

A COLLECTION OF DIAGRAMS

Representing the General Plan of

TWENTY-SIX DIFFERENT WATER-WORKS,

Contributed by Members of the

NEW ENGLAND WATER - WORKS ASSOCIATION,

And Compiled by a Committee.

1887.

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91.100

NEW ENGLAND WATER-WORKS ASSOCIATION,

OFFICE OF SECRETARY,

NEW BEDFORD, MASS., November 1, 1887.

THIS collection of diagrams is the result of the persistent efforts of Messrs. William B. Sherman, of Providence, R. I., and Walter H. Richards, of New London, Conn., who, as a Committee on Exchange of Sketches, have secured these drawings from members of the Association. The following extract from a report presented by these gentlemen at the Manchester, N. H., meeting in June, 1887, will explain in part the origin of the collection:

"In answer to circular letters sent out to members, there were received rough sketches of general plans of twenty-three water-works represented in the Association. Having this data on hand, though crude in many particulars, it was decided to put the same into available shape for the benefit of the members. This has been accomplished by the Committee without cost to the Association. From these rough sketches—revised, reduced to uniform size of 10 by 15 inches—a set of tracings has been made, and a sample folio of blue prints prepared. This folio and set of tracings are herewith presented as forming the main part of this report."

Since the Manchester meeting three more subjects have been received and subscriptions for sets of reproductions from the tracings have been called for. The ready response to the call is evidence of the value of the Committee's work, and arrangements were made with *The Engineering and Building Record* for publication in this present form.

R. C. P. COGGESHALL,

Secretary,

New England Water-Works Association.

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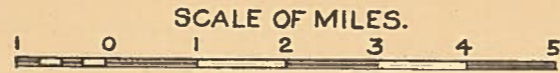
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PE

# BOSTON WATER WORKS.

—1886.—



	SUDBURY AND COCHITUATE WORKS.	MYSTIC WORKS.
MILES OF PIPE	400.	131.
NUMBER OF SERVICES	51,810.	15,928.
NUMBER OF METERS AND MOTORS	4,417.	550.
NUMBER OF FIRE HYDRANTS	4,681.	781.

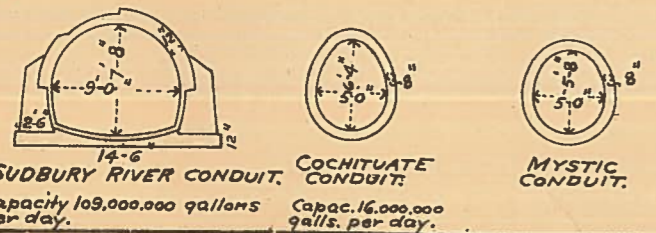
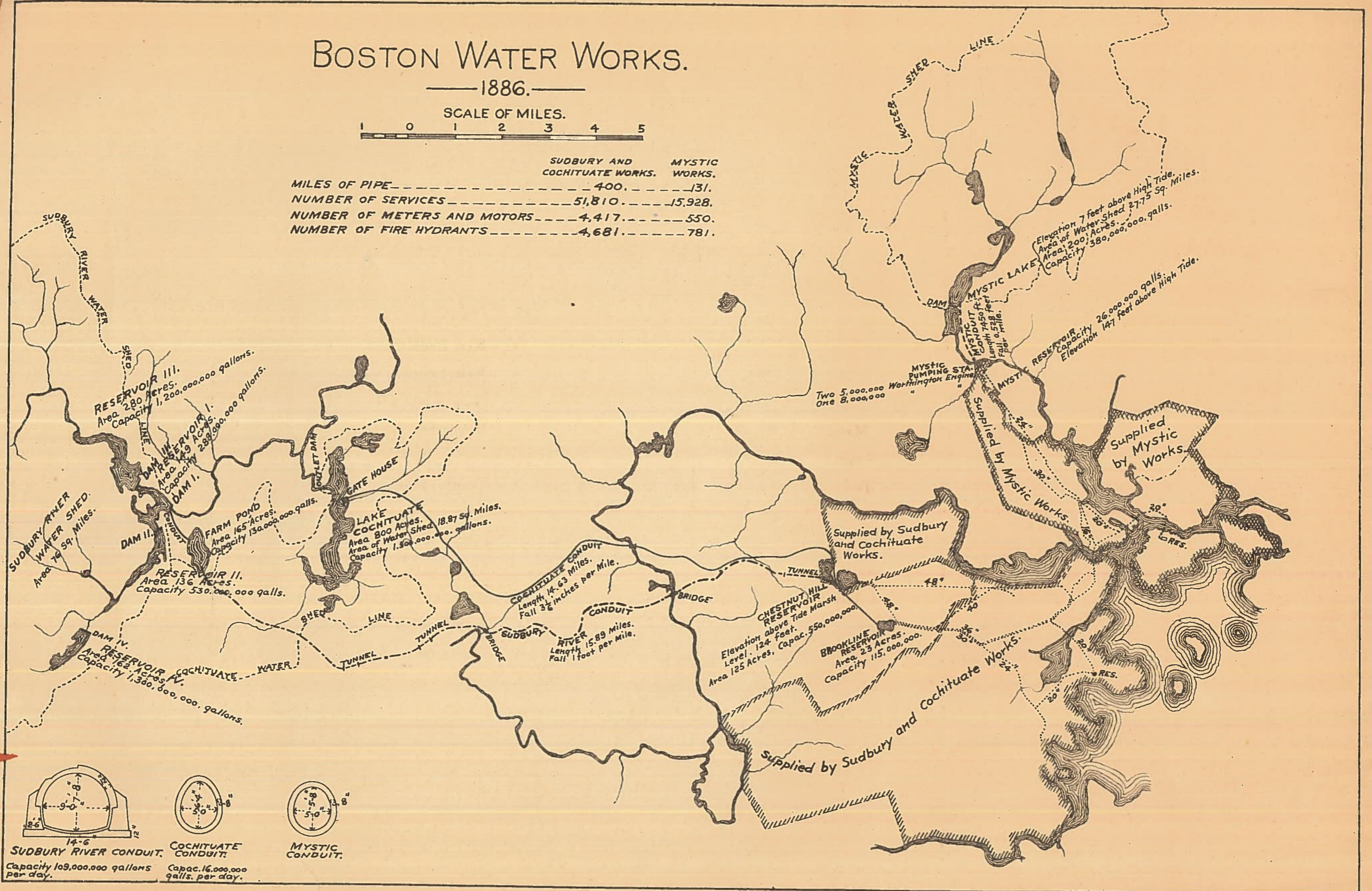


PLATE I.

General Plan.

CITY WATER WORKS,

BURLINGTON, VERMONT,

F. H. Parker, Supt.,

1886.

Built by D. C. Linsley, 1867-8.

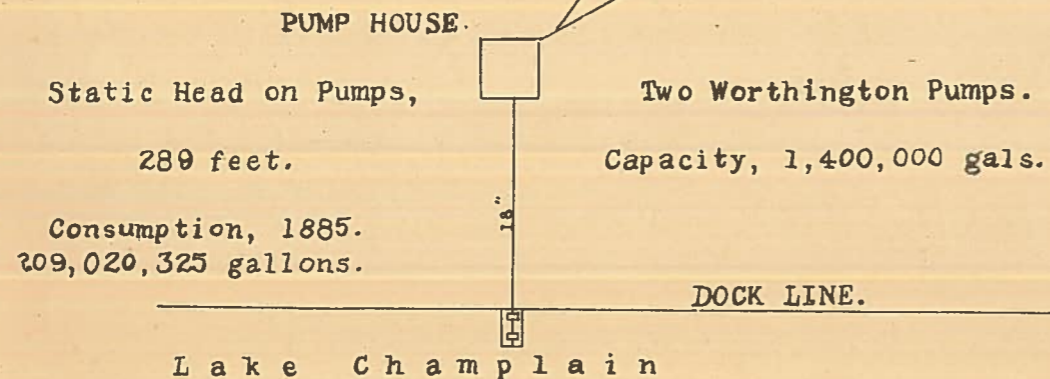
Cost \$311,340.13

Statistics.

Year ending Dec. 31, 1885.

Population, 13,359.	do. supplied 12,700
Miles of Mains, 28.7.	Hydrants, 162.
No. Services, 2,145.	Gates, 251.
No. Meters, 239.	Motors, 5.
Average Consumption,	572,674 gals.

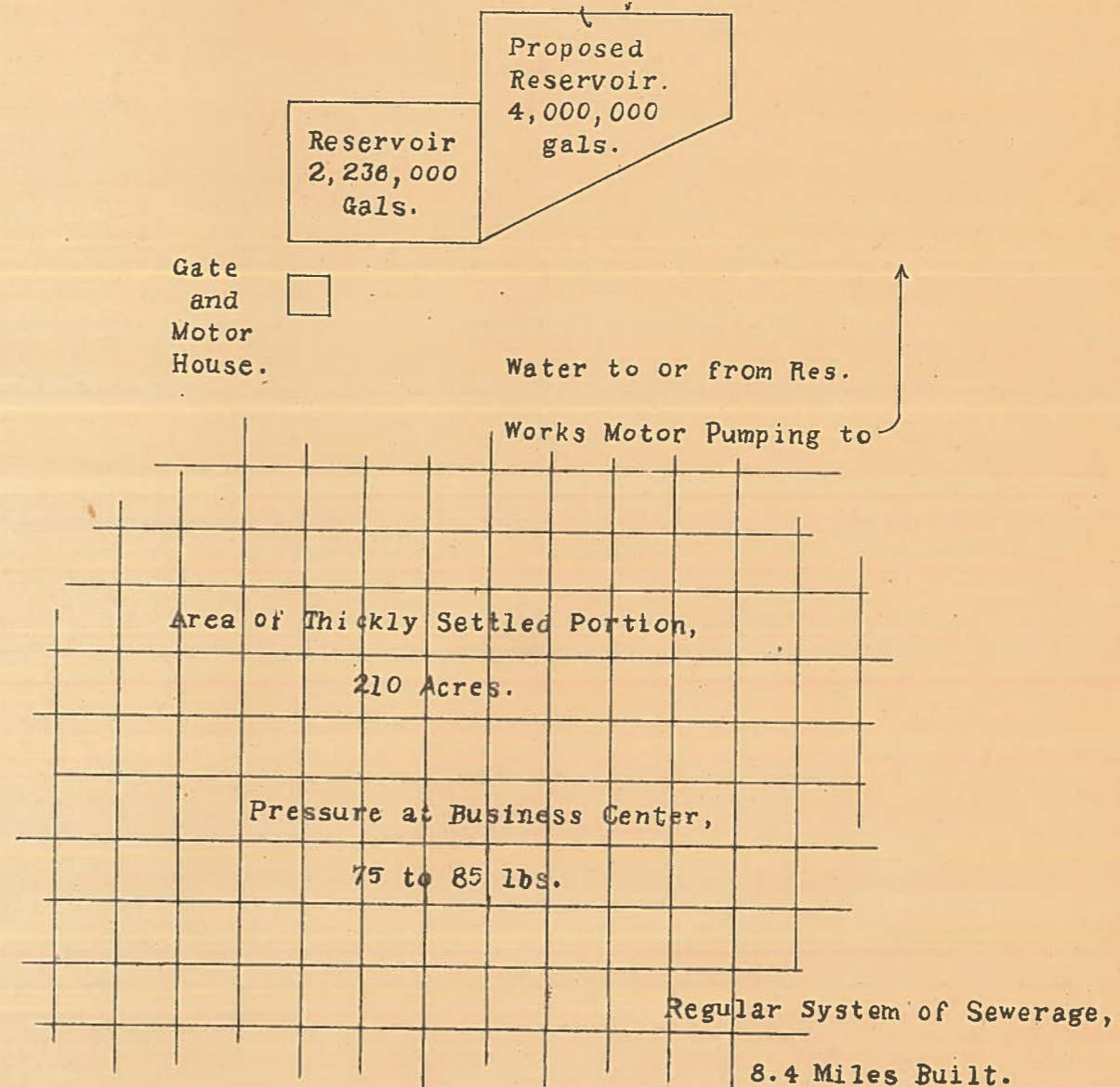
Pump into and distribute from same  
Mains; excess goes to Reservoir,  
distance 1.6 miles.



Tank Higher Service.

Capacity ○ 105,000 gals.

Level Full 85' above Res.



# CAMBRIDGE WATER WORKS. General Plan CAMBRIDGE MASS.

Wm S. Barbour City Engineer

Hiram Nevins Supt. H.W. +16.85

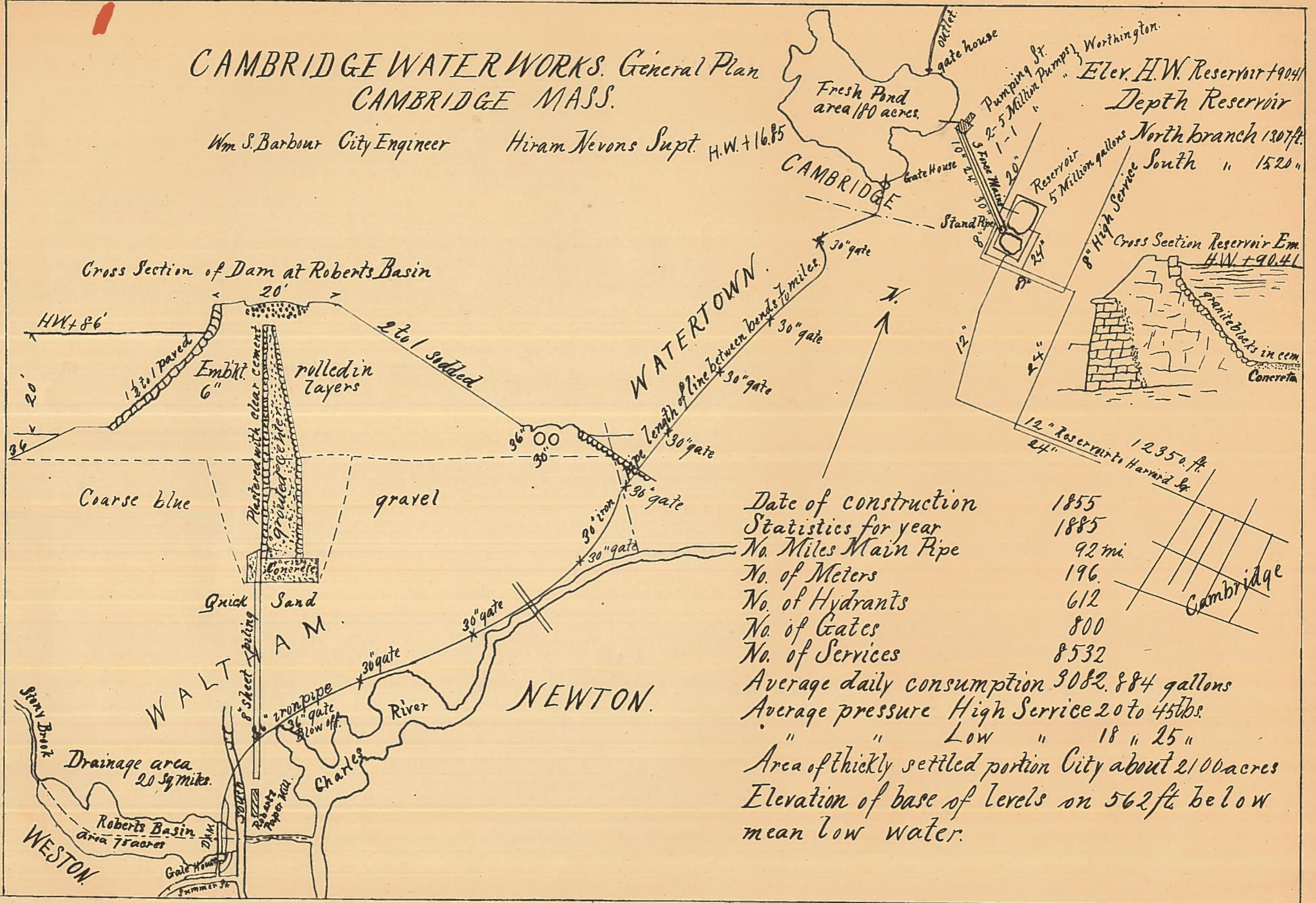


PLATE III.

