REPORT

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OF THE

BOARD OF WATER COMMISSIONERS

TRANSMITTING THE REPORT

OF

W. E. WORTHEN, ESQ., CIVIL ENGINEER,

CPON THE SUBJECT OF AN ADDITIONAL SUPPLY OF WATER.

Hartford, March 7, 1864.

HARTFORD: PRESS OF CASE, LOCKWOOD & COMPANY. 1864.

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UPON THE SUBJECT OF AN ADDITIONAL SUPPLY OF WATER.

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HARTFORD: PRESS OF CASE, LOCKWOOD & COMPANY. 1864. CITY OF HARTFORD, | Nov. 9th, 1863.

By concurrent action in Court of Common Council, it was

Resolved, That the Board of Water Commissioners be authorized and directed to procure plans, surveys, and estimates, so far as may be necessary for an increased permanent supply of water from Connecticut River, as recommended in the Report of Mr. Worthen to said Board, and make report to this Council.

A true copy.

Attest, LEVI WOODHOUSE, City Clerk.

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REPORT.

To the Hon. Court of Common Council of the City of Hartford:

The Board of Water Commissioners, as directed in a Resolution of your Hon. Court, under date of Nov. 9th, 1863, have employed W. E. Worthen, Esq., of New York, Mechanical and Civil Engineer, (the same gentleman named in the resolution, as having made some preliminary examinations and suggestions last fall upon the subject of our water supply,) to make a full and thorough examination of the whole subject, and now have the honor to present herewith his Report, together with his estimate of costs and plans for construction.

It will be seen that the plan contemplates a new reservoir of 35,000,000 gallons capacity, on some site on Zion's Hill; an enlargement of the present engine-house; the addition of another boiler; another engine and pump of double the capacity of the present, making the joint pumping capacity equal to 6,000,000 gallons per day; with two rising or forcing mains, connected with the reservoir, and connecting also along their lines with the general distributing pipes, and in this manner mainly feeding the distributing mains directly from the river; and the whole at an estimated cost of \$230,000.

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The Board have every confidence in the ability and general accuracy of Mr. Worthen, and they can suggest no more practicable or economical plan for obtaining an additional supply of water from the Connecticut River, than the one by him recommended.

Respectfully submitted.

HIRAM BISSELL, SETH E. MARSH, N. H. MORGAN, E. T. SMITH, S. H. HAVENS.

REPORT.

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

GENTLEMEN :---

Agreeably to your request for the preparation of a design for a new set of works, constructed in partial connection with, and drawing the water supply from the same source as the present works, i. e., the Connecticut River, I beg leave to submit the following plan and estimates.

Every one conversant with the condition of the present works, recognizes the absolute necessity of a new engine. They understand that the present engine and pumps are worked far beyond their estimated capacity; that with great difficulty they keep up a supply equal to the present requirements of the city, and are entirely inadequate to the prospective demands of even the present year; and that on this single machine depends the whole water supply. The question is not, therefore, whether a new engine shall be constructed, but what class of engine. On this subject I have carefully considered, not only what may be an economical engine, both in construction and working, but also, one that will act in harmony with your present arrangement of mains and reservoir, reference being had to the present and prospective requirements of water supply.

When your present pumping machinery was designed and adopted, it was thought, that in first cost it would be cheaper, and in duty superior to the Cornish engine. In cost, there can be but little difference, if the foundations and engine house are included in both cases; in duty, by experimental test, the Cornish engine at Belleville proved itself superior. Still the Hartford engine by its works has proved itself a very fair machine; its working duty is, I think, above the average of pumping engines in this country, and the repairs but trifling, due rather to its excellence in workmanship, than in design. I would not recommend the construction of another machine like the present, and the objections would be still stronger against a larger engine of this class, such as you would now require; the moving parts are too many, the stroke of the pumps too short, and their construction unnecessarily complicated.

