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REPORT

OF A

SPECIAL COMMITTEE

OF THE

COMMISSIONERS OF FAIRMOUNT PARK,

UPON

The Preservation of the Purity of the Water Supply.

PHILADELPHIA:
KING & BAIRD, PRINTERS, 607 SANSOM STREET.
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At a meeting of the Commissioners of Fairmount Park, held Friday, October 11th, 1867, the following Report was presented and approved.

MORTON McMICHAEL,
President.

JOSEPH F. MARCER,
Secretary.

To the

COMMISSIONERS OF FAIRMOUNT PARK.

GENTLEMEN: Your Committee to whom was referred the investigation of the means of preserving the purity of the water supply, having carefully considered the subject, begs leave to present the following report:

In obtaining a supply of water for the domestic uses of a city, the following conditions must be sought for and examined.

First. The quality of the water and the means of maintaining it pure.

Second. The quantity available and the probability of insuring a daily increasing demand.

Third. Facility of getting the supply into reservoirs of suitable altitude to properly supply the highest levels of the city.

Fourth. The cost of raising and distributing the water.

The object of this report is principally the consideration of the first two points—namely: quality and quantity.

The superior quality of the water of the Schuylkill, at Philadelphia, chemically considered, when free from impurities introduced by human agency, cannot be doubted; all analyses yet made place it in the first rank as a water proper and desirable for the ordinary domestic uses; perfectly soft, pleasant to the taste, and remarkably free from organic matter, it compares favorably with the water supplied to other places. That this may be seen at a glance, the following table is introduced of the solid matter contained in a gallon of a number of waters supplied to other cities:

Cochituate, supplied to Boston	3.37	grains	per gal.
Delaware river, supplied to Philadelphia	3.64	"	"
Gunpowder river, proposed for Baltimore	4.41	"	"
Schuylkill river, analyzed by Boye, in 1842	4.42	"	"
Patroon's creek, supplied to Albany	4.72	"	"
Schuylkill, by Silliman, in 1850	5.50	"	"
Supplied to New Haven	5.60	"	"
" " Cincinnati	5.79	"	"
" " Detroit	5.72	"	"
" " Baltimore, Jones' Falls	5.85	"	"
Schuylkill, by Booth and Garrett, in 1854	6.10	"	"
Supplied to Troy	6.29	"	"
Schuylkill, by Booth and Garrett, in 1862	7.04	"	"
Hudson, at Albany	7.24	"	"
Supplied to Jersey City	7.44	"	"
Mohawk, at Troy	7.88	"	"
St. Charles river, supplied to Quebec	8.10	"	"
Supplied to Rochester	10.	"	"
Croton river, supplied to New York	10.93	"	"
Average of all the above except the Schuylkill	7.46	"	"
" " four analyses of the Schuylkill	5.76	"	"

We add a few of the waters supplied to European cities.

Glasgow, from Loch Katrine	2.82	grains	per gal.
Manchester, from Lakes	3.33	"	"
Part of Glasgow, from Corbal's works	5.19	"	"
Cumberland Lakes	4.16	"	"
River Severn, proposed for London	9.80	"	"
Artesian well, Grenelle, supply part of Paris	9.86	"	"
Geneva, from the lake	10.64	"	"

Paris, from the Seine	12.74	grains per gal.
Lyons, from the Rhone	12.88	" "
Supplied to Leeds	13.32	" "
Average now supplied to London by 8 Co's	18.04	" "
" formerly " " "	22.60	" "
Part of London " by wells	40.	" "
Supplied to Bristol	52.	" "

It must be remembered that it is not always the best water for domestic purposes which contains the smallest amount of solid matter, and that a total absence of impurity, as in distilled water, renders it unsuitable as a beverage.

Two objections have been urged against the water of the Schuylkill. First, the presence of sulphuric acid at its head-waters; and second, the amount of impurity thrown into the stream from manufactories and other sources on its banks.

