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DEPARTMENT OF SURVEYS.

ANNUAL REPORT

OF THE

CHIEF ENGINEER AND SURVEYOR

OF THE

CITY OF PHILADELPHIA.

R - 1866

Submitted to the Mayor January 7th, 1867.

PHILADELPHIA:

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1867.

REPORT
OF THE
CHIEF ENGINEER AND SURVEYOR
OF THE CITY OF PHILADELPHIA.

DEPARTMENT OF SURVEYS,
PHILADELPHIA, Jan. 7, 1867.

To the Hon. MORTON McMICHAEL,
Mayor of Philadelphia.

SIR:—In obedience to your directions, I hereby present a statement exhibiting the appropriations to and the disbursements by this Department, during the year 1866, and also a report relative to the condition of such works as have been under its supervision.

General appropriation, \$30,923 20

Which has been expended as follows:

Expenses, General Office,	\$19,005 46
Salaries of District Surveyors,	6,000 00
New surveys, revisions and landmarks,	3,736 33
Balance of appropriation to merge,	2,181 41

\$30,923 20

The following sectional plans of survey and revisions have been filed during the year :

No.	Title.	Approved by Board.
13.	Revision of grades, Poplar St. from 29th St. to Pennsylvania avenue.	Jan. 15, 1866.
118.	“ “ Between 9th and 13th and Berks St. and Susquehanna avenue.	May 24, “
13.	Widening of Poplar St. Between West College av. and Pennsylvania avenue.	Oct. 1, “
72.	Revision of grade. Main St., Manayunk.	Oct. 15, “
207.	Lines and grades. 5th Sec. late township of Bristol.	
214.	Lines and grades. 11th Sec. Twenty-second Ward.	

The following is a list of sewers authorized by the Board of Surveyors during the year 1866 :

	Location.	Size. Ft. In.
Nineteenth St., from Penn'a avenue to	Green street,	3
Front St., from Thompson	Girard avenue	3
Hamilton “	Nineteenth Twentieth street	2 6
Brighton “	Fifteenth Broad “	2 6
Barclay “	“ Broad “	2 6
Twenty-second “	Sansom Locust “	2 6
Sixth “	Indiana Clearfield “	3
Market “	Fortieth Forty-first “	2 6
Levant “	Pear Southward	8
Eighteenth “	Master to Seybert “	8
Hackley “	Fourth Fifth “	3
Fourth “	Hackley Norris “	3
Monterey “	Twelfth Thirteenth “	10
Oxford “	Palethorp Bodine “	2 6
Nectarine “	bet. Eighth and Ninth “	8
Market “	Thirteenth and Juniper “	10
Master “	from Thirteenth to 105 feet west	2 6
Juvenal “	Walnut Sansom street	10
Bay “	Sixth 280 feet west	10
Fitzwater “	Twelfth Juniper street	2 6
Eighth “	Noble Green “	3
Hutchinson “	bet. Poplar and Girard avenue	10
Fourth “	Colum'a av. and Oxford street,	8
Green “	from Tenth to Eleventh street,	2 6
10 ft alley	bet. 2nd and 3rd and south from Arch street,	10
Pine “	from Fifth westward	10
Otis “	bet. Memphis and Tulip street	8
Rhoades “	from Eighteenth to Nineteenth street	2 6
Hancock “	Norris northward	8

