

years, and the price per hydrant, \$50. The franchise is owned by the Eufaula Water Co.; President, S. H. DENT; Secretary and Treasurer, E. B. YOUNG; Superintendent, R. H. WALKER. The present population is estimated at 5,000.

Montgomery, Ala.—During the year about 5 miles extension has been added to the original system. The works were designed by A. H. HOWLAND, and W. F. ELLIS was Constructing Engineer; the contractors were A. H. HOWLAND and associates. The franchise is for 20 years, and the price per hydrant \$55. The franchise is owned by the Capital City Water Co.; President, J. W. DIMMICK; Superintendent, W. F. ELLIS, Jr. The present population is estimated at 35,000.

Ann Arbor, Mich.—The works were commenced in 1885 and completed in 1886; they were designed by CHAS. E. GREENE, who also acted as Constructing Engineer. The reservoir is 175 ft. above the city. The franchise is for 20 years, and the price per hydrant is \$45 for the first 100, and \$40 beyond that number. The supply is drawn from springs and pumped to the reservoir. There are 20 miles of pipe, 105 hydrants, 890 taps and 2 meters; the mains are of cast-iron and the services galvanized iron. The pressure is 70 lbs. The cost was \$215,000; debt, \$150,000; rate of interest, 6 per cent.; the public revenue is \$4,775 and the private revenue is stated to be satisfactory. The franchise is owned by the Ann Arbor Water Co.; President and Superintendent, ALEX. W. HAMILTON; Secretary, C. E. HISCOCK. The present population is estimated at 10,000.

TO BE CONTINUED.

Report on the Water Works at Dover, N. H.

Mr. PERCY M. BLAKE, Civil Engineer, of Hyde Park, Mass., has submitted to the Mayor of Dover, N. H., his report on the sources of water supply available for the city and the cost of the several plans for water-works shown by investigation to be practicable.

As regards the present water supply it is stated that a considerable portion of the city on the east side of the river is supplied with water from springs in Page's meadow by the Dover Landing Aqueduct Co., organized in 1826. This company supplies water for fire purposes to 4 public reservoirs, has about 200 consumers and collects an annual income of about \$2,000. There are about 3 miles of street mains but no fire hydrants. All the water from this source passes at one point through a 6-in. pipe, at which point the maximum delivery under full head is 290 galls. per min. The well is 69.4 ft. above the street level at the City Hall. The Cocheco Aqueduct Association, organized in 1832, supplies the remaining portion of the city on the east side of the river from springs, with a supplementary supply from Willand pond. The well is about 100 ft. above the street level at the City Hall. The company has 13.125 miles of pipe, including 1, 1½, 2, 3, 4, 6 and 8-in. cast-iron pipe, 6-in. wrought-iron, cement lined, and 2, 3 and 4-in. wooden log lines; there are 63 gates, 2-in. to 8-in.; 12 public reservoirs are supplied without charge. The company has about 600 consumers, and collects an annual income of about \$11,000. The Dover Aqueduct Co. furnishes a supply from springs to the part of the city on the west side of the river, with a supplementary supply from Barbadoes pond which can be increased when necessary by a pumping engine with a capacity of 90 galls. per minute. The main well is about 66 ft. above the street level at the City Hall. All the water passes through two pipes 4 and 6 ins. diameter, with a maximum aggregate delivery of 350 galls. per minute. There are about 5 miles of street mains, 2 small distributing reservoirs and 4 public reservoirs, no fire hydrants. The company has about 400 consumers and an annual income of about \$4,000. In addition to the water supply for fire purposes furnished by these companies there is a reservoir of about 200,000 galls. capacity, about 93 ft. above the street at the City Hall, with a 6-in. pipe; and a spring basin which supplies water by gravity, with a light head.

The present population is about 14,500. To supply water to a city of this size, with suitable pressure at all points, not less than 1,000,000 galls. per day must be provided, or 1,333,000 for a population of 20,000. An ordinary 1½ in. fire stream, thrown from a hydrant under a static head of 200 ft., will discharge nearly 250 galls. per minute; ten such streams would, of course, require a continuous supply of 2,500 galls. per minute under the necessary pressure, and this capacity of fire streams, without the assistance of fire engines, is the least that should be provided for Dover. Seven sources of supply were considered; Bellamy river, Barbadoes pond and Kelley's springs, Cocheco river, Blackwater brook, springs in Page's meadow, springs of the Cocheco Aqueduct Association, Willand Pond. All of these are considered in the report, and the latter is recommended.