The first-named is probably not found to the same extent in any other known river; whilst the latter source of contamination does exist and is common to all rivers and streams, which naturally afford the most ready means of disposing of refuse matter.

As this cause of impurity exists in all rivers and streams, it will be for us to satisfy ourselves whether it is likely to be more objectionable in the Schuylkill when compared with the volume of pure water in the stream than in other sources of supply within our reach; and whether the larger portion of impurity of this kind discharged into the river cannot be successfully intercepted.

But before entering upon the latter branch of the subject it will be proper to deal with the first named, which has caused considerable alarm to those persons unacquainted with a most beautiful provision of nature, a knowledge of which entirely relieves us from fear that the discharge of sulphuric acid from the mines will be injurious to the water supplied to the city.

This acid is undoubtedly present in large quantities in the upper waters of the river; and at Schuylkill Haven as much as ten grains to the gallon have been detected; but, fortunately, the whole of this acid is neutralized, or rather converted into sulphates of lime and magnesia by the waters of several streams, which, flowing through limestone formations, discharge their waters into the river at and above Reading, and even at that place the water has been found to test alkaline.

Moreover, it is believed that the amount of acid caused by the coal mines has probably reached its maximum. Analyses made by Messrs. Booth and Garrett show that whilst the acid in the water above Reading increased between the years 1842 and 1854 at the rate of $30\frac{3}{4}$ per cent. per annum, in the following years, from 1854 to 1862, it only increased at the rate of $\frac{3}{4}$ per cent. per annum.

This is, doubtless, caused in a great measure by the fact of the cost of raising coal in the old and deep mines in the Schuylkill valleys being greater than that upon the less expensive mines in other coal fields nearer the surface which do not discharge their mine water into the Schuylkill. We consequently expect a still further decrease of sulphuric acid from the mines.

The following language is used by Messrs. Booth and Garrett in a report of an analysis made of the Schuylkill water in 1862. We think it so conclusive as to make any other remarks upon this branch of our subject entirely unnecessary. They say:

"We have dwelt at length on sulphuric acid in Schuylkill water, because it appears to us the most important question in relation to future supply. To avoid misunderstanding, let us again note, that it does not reach Philadelphia in the form of sulphuric acid; that it is already neutralized at Reading and may be called the sulphates of lime and magnesia, and that the neutral water of Reading becomes decidedly alkaline before it reaches Valley Forge, and maintains a uniform composition from that point to Fairmount."

"The same causes of neutralization and alkalinity will undoubtedly continue to operate, whatever may be the extension of coal mining in the Schuylkill valley. An increase in the content of sulphuric acid on the upper Schuylkill will only result in an increase of sulphate of lime at Philadelphia."

The gentlemen say further: "The quantities of lime, magnesia, and sulphuric acid in solution are only such as to produce a very slight curdling of soap, scarcely tending to produce pan stone, producing no injurious medicinal effect that we have heard of; but their presence results in the positive benefit of forming a hard, white, and insoluble coating on lead, so that lead pipe may be employed to any extent in conveying the water without the least apprehension of the latter becoming deleterious by taking up lead into solution. Add to this enumeration the important fact that it is almost wholly free from organic matter, one of the most objectionable constituents of water for domestic uses; and we think our conclusion tenable, that the Schuylkill water from Valley Forge to Fairmount will prove superior to most waters of the world employed in large cities."

The amount of impurity in the Schuylkill is at present really so small, when compared with the volume of the river, as to present objectionable matter at Fairmount in so minute a quantity that no chemical test, however delicate, can ordinarily detect it. The surface-current is so slow (probably not more than two miles per day in the ordinary stages of the river) that it would require some three days to bring down impurity from Manayunk to the dam at Fairmount, and any but the lightest floating matter will have deposited its noxious qualities long before the third day.

A series of circumstances occurred last winter which, for a time, made the water unpleasant to the taste; the same train of events never occurred before and may never do so again. New York, Boston, Albany, Brooklyn, and New Haven have all, at some period, been subjected to the same trouble; it cannot, therefore, be considered as belonging to the Schuylkill alone.

