Council Chamber, Ann Arbor, Mich., Jan. 15th, 1912. Regular Session.

Meeting called to order by Pres. Mills. Present: Pres. Mills, Ald. Schmid, Murray, Hochrein, Sweet, Koernke, Pipp, Sherk, Goodyear, Ramsay, Lutz, Lindenschmitt, 12. Absent: Ald. Flynn, Manwaring, 2. Minutes of previous meeting approved.

Communications.

Jan. 15th, 1912.

The Honorable Common Council of the city of Ann Arbor: Gentlemen—I herewith tender my resignation as sexton of Fair View cemetery, taking effect immediately.

Respectfully submitted, Matthew Luippold.

Moved by Ald. Sherk, that the matter be referred to the Cemetery Committee. Adopted.

Communication from Mrs. S. L. Kramer, relative to slush on sidewalks and violation of other laws, received and ordered on file.

From Board of Public Works.

Annual Report of the City Engineer:

To the Board of Public Works—Cost of Paving:

DISTRICT NO. 16.

Ann Arbor, Mich., Dec. 20, 1911.

Hon. Board of Public Works, Wirt Cornwell, Pres.: Gentlemen—I herewith submit the following statement of the cost of paving Washtenaw av. from E. University av. to Oxford road:

Labor	$ 3,860.49
$2,051.00; 75 loads at $1.10, $82.50	2,133.50
Gravel, 2,051 loads, at $1.00	
Cement, 2,835.5 bbls., at $1.05	2,977.27
Curbing, 6,710 ft., at $0.22	1,476.16
Bitumen used in 1910, 439 gal., at $0.03, $13.17; gravel for top in 1910, 14 loads, at $1.00, $14	27.17
Bitumen used in 1911, 4,695 gal., at $0.08	375.60
Gravel for top in 1911, at $0.005 per square yard	52.16
City team	97.50
Water from A. A. Water Co	136.10
Stakes	12.10
Demurrage and rental of tank cars	15.73
Superintendence and tools on 12,092 square yards at $0.10	1,209.20
Supplies—	
Muehlig & Schmid	3.75
C. L. Pray	2.27
M. Staebler & Son, coal	26.25
Luick Bros., lumber and mill work	37.07
Dean & Co., gasoline	4.43
C. Schlenker, oil, etc	4.68
Benz Bros., supplies	6.20
Fischer Hdw. Co	1.20
O. F. Blaess, coal	13.00
Lamb & Spencer, coal oil	3.00
Total	$12,474.83
Credit by work for private corporations—	
A. A. Water Co	$12.76
Michigan State Tel. Co	35.00
Home Tel. Co	8.00
Total	$55.76
Driveways and curb for private parties	$26.26
Total credit	$82.02
Less credit	$82.02
Total cost of improvement	$12,392.81

Respectfully, E. W. GROVES, City Engineer.

Ann Arbor, Mich., Dec 20, 1911.

Hon. Board of Public Works, Wirt Cornwell, Pres.: Gentlemen—I herewith submit the following statement of the distribution of the cost of paving Washtenaw av. from E. University av. to Oxford road:

The city to pay for—

2,259 sq. yds. in intersections, at $0.902	$2,037.62
726 lin. ft. of curb, at $0.22	159.72
Total	$2,197.34
20 per cent of the remainder	2,039.09
Total for city to pay	$4,236.43
Total for property to pay	$8,156.38

Respectfully, E. W. GROVES, City Engineer.

DISTRICT NO. 17.

Ann Arbor, Mich., Dec. 20, 1911.

Hon. Board of Public Works, Wirt Cornwell, Pres.: Gentlemen—I herewith submit the following statement of the cost of paving State st. from Packard st. to Arch st.:

Labor	$ 830.17
Gravel, 426 loads, at $1.00	426.00
Cement, 679.4 bbls., at $1.05	713.37
Curb, 1,272 ft., at $0.22	279.84
Bitumen, 1,164 gal., at $0.08	93.14
Gravel, for top, at $0.005 per square yard	12.94
City team	15.00
Water from A. A. Water Co	29.11
Stakes	2.58
Demurrage and rental of tank cars	3.36
Superintendence and tools on 2,587 square yards, at $0.10	258.70
Supplies—	
M. Staebler & Son, coal	1.50
Fischer & Finnell, coal oil	1.14
J. C. Fischer & Co., hardware	4.26
Dean & Co., gasoline	5.57
Benz Bros.	3.00
Luick Bros. & Co., lumber	8.20
Total	$2,687.88
Credit by work for public service corporations	$ 4.50
Pavement and curb for private parties	10.89
Less credit	15.39
Total credit	$15.39
Total cost of improvement	$2,672.49

Respectfully, E. W. GROVES, City Engineer.

Ann Arbor, Mich., Dec. 29, 1911.

Hon. Board of Public Works, Wirt Cornwell, Pres.: Gentlemen—I herewith submit the following statement of the distribution of the cost of paving State st. from Packard st. to Arch st.:

City to pay for—

355 sq. yds. pavement in intersections, at $0.92 ..... $326.60
101 lin. ft. of curb, at $0.22 ..... 22.22

Total $348.82
20 per cent of the remainder $464.73

Total for the city to pay $813.55
Total for the property to pay ... $1,858.94

Respectfully, E. W. GROVES, City Engineer.

DISTRICT NO. 18.

Ann Arbor, Mich., Dec. 20, 1911.

Hon. Board of Public Works, Wirt Cornwell, Pres.: Gentlemen—I herewith submit the following statement of the cost of paving S. Main and Packard sts., from William st. to Granger av.:

Labor	$ 8,734.49
Gravel (local)	3,007.00
Gravel shipped from Chilson	345.94
Freight on same	274.74
Demurrage on cars	29.00
Cement, 5,193.5 bbls., at $1.05	5,453.67
Curb, 12,872.6 lin. ft., at $0.22	2,831.97
Bitumen, 9,696.6 gal., at $0.08	775.73
Gravel for top at $0.005 per sq. yd.	107.74
City team	173.50
Water from A. A. Water Co.	242.23
Stakes	21.54
Demurrage and rental of tank cars	28.01
Superintendence and tools on 21,548 sq. yds. at $0.10	2,154.80
Supplies—	
M. Staebler & Sons, coal	31.00
W. H. L. Rohde, coal	20.13
C. L. Pray, coal oil	2.10
C. Schlenker, machine oil	3.15
Fischer & Finnell, coal oil	15.28
J. C. Fischer, machine oil	4.50
Dean & Co., gasoline	5.00
Benz Bros., plow points, etc	30.75
Luick Bros. & Co., lumber and mill work	67.29
O. F. Blaess, coal	17.50
C. H. Heck & Son, coal	19.46
Total	$24,396.52
Credit to District No. 18—	
Work for public service corporations	$ 46.00
Curb and driveways for individuals	329.29
Six-inch strip of concrete along either side of D. J. & C. ry. track, amounting to 722.0 sq. yds., at $0.9767	705.18
Excavation for D. J. & C. ry.	144.00
Total credit to Dist. No. 18	$1,224.47
Less total credit	$23,172.05

The above figure being the total cost charged to Paving Dist. No. 18.

Respectfully, E. W. GROVES, City Engineer.

Ann Arbor, Mich., Dec. 20, 1911.

Hon. Board of Public Works, Wirt Cornwell, Pres.: Gentlemen—I herewith submit the following statement of the distribution of the cost of paving S. Main and Packard sts. from William st. to Granger av.:

City to pay for—

4,275.0 sq. yds. in intersections at $0.9767	$ 4,175.49
1,484.0 lin. ft. of curb, at $0.22	326.48
Total	$ 4,501.97
20 per cent of the remainder	3,734.02
City to pay	$ 8,235.99
Total for property to pay	$14,936.06

The city is also charged with—

Putting in brick outside of rails	$1,689.48
Six-inch strip of concrete on either side of rail for total length of pavement	705.18
Excavation for D. J. & C. ry.	144.00
Total	$2,538.66

The above amount to be collected from the D. J. & C. Ry. Co.

Respectfully, E. W. GROVES, City Engineer.

DISTRICT NO. 19.

Ann Arbor, Mich., Dec. 20, 1911.