The Cornish engine, although it may be made to yield a very high percentage of duty, needs constant and skillful attendance to secure this duty and to guard against accident; is a very costly machine according to its capacity, and can not be run in connection with your present rising main, without the addition of a stand-pipe; and this standpipe, when connected with the rising main to new reservoir on Zion Hill, should be at least 200 feet high above low water mark at the river. The Ridgewood engines at Brooklyn are open to the same objections as the Cornish engines, cost, sensitiveness to slight changes in steam pressure or water column, variable stroke, the necessity of constant care, and consequent liability to accident. In all these respects a crank engine is superior; its cost may be less, its stroke is fixed, its valve gear is not dependent upon any cataract arrangement, but upon eccentrics on the crank shaft, and its whole construction is so much more simple, that it can be run with even less attention than a common stationary engine. From my own experiments on the engine at Prospect Hill, Brooklyn, and from the results obtained by Mr. Simpson in England, I do not think, that in percentage of working duty the pumping engine with crank and fly-wheel connections will be inferior to either the Cornish or Ridgewood engines. I therefore recommend this class of engine for your construction; a machine without any novelty in its details, but only in the arrangement of parts, to adapt it to its position and requirements.

The engine to be double-acting and condensing; the cylinder to be vertical, its bottom level with the floor of the old office at the engine-house, and its piston-rods working downwards to connect directly with the pump beneath. The pump to be placed so low that its delivery port will be below the level of ordinary low-water, and the water will fill the pump by gravity. The pump to be of the Thames-Ditton variety, in general construction similar to the Ridgewood pumps, except that the piston-rod is enlarged to a cross sectional area equal to one-half that of the pump-barrel, and by its displacement makes the water delivery of the down-stroke. The pump-pole to be connected with a crank on a shaft, on which are the valveeccentrics, a fly-wheel, and another crank for the air-pump connections. The machine, it will be seen, is therefore simple in its construction, and with but few moving parts; there is no working-beam, and the fly-wheel serves to make the expansion of steam available, and to-carry the crank past its centres.

From a careful study of your Reports, and to suit the present arrangement of mains, I have fixed the ordinary working capacity of the pump at 4,000,000 gallons per 24 hours, and for this purpose the steam-cylinder to be 42 in. diameter, initial steam 35 lbs. to be cut off at about onefourth stroke, pump-barrel 30 in. diameter, stroke 8 feet, number of strokes 10 per minute.

This engine should be constructed as soon as possible, before the other works to be proposed, (which should also be begun,) can be completed, and the pump should be connected with the present rising main of 16 in. diameter. The connecting main to be 30 in. diameter, to admit of

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other branches hereafter, and on this large main a high air-chamber near to the pump. The engine I propose to place in an addition to your present engine-house, directly in the rear of the present engine-room; the supply-pipe to the pump to run to the present pipe pier, and to extend this pier if necessary; the delivery-pipe to run along the north side of the present engine-room, and connect with the 16-in. main in front of the engine-house; the airchamber to be raised in the north-west corner of the proposed engine-room, to be carried to the height of the tower in front, and to be covered with a similar tower.

Whilst in connection with the 16-in. main only, it will be unsafe to run the pump to its full speed, but with the large air-chamber proposed, a capacity may be realized much beyond the wants of the city this summer. An airchamber, somewhat similar to the one proposed, was added to your present pumps at my suggestion last fall, and with relief to the pumps. Such an air-chamber, with the pump proposed, will serve nearly as good a purpose as a standpipe; will be much less expensive and unsightly, and much preferable to a low air-chamber, which, under the pressure of a water-column like that for the service of your city, would give, at the change of stroke of the pump-piston, too quick a pulsation.

The boiler proposed for this engine to be a duplicate of the present one; to be placed beside it in the present boiler-house; and to be so connected that either or both may be used. Whenever the engine is worked to its full capacity, a third and similar boiler will be necessary, for which there is also room in the present engine-house.

The foundations for the engine to be of piles, with a superstructure of brick, with stone wall-plates, and iron coping. The walls of the engine-house to be of dry rubble masonry; the east wall to form a river-wall, extending from the southeast corner of the new engine-house, to northeasterly corner of lot, and thence along northerly line of lot to Water street. The floor of the engine-room to be laid with face brick, and on a level with the old office floor, and to be connected with it by a balcony or raised walk along northerly side of present engine-room, and covering the 30-in. main. The engine-house to be but one story high, the roof trusses of iron, with covering of slate, the door connecting the two engine-rooms to be of iron, and the new engine-house to be virtually fire-proof.