The legislative powers vested in the city have never yet been exercised to any considerable extent. It is quite evident that much that is thrown into the river is a wanton outrage upon common decency, and can be restrained without affecting in the least the business of the parties employed in manufacturing on the banks of the stream.

The matter least under control is dye-stuff discharged from the mills. The liquid parts of this cannot so easily be disposed of, but there is no excuse for throwing in the solid residue from the dye vats, and cotton and woolen waste, as is now done. This is unpardonable, and can be prevented by the exercise of existing legislative enactments.

Having shown, as we think, that the natural purity of the water is beyond reproach, it remains to be seen what may be done to prevent its contamination.

Your Committee believes that through the intervention of the Park Commission and City Councils, the river can be much better protected from pollution than other streams of smaller size, from which it has been proposed to supply the city; so much of the river is now within the limits of the city and the jurisdiction of Councils, that there should be no difficulty whatever in obtaining the proper legislation for guarding its banks sufficiently high up to insure a supply of water as pure as can ordinarily be obtained from a river.

Much the larger portion of this objectionable matter is now thrown into the river at Manayunk; both as town drainage and refuse from mills of various characters.

And as this is the highest point up stream where we find impurities in large quantities flowing into the pool, the first question to decide is, as to the practicability of preventing this sewage polluting the water in the river, and passing with the current to the pumps at Fairmount. In some localities this might be reached by an arrangement of subsiding reservoirs for retaining the sewage and refuse, until, by precipitation, the liquid matter would become innocuous to the river water, and at the same time would allow any fertilizing qualities it may contain to be made available ; but the topographical features of the river shores, between Fairmount and Manayunk, preclude the adoption of such a plan ; therefore, we are forced to provide for it a separate channel through which it may be carried to the lower level of the river below Fairmount dam.

From Manayunk to the nearest point on the river where this sewage could be safely delivered is about six miles ; and a sewer can be constructed along the eastern shore of the river, which will not only carry all the Manayunk sewage, but intercept the flow from the mills at the Wissahickon, Falls Village, and the breweries at the Spring Garden works.

This sewer need not be of large dimensions, as it is intended solely for conveying sewage, leaving the flow of storm waters to take its ordinary channel ; the cost therefore would not exceed an amount which the importance of the project would fully warrant.

The western side of the river for the greater distance between Fairmount and the city line, about one mile below Manayunk, will be under the control of the Park Commission, and so far as their riparian ownership extends, will be kept free from objectionable drainage ; while the character of the upland not occupied by the Park is such, in connection with its peculiar location, as to prevent its occupancy by other than suburban residences of taste and value. The dye-works and oil-refineries, now located along this shore, are entirely within the power of the

Water Department, and under existing laws can be restrained from throwing their impurities into the pool whenever it may be deemed imperative.

Yet at or near the West Philadelphia Water Works is the opening of a valley which drains a section of the Twenty-fourth Ward, the sewage from which cannot be diverted from the Schuylkill, but can be carried below the dam, without great expense, by constructing a berm bank for the Schuylkill Navigation Company's canal from the guard-lock at Fairmount, a distance of some two thousand feet up-stream; this will confine the drainage from this valley to the canal, and can be carried to the lower level during navigation with the passing traffic; and during the winter season through a flume or waste weir.

No instrumental examination having been made over the ground here alluded to, this can be considered but a very general view of the subject as to what is believed to be practicable in averting the terrible results which impure water used for domestic purposes in a city would entail upon its inhabitants, but is sufficiently in detail to relieve us from any absolute anxiety upon this one very important point in the question under examination; and also to warrant an early instrumental determination of the proposed location of the sewer, with its cost. As a rough estimate of the expenditure necessary, we would say that we believe eight hundred thousand dollars will construct the entire works.