Hon. Board of Public Works, Wirt Cornwell, Pres.: Gentlemen—I herewith submit the following statement of the cost of paving N. Main st. from Catherine st. to the north line of the Boland property:

Labor	$ 3,817.36
Gravel, 1,737 loads, at $1.00	1,737.00
Cement, 2,681.75 bbls., at $1.05	2,815.84
Curb, 4,943.0 lin. ft., at $0.22	1,087.46
Bitumen, 4,552.6 gal., at $0.08	364.21
Gravel for top at $0.005 per sq. yd.	50.58
City team	80.00
Water from A. A. Water Co.	113.80
Stakes	10.12
Demurrage and rental of tank cars	13.15
Superintendence and tools on 10,117 sq. yds., at $0.10	1,011.70
Supplies—	
Tar from A. A. Gas Co., 515 gal., at $0.05	25.75
M. Staebler & Son, coal	37.65
C. L. Pray, coal oil	6.00
J. C. Fischer, machine oil	2.50
Dean & Co., gasoline	2.94
C. Schlenker, machine oil	1.20
Benz Bros.	12.95
Luick Bros., lumber and mill work	24.22
Total	$11,214.43
Credit by work for public service corporations	$14.00
Credit by driveways and curb for private parties	89.57
Total credit	$103.57
Less credit	103.57
Total cost of improvement	$11,110.86

Respectfully, E. W. GROVES, City Engineer.

Ann Arbor, Mich., Dec. 20, 1911.

Hon. Board of Public Works, Wirt Cornwell, Pres.: Gentlemen—I herewith submit the following statement of the distribution of the cost of paving N. Main st. from Catherine st. to the north line of the Boland property:

City to pay for—

1,142 sq. yds. in intersections, at $0.9907	$1,131.38
382 lin. ft. of curb, at $0.22	84.04
Total	$1,215.42
20 per cent of the remainder	1,979.09
Total for city to pay	$3,194.51
Total for property to pay	$7,916.35

Respectfully, E. W. GROVES, City Engineer.

DISTRICT NO. 21.

Ann Arbor, Mich., Dec. 20, 1911.

Hon. Board of Public Works, Wirt Cornwell, Pres.: Gentlemen—I herewith submit the following statement of the cost of paving Fifth av. from Packard st. to Detroit st.:

Labor	$ 3,889.74
Gravel, 1,745 loads, at $1.00	1,745.00
Cement, 3,009.6 bbls., at $1.05	3,160.08
Curb, 5,368.0 lin. ft., at $0.22	1,180.96
Bitumen, 4,717.35 gal., at $0.08	377.39
235.00 gal. asphalt, at $0.18	42.30
Gravel for top, at $0.005 per sq. yd.	52.41
(Includes $16.50 for gravel from Neithammer.)	
City team	77.00
Water from A. A. Water Co.	115.26
Stakes	10.48
Demurrage and rental of tank cars	13.63
Superintendence and tools on 10,483.00 sq. yds., at $0.10	1,048.30
Extra work on curb	13.90
Supplies—	
M. Staebler & Son, coal	13.25
A. A. Garage, packing, etc.	2.54
C. L. Pray, coal oil	3.90
J. C. Fischer	10.58
Dean & Co., gasoline	13.77
Benz Bros	15.15
Luick Bros. & Co., lumber	22.37
Total	$11,808.01
Credit to Dist. No. 21—	
Work for public service corporations	$ 15.50
Driveways and curb for individuals	114.20
Total credit	$129.70
Less total credit	$129.70
Total cost of improvement	$11,678.31

Respectfully, E. W. GROVES, City Engineer.

Ann Arbor, Mich., Dec. 20, 1911.

Hon. Board of Public Works, Wirt Cornwell, Pres.: Gentlemen—I herewith submit the following statement of the distribution of the cost of paving Fifth av. from Packard st. to Detroit st.:

City to pay for—	
902.0 sq. yds. in intersections, at $1.00	$ 902.00
303.0 lin. ft. of curb, at $0.22	66.66
Total	$ 968.66
20 per cent of the remainder	$2,141.93
Total for city to pay	$3,110.59
Total for property to pay	$8,567.72

Respectfully, E. W. GROVES, City Engineer.

DISTRICT NO. 22.

Ann Arbor, Mich., Dec. 20, 1911.

Hon. Board of Public Works, Wirt Cornwell, Pres.: Gentlemen—I herewith submit the following statement of the cost of paving the alley in B 1 N., R. 5 E. (back of Y. M. C. A. building.)

Labor, including bill of C. B. Gass	$ 99.33
Gravel, 45 loads, at $1.00	45.00
Cement, 78.5 bbls., at $1.05	82.43
Bitumen, 132 gal., at $0.08	10.56
Gravel for top at $0.005 per sq. yd.	1.46
City team	2.25
Water from A. A. Water Co.	3.30
Demurrage and rental of tank cars	.38
Superintendence and tools on 293 sq. yds. at $0.10	29.30
Luick Bros. & Co., lumber	8.43
81.0 ft. of sewer extensions, at $0.40	32.40
Total cost of improvement	$314.84

There being no intersections all of the above is to be charged to the property.

Respectfully, E. W. GROVES, City Engineer.

PAVING DISTRICT NO. 23.

Ann Arbor, Mich., Dec. 20, 1911.

Hon. Board of Public Works, Wirt Cornwell, Pres.: Gentlemen—I herewith submit the following statement of the cost of paving the alley in B. 3 S., R. 4 E.:

Labor	$ 404.24
(Includes bill of C. M. Thompson.)	
Gravel, 159.0 loads at $1.00	159.00
Cement, 188.0 bbls., at $1.05	197.40
Bitumen, 414.0 gal., at $0.08	33.12
Gravel for top, at $0.005 per sq. yd.	4.60
City team	4.50
Water from A. A. Water Co.	10.37
281.0 ft. of sewer extensions, at $0.40	112.40
Demurrage and rental of tank cars	6.20
Superintendence and tools on 920 sq. yds., at $0.10	92.00
Supplies—	
Benz Bros	1.50
Luick Bros. & Co., lumber	12.55
Total	$1,032.88
Credit by work for public service corporations	3.50
Total cost of improvement	$1,029.38

Respectfully, E. W. GROVES, City Engineer.

PAVING DISTRICT NO. 24.

Ann Arbor, Mich., Dec. 20, 1911.

Hon. Board of Public Works, Wirt Cornwell, Pres.: Gentlemen—I herewith submit the following statement of the cost of paving Arch st. from Packard st. to State st. and its intersection with Thayer (now White) st.:

Labor	$ 494.82
Gravel, 269 loads, at $1.00	269.00
One car gravel from Chilson	23.15
Cement, 423.75 bbls., at $1.05	444.94
Curb, 915.0 lin. ft., at $0.22	201.30
Bitumen, 825.0 gal., at $0.08	66.00
Gravel for top at $0.005 per sq. yd.	9.16
City team	12.00
Water from A. A. Water Co.	202.62
Stakes	1.83
Demurrage and rental of tank cars	2.38
Superintendence and tools on 1,833.0 sq. yds., at $0.10	183.30
Supplies—	
Staebler & Son, coal	2.75
J. C. Fischer, oil	.90
Luick Bros. & Co., lumber and mill work	16.70
Total	$1,748.85
Credit by work for public service	

corporations 1.50

Total cost of improvement $1,747.35
Respectfully, E. W. GROVES, City Engineer.

Ann Arbor, Mich., Dec. 20, 1911.

Hon. Board of Public Works, Wirt Cornwell, Pres.: Gentlemen—I herewith submit the following statement of the distribution of the cost of paving Arch st. from Packard st. to State st., and its intersection with Thayer (now White) st.:

City to pay for—
519.0 sq. yds. in intersection, at $0.8434 .....$437.72
161.0 lin. ft. of curb, at $0.22 ..... 35.42

Total $473.14
20 per cent of the remainder 254.84

Total for city to pay $727.98
Total for property to pay $1,019.37
Respectfully, E. W. GROVES, City Engineer.

PAVING DISTRICT NO. 25.

Ann Arbor, Mich., Dec. 20, 1911.

Hon. Board of Public Works, Wirt Cornwell, Pres.: Gentlemen—I herewith submit the following statement of the cost of paving S. State st., from Monroe st. to Packard st.:

Labor .....$ 993.42
Gravel, 468 loads, at $1.00 ..... 468.00
59 lds. gravel hauled by city, at $0.20 11.80
Cement, 816.4 bbls., at $1.05 .... 857.22
Curb, 1,631.0 lin. ft., at $0.22..... 358.82
Bitumen, 1,421.1 gal., at $0.08 .... 113.69
Gravel for top, at $0.005 per sq. yd. 15.79
City team 15.00
Water from A. A. Water Co. 35.52
Stakes 3.16
Demurrage and rental of tank cars 4.10
Superintendence and tools on 3,158.0 sq. yds., at $0.10 ..... 315.80
Supplies—
M. Staebler & Son, coal 8.25
W. H. L. Rohde, coal 2.25
J. C. Fischer, oil ..... .90
Fischer & Finnell, coal oil 1.20
Benz Bros., plow points 3.00
Luick Bros. & Co., lumber and mill work 24.62

Total $3,232.54
Credit to District No. 25—
By work for public service corporations .....$ 4.50
Driveways and curb for individuals 46.47

Total credit to Dist. No. 25.....$ 50.97
Less credit 50.97

Total cost of improvement $3,181.57
Respectfully, E. W. GROVES, City Engineer.

