REPORTS

ON

ADDITIONAL WATER SUPPLY

FOR THE

CITY OF HARTFORD.

HARTFORD : PRESS OF CASE, LOCKWOOD AND COMPANY. 1862.

352.6 H2510

REPORT.

OFFICE WATER COMMISSIONERS, | HARTFORD, March 8th, 1862.

To the Honorable the Mayor and Court of Common Council of the City of Hartford:

GENTLEMEN,—At a meeting of your honorable body, held May 27th, 1861, the following vote was passed by concurrent action:

Voted, "That the reports and papers relating to an additional supply of water for the city, be referred to the Board of Water Commissioners, with power to employ such assistance as may be needed to re-examine and report anew on the various projects for furnishing the city with an additional supply of water."

This Board, fully appreciating the importance of a subject so vital to the interests of the city as its water supply, respectfully beg leave to report, that in accordance with the foregoing vote, and with a view to elicit information of a reliable character, they employed Prof. B. Silliman, Jr., Analytical Chemist, to examine the waters of Trout Brook, at West Hartford, and report as to their chemical and physical properties, and the adequacy of the supply from that source. His very able report, in detail, we herewith submit and recommend the same to your careful consideration.

The Board also employed McRee Swift, Esq., civil engi-

neer, whose large experience in the construction of waterworks has eminently qualified him for the duties required. At

At

At

A

A

A

He was instructed to examine the whole subject of our present and prospective wants, relative to a water supply, and report on what, in his opinion, would be the most reliable, economical and *best* plan for obtaining such additional supply. This service Mr. Swift has performed, and his able report is herewith submitted to your honorable body. It will be observed by reference to this report that Mr. Swift estimates on two plans, one by pumping, and one by gravitation, and recommends the latter for adoption.

By reference to Prof. Silliman's report, it will be found that the water from the proposed source at West Hartford, is of a very pure quality, and that no fears need be entertained as to any unfavorable effect of storing the same in reservoirs.

In regard to our present condition, relative to the effectual head upon which the city is now dependent for its water supply, actual experiment has verified the fact, that at present rate of consumption, the ordinary draught during the day, upon the distributing pipes, reduces the effectual head about fourteen feet.

Total loss or difference between apparent and

					Actu with reserv	al head a fuii 70ir.	heat first as it	d on floor ordi- ly ex-
At road	d bed on M	lain st	reet near Trun	bull street,	52	feet.		feet.
66	66	"	in front of Sta	te House,	66	66	42	66
66	66	66	in front of Sou	th Church	,78	66	49	66
66	66	66	at Canton stre	et,	44	"	20	66

ater-		41	feet.		
red.	" " Suffield street,	38		14	66
our	" "Washington st., cor. Buckingham,			19	66
ply,	" " cor. Jefferson st.,		"	12	"
nost	" " Hydrant in front				
ddi-	of Retreat Gate,	12	66	0	66
	At road bed on Washington st. at New Britain and				
and	• Webster st	16	66	0	66
ıble	At road bed on New Britain av. in front of J. Sey-				
hat	mour's road,	12	66	0	55
ınd	At road bed on New Britain av. in front of H.				
on.	Seymour's late residence,	5	66	0	66
ınd	At road bed on Webster st. in front of Edwin				
rd,	Merritt's house,	22	66	0	66
er-	At road bed on Webster st. at junction with Ma-				
in	ple avenue,	39	66	15	"
	At road bed on Vernon st. cor. of Washington,	18	66	0	66
ef-	" " at road in front of John				
	Allen's house,	15	66	0	66
its	At road bed on Baker st. at hydrant corner of				
lat	Wolcott st.,	49	66	25	66
ht	At road bed on Baker st. at cor. Linden st.,	42	66	18	66
be	" " Affleck st.,	34	66	10	66
	" " Putnam st.,	22	66	0	66
1:	" " Zion st.,	20	66	0	66
٠t.	" " Park street, "	27	66	3	66
6	" " " Affleck st.,	45	66	21	"
6	" " Retreat av. at Retreat Gate,	50	66	26	"
2	" " Capen st., cor. of Clark st.,	30	66	6	66
	" " Clark st., in front of Peckham's			Ŭ	
t.	house,	32	66	8	66
e	At road bed on Clark st. at Westland st.,	27		3	
	" " Albany av. at Center st.,	65		41	
	" " Kenyon's House,	63		39	46
n .	" Maple av. at Gate at the Retreat			00	
1-	Grounds,	46	66	22	66
	At road bed on Maple av. at junction of Webster,			15	"
*	at road bed on maple ave at junction of webster,	03		10	