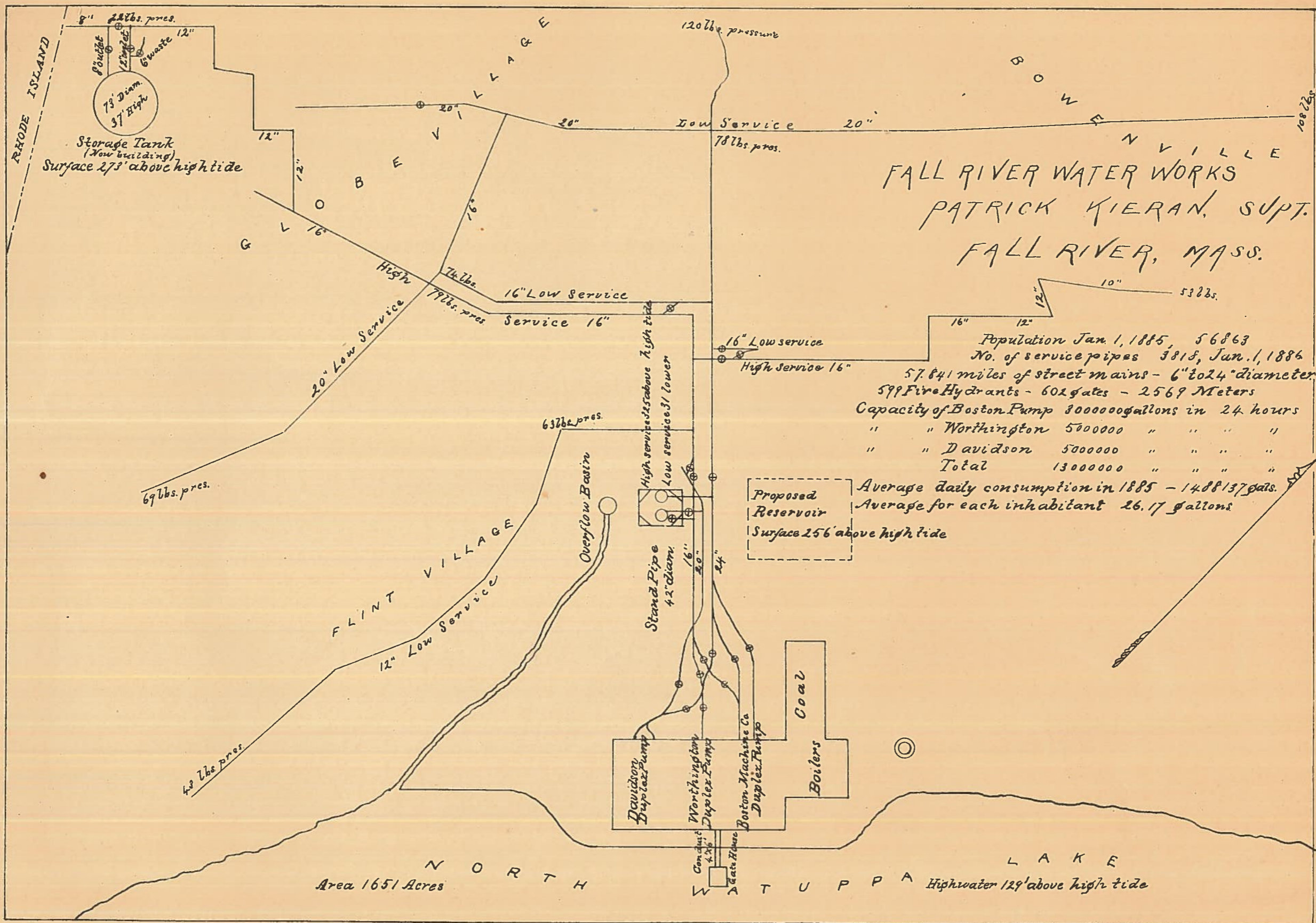
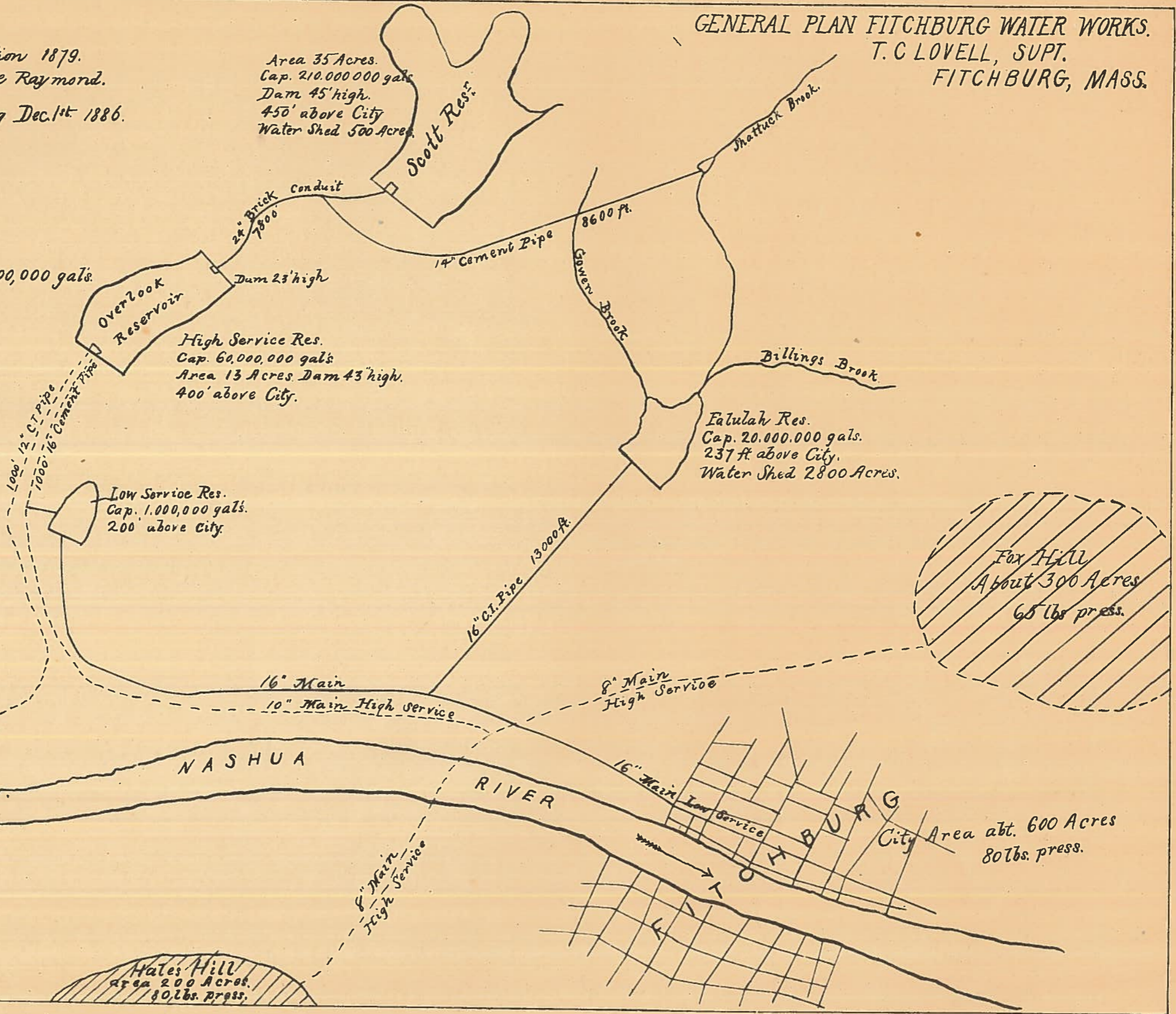


PLATE IV.

GENERAL PLAN FITCHBURG WATER WORKS.  
T. C. LOVELL, SUPT.  
FITCHBURG, MASS.

Date of Construction 1879.  
Designed by George Raymond.  
Statistics for year ending Dec. 1<sup>st</sup> 1886.  
No. miles pipe  $33 \frac{52}{100}$ .  
No. hydrants. 245  
No. gates 201  
No. services 1999  
No. meters 453  
Av. daily consumption 1,000,000 gals.

Area 35 Acres.  
Cap. 210,000,000 gals.  
Dam 45' high.  
450' above City  
Water Shed 500 Acres.



WEST  
FITCHBURG  
Aht 300 Acres  
110 lbs. press.

Fox Hill  
About 300 Acres  
65 lbs. press.

Hales Hill  
Area 200 Acres.  
80 lbs. press.

City Area abt. 600 Acres  
80 lbs. press.

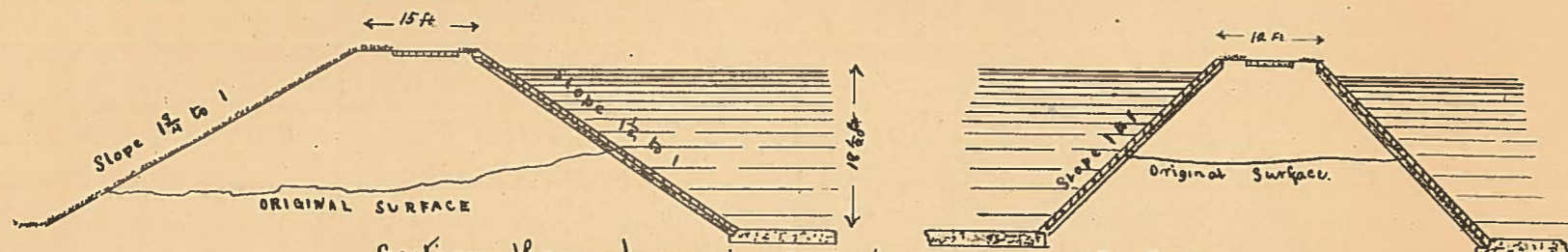


# Knoxville Water Works Knoxville Tenn.

Owned by a Stock Company

Constructed 1882-3.

Water turned on May, 83.



Section through one bank and Centre wall of Reservoir

The Reservoir is built upon a hill in Eastern portion of the city and occupies the site of what was during "the late unpleasantness", an extensive earth work.

The hill is composed of the red clay of the country resting upon a foundation of limestone, cavernous and unstable ground.

Excavation was made in the original, and the material taken out used for the embankments. Work was done by contract and about all the packing the banks received was from the teams transporting the clay. The inner slopes were faced up with a foot thickness of the same clay, put on in layers and tamped, they were then dressed down and covered with about 3 inches of broken stone, grouted with 1 part Louisville cement to 2 parts sand, on this bricks were loosely laid on their edges, and brushed over with a thin coat of cement.

The bottom was concreted to a depth of 18' with the same cement, sand and stone. The outer slopes were left unsodded and the tops unpaved.

Soon after the water was let on, the corner of one reservoir went in, and in 5 minutes it was emptied into the caverns below. Repairs were made, but the same result occurred from time to time up to May 1884. When the eighth break was repaired. At that time only 6 to 8 ft. of water was being carried.

In June 1884 the management was changed, and the works generally reconstructed. The reservoirs were repaired as well as possible without rebuilding entirely. The bricks were taken off and relaid in cement mortar and the whole interior surfaces treated with a trowel coat of cement mortar from 1/4 to 3/4 inch thick using Olsen's German Portland, and finished off with a thin smooth trowel coat of pure cement of same make.

The outer banks were sodded, and tops paved sloping inwardly. Since Nov. 1884 they have been worked to their full capacity without any sign of leakage from within, the prevailing fear is of disintegration from outside water leaking in.

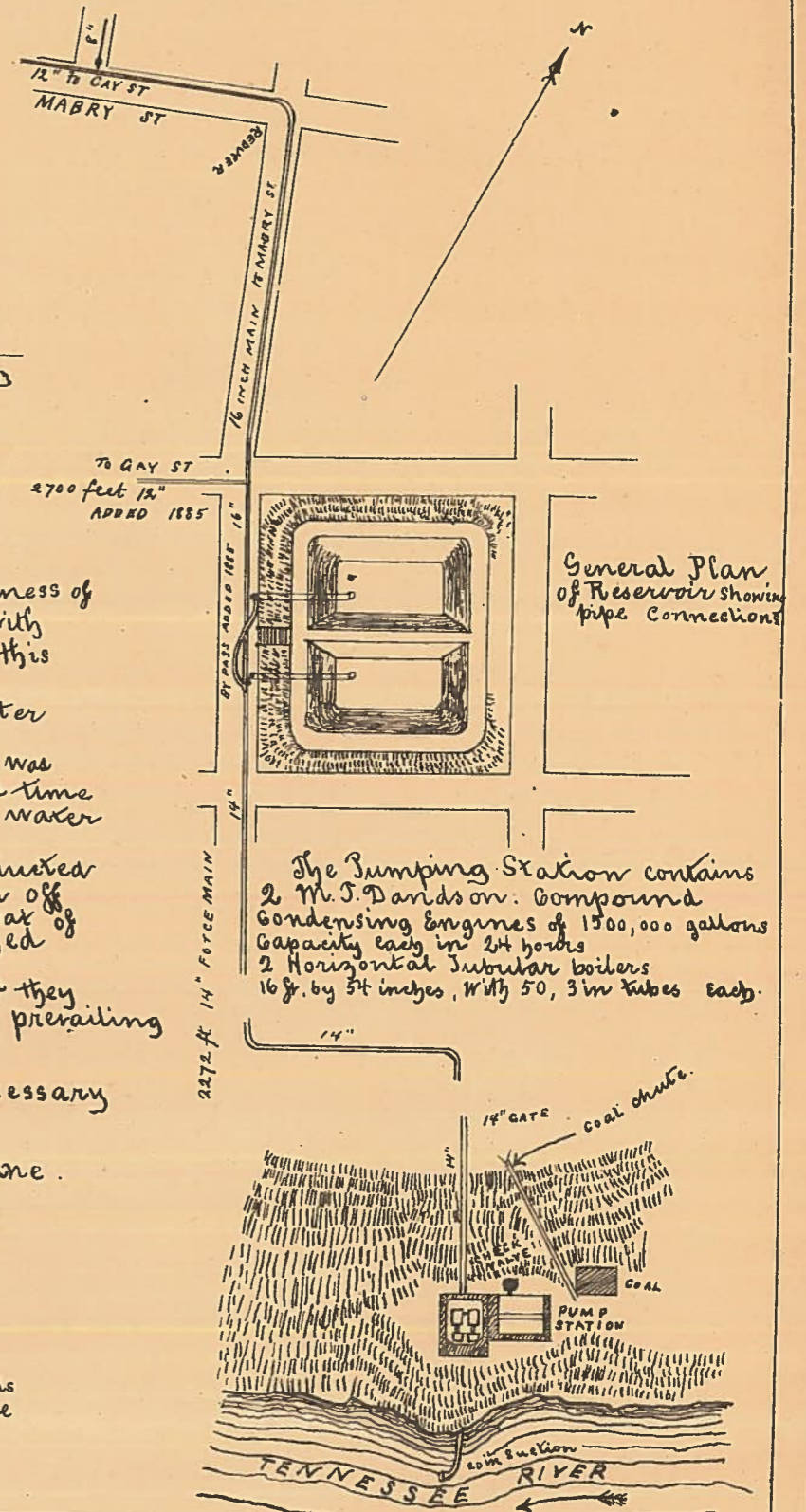
The pumps at pump station are at the bottom of a pit 30 ft deep, it was found necessary to take them up and reset them on secure foundations.

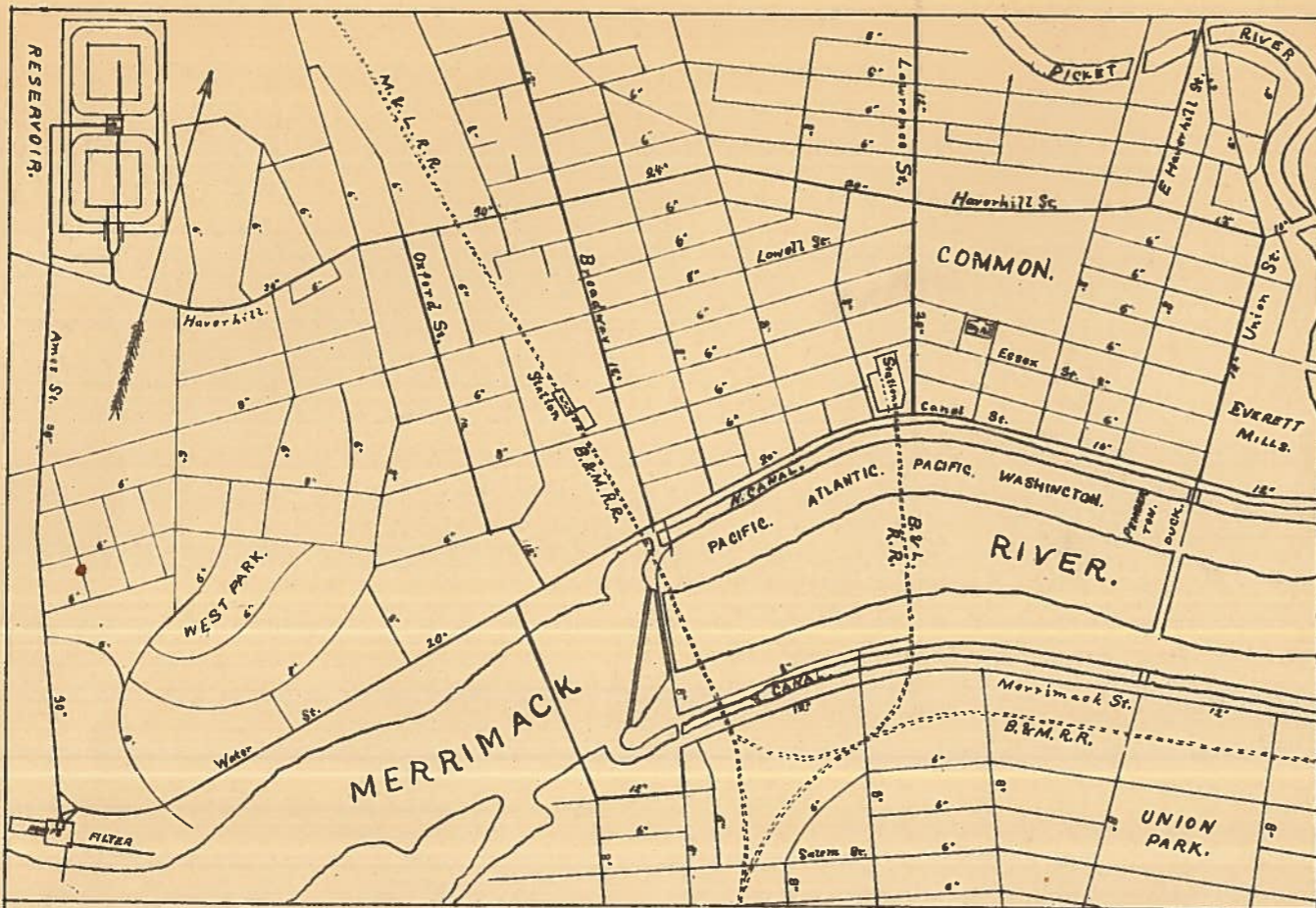
Constructed in 1882-3 by Contract from modified plans of Moses Lane.

No. miles of cast iron pipe, from 4" to 16" diam.	12 +
" " " wrought " " " 3 1/2 "	3 +
" Hydrants, double nozzle.	15.
" " " single	77.
" Gates, including those at reservoir.	44.
" Services.	627.
" Hydraulic elevators.	8.

The average daily consumption is about 850,000 galls — Population of city including thickly settled lands outside the limits, reached by water mains, estimated at 32,000 — The country is hilly and the pressure varies from 23 to 80 pounds — The business portion is S.E. of reservoir, dist about 2,200 ft. and is now supplied through 2-12" pipes as seen in plan —

A. H. Martine - Supt





GENERAL PLAN LAWRENCE WATER WORKS.

LAWRENCE, MASS.

HENRY W. ROGERS, SUPT.

GENERAL STATISTICS.

Date of construction 1873. Preliminary plans designed by L. Fred. Rice, Boston, Mass. Constructed under direction of W.F. McConnell as Engineer and Jas. P. Kirkwood as Consulting Engineer.

PUMPING STATION.

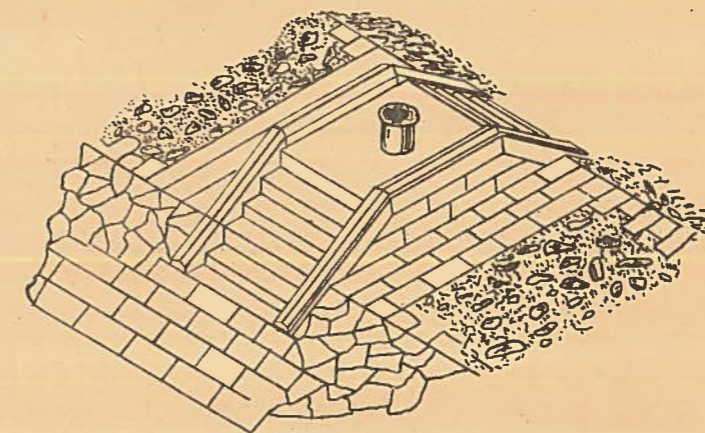
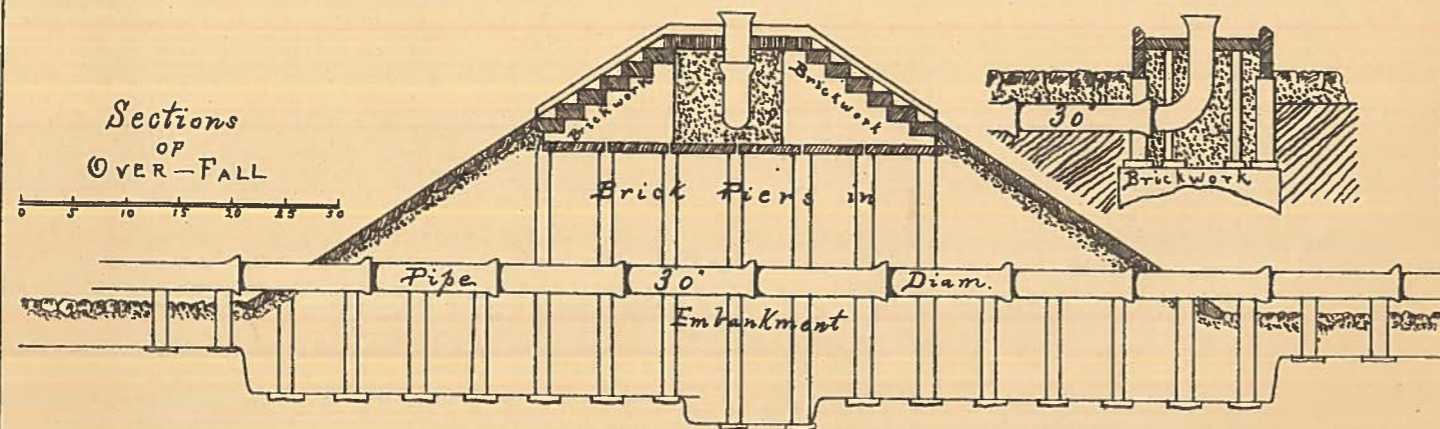
Conduit, river to pump well, 170 feet long. Pumping engines built by I.P. Morris & Co. from designs of E.D. Leavitt Jr. 2 compound beam engines coupled to same crank shaft carrying fly wheel weighing 18 tons (Diam. 30 Ft.) Capacity of each engine 20000 Gals. per hour, with speed 16 rev. per minute. Chimney is 183 ft. in high above floor line.

