving ferrules ..	38 91
29	United Gas Improvement Co.....	Raising main.....	137 44
29	United Gas Improvement Co.....	Raising main.....	20 40
29	United Gas Improvement Co.....	Raising main.....	14 93
29	United Gas Improvement Co.....	Raising main.....	49 63
29	United Gas Improvement Co.....	Lowering main.....	20 56
29	United Gas Improvement Co.....	Lowering main.....	18 38

Miscellaneous Receipts for the Year 1898—Continued.

July 11	United Gas Improvement Co.....	Lowering main.....	\$21 77
11	United Gas Improvement Co.....	Lowering main.....	30 29
27	R. Bennis.....	Driving ferrule.....	3 50
27	R. Bennis.....	Repairing main, etc.....	11 49
Aug. 6	Merchants' Electric Light Co.....	Moving fire hydrant.....	23 07
9	United Gas Improvement Co.....	Moving stop.....	20 85
9	United Gas Improvement Co.....	Raising main, etc.....	554 80
12	J. A. Sheppard & Co.....	Renewing fire hydrant.....	39 70
13	Geo. W. Ruch & Co.....	Repairing main.....	23 46
15	United Gas Improvement Co.....	Lowering and raising main.....	59 33
20	Union Traction Co.....	Shifting stops.....	145 82
23	United Gas Improvement Co.....	Repairing and lowering main, etc.....	170 53
24	United Gas Improvement Co.....	Renewing stop-box.....	4 33
Sept. 9	United Gas Improvement Co.....	Raising main and fire hydrant.....	47 69
10	W. H. Achuff.....	Repairing main.....	9 80
22	Quaker City Croquet Club.....	Rent of ground.....	10 00
23	Jos. Dauphin.....	Replacing main.....	29 26
27	Vulcanite Paving Co.....	Repairing leak.....	6 00
Oct. 12	United Gas Improvement Co.....	Making shut-offs.....	3 25
19	Jos. Perna.....	Repairing main.....	17 86
20	Union Traction Co.....	Removing stop.....	34 26
20	Union Traction Co.....	Removing stop.....	41 28
20	Union Traction Co.....	Shifting stop.....	91 58
22	United Gas Improvement Co.....	Lowering pipe.....	36 15
24	Bureau of Water.....	Overdrawn warrant.....	70
Nov. 4	United Gas Improvement Co.....	Disconnecting pipe.....	7 55
4	United Gas Improvement Co.....	Repairing main.....	62 95
7	John Kerrigan.....	Repairing leaks.....	7 38
9	United Gas Improvement Co.....	Material used.....	9 00
9	United Gas Improvement Co.....	Cutting out main.....	6 70
10	United Gas Improvement Co.....	Lowering pipe.....	52 23
10	United Gas Improvement Co.....	Replacing pipe.....	20 74
14	Philadelphia Traction Co.....	Shifting stop.....	25 57
14	Philadelphia Traction Co.....	Renewing stop-boxes.....	39 75
14	Philadelphia Traction Co.....	Putting in stop.....	52 18
14	Philadelphia Traction Co.....	Shifting stops.....	52 56

Miscellaneous Receipts for the Year 1898—Continued.

Nov. 15	Pennsylvania Heat and Light Co.	Lowering pipe.....	21 75
16	United Gas Improvement Co.....	Lowering pipe.....	27 88
23	D. S. F. Nichols.....	Sale of horse.....	4 00
30	John Hevener.....	Rent of Farm No. 3.....	78 50
Dec. 14	Holmesburg Water Co.....	Stop and sleeve... ..	29 70
17	Girard Metal Works.....	Scrap-iron.....	1,004 85
28	Colonnade Hotel.....	Renewing stop.....	16 87
30	United Gas Improvement Co.	Redriving ferrules.....	19 69
	Total.....		\$5,861 41

	g Fees for Searches.	Charge for Ferrules on New Connections.	h Miscellaneous.	Totals.
January.....	\$406 75	\$126 00	\$28 68	\$44,934 16
February ...	339 25	42 00	.....	212,862 11
March	480 00	578 00	793 08	234,129 11
April.....	453 25	721 00	79 94	359,621 57
May.....	447 75	441 00	1,668 96	1,544,068 97
June.....	457 00	653 00	314 19	77,468 71
July	366 75	587 00	67 06	71,387 06
August	273 25	447 00	1,041 89	129,174 23
September ..	384 25	682 00	102 75	71,854 78
October.....	390 25	881 00	225 08	123,047 81
November ..	402 50	501 00	468 74	82,663 56
December ...	478 75	85 00	1,071 11	115,028 79
Totals for	\$4,929 75	\$5,744 00	\$5,861 41	\$3,065,665 86
Totals for	5,243 25	5,062 00	3,564 08	2,971,357 52
Increase	.....	\$692 00	\$2,297 33	\$94,308 34
Decrease	\$313 50			

a "Current charges on unpaid schedule rents, and on September 1st are due in advance and are still unpaid. If these penalties are paid on or before December 1st after that date they are classed as "Delinquent." Hence, those are not reported as such in the preceding year.

b "Delinquent City for the cost of laying service mains (mains to which the City is entitled) in any street, the owners of property fronting upon such street, and the owners of property fronting upon each side. For four months following date of serving notice of the expiration of Taxes. Upon the expiration of the four months the rents on new connections are not reported.

d "By Municipal Ordinances issued relative to municipal claims for pipe frontage at end of not more than one year, the City is entitled to the ferrule of the pipe laid, and the laying of water pipe. In the same manner, the laying of water pipe. At the end of each year, the Receiver of Taxes, in the receipts from the operators, the receipts from the operators are reported, unless payments are made in advance.

Detailed Expenditures of the Bureau for 1898.

General Appropriation.	Amount appropria'd.	Amount expended.	Amount merging.	Amount not merging
An Ordinance to make an appropriation to the Bureau of Water, approved Jan. 7, 1898....	\$1,063,843 40			
Balance from books of 1897.....	69,588 52			
Increased by additional appropriations.....	473,183 01			
Net appropriation.....	\$1,611,616 93			
Item 1—Salaries.....	\$303,354 00			
Increased by additional appropriations.....	19,985 01			
	\$323,339 01			
Diminished by transfer..	6,800 00			
Net appropriation to Item.....	316,539 01			
For Salary of 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	3,500 00		
Clerks to general superintendent.....	2,000 00	2,000 00		
Assistants to Chief.....	3,600 00	3,600 00		
Pipe inspector and clerk	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 clerks.....	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	4,483 38		
Hydrant inspectors.....	7,050 00	5,111 25		
General foremen.....	6,634 00	6,634 00		
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	900 00		
Watchmen (offices and yards).....	6,075 00	5,893 64		
Storekeepers.....	1,400 00	1,400 00		
Foreman machinist.....	1,500 00	1,500 00		
Foreman bricklayer.....	1,100 00	1,100 00		
Foreman carpenter.....	1,000 00	1,000 00		
Foreman stonemason.....	900 00	965 05		
Foreman painter.....	900 00	900 00		
Foreman rigger.....	900 00	900 00		
Foreman laborer.....	840 00	840 00		
Janitor main office.....	720 00	720 00		
Lineman.....	1,000 00	1,000 00		
Telephone operators.....	1,100 00	1,100 00		
Electrician.....	1,200 00	1,200 00		
General storekeeper.....	1,000 00	1,000 00		
Yard keeper, Fourth District.....	915 00	858 43		

Detailed Expenditures of the Bureau for 1898.

General Appropriation.	Amount appropriat'd.	Amount expended.	Amount merging.	Amount not merging.
Item 1.—Continued.				
SALARIES AT PUMPING STATIONS.				
Fairmount, engineers, oilers, &c.....	\$15,000 00	\$14,083 47		
Spring Garden, engineers, oilers, &c....	84,000 00	82,664 29		
Belmont, engineers, oilers, &c.....	27,000 00	26,943 77		
Belmont Auxiliary, engineers, oilers, &c.....				
Queen Lane, engineers, oilers, &c.....	33,535 01	31,492 82		
Roxborough, engineers, oilers, &c.....	25,500 00	25,122 11		
Roxborough Auxiliary, engineers, oilers, &c.....				
Mt. Airy, engineers, oilers, &c.....	4,000 00	3,901 64		
Chestnut Hill, engineers, oilers, &c....	2,000 00	1,911 33		
Frankford, engineers, oilers, &c.....	18,000 00	17,355 61		
Total.....		\$315,550 74	988 27	
Item 2.—For general supplies, includ- ing fuel, oil and small stores..... \$225,000 00				
Increased by additional appropriations and transfers.....	160,500 09			
Net appropriation to item.....	\$385,500 00			
Chandlery.....		3,864 18		
COAL FOR SHOP AND OFFICES.				
2 tons bituminous at \$3.50.....	\$7 00			
2 tons bituminous at \$3.52.....	7 04			
4 tons nut at \$5.53.....	22 12			
7 tons bituminous at \$3.42.....	23 94			
7 tons stove at \$5.13.....	35 91			
14 tons stove at \$5.23.....	73 22			
16 tons stove at \$5.03.....	80 48			
76.6 tons bituminous at \$2.97...	236 18			
44 tons stove at \$4.73.....	222 97			
308 tons pea at \$3.....	924 00			
		1,632 86		
COAL FOR STATIONS.				
180.03 tons egg, Fairmount, at \$4.20.....	\$467 10			
233.05 tons pea, Chestnut Hill, at \$2.95.....	688 53			
900.03 tons buck, Mt. Airy, at \$2.09.....	1,881 30			
7,494.07 tons buck, Frank- ford, at \$1.98.....	14,838 81			
18.18 tons buck, Belmont, at \$1.95.....	36 49			
25,006.19 tons pea, Belmont, at \$2.69.....	67,267 61			
25,316.03 tons pea, Roxbo- rough, at \$2.72.....	68,853 93			
26.08 tons buck, Queen Lane, at \$2.25.....	59 40			
33,847.18 tons pea, Queen Lane, at \$2.95.....	99,848 37			

Detailed Expenditures of the Bureau for 1898.

General appropriation.	Amount appropriat'd.	Amount expended.	Amount merging.	Amount not merging.
Item 2—Continued.				
1,727.18 tons pea, Spring Garden, at \$2.72.....	4,699 89			
46,104.07 tons buck, Sp'g Garden, at \$1.95.....	107,848 89			
Coke.....		\$366,481 32		
Hauling coal, Roxborough to Roxbor- ough Auxiliary, 40 tons, at 30c.		552 80		
1 42 $\frac{3}{4}$ tons, at 34c.....	\$12 00			
	499 80			
Lubricant, 9,870 lbs., at 10c.....		511 80		
		987 00		
OIL.				
103 gals. electric, at 14c....	\$14 42			
256 gals. black, at 6 $\frac{1}{2}$ c.....	16 64			
54 gals. lard, at 38.98c.....	21 05			
348 gals. gasoline, at 8c....	27 84			
632 gals. engine, at 12.97c.	81 96			
640 gals. cylin'r, at 13.35c.	85 44			
2 6 gals. cylinder, at 45c....	89 60			
318 gals. lard, at 40.48c.....	129 13			
4,749 gals. headlight, at 7 $\frac{1}{4}$ c.	344 35			
5,471 gals. engine, at 16c.....	715 68			
6,718 gals. cylinder, at 17c...	1,142 11			
2,723 gals. cylinder, at 45c...	1,225 35			
5,379 gals. engine, at 35c.....	1,812 65			
Paints.....		5,706 22		
Tallow.....		1,274 85		
Wood, 27 cords, at \$7.....		45 00		
		189 00		
Total.....		\$381,245 03	\$4,254 97	
Item 3. For repairs to machinery, in- cluding the conveyance of workmen incident thereto..... \$50,000 00				
Balance from books of 1897	2,389 00			
Increased by additional ap- propriations.....	36,500 00			
Net appropriation to item.....	\$88,889 00			
Brass fittings.....		\$1,437 01		
Bricks, lime and sand.....		1,500 00		
Chandlery.....		586 43		
Donkey pumps.....		420 75		
Fire bricks.....		772 90		
Gum goods and packing.....		4,476 05		
Hardware, bolts and nuts.....		500 00		
Iron (bar).....		4 39		
Iron castings:				
246 lbs., at 2 $\frac{3}{4}$ c.....	\$6 77			
5,200 lbs., at 3 $\frac{1}{4}$ c.....	182 00			
40,000 lbs., at 1 $\frac{1}{4}$ c.....	500 00			
		688 77		
Iron fittings.....		656 98		
Jet heads.....		33 00		
Machine work.....		64 07		
Repairs to boilers:				
Frankford.....	\$272 87			
Roxborough.....	307 71			
Belmont.....	1,511 74			
Spring Garden.....	5,050 61			
Queen Lane.....	6,127 84			
		13,270 77		

Detailed Expenditures of the Bureau for 1898.

General Appropriation.	Amount appropriat'd.	Amount expended.	Amount merging.	Amount not merging.
Item 3—Continued.				
Repairs to boiler covering:				
Queen lane.....	\$300 36			
Spring Garden.....	528 41			
		\$828 77		
Repairs to condenser.....		4 20		
Repairs to engines:				
Belmont.....	365 90			
Roxborough.....	2,357 64			
		2,423 54		
Repairs to grate bars:				
Queen Lane.....	\$19 20			
Belmont.....	168 68			
		187 88		
Repairs to jacks.....		20 65		
Repairs to pump.....		5 25		
Steam clamps.....		210 10		
Valves.....		972 46		
Transportation.....		1,999 00		
Wages:				
Carpenters.....	\$3,186 00			
Bricklayers.....	11,257 30			
Laborers.....	14,105 52			
Machinists.....	19,691 82			
Stone masons.....	6,121 50			
		54,362 14		
Total.....		\$85,425 01	\$3,468 99	
Item 4. For maintenance and repairs to buildings, grounds and reservoirs.....				
Balance from books of 1897.....	\$75,000 00			
Increased by additional appropriations.....	44,000 00			
Net appropriation to item.....	\$119,000 00			
Ammonia.....		\$6 08		
Belgian blocks.....		960 00		
Brass fittings.....		482 37		
Bricks, lime and sand.....		1,810 08		
Brushes.....		128 80		
Carts.....		129 60		
Cement.....		2,166 95		
Chandlery.....		801 85		
Cleaning wells.....		138 00		
Composition and pebbles.....		243 53		
Compost.....		10 00		
Curbing.....		1,345 77		
Disinfectant.....		14 00		
Disinfectant (rental).....		150 75		
Electric current.....		164 80		
Electric supplies.....		2,202 31		
Forage.....		1,399 06		
Frames.....		3 30		
Gum goods.....		1,794 08		
Hardware.....		1,603 20		
Harness repairs.....		54 03		
Horses.....		270 00		
Horse-shoeing.....		230 55		
Hydraulic jacks.....		133 25		
Ice.....		400 00		
Iron (bar).....		149 03		
Iron fittings.....		539 53		
Lumber.....		2,999 73		
Paints.....		20 00		

Detailed Expenditures of the Bureau for 1898—Continued.

General Appropriation.	Amount appropriat'd.	Amount expended.	Amount merging.	Amount not merging
Item 4.—Continued.				
Plants.....		123 89		
Repairs to roofs.....		2,791 75		
Repairs to telephone line.....		50 00		
Relin'g north basin, Queen Lane Res.				
Retained per cent. upon contract.....		966 46		
Soundings (George's Hill).....		34 88		
Tin.....		176 08		
Transportation.....		120 00		
Turpentine.....		18 88		
Wagon.....		164 50		
Wagon repairs.....		228 94		
Window shades, etc.....		45 41		
Wages:				
Engineer corps.....		10,585 00		
Bricklayers..... \$500 00				
Carpenters..... 4,132 50				
Helpers..... 10,348 25				
Horses, carts, drivers.. 7,432 00				
Laborers..... 32,832 58				
Painters..... 5,460 00				
Stonemasons..... 442 35				
		\$81,147 68		
Total.....		\$116,827 92	\$8,138 54	
Item 5.—For repairs and improve-				
ment of the distribution, including				
the purchase of material in connec-				
tion therewith and expenses inci-				
dentical thereto..... \$100,000 00				
Increased by additional				
appropriation..... 27,500 00				
Net appropriation to Item.....	\$127,500 00			
Bicycles, 3 @ \$60.....		\$180 00		
Block tin.....		147 50		
Brass fittings.....		976 42		
Bricks, lime and sand.....		1,000 00		
Chandlery.....		471 08		
Forage.....		1,012 89		
Gum goods.....		1,300 00		
Hardware.....		856 18		
Harness.....		49 00		
Iron (bar).....		192 11		
Iron castings:				
44,444½ lbs. @ 2¼c.....	\$1,000 00			
94,545 lbs. @ 1½c.....	1,418 18	2,418 18		
Iron fittings.....		500 41		
Iron water pipe:				
25 20 in., 46,402 lbs. @ 80c.....	\$373 54			
1,498 6-in., 751,832 lbs. @				
81c.....	4,469 97	4,843 51		
Inspecting pipe.....		55 95		
Lumber.....		2,984 80		
Machine work.....		69 50		
Pig lead.....		1 56		
Plumbing.....		52 04		
Transportation.....		1,040 00		
Wages:				
Improvement.....	\$11,883 72			
First District.....	11,904 74			
Second District.....	13,068 18			

Detailed Expenditures of the Bureau for 1898.

General Appropriation.	Amount appropriat'd.	Amount expended.	Amount merging.	Amount not merging
Item 5—Continued.				
Third District.....	\$25,341 46			
Fourth District.....	16,531 25			
Fifth District.....	8,350 83			
Sixth District.....	21,085 45			
		\$108,165 68		
Total.....		\$126,316 61	\$1,188 39	
Item 6. For supplies, including fuel and labor at the City Construction and Repair Shop..... \$50,000 00				
Increased by additional ap- propriation.....	9,000 00			
Net appropriation to item.....		\$59,000 00		
Brass castings, etc.				
100 lbs. Babbitt metal at 8c.....	\$8 00			
45 lbs. hammered copper at 30c.....	13 50			
263 lbs. expans'n metal at 24½c.....	64 44			
13,127 lbs. lead coating, at 3.95c.....	518 52			
9,283 lbs. red brass, at 10.95c.....	1,016 50			
17,355½ lbs. yellow brass, at 8c.....	1,388 44			
7,343 lbs. Ajax metal, at 21½c.....	1,686 24			
	\$4,695 64			
CR.				
2,600 lbs. scrap brass, at 6¼c.....	\$159 25			
5,850 lbs. turnings at 4c.....	234 00			
	\$393 25			
Brass fittings.....		\$4,302 39		
Chandlery.....		728 99		
		528 21		
Corporation cocks.				
375 ½-inch, at 29.50c.....	\$110 63			
158 ¾-inch, at 36c.....	56 88			
50 2-inch, at 2.7c.....	103 50			
		271 01		
Dumping dirt.....		10 00		
Gum goods.....		143 85		
Hardware, bolts and nuts.....		1,501 92		
Horse shoeing.....		18 00		
Iron (bar).....		755 26		
Lead (pig), 29,783 lbs. at 3.90c.....		1,161 54		
Listing.....		3 00		
Lumber.....		1,909 03		
Machine work.....		107 70		
Paints, etc.....		20 87		
Plug valves, 500, at .70c.....		350 00		
Reamers.....		6 40		

Detailed Expenditures of the Bureau for 1898—Continued.

General Appropriation.	Amount appropriat'd.	Amount expended.	Amount merging.	Amount not merging
Item 6—Continued.				
Shop castings.				
9,528 lbs. at 2 $\frac{1}{4}$ c.....	\$262 04			
14,485 lbs. at 3 $\frac{1}{2}$ c.....	506 98			
25,582 lbs. at 2 $\frac{1}{4}$ c.....	575 39			
65,237 lbs. at 1.30c.....	822 08			
85,949 lbs. at 1.20c.....	1,031 39			
279,804 lbs. at 1 $\frac{1}{2}$ c.....	3,492 03			
436,600 lbs. at 1.40c.....	6,075 01			
		\$12,765 12		
Stable supplies.....		15 30		
Stone.....		500 00		
Transportation.....		25 00		
Wages.....		32,829 61		
Total.....		\$57,953 43	\$1,046 57	
Item 7. For general, incidental and				
contingent expenses, including				
keep of horse for Chief of Bureau.				
General Superintendent and assist-				
ant, each \$400.....				
	\$16,300 00			
Increased by transfer from				
Item 1.....	1,800 00			
Net appropriation to item.....	\$18,100 00			
Advertising.....		221 85		
Carriage hire.....		39 00		
Care of clocks.....		15 00		
Chairs.....		12 00		
Chandlery.....		14 45		
Clocks.....		13 00		
Drawing.....		40 00		
Flags.....		124 59		
Fire insurance.....		242 00		
Frames.....		15 68		
Ground rent (918 Cherry street).....		26 66		
Graphophone and supplies.....		118 90		
Incidentals.				
General Superintendent... \$28 25				
Hydrographic Corps..... 148 11				
Chief of Bureau..... 253 57				
		429 93		
Keep of horses.....		799 94		
Lamps.....		21 10		
Maps.....		746 50		
Messenger and telegraph service.....		31 21		
Moving safes.....		25 00		
Putting up awnings.....		5 20		
Rent (1821 Filbert street).....		250 00		
Repairs to bicycle.....	\$6 65			
Repairs to chairs.....	17 50			
Repairs to clocks.....	1 50			
Repairs to filter.....	3 85			
Repairs to gauge.....	2 30			
Repairs to locks.....	1 75			
Repairs to stamps.....	5 00			
Repairs to stoves.....	7 75			
Repairs to tape.....	4 22			
		50 52		
Stationery, blank books, etc.....		9,533 07		
Subscriptions (periodicals).....		21 00		
Serving daily papers.....		26 48		
Telephone calls.....		10 50		

Detailed Expenditures of the Bureau for 1898—Continued.

General Appropriation.	Amount appropria'd.	Amount expended.	Amount merging.	Amount not merging
Item 7—Continued.				
Text-books.....		\$219 04		
Transportation.....		70 00		
Type-writer.....		200 00		
Type-writing.....		16 20		
Type-writer supplies.....		65 95		
Washing towels.....		111 00		
Writing duplicates.....		2,215 91		
Wages, Hydrographic Corps.....		1,560 00		
		17,291 76	\$808 24	
Item 8. For the purchase of material and cost of labor in connection with the laying of service mains and expenses incident thereto. \$225,000 00				
Increased by additional appropriations.....	25,000 00			
Net appropriation to item.....	\$250,000 00			
Brass fittings.....		448 52		
Bricks, lime and sand.....		499 63		
Cement.....		827 95		
Chandlery.....		1,910 90		
Clay.....		200 00		
Corporation cocks:				
7,532 1/2-in., @ 29 1/2c.....	\$2,251 44			
242 5/8-in., @ 36c.....	123 12			
200 3/4-in., @ 50c.....	100 00			
200 1-in., @ 76c.....	152 00			
		2,626 56		
Curb stops, 3466, @ 31c.....		1,074 46		
Disinfectant.....		28 00		
Dynamite.....		261 67		
Forage.....		1,917 79		
Gum goods.....		1,979 86		
Hardware.....		1,696 71		
Harness.....		133 50		
Harness repairs.....		256 66		
Hauling.....		2,883 67		
Horses, 5 @ \$135.....		675 00		
Horse-shoeing.....		675 02		
Ice.....		485 56		
Inspecting pipe.....		45 00		
Iron fittings.....		501 30		
Iron water pipe and special castings:				
277 6-in., 9,843 lbs., @ .8169c.....	\$804 13			
12,550 6-in., 4,589,364 lbs., @ .81c.....	37,173 85			
1,000 8-in., 491,758 lbs., @ .81c.....	3,983 25			
1,100 10-in., 677,390 lbs., @ .8058c.....	5,458 42			
2,277 12-in., 2,099,936 lbs., @ .8058c.....	16,922 09			
300 16-in., 401,570 lbs., @ .805c.....	3,232 64			
175 20-in., 318,925 lbs., @ .805c.....	2,567 35			
60 36-in., 307,349 lbs., @ .816c.....	2,504 89			
50 48-in., 403,222 lbs., @ .815c.....	3,286 26			
332,960 lbs. special castings, @ 1 1/2c.....	4,994 41			
	\$80,927 29			
Less difference in price for 277 6-in.....	6 79			
		80,920 50		

Detailed Expenditures of the Bureau for 1898—Continued.

General Appropriation.	Amount appropriat'd.	Amount expended.	Amount merging.	Amount not merging.
Item 8.—Continued.				
Lead (pig), 307,666 lbs., @ 3.90c.....		\$11,998 98		
Lumber.....		972 79		
Plumbing.....		18 25		
Professional services, V. S.....		111 75		
Rent of office and shop, Fifth District.....		170 50		
Repairs to drill.....		1 00		
Repairs to pavement.....		35 00		
Shop castings:				
139,257 lbs., @ .98c.....	\$1,364 73			
66,666½ lbs., @ 2¼c.....	1,500 00			
		2,864 73		
Stable supplies.....		95 88		
Stone.....		33 80		
Supporting tracks.....		128 25		
Traveling expenses (Pipe inspectors).....		1,094 62		
Transportation.....		5 00		
Wagon.....		194 00		
Wagon repairs.....		793 76		
Tapping machines:				
One No. 3.....	\$400 00			
One No. 2.....	600 00			
		1,000 00		
Tapping machine fittings.....		4,926 48		
Water meters (Venturi):				
One 20-in.....	\$875 00			
One 30-in.....	1,175 00			
One 36-in.....	1,450 00			
		3,500 00		
Wages:				
Improvement.....	\$6,757 78			
First District.....	13,448 78			
Second District.....	19,979 34			
Third District.....	27,179 40			
Fourth District.....	15,969 22			
Fifth District.....	5,489 72			
Sixth District.....	23,714 32			
		\$114,538 56		
Total.....		\$242,531 88	\$7,968 12	
Item 9—For service pipe and meters..... \$10,000 00				
Increased by additional appropriation.....	10,000 00			
		\$20,000 00		
Diminished by transfers.....	5,500 00			
Net appropriation to item.....	\$14,500 00			
Brass fittings.....		\$460 22		
Block tin, 1,000 lbs., @ 14¼c.....		147 50		
Corporation cocks:				
100 ½ in., @ 35c.....	\$35 00			
100 ¾ in., @ 50c.....	50 00			
100 1 in., @ 75c.....	75 00			
1,000 ¼ in., @ 29½c.....	295 00		457 00	
Fittings for meters.....		792 86		
Lead pipe, 171,312½ lbs., @ 4c.....		6,852 50		
Water meters:				
1 ¼ in. Crown.....	\$12 00			
1 ½ in. Crown.....	19 00			
1 1 in. Crown.....	27 00			
12 1½ in. Crown @ \$50.....	600 00			

Detailed Expenditures of the Bureau for 1898—Continued.

General Appropriation.	Amount appropria'd.	Amount expended.	Amount merging.	Amount not merging
Item 9.—Continued.				
10 2 in. Crown @ \$65.....	650 00			
1 2 in. Gem.....	45 00			
12 3 in. Crown @ \$135.....	1,620 00			
1 3 in. Gem.....	90 00			
5 4 in. Crown @ \$250.....	1,250 00			
1 4 in. Gem.....	175 00			
1 6 in. Gem.....	400 00			
1 6 in. Crown.....	500 00			
		5,388 00		
Total.....		\$14,097 58	\$402 42	
Item 10.—For emergencies.....				
Repairs to engines.....	\$5,000 00			
Spring Garden.....	88 00			
Queen Lane.....	859 13			
Roxborough.....	1,473 10	\$2,430 23		
Smoke-stack, Roxborough, (extension).....		550 00		
Total.....		\$2,980 23	\$2,019 77	
Item 11.—For the purchase of a lot of ground on the south-east side of Shawmont ave., 871 feet 2¼ inches south-east of corner of Cross street..				
	\$625 00	\$625 00		
Item 12.—To pay the Alcatraz Paving Co. for repairs to the new Rox- borough Reservoir.....				
	\$8,564 40	\$8,564 40		
Item 13.—For repairs to and improve- ment of reservoirs; appropriations June 19th, 1895, and May 5th, 1896; balance January 1st, 1898.....				
	\$42,387 86			
Coping stone at Queen Lane Res.....				
298.4 ft. 2 in. @ \$2.95.....	880 28			
2.578 ft. 3 in. @ \$3.35.....	8,636 97			
	\$9,517 25			
Less 20 per cent.....	1,903 44	\$7,613 81		
Retaining wall, new Roxborough Res.				
294 cubic yards excava- tion @ 35c.....	\$102 90			
84 cubic yards masonry @ \$6.50.....	546 00			
327 cubic yards founda- tion @ \$3.70.....	1,209 90			
7 cubic yds. reconstruc- tion @ \$2.50.....	17 50			
80 lineal feet coping @ \$1.25.....	100 00			
	\$1,976 30			
Less 20 per cent.....	395 26			
	\$1,581 04			

Detailed Expenditures of the Bureau for 1898.