The coal-shed at present in use, is a temporary structure, inadequate to its present requirements, and inconsistent with the rest of the edifice. A new shed is therefore proposed, about 88 ft. by 40 ft., to extend along the northerly line of the lot; its easterly end to be on a line with that of the proposed addition, and its westerly end with that of the front office. The boiler-house to be extended to connect with the shed.

The present reservoir is not large enough for the purposes of a reservoir for your city, nor high enough to supply some of the elevated portions of it, now becoming settled. It is true that when there are relay engines and pumps, there may be a satisfactory supply of water without any reservoirs, as is the case with most of the London water-works, but the engines are run continuously, and the supply is mostly intermittent, by districts, each house having its own butt or reservoir, which is filled daily at stated times, and then shut off. Extensive filter beds are also necessary for the purification of the water. For your purpose, as a site can be procured, the simplest and most economical way is to construct a reservoir of such capacity that it may also serve as a subsiding reservoir, and contain sufficient supply for the wants of the city without pumping, during the times of the turbid water of freshets. During the early days of your present works, your present reservoir served this purpose, but is now inadequate, and in times of high water, in some portions of the city, there is great complaint. The only feasible site for the

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reservoir proposed is Zion Hill, and the best position is on the land of John Allen, Esq. The estates of Henry Barnard, Esq., to the north, and of Solomon Porter, Esq., to the south of Mr. Allen's, are eligible sites, but are not of area enough for the reservoir proposed. The capacity of proposed reservoir to be 35,000,000 gallons; on either of the other sites reservoirs of 25,000,000 could probably be constructed.

The water surface of the reservoir to be 165 feet above low-water mark, and the depth of water 20 feet. The top of reservoir embankment to be 170 feet above low-water mark, width at top 20 feet, slopes interior and exterior l_2^1 to 1. Puddle to face interior slopes, 2 feet; bottom, 1 ft. thick; concrete to face interior slopes and bottom, 6 in. thick. Stone paving for interior slopes, 1 ft. 6 in. thick.

The reservoir to be connected with the pumps by an extension of the 16-in. main from the corner of Spring and Asylum streets, through William street, and across the Park river, thence by the most direct and convenient streets, as they may be laid out, to the gate-house at center of east bank of reservoir ; and also by a 20-in. main from the engine-house, along Front street direct to Wyllys avenue, and along Wyllys ave., Jefferson and Washington streets, and a proposed street, direct to the gatehouse. The 16-in. main should be ready by the time the reservoir is completed, and the 20-in. main as soon after as may be, say some time in course of the next year; and as soon as this last connection is made, the present reservoir may be discontinued and its site sold, as two reservoirs of unequal elevation would be unnecessary and troublesome.

In the gate-house (which I propose to be of brick and within the slope of the reservoir,) 4 20-in. pipes will be introduced, 3 for water connections with the pumps to be now or hereafter made, and one for discharge into the sewer.

ESTIMATES.

ENGINE-HOUSE.

Excavation and keeping free from water,		\$1,500
Pile foundation and Coffer-dam,	-	600
Foundation for Engine, brick, 140 M, at \$15,		2,100
Rough Wall, 390 perch, at \$2,	-	780
Superstructure complete,		3,400
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ENGINE.

Engine and Boiler, set and complete with all the	
Furniture,	13,000
140 ft. of 30-in. Main between pump-well and pier,	
set complete, with 1 30-in. gate,	5,000
340 ft. 30-in. connection between pump and 16-in.	
main, with air-chamber and one gate, -	5,000
Small Donkey Pump, with connections, for freeing	
pump-well from water	500

\$53,500

\$8.380

COAL-HOUSE.

Rough Wall Foundation, Building complete.	520	perch,	at \$2, -	-	\$1,040
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RIVER AND DIVISION WALL.

Not estimated in foundations of Engine and Coal-House, 530 perch, at \$2, - - \$1,060

MAINS.

6,500 feet 16-in. Wrought-Iron and Cement Pipe, at \$2.75, - - \$17,875 12,000 feet 20-in. Wrought-Iron and Cement Pipe, at \$3.50, - - 42,000

\$59,875