

DEPARTMENT FOR SUPPLYING THE CITY WITH WATER.

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ANNUAL REPORT

OF THE

CHIEF ENGINEER OF THE WATER DEPARTMENT

OF THE

CITY OF PHILADELPHIA,

AND

PLAN OF SUPPLYING THE CITY WITH WATER  
BY AQUEDUCT,

FROM THE

PERKIOMEN,

PRESENTED TO COUNCILS, FEBRUARY 15,

1866.

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PHILADELPHIA:

WILLIAM F. GEDDES, PRINTER, 320 CHESTNUT STREET.

1866.

# COMMITTEE ON WATER WORKS.

1865.

HENRY W. GRAY, Chairman,  
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SAMUEL W. CATTELL,  
CHARLES THOMSON JONES,  
JAMES ARMSTRONG,  
C. E. KAMERLY, M. D.,

JAMES G. PEALE,  
ROBERT M. EVANS,  
MATTHEW J. BRADY,  
JAMES H. BILLINGTON,  
JAMES T. ALLEN,  
THOMAS H. GILL.

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W. J. P. WHITE,

### Chief Clerk.

ALBERT H. O'BRIEN.

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JOHN BIRKINBINE.

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First District,	E. B. COBB,	Office 615 Carpenter Street.
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Third "	ROBERT C. HICKS,	" 1420 Frankford Road.
Fourth "	JACOB C. APPLE,	" 1324 Buttonwood Street.

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<i>Schuylkill</i>	" WILLIAM HODGES,	JOSHUA BARTLEY,
<i>Delaware</i>	" BENJAMIN F. NORMAN,	JOSEPH THOMPSON,
<i>24th Ward</i>	" JAMES BUCKLEY,	WILLIAM GEBLER.

# COMMITTEE ON WATER WORKS.

1866.

HENRY W. GRAY, Chairman,  
SAMUEL W. CATTELL,  
CHARLES THOMSON JONES,  
WILLIAM F. SMITH,  
JOHN A. SHERMER,  
C. E. KAMERLY, M. D.,

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JAMES H. BILLINGTON,  
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First, Second, Third, Fourth and Twenty-sixth Wards.  
JOHN A. SHERMER, WILLIAM STOKES, and C. E. KAMERLY, M. D.

#### *Second District.*

Fifth, Sixth, Seventh, Eighth, Ninth, Tenth, and Twenty-fourth Wards.  
SAMUEL W. CATTELL, WALTER ALLISON, and THOMAS H. GILL.

#### *Third District.*

Eleventh, Twelfth, Sixteenth, Seventeenth, Eighteenth, Nineteenth, Twenty-third, and Twenty-fifth Wards.  
JOSEPH T. VANKIRK, W. F. SMITH, and DANIEL P. RAY.

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WILLIAM STOKES,

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C. E. KAMERLY, M. D.

### On Extensions.

C. THOMSON JONES,  
S. W. CATTELL,

THOMAS H. GILL,  
H. W. GRAY.

### On Works.

JAMES H. BILLINGTON,  
WALTER ALLISON,

W. F. SMITH,  
DANIEL P. RAY.

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ANNUAL REPORT .  
OF THE  
CHIEF ENGINEER OF THE WATER DEPARTMENT,  
FOR THE YEAR 1865 :  
PRESENTED TO COUNCILS, FEBRUARY, 1866.

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

*Gentlemen* :—I have the honor of presenting my Sixth Annual Report, on the condition and operation of the Water Department of this City, together with some suggestions relative to a future supply.

PRESENT SOURCES OF WATER SUPPLY.

There is no subject about which the Department is so solicitous as that of the character of the water in Fairmount Dam, from which more than five-sixths of the supply of the city is drawn. The rapid increase of sources from which objectionable matter is drained into the dam is a constant anxiety, and I would be recreant to my duty did I not call your attention to it. This subject, because of its importance, has been urged in all my previous Reports.

Fairmount Dam, below the Columbia Bridge, may be considered the Subsiding Reservoir for the Works, and indeed the only one,

the storage capacity of the reservoirs connected with the Works being so small that the water has but little time for subsidence; and as a consequence the water supplied from the reservoirs is about the same as that in the river; when the river is turbid the water furnished for use is of the same character.

The Schuylkill becomes more frequently turbid as the country drained by it is brought under cultivation; this is caused not only by the tillage of the land, but also by clearing the forests, which to a considerable extent held back the flood water, and protected the soil from denudation.

The accumulation of mud in the lower parts of the Dam, has increased in a much greater ratio this year than during any previous one: other duties have so occupied the Department that no survey has been made, but the increase is so marked as to require no actual measurement to demonstrate it.

The accumulations of mud which are most objectionable are, that on the east side of the river between the steam-boat wharf and the Skating Club House, and that on the west side, extending from Girard Avenue Bridge to the Brewery, each covering from 18 to 20 acres. There is no doubt that these large areas of shallow water exert a deleterious effect upon the entire river.

The accumulation of mud in front of the Twenty-fourth Ward Water Works, has grown to be so serious an evil as materially to impair the salubrity of the water supplied by these works, and unless some alterations be made in the part of the river from which the supply is taken, the present location must be abandoned. It was proposed to place the new pumping machinery, authorized by Councils for this District, at a point higher up the river, near the Columbia Bridge. The nearer we approach to Manayunk, the principal source from which objectionable matter is drained into the river, the less opportunity for subsidence and neutralization of these impurities, and consequently the higher up the river the location the less desirable as a source of supply. The deposits of mud

above referred to, extend over a space in length seventeen hundred feet by four hundred in the widest part, covered only by from three to thirty inches of water, and in many places spots appear above the surface.

The action of the sun upon this accumulation of mud produces putrescent decomposition, and doubtless materially affects the health of the neighborhood.

The means proposed for improving the character of Water supplied by the Twenty-fourth Ward Works, have been as follows :

1. Carrying out a conduit, to take the water from the channel of the river, beyond the mud-flat. This would not prevent the deleterious effect of this shallow water upon the river generally, although that supplied by these Works would be much improved. During the past summer, the water became so objectionable that it was found necessary to open a temporary channel across this mud to the deeper water beyond.

2. Dredging the accumulated mud.

This would remove the difficulty effectually, but only for a time, as the detritus would again accumulate. The river at this point is one thousand feet wide, while immediately above Girard Avenue Bridge it is only four hundred and thirty feet ; the cove thus formed will fill again. To remove the mud and make a depth of but six feet, would cost about one hundred thousand dollars.

3. Constructing an island, by dredging a channel along the western shore, say two hundred feet wide, forming an island about twelve hundred feet in length and three hundred and fifty feet in its widest part ; this island to be formed by the mud taken from the proposed channel and from around the island. There might be deposits in the proposed channel, but it would most probably be kept clean by the action of the water in time of freshet. To construct this island would cost about seventy thousand dollars.

4. Altering the line of the towing-path, and placing it at the outer edge of the mud flat. It has not been used for the purpose of tow-

ing for years, as it is impossible to tow by horses even empty boats along this part of the river: the Schuylkill Navigation Company employ a steam tug to take all boats past this point. The space enclosed by the proposed towing-path will be excavated to the depth of fifteen feet, and the material taken out used to form embankments. These will be made broad enough to allow of a towing-path fifteen feet wide, ten feet of grass, a carriage-drive thirty-five feet wide, ten feet of grass, and a walk fifteen feet wide, thus forming a large subsiding reservoir. The water will be admitted at the upper end, will flow over a weir and around a promontory into the sluice-way leading to the present subsiding reservoir. The effect of this improvement would be to give to the Twenty-fourth Ward limpid water at all times, no matter what the condition of the river, and the water in the subsiding reservoir would be greatly improved in quality. Occupying so much of the broad expanse of the river and directly opposite the Park is to be regretted, for no matter how improved and beautified it may be, the attractiveness of the river will be impaired thereby; but should the accumulated mud become fast ground, it will probably be claimed by the parties owning property along the shore, and may be built upon. The space occupied by the subsiding reservoir, drives and walks, would be from seventeen to twenty acres. To construct the reservoir, walks and drives, as proposed, will involve an expenditure of sixty-five thousand dollars.

Immediate action upon this subject is necessary, on account of the unsatisfactory character of the water now supplied by the Twenty-fourth Ward Works, and the injurious effects of this mud flat upon the water of the river; also from the fact that should the ground forming become fixed and be occupied by other parties, the City would be involved in litigation and expense in order to obtain the use of that for which damages have already been paid, and for the purpose contemplated in this Report, viz: the supply of water to the City. This cove was doubtless fast land before the building



of the dam at Fairmount, which caused its overflow, and the City paid damages for the property thus destroyed. •The winter is the only season when it would be proper to execute this work, on account of the dangerous exhalations caused by moving so large a mass of mud.

The same suggestions may be made in reference to the deposit of mud laying south of the Park, between the steamboat landing and the Skating Club House. If the last recommendation were adopted, the enclosed subsiding reservoir would materially improve the character of the water supplied by the Fairmount Works.

These large deposits of mud are so objectionable that the Department would earnestly press upon you the necessity of action.

The shore line of the river should be defined and deepened, so that there would be no places where aquatic plants could grow, or where the water would become stagnant. It would probably only be necessary to do this south of Columbia Bridge.

The Department should have the power of preventing all encroachments into the river or alterations of the shore line.

#### DRAINAGE.

Large quantities of objectionable matter drain into the river between Fairmount and Flat Rock Dam, from sewers, factories, dye-works, paper-mills, laboratories, gas-works, &c. Not only the waste liquids, but all refuse matter from these establishments, are either thrown directly into the river, or placed in such a manner that the first rise of water will carry them away. The cinders, lime, ashes and heavier material are all deposited in the lower part of the dam, and contribute largely to form the objectionable mud-flats referred to above. Many of the factories are located for the express purpose of getting rid of their dross by discharging it into the river. This has been done in violation of law, (see Acts of Assembly, April 12th, 1828, and February 7th, 1832). Those factories purchasing land or power from the Schuylkill Navigation Company also violate an

express prohibition, which by the agreement of the said Company with the City, (dated January 14th, 1824,) forms a part of all such contracts. Should these laws and contracts be strictly enforced, many individuals and companies would suffer heavy pecuniary loss, and it would prevent a large number of establishments from doing business, and necessitate the removing of them from the Schuylkill. While the City discharges all the refuse from the Gas Works at Manayunk and several common sewers, directly into the river, it may be a question how far the City could in justice prevent private individuals and companies from doing the same. When Manayunk, Roxborough and Falls Village are supplied with water, the amount of objectionable matter carried into the river will be greatly augmented, and much refuse now destroyed by the action of the sun and air, will be conveyed into the dam by the water flowing in the gutters and drains.

The rapid increase of manufacturing establishments placed so as to discharge refuse matter into the dam, demands some action of Councils, or it will only be a question of time, when the water of the Schuylkill, now highly prized by our citizens, will be so contaminated as to necessitate the abandoning of it for some purer source of supply. At present, these objectionable substances do not perceptibly affect the salubrity of the water, and by chemical test as well as by ordinary observation, the water supplied is still of a satisfactory character.

It has been proposed to construct an open canal along each side of the river, by forming an embankment in it, and carrying the sewerage and refuse from the mills, &c., to the overfall of the dam. There are many obvious objections to such a plan, if, indeed, it be at all practicable.

In the above remarks much is repeated that has occupied portions of all the Reports I have had the honor of presenting to you. The excuse offered is, the importance the subject possesses in the estimation of the Department.

**THE WATER TAKEN FROM THE DELAWARE.**

The character of the water taken from the Delaware has been much improved by the extension of the wharf and suction main to the extreme Port Warden's line, and no complaints have reached the Department of the quality of water supplied. The only objection now made is when the river is turbid ; the small capacity of the reservoirs renders subsidence impossible. On account of the large demands made upon the Works, and the limited capacity of the single pumping main, the service mains have in several places been connected to the pumping main. This arrangement, of course, supplies some of the water directly from the river, without going into the reservoirs. About one-sixth of the water supplied to the City is taken from the Delaware.

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**CONDITION AND OPERATION OF THE WORKS.****FAIRMOUNT DAM.**

This structure is in a dilapidated condition, the action of the water and ice for over forty years has, in some places, removed part of the foundation cribs, and washed out much of the filling, so that the dam has sunk in several places, in the deepest water.

The crib-work which is now being placed below the dam, so as to secure the foundations across the deep water, a distance of four hundred and fifty feet, will entirely protect the dam, and prevent any further wear and consequent weakening of the foundation. It will also make the structure perfectly safe for several years. It will ultimately be necessary to rebuild the dam from low water up ; or it would be better to construct a dam of stone, below and against the old one. For this purpose, the work now being done will furnish a reliable foundation. During the ice freshets of the spring, it was feared that the dam would yield to the unusual pressure upon it. Doubtless this would have been the case, but for the crib

sunk last winter, under what appeared to be the weakest part of the dam, which was of great service, although much broken up by the masses of ice and timber falling upon it.

The crib or apron now being constructed to strengthen the dam, appears to answer the purpose perfectly well. It is constructed as follows: The bottom courses are of heavy flitched hemlock timber, accurately fitted to the bed of the river; the crib is then built up to near low water with heavy round hemlock, and finished with flitched white pine. The crib is divided into compartments eight feet square, which are filled with stone. In order to sink the crib, one-half of these compartments have bottoms; the others are open, so that the stone will rest on the bottom of the river. The crib is sunk below and against the dam, and extends thirty feet from it. After being filled with stone, it is decked with white oak timber, ten inches thick. The front of the crib is protected by eight-inch white oak fenders, secured to the deck by wrought iron knee plates. This work was to have been finished in the month of October, but for various reasons, the contractors have not entirely completed it. The most dangerous part of the dam, however, is now protected and perfectly safe.

A portion of the outside wall between the western abutment of the dam and the guard lock, was washed out by the great freshet of July last. Fears were entertained that the entire structure would be destroyed. It has been repaired in such a manner as to remove all danger of failure at this point again. The outside wall protecting the guard lock and canal, is in a dangerous condition, and should be repaired, but this is entirely under the control of the Navigation Company. A detailed account of the work done and the expense of these repairs will be found under the head of extensions, as the warrants were drawn, by your orders, from the proceeds of the Water Loan, made for the extension of the Works, May 5th, 1865.

**FAIRMOUNT WORKS.****OLD MILL HOUSE.**

The old Pumping Works, with the exception of the turbine wheel and pump, are so much worn and broken, that it is only by constant labor and a large outlay for repairs, that they can be kept at work. Two millwrights are constantly employed at repairs, and it is frequently necessary to procure extra help. Had it not been for the expectation that you would authorize the rebuilding and enlarging of these Works, an appropriation would have been asked for to repair thoroughly the old machinery. This would cost about \$40,000.

The freshet in July damaged wheels Nos. 5 and 6 so greatly, as to make it necessary to rebuild them to a great extent. If these Works are to be run any length of time, most of the pumps will require renewing. The following repairs should be made. No. 2, two new valve-boxes and new brasses for crank-pins. No. 3, one new valve-box, two new valves, and brasses for crank-pin. No. 4, new brasses for crank-pin. No. 5, one new valve-box, and brasses for crank-pin. No. 7 requires a new pump entire. No. 8 requires a new cap for valve-box, and new bearings for main shaft. Nos. 4 and 5 wheels will require new breasts, and No. 4 a new gate. The wood work, generally, requires renewing. All the pump chambers require boring and new pistons. From the above, it is evident that a large amount of money should be expended upon the repairs of these Works. The Department propose, however, to do as little as possible, in hope that some early action will be taken by Councils, so that the rebuilding of them may be commenced. It must be borne in mind, that extensive repairs cannot be delayed much longer, and, indeed, there is great risk in running these Works in their present condition.

A freshet, such as occurred in July last, will endanger these Works. The gates, flumes, &c., are more or less decayed, and unfit to resist any unusual pressure.

#### NEW MILL HOUSE.

The machinery in these Works is in perfect order, and will require only the ordinary repairs incident upon the wear of the machinery. Many of the defects in the work, as it was left by the contractor, have been remedied, but there is still room for improvements. These the Department propose to make, from time to time, as opportunity offers, without asking for any large or special appropriation for the purpose. The valves in the pumps are now being taken out and repaired; and notwithstanding they have been in constant use for nearly four years, the faces of the valves are in perfect order.

During the year, the total amount of water pumped by these Works was 7,082,015,640 gallons, a daily average of 19,402,791. The greatest daily average pumped was in the month of June, viz., 23,593,453 gallons, and the lowest daily average in January, when 13,508,602 were pumped. The average daily amount of water pumped by these Works in 1865 exceeded that in 1864 by 3,044,431 gallons.

Table No. 1 exhibits the operation of the Works for the year. It will be seen that the consumption of oil and tallow are proportionally greater to the number of gallons pumped, than in 1864. This would represent a waste of  $48\frac{1}{2}$  gallons of oil, at the average price paid, amounting to \$78.64, and a waste of 257 pounds of tallow, amounting to \$48.05. Notwithstanding this, the saving in the running expenses of the Works, after making these deductions and allowing for the additional amount of water pumped, is \$793.97, as compared with 1864.

No. 1. OPERATION OF FAIRMOUNT WORKS DURING 1865.

MONTHS.	WATER.		OIL.			TALLOW.		
	Number of Gallons pumped each month during the year.	Average number of Gallons pumped per day each month.	Quarts of Oil used each month during the year.	Number of Gallons raised in Reservoir, per quart of Oil.	Duty in millions Gallons raised one foot high per quart of Oil.	Pounds of Tallow used each month during the year.	Number of Gallons raised in Reservoir, per pound of tallow.	Duty in million gallons raised one foot high, per pound of tallow.
January .....	418,766,675	13,508,602	130	3,221,282	322	15½	27,017,205	2,702
February .....	478,654,900	17,094,818	120	3,988,790	399	46	10,405,541	1,041
March .....	538,960,045	17,385,808	200	2,694,800	269	20	26,948,000	2,695
April .....	604,170,726	20,139,024	181	4,611,990	461	166½	3,628,653	363
May .....	600,282,968	19,363,967	154	3,597,941	390	148	4,055,966	405
June .....	707,803,597	23,593,453	175	4,044,592	404	83	8,527,754	853
July .....	643,509,835	20,758,382	182	3,851,614	385	50	12,870,197	1,287
August .....	741,616,561	23,923,115	200	3,708,083	371	65	11,409,486	1,141
September .....	659,646,445	21,988,214	158	4,174,977	417	45	14,658,809	1,466
October .....	666,960,721	21,514,862	180	3,705,337	371	34½	19,332,105	1,933
November .....	590,519,255	19,683,975	175	3,374,396	337	none.	.....	.....
December .....	431,123,912	13,907,223	103	4,155,669	418	12½	34,489,913	3,448
	7,082,015,640	19,402,791	1,918	3,692,396	369	686	10,323,638	1,032

## RUNNING EXPENSES OF FAIRMOUNT WORKS.

Salaries of Engineers and labor, . . . . .	\$4,800 00
Gas for lighting, . . . . .	1,500 57
96 tons of coal, for warming Works, at average price, \$10 05½ per ton, . . . . .	965 25
554½ gallons of oil, at average price, \$1,81¼,	1,006 11
660 pounds of tallow, " " 18½,	123 32
Packing and small stores, . . . . .	1,085 33
Repairs, . . . . .	7,189 27
	<hr/>
	\$16,669 65
Interest on cost of Works and Water power,	\$36,000 00
	<hr/>
	\$52,669 65

Cost of raising water into reservoir, per million gallons, including interest on cost of Works, . . . . .	\$7 44
Not including interest on cost of Works, . . . . .	2 35
Cost of raising water per million gallons, one foot high, including interest on cost of Works, . . . . .	07¼
Not including interest on cost of Works, . . . . .	02½
Maximum price of coal per ton, . . . . .	\$10 25
Minimum " " " " . . . . .	9 90

*Tallow.*

	Pounds.
Amount on hand January 1st, . . . . .	200
Received during the year, . . . . .	949
	<hr/>
	1,149
Consumed during the year, . . . . .	989
On hand December 31st, 1865, . . . . .	198



## SCHUYLKILL WORKS.

A large amount of repairs have been made to these Works, and the machinery improved in strength and efficiency. The following are the principal repairs and improvements. No. 4, Cornish Engine, air-pump repaired; new follower, valve, studs, packing-rings and guard for valve; steam cylinder, upper head strengthened, new piston rings, and equilibrium valve repaired, main beam strengthened with a six inch brace, main shaft turned and boxes refitted, pump guide braced, new wrists of wrought iron in place of cast iron, plug rod fitted with new screws, and valve rods all repaired. No. 3, rock shaft repaired, new pedestals, pump cylinder bored out and fitted with new piston. No's 1 and 2 have received few repairs, except such as the hands employed at the Works have done. Engines 1, 2 and 3 are only used in time of emergency, the Cornish Engine being made to do all the work possible, on account of the economy with which it is run, as compared with the other engines. The boilers have required considerable attention, as most of them are old, some having been in use for twenty years. Table No. 2, exhibits the operation of the Works for the year 1865. The amount of water pumped in 1865 exceeded 1864 by 279,593,834 gallons. The greatest average amount pumped in a day was in June, 9,437,029 gallons; the lowest amount in February, 515,657 gallons. There was a marked saving in coal, oil and tallow, in running these Works, as compared with 1864, allowance being made for the additional amount of water pumped. The saving was in coal, 296 tons, at the average price, \$2,541 52. In oil, less the deficiency, 75 gallons, \$154 50. In tallow, 492 pounds, \$83 98; making a total saving in coal, oil and tallow of \$2,780 00. This exhibits care in the management of the Works, shows their condition to be much improved, and is creditable to the engineers in charge of them.