General Appropriation.	Amount appropriat'd.	Amount expended.	Amount merging.	Amount not merging
Item 13—Continued.				
Less amount retained to cover damages for delay in construction of the work.....	\$850 00	\$731 04		
Retained per cent. upon contracts for coping stone.....	\$2,931 45			
Less amount retained to cover damages for delay in completion of the work, and for material belonging to the City removed by the contractor.....	\$1,500 00	\$1,431 45		
Retained per cent. upon contract for relining north basin Queen Lane Reservoir.....		\$27,999 93		
Total.....		\$37,776 23		\$4,611 63
Item 14.—For extensions:				
Balance Jan. 1, 1898.....	\$23,845 20			
Final payment for pumping engine at Frankford Station.....		\$23,845 20		
Item 15. For stack, flue, boiler house and boilers at Belmont Station:				
Appropriation June 10, 1898.....	40,700 00			
Annex to boiler house.....		4,398 00		
Inspecting boiler construction.....		312 00		
Stack and flue.....		10,685 00		
Total.....		\$15,395 00		\$25,305 00
Item 16. For boiler house and boilers at Roxborough Station:				
Appropriation July 12, 1898.....	\$30,000 00			\$30,000 00
Item 17. For new pumping main from Queen Lane Station to Queen Lane Reservoir:				
Appropriation July 12, 1898.....	\$80,000 00			
Inspecting pipe.....		\$176 62		
Iron water pipe and special castings:				
250—48", 1,339,889 lbs., at .51c.....	\$15,713 93			
310—48", 2,868,836 lbs., at .84c.....	24,098 22			
188,796 lbs. special castings, at 1.85c.....		39,812 15		
Machine work.....		3,492 73		
Lead (pig), 110,323 lbs., at 4¼c.....		302 85		
Lead (pig), 110,323 lbs., at 4¼c.....		4,688 73		
Wages, Fifth District.....		1,097 74		
		\$49,570 82		\$30,429 18

Detailed Expenditures of the Bureau for 1898.

RECAPITULATION.

General Appropriation.				
Balance from books of 1897.....		\$69,538 52		
Special appropriations.....		473,185 01		
Annual appropriation.....			\$542,773 53	
			1,068,843 40	1,611,616 93
Expended for maintenance.....	1,360,220 19			
Expended for extensions.....	135,776 65			
Amount merging.....			1,495,996 84	
Amount not merging.....		25,274 28		
		90,345 81		
			115,620 09	1,611,616 93

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:

YEAR.	Receipts.	Estimates.	Available Appropriations.	Expended.
1891.....	\$2,500,762 73	\$2,000,000 00	\$1,880,683 48	\$1,530,294 04
1892.....	2,634,456 02	1,500,000 00	2,476,628 37	1,372,457 31
1893.....	2,674,275 24	2,871,800 00	3,313,973 92	2,593,390 81
1894.....	2,759,630 59	4,230,564 00	3,888,326 05	2,912,856 04
1895.....	2,329,857 17	4,335,366 00	2,616,077 32	1,897,225 20
1896.....	2,879,133 26	4,385,674 00	2,231,671 15	1,825,610 80
1897.....	2,971,357 52	4,948,379 00	1,882,628 42	1,665,153 21
1898.....	3,065,665 66	{ 5,443,379 00 3 088,124 00 }	1,611,616 93	1,495,196 84
Appropriation for 1899.....			\$1,264,439 00	
Balance from 1898.....			90,345 81	

Requirements and Appropriations.

The following table makes comparison between the requirements of this Bureau for the year 1899 and the amounts appropriated:

*Statement Showing the Estimates of the Bureau for the year
1899 and the Amounts Appropriated.*

Item.	Estimates.	Appropriations.	
1	Salaries.....	\$31,124 00	\$331,264 00
2	For the purchase of coal.....	365,000 00	300,000 00
3	For the purchase of oil, lubricants, paints, etc.	10,000 00	8,000 00
4	For wages, repairs to machinery, buildings, grounds and reservoirs.....	147,000 00	75,000 00
5	For wages, repairs to distribution and laying of water pipe.....	225,500 00	115,000 00
6	For wages, City Construction and Repair Shop..	40,000 00	20,000 00
7	For the purchase of iron water pipe, etc.....	240,000 00	120,000 00
8	For wages of the Engineer Corps.....	11,000 00	5,500 00
9	For the purchase of hardware, bolts and nuts...	8,000 00	6,000 00
10	For the purchase of iron, steel and malleable castings.....	20,000 00	17,000 00
11	For the purchase of gum goods and packing....	12,000 00	9,000 00
12	For repairs to boilers.....	20,000 00	16,000 00
13	For the purchase of chandlery.....	6,000 00	5,000 00
14	For the purchase of wrought iron pipe and fit- tings.....	3,500 00	2,000 00
15	For the purchase of fire bricks and fire clay....	1,500 00	1,000 00
16	For the purchase of brass fittings, etc.....	8,000 00	7,000 00
17	For covering steam pipes and boilers.....	4,000 00	2,000 00
18	For the purchase of lumber.....	16,000 00	8,000 00
19	For the purchase of forage.....	5,000 00	4,000 00
20	For hauling water pipe and machinery.....	10,000 00	4,000 00
21	For the purchase of cement.....	10,000 00	4,000 00
22	For the purchase of iron and steel.....	8,000 00	2,000 00
23	For the purchase of bricks, lime, stone, etc.....	4,000 00	3,000 00
24	For the purchase of electric supplies.....	5,000 00	2,500 00
25	For repairs to roofs.....	3,000 00	1,500 00
26	For the purchase of granite curb and coping stone.....	5,000 00	1,000 00
27	For the purchase of brass castings.....	6,000 00	5,500 00
28	For the purchase of stationery, blank books, etc.	10,000 00	6,000 00
29	For wages of Hydrographic Corps.....	1,600 00	
30	For clerk hire in writing up duplicates.....	2,800 00	2,275 00
31	For keep of horse for Chief, General Superin- tendent and Assistant.....	1,200 00	1,200 00

Statement of Estimates and Appropriations—Continued.

Item.	Estimates.	Appropriations.
32 For the purchase of horses	1,200 00	1,000 00
33 For the purchase of meters to measure water in large pipes.....	9,000 00	2,500 00
34 For the purchase of tapping machines.....	10,000 00	6,000 00
35 For the purchase of wagons and carts.....	2,000 00	300 00
36 For the purchase of harness and stable supplies..	1,000 00	500 00
37 For the purchase of donkey pumps and tools....	5,000 00	1,000 00
38 For asphalt paving and repairs to asphalt paving	5,000 00	1,000 00
39 For advertising, office supplies, text books and incidentals.....	5,000 00	2,000 00
40 For the purchase of special articles, etc.....	5,000 00	1,500 00
41 For the purchase of lead pipe and meters.....	100,000 00	6,000 00
42 For emergencies.	25,000 00	5,000 00
43 For extensions.....	1,375,000 00	150,000 00

APPENDIX B.

REPORT

OF THE

GENERAL SUPERINTENDENT

OF

Work during 1898, on Buildings, Grounds and Reservoirs,
and on Boilers and Machinery at the Pumping Stations.

Philadelphia, January 20, 1899.

MR. JOHN C. TEAUTWINE, JR.,
Chief of Bureau.

DEAR SIR:—I have the honor to submit the following report of work performed under my direction during the year 1898:

The engines and boilers at the several stations have, as a rule, been driven to their utmost, night and day, but extensive repairs are required to some of them, namely, at Spring Garden, Belmont, Queen Lane and Roxborough Pumping Stations.

The reservoirs, buildings and grounds have been kept in as good order as the means granted us will permit, and such repairs as were possible have been made thereto.

The following tables show the pumpage—annual, maximum, average daily, and daily per capita—as compared with that for the year 1897; also the cost of raising one

million gallons one hundred feet as compared with that for 1897; the volume and cost of pumpage, etc., for the years 1888 to 1898, both inclusive, and the nominal, minimum, and average daily pumpage for 1897 and 1898:

The following table shows the pumpage—annual, maximum, average daily, and daily per capita—as compared with that for the year 1897.

Comparison of Pumpage for 1897 and 1898:

	1897. Gallons.	1898. Gallons.	Increase. Gallons.
Annual pumpage:			
From rivers.....	93,999,191,121	100,254,834,542	6,255,443,421
High service.....	1,668,275,750	1,987,000,880	318,725,080
Total.....	95,667,466,871	102,241,835,422	6,574,368,551
Maximum daily pumpage:			
From rivers.....	314,851,516	334,062,741	19,211,225
High service.....	4,865,350	5,612,595	1,247,235
Total.....	319,216,876	339,675,336	20,458,460
Average daily pumpage:			
From rivers.....	257,532,031	274,670,779	17,138,748
High service.....	4,570,618	5,443,837	873,219
Total.....	262,102,649	280,114,616	18,011,967
Average daily pumpage:			
From rivers, per capita.....	185.8	196.2	10.4

*Cost of Raising 1,000,000 Gallons 100 Feet during 1897
and 1898.*

Stations.	1897.	1898.	Increase.	Decrease.
Fairmount.....	\$1 66	\$1 36		\$0 30
Spring Garden.....	3 44	2 99		45
Belmont.....	3 84	4 06	\$0 22	
Belmont High Service.....	24 69	31 05	6 36	
Queen Lane.....	2 12	2 14	02	
Roxborough.....	3 37	3 45	08	
Roxborough High Service.....	7 05	6 60		45
Mt. Airy High Service.....	11 96	12 03	07	
Chestnut Hill High Service.....	482 78	69 22		363 56
Frankford.....	4 24	3 95		29
Average.....	\$3 16	\$2 97		\$0 19

*Volume and Cost of Pumpage for the Years 1888 to 1898,
Inclusive.*

Years.	Number of gallons pumped.†	Number of gallons pumped 100 feet high.‡	Cost per million gallons pumped 100 feet high.	Gallons pumped per capita per day.	Population Estimated.
1888	87,088,760,428	59,483,831,199	\$4 49	100	1,020,000
1889	42,518,919,781	69,084,118,434	8 87	110	1,050,000
1890	51,698,508,099	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	102,448,373,681	2 68	143	†1,142,650
1893	65,352,736,978	110,590,708,479	3 22	150	1,190,493
1894	72,078,724,238	121,199,588,887	3 48	159	1,238,112
1895	78,775,849,104	132,040,954,195	3 69	162	1,329,957
1896	87,693,642,529	161,776,711,713	3 43	172	1,367,815
1897	95,667,466,871	187,371,927,277	3 16	185	1,385,734
1898	102,241,835,372	210,828,629,625	2 97	196	1,400,000

* United States Census.

† City census.

‡ Including repumpage or high service.

DAILY PUMPAGE.

Table showing the Nominal, Maximum, Minimum and Average Daily Pumpage for 1897 and 1898.

NAME OF STATION.	NOMINAL.		MAXIMUM.		MINIMUM.		AVERAGE.	
	1897.	1898.	1897.	1898.	1897.	1898.	1897.	1898.
Fairmount.....	33,290,000	33,290,000	39,994,701	41,626,170	784,664	1,021,115	20,795,278	24,423,039
Spring Garden.....	170,000,000	170,000,000	168,563,170	154,343,440	45,524,300	37,348,500	124,332,590	120,440,447
Belmont.....	38,000,000	38,000,000	33,191,583	34,591,422	15,265,905	20,864,035	27,307,458	29,112,162
Queen Lane.....	80,000,000	80,000,000	78,292,150	78,920,950	11,695,680	19,263,550	58,222,068	65,283,471
Roxborough.....	24,500,000	24,500,000	23,062,430	24,273,740	5,799,700	11,945,400	17,853,506	20,329,722
Totals from Schuylkill.....	345,790,000	345,790,000	343,104,034	333,755,722	79,050,249	90,442,600	243,511,200	259,588,841
Increase.....						11,382,351		16,077,640
Decrease.....				9,348,312				
Frankford.....	42,000,000	42,000,000	23,362,138	20,528,310	7,032,780	8,437,580	14,007,474	15,081,936
Total from Delaware.....	42,000,000	42,000,000	23,362,138	20,528,310	7,032,780	8,437,580	14,007,474	15,081,936
Increase.....						1,404,800		1,074,462
Decrease.....				2,833,828				
Total from Delaware and Schuylkill.....	387,790,000	387,790,000	366,466,172	354,284,032	86,093,029	98,880,180	257,518,674	274,670,777
Increase.....						2,787,151		17,152,103
Decrease.....				12,182,140				

Nominal, Maximum and Minimum and Average Daily Pumpage for 1897 and 1898—Continued.

NAME OF STATION.	NOMINAL.		MAXIMUM.		MINIMUM.		AVERAGE.	
	1897	1898	1897	1898	1897	1898	1897	1898
Belmont High Service	2,500,000	2,500,000	1,153,440	1,161,200	202,920	228,285	445,911	457,015
Roxborough High Service.....	5,000,000	5,000,000	4,980,690	5,444,010	2,212,650	953,370	3,114,330	3,726,540
Mt. Airy High Service.....	3,000,000	3,000,000	1,965,000	2,388,750	641,250	248,750	1,010,347	1,614,464
Chestnut Hill High service.....	750,000	750,000	378,840	944,640	36,900	36,900	13,354	98,817
Total High Service..	11,250,000	11,250,000	8,477,970	9,938,600	3,093,720	1,462,310	4,583,942	5,443,836
Total daily.....	399,040,000	399,040,000	374,944,142	364,222,632	89,186,749	100,342,480	262,102,616	280,114,613
Increase						11,155,731		18,011,997
Decrease.....				10,721,510				

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The following is a summary of the work done at the several stations and reservoirs:

Fairmount.

During the summer, while the wheels were out of service on account of low water in the Schuylkill river, all the wheels and pumps at this station received attention and the necessary repairs, and much work was done to the grounds and reservoirs.

Spring Garden Pumping Station.

On August 25, the fly-wheel of No. 6 engine at this station broke, and the engine, since that date, has been out of service.

On September 10, the lower pump-chamber under the high-pressure cylinder of No. 2 Holly (30-million gallon) engine broke through the valve seats, throwing this part of the engine out of service. The broken pump was disconnected and the engine was started with two pumps, reducing the capacity one-third.

A new fly-wheel has been ordered from the Southwark Foundry and Machine Company of this City, for the No. 6 engine, but, owing to the insufficiency of force in the drafting room, no steps have been taken toward repairing No. 2, and the engine is still running at two-thirds of its capacity, viz: 20-million gallons.

The other two pump chambers of No. 2, and all three of those in No. 3, are more or less broken, and therefore in critical condition.

No. 5 Southwark Engine (20-million gallons capacity) has been running at half capacity at intervals, on account of certain parts of it being taken at different times to supply similar ones which had broken on No. 1 engine at Roxborough Station, which is of identical design and make.

With the exceptions above noted, the engine and boilers

at this station has been operated continuously, needing no repairs other than those incidental to hard-worked machinery.

Belmont Pumping Station.

The machinery at this station has been overworked. During the summer the demand was such that, in order to keep the reservoir from being entirely emptied, it was necessary to shut it off from the distribution, and to supply the district by direct pumpage.

A new chimney and flue were built, and on September 21, nine days after their completion, boilers Nos. 1 to 5, inclusive, were cut off from the old stack and turned into the new one. This afforded some relief and enabled us to re-open the reservoir for distribution of the subsided water to the district and to keep up the supply without again resorting to direct pumpage.

A new boiler house, of sufficient dimensions to accommodate eight boilers, has been constructed. Seven boilers have been contracted for and built, and these are now being placed in position and will be ready for service early in 1899, when some relief will be afforded the boilers now in use at this station.

A new flue, to connect boilers Nos. 9 to 12, inclusive, with the brick chimney, is in course of construction, and when work upon this is completed the use of the iron stack will be dispensed with.

The engines at this station are run under the same unfavorable conditions as set forth in my reports for 1896 and 1897.

Engine No. 4 (20-million gallon high-duty Worthington) is still protected only by the rude shelter of boards erected by employees of this Bureau in 1895, no appropriation for an engine house having been granted.

Queen Lane Pumping Station.

There have been no steps whatever taken towards bettering the conditions under which the engines at this station are supplied with water. The situation remains unchanged from that stated in my report for 1897. We are compelled to shut these engines down every few days in order to caulk the joints in the suction mains. The admission of air into these mains has been the cause of many breaks and of bad cracks in the pump chambers.

The district supplied from this station has been enlarged to such extent that it now requires the services of all four of the pumps the greater part of the time in order to keep up the supply.

The conditions under which the coal is delivered to this station remain the same as stated in my report for 1897, the supply all being hauled from the Wissahickon station, on the Reading Railroad, no appropriation having been granted for proper facilities in this respect.

Pea coal is delivered at Spring Garden station at a cost of \$2.75 per ton; at Queen Lane station the cost is \$2.95, an increase of 23 cents per ton.

During the year there were 35,136 tons of coal consumed at this station. The cost for hauling this quantity, at 23 cents per ton, from Wissahickon station, amounted to \$8,081. Add to this the cost of handling the coal at the station, \$1,118.25, and we have a sum total of \$9,199.53, the amount which could have been saved in the expenditure for coal during 1898 at this station if proper terminal facilities had been provided for.

The additional cost of coal for Queen Lane station during the years 1896, 1897 and 1898, owing to lack of proper facilities for its delivery, was as follows:

For 1896	\$4,871 00
For 1897	7,563 00
For 1898	9,199 53
Total	<u>\$21,633 53</u>

I therefore again respectfully urge that some means be adopted by which we can be relieved of this excessive expenditure.

Roxborough Pumping Station.

Notwithstanding the fact that the boilers and engines at this station have been forced to their maximum capacity, many parts of the district supplied by it have been short of water. Early in the summer it became necessary to resort to direct pumpage in order to keep the reservoir from being entirely emptied, and the district is still supplied in that manner.

The New Roxborough reservoir has only a few feet of water in it. Every effort has been made to fill this reservoir to its intended depth, but at no time during the year, owing to the inadequacy of the pumps at the Roxborough station to keep up the supply, has it received one-half of the quantity for which it was designed and built.

No. 1 engine, 12-million gallons capacity, the largest engine at this station, is continually breaking, and the greatest care is required to keep it in operation. This engine and the pumps connected with it have given very unsatisfactory service since their installation in 1893. The engine has broken in all conceivable parts and has proven to be the most expensive one in the Bureau to keep in repair. The total length of time which it has, at different periods, been out of service for repairs, exceeds that of all the other engines combined.

The Roxborough station is in a deplorable condition, and if something is not done to give it relief at an early date it will be impossible to supply the demands of the rapidly-growing district dependent upon it.

A new chimney and six new boilers for this station have been contracted for, but it will be some months before they will be ready for service.

During the summer an iron stack, 50 feet in height, was built and placed on the brick chimney, and considerable benefit has been derived from its use.

Frankford Pumping Station.

Very little work in the nature of repairs has been required at this station. Owing to the refusal of appropriation for an improvement in the distribution facilities, we are unable to utilize the entire capacity of the pumps at this station. We are therefore not obliged to run the machinery to its maximum capacity, and repairs can be made as required. This station is, therefore, operated at little expense, and it is in good condition.

The High-Service Stations.

At the Roxborough high-service station, Mr. d'Auria, having a pump of his own design, of about 2½-million gallons capacity, was given permission to install it for experimental purposes. It was started on May 12, 1898, and has been in operation, at uncertain intervals, since that time.

The high-service station at Belmont is in the same condition as reported last year—it having only one engine for keeping up the supply.

At both the Roxborough and Belmont stations, it is of the utmost importance that a second pump be installed to provide against emergencies.

The Mount Airy high-service station is in good order, costing very little for repairs.

Reservoirs.

The reservoirs have all been kept in good repair. Much work was done to the inner slopes of East Park reservoir, extending almost entirely around the bank, and from about the 20-foot line to the top.

At Queen Lane reservoir the steps on the east and the west sides were completed and a new set placed on the northeast corner. Lamps were placed at all the steps, and gates were placed on the north, south and division banks to prevent fast bicycle riding.

In the early part of December a few small water cracks, such as are likely to appear in any wall, were noticeable in the retaining wall. These were of little importance, and did not in any way affect the safety of the wall.

At the New Roxborough reservoir, the top or finishing coat of the asphalt lining in the north section showed evidence of sliding in many places, particularly on the north and west banks. Notwithstanding notice to the contractors, nothing has been done to remedy this.

Stops were placed on the inner ends of the two outlet pipes in the north section, and bridges were built for operating them from the top of the banks. Similar stops are being prepared for the south basin.

At Fairmount reservoir a new cement walk was laid from the bridge entrance part way to the garden.

At Corinthian reservoir, the northwest and northeast corners were closed with iron railings, and a retaining wall was built at the incline on the southwest corner. The fence around this reservoir was almost entirely renewed or repaired.

The old watch boxes at both the Corinthian and the Spring Garden reservoirs were torn down and replaced by new and ornamental ones.

A new fence was placed around the Chestnut Hill reservoir, and the tank and the top of the tower were rebuilt.

On June 1, 1898, the engineers, oilers, firemen and coal passers were placed upon 8-hour time, in accordance with the provisions of the Act of Assembly, approved July 6, 1897. This shortening of the hours from 12 to 8, for a day's labor, necessitated the increasing of the force at the

stations from 25 to 33 engineers, from 50 to 63 oilers, from 90 to 104 firemen, and from 30 to 44 coal passers, and at the same time reduced the hours of laborers from 9 to 8 hours for a day's work.

In conclusion, I desire to state that, with the single exception of that at Frankford station, all the pumping machinery in the several stations of this Bureau has been operated to its maximum capacity and yet we have been unable to satisfy the demands of our people for water to be used and for still greater quantities of water to be wasted.

As it is imperative that some steps be taken looking to the adoption of means by which this over-taxed machinery can be relieved in the near future, I respectfully renew the following oft-repeated recommendations, and urge that action be taken in the matter:

For the relief of Belmont station I respectfully recommend that a pump or pumps, of not less than 20-million gallons capacity be installed, and that an engine house be built for their accommodation.

Also, that the 20-million gallon engine now unprotected at that station be provided with a suitable enclosure.

Also, that engines of 20-million gallons capacity be provided for the Roxborough pumping station, with engine house and extension of boiler house to cover boilers already contracted for.

Also, that one 5-million gallon pump be provided for the Roxborough high-service station.

Also, that one 3-million gallon pump be provided for the Belmont high-service station.

In this connection, I desire to call attention to the fact that unless some means are adopted to prevent the extravagant waste of water, pumps of far greater capacity will be required, in addition to those named, as soon as they can be built; otherwise, it will be impossible for the Bu-

PING STATION.

egg Garden.....

ont.....

STATE OF TEXAS

COUNTY OF ...

Know all men by these presents that ...

... of the County of ... State of Texas ...

reau to meet the daily increasing demands upon its already inadequate and over-taxed pumping facilities.

As it will require a year or more to construct the engines named in my recommendation above, I cannot too strongly urge the necessity of taking immediate action looking to their introduction at the stations specified.

Respectfully submitted,

F. L. HAND,

General Superintendent.

Total Capacity—2,500,000
gallons per day.

BELMONT HIGH SERVICE STATION.

No. 1.—Worthington Duplex—Capacity,
2,000,000 gallons per day.
No. 2—Snow—Capacity, 500,000 gallons
per day.

1898.	Running Time of each Engine in Hours.		Gallons Pumped by each Engine.		Total Pumpage per Month	Average Pumpage per Day.	Coal.		Percentage of Ashes.	Oil.		Mean Water Pressure.	
	No. 1.	No. 2.	No. 1.	No. 2.	Gallons	Gallons.	Tons. (2,240 lbs.)	Lbs.		Cylinder.	Engine.	No. 1.	No. 2.
January.....	204		9,804,240		9,804,240	316,265	53	990	.25	31	7	61	
February.....	169		8,110,125		8,110,125	289,647	41	960	.25	28	7	60	
March.....	186		8,623,270		8,623,270	278,170	50	570	.25	31	7	61	
April.....	218		10,653,050		10,653,050	355,131	56	940	.25	30	8	62	
May.....	272	2	13,010,330	47,210	13,057,545	421,211	61	450	.25	31	8	62	62
June.....	428		20,619,730		20,619,730	687,324	90	875	.25	30	7	61	
July.....	471		22,782,030		22,782,030	734,904	97	700	.25	31	8	62	
August.....	358		17,110,796		17,110,796	551,961	65	1,485	.25	46	8	61	
September.....	377		18,154,645		18,154,645	605,154	64	1,625	.25	45	13	63	
October.....	285		13,769,193		13,769,193	444,168	64	1,165	.25	46	8	62	
November.....	242		11,618,505		11,618,505	387,284	52	1,920	.25	45	8	61	
December.....	260		12,507,615		12,507,615	403,471	59	2,235	.25	47	8	61	
Totals and averages.....	3,170	2	166,763,534	47,210	166,810,744	457,015	749	475	.25	441	97	61	62

gallons per
 Jonval Turbine horizontal—5,330,000
 Total capacity per day—5,100,000

9,000 gallons per day.
 d. 10,000,000 gallons per day.
 .. 20,000,000 gallons per day.
 000,000 gallons per day.
 .000 gallons per day.

	OILS.	
	yl.	Engine.
	arts.	Quarts.
January		182
February ... 17		160
March..... 4		213
April..... 2		210
May..... 2		216
June..... 26		206
July.....		117
August..... 47		201
September.. 24		115
October.... 40		148
November.. 44		215
December.. 61		281
Totals and Averages	57	2,264

Mean Water Pressure and Mean Suction Lift in Pounds per Square Inch.					Gallons Raised 100 feet per pounds of Coal.
No. 5.	No. 6.	No. 7.	No. 8.	No. 11.	
50	50	58	86	54	567.8
54	54	54	80	80	528.7
52	52	57	80	50	489.0
54	50	56	84	52	513.9
52	50	52	64	52	537.5
54	54	54	81	54	494.2
52	52	52	81	52	542.8
54	54	54	82	54	484.9
50	.....	50	72	56	565.9
55	.....	60	85	52	574.0
58	.....	52	84	54	509.4
54	.....	54	87	52	574.9
53	62	54	81	55	533.9

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.

1898.	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 and Mean Suction Lift in Pounds per Square Inch.			Gallons Raised 100 feet per Pound of Coal.
												Cylinder.	Engine.				
	No. 1.	No. 2.	No. 3.	No. 1.	No. 2.	No. 3.	Gallons.	Gallons.	Tons. (2,240 lbs.)	Lbs.	Qts.	Qts.	No. 1.	No. 2.	No. 3.		
January	711	288	681	317,094,900	68,556,300	197,670,450	583,321,650	18,816,827	2,060	1,680	.25	679	717	160	145	158	469.9
February	593	191	621	286,348,880	46,291,400	187,317,360	519,952,640	18,569,737	1,773	680	.25	589	754	160	145	158	486.2
March	707	289	535	336,663,580	69,543,300	163,919,110	570,025,990	18,387,935	1,903	1,040	.25	576	904	160	145	158	497.1
April	707	819	247	347,071,920	75,953,650	80,695,740	503,721,310	16,790,710	1,566	1,180	.25	402	797	160	145	158	536.9
May	720	106	693	316,630,740	25,697,450	210,419,670	582,747,860	18,793,318	1,832	1,560	.25	429	855	160	145	158	527.9
June	702	330	673	349,688,040	72,714,550	196,674,090	619,076,640	20,635,888	1,916	680	.25	511	859	152	145	153	536.3
July	739	702	737	350,147,280	147,556,050	195,442,820	693,146,150	22,359,553	2,284	560	.25	594	893	150	148	151	503.8
August	700	661	704	332,954,760	144,496,900	201,048,870	678,500,530	21,887,113	2,201	980	.25	505	760	146	146	150	511.7
September	683	681	701	295,751,180	155,639,300	217,468,320	668,858,800	22,295,293	2,191	80	.25	570	762	146	145	150	506.8
October	735	701	743	316,452,480	151,270,100	219,720,600	687,443,180	22,175,586	2,368	1,640	.25	645	804	147	145	150	483.8
November	696	708	716	303,498,300	148,765,850	197,370,420	649,634,270	21,654,476	2,290	1,120	.25	655	740	150	145	150	470.8
December	735	699	712	315,327,600	150,379,200	198,212,970	663,919,770	21,416,766	2,862	1,560	.25	668	781	150	145	150	466.5
Totals & averages.	8,428	5,670	7,763	3,897,524,660	1,256,863,750	2,265,960,380	7,420,348,790	20,329,722	24,741	1,540	.25	6,823	9,626	153	145	154	497.9

Total Capacity, 5,000,000 gallons per day.

ROXBOROUGH HIGH SERVICE PUMPING STATION.

No. 1—Worthington Duplex, Capacity 5,000,000 gallons per day.

1898.	Runn'g time of each Engine in hours	Gallons Pumped by Engine.	Total Pumpage of each Month.	Average Pumpage per Day.	Coal.		Percentage of Ashes.	OIL.		Mean Water Pressure.		
					Gallons.	Gallons.		Tons. (2,240 lbs.)	Lbs.		Cylinder. Qts.	Engine. Qts.
January	744	94,687,860	98,687,860	3,183,479	160	2,010	.25	124	8	56		
February	672	92,135,346	92,135,346	3,290,518	141	640	.25	112	8	56		
March	741	107,016,920	107,016,920	3,452,158	155	1,610	.25	124	8	56		
April	682	96,646,370	86,646,370	3,221,545	153	190	.25	117	8	56		
May	744	106,911,880	109,911,880	3,545,514	163	1,950	.25	124	16	56		
June	720	112,343,020	112,343,020	3,744,767	162	1,050	.25	128	16	56		
July	738	125,204,290	125,204,290	4,338,848	183	930	.25	132	8	56		
August	742	122,308,850	122,308,850	3,945,446	178	1,930	.25	124	8	56		
September	699	123,503,000	123,503,000	4,116,766	173	380	.25	120	8	56		
October	744	130,457,160	130,457,160	4,208,296	181	1,490	.25	124	8	56		
November	717	127,759,360	122,759,360	4,091,979	177	1,170	.25	120	8	56		
December	712	119,213,130	119,213,130	3,845,584	179	.....	.25	124	8	56
Totals and averages	8,655	1,350,187,186	1,360,187,186	3,726,540	2,011	70	.25	1,473	112	56		

Total Capacity 3,000,000
gallons per day.