Jefferson	St. from 13th St.	to 90 feet east of Cadbury av.	2	6
Callowhill	" bet. 24th	and Twenty-fifth streets		8
Eleventh	" Montgom'y	and Columbia avenue		10
Cuba	" Morris	and Moore streets		10
Apple	" from Norris	northward	2	6
Alder	" Poplar	to Girard avenue	2	6
Market	" Forty-First	Wyoming "	2	6
Oxford	" Mifflin	W. of Sixth street	3	
Fifteenth	" Sp'g Garden	Brandywine "	2	6
Brandywine	" Fifteenth	Sixteenth "	2	6
Norris	" Almond	Girard avenue	2	6
Germantown road and Oxford St.	} b. Mifflin	and Columbia avenue.		
Spruce	St. bet. Fifteenth	Sixteenth streets	2	6
Ninth	" Chestnut	Market "	2	6
Poplar	" from Broad	to Fifteenth "	2	6
Chestnut	" Fortieth	400 feet westward	3	
Fortieth	" Chestnut	Locust street,	3	
Locust	" Fortieth	350 feet westward	3	
Fifteenth	" Lombard	Pine street	3	
Arch	" bet. Eleventh	and Twelfth street		10
Julia	" Coates	Brown		10
Linn	" from Twenty-third	to Twenty-fourth	"	3
Walnut	" Seventeenth	Eighteenth	"	2
Mt. Vernon	" Tenth	Eleventh	"	2
Green	" Eighteenth	Nineteenth	"	2
Twelfth	" Spruce	Pine	"	2
Twenty-third	" bet. Arch	and Cherry	"	10
Second	" Race	Vine	"	10
Gaskill	" Fourth	Fifth	"	10
Thirteenth	" from Arch	to Wager	"	2
Arch	" bet. Second	and Third	"	10
Parrish	" Ontario	Broad	"	10
Buckley	" Fifth	Sixth	"	10
Sixth	" from Dauphin	to Germantown road		2
Twentieth	" Arch	Race	"	3
Outlet	" Twenty-first	Twenty-second	"	2
Pemberton	" Wallace	southward		10
Second	" bet. South	and Lombard	"	10
St. Mary's	" Sixth	Seventh	"	2
Charlotte	" George	Culvert	"	10
Third	" Race	Vine	"	10
Levant	" Pear	Spruce	"	10
Cherry	" Sixth	Seventh	"	12
Barclay	" from Broad	to Fifteenth	"	2
Davis	" Twelfth	60 feet westward		10
Naudain	" Eighteenth	206 "		10
Bingham	" Spruce	140 feet northward		10
Summer	" Twenty-first	Twenty-second	"	2
Water	" bet. Spruce,	and Pine	"	10
Eighth	" Cherry	Race	"	10
Charlotte	" Brown	Poplar	"	10

Germantown road bet	Master and	Thompson	street	10
Front	St.,	Willow	"	8
Little Pine	"	Sixth	"	10
Callowhill	"	Canton	"	12
Washington av.	Front	Ridge avenue	"	12
		Swanson	"	12

Upon the most important question of drainage, I am gratified in being able to state, that, since the enactment of the ordinance regulating the assessment upon property for the construction of sewers, the public have shown their entire approval of the system as well as of the amount of assessment there ordered (\$1²⁵/₁₀₀ per ft. of front), by the large number of applications for sewers which have been presented to and acted upon by the Board of Surveyors since May last. The amount of lincal assessment as yet, does not cover the cost of sewers, notwithstanding the City assumes the payment of the street intersections, and such portion of the length of sewer as may be deducted for corner lots, (one-third the frontage, with a maximum of fifty feet.) To enable us, therefore, to proceed with the sewer constructions, authority was granted by Councils to draw upon the appropriation made for the Highway Department, to the amount of \$300 for each sewer contract; and, under this privilege, many sewers have been constructed which otherwise could not have been built unless the property owners had furnished the deficiency required. As to the requirements of the City in the extension of sewers, I would refer to the report presented to Councils through the Committee of Surveys and Regulations, on July 5, 1866, to which is attached a bill appropriating \$822,000 for constructing arterial sewers, and making certain changes where depressions of grade cause too rapid an accumulation of surface-flow at one point. There are many other lines necessary—enough, in fact, I believe, to cover an expenditure of \$1,000,000.