## RUNNING EXPENSES OF SCHUYLKILL WORKS.

Salaries of engineers and firemen, . . . . .	\$8,156 94
2,288 <sup>5</sup> / <sub>16</sub> tons of coal, at average price of \$8 62 per ton, 19,725 15	
165 gallons of oil, at average price, \$2 05 <sup>5</sup> / <sub>16</sub> , . . . . .	339 43
949 pounds of tallow, " " 17 cents, . . . . .	163 46
Gas for lighting Works, . . . . .	507 37
Packing and small stores, . . . . .	711 19
Repairs, . . . . .	5,969 16
	<hr/>
	\$35,572 70
Interest on cost of works, (\$150,000) . . . . .	\$9,000 00
	<hr/>
	\$44,572 70

Cost of raising water into reservoir per million gallons, including interest on cost of Works, . . . . .	\$22 25
Not including interest on cost of Works, . . . . .	17 76
Cost of raising water per million gallons one foot high, including interest on cost of Works, . . . . .	19 <sup>1</sup> / <sub>2</sub> cents.
Not including interest on cost of Works, . . . . .	15 <sup>1</sup> / <sub>2</sub> cents.
Maximum price of coal per ton, . . . . .	\$12 50
Minimum " " " " . . . . .	6 00

## COAL, OIL AND TALLOW ACCOUNT OF SCHUYLKILL WORKS, 1865.

*Coal.*

	Tons.	Cwt.	Qrs.	lbs.
Amount on hand January 1st,	411	0	0	0
Received during January,	181	7	1	5
" " February,	0	0	0	0
" " March,	0	0	0	0
" " April,	0	0	0	0
" " May,	0	0	0	0
" " June,	121	17	0	0

	Tons.	Cwt.	Qrs.	lbs.
Received during July,	294	3	0	0
“ “ August,	437	6	0	0
“ “ September,	121	19	0	0
“ “ October,	521	6	0	0
“ “ November,	210	15	0	0
“ “ December,	400	3	0	0
	<hr/>			
	2,699	16	1	5
Coal consumed, including amount consumed in stoves,	2,219	7	3	16
	<hr/>			
Coal on hand Dec. 31, 1865,	480	8	0	17

*Oil.*

	Gallons.
Amount on hand January 1st, . . . . .	21
Received during the year, . . . . .	165
	<hr/>
	186
Consumed during the year, . . . . .	86 $\frac{1}{2}$
Consumed in lamps, . . . . .	6
	<hr/>
	92 $\frac{1}{2}$
On hand December 31st, 1865, . . . . .	56
Deficiency unaccounted for, . . . . .	36 $\frac{3}{4}$

*Tallow.*

	Pounds.
Amount on hand January 1st, . . . . .	160
Received during the year, . . . . .	529
	<hr/>
	689
Consumed during the year, . . . . .	570
On hand December 31st, 1865, . . . . .	200

**DELAWARE WORKS.**

These Works have required no extensive repairs. Both engines have been generally overhauled, and are in good working order. The valve-box of pump No. 1 should be replaced with a new one. This is the only valve-box not renewed in the Works. The stand-pipe has answered all expectations. It has relieved the machinery from the excessive strain upon it, and enabled both of the pumps to be worked at the same time, without any risk but that of pumping over the stand-pipe, when they are run too rapidly.

The saving in repairs to the Works will more than equal the interest on the cost of the stand-pipe. The average daily capacity of the Works has been increased by the stand-pipe, from three to five million gallons. Enough was saved from the item for repairs to purchase two new boilers, at a cost of \$2,150, and it is proposed to set and connect them this year, without asking for any additional appropriation.

The suction main leading from the pumps out to the end of the wharf, has caused a great amount of trouble and expense on account of the imperfect manner in which it was jointed, partially due to the inclement season in which it was laid, and the difficulty of making the joints through the wharf.

The operation of the Works is shown by table No. 3. From this it will be seen that the consumption of coal as compared with 1864, allowance being made for the additional amount pumped, is sixty tons greater, at the average price \$538. The saving in oil was 56 gallons, \$108.64, and loss in tallow, including the deficiency unaccounted for, 175 pounds, \$33.25; showing a total loss of \$462.61: This may be accounted for by the fact that the Works have been forced to their utmost ability; the loss is principally due to the want of sufficient boiler capacity. The new boilers now being connected will remedy this defect.

These Works pumped 338,707,640 gallons more during 1865 than in 1864. The greatest daily average was in July, 5,051,611 gallons; the least, in January, 2,407,267 gallons.

No. 2. OPERATION OF THE SCHUYLKILL WORKS DURING THE YEAR 1865.

MONTHS.	WATER.		COAL.			OIL.			TALLOW.		
	Number of Gallons pumped each month during the year.	Average number of Gallons pumped per day, each month.	Pounds of Coal consumed during each month.	Gallons raised in 'o Reservoir per pound of Coal.	Duty in Gallons raised one foot high, per pound of Coal.	Quarts of Oil used during the month.	Gallons raised into Reservoir, per quart of Oil.	Duty in million Gallons raised one foot high per quart of Oil.	Pounds of Tallow used during the month.	Gallons raised into Reservoir per pound of Tallow.	Duty in million Gallons raised one foot high per pound of Tallow.
January.....	24,464,480	789,177	99,568	245.7	28,255	24	1,019,353	117	13	1,881,883	216
February.....	14,438,400	515,657	69,440	207.9	23,908	12	1,203,200	138	9	1,604,266	184
March.....	64,289,760	2,073,863	186,368	344.9	39,663	14	4,592,126	528	29	2,216,888	255
April.....	40,485,600	1,349,520	121,432	332.8	38,272	16	2,530,350	291	30	1,349,520	155
May.....	144,810,480	4,671,306	262,304	552	63,480	26	5,569,634	640	65	2,227,853	256
June.....	283,110,880	9,437,029	313,456	719.5	89,584	31	9,132,609	1059	102	2,775,597	309
July.....	286,633,042	9,246,227	722,064	396.1	45,552	65	4,409,739	507	137	2,092,212	241
August.....	263,488,740	8,499,637	777,392	388.9	38,973	37	7,121,317	819	120	2,195,739	253
September.....	278,723,902	9,290,797	774,132	360	41,400	29	9,611,169	1105	129	2,160,650	248
October.....	234,004,320	7,548,526	633,920	369.1	42,446	40	5,850,108	673	140	1,671,459	192
November.....	151,048,080	5,034,936	294,000	513.7	59,075	10½	14,385,531	1654	66	2,288,607	263
December.....	217,540,800	7,017,445	637,168	341.4	39,261	42	5,179,543	596	149	1,460,005	168
	2,005,038,484	5,493,256	4,971,444	403.3	46,379	346½	5,786,576	665	989	2,027,339	233

Average duty for the year, 38,649,100 pounds, raised one foot high, by the consumption of 100 lbs. of anthracite coal.

No. 3. OPERATION OF THE DELAWARE WORKS DURING THE YEAR 1865.

MONTHS.	WATER.		COAL.			OIL.			TALLOW.		
	Number of Gallons pumped each month during the year.	Average number of Gallons pumped per day each month.	Pounds Coal consumed during the month.	Gallons raised into Reservoir per pound of Coal.	Duty in gallons raised one foot high per pound of coal.	Quarts of oil used during the month.	Gallons raised into Reservoir per quart of Oil.	Duty in million Gallons raised one foot high per quart of oil.	Pounds of Tallow used during the month.	Gallons raised into Reservoir per pound of Tallow.	Duty in million gallons raised one foot high per pound of Tallow.
January .....	74,625,280	2,407,267	327,392	227.9	24,524	25	2,985,011	334	50	1,492,506	167
February .....	76,597,640	2,735,630	319,143	240	26,880	29	2,641,298	295	45	1,702,169	191
March .....	91,153,570	2,940,438	402,564	226.4	25,356	31	2,940,438	329	50	1,823,071	204
April .....	101,073,050	3,369,102	396,550	254.9	28,549	45	2,246,068	252	25	4,042,922	453
May .....	101,202,450	3,264,595	443,080	228.4	25,581	43	2,353,545	264	25	4,048,098	453
June .....	142,548,910	4,751,630	615,060	231.7	25,750	51	2,795,077	313	50	2,850,978	319
July .....	156,599,930	5,051,611	668,575	234.2	26,230	62	2,525,805	283	62	2,525,805	283
August .....	155,422,290	5,013,622	735,340	211.3	23,665	31	5,013,622	562	62	2,506,811	281
September .....	148,259,740	4,941,991	710,975	208.5	23,352	40	3,706,493	415	48	3,088,746	346
October .....	142,094,810	4,583,703	723,715	196.3	21,985	37	3,840,400	430	50	2,841,896	318
November .....	114,555,610	3,818,520	617,712	185.4	20,765	15	7,637,040	855	51	2,246,188	252
December .....	125,458,420	4,047,046	724,134	173.2	19,398	23	5,454,714	611	52	2,412,662	270
	1,429,591,700	3,916,689	6,684,240	213.8	23,945	432	3,309,240	371	570	2,508,056	280

Average duty for the year 19,954,100 pounds, raised one foot high, by the consumption of 100 lbs. of anthracite coal.

## RUNNING EXPENSES OF DELAWARE WORKS..

Salaries of engineers, firemen, &c., . . . . .	\$5,595 00
3459 tons of coal, at average price of \$8.98 per ton,	31,068 03
132 gallons of oil, at average price, \$1.93 <sup>1</sup> / <sub>10</sub> , . . . . .	255 88
529 pounds of tallow, do. 19 <sup>2</sup> / <sub>10</sub> , . . . . .	101 64
Coal oil for lighting Works, . . . . .	162 90
Packing and small stores, . . . . .	337 06
Repairs, . . . . .	3,167 65
	<hr/>
	\$40,687 86
Interest on cost of Works, (\$150,000)	9,000 00
	<hr/>
	\$49,687 86

Cost of raising water into reservoir, per million gallons, including interest on cost of Works, . . . . .	\$34 75
Not including interest on cost of Works, . . . . .	28 45
Cost of raising water, per million gallons, one foot high, including interest on cost of Works, . . . . .	31
Not including interest on cost of Works, . . . . .	25 <sup>1</sup> / <sub>10</sub>
Maximum price of coal per ton, . . . . .	\$11 50
Minimum do do do . . . . .	6 00

## COAL, OIL, AND TALLOW ACCOUNT OF DELAWARE WORKS, 1865.

*Coal.*

	Tons.	Cwt.	Qrs.	lbs.
Amount on hand January 1st,	10	0	0	0
Received during January,	156	0	0	0
“ “ February,	146	0	0	0
“ “ March,	165	0	0	0
“ “ April,	244	0	0	0
“ “ May,	150	0	0	0
“ “ June,	478	12	0	0

	Tons.	Cwt.	Qrs.	lbs
Received during July,	345	18	0	0
“ “ August,	185	9	0	0
“ “ September,	574	17	0	0
“ “ October,	285	4	0	0
“ “ November	56	0	0	0
“ “ December	163	0	0	0

---

3,469

Consumed during the year, including amount con- sumed in stoves,	3000	0	2	24
Coal on hand December 31st, 1865,	400	0	0	0

*Oil.*

	Gallons.
Amount on hand January 1st,	20
Received during the year,	132
Consumed during the year,	108
On hand December 31st, 1865,	40

*Tallow.*

	Pounds.
Amount on hand January 1st,	20
Received during the year,	790
	<hr/>
	810
Consumed during the year,	433
	<hr/>
	377
Purveyor 3d District, and for stand-pipe,	52
On hand December 31st, 1865,	150
Deficiency unaccounted for,	175



## TWENTY-FOURTH WARD WORKS.

These Works have received the usual repairs, but nothing has been done permanently to improve them, or restore them to their original condition. The Works are pressed so much beyond their capacity and so constantly kept in operation, that no opportunity exists for giving either engine the thorough repairs they have needed for several years.

The Pennsylvania Rail Road Company, one of the largest consumers, are erecting works to supply themselves. The paper mill, in this Ward, receives about 24 000,000 gallons for \$1,200, which cost the City, for pumping alone, \$960. If the supply were cut off from these two large consumers, these Works could be managed to much greater economy, and without the destructive wear they are now subjected to.

The operation of these Works is shown by table, No 4. From this it will be seen that 16,045,560 gallons, more water was pumped than in 1864. The greatest daily average was in July, 1,702,385 gallons, and the least in February, 1,173,931 gallons.

The consumption of coal as compared with 1864, allowance being made for the increased amount of water pumped, shows a saving of 103 tons, which at the average price paid, amounts to \$917 73; a waste of  $1\frac{3}{4}$  gallons of oil, \$4 37; and of tallow, of 155 lbs., \$22 81; showing a saving in the running expenses of the year of \$890 54.

No. 4. OPERATION OF THE TWENTY-FOURTH WARD WORKS DURING THE YEAR 1865.

MONTHS.	WATER.		COAL.			Quarts of Oil used each month during the year.	OIL.		TALLOW.		
	Number of Gallons pumped each month during the year.	Average number of Gallons pumped per day each month.	Pounds of Coal consumed during the month.	Gallons raised into Reservoir per pound of Coal.	Duty in Gallons raised one foot high per pound of coal.		Number of Gallons raised into Reservoir, per quart of Oil.	Duty in millions Gallons raised one foot high per quart of Oil.	Pounds of Tallow used each month during the year.	Number of Gallons raised into Reservoir, per pound of Tallow.	Duty in million Gallons raised one foot high, per pound of Tallow.
January.....	37,171,980	1,199,097	147,300	252.3	58,029	5	7,434,396	1,710	40	929,299	214
February....	32,870,970	1,173,931	130,000	250.5	57,615	4	8,217,742	1,890	24	1,369,624	315
March.....	37,800,720	1,219,378	148,900	253.8	58,374	6	6,300,120	1,449	30	1,260,024	290
April.....	38,817,270	1,293,909	145,400	266.9	61,387	5	7,763,454	1,785	35	1,109,065	255
May.....	45,915,660	1,481,150	174,100	263.7	60,651	7	6,559,380	1,509	42	1,093,230	251
June.....	48,126,960	1,604,232	187,000	257.3	59,179	6	8,021,160	1,845	41	1,173,828	270
July.....	52,773,930	1,702,385	211,500	249.5	56,385	6	8,795,655	2,023	42	1,256,522	293
August.....	52,404,570	1,690,470	234,700	223.2	51,336	5	10,480,914	2,411	44	1,191,013	274
September....	50,069,970	1,663,999	220,700	226.8	52,164	6	8,344,995	1,919	42	1,192,142	274
October.....	49,099,140	1,583,543	212,000	231.1	53,153	4	12,274,785	2,823	28	1,753,541	403
November.....	44,488,710	1,482,957	204,800	217.2	49,956	5	8,897,742	2,046	32	1,390,272	320
December.....	46,383,480	1,496,241	199,800	232.1	53,383	5	9,276,696	2,134	33	1,405,590	323
	535,923,360	1,468,283	2,216,200	241.8	55,614	64	8,373,802	1,925	433	1,237,698	284

Average duty for the year 46,348,900 pounds raised one foot high, by the consumption of 100 lbs. of anthracite coal.

## RUNNING EXPENSES OF THE TWENTY-FOURTH WARD WORKS.

Salaries of Engineers and firemen, . . . . .	\$4,100 18
1019 $\frac{1}{2}$ tons of coal, at average price of \$8 90 per ton, . . . . .	9,085 12
40 gallons of oil, at \$2 50, . . . . .	100 00
790 pounds of tallow, at average price 16 $\frac{1}{2}$ cents, . . . . .	1,28 21
Coal oil for lighting Works, . . . . .	187 05
Packing and small stores, . . . . .	237 06
Repairs, . . . . .	4,747 86
	<hr/>
	\$18,585 48
Interest on cost of Works, . . . . .	3,300 00
	<hr/>
	\$21,885 48
Cost of raising water into stand pipe, per million gallons, including interest on cost of Works, . . . . .	\$40 83
Not including interest on cost of Works,	34 67
Cost of raising water, per million gallons one foot high, including interest on cost of Works, . . . . .	18
Not including interest on cost of Works,	15
Maximum price of coal per ton, . . . . .	\$11 00
Minimum " " " " . . . . .	7 25

**COAL, OIL AND TALLOW ACCOUNT OF TWENTY-FOURTH WARD  
WORKS, 1865.**

*Coal.*

	Tons.	Cwt.	Qr.	lbs.
Amount on hand January 1st.,	50	0	0	0
Received during January,	55	7	3	27
"    "    February,	45	2	3	22
"    "    March,	81	0	1	12
"    "    April,	70	8	1	26
"    "    May,	80	16	5	9
"    "    June,	80	0	0	20
"    "    July,	102	1	0	00
"    "    August,	100	14	0	02
"    "    September,	101	0	0	00
"    "    October,	100	17	3	22
"    "    November,	100	12	2	10
"    "    December,	101	14	2	16
	<hr/>			
	1,069	17	1	26
Consumed during the year, including amount consumed in stoves, 994		7	2	0
		<hr/>		
Coal on hand December 31, 1865,	75	9	3	26

*Oil.*

	Gallons.
Amount on hand January 1st., . . . . .	16
Received during the year, . . . . .	40
	<hr/>
	56
Consumed during the year, . . . . .	16
On hand December 31, 1865, . . . . .	35
Maximum price of coal per ton, . . . . .	\$11 00
Minimum " " " " . . . . .	7 25

## WATER SUPPLIED.

Table No. 5 exhibits the total amount of water pumped during the year 1865. The total amount supplied was 1,743,561,335 gallons greater than in 1864, being a daily average increase of 4,776,881 gallons. The greatest daily average was in June, viz., 39,386,344 gallons. The increase in the amount of water furnished during 1865, has been much greater than in any previous year. The thirty inch main laid on Poplar street has enabled the Department to furnish an additional amount of about two millions of gallons per day, to the district lying north of it. This, however, does not entirely meet the wants of this rapidly increasing district, and there are still frequent complaints.

The connection of the pumping main of the Delaware Works with the distributing mains, which the erection of the stand-pipe has enabled the Department to make, has given to this district a full supply of water, but nothing more.

There will be a scarcity of water in this part of the City the coming season, because of the rapid increase of consumers.

## No. 5.

## TOTAL QUANTITY OF WATER PUMPED BY ALL THE WORKS DURING THE YEAR 1865.

MONTHS.	Gallons pumped each month.	Average number of gallons pumped per day.
January ... ..	555,028,415	17,904,143
February.....	602,561,910	21,520,036
March .....	732,204,095	23,619,487
April .....	784,546,646	26,151,555
May.....	892,211,558	28,781,018
June .....	1,181,590,347	39,386,344
July.....	1,139,516,737	36,758,605
August .....	1,212,932,161	39,126,844
September.....	1,136,700,057	37,890,001
October.....	1,092,158,991	35,230,934
November .....	900,611,655	30,020,388
December.....	820,506,612	26,467,955
<b>Total.</b>	<b>11,050,569,184</b>	<b>30,275,532</b>

Of the above, the following amounts were pumped by each of the Works :

	Total.	Daily average.
Fairmount Works,	7,082,015,640	19,402,783
Schuylkill,	2,003,038,484	5,487,777
Delaware,	1,429,591,700	3,916,689
Twenty-fourth Ward,	535,923,360	1,468,283
	<hr/>	<hr/>
	11,050,569,184	30,275,532

The combined pumping capacity of all the Works is 36,000,000 gallons per day. During the months of June, July, August and September, the average daily amount of water supplied was greater. In August it was 39,126,844 gallons, and notwithstanding the Works were pressed beyond their capacity, most of the reservoirs were so reduced that but three feet of water remained in them at the close of the day. At such times, any unusual demands, such as a great fire, or the prevalence of any disease requiring extra flushing of gutters and sewers, would have entirely exhausted all the reservoirs.

If the demand for water increases in the same ratio this year, it will be out of the power of the Works to maintain a supply.

The average amount of water supplied has not furnished a corresponding increase in the revenue; much is wasted, and the City receives pay for little over one-half of the water pumped.

The following Table, No. 6, exhibits the revenue, and amount of water supplied, as compared with the population of the City at different periods.

The statement of 1850 is omitted for want of information in regard to the amount supplied by the Spring Garden and Northern Liberty Works. From the table, it will be seen that in 1830, but 12½ gallons were required per inhabitant. In 1865, 41 gallons were necessary.

## No. 6.

## POPULATION, WATER SUPPLY AND REVENUE.

DATE.	Population.	Daily average supply in Gallons.	Daily supply per Inhabitant.	Revenue from Water.	Revenue per million gallons.	Revenue per Inhabitant
1830	162,000	2,020,100	12,5 gal.	\$68,918 27	\$93 36	42 cents
1835	195,000	3,364,625	17 "	92,116 82	75 00	41 "
1840	230,000	4,034,638	17,6 "	126,074 51	85 58	55 "
1845	300,000	6,142,654	20,7 "	135,465 37	60 42	43 "
1855	450,000	11,700,786	26 "	327,176 24	66 96	73 "
1860	566,000	20,382,064	36 "	494,424 22	66 22	87 "
1865	725,000	30,281,019	41 "	595,661 44	53 98	82 "

## COST OF PUMPING.

Notwithstanding the high price of coal, oil and tallow, during the year, there has been a marked saving in the cost of pumping. In 1864, the total cost of running the four pumping Works was, \$159,916 37, being \$17 18 per million gallons, or \$6,271 68 per million gallons, per annum. In 1865, the total cost was, \$168,815 69, being \$15 27½ per million gallons, or \$5,606 60 per million gallons per annum, a saving of \$1 91 per million gallons; a total saving of \$21,965, in the running expenses over 1864, if allowance be made for the additional amount pumped.