Coal room has a capacity of 800 tons. Roof being at grade, coal is dumped through scuttles saving all cost of trimming.

See Vol. I No. 2 Journal N.E.W.W.A. for detailed history of the works.

STATISTICS for YEAR ENDING DEC. 31, 1886.

No. of miles main pipe	52 (6 to 30 inch Diam.)
No. of hydrants (Lowry)	490
No. of gates	640
No. of services	4300

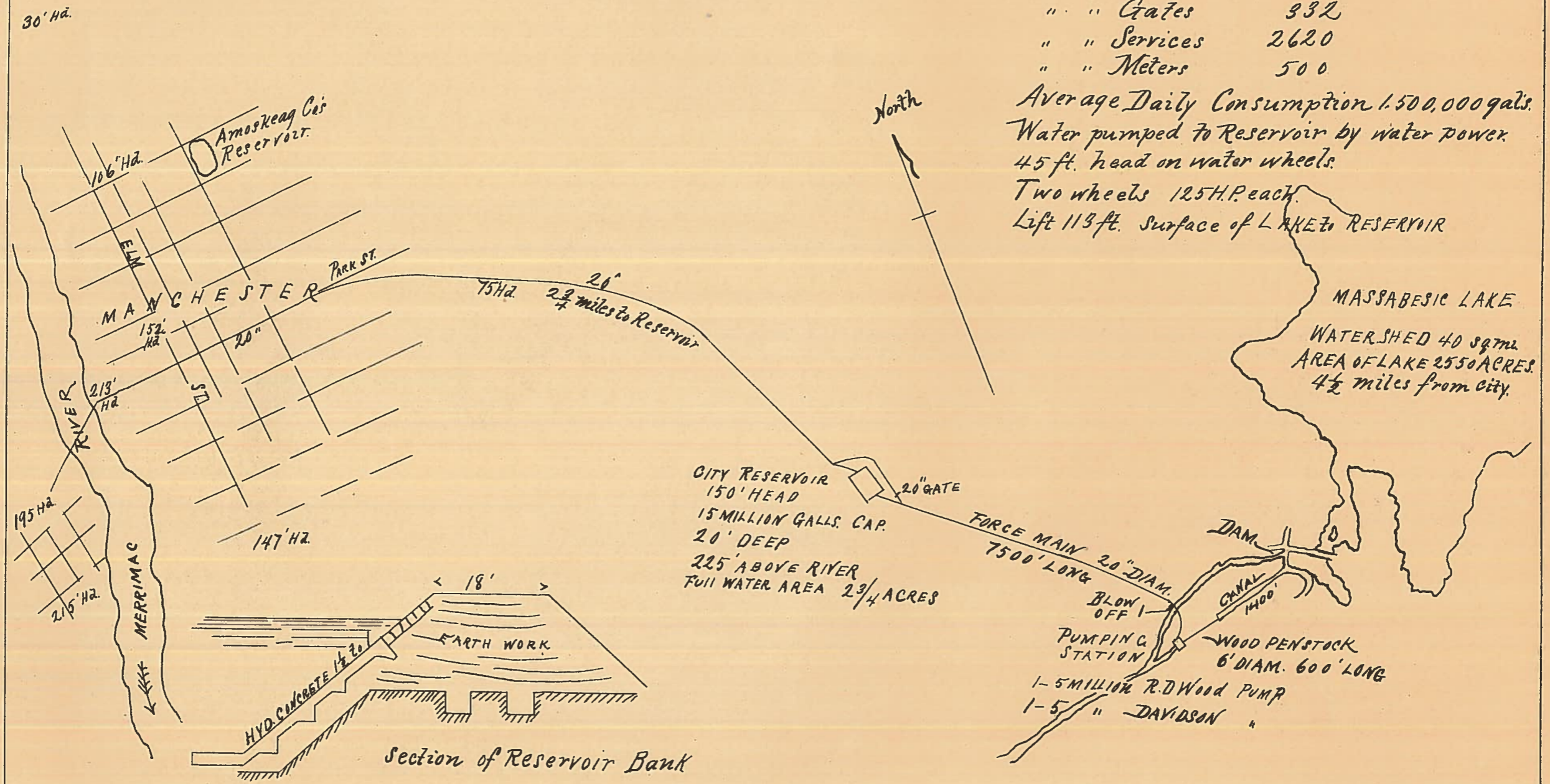


GENERAL PLAN OF MANCHESTER WATERWORKS.  
 CHARLES K WALKER Supt.  
 MANCHESTER N. H.

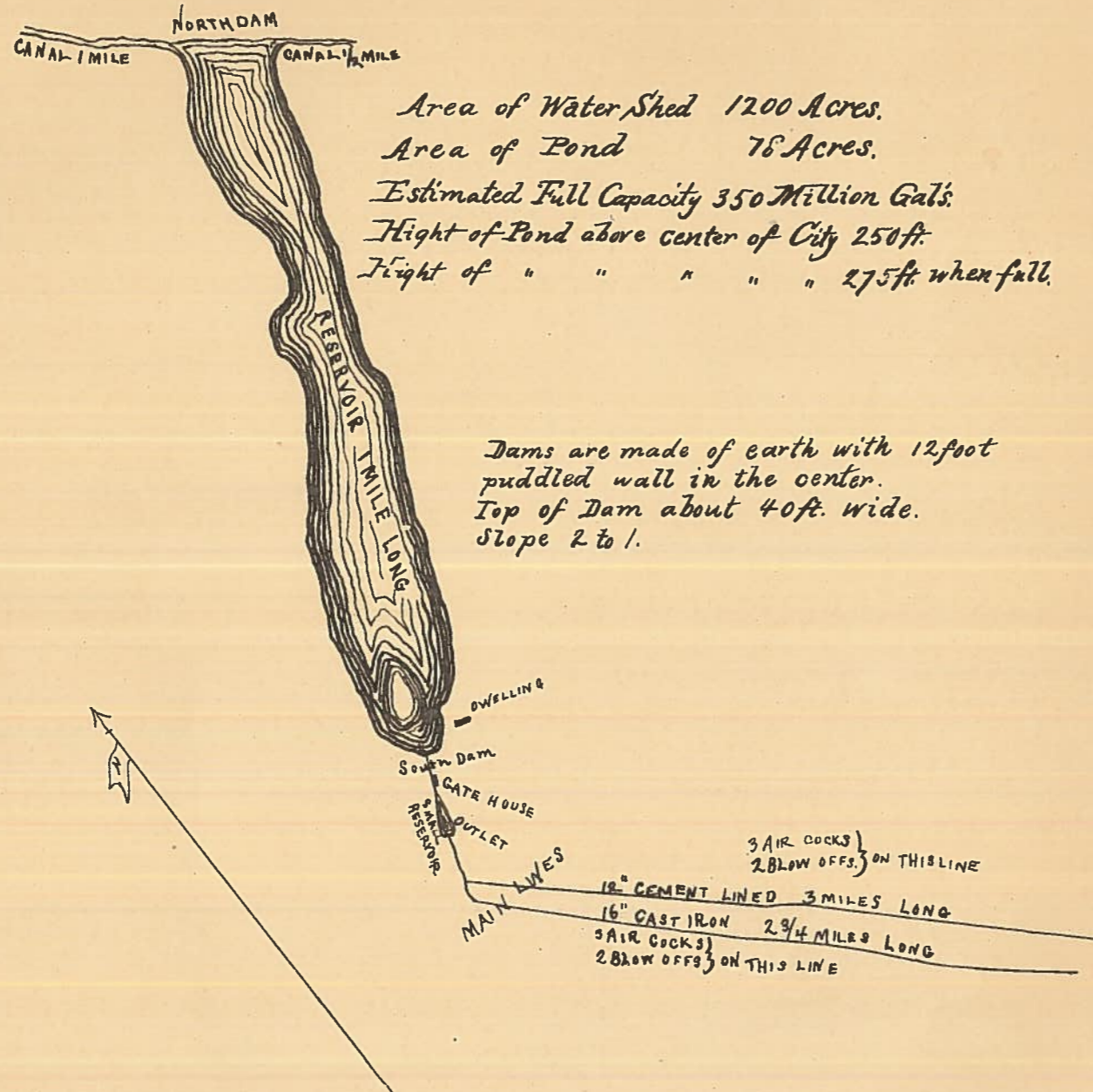
Wood Penstock. 6 feet clear internal diameter  
 constructed of Georgia pine staves, four inches thickness.  
 laid in place so as to break joints in a continuous tube  
 hooped every 18" with screw bolt wrought iron hoops

Date of Construction	1872
Miles of Main Pipe	46
No. of Hydrants	389
" " Gates	332
" " Services	2620
" " Meters	500

Average Daily Consumption 1,500,000 gals.  
 Water pumped to Reservoir by water power  
 45 ft. head on water wheels.  
 Two wheels 125 H.P. each.  
 Lift 113 ft. Surface of LAKE to RESERVOIR



GENERAL PLAN MERIDEN WATER WORKS.  
 H. L. SCHLEITER, Supt.  
 MERIDEN, CONN.



Area of Water Shed 1200 Acres.  
 Area of Pond 78 Acres.  
 Estimated Full Capacity 350 Million Gals.  
 Height of Pond above center of City 250 ft.  
 Height of " " " " " 275 ft. when full.

Dams are made of earth with 12 foot puddled wall in the center.  
 Top of Dam about 40 ft. wide.  
 Slope 2 to 1.

Date of Construction 1869.  
 Designed by Geo. W. Bishop

STATISTICS FOR YEAR ENDING DEC. 31<sup>ST</sup> 1885

No. of Miles of Main Pipe	abt. 30.
No. of Hydrants	193
No. of Gates	160
No. of Services	abt 2800
No. of Meters in use	65
Average Daily Consumption	1,200,000 gals.
Population	20,000
Water Takers, no. of families	3,500
" " manfys.	45
Cost of Works	\$ 400,000.
Water Receipts per year	\$ 45,000.

There is no regular system of sewerage for the city.

Our system is Gravity.  
 Highest Pressure 120 lbs.  
 Lowest " " 40 ".

# MIDDLETOWN WATER WORKS.

## — GENERAL PLAN —

JOHN C. BROATCH, SUPT.  
MIDDLETOWN, CONN.

DATE OF CONSTRUCTION, 1866.

DESIGNED BY GEO. H. BISHOP, C.E.

STATISTICS FOR YEAR ENDING DEC 31<sup>ST</sup>, 1885

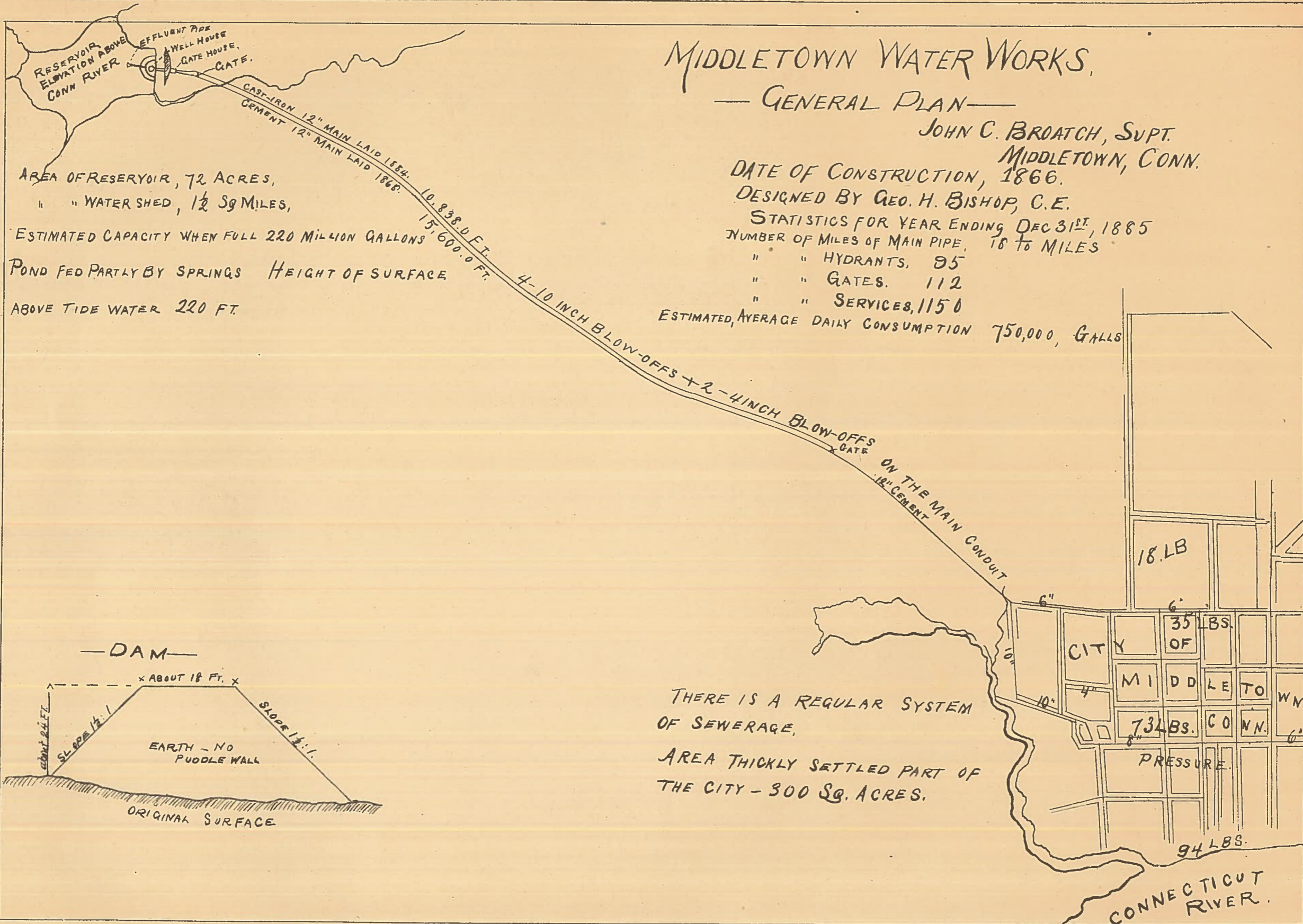
NUMBER OF MILES OF MAIN PIPE, 18 1/2 MILES

" " HYDRANTS, 95

" " GATES, 112

" " SERVICES, 1150

ESTIMATED AVERAGE DAILY CONSUMPTION 750,000 GALLS



AREA OF RESERYOIR, 72 ACRES,  
" " WATER SHED, 1 1/2 Sq MILES,  
ESTIMATED CAPACITY WHEN FULL 220 MILLION GALLONS  
POND FED PARTLY BY SPRINGS HEIGHT OF SURFACE  
ABOVE TIDE WATER 220 FT.

THERE IS A REGULAR SYSTEM  
OF SEWERAGE,  
AREA THICKLY SETTLED PART OF  
THE CITY - 300 SQ. ACRES.

MILFORD WATER WORKS,

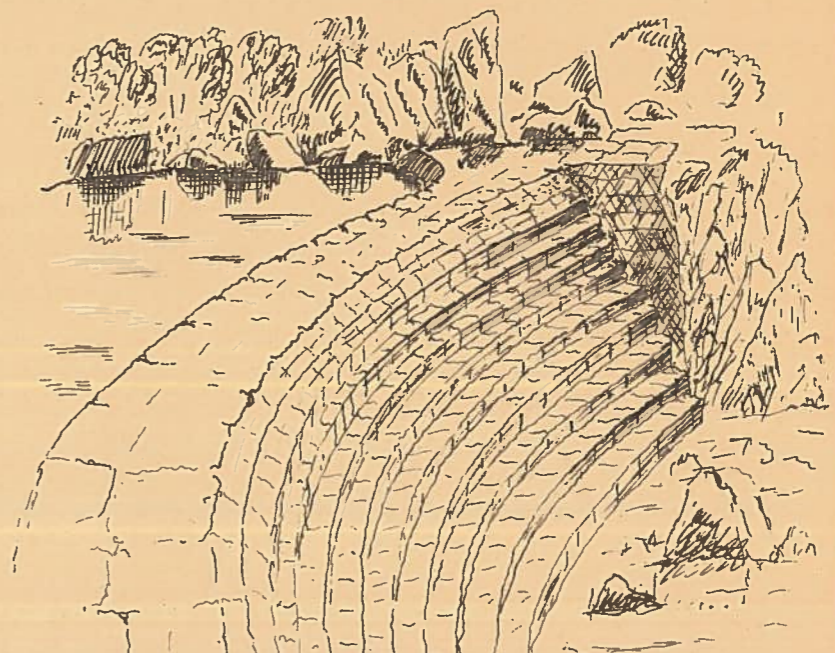
MILFORD, MASS.

WM. H. BARNEY, SUPT.

Date of Construction 1881.  
Moses Joy, Jr., Engineer.

No. Miles of Mains,	15
No. of Hydrants,	76
No. of Gates,	57
No. of Services,	547
No. of Takers,	887
No. of Motors,	1
Average Consumption	300,000 Gallons.
No system of sewerage.	

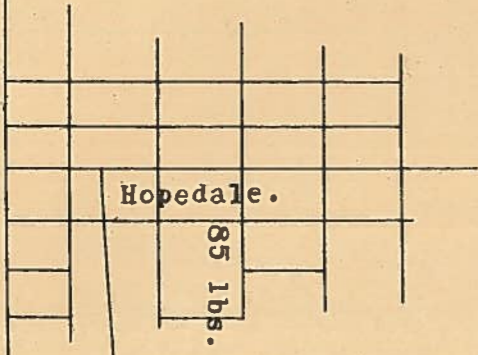
Proposed Site of Reservoir  
180 ft. above  
Charles River.  
Capacity 1,500,000.



Description of Solid Stone Dam.  
102 ft. long, 22 ft. high,  
18 ft. wide, at bottom,  
5 ft. wide at top. Curve 300 ft. rad.  
By raising 5 ft. will double capacity.