The bill to "Promote Public Cleanliness and Health," which was again before Councils during the past year, I regret to say has not been favorably received by the Common Branch, and consequently the connections for privy wells, so much complained of by the Board of Health, as well as this Department, continue to be constructed, and by persons whose experience in such work would not warrant their being so employed. Much work thus done requires repair at the expense of the City, sometimes after great injury has accrued to the

property intended to be drained. The enactment of this bill would place the construction of all sewer connections with private houses entirely under the control of the City, prevent the pollution of sewers, either by the overflow of cess-pools, the refuse of slaughter-houses or factories, and correct the open gutters over the sidewalks *where they may be a nuisance, or dangerous from the accumulation of ice.*

The hope and desire of this Department has been, that by legally preventing the cess-pit connections we should gradually abolish the use of cess-pools, or previous privy wells; or at least prevent, to a great extent, their increase by the more general use of the water closet connection with the sewer, which, it is believed, will correct a great evil, and not by entailing a greater one upon the public as some have intimated; for our sewers generally, with the free use of water, as is requisite by the water-closet arrangement, would carry off all fecal matter that may be delivered into them, without any danger of deposit. I do not wish to be understood as setting forth the present water closet system as perfected, for it has its objectionable feature in the fact that their delivery flows through the sewers into the rivers; and large as is the capacity of our river Delaware in comparison with the Thames, and small as is our population compared to that of London, yet we have a large area of territory which may be as extensively and densely populated as either London or Paris; and notwithstanding many years may elapse before our population will reach a number which will bear the same comparison to our water capacity as London does to that of the Thames, yet it is not too soon to give a thought as to what shall be done with the sewage. More fears may justly be felt as regards the Schuylkill than the Delaware, for already have we at least twenty-five per cent. of our population delivering their refuse into it, and the progress of improvements in West Philadelphia has been and will continue to be very rapid.

The Delaware, *between the Island and the City*, has a delivery of about 12,000,000 cubic feet per minute, with about 500,000 people draining into it; the Schuylkill 2,000,000 cubic feet per minute, with about 200,000 of population. The Thames, at London, has a flow of about 4,000,000 cubic feet per minute, with a population of about 2,000,000 in the city and 900,000 additional above the city, and even then I find in a Parliamentary report of 1865, these words: "In the

“investigations relating to London sewage and its effects on the Thames, and the injury to health inflicted thereby, it is conclusively shown that the greater part of the nuisance lies in the sedimentary matter which *lines the banks* and is in an active state of putrefaction.” I state this to show that we need not, even on the Schuylkill with one-half our water capacity and one tenth the population, have any *immediate* fear of injury to our rivers should we continue the water-closet system in preference to the cess-pits.

In several previous reports I endeavored to call attention to the necessity of abolishing, gradually, the use of cess-pits or privies. Nevertheless, as I have met with conflicting views from high authority in our midst, tending to the retention of cess-pits, on the grounds of the fertilizing value of their contents, I will again remark by quoting largely from reports made to Parliament, and say that local registrars in London record the heaviest death rates in districts where the cess-pit is used in preference to the water-closet, and the parish money is mostly spent by the relieving officer among the wretched inhabitants subject to this curse. The operation of cleaning is foul, mischievous and unremunerative, while the loss to the inhabitants in damaged health cannot be estimated. And further, that although streams and rivers may be fouled, yet it is distinctly asserted that the value of human life has been *increased in proportion as cess pits have been abolished* and refuse removed in water from the tenements; and it is believed that in many cases, though the cess-pit is condemned by the judgment of the parties, yet the fear of sewer charges are by them more dreaded; *i. e.*, the health of the community is by them measured by money value. Cholera, from which we have been so wonderfully spared during the past season, requires fermenting filth, foul air and squalor—and these elements are necessary to grow such diseases before they can prevail and become epidemic; and therefore, “as compared with privy and cess-pit, the water-closet is a vast improvement, and if drain, sewer and water supply are complete, no fouling of the urban atmosphere or sub-soil can take place; from a well drained house and completely sewered town, all refuse is removed at a rate of *at least one mile per hour*. Dry closets, of every description, are necessarily social abominations in a town.”

As to the utilization of sewage, there has been much writ-

ten and many experiments tried, the result of which appears to be that there is no known or tried form of precipitating sewage so as to obtain a portable solid manure that has ever been made to pay in Great Britain; and that, if the sewage from a city can be distributed upon meadow land by gravitation—as pumping adds too greatly to the expense—then large and frequent crops of grass may be obtained and the system be remunerative. Yet even this cannot be asserted as applicable to all localities, for in its result it is entirely subject to local contingencies.