The expense of pumping could be much reduced by rebuilding the old mill house, at Fairmount, and using turbines in place of breast wheels; and placing cornish pumping engines in the steam works, instead of the old engines now in use. These improvements would pay a return equal to several times the interest on their cost.

## RESERVOIRS.

The Reservoirs are all in a satisfactory condition. The leak in the western bank of the Corinthian Avenue Reservoir, which has been a source of annoyance for years, has been discovered

and repaired. The small capacity of the Reservoirs is a great annoyance to citizens and to the Department ; the consumption of water has increased so much that they can scarcely be considered as Reservoirs, their entire capacity being but twice that of the largest average daily demand. There is, therefore, comparatively no reserve supply, and the water is furnished to the city in about the same condition as when taken from the river. The Works should have Reservoir capacity equal to at least ten days maximum supply.

The Reservoir now being constructed at Roxborough, is only for the high service necessary for the supply of Roxborough and Germantown. It will store 12,000,000 gallons. That authorized for the Twenty-fourth Ward will have a capacity of 24,000,000 gallons. Neither of these Reservoirs will be available for the larger part of the city now supplied by the Works, and from the present Reservoirs.

#### DISTRIBUTION.

*Pipe has been laid in the following streets, in 1865 :—*

#### FIRST DISTRICT.

##### ACCOUNT OF IRON PIPES LAID IN THE FIRST, SECOND, THIRD, FOURTH AND TWENTY-SIXTH WARDS.

STREET	Location.	Size.	
		Inches.	Feet.
Wharton.	From Sixteenth to Seventeenth,	6	425
Twenty-second.	“ Montrose to Carpenter,	6	183
Bond.	“ Moore to Mifflin,	4	436
Prime.	“ Broad to Fifteenth,	6	470
Washington Av.	“ Twenty-second to Twenty-third, N. S.,	6	470
“	“ Twenty-second to Twenty-third, S. S.,	6	470



Street.	Location.	Size.	
		Inches.	Feet.
Ellsworth.	From Twenty-first to Twenty-second,	6	450
Sixteenth.	“ Federal to Wharton,	6	615
“	“ Reed to Wharton,	6	429
Eleventh.	“ Carpenter to Washington Avenue, E. S.,	4	438
Seigel.	“ Second to Moyamensing Av.;	4	556
Twenty-fourth.	“ South to Shippen,	6	300
Jackson.	“ Washington Av. to Ellsworth,	4	438
Washington Av.	“ Broad to Twenty-first,	20	3211
“	“ “ “	12	9
“	“ “ “	6	26
Plug attachments,			79
<b>Total number of feet of pipe laid in First District,</b>			<b>9005</b>
Or 1.70 miles.			

The number of feet of new pipe laid was :

Of four inch,	1947
Of six inch,	3838
Of twelve inch,	9
Of twenty inch,	3211
	<hr/>
	9005

### SECOND DISTRICT.

ACCOUNT OF IRON PIPES LAID IN THE SIXTH, SEVENTH, EIGHTH, NINTH, TENTH AND TWENTY-FOURTH WARDS, 1865.

Street.	Location.	Size.	
		Inches.	Feet.
Myrtle.	From Forty-first to Preston,	6	391
Preston.	“ Myrtle to Aspen,	6	802
Brooklyn.	“ Haverford Rd to Lancaster Av.,	6	50
Thirty-first.	“ Chestnut to Locust,	6	561

Street.	Location.	Size.	
		Inches.	Feet.
Forty-second.	From Oak to York,	6	566
"	" Spruce to Pine,	6	401
Walnut.	" Thirty-first west,	6	193
Elder.	" Sergeant to Morgan,	3	225
Haverford Road	" Forty-first to Forty-third,	6	850
Pine.	" Fortieth to Forty-first,	8	679
"	" " "	6	64
Locust.	" Forty-first to Forty-second,	6	412
Forty-second.	" Kingsessing Av. to Darby Rd.,	8	471
"	" " " "	6	80
Spruce.	" Fortieth to Forty-first,	8	716
Walnut.	" Twenty-second to Aspen,	6	202
Market Street Bridge, (relaid)		4	165
Chestnut, east of Thirty-second, (relaid)		6	135
Spruce,	" " "	8	80
Walnut.	From w. s. of Fortieth, (rel'd) east,	10	165
Fortieth.	" s. side of Walnut, " north,	12	215
Market.	" Twentieth street west	6	225
Attachments for private parties,		4	207
Plug attachments,		4	428
Total number of feet of pipe laid in the Second District,		<hr/>	
Or 1.57 miles.		8283	

The number of feet of pipe relaid was :

Of four inch,	165
Of six inch,	135
Of eight inch,	80
Of ten inch,	165
Of twelve inch,	215
<hr/>	
	760

Or .14 of a mile.

Total number of feet of new pipe laid :	
Of three inch,	225
Of four inch,	635
Of six inch,	4797
Of eight inch,	1866
	<hr/>
	7523

Or 1.43 miles.

Total number of feet of pipe laid for private parties, 4 inch, 207

### THIRD DISTRICT.

ACCOUNT OF IRON PIPES LAID IN THE ELEVENTH, TWELFTH, SIXTEENTH, SEVENTEENTH, EIGHTEENTH, NINETEENTH, TWENTY-THIRD AND TWENTY-FIFTH WARDS, 1865.

Streets.	Location.	Size.	
		Inches	Feet.
Jasper.	From York to Huntingdon,	4	607
"	" " "	6	446
Norris.	" Second to Fourth,	6	986
Blair.	" Otis to Norris,	4	510
Vienna.	" Tulip to Cedar,	4	932
"	" " "	6	18
Canal.	" Thompson to Lawrence,	6	276
Richmond.	" Butler to Bridge,	6	7950
"	" Bridge Street north, 800 feet,	6	616
Montgomery,	" Frankford Rd. to Phila. & T. Railroad,	4	300
Townsend.	" Sepviva to Cedar,	4	1006
Cedar.	" Vienna to Otis,	4	325
Norris.	" Belgrade to Thompson,	6	665
Wildey.	" Palmer to Montgomery Avenue,	6	410
Columbia Av.	" Second to Hancock,	6	265
Plug attachments,		4	254
Delaware Water Works,		3	92
		<hr/>	
Total number of feet of pipe laid in the Third District,			15,658
Or 2.96 miles.			

The number of feet of new pipe laid was :

Of three inch,	92
Of four inch,	3934
Of six inch,	11632

Total number of feet of new pipe laid in the Third District, 15658

#### FOURTH DISTRICT.

ACCOUNT OF IRON PIPES LAID IN THE THIRTEENTH, FOURTEENTH, FIFTEENTH, TWENTIETH AND TWENTY-FIRST WARDS, 1865.

Street.	Location.	Size.	
		Inches.	Feet.
Sydenham.	From Master to Columbia Avenue,	4	1186
Eighteenth.	“ Thompson to Berks,	6	2083
Oxford.	“ Broad to Twenty-third,	6	4108
Thompson.	“ Standpipe east of Thirty-first,	6	1080
Alder	“ Columbia Av. to Montgomery,	4	600
Seybert.	“ Eighteenth to Ridge Avenue,	4	850
Nineteenth.	“ Thompson to Master,	6	520
Twenty-second.	“ N. College Av. to Oxford,	10	85
Twenty-first.	“ “ “ Ridge Av.,	10	748
Poplar.	“ Ridge Avenue west,	30	834
Valeria.	“ Sixteenth to Seventeenth,	6	400
“	“ “ “	10	18
Roxborough Reservoir.		12	108
“	“	20	384
“	“	3	700
48 inch main from Fairmount,			1104
Poplar, east of Nineteenth, (relaid),		6	169
Fairmount Park, (relaid),		4	63
Private attachments,		3	36
“	“	4	314

Total number of feet of pipe laid in the Fourth District, 15390  
Or 2.91 miles.

The number of feet of new pipe laid was:—

Of three inch,	*700
Of four inch,	2636
Of six inch,	8191
Of ten inch,	851
Of twelve inch,	*108
Of twenty inch,	*384
Of thirty inch,	†834
Of forty-eight inch,	‡1104
	<hr/>
Total number of feet of new pipe laid was	14808
Or 2.80 miles.	

The number of feet of pipe relaid was:—

Of four inch,	63
Of six inch,	169
	<hr/>
Total number of feet of pipe relaid,	232
Or .04 of a mile.	

Total number of feet of pipe laid for private parties:—

Of three inch,	36
Of four inch,	314
	<hr/>
	350
Or .07 of a mile.	

\* Laid at Roxborough Reservoir.

† Main on Poplar Street from Ridge Avenue west.

‡ Connecting main from Water Tower, Fairmount, to the Corinthian Avenue Reservoir.

## No. 7.

## RECAPITULATION OF PIPE LAID IN THE SEVERAL DISTRICTS DURING THE YEAR 1866.

WARDS.	3 in. diam.	4 in. diam.	6 in. diam.	8 in. diam.	10 in. diam.	12 in. diam.	20 in. diam.	30 in. diam.	48 in. diam.	Total.
1st Dist. 1, 2, 3, 4, 26, ...		1,947	3,838			9	3,211			9,005
2d Dist. { 5, 6, 7, 8, 9, 10, 24,.....	225	635	4,797	1,866						7,523
3d Dist. { 11, 12, 16, 17, 18, 19, 23, 25,	92	3,934	11,632							15,658
4th Dist. { 13, 14, 15, 20, 21,.....	700	2,636	8,191		851	108	384	834	1,104	14,808
Total.. .....	1,017	9,152	28,458	1,866	851	117	3,595	834	1,104	46,994

Being a total of 8.8 miles.

Total number of feet laid previously, . . . . . 1,920,671  
 " " " during the year, . . . . . 46,994  
 Total, . . . . . 1,967,665

Being a total of 372 miles 3,505 feet, of water main now laid  
 in the City.

## No. 8.

ACCOUNT OF THE NUMBER OF HOLES DRILLED FOR MAKING NEW ATTACHMENTS TO PUBLIC MAINS DURING THE YEAR 1865.

MONTHS.	$\frac{1}{2}$ in. diam.	$\frac{3}{4}$ in. diam.	$\frac{1}{2}$ in. diam.	1 in. diam.	Total holes drilled and attachments made.	Shut off for re-pairs to private pipes.	Shut off for re-pairs to public pipes.
January,.....	10	4	2	1	17	18	13
February,.....	4	8	3	2	17	14	20
March,.....	59	40	16	1	116	61	18
April,.....	45	36	12	3	96	26	2
May,.....	41	57	11	2	111	28	6
June,.....	64	38	12	5	119	22	3
July,.....	72	58	10	1	141	27	2
August,.....	67	44	11	8	130	11	1
September,.....	64	45	28	5	142	24	3
October,.....	65	52	15	3	135	25	1
November,.....	69	78	24	9	180	37	9
December,.....	27	93	13	11	144	23	5
	587	553	157	51	1,348	316	83

## No. 9.

THE ABOVE ATTACHMENTS WERE MADE IN THE WARDS AS FOLLOWS:

WARDS.	$\frac{1}{2}$ in. diam.	$\frac{3}{4}$ in. diam.	$\frac{1}{2}$ in. diam.	1 in. diam.	Total holes drilled.	Shut off private pipes.	Shut off public pipes.
1st Dist. 1, 2, 3, 4, 26,....	137	77	10	12	236	29	11
2d Dist. { 5, 6, 7, 8, 9, { 10 and 24,....	149	142	47	16	354	98	19
3d Dist. { 11, 12, 16, 17, { 18, 19, 23, 25,	179	65	25	7	276	102	33
4th Dist. { 13, 14, 15, 20, { and 21, .....	122	269	75	16	482	87	20
	587	553	157	51	1,348	316	83

## ACCOUNT OF NEW STOPS AND FIRE PLUGS.

Districts.	No. of Stops.	No. of Fire Plugs.	
First District.....	22	9	
Second do .....	24	15	
Third do .....	22	18	
Fourth do .....	36	17	
<b>New Stops,.....</b>	<b>104</b>	<b>New Fire Plugs .....</b>	<b>59</b>
Account per last report.....	3967	Account per last report..	3255
<b>Total.....</b>	<b>4071</b>	<b>Total.....</b>	<b>3314</b>

## PIPE ORDERED BY COUNCILS, BUT NOT YET LAID.

*Pipe ordered to be laid in the First District.*

Moore Street, from Seventh to Ninth.	
Taylor " " Eighth to Ninth.	
Twenty-sixth " Park to Gray's Ferry Road.	
Twelfth " From Wharton to Passyunk Road.	
Prie " Seventh to Eighth.	
Reed " Eleventh to Thirteenth.	
Moore " Ninth to Broad.	
Fernon " Tenth to Eleventh.	
Reed " Fifteenth to Sixteenth.	
Montrose " Jessamine west, 170 feet..	
Pierce " Passyunk Road to Thirteenth.	
Twenty-third " Shippen to Pemberton.	
Twenty-second " Washington to Federal.	
Alter " Twenty-first to Twenty-second.	
Christian " Gray's Ferry Road to Sutherland Avenue.	
Ingerson " Christian to Gray's Ferry Road.	
Burnett " " " "	
Carpenter " Burnett " "	
Ingerson " " " "	
Seventeenth " Federal to Reed.	
Wharton " Sixteenth to Eighteenth.	
Mt. Holly " 300 feet south from Wharton.	
Evergreen " Twenty-first to Twenty-second, and between Fitzwater and Catharine.	
Bedford " Broad to Fifteenth.	
Gray's Ferry Rd " Twenty-ninth to Thirty-first.	
Twentieth " Carpenter to League.	
Kimball " Nineteenth to Twentieth.	
Carpenter " Nineteenth to Twentieth.	
Federal " Sixteenth to Seventeenth.	



*Pipe ordered to be laid in the Second District.*

Brooklyn Street	from Haverford to Lancaster Avenue.
Thirty-first	“ Walnut to Locust.
Preston	“ Myrtle to Hutton.
Thirty-eighth	“ North of Market to Filbert.
Thirty-fifth	“ Sycamore to Aspen.

*Pipe ordered to be laid in the Third District.*

York Street	from Second to Germantown Road.
Toronto	“ Melvale south, 806 feet.
Wager	“ Fourth to Fifth.
Day	“ Girard Avenue to Thompson.
Tilton	“ Emery to Huntingdon.
Huntingdon	“ Almond to Frankford Road.
Sergeant	“ Cedar to Memphis.
Emlen	“ Trenton Avenue to Cedar.
Gordon	“ Geisse to West.
Leib	“ Harrison to south line of Estate of Lydia Harrison.
Sixth	“ Somerset to Reading R. R.
Waterloo	“ Cumberland to Davis.
Palethorp	“ York to Dauphin.
Lloyd	“ Sergeant to Hamilton.
Anthracite	“ Salmon to Almond.
Reese	“ Dauphin to York.
Berks	“ Front to Germantown Road.
Newkirk	“ Cumberland to the line of the property owned by the Church of the Messiah.
Eyre	“ From Wildey to Robertson.
Ann	“ Emerald to Kensington.
Penn	“ Allen to Arrott.

*Pipe ordered to be laid in the Fourth District.*

Thompson Street	from William to Schuylkill Works.
Master	“ Twenty-seventh to Twenty-eighth.
Franklin	“ Diamond to Susquehanna Avenue Avenue.
Diamond	“ Seventh to Ninth.
Geary	“ Poplar to Wiley.
Ninth	“ Montgomery to Berks.
Eleventh	“ “ “
Ridge Avenue.	“ Twenty-second to Columbia Avenue.
Thirty-first	“ Girard Avenue to Thompson.
“	“ Master to Jefferson.

Nineteenth	from Thompson to Master.
Callowhill	“ Twenty-sixth to Wire Bridge.
Cadbury	“ Columbia Avenue to Berks.
Broad	“ Berks to Germantown and Reading R. R.
Eleventh	“ Berks to Norris.
Mervine	“ “ “
Twelfth	“ “ “
Camac	“ “ “
Thirteenth	“ “ “
Uber	“ Montgomery to Columbia Avenue.
Township Line Road from Tioga Street to junction of the water pipe laid by the Germantown Water Company.	
Tioga Street from Township Line Road to Seventeenth.	
Venango from “	“ “ “ Eighteenth.

ACCOUNT OF PIPES, BRANCHES, TOOLS, ETC., IN THE HANDS OF THE  
PURVEYORS OF THE DIFFERENT DISTRICTS.

FIRST DISTRICT.

*Stock of Pipes, Branches, &c., on hand at the Yard, No. 615  
Carpenter Street.*

Pipes nine feet long : of three inch inch, 5 ; of four inch, 6 ; of six inch, 8 ;  
of ten inch, 9.

Fire-plugs : single, of four inch, 7.

Branches : four way, of six inch, 5 ; of four inch, 11.

Branches : three way, of six inch, 8 ; of four inch, 2 ; of three inch, 2.

Sleeves : of six inch, 3 ; of four inch, 7 ; of ten inch, 4.

Bonnets : of twelve inch, 1 ; of ten inch, 2 ; of six inch, 3 ; of four inch, 4 ;  
of three inch, 1.

Reducers : of six inch, 12 ; of four inch, 6.

Bevel hubs : of six inch, 2 ; of four inch, 4.

Curved pipe : of six inch, 5.

Quarter turns : of six inch, 2.

Goose-necks : of four inch, 7.

Stop-cocks : of six inch, 1 ; of four inch, 2.

Stop-cock boxes : of six inch, 3.

Frames and covers : of six inch, 4.

Fire-plug cases : of six inch, 7.

Plug-lids : of six inch, 6.

Fire-plug tops : of six inch, 4.

Pipe twelve feet long : of twenty inch, 4.

Lead, 50 pounds.

Gasket,  $\frac{1}{2}$  bale.

## TOOLS, ETC.

Caulking irons, 23; gasket irons, 20; bull nose chisels, 10; cold chisels, 6; pipe cutters, 4; lead cutters, 1; picks, 30; pick handles, 35; shovels, 42; screw wrenches, 6; pot hooks, 2 sett; washers, 20; eye bolts, 11 sett; hand saw, 1; bonnet bolts, 28; pecking box bolts, 18; spindle keys, 5; monkey keys, 4; s. hooks, 20; guage, 1; augers, 1; brand, 2; drills, 12; reamers, 3; drifts, 3; bending iron, 1; lever wrenches, 2; lead pots, 1; clay box, 1; crow bars, 8; furnaces, 1; pot bars, 2; wooden plugs, 6; half spanners, 1; hammers, 7; sledges, 1; plug swivels, 20; plug monkeys, 8; packing box caps, 10; plug nuts, 20; chains, 2; buckets, 6; stop cock keys, 8; hydrant keys, 2; long jawed keys, 4; short jawed keys, 2; stop cock bailers, 1; wheelbarrows, 2; crows, 3; tool boxes, 1; tool houses, 1; vice, 1; oil cans, (brass,) 2; oil cans, (tin,) 2; oil can, (1 gallon) 1; oil can, (5 gallons,) 1; grind stone, 1; desk, 1; stove, 1; stove pipe, 7 lengths; brooms, 2; brushes, 1; trussels, 4; oar poles, 2; axe, 1; brass plugs, 6; monkey wrenches, 2; plug spanners, 3; hammer handles, 12; lamps, 2; oil, 2 gallons; pipe plans, 1; wood saw, 1.

## SECOND DISTRICT.

*Stock of Pipes, Branches, &c., on hand at the Yard, 918 Cherry Street.*

Pipes nine feet long: of three inch, 3; of four inch, 4; of six inch, 3; of eight inch, 9; of ten inch, 29; of twelve inch, 8.  
 Fire plugs, (steam,) 1; of single fire plugs, 2; cases, 1.  
 Branches: four-way; of four inch, 16; of six inch, 20; of eight inch, 2; of ten inch, 3; of twelve inch, 1.  
 Branches: three-way; of six inch, 14; of eight inch, 4.  
 Sleeves: of three inch, 4; of four inch, 6; of six inch, 1; of eight inch, 7; of ten inch, 8; of twelve inch, 16; of sixteen inch, 3; of twenty inch, 2; of thirty inch, 1.  
 Reducers: of four inch, 1; of twelve inch, 1; of thirty inch, 2.  
 Bevel hubs: of three inch, 1; of four inch, 1.  
 Curved pipe: of four inch, 8; of six inch, 2.  
 Saddle pipe: of four inch, 12; of six inch, 5.  
 Quarter turns: of three inch, 2; of four inch, 3; of six inch, 3.  
 Bonnets: of four inch, 2; of six inch, 4; of eight inch, 9.  
 Goose necks: of three inch, 11; of four inch, 1.  
     do for steam fire plugs: of four inch, 1.  
 Stop cock monkeys: of four inch, 1.  
 Rolls of Gasket: 2.  
 Packing: 75 pounds.  
 Salt: 2 bushels.  
 Pieces of pipe: of three inch, 3; of four inch, 3; of eight inch, 2.  
 Lead: 100 pounds.