Description of Echo Lake.  
Area 90 Acres.  
Water Shed 4 sq. miles.  
Source of Charles River.  
Capacity 500,000,000 Gallons.

Basin for reserve  
water in case of fire.



8 in. Main.

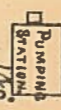
35 lbs.

14 in. Main.  
8,000 ft.

14 in. Main.

Milford.

Holly Direct Pumping System.  
Pumps 1,000,000 capacity.  
Two Horizontal Tubular Boilers.



Charles River.

3 Miles.

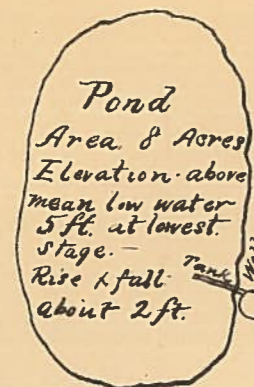
Echo Lake.

90 lbs.

Wannacomet Water Works  
Wm. F. Coada Supt.  
Nantucket Mass.

Date of Construction 1878  
Designed by Moses Joy, Jr.  
Dec. 31, 85

No. Miles Main pipe	7
No. Hydrants	31
No. Gates	37
No. Services	390
Ar. daily consumption	50,000 gals.



- 1-Worthington pump 1 1/2 M-galls.
- 1-Duplex Blake "
- 2-Hor. tubular boilers

Engine House-

8" cast iron pipe 11000 ft. to town.

400 ft. Pond to Tank

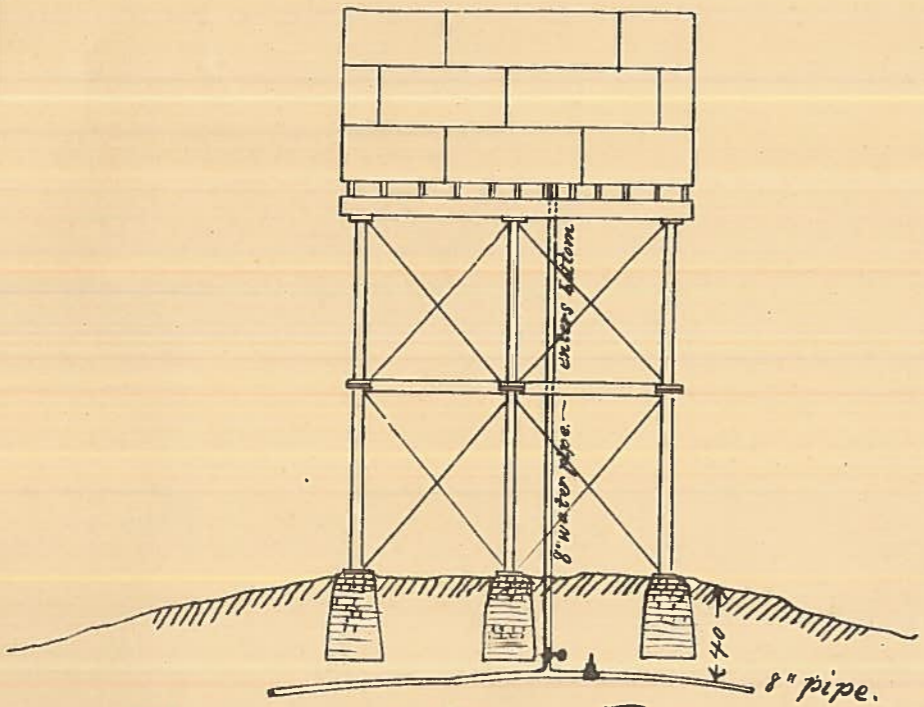
Tank.

50,000 gallons

Stands on Hill 63 ft. high

Tank is shut off for fire pressure

Water shed about 25 Acres  
No buildings (dwellings)  
on water shed.  
Pond fed partly by springs  
Water very pure.



Elevation of Water Tank

Tank - 24 ft. diam 15 ft. high. - of 1/4" boiler iron

Trestle - 27 ft. high 9 cast iron columns

Top of Tank. - 104 ft. above mean low water

Tank not covered on top. -

Stand pipe into tank boxed and packed to prevent freezing.



Shore

Cliffs

Summer Residences

Town of Nantucket

Light

Nantucket Harbor

37 lbs

20 lbs

20 lbs

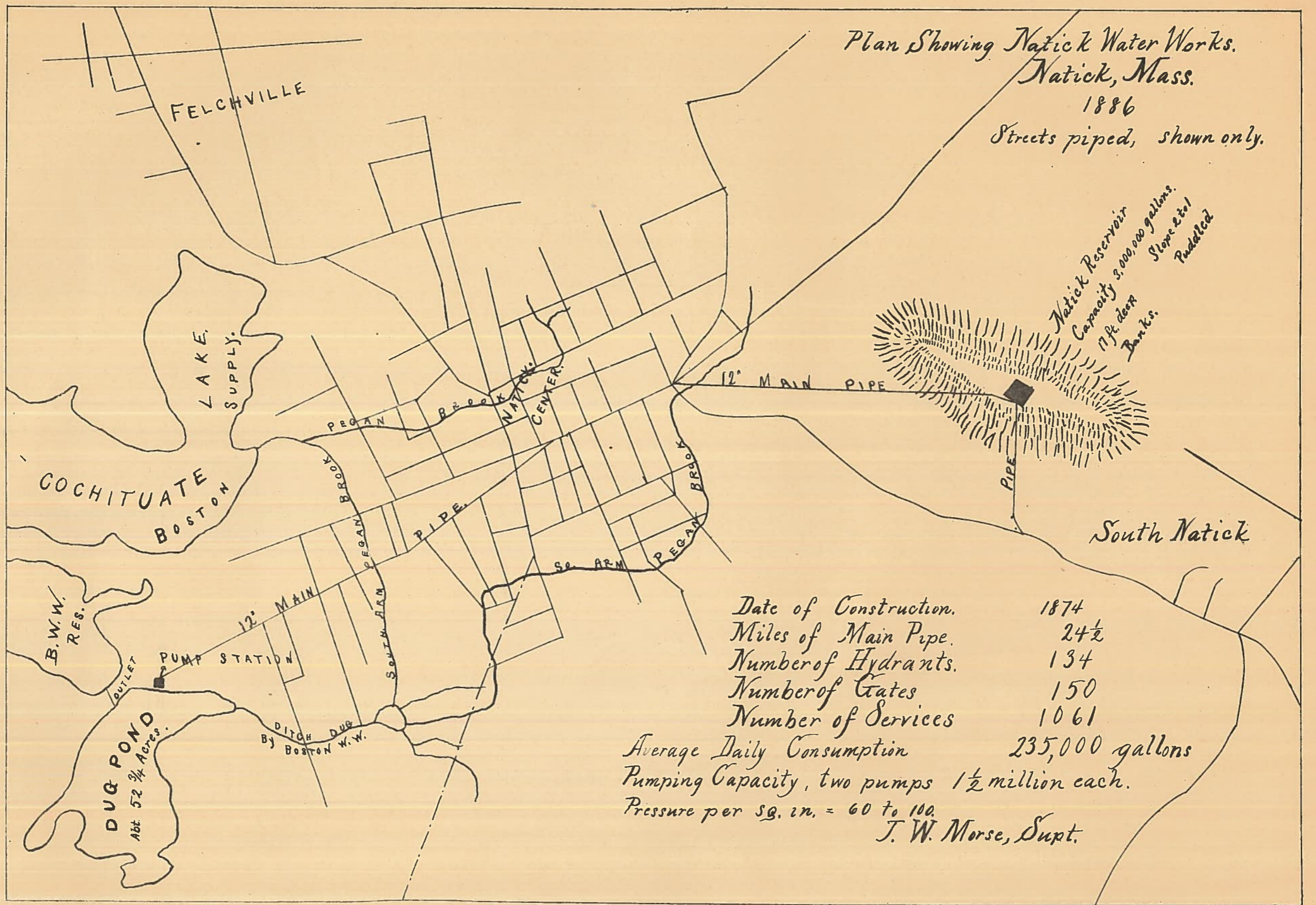
30 lbs

No system of Sewerage for Town.  
About 1/3 of families are supplied with water.  
Consumption during summer about 100,000 gallons daily. Winter, 25,000 gallons

Plan Showing Natick Water Works.  
Natick, Mass.

1886

Streets piped, shown only.



Natick Reservoir  
Capacity 3,000,000 gallons.  
17 ft deep  
Banks Sloped & puddled

Date of Construction.	1874
Miles of Main Pipe.	24½
Number of Hydrants.	134
Number of Gates	150
Number of Services	1061
Average Daily Consumption	235,000 gallons
Pumping Capacity, two pumps	1½ million each.
Pressure per sq. in. =	60 to 100.

J. W. Morse, Supt.

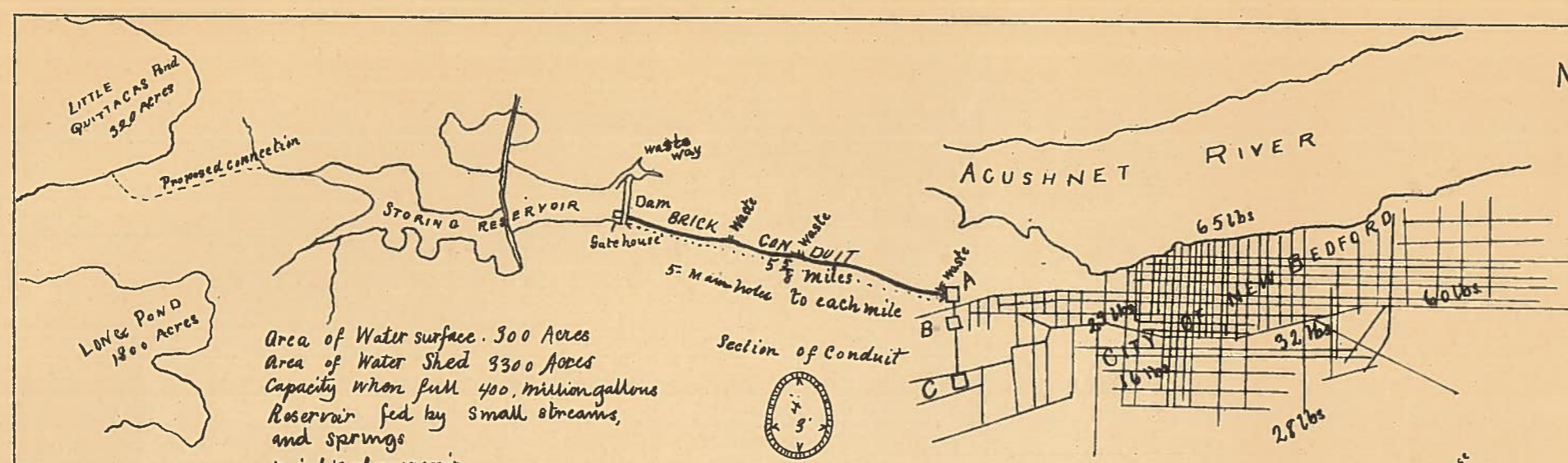


# NEW BEDFORD WATER WORKS

## GENERAL PLAN

R. C. R. Coggeshall Supt.

Population 1885 = 33,392  
 Date of Construction 1866 to 1869  
 Owned by the City of New Bedford  
 By whom designed  
 W. J. McAlpine Consulting Eng.  
 Geo. A. Briggs Chf. Eng.

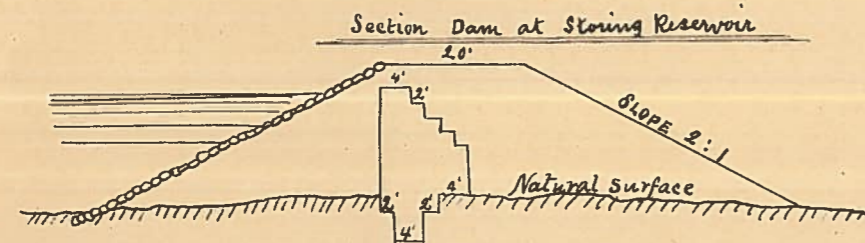


LITTLE  
QUITTACAS Pond  
320 Acres

LON & POND  
1800 Acres

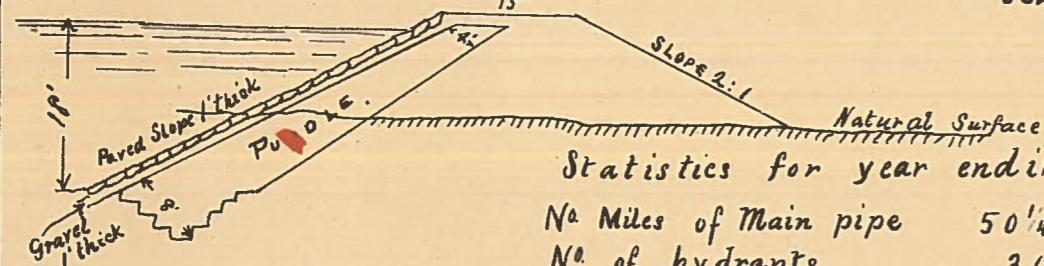
Area of Water surface. 300 Acres  
 Area of Water Shed 3300 Acres  
 Capacity when full 400 million gallons  
 Reservoir fed by small streams,  
 and springs  
 Height of reservoir  
 above tide water = 40 feet

Grade of Conduit  
 0.58' per mile



Section of Dam at Storing Reservoir

There are two force  
 mains leading from  
 the pumping station  
 to the distributing  
 Reservoir:  
 one 16" diameter  
 one 30" "  
 length of each  
 about 1900 feet

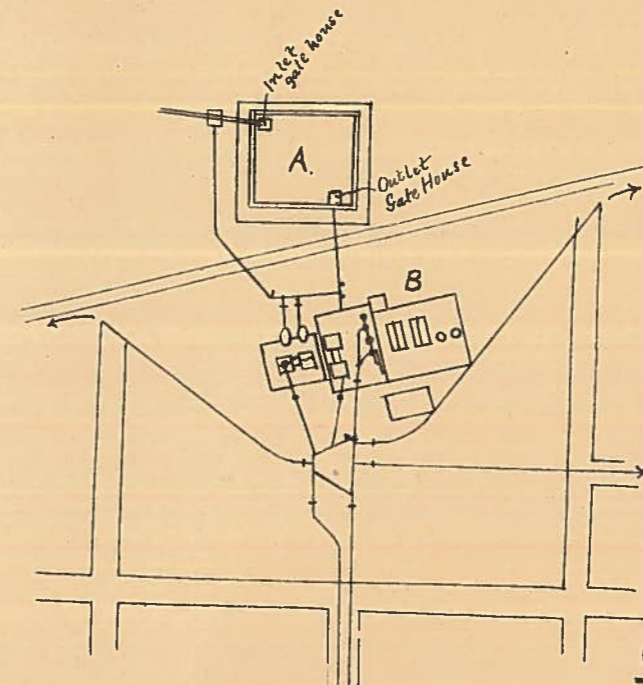


Section of Dam Distributin Reservoir

### Statistics for year ending November 30, 1885

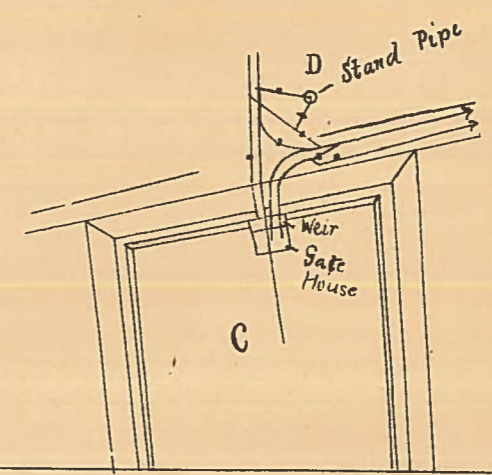
No Miles of Main pipe	50 1/4 miles
No of hydrants	367
No of gates	475
No of Services	4965
No of meters	67

There is a regular system of sewer  
 Area of thickly settled portion of City about 1300 Acres



A = Receiving Reservoir  
 Depth when full = 12'  
 When full height  
 above tide = 30'  
 Capacity 3 million gallons

B = Pumping Station  
 containing  
 1 - 3 Million Mc Alpine Engine  
 1 - 3 " Worthington "  
 1 - 3 " " "  
 4 horizontal tubular boilers  
 2 Vertical " "



C = Distributing Reservoir  
 Depth when full = 18'  
 Height when full  
 above tide = 154.8  
 Water Area when  
 full = 3 1/2 Acres  
 Capacity 15 Million gallons

D = Stand Pipe  
 Diameter = 5 ft  
 Height of top  
 above tide 187'