Ann Arbor, Mich., Dec. 20, 1911.

Hon. Board of Public Works, Wirt Cornwell, Pres.: Gentlemen—I herewith submit the following statement of the distribution of the cost of paving S. State st. from Monroe st. to Packard st.:

City to pay for—
424.0 sq. yds. in intersections, at $0.2940 ..... $[illegible]
147.0 lin. ft. of curb, at $0.22..... 32.34

Total $411.40
20 per cent of the remainder $554.03

Total for city to pay $965.43
Total for property to pay $2,216.14
Respectfully, E. W. GROVES, City Engineer.

STATEMENT OF STREET PAVEMENT LAID IN CITY OF ANN ARBOR DURING THE YEAR 1911—

Streets upon which pavement was laid.	Dist. No.	Width of Pav.	Kind	No. sq. yds. of concrete	Cost of excavation	Lin. ft. of curb	Tot. cost of pavement	To be paid by city	To be paid by property	Cost per sq. yd. for pavem't only.
Washtenaw Ave.	16	34	Dolarway	12,092	$1,516.87	6,710.0	$12,392.81	$4,236.43	$8,156.38	$0.7773
State, Packard to Arch	17	34	Dolarway	2,587	211.78	1,272.0	2,672.49	813.55	1,858.94	0.8430
S. Main & Packard sts.	18	34	Dolarway	20,826	4,317.78	12,872.6	23,172.05	8,235.99	14,936.06	0.7760
N. Main st.....	19	34	Dolarway	10,117	1,764.06	4,943.0	11,110.86	3,194.51	[illegible]	0.8163
Hill & Oswego	20	24	Dolarway	1,780			Not Completed.			
Fifth Ave.	21	34	Dolarway	10,483	1,685.61	5,368	11,678.31	3,110.59	8,567.72	0.8405
Alley, B 1 N. R. 4 E..	22	10	Dolarway	293	37.04	.....	314.84	.....	314.84	0.8375
Alley, B. 3 S. R. 3 E..	23	16	Dolarway	920	210.75	.....	1,029.38	.....	1,029.38	0.7676
Arch & Thayer	24	30	Dolarway	1,833	138.45	915	1,747.35	727.98	1,019.37	0.7679
State, Monroe to Pack.	25	34	Dolarway	3,158	342.86	1,631	3,181.57	965.43	2,216.14	0.7824

Note—Each district is charged ten cents per sq. yd. for superintendence and tools.

The following statement shows the cost of the sanitary sewer system up to date:

Main sewer $41,252.83
District No. 1 ..... 3,954.44

District No. 2	6,831.09
Dist. No. 3	27,912.80
Dist. No. 4	4,303.19
District No. 5	8,454.98
District No. 6	12,587.00
District No. 7	1,887.84
District No. 8	527.43
District No. 9	2,163.46
District No. 10	1,541.47
District No. 11	1,169.51
District No. 12	2,083.02
District No. 13	5,024.40
District No. 14	2,322.48
District No. 15	1,735.64
District No. 16	1,265.58
District No. 17	590.84
District No. 18	4,111.52
District No. 19	574.76
District No. 20	2,147.27
District No. 21	1,067.92
District No. 22	2,369.03
District No. 23	250.00
District No. 24	1,530.70
District No. 25	2,186.67
District No. 26	4,989.01
District No. 27	8,035.98
District No. 28	1,895.50
District No. 29	632.31
District No. 30	1,149.36
District No. 31	943.60
District No. 32	2,229.03
District No. 33	513.49
District No. 34	6,300.06
District No. 35	240.69
District No. 36	741.30
District No. 37	911.39
District No. 38	1,037.00
District No. 39	815.93
District No. 40	667.77
District No. 41	3,229.79
District No. 42	680.14
District No. 43	646.55
District No. 44	204.26
District No. 45	247.32
District No. 46	538.53
District No. 47	532.71
Total	$177,026.59

Statement of the cost of storm water sewers built since 1888:

Cost of storm water sewers built prior to 1900	$26,411.72
Cost of storm water sewer on State st.	1,667.22
Cost of storm water sewer on Ann st.	543.95
Cost of storm water sewer on N. University av.	361.00
Cost of storm water sewer on E. William st.	3,014.67
Cost of storm water sewer on Roosevelt av.	1,710.41
Cost of storm water sewer on E. Washington st.	4,111.52
Cost of storm water sewer on Hill st. and Washtenaw av.	653.90
Cost of storm water sewer on Washington st.	536.37
Cost of storm water sewer on Ann st. and alley, B 1 N, R 4 E.	443.14
Cost of storm water sewer on alley, B 3 S, R 3 E.	250.92
Cost of storm water sewer on Hill st. (Oxford to Cambridge)	116.87
Cost of storm water sewer on Packard (Hill to Monroe)	868.97
Cost of storm water sewer on Hill st. (Cambridge to Oswego)	324.60
Cost of storm water sewer on N. Main st.	207.47
Cost of storm water sewer on Mary and Benjamin	860.98
Cost of storm water sewer on Church (Washtenaw to S. U.)	1,291.44
Cost of other storm water sewer work, including the sewer on Packard at Dewey av., due to pavements	1,552.01
Total	$44,927.16

The following statement shows approximately the total amount spent on public improvements since 1894:

For storm water sewers	$ 44,927.16
For sanitary sewers	177,026.59
For pavements	252,423.51
Total	$474,377.26

STATEMENT OF SEWERS BUILT BY CONTRACT

Streets upon which sewers were built.	District	Size of Sewers. 4-inch.	8-inch	12-inch	15-inch	18-inch	Manholes	Flush Tanks	House branches.	Inlets	Depth 0 to 6 ft.
N. Main st.	42	230	651	.....	.....	.....	2	1	17	.....	584
N. Fourth ave.	43	...	869	.....	.....	.....	2	1	31	.....	270
Depot st.	44	...	334.6	.....	.....	.....	.	1	9	.....	352.6
McKinley ave.	45	...	344.6	.....	.....	.....	1	1	18	.....	380.6
Olivia av. & Minerva rd.	46	...	733.1	.....	.....	.....	2	1	29	.....	115.6
E. Ann st.	47	...	655.2	.....	.....	.....	1	1	28	.....	.....
Church st.		...	.....	442.3	.....	920.6	2	.	..	10	617.6
STATEMENT OF STORM WATER SEWER BU											
Benjamin & Mary sts.		...	.....	760.0	715.0	.....	4	.	..	14	1485.0
Totals		230	3587.5	1202.3	715.0	920.6	14	6	132	24	3807.9

For other storm water sewers built by city, see Street Commissioner's Report.

SUMMARY OF PAVEMENTS IN THE CITY OF ANN ARBOR.

Street.	When Laid.	No. Sq. Yds.	Total Cost.	Cost Per Sq. Yd. of Pavement.
Main st.	1898	12,730	$31,375.15	$1.64 Brick on concrete
Washington	1899	5,140	$11,645.17	$1.73 Brick on concrete
Huron	1900	10,791	$27,845.38	$2.17 Aspht. bk. on sand
State	1902	12,484	$31,778.98	$2.16 Aspht. bk. on sand
Ann	1902	1,589	$ 2,860.70	$1.93 Brick on sand
Liberty	1903	9,140	$24,486.06	$2.19 Aspht. bk. on sand
Fourth av.	1903	2,431	$ 6,490.80	$2.19 Aspht. bk. on sand
William st.	1907	7,519	$19,092.01	$2.03 Bithulithic
N. University	1905	5,045	$10,720.16	$1.63 Brk. on concrete
Alley	1908	350	$ 672.74	$1.50 Brk. on concrete
Maynard	1909	1,883	$ 1,930.13	$0.783 Dolarway
N. Fourth av.	1910	1,159	$ 1,351.34	$0.8789 Dolarway
E. Huron & 12th	1910	6,765	$ 6,685.50	$0.7613 Dolarway
Washington	1910	8,633	$ 8,189.73	$0.7108 Dolarway
Washtenaw av.	1911	12,092	$12,392.81	$0.7773 Dolarway
State dist. 17	1911	2,587	$2,672.49	$0.8430 Dolarway
S. Main & Pack.	1911	20,826	$23,172.05	$0.7760 Dolarway
N. Main	1911	10,117	$11,110.86	$0.8163 Dolarway
Fifth av.	1911	10,483	$11,678.31	$0.8405 Dolarway
Alley	1911	293	$ 314.84	$0.8375 Dolarway
Alley	1911	920	$ 1,029.38	$0.7676 Dolarway
Arch & Thayer	1911	1,833	$ 1,747.35	$0.7679 Dolarway
State Dist. 25	1911	3,158	$ 3,181.57	$0.7824 Dolarway
Totals		147,968	$252,423.51	

During the year 1911 there were laidon Hill st. 1,780 sq. yds. of pavement and 3,962 lin. ft. of curb, being somewhat less than 1-3 of the total yardage and all the curb, as estimated, which has been ordered for said street. The pavement between the rails of the street car tracks on Washtenaw av. and between the rails and for a distance of 18 inches out on either side of the track on Packard and S. Main sts., is not included in the above statement.