The annual increase of the consumption of water, and the corresponding increase of engine duty, is shown by the following table :

	Running time.		of ns of ft.	pounds Li med.	of deliver- the ir.	of livered ervoir lb. of sum'd.	o. of consum'd day in ear.	of ir day from year.	
Year.	Hours.	Min.	Number of revolutions Cam Shaft.	Total pour of Coal consumed	Gallons c Water d ed into ti Reservoli	Av. No. o Gals. deli into Resen for each l	Av. No. c Gais. con each day the year.	Av. No. o Gals. per increase year to y	
10 months for 1856. 12 months	1,291		690,228	282,944	104,914,656	450	845,114		
for 1857. 12 months	2,169		1,248,762	876,900	190,456,208	605	521,797	176,688	
for 1858. 12 months	2,718	50	1,589,211	489,024	2+2,854,674	495	661,245	189,448	
for 1859. 12 months	8,205	35	1,879,668	582;875	286,648,604	492	785,888	124,093	
for 1860. 12 months	8.577	11	2,147,004	688,200	827,417,801	479	897,035	111,697	
for 1861.	4,429	80	2,680,085	777,928	401,080.885	515	1,098,850	201.825	

The imperative necessity of providing for an additional supply of water from some source, and at an additional elevation of reservoir head, sufficient to meet the growing demands of the higher portions of our city; and the danger of accidents to the present machinery, upon which our supply of this indispensable element of existence so entirely depends, have long protruded themselves with such painful earnestness upon the Board of Water Commissioners, that they have frequently solicited the attention of the council to the subject.

The opinion which they have heretofore, and uniformly expressed, in favor of meeting these additional wants, by a supply by gravitation from Trout Brook, so called, in West Hartford, was not a mere theoretical or speculative opinion, loosely formed, but was the result of patient and careful investigation of the whole subject—and neither a single member of the present, nor any past Board, who has participated in those investigations, has ever come to any different result, or has hesitated in giving this the preference over every other plan proposed.

The Board therefore, in cordially indorsing, as they do, the mode of supply recommended in the accompanying

6

repo scier erate r, and wn by

Av. No. of Gals. per day increase from year to year.

176,688

139,448 124,098 111,697 201.825 ional onal wing danour tireuch ionthe

mly by , in ive and r a 'ho to he

lo,

reports, from gentlemen of great professional skill and science, and eminent as adepts on such matters, only reiterate their former convictions upon this subject.

Respectfully submitted,

HIRAM BISSELL, E. D. TIFFANY, SETH E. MARSH, N. H. MORGAN, D. CRARY,

REPORT

OF MCREE SWIFT, Esq., CIVIL ENGINEER.

To the Board of Water Commissioners of the City of Hartford:

GENTLEMEN :

At your request I herewith submit my views on the question of securing an additional supply of water for the City of Hartford.

The average daily consumption of water in Hartford for the year ending March 1, 1861, was 897,035 gallons, the extremes being 717,395 gallons daily in April 1860, and 1,028,312 gallons per day in February 1861. A basis of 2,000,000 gallons per day is therefore considered sufficient for the present and prospective population of your city.

After a careful examination of the whole subject, I am satisfied that one of two plans should be adopted to secure this increased supply ;—either by increasing your present pumping facilities, and building a larger reservoir on higher ground, or by adopting the proposition to construct a large receiving or storing reservoir on Trout Brook in West Hartford, of elevation sufficient to deliver the requisite quantity of water into every part of the city by gravitation.

As this subject has engaged your attention for a long while, and the details connected therewith have been extensively discussed, I shall confine my remarks to the comparative merits of these two projects.

By reference to the report of Prof. Silliman recently submitted to you, it will be seen that a comparison of the purity and physical properties of the water in Connecticut river at Hartford, and Trout Brook, would indicate no preference between them for all practical purposes; both waters being remarkably pure.

From personal examination of the proposed site for the reservoir on Trout Brook, I have no hesitation in saying, that the grounds are better adapted for keeping stored water in a pure state than those of any large reservoir I know of. Care must be taken to thoroughly clean the bottom and sides of the reservoir, and especially should no vegetation be allowed at the water line; for this purpose I have estimated an expenditure of \$5000, and with so liberal an outlay, I have no doubt the retained water would remain pure. The water supply of the Brooklyn City works, is collected in a series of reservoirs constructed as this is proposed to be, but with the disadvantage of less average depth, and the water is remarkably fine.