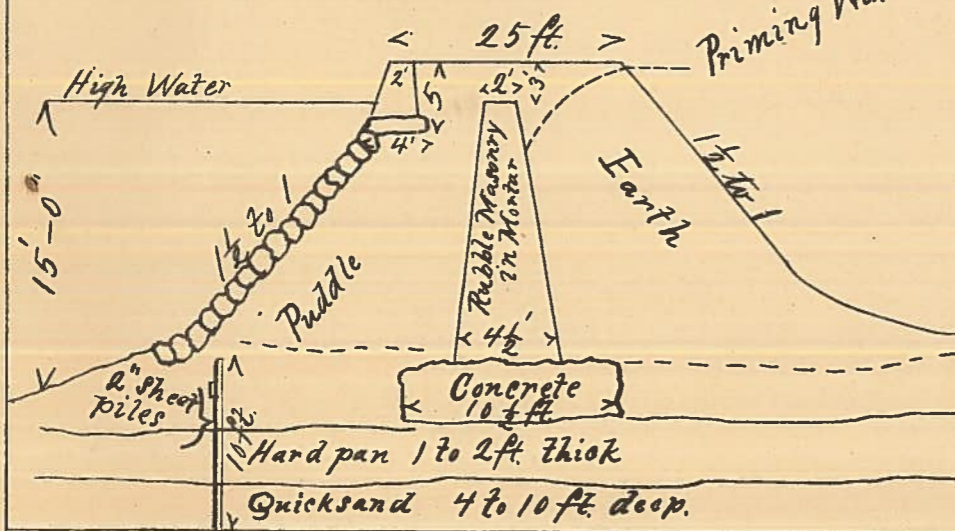
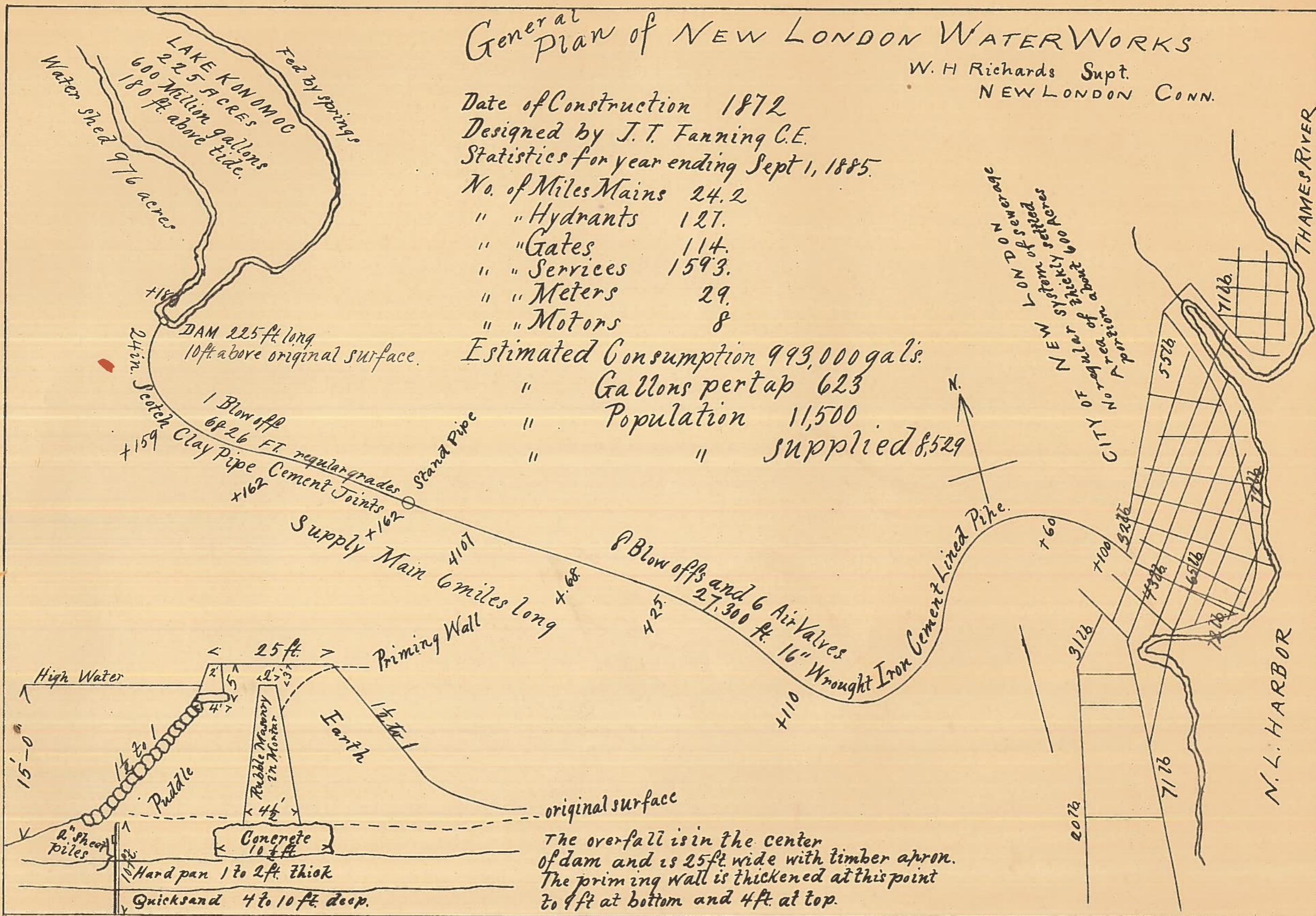
# General Plan of NEW LONDON WATERWORKS

W. H. Richards Supt.  
NEW LONDON CONN.

Date of Construction 1872  
Designed by J. T. Fanning C.E.  
Statistics for year ending Sept 1, 1885.

No. of Miles Mains 24.2  
" " Hydrants 127.  
" " Gates 114.  
" " Services 1593.  
" " Meters 29.  
" " Motors 8

Estimated Consumption 993,000 gals.  
" Gallons per tap 623  
" Population 11,500  
" " supplied 8,529

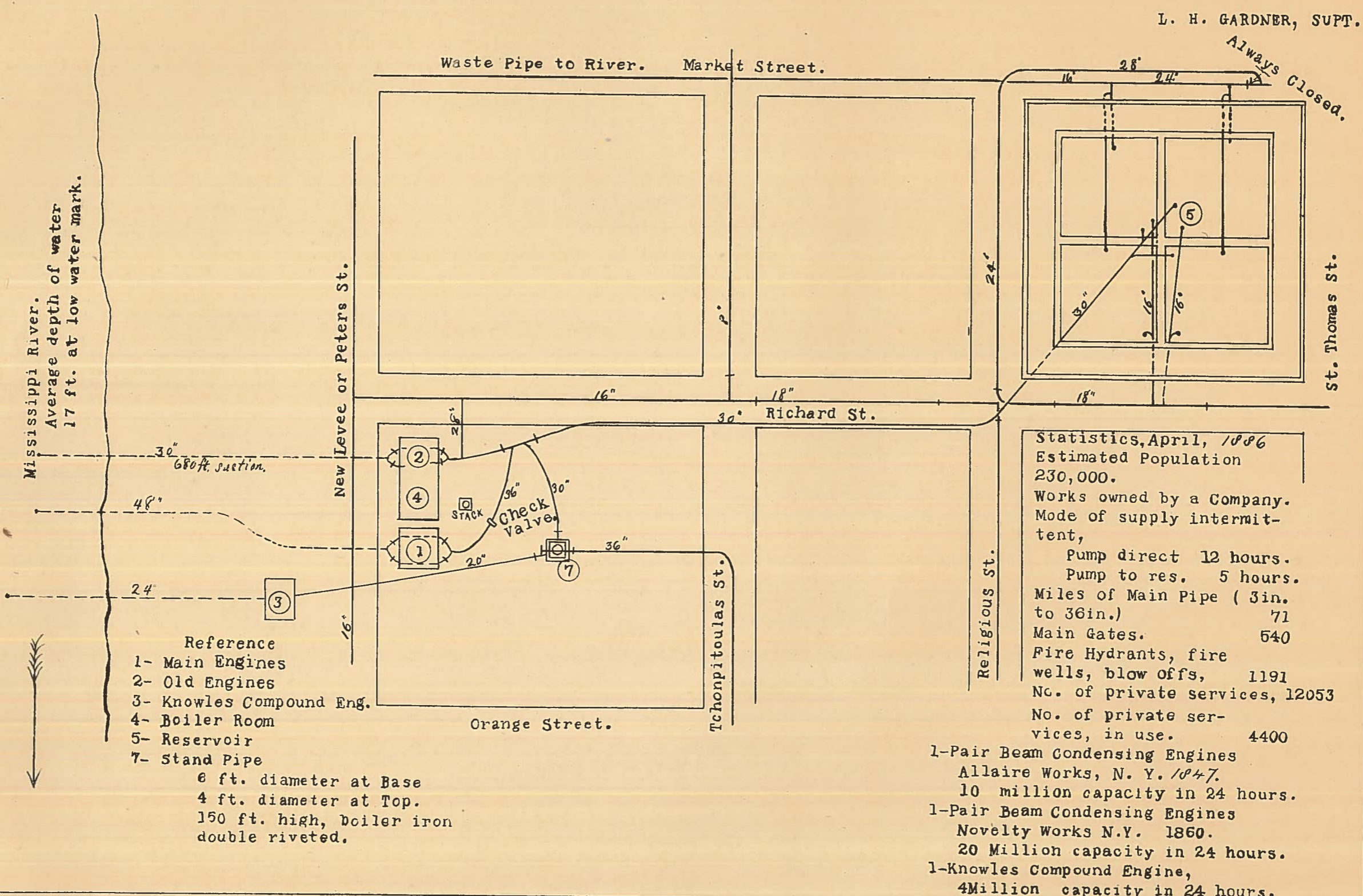


The overfall is in the center of dam and is 25 ft. wide with timber apron. The priming wall is thickened at this point to 9 ft. at bottom and 4 ft. at top.

GENERAL PLAN NEW ORLEANS WATER WORKS

NEW ORLEANS, LOUISIANA.

L. H. GARDNER, SUPT.



Mississippi River.  
Average depth of water  
17 ft. at low water mark.

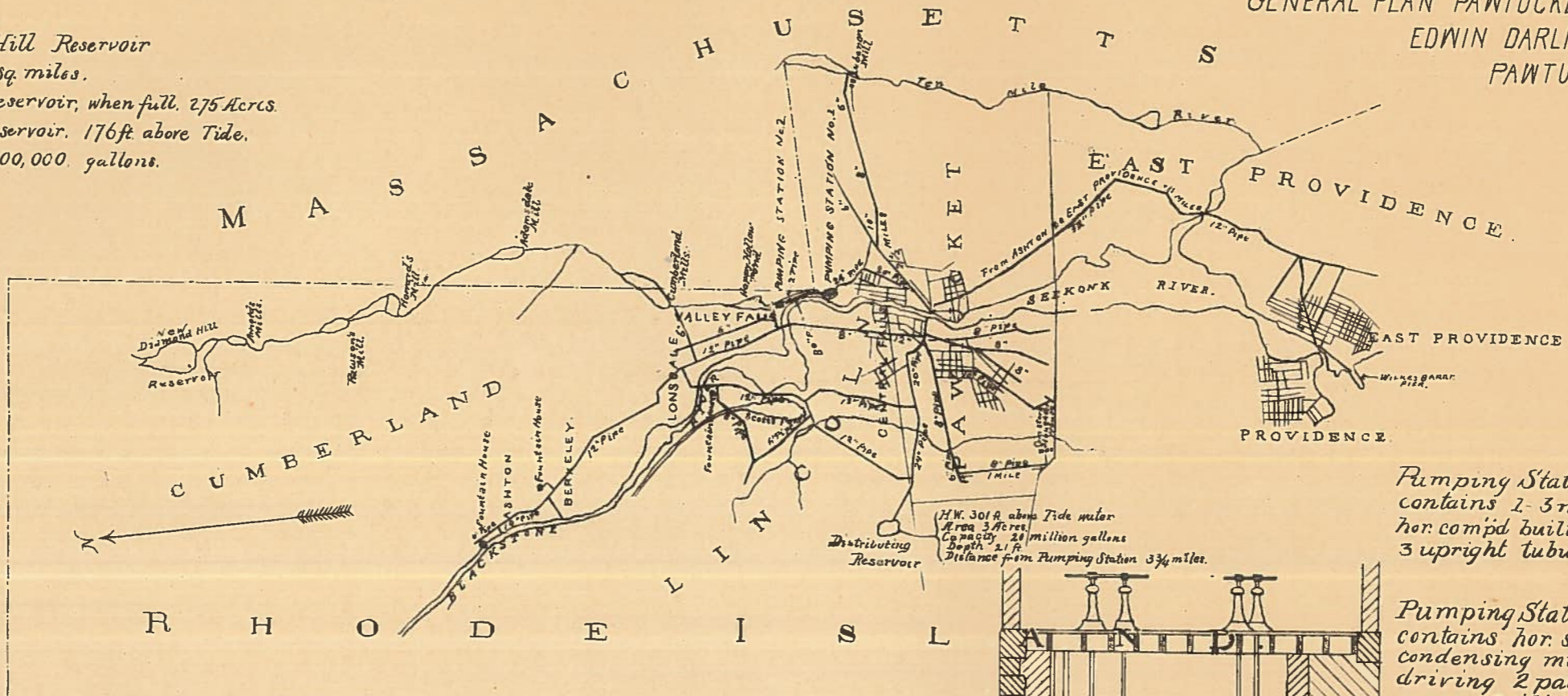
- Reference
- 1- Main Engines
  - 2- Old Engines
  - 3- Knowles Compound Eng.
  - 4- Boiler Room
  - 5- Reservoir
  - 7- Stand Pipe
- 6 ft. diameter at Base  
4 ft. diameter at Top.  
150 ft. high, boiler iron  
double riveted.

Statistics, April, 1886  
Estimated Population  
230,000.  
Works owned by a Company.  
Mode of supply intermittent,  
Pump direct 12 hours.  
Pump to res. 5 hours.  
Miles of Main Pipe (3 in.  
to 36 in.) 71  
Main Gates. 540  
Fire Hydrants, fire  
wells, blow offs, 1191  
No. of private services, 12053  
No. of private ser-  
vices, in use. 4400

- 1-Pair Beam Condensing Engines  
Allaire Works, N. Y. 1847.  
10 million capacity in 24 hours.
- 1-Pair Beam Condensing Engines  
Novelty Works N.Y. 1860.  
20 Million capacity in 24 hours.
- 1-Knowles Compound Engine,  
4 Million capacity in 24 hours.

GENERAL PLAN PAWTUCKET W. W.  
EDWIN DARLING SUPT.  
PAWTUCKET, R. I.

Diamond Hill Reservoir  
Water Shed  $7\frac{1}{2}$  sq. miles.  
Water area of Reservoir, when full, 275 Acres.  
High Water in Reservoir, 176ft above Tide.  
Capacity 1,600,000,000 gallons.



Pumping Station No. 1  
contains 2-3 million engine  
hor. compd built by Geo H Corliss.  
3 upright tubular boilers.

Pumping Station No. 2  
contains hor. steam jacketed  
condensing mill engine  
driving 2 pairs of geared  
pumps built by Geo H Corliss.  
Two upright tubular boilers.

These pumps are arranged  
to run by water line shaft  
being connected to 2 turbine  
wheels 50 and 75 HP  
Capacity of pumps each  
pair  $\frac{1}{2}$  million gals.

This system of water works was constructed  
in 1877 and embraces five divisions, viz:

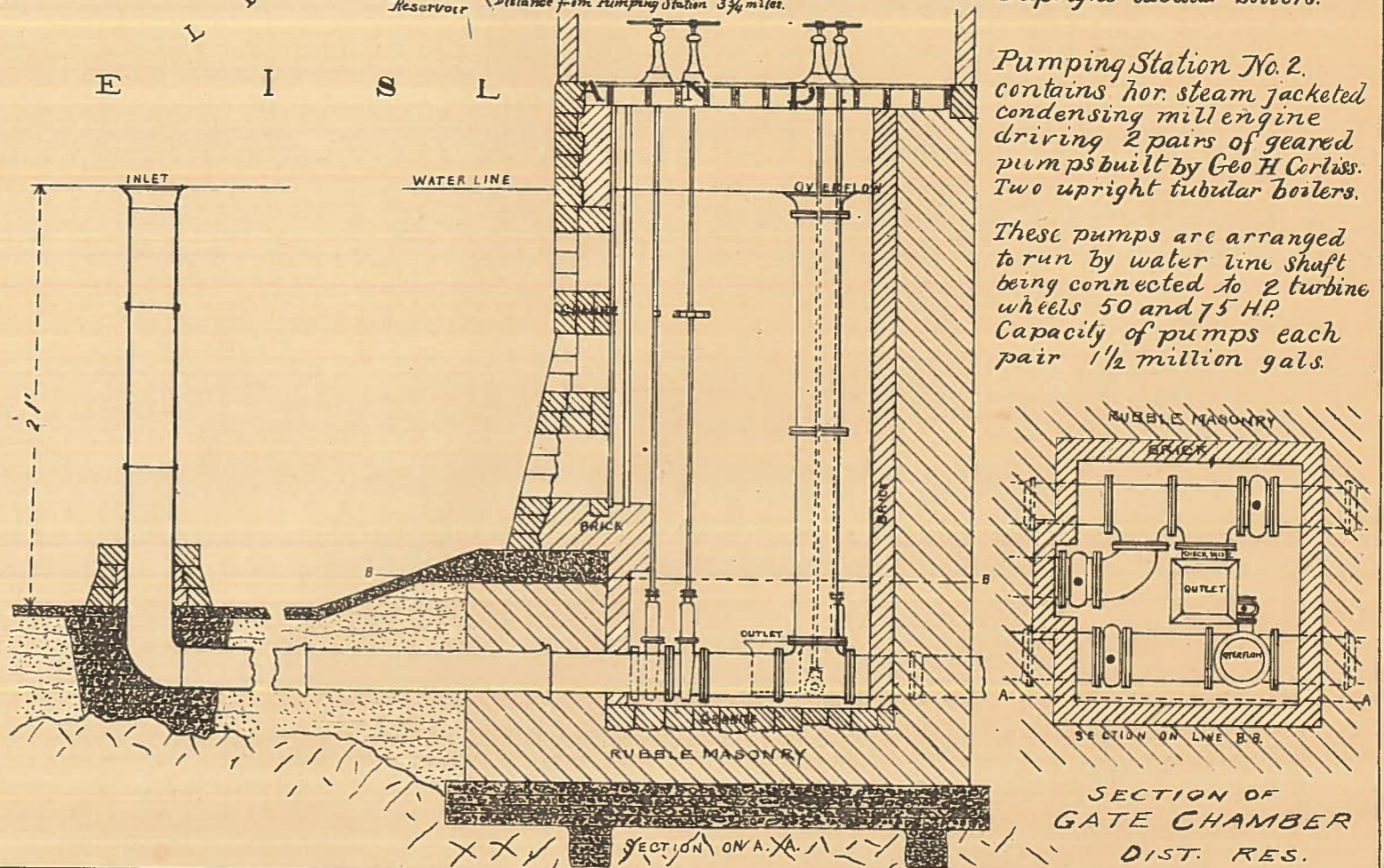
1. Pawtucket	24,000 Pop.
2. East Providence	8,000 "
3. Central Falls	
4. Lonsdale and Valley Falls	16,000 "
5. Berkeley and Ashton	
<hr/>	
Total supplied	48,000 Pop.
	40,000 "

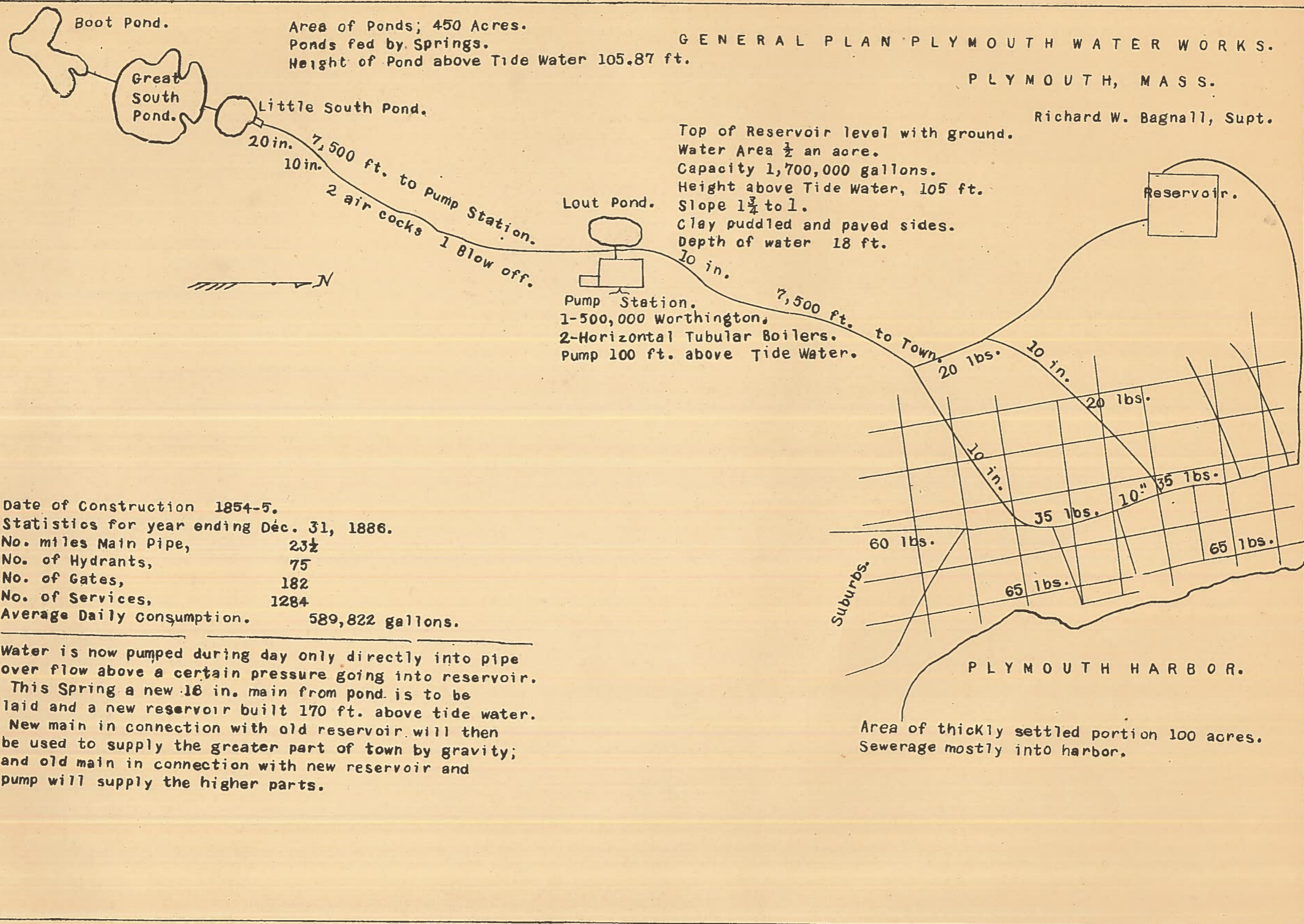
Statistics for year ending Dec 1<sup>st</sup> 1886.