Respectfully submitted, E. W. GROVES, City Engineer.

Annual Report of the Street Commissioner.

To the Board of Public Works, City of Ann Arbor, Mich., 1911:

Office of the Street Commissioner, Ann Arbor, Mich., Jan. 2, 1912.

To the Hon. Board of Public Works, Wirt Cornwell, Esq., President: Gentlemen—I herewith submit to your Honorable Body the annual report of the work done in my department for the year ending December 31, 1911, including the care of streets and sidewalks, construction of culverts, storm sewers, etc., sidewalk extensions and crosswalks, street paving and the cement, gravel and other materials purchased under your direction and used during the year:

STREET WORK—

Cleaning paved streets, labor $3,971.61
(Feb., $37.70; March, $327.42; April, $299.67; May, $407.97; June, $398.18; July,

IN CITY OF ANN ARBOR DURING YEAR 1911.

of Sewers. 6 to 8 ft....	8 to 10 ft...	Total cost	Amount paid to contractor	Amount retained	To be paid by city	When balance is due	Kind.	Contractor.
231	.....	$ 680.14	$ 632.51	$ 33 29	$ 59.50	June 29, '12	Sanitary	E. L. Schneider
661	.....	646 55	599.97	31.58	19.63	June 29, '12	Sanitary	E. L. Schneider
.....	.....	204 26	194.05	10.21	12.18	Aug. 1, '12	Sanitary	Hutzel & Co.
.....	.....	247.32	234.96	12.36	16.53	Aug. 1, '12	Sanitary	Hutzel & Co.
676.1	.....	538.53	511.61	26.92	73.26	Aug. 1, '12	Sanitary	Hutzel & Co.
181.0	530.2	532.71	506.08	26.63	26.20	July 3, '12	Sanitary	Hutzel & Co.
745.3	.....	1,291.44	1,226.87	64.57	1,291.44	Aug. 4, '12	Storm	E. L. Schneider
WATER COURSE BUILT BY CITY DURING 1911.								
50	.....	860 98	.....	.....	860.98	.....	Storm	
2544.4	530.2	$5,001.93	$3,906.05	$205.56	$2,359.72			

$413.82; August, $550.90; Sept., $501.21; October, $547.10; November, $263.84; December, $223.80.)
Painting and putting up street signs—
Labor $10.78
Hire rig, D. Staebler 1.50
Total $12.28
Taking care of snow, labor—
Cleaning snow from crosswalks, gutters and inlets $388.62
(Jan., $123.67; Feb., $120.00; March, $13.87; April, $3.80; Nov., $71.33; Dec., $55.95.)
Sanding sidewalks, January 9.74
Cleaning snow from park walks 18.41
(Jan., $6.82; Feb., $4.05; March, $1.00; Nov., $2.25; Dec., $4.29.)
Plowing snow from sidewalks 312.46
(Jan., $68.00; Feb., $69.34; March, $35.12; Nov., $68.00; Dec., $72.00.)
Plowing snow from gutters 13.46
(Jan., $2.23; Feb., $2.23; March, $1.50; Nov., $4.00; Dec., $3.50.)
Total $742.69
Repairs paved streets—
Labor $8.92
3 lds. gravel (includes hauling, at $1.00. ... 3.00
Cement, 10, 1-2 sacks, 2.625 bbl., at $1.05 ..... 2.76
Total ..... $ 14.68
Cleaning up broken branches after storm (June) labor ..... $ 12.85
Tarring paved streets, labor $196.72
(March, $14.64; April, $0.83; June, $77.47; July, $56.05; Aug., $24.50; Sept., $10.10; Oct., $11.86; Nov., $1.27.)
976 gals. tar, (A. A. Gas. Co.) at $0.05 ..... 48.00
750 gals. tar from Chicago, at $0.08 60.00
Demurrage and car rental tank car from Chicago. 1,400 sq. yds. at
Sand, Chilson, 1,400 yds., at $0.005.. 7.00
$0.0013 ..... 1.82
Total... ..... $314.34
Patching holes and repairing dirt streets in the several wards, labor ..... $ 92.02
(Jan., $1.44; March. $4.95; April, $5.49; May, $40.85; June, $20.40; Dec., $18.89.)
Grading streets (with street drag) in the several wards, labor 133.68
(March, $2.23; April, $105.09; Oct., $26.36.)
Graveling and grading streets in the several wards, labor $1,089.47
(March, $10.59, April, $138.86; May, $144.35; June, $228.87; July, $79.60; Aug., $102.09; Sept., $92.82; Oct., $189.41; Nov., $102.28.)
343 loads gravel 121.70
Total $1,211.17
240 lds., at $0.20 ..... $ 48.00
18 loads at $0.25..... 4.50
79* loads at $0.80..... 63.00
6* loads, at $1.00 ..... 6.00
Total, 343 loads $121.70
(*) includes hauling.
Cleaning sand and gravel pits, labor... ... $ 15.14
Cleaning alleys, labor 7.84
(March, $4.67; Dec., $3.17.)
Cleaning gutters on dirt streets in the several wards, labor 2,575.01
(March, $29.42; April, $286.61; May, $145.93; June, $570.65; July, $726.38; Aug., $549.84; Sept., $4.53; Oct., $154.46; Nov., $107.19.)
($261.65 of above was for taking care of leaves during October and November.)
Cutting weeds in streets and from lawn extensions and in various localities in the several wards, labor 705.58
(May, $26.20; June, $209.13; July, $364.74; Aug., $92.80; Sept., $12.71.)
Graveling Detroit street—
Labor ..... $ 380.10
337 loads gravel, at $0.20..... 67.40
Total ..... $ 447.50
Total street work $10,259.39
CULVERTS—
Culvert in State, Arch and White streets, and McKinley av.—
Beginning west of the southwest corner of State and Edwin st.; thence east across State st.; thence south on the east side of State to S. side Arch st.; thence E. on the south side of Arch to White st., (formerly known as S. Thayer st.) thence south on the west side of White to McKinley av., (formerly known as Creek st.); thence east and northeast on the south side of McKinley av.. to Packard st.; thence across Packard to the southeast corner of Packard st., and E. University av., (except about 232 lin. ft. on McKinley av.); total length of completed culvert, 1,684.9 lin. ft.; size 3 ft.x3 ft.
Labor $2,169.38
721.3125 bbls. cement, at $1.05..... 757.38
488 loads gravel (including hauling), at $1.00 ..... 488.00
105 loads gravel, (hauled by city teams), at $0.20 ..... 21.00
153.03 gal. gasoline 16.43
(Dean & Co., Ltd., $13.28; Fischer & Finnell, $3.15.)
41 gals. ker. oil (Fischer & Finnell, $4.90; Dean & Co., Ltd., $0.12) 5.02
9 gals. mach. and gas engine oil and packing..... 3.33
(C. Schlenker, $0.85; J. C. Fischer Co., $2.48.)
170.03 rods wire fencing to re-enforce top 103.15
(Benz Bros., fencing, $102.10; one roll felt, $1.05.)
Various supplies, nails, $1.00; 4 pc. 12-inch tile, $2.24 ..... 3.24
3 manhole frames and covers, at $6.50..... 19.50
New lumber, (Sauer & Co., $10.33; Luick Bros. & Co., $6.70)..... 17.03
Old lumber used, $20.00; hauling by city team, $25.00 ..... 45.00
Total cost $3,648.46
Less to be paid by property owners for sidewalk, 680, 3x5 ft., 3,401.5 sq. ft., at $0 10 ..... 340.15
Net cost $3,308.31
Cost of culvert per lineal foot, $2.1653.
Cleaning culvert over Allen's creek in 5th av., and channel of Allen's creek in Hill and Division sts., labor ..... $ 88.95
(April, $29.55; Aug., $4.25; Sept., $55.15.)
Repairs Spring st. culvert, between Hiscock and Summit st., labor ...$ 17.74
1 pc. 24-inch tile (Rohde)..... 1.63

5 pcs. 24-inch tile, at $1.105..... 5.53
3 sks. cement, 3-4 bbl., at $1.05..... .79

Total .... $ 25.69
Total culvert work $3,422.95

SIDEWALKS—

Grading for sidewalks in the several wards, labor $1,607.64
(March, $292.33; April, $746.12; May, $206.70; June, $26.80; July, $53.45; Aug., $65.99; Sept., $80.51; Oct., $135.74.)