As to the natural flow of water in Trout Brook, the frequent gaugings and measurements kept by your engineer for upwards of a year, leave not a shadow of doubt as to the sufficiency of supply; these gaugings give a minimum flow of 500,000 gallons in twenty-four hours, after a drouth of near six weeks duration, and a daily average for the year of over 6,000,000 gallons; and my own observation of the capacity of the stream made at three different times, satisfy me that this estimate is not too large; and that the supply would be equal to the demands of a population of 100,000.

Thus the chemical properties and the reliability of supply being about equal in the two projects, the question of preference should be decided by the comparative cost of the two.

8

The great draft upon the distributing pipes in large cities, reduces materially the effectual head on the distribu

in

is

Y

in

Re

no

po

fo

pi

w fiv

SI

a) re

e

0

a t

f

C

bution—so that, at points lower than the level of water in the reservoir, no water can be obtained when the draft is large below them. This may be observed daily in New York city, where it is a cause of great complaint, and also in your own city, especially on high portions, as at the Retreat for the Insane,* where, with a head of twelve feet, no water can be obtained from the pipes, when the low portions of the city are drawing largely.

For this reason, as well as to provide a sufficient head for the highest portions of the city, Zion's Hill has been proposed for the site of a new reservoir. The surface of water in this reservoir would be one hundred and seventyfive feet above the river, and seventy-five feet below the surface of water in the proposed reservoir at West Hartford, and fifty feet higher than your present reservoir. This reservoir should be so constructed, that with a depth of eighteen feet, it will contain at least 20,000,000 gallons, or ten days supply; it will occupy between six and seven acres of ground, and should have two compartments, so that when the water of the river is in a turbid state, time for settling may be allowed, before it is distributed to the city; such a division too, will enable you to keep the reservoir in a cleanly condition, a most important matter.

Should you conclude to adopt the plan for bringing the water from Trout Brook by gravitation, I do not consider a distributing reservoir essential, because your storing reservoir of twenty-five acres on Trout Brook, to contain 121,000,000 of gallons, would be but five miles distant, and reservoirs so located have proved sufficient for other places. The new receiving and distributing reservoir now under construction at Central Park in New York city, is more than five miles from the City Hall, and became necessary in consequence of the insufficiency of the present

* It is seldom that water can be drawn at this point, except at night, even with a full reservoir.—*Commissioners*.

y

le

1t

0

h

e

5,

d I

e

9

h

of

y01

to

me

ma

ne

eq

Hi

ete

su

of

en

pr

Fo

F

F

F

F

All that you would provide against by a distributing reservoir in the city, would be the remote contingency of a failure in the main pipe.

Should you deem it advisable to provide for such a contingency, a reservoir of sufficient capacity, say 4,000,000 gallons, near Vanderbilt's, two miles from the State House, and three miles from the Trout Brook reservoir, can be built for \$13,703, which includes the connections and cost of site—two and a half acres.

The calculations for the delivery of water, taken from Trout Book by a sixteen inch main, are based upon the well known formula of Eytelweyne, viz.:

 $\sqrt{\frac{D \times 2500 \times H}{L + (D \times 50)}}$ = velocity per second; in which D represents the diameter of pipe, H the head of water, and L the length of pipe.

At the proposed reservoir near Vanderbilt's, one hundred and ninety feet above the river, and sixty feet below the Trout Brook reservoir, and 16,000 feet from it, the delivery would be 3,182,000 gallons of 231 cubic inches in twentyfour hours. At the river in Hartford, estimating the main 26,400 feet long, the delivery would be 5,062,264 gallons, and at a point in the city ninety feet above the river, the delivery would be 4,049,741 gallons, and at one hundred and twenty-five feet above the river, the height of your present reservoir, the delivery would be 3,579,700 gallons in twenty-four hours.

In order to procure the requisite supply of 2,000,000 per day, by pumping, your present facilities must be materially increased, either by an alteration of your present machinery, the constructing of a new engine and pumps of sufficient capacity, or by both, and as the risk of failure to which all machinery is liable, should be as far as possible avoided, particularly in so vital a matter as the water supply for a city of the present and prospective population of Hartford, I would recommend you, not only to alter your present engine so as to increase its power, but also to construct a new set of machinery, equal to the above mentioned duty of 2,000,000 per day.