*Old Stock.*

Branches: four-way; of four inch, 15.  
do three-way; of four inch, 3.  
Frames and Covers, 3.

*Tools, &c.*

Shovels, long handle, 9; shovels, d. handles, 8; picks, 20; bars, 9; bars for tunnelling, 3; furnace, 1; lead pot, 1; ladles, 4; lines, 2; packing irons, 4 setts; caulking irons, 4 setts; stop cock keys, 8; hydrant keys, 3; monkey wrenches, 4; wrenches, 3; guages, 1; augers, 3; clay boz, 1; buckets, 5; dippers, 2; tongs, 3; spanners, 5; half spanners, 2; powder cans, 1; hammers, 6; hatchets, 1; axes, 2; drilling tools, 3 setts; drilling poles, 2; sledges, 2; guages, 8; cold chisels, 4; hand saws, 1, wood saw and buck, 1; oil cans, 3; chains, 2; trussels, 9; oar poles, 2; lanterns, 2; tool houses, 1; stoves, 1; chairs, 5; stools, 1; desk, 1; maps, 2.

*At West Philadelphia.*

Pipe nine feet long: of four inch, 2; of six inch, 4; of ten inch, 1.  
Branches: four way; of six inch, 3.  
Sleeves: of eight inch, 2; of ten inch, 1; of six inch, 1; of four inch, 3; of three inch, 1.  
Goose necks: of three inch, 1; of four inch, 1.  
Reducers: of four inch, 1.  
Quarter turns: of six inch, 2.  
Bonnets: of six inch, 6; of eight inch, 1.  
Stop cocks: of six inch, 4.  
Stop cock boxes, 3.  
Frames and covers, 1.  
Fire plugs, 2.  
Wooden plugs: of six inches, 6.  
Eyebolts, 10.  
Stop cock monkey: 6 inches, 1;  
Caps for stop cock boxes, 2.  
Stuffing box bolts, 2.  
Lead, 150 pounds.  
Pieces of pipe: of three inch, 2; of four inch, 6; of six inch, 5; of eight inch, 1.

*At Stand Pipe.*

Branches: three-way; of twelve inches, 5.  
do four-way: of sixteen inch, 1.

*Tools, &c.*

Shovels, long handle, 1 ; shovels, d. handle, 8 ; picks, 1 ; bars, 2 ; stop cock keys, 8 ; hydrant keys, 3 ; saws, 1 ; tongs, 2 ; wrenches, 2 ; monkey wrenches, 1 ; hammers, 2 ; drilling tools, 8 sets ; drilling poles, 1 ; tin cups, 1 ; buckets, 3 ; trussels, 6 ; oar poles, 6 ; oil cans, 1.

**THIRD DISTRICT.***Stock of Pipes, Branches, &c., on hand at the Yard, 1420 Frankford Road.*

Fire plugs for steamers, 2.  
 Fire plug cases for steamers, 2.  
 Fire plug case : single, 1.  
 Small fire plugs, repaired, 9.  
 Pipes nine feet long : of four inch, four ; of six inch, 5 ; of ten inch, 3 ; of eighteen inch, 2.  
 Branches : four way ; of four inch, 3 ; of 6 inch, 4 ; of ten inch, 4 ; of eighteen inch, 1.  
 Branches : three-way ; of four inch, 2 ; of six inch, 15 ; of ten inch, 6.  
 Sleeves : of four inches, 7 ; of ten inch, 5 ; of eighteen inch, 1 ; of twenty-six inch, 1 ; of six inch, 3.  
 Reducers : of ten inch, 4.  
 Quarter turns : of four inch, 5 ; of six inch, 1.  
 Bevel hubs : of six inch, 6 ; of eighteen inch, 1 ; of twenty-four inch, 1.  
 Saddle pipe : of ten inch, 2.  
 Stop cocks : of six inch, 3 ; of ten inch, 1.  
 Stop cock boxes : of six inches, 4.  
 Goose necks : of four inch, 3, (for steam plugs).  
     do (for single plugs) : of four inch, 7.  
 Bonnets : of four inch, 6 ; of six inch, 5 ; of ten inch, 3.  
 Wooden plugs : of four inch, 3 ; of six inch, 6 ; of eight inch, 5 ; of ten inch, 1 ; of twelve inch, 1.  
 Gasket, 70 pounds.  
 Scantling, (3 by 4) 100 feet.  
 Coke, 15 bushels.  
 Pine wood, three-quarters of a cord.  
 Lead, eight pigs.

*At Frankford.*

Pipe nine feet long : of four inch, 3 ; of six inch, 4 ; of ten inch, 1.  
 Branches, four-way, of ten inch, 1.  
 Branches, three-ways, of ten inch, 1.  
 Curved pipe, of six inch, 1.  
 Fire plug cases 2, (old.)

## TOOLS, ETC.

Grindstones, 1; tool houses, 2; wheel barrows, 2; wrenches, 4; cape chisels, 2; cold chisels, 1; gland, six inch, 9; eye bolts, 5 pair; caulking irons, 5; ladles, 5; furnace, 1; drilling tools, 1 sett; wood buck, 1; stop cock keys, 4; crow keys, 2; skimmer, 1; sledge, 1; picks, 24, (old); crow bar, 1; hand-saws, 2, (old,); oar poles, 4; monkey\_wrenches, 2; S. wrenches, 1; spanners, 2.

*At Wood Street Wharf.*

Furnaces, 1; lead pot, 1; shovels, 7, (old); picks, 3, (old); caulking irons, 4; gasket irons, 4; saw, 1; S. wrench, 1; ladle, 1; cold chisel, 1; wood saw, 1; tape line, 1; crow bar, 1.

## FOURTH DISTRICT.

*Stock of pipes, branches, &c., on hand at the yard 1324 Buttonwood Street.*

Pipe nine feet long: of six inch, 4; of eight inch, 27; of twenty inch, 4.  
 Pipe twelve feet long: of ten inch, 140; of twelve inch, 88; of sixteen inch, 3.  
 Branches, four-way: of six inch, 35; of four inch, 22; of six by four inch, 9; of eight by six inch, 2; of ten by six inch, 5  
 Branches, three-way: of six by four inch, 3.  
 Sleeves: of four inch, 4; of twelve inch, 4; of eighteen inch, 1.  
 Bevel hubs: of four inch, 5; of six inch, 4; of eight inch, 4.  
 Goose necks: of four inch, 10.  
 Stop cocks: of four inch, 1; of six inch, 2.  
 Bonnets: of six inch, 1; of ten inch, 1.  
 Fire plugs: three-way, 1.  
 Fire plugs, (old,) 4.  
 Fire plug: three-way, complete, 1.  
 Frames: without cover, 2.  
 Pieces of pipe: of four inch, 4; of sixteen inch, 1.

## TOOLS

Grindstones, 1; stop cock wrenches, 3; stop cock keys, 6; push carts, 2; s. wrenches, 1; monkey wrenches, 2; buckets, 2; hammers, 3; sledges, 1; bars, 2; dippers, 1; picks, 2; shovels, 4; caulking tools, 1 sett; oil cans, 2; drillers tools, 3 setts; hydrant keys, 3; hatchet, 1; hand saw, 1; platform scales, 1; derrick block and falls, 1.

Tools at the ditch laying 48 inch main: tool house, 1; caulking irons, (handled,) 4 setts; caulking irons, 4 setts; lead chisels, 4; pipe cutters, (round mouth,) 1; pipe cutters, (square,) 2; tunneling bars, 2; crow bars, 4; derrick complete, 1; lead pot, 1; furnace, 1; shovels, 98; picks, 41.

THE EXPENSE OF LAYING PIPES IN THE DIFFERENT PURVEYORS' DISTRICTS HAS BEEN AS FOLLOWS:

	Cents per foot.
First District,	20.9
Second “	25.5
Third “	28.2
Fourth “	25.9
Average cost,	26

The cost of making attachments has been, in the

	Per attachment.
First District,	\$5 95
Second “	3 97
Third “	4 69
Fourth “	2 92
Average cost,	4 09

The following exhibits the number of repairs to Mains, Stops, and Plugs, by the different Districts, during the year 1865:

	Repairs to Mains.	Repairs to Stops.	Repairs to Plugs.
First District,	24	120	413
Second “	19	402	427
Third “	54	291	192
Fourth “	22	210	251
	<hr/>	<hr/>	<hr/>
Total,	119	1023	1283

## DISTRIBUTION.

The several corporations which now form the consolidated City had each a system of distribution arranged, without reference to the others. In consolidating the Works this was found a great impediment to a satisfactory distribution. The difficulties have, in part, been remedied by laying mains and forming connections. The connecting main authorized to be laid between the Corinthian Avenue and the Kensington reservoirs, will do much towards perfecting the distribution, but several additional mains will be necessary.

It has been the practice of this and other cities to lay service mains of too small capacity. The demand for water has increased so much, that at the present time the mains are required to be at least three times the size that would have been sufficient in 1830, as will be seen by reference to Table No. 6.

This increased consumption, and the introduction of steam fire apparatus, which require a much greater supply of water than was necessary for the hand engines, make additional feeding mains necessary in almost every section of the City.

The total amount of service pipe laid during the year was much below the requirements of the City. Many streets, some of them built up, are without water pipe. The amount appropriated for this purpose being inadequate to lay a sufficient amount of pipe.

At the present high price of labor and materials, the amount received for pipe from the owners of property in front of which it is laid, viz., 75 cents a foot, does not pay the expense incurred by the City. Deducting the pipe laid for crossing streets, and the allowance made on corner properties, the Department cannot charge for over four-fifths of the pipe laid. When the law fixing the price at 75 cents per foot, was passed by the Legislature, the cost of materials and labor was less than one-half the present price.

The amount of service pipe laid during the year was 40,644 feet. Of this amount, the Department received pay for 28,148 feet.



Bills for 7,997 feet were sent to the City Solicitor, for lien, and bills for 643 feet in excess of the amount, remained on hand the first of the year. The amount received at the office, for pipe, was \$34,221.06; sent to the Solicitor to be liened, \$11,970.42; bills on hand, less bills on hand 1st of January, 1865, \$965.65; a total of \$47,157.13. Leaving \$40,003.96 loss to the City on laying service mains during the year.

#### COST OF LAYING PIPE.

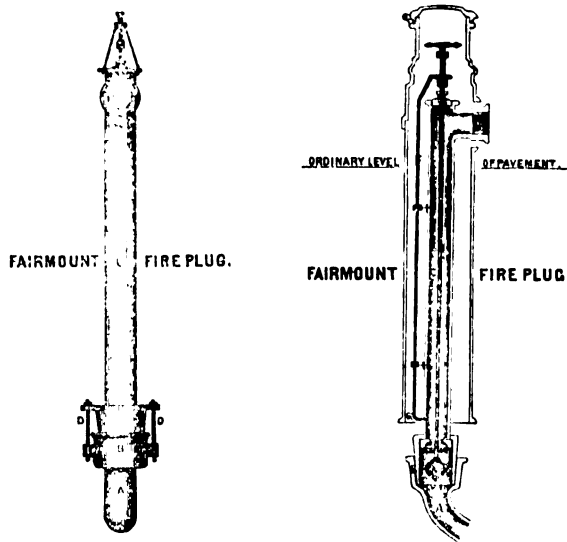
The average cost of laying pipe was for labor, digging, filling, making joints, setting plugs and stops, hauling and handling pipe, twenty-six cents a foot; a saving of six cents per foot over 1864; including all other expenses incident upon laying pipe, viz., fitting stops and fire plugs, inspecting, measuring, making bills, &c., fifty cents per foot, which, upon the entire amount of pipe laid, will be a saving of \$4,876.28. The cost of pipe and labor of all kinds was \$2,11½ cents per foot.

#### FIRE PLUGS.

These important fixtures have received much attention from the Department.

The fire plugs now used in this city are principally made from what is known as the old Fairmount pattern; they are placed upon the sidewalk, against the curb-stone. Fig. 1 will illustrate the manner in which they are constructed.

FIG. 1.



The connections to the street mains are generally made by a four-inch branch and a four-inch pipe laid to the side of the street, where a hydrant bend *A* is attached; this is a pipe curved up, with a tapering bell *B*, enlarged, so as to receive the fire plug or stand-pipe *C*; this bend has lugs cast on it to receive the stirrups *D D*, by which the plug is kept in its place. The plug or stand pipe is a pipe enlarged at the bottom to allow room for the valve *V*, and the passage of the water around it. The valve is conical, and made of leather; it is operated by a rod *E* passing up through a stuffing box on the top of the stand: the valve is opened and closed by a screw worked by a handle.

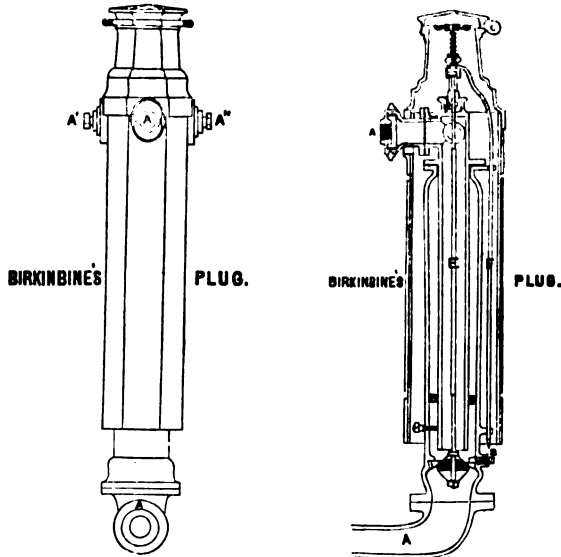
The valve seat is brass, secured to its place by a lead packing. The water passes out by a short branch near the top; this has a brass nut secured in it by lead packing; the nut is cut so as to fit

the screws upon ordinary sized hose couplings, used by all the fire companies. At the back of the plug is a rod *F*, which is lifted by the screw operating the valve. When the plug is closed this rod is lifted, thus opening the waste or frost stop *G* at the bottom of the plug, allowing the water in the plug to flow out. When the plug is opened the rod drops into its place and closes the frost valve, so as to prevent waste while the plug is in use. The plug is held in place by a yoke *H* and the two stirrup bolts. The case is made of iron, in three pieces; so that it can be readily taken apart to facilitate repairs.

There are over three thousand plugs of this kind in the city, and most of the Water Works in the country use substantially the same plug.

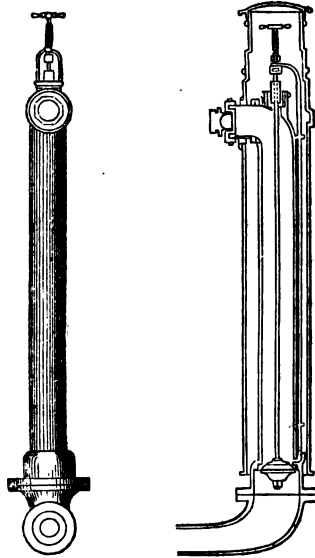
These plugs do not answer satisfactorily for the steam fire engines, and whenever a fire occurs almost all of them used by the steamers require repairing. This pattern of plug, however, has so many good features about it, that it is difficult to improve upon it, and notwithstanding a number of patented plugs have been introduced, the one most used is substantially the same. The Department constructed a plug in 1861, when the steamers were first introduced, represented by fig. 2; a number of them are in use. The difference between this and the old Fairmount plug is in the size of the standpipe and outlet, and in its furnishing accommodation for three connections; but the principal difference is in the air chamber *B B*, placed outside and enclosing the standpipe *E*; this is intended to receive the ram of the water produced by the pumps of the steamers, and prevent it from destroying the mains and other water fixtures. The steamers are now so arranged as to prevent this concussion, and the air vessel is no longer necessary.

FIG. 2.



The Department are now using the plug represented by fig. 3, which it will be seen, is very much like the old Fairmount plug. The alterations are in the enlarged size of the stand-pipe and outlet, being fully equal in area to four inches in diameter. The plug is lengthened so as to place the valve deeper in the ground; the waste is arranged to draw all the water from above the valve, and the goose-neck and stands are permanently connected by flanges bolted together, instead of the socket and stirrup, as in the old plug. This plug answers perfectly, and furnishes a full supply to a steamer; it is enclosed in the same case as the old plug, and can be substituted, as is done whenever repairs are necessary. All the new plugs now made by the Department are of this kind.

FIG. 3.



**ABUSE OF PLUGS.**

The fire plugs are erected to be used only in case of fire, or for flushing the gutters, when ordered by the Board of Health, the Mayor, or Committee on Water. Their use has been allowed, for filling the casks of the street sprinklers, and washing the gutters when the streets are swept. They are not intended to be used for private or any other purposes, and every use of them except the above, is in violation of law. In this respect the laws are constantly violated, and the Department find it impossible to prevent the use of the plugs for illegal purposes. Four men are detailed for the special purpose of looking after the plugs, and seeing that they are kept in repair, but as it is necessary to detect the parties using the plugs, and sue them before an alderman, very little can be done by the Department to prevent this abuse.

If the police would take the matter in hand, this indiscriminate use of plugs could be prevented, and, as a consequence, a large amount of water saved, particularly in excessively warm days, when water is most needed for legitimate uses. Frequently, on such days, the Department know from observation, that from two to four millions gallons of water are wasted by fire companies and others using plugs illegally.

During the year, it has been necessary to repair 1283 plugs, at an expense of about \$8,000. Many of the plugs are wantonly broken by the firemen, who ought to be equally interested with the Department in keeping them in repair. When a number of steamers are collected near a fire, they exhaust the capacity of the mains, and some of them find it impossible to procure a supply of water; at such times plugs in perfect order are wantonly destroyed. There is, perhaps, not a single locality where over twelve steamers can be supplied with water at the same time, so as to concentrate their force upon a burning building, and when a larger number are in service they only create confusion and trouble.

#### FROZEN PLUGS

Every winter some of the plugs are frozen, notwithstanding the care and attention bestowed upon them. Some years ago, it was the habit of the Department to pack them with hay or straw each winter. But this was found to be no protection when the packing became wet; and when frozen, it was almost impossible to thaw them. The packing has not been resorted to for the past six years, and a less number have been frozen. The only plugs which become frozen, are such as are so located that they cannot be drained, or where the ice is suffered to fill the gutters and overflow the pavement. In such cases, the space between the plug and case and the inside of the plug become filled with ice. Where vaults have been constructed and plugs exposed, they are also liable to be frozen. Salt introduced into the stand pipe of plugs which are

liable to become frozen, has been found a preventative, or should they be frozen, it will free them from ice.

#### OPERATION OF THE SHOP.

A small engine, formerly used for forcing air into the air vessels at the Twenty-fourth Ward Works, was rebuilt at the shop, and is now running ; it has taken the place of the wheel propelled by man power, which, for over forty years, was the only propelling force in the City shop. This engine has enabled the shop to do a much larger amount of work. The engine, a new boiler and shafting have been paid for out of the ordinary appropriation, as, also, the expense of placing another story on the shop. It is proposed to add some tools, and, if possible, construct a new smith shop, during the present year, without asking for an extra appropriation.

The operations of the shop are very satisfactory. The prices for work are, in the majority of cases, less than it could be purchased for elsewhere.

An appropriation of fifteen or twenty thousand dollars, for the purpose of stocking it at once with tools and enlarging it, would, no doubt, be a profitable investment for the City, besides the convenience of having our own shop, and getting the work uniform in pattern and character.

From the accompanying statement, it will be seen that the shop has earned \$4,035.93 during the year.