At Edinburg, the system, under peculiarly favorable circumstances, has been more successful than at any other place; and even here where the distribution by gravity has been substituted by pumping, there has been loss, though the height raised was but trifling.

At Rugby, with a population of about 6,000, the sewage is pumped, and was arranged to be distributed for the irrigation of 470 acres. After eleven years of trial, the irrigating area has been reduced to 120 acres and found to be inapplicable to any other crop than grass. In many other towns in England, such as Croydon, Watford, Alnwick and others, the results are the same.

It is also decided that if more than 5,000 tons of sewage is distributed per annum upon an acre of meadow, that there is waste, and the water therefrom will pass off without being purified, and therefore with much of the fertilizing properties of the sewage in solution, still carrying its polluting effect to the streams. If properly applied, there is no better purifier than the meadow soil, from which sewage will flow, clarified, free from its deleterious solvents, and can be used without fear or inconvenience.

To be remunerative to the farmer, he cannot afford to pay more than one cent. per ton upon his land, the sewage to be delivered to him, and estimated clear of the storm water—but including, of course, the general water supply and drainage.

The quantity of sewage that is due population, is found to be 100 tons per head per annum, including rain fall and sub-soil water, or 60 tons exclusive of storm water; therefore it would require the excretal and other matters of fifty individuals to supply the requisite quantity for one acre; or, for the City of Philadelphia, with an estimated population of 800,000, an area of about 16,000 acres.

It would be difficult to apply this irrigating system for the entire section of our City lying between the rivers, without enormous expense, as the area of meadow, in what is termed "the Neck," is but about 5,000 acres, sufficient only for the sewage of a population of 250,000 souls, while but a *portion of this* could be reserved for such purposes so rapidly are improvements advancing in that direction. In fact, I believe that that entire area will be occupied for commercial and manufacturing purposes before the necessities of the City require a resort to such or a similar project. For that portion of the City lying west of the river, it may be found feasible to make use of the extensive meadows between the river and Darby creek, which, I believe upon examination, would be well adapted to the purposes, and throw the surplus of drainage into the Delaware by that creek; and when in the future the time should arrive that an expenditure of \$30,000,000 would be considered as a necessity, (as of late in London,) these meadows and this creek will be found of great importance in devising a general plan for such expenditure.

Several methods of utilizing the excreta of the population, exclusive of sewage and without cess-pits, have been suggested both abroad and among ourselves, which are entirely practicable, but with such a marked innovation upon our accustomed habits as to cause difficulty of their introduction, all of which adopt the first principle that all such matters should be carried off from about the neighborhood of residences as speedily as possible. Was this taken from our sewage there remains what may be more easily dealt with, viz, the manufacturing refuse and the offal from slaughter houses. The latter should be dealt with summarily and as soon as possible, for there are but few of our arterial sewers that are not horribly polluted with the refuse of these establishments; and our river gives evidence that some arrangement ought to be made by which we should be relieved, at least from those nuisances which are repulsive both to smell and sight. Our sister cities are advancing in these particulars more rapidly than we are, as they have already at Chicago and New York authorized abattoirs or general slaughter houses, whereby the City is relieved from all those annoyances, and if properly managed, insure healthy flesh for the market.

All the bridges belonging to the City are now in good re-

pair, and the new structures which were in progress at the date of my last report, are so far completed as to be open for public travel. At Penrose Ferry it was found necessary to change the line of bridge and erect four new piers, one of which (the North draw pier) was built upon the old work; submarine examinations having been made, which proved the foundation to be secure, and that by the wash and settlement a rock bed had been reached by the crib; the superstructure and approaches are entirely new. It was thrown open to public travel on the 30th of October. In addition to the re-erection of bridge at an increased elevation, we are placing fenders at the pier heads as required, to facilitate navigation. The cost of this structure will be \$62,000.

The Chestnut street bridge was open for the use of the Chestnut and Walnut Sts. Passenger Railway Company by its cars, on July 4th, 1866, and to the public generally so soon as the railing was in place, September 1, 1866. Some of the ornamental work is still to be fitted and the flag footway laid, before it can be painted for completion.