I understand Messrs. Woodruff & Beach have recently made you a proposal to this effect, to wit, for a total remuneration of \$33,000,

1st. To alter the present machinery, so as to make it equal to forcing 1,500,000 gallons into the proposed Zion's Hill reservoir, through a rising main of 20 inches in diameter in 12 hours.

2d. To construct another engine and pumps of power sufficient to force into the same reservoir through a pipe of same diameter, 2,000,000 gallons in 12 hours.

3d. To make all necessary alterations at the present engine house to accommodate both sets of machinery.

Based upon this proposition, my estimate for	or cost of
proposed means of supply by pumping is :	
For increasing capacity of present machinery,	
for new engine and pumps and for alter-	
ations at engine house, as per proposition	
	\$33,000
For reservoir on Zion's Hill to contain 20,000,-	
000, gallons,	38,245
For 12,800 feet rising main, 20 in. diameter,	
at \$2.75 per foot,	35,200
For 5,700 feet return pipe through Vernon St.	
and Retreat Avenue, of 16 in. diameter,	
at \$2.05 per foot,	11,685
For 1,500 feet waste pipe, 12 in. diameter,	
at \$1.25 per foot, .	2,100
œ	120,230
Less 2,500 feet, 6 in. distribution pipe in Ver-	120,200
non St. at \$0.62 per foot, substituted by	
a part of the return pipe,	1,550
a part or me retain pipe,	1,000

Total, \$118,680

SS

gof

1-0

», e

:t

To which must be added the annual cost of forcing 2,000,000 gallons per day, into Zion's Hill reservoir.

gr ac

Т

I base so much of this estimate as relates to the cost of fuel, oil and waste, upon information derived from the report made by the Water Commissioners of Brooklyn, Jan. 1862, where I find that 1,649,172,500 gallons of water was raised 170 feet through a main 36 inches diameter and 5,800 feet long in 3,082 hours, by an expenditure of 4,920,748 lbs. of coal, being 2,984 lbs. for each million of gallons raised; the cost of oil, waste and tallow for this service, being at the rate of 40 cents per million gallons. So much of the estimate as relates to wages of engineer, fireman and laborers, and the repairs of machinery, I base upon the statement in your report of March, 1861, adding thereto \$360 for additional labor of coaling and attending to extra engine.

The duty requisite for your proposed improvement is 730,000,000 gallons, to be forced through a main 20 in. in diameter and 12,800 ft. long, to a height of 175 ft. in 4,380 hours, which would require, at above ratio, 972 tons—of 2,240 lbs—of coal, to which should be added 12 per ct., equal to 117 tons, to overcome increased friction incident to additional length and decreased diameter of forcing tube.

The annual cost of pumping will then be:-
For salary of engineer, firemen and laborers, \$2,160
For fuel—1,089 tons coal—at \$5.25 per ton, 5,717
For oil, waste and tallow,
For repairs machinery, 700
\$8,869
Representing a capital of \$147,816
To which should be added the first cost, as
above,
Total cost by pumping \$266,496

The estimate for cost of proposed means of supply by gravitation, with a storing reservoir on Trout Brook of 25 acres, to contain 121,000,000 gallons, is,

ng

of

je

n,

8-

эг

of

of r-

10

a.,

e

g

g

S

n

0

f

32,000 cub. yards of earth in dam, at 20 cts., \$6,400 2,000 " " puddle wall " 50 " 1,000 Cleaning and preparing site for Reservoir, 5,000 Land and damages to mill privileges, &c., 20,000 " 26,400 ft. 16 in. main, laid complete, at \$2.05, 54,120

" Gate chambers, gates and overflow, &c., 2,500

\$89,020

To which if distributing reservoir be construct-

ed near Vanderbilt's, (deemed unneces-

sary,) should be added its cost, . \$13,703

Total, \$102,723

The pipes for which I have estimated in both projects, are the wrought iron and cement, which are now used in your vicinity, at New Britain, Danbury, and New Haven, and extensively elsewhere.

Should you prefer cast iron pipes, 70 cts. per foot should be added to the rates for 16 inch pipe, and \$1.25 per foot to the rates for 20 inch pipe, making an addition to the total cost in the estimate for pumping of 19,990, and in the estimate by gravitation, of 19,880.

By comparing these estimates for the cost of the two plans, it will be seen that the plan by Gravitation, has greatly the advantage. I would therefore recommend it to you for adoption.

Respectfully submitted,

by your obedient servant,

MCREE SWIFT, CIVIL ENGINEER.