**STATEMENT OF THE OPERATION OF THE SHOP FROM JANUARY 1st  
TO DECEMBER 31st, 1865.**

Dr. to stock on hand January 1st, 1865,	-	-	\$3,675 85
"    24,898 lbs. wrought iron, at average 6.21 cts, 1,547 64			
"    113,593 " cast " " 4.1 " 4,680 49			
"    4,994½ " brass castings " 53.3 " 2,661 55			
"    1,098¾ " steel " " 26 " 285 68			
"    20,517 feet of lumber,			844 40
"    36 tons blacksmith's coal, - - -			893 00
" machine work, - - - - -			1,990 80
" hardware, &c., - - - - -			305 43
" leather, &c., - - - - -			369 80
" paints, &c., - - - - -			232 40
" wages paid hands, - - - - -			9,615 96
" scrap iron from various works and districts, -			219 64
" lead, - - - - -			392 88
			\$27,215 52

**Cr. by ferrules furnished to Register's office,**

"    522 lbs. ferrules, ½ inch, at 90 c.,	\$469 80
"    639 " ¾ " "	575 10
"    108 " ¾ " "	97 20
"    78 " 1 " "	70 20
"    205 fire plug cases, at \$20,	4,100 00
"    38 fire plugs, small size, at \$25,	950 00
"    75 " large " \$45,	3,375 00
"    365 stop cock boxes, at \$4,	1,460 00
"    36 stop cocks, 6 inch, at \$65,	2,340 00
"    32 " 4 " 45,	1,440 00
"    4 " 8 " 100,	400 00
"    2 " 20 " 350,	700 00

Amount carried forward,

\$15,977 30    \$27,215 52



Amount brought forward,	\$15,977 30	\$27,215 52
Cr. by 2 stop cocks, 30 inch, at \$450,	900 00	
“ 6 “ 16 “ 275,	1,650 00	
“ 75 goose necks, at \$6,	450 00	
“ 105 frames and covers, at \$9 20,	966 00	
“ 1 iron rack,	150 00	
“ engine put up in shop,	400 00	
“ patterns made and repaired,	200 00	
“ Scrap iron and brass turnings,	259 56	
“ repairs for First District,	749 62	
“ “ Second District,	1,048 26	
“ “ Third “	641 01	
“ “ Fourth “	640 46	
“ work done for 48 inch main,	275 61	
“ “ Flat Rock Basin,	507 19	
“ “ W. Phila. Extension,	132 78	
“ “ “ “ Works,	55 93	
“ “ Fairmount “	558 17	
“ “ Schuylkill “	77 40	
“ “ Delaware “	148 50	
“ Tools and repairs,—Fairmount Dam,	733 72	
“ 87,070 wharf bolts,—Fair't D., 10c.,	870 70	

*Stock on hand.*

“ 401 lbs. of brasses, finished, at 90c.,	360 90
“ 303 lbs. ferrules finished, at 90 cts.	272 70
“ 45 spindles, “ “	6 00 270 00
“ 24 screws, 6 inch at	6 00 144 00
“ 17 “ 4 “ “	6 00 102 00
“ 10 “ 20 in. sq. tops, at 16 00	160 00

Amount carried forward,	\$28,701 81	\$27,215 52
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Amount brought forward,		\$28,701 81	\$27,215 52
Cr. by 1 screw, 10 in. sq. tops,	12 00	12 00	
“ 3 “ 8 “ “ “ “	11 00	33 00	
“ 3 “ 6 “ “ “ “	9 00	27 00	
“ 1 “ 4 “ “ “ “	8 00	8 00	
“ 1 “ 3 “ “ “ “	6 00	6 00	
“ 8 “ for fire plugs, at	3 00	24 00	
“ 25 fire plug nuts, at	2 00	50 00	
“ 32 monkeys, etc., for plugs,	6 00	192 00	
“ 5590 lbs. wrought iron, at	08 cts.	447 20	
“ 165 lbs. steel, “	26 “	42 90	
“ 1229 lbs. bolts and washers, at	16 “	196 64	
“ 24,113 lbs. cast iron, “	04 “	964 52	
“ 42 lbs. nails, “	09 “	3 78	
“ 1,345 lbs. forged work, “	20 “	269 00	
“ 10 tons of coal, at	10 00	100 00	
“ 50 lbs. gum rings, at	1 75	87 50	
“ 300 feet of lumber, at	04 cts.	12 00	
“ 36 wooden plugs, at	60	21 60	
“ 21 gallons oil, (sperm,) at	2 50	52 50	
Balance, profit of shop,			\$4,035 93
			<hr/>
		\$31,251 45	\$31,251 45

### BUILDINGS AND GROUNDS.

Notwithstanding the large amount of money expended upon the buildings during the year, there are few permanent improvements to report, nor are the buildings in as satisfactory a condition as buildings used for the purpose and located as the most of them are, should be; the temporary manner in which they have been built, with so large a proportion of perishable material, and the effect of moisture, steam and heat, make large annual expenditures for repairs and renewals necessary. The only exception is the new

mill-house at Fairmount, in which there is no perishable material, except windows and doors.

The only permanent improvement made was the addition of a story to the shop, and placing an engine, boiler and shafting in it.

The temporary canal, which it was found necessary to construct across the mud flat, at the Twenty-fourth Ward Works, for procuring water from the channel of the river, was paid for out of the appropriation; it cost \$954 97.

#### GROUNDS.

The only permanent improvements made to the grounds were the vase placed on the rocks, near the Water Tower at Fairmount, and the fountain of Berks county sand-stone for the mineral spring at the Schuylkill Works.

The carriage drive from the Green street entrance was finished by way of the Water Tower to the Coates Street entrance; 8,000 square yards of drives and walks, were graveled and repaired; 2,117 square yards of sodding, and 5,302 square feet of edging done. A new walk was made on the west side of Reservoir, near Callowhill street entrance. Twenty-four new settees, 345 seats were made for the Park, but a larger number are necessary. A number of trees which had died were replaced; and ivies and other clambering vines were planted.

During the summer a very good band of music performed every afternoon in the small Park, the expense of which was paid by the Rail Road Companies, and the person who was permitted to sell refreshments in the old engine house. The music stand was a rough, temporary structure, erected by the above parties. The music was a source of enjoyment to many citizens; and I would suggest that a permanent music stand be erected, and arrangements made for the accommodation of those who come to listen, by providing a suitable number of seats; this will require some

alteration in the Park. The want of proper accommodation has been a constant source of complaint.

The amount appropriated for keeping the grounds in order is not sufficient, and they as a consequence, are not kept in satisfactory condition. It should be borne in mind that there are 32 acres at Fairmount, which in favorable weather, is constantly crowded with visitors; and 18 acres at the Schuylkill Works, now becoming quite a place of resort, particularly since the mineral spring has been opened. Much of the ground at the latter place is entirely unimproved.

Any one who visits Fairmount on a pleasant day, particularly on a holiday, and observes the immense number who resort there for recreation, will be convinced that in no way can money be more judiciously applied to add to the happiness of the citizens, than in improving and beautifying these grounds. Even the immense expenditures of the city of New York cannot be objected to, when the benefit and pleasure conferred on thousands, are considered. An annual appropriation of but ten thousand dollars a year, less than many of our citizens expend upon their private country seats, would enable the Department to make some marked improvement every year. There is perhaps no spot equal in natural beauty, as accessible to any other city; situated as this is almost in its very geographical centre. It is hoped that you will make some liberal provisions for improving these grounds and keeping them in order, either by loan, or from the ordinary receipts of the city.

The Department would also suggest the passage of more stringent laws, to protect from depredation the shrubbery and improvements of the Park. A fine of not less than twenty-five dollars and imprisonment of at least thirty days, in all cases where parties are convicted, would not be too severe. This, with sufficient and energetic police force, would give the requisite protection.

## EXTENSION AND IMPROVEMENT OF THE WORKS.

## TWENTY-INCH MAIN ON WASHINGTON STREET.

The twenty-inch main has been laid out Washington street from Broad to Twenty-first—a distance of 3,246 feet—at a cost of \$20,270 85; \$6 25 per foot. This main furnishes a full supply of water to the large manufacturing establishments situated on this street. To perfect the supply of this section of the city, the main should be extended on Washington street west to Gray's-ferry road, and east from Fifth to Front street.

There should also be a twenty inch main on Broad street, south from Washington street. Thus far, the water supply to this district has been absorbed about as rapidly as it has been extended, on account of the great number of new buildings and factories erected.

The water rent received from this district, which comprises the first, second, third, fourth and twenty-sixth wards, was \$62,534 77 in 1859, before the thirty-inch main, by which it is supplied, was laid. The water rent of this, the first district, for 1866, is \$110,740 25; indicating the necessity for further extensions.

## THIRTY-INCH MAIN ON POPLAR STREET.

This main, which was laid on Poplar street from Seventeenth to Nineteenth streets, connects the thirty-inch main, leading from the Spring Garden Reservoir, with the two sixteen-inch mains from the same Reservoir. This main is 834 feet long, and cost \$12,121 85; \$14 53 per foot. It has enabled the Department to distribute about two million gallons of water per day, in addition to what was furnished by the other mains supplying this district. This has given great relief, but not a full and satisfactory supply.

The water rent of the Twentieth Ward alone, has been increased from \$28,740 in 1860, to \$52,767 50. The main authorized to be laid between the Corinthian Avenue Reservoir and the Kensington

Reservoir, will add much to the supply, and for a time be all that is necessary, except in the high parts of the Ward, where it will always be difficult to furnish a supply to the upper stories, from any of the Reservoirs of the city. For a full and satisfactory supply of this district, the water should be drawn from a source at least twenty-five feet higher than any of the existing Reservoirs.

#### REPAIRING FAIRMOUNT DAM.

This work, although not strictly extension or enlargement, you have directed to be paid for out of the loan created to extend the Works. By the provisions of the contract the work was to have been done by October last. The work in front of that part of the dam immediately dangerous, has been completed, and a few weeks of favorable weather will enable the contractor to finish the entire work.

The stone for filling the crib has been quarried and furnished by the Department, by days' labor; the price for laborers was \$1 75 per day.

A shoot will be arranged, to allow fish to pass up above the dam. Legislation will be necessary to prevent fishing in it, and not only fines but imprisonment should be made the penalty for so doing; without such provisions few fish will be able to ascend without being captured.

The crib work now being sunk will furnish a reliable foundation for rebuilding the dam, when it becomes necessary. The amount of money expended thus far, has been \$26,833 17.

#### IMPROVING THE DELAWARE WORKS.

The wharf and the suction main have been completed. The stand pipe is erected, connected and in use, and requires only the stone work around the base to finish it. Upon these improvements there has been expended this year, \$14,497 97, and all the proposed work is done except the stone work around the base of

the standpipe. These have enabled the Department to supply a larger amount of water, and of much better quality. This district is increasing so rapidly, and so large a number of manufactories are being built, that these Works will most probably be deficient in capacity the coming season.

The pumping engines in these Works are the most expensive in the Department, to maintain and keep in operation. A Cornish pumping engine would pump the same amount of water, with one third the amount of coal these engines require. Such an engine would have saved at least \$20,000, one-third of its cost, during the year.

#### FORTY-EIGHT INCH PUMPING MAIN.

This main was part of the original plan of the new mill house, and is intended to conduct the water pumped by it to the Corinthian Avenue Reservoir. The water is now forced through a thirty-inch main, connecting the old Works with the Corinthian Avenue Reservoir; it is impossible to work the pumps to their full capacity through this main. The forty-eight-inch main, when completed, will increase the pumping capacity of the new Works four million gallons per day. The increase in the capacity of these Works is all the Department will have for meeting the demands for water from new consumers the coming season. This main will effect a saving, by enabling the Department to supply so much larger a proportion of the water from Fairmount, instead of from the steam works.

The amount of money expended upon the main was \$41,780 18. I would remind you, that the amount you have appropriated for this purpose is but \$50,000, while my estimate was \$85,000; you have allowed me to draw upon the balance of the appropriation for the Washington street main, but there still remains a deficiency of \$13,000 to be provided for. The work of laying this pipe is being pressed, notwithstanding the inclement season of the year,

because of its importance. About one half is now laid; almost the entire distance has been through rock, making the work slow and expensive.

#### NEW WORKS AT FLAT ROCK.

These Works are intended for the supply of Roxborough and Germantown, and for the present, they will also be used for the supply of Manayunk. The Pumping Works will be situated at Greentree Station, and the reservoir on Crosky's lane, near the Ridge Road. The Department has secured all the property necessary for these Works.

By the terms of the contract, which you authorized with the Germantown Water Company, the City will be required to furnish a supply of water in eighteen months from the date of the contract. With this in view, and in expectation that the contract would be closed immediately, work was commenced as soon as possession could be had of the site for the reservoir, and preparations made for the other work.

#### RESERVOIR.

The surface of the water in this reservoir will be 375 feet above City datum. It will be 20 feet deep, 410 feet long, 240 feet wide at the surface of the water, and will store 12,000,000 gallons. The amount of money expended upon the reservoirs was \$18,622.34. Of this amount, \$14,179.23 was expended for labor. The prices paid were, for labor, \$1.75 per day; for horse, cart and man, \$3.50 per day. The following amount of work has been done:

1,110	cubic yards of top soil removed at a cost of	42	cts.	per	yd.
905	"	pipe trenches	"	32	"
22,292	"	embankments	"	42	"
2,800	perches of stone, quarried out of the reservoir and perched,	80	"	p'h.	



The embankment of the reservoir has been built up with great care, the material selected, the clay and loam placed on the inside, and the coarser material outside. It has been built in layers, not exceeding twelve inches in depth in any instance, and all the carts have been made to travel the length of the embankment, loaded and empty. From the above statement, it will be seen that this work, thus far, has cost the City no more than it could have been contracted for; and the work has been done with a care that few contractors could be induced to take, and employment has been given to a large number of returned soldiers, at fair wages.

The stone quarried out of the Reservoir will be used for lining it and for building the engine house. No work has been done for the engine house, on account of difficulties in getting possession of the property on which it is to be built. The City has at last succeeded in purchasing this property, and work will be commenced upon it as soon as the weather will permit.

#### ENGINE.

The plans of the engine are now in the hands of the contractors, Messrs. Matthews & Moore, of the Bush Hill Iron Works, and work has been commenced upon it under the inspection of the Department. The agreement is by the pound, for the material, and by the day, for finishing and erecting it. The committee, believing that by this means the City would procure better work and a more reliable engine than by contracting for it to the lowest bidder. The engine will be placed in a particularly trying position, on account of the great height to which the water must be forced. The best of material and workmanship will therefore be necessary to insure a machine of sufficient strength and durability.

The engine is a Cornish pumping engine, steam cylinder, 72 inches diameter; pump plunger, 20 inches diameter; stroke of each, 10 feet. The only features in which this differs from ordinary Cornish pumping engines is in the equilibrium governor and the valves of the pump.

**TWENTY-FOURTH WARD WORKS.**

The only work upon the extension of these Works, as yet commenced, is the excavation for the engine proposed to be placed in the present building, to accommodate which it is necessary to make considerable excavations entirely in rock. Blasting cannot be resorted to on account of the stack, engine and building being upon this rock, and the work will, therefore, of necessity, be tedious.

The reasons for placing the engine in the old Works, instead of selecting a new site further up the river, have been given in a previous part of the Report.

The Department have not yet succeeded in procuring property upon which to erect the Reservoir. The Reservoir proposed will have a storage capacity of 25,000,000 gallons. This is abundantly large for the present demands, but it would be advisable to construct one of much larger capacity, as this district is, no doubt, destined to contain a very large population.

**THIRTY-INCH CONNECTING MAIN.**

This main is intended to connect the Corinthian Avenue and Delaware Reservoirs, and to act as a supply main for the district through which it passes. It will also enable the Department to furnish a portion of the water from Fairmount Works. The pipe is now being delivered, and the work of laying it will be commenced as soon as the weather will permit.

**FURTHER EXTENSION OF THE WORKS.**

In the appropriation of one million dollars for the extension of the Water Works, most of it has been for the outer wards, leaving deficiencies, which occasion much complaint, in the larger and more densely populated part of the City still unprovided for. The larger portion of the money from this loan, thus expended, will, therefore, not yield an immediate return in water rents or in the economy of

the Works ; although long before the loan matures these improvements in the outer districts will, no doubt, return principal and interest into the treasury ; besides, the increased value these Works will give to property in the important districts they are intended to supply, viz., Twenty-fourth Ward, Germantown, Roxborough and Manayunk.

An additional amount of one, or even two millions of dollars, could be judiciously expended upon the Works, for the purpose of constructing larger and more efficient pumping machinery, laying supply mains, and providing sufficient storage capacity. Such an amount, if judiciously expended, would yield an immediate and large return, in the increased revenue and decreased expenses of the Department, and, instead of being a burden on the treasury, would add to the revenue of the City, above the interest and the required amount to the sinking fund, to absorb the principal.

I have no new suggestions to make in regard to extensions, but would simply reiterate those so frequently pressed upon your attention in my former Reports, and remind you that the general interest of the City is now suffering on account of the insufficient supply of water to many districts. At no time in its history, since it has had a water supply, has the capacity of the Works been so far behind the requirements of the City.

Your attention is also called to the project for supplying the City with water, by gravitation, from the Perkiomen, appended to the Report. This, or some system of Water Works looking to what will be needed at least twenty years from this time, should be adopted ; which, you need not be reminded, will be to the interest of the City.

Table No. 6 exhibits the increase in the amount of water supplied from 1830 to 1865, from which it is evident that if the growth of the City continues in the same ratio, the average daily amount of water required in 1885 will be from 150,000,000 to 200,000,000 gallons.

## RECEIPTS AND EXPENDITURES.

## RECEIPTS.

The receipts for water have been greater this year than for any previous one, and even larger than estimated in the Report of last year, but not so large as the quantity of water supplied should make them. From Table No. 6, you will see that the amount of water furnished per inhabitant is constantly increasing, and also that the receipts for water rent are decreasing. In 1830 the amount received per million gallons was \$93.36, and in 1865 but \$53.98. No change has been made in rates charged for water. The prices are based upon an average of \$150 per million gallons. Allowing one-half of the water for municipal purposes and waste, the income of the Department, for water alone, should therefore have been over \$700,000. The Department will do all in its power to prevent waste and to discover fraudulent use of water. The police could render valuable assistance in preventing the illegal use of the fire plugs.

The receipts of the Register's office will be exhibited by the appended report of W. J. P. White, Esq., Register, which shows a total from all sources of \$629,882.30. Add to this the receipts of the Engineer's office, \$6,500.95, making the total receipts for the year, \$636,383.25.

The two additional permit clerks and four additional inspectors you permitted me to appoint, have not only decreased the expenses of the Department, by allowing a number of temporary appointments to be dispensed with, but have also enabled the Department to increase the revenue to a considerable extent. The good effects of this new arrangement will be more apparent after this year.

The following Table, No. 10, exhibits the sources from which the revenue is derived. The number of water-takers now upon the books of the Department is 82,261. The average amount received for water is \$7.26½ for each tenant.

No. 10.

SOURCES OF REVENUE.

10

WARDS.	1st.	2d.	3d.	4th	5th	6th	7th	8th	9th	10th	11th	12th	13th	14th	15th	16th	17th	18th	19th	20th	21st	23d.	24th	25th	26th	Total.	Rate.
Dwellings, . . .	3009	3464	1842	1791	2519	2642	3354	2735	2168	2722	1640	1799	2711	3199	4564	1882	1784	2853	4277	5484	261	59	1433	489	3266	61,857	\$5 00
"    "    "    "	98	232	104	112	303	25	133	59	41	89	36	44	61	167	336	138	197	499	349	283		5	30	75	59	3,434	\$3 75
"    "    "    "	418	1147	1170	1461	474	443	1325	548	437	999	928	720	594	454	987	1182	1126	690	592	519	4	43	167	544	16,970	\$2 50	
Factories, . . .	10	12	4	7	38	28	12	1	17	13	36	13	8	22	47	44	26	14	110	41	2	2	18	7	21	553	
Engines, . . .	22	15	6	7	35	66			31	20	18	13	8	22	61	42	18	33	51	30	2	4	11	2	14	531	
Horse Power, . . .	414	306	32	107	317	974	347	111	423	410	236	173	97	465	1562	751	319	724	776	245	22	19	284	84	287	9,435	\$3 per H. P.
Stables & Car-riages, . . .	261	347	146	292	555	598	652	931	1120	565	277	589	513	664	1032	268	315	319	1520	1238	1		475	91	470	13,214	\$1 00
Bakeries, . . .	20	8	5	15	11	7			25	11	15	17	9	28	27	23	17	19	40	44	1		4	1	17	364	\$3 00
Baths, . . .	813	748	563	371	698	504	1536	1555	1062	1412	361	589	1488	1450	2348	412	307	391	355	2877	246	8	621		631	21,346	\$3 00
Basins, . . .	18	9	36	45	732	1098	520	1115	763	636	100	90	258	271	1391	11	26	14	104	772	4	7	231	1	114	8,276	\$1 00 to \$2.
Wash Paves & Screw-nozls, . . .	154	205	180	113	385	270	823	1016	622	902	121	391	782	1010	1817	208	128	179	343	1839	249	19	318	32	278	12,384	\$3 00
Water Closets and Urinals, . . .	42	13	29	38	736	1244	594	1290	702	573	45	105	162	103	799	7	11	18	49	508	210	1	279	9	77	7,694	\$1 00 to \$25
Bars, . . .	64	126	76	148	280	231	66	77	141	50	156	73	31	56	146	93	125	103	163	172	1	3	46	44	96	2,566	\$10 00
Horse-troughs, . . .	7	3	4	4	7	7	4	4	7	4	11	4	2	5	31	5	9	13	23	16		5		1	14	161	\$10 00
Tubs, . . .					3	12	21	38	57	48	22	17	7	5	7					16		30				311	\$1 00
Fountains, . . .		1			5		3	8	9	7	1	6	2	2	11				3	3	7					65	\$5 00 to \$20

69

The ordinance for equalizing the water rates, now under discussion in Councils, will make the following changes in the revenue, 3,434 three-quarter dwellings, now charged \$3 75, and 16,970 half dwellings, now charged \$2.50, proposed to make \$3, making an increase of \$5,909.50; 7,694 water closets, now charged \$1, proposed to make \$2, making an increase of \$7,694; 2,566 bars, now charged \$10, proposed to make \$15, making an increase of \$12,380; increase in other items \$5,000; making a total increase in the revenue of \$31,433.50 per annum.

The subject of increasing the rates charged for water, for the purpose of producing a larger revenue to the City, has frequently been suggested. How far a tax upon an element so essential to the health, comfort and prosperity of the City, would be judicious, you are the proper parties to judge. The rates now charged pay all expenses and leave a balance greater than the interest on the entire cost of the Works.