MOUNT AIRY HIGH SERVICE
PUMPING STATION.

No. 1—Davidson Rotary,
1,000,000 gallons per day.
No. 2—Davidson Rotary,
1,000,000 gallons per day.
No. 3—Knowles Rotary,
1,000,000 gallons per day.

1898.	Running Time of each Engine in Hours.			Gallons Pumped by each Engine.			Total Pumpage each Month.	Average Pumpage per Day.	Coal.		Percentage of Ashes.	OIL.		Mean Water Pressure and Mean Suction Lift in Pounds 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. (2,240 lbs.)			Qts.	Qts.	No. 1	No 2	No. 3	
									Lbs.	Lbs.							
January.....	744			34,648,750			34,648,750	1,117,761	96	1,960	.25	62	31	60			218.5
February.....	672	4		31,571,250	130,000		31,701,250	1,132,187	87	1,120	.25	56	28	60	60		221.4
March.....	744	8		35,073,750	390,000		35,463,750	1,143,991	83	580	.25	64	31	60	60		250.3
April.....	720	8		34,224,750	267,500		34,491,250	1,149,708	80	1,300	.25	60	30	60	60		251.5
May.....	744			35,575,300			35,575,300	1,147,590	83	80	.25	62	31	60			251.8
June.....	610	64		30,486,250	3,033,750		33,520,000	1,117,333	76	760	.25	58	30	60	60		253.3
July.....	724	94		36,001,250	4,436,250		40,437,500	1,304,435	86	1,860	.25	82	45	60	60		284.6
August.....	744	4		37,217,500	180,000		37,397,500	1,206,370	83	80	.25	80	31	60	60		275.2
September.....	680	64		33,308,750	3,225,000		36,533,750	1,217,791	82	820	.25	93	27	60	60		271.0
October.....	232	512		11,421,900	24,390,600		35,812,500	1,155,242	83	80	.25	93	31	60	60		253.5
November.....	20	701		975,000	32,377,750		33,352,750	1,111,758	80	800	.25	90	30	60	60		253.6
December.....	196	523		10,803,750	24,196,500		35,000,250	1,129,040	83	80	.25	78	31	60	60		257.6
Totals & averages	6,830	1,987		331,307,200	92,627,350		423,934,550	1,161,464	1,006	560	.25	878	376	60	60		257.4

Total Capacity, 750,000 gallons per day.

CHESTNUT HILL HIGH SERVICE STATION.

No. 1.—Knowles. Capacity, 250,000 gallons per day.

No. 2.—Worthington Duplex. Capacity, 500,000 gallons per day.

1898	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 and Mean Suction Lift in Pounds per Sq. In.		Gallons Raised 100 feet per Pound of Coal.
	No. 1.	No. 2.	No. 1.	No. 2.	Gallons.	Gallons.	COAL.			Cylinder.	Engine.	No. 1.	No. 2.	
							Tons. (2,240 lbs.)	lbs.							Qts.	Qts.
January.....							12	643	.25					
February.....		2		73,800	73,800	2,671	11	363	.25	1			50	3.2
March.....		4		152,520	152,520	4,920	12	1,309	.25	1			50	6.2
April.....		21		843,860	843,860	28,128	12	1,640	.25	3			50	34.1
May.....							11	1,949	.25					
June.....		222		8,442,720	8,442,720	281,424	24	1,108	.25	36			50	177.7
July.....		228		8,936,460	8,936,460	289,885	29	1,407	.25	35			50	156.3
August.....		92		3,619,820	3,619,820	116,768	16	952	.25	10			50	113.6
September.....		158		6,777,920	6,777,920	225,930	17	1,692	.25	15			50	196.8
October.....	14	73	405,600	2,373,200	3,278,800	105,770	14	852	.25	8		50	50	117.5
November.....	12	17	294,400	689,120	983,520	32,784	11	1,840	.25	3		50	50	42.8
December.....	13	69	389,500	2,519,350	2,908,850	98,833	16	492	.25	9		50	50	92.4
Totals and averages..	39	886	1,089,500	34,978,850	36,068,350	98,817	191	804	.25	121		50	50	97.1

DURIN

E PUMPAGE.

Chestnut Hill.

	1870	1871	1872	1873
	73,800	100,000	100,000	100,000
	152,520	150,000	150,000	150,000
	843,860	850,000	850,000	850,000
	8,442,720	8,500,000	8,500,000	8,500,000
	8,986,460	9,000,000	9,000,000	9,000,000
	3,619,820	3,600,000	3,600,000	3,600,000
	6,777,920	6,800,000	6,800,000	6,800,000
	3,278,880	3,300,000	3,300,000	3,300,000
	984,520	1,000,000	1,000,000	1,000,000
	2,908,850	2,900,000	2,900,000	2,900,000
	36,068,860	36,000,000	36,000,000	36,000,000
	31,194,170	31,000,000	31,000,000	31,000,000

APPENDIX C.

REPORT

OF

Assistant in Charge of Distribution.

Philadelphia, January 20, 1899.

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

DEAR SIR:—Experience during the past year fully justifies the repetition of a statement in my last report, that “we are about at the end of our resources for drawing water from one section to supply another, and, in the future, any material improvement to, and even maintenance of, the present unsatisfactory supply, must be provided for by additional expenditures for the construction of new works, or by a far better method—the restriction of the waste of water.”

Notwithstanding the urgent necessity for increasing the supply of water in many localities, it was impossible to extend the areas of any of the water systems for this purpose, even to afford temporary relief to neighboring sections, except in the case of the Queen Lane system, which was extended into the East Park district on the east, between Ninth and Sixth streets, and north from Montgomery avenue to Dauphin street, and on the west, along

Ridge avenue, to supply the lower levels of Manayunk, and relieve, in a measure, the over-taxed Shawmont pumping station.

Many attempts were made during the year to give relief where the conditions were extremely annoying to many of our citizens, and, as a final expedient, the dangerous practice of partially shutting off the water at night was resorted to, in order to reduce the consumption and enable us to store the water thus held back for supplying the needs of the following day. This method of saving water for the day consumption was practiced in connection with the gravity supplies in Germantown, Manayunk, and West Philadelphia, and was effective during the early part of the season, but later on the increase in demand and the decrease in pumpage—the latter due to lack of steam power or to the crippling of some of the pumping engines, brought about the former condition of low water in the reservoirs, and innumerable complaints from suffering water-takers immediately followed.

Residents of West Philadelphia have justly complained of having the meagre quantity which they received supplied to them by direct pumpage, and their appeals for more and better water have been numerous and persistent.

Manayunk is so fortunately situated topographically, that at no time was there a deficiency in the supply to that section, even when the night consumption was partially turned off in order to save water to supply Germantown, where the supply was also throttled at night; but in the latter case the supply was severely affected on the high levels, and numerous complaints were made, by residents, of their inability to obtain water on the second floors of their premises after the early part of the evening.

The northwest section of the City, particularly above Lehigh avenue and between Front and Sixth streets, suffered greatly from lack of water; but the conditions in

this section, aside from the waste of water, were due to the incapacity of the mains to deliver from the reservoir the quantity of water necessary to supply this district, where, at times, no water could be obtained on the second floors on week-days, and, in some instances, during the heated term, *none could be obtained on the first floors*—for cooking or any other purpose.

A serious feature in connection with an inadequate supply of water is the resulting frightful condition of the sanitary arrangements, which, without unremitting attention on the part of the occupants of a dwelling, would make it almost uninhabitable, and would be at all times sources of danger not only to the occupants but to the community as well.

The average daily pumpage throughout the City for the six months from May to October, was 284,874,000 gallons, which is equal to 202 gallons per capita per day. Computation of pumpage based on the displacement of the plunger, may be questioned by those who doubt the correctness of results so obtained; but computations in such manner are universal, and any exception to this method necessitates recourse to special arrangements for the purpose, and these are, in a more or less degree, expensive.

Admitting that the pumps do not discharge more than one-half of their computed capacities (which is an absurd proposition), there would still remain 101 gallons per capita per day, which numerous investigations show to be far in excess of all legitimate requirements, and there should therefore be an ample supply, with satisfactory pressures, in all parts of the City. The fact that this is not the case is almost wholly due to the number of openings or fixtures, in good and in bad condition, from which water is allowed to run to waste. We can partly judge from this what results might be expected from a practical application of

the sentimental theory that "water should be as free as air."

The great pipe systems of the City distribute to its inhabitants fully three or four times more water than can be properly used by them, yet, owing to useless waste on the part of a minority of its consumers, many of the majority who do not permit waste are deprived of even a necessary allowance.

In order to remedy this unfortunate condition of affairs, an expenditure of from two to three million dollars is needed for new pumping and supply mains, a proportionate amount for new pumps, and likewise for the purification of the additional quantity of water required.

A more effective remedy would be to adopt the meter system, which would undoubtedly prevent undue waste of water and would give many who are not now adequately supplied an opportunity to draw all the water they require from the volume which would be saved from waste by the use of meters.

During 1898 over thirty-four (34) miles of service mains were added to the distribution system, and to these pipes, in addition to those previously laid, 7,152 new attachments were made to supply additional water-takers. These outlets aggregate 1999.7 square inches in area, and, in a measure, account for the average daily increase in consumption of 17,138,748 gallons. Not a length of pipe is yet in service to provide for distributing from the reservoirs this additional quantity of water, or that which will be needed in 1899, and the above statements are submitted with a view to urging the importance of laying at once the proposed 48-inch main from Wentz Farm reservoir to Lehigh avenue, which, it is estimated, will cost \$490,000.

The Frankford station is provided with ample pumpage facilities for present requirements, and it is only necessary to lay this main to give the much-needed relief to the

northeast section of the City, where, as already stated, no water can be obtained at times even on the first floors of properties.

The following named mains are almost as urgently needed:

PUMPING MAIN.

From Shawmont station to Ann street and Shawmont avenue	36-inch	\$40,000
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SUPPLY MAINS.

Belmont System.

From Belmont reservoir to Thirty-eighth street and Lancaster avenue	30-inch,	163,000
From Sixty-third street and Lan-downe avenue to Overbrook.....	20-inch,	23,000

Corinthian System.

From Corinthian reservoir to Eleventh and Poplar streets	36-inch,	55,000
From Eleventh and Poplar streets to Eleventh and Green streets	30-inch,	22,000
From Eleventh and Green streets to Eleventh and Vine streets.....	20-inch,	12,500
From Broad and Green streets to Sixth and Green streets	16-inch,	12,500

Fairmount System.

From Fairmount reservoir to Broad and South streets	36-inch,	170,000
From Broad and South streets to Broad street and Washington avenue.....	30-inch,	20,000

East Park System.

From East Park reservoir to supply old city.....	48-inch,	375,000
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Queen Lane System.

From Nicetown lane and Thirty-second street to Germantown avenue.....	48-inch,	130,000
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Evidence of Waste of Water.

In former reports frequent mention was made of investigations to ascertain the quantities of water used and wasted in the several sections examined. These investigations show absolute waste ranging from 62 to 86 per cent of the total consumption; and many persons who, through their occupation, have opportunity for observing fixtures connected with the delivery of water, state that they know of numerous instances where there is an absolutely unnecessary waste of water, which could and should be prevented, and that this waste amounts to many times the quantities required for an abundant supply to the consumers.

A certain saloon keeper, who complained of the amount of his water bills, repeatedly asked to have the meter removed from the supply pipe on his premises and to be permitted to pay his water rent at schedule rates, which would amount to \$40 per annum.

The meter in question was set on May 21, 1897, and registered at a rate equivalent to a water bill, for the entire year, of \$77.19. In February, 1898, a leak was discovered in the beer motor upon the premises. This was immediately repaired, and, as a result, the meter bills for 1898 amounted to only \$42.72, a sum satisfactory to the saloon keeper as well as to the City.

Investigation disclosed the fact that air escaping from the leaky beer motor caused it to do additional work, and, of course, to consume more water, and this waste would have continued had it not been for the high registering of the meter, which led to the examination. There are doubtless many of these unseen and unsuspected leaks which the application of a meter alone would detect.

An inspection, by means of a Deacon meter, of the block between Huntingdon street and Lehigh avenue and

Ninth and Hutchinson streets, showed an average consumption as follows:

Time.	6 HOURS.	12 HOURS.	24 HOURS.
	Gallons.	Gallons.	Gallons.
6 A. M. to 12 M.....	23,311		
12 M. to 6 P. M.....	22,720	46,230	
6 P. M. to 12 P. M.....	22,960		
12 P. M. to 6 A. M.....	19,993	40,983	87,213

During a period of five (5) hours, from 12 P. M. to 5 A. M., when presumably little, if any, water was being used, the meter registered 16,543 gallons, or 19 per cent of the twenty-four hours' consumption. This water was undoubtedly being wasted, and if the waste continued at the same rate during the remaining nineteen hours out of the twenty-four, it would equal 79,400 gallons out of the total consumption of 87,213 gallons, leaving only 8,713 gallons, or 20 gallons per capita actually used. Even if this estimate be questioned, it surely demonstrates that there is every indication of considerable waste, and this is further verified by the per capita consumption, in this section, of 211 gallons per day.

Meters have been placed for experimental purposes on a number of residences, some of which are occupied by prominent citizens. It is probable that no unnecessary waste is permitted in these dwellings, and the consumption was found to be only 34.4 gallons per capita per day. Certainly if so small a quantity would suffice for all needs and purposes where there was no restraint or inducement to economize, a similar quantity should be ample in less pretentious dwellings, and the disparity shown can be accounted for only by the difference between careful use and extravagant waste.

Many instances might be cited which indicate extensive waste, but, aside from that which is visible to the eye and that which has been measured by meters, there is no more conclusive evidence of it than that shown by a comparison of the consumption during the four quarters of the day, of which the following, selected at random, is an illustration:

CONSUMPTION OF WATER DURING TWENTY-FOUR HOURS.

	6 A. M. to 12 M.	12 M. to 6 P. M.	6 P. M. to 12 P. M.	12 P. M. to 6 A. M.	Total.
Gallons.....	77,386,110	78,270,841	67,450,032	68,959,608	292,066,591
Per Cent.....	26.5	27.3	23.5	23.3	100

Our Deacon meter investigations show that between midnight and 6 A. M. only about 10 per cent of the consumption during this period is actually used, and that the balance of it, or 90 per cent, is wasted. In all these investigations the waste has been traced directly to the fixtures from which it was discharging; and, furthermore, it was found that the sum total of the leaks or discharges accounted approximately for the 90 per cent of the water which was being wasted.

If 10 per cent be deducted from the above consumption during the hours from 12 P. M. to 6 A. M., the waste during that period would be 57,563,648 gallons, which, continued at the same rate during the balance of the twenty-four hours, would make a total of 230,254,592 gallons wasted, and leave, out of the total day's supply, 56,811,999 gallons actually used, or approximately 40 gallons per capita.

This estimate of water used and water wasted compares closely with the results obtained with the Deacon meter in local examinations, and it is not far from the true proportions of the quantities actually used and those wasted.

Pennsylvania Avenue Subway.

All the work in connection with the alteration of the lines of mains crossing the Pennsylvania Avenue Subway has been completed with the exception of lowering the 6-inch pipe in Thirteenth street, relaying the 6-inch pipe at sub-grade in Seventeenth street, and the 48-inch main in Green street, and the substitution of a single line for the two 36-inch mains at Fairmount avenue.

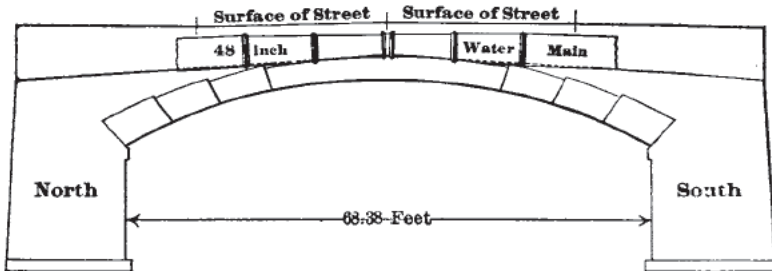
At Twenty-fourth street, at Green street and at Fairmount avenue, there was not sufficient space between the street surface and the top of the arch in which to lay 48-inch mains, and at Fairmount avenue two 36-inch pipes were substituted for the original 48-inch line. In order to lay these two 36-inch lines and have sufficient covering over them for paving the street, it was necessary to imbed them in the masonry to a depth of a little over two-thirds of the brick ring. Objection was afterward made to this construction by the railroad engineers, who insisted that the brick rings of the arches at Twenty-fourth street and at Green street should remain intact.

It was finally decided to overcome the difficulty of insufficient space over the tunnel in which to lay the 48-inch mains, by reducing the mains from 48 inches diameter to 30 inches each side of the centre of the arch, as shown in Fig. 1. The reduced sections straddling the arches are 36 feet $7\frac{1}{2}$ inches in length; the throat ratios are as 1 to 2.51; the top is straight and the bottom is 18 inches higher at the centre than at the ends, thus permitting the line to be laid that much lower and thereby obtaining the space necessary for paving.

Both the 48-inch mains in Twenty-fourth street have been equipped with reduced sections as described above, and have been tested with a view to ascertaining the loss of head, due to the contractions, with the following results:

Velocity. Feet per second.	Discharge in 24 hours. Million gallons.	Loss of head Feet.
.998	14.3	.04
6.526	51.9	.51

The tests show so little loss of head due to the contractions that there was no hesitancy in applying the same arrangement to the Green street main, also, at the request of the railroad engineers, to substitute a similar section for the two 36-inch mains imbedded in the masonry of the arch at Fairmount avenue, all of which work is now under way.



CROSS SECTION OF PENNSYLVANIA AVE SUBWAY AT TWENTY-FOURTH ST.,
SHOWING REDUCTION OF THE 48-INCH MAIN AT THE CENTRE

Of the thirty-two service, supply and pumping mains crossing the line of the Subway, many were temporarily removed during the progress of the work, but the most important, particularly those mains upon which the lower part of the City is dependent for its supply, were maintained in position and use and were subject to all the dangers incident to the construction of the Subway. The immunity from any serious accident throughout the entire period of construction was owing to the careful handling of the work by the contractors, Messrs. E. D. Smith & Company, and to the application of the knowledge and experience of Mr. John Montgomery, Purveyor of the



VIEW AT TWENTY-FOURTH STREET AND PENNSYLVANIA AVENUE SUBWAY,
SHOWING METHOD OF SUPPORTING 48 INCH MAINS.

Fourth District, who was in active charge of the alterations in the lines of mains.

Appended hereto is a list of the pipes laid and re-laid in connection with this work during 1898.

Meters.

The regulations now governing the application of meters are simply a means by which the consumer may endeavor to reduce the amount of his water rent; for if upon trial it is found that the amount by meter is greater than that by schedule rates, he has only to make the request and his property will be restored to schedule rates.

Under these circumstances the City not only loses the expected benefit to be derived from charging for water actually consumed, but also the expense in connection with the setting and removing of meters. Either the present regulations should be changed so that when meters are placed on service pipes at the request of consumers they should remain there for a reasonable period, or the use of meters should be wholly discontinued except for detecting the illegal use of water from fire connections, and in such cases where the source of supply is both public and private, as provided for in the ordinance of Councils of July 9, 1897.

The old 12, 20 and 48-inch Venturi meters have been in almost constant use during the past year, and a new 20-inch meter of this class was purchased and placed on the discharge pipe of No. 2 pump at the Roxborough auxiliary pumping station. This meter was used for informal tests of the d'Auria pump and it still remains in position for future use.

The 30 and 36-inch meters were procured for the Belmont pumping mains, but owing to the impossibility of dispensing with the use of these mains for a sufficient length of time to attach the meters, the latter have not yet been placed in their intended positions.

A Pitot meter was used to ascertain the discharge from the 48-inch supply main at Twenty-fourth street and Pennsylvania avenue Subway, but the result obtained differed nearly 8 per cent from that computed from the difference of head due to the velocities in the main and the contracted area of the reduced section of the main previously described herein.

The lateness of the season prevented a continuation of the experiments with a view to ascertaining the reason for the disparity noted between the two results obtained, but this information will be obtained at the earliest opportunity.

Pipe Cleaning.

In accordance with your instructions, a test was made of the Kear-Wells Company's device for removing incrustations from the interior of water pipes, it being applied to a length of 400 feet of the 6-inch main in the north side of Market street, between Sixteenth and Seventeenth streets. This main, which was laid in 1834, shows considerable incrustation on the inner surface.

The Kear-Wells device consists of two sections fastened together tandem, each section being provided with two sets of spring steel blades which are attached to a cylinder parallel with the axis, one set being placed in advance of the other. The steel blades are broadened on the outer ends and flare outwardly in such manner as to form, when free, a circle about two inches greater in diameter than the pipe to be cleaned.

The method pursued in cleaning is to draw this apparatus through the pipe by horse or windlass power, which operation causes the steel scrapers to press against the walls of the pipe with sufficient force to remove the incrustations.

Preparations for the test were made, first, by excavating the trench for a distance of 24 feet at Sixteenth street, and another for a distance of 8 feet at Seventeenth street, after

which a section of pipe was removed from the 24-foot trench and a Gem meter was attached to the 400-foot length of pipe to be cleaned. Water was then turned on at Seventeenth street, and the quantity discharged in a given time was noted. The meter was removed and a short section of the pipe was taken out of the 8-foot trench. Sections of $\frac{1}{2}$ -inch gas pipe, 16 feet in length, were then inserted into the main, one after the other, at the 24-foot opening, these sections being joined end to end and forced by hand through the pipe until the 8-foot opening at the other end was reached. A steel cable was then attached to the exposed end of the rod, after which the rods were withdrawn and disconnected, one after the other, at Sixteenth street, and the cable was drawn through the pipe. The opening in the main at Seventeenth street was then closed and the water turned on.

The cable, after passing around a pulley at Sixteenth street, was drawn through and then back over the pipe line by a pair of horses; the operation being intermittent, in order to permit water to pass the scrapers and wash out the accumulations in the pipe and thus prevent them from becoming jammed. In this manner the apparatus was sent once through the pipe, after which the meter was re-attached to the main and the discharge ascertained to have increased 94 4-10 per cent.

The time required to clean the 400-foot section was 41 minutes and 17 seconds. The cost of labor in connection therewith, including that for excavation of trench, etc. (exclusive of expense in connection with meter), was 13 7-10 cents per lineal foot of pipe cleaned. This amount would be considerably reduced after our men became familiar with the operation of the device, and the expense would also be further reduced by cleaning sections of greater length than the 400 feet experimented upon.

To the above cost of labor, etc., of 13 7-10 cents per

lineal foot, there must be added a royalty for the use of the Kear-Wells Company's device.

There is no doubt that the removal of incrustations from the interior of our old water pipes, especially from those which have been in service from 30 to 50 years, would result in a much higher pressure on the mains and better supply and fire protection in localities greatly deficient in these respects. I am not, however, prepared to state the length of time this improvement would last, as this could be determined only by experiment.

Broken Mains.

One hundred and twenty-eight breaks occurred in the water mains during the year, and for sixty of these no reason can be assigned. One of the most serious of these breaks was that which occurred at 10 P. M., September 26th, to the 30-inch supply main between the high-service stations at Chestnut Hill and at Roxborough at a point on Hartwell avenue southwest of the Pennsylvania Railroad. During the making of repairs to the main in question (which were completed and the water turned in on the following day, at 8 P. M.), the high elevations in Chestnut Hill were deprived of water.

Another, equally serious, was that which occurred at 3.30 A. M., December 6th, to the 36-inch supply main in Twenty-sixth street, between Poplar and Parrish streets. The Bureau was notified of the break at 3.45 A. M., and at 4.20 A. M. the men succeeded in getting the water shut off. The break was of such nature that it required a new piece of pipe to repair the main, and the work of inserting this was completed at 1.30 P. M.—about 10½ hours after the break occurred.

The water escaping from the broken pipe flooded a number of streets and cellars, but no serious damage resulted.

A few hours after the water was turned on, or at about

7.05 P. M., another break occurred in this main, in Thompson street, between Taney and Twenty-sixth streets. Some difficulty was experienced in getting the water shut off in this instance, owing to the flooding of the street where the nearest stops were located, and it became necessary to resort to the closing of a main stop at some distance from the scene of the break. The water was eventually shut off at 7.45 P. M., and it was then found that a large piece had broken out of the pipe. The street surrounding it was badly washed out and the cellar of the school house in the immediate vicinity was flooded by the escaping water. The streets in the neighborhood were also flooded over a considerable area, but little damage was done to private property.

Mains.

The following is a statement of mains laid, relaid, taken up, etc.:

New Work.

Service mains laid.....	150,264 feet.
Supply mains laid.....	18,896 feet.
Pumping mains laid.....	2,387 feet.
Connections, etc.....	11,281 feet.
Total	182,828 feet.

*Comparison of Conditions relating to the Distribution—
1897-1898.*

	1897.	1898.	Increase.	Decrease.
Service mains, 4-in. to 12-in.....	135,112	150,264	15,152	
Supply mains, 8-in. to 48-in.....	15,062	18,896	3,834	
Pumping mains, 20-in. to 48-in.....	220	2,387	2,167	
Connections and miscellaneous work..	11,416	11,281		135
Totals in feet.....	161,810	182,828	21,153	135
Relaid, 4-in. to 48-in.....	45,902	38,555		7,347
Miscellaneous repairs, 3-in. to 48-in..	3,228	5,796	2,573	
Taken up, 3-in. to 48-in.....	34,612	34,793	181	
Lowered, raised, shifted, 4-in. to 48-in.	6,433	6,570	137	
Totals in feet.....	90,170	85,714	2,891	7,347
Pipe cut off and aban'd, 3-in. to 30 in.	10,121	10,583	462	

Meters.

	1897.	1898.	Increase.	Decrease.
Meters in use.....	1,386	1,481	95	

*Number of Dwellings and of Principal Appliances for the
Use of City Water.*

	1897.	1898.	Increase.	Decrease.
Dwellings with water.....	219,508	225,958	6,450	
Dwellings without water.....	12,588	12,605	17	
Water-closets.....	187,664	202,399	14,735	
Baths.....	154,668	161,453	6,795	
Wash-paves.....	31,966	32,398	7,432	
Basins and sinks.....	81,226	85,401	4,175	
Urinals.....	4,709	4,892	123	

Repairs.

Mains relaid.....	38,555 feet.	
Repairs and connections	5,796 feet.	
		44,351 feet.
Old pipe taken up.....	34,793 feet.	
Pipes lowered, raised and shifted	6,570 feet.	
		41,363 feet.
Total.....		85,714 feet.

Abandoned.

Three-inch	1,714 feet.
Four-inch.....	4,272 feet.
Six-inch.....	3,707 feet.
Ten-inch.....	30 feet.
Twelve inch.....	860 feet.
	10,583 feet.

The total quantity of pipe handled for all purposes throughout the year was 268,542 feet, weighting 13,006,775 pounds.

The total quantity of new pipe laid was 182,828 feet, or 34.63 miles, making, in addition to that previously laid, 1,278.02 miles now in use.

Fire Hydrants.

New style fire hydrants in new locations.....	618
Old style fire hydrants in new locations.....	0
New style fire hydrants in place of old style.....	267
Old style fire hydrants in place of others of the old style.....	1
	886
Total.....	886
New style fire hydrants taken out.....	44
Old style fire hydrants taken out.....	54
	98
Total.....	98

The total number of new style fire hydrants added to the distribution system was 520, and the total number in use December 31, 1898, was 11,621, of which 903 are of the old style and 10,718, or 92.2 per cent are of the new pattern.

Drills for Attachments.

The following new attachments were made to the mains:

One-half inch.....	6,484	area of openings.....	1,273	square inches
Five-eighth inch.....	323	area of openings.....	99	square inches
Three-quarter inch.....	138	area of openings.....	61	square inches
1 inch.....	82	area of openings.....	64	square inches
One and one-quarter inches	8	area of openings.....	10	square inches
One and one-half inches.....	26	area of openings.....	46	square inches
Two inches.....	75	area of openings.....	236	square inches
Three inches.....	8	area of openings.....	57	square inches
Four inches.....	4	area of openings.....	50	square inches
Six inches.....	4	area of openings.....	113	square inches
Total.....	7,152	area of openings.....	2,009	square inches

The following attachments, including the ferrules, service pipes and curb stops were put in from the street mains to the curbs, by employees of this Bureau, in order to provide for possible future service without breaking of street pavements (see Table A).

Meters.

During the past year one hundred and fifty (150) meters have been set in new locations. Eighty-seven (87) meters that were defective, or where a different size or style was required, have been renewed, and forty-eight (48) were removed where the use of water by meter was discontinued.

The total number of meters in use December 31, 1898, was one thousand four hundred and eighty-one (1,481), an addition of ninety-five (95) to the number in use during the previous year.

Tabulations of the work performed and expenditures made are submitted herewith; also report of Captain Theodore S. S. Baker, Chief Pipe Inspector, relative to the inspection of pipe and other castings.

Yours respectfully ,

ALLEN J. FULLER,

Assistant in Charge of Distribution.

Philadelphia, January 20, 1899.

MR. ALLEN J. FULLER,
Assistant in Charge of Distribution.