Number of miles of main pipe	95
" " gates	
" " hydrants	753
" " meters	2596
" " services, principally wrought iron	4452
" " motors	10

Average daily consumption in gals.	2,256,281
Maximum " " July 7th "	4,000,000
Minimum " " May 31st "	1,000,000

The city has a regular system of sewerage.





Area of Ponds; 450 Acres.  
 Ponds fed by Springs.  
 Height of Pond above Tide Water 105.87 ft.

GENERAL PLAN PLYMOUTH WATER WORKS.  
 PLYMOUTH, MASS.

Richard W. Bagnall, Supt.

Top of Reservoir level with ground.  
 Water Area 1/2 an acre.  
 Capacity 1,700,000 gallons.  
 Height above Tide Water, 105 ft.  
 Slope 1 3/4 to 1.  
 Clay puddled and paved sides.  
 Depth of water 18 ft.

Lout Pond.  
 Pump Station.  
 1-500,000 Worthington,  
 2-Horizontal Tubular Boilers.  
 Pump 100 ft. above Tide Water.

Date of Construction 1854-5.  
 Statistics for year ending Dec. 31, 1886.

No. miles Main Pipe,	23 1/2
No. of Hydrants,	75
No. of Gates,	182
No. of Services,	1284
Average Daily Consumption.	589,822 gallons.

Water is now pumped during day only directly into pipe over flow above a certain pressure going into reservoir. This Spring a new 16 in. main from pond is to be laid and a new reservoir built 170 ft. above tide water. New main in connection with old reservoir will then be used to supply the greater part of town by gravity; and old main in connection with new reservoir and pump will supply the higher parts.

PLYMOUTH HARBOR.  
 Area of thickly settled portion 100 acres.  
 Sewerage mostly into harbor.

1-2 Million Deane Compound Pump  
 1-2 Million Deane Duplex Pump High Pressure

Average Daily Consumption 200,000 gallons  
 Population 12,500  
 No System of Sewerage.  
 Cast Iron and Wrought Iron  
 Kalamine Pipe

Quincy Water Company  
 Frank E. Hall Supt.  
 Quincy Mass.

No. Miles Main Pipe	23.5
No. Hydrants	89
No. Gates	75
No. Services	600
No. Blow Offs	6

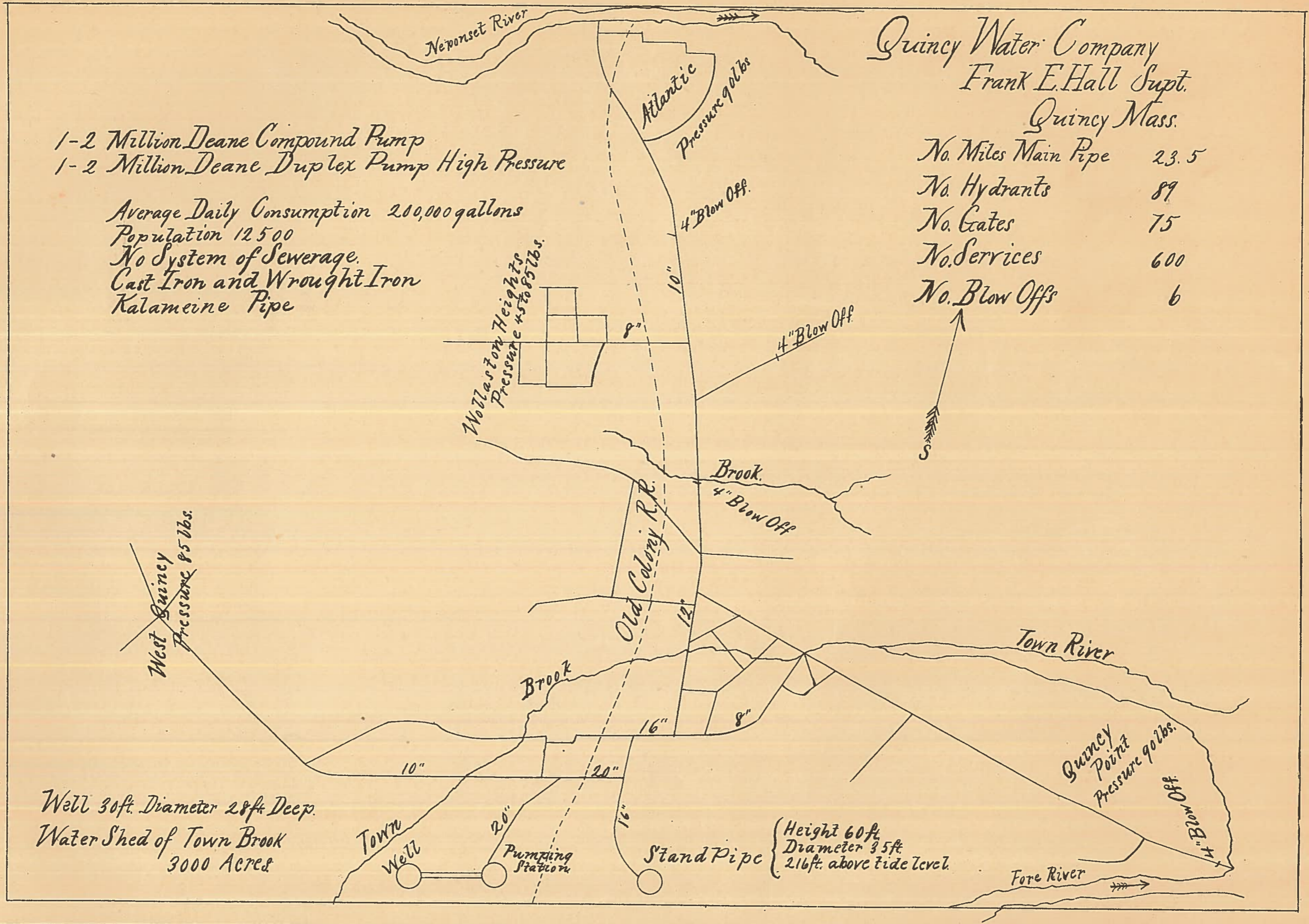
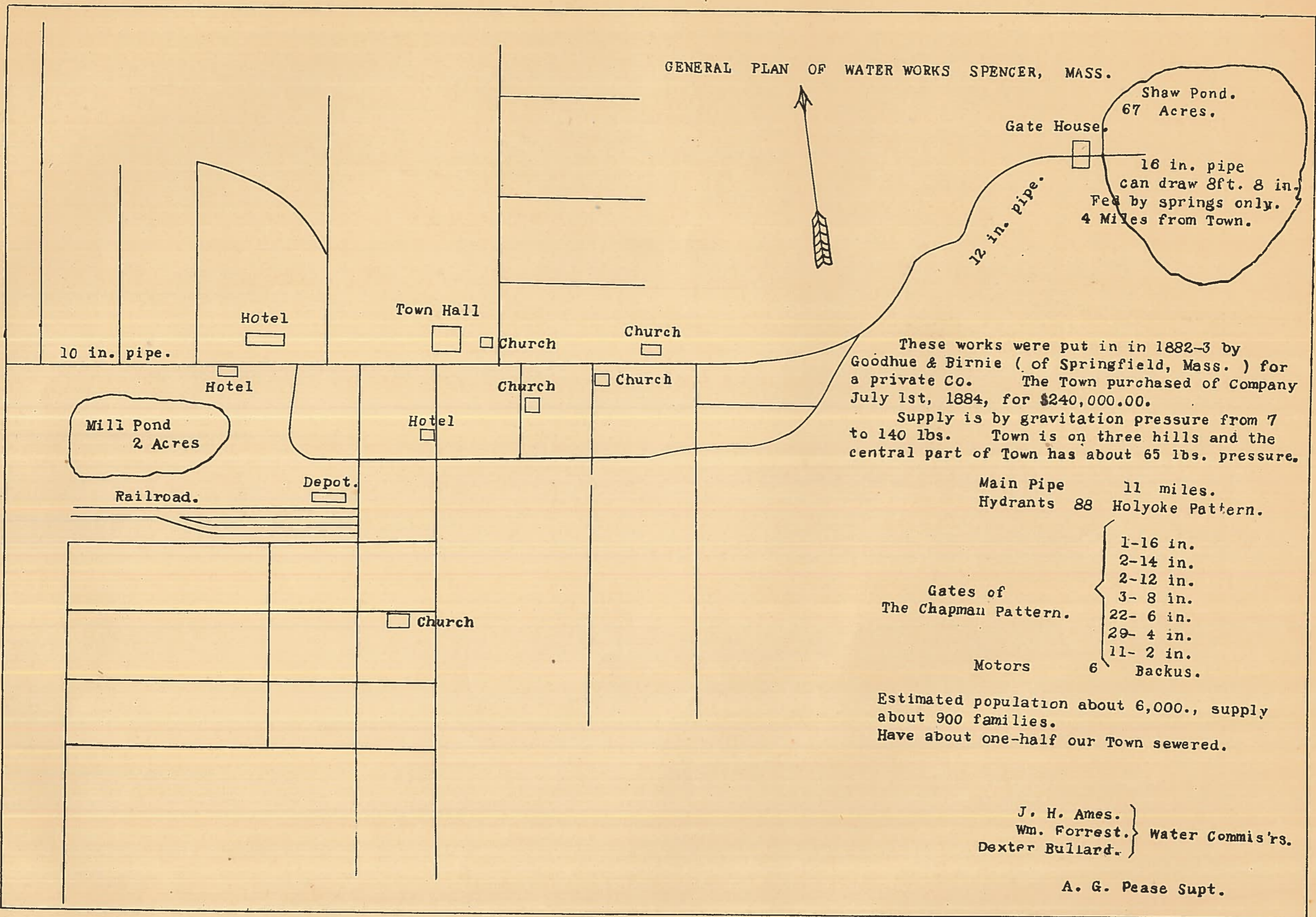


PLATE XIX.

GENERAL PLAN OF WATER WORKS SPENCER, MASS.



Shaw Pond.  
67 Acres.  
16 in. pipe  
can draw 8ft. 8 in.  
Fed by springs only.  
4 Miles from Town.

These works were put in in 1882-3 by Goodhue & Birnie ( of Springfield, Mass. ) for a private Co. The Town purchased of Company July 1st, 1884, for \$240,000.00.  
Supply is by gravitation pressure from 7 to 140 lbs. Town is on three hills and the central part of Town has about 65 lbs. pressure.

Main Pipe 11 miles.  
Hydrants 88 Holyoke Pattern.

Gates of The Chapman Pattern. {  
1-16 in.  
2-14 in.  
2-12 in.  
3- 8 in.  
22- 6 in.  
29- 4 in.  
11- 2 in.  
Motors 6 Backus.

Estimated population about 6,000., supply about 900 families.  
Have about one-half our Town sewered.

J. H. Ames. }  
Wm. Forrest. } Water Commis'rs.  
Dexter Bullard. }

A. G. Pease Supt.

Springfield Water Works General Plan

J. C. Hancock Supt.

Springfield, Mass.

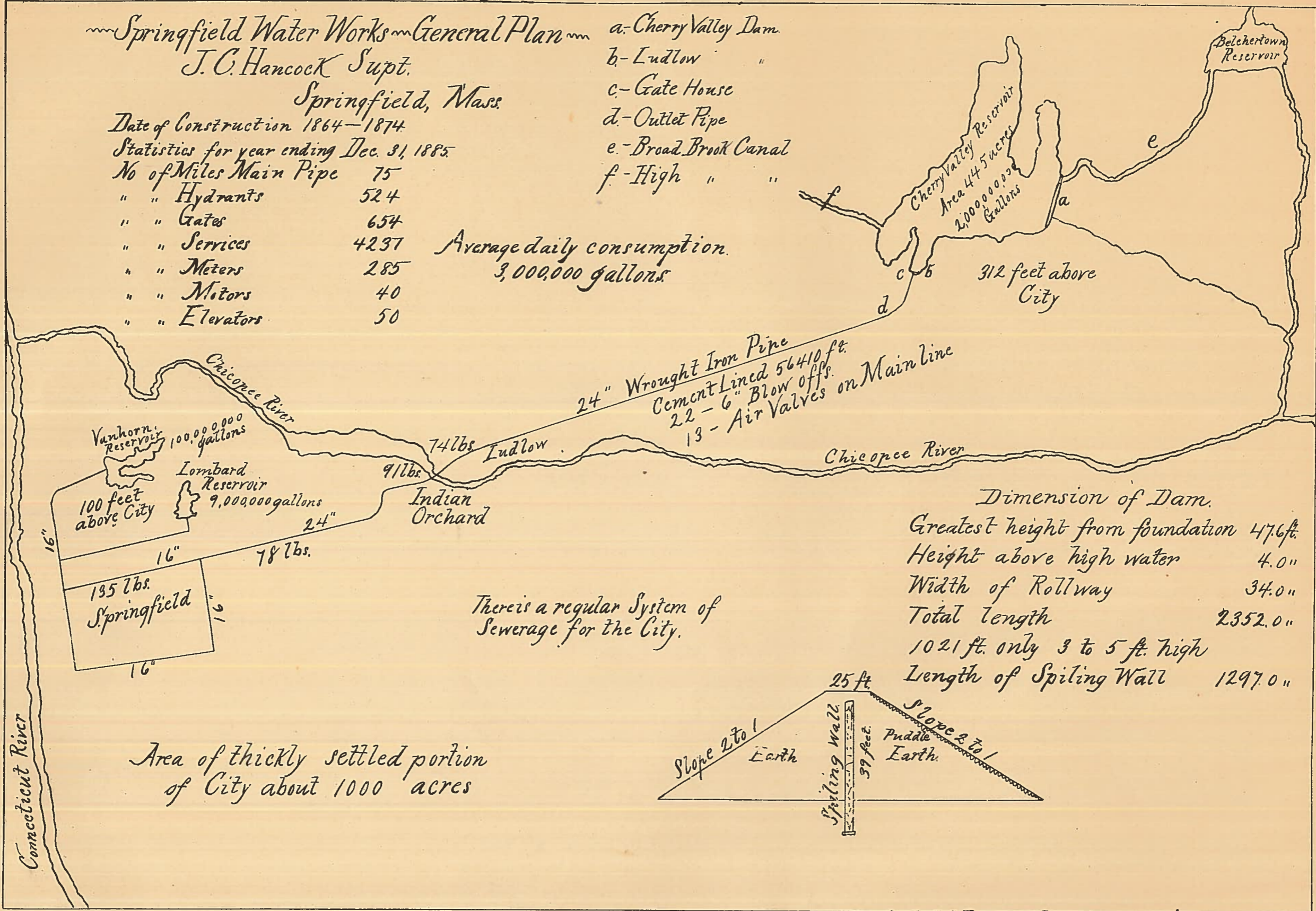
Date of Construction 1864-1874

Statistics for year ending Dec. 31, 1885.

No of Miles Main Pipe	75
" " Hydrants	524
" " Gates	654
" " Services	4237
" " Meters	285
" " Motors	40
" " Elevators	50

Average daily consumption.  
3,000,000 gallons

- a- Cherry Valley Dam.
- b- Ludlow "
- c- Gate House
- d- Outlet Pipe
- e- Broad Brook Canal
- f- High " "



Dimension of Dam.

Greatest height from foundation	47.6 ft.
Height above high water	4.0 "
Width of Rollway	34.0 "
Total length	2352.0 "
1021 ft. only 3 to 5 ft. high	
Length of Spiling Wall	1297.0 "

There is a regular System of Sewerage for the City.