The following amounts have been received at the Chief Engineer's office, and paid to the City Treasurer :

For making connections with barracks at Camp Cad-	
wallader, - - - - -	\$3,897 14
" work done for Phila., Wilm. & Balt. R. R. Co.,	174 77
" " " " & W. Chester R. R. Co.,	132 76
" " " Murphy & Allison, - - -	357 53
" " " Daniel Sheets, - - -	39 57
" " " Harrison, Havemeyer & Co.,	- 139 22
" " " J. Lips, - - -	- 247 78
" " " James Naulty, - - -	- 69 33
" " " Penna. Central R. R. Co., - -	- 194 53
" " " Camden & Amboy R. R. Co.,	- 93 07
" " " Northern Liberty Gas Co., - -	- 322 24
" wharfage, - - - - -	- 52 00
	<hr/>
Amount carried forward,	\$5,719 94

	Amount brought forward,	\$5,719 94
For rents, - - - - -		- 360 00
“ hay, - - - - -		- 67 27
“ hemlock timber, - - - - -		- 111 10
“ old iron, brass, &c., - - - - -		- 133 62
“ frame and cover, (W. M. Oglesby), - - - - -		- 9 04
“ three-way plug, complete, (J. B. Baxter), - - - - -		- 100 00
		<hr/>
		\$6,500 95

## REGISTER'S STATEMENT.

DEPARTMENT FOR SUPPLYING THE CITY WITH WATER,  
REGISTER'S OFFICE,

January 23d, 1866.

H. P. M. BIRKINBINE, ESQ.,

Chief Engineer of the Water Department :

DEAR SIR:—I herewith respectfully submit a statement of the transactions of this office for the year 1865. The details of which are exhibited in the accompanying tabular statement.

By comparing the receipts of the year 1865 with 1864, it shows an increase in the amount of water rents of \$20,225 58; and an increase in the amount received from water pipe of \$11,942 49.

There has been a decrease in the amount received from delinquent water rents of \$8,695 84 and \$3,270 40 in the amount received from fractional water rents.

The falling off in the amount from delinquent water rents is attributable to the unusually large amount collected in the year 1864, thereby reducing their amount to an inconsiderable sum.

The increase in receipts from water pipe is accounted for by the greater number of feet of iron pipe laid in 1865, over that in 1864.

The amount due for iron pipe still outstanding, is \$6,791 11, exclusive of \$11,970 42 sent to the City Solicitor for lien.

Annexed are the amounts of the duplicates arranged in Wards, for the years 1865 and 1866; showing more clearly the increase. This, together with income from delinquent water rents and fractional water rents, will probably produce an aggregate of \$630,000 for the year 1866.

The income from iron pipe will depend on the number of feet of water pipe laid. About fifty per cent. of the cost of which is received in this office—15 per cent. is sent to the City Solicitor for lien—showing a loss to the city of 35 per cent., which is absorbed in expense of intersections, crossings and allowances for corner properties, etc.



WARDS.	1865.	1866.
First, - - -	\$18,384 25	\$24,017 25
Second, - - -	27,207 10	28,099 25
Third, - - -	16,599 25	17,074 00
Fourth, - - -	17,686 25	17,919 75.
Fifth, - - -	27,123 00	27,224 25
Sixth, - - -	31,933 75	31,341 00
Seventh, - - -	32,278 75	32,245 00
Eighth, - - -	30,843 25	33,114 00
Ninth, - - -	28,371 00	28,877 00
Tenth, - - -	29,233 75	28,634 50
Eleventh, - - -	17,432 75	17,711 50
Twelfth, - - -	18,951 00	18,609 25
Thirteenth, - - -	26,232 00	26,514 50
Fourteenth, - - -	30,070 00	30,312 00
Fifteenth, - - -	48,281 25	50,346 00
Sixteenth, - - -	21,126 30	21,560 25
Seventeenth, - - -	18,203 75	18,926 25
Eighteenth, - - -	19,647 75	24,501 50
Nineteenth, - - -	31,271 75	35,526 50
Twentieth, - - -	49,051 75	52,767 50
Twenty-first, - - -	1,975 00	3,258 00
Twenty-third, - - -	519 00	603 00
Twenty-fourth, - - -	18,177 05	18,146 00
Twenty-fifth, - - -	4,316 00	4,483 00
Twenty-sixth, - - -	23,282 25	26,630 00
Total, - - -	<u>\$588,297 95</u>	<u>\$618,435 25</u>

No. 11.

Statement of Receipts at Register's Office, from January 1st, to December 31st, 1865.

MONTHS.	Fractional Rents.	Rents of 1863.	Penalties of 1863.	Rents of 1864.	Penalties of 1864.	Rents of 1865.	Penalties of 1865.	Iron Pipes.	Total Monthly.
January.....	\$1,153 00	\$367 50	\$26 86	\$1,697 00	212 03	\$31,931 50		2,432 36	37,820 25
February.....	379 25	194 00	19 65	1,865 75	256 21	67,709 45		1,836 73	72,261 04
March.....	1,293 75	376 75	39 15	1,529 00	201 44	99,795 25		559 23	103,794 57
April.....	1,080 25	270 75	27 13	684 50	85 84	181,620 09		193 50	183,962 06
May.....	1,469 57	238 00	26 07	692 00	75 49	115,153 00	311 05	45 00	118,010 18
June.....	1,402 00	346 00	16 73	369 75	62 50	22,548 75	933 38	5,874 99	31,554 10
July.....	1,385 40	232 00		101 00	7 13	3,718 25	526 89	7,533 98	13,504 65
August.....	1,342 25	74 50	5 94	81 00	5 41	6,738 50	956 09	4,511 65	13,715 34
September.....	1,236 85	119 25	14 36	78 50	4 21	11,691 20	1,675 04	3,554 43	18,373 84
October.....	998 25	24 00	3 60	144 50	14 78	8,311 50	1,124 69	2,879 12	13,500 44
November.....	1,193 25	366 00	43 15	337 00	34 40	7,675 40	1,065 07	1,836 30	12,550 57
December.....	1,375 25	428 00	32 71	114 00	15 24	5,558 75	432 70	2,883 78	10,840 43
	\$14,309 07	3,036 75	255 35	7,694 00	974 68	562,451 64	7,024 91	34,141 07	629,887 47

The appointment of four additional Inspectors has worked advantageously. It enabled the Department to divide the city into eight districts, in place of four, as heretofore; thereby securing a more thorough inspection of properties liable to a charge for water rent. The system adopted, of each Inspector having a book in the office, wherein he makes a written report of all inspections made in his district, has had the effect of insuring a more careful performance of the duties assigned them.

The First and Nineteenth Wards have been carefully assessed during the past year. The First Ward duplicate for the year 1866, shows an increase of \$5,633 over that of the previous year. The Nineteenth Ward, notwithstanding three precincts have been taken from it, and added to the Eighteenth Ward, exhibits an increase of \$4,254 75 over that of the year 1865. The Eighteenth Ward shows an increase of \$4,853 75 over that of last year.

W. J. P. WHITE,  
*Register.*

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#### EXPENDITURES.

The total amount expended for maintaining the Works, laying service mains, &c., was \$284,262.63. The embarrassment of the treasury, which placed warrants at a discount, has added greatly to the expenses of the year, amounting to fully \$20,000. In the purchase of coal and other leading articles, the Department found it necessary to add the market rates of discount on warrants upon the bills, when presented. It is hoped that some arrangements will be made to enable the Treasurer to cash warrants when presented, before the contracts are made by this Department for the necessary supplies for the year. If this is not done they will cost an advance of from ten to twelve per cent. upon the cash prices.

I would most respectfully suggest an advance in the salaries of the officers of this Department. In no other is experience, skill and integrity so essential to the interest of the City, and you

need not be reminded that men who are generously paid will feel a livelier interest in the discharge of their duty than those who are not fully compensated for their labor and skill.

The total amount expended during the year from the loan for extending the Water Works was, \$183,074.95. The following is a detailed statement of the expenditures for the year :

EXPENDITURES OF THE DEPARTMENT FOR THE YEAR 1865.

Salaries of chief engineer, register, clerks, &c.,		\$23,152 31
Office expenses, - - - - -		3,800 05
Salaries of engineers, firemen, &c., at Works, -		22,653 02
Supplies to Works, viz. :		
Coal, - - - - -	\$60,843 55	
Tallow, oil and gas, - -	4,575 94	
Wood, - - - - -	72 90	
Small stores, - - - - -	2,370 64	
	<hr/>	67,863 03
Repairs, viz. :		
Fairmount Works, - -	7,189 27	
Delaware " - -	3,167 35	
Schuylkill " - -	5,969 16	
Twenty-fourth Ward Works,	4,747 86	
	<hr/>	21,073 64
Buildings, Grounds and Reservoirs - - -		21,762 70
" Iron pipes, fire plugs, and other fixtures, and materials for laying pipe, &c.," viz. :		
Iron pipe, - - - - -	49,721 91	
Iron castings, - - - - -	5,084 74	
Brass " - - - - -	2,482 23	
Lead, - - - - -	4,596 30	
	<hr/>	
Amount carried forward,	\$61,885 18	\$160,304 75

Amount brought forward,	\$61,885 18	\$160,304 75
Wrought iron and steel. -	983 76	
Wood, - - - -	77 36	
Hardware, - - - -	189 43	
Coal, - - - -	158 50	
Repairs, - - - -	372 04	
Bolts and nuts, - - - -	331 17	
Leather, - - - -	223 05	
Lumber, - - - -	1,121 29	
Oil, - - - -	171 40	
Gasket, - - - -	480 40	
Paints, - - - -	77 09	
Machine work, - - - -	299 60	
Covering spindles with boxes,	183 80	
Sundry bills, - - - -	34 00	
	<hr/>	66,588 07
Labor, laying pipe, setting plugs, &c., and for fitting up stop cocks, fire plugs, &c., viz. :		
Pipe, First District, - -	1,213 28	
"    Second    "    - -	2,114 55	
"    Third    "    - .	4,425 43	
"    Fourth    "    - -	3,174 24	
Shop, viz. :		
Wages, - - - -	7,534 75	
Bills, - - - -	301 62	
Inspecting pipes, - -	404 03	
Surveyors, for measuring pipe,	1,405 12	
	<hr/>	20,573 02
Keeping pipes, plugs, stops and fixtures in good order, viz. :		
Wages First District, - -	3,413 88	
"    Second    "    - -	4,369 93	
Amount carried forward,	\$7,783 81	\$247,465 84

Amount brought forward,	\$7,783 81	\$247,465 84
Wages Third District, -	3,905 07	
"    Fourth    " - -	4,208 10	
Paving, - - - -	603 50	
Plumbing, &c , - - -	481 00	
	<hr/>	16,981 48
Drilling and making new attachments, viz :—		
Wages, First District,-	1,404 00	
"    Second    " -	1,404 00	
"    Third    " -	1,296 00	
"    Fourth,    " -	1,408 50	
	<hr/>	5,512 50
Germantown Water Company, - - -		275 00
Railing at Fairmount, - - - -		170 01
Survey for a better supply of water, - - -		1,953 61
To pay claims of A. Smith and others, - - -		221 50
Bills for 1861, 1863, 1864, - - - -		5,525 71
Gutters at Fairmount, - - - -		622 88
Drinking hydrants, - - - -		20 90
Repairs to Fairmount Dam :—		
Contract for crib, - - -	1,143 40	
Iron, - - - -	132 85	
Lumber, - - - -	120 94	
Hardware, - - - -	87 83	
Rope, - - - -	131 86	
Stone, - - - -	270 00	
Cement, - - - -	326 75	
Sundries, - - - -	25 50	
Wages, - - - -	3,274 07	*5,513 20
	<hr/>	
Total amount of ordinary expenses, - - -		\$284,262 63

\* Of the above amount, \$2,570.25 was used in repairing wing-wall to dam, damaged by the freshet of July, 1865.

## EXTENSION OF WORKS.

## AMOUNT PAID FROM WATER LOAN.

Laying a twenty-inch main on Washington Avenue, from Broad Street to Twenty-first Street:

Main, - - - - -	\$15,102 86	
Lead, - - - - -	1,850 06	
Hardware, - - - - -	61 00	
Iron castings, - - - - -	246 27	
Lumber, - - - - -	26 20	
Sundry bills, - - - - -	256 66	
Wages, - - - - -	2,727 80	
		<hr/>
		\$20,270 85
Number of feet laid, - - - - -	3,246	
Price per foot, - - - - -	\$6 25	

Laying a thirty-inch main on Poplar St:—

Main, - - - - -	\$9,136 97	
Lead, - - - - -	670 34	
Hardware, - - - - -	11 25	
Iron castings, - - - - -	399 88	
Machine work, - - - - -	172 00	
Sundry bills, - - - - -	148 17	
Wages, - - - - -	1,583 24	
		<hr/>
		12,121 85
Number of feet laid, - - - - -	834	
Price per foot, - - - - -	\$14 53	

Making and sinking a crib in front of Fairmount Dam, through the deep water, and placing an oak apron upon it:—

Amount carried forward,	<hr/>	\$32,392 70
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Amount brought forward,		\$32,392 70
Timber, - - - - -	\$14,312 13	
Lumber, - - - - -	417 60	
Iron, etc. - - - - -	639 15	
Hardware, - - - - -	44 57	
Machine work, - - - - -	124 19	
Ropes, - - - - -	145 16	
Contractors, - - - - -	2,142 15	
Incidentals, towing logs, etc. -	150 33	
Sundries, - - - - -	149 15	
Wages, - - - - -	6,787 89	
Wages due December 31st, 1865,	*1,920 85	
	<hr/>	26,833 17

For extending the wharf, laying a suction main, erecting a stand-pipe and connecting the same at the Delaware Water Works:

Stand pipe, - - - - -	\$5,782 88	
Raising stand-pipe, - - - - -	762 21	
Contractors, - - - - -	3,803 75	
Lumber, - - - - -	520 88	
Hardware, - - - - -	53 63	
Castings, - - - - -	38 48	
Paints, - - - - -	283 54	
Carpenter work, - - - - -	840 82	
Sundries, - - - - -	216 15	
Wages, - - - - -	2,195 63	
	<hr/>	14,497 97
Amount carried forward,		\$73,723 84

\* Warrants drawn January 2, 1866.



Amount brought forward,	\$73,723 84
For purchase and laying forty-eight inch pumping main from the new mill house at Fairmount to the Corinthian Ave- nue Reservoir :	
Main, - - - - -	\$31,804 82
Lead, - - - - -	1,463 80
Machine work, - - - - -	423 22
Lumber, - - - - -	78 60
Hardware, - - - - -	121 12
Iron, - - - - -	121 91
Sundries, - - - - -	113 59
Wages, - - - - -	7,653 12
	* 41,780 18

## FOR WORKS AT FLAT ROCKS.

*Item No. 4.*

For Reservoir :—	
Pipe, castings, etc. - - - - -	\$2,753 31
Machine work, - - - - -	524 73
Lumber, - - - - -	284 00
Hardware, - - - - -	212 60
Wheel-barrows, - - - - -	212 00
Blacksmith's coal, - - - - -	54 00
Surveying, leveling, etc., - - - - -	187 00
Plough, etc., - - - - -	35 20
Sundries, - - - - -	180 27
Wages, - - - - -	11,126 30
Wages due December 31st, 1865,	†3,052 93
	\$18,622 34
Amount carried forward,	\$134,126 36

\* Of the above amount there was drawn from balance of appropriation for laying a twenty-inch main on Washington Avenue, \$9,423 15, as authorized by Councils as per Resolution.

† Warrants drawn January 3d, 1866.

*Item No. 7.*

Amount brought forward,	\$134,126 36
For incidentals:—	
Incidentals, - - - - -	25 35

## FOR WORKS AT TWENTY-FOURTH WARD.

*Item No. 8.*

For Cornish pumping engine, boilers, and connections:—	
Drawings, - - - - -	41 25

*Item No. 9.*

For Engine house, foundations and stack:	
Hardware, - - - - -	\$9 00
Wages, - - - - -	772 76
	781 76

*Item No. 14.*

For a thirty-inch main to connect Corinthian Avenue Reservoir with the Kensington Water Works:

Main, - - - - -	2,404 17
Brass Castings, - - - - -	131 70
Machine work, - - - - -	17 50
Bolts, etc., - - - - -	35 86
Wages, - - - - -	511 00
	3,100 23
	\$138,074 95

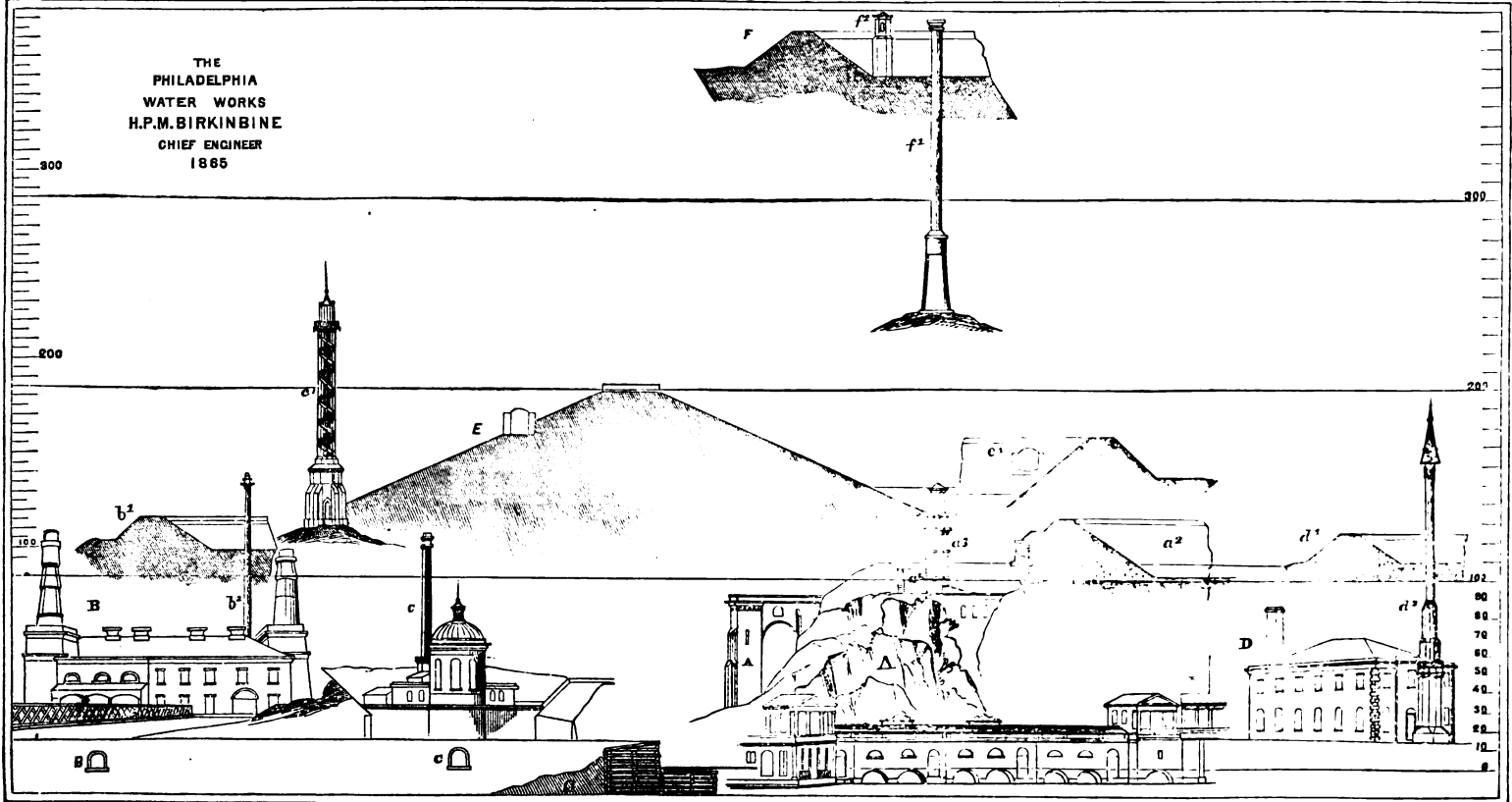
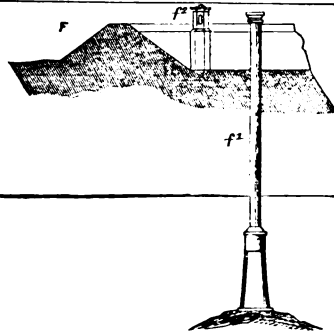
The operations of the Department are constantly enlarging and growing in importance, and the water supply of a large city is so vital to its health, comfort and prosperity, that some arrangements should be made to insure a more permanent organization of the Department, and also of the Committee of Councils, who supervise it. The changes so frequently made, have prevented any settled policy in the management or extension of the Works. There is no doubt that a permanent policy would insure a more satisfactory and economical management of the Works, and an increased income from the Department.

It is impossible to enforce many of the existing ordinances for the protection of the Works, and for the prevention of fraudulent and improper use of water. It is evident that a large amount of water is used for which the city receives no remuneration, and which it is impossible for the Department to detect or prevent under existing ordinances. There is, perhaps nothing that would render such valuable assistance as the licensing of plumbers, and making their interest one with the city, in preventing fraudulent uses of water, and the making of attachments without permit.