DEAR SIR:—I have the honor to submit the following report of inspections of pipe and special castings made, with the aid of two assistants and one temporary assistant, during the year 1898, for the Department of Public Works, Bureau of Water, at the following named foundries:

Camden Iron Works.

Donaldson Iron Company.

McNeal Pipe and Foundry Company.

Reading Foundry Company, Limited.

William S. Rhodes & Company.

The quantities of castings inspected, rejected, cancelled and accepted will be found in list attached hereto.

Yours respectfully,

THEO. S. S. BAKER,

Chief Pipe Inspector.

SERVICE AND SUPPLY MAINS LAID DURING 1898.

FIRST DISTRICT.

Comprising the 1st, 2d, 3d, 4th, 26th, 30th, 36th, and 39th Wards.

Purposes for which used.	SIZE IN INCHES.								Total in feet and pounds.
	3	4	6	8	10	12	16	20	
New pipe or feet added.	Service mains.....			15,294	1,351	2,619			19,264
	Supply mains.....					6,057	7,628	54	14,139
	Supply main connections.....					269	57	35	374
	Fire hydrant connections.....			802					872
	Total.....			16,096	1,751	8,945	7,685	89	409	34,575
			531,168	56,712	491,075	553,320	9,790	65,031	1,708,026
Pipe used, but adding nothing to feet in ground.	Pipe relaid.....			13,227	62				13,289
	Repairs, general.....			420	6	75	22	3	526
	Pipe taken up.....	203	12,860	118					13,181
	Pipe lowered.....			184		55			239
	Total.....			13,949	68	130	22	3	27,235
	3,045	244,340	460,317	2,856	7,150	1,584	330	65,031	719,022
Total handled.....			30,045	1,419	9,075	7,707	92	409	61,810
	3,045	244,340	991,485	59,598	499,125	554,904	10,120	65,031	2,427,648
Pipe cut off and abandoned.....		134	110						244

SECOND DISTRICT.

Comprising the 5th, 6th, 7th, 8th, 9th, 10th, 24th, 27th, 34th and 40th Wards.

Purposes for which used.	SIZE IN INCHES.										Total in feet and pounds.		
	3	4	6	8	10	12	20	30	36	48			
New pipe or feet added.	Service mains.....			34,479	8,938	780	525					44,722	
	Pumping mains.....							1,400				1,400	
	Service-main connections.....			92								92	
	Pumping-main connections.....		9									9	
	Service-supply connections.....		141									141	
	Fire-hydrant connections.....			1,705								1,705	
	Fire connections (private).....		40	63								103	
	Supply connections (private).....	215	212	122								549	
Total.....	{ Feet.....	215	402	36,461	8,938	780	525	1,400				48,721	
	{ Pounds.....	3,225	7,638	1,203,213	373,396	42,901	37,800	222,600				1,892,772	
Pipe used, but adding nothing to feet in ground.	Pipe relaid.....		64	4,856	36		860					5,816	
	Repairs general.....	3	44	614	59	51	83	17	12	8	9	960	
	Pipe taken up.....	632	1,888	456								2,976	
	Pipe lowered.....			16								16	
	Pipe raised.....			46								46	
	Pipe shifted.....			35			72	1 30				267	
	Total.....	{ Feet.....	635	1,996	6,023	95	51	1,015	147	12	8	9	9,991
		{ Pounds.....	9,625	37,924	198,759	3,990	2,805	73,980	23,373	3,984	3,376	5,265	362,061
Total handled.....	{ Feet.....	870	2,398	42,484	9,033	831	1,510	1,547	12	8	9	58,712	
	{ Pounds.....	12,750	45,562	1,401,972	379,386	45,705	110,880	245,973	3,984	3,376	5,265	2,254,853	
Pipe cut off and abandoned.....	1,281	948	426			860						3,515	

THIRD DISTRICT.

Comprising the 11th, 12th, 16th, 17th, 18th, 19th, 23d, 25th, 35th, and part of 22d, 33d and 37th Wards.

Purposes for which used.	SIZE IN INCHES.									Total in feet and pounds.	
	3	4	6	8	10	12	16	30	48		
New pipe or feet added.	Service mains.....			22 313	647	1,588	1,401				26,039
	Supply mains.....						2,388				3,382
	Supply main connections.....					13	35	994			48
	Bye-pass connections.....			60	85						145
	Service supply connections.....		78								78
	Fire hydrant connections.....			1,859							1,859
	Fire connections (private).....			81							81
	Supply connections (private).....	18	45								63
	Drains.....			11							11
	Total { Feet.....	18	123	24,324	732	1,601	3,914	994			31,706
{ Pounds.....	270	2,337	802,692	30,744	88,055	281,808	109,340			1,315,246	
Pipe used but adding nothing to feet in ground.	Pipe relaid.....		10,869		23	914				11,806	
	Re-pairs, general.....		71	1,364	41	78	8			1,608	
	Pipe taken up.....	108	5,584	4,887				33	13	10,549	
	Pipe shifted.....			1,206						1,206	
	Total { Feet.....	108	5,655	18,296	41	101	922		33	13	25,169
{ Pounds.....	1,620	107,445	603,768	1,722	5,555	66,384		10,956	7,605	805,055	
Total handled	{ Feet.....	126	5,778	42,620	773	1,702	4,836	994	83	13	56,875
	{ Pounds.....	1,890	109,782	1,406,460	32,466	93,610	348,192	109,340	10,956	7,605	2,120,301
Pipe cut off and abandoned.....	298	411	937							1,646	

FOURTH DISTRICT.

Comprising the 13th, 14th, 15th, 20th, 28th, 29th, 32nd, and part of 37th and 38th Wards.

Purposes for which used.	Size in Inches.													Total in feet and pounds.		
	3	4	6	8	10	12	16	20	22	24	30	36	48			
New pipe or feet added.	Service mains.....		163	10,476		81	1,859								12,579	
	Supply mains.....					14		243							479	
	Service main connections.....						12								14	
	Supply main connections.....														12	
	Fire-hydrant connections.....			404											404	
	Fire connections (private).....			16											16	
	Supply connections (private).....	14	54	26	26										120	
	Drains.....			13											13	
	Total { Feet.....	14	217	10,985	26	95	1,871		243						236	13,637
	{ Pounds.....	210	4,123	869,855	1,092	5,225	134,712		38,637						138,060	682,914
Pipe used, but adding nothing to feet in ground.	Pipe relaid.....			3,167		111	593		148	100	301	129	205	326	4,880	
	Repairs, general.....	5	38	1,222	8	11	50	5				29	24	34	1,426	
	Pipe taken up.....	8	1,666	2,203		140	334		845	1,124	10	475		659	7,464	
	Pipe lowered.....		15	659											674	
	Pipe raised.....			42						75					965	
	Total { Feet.....	13	1,719	7,293	8	262	777	5	993	1,299	311	633	229	1,867	15,409	
	{ Pounds.....	195	32,661	240,669	336	14,410	55,944	550	157,887	324,760	96,410	210,156	96,638	1,092,195	2,322,301	
Total handled	{ Feet.....	27	1,936	18,228	34	357	2,648	5	1,236	1,299	311	633	229	2,103	29,046	
	{ Pounds.....	405	36,784	601,524	1,428	19,635	190,656	550	196,524	324,750	96,410	210,156	96,638	1,230,255	3,005,715	
Pipe cut off and abandoned.....		424	2,097		30										2,551	

FIFTH DISTRICT.
Comprising the Twenty-first and part of the Thirty-eighth Wards.

Purposes for which used.	SIZE IN INCHES.										Total in feet and pounds.	
	4	6	8	10	12	16	20	30	36	48		
New pipe or feet added.	Service mains.....	1,814		853	606						3,278	
	Pumping mains.....								46	941	987	
	Supply main connections.....					27					27	
	Pumping main connections.....						98	397			495	
	Fire hydrant connections.....		147								147	
	Fire connections (private).....		6								6	
	Drains.....			166	48							204
Total.....	{ Feet.....	1,967	156	901	633	98	387		46	941	5,139	
	{ Pounds.....	64,911	6,562	49,555	45,576	10,780	63,121		19,412	550,485	810,394	
Pipe used, but adding nothing to feet in ground.	Repairs, general.....	22	70		7	17		2	6	8	5	137
	Pipe lowered.....		549			108		326				983
	Total.....	{ Feet.....	22	619		7	125		328	6	8	5	1,180
{ Pounds.....		418	20,427		385	9,000		52,152	1,992	3,376	2,923	90,675
Total handled.....	{ Feet.....	22	2,586	156	908	768	98	725	6	54	946	6,259
	{ Pounds.....	418	85,388	6,562	49,940	54,576	10,780	115,275	1,992	22,788	553,410	901,069

	New pipe or feet added.				Total in feet and pounds.
	24	30	36	48	
					150,264
				236	18,896
			46	941	2,387
					210
					494
					568
					1,001
					219
					7,607
					222
					732
					228
			46	1,177	182,928
			19,412	688,545	8,436,598
	301	129	205	326	38,555
		92	40	61	5,796
	10	475		659	34,793
					4,116
				848	1,011
					1,443
	311	696	245	1,894	85,714
	96,410	231,072	103,890	1,107,990	4,570,177
	311	696	291	3,071	263,542
	96,410	231,072	122,802	1,796,535	13,006,775
Pipe					10,588

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SIXTH DISTRICT.
Comprising the 22d, and part of 33d, 37th and 38th Wards.

PURPOSES FOR WHICH USED.		SIZE IN INCHES.							Total in Feet and Pounds.	
		3	4	6	8	10	12	16		30
New pipe or feet added.	Service mains.....			28,632	8,067	386	7,302			44,387
	Supply mains.....						900			900
	Service main connections.....			104						104
	Supply main connections.....					16	17			33
	Pumping main connections.....							64		64
	Bye-pass connections.....			736	100		20			856
	Fire hydrant connections.....			2,690						2,690
	Fire connections (private).....			16						16
Total.....				32,178	8,167	402	8,239	64		49,050
				1,061,874	343,014	22,110	593,208	7,040		2,027,246
Pipe used but adding nothing to feet in ground.	Pipe relaid.....			2,296	305		163			2,764
	Repairs, general.....	10		648	366	14	115	14	12	1,199
	Pipe taken up.....		274	349						623
	Pipe lowered.....			1,478			726			2,204
	Total.....	10	294	4,771	671	14	1,004	14	12	6,790
		150	5,586	157,443	28,182	770	72,288	1,540	3,984	269,943
Total handled.....		10	294	36,949	8,838	416	9,243	78	12	55,840
		150	5,586	1,219,317	371,196	22,880	665,496	8,580	3,984	2,297,189
Pipe cut off and abandoned.....		135	2,355	137						2,627

*Alterations to Water Pipes on line of Pennsylvania Avenue
Subway.*

Street.	Location.	PIPE.	
		Size.	Feet.
<i>Service Main (temporary).</i>			
Thirteenth street, east side, from 148 feet 3 inches south of south house line of Hamilton street north.....		4	168
<i>Supply Main Laid at Sub-grade.</i>			
Broad street, west side, from 10 feet south of north house line of Callowhill street, north		20	248
<i>Service Main Relaid at Sub-grade.</i>			
Broad street, from 18 feet north of south house line of Callowhill street to 14 feet 6 inches south of north house line of Noble street.		12	362
<i>Service Main Connection.</i>			
Broad street, west side, intersection of Callowhill street		10	14
<i>Service Main.</i>			
Pennsylvania avenue, north side, from centre of Fifteenth street to 100 feet east of east house line of Sixteenth street.....		6	325
<i>Supply Connection for Tank.</i>			
Pennsylvania avenue, north side, 164 feet east of east house line of Sixteenth street.....		4	45
<i>Service Main Relaid, Suspended from Bridge.</i>			
Nineteenth street, from 4 feet 3 inches south of north house line of Shamokin street to 1 foot south of north house line of Pennsylvania avenue		10	111
<i>Service Mains Relaid at Sub-grade.</i>			
Twenty-first street, east side, from 58 feet south of southwest house line of Pennsylvania avenue, north, to end of pipe relaid 1897.....		6	32
Twenty-first street, east side, from end of pipe relaid 1897 192 feet north of southwest house line of Pennsylvania avenue, north.....		6	7
Twenty-first street, east side, from end of pipe relaid 1897 16 feet 4 inches north of south house line of Hamilton street, north.....		6	32
<i>Supply Mains Relaid at Sub-grade.</i>			
Twenty-first street, east side, from 61 feet south of southwest house line of Pennsylvania avenue, north		20	17
Twenty-first street, east side, from 59 feet south of southwest house line of Pennsylvania avenue, north, to end of pipe relaid 1897.....		48	32

*Alteration to Water Pipes on line of Pennsylvania Avenue
Subway—Continued.*

Street.	Location.	PIPE.	
		Size.	Feet.
<i>Supply Mains Relaid at Sub-grade.</i>			
Twenty-first street, east side, from end of pipe relaid in 1897, 18 feet 2 inches north of south house line of Hamilton street, north.....		48	85
Twenty-first street, west side, from 62 feet 6 inches south of southwest house line of Pennsylvania avenue north to end of pipe relaid in 1897.....		20	31
Twenty-first street, west side, from end of pipe relaid in 1897 176 feet 7 inches north of southwest house line of Pennsylvania ave., north.....		20	100
Twenty-first street, west side, from 20-inch main 45 feet south of southwest house line of Pennsylvania avenue north to end of pipe relaid in 1897.....		24	15
Twenty-first street, west side, from end of pipe relaid in 1897 176 feet 7 inches north of southwest house line of Pennsylvania avenue north 39 feet 10 inches, thence west on south side of Hamilton street to connect with pipe relaid in 1897 9 feet 6 inches south-west of northeast house line of Pennsylvania avenue, and 97 feet 8 inches south of north house line of Hamilton street.....		24	253
<i>Service Mains Relaid over Tunnel.</i>			
Twenty-second street, from 13 feet 7 inches north of north house line of Hamilton street, north.....		6	120
Twenty-third street, from southwest house line of Pennsylvania avenue, north.....		6	112
Spring Garden street, south side, from 25 feet west of east house line of Twenty-third street, west.....		6	123
Spring Garden street, north side, from 4 feet 8 inches west of west house line of Twenty-third street, west.....		6	146
<i>Supply Mains Relaid over Tunnel.</i>			
Twenty-fourth street, east side, from 213 feet 7 inches north of north house line of Spring Garden street north.....		48	42
Twenty-fourth street, west side, from 240 feet north of north house line of Spring Garden street, north.....		{ 30 48	{ 20 38
<i>Service Main Relaid over Tunnel.</i>			
Twenty-fourth street, west side, from 208 feet north of north house line of Spring Garden street, north.....		6	125
<i>Supply Mains Relaid over Tunnel.</i>			
Pennsylvania avenue, northeast side, from south curb line of Green street, northwest.....		24	83
Green street, from 87 feet west of west house line of Twenty-fourth street, west.....		22	100

*Alterations to Water Pipes on Line of Pennsylvania Avenue
Subway—Continued.*

Street.	Location	PIPE.	
		Size.	Feet.
<i>Pumping Mains Relaid Over Tunnel.</i>			
Fairmount avenue, from 206 feet west of west house line of Twenty-fifth street, west.....		30	89
Pennsylvania avenue, northeast side, from 48-inch main, 50 feet 6 inches north of south house line of Fairmount avenue, northwest 116 feet 11 inches, thence southwest 11 feet.....		48	128
Pennsylvania avenue (south connection), from 48-inch main on northeast side, at a point 80 feet northwest of north house line of Fairmount avenue, and 23 feet southwest of northeast house line of Pennsylvania avenue, southwest.....		36	90
Pennsylvania avenue (north connection), from 48-inch main on northeast side, at a point 60 feet northwest of north house line of Fairmount avenue, and 23 feet southwest of northeast house line of Pennsylvania avenue, southwest.....		36	97
<i>For Drain From Thirty-Inch Main.</i>			
Fairmount avenue, 2 feet west of northeast house line of Pennsylvania avenue.....		6	13
<i>Service Main Laid to Supply Connection.</i>			
Thirtieth street, from 4 feet south of south house line of Ogden street, north to connect.....		10	81
<i>Supply Connection for Sandpipe.</i>			
Thirtieth street, east side, 64 feet south of south house line of Ogden street.....		6	

Total Feet of Pipe in Use December 31, 1898.

Size in inches.	Total in use Dec. 31, 1897.	EXTENSIONS AND RELAYS DURING 1898.		Total.	DEDUCTIONS DURING 1898.			Total in use Dec. 31, 1898.
		Laid.	Relaid.		Taken up.	Abandoned.	Total.	
1	175			175				175
1½	3,566			3,566				3,566
2	3,855			3,855				3,855
3	102,719	247		102,966	951	1,714	2,665	100,301
4	321,954	742	64	322,760	22,272	4,272	26,544	296,216
6	4,448,477	121,961	34,415	4,604,853	7,983	3,707	11,690	4,593,163
8	199,735	19,370	403	219,508				219,508
10	356,191	12,724	134	369,049	140	30	170	368,879
12	365,334	22,867	2,330	390,531	334	860	1,194	389,337
16	110,519	1,245		111,764				111,764
18	16,085			16,085				16,086
20	215,468	2,449	148	218,065	845		845	217,220
22	1,630		100	1,730	1,124		1,124	606
28	27			27				27
24	2,405		301	2,706	10		10	2,696
30	208,422		129	208,551	475		475	208,076
36	72,390	46	205	72,641				72,641
48	142,992	1,177	826	144,495	659		659	143,836
Total.	6,571,944	182,828	38,555	6,793,327	34,793	10,588	45,376	6,747,951

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	16	20	30	36	48		
First.....													
Second.....	1	2	2	1	2		1	3	1				13
Third.....			1	10				1					13
Fourth.....		2	11		2	1					2		18
Fifth.....													
Sixth.....		1	9		2	3			1				16
Total.....	1	6	32	1	6	4	1	4	2	2	1		60

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.	
	3	4	6	8	10	20	30	36	48			
First.....				4	1							5
Second.....			2	21	1	1						25
Third.....			1	4	1	2						8
Fourth.....	1	1	9					1			1	13
Fifth.....				3	2		1		1	1		6
Sixth.....				3	6							9
Total.....	1	10	46	3	3	1	1	1	1	2		66

Recapitulation of Fire Hydrants Set, Renewed and Removed.

Districts.		STYLE.					Total.
		O.S.	No. 1.	No. 2.	No. 3.	No. 5.	
Set.	First.....		62	11			73
	Second.....		121	4			125
	Third.....		163	2			165
	Fourth.....		80	7			87
	Fifth.....		14				14
	Sixth.....		190	14			204
	Total.....		580	38			618
Renewed.	First.....		31	8			39
	Second.....	1	60	17			78
	Third.....		22	2			24
	Fourth.....		1	2			3
	Fifth.....		17				17
	Sixth.....		64	43			107
	Total.....	1	195	72			268
Total new hydrants.....							886
Removed.	First.....	3	1	3	4		11
	Second.....	7	5	2	3	1	18
	Third.....	13	5	1	1		20
	Fourth.....	3		4	3		10
	Fifth.....						
	Sixth.....	28	6	3	2		39
	Total.....	54	17	13	13	1	98
Total added during 1898.....							520

Fire Hydrants by Wards.

WARDS.	STYLE.						Total.
	O. S.	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	
First.....	12	181	69	8			270
Second.....	11	97	93	16			317
Third.....	9	67	43	6			125
Fourth.....	2	61	32	14			109
Fifth.....	23	98	51	12			184
Sixth.....	11	67	45	12			135
Seventh.....	14	103	83	9		1	310
Eighth.....	12	101	100	6		1	220
Ninth.....		123	70	6		1	200
Tenth.....		97	66	3		4	170
Eleventh.....	6	65	29	1			101
Twelfth.....	7	50	31	6			94
Thirteenth.....	35	49	55	10			149
Fourteenth.....		73	33				106
Fifteenth.....	16	175	173	10	1	2	377
Sixteenth.....	2	67	41	4	1		115
Seventeenth.....	12	78	30	2			122
Eighteenth.....	16	138	62	9			225
Nineteenth.....	36	271	125	5			337
Twentieth.....	36	107	121	2			266
Twenty-first.....	110	194	79	4			387
Twenty-second.....	124	814	266	36			1,240
Twenty-third.....	38	286	81	1			406
Twenty-fourth.....	94	202	127	18			441
Twenty-fifth.....	15	391	133	1			540
Twenty-sixth.....	3	186	124	14			327
Twenty-seventh.....	67	222	85	6		1	381
Twenty-eighth.....	1	118	122	23			264
Twenty-ninth.....	42	152	169	16		1	380
Thirtieth.....	11	107	112	6			236
Thirty-first.....		173	72	7			252
Thirty-second.....	18	101	85	12		1	217
Thirty-third.....	25	456	186	24	1		692

Fire Hydrants by Wards—Continued.

WARDS.	STYLE.						Total.
	O. S.	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	
Thirty-fourth.....	39	352	69	14	.....	1	475
Thirty-fifth.....	.....	67	11	.....	.....	.....	78
Thirty-sixth.....	15	196	102	29	.....	.....	342
Thirty-seventh.....	10	78	69	6	.....	.....	163
Thirty-eighth.....	22	290	99	11	.....	.....	422
Thirty-ninth.....	1	185	90	8	.....	.....	284
Fortieth.....	8	156	41	2	.....	.....	207
Total.....	908	6,794	3,527	381	3	13	11,621

Statement of the Number of Fire Hydrants by Districts and Wards during 1898, and total previous thereto.

	FIRST DISTRICT.										SECOND DISTRICT.										THIRD DISTRICT.										FOURTH DISTRICT.										FIFTH DISTRICT.		SIXTH DISTRICT.		Total.																																																						
	Wards.					Total.	Wards.					Total.	Wards.					Total.	Wards.					Total.	Wards.		Total.																																																																								
	1	2	3	4	5		6	7	8	9	10		11	12	13	14	15		16	17	18	19	20		21	22		23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39		40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93
Prior to 1898.....	1,889											2,483											2,807											2,081	21 38		1,439	22 33		11,101																																																											
During 1898.....	12 3 35 6	73	1	2	1	7	4	11	48	49	1	125	1	2	2	4	33	3	12	14	6	77	9	165	1	2	8	1	15	4	3	3	37	4	10	14	120	40	44	204	618																																																										
Total.....	1,902											2,608											2,972											2,068	21 38		1,643	22 33		11,719																																																											
Taken out, 1898....	1	3	5	1	11	3	1	1	2	8	3	18	2	2	2	5	1	6	2	1	1	20	2	20	2	3	2	8	4	1	10	10	10	19	9	11	39	98																																																													
Total in city.....	1,951											2,600											2,952											2,058	21 38		1,604	22 33		11,621																																																											

Number of attachments for fire purposes previously reported..... 649

First District.....	8
Second District.....	4
Third District.....	1
Fourth District.....	2
Fifth District.....	2
Sixth District.....	2
Total.....	661

Fire Hydrants by Purveyors' Districts.

DISTRICTS.	STYLE.						Total.
	O. S.	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	
First.....	61	1,090	696	104			1,951
Second.....	262	1,520	708	91		9	2,590
Third.....	159	1,971	765	55	2		2,952
Fourth.....	167	900	914	72	1	4	2,058
Fifth.....	112	267	81	6			466
Sixth.....	142	1,046	363	58			1,604
Total.....	908	6,794	3,527	381	3	13	11,621

*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.										Resumed for larger attachments.	Re-driven.	Discontinued.	Transfer.	REPAIRS.		Total.	DRAWN.			Total.	Drawn and re-driven.
	1/2-inch.	3/8-inch.	3/4-inch.	1-inch.	1 1/4-inch.	1 1/2-inch.	2-inch.	3-inch.	4-inch.	6-inch.					Total.	Not drawn.		Drawn and re-driven.	Discontinued and abandoned.	Delinquent.			Leak.	Total.
First.....	872	25	22	9	2	10	1			941		81	21		26	128	14	2	113	129	107	
Second.....	2,590	121	49	80	2	8	25	1		2,826	78	78	178	2	54	392	20	6	115	141	197	
Third.....	1,091	34	34	29	2	10	21	5	4	1,230	16	68	80	3	31	14	162	16	129	291	708	
Fourth.....	835	63	18	3	2	3	12	1	2	934	36	90	8	1	17	88	24	6	2	115	128	109
Fifth.....	231	4	3	3	2					245	1		6	3	5	28	43	1		1	2	16
Sixth.....	865	76	17	8		3	5			976	7	42	10	76	11	3	149	1			1	1
Total.....	6,484	323	138	82	8	26	75	8	4	7,152	135	359	248	85	64	223	1,114	188	26	473	687	1,138

Permits Issued During the Year 1898.

Aquaria.....	1	Ice cream saloons.....	5
Bakeries.....	18	Lawn sprinklers.....	3
Barber shops.....	135	Laundries.....	64
Bars.....	63	Laboratories.....	2
Basins and sinks in dwellings.....	4,332	Machines for scouring, rinsing, etc.....	8
Basins and sinks in offices and stores.....	259	Milk houses.....	27
Baths in dwellings.....	6,860	Motors, beer.....	138
Baths in hotels, etc.....	23	Motors, organ.....	13
Baths, shower.....	8	Photograph galleries.....	2
Bidets.....	1	Pantry sinks.....	287
Boats, etc., supply of.....	156	Pools, swimming.....	1
Bottling establishments.....	15	Pools in churches.....	5
Building purposes.....	529	Restaurants and eating saloons.....	41
Carriages and wagons.....	92	Slaughter houses.....	3
Cellar drainers.....	9	Stables.....	40
Dwellings, half.....	29	Stalls, in stables.....	595
Drug stores.....	31	Steam boilers, number.....	68
Dye houses.....	3	Steam boilers, horse-power.....	1,407
Factories.....	4	Steam engines, number.....	22
Ferrules, number.....	7,168	Steam engines, horse-power.....	88
Filters.....	1	Street sprinklers.....	211
Fire hydrants, for use of.....	174	Tubs, vats and tanks.....	31
Fish troughs and stands.....	3	Urinals in stores, offices, etc.....	65
Forges.....	5	Urinals, troughs.....	60
Fountains, counter.....	18	Wash-paves and screw-nozzles....	3,854
Fountains, garden.....	4	Wash-paves for watering horses..	38
Greenhouses.....	18	Wash-tubs, stationary.....	2,026
Heating boilers.....	27	Water-closets in dwellings.....	14,645
Hydrants in new buildings.....	6,570	Water-closets in stores, etc.....	301
Hydraulic elevators.....	1		

Premises Supplied and Appliances in Use January 1, 1899.

Aquaria.....	9	Filters	18
Arsenals.....	2	Fire stations	42
Asylums.....	8	Fountains, garden.....	31
Bakeries.....	1,416	Fountains, counter.....	467
Barber shops.....	1,433	Forges	1,176
Bars.....	1,652	Furnaces	26
Basins and sinks in dwellings.....	59,748	Gas works and holders.....	6
Basins and sinks in offices and stores.....	25,653	Glass works.....	14
Baths in dwellings.....	159,961	Green houses.....	961
Baths, public.....	1,160	Grind stones.....	141
Baths, shower.....	285	Halls and club houses.....	214
Baths, foot.....	107	Hatters planks, per set.....	16
Beam houses and tanneries.....	22	Hydrants.....	237,453
Bidets	432	Hospitals	45
Bottling establishments.....	609	Hotels.....	53
Brick yards.....	20	Hydraulic elevators.....	216
Brick yards, gangs of men.....	91	Ice cream saloons	278
Breweries.....	90	Institutions, charitable.....	79
Barrels brewed.....	1,999,643	Ice machines	141
Cars, steam and electric.....	1,139	Laundries	658
Carriages and wagons.....	8,514	Lawn sprinklers.....	255
Cellar drainers.....	21	Laboratories.....	34
Cemeteries.....	24	Machines for washing, scouring, etc.....	2,564
Churches	504	Marble yards	77
Coal yards.....	245	Malt houses	18
Coloring rooms.....	158	Market houses.....	69
Condensers.....	13	Milk houses.....	451
Depots and railroad stations.....	104	Mint	1
Dwellings with water.....	225,958	Motors, beer.....	1,666
Dwellings without water.....	3,221	Motors, organ.....	196
Dwellings half without water.....	9,384	Photograph galleries.....	125
Dyers	694	Photograph galleries, operators.....	168
Drug stores.....	323	Police stations and patrols.....	42
Dye houses.....	684	Polishing wheels.....	23
Engines on railroads.....	269	Pools, swimming.....	31
Factories, foundries and mills.....	1,627	Pools in churches.....	76

Premises Supplied and Appliances in Use—Continued.

Printing establishments	168	Steam saws.....	68
Prisons	4	Steam presses and hammers.....	57
Rectifying establishments.....	9	Shops and stores with water.....	4,973
Restaurants and oyster saloons...	951	Shops without water.....	962
Shot tower.....	1	School houses.....	304
Slaughter houses.....	451	Theatres.....	18
Soap boiling establishments.....	19	Tubs, vats, and tanks	2,053
Stand pipes for watering engines	26	Turbine wheels.....	31
Stables	7,312	Urinals in dwellings.....	172
Stalls in stables.....	48,752	Urinals in stores, offices, etc.....	4,189
Stalls in markets.....	6,921	Urinals, troughs	531
Stalls, fish and trough.....	88	Vinegar establishments.....	8
Steam boilers, number.....	8,089	Wash paves and screw nozzles...	92,398
Steam boilers, horse power.....	100,646	Wash paves for watering horses	543
Steam boilers, heating, number...	746	Wash tubs, stationary.....	23,409
Steam boilers, heating, horse power.....	4,814	Water closets in dwellings.....	177,360
Steam engines, number.....	1,369	Water closets in stores, etc.....	25,039
Steam engines, horse power.....	32,684	Wool washers.....	88

TABLE "A."