Repairs cement and tar sidewalks in the various wards, labor ..... $ 99.53
(Oct., $67.20; Nov., $13.96; Dec., (cinders) $18.37.)
(127 defective places repaired.)

2 1-2 loads gravel, at $0.20 ..... .50
26 sks. cement, 6.5 bbl., at $1.05..... 6.83

Raising Mullison walk, Packard st., (city portion), labor, M. G. Richmond 14.00

Total $120.86

Sidewalks built by city, under contract, tar, Bernard Mast—

Culvert, Fountain, bet. Miller av. and Cherry st., 1 1-2 rods, at $4.50 $6.75
W. side 8th bet. Washington and Liberty, 21.919 rods, at $4.50... ... 98.64
W. side Ferdon road, lots 7, 8, 9, 10, 11, 12, six lots, each 50 ft. 3.0303 rods, at $4.75, $14.39 ..... 86.34
Lot 13, 2.303 rods, at $4.75 ..... 10.94
Lot 14, 2.5412 rods, at $4.75 ..... 12.07
Lot 20, 5.50206 rods, at $4.75..... 26.13
Lot 21, 3.0303 rods, at $4.75 ..... 14.39
Lot 22-23, 2.21975 rods, at $4.75.... 10.54
Lot 22-23, 1,52775 rods, at $4.75..... 7.26
Lots 24, 25, 26, 27, 28, 29, 30, 31, 32, nine lots, each 50 ft., 3.0303 rods, at $4.75, $14.39 ... . 129.51
E. side 7th, bet. Huron and Miller av—
4 rods, at $4.75 .... 19.00
11.696 rods, at $4.75 ..... 55.56
9.0303 rods, at $4.75 ..... 42.89
3.8131 rods, at $4.75 ..... 18.14
2.0757 rods, at $4.75 ..... 9.86
Tar, C. M. Thompson & Son—
E. side Forest, bet. Wells and Woodlawn, 3.0303 rods, at $4.50 ..... 13.64
E. and W. side Olivia, bet. Wells and Granger—
Lots 26, 16, 11, 12, 13, 5 lots, Eberbach addition, 50 ft. each, 3.0303 rods, at $4.50, $13.64 ..... 95.48
S. side S. Univ. E. of Washtenaw, 9.722 rods, at $4.50 ..... 43.75
S. side Felch, bet. Spring and Fountain, 10 rds., at $4.75 ..... 47.50
W. side Olivia, bet. Wells and Granger, 8 rds., at $4.75 ..... 38.00
E. side Wall, bet. Broadway and Huron river, 4 rds., at $4.75 ..... 19.00
Cement, Gas & Son—
Henning block, Huron and 4th av..$275.00
(Let by contract by Bd. of Pub. Wks.)
Engine house, Huron and 5th av., 313.93 sq. ft. cement walk, at $0.10 31.39
Total $1,111.78

Total sidewalks laid, tar, 40; cement, 2, 42.
For property owners, tar, 39; cement, 1.40
For city, tar, 1; cement, 1..... 2

Total 42
Total sidewalk work $2,840.28

CROSSWALKS, EXTENSIONS, STORM WATER GUTTERS, REPAIRS, BRIDGES, ETC.—

Building crosswalks, sidewalk extensions and storm gutters at street intersections in the several wards and repairs bridges, etc., including 14 new crosswalks, 3 crosswalks relaid, 39 extensions, and 7 cement storm water gutters:

Labor $629.31
281 sacks, 70.25 bbls. cement, at $1.05 .... 73.77
56 loads gravel, at $0.25 ..... 14.00
2* loads gravel, at $1.00 ..... 2.00
Lumber for cement gutters 25.48
(Sauer & Co., $13.72; Gill & Co., $11.76.)
33 crossing irons (A. A. Mach. Co.) 16.50
8 pcs. 15-inch tile, 16 ft., at $0.2565. 4.11
8 loads sand, at $0.50... ..... 4.00
27 loads filling, at $0.50..... 13.50

Total $782.67

Sidewalk extensions laid by contract—

Cor. Granger av. and Ferdon road, (tar) Thompson & Son ..... $ 1.44
N. E. Cor. State and Packard, F. C. Welch, cement 12.01
S. E. Cor. Maynard and Liberty, Koch Bros., cement 25.18
N. W. Cor. State and Packard, C. M. Thompson & Son, cement 42.50
N. W. Cor. 5th av. and Washington, M. G. Richmond, 96 sq. ft. cement, at $0.10 .... 9.60
S. E. Cor. S. University & Washtenaw, C. M. Thompson & Son, 376.455 sq. ft. cement, at $0.10 .... 37.65

Total $128.38

Repairs bridges—

Replanking and repainting No. 3 bridge, labor $82.90
5,331 ft. oak plank, (A. A. Mach. Co.) at $30.00 .... 159.93
Steel girders 76.81
50 gals. tar (A. A. Gas. Co.) at $0.05 2.50
1 keg 40d nails (J. C. Fischer Co.)... 2.50
Paint brushes, Fischer, $0.60; Schlenker, $0.75 ..... 1.35

Total $325.99

Plank for replanking No. 1 bridge (stored at city yd.) 124.02
Minor repairs bridge sidewalks, painting post No. 2 bridge etc., labor ....$ 25.82
Lumber (Wood & Co.) 4.69

Total .... $ 30.51

Tarring and graveling No. 1 bridge, labor ..... $ 84.00
601 gals. tar (A. A. Gas Co.), at $0.05..... .... 30.05
3.815 tons crushed stone (E. M. E. Co.) 10.49
1 load washed gravel (Neithammer) 1.50
12 bbl. pitch (Chicago), at $4.218... 50.62
2 bbl. asphalt, 100 gals., at $0.18.... 18.00
4 loads gravel, at $0.25 ..... 1.00
7 loads gravel, at $0.20 ..... 1.40

Total $197.06

Cleaning inlets and catch basins, labor .... $ 83.40
(March, $2.50; June $14.11; Aug., $32.79; Oct., $25.72; Dec., $8.28.)
Unloading cars of cement, sand and sewer pipe; hauling cement for curbing, etc., packing and shipping empty cement sacks, labor 617.72
(April, $34.67; May, $84.67; June, $85.45; July, $89.91; Aug., $157.25; Sept., $85.96; Oct., $36.89; Nov., $1.50; Dec., $1.42. Sand—June, $3.90; July, $4.50; Aug., $11.60; Sept., $17.60; Oct., $1.40. Total, sand, $39.00.)

Cleaning crosswalks—
Labor $85.39
(Feb., $5.34; March, $6.53; April, $23.77; Sept., $15.61; Nov., $21.41; Dec., $12.72.)
Laying tile across sidewalks and extensions Summit st., bet. Spring and Fountain and Fountain and Gott st.—
Labor .....$ 9.38
7 pcs. 24-inch tile (Wood), at $1.60.. 11.20
10 pcs. 24-inch tile, at $1.105 ..... 11.05
9 pcs. 24-inch tile (bet. Fountain and Gott) at $1.105 ..... 9.95
4 sacks cement, 1 bbl..... 1.05

Total .....$ 42.63
Cleaning bridges, labor .....$ 13.94
(Feb., $7.09; Oct., $4.60; Nov., $2.25.)
Foundation tool house, rear city hall, labor .....$ 28.28
8 loads gravel, at $0.25 ..... 2.00
57 sacks cement, 14.25 bbl., at $1.05 14.97

Total .....$ 45.25
Foundation for tar tank and setting and painting same—
Labor $220.52
(July, $31.60; Aug., $1.50; Sept., $63.90; Oct., $24.31; labor and material, $99.21.)
15 loads gravel, at $0.20 ..... 3.00
Lumber (Wood & Co.) $11.09, $0.96, $0.60..... 12.65
10 loads gravel, at $0.25 ..... 2.50
88.5 sacks cement, 22.125 bbls., at $1.05 ..... 23.24

Total $261.91
Heating tar tank, labor .....$ 36.32
Coke, (A. A. Gas Co.) 15.35

Total .....$ 51.67
Laying and relaying pavements to match with new paving work, labor $266.25
(May, $5.92; June, $113.10; July, $29.42; Aug., $57.10; Sept., $32.75; Oct., $27.96.)
Work at wells S. State st., labor.. $17.23
7 sacks cement, 1.75 bbl., at $1.05.. 1.84