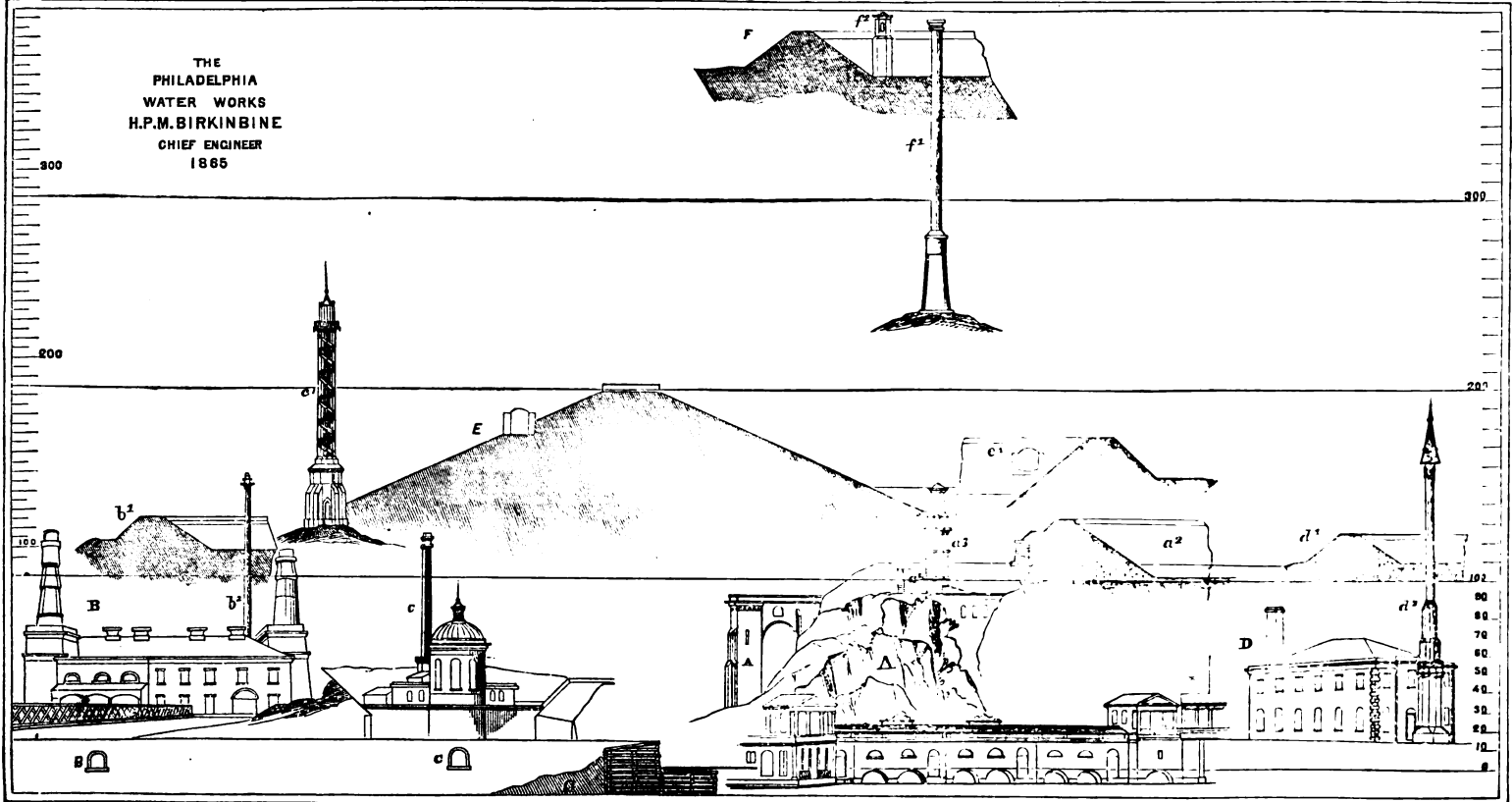
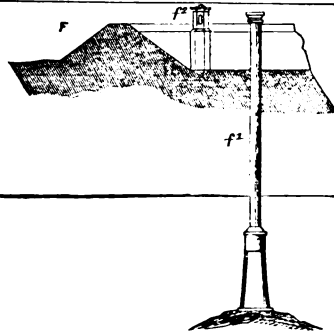
HENRY P. M. BIRKINBINE.

*Chief Engineer.*

THE  
PHILADELPHIA  
WATER WORKS  
H.P.M. BIRKINBINE  
CHIEF ENGINEER  
1865



THE  
PHILADELPHIA  
WATER WORKS  
H.P.M. BIRKINBINE  
CHIEF ENGINEER  
1885



DEPARTMENT FOR SUPPLYING THE CITY WITH WATER.

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PRELIMINARY SURVEYS

FOR

PROCURING A SUPPLY OF WATER BY GRAVITATION,

FOR THE

CITY OF PHILADELPHIA,

FROM THE

PERKIOMEN,

BY

H. P. M. BIRKINBINE,

CHIEF ENGINEER.

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PHILADELPHIA:

WILLIAM F. GEDDES, PRINTER, 320 CHESTNUT STREET.

1866.

# PRELIMINARY SURVEYS

FOR A SUPPLY OF WATER FROM SOURCES BEYOND THE LIMITS OF  
THE CITY.

In the first Report I had the honor of making to Councils, in October, 1858, their attention was drawn to the importance of looking for a water supply to other sources than the two noble rivers flowing past and through our City ; not because the water in either is of inferior quality, but because so much objectionable matter is drained into them. As the City increases in population the sources of contamination are of necessity augmented, and no care or legislation can entirely protect the purity of these rivers, as all drainage naturally tends towards them.

The dam at Fairmount prevents the sewerage discharged into the Schuylkill below it from being carried above the Works, but there is a large and constantly increasing drainage into the dam itself. This has been referred to in former Reports. A portion of the sewerage entering into the Delaware is carried by the ebb and flow of the tide past the Works, and as a consequence, contaminates, to some extent, the water taken from it.

Pumping the amount of water necessary to meet the wants of this large City, requires a great deal of labor and a large expenditure of money. The City has now fifteen pumps propelled by water, and eight by steam. Two additional steam engines are in course of construction.

The Works supplying the City were constructed at different periods of time and for the purpose of furnishing the various districts now forming the consolidated City. The reservoirs are of

different elevations, and the distribution arranged simply with reference to the several districts they were intended to supply.

The engraving in the front of the Report exhibits the Works and Reservoirs of the consolidated City. The figures upon the right hand show the elevation above City datum, and those on the left, the elevation above Fairmount Dam.

The Fairmount Water Works is represented at *A*.

*A* section of the dam at *a*.

*A* section of Fairmount Reservoir at *a*<sup>1</sup>.

*A* section of Corinthian Avenue Reservoir at *a*<sup>2</sup>.

This Reservoir is connected with the Fairmount Works, and supplied by the pumps in the new mill house. The Water Tower, *A*, and Stand Pipe, *a*<sup>3</sup>, are used in connection with these pumps.

The Works at Fairmount were originally intended to supply the old City and the former districts of Southwark and Moyamensing.

In the old mill house there are eight double acting pumps, sixteen inches in diameter, propelled by breast wheels, and one by a turbine wheel. In the new mill house there are six double acting pumps, eighteen inches in diameter, propelled by turbines. The full capacity of both these Works, at ordinary stages of the river, is 28,000,000 gallons per day.

The Schuylkill Works, formerly the Spring Garden and Northern Liberties, are represented at *B*. The water is drawn from Fairmount Dam at *B*, and pumped into the Reservoir at *b*<sup>1</sup>. These Works also supplied the former district of Penn. In these Works there is a Cornish pumping engine, thirty inches diameter of plunger, ten feet stroke; one condensing bell-crank engine, double acting pump, twenty-two inches in diameter, four feet stroke; and two beam condensing engines, double acting pumps, eighteen inches diameter, and six feet stroke.

These Works can supply 8,000,000 gallons per day, and may be forced to 10,000,000 gallons.

The Twenty-fourth Ward Works, formerly West Philadelphia, are



represented at *C*. These Works receive the water from Fairmount Dam at *c*, and pump into the stand pipe at *c*<sup>1</sup>. No reservoir has been built for this district; one, however, is authorized, and will be commenced in the spring.

In these Works there are two Cornish Bull engines, plungers seventeen and a half inches in diameter, eight feet stroke. The works can supply 1,000,000 gallons per day, and may be forced to 1,500,000.

The Delaware, formerly Kensington Works, are represented at *D*. The water is taken from the Delaware river in front of the Works, and is pumped into the reservoir at *d*<sup>1</sup>. These Works were also intended to supply the former district of Richmond.

In these Works is a high pressure engine, propelling a double acting pump, eighteen inches diameter, six feet stroke, and a condensing engine, propelling a double acting pump, nineteen inches diameter, six feet stroke. The capacity of these Works is 3,000,000 gallons, and they may be forced to 4,000,000.

The present supply of water is furnished at such various elevations, and the systems of distribution are from so many different sources, that it will be advisable to entirely abandon the old system, and adopt one that will command all of the City except the comparatively small districts, Germantown, Chestnut Hill and Roxborough. These portions of the City are so high that it would be impossible to arrange a system which would embrace them, without making the pressure upon pipes in the other portions of the City so great as to destroy them.

The Reservoir which is intended to supply these high districts is now in course of construction, and is represented at *F*. It is to be supplied with water taken from the Schuylkill, at Flat Rock Dam. The stand pipe for the Germantown Water Works is represented at *f*<sup>1</sup>. It will be connected with this Reservoir.

Believing that there were sources within a reasonable distance, from which water could be supplied to the City, with the above

exception, at an elevation greater than any of the reservoirs now in use, you were urged, from time to time, to make the appropriation for preliminary examinations to determine this fact; and, finally, in the spring of 1864, \$3,000 were appropriated for the purpose.

The preliminary surveys authorized by ordinance of Councils, under date of April 15th, 1864, for the purpose of ascertaining the practicability of procuring a supply of water from sources other than the present, and beyond the limits of the City, have been carefully prosecuted, and examinations made of a number of streams within a moderate distance of the City.

The following have been examined, with a view of ascertaining the practicability of procuring a supply of water from them. With the exception of the Perkiomen, no actual surveys have been made, but the various streams have been carefully examined from their sources to their mouths, and all information within reach collected, as far as the moderate appropriation you made for this purpose would enable the Department to do.

#### CHESTER CREEK.

Chester creek has three principal branches, the northwest, west, and main. The northwest branch rises in West Chester borough, and flows for five miles in a southeasterly direction, joining the main branch at Cheyney's shops. The west branch rises in Concord township, Delaware county, and flows in a northwesterly direction for eight and a half miles, entering the main branch at Glen Riddle. The main branch rises in West Whiteland township, Chester county, and flows twenty-one miles in a southeasterly direction, through Chester and Delaware counties, entering the Delaware river at Chester.

This creek has a drainage area of seventy square miles, and furnishes power for thirteen grist mills, nine saw mills, eight woolen mills, six cotton mills, two paper mills, and two wate,

works—total forty. The Water Works supply West Chester and the West-town Boarding School.

A dam from which water could be supplied to the City by aqueduct, could probably be made about six miles above the mouth of the creek, below the confluence of the main and west branches. Above this point there are thirty-two mills, and the creek has a drainage area of sixty-one square miles. The proposed site for a dam is fifteen miles in a direction east south-east from Broad and Market streets.

A supply of 50,000,000 gallons per day could be furnished from this source, but the region drained by it is highly cultivated and densely populated, and the naturally excellent character of the water to a large extent impaired; it receives all the drainage of West Chester, a large and flourishing town.

To utilize the amount of water, estimated as procurable from this and the other creeks mentioned, will require impounding reservoirs of sufficient capacity to store and keep back the storm, or flood water; to be used in seasons of drought, or when the creeks flow but a small amount of the average estimated.

#### RIDLEY CREEK.

This Creek rises in East Whiteland Township, Chester county, and flows for twenty miles in a southeasterly direction, through Chester and Delaware counties, entering the Delaware river one mile north-east of Chester. The creek has a drainage area of thirty-eight square miles, and furnishes power to seven grist mills, seven saw mills, seven woollen mills, two paper mills, two edge-tool works, and two drug mills—total twenty-seven.

A dam from which a supply to the City could probably be obtained, might be made at Media, six miles above the mouth of the creek. There are thirteen mills above this point, and the creek has a drainage area of thirty and a half square miles. This point is thirteen miles east south-east of Broad and Market streets.

From this source about 25,000,000 gallons per day could be procured for supplying the City. The country drained by this creek is of the same character as that drained by Chester Creek.

#### CRUM CREEK.

This creek rises in Willistown township, Chester county, and for eighteen and a half miles flows in a southeasterly direction through Delaware and Chester counties, entering the Delaware river eight miles below the confluence of the Delaware and Schuylkill rivers. The creek has a drainage area of thirty-eight square miles, and furnishes power to four grist mills, four saw mills, four cotton mills, two woollen mills, one paper mill, and one edge-tool works—total sixteen.

A dam from which water could be supplied to the City, could probably be made at the edge-tool works, six and a half miles above the mouth of the creek. Above this there are seven mills, and the creek has a drainage area of twenty-nine square miles. This point is ten and three-fourths miles east south-east from Broad and Market streets. The creek would afford about 20,000,000 gallons of water per day.

#### DARBY CREEK.

This creek rises in East-town township, Chester county, and for twenty-three and a half miles flows through Chester and Delaware counties in a southeasterly direction, entering the Delaware river at Tinicum Island, seven miles below the confluence of the Delaware and Schuylkill rivers. It has a drainage area of fifty square miles, and furnishes power to nine grist mills, seven saw mills, nine woollen mills, three cotton mills, and two shoddy mills—total thirty.

Ten and a half miles above the mouth of the creek, near Garrettsford, a dam could probably be constructed to furnish a supply to the City; above this there are twenty-three mills, and the creek has a

drainage area of thirty-seven square miles. This point is seven and a half miles east of Broad and Market streets. A supply of about 25,000,000 gallons per day could be procured from this source.

#### COBB'S CREEK.

This creek is properly a branch of Darby creek, but as the confluence of the two streams is at tide water, it is mentioned as a separate creek. It rises in Haverford township, Delaware county, and flows nearly south for eleven miles, entering Darby creek one mile below Paschalville.

The creek supplies power to eight woollen mills, two grist mills, two saw mills, two cotton mills, one paper mill, one forge, and one snuff mill—total, seventeen.

At Haddington, six miles from its mouth, a dam could probably be constructed to supply the city with water; above this place there are nine mills, and the creek has a drainage area of ten miles. This point is five miles east north-east of Broad and Market streets. From this source about 12,000,000 gallons of water per day could be procured.

An amount of water sufficient to supply a city three times the size of Philadelphia—say 100,000,000 gallons per day—could be procured from these five streams, viz : Chester, Ridley, Crum, Darby and Cobb creeks. They could all be brought in by gravitation, at sufficient elevation to supply any reservoir now in use in the City. The quality of the water is naturally unexceptionable, but the large population inhabiting the country drained by these streams, and the great proportion of the land under tillage, doubtless impairs the purity of the water. The value of property occupied or damaged, and the number of mill sites destroyed or injured, if a supply of water should be obtained from these streams, is a subject worthy of consideration; until, however, over 60,000,-

000 gallons of water are required per day, an amount double the present daily consumption, these mill powers could be compensated by water spared from the store reservoirs.

Were there no other apparently more desirable sources, these would be recommended.

#### MILL CREEK.

This creek rises in Lower Marion township, Montgomery county, and flows in an easterly direction six and a half miles, entering the Schuylkill one mile above Flat Rock Dam. It has a drainage area of nine square miles, and furnishes power to one grist mill, two cotton mills, two paper mills, three woollen mills, three shoddy mills, one rolling mill, and one machine shop—total, thirteen.

One mile and three-fourths from the mouth of the creek a dam could probably be constructed from which a supply of water could be obtained. Above this point, which is seven and three-quarter miles northwest of Broad and Market streets, there are eight mills, and the creek drains an area of seven and a half square miles.

This stream I recommended to the district of West Philadelphia, as a source from which a supply of water could be procured, before the present Twenty-fourth Ward Works were constructed. It could have been brought in for about the amount the present Works cost; but the Committee of Councils of the then district of West Philadelphia, who were induced to visit the stream, thought it best to trust to a supply pumped by steam from the Schuylkill, rather than to one procured by gravity from this source.

#### GULF CREEK.

This creek rises in Frediffrin township, Chester county, and flows for six miles through Chester, Delaware and Montgomery counties, and enters the Schuylkill river just below Catfish Dam, at Conshohocken. It has a drainage area of seven and a half

square miles, and furnishes power for three woollen mills, one grist mill, and one saw mill—total, five.

A small dam could be constructed of sufficient height to supply the City, three miles from the mouth of the creek. Above this point, which is twelve miles northwest from Broad and Market streets, there are two mills, and the creek has a drainage area of five square miles.

#### EAST VALLEY CREEK.

This creek rises two miles northeast of White Horse Station, Chester Valley Rail Road, and flows for nine and a half miles in a direction east northeast through Chester county, entering the Schuylkill at Valley Forge, above Pauling's Dam. It supplies power to seven grist mills, four saw mills, one plaster mill, and one woollen mill—total, thirteen. It has a drainage area of twenty-one square miles.

A dam from which water could be delivered into the City, could probably be constructed four miles from the mouth of the creek. Above this site, which is eighteen and three-quarter miles northwest of Broad and Market streets, the creek has a drainage area of seventeen square miles.

These three creeks enter the Schuylkill from the west, above the Fairmount Dam, and are all too inconsiderable to require further notice as a source of supply for the City, even were they collected together.

The creeks entering the Schuylkill from the east are, with the exception of the Wissahickon creek, of little importance. They have, however, received sufficient attention to exhibit their value.

#### WISSAHICKON CREEK.

This creek rises in Montgomery township, Montgomery county, about one and a half miles southeast of Landsdale station, on the

North Pennsylvania Railroad, and flows for nineteen miles in a southern direction, through Montgomery and Philadelphia counties, entering the Schuylkill river about four and a half miles above Fairmount Water Works. The creek furnishes power to sixteen grist mills, six saw mills, three woollen mills, three cotton mills, two paper mills, one carpet manufactory, one oil mill and one print works,—total, thirty-three. The creek has a drainage area of seventy-eight square miles. Water for supplying the City could be obtained at sufficient elevation, ten miles above the mouth of the creek, and thirteen miles north of Broad and Market streets. Above this point the creek has a surface drainage of forty-four square miles, and below there are eighteen mills.

#### PLYMOUTH CREEK.

This creek rises one and a half miles northeast of Hickorytown, Montgomery county, and flows for five miles in a southern direction, entering the Schuylkill at Conshohocken. It has a drainage area of eight square miles, and furnishes power to one saw mill. The creek is about twelve miles north of Broad and Market streets.

#### SAW MILL RUN.

This creek rises near Springtown, Montgomery county, and flows in a westerly direction, entering the Schuylkill river at Norristown. It has a drainage area of five square miles, and furnishes power to two saw mills. The creek is fourteen miles northwest of Broad and Market streets.

#### STONY CREEK.

This creek rises in Worcester township, Montgomery county, and flows seven and a half miles in a southwestern direction, entering the Schuylkill at Norristown. It furnishes power to four grist mills, one oil mill, one clover mill, one machine shop, one plaster



mill and one woollen mill ;—total, nine. This creek is about sixteen miles northwest of Broad and Market streets. It has a drainage area of sixteen square miles.

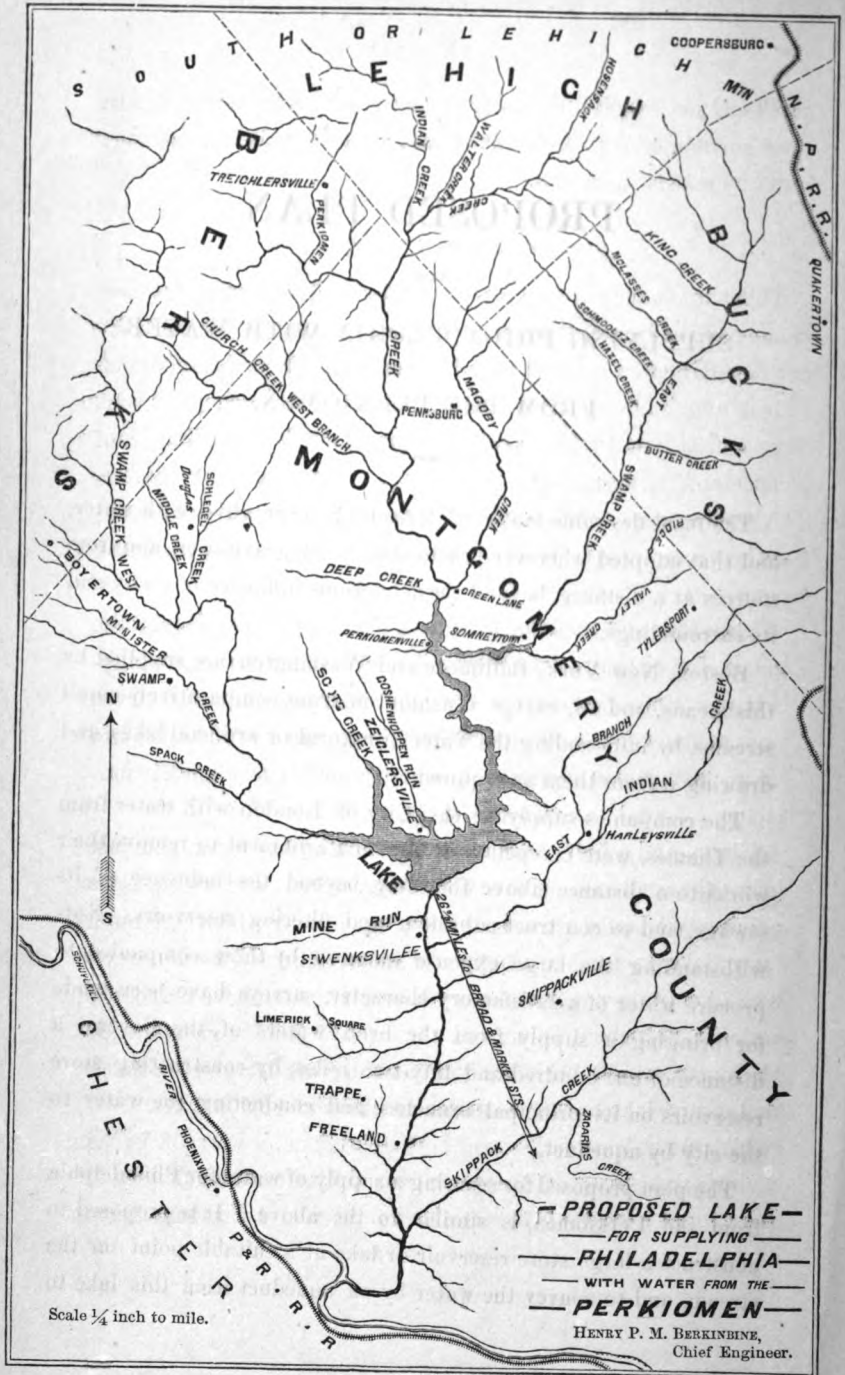
#### PERKIOMEN CREEK.