Service Attachments Laid to the Curb (on Streets to be Paved or Repaved) by the Bureau of Water.

DISTRICTS.	SIZE.
	$\frac{1}{2}$ -inch.
First	325
Second	900
Third	703
Fourth	423
Fifth	248
Sixth	1,627
Total	4,226

Account of New Stops and Check Valves for 1898.

DISTRICTS.	BUREAU OF WATER.		VINEY.		BAR-TON.	Smith Patent.	Check Valve.	Total
	2-Way.	Butterfly.	3-Way.	4-Way.	6-Way.			
First	164			3		5		172
Second	290	1	2		1	17	1	312
Third	234	1				8		243
Fourth	72	5	4	5				86
Fifth	35	1				1		37
Sixth	227					3		230
Total	1,022	8	6	8	1	34	1	1,080

*Repairs to Mains, Stops and Fire Hydrants, also Stops and
Fire Hydrants Removed during 1898.*

DISTRICTS.	Repairs to Mains.	STOPS.			FIRE HYDRANTS.		
		Repaired.	Renewed.	Removed.	Repaired.	Renewed.	Removed.
First.....	34	122	25	.....	856	81	11
Second.....	192	117	30	7	85	78	18
Third.....	231	310	111	7	213	24	20
Fourth.....	275	504	3	17	1,871	3	10
Fifth.....	12	1	6	1	.....	17	.....
Sixth.....	99	10	16	6	29	107	89
Total.....	843	1,064	191	38	2,554	260	98

Check Valves Put In.

	Location.	Ward.	Size.
Belmont Pumping Station, West Fairmount Park.....	17 feet south of south wall and 7 feet east of east wall of No. 1 Engine House, on No. 4 Pumping Main.....	24	36

Total Number of Stop Valves in the City—Arranged by Districts.

PATTERN.	Size.	Outlets.	DISTRICTS.						TOTAL.
			1st.	2d.	3d.	4th.	5th.	6th.	
Single Gate. Bureau of Water.	3	2 Way.	1	196	1	10	2	13	228
	4	2 Way.	90	224	169	168	39	95	785
	6	2 Way.	3,491	3,912	3,921	3,133	566	2,061	17,084
	8	2 Way.	128	323	80	77	7	63	678
	10	2 Way.	185	271	221	275	28	156	1,186
	12	2 Way.	84	331	249	130	44	176	1,014
	16	2 Way.	36	38	46	22	2	89	188
	18	2 Way.	.....	.....	5	.....	.....	1	6
	20	2 Way.	24	39	14	46	14	16	158
	30	2 Way.	8	10	23	38	10	3	92
	36	2 Way.	3	4	8	12	8	.....	85
	48	2 Way.	.....	.....	3	10	.....	.....	13
Totals.....			4,050	5,348	4,740	3,921	720	2,623	21,492
Butterfly. Bureau of Water.	20	2 Way.	.....	4	2	9	3	2	20
	30	2 Way.	2	1	2	9	9	1	24
	36	2 Way.	.....	.....	.....	17	.....	.....	17
	48	2 Way.	.....	1	1	26	17	.....	45
	Totals.....			2	6	5	61	29	3	106
Barton.	6	4 Way.	3	2	.....	12	.....	.....	17
	8	4 Way.	.....	.....	.....	5	.....	.....	5
	6	5 Way.	12	32	.....	.....	.....	.....	44
	6	6 Way.	.....	7	.....	.....	.....	.....	7
	Totals.....			15	41	17	.....	.....	73

Total Number of Stops, Valves, etc.—Continued.

PATTERN.	Size.	Outlets.	DISTRICTS.						TOTAL.
			1st.	2d.	3d.	4th.	5th.	6th.	
Viney.	6	2 Way.	7		4	3			14
	6	3 Way.	54	69	38	235	6	10	412
	8	3 Way.		5					5
	10	3 Way.				3			3
	12	3 Way.		2		3			5
	6	4 Way.	24	45	24	123	3	15	234
	8	4 Way.	1	6	2				9
	10	4 Way.		5		14			19
	12	4 Way.						2	2
	6	5 Way.	25	6	2	23			61
		Totals		111	138	70	409	9	27	764
Smith Patent.	3	2 Way.		10					10
	4	2 Way.		12	1				13
	6	2 Way.		23	8	2	6	4	43
	8	2 Way.	1		6				7
	10	2 Way.			3				3
	12	2 Way.	1	3	7				11
	16	2 Way.	4		2				6
	20	2 Way.		2			1		3
	Totals		6	50	27	2	7	4	96
Ludlow.	3	2 Way.		1					1
Total number of stops.			4,184	5,584	4,842	4,410	765	2,667	22,442
Check valves.	30				1		2		3
Bureau of Water.	36			1					1
	48				4	4	6		14
	Totals			1	5	4	8		18

*Number of Valves Raised in the several Districts during
the year 1898.*

Districts.	BARTON.			VINEY.		SINGLE GATE.							Total.	
	4-way.	5-way.	6-way.	3-way.	4-way.	8-inch.	6-inch.	10-inch.	12-inch.	20-inch.	30-inch.	36-inch.		48-inch.
First	4				1			2			1			8
Second.....		2	1	1	3	1	7	1	1		1			18
Third.....				1	1		9							11
Fourth.....	1			9	5		18	1				1	1	36
Total.....	5	2	1	11	10	1	36	2	1	1	1	1	1	78

Number of Complaints and Examinations during 1897 and 1898.

MONTHS.	Hydrants.		Service Pipes.		Wash-paves.		Spigots.		Water-closets.		Horse-troughs.		No Leaks.		Total.	
	1897	1898	1897	1898	1897	1898	1897	1898	1897	1898	1897	1898	1897	1898	1897	1898
January.....	132	124	117	105	15	18	1	3	19	14	2	.....	10	15	296	279
February.....	90	104	92	97	11	19	.....	4	9	22	.....	1	9	13	211	260
March.....	120	90	125	74	8	8	6	3	19	14	.....	.....	12	6	290	195
April.....	116	67	75	57	7	3	2	.....	50	19	2	1	10	5	262	152
May.....	136	101	72	64	8	2	.....	2	37	31	1	.....	8	11	362	211
June.....	132	90	77	73	6	6	1	4	71	27	1	.....	3	10	291	210
July.....	105	69	87	55	6	7	3	1	34	13	.....	1	11	8	246	154
August.....	100	136	96	69	5	3	2	5	10	20	1	1	13	9	227	243
September.....	106	101	69	91	9	4	3	6	12	15	.....	4	3	5	202	226
October.....	72	112	79	90	7	5	4	5	20	18	.....	3	6	5	188	238
November.....	116	91	70	76	3	6	5	7	19	17	1	1	3	6	217	204
December.....	103	111	123	151	9	10	4	8	17	29	1	.....	12	15	269	324
Totals.....	1,328	1,196	1,082	1,002	94	91	31	48	317	239	9	12	100	108	3,061	2,696

New Meters Set.

Wards.	Occupant.	Location.	Business.	Date When Set.	Name of Meter.	SIZE.								Total.	Gallons Consumed.	Remarks.
						1/8-inch.	3/8-inch.	1-inch.	1 1/2-inch.	2-inch.	3-inch.	4-inch.	6-inch.			
1	Brady, J. J.	S. E. cor. Dickinson and Swanson streets.	Paint works.	June 16.	Crown.		1							1	31,590	
1	Epiphany R. C. Church.	N. E. cor. Twelfth and Jackson streets.	School.	Feb. 14.	Crown.					1				1	1,673,250	
1	United Gas Imp't Co.	{ Ninth street, S. E. cor. Mifflin to N. E. } cor. Dudley	Gas works.	June 1.	Gem.						1			1	193,500	
1	United Gas Imp't Co.	{ Ninth street, S. E. cor. Mifflin to N. E. } cor. Dudley	Gas works.	June 3.	Crown.	2			1					3		
2	Milne, C. J., & Sons Co.	N. S. Washington ave. from 10th to 11th sts.	Mill.	Jan. 22.	Crown.					1				1	2,686,500	
2	Milne, C. J., & Sons Co.	N. S. Washington ave. from 10th to 11th sts.	Mill.	Jan. 24.	Gem.						1			1		
2	Grove Linseed Oil Co.	1034 Washington ave., S. E. cor. Eleventh st.	Lead pipe factory.	April 15.	Crown.		1	1						2	268,500	
2	Lussman, M.	935-37 South Fourth street.	Bath-house.	Mar. 22.	Crown.						1			1	1,059,000	
2	Mitchell & Pierson.	1012 Passyunk avenue.	Morocco factory.	June 10.	Crown.						1			1	3,110,250	
5	Brooks, Thomas.	229-31 South Fifth street.	Office building.	Jan. 19.	Crown.					1				1	375	
5	Pennsylvania R. R. Co.	300-08 South Delaware avenue.	Warehouse.	July 27.	Crown.		1							1	264,000	
5	Tatham, Chas.	232-34 South Fifth street.	Miscellaneous.	Dec. 9.	Crown.			1						1		No water used.
5	Thompson.	235-37 South American street.	Miscellaneous.	May 9.	Crown.			1						1	16,500	
6	Chorley, Henry F.	515 Summer street.	Brass works.	May 6.	Crown.		1							1	188,000	
6	Harvey Estate.	207-15 Cuthbert street.	Planing mill.	April 9.	Crown.					1				1	1,182,000	

New Meters Set—Continued.

06
Ward.

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Ward.	Occupant.	Location.	Business.	Date when Set.	Name of Meter.	SIZE.										Total.	Gallons consumed.	Remarks.
						1/2-inch.	3/4-inch.	1-inch.	1 1/2-inch.	2-inch.	3-inch.	4-inch.	6-inch.	20-inch.				
6	Kirschbaum Est., A. B.	306 Market street.....	Horse goods.....	July 11.....	Crown.....				1						1	168,000		
6	McGrath, Wm. V., Jr...	227-29 North Third street.....	Hotel.....	June 2.....	Crown.....				1						1	2,295,000		
6	Opdyke, Benj. P.....	237-41 Bread street.....	Miscellaneous.....	Sept. 8.....	Crown.....	1									1	5,250		
6	Quaker City Fruit Co...	Pier No. 5, North Wharves.....	Fruit wharf.....	Sept. 19.....	Gem.....						1				1	39,750		
6	Trotter, F. L.....	139 N. Second street.....	Furniture factory.....	June 12.....	Crown.....	1									1		No water used.	
6	Wilbur, H. O., & Sons...	235-41 N. 3d st. & W.S. Bread st.S. of New st	Chocolate manf.....	Sept. 2.....	Crown.....		1								1	52,500		
8	Freeman, Sam'l F.....	S. W. cor. Twelfth and Walnut streets.....	Auction house.....	April 15.....	Crown.....				1						1	209,250		
8	Gibson, John, Estate...	2217 Chestnut street.....	Plaster of Paris factory	Feb. 12.....	Trident.....		1								1	21,750		
8	Land Title & Trust Co.	S. W. cor. Broad and Chestnut streets.....	Office building.....	Jan. 22.....	Gem.....						1				1	16,638,300		
8	Real Est. Title & Tr't Co.	S. E. cor. Chestnut and Broad streets.....	Office building.....	Oct. 26.....	Gem.....						1				1	891,750		
9	Adams Express Co.....	N. W. cor. 22d and Ludlow streets.....	Stables.....	Dec. 6.....	Crown.....				1						1	69,750		
9	Mack Paving Co.....	1310 Arch street.....	Filter plant.....	April 25.....	Crown.....						1				1	4,461,000		
9	Wanamaker, Jno.....	1226 Market street and rear.....	Laundry.....	Dec. 19.....	Crown.....				1						1	78,000		
9	Wernwag, C. T.....	1709 Chestnut street.....	Miscellaneous.....	June 28.....	Hersey.....				1						1	33,750		
9	Wm. Penn Charter Sch'l.	8 S. 12th street.....	School.....	Dec. 20.....	Crown.....					1					1		No water used. Not charged by meter.	

New Meters Set—Continued.

Ward.	Occupant.	Location.	Business.	Date when Set.	Name of Meter.	SIZE.								Total.	Gallons consumed.	Remarks.
						1/2-inch.	3/4-inch.	1-inch.	1 1/2-inch.	2-inch.	3-inch.	4-inch.	6-inch.			
9	United Gas Imp. Co.....	Filbert st., S. W. cor. 22d to Schuylkill R.....	Gas works.....	June 13.....	Crown					1		5		6	} 47,013,750	
9	United Gas Imp. Co.....	Filbert st., S. W. cor. 22d to Schuylkill R.....	Gas works.....	June 21.....	Trident.....		1							1		
9	United Gas Imp. Co.....	Filbert st., S. W. cor. 22d to Schuylkill R.....	Gas works.....	July 6.....	Gem							1		1		
10	Mellor & Rittenhouse.....	214-18 N. Twenty-second street.....	Laboratory.....	April 4.....	Crown							1		1	27,219,000	} No water used.
10	Miller, Wm.....	233-35 N. Twenty-third street.....	Foundry.....	June 17.....	Crown			1						1		
10	Seeds, Thos. M., Jr.....	1025 Race street.....	Laundry	April 25.....	Crown			1						1	4,230,000	
10	Townsend, F. C., Trs't.....	2301-05 Cherry street.....	Mills	July 29.....	Crown		1	1						2	374,250	} No water used.
10	Wells, Geo. B.....	S. S. Vine street E. of Tenth street.....	Hat Factory.....	Jan. 17.....	Crown			1						1	5,250	
11	Bell, Samuel, Jr.....	416 North Second street.....	Bakery.....	June 4.....	Crown			2						2		
11	Goodman, Solomon.....	211 Vine street.....	Bath-house.....	Sept. 2.....	Gem					1				1	180,750	} 35,250
12	Roehm, John.....	847-51 N. 4th street and 848 Orianna street.....	Brewery.....	May 4.....	Crown						1			1	6,879,750	
13	Keeley, Mary E.....	N. E. cor. Eighth and Willow streets.....	Miscellaneous.....	Oct. 19.....	Gem					1				1		
13	Keeley, Mary E.....	N. E. cor. Eighth and Willow streets.....	Miscellaneous.....	Oct. 20.....	Crown		1							1		
13	Lippincott, W. A.....	811-13 Fairmount avenue.....	Foundry.....	June 7.....	Crown			1						1	83,000	} 906,750
14	Cooper, Wm. S.....	N. W. cor. Thirteenth and Hamilton streets.....	Brass works.....	April 2.....	Crown					1				1		

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New Meters Set—Continued.

Ward.	Occupant.	Location.	Business.	Date when Set.	Name of Meter.	Size.									Total.	Gallons Consumed.	Remarks.
						1/2-inch.	3/4-inch.	1-inch.	1 1/2-inch.	2-inch.	3-inch.	4-inch.	6-inch.	20-inch.			
14	Keystone Spring Wks.	N. W. c. Thirteenth and Buttonwood streets.	Spring works.....	Dec. 3.....	Crown			2							2	126,000	
15	Hankey A. & Son, Inc..	2233-37 Vine street.....	Foundry	June 15.....	Crown		1								1	964,500	
15	Lucas, Littlewood & Davidson.....	811-27 Taney street.....	Storage house.....	June 14.....	Crown					1					1	369,000	
15	United Gas Imp. Co.....	S. s. Calowhill street, East of Twenty-fifth st.	Gas works.....	May 31.....	Crown	1					1				2	102,750	
16	Estate of Mary Disston	83 Laurel street.....	Miscellaneous.....	Jan. 1.....	Gem							1			1	7,330,500	
17	Boyle.....	1210-20 Orianna street	Dye house.....	Feb. 10.....	Trident.....			1							1	94,500	
17	Burk & Bro.....	1212-24 and rear N. Third street.....	Packing house.....	Feb. 26.....	Crown						1				1	7,029,150	
17	Heimgaertner, Wm.....	1226-28 Frankford avenue.....	Brewery	May 26.....	Crown						1				1	634,500	
18	Hillman, C., Ship and Engine Building Co.,	1441 Beach and 1424-26 Beach street.....	Shipbuilding	March 5.....	Crown	1		1							2	1,986,700	
19	Gillingham, H. T.....	1708-12 N. Front st. and 105 Columbia ave..	Carpet mill.....	Nov. 25.....	Crown	1				1					2		No water used.
19	Hamilton, John.....	N. E. cor. Howard and Huntingdon streets..	Machine shop.....	May 12.....	Crown						1				1	2,733,750	
19	Harvey's, J., Estate.....	1716-22 N. Fifth st. and 1711-13 Randolph st.	Miscellaneous.....	Mar. 28.....	Crown.....				1						1	1,519,500	
19	Harvey's, J., Estate.....	1716-22 N. Fifth st. and 1711-13 Randolph st.	Miscellaneous.....	April 5.....	Thomson.....						1				1		
19	Hess, D. M.....	S. E. cor. Turner and Mascher sts.....	Miscellaneous.....	May 11.....	Gem						1				1	4,473,750	
19	Hess, D. M.....	S. E. cor. Turner and Mascher sts.....	Miscellaneous.....	Nov. 25.....	Crown.....			1		1					2		

New Meters Set—Continued.

Ward.	Occupant.	Location.	Business.	Date when Set.	Name of Meter.	SIZE.									Total.	Gallons Consumed.	Remarks.
						1/2-inch.	3/4-inch.	1-inch.	1 1/4-inch.	2-inch.	3-inch.	4-inch.	6-inch.	20-inch.			
19	Schuck, Chas. & Bro.....	2448-54 Franklin street.....	Nursery	Mar. 25.....	Crown					1					1	40,800	
20	Dessait, Chas.....	1742-48 Mervine street and rear.....	Brewery.....	Mar. 13.....	Gem.....					1					1	1,514,175	
20	United Gas Imp. Co....	2000 N. Ninth street, N. W. cor. Diamond st..	Tank.....	June 7.....	Crown.....						2				2	2,295,000	
20	Weber, Henry.....	1408-12 North Eighth street.....	Sheet Iron Works.....	April 5.....	Crown.....		1								1	1,500	
21	Liebert & Obert.....	4057-59 Main street.....	Spring Bed Factory.....	Jan. 17.....	Trident		1								1	235,500	
21	Rox. Aux. Pumping St.	Roxborough.....	Tank.....	April 13.....	Venturi.....									1	1		Not charged by Meter.
21	United Gas Imp. Co....	E. S. Main street, North of Ridge avenue.....	Tank.....	June 30.....	Gem.....					1					1	75,000	
22	Ballantine, J.....	Rear 161 Ashmead street.....	Cotton Mill.....	May 17.....	Crown.....					1					1	2,250	
22	First M. E. Church.....	N. E. cor. Main and High streets.....	Church.....	Jan. 14.....	Gem.....					1					1	196,875	
22	First M. E. Church.....	N. E. cor. Main and High streets.....	Church.....	Jan. 14.....	Trident.....		1								1		
22	Goodman, Samuel.....	W. S. Germantown and S. Chestnut Hill ave.	Dwelling.....	Jan. 13.....	Nash.....			1							1	450	Not charged by Meter.
22	Philada. Cricket Club..	N. W. S. Hartville and N. E. of 37th street..	Club House	June 28.....	Crown.....					1					1	246,000	
22	Seeds, J.....	151 School lane.....	Dwelling.....	Jan. 13.....	Trident.....		1								1	326,250	Not charged b Meter.
22	United Gas Imp. Co ..	15 Rittenhouse street.....	Shop.....	July 6.....	Crown.....		1								1	130,500	
22	United Gas Imp. Co....	S. S. Collum street, E. of P. & R. R. W. Co....	Tank.....	July 7.....	Crown.....			1							1	774,000	

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New Meters Set—Continued.

Ward.	Occupant.	Location.	Business.	Date when Set.	Name of Meter.	SIZE.										Total.	Gallons consumed.	Remarks.
						3/8-inch.	3/4-inch.	1-inch.	1 1/2-inch.	2-inch.	3-inch.	4-inch.	6-inch.	20-inch.				
23	Comly, James	S. E. cor. Paul and Meadow sts.....	Bicycle Factory.....	Nov. 24.....	Crown.....		1							1		No water used.		
23	Dudley, William E.....	S. E. cor. Unity and Leiper sts.....	Mill.....	July 14.....	Crown.....				1					1	342,750			
23	Ford, William R.....	W. S. Tacony rd. S. of Orchard st.....	Mill.....	Oct. 24.....	Crown.....				1					1	55,500			
23	Whitaker Bros.....	S. E. cor. Frankford av. and Worrell sts.....	Mill.....	Mar. 3.....	Crown.....		1							1	126,000			
23	Woodhouse, Samuel F.....	1526 Unity st., S. W. cor. Franklin st.....	Paint Works.....	June 29.....	Crown.....			1						1	148,500			
24	Groves, George P.....	3121 Haverford st.....	Laundry.....	Nov. 23.....	Crown.....				1					1	116,250			
24	Lindsay, D. S.....	4301-05 Lancaster ave.....	Grocery Store.....	Aug. 24.....	Crown.....			1						1	159,000			
24	Lloyd, H. S.....	3728-30 Mt. Vernon st.....	Elec. Carriage Factory.....	Jan. 17.....	Crown.....			1						1	6,000			
24	Phila. Country Club.....	N. S. Conshohocken av. E. of Windmere av.....	Club House.....	Oct. 13.....	Crown.....				1	2				3	358,523			
24	West Hope Pres. Ch.....	S. W. cor. Preston and Aspen sts.....	Church.....	June 1.....	Crown.....						1			1	73,500			
24	Vulcanite Paving Co.....	E. S. 30th, So. Powelton ave.....	Stone Yard.....	Apr. 29.....	Crown.....					1				1	2,368,500			
25	Bill, Jno. R. & Co.....	1824 E. Clearfield St.....	Mill.....	Jan. 20.....	Crown.....			1						1	1,522,500			
25	Deitrick, J. F., Exr.....	1826-32 E. Clearfield st.....	Mill.....	Nov. 1.....	Crown.....				1					1	42,000			
25	Masland, C. H.....	E. S. Collins st. N. of Kennedy st.....	Cotton Mill.....	Jan. 1.....	Trident.....		1				1			2	13,380,000			
25	Rust, C. J.....	N. W. cor. Emerald and Wishart sts.....	Cotton Mill.....	Nov. 23.....	Crown.....				1					1		No water used.		

New Meters Set—Continued.

Ward.	Occupant.	Location.	Business.	Date When Set.	Name of Meter.	SIZE.								Total.	Gallons Consumed.	Remarks.
						1/2-inch.	3/4-inch.	1-inch.	1 1/2-inch.	2-inch.	3-inch.	4-inch.	6-inch.			
25	United Gas Imp. Co	N. S. Tioga st E. of Brabant st	Gas Works	July 19.....	Crown.....							2		2	} 26,701,500	
25	United Gas Imp. Co	N. S. Tioga st. E. of Brabant st	Gas Works	July 20.....	Gem								1	1		
26	Cooper, J. W.....	1720 Washington ave.....	Cabinet Works	Oct. 1.....	Crown.....				1					1	492,750	
26	Federal Hat Co.....	1434-36 Federal street.....	Hat Factory.....	Jan. 20	Crown.....				1					1	467,250	
27	Lindsay, D. S	28 South Fortieth street.....	Plumbing shop.....	Aug. 22.....	Crown.....	1								1	26,250	
27	Love & Son.....	West side Thirtieth st., south of Locust st...	Mill.....	June 13.....	Crown.....			1						1	927,600	
27	Perseverance Mfg. Co...	West side Thirtieth st., south of Locust st...	Mill.....	June 13.....	Gem					1				1	10,326,750	
27	Tatham Bros.....	East side Thirty-first st., north of Walnut...	Miscellaneous.....	May 5.....	Crown.....	1								1	77,250	
28	Dobson, J. & J.....	Ridge ave., east side, cor. P. & R. Ry. Co.....	Carpet mill.....	June 8.....	Gem							2		2	100,275	
28	Midvale Steel Works....	Nicetown.....	Steel works.....	Jan. 23	Gem							1		1	100,917,750	
28	Warrington, J.....	2200 North Broad street.....	Bicycle factory	Oct. 26.....	Crown.....			1						1	30,750	
31	Kensington Electric Co.	2207-11 Frankford ave. and 2206-12 Blair st..	Power house.....	June 23.....	Gem				1	1				2	6,477,250	
31	Marshall, Wm. & Son...	1926-30 Boston street.....	Mill.....	June 25.....	Hersey				1					1	75,750	
31	Schmidt, R. C.....	1845-49 Hazzard street.....	Mill	Dec. 14.....	Gem				1					1		No water used.
32	Carbon Dioxide and Magnesia Co.....	N.W. cor. Twenty-ninth & Montgomery av..	Magnesia works.....	Sept. 12.....	Crown.....	1								1	562,500	

New Meters Set—Continued.

Ward.	Occupant.	Location.	Business.	Date When Set.	Name of Meter.	SIZE.								Total.	Gallons Consumed.	Remarks.	
						1/2-inch.	3/4-inch.	1-inch.	1 1/2-inch.	2-inch.	3-inch.	4-inch.	6-inch.				20-inch.
33	Evans, John Sons.....	3360 Marshall street.....	Mill.....	Feb. 21.....	Crown.....			1					1	68,250			
34	Arthur, James.....	5701-03 Market street.....	Store.....	April 15.....	Gem.....					1			1		No water used.		
34	Carroll, H. C. & Sons...	East side Fifty-ninth street, n. Girard ave...	Brickyard.....	Feb. 28.....	Crown.....			1					1	66,750			
34	Carroll, H. C. & Sons...	South side Girard ave., bet. 57th and 58th.....	Brickyard.....	March 1.....	Crown.....			1					1	637,750			
36	Atlantic Refining Co....	W. Passyunk ave., no. side, cor. River road..	Oil works.....	August 9.....	Crown.....			1		1			2	80,250			
36	Greaves, N. F.....	S. E. cor. Twentieth and Tasker streets.....	Varnish factory.....	Feb. 7.....	Crown.....			1					1	43,750			
36	Rosengarten, S. G.....	S. W. cor. Thirty-fifth and Moore streets.....	Laboratory.....	April 6.....	Crown.....					1			1	459,750			
36	Snyder, Frank L.....	1734 McClellan street.....	Dwelling.....	Sept. 12.....	Crown.....		1						1	7,500	{ Not charged by meter.		
36	United Gas Imp. Co.....	S. side Old W. Passyunk rd. and river front.	Gas works.....	Aug. 9.....	Gem.....							1	1	2,186,250			
36	United Gas Imp. Co.....	S. side Old W. Passyunk rd. and river front	Gas works.....	Aug. 9.....	Crown.....		2	1					3				
36	Young, Charles A.....	East side Twenty-fourth st., S. of McKean..	Brick yard.....	Dec. 14.....	Nash.....				1				1		No water used.		
37	Batley, Thomas.....	2744-50 Germantown avenue.....	Hall.....	Dec. 8.....	Trident.....		1						1		No water used.		
37	Bureau of Water.....	S. W. cor. Hutchinson and Lehigh avenue..	Dwellings.....	Nov. 3.....	Deacon.....								1		{ Not charged by meter.		
37	Christman, J. W.....	2923-25 North Broad street.....	Miscellaneous.....	Dec. 19.....	Crown.....		1						1	7,500			
37	Ch. of the Resurrection	3501 N. Broad st., N. E. cor. Tioga st.....	Church.....	Sept. 27.....	Gem.....				1				1	46,800			

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.	2½-inch.			
37	Flitts, J. L.....	221 North Tenth street.....	Dwelling.....	July 9.....	Crown.....	1									1	15,750	Not charged by meter.
38	Adams, John.....	South side Indiana ave., W. of Sixteenth st.	Mill.....	June 29.....	Crown.....			1							1	1,003,500	
38	Breuil, James F.....	N. side Clearfield st., E. of Twentieth st.....	Foundry.....	March 11.....	Crown.....				1						1	525,000	
38	Electric Storage Bat. Co.	S. W. cor. Nineteenth and Allegheny ave.....	Electric works.....	Oct. 14.....	Crown.....					1					1	60,000	
31	Leatherman, Joseph.....	N. W. cor. Moyer and Harold streets.....	Chalk works.....	April 29.....	Crown.....				1						1	507,000	
	Total.....					4	28	28	17	30	20	17	5	1	150	336,728,923	

1898.

DISCONTINUED

Taken Out

Thomson.	Worthington.
	1
1	
1	1

sampled, as

Attachments made and delivered to Districts during the year 1898.

Districts.	Attachments made and Delivered.	LEAD PIPE, FEET.
		$\frac{5}{8}$ -Inch.
First.....	470	7,741
Second.....	975	18,704
Third.....	730	10,281
Fourth.....	542	9,088
Fifth.....	275	4,027
Sixth.....	1,820	30,130
Total.....	4,812	79,971

DISTRIBUTION EXPENSES

DURING THE YEAR 1898.

Including Expenses of Main Office, Purveyors' Districts and Meter Shops.