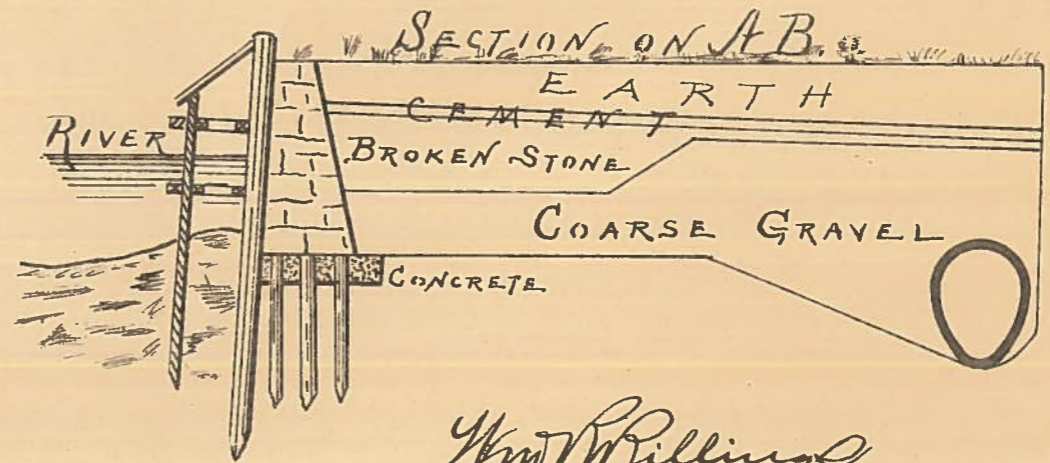
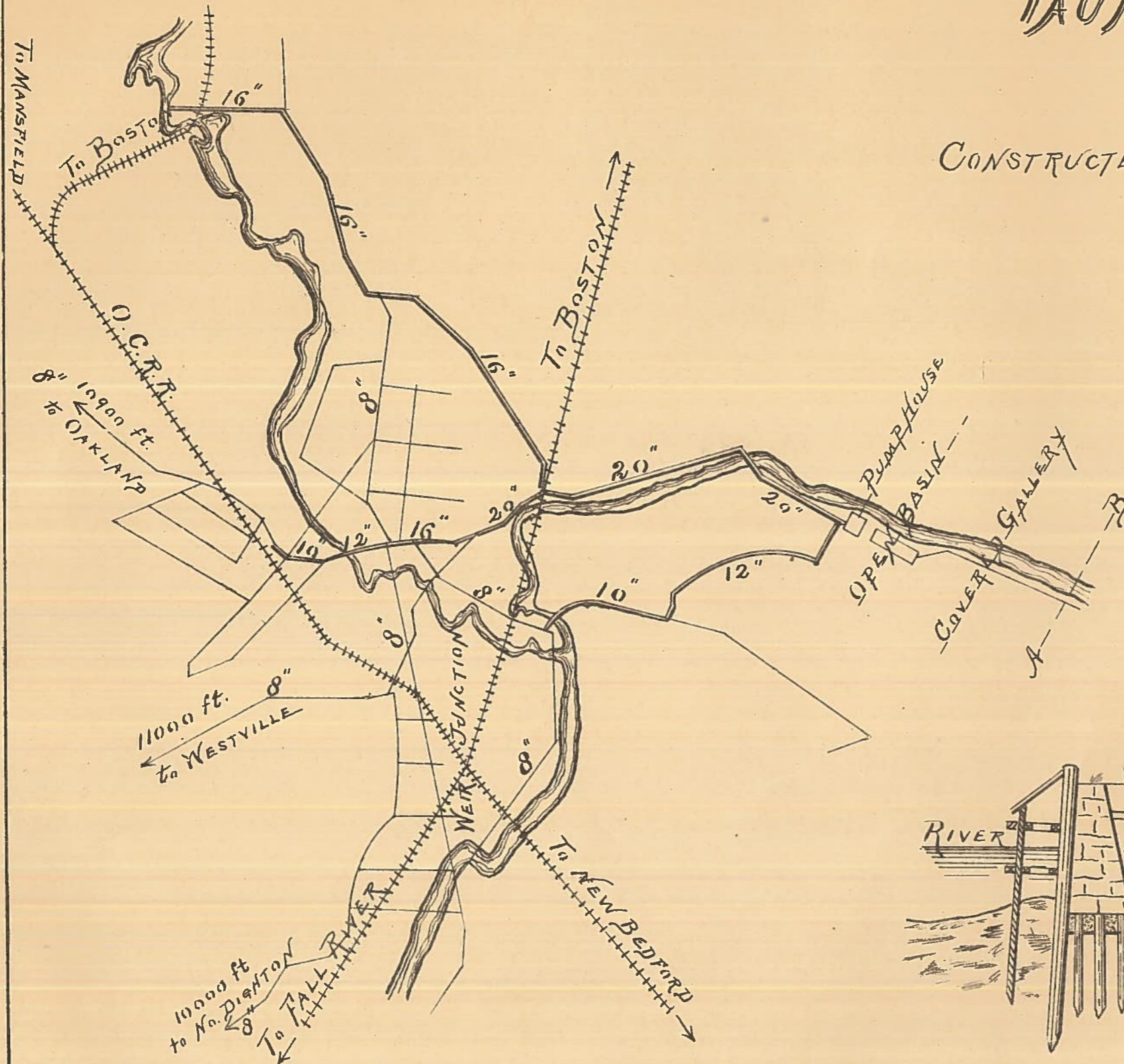
Area of thickly settled portion of City about 1000 acres



# TAUNTON WATER WORKS, TAUNTON, MASS.

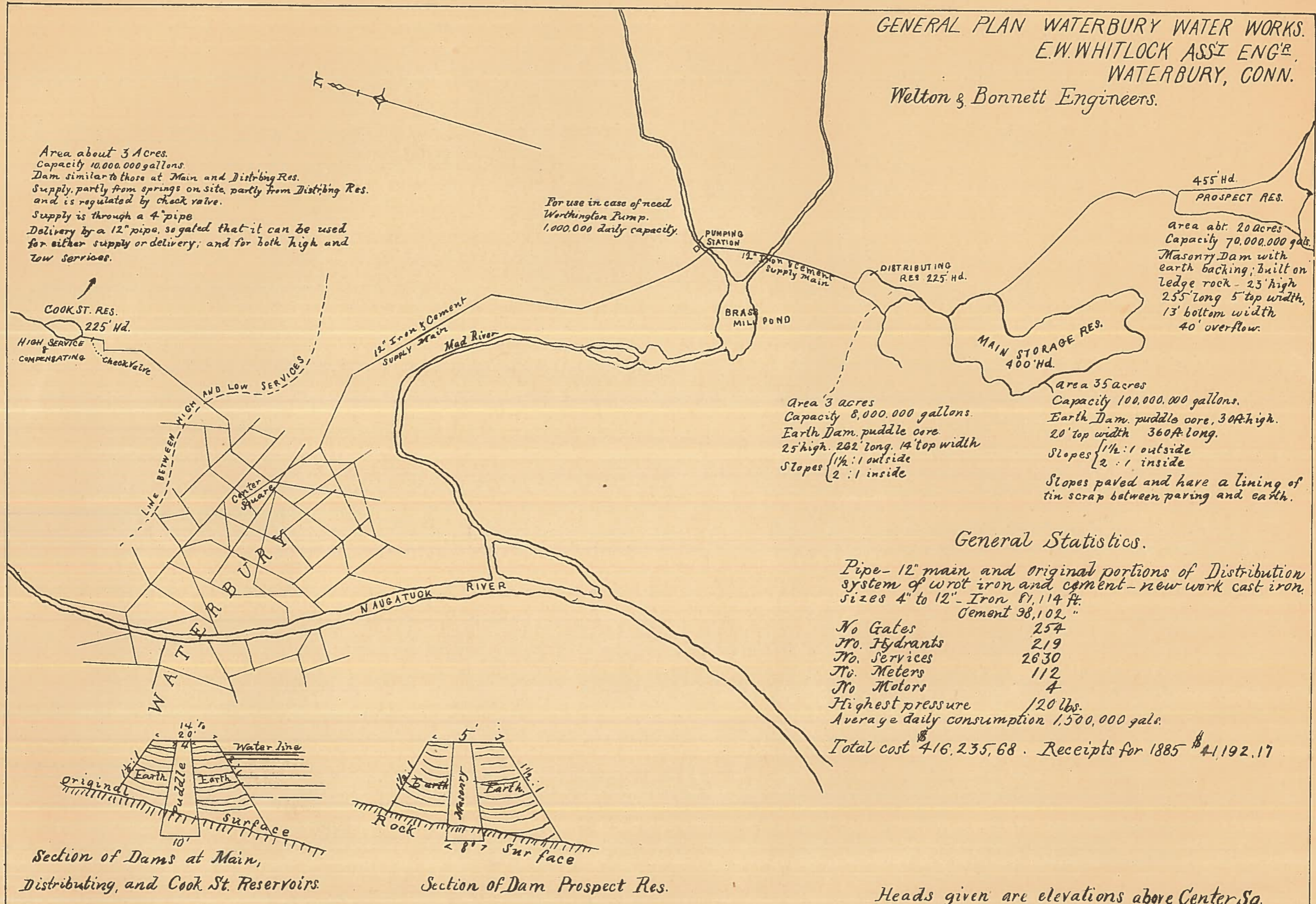
CONSTRUCTED BY CITY IN 1876

SYSTEM - DIRECT PUMPING  
 ONE QUAD. HOLLY PUMP. 2 MILLION  
 ON ROTARY " " 1/2 "  
 THREE HOR. BOILERS 16' x 5'  
 55 MILES CAST IRON MAINS  
 2935 CEMENT LINED SERVICES  
 AVE. DAILY CONSUMPT. IN 1886 - 773531 g.  
 ABOUT 10 MILES OF SEWERS. NO SYSTEM



*Wm. H. Billings*  
Supt.

GENERAL PLAN WATERBURY WATER WORKS.  
 E.W. WHITLOCK ASS' ENG' R.  
 WATERBURY, CONN.  
 Welton & Bonnett Engineers.



Area about 3 Acres.  
 Capacity 10,000,000 gallons.  
 Dam similar to those at Main and Distributing Res.  
 Supply, partly from springs on site, partly from Distributing Res.  
 and is regulated by check valve.  
 Supply is through a 4" pipe  
 Delivery by a 12" pipe, so gated that it can be used  
 for either supply or delivery; and for both high and  
 low services.

For use in case of need  
 Worthington Pump.  
 1,000,000 daily capacity.

455' Hd.  
 PROSPECT RES.  
 Area abt. 20 acres  
 Capacity 70,000,000 gals.  
 Masonry Dam with  
 earth backing; built on  
 ledge rock - 23' high  
 255' long 5' top width,  
 13' bottom width  
 40' overflow.

Area 3 acres  
 Capacity 8,000,000 gallons.  
 Earth Dam, puddle core  
 25' high, 262' long, 14' top width  
 Slopes  $\begin{cases} 1\frac{1}{2} : 1 \text{ outside} \\ 2 : 1 \text{ inside} \end{cases}$

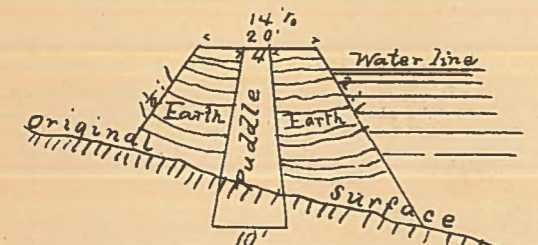
Area 35 acres  
 Capacity 100,000,000 gallons.  
 Earth Dam, puddle core, 30ft high.  
 20' top width 360ft long.  
 Slopes  $\begin{cases} 1\frac{1}{2} : 1 \text{ outside} \\ 2 : 1 \text{ inside} \end{cases}$   
 Slopes paved and have a lining of  
 tin scrap between paving and earth.

General Statistics.

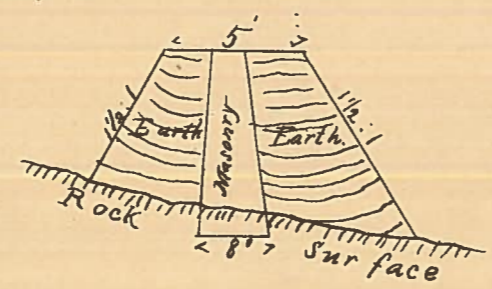
Pipe - 12" main and original portions of Distribution  
 system of wrought iron and cement - new work cast iron.  
 sizes 4" to 12" - Iron 81,114 ft.  
 Cement 98,102 "

No Gates	254
No. Hydrants	219
No. Services	2630
No. Meters	112
No. Motors	4
Highest pressure	120 lbs.
Average daily consumption	1,500,000 gals.

Total cost \$416,235,68. Receipts for 1885 \$41,192.17



Section of Dams at Main,  
 Distributing, and Cook St. Reservoirs.



Section of Dam Prospect Res.

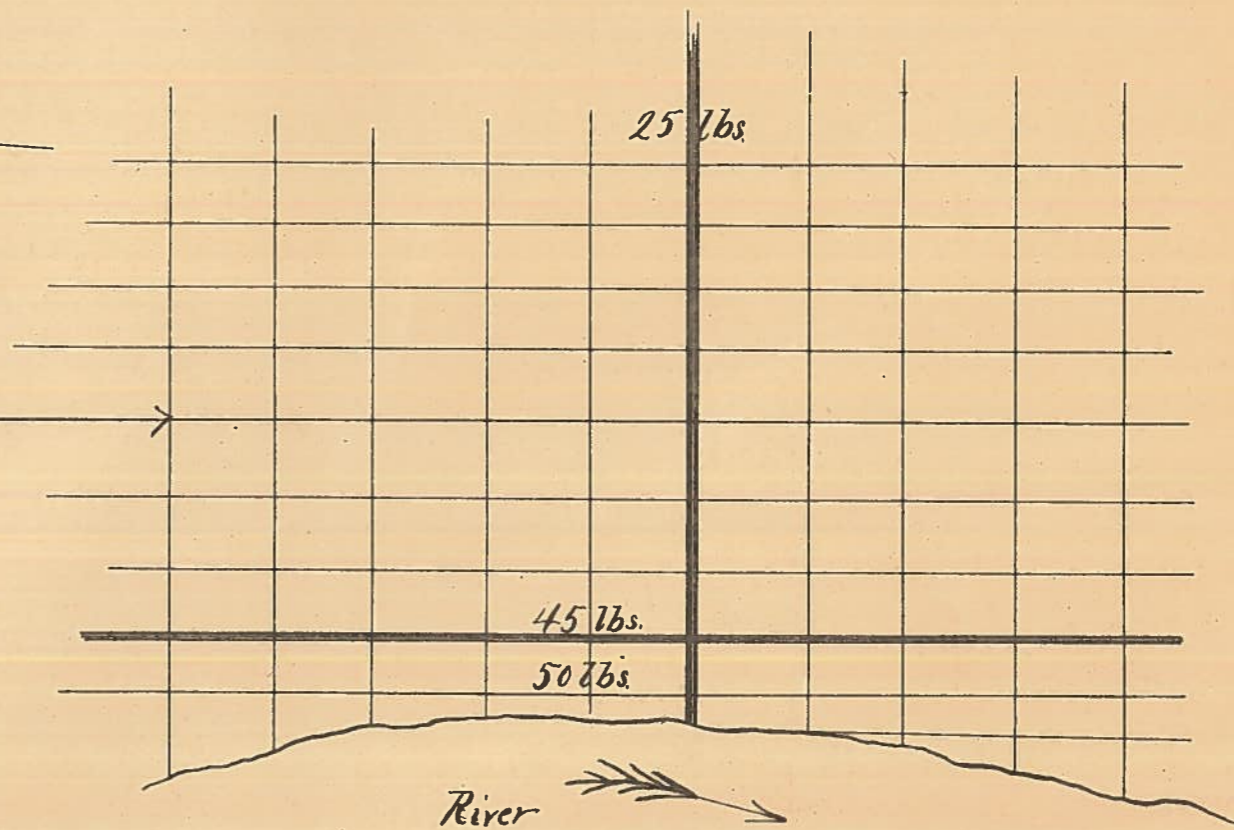
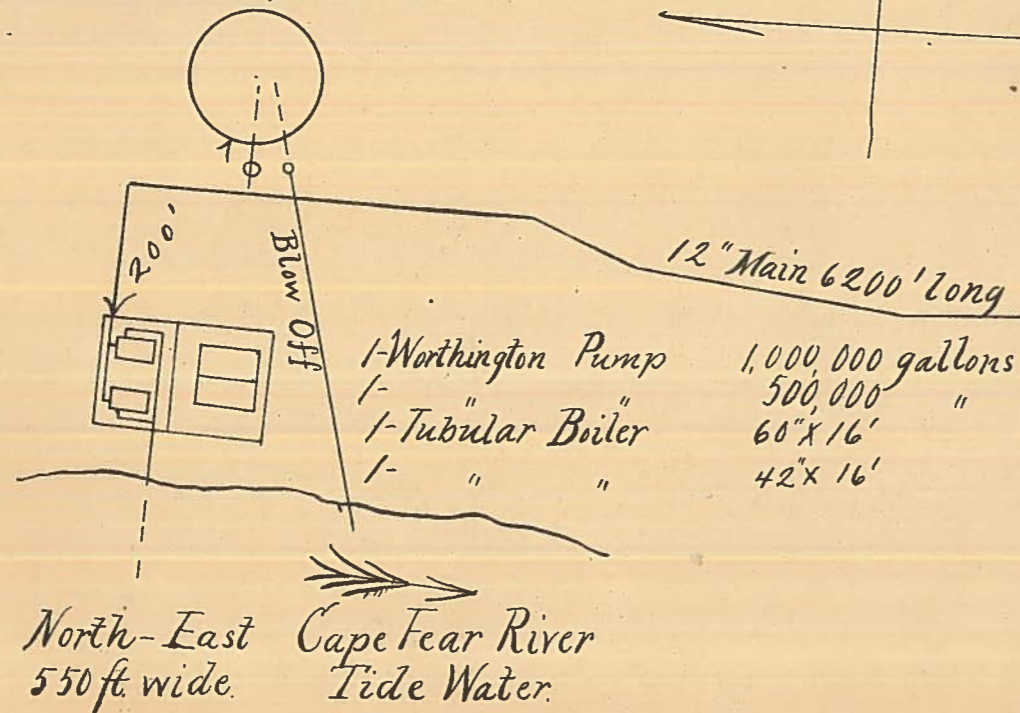
Heads given are elevations above Center Sq.

Clarendon Water Works Co. - General Plan -  
 Wilmington, North Carolina  
 John C. Chase,  
 Supt. & Engineer.

Built 1881  
 Designed by contractor  
 — Statistics — Sept. 30, 1885 —  
 Miles Pipe 12 1/2  
 Hydrants 105  
 Meters 87  
 Motors 18  
 Services 467  
 Gates 48  
 Blow Offs 3

Daily consumption 285,000 gallons  
 — No system of sewerage. —  
 Thickly settled area about 600 acres

— Stand Pipe —  
 20 ft. dia. 90 ft. high  
 Base 35 ft. above River



# Woonsocket Water Works, General Plan

Willard Kent Supt.  
Woonsocket, R.I.

Assumed Base of Elevations  
About 54' above mean low water  
at Providence.

Date of Construction 1884

Statistics for year ending April 1886 <sup>266</sup>

No. of Miles Main Pipe 13 <sup>266</sup>/<sub>1000</sub>

No. of Hydrants 270

No. of Gates 204

No. of Services 425

Average Daily Consumption 143000 Gallons.

Pressure from 120 lbs of River to  
60 lbs. on hillsides

Distributing Pipe Cast Iron  
3124' of 12"  
10352' of 8"  
34965' of 6"  
34229' of 4"

Lead Service Pipe to Curb 6902 feet.