Total .....$ 19.07
Repairs wall and building, cement foundation for closet, and sewer connection and repairs coping, 2d ward polling place, labor.....$ 25.15
3 loads gravel (Herrst) including hauling, at $1.00 ..... 3.00
5 pcs. 4-inch tile (Rohde) ..... .65
1 pcs. 24-inch tile 1.11
15 sacks cement, 3.75 bbls., at $1.05.. 3.94

Total .....$ 33.85
Repairs fence alley No. 23, labor..$ 3.06
4 posts (Luick Bros. & Co.) ..... .80
Wire fence and hinges (Benz Bros.) 1.50

Total .....$ 5.36
Total crosswalks, extensions, repairs, bridges, etc.....$3,115.07
STORM WATER SEWERS, INLETS, ETC.—
Storm water sewers and inlets and conns. for same and resetting inlets for paving work, etc.:
Storm water sewer and inlets Ann, 4th to 5th av., and in alley No. 22, labor $224.73
338 ft. 18 in. tile, at $0.323 ..... 109.18
62 ft. 12 in. tile, at $0.17 ..... 10.54
3 pcs. 12 in. L, at $0.51 ..... 1.53
3 inlets, at $6.50 ..... 19.50
3 manhole tops, at $6.50 ..... 19.50
215.5 ft. 12 in. tile, at $0.17..... 36.64
12 pcs. 12 in. Y br., at $0.68..... 8.16
2 pcs. 12 in. T, at $0.68 ..... 1.36
3 box grates in alley, at $4.00..... 12.00

Total $443.14
Storm water sewer and spills alley No. 23, labor $140.83
445 ft. 12 in. tile, at $0.17 ..... 75.65
33 pcs. 12 in. Y br., at $0.68..... 22.44
3 box grates, at $4.00 ..... 12.00

Total $250.92
Resetting inlets Washtenaw av., labor .....$ 40.40
42 ft. 12 in. tile, at $0.19 ..... 7.98
1 pc. 12 in. L, at $0.57 ..... .57
1 new inlet, at $6.50 ..... 6.50
2 grates, at $1.50 ..... 3.00

Total .....$ 58.45
Resetting inlets 5th av. and new inlets and storm sewer 5th av. and Jefferson, labor .....$ 62.47
5 pc. (10 ft.) 12 in. tile, Rohde..... 2.80
1 pc. 12 in. L, Rohde 1.32
10 pcs. (20 ft.) 10 in. tile, Rohde.. 5.00
1 pc. 10-in. L, Rohde ..... .99
1 pc. 10-in. long curve, Rohde..... .99
50 ft. 12 in. tile, at $0.19... ... . 9.50
1 pc. 12 in. L, at $0.57 ..... .57
2 inlets, at $6 50 ..... 13.00

Total .....$ 96.64
20 in. storm water sewer, Hill bet. Oxford and Cambridge road, labor .....$ 62.21
22 pcs. (44 ft|) 20 in. tile, Rohde... 27.50
28 pcs. (56 ft.) 20 in. tile, Koch Bros. 27.16

Total $116.87
Inlets and new spill conns., and resetting inlets N. Main, Main and Knigsley, 5th av., and Liberty, State and Arch, Main near Summit, labor $56.83
1 12 in. L, Rohde 1.32
92 ft. 12 in. tile, at $0.19 ..... 17.48
1 pc. 12 in. L, at $0.57 ..... .57
1 inlet, (Main) 6.50
2 12 in. grates (Main), at $1.50..... 3.00
1 grate (Arch No. 24) 1.50

Total $87.20
Hauling tile to Hill and Cambridge road, Packard, Hill to Monroe, Dewey av., and other points, city teams.....$ 59.56
Godfrey 55.45

Total $115.01
Storm water sewer Packard, Hill to Monroe and inlets and spill conns. Packard and State, Hill and Monroe, labor $412.56
Less paid by Mich. State Tel. Co... 16.62

Total $395.94
698 ft. 20 in. tile, at $0.4275 ..... 298.40
172 ft. 12 in. tile, at $0.19 ..... 42.68
2 pcs. 20 in. by 12 in. T, at $1.71... 3.42
5 pcs. 12 in. L, at $0.57 ..... 2.85
64 ft. 18 in. tile (State), at $0.323.. 20.68
196 ft. 12 in. tile (State), at $0.19.. 37.24
1 pcs. 12 in. Y; 1 pc. 12 in T, 2. at $0.76 ..... 1.52
2 manhole frames and covers, at $6.50 ..... 13.00
1 pc. 12 in. by 12 in. by 12 in., T.,

Rohde 1.48
2 pcs. 12 in. L, Rohde 2.64
2 pcs. 12 in. L, Rohde 2.64
1 pc. 10 in. by 12 in. T, Rohde..... 1.48
1 pc. 12 in. L, (2d hand) (Wood).. .50
3 inlets, (State), at $6.50 ..... 19.50
1 square grate (State) 4.00
3 inlets, (Monroe) at $6.50 ..... 19.50
1 grate, (Monroe) 1.50

Total $868.97

Storm water sewers and inlets Packard and Division, Packard and Arch, Packard and Dewey, State and Hill, Packard and Woodlawn, labor $337.16
Division—116 ft. 12 in. tile, at $0.19.$ 22.04
2 12 in. L, at $0.57... ..... .57
1 grate..... ... . 1.50
Arch—348 ft. 12 in. tile, at $0.19.... 66.12
3 12 in. L, at $0.57 ..... 1.71
2 12 in. Y, at $0.76 ..... 1.52
1 12 in. T..... .... .76
1 manhole top 6.50
2 inlets, Arch & Pack., at $6.50.... 13.00
1 grate, Arch and Packard 1.50
Packard east of Dewey—474 ft. 15 in. tile, at $0.2565 ..... 121.58
7 pcs. 12 in. L, at $0.57..... 3.99
3 pcs. 12 in. Y, at $00.76..... 2.28
2 pcs. 12 in. T, at $00.76 ..... 1.52
4 manhole tops, at $6.50 ..... 26.00
5 inlets, Woodlawn-Wells, at $6.50.. 32.50
6 grates, Woodlawn-Wells, at $1.50 9.00
2 inlets (State No. 25), at $6.50..... 13.00

Total $662.25

Storm water sewer Hill, Cambridge road to Oswego and inlets Cambridge road and Hill, labor $182.66
64 ft. 20 in. tile, at $0.4275 ..... 27.36
414 ft. 12 in. tile, at $0.19..... 78.66
1 pc. 12 in. Y..... ..... .76
2 pcs. 12 in. L, at $0.57 ..... 1.14
2 pcs. 12 in. T, at $0.76 ..... 1.52
1 manhole top 6.50
4 inlets, (Oxford and Cambridge rd.), at $6.50 .... 26.00

Total $324.60

Storm water sewer Dewey, W. of Packard, inlet conns. Oswego and Hill, inlets S. University and Washtenaw, 4th av. and Packard, S. Main and Packard, connecting inlets Packard bet. Arch and State and at State, Packard and E. University, Packard and 5th av., Main and William; repairs inlet Glenn and Ann, repairs tile Olivia av. S. of Wells, labor $166.97
Dewey—332 ft. 12. tile, $0.19..... 63.08
Washtenaw—24 ft. 12 in. tile, $0.19.. 4.56
17 ft. 12 in. tile, $0.19 3,23
Oxford, 12 ft. 12 in. tile, at $0.19.... 2.28
2 pcs. 10 in. L. (Wood & Co.)..... 1.44
4th & 5th av.—96 ft. 12 in. tile, at $0.19 .... 18.24
1 pc. 12 in. by 12 in. T..... .76
1 pc. 12 in. L..... ..... .57
5th av., S. Main—1 inlet, at $6.50; 1 grate, $1.50... ..... 8.00
14 ft. 12 in. tile, at $0.19 ..... 2.66
2 12 in. by 12 in. T. at $0.76..... 1.52
1 pc. 15 in. L. 45° Rohde 1.78
1 inlet, $6.50; 1 grate, $1.50..... 8.00
1 grate, (5th av.) 1.50
2 inlets (Packard bet. Arch and State) 13.00

Total $297.59

Storm water sewer, Benjamin and Mary st., and inlets and conns., labor $352.11
Tile, etc., (detailed report made by city engineer) 508.87