MATERIAL AND LABOR.	First District.	Second District.	Third District.	Fourth District.	Fifth District.	Sixth District.	Distribu- tion.	Meter Shops.	Main Office.	TOTALS.
Lead	\$2,340 00	\$2,340 00	\$2,340 23	\$2,340 00	\$5,078 73	\$2,123 75				\$16,562 71
Gasket	39 81	83 90	79 27	82 94	17 55	49 16				352 63
Coke	73 00	74 10	91 00	126 00	31 50	135 30				530 90
Wood	7 00			140 00		42 00				189 00
Pipes.....							\$120,581 75			120,581 75
Small specials.....							6,482 19			6,482 19
Large specials.....							3,795 04			3,795 04
Frames and covers.....	325 78	406 04	380 50	183 75	94 67	282 76		\$270 38		1,948 88
Hauling, transportation and hotel.....	90 00	180 00	50 00	45 00	35 00	100 00	3,785 86	480 00		4,765 86
Supplies, tools, small stores, etc.....	2,111 00	1,933 16	4,889 99	3,573 06	794 54	1,983 18	2,475 26	3,489 17	\$288 54	21,537 90
Plumbing and plumbing supplies.....		15 00		7 95	3 25	29 05		9,164 68		9,219 93
Meters, etc.....								9,686 28		9,686 28
Repairs to buildings, etc.....	88 50					61 25		39 30		189 05
Brick, stone, lime and cement.....	57 51	256 01	101 14	884 66	38 76	192 53		15 87		1,546 48
Lumber.....	2,492 81	183 83	819 15	707 25	281 19	585 78		103 11		5,083 12
Hay, feed, etc.....	680 80	513 72	668 40	749 99	131 42	76 67				2,821 00

Distribution Expenses—Continued.

Material and Labor.	First District.	Second District.	Third District.	Fourth District.	Fifth District.	Sixth District.	Distribution.	Meter Shops.	Main Office.	Totals.
Stable supplies	\$259 05	\$189 10	\$224 90	\$316 50	\$250 83	\$22 25				\$1,262 63
Stable repairs.....	193 05	215 99	351 98	197 88	6 53	29				965 74
Stable medicines.....	36 75	19 13	11 75	38 00						105 63
Stable shoeing.....	199 00	114 00	163 55	148 00	\$34 77	\$13 00				682 32
Supplies, stationery...	272 24	288 77	279 38	181 09	18 81	96 24	\$780 67	\$102 10	\$1,255 62	\$3,224 92
Wages... { Per diem.....	25,353 52	29,621 06	52,520 86	30,325 34	11,642 87	46,004 82	4,253 64	9,718 24	4,053 03	213,583 38
Wages... { Salary.....	4,649 00	5,996 90	6,763 80	7,249 79	1,739 00	3,269 00				29,667 49
Total cost of labor and material on account of distribution.....	\$39,178 82	\$42,380 71	\$69,735 90	\$47,297 20	\$20,199 44	\$55,167 03	\$142,154 41	\$33,069 13	\$5,597 19	\$454,779 83
Buildings, grounds, and reservoirs.....		\$3,428 56		\$2,178 14	\$3,295 42	\$704 95		\$724 59		\$10,331 66
Bureau of Surveys, labor.....				*14,949 58				*358 75		15,308 33
Bureau of Surveys, material.....				149 60				1,539 83		1,689 43
Total labor and material.....	\$39,178 82	\$45,809 27	\$69,735 90	\$64,574 52	\$23,494 86	\$55,871 98	\$142,154 41	\$35,692 30	\$5,597 19	\$482,109 25

* Paid by Bureau of Surveys.

APPENDIX D.

REPORT

OF THE

Superintendent of the Construction and Repair Shop,

TWELFTH AND REED STREETS.

FOR THE YEAR 1898.

Philadelphia, January 9, 1899.

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

SIR:—I herewith submit the Annual Report of the operations of the Construction and Repair Shop at Twelfth and Reed streets for the year ending December 31, 1898.

Respectfully,

JAMES H. DEAN,
Superintendent of Shop.

MERCHANDISE.

	DR.	
To stock as per inventory, Jan. 1, 1898.....	\$30,483	28
Bolts and nuts.....	876	20
Hardware.....	344	11
Steel.....	453	41
Wrought iron.....	519	13
Iron castings..	12,980	74
Brass castings.....	4,155	62
Lead coating.....	518	52
Lumber.....	588	18
Paints, brushes, etc.....	128	38
Oils and tallow.....	39	54
Chandlery.....	112	85
Coal.....	1,111	47
Coke.....	29	20
Gum goods.....	376	20
Plug valves.....	872	80
Brass fittings.....	73	32
Lead.....	1,161	54
Bricks, lime, cement, etc.....	317	93
Wrought iron pipe and fittings.....	7	81
Forage, stable supplies, etc.....	165	10
Miscellaneous.....	350	44
Wages.....	32,829	61
	<hr/>	\$88,495 38

MERCHANDISE.

	CR.	
First District.....	\$8,393	42
Second District.....	6,459	94
Third District.....	11,155	42
Fourth District.....	14,259	09
Fifth District.....	1,998	01
Sixth District.....	11,086	43
	<hr/>	53,352 34
Spring Garden Pumping Station.....	\$4,472	46
Fairmount Pumping Station.....	564	82
Belmont Pumping Station.....	1,974	29
Queen Lane Pumping Station.....	1,565	72
Queen Lane Reservoir.....	121	62
Roxborough Pumping Station.....	2,294	36
Roxborough Reservoir.....	1,254	39
East Park Reservoir.....	166	52
Mount Airy Pumping Station.....	36	76
Frankford Pumping Station.....	388	98
	<hr/>	12,839 92

Distribution.....	\$187 83	
Main office.....	117 49	
Meter Department.....	477 51	
Hydrographic work.....	131 86	
General buildings and grounds.....	1,607 17	
Fixed patterns.....	1,091 72	
Shop machinery.....	395 23	
Construction and repair shop.....	1,462 47	
Old metals.....	480 85	
		<u>\$5,952 13</u>
		\$72,144 39
Total Cr.....	\$72,144 39	
Inventory, January 1, 1899.....	34,700 25	
		<u>\$106,844 64</u>
Total Dr.....	88,495 38	
Balance.....		18,349 26

INVENTORY, JANUARY 1, 1899.

150 No. 1 fire hydrants, at \$25.00.....	\$3,750 00	
3 4-inch stop valves, at 11 00.....	33 00	
126 6-inch stop valves, at 12.00.....	1,500 00	
13 8-inch stop valves, at 20.00.....	260 00	
33 10-inch stop valves, at 30.00.....	990 00	
5 12-inch stop valves, at 35.00.....	175 00	
7 16-inch stop valves, at 60.00.....	420 00	
6 20-inch stop valves, at 95.00.....	570 00	
2 30-inch stop valves, at 190.00.....	380 00	
2 36-inch stop valves, at 300.00.....	600 00	
		<u>8,678 00</u>
Finished parts of fire hydrants.....	\$1,763 38	
Finished parts of stop valves.....	1,499 95	
Finished parts of rotary valves.....	210 70	
		<u>3,474 03</u>
52 Old-style stop screws.....	\$346 25	
106 Viney stop screws, at \$2.00.....	212 00	
21 Barton stop screws, at \$3 50.....	73 50	
11 Barton bonnet and screw, at \$8.00.....	88 00	
8 Drilling machines, at \$45.00.....	360 00	
		<u>1,079 75</u>
3 20-inch rotary stop valves, at \$265.....	\$795 00	
1 48-inch rotary stop valve.....	665 00	
1 36-inch check valve.....	375 00	
1 36-inch check valve, unfinished.....	285 00	

1 20-inch check valve unfinished.....	\$134 00	
1 36-inch rotary stop valve, unfinished.....	500 00	
1 Bell crank, unfinished.....	15 00	
76 Fish traps, unfinished.....	240 16	
		\$3,009 16
480 New style stop screws, 4-inch to 48-inch.....	\$1,470 25	
107 Socket screws, \$1.75.....	187 25	
93 Spindles, \$1.50.....	139 50	
		1,797 00
576 Iron bands, 4-inch to 48-inch.....	\$1,432 00	
		1,432 00
515 4-inch fire hydrant valves, at 70 cents.....	\$360 50	
110 6-inch fire hydrant valves, at \$1.59.....	174 90	
60 4-inch fire hydrant valves, metal at \$1.00.....	60 00	
300 Frost valves, at 50 cents.....	150 00	
		775 40
137 Fire hoe heads, at \$1.75.....	\$239 75	
30 Air pump rod straps, at \$9.50.....	285 00	
66 Air pump rod brasses, at \$2.50.....	165 00	
26 Sets, Gibs & Keys, at \$4.50.....	117 00	
		806 75
Articles and tools carried in stock, issued to districts.....	\$2,434 85	
		2,434 85
55,188 Pounds wrought iron at 1½ cents.....	\$777 82	
2,465 Pounds iron forgings at 8 cents.....	197 20	
18,552 Pounds steel.....	666 05	
1,607 Pounds expansion metal, at 25 cents.....	401 75	
47,515 Pounds lead at 3.9 cents.....	1,853 09	
409 Pounds Babbitt metal, at 8 cents.....	32 72	
		3,928 63
135,420 Pounds stop valve castings, at 1.25.....	\$1,692 75	
109,676 Pounds fire hydrant castings, at 1.40.....	1,335 46	
2,172 Pounds machinery castings, at 1.30.....	28 24	
14,181 Pounds brass castings, at 10 cents.....	1,418 10	
2,025 Pounds Ajax metal, at 21½ cents.....	435 37	
849 Pounds rolled brass, at 16 cents.....	135 84	
		5,245 76
Hardware.....	\$124 03	
Bolts and nuts.....	769 35	
Oils and tallow.....	33 79	
Paints, oils, brushes, etc.....	59 16	
Chandlery.....	52 59	
Gum goods.....	259 80	
Lumber.....	770 20	
		2,068 92
		<u>\$34,700 25</u>

Principal Articles Delivered to Purveyor's Districts, etc.

30

Districts.	Fire Hydrants.	WEDGE STOP VALVES.								36-inch Check Valve.	ROTARY VALVES.			PLUGS.		Stop Box Risers.	FISH TRAPS.					Iron Bands.	
		4-inch.	6-inch.	8-inch.	10-inch.	12-inch.	16-inch.	20-inch.	30-inch.		36-inch.	30-inch.	36-inch.	48-inch.	Wood.		Brass.	1½-inch.	2-inch.	3-inch.	4-inch.		6-inch.
First.....	107		107	9	54	21								104	198	24							12
Second.....	76	12	183	35										156	144	58							20
Third.....	201	6	292	6		25		1						86	144	299							12
Fourth.....	12		27		6	13		3			1	2	13	116	234	78							106
Fifth.....	80	4	18		3	2	2	3	1					13	36								3
Sixth.....	237		196	14	2	23	2							240	190	175							84
Meter Department.....																	18	47	27	5	6		
Works.....								2	1														
Total.....	663	23	823	64	65	34	4	3	5	2	1	1	2	13	665	946	634	18	47	27	5	6	237

451

PRINCIPAL ARTICLES MANUFACTURED DURING 1893.

744	No. 1 fire hydrants, at \$25.....	\$18,600 00
23	4-inch stop valves, at \$11.....	253 00
935	6-inch stop valves, at \$12.....	11,220 00
60	8-inch stop valves, at \$20.....	1,200 00
77	10-inch stop valves, at \$30.....	2,310 00
92	12-inch stop valves, at \$35.....	3,520 00
9	16-inch stop valves, at \$60.....	540 00
5	20-inch stop valves, at \$95.....	475 00
5	30-inch stop valves, at \$190.....	950 00
2	36-inch stop valves, at \$300.....	600 00
3	20-inch rotary stop valves, at \$265.....	795 00
1	30-inch rotary stop valves, at \$385.....	385 00
2	36-inch rotary stop valves, at \$525.....	1,050 00
3	48-inch rotary stop valves, old style, at \$665.....	1,995 00
10	48-inch rotary stop valves, new bell end, at \$550.....	5,500 00
1	48-inch rotary stop valves, new style flanged end, at \$550.....	550 00
2	36-inch check valves, at \$375.....	750 00
6	6-inch 4-way stops, at \$30.....	180 00
2	Truss foot bridges for Roxborough reservoir.....	508 60
1,322	Wood plugs, at 50c.....	661 00
774	Stop box risers, at 35c.....	270 90
180	Fire hoe heads, at \$1.75.....	315 00
103	Fish traps.....	386 00
216	Iron bands.....	1,109 75

 \$54,124 25

APPENDIX E.

Report of Assistant in Charge of Hydrographic Work.

Philadelphia, January 31, 1899.

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

SIR:—The following report on Hydrographic Work and data collected during the year 1898 is respectfully submitted.

Rainfall observations at twenty-two stations, three of which are provided with automatic gauges, have been continued, completing sixteen years continuous records of data relating to precipitation.

Stream flow observations by automatic gauges on the Perkiomen, Neshaminy and Tohickon streams have been continued, completing fifteen years continuous records.

Observations on the Wissahickon, begun last year, have been continued, making one year and eight months of recorded stream flow.

Observations on the Schuylkill, with the automatic stream gauge put in operation last year, have been continued at Fairmount.

The amount of rainfall for the year ending September 30, 1898, on the area comprising the watershed of the

three streams, was 46.21 inches, being 2.16 inches less than the average for the past fifteen years, and 0.68 inch more than the amount for 1897.

The greatest monthly rainfall during the year, 6.39 inches, occurred in November.

There was a deficiency in the months of October, March, June and September, and an excess in the months of November, May and August. The remaining months show an average rainfall.

On August 3d occurred the most terrific electrical and rain storm on record in this City. The automatic rain gauge at Thirty-second and Spruce streets showed that a light rain fell from 5.20 to 6.45 A. M.; there was also a very peculiar yellow light from about 5.45 to 6.06 A. M., which gave familiar objects a strange appearance.

About 8 A. M. the sun shone through the clouds and it seemed as though it would be an ordinary sultry August day. About 10 A. M. black clouds began to gather, and it soon became very dark; at 11 A. M. the storm of electricity and rain began moving in a nearly due east direction, the rain coming down in torrents.

The centre of the storm seemed to pass near the City Hall. The wind, for a short time, was very strong from the northwest, tearing flags to pieces and blowing signs and awnings into the streets. At 11.40 A. M. there was a sudden lull in the storm, which continued for about fifteen minutes, when the wind shifted and the storm seemed to return over the course it had previously followed, and from 11.55 until 12.40 its force was even greater than before. The City Hall was struck by lightning several times.

The storm was a purely local one. At Jenkintown, 10 miles from the City Hall, the storm was not of an unusual character, and at the Forks of the Neshaminy, 20 miles from the City Hall, the rain was not sufficient to lay the

dust in the roads. It appears to have had no unusual conditions outside of a five mile radius from the City Hall.

The automatic gauge recorded 4.69 inches of rain in 2 hours and 45 minutes. During 90 minutes of this time 4.65 inches of rain fell, or at the rate of 3.10 inches per hour.

For the purpose of comparison I have made the following computation of this volume of water falling on an area of 10 miles in diameter with the City Hall for a center. One inch of rainfall on one square mile is equal to 17,378,742 gallons, or 4.65 inches on a circle 10 miles in diameter would produce a volume of water equal to 6,351,000,000 gallons, or about as much as the Queen Lane Pumping Station could pump in 80 days if all the pumps were run at their full capacity, or five times the total reservoir capacity of the City, or, allowing 300,000,000 gallons per day, it would supply the City for 21 days with pure rain water.

During the year twelve storms occurred in which the rate exceeded 0.25 of an inch per hour. The automatic gauges at Spring Mount and the Forks of the Neshaminy recorded fifteen storms each in which the rate exceeded 0.25 of an inch per hour.

The following tables, compiled as in previous years, accompany this report:

- I. Monthly precipitation on sundry water sheds.
- II. } Rain storms exceeding $\frac{1}{4}$ inch
- III. } per hour. -
- IV. } { Philadelphia.
Forks of Neshaminy,
Spring Mount or Frelerick,
Perkiomen Valley.
- V. Inches of rainfall flowing in the { Perkiomen,
Neshaminy.
Tohickon.
- VI. Average yield of streams.

VII. Comparative stream flow { Perkiomen,
Neshaminy,
Tobickon,
Wissahickon,
Schuylkill.

VIII. } Monthly and daily yield of { Perkiomen,
IX. } Neshaminy,
Tobickon,
Wissahickon,
Schuylkill.

Observations on the flow of the Wissahickon show, for the year, an average daily flow of about 62,600,000 gallons. The low flow of this stream is much in excess of the others, but, as stated in last year's report, no satisfactory explanation can be given for this.

The automatic recording gauge at Fairmount has given a better and more satisfactory method of computing the flow of the Schuylkill river at the Fairmount Dam.

The results show that with a yearly rainfall of 49.53 inches, 24.39 inches are found flowing in the stream. The maximum daily flow for one month was 4,258,000,000 gallons, and the daily minimum flow for one month was 440,400,000 gallons.

It is much to be regretted that Councils have disallowed the annual appropriation of \$1,600 for the continuance of this survey during 1899, and that it may therefore have to be abandoned. The great fluctuations in flow of our Pennsylvania streams can be ascertained only by patient and systematic observations extending over a series of years sufficiently long to clearly indicate periods and continuations of low flows.

Before the pending question of a future water supply for the City is settled these data may prove of inestimable value.

The following named persons have been engaged as observers and rodmen during the 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, rodman and gauge observer, Point Pleasant, Pa.

Dr. George M. Grim, gauge observer, Ottsville.

George Louder, 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 persons who have kindly furnished rainfall records:

Mr. Thomas MacKellar, Germantown, Philadelphia.

Mr. J. L. Hancock, Quakertown, Pa.

Sergeant L. M. Dey, U. S. Weather Bureau.

Mr. Benjamin Shoemaker, Pennsylvania Hospital, Philadelphia.

Mr. E. F. Smith, Engineer of Canals, Reading, Pa.

Mr. Thomas J. Beans, Moorestown, N. J.

Dr. Charles Moore, Pottstown, Pa.

During 1898 all observations on rainfall were taken uniformly in accordance with the instructions given at the beginning of the year.

Yours 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 1898.

DATE OF OBSERVATION.	AUTOMATIC RAIN GAUGE.					REMARKS.
	TOTAL FALL.		MAXIMUM FALL.			
	Amount in Inches.	Duration—Hrs. Min.	Amount in Inches.	Duration in Minutes.	Rate per Hour during Maximum Fall.	
February 20th, rain storm.....	2.74	64—10	.62	28	1.33	Local storm, accompanied with severe lightning and thunder.
May 8th, rain storm.....	1.60	21—35	.40	40	.60	
May 13th, rain storm.....	.88	6—15	.73	10	4.38	
May 21st, rain storm.....	.93	6—40	.66	15	2.64	
June 28th, shower.....	.91	6—40	.60	15	2.40	
July 4th, shower.....	1.17	4—05	1.00	35	1.71	
July 27th, shower.....	.81	8—45	.32	25	.77	
August 3d, rain storm.....	4.69	2—45	4.65	90	3.10	
August 5th, shower.....	1.25	5—50	.50	30	1.00	
October 26th, rain storm.....	1.55	17—45	.80	15	1.20	
November 10th, rain storm.....	1.86	11—05	.55	15	2.20	
December 4th, rain storm.....	1.10	12—30	.40	8	3.00	

Observations at Philadelphia.

	TOHICKON SERIES.				NESHAMINY SERIES.		
	Ottville.	Quakertown.	Smith's Corner.	Point Pleasant.	Lausdale.	Forks of Neshaminy.	Doylestown.
ELEVATION	5 990	536	480	119	350	143	405
	Inches.	Precipitation in Inches.	Precipitation in Inches.	Precipitation in Inches.	Precipitation in Inches.	Precipitation in Inches.	Precipitation in Inches.
January.....	4.32	4.20	4.09	4.15	3.86	3.88	4.15
February.....	3.20	3.64	3.27	3.34	3.03	3.09	3.62
March.....	2.83	3.19	2.87	2.46	2.94	3.10	3.08
April.....	4.46	3.66	3.68	3.11	3.89	3.55	4.16
May.....	6.27	6.26	7.80	10.15	5.82	7.51	5.94
June.....	0.75	0.89	0.60	0.79	0.74	0.82	1.18
July.....	2.15	3.45	4.24	6.29	2.86	4.42	3.11
August.....	5.70	5.38	7.05	6.07	10.01	6.65	7.26
September.....	2.09	2.70	2.03	1.28	1.81	1.90	1.95
October.....	5.25	5.20	5.52	4.87	4.84	4.61	5.14
November.....	7.25	7.34	6.17	6.47	5.36	6.48	6.28
December.....	3.49	4.47	3.60	3.42	3.62	3.40	3.74
Total.....	47.76	50.38	50.92	52.40	48.80	50.34	49.59
Percentage..	97	103	103	107	99	103	100
16 years year	49.36	49.63	50.61	50.44	46.52	48.70	47.70
Average.....	126	127	130	130	120	125	122
Average def	1.60	0.75	0.31	1.96	2.48	1.64	1.89
Percentage	3.2	1.5	0.6	3.8	5.4	3.3	4

THE HISTORY OF THE UNITED STATES

CHAPTER I
THE DISCOVERY OF AMERICA
The first discovery of America was made by Christopher Columbus in 1492. He sailed from Spain in search of a westward route to the Indies. On October 12, 1492, he landed on the island of San Salvador in the West Indies. This event marked the beginning of European contact with the Americas.

CHAPTER II
THE EARLY YEARS
The early years of the United States were marked by the struggle for independence from Great Britain. The American Revolution began in 1775 and ended in 1783. The Declaration of Independence was signed on July 4, 1776. The Constitution was adopted in 1787.

CHAPTER III
THE GROWTH OF THE NATION
The growth of the United States was rapid in the early years. The territory of the United States expanded westward. The Louisiana Purchase of 1803 doubled the size of the nation. The War of 1812 established the United States as an independent nation.

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 1898.

DATE OF OBSERVATION.	AUTOMATIC RAIN GAUGE.					Remarks.
	TOTAL FALL.		MAXIMUM FALL.			
	Amount in Inches.	Duration in Hrs. Min.	Amount in Inches.	Duration in Minutes.	Rate per Hour during Maximum Fall.	
February 20th, rain storm.....	3.64	64—10	1.00	60	1.00	
May 8th, rain storm.....	2.33	22—30	.25	20	.75	
May 12th, rain storm.....	.60	1—15	.45	15	1.80	
May 21st, rain storm.....	.85	14—45	.30	12	1.50	
May 24th, rain storm.....	.42	18—15	.40	15	1.60	
June 25th, shower.....	.37	1—00	.30	20	.90	
July 21st, shower.....	2.67	3—00	2.25	45	8.00	
August 4th, rain storm.....	.68	8—00	.40	17	1.41	
August 5th, rain storm.....	1.04	7—00	.40	18	1.33	
August 18th, rain storm.....	.92	3—40	.50	30	1.00	
August 19th, rain storm.....	1.80	7—20	.45	20	1.85	
September 23d, rain storm	1.10	11—15	.25	15	1.00	
October 14th, shower.....	.41	4—20	.25	30	.80	
October 19th, rain storm.....	.54	7—20	.27	60	.27	
October 22d, rain storm.....	1.11	20—45	.20	15	.80	

TABLE IV.

Rain Storms exceeding in rate 0.25 inches per hour, as recorded by the Automatic Rain Gauge at Frederick for the year 1898.

DATE OF OBSERVATION.	AUTOMATIC RAIN GAUGE.					Remarks.
	TOTAL FALL.		MAXIMUM FALL.			
	Amount in inches.	Duration in Hrs. Min.	Amount in inches.	Duration in minutes.	Rate per hour during maximum fall.	
February 20th	3.02	69—35	.60	60	.60	
May 8th, rain storm.....	2.00	21—30	.20	25	.40	
May 15th, rain storm.....	1.25	10—00	.15	10	.90	
May 24th, rain storm.....	.40	13—30	.30	20	.90	
July 19th, shower.....	1.42	4—40	.60	30	1.20	
July 20th, shower .....	.75	4—15	.40	25	.96	
August 10th, rain storm	1.54	21—40	.35	20	1.05	
August 19th, rain storm.....	3.22	8—15	.90	45	1.20	
September 7th, shower.....	1.11	2—00	.40	22	1.08	
September 23d, rain storm	1.26	9—00	.35	22	.96	
October 14th, rain storm.....	.80	4—20	.25	15	1.00	
October 26th, rain storm.....	1.26	21—00	.45	30	.90	
November 10th, rain storm.....	1.93	20—20	.25	60	.25	
November 19th, rain storm.....	1.90	37—00	.25	60	.25	
December 4th, rain storm.....	1.28	11—25	.45	25	1.08	

TABLE V.
Inches of Rainfall Flowing in the Perkiomen, Neshaminy, and Tohickon Creeks.

WATERSHEDS.	Area in Miles.	PERCENTAGE OF TOTAL AREA.				AVERAGE FOR 15 YEARS (1863—1898).												
		Woodland.	Cultivated.	Flats.	Roads.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.
Perkiomen, at Frederick, 15 years.....	152	25	71	2	2	2.95	3.82	3.59	2.17	1.52	0.59	1.3	0.98	0.95	0.90	1.80	2.12	
Neshaminy, below Forks, 15 years.....	139.3	6	92	½	2	3.40	4.14	3.46	2.04	1.79	0.80	1.12	0.90	0.84	0.67	1.61	2.38	
Tohickon, 15 years.....	102.2	24	72	2	2	3.98	4.80	4.40	2.58	2.24	0.90	1.38	1.26	1.14	0.88	2.26	2.72	
Perkiomen, at Frederick.....	Maximum 15 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	
	Minimum 15 years.....					0.59	1.25	1.56	0.97	0.46	0.28	0.17	0.28	0.16	0.20	0.34	0.91	
Neshaminy, below Forks.....	Maximum 15 years.....					6.77	10.44	8.55	3.57	7.41	2.46	5.47	3.37	3.51	2.55	6.31	4.56	
	Minimum 15 years.....					1.60	0.90	1.51	1.03	0.35	0.08	0.04	0.14	0.03	0.06	0.11	0.41	
Tohickon.....	Maximum 15 years.....					7.34	10.41	6.37	4.76	8.56	3.43	6.41	3.75	5.49	3.54	7.97	4.28	
	Minimum 15 years.....					0.54	1.19	1.83	0.78	0.30	0.08	0.11	0.10	0.04	0.05	0.14	0.67	

TABLE VI—Average Annual Yield of Sundry Watersheds to October 1, 1898.

Watersheds.	Period covered, years.	Area in miles.	Average rainfall in inches.	Average rainfall flowing off in inches.	Per cent. flowing off.	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.....	15	152.	47.613	23.200	48.73	61,277,600,000	167,840,000	1.708	0.0360
Neshaminy, below Forks.....	15	139.3	47.768	22.604	47.32	54,719,060,000	149,886,330	1.665	0.0348
Tohickon.....	16	102.2	49.746	28.228	56.740	50,183,182,300	137,215,600	2.077	0.0417
Wissahickon.....	1½	64.6	48.651	.....	.....	.....	.....	.....	.....
Schuykill.....	1	1,910.	.....	.....	.....	.....	.....	.....	.....
Sudbury, Mass.....	23	75.2	45.767	22.224	48.56	29,012,436,000	79,486,400	1.637	0.0356
Croton, N. Y.....	19	338.0	45.970	22.760	49.500	135,400,000,000	371,600,000	1.680	0.0365

TABLE VII—Comparative Daily Stream Flow, 1897 and 1898.

Watersheds.	Area of watershed.	MAXIMUM GALLONS.		Date.	MINIMUM GALLONS.		Date.
		Per day.	Per square mile.		Per day.	Per square mile	
Perkiomen.....	152	2,588,554,000	28,600,000	February 20th	7,705,000	50,600	September 19th
Neshaminy.....	139.3	3,280,581,000	23,600,000	February 2 th	3,815,000	27,400	September 21st
Tohickon.....	102.2	2,588,492,000	26,300,000	February 20th	2,715,000	26,000	September 20th
Wissahickon.....	64.6	976,965,000	15,123,000	February 20th	12,469, 00	193,000	September 20th
Schuykill.....	1915.	15,041,000,000	7,876,000	February 20th

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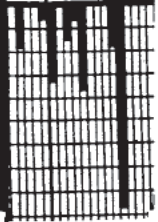
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APPENDIX F.

REPORT OF CHIEF DRAFTSMAN

Philadelphia, January 31, 1899.

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

SIR:—The following report of work for the year 1898 is respectfully submitted.

One hundred and sixty-five (165) drawings, as follows: relating to the construction of buildings, boilers, engines, reservoirs, intakes, conduits, chimneys, maps and profiles have been made and recorded, besides a large quantity of material relating to statistics, of which diagrams were made but not recorded.

Buildings.....	35
Reservoirs.....	31
Boilers.....	20
Special castings.....	9
Valves.....	5
Filter plants.....	6
Pipe plans.....	18
Furniture.....	6
Miscellaneous diagrams, etc.....	35

Many of these drawings required much time, study and labor in perfecting them.

Specifications were prepared for work which required to be advertised as follows: the chimneys and flues at Belmont and Roxborough pumping stations, one 150 and the

other 175 feet high; a boiler house and seven new boilers for the Belmont station; a boiler house and six new boilers for the Roxborough station; the proposed new basin No. 3 at George's Hill, West Philadelphia, and the two proposed 5-million gallon compound pumping engines for the Roxborough station.

The roof truss of the boiler house extension at Belmont station was very unexpectedly condemned by the Building Inspection Department, but when it was pointed out that the truss was a copy of the one already on the 100 feet of the old portion of the building, and that it had stood the test of over thirty-one (31) years of use, and showed no signs of weakness, the contractor was allowed to proceed with his work. A change of plan would have required the removal of the whole roof and would have put the Bureau to much unnecessary expense.