The Park Commission, as you are aware, proposes taking up the land on both sides of the river, and after the limits of the Park proper are reached, to extend a road of one hundred feet in width as high as the falls on the west side, and as high as the Wissahickon creek on the east; if this plan be carried out it will afford a good opportunity of constructing a sewer as proposed. The remarks upon this important branch of our subject herein introduced, together with the rough estimate of cost, have been furnished by the Chief Engineer and City Surveyor, Mr. Kneass. Your Committee is satisfied of the entire practicability of building the sewer, without meeting extraordinary or insurmountable engineering difficulties, and at a comparatively small cost.

Your Committee would therefore recommend the Commission to exercise the power vested in it to urge upon Councils the importance of eventually carrying out such a plan for the preservation of the purity of the water.

The consideration of the sufficiency of the Schuylkill as a source of supply for a considerable number of years, involves, first, the somewhat difficult problem of estimating with certainty the increase of population, and the corresponding increase of the water required for its use; and, secondly, the power of equalizing the supply of water in the river by artificial means, so that the flood water may be made to compensate for the diminished flow in the dryest of the summer months.

It is found that the increased demands for water do not obey the same laws as that of the population. Each year shows that a larger supply is required than the accessions to the number of the inhabitants would appear to indicate. The increase in the population for the ten years preceding 1850 was about 70 per cent., at which rate the population now would be 788,471, which is probably very near the number. Taking the same rate of increase for the next twenty years we should have in 1887 a population of 2,278,680.

The increase in the quantity of water supplied in the last ten years has been about 88 per cent., at which rate the average supply in 1887 would be 92,725,750 gallons per day, and the maximum required during the summer months would probably be 145,622,367 gallons per day.

The minimum flow of the Schuylkill has been set down at about 400,000,000 gallons per day, but during ten months of the year would probably be at least five times greater.

The smallest quantity of water flowing to waste over the [illegible] after the city and the Navigation Company had taken the supply, was this year in the month of September, when at least 1,680,276,000 gallons passed over the dam; and the average quantity thus flowing to waste in the months of May, June, July, August and September, was 2,714,292,000 gallons.

Previous to the year 1856, careful record was kept of the water flowing over the dam, from which it appears that the minimum quantity passing over the dam in 1853, 1854, 1855, was in the month of September each year, when it reached an average of 2,765,992,800 gallons, and the annual average of the three years named was equal to a daily flow to waste of 4,242,416,396 gallons.

From the above it will appear that even during the lowest stage of water this year we could have pumped, by the use of turbine wheels, fully 115,000,000 gallons, and that the average supply of the five months named would have been ample to supply 194,000,000 gallons, and the yearly average of 1853, '4, '5, would supply 303,000,000 gallons. It will be seen, therefore, if some means can be devised to equalize the flow of the river, so that the small discharge of the summer months can be compensated by the surplus of the winter, we should have it in our power to raise by water power alone all the water the city is likely to require for the next fifty years.

That a judgment may be formed of the ability to do this we must examine two points:

First, what is the entire annual flow of the river?

And, next, what degree of uniformity of flow can be maintained?

The whole annual flow may be ascertained from existing records of the annual rain-fall applied to the whole area of the country drained, with such allowance for evaporation and other causes of loss, as the topography and surface character may require.

Records extending back half a century show the annual rain-fall of the region to be about 42 inches of water, distributed with an approach to equality through the different months as to its whole quantity, but varying greatly as to the proportion available for river flow.

Rain-falls of two quite different kinds yield but little water that is available.

Gentle showers, giving less than one-eighth of an inch of water, are mostly absorbed by the soil and carried off by evaporation and vegetable respiration. Violent storms, exceeding one inch and sometimes reaching six inches or more, pass quickly into the streams, producing destructive floods running rapidly to waste. This waste can be prevented by skilful engineering, and the water made useful for hydraulic purposes. The product of rain-falls intermediate between these extremes is largely available for these purposes without costly works.

The proportion of the whole rain-fall which will flow into the rivers depends greatly upon the topography and geology of the surface drained.