This is the next creek entering the Schuylkill from the east, and is one of the largest tributaries. The main branch rises near Peryville, Hereford township, Berks county, and flows through Berks, Lehigh and Montgomery counties, entering the Schuylkill about three miles below Phoenixville. It has a number of tributaries of considerable importance, (*see map*). The largest of these are Skippack creek, East Branch Perkiomen, Swamp creek, west ; Swamp creek, east ; West Branch Perkiomen, and Hosensack creek.

The creek and its tributaries have a drainage area of about three hundred and twenty-five square miles, and furnishes power to eighty-seven grist mills, seventy-two saw mills, twenty-one oil mills, eleven powder mills, four clover mills, four forges, two cotton mills, two fulling mills, one woollen mill, one paper mill, one gimlet manufactory ;—total, two hundred and six.

Eleven and a half miles above the mouth of the creek, and just below the confluence of West Swamp creek, is a site which seems admirably adapted for the erection of a dam by which to form a large lake, to furnish a supply of water to the City, by aqueduct. The level of the water of the creek here is 125 feet above that of the water in Fairmount Dam ; and a dam of 65 feet in height and 1100 in length, would back the water up the creek for over six miles, and form a lake having a surface area of about 15 00 acres.

This point is twenty-six and five-eighths miles west of Broad and Market streets. The water from this lake can be delivered in the City at a head of 175 feet above the level of Fairmount Dam.



# PROPOSED PLAN

FOR

SUPPLYING PHILADELPHIA WITH WATER

FROM THE PERKIOMEN.

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The most desirable mode of furnishing large cities with water, and that adopted wherever practicable, is, by gravitation, and from sources at a distance, beyond the deleterious influence of a city and its surroundings.

Boston, New York, Baltimore and Washington are supplied by this means, and all, except Washington, from comparatively small streams, by impounding the water in natural or artificial lakes, and drawing it from them as required.

The companies supplying the City of London with water from the Thames, were compelled by Act of Parliament to remove their works to a distance above the City, beyond the influence of its sewage, and to construct subsiding and filtering reservoirs. Notwithstanding the large expense incurred by these companies to procure water of a satisfactory character, surveys have been made for bringing a supply from the head waters of the Severn, a distance of one hundred and fifty-two miles, by constructing store reservoirs on its principal branches, and conducting the water to the city by aqueduct.

The plan proposed for securing a supply of water for Philadelphia from the Perkiomen, is similar to the above. It is proposed to construct a large store reservoir or lake at a suitable point on the stream, and to convey the water by an aqueduct from this lake to

a distributing reservoir located upon the higher ground in the northern part of the City, and connected by supply mains to the several centres of distribution of the present Works.

#### LAKE OR STORE RESERVOIR.

Between Swenksville and Zieglersville, the Perkiomen has cut a narrow passage through the trap hills, which cross the country at this point from east to west. These hills rise to from four hundred to five hundred feet above tide, and about three hundred and fifty feet above the creek. At this point it is proposed to construct a dam, for which purpose it possesses unusual advantages. The trap is forced up through the overlaying strata and crops out upon the surface, forming reliable foundations and abutments for such a structure. No danger need, therefore, be apprehended of the water finding its way through unseen channels, under or around the dam. It will only be necessary to construct the dam of sufficient strength and join it to the rock on the sides and bottom, to insure a structure that will never yield to any force that may come against it. A dam of any desirable depth may be constructed at this point, and a lake of corresponding area made.

A line of levels were run around what would be the surface of the water in the lake if it was raised sixty-five feet above the present level of the stream and two hundred and four feet above city datum. The water, at this depth, would cover an area of fifteen hundred acres. It is proposed to place the outlet so as to draw it down twelve feet. At this depth, the lake would contain over five thousand million gallons, an amount of water sufficient, if no water flowed into it from its numerous tributaries, to supply the present demands of the City for about two hundred days. A lake of double the storage capacity of this, could be constructed at this point, if desired.

If the water be made sixty-five feet deep it will overflow two grist mills, two saw mills, two powder mills, three oil mills, one woollen mill, one forge, one tannery and sixteen dwellings. Below

the proposed dam, there are ten grist mills, three saw mills and one oil mill. The amount of land overflowed would be fifteen hundred acres, much of it rocky and of comparatively little value for farming. The shores would be to a great extent precipitous and rocky.

The object of this lake is to impound the storm water, so as to supply deficiencies that occur in seasons of drought. It would not be of sufficient capacity to store all the surplus water, large as it is proposed to make it; even if increased in depth, so as to cover two thousand acres, other store reservoirs would be required, which could be constructed upon the different tributaries, as made necessary by the demands of the City.

The accompanying map of the Perkiomen exhibits the lake and the various streams that will be drained into it. The proposed dam is shown at *E*, on the cut in front of the report, and the distributing reservoir in the City which would receive the water from the aqueduct at *e*. It will be seen by the cut that the water in this reservoir will be at a greater elevation than in any other in the City, except the one in course of construction at Roxborough.

#### AQUEDUCT.

The means at the disposal of the Department were too limited to make surveys to indicate the line of the aqueduct. From a careful examination of the country laying between the city and the proposed lake, there appear to be fewer difficulties in the way than are generally found, and several routs appear to be practicable. This subject will require careful investigation, so as to select a rout best adapted for the purpose. An aqueduct twenty-four miles long, will, most probably, connect the lake with a suitable site for a reservoir in the upper part of the City. The aqueduct should be made of sufficient capacity to bring down the maximun amount of water that may be required.

**RESERVOIR.**

To perfect the plan of supplying the City, a large reservoir should be constructed capable of storing at least 1,000,000,000 gallons; no matter what plan of supply be adopted such a reservoir will be indispensable. The water from the Perkiomen could be delivered at an elevation fifty feet higher than the Corinthian Avenue Reservoir, and seventy-five feet higher than Fairmount. There are numerous localities in the northern part of the City adapted for such a reservoir. The reservoir directed to be constructed in the Twenty-fourth Ward could be supplied from the Perkiomen; and all the present reservoirs could be abandoned and the property put to other uses.

**SUPPLY MAINS.**

The Reservoir to be at sufficient elevation, will be located at some distance from the present centre of distribution, and it will be necessary to lay several lines of large supply mains. To furnish 75,000,000 gallons per day, four forty-eight inch mains leading from the Reservoir will be necessary; and as the demands of the City increase additional mains can be laid.

**QUANTITY OF WATER.**

In the absence of actual measurement of the capacity of the Perkiomen by gaging, which would require observations extending over several years, the following estimates of the quantity of water procurable from this source are substituted.

Twelve cities of Great Britain, supplied from impounding reservoirs situated on comparatively small streams draining areas of various extent, are given as follows:

Ashton,	Annual rain fall, 40 inches ; of this, 384 is utilized.
Belfast,	“ “ 32 “ “ 522 “
Bolton,	“ “ 50 “ “ 619 “
Dublin,	“ “ 45 “ “ 500 “
Glasgow,	“ “ 60 “ “ 402 “
Greenock,	“ “ 60 “ “ 603 “
Huddersfield,	“ “ 33 “ “ 537 “
Liverpool,	“ “ 55½ “ “ 436 “
Macclesfield,	“ “ 40 “ “ 526 “
Manchester,	“ “ 37 “ “ 617 “
Oldham,	“ “ 35 “ “ 415 “
Paisley,	“ “ 56½ “ “ 548 “

The average rain fall upon the surface drained for the supply of the above cities, is 45.32 inches per annum, stored or utilized, .509 equal to 23.06 inches per annum. The amount of the rain fall utilized, would be greater, if the capacity of the several reservoirs were sufficient to retain a larger portion of the flood water, as in the case of Bolton, Greenock, and Manchester; these reservoirs are of larger proportionate capacity, and above sixty per cent of the rainfall is utilized. The Department are not in possession of sufficient data to make an analysis of the Works supplied by similar means, in this country.

No record could be found of the rain fall upon the country drained by the Perkiomen, probably, none has ever been kept. The Department have placed rain gauges at Trichlersville, at the foot of the mountains, near the northern boundary of the water shed ; at Boyerstown, near the western boundary of the water shed ; and at Zieglersville, near the site of the proposed lake. The Polytechnic College of Pennsylvania has also placed rain gauges on its farm, near the eastern boundary of the water shed. The records of these observations will form a reliable basis for future calculations. For present purposes, the careful observations of J. A. Kirkpatrick, A. M., of the rain fall in this city, reported in

the Journal of the Franklin Institute, are used. The average annual rain fall in Philadelphia for the past thirteen years, has been 45.436 inches, about the same as the average fall upon the surface drained for the twelve Works instanced above.

The amount of rain which falls upon the country drained by the Perkiomen, is no doubt greater than that which falls on this City. The stream rises in the South, or Lehigh Mountains; the first elevated land west of the Atlantic ocean. These hills rise to from 900 to 925 feet above tide, and are about 100 miles from the ocean. The amount of rain falling upon this elevated land is no doubt greater than upon the comparatively low position of the observer of the rain fall in Philadelphia, 60 feet above tide.

Above the site of the proposed lake the flow of the Perkiomen and its tributaries is rapid, and the surface of the country drained of such a character that the rain which falls upon it soon flows off. Water which finds its way into the earth, will most probably, all be stopped and forced up by the trap, which forms what will be the entire southern or lower boundary of the lake; the only loss, therefore, will be that absorbed by vegetation and by evaporation. The experiments made upon the amount of water evaporated, upon which calculations of this kind are usually based, are very unsatisfactory and variable. The Croton Board have caused a series of observations to be made, but these can not be applied in the present calculations. The amount lost by evaporation is generally over estimated. In this country it is no doubt greater than in Great Britain; but in the case of the Perkiomen, the loss by evaporation will be comparatively small, fully one-third of the surface drained by it is covered with forests, and likely to remain so, on account of its broken and rocky character, and a large proportion of the country under cultivation is kept in grass. On account of the great depth of water in the proposed lake, the evaporation from it will be comparatively small. The amount of rain-fall that can be utilized will, therefore, be at least as great as that of the Works of the twelve cities mentioned above.



An estimate of the quantity of water that may be procured from the drainage area of the Perkiomen, based upon the above data, will be found correct, at least sufficiently so for the purposes of this report.

The country drained by this stream, above the proposed dam, is about 220 square miles. Estimating the average amount of rainfall upon this surface to be the same as at Philadelphia, 45.43 inches, the amount that can be utilized will be 23.12 inches.

The quantity of water that can be collected and furnished from this source, if impounding reservoirs of sufficient capacity be constructed to store the storm or flood water, will be a daily average of 240,000,000 gallons; a quantity sufficient to supply to 4,000,000 of inhabitants, an average of 60 gallons of water each, per day.

Large reductions may be made to these estimates, and still a supply of water be procured sufficient for Philadelphia, for many years to come.

#### QUANTITY OF WATER REQUIRED.

When the Water Power Works at Fairmount were first started, their total pumping capacity, as projected, was 10,000,000 gallons per day; this it was supposed, would furnish an ample supply of water to the city and surrounding districts, even for a population greater than the present. The average daily amount of water furnished, has been as follows: in 1825, 1,280,700 gallons; in 1835, 3,364,625 gallons; in 1845, 6,142,654 gallons; in 1855, 11,700,786 gallons; and in 1865, 30,281,019 gallons.

The amount of water required per inhabitant, has steadily increased; in 1830 an average of  $12\frac{1}{2}$  gallons per day was required, and in 1865, 41 gallons.

When water was introduced into New York by the Croton Aqueduct, in 1842, the capacity of the Works, as then completed, was 35,000,000 gallons per day; this, it was estimated, would furnish an ample supply for 1,750,000 inhabitants. In less than

twenty years from that time, the supply of water to New York was deficient, with less than one-half that number of inhabitants, and notwithstanding the large sums of money expended for increasing the capacity of the Works, they are not now equal to the requirements of that City, although nearly doubled in capacity.

With the growth of a city in extent and population, the dependence upon a water supply from sources beyond its limits becomes greater, and the necessity for a larger proportionate supply increases.

Should the demands of Philadelphia increase in the same ratio as during the last twenty years, the amount that will be required in 1875 will be about 75,000,000 gallons per day, and in 1885 150,000,000 gallons. A Works, therefore, projected to furnish the City for a reasonable length of time, say twenty-five years, looking forward to the same ratio of growth in population and corresponding demands for water, should have a capacity of not less than 175,000,000 gallons per day.

#### QUALITY OF WATER.

Specimens of water taken from the Perkiomen, at the site of the proposed dam, and submitted to Clark's soap test, were found to be 6.4 degrees of hardness, indicating the presence of a corresponding number of grains of mineral salts to the gallon. The water of the Schuylkill, in Fairmount Dam, by the same test, indicates 6.19 degrees. The water was taken from the Perkiomen in October, when it was at its lowest stage, and most probably flowed only spring water, as there had then been a long season of drought. Should the lake be constructed, the water it would contain would be largely the rain fall, drained from the surface, purer and much softer than spring water.

Water collected from surface drainage will be affected by the character of the soil it falls upon. The land drained by the Perkiomen is remarkably well adapted for collecting water, being composed almost entirely of trap and sandstone. The only minerals

found are lime, from eight to ten square miles, and a few deposits of hematite. The Perkiomen copper and lead mines are all south of the trap and below the area draining into the proposed lake. There are no manufactories which would impair the purity of the water, and the villages are all small. This region offers no inducements to manufacturers, nor is it likely ever to become thickly settled; it probably does not now contain a larger population than it did fifty years ago. There is, perhaps, one-third still in forest, and there probably never will be a less proportion. The soil is not valuable, and much that is now tilled would pay a greater return if planted with trees; a large proportion is kept in grass. This surface is, therefore, a most desirable one for collecting water. On account of the depth of the lake, and the large volume of water contained in it, the water would always be pure, bright and limpid, probably never made turbid by freshets in the streams flowing into it.

#### COST OF WORKS.

Without actual surveys and detailed plans and specifications, it is impossible to form an estimate of the cost of this work. The means at the disposal of the Department were not sufficient to do this, but, it is believed the object for which you made the appropriation has been accomplished, and sufficient information presented to satisfy you that the City can be supplied with an abundance of most excellent water from the Perkiomen.

#### DAMAGES.

It is always difficult to estimate damages, particularly where water rights are concerned, and care must be taken to procure such legislation as will protect the City against combinations and exorbitant charges. Most of the land which would be overflowed by the lake is of little value, a great proportion of it being rocky, and if offered for sale would probably not bring an average of

forty dollars per acre. Several of the mills which will be destroyed, are good and substantial buildings ; it will be necessary to purchase all the mills and buildings that will be overflowed. Without locating the aqueduct it is impossible to form any approximate estimate of damages.

The mill-powers below the dam would not be injured until a large amount of water was taken for the City, say over 60,000,000 gallons per day. The effect of the lake in keeping back the storm water, would compensate to a great extent for the amount taken for the use of the City ; a portion of that stored could be spared in seasons of drought and supplied to the creek as required. By constructing store reservoirs on the East Perkiomen, for the purpose of compensating the mills below, for water taken from the main stream, it will be a long time before any actual damage will be done. The mill powers would rather be benefited by having the flow of water more constant ; but if the mills below could be purchased at a fair valuation, it would no doubt be better to do so, than to incur the expense of constructing compensating reservoirs.

For the purpose of comparison, the cost of the entire work is placed at ten million dollars ; a sum certainly sufficient to purchase the necessary real estate, and to do the work in the best and most substantial manner, and pay all proper claims for damages ; say for dam, damages, and all expenses at the lake \$1,000,000 : Twenty-four miles of aqueduct, at an average cost of \$250,000 per mile, \$6,000,000 : Store reservoir in the City \$1,000,000 : Supply mains to connect with present Works \$1,000,000 : Contingencies \$1,000,000. A survey of the route and detailed plans and specifications may make important changes in these estimates, but it is not probable that this gross amount will be exceeded. This contemplates Works that would furnish to the reservoir an average of 175,000,000 gallons per day, and distribute to the City 75,000,000 gallons.

## ANNUAL EXPENSES.

The annual cost of supplying the City with water from the Perkiomen, estimating the Works to cost, as above, will be for interest, appropriation to the sinking fund, etc., eight per cent. and for repairs, management, etc., say \$52,000, making the total annual expense \$852,000, or \$11,360 per annum per million gallons, when a daily average of 75,000,000 gallons are supplied. When an average of 150,000,000 gallons per day are furnished, the expense will be \$6,000 per annum per million gallons. This, compared with the cost per million gallons of water supplied to other cities, by similar means, will indicate the economy of these Works. The water supplied to the City of New York by the Croton Aqueduct, cost \$40,000 per annum per million gallons. That supplied to Boston by the Cochituate Aqueduct, cost \$24,000 per annum per million gallons. That supplied to Albany, also by aqueduct \$28,000. In Great Britain: the water supplied to Liverpool is at a cost of £45,000 per annum per million gallons. Manchester is supplied at a cost of £34,000. The supply to London, by the proposed aqueduct, will be at a cost of £71,000 per million gallons, when the Works furnish a daily average of 120,000,000 gallons; and of £49,000 when their full capacity, 220,000,000 gallons per day is required.

When a comparatively small amount of water is required, it can generally be procured at a less cost by pumping, if the source be near at hand, than by going to a distance to procure a supply by gravitation. This City, up to the present time, has been supplied at a less cost by the pumping works than it could have been by bringing in water by gravitation from some of the sources indicated above; and were the character of the water now furnished perfectly satisfactory, the amount could be increased to 50,000,000 gallons per day, by pumping, at a less cost than by the proposed aqueduct, but, beyond that amount, it can be furnished at a less cost from the Perkiomen.

The water supplied in 1865 cost \$6,000 per annum per million gallons. Of this amount sixty-four per cent. was pumped by the water power at Fairmount. By erecting new Works the amount furnished from this power could be increased 10,000,000 gallons per day.

To furnish 75,000,000 gallons per day, by pumping, would cost as follows:—

30,000,000 gallons from the present Works, at \$6,000,	\$180,000
10,000,000 “ additional from Fairmount water power, at \$3,000,	30,000
35,000,000 gallons from steam Works, at \$20,000,	700,000
	<hr/>
75,000,000 gallons, at a total cost of	\$910,000

To this must be added the cost of store reservoir and supply mains, the same as in the Perkiomen project, \$2,000,000; add interest, &c., \$160,000, making the total cost for a supply of 75,000,000 gallons per day, \$1,070,000, or \$14,266 per annum per million gallons. By comparing this estimate with the cost of furnishing the same amount by the proposed aqueduct, it will be seen that the aqueduct will save \$218,000 per annum, and when 150,000,000 gallons per day are used, it will be at a saving of \$1,510,000 per annum.

#### REVENUE.

When the prospective income for the water rents of the City is taken into account, the project of bringing in the Perkiomen loses much of its apparent magnitude. In 1825 the total amount received for water was \$27,299.18; in 1835, \$92,166.82; in 1845, \$135,465.37; in 1855, \$327,176.24; and in 1865, \$595,661.44. The revenue derived from water will no doubt be sufficient to pay all expenses as soon as the aqueduct can be built, and the profits would repay the total investment long before the bonds issued for

the construction of the Works would mature. When the City requires the full capacity of these Works, the annual net revenue from them, after paying all expenses, will be over four millions of dollars.

The Perkiomen possesses many advantages; in fact, all that can be desired; abundance of water of most excellent character, and in no danger of contamination, and a head sufficient for all parts of the City, with trifling exceptions. The entire work can be executed at a comparatively small cost. There appears, therefore, no necessity for looking to other sources.

Although the means at the disposal of the Department did not admit of the full investigation desirable, before recommending a project of such importance and magnitude, yet, with the information collected, I do not hesitate to urge upon you the adoption of the project, and would ask for the means of making the necessary surveys, plans and estimates for the work. Should you take the same favorable view of the project, immediate action will be necessary. A railroad is already located up the valley of the Perkiomen, which, should it be built as located, will interfere with the construction of the proposed lake. I would also remind you that to execute a work of this character will require a number of years after the necessary legislation is procured, the plans definitely arranged, and the location of the different parts fixed. I therefore respectfully suggest an appropriation of twelve thousand dollars, for the purpose of making the necessary surveys, plans and specifications.

HENRY P. M. BIRKINBINE,

*Chief Engineer.*

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