The plan proposed provides for a pumping station and receiving basin in Page's meadow, the spring water to be used for the engine. A 12-in. conduit is to be laid from the basin to the springs of the Cocheco Aqueduct Association, where a well would be constructed and carried down below the level at which surface water can infiltrate; the present connection of the Cocheco company with Willand pond can be utilized. This arrangement, which would be very economical in cost of construction, would give a supply of about 1,500,000 galls. per day. From the pumping station a 14-in. main would lead to a 16-in. rising main laid up Garrison hill to a distributing reservoir, built of earth (largely in excavation) lined with puddle, and having a concrete floor and granite block paving on the slopes. One 16-in. main would connect the reservoir with the rest of the system. The cost of construction of this plan would be \$150,000.

The delivering capacity of the pipe system would be 12 fire streams simultaneously to a height of 85 ft. in the elevated part of the city, or 130 ft. at the City Hall. The work to include cast-iron street mains; stop gates and non-freezing, double nozzle, post hydrants. The annual cost of maintenance is estimated at \$17,500, and the guaranteed annual income at \$17,000, the deficiency being more than met by increased water rates from new consumers the first year; the guaranteed income results from the purchase of the works of the three existing companies. The system as proposed would be sufficient for a population of 25,000, and an additional supply can be obtained, when needed.

The engineer's estimate is as follows:

DISTRIBUTION PIPING.		lbs.
16-in.,	6,160 ft. at 130 lbs.	800,800
14-in.,	1,300 ft. at 115 lbs.	149,500
10-in.,	5,788 ft. at 65 lbs.	376,220
8-in.,	30,024 ft. at 45 lbs.	1,351,080
6-in.,	54,024 ft. at 30 lbs.	1,620,720
4-in.,	9,154 ft. at 20 lbs.	183,080
106,450 ft.		4,481,400

COST OF LAYING.		
6,160 ft. at 40 cts.		\$2,464.00
1,300 ft. at 37 cts.		481.00
5,788 ft. at 30 cts.		1,736.40
30,024 ft. at 28 cts.		8,406.72
54,024 ft. at 25 cts.		13,506.00
9,154 ft. at 20 cts.		1,830.80
		\$28,424.92

4,481,400 lbs. = 2,000.7 tons:		
Say 2,020 tons, at \$35.		70,700.00
85 tons of special castings, at \$60.		5,100.00
205 gates and boxes.		5,800.00
125 hydrants, at \$32.		4,000.00
Total cost of distribution.		114,024.92

PUMPING STATION, ETC.		
Engine house.		7,000.00
Engine and boilers.		11,000.00
Lower collecting gallery.		6,000.00
Receiving basin.		9,500.00
12-in. conduit, 3,660 ft.		7,320.00
Upper collecting gallery.		6,000.00
Valves and connections.		1,200.00

RESERVOIR ON GARRISON HILL.		
Capacity, 2,000,000 galls.		15,000.00
Force mains.		3,000.00
Total cost.		\$180,044.92

CONSTRUCTION NEWS.

Water.

The Rochester Superheated Water Co. has been incorporated at Rochester, N. Y., by T. N. VAIL, Boston, Mass.; RICHARD A. ELMER, New York; MARSEUS H. BRIGGS, of Rochester, and others. The capital stock is \$150,000.

The West Depere Artesian Water Supply Co. has been incorporated at West Depere, Wis., with a capital stock of \$4,000. The contract for a well has been let to Gray Bros., of Milwaukee, Wis., who will commence work at once.

The Pacific Sewerage Co. has been incorporated in Colorado, with office at Denver, by A. M. JORDAN, of Atlantic City, and W. S. SNYDER and A. C. CHAMBER, of Philadelphia. The company has been organized for the purpose of introducing the West system of sewerage and water filtering.

Water Waste at Toronto.—The Toronto Globe says that the agitation of the water question, and the adoption of a system of inspection has had the effect of reducing the waste probably 2,500,000 galls. per day. Tests made in September showed that about 6,000,000 galls. per day were running to waste, and it was then predicted by Aldermen Rogers that from 3,000,000 to 5,000,000 galls. of this amount could be prevented.