The steel construction for the roof of the proposed new boiler house at Roxborough station was also inspected and suggestions were made for some changes, the principal one being made on a misunderstanding of the drawings.

Very little delay or inconvenience was experienced in moving the drawings into our new quarters in the City Hall. The system of keeping the drawings, and the complete manner in which the Building Commissioners had fitted up the draughting room, making it a comparatively simple operation for the draughtsmen to rearrange them. All drawings are now being arranged and indexed on cards, which will simplify the matter of reference to any subject sought.

From data prepared by the Inspectors of this Bureau, two hundred and thirty-six (236) calculations for boiler horse power were made.

From these calculations are determined the water rents to be paid by owners of steam boilers using City water.

During the year the photographer employed by the

Bureau and detailed to this Department, made about 3,500 blue prints of various parts of machinery, detail plans, etc., which were used at the machine shops and stations. About 300 photographic prints were made, including views showing work during the erection of the stack, etc., at Belmont pumping station, also views of Shawmont, Roxborough and Queen Lane stations.

Several views were taken showing the position of water mains across the Reading Subway at different points, also of the ground selected for the new basin No. 3 at George's Hill, West Philadelphia.

In the preparation of plans for this basin all available data was used and studies were made of existing reservoirs which present any features which could be made use of in designing this work. For this purpose a visit was made to the Jerome Park reservoir, New York, the Highland Avenue reservoir, at Pittsburg, and the Brook Farm reservoir, at Trenton.

A visit was also made, with the Committee on Plans and Improvements of the Commissioners of Fairmount Park, to Boston, to examine reservoirs constructed with long sloping banks, with a view to the application of this feature to the basin contemplated.

As a result of this visit the new basin was designed with a sloping bank on the north and west sides and a masonry wall on the south and east sides.

I have supervised the construction of the seven (7) steel boilers for the Belmont pumping station built by Messrs. Robert Wetherill & Co., Chester, Pa., also the six (6) steel boilers for the Roxborough pumping station, built by the I. P. Morris Co., of Philadelphia.

The steel plates for all these boilers were rolled by the Lukens Iron and Steel Co., Coatesville, Pa., and I inspected these plates also.

The specifications for these boilers required that the

steel plates be made by the open hearth process, shell and heads, flange steel, combustion chamber and front tube sheets, fire box steel, tensile strength 52,000 to 60,000 pounds per square inch, elongation 25 per cent.

The steel plates for the Belmont boilers were inspected during the last week in August, those for the Roxborough boilers from November 21st to November 25th.

The accompanying tables of tests of steel plates show that they fulfilled all the requirements of the specification.

The daily pumpage chart and the daily stream flow charts for hydrographic work have been prepared as in former years.

I desire to call your attention to the limited force of the draughting and engineering corps, and to the entirely inadequate length of time often allowed for work which requires much patient study and labor in order that the best results may be produced.

Very respectfully,

JOHN E. CODMAN,
Chief Draughtsman.

TEST OF STEEL BOILER PLATES

Made by John E. Codman, Chief Draughtsman, Bureau of Water, Department of Public Works, at Lukens Steel Co., Limited, Coatesville, Pennsylvania, September, 1898.

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MARKS.	MEASUREMENTS.			Applied load.	Strain in pounds per sq. inch.	ELONGATION in eight inches.		REDUCTION OF AREA.				REMARKS.
	Breadth	Width.	Area.			Elongation in inches.	Elongation in percentage.	Breadth	Width.	Area.	Percentage.	
1 5733	1.035	.560	.580	17,700	30,520	Elastic limit						Corrugated flue.
				31,000	53,440	.50						
				32,800	56,550	1.00						
				33,500	57,750	1.50	2.48	31.00	.690	.310	.214		63.1
2 5733	1.505	.590	.888	27,000	30,410	Elastic limit						NOTE.—Boilers 8 feet 6 inches diameter, $\frac{3}{8}$ -inch shell. Built by Robert Wetherill, Chester, Pa., 1898.
				44,000	49,550	.50						
				48,500	54,610	1.00						
				50,800	57,200	1.50	2.20	27.50	1.060	.360	.382		57.
3 5733	1.485	.575	.854	27,700	32,430	Elastic limit						
				41,000	48,000	.50						
				48,000	56,200	1.00						
				48,500	56,790	1.50	2.40	30.00	1.060	.340	.360		57.8
4 5733	1.035	.582	.602	19,000	31,560	Elastic limit						
				32,000	53,160	.50						
				33,900	56,310	1.00						
				35,100	58,300	1.50	2.24	28.00	.710	.340	.241	

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Test of Steel Plate—Continued.

MARKS.	MEASUREMENTS.			Applied load.	Strain in pounds per sq. inch.	ELONGATION in eight inches.		REDUCTION OF AREA.				REMARKS.
	Breadth	Width.	Area.			Elongation in inches.	Elongation in percentage.	Breadth	Width.	Area.	Per-centage	
5 5733	1.035	.582	.602	18,300 31,200 33,800 34,200	30,400 51,830 55,150 56,810	Elastic limit .50 1.00 1.50 2.40	30.00	.710	.360	.256	57.1	
6 5733	1.035	.577	.597	19,100 31,000 33,500 34,600	31,990 51,930 56,120 57,960	Elastic limit .50 1.00 1.50 2.40	30.00	.700	.320	.224	62.4	
7 5733	1.485	.573	.851	26,100 44,000 47,000 49,400	3,670 51,700 55,220 58,040	Elastic limit .50 1.00 1.50 2.60	32.50	1.050	.300	.315	63.	
8 5733	1.035	.584	.604	19,000 31,000 34,000 34,400	31,460 51,340 56,390 56,950	Elastic limit .50 1.00 1.0 2.48	31.00	.710	.330	.234	61.2	

Test of Steel Plate—Continued.

MARKS.	MEASUREMENTS.			Applied load.	Strain in pounds per sq. in.	ELONGATION in eight inches.		REDUCTION OF AREA.				REMARKS.
	Breadth	Width.	Area.			Elongation in inches.	Elongation in percentage.	Breadth	Width.	Area.	Per-centage.	
9 5733	1.500	.570	.855	27,000 43,000 49,000 50,400	31,580 40,290 57,300 58,940	Elastic limit .50 1.00 1.50 2.24	28.00	1.110	.360	.422	50.6	
10 5733	1.500	.585	.878	28,000 44,000 48,300 50,000	31,890 51,110 55,000 56,950	Elastic limit .50 1.00 1.50 2.20	27.50	1.080	.350	.378	57.	
11 5733	1.035	.582	.602	19,500 30,000 32,300 34,500	32,390 49,840 53,660 57,310	Elastic limit .50 1.00 1.50 2.32	29.00	.700	.330	.231	61.6	
12 5733	1.035	.583	.605	19,200 31,900 33,540 34,600	31,780 51,240 55,370 57,190	Elastic limit .50 1.00 1.50 2.32	29.00	.720	.360	.250	57.2	

Test of Steel Plate—Continued.

MARKS.	MEASUREMENTS.			Applied load.	Strain in pounds per sq. inch	ELONGATION in eight inches.		REDUCTION OF AREA.				REMARKS.
	Breadth	Width.	Area.			Elongation in inches.	Elongation in percentage	Breadth	Width.	Area.	Percentage	
13 5,733	1.500	.565	.848	26,000 43,200 47,500 49,000	30,660 50,940 56,000 57,770	Elastic limit .50 1.00 1.50 2.44	30.50	1.050	.310	.326	61.5	
14 5,733	1.500	.560	.840	27,500 44,000 48,000 49,400	32,730 52,370 57,140 58,800	Elastic limit .50 1.00 1.50 2.40	30.00	1.060	.310	.329	60.8	
						Elastic limit .50 1.00 1.50						
						Elastic limit .50 1.00 1.50						

Test of Steel Plate—Continued.

MARKS.	MEASUREMENTS.			Applied load.	Strain in pounds per sq. inch.	ELONGATION. in eight inches.		REDUCTION OF AREA.				REMARKS.
	Breadth	Width.	Area.			Elongation in inches.	Elongation in percentage.	Breadth	Width.	Area.	Per-centage.	
						Elastic limit .50 1.00 1.50						
						Elastic limit .50 1.00 1.50						
1 5713	1.020	.670	.683	20,500 35,000 40,000 41,000	30,010 51,240 58,560 60,030	Elastic limit .50 1.00 1.50 2.00	25.00	.710	.440	.312	54.3	Fire box flange.
2 5713	1.020	.650	.663	20,000 34,000 39,200 40,200	30,160 51,260 59,120 60,620	Elastic limit .50 1.00 1.50 2.04	25.50	.720	.410	.295	55.5	Fire box flange.

Test of Steel Plate—Continued.

MARKS.	MEASUREMENTS.			Applied load.	Strain in pounds per sq. inch.	ELONGATION in eight inches.		REDUCTION OF AREA.				REMARKS.
	Breadth	Width.	Area.			Elongation in inches.	Elongation in percentage.	Breadth	Width.	Area.	Per-centage.	
3 5717	1.010	.648	.654	20,500 34,200 39,000 39,900	31,340 52,280 59,620 61,000	Elastic limit .50 1.00 1.50 2.12	26.50	.730	.390	.285	56.4	Fire box flange.
4 5717	1.010	.655	.662	20,200 37,000 40,100 41,900	30,510 55,880 60,570 61,920	Elastic limit .50 1.00 1.60 2.04	25.50	.700	.410	.287	56.6	Fire box flange.
5 5717	1.010	.650	.656	20,300 31,000 39,500 40,400	30,940 47,250 60,210 61,580	Elastic limit .50 1.00 1.50 2.20	27.50	.700	.390	.273	58.3	Fire box flange.
6 5717	1.015	.660	.670	20,800 35,000 39,100 40,000	31,040 52,240 58,350 59,700	Elastic limit .50 1.00 1.60 2.48	31.00	.680	.390	.265	60.4	Fire box flange.

Test of Steel Plate—Continued.

MARKS.	MEASUREMENTS.			Applied load.	Strain in pounds per sq. inch.	ELONGATION in eight inches.		REDUCTION OF AREA.				REMARKS.
	Breadth	Width.	Area.			Elongation in inches.	Elongation in percentage.	Breadth	Width.	Area.	Per-centage.	
7 5717	1.015	.655	.665	20,000 33,100 38,100 39,800	30,080 49,780 57,290 59,850	Elastic limit .50 1.00 1.50 2.40	30.00	.720	.400	.238	56.7	Fire box flange.
8 5717	1.020	.635	.648	20,200 33,600 38,200 39,600	31,170 51,850 58,950 60,180	Elastic limit .50 1.00 1.50 2.00	25.00	.700	.370	.259	60.	
9 5717	1.020	.625	.637	19,400 34,200 38,500 39,400	30,460 53,700 60,450 61,860	Elastic limit .50 1.00 1.50 2.16	27.00	.690	.380	.262	58.8	
10 5717	1.020	.635	.648	19,800 31,000 38,200 49,600	30,550 52,460 58,940 61,110	Elastic limit .50 1.00 1.50 2.36	29.50	.730	.390	.285	56.	

Test of Steel Plate—Continued.

MARKS.	MEASUREMENTS.			Applied load.	Strain in pounds per sq. inch.	ELONGATION in eight inches.		REDUCTION OF AREA.				REMARKS.
	Breadth	Width	Area.			Elongation in inches.	Elongation in percentage.	Breadth	Width.	Area.	Percentage.	
11 5717	1.020	.625	.637	19,700 32,000 36,200 38,100	30,920 50,240 56,820 59,810	Elastic limit .50 1.00 1.50 2.20	27.50	.710	.380	.270	57.6	
12 5717	1.010	.635	.641	20,400 34,000 37,800 38,700	31,820 53,040 57,720 60,370	Elastic limit .50 1.00 1.50 2.12	26.50	.710	.400	.284	55.5	
13 5717	1.015	.648	.658	20,300 35,100 39,500 40,000	30,850 53,340 60,030 60,790	Elastic limit .50 1.00 1.50 2.20	27.50	.760	.400	.304	53.8	Fire box flange.
14 5717	1.010	.625	.631	19,400 32,300 37,600 37,600	30,590 51,200 59,600 59,600	Elastic limit .50 1.00 1.50 2.36	29.50	.730	.400	.292	53.7	

Test of Steel Plate—Continued.

MARKS.	MEASUREMENTS.			Applied load.	Strain in pounds per sq. in.	ELONGATION in eight inches.		REDUCTION OF AREA.				REMARKS.
	Breadth	Width.	Area.			Elongation in inches.	Elongation in percentage.	Breadth	Width.	Area.	Per-centage	
15 4001	1.020	.875	.898	27,000 48,900 54,200 54,200	30,240 54,760 60,700 60,700	Elastic limit .50 1.00 1.50 2.16	27.00	.710	.580	.412	58.8	
16 4008	1.020	.881	.898	27,400 45,800 50,100 50,400	30,510 50,550 56,000 56,000	Elastic limit .50 1.00 1.50 2.32	29.00	.710	.580	.412	54.1	
						Elastic limit .50 1.00 1.50						
						Elastic limit .50 1.00 1.50						

Test of Steel Plate—Continued.

MARKS.	MEASUREMENTS.			Applied load.	Strain in pounds per sq. in.	ELONGATION in eight inches.		REDUCTION OF AREA.				REMARKS.
	Breadth	Width.	Area.			Elongation in inches.	Elongation in percentage.	Breadth	Width.	Area.	Per-centage.	
17 to 19 5726	1.030	.435	.448	15,500 22,000 24,400 25,500	34,600 49,110 54,470 56,920	Elastic limit .50 1.00 1.50 2.20	27.50	.700	.240	.168	62.5	
20 to 25 5727	1.030	.493	.508	16,000 24,000 28,700 28,900	31,500 47,250 56,500 56,900	Elastic limit .50 1.00 1.50 2.40	30.00	.670	.260	.174	65.7	
26 4003	1.025	.865	.887	28,500 44,800 49,000 49,900	32,130 50,500 55,230 56,250	Elastic limit .50 1.00 1.50 2.32	29.00	.730	.580	.423	52.3	
27 4003	1.020	.877	.895	27,500 45,200 50,700 51,500	30,780 50,500 56,550 57,550	Elastic limit .50 1.00 1.50 2.16	27.00	.740	.590	.437	51.1	

Test of Steel Plate—Continued.

MARKS.	MEASUREMENTS.			Applied load.	Strain in pounds per sq. in.	ELONGATION in eight inches.		REDUCTION OF AREA.				REMARKS.
	Breadth	Width.	Area.			Elongation in inches.	Elongation in percentage.	Breadth	Width.	Area.	Per-centage.	
28 4008	1.025	.870	.892	27,200 46,000 49,000 50,300	30,500 51,570 54,930 56,390	Elastic limit .50 1.00 1.50 2.48	31.00	.710	.560	.398	55.3	
29 4003	1.025	.885	.907	27,700 46,900 51,500 52,000	30,540 50,720 56,780 57,330	Elastic limit .50 1.00 1.50 2.08	26.00	.720	.600	.432	52.3	
30 4,003	1.025	.870	.892	27,400 44,900 50,000 51,300	30,720 50,340 56,050 57,510	Elastic limit .50 1.00 1.50 2.44	30.50	.690	.540	.373	58.1	
31 4,006	1.030	.885	.912	27,500 47,100 52,400 54,200	30,150 51,640 57,450 59,420	Elastic limit .50 1.00 1.50 2.20	27.50	.730	.590	.431	52.7	

Test of Steel Plate—Continued.

MARKS.	MEASUREMENTS.			Applied load.	Strain in pounds per sq. inch.	ELONGATION. in eight inches.		REDUCTION OF AREA.				REMARKS.
	Breadth	Width.	Area			Elongation in inches.	Elongation in percentage.	Breadth	Width.	Area.	Per-centage.	
32 to 34 5,726	1.035	.450	.466	15,200 22,200 26,000 26,400	32,620 47,640 55,800 56,650	Elastic limit .50 1.00 1.50 2.40	30.00	.700	.240	.168	64.	
35 to 41 5,726	1.035	.455	.471	15,600 22,900 26,000 28,600	33,120 48,620 55,210 60,730	Elastic limit .50 1.00 1.50 2.04	25.60	.730	.280	.204	56.6	
42 to 49 4,006	1.035	.890	.921	28,600 46,600 52,200 54,100	31,050 50,590 56,670 58,780	Elastic limit .50 1.00 1.50 2.32	29.00	.730	.590	.431	53.2	
50 4,008	1.035	.885	.916	28,300 47,700 51,000 58,400	30,900 52,070 55,670 58,300	Elastic limit .50 1.00 1.50 2.20	27.50	.720	.580	.418	54.3	

Test of Steel Plate—Continued.

MARKS.	MEASUREMENTS.			Applied load.	Strain in pounds per sq. inch.	ELONGATION in eight inches.		REDUCTION OF AREA.				REMARKS.
	Breadth	Width	Area.			Elongation in inches.	Elongation in percentage.	Breadth	Width	Area.	Per-centage	
51 4006	1.035	.885	.916	27,500 48,000 52,500 54,700	30,350 52,400 57,310 59,710	Elastic limit .50 1.0 1.50 2.00	25.00	.750	.600	.450	50.8	
52 4006	1.035	.886	.917	28,000 48,000 54,000 54,200	30,530 52,330 58,880 59,100	Elastic limit .50 1.00 1.50 2.16	27.00	.730	.600	.438	52.2	
53 4007	1.030	.867	.893	29,000 49,600 53,400 54,400	32,470 55,540 59,800 60,920	Elastic limit .50 1.00 1.50 2.04	25.50	.750	.600	.450	50.	
54 4006	1.035	.893	.924	28,100 48,200 54,000 54,500	30,410 52,160 58,440 58,960	Elastic limit .50 1.00 1.50 2.04	25.50	.720	.600	.432	53.2	

Test of Steel Plate—Continued.

MARKS.	MEASUREMENTS.			Applied Load.	Strain in pounds per sq. inch.	ELONGATION in eight inches.		REDUCTION OF AREA.				REMARKS.
	Breadth	Width.	Area.			Elongation in inches.	Elongation in percentage.	Breadth	Width.	Area.	Percentage	
55 4006	1.010	.885	.920	28,400 48,300 54,000 54,800	30,870 52,490 58,690 59,560	Elastic limit .50 1.00 1.50 2.08	26.00	.720	.570	.410	55.4	
56 4006	1.030	.880	.906	28,000 46,000 52,000 53,500	30,900 50,770 57,400 59,050	Elastic limit .50 1.00 1.50 2.40	30.00	.730	.580	.423	53.3	
162 to 164 5726	1.020	.625	.538	19,300 33,200 38,600 38,800	30,250 52,040 60,510 60,820	Elastic limit .50 1.00 1.50 2.24	28.00	.710	.380	.270	57.6	
165 to 167 5727	1.030	.625	.544	20,200 34,000 37,400 38,100	31,370 52,800 58,080 59,160	Elastic limit .50 1.00 1.00 2.32	23.00	.710	.380	.270	58.	

Test of Steel Plate—Continued.

MARKS.	MEASUREMENTS.			Applied Load.	Strain in pounds per sq. inch.	ELONGATION in eight inches.		REDUCTION OF AREA.				REMARKS.
	Breadth	Width.	Area.			Elongation in inches.	Elongation in per centage.	Breadth	Width.	Area.	Per centage.	
57 to 70 5726	1.035	.580	.600	18,800 32,000 36,700 37,000	31,330 53,320 61,170 61,670	Elastic limit .50 1.00 1.50 2.32	29.00	.720	.360	.259	56.8	
71 to 76 5727	1.025	.490	.502	15,800 26,000 28,500 29,800	31,480 51,800 56,780 59,370	Elastic limit .50 1.00 1.50 2.48	31.00	.660	.270	.178	64.5	
77 to 84 5727	1.025	.513	.526	16,000 28,000 31,000 32,500	30,420 53,240 58,940 61,790	Elastic limit .50 1.00 1.50 2.40	30.00	.710	.310	.220	58.1	
86 to 91 5727	1.430	.505	.722	22,600 38,400 42,000 43,600	31,300 53,180 58,170 60,380	Elastic limit .80 1.00 1.59 2.32	29.00	1.020	.280	.286	60.4	

Test of Steel Plate—Continued.

MARKS.	MEASUREMENTS.			Applied load.	Strain in pounds per sq. inch.	ELONGATION in eight inches.		REDUCTION OF AREA.				REMARKS.
	Breadth.	Width.	Area.			Elongation in inches.	Elongation in percentage.	Breadth.	Width.	Area.	Percentage.	
92 to 97 5727	1.435	.510	.732	23,200 39,200 43,500 44,800	31,700 53,550 59,420 61,200	Elastic limit .50 1.00 1.50 2.00	25.00	1.020	.300	.306	58.2	
168 to 170 5727	1.025	.626	.642	22,700 33,700 38,200 39,500	35,360 52,500 59,510 61,530	Elastic limit .50 1.00 1.50 2.20	27.50	.730	.360	.263	59.	
171 to 173 5727	1.025	.620	.635	20,500 34,700 38,500 39,100	32,280 54,650 60,640 61,580	Elastic limit .50 1.00 1.50 2.40	30.00	.710	.400	.284	55.2	
.74 to 175 5727	1.025	.625	6.41	21,400 34,000 39,000 39,500	33,390 53,040 60,840 61,620	Elastic limit .50 1.00 1.50 2.32	29.00	.740	.420	.311	51.5	

Test of Steel Plate—Continued.

32 MARKS.	MEASUREMENTS.			Applied load.	Strain in pounds per sq. inch.	ELONGATION in eight inches.		REDUCTION OF AREA.				REMARKS.
	Breadth.	Width.	Area.			Elongation in inches.	Elongation in percentage.	Breadth.	Width.	Area.	Per-centage.	
176 to 178 ● 5727	1.025	.680	.646	21,200 34,000 39,000 40,000	32,820 52,630 60,870 61,920	Elastic limit .50 1.00 1.50 2.20	27.50	.760	.420	.315	51.2	
179 to 181 5727	1.025	.627	6.43	19,400 32,000 36,000 36,500	30,170 49,770 55,99J 56,760	Elastic limit .50 1.00 1.50 2.08	26.00	.700	.360	.252	60.8	
108 4003	1.025	.880	.902	28,800 46,200 50,000 52,900	31,920 51,210 55,420 58,640	Elastic limit .50 1.00 1.50 2.12	26.50	.720	.590	.425	52.9	
113 to 127 5727	.975	.560	.546	17,000 26,300 31,600 32,900	31,140 48,170 56,780 60,280	Elastic limit .50 1.00 1.50 2.72	34.00	.680	.330	.224	59.	

Test of Steel Plate—Continued.

MARKS.	MEASUREMENTS.			Applied load.	Strain in pounds per sq. inch.	ELONGATION in eight inches.		REDUCTION OF AREA.				REMARKS.	
	Breadth	Width	Area.			Elongation in inches.	Elongation in percentage.	Breadth	Width.	Area.	Per-centage.		
109 4009	1.040	.872	.907	27,700 19,000 54,300 55,600	30,540 54,020 59,870 61,800	Elastic limit .50 1.00 1.50 2.00		25.00	.730	.600	.438	51.7	
110 4008	1.035	.885	.916	28,700 47,000 50,000 51,700	31,330 51,300 54,580 56,430	Elastic limit .50 1.00 1.50 2.48		31.00	.700	.550	.385	58.	
111 4008	1.035	.880	.911	28,900 47,700 52,000 53,100	31,730 52,360 57,080 58,298	Elastic limit .50 1.00 1.50 2.20		27.50	.740	.580	.420	52.9	
112 4008	1.030	.865	.891	27,900 49,000 50,000 50,430	31,310 54,990 55,110 56,560	Elastic limit .50 1.00 1.50 2.16		27.00	.720	.550	.396	55.5	

Test of Steel Plate—Continued.

MARKS.	MEASUREMENTS.			Applied load.	Strain in pounds per sq. inch.	ELONGATION in eight inches.		REDUCTION OF AREA.				REMARKS.
	Breadth	Width.	Area.			Elongation in inches.	Elongation in percentage.	Breadth	Width.	Area.	Per-centage.	
12-139 5727	1.040	.587	.590	13,000 31,000 35,000 35,700	30,510 52,540 59,320 60,500	Elastic limit .50 1.00 1.50 2.00	25.00	.700	.330	.281	60.8	
140 5727	1.485	.456	.677	21,700 34,300 40,000 41,200	32,050 50,660 59,080 60,660	Elastic limit .50 1.00 1.50 2.44	30.50	1.050	.260	.273	59.6	
141 4010	1.35	.870	.901	28,400 47,000 50,500 52,000	31,520 52,160 56,950 57,710	Elastic limit .50 1.00 1.50 2.40	30.00	.710	.530	.376	58.2	
142 4009	1.040	.994	.930	29,600 43,000 53,200 55,000	31,330 51,690 57,200 59,150	Elastic limit .50 1.00 1.50 2.08	26.00	.710	.580	.412	55.7	

Test of Steel Plate—Continued.

MARKS	MEASUREMENTS.			Applied load.	Strain in pounds per sq. inch.	ELONGATION in eight inches.		REDUCTION OF AREA.				REMARKS.
	Breadth	Width.	Area.			Elongation in inches.	Elongation in percentage.	Breadth	Width.	Area.	Per-centage.	
143 4009	1.040	.893	.929	29,000 49,000 54,000 56,700	31,220 52,740 58,120 61,030	Elastic limit .50 1.00 1.50 2.16	27.00	.780	.590	.431	53.6	
144 4009	1.040	.883	.918	28,100 49,000 53,000 54,100	30,610 53,370 57,730 58,930	Elastic limit .50 1.00 1.50 2.20	27.50	.710	.600	.426	53.6	
145 4009	1.040	.882	.917	27,900 49,900 54,000 56,900	30,420 54,410 58,880 60,960	Elastic limit .50 1.00 1.50 2.20	27.50	.750	.590	.443	51.7	
146 4009	1.040	.880	.915	28,000 47,000 52,000 53,600	30,600 51,360 56,830 58,580	Elastic limit .50 1.00 1.50 2.08	26.00	.780	.570	.416	54.5	

Test of Steel Plate—Continued.

MARKS.	MEASUREMENTS.			Applied load.	Strain in pounds per sq. inch.	ELONGATION in eight inches.		REDUCTION OF AREA.				REMARKS.
	Breadth	Width.	Area.			Elongation in inches.	Elongation in percentage.	Breadth	Width.	Area.	Per-centage.	
147 4010	1.080	.868	.894	27,300 45,000 48,200 50,700	30,530 50,530 53,900 56,700	Elastic limit .50 1.00 1.50 2.40	30.00	.730	.570	.416	53.4	
148 4010	1.025	.883	.905	27,700 47,000 49,400 50,900	30,600 51,900 54,570 56,230	Elastic limit .50 1.00 1.50 2.80	35.00	.690	.530	.366	59.6	
149 4010	1.025	.887	.909	27,500 45,000 48,500 51,400	30,250 49,500 53,350 56,740	Elastic limit .50 1.00 1.50 2.32	29.00	.710	.530	.376	59.6	
150 4010	1.025	.878	.897	27,700 43,000 48,000 50,600	30,880 47,930 53,500 56,400	Elastic limit .50 1.00 1.50 2.48	31.00	.680	.560	.341	62.	

Test of Steel Plate—Continued.

MARKS.	MEASUREMENTS.			Applied load.	Strain in pounds per sq. inch.	ELONGATION in eight inches.		REDUCTION OF AREA.				REMARKS.
	Breadth	Width.	Area.			Elongation in inches.	Elongation in percentage.	Breadth	Width.	Area.	Per-centage.	
151 4010	1.025	.865	.887	27,100 46,000 49,400 49,700	30,550 51,850 55,680 56,020	Elastic limit .50 1.00 1.50 2.32	29.00	.700	.540	.378	57.4	
152 4010	1.025	.887	.909	28,100 48,000 53,000 53,800	30,910 52,800 58,300 59,180	Elastic limit .50 1.00 1.50 2.24	28.00	.720	.550	.396	56.4	
153 4010	1.025	.866	.888	26,800 47,000 51,000 51,600	30,170 52,910 57,420 58,100	Elastic limit .50 1.00 1.50 2.32	29.00	.710	.560	.398	55.2	
154 4010	1.025	.867	.889	27,000 47,000 49,200 50,600	30,370 52,860 55,330 56,910	Elastic limit .50 1.00 1.50 2.00	25.00	.680	.550	.374	58.	

Test of Steel Plate—Continued.

MARKS.	MEASUREMENTS.			Applied load.	Strain in pounds per sq. in.	ELONGATION in eight inches.		REDUCTION OF AREA.				REMARKS.
	Breadth	Width.	Area.			Elongation in inches.	Elongation in percentage.	Breadth	Width.	Area.	Per-centage.	
155 4010	1.025	.875	.897	27,200 45,000 51,200 52,400	30,320 50,170 57,080 58,410	Elastic limit .50 1.00 1.50 2.48	31.00	.710	.560	.398	55.6	
156 4009	1.580	.577	.912	27,700 48,000 52,200 53,900	30,370 52,630 57,240 59,100	Elastic limit .50 1.00 1.50 2.32	29.00	1.160	.370	.425	53.4	
189 5735	1.580	.637	1.007	30,800 54,000 61,000 62,000	30,590 53,620 60,570 61,570	Elastic limit .50 1.00 1.50 2.40	30.00	1.150	.420	.483	52.	
157 4011	1.025	.875	.897	28,000 47,000 50,000 52,300	31,210 52,300 55,730 58,300	Elastic limit .50 1.00 1.50 2.12	26.50	.710	.600	.426	52.5	

Test of Steel Plate—Continued.