The Chestnut and Walnut Sts. Railroad Company gave us full authority to use their bonds, amounting to \$100,000, so soon as they had the free use of the bridge, and the masonry contractors, Messrs. Clark, McGrann and Kennedy, have been paid their final estimate, which, computed upon the contract prices, amounted to \$279,383 89, or \$12,467 61 less than estimated cost as presented to Councils by this Department, \$291,851 50. With the advance on prices, as directed in ordinance approved December 10, 1863, the final estimate amounted to

\$360,366 06

Which was paid as follows :

City Loan,	\$292,866 06
Philadelphia City Pass'r Railroad Bonds,	67,500 00
	<hr/>
	\$360,366 06

For the iron superstructure there is yet about \$4,500 of work to do. Mr. Simons has now received in

City Loan	\$100,210 00
Railroad Bonds,	14,000 00
	<hr/>
Total,	\$114,210 00

Leaving a balance payable under the limit of his contract of \$20,367 00.

Upon the superstructure, no advance of price whatever has been made or even asked for until within the last month, when the application for relief, as made by the contractor to this Department, was sent to Councils; but as the contract was executed prior to the opening of the rebellion, with prices ruling at that time, there can be no doubt but that the amount expended upon the work by the contractor far exceeds what has been paid him by the City.

I beg leave to call your attention to the question of carriage-way paving, and the necessity of providing other material than the cobble stone, particularly for the horse-path of the City passenger railways, which, from such constant use in a given line, becomes so smooth that it is difficult for horses to keep their feet. The granite cubical block is a great improvement when prepared of proper material and not over three inches in width, set with open joint, as is shown by the great protection they afford when laid in alternate lengths alongside the rail of our passenger railways, the reduction in expenses of repairs will fully repay the first outlay. Another pavement which is extensively used and meets with great favor in our Western cities, is the Nicholson pavement, which was introduced in Chicago in 1856, St. Louis and Milwaukee in 1859, and where it is still being laid on their new thoroughfares. In Chicago, Wabash avenue has just been completed, and its continued use there, for now over ten years, proves it to be acceptable. It is also in use in Cincinnati, Cleveland, Detroit, Toledo, San Francisco, Elmira, and has also been laid in the city of New York within the past month. It is composed of wood with gravel screenings, but is entirely different in its construction from the wooden pavement which proved so great a failure in our City some twelve years past. The blocks of wood used are either white pine or a more common timber Burnetized; and in St. Louis they are using the cotton wood of the West, so prepared.

In arranging for this pavement, the earth between curbs, should be excavated to a depth of about twenty-two inches below the curb height, upon which a layer of gravel six inches deep should be laid, and after being carefully surfaced to the form of road, a layer of sand or fine screened gravel should be spread and smoothed to a regular and even surface; the

foundation of inch boards, dipped in a composition of coal tar and pitch, is then carefully laid upon the sand or gravel with a double course whenever there is a liability of uneven settling. Upon this are placed the blocks forming the roadway, which are six inches deep, three inches thick, and should not be over ten inches wide. These are set upon their ends so that the wear is upon the end of the fibre. As they are arranged in place in true line across the street, they are dipped in the composition of tar to a depth of four inches, and a small strip three inches wide and one inch thick is set against them lying close to the board foundation and nailed to the blocks at intervals of about eighteen inches, the nail so driven as to pass through the strip or picket into the boards below; after being so laid with ranges of blocks having one inch spaces between these spaces are filled with gravel screenings varying in size from a pea to a walnut, after which the coal tar composition is poured in hot, filling all the interstices; the gravel being previously heated, the tar is not chilled and suddenly hardened as it otherwise would, and should not be. In its composition, the desire is to so proportion the mixture that it shall not be brittle, but a sort of paste, accommodating itself to any movement of the blocks; this gravel is then rammed to place and the vacant space thus formed again filled with gravel and tar, and again rammed. After this the entire surface is spread with the tar and covered with screened gravel, when it is ready for immediate use. At street intersections, to prevent the line of travel running in the line of blocks, they are placed on a range diagonally with the lines of streets. As to the strength of this pavement a trial was made in San Francisco, and where a heavy locomotive was drawn over it, which, by its weight, tore the ordinary pavement into ruts, upon this there was no impression whatever. As to durability, they speak most favorably of it in Chicago where they have bought the right to use from the patentee, and I have in my office a block which was laid in Chicago in Nov. 1856, and taken up for examination in November, 1865, after a severe use of nine years. From a height of six inches, as originally laid, it is reduced to four and a-half inches, showing a wear of a little over one-eighth inch per year, while the timber is as free from decay as when laid; the top, of course, is broomed up and filled with gravel and small stones pressed into it by the travel, and the brooming projects about enough over the