Supplied by Crook Falls Brook  
Reservoir No. 2  
Area 8 1/2 Acres  
Capacity 15 Million Gallons  
Elevation of Surface of water 136.83'

TOTAL WATER SHED OF CROOK FALLS BROOK  
Estimated at 7 Square Miles

Reservoir No. 1  
Area 10 1/2 Acres  
Capacity 36 Million Gallons  
Elevation of Surface 118.83'  
16" Suction pipe  
Pumping Station  
Elev. of pumps 110.32  
1 - 1 Million Gallon Worthington Compound Independent Condenser  
1 - 1 Million " " High Pressure " "  
2 Horizontal Tubular Boilers

Manville Road  
Providence and Worcester Railroad  
Manville Pond  
Part of BLACKSTONE RIVER  
Elev 55.00'  
12" Cast Iron Force Main to Tank  
Elev. 70.00'

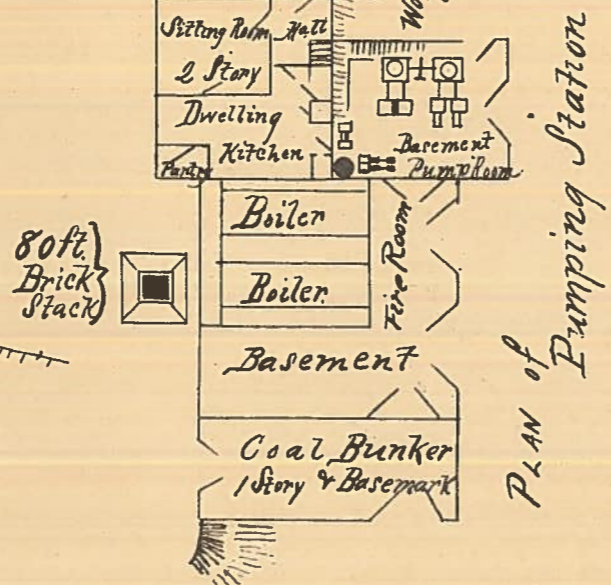
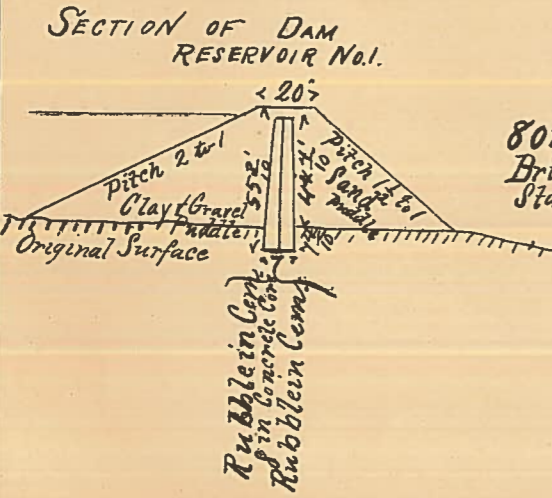
4 Blow off  
No Air Cocks  
3 Gates  
Worthington Pump  
On this line

Elev. of surface of Water in tank 89.40'  
14" Supply Main to center of Town 1 mile  
Elev. 199.50'

Bernon Dam  
Woon. Dam X  
MARKET SQUARE  
Elev. 96.70'

Woonsocket  
Hamlet Dam  
BLACKSTONE RIVER  
Elev. 65.00'

Area of thickly settled portion of town about  
1000 Acres  
There is no regular system of Sewerage



PLAN of Pumping Station

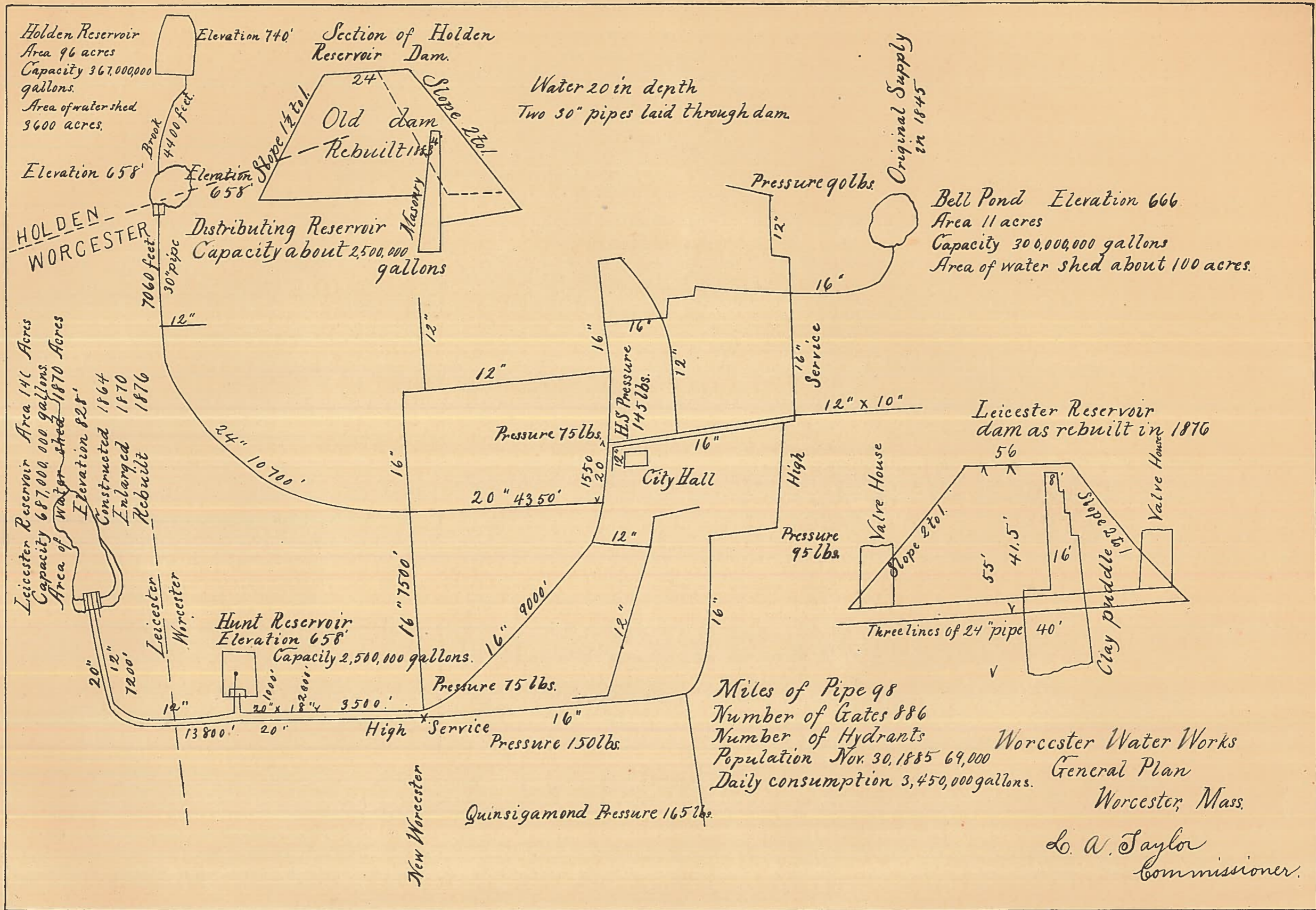


PLATE XXVI.

COMMITTEES intrusted with the erection of Public Buildings and Engineering Works should advertise for proposals in *The Engineering and Building Record*. They will thus reach Contractors in every State and Territory, likewise in Canada. The advantage of competition thus secured is obvious.

---

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THE SIXTEENTH VOLUME  
OF  
THE ENGINEERING AND BUILDING RECORD

AND  
THE SANITARY ENGINEER.

(June 4, 1887—November 26, 1887.)

Aside from the weekly record of events of special interest to Engineers, Architects, Municipal Officers, Mechanics, and Contractors, the following of the numerous special articles are mentioned as of permanent interest.

FULL-PAGE ARCHITECTURAL ILLUSTRATIONS:

Waste-weir outlet of the Kangra Tank, Ahmedabad, India.  
A mantel in the Tiffany House, designed by Louis C. Tiffany.  
Staircase, Examination Schools, Oxford, Eng., T. G. Jackson, architect.  
Denver Club House, Denver, Col., Varian & Sterner, architects.  
Metropolitan Club, Washington, D. C., Gray & Page, architects.  
New Dormitory, McCormick Theological Seminary, Chicago, A. Page Brown, architect.  
Y. M. C. A. Building and Turner Building, Newburg, N. Y., McKim, Mead & White, architects.  
Hall in Mrs. Bent's House at Longwood, Mass., E. A. P. Newcomb, architect.  
The Quadrangle of the New University Building, Edinburg, R. Rowand Anderson, LL.D., architect.  
Residence of Mr. C. W. Norton at Alston, Mass., Hartwell & Richardson, architects.  
Hanan & Son's Shoe Factory, New York, Babb, Cook & Willard, architects.  
Hall in the Tiffany House, New York, McKim, Mead & White, architects.  
Lumber Exchange at Minneapolis, Minn., Long & Kees, architects.  
Residence of William Edgar, Newport, R. I., McKim, Mead & White, architects.  
A House in Camden, N. J., Wilson Eyre, architect.  
A Manufacturing Building, H. R. Marshall, architect.  
Hotel D'Almy, Blois, France.  
A Residence in M Street, Washington.  
An Old Colonial House at Jamaica Plains, Mass.  
Residence of W. D. Sloane, Lenox, Mass., Peabody & Stearns, architects.  
A Hall in E. W. Anthony's House, E. A. P. Newcomb, architects.  
Interior of St. Etienne du Mont, Paris.  
Hotel Pourtales, Paris, France.  
Thornwall Orphanage, Clinton, S. C., A. Page Brown, architect.  
Residence of Mrs. Cowden, Far Rockaway, McKim, Mead & White, architects.  
College of Physicians and Surgeons, W. Wheeler Smith, architect.  
Beside twenty-one vignette illustrations, and several drawings of details to scale.

ARTICLES OF SPECIAL INTEREST TO ARCHITECTS:

Result of Cincinnati Architectural Competitions. Regarding the Study of Architecture; further letters on this subject.  
Description of the Children's Hospital at Walnut Hill, Cincinnati. (Three Illustrations.)  
Building Construction Details—Balloon Frames. (Two Illustrations.)  
Nautical Arena, Paris (description).  
The Hastings, St. Leonard's, and East Sussex Hospitals (descriptions and plans). (Three Illustrations.)  
Architecture of London Streets.  
Bath-House of Hospital at St. Antoine, Paris. (Two Illustrations.)  
Ready-Made Specifications (a criticism).  
Fall of an Elevator in a New York Dry-Goods House. (Illustrated.)  
Description of the Methodist General Hospital, Brooklyn. (Two Illustrations.)  
Trussed Roof over a Drill-Shed at Bury, England. (One Illustration.)  
Paris Ordinance Concerning Theatres.  
Mud Architecture in Persia.  
Dry Rot in a New York Apartment House, Fourth Avenue and Sixty-Second Street. (One Illustration.)  
Grain Elevators (Description, with seven illustrations.)  
Gettysburg Cyclorama Building (details of roof and structural iron-work). (One Illustration.)  
Paramount Requirements of a Large Opera House (paper by D. Adler, Chicago).

ENGINEERING:

Among the specially prepared articles in the series of Builders' and Contractors Engineering and Plant are:  
Traveler for erecting Kings County Elevated Railroad. (Three Illustrations.)  
Excavating apparatus used on the Tancarville Canal and Sewer. (Three Illustrations.)  
Derrick Foot Block and Sheaves at Shaft 14 on the New Croton Aqueduct. (Two Illustrations.)  
Potomac Flats Dredging Plant. (Four Illustrations.)

Tube Riveting Machine at Forth Bridge. (Two Illustrations.)  
Lockwood Dredge used on Cape Cod Ship Canal (Eight Illustrations.)  
Location of Plant at shafts on New Croton Aqueduct. (Two Illustrations.)  
Recent Water-Works Construction—East Orange and Bloomfield, N. J., Water Companies. (Three Illustrations.)  
Water-Works at Ware, Mass. (Four Illustrations.)  
Water-Works at Calais, Me. (Three Illustrations.)  
Pavements and Street Railroads—Continuation of this series, in which the question of wood pavements in London is fully discussed.  
New CPoton Aqueduct. No. XIII. Disc for Measuring Cross-section in Tunnels. (Nine Illustrations.)  
Tipple for Dumping Cars on the New Croton Aqueduct. (Six Illustrations.)  
Modern Sewage Disposal and Engineering. By E. S. Philbrick, M. Am. Soc. C. E. (Two illustrated articles.)  
Sweetwater Dam and Irrigation Experience in Southern California. (One Illustration.)  
Collapse of 75-Ton Derrick at Brooklyn Navy Yard.  
Repair and Maintenance of Roads. By W. H. Wheeler, C. E.  
Report of the Disposal of Sewage in the City of Worcester, Mass.  
Portland Cement Tests at Long Dates.  
Receiving and Catch Basins at Waterbury, Conn. (Four Illustrations.)  
Testing of Portland Cement for the Harbor Works at Calais and Boulogne. By F. Guillaud.  
Carrying Water-Mains Across the River at Ekhart, Ind. (Two Illustrations), and at Grand Rapids, Mich. (Three Illustrations.)  
Tubular Subway Under Northumberland Straits. (Two Illustrations.)  
Filtration or Subsidence. By J. D. Cook, C. E.  
Special Report of the Chicago Drainage and Water-Supply Commission.  
Driven-Well System as a Source of or Means of Obtaining a Water-Supply.  
Recent Sewer Construction. Chiswick Sewage Works. (Three Illustrations.)  
Burial of Sewage and Refuse. (Criticism on an Address by Dr. G. V. Poore, of London.)  
The Molteno Reservoir at Cape Town, Africa.  
Downfall of the Suspension Bridge over the Ostrowitz. (Two Illustrations.)  
Some Details of Water-Works Construction. By William R. Billings, C. E. (Four articles of this series, with illustrations, have appeared.)  
Accident on the New Croton Aqueduct—Collapse of Bulkhead. (Four Illustrations.)  
Preparing Refuse Stone for Concrete. (One Illustration.)  
History of the Development of the Art of Bridge Construction. By Prof. William P. Trowbridge. (Twelve Illustrations.)  
Kanawha River Improvement (description, with six illustrations.)  
Fall of a Retort-House Roof—Metropolitan Branch Consolidated Gas Company. (One Illustration.)  
Armory Roof, Buffalo—180-foot combination roof, showing scaffold used in erecting. (Two Illustrations.)  
Eads' Last Work—Letter written ten days before his death, giving details of construction regarding design of his plant. (Three Facsimile Illustrations.)  
New Water-Works Tunnel, Chicago—Abstract of specifications. (One Illustration.)  
Effect of Temperature upon Structural Iron and Steel—Paper by Joseph Ramsay, Sr.  
Description of Water-Tower at Franklin, Mass. (Four Illustrations.)  
Cape Cod Ship Canal (Description of Work).  
Manufacture of Hydraulic Cement from Blast-Furnace Slag. By J. E. Stead.  
Wreck of Seneca Falls Stand-Pipe. (Description and Four Illustrations.)  
Bursting of Little Falls Reservoir. (Description.)  
Fall of Derrick at the New Court-House, Boston, Mass. (Two Illustrations.)  
Fall of an Erecting Crane on the Union Elevated Railroad, Brooklyn, N. Y.  
Six Years' Experience with Memphis Sewers; Special Report to THE ENGINEERING AND BUILDING RECORD, by Rudolph Hering, with Editorial Comment.  
Remarkable Meeting of Headings on the New Croton Aqueduct.  
Milwaukee Double Track Draw Span, Designed by the Edge Moor Iron Co. (Two Double-page Illustrations and Description.)

Report of Tests of the Westinghouse Air-Brake at Ridgefield, N. J.

MISCELLANEOUS:

Micro-organisms in the Atmosphere.  
The Need of Hospitals for Contagious Diseases.  
Massachusetts Investigation of Water-Supply.  
London Sewage Disposal—discussion of methods.  
Wages in Great Britain—table of wages paid to the different mechanics.  
Plan to Provide Chicago with Sub-cellars, and Trifle with the Sewage Problem. (A criticism.)  
Death-Rates of Different Classes.  
Stable Floor Construction—description of constructive features in notable stables in New York and Boston. (Two Illustrations.)  
Peculiar Methods in the Distribution of the New York Croton Aqueduct Reports. (A criticism.)  
Sanitary Engineering and its Results, as Illustrated in the City of Dublin—review showing reduction of death-rate following municipal improvements.)  
Pavements from Blast-Furnace Slag.  
Specific Germs of Typhoid Fever.  
Manufacture of Salt near Middleboro.  
Lining an Aqueduct with Lead (Arcueil).  
Lessons from Recent Water Works Disasters.  
American Public Health Association and National Quarantine.

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Descriptions of Plumbing—Kitchen Boiler Arrangement—Residence of H. C. Fahnstock, Esq. (Two Illustrations.)  
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Equitable Building, New York. (Description of Plumbing. Four Illustrations.)  
Bath in the Residence of Mr. E. H. Wales. (One Illustration.)  
Comparative Value of Steam and Hot Water for Transmitting Heat and Power. Chas. E. Emery.  
Domestic Engineering—Army Mess Hall at Davids Island. (Four Illustrations.)  
Novel Pipe Joints or Couplings for Natural Gas.  
Plumbing—Hot-Water Circulation from Kitchen to Top Floor of Building.  
Foot-Vents, their Location and Termination. By Giles Smith.  
Trade Schools and Technical Education in their Relation to the Plumber of the Future.  
House Drainage Regulations of Haverhill, Mass.  
Specimens of Bad Plumbing Discovered by the New York Board of Health. (A series. Illustrated.)  
Conanicut Park Fever Outbreak.  
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Plumbing Violations. (Several Illustrations.)  
Revised Plumbing Regulations, New York Board of Health.  
The Fitting up of Hot-Water Boilers in English Plumbing Practice. (Three Articles, Illustrated.)  
Equitable Building Plan, Showing Domestic Engineering Plants, Including Boilers, Engines, Hydraulic Pumps and Elevators, Dyr Amos, Pneumatic Service, Heating Mains, Etc. (Seven articles with illustrations.)  
Plumbing in the Residence of Mr. Francis Lynde Stetson. (Three Illustrations.)  
Washington, D. C., Plumbing Regulations. (Controversy Over Them.)  
Plumbing in Residence of Mr. W. F. Weld, Brookline, Mass. (Six Illustrations.)

REPORTS, CONVENTIONS, ANNUAL MEETINGS, ETC.

American Society of Civil Engineers; American Institute of Architects; Western Association of Architects; Annual Convention of Master Plumbers; American Water-Works Association; American Association for the Advancement of Science; New England Water-Works Association.

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# IN PRESS.

## SOME DETAILS OF WATER-WORKS CONSTRUCTION.

By W. R. BILLINGS,

Superintendent of Water-Works at Taunton, Mass.

WITH

Illustrations from Sketches by the Author.

### INTRODUCTORY NOTE.

Some questions addressed to the Editor of *The Engineering and Building Record* and *The Sanitary Engineer* by persons in the employ of new water-works indicated that a short series of practical articles on the Details of Constructing a Water-Works Plant would be of value; and, at the suggestion of the Editor, the preparation of these papers was undertaken for the columns of that journal. The task has been an easy and agreeable one, and now, in a more convenient form than is afforded by the columns of the paper, these notes of actual experience are offered to the water-works fraternity, with the belief that they may be of assistance to beginners and of some interest to all.

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## WATER-WASTE PREVENTION:

Its Importance and the Evils Due to Its Neglect.

With an Account of the Methods Adopted in Various Cities in Great Britain and the United States.

By HENRY C. MEYER, Editor of THE ENGINEERING AND BUILDING RECORD.

With an Appendix.

### EXTRACT FROM PREFACE.

During the summer of 1882 the Editor of THE ENGINEERING AND BUILDING RECORD carefully investigated the methods employed in various cities in Great Britain for curtailing the waste of water without subjecting the respective communities to either inconvenience or a limited allowance. The results of this investigation appeared in a series of articles entitled "New York's Water-Supply," the purpose being to present to the readers of THE ENGINEERING AND BUILDING RECORD such facts as would stimulate public sentiment in support of the enforcement of measures tending to prevent the excessive waste of water so prevalent in American cities, and especially the city of New York, which was then suffering from a short supply. Numerous requests for information, together with the recent popular agitation in connection with a proposition to increase the powers of the Water Department of New York City with a view to enabling it to restrict the waste of water, have suggested the desirability of reprinting these articles in a more convenient and accessible form, with data giving the results of efforts in this direction in American cities since the articles first appeared, so far as they have come to the author's notice.

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