Total $860.98

Drain Washtenaw av., E. of Church, repairs san. sewer Mary st., cleaning san. sewer Church st. and building manhole, tile Cambridge road bet. Forest and Olivia, repairs storm water sewer and new inlets 1st and Miller av., repairs tile Packard and Granger, labor..$94.92
Washtenaw and Church—90 pcs. (180 ft.) 6 in. tile, Rohde. ... 18.00
4 pcs. 6 in. L, at $0.228 ..... .92
4 pcs. 6 in. T, at $0.304 ..... 1.22
4 6 in. grates, at $0.50 ..... 2.00
Olivia—16 ft. 20 in. tile, at $0.4275.. 6.84
Miller av.—34 ft. 12 in. tile, at $0.19 6.46
5 pcs. (10 ft.) 12 in. tile (Wood & Co.) 3.50
1 pc. 12 in. by 12 in. T, at $0.76... .76
1 pc. 12 in. L, at $0.57 ..... .57
2 inlets, at $6.50 ..... 13.00
1 manhole top 6.50

Total $154.19

Cement used in above work, 358 sacks, 89.5 bbls., at $1.05 .....$93.98
Gravel hauled for above work, 6 loads, at $1.00 ..... 6.00

Total $4,436.79

Storm water sewer N. Main from Allen's creek west to west side Main st., labor, (E. L. Schneider) $103.60
184 ft. 20 in. tile, $0.4275... ..... 78.66
100 ft. 12 in. tile, at $0.19..... 19.00
3 pcs. 12 in. grates, at $1.50..... 4.50
1 pc. 20 in. by 12 in. T..... 1.71

Total ....$ 207.47

Grand total $4,644.26

NOTE—No account taken above of brick for manholes, etc., for which old brick from crosswalks torn up was used, but hauling of brick, also cement, tile and gravel in small lots (except hauling mentioned above) is included in the labor account.

Making connections to sanitary sewers and flushing and repairs sanitary sewers, labor .....$ 71.44
(Jan., $8.75; Feb., $4.13; April, $6.18; May, $25.34; June, $4.34; Oct., $6.65; Nov., $6.40; Dec., M. H. W. Liberty, $8.90; flushing, $0.75; total, $9.65.)
Laying tile Chubb road, labor.....$ 4.45
9 pcs., 18 ft. 12 in. tile, at $0.19..... 3.42
1 pc., 2 ft. 10 in. tile, at $0.15 1-2.. .31
1 sack, 1-4 bbl. cement, $1.05 ..... .27

Total ... .$ 8.45

Laying tile Granger av., south of Packard, labor and materials.... 5.00
Laying tile Dewey av., labor 2.34
3 pcs. 6 in. tile, at $0.136 ..... .41

Total ....$ 2.75
Total storm sewers, inlets, etc...$4,731.90

GENERAL WORK—

Repairs sweepers and snow plows, making new snow plows and street sweeper brooms, labor $86.00
(Brooms—Jan., $24.87; Feb., $6.95; Nov.,

$13.34; Dec., $20.56; total, $65.72. Snow-plows—Oct., $17.59; Dec., $2.69. Total, $20.28.)
Putting up and taking down voting booths, labor 1.87
Repairs carts and cement mixers, painting carts, scraper and portable tool house, making gutter boxes, making street barricades, repairs steam roller, building closets, painting signs, repairs wagons and plows, labor 124.25
(Jan., $10.87; Feb., $43.19; March, $13.31; April, $11.53; May, $23.38; Sept., $6.17; Nov., $15.80.)
Work at city yard, piling lumber, brick, stone and other materials, labor 48.22
(July, $25.05; Oct., $17.88; Dec., $5.29.)
Miscellaneous repairs at different points in the city and hauling brick, stone and other materials to city yard, labor 72.99
(Feb., $6.24; March, $9.38; April, $2.16; May, $11.28; Aug., $16.53; Oct., $6.00; Nov., $21.40.)

Total general work $333.33

PAVING—

Paving to the amount of 63,145 sq. yds. has been done during the past season under direction of your Honorable Board by the city engineer and street commissioner. Full details of the cost and expense of each improvement are given by the city engineer in his detailed reports on each paving district, therefore I will give merely the total cost of each improvement. The amounts of cement and gravel used in each district will, however, be found under their proper headings.

Paving Dist. No. 16, Washtenaw av., total cost $12,474.83
Of this reported in 1910 ..... 2,056.75

Work done in 1911 ..... $10,418.08
Paving Dist. No. 17, State-Packard-Arch 2,687.88
Paving Dist. No. 18, S. Main and Packard 24,396.52
Paving Dist. No. 19, N. Main 11,214.43
Paving Dist. No. 21, 5th av..... 11,808.01
Paving Dist. No. 22, alley 314.84
Paving Dist. No. 23, alley 1,032.88
Paving Dist. No. 24, Arch 1,748.85
Paving Dist. No. 25, State, Monroe-Packard 3,232.54
Paving Dist. No. 20, Oswego and Hill (unfinished, paving laid Hill, Washtenaw to Oxford and intersect. Oxford; curbing all set)
Labor ..... $ 817.86
Gravel, 329 loads, at $1.00 ..... 329.00
Cement, 395 bbls., at $1.05 ..... 414.75
Supplies, etc..... 21.55
Curbing 917.29
(150.5 bbl. cement at $1.10, $165.55, included.)
800 gals. tar, at $0.08 ..... 64.00
Gravel for top, 1,780 sq. yds., at $0.005 ..... 8.90
Demurrage and car rental on 1,780 yds., at $0.0013..... 2.31

Total $2,575.66

Total, paving $69,429.69
Less total credits to paving districts 1,606.12

Net cost of paving to city and property owners $67,823.57

PAVING YARDAGE—
Dist. No. 16 ..... 12,092 sq. yds.
Less laid in 1910 ..... 1,666 sq. yds.

Laid in 1911 ..... 10,426 sq. yds.
Dist. No. 17 ..... 2,587 sq. qds.
Dist. No. 18 ..... 21,548 sq. yds.
Dist. No. 19 ..... 10,117 sq. yds.
Dist. No. 21 ..... 10,483 sq. yds.
Dist. No. 22 ..... 293 sq. yds.
Dist. No. 23 ..... 920 sq. yds.
Dist. No. 24 ..... 1,833 sq. yds.
Dist. No. 25 ..... 3,158 sq. yds.

Total ..... 61,365 sq. yds.
Dist. No. 20, Oswego and Hill (unfinished) ..... 1,780 sq. yds.

Laid season of 1911 ..... 63,145 sq. yds.

SUPPLIES, REPAIRS, ETC.—
Supplies, repairs, etc., except as included in foregoing statement:
Street account ..... $ 102.05
Sidewalk account 40.50
Bridge, culvert and crosswalk account 2,346.71
2 cement mixers 2,000.00
Tar tank 608.00
Sprinkling 240.00
Insurance 242.30

Total supplies, repairs, etc..... $5,579.56

RECAPITULATION—
Street work $10,259.39
Culverts 3,422.95
Sidewalks 2,840.28
Crosswalks, extensions, bridges, etc..... 3,115.07
Storm water sewers, inlets, etc... 4,731.90
General work 333.33
Paving 69,429.69
Supplies, repairs, etc... ..... 5,579.56
Total $99,712.17

No. of culverts built 1
(Length 1,684.9 lin. ft.)
No. of crosswalks built 17
No. of extensions built (city) 39
No. of extensions built (by contract)... 6
No. of sidewalks, city property, tar, 1; cement, 1..... 2
No. of storm water cement gutters built 7
(Length about 259 lin. ft.)
No. of sq. yds. of street pavement laid... 63,145
No. sidewalks built by city under contract 42
(Tar, 40; cement, 2; rods, tar, 161.15876 or 2,659.119 lin. ft.; sq. ft. cement, 313.93 not including Henning block.)
No. of notices served to fill holes in streets, remove obstructions, snow, etc., and repair holes in sidewalks 71
No. of notices served to cut weeds..... 87
GRAVEL ACCOUNT—

Streets:	Loads.
Graveling and patching in the several wards...	258
Graveling and patching in the several wards	85*
Graveling Detroit st.....	337
Total	680
Crosswalk and extension work	56

Crosswalk and extension work 2*

Total 58
Repairs sidewalks 2.5
Repairs pavements 3*
Foundation tool house, city hall.....8
Culvert State, Arch, White, etc.....488*
Culvert State, Arch, White, etc.....105

Total 593
Storm water sewers and inlets 6*
Foundation tar tank 25
Second ward polling place..... 3*
Tarring and graveling No. 1 bridge.....11
Tarring and graveling No. 1 bridge.....1*

Total 12
Paving Work—
Washtenaw No. 16 .....2126*
Less used in 1910 ..... 278*

Total, 1911 ....1848*
State to Arch No. 17 ..... 426*
S. Main and Packard No. 18.....3007*
S. Main and Packard No. 18..... 738.5

Total 3745.5
North Main No. 19 .....1737*
Fifth av. No. 21.... .....1745*
Alley No. 22 ..... 45*
Alley No. 23 .... 159*
Arch No. 24 ... .269*
Arch No. 24 .... 25.5

Total..... . ...$294.5
State to Packard No. 25 .....468*
State to Packard No. 25 59

Total 527
Hill and Oswego No. 20 (unfinished)..329*

Total 12,246.5
Hauled by teams on city time 1,624.5
Cost of gravel included in hauling..10,622

Total 12,246.5
RECAPITULATION—
Street work 680
Culvert, extensions and other work 710.5
Paving 10,856

Total 12,246.5

NOTE—(*)—Cost of gravel included in hauling; balance hauled on city time.