MARKS.	MEASUREMENTS.			Applied load.	Strain in pounds per sq. in.	ELONGATION in eight inches.		REDUCTION OF AREA.				REMARKS.
	Breadth	Width.	Area.			Elongation in inches.	Elongation in percentage.	Breadth	Width.	Area.	Per-centage.	
158 4012	1.580	.510	.806	25,800 41,200 45,300 47,400	32,010 51,110 56,200 58,800	Elastic limit .50 1.00 1.50 2.40	30.00	1.110	.270	.300	62.8	
159 4012	1.580	.518	.818	26,000 43,000 49,000 50,000	31,780 52,560 59,900 61,120	Elastic limit .50 1.00 1.50 2.32	29.00	1.150	.320	.368	55.	
160 6465	1.015	.878	.891	28,900 43,200 51,000 53,400	32,430 48,480 57,230 59,930	Elastic limit .50 1.00 1.50 2.40	30.00	.670	.570	.382	67.1	
161 6465	1.015	.880	.893	29,000 42,000 48,000 53,900	32,480 47,030 53,750 60,860	Elastic limit .50 1.00 1.50 2.40	30.00	.710	.590	.419	53.	

Test of Steel Plate—Continued.

MARKS.	MEASUREMENTS.			Applied load.	Strain in pounds per sq. inch.	ELONGATION in eight inches.		REDUCTION OF AREA.				REMARKS.
	Breadth	Width.	Area.			Elongation in inches.	Elongation in percentage.	Breadth	Width.	Area.	Percentage.	
						Elastic limit .50 1.00 1.50						
						Elastic limit .50 1.00 1.50						
182 to 184 5727	1.435	.626	.898	28,000 48,000 54,000 55,500	31,180 53,440 60,130 61,800	Elastic limit .50 1.00 1.50 2.44	30.50	1.030	.390	.402	55.2	
185 to 188 5727	1.435	.640	.918	28,200 48,600 51,500 54,000	30,720 52,940 58,280 58,820	Elastic limit .50 1.00 1.50 2.40	30.00	1.030	.410	.422	54.	

Test of Steel Plate—Continued.

Marks.	MEASUREMENTS.			Applied load.	Strain in pounds per sq. inch.	ELONGATION In eight inches.		REDUCTION OF AREA.				REMARKS.
	Breadth	Width.	Area.			Elongation in inches.	Elongation in percentage.	Breadth	Width.	Area.	Percentage	
85 4009	1.025	.885	.907	28,000 47,200 52,000 53,500	30,870 52,040 57,380 58,990	Elastic limit .50 1.00 1.50 2.32	29.00	.710	.590	.419	53.8	
98 to 105 5727	1.525	.510	.778	25,500 38,600 44,000 46,000	32,780 48,854 56,550 59,120	Elastic limit .50 1.00 1.50 2.48	31.00	1.050	.300	.315	59.5	
106 4008	1.025	.875	.897	27,500 46,300 52,000 52,800	30,660 51,610 57,970 58,860	Elastic limit .50 1.00 1.50 2.04	25.50	.750	.600	.450	50.	
107 4008	1.025	.875	.897	28,100 48,000 53,000 53,400	31,330 53,510 59,090 59,540	Elastic limit .50 1.00 1.50 2.20	27.50	.720	.590	.425	52.6	

Tests of Steel Boiler Plates, made by John E. Codman, Chief Draughtsman, Bureau of Water, Department of Public Works, at Lukens Steel Co., Limited, Coatesville, Pa., November, 1898.

MARKS.	MEASUREMENTS.			Applied load.	Strain in pounds per sq. inch.	ELONGATION in eight inches.		REDUCTION OF AREA.				REMARKS.	
	Breadth	Width.	Area.			Elongation in inches.	Elongation in percentage.	Breadth	Width.	Area.	Percentage.		
1 to 6 4075	1.150	.880	1.012	32,000 52,200 58,100 59,600	31,620 51,580 57,420 58,900	Elastic limit .50 1.00 1.50 2.32		29.00	.740	.500	.370	68.40	Shell.
7 6509	1.250	.869 .835 .870	1.044	32,000 54,100 58,000 60,100	30,650 51,810 55,850 57,560	Elastic limit .50 1.00 1.50 2.48		31.00	.820	.500	.410	60.70	Shell.
8 6509	1.250	.860 .870	1.063	31,900 52,800 60,000 61,900	30,010 49,670 56,440 58,230	Elastic limit .50 1.00 1.50 2.44		30.50	.820	.480	.394	68.00	Shell.
9 6509	1.250	.860 .870	1.075	33,000 54,100 60,000 63,600	30,700 50,320 55,810 59,160	Elastic limit .53 1.00 1.50 2.40		30.00	.810	.500	.405	62.30	Shell.

NOTE—Boilers 8 feet 6 inches diameter, $\frac{7}{8}$ shell. Built by I. P. Morris & Co., Philadelphia, 1898.

Test of Steel Plate—Continued.

MARKS.	MEASUREMENTS.			Applied Load.	Strain in pounds per sq. inch.	ELONGATION in eight inches.		REDUCTION OF AREA.				Remarks.
	Breadth	Width.	Area.			Elongation in inches.	Elongation in percentage.	Breadth	Width.	Area.	Per-centage.	
10 5805	1.250	.870	1.088	35,400 56,200 61,000 65,800	32,530 51,640 58,810 60,010	Elastic limit .50 1.00 1.50 2.48	31.00	.870	.540	.470	56.60	Shell.
11 6503	1.250	.859 .871	1.074	34,100 54,000 61,000 63,200	31,750 50,280 56,800 58,840	Elastic limit .50 1.00 1.50 2.60	32.50	.830	.510	.423	59.70	Shell.
12 6509	1.260	.857 .870	1.080	31,200 60,000 62,500	30,740 55,550 57,960	Elastic limit .50 1.00 1.50 2.60	32.50	.830	.520	.432	60.00	Shell.
13 6509	1.250	.855 .870	1.069	33,000 53,100 60,000 61,300	30,860 49,660 51,120 57,340	Elastic limit .50 1.00 1.50 2.43	31.00	.800	.500	.400	62.60	Shell.

Test of Steel Plate—Continued.

MARKS.	MEASUREMENTS.			Applied load.	Strain in pounds per sq. inch.	ELONGATION in eight inches.		REDUCTION OF AREA.				REMARKS.
	Breadth	Width.	Area.			Elongation in inches.	Elongation in percentage	Breadth	Width.	Area.	Per-centage.	
14 & 15 6829	1.250	.860 .872	1.063	32,200 52,000 58,100 60,000	30,290 48,910 54,650 56,440	Elastic limit .50 1.00 1.50 2.40	30.00	.830	.500	.415	61.00	Shell.
16 4084	1.250	.860	1.075	33,000 51,200 58,100 59,400	30,690 47,640 54,040 55,250	Elastic limit .60 1.00 1.50 2.84	35.50	.800	.490	.392	63.50	Shell.
17 4084	1.250	.865 .870	1.081	32,200 54,000 60,000 61,400	29,780 49,950 55,500 56,800	Elastic limit .60 1.00 1.50 2.56	32.00	.820	.500	.410	62.00	Shell.
18 5800	1.250	.870	1.088	33,500 55,000 61,200 63,600	30,780 50,540 56,240 58,440	Elastic limit .60 1.00 1.50 2.60	32.50	.840	.520	.437	59.80	Shell.

Test of Steel Plate—Continued.

MARKS.	MEASUREMENTS.			Applied load.	Strain in pounds per sq. inch.	ELONGATION in eight inches.		REDUCTION OF AREA.				REMARKS.
	Breadth	Width.	Area.			Elongation in inches.	Elongation in percentage.	Breadth	Width.	Area.	Per-centage.	
19 5800	1.260	.870	1.096	36,900 54,000 62,100 65,800	33,670 49,260 56,660 60,030	Elastic limit .50 1.00 1.50 2.40	30.00	.820	.530	.435	60.30	Shell.
20 4005	1.240	.850 .870	1.063	32,200 54,100 61,000 64,400	30,290 50,890 57,380 60,580	Elastic limit .50 1.00 1.50 2.20	27.50	.860	.540	.464	56.30	Shell.
21 4092	1.250	.880	1.100	34,300 54,200 61,300 63,500	31,180 49,270 55,730 57,730	Elastic limit .50 1.00 1.50 2.40	30.00	.810	.500	.406	63.20	Shell.
22 4092	1.250	.875	1.094	33,300 53,000 61,100 61,900	30,440 48,440 55,810 56,570	Elastic limit .50 1.00 1.50 2.44	30.50	.800	.490	.392	64.10	Shell.

Test of Steel Plates—Continued.

MARKS.	MEASUREMENTS.			Applied Load.	Strain in pounds per sq. inch.	ELONGATION in eight inches.		REDUCTION OF AREA.				REMARKS.
	Breadth.	Width.	Area.			Elongation in inches.	Elongation in Percentage	Breadth.	Width.	Area.	Percentage	
23 to 27 and 40 6542	1.000	.555	.555	18,000 26,400 28,300 30,400	32,440 47,570 51,000 54,780	Elastic limit .50 1.00 1.50 2.44	30.50	.630	.300	.189	65.90	Butts.
28 6513	1.250	.885	1.106	37,500 58,200 64,000 68,300	33,900 52,610 57,850 61,750	Elastic limit .50 1.00 1.50 2.04	25.50	.880	.590	.521	62.90	Shell.
29 4074	1.250	.875	1.094	36,800 54,100 60,500 63,100	33,640 49,350 55,300 57,680	Elastic limit .50 1.00 1.50 2.16	27.00	.880	.500	.415	62.00	Shell.
30 6489	1.250	.875	1.094	34,600 53,200 60,000 61,400	31,620 48,630 54,840 56,120	Elastic limit .50 1.00 1.50 2.60	32.50	.840	.520	.437	60.00	Shell.

Test of Steel Plate—Continued.

MARK.	MEASUREMENTS.			Applied Load.	Strain in pounds per sq. inch.	ELONGATION in eight inches.		REDUCTION OF AREA.				Remarks.
	Breadth	Width.	Area.			Elongation in inches.	Elongation in percentage.	Breadth	Width.	Area.	Per-centage.	
31 to 33 6496	1.520	.425	.646	20,900 30,200 34,000 34,500	32,350 46,750 52,640 58,410	Elastic limit .50 1.00 1.50 2.48	31.00	1.010	.200	.202	68.70	Dome.
34 6513	1.250	.865	1.081	35,200 54,400 60,200 63,100	32,560 50,340 55,680 58,360	Elastic limit .50 1.00 1.50 2.44	30.50	.880	.500	.415	61.60	Shell.
35 to 37 6496	1.495	.415	.621	21,600 31,900 33,800 34,700	34,780 49,920 54,440 55,880	Elastic limit .50 1.00 1.50 2.60	32.50	1.000	.210	.210	66.20	Dome.
38 5805	1.250	.850	1.068	36,500 54,200 62,200 64,400	34,330 50,980 58,500 60,570	Elastic limit .50 1.00 1.50 2.08	26.00	.880	.550	.484	54.50	Shell.

Test of Steel Plate—Continued.

MARKS.	MEASUREMENTS.			Applied load.	Strain in pounds per sq. inch	ELONGATION in eight inches.		REDUCTION OF AREA.				REMARKS.
	Breadth	Width.	Area.			Elongation in inches.	Elongation in percentage	Breadth	Width.	Area.	Per-centage	
39 5805	1.255	.880	1.105	34,900 56,800 64,400 66,700	31,580 50,940 58,270 60,360	Elastic limit .50 1.00 1.50 2.20	27.50	.870	.580	.495	55.20	Shell.
41 to 46 6542	1.000	.565	.565	18,300 27,000 29,700 30,700	32,300 47,800 52,570 54,340	Elastic limit .50 1.00 1.50 2.60	32.50	.620	.290	.180	63.10	Butts.
47 to 52 6542	1.150	.570	.655	21,300 31,000 33,900 34,900	32,520 47,800 51,750 53,280	Elastic limit .50 1.00 1.50 2.80	35.00	.720	.280	.202	69.10	Butts.
53 to 58 4052	1.530	.455	.696	22,000 31,200 36,400 38,300	31,610 44,830 52,800 55,020	Elastic limit .50 1.00 1.50 2.72	34.00	1.040	.220	.229	67.40	Dome.

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Test of Steel Plate—Continued.

MARKS.	MEASUREMENTS.			Applied load.	Strain in pounds per sq. inch.	ELONGATION in eight inches.		REDUCTION OF AREA.				REMARKS.
	Breadth	Width	Area.			Elongation in inches.	Elongation in percentage.	Breadth	Width	Area.	Per-centage	
59 to 70 6538	1.000	.745	.745	22,800 37,000 39,400 40,500	30,600 49,660 52,880 54,360	Elastic limit .50 1.00 1.50 2.80	35.00	.610	.460	.244	67.20	Manhole.
71 4074	1.000	.890	.880	33,100 44,000 48,300 50,000	37,610 50,000 54,890 56,800	Elastic limit .50 1.00 1.50 2.48	31.00	.650	.500	.325	63.10	Shell.
72 4092	1.000	.887	.887	31,500 43,000 48,000 49,000	35,510 48,470 54,100 55,280	Elastic limit .50 1.00 1.50 2.48	31.00	.600	.520	.312	64.80	Shell.
78 4084	1.000	.895	.895	30,200 45,000 48,100 49,600	38,740 50,270 53,740 55,410	Elastic limit .50 1.00 1.50 2.40	30.00	.640	.520	.333	62.80	Shell.

Test of Steel Plate—Continued.

MARKS.	MEASUREMENTS.			Applied load.	Strain in pounds per sq. inch.	ELONGATION. in eight inches.		REDUCTION OF AREA.				REMARKS.	
	Breadth	Width.	Area.			Elongation in inches.	Elongation in percentage.	Breadth	Width.	Area.	Percentage.		
74 4092	1.000	.900	.900	31,200 46,700 51,200 52,500	34,670 51,890 56,890 68,330	Elastic limit .50 1.00 1.50 2.32							
							29.00	.670	.550	.369	69.00	Shell.	
75 to 82 4093	1.530	.565	.864	26,000 42,100 48,000 49,400	30,000 48,730 55,540 57,170	Elastic limit .50 1.00 1.50 2.40							
							30.00	1.010	2.80	.283	67.20	Butts.	
83 to 90 4093	1.530	.575	.880	27,500 43,000 48,100 47,400	31,250 48,860 51,660 56,130	Elastic limit .50 1.00 1.50 2.48							
							31.00	1.010	.290	.293	66.70	Butts.	
91 to 107 1535	1.530	.565	.864	28,100 42,200 47,100 47,500	32,520 48,840 54,510 56,130	Elastic limit .50 1.00 1.50 2.32							
							29.00	1.060	.300	.318	63.20	Butts.	

Test of Steel Plate—Continued.

MARKS.	MEASUREMENTS.			Applied load.	Strain in pounds per sq. inch.	ELONGATION. in eight inches.		REDUCTION OF AREA.				REMARKS.
	Breadth	Width.	Area			Elongation in inches.	Elongation in percentage.	Breadth	Width.	Area.	Per-centage.	
108 to 113 6586	1.540	.565	.870	30,000 47,300 50,400 51,500	34,480 54,360 57,920 59,190	Elastic limit .50 1.00 1.50 2.20	27.50	1.100	.310	.341	60.80	Butts.
114 to 121 6493	1.150	.556	.639	20,600 32,000 35,200 36,400	32,240 50,080 55,090 56,970	Elastic limit .50 1.00 1.50 2.60	32.50	.740	.300	.222	65.20	Butts.
122 to 137 6535	.990	.570	.564	20,500 31,000 32,300 32,600	36,350 54,970 57,280 57,810	Elastic limit .50 1.00 1.50 2.60	32.50	.660	.290	.191	64.10	Butts.
188 4100	1.000	.890	.890	30,400 44,100 47,400 48,500	34,160 49,580 53,250 54,490	Elastic limit .50 1.00 1.50 2.20	27.50	.640	.530	.329	63.00	Shell.

Test of Steel Plate—Continued.

MARKS.	MEASUREMENTS.			Applied load.	Strain in pounds per sq. inch.	ELONGATION in eight inches.		REDUCTION OF AREA.				REMARKS.
	Breadth	Width.	Area.			Elongation in inches.	Elongation in percentage.	Breadth	Width.	Area.	Percentage.	
189 6544	1.000	.877	.877	32,000 46,200 51,000 51,700	36,490 52,670 58,140 58,940	Elastic limit .50 1.00 1.50 2.20	27.50	.640	.520	.339	61.30	Shell.
140 6543	1.010	.875	.884	28,100 42,200 47,100 48,100	31,790 47,730 53,280 54,410	Elastic limit .50 1.00 1.50 2.72	34.00	.640	.500	.320	63.80	Shell.
141 6543	1.150	.670	.771	24,500 38,200 42,600 43,500	31,780 49,510 55,250 56,420	Elastic limit .50 1.00 1.50 2.20	27.50	.800	.400	.320	58.50	Head.
142 to 156 6535	1.215	.555	.674	22,800 34,200 37,800 38,800	33,820 50,740 56,080 57,560	Elastic limit .50 1.00 1.50 2.32	29.00	.850	.300	.255	62.10	Butts.

Test of Steel Plate—Continued.

MARKS.	MEASUREMENTS.			Applied load.	Strain in pounds per sq. inch.	ELONGATION in eight inches.		REDUCTION OF AREA.				REMARKS.			
	Breadth	Width.	Area.			Elongation in inches.	Elongation in percentage.	Breadth	Width.	Area.	Percentage.				
157 6544	1.300	.885	1.151	38,800 56,000 62,000 68,900	33,710 48,650 53,860 59,860	Elastic limit .50 1.00 1.50 2.48									
							31.00	.930	.580	.539	53.10	Shell.			
158 4100	1.220	.885	1.080	34,000 54,300 58,200 59,400	31,940 50,270 53,880 54,990	Elastic limit .50 1.00 1.50 2.40									
							30.00	.840	.560	.470	56.60	Shell.			
159 4100	1.255	.885	1.111	34,200 54,300 60,600 60,400	30,780 48,870 54,000 54,360	Elastic limit .50 1.00 1.50 2.16									
							27.00	.860	.500	.430	61.30	Shell.			
160 6544	1.235	.885	1.093	37,700 56,500 62,200 63,600	34,490 51,700 56,910 58,190	Elastic limit .50 1.0 1.50 2.20									
							27.50	.810	.530	.429	60.70	Shell.			

Test of Steel Plate—Continued.

MARKS.	MEASUREMENTS.			Applied load.	Strain in pounds per sq. inch.	ELONGATION in eight inches.		REDUCTON OF AREA.				REMARKS.
	Breadth	Width.	Area.			Elongation in inches.	Elongation in percentage	Breadth	Width.	Area.	Per-centage.	
161 6544	1.250	.875	1.094	36,500 58,200 62,000 63,900	33,460 53,200 56,670 58,410	Elastic limit .50 1.00 1.50 2.40	30.00	.820	.540	.443	59.50	Shell.
162 4100	1.250	.880	1.100	35,000 55,000 59,200 59,900	31,810 50,000 53,810 54,450	Elastic limit .50 1.00 1.50 2.32	29.00	.870	.570	.496	54.90	Shell.
163 6544	1.225	.875	1.072	34,200 56,100 60,000 61,900	31,900 52,320 55,960 57,730	Elastic limit .50 1.00 1.50 2.20	27.50	.820	.500	.410	61.70	Shell.
164 6544	1.225	.880	1.078	36,400 56,200 62,300 63,800	33,760 52,130 57,780 59,180	Elastic limit .50 1.00 1.50 2.40	30.00	.820	.530	.435	59.60	Shell.

Test of Steel Plate—Continued.

MARKS.	MEASUREMENTS.			Applied load.	Strain in pounds per sq. in.	ELONGATION in eight inches.		REDUCTION OF AREA.				REMARKS.
	Breadth	Width.	Area.			Elongation in inches.	Elongation in percentage.	Breadth	Width.	Area.	Per-centage.	
165 6544	1.300	.885	1.151	35,000 58,300 66,500 69,400	30,400 50,640 67,770 60,290	Elastic limit .50 1.00 1.50 2.40	30.00	.900	.550	.495	57.00	Shell.
166 6543	1.300	.877	1.140	34,000 57,200 62,100 68,000	29,820 50,170 64,470 55,260	Elastic limit .50 1.00 1.50 2.20	27.50	.890	.550	.490	57.00	Shell.
167 6544	1.250	.880	1.100	34,900 56,800 64,100 66,000	31,730 51,180 64,270 60,900	Elastic limit .50 1.00 1.50 2.20	27.80	.900	.500	.450	59.10	Shell.
168 6543	1.250	.888	1.110	34,000 56,000 60,200 61,500	30,680 50,450 64,230 55,400	Elastic limit .80 1.00 1.50 2.32	29.00	.840	.550	.462	58.40	Shell.

Test of Steel Plate—Continued.

MARKS.	MEASUREMENTS.			Applied load.	Strain in pounds per sq. inch.	ELONGATION in eight inches.		REDUCTION OF AREA.				REMARKS.
	Breadth	Width.	Area.			Elongation in inches.	Elongation in percentage.	Breadth	Width.	Area.	Per-centage.	
169 6544	1.300	.880	1.144	35,000 56,200 65,000 68,400	30,590 49,130 56,820 59,800	Elastic limit .50 1.0 1.50 2.40	30.00	.860	.560	4.82	57.90	Shell.
170 4100	1.280	.883	1.086	36,000 56,800 59,500 60,500	33,150 51,840 54,780 55,700	Elastic limit .50 1.00 1.50 2.40	30.00	.800	.510	.408	62.40	Shell.
171 6543	1.300	.870	1.131	34,000 55,500 60,200 61,400	30,060 49,070 53,230 54,280	Elastic limit .50 1.00 1.50 2.44	30.50	.860	.500	.430	62.00	Shell.
172 6543	1.300	.890	1.157	34,400 56,400 61,200 62,400	29,730 48,750 52,900 53,930	Elastic limit .50 1.00 1.50 2.60	32.50	.880	.540	.475	59.00	Shell.

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Test of Steel Plate—Continued.

MARKS.	MEASUREMENTS.			Applied load.	Strain in pounds per sq. inch.	ELONGATION in eight inches.		REDUCTION OF AREA.				REMARKS.
	Breadth	Width.	Area.			Elongation in inches.	Elongation in percentage.	Breadth	Width.	Area.	Per-centage.	
173 6543	1.300	.886	1.152	35,000 56,200 61,000 62,700	30,380 48,780 52,950 54,420	Elastic limit .50 1.00 1.50 2.48	31.00	.890	.550	.490	57.40	Shell.
174 6543	1.300	.890	1.157	34,000 58,300 64,100 65,100	29,380 50,390 55,400 56,260	Elastic limit .50 1.00 1.50 2.40	30.00	.890	.550	.490	57.60	Shell.
175 6549	1.560	.650	1.014	32,900 54,000 58,000 59,000	32,450 53,250 57,200 58,180	Elastic limit .50 1.00 1.50 2.48	31.00	1.100	.400	.440	56.60	Head.
176 4105	1.300	.663	.862	25,500 41,000 45,000 46,600	29,580 47,660 52,200 54,050	Elastic limit .50 1.00 1.50 2.40	30.00	.900	.400	.360	58.20	Head.

Test of Steel Plate—Continued.

MARKS.	MEASUREMENTS.			Applied load.	Strain in pounds per sq. inch.	ELONGATION in eight inches.		REDUCTION OF AREA.				REMARKS.
	Breadth	Width.	Area.			Elongation in inches.	Elongation in percentage.	Breadth	Width.	Area.	Per-centage.	
177 6549	1.300	.655	.852	26,000 42,100 47,000 48,900	30,510 49,420 55,160 57,390	Elastic limit .50 1.00 1.50 2.40	30.00	.900	.400	.360	57.70	Head.
178 6549	1.300	.655	.852	27,000 45,000 48,200 49,000	31,690 52,810 56,570 57,500	Elastic limit .50 1.00 1.50 2.40	30.00	.900	.370	.333	60.90	Head.
179 4105	1.025	.662	.678	21,000 32,300 35,200 36,900	30,970 47,640 51,910 54,440	Elastic limit .50 1.00 1.50 2.32	29.00	.700	.400	.280	58.70	Head.
180 4105	1.025	.675	.692	22,000 32,100 36,100 37,600	31,790 46,380 52,170 54,330	Elastic limit .50 1.00 1.50 2.40	30.00	.690	.400	.276	60.10	Head.

Test of Steel Plate—Continued.

MARKS.	MEASUREMENTS.			Applied Load.	Strain in pounds per sq. inch.	ELONGATION in eight inches.		REDUCTION OF AREA.				REMARKS.
	Breadth	Width.	Area.			Elongation in inches.	Elongation in percentage.	Breadth	Width.	Area.	Percentage.	
181 4105	1.025	.646	.662	21,000 31,200 35,200 36,100	31,720 47,120 53,170 54,530	Elastic limit .50 1.00 1.50 2.16	27.00	.700	.400	.280	57.70	Head.
182 4105	1.025	.660	.676	21,300 31,200 35,100 36,800	31,510 46,160 51,920 54,440	Elastic limit .50 1.00 1.50 2.08	26.00	.650	.390	.254	62.40	Head.
183 6515	1.025	.658	.674	21,000 32,200 38,100 39,300	31,150 47,780 56,530 58,900	Elastic limit .50 1.00 1.50 2.40	30.00	.690	.400	.276	59.00	Head.
184 6515	1.025	.658	.654	21,000 32,200 38,000 39,100	32,110 49,240 58,100 59,790	Elastic limit .50 1.00 1.50 2.48	31.00	.710	.400	.284	56.50	Head.

Test of Steel Plate—Continued.

MARKS.	MEASUREMENTS.			Applied Load.	Strain in pounds per sq. inch.	ELONGATION in eight inches.		REDUCTION OF AREA.				Remarks.
	Breadth	Width.	Area.			Elongation in inches.	Elongation in percentage.	Breadth	Width.	Area.	Per-centage.	
185 6549	1.025	.635	.651	21,000 32,300 37,200 38,100	32,250 49,620 57,140 58,520	Elastic limit .50 1.00 1.50 2.16	27.00	.780	.400	.292	55.10	Head.
186 6544	1.080	.875	.901	29,000 47,000 52,500 53,000	32,190 52,160 58,880 58,820	Elastic limit .50 1.00 1.50 2.40	30.00	.700	.560	.392	56.50	Shell.
187 to 189 5790	1.580	.625	.956	29,000 47,200 52,100 52,800	30,330 49,370 54,500 55,230	Elastic limit .50 1.00 1.50 2.20	27.50	1.040	.850	.364	61.90	Comb. chamber.
190 to 191 6499	1.255	.625	.784	29,400 41,000 43,000 45,100	29,840 52,290 54,640 57,520	Elastic limit .50 1.00 1.50 2.40	30.00	.830	.330	.274	65.00	

Test of Steel Plate—Continued.

MARKS.	MEASUREMENTS.			Applied Load.	Strain in pounds per sq. inch.	ELONGATION in eight inches.		REDUCTION OF AREA.				REMARKS.
	Breadth	Width	Area.			Elongation in inches.	Elongation in Percentage	Breadth	Width	Area.	Percentage	
192 to 194 5790	1.525	.635	.968	29,000 48,300 53,400 54,200	29,960 49,900 55,160 55,990	Elastic limit .50 1.00 1.50 2.44	30.50	1.040	.380	.343	64.50	
195 to 197 4093	1.000	.630	.630	24,000 36,100 41,000 41,800	38,090 57,800	Elastic limit .50 1.00 1.50 2.08	26.00	.680	.390			
198 to 199 4093	1.000	.605	.605	19,800 31,100 33,200 34,700	31,900 51,410 54,880 57,360	Elastic limit .50 1.00 1.50 2.40	30.00	.660	.340	.224	63.00	Comb. chamber.
200 to 203 5784	1.525	.635	.968	29,300 47,000 53,000 54,900	30,270 48,560 54,750 56,710	Elastic limit .50 1.00 1.50 2.72	34.00	1.010	.350	.354	63.40	

Test of Steel Plate—Continued.

MARKS.	MEASUREMENTS.			Applied Load.	Strain in pounds per sq. inch.	ELONGATION in eight inches.		REDUCTION OF AREA.				REMARKS.
	Breadth	Width	Area			Elongation in inches.	Elongation in Percentage.	Breadth	Width	Area.	Per-centage	
204 to 205 4093	1.000	.632	.632	21,000 32,200 35,100 36,600	33,230 50,950 55,540 57,920	Elastic limit .50 1.00 1.50 2.40	80.00	.640	.360	.230	68.60	
206 to 207 4093	1.010	.640	.646	20,000 32,200 35,100 36,100	30,960 49,850 54,340 55,880	Elastic limit .50 1.00 1.50 2.40	80.00	.630	.320	.202	68.70	
208 to 210 6492	1.255	.640	.803	24,000 41,000 44,000 45,200	29,890 51,060 54,790 56,290	Elastic limit .50 1.00 1.50 2.40	80.00	.810	.350	.234	64.60	
195 to 197 4093	1.480	.680	.932	28,200 43,200 52,100 53,300	30,250 46,340 55,900 57,180	Elastic limit .50 1.00 1.50 2.80	82.50	.1000	.880	.880	64.60	

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