The area drained by the Schuylkill and its numerous tributaries is computed to exceed 1,800 square miles, one-third of which comprises the mountains and steep hills among which its head-waters rise. A region of this character is found by observation to pour 75 per cent. or more of its annual rain-fall into its river channels, making the total flow from this district about forty billion of cubic feet a year. In the lower districts, comprising 1,200 square miles, the country opens into gentle slopes and rolling ground, largely under culture and pasturage, from which the flow is usually estimated to average one-half the entire rain-fall. This district may be computed to supply about fifty-seven billion cubic feet, making the entire flow into the river ninety-seven billion cubic feet per annum.

It will probably be safe to assume the available waters of the whole valley of the river to be 50 per cent. of the annual rain-fall, making the whole flow equal to ninety billion cubic feet a year, or an average of eighteen hundred million gallons per day.

It has been estimated that the average annual flow of the Schuylkill at Fairmount, exclusive of storm floods, is about thirty-two billion cubic feet.

If this be correct, it shows the waste from storm floods to be near sixty billion cubic feet, or two-thirds the whole annual flow; of the remaining third it is known that a large part passes, in the winter and spring months, in excess of the daily wants of the city, and leaves an inadequate supply for part of the summer and autumn.

The vast amount of wasteful flow in high freshets must be evident to any one who has seen the rush of waters over Fairmount dam on these occasions; and it may be demonstrated by a computation, based on the mathematical formula usually applied to such measurements, that the discharge over the dam in high floods is more than three hundred times as great as in the ordinary low stage of the summer months, making a waste in four or five hours equal to two months of flow in summer.

Such a flood would pass in ten or twelve days a quantity of water equal to the whole annual drainage.

An obvious remedy for these irregularities is well-known to hydraulic engineers. It is to establish pools or lakes of storage at several points on the river or its principal tributaries, in which the superfluous waters of annual snow-thaws and great storms (or so much of them as may be needed) shall be arrested and kept for gradual use.

By arranging the outlet of these pools so as to allow a constant discharge into the natural channels equal to the ordinary average flow, the entire country bordering on the stream will receive its usual supply with increased regularity, and would also to some extent be protected against the ravages of floods.

In some respects this plan is less objectionable than that which carries the impounded waters to their destination in an artificial channel or aqueduct, and requires the storage works to be placed at a fixed altitude irrespective of cost, and also takes the waters away from the district entitled to their natural flow. It admits of a selection of places least expensive for land damages and cost of construction, and avoids entirely the great expense of making a graded aqueduct; it also allows the work to be done in successive portions available for use, and the entire system may be thus enlarged gradually to meet a growing demand.

On the other hand, the system of pools at high elevation, with a graded aqueduct, will deliver the water directly into the distributing reservoirs without the aid of pumps; and will thus save the cost of expensive machinery and its daily attendance and wear.

On which side the greatest economy will be found, can be determined only by careful and thorough investigation of all the details of the subject.

This lies outside of the present inquiry, which aims only at the determination of the capacity of the Schuylkill for supply by any system that may be adopted.

The oldest work of the kind that we are considering, now in use, is believed to be the reservoir of Saint Ferreol, constructed in the year 1667, on the Languedoc canal, in France; it is of considerable magnitude, giving a water depth exceeding one hundred feet, and is shown to have been substantially built by its continued efficiency through two centuries. Several others have been established in the United States, to feed canals, and for water supplies, some of which have a water depth of more than fifty feet; a series of such storage lakes on a grand scale, with an aggregate capacity of three hundred billion feet, was projected ten or twelve years ago, for maintaining a uniform navigable depth of water in the Ohio river.

Perfectly reliable estimates cannot be made of the cost of pools on the Schuylkill, in the absence of proper surveys and measurements; a general notion may be derived from the actual and estimated cost of some of the works heretofore established or projected. As a general rule, the cost per cubic foot of contents diminishes as the capacity of the pool increases. Some of the pools in this State having a capacity of only forty million cubic feet have cost one dollar per 1,500 cubic feet.