thickness of the block to cover, with the adjoining block, the gravel space between them. Some objection has been made on the grounds of difficulty of repair, or of replacing it after being removed for water or gas connections. In this I am advised by those familiar with its use, that there is no difficulty if attended to with ordinary care, and I am inclined, in watching its construction on the experimental square in Broad street, to believe such to be the fact.

Among other advantages claimed and endorsed by some leading chemists in Boston, is that of healthfulness, from the fact that the tar used in its construction is a correction to nephetic gases.

Should this pavement prove acceptable, and I can now see no reason why it should not be, its general use will be a great saving to all who are at the expense of supporting horses and vehicles, whether for business or pleasure.

In the operation of the Registry Bureau, we have been more successful in obtaining descriptions of properties than we had anticipated, as we have now about 40,000 entered. Our books of record are prepared, covering the City plot from South street to Erie avenue, including Germantown and the Twenty fourth Ward, upon which 15,000 of the properties are plotted and entered in the general Index Book, showing the names of the present owners and also the transfers or sales of properties that have been made. The progress already made in this work is sufficient to be of great value in locating property for assessment, and will now be used by the Board of Revision; yet it is a matter of regret that the office of the Board is not immediately adjoining this Department, so that the books now in course of preparation could be used by them without the expenditure required in their duplication as directed by law. The yearly removal of the duplicates would be a serious matter, as also would be the loss of time on keeping them up with the originals. The cost of the work of duplicating would be, including cost of book, at least \$80 for each volume, which, for the 200 volumes, would make an aggregate, in first cost, of \$16,000.

I must again call attention to the insecurity of our official plans or maps of record, and earnestly ask that the subject may have its true weight with Councils. Although our fire-proof is as well built as one of its kind probably can be, yet was our office building, or the house adjoining with its black-

smith's shop, to take fire, I fear the location of our fire-proof is such that it would, most probably, be destroyed, and with it much that can never be replaced, while what is necessary to be renewed would cost tens of thousands of dollars.

Much work has been done during the past year in opening Broad street for public travel from Columbia avenue to Fisher's lane; the graduation is nearly completed, but the bridge over the Reading railroad has not, as yet, been authorized by Councils, nor has it been absolutely necessary until now; but unless its construction is directed at an early day, so that it may be erected when the roadway is being ballasted, there will be an interruption to the travel upon this street which will be a great annoyance to our citizens. It is believed the Reading Railroad Company will make the same arrangement with the City with reference to this bridge as they have done with other similar structures, *i. e.*, that they will construct it upon such plan as may be approved by the City, the cost thereof to be divided equally between them and the City. I am not prepared with an estimate of it, but hope, at an early day, to receive a plan and proposition from the Company, which will be submitted.

The completion of this street, in accordance with proposed plan, and by the removal of the railroad tracks between South and Callowhill streets, will give us an avenue that we may justly be proud of, as we will then have a straight drive of 113 feet wide and ten miles long, with two miles of extension yet to open. Of this distance, about four miles is now paved, $2\frac{2}{10}$ miles under contract for paving, a-half mile curbed and not paved, and $3\frac{3}{10}$ miles in travelling condition. Its entire completion will be a great ornament to our City.

Respectfully submitted,

STRICKLAND KNEASS,

Chief Engineer and Surveyor.