Columbia, S. C.—The Water-Works Committee has reported to the City Council in favor of the construction of an additional reservoir near the present one, at a cost of about \$12,000; also for the putting in of additional pumping plant. It is desired to try the effect of

these recommendations before filters are put in, but if pure water cannot thus be obtained, filters can be put in for \$2,500. The report has been adopted and the committee authorized to undertake the work at once.

The Newark Intercepting Sewer.—The intercepting sewer at Newark, N. J., was formally turned over to the city on Nov. 1, by Chief Engineer SCHAEFFER, and is now under the control of the Sewer Committee. The sewer and pumping station were inspected, and speeches were made by engineers SCHAEFFER and FELLY, among others. The sewer is 14,500 ft. long, 3 ft. diameter at one end and 6 ft. 6 ins. at the pumping station. The total cost was about \$600,000.

Water Famine.—Reports from Fort Wayne, Ind., state that a water famine is imminent; owing to the long drought the water in the reservoir as well as the small streams that feed it has become so low that the elevators, in the hotels, etc., cannot be worked and the electric light company cannot obtain a sufficient supply for the boilers.—At Angus, Ia., there is an alarming scarcity of water, owing, it is said, to the mines which underlie the town having drained the water from the sand stratum above the coal.

Water Meters.—At St. Louis, Mo., parties who wanted to reduce the cost of their water supply had meters put in; they are now having them removed as they find it costs more to pay by the gallon than by the year.

Irrigation.—The Porter Ditch & Irrigation Co. has been incorporated at Denver, Col., by J. S. PORTER, W. E. TRYON and others. Capital stock, \$3,600.—The Mohawk Canal Co., of Yuma, Ariz., will excavate 20 miles of canal; the work to be completed in December, 1888. GEO. W. NORTON is Engineer.—The North Star Land & Canal Co., has been incorporated at Del Norte, Col., to take water from the Rio Grande, 7 miles below the city.

New Water-Works.—Vermont.—Woodstock. The Woodstock Aqueduct Co. has completed its works; the reservoir is 2 miles from the village, and has a capacity of 2,500,000 galls. A hydrant test resulted satisfactorily.

New Hampshire.—Dover. The water-works question will be voted on Nov. 30.

Massachusetts.—Beverly. A test of the new water supply was made Nov. 17 by the fire department.—North Easton. The works are being pushed to completion. The stand-pipe will be 104 ft. high, and 196 ft. above the village. The well will yield 1,000 galls. per minute.

Connecticut.—Windsor Locks. The Windsor Locks Water Co. will begin work in the spring. The cost of reservoir and pipe laying will be about \$15,000.

New Jersey.—Kearny. Water has been turned on in the lower part of the township. The entire system will be completed by January.

Ohio.—Gallipolis. A system of water-works is wanted but the town is not willing to pay a large amount.

Virginia.—Portsmouth. The Portsmouth & Suffolk Water Co. will complete its works at once.

Kentucky.—Central City. Water-works are contemplated. Address the Central Coal & Iron Co.

South Carolina.—Columbia. A new reservoir will be built, and a new pump with a daily capacity of 1,500,000 galls. put in.

Florida.—Sanford. The Sanford Water Co. will improve its works.—Gainesville. Water-works are contemplated.

Alabama.—Decatur. The Decatur Water Co. will hold a meeting Nov. 30 to consider the question of borrowing money to build the works. JOHN D. ROQUEMORE is President.

Michigan.—Sturgis. A system of water-works is to be established.

Illinois.—Carlyle. The City Council has not yet accepted the water-works, but is waiting for a satisfactory test.—Hillsboro. A water-works committee has been appointed and an engineer will be employed to prepare plans and superintend the construction of the proposed works.

Minnesota.—Pipestone. The city has voted 117 to 54 in favor of issuing \$20,000 bonds for water-works. The contract has been let to a Dubuque firm and work will be commenced at once.

Dakota.—Salem. A system of water-works is to be established.

Idaho.—Bellevue. The water-works have been completed. The total cost was about \$15,000.

Montana.—Fort Benton. Water-works are to be constructed. For particulars address the Water Commissioners.

Texas.—Terrell. The well for the water-works will soon be completed.—Gainesville. An artesian well will be put down by Bell & Myers.—Bonham. The City Council has determined upon a complete system of water-works and the officials have been inspecting the works of other cities. Action will probably be taken shortly.

Arizona.—Phoenix. The City Council has granted a franchise for water-works to J. J. Gardiner.