The lakes proposed for the Ohio river project were to have a capacity of twenty-five billion cubic feet each, and their estimated cost was one dollar per 12,500 feet of capacity.

An approximate estimate for pools containing one billion cubic feet would be one dollar per 5,000 feet, or $200,000 for each pool of this capacity. The total amount of storage to be provided will be different upon the two systems mentioned; if the stored waters are to furnish hydraulic power to lift the supply into distributing reservoirs, their quantity must be much larger than will be required if they flow into these reservoirs by gravitation.

The first-named system will most severely test the sufficiency of water supply in the river, and the estimates which follow are, therefore, made with reference to it.

The greatest supply of water furnished by all the works belonging to the city appears, from the published official reports, to have been under twelve hundred million gallons per month; the largest proportion raised by water-power at Fairmount has been under nine hundred million gallons per month, showing a deficiency of this power to the extent of nearly one-fourth of the supply required. If new and improved motives were substituted for the old wheels, the whole of this deficiency would be supplied without addition to the expenditure of the water-power.

Assuming that the quantity needed in the next two or three years will reach fifteen hundred million gallons per month, provision must be made for increasing the river flow at least one-fourth beyond its present minimum average, which is computed to be nearly two billion cubic feet per month during the three driest months of the year. If, instead of adding one-fourth, we make it double, we must provide storage for six billion cubic feet, or one-tenth of the storm waters now running to waste. Six pools of the magnitude suggested would provide the requisite storage, and, according to the approximate estimate given, their aggregate cost would be $1,200,000.

By increasing the number or the capacity of these pools from time to time, they might eventually reach a capacity for storing all the storm waters of the region which is their ultimate useful limt.

A computation, based on the data above stated, will show that the average flow of the river would then give sufficient water-power to raise into distributing reservoirs at Philadelphia over three and one-half billion gallons per month, or 116,000,000 gallons per day, throughout the driest period of the year.

This may be held to be at such times the limit of the water-power of the Schuylkill; but the city supply may be increased to any extent that can probably be needed, by the use of auxiliary steam-power, or by high pools and graded aqueducts.

The maximum demand takes place in summer, when we have usually the minimum quantity of water in the river. The importance of having some compensating supply to rectify this will be evident.

As the expense of pumping has been urged against the Schuylkill, and has been brought forward in favor of a gravitation supply from other sources, it may not be amiss to show to what extent we may go in the use of power before reaching an annual expenditure greater than the interest upon the outlay necessary to bring the water by means of an aqueduct from the nearest point yet proposed.

In estimating the cost of power, the actual cost of raising water in 1866 at Fairmount and Spring Garden Works, with the interest on the cost of the works added, is taken, to which, in the case of water-power alone being used, we add the interest on the estimated cost of the proposed sewer and compensatory reservoir, amounting together to $120,000. The cost, then, to raise 145,000,000 gallons per day, the estimated quantity required in 1887, would be $474,780.

To raise	145,000,000	gallons	for	8	months	by water alone,	$284,204
"	115,000,000	"	"	4	"	" "	} 221,363
"	30,000,000	"	"	4	"	by steam,	}
							$505,768

The interest on the sewer being added, but not that of compensating reservoirs.

To pump as much as indicated above by water-power would, however, require the erection of additional mill-houses; with the present mill-house and the substitution of turbine wheels, the total capacity will be 50,000,000 gallons per day. The cost to raise 145,000,000 will then be:

50,000,000 gallons by water power, with sewer....		$170,275
95,000,000 " " steam "	....	1,213 625
		$1,383,900

This is considered a high estimate, as the steam power now in use, upon which it has been based, may, when new works are constructed, be much improved.

It will be remembered that 145,000,000 gallons will not be required before twenty years from the present time.

The original cost of the Croton aqueduct was at the rate of $218,750 per mile, to which add 80 per cent., as the probable cost of such work now, would make the cost of twenty-four miles of conduit, the shortest line yet proposed, $10,400,000, the interest on which is $602,400, to which should be added $50,000 for repairs and maintenance, making the annual cost by such a plan $652,400. And if the water was brought from the Delaware Water Gap, as has been proposed, the annual cost would not be less than $2,315,000. If an aqueduct be built to supply the city, it must be made of sufficient size now to deliver the quantity which will be required twenty years hence, and the $10,400,000 (supposing that to be its cost) must be expended in five years, the probable time required to construct it.

If power be used to raise the water, additions can be made from time to time as the increase of the population will demand, the total expenditure (which in this case will possibly not exceed $3,500,000) will be extended over twenty years.

The cost of increasing the present works to make them available during the five years required to construct the aqueduct will have to be charged against it.

Large distributing reservoirs are required in either case, and are, therefore, excluded from the estimate. Such reservoirs should, however, be of larger size when used in connection with an aqueduct, than when power is employed; for the reason that they must be large enough to permit time for the repair of the aqueduct should it be carried away or damaged by a flood, whilst if power is used it is scarcely likely that all the machinery will be disabled at one time.

A few words in regard to the Delaware river—a source of supply which has, to some extent, occupied the attention of our citizens—may not be out of place, and may give an additional reason (if any be required) for going to considerable expense to protect the purity of that stream, which has so long and so faithfully supplied the daily wants of our people.

The Delaware, from its great volume and the extraordinary chemical purity of its water, would, of course, be a desirable source of supply if its waters were taken above the influence of tide water.

But, unfortunately, there is no point within a reasonable distance at which a sufficient head can be obtained to bring in the water by gravitation. The level of the stream at Easton (distant from the city in a direct line about sixty miles) is but 160 feet above tide; of this probably sixty feet would be lost in bringing the water to the city through an aqueduct, leaving but one hundred feet head, whilst there are parts of the city upon the east side of the Schuylkill which require a head of about 140 feet.

To obtain a supply from the Delaware will, therefore, require the employment of power; there are points upon the river where a water-power of sufficient magnitude can be made, but at an expense far greater than the probable cost of building a sewer from Manayunk to Fairmount.

Though not strictly within the duties of this Committee, it takes the liberty of making a few suggestions as to the means proposed for increasing and insuring the supply from the Schuylkill.

First. By the construction of a sewer from Manayunk to a point below Fairmount dam.

Second. By the improvement of the water-power to its fullest extent.

Third. By the erection of large auxiliary engines to be used during the dry weather of summer, which might, to some extent, be so arranged as to be able to raise the water from below the dam in case any accident should occur to that important structure.

Fourth. Additional engines of large size at Spring Garden works, capable of supplying the Delaware reservoirs as well as their own.

Fifth. The construction of very large distributing reservoirs or reservoir.

Sixth. The building of large retaining compensating reservoirs upon some of the streams at the head waters of the river.

In conclusion, your committee is of the opinion that through the powers vested in the Park Commission and City Councils, the river Schuylkill may be made a suitable source of supply for very many years; and that by the construction of compensating reservoirs, (as above indicated,) and by the employment of steam-power in part, the quantity of water will be ample for at least fifty years, and it believes that this can be effected without unreasonable expense, and at a much less cost than any other plan proposed for the introduction of other streams.

It therefore recommends this Commission to urge City Councils to retain the Schuylkill as a source of supply, and to take immediate steps for the improvement of its quality and quantity, in the manner here briefly indicated.

Your committee has not entered into the details of improving the works and constructing the sewer, which belong properly to the Chief Engineer and City Surveyor, and the Chief Engineer of the Water Department, who, when called upon, will doubtless furnish suitable designs for carrying out the plans named.

All of which is respectfully submitted.

FRED. GRAFF, *Chairman*,
JNO. C. CRESSON,
GEO. G. MEADE,
STRICKLAND KNEASS,
WM. SELLERS.