COST OF GRAVEL—
Cost of gravel (not including paving work)
680 loads on streets (including Detroit st.) $189.10
(85 loads, cost includes hauling.)
58 loads, extensions and crosswalks 16.00
(2 loads, cost includes hauling.)
593 loads culvert 509.00
(488 loads, cost includes hauling.)
59.5 loads, various repairs, etc 23.90
(13 loads, cost includes hauling.)
Totals loads—1,390.5.

Total cost of gravel $738.00

CEMENT ACCOUNT—
The cement bought during the season of 1911 under order of your Honorabl Board, for various city improvements, amounted to 18,190 1-2 barrels. The following is a detailed statement of the amount purchased, and the purposes for which it was used:

	Bbls.
Cement on hand, Jan. 1, 1911	101.2500
Bought during season:	
April 15	150
May 2-27	3135
May 31-July 7.	3490
July 15-July 31	3680
Aug. 1-Aug. 29	2945
Aug. 30-Sept. 25	3355
Sept. 26-Oct. 16	1437
Total	18192
Less allowance, 1.5	18190.5000
Total	18291.7500
Used as follows—	Bbls.
Paving—	
Washtenaw, No. 16.	2,835.500
State to Packard, No. 17	679.375
S. Main and Packard, No. 18	5,193.500
N. Main, No. 19	2,681.750
Fifth av., No. 21	3,009.625
Alley, No. 22	78.500
Alley, No. 23	188.000
Arch, No. 24	423.750
State to Arch, No. 24	816.375
Total	15,906.375
Less Washtenaw, No. 16. 1910..	384.500
Paving total	15,521.875
Curbing:	
No. 16, (1911), Richmond	94.0000
No. 17, Thompson	29.6875
No. 18, Thompson...	206.7500
No. 18, Gass...	253.8750
No. 19, Richmond	179.7500
No. 20, Richmond	150.5000
No. 21, Gass	196.7500
No. 24, Thompson	21.0000
No. 25, Richmond	48.5000
No. 18, Richmond, cor. Packard and Main	4.2500
Total curbing	1,185.0625
Hill and Oswego paving, No. 20..	395.0000
Culvert, State, Arch, White and McKinley	721.3125
Sewers, inlets, etc., 358 sacks ...	89.5000
Extensions, crosswalks, etc., 281 sacks	70.2500
Miscellaneous—	
Wells S. State, 7; 2d ward polling place, 15; repairs cement pavements, 10.5; tile, Summit, Spring, Fountain. 4; foundation tar tank, 88.5; Spring st. culvert, 3; foundation tool house city hall, 57; sidewalk repairs, 26 tile Chubb road, 1.	
Total, 212 sacks	53.0000
Sold—	
Gass, Henning blk. and engine house, sidewalk	62.25
Richmond	6.50
Groves ..	69.75
Richmond, Mullison walk	2.00
Richmond, armory	2.00
G. Clark	10.00
Total sold	152.5000
On hand, Jan. 1, 1912	103.2500
Total	18,291.7500

Respectfully submitted, J. WISNER, Street Commissioner.

INVENTORY, STREET DEPARTMENT—

1 tar kettle and outfit	$ 8.00
4 two-wheeled scrapers ...	15.00
1 mixing board	3.00
3 hand saws	3.00
3 tool boxes	9.00
1 mortar box	1.50
4 scoop shovels, $2.00; 2 small shov-	

els, $1.00	3.00
3 cement shovels	3.00
2 tamps	1.50
6 iron crow bars	3.00
3 hammers	1.50
3 wrenches	.75
2 hatchets, $1.50; 1 axe, $0.50	2.00
2 pounders	1.00
2 pumps	15.00
1 pair bobs	20.00
2 street sweepers	350.00
Stencil and alphabet	1.00
1 hack	5.00
2 road scrapers	100.00
18 snow plows	260.00
1 steel snow plow	25.00
1 team horses	150.00
1 double harness, $20.00; 4 blankets, $4.00	24.00
1 steam road roller	1,600.00
6 picks	3.00
1 50-gal. gasoline can	4.00
3 5-gal. oil and gasoline cans	1.50
5 2-gal. and 1-gal. cans	1.25
Tools for filling brooms for sweepers	9.00
4 water pails	1.00
1 sidewalk building outfit	8.00
1 tar wagon	45.00
1 sand wagon	25.00
2 stone forks	1.20
2 paving hammers	1.00
2 brick hammers	1.00
300 feet hose	24.00
1 street drag	20.00
10 wood horses for blocking streets	10.00
1 steel square	.50
50 sewer jacks	25.00
1 rooter	8.00
1,100 bamboo splints	22.00
6 street brushes	5.70
3 steel trowels	1.50
8 wood trowels	2.50
1 stencil for marking cement and letters	6.00
25 empty barrels	20.00
2 ladders	2.00
1 life preserver and ropes	2.50
2 bales hickory splints	4.00
4 street sweeper brooms	40.00
3 canvass for covering cement	11.25
25 lbs. bolts	1.00
Paint brushes	2.00
6 spindles for street sweeper brooms	18.00
3 large plows	6.00
2 sand screens	4.00
1 cross cut saw, 1 one-man saw	2.50
1 slip scraper	2.50
1 sprinkling wagon	150.00
3 carts	90.00
2 dump wagons	200.00
1 bolt cutter	1.00
Bits and brace	3.00
30 red lanterns	19.50
2 levels	1.00
Bag carrier	2.50
24 steel wheelbarrows	84.00
6 grub hoes	3.00
4 scythes and snaths	4.00
1 sidewalk roller	5.00
1 iron vice and bench	3.00
8 voting booths	64.00
1 set platform scales	150.00
1 lot sewer rods	85.00
1 tool box on wheels	20.00
1 Advance cement mixer	100.00
1 small batch mixer	25.00
2 Foote continuous mixers	1,800.00
2 grindstones	6.50
4 closets	16.00
10 snow shovels	5.00
2 tar cans	3.00
1 lot rope	4.00
1 lot 3-4 inch and 1 inch galvanized iron pipe and fittings	50.00
Total	$5,841.60

Correct, attest: J. WISNER, Street Commissioner.

Ann Arbor, Mich., Jan .2, 1912.

INVENTORY, BUILDING MATERIAL, ETC., STREET DEPT.—

103.25 bbls. cement	$108.42
10 loads sidewalk stone	25.00
6,000 ft. bridge timber, old	40.00
8,000 ft. old oak plank	63.00
1,500 ft. new pine lumber	25.00
15 turned posts	7.50
50 12 ft. wing bars for culverts	17.00
50 lbs. nails and spikes	2.00
1,000 ft. 4-in. by 4 in. pine lumber	15.00
28 crosswalk grates (old)	50.00
1 lot, 81 pcs., old sewer pipe; 4 pcs. 30-inch; 1, 20-inch, 45°; 2, 24-inch, 45°; 22, 20-inch; 11, 8-inch; 38, 18-inch; 5, 15-inch; 2, 15-inch by 12-inch T	64.00
300 wood paving blocks	5.00
1 bbl. pitch	4.00
1-2 ton old bridge iron	4.00
1 pc. 8-inch iron pipe	4.00
10,000 old brick	100.00
14 old M. H. frames	70.00
3 inlets	18.00
4, 24-inch grates, $6.00; 3 small grates, $1.50	7.50
1 lot cobble and face stone	10.00
4,134 ft. new oak plank	124.00
53 pcs. 15-inch tile, at $0.513	27.19
18 pcs. 18-inch tile, at $0.646	11.63
17 pcs. 20-inch tile, at $0.855	14.54
41 pcs. 4-inch tile, at $0.085	3.49
21 pcs. 6-inch L, at $0.228	4.79
4 pcs. 6-in. T, at $0.304	1.22
3 pcs. 6-inch tile, at $0.136	.41
3 pcs. 6-inch curve, at $0.204	.62
17 pcs. 12-inch Y, T and 12-inch by 6-inch T, at $0.76	12.76
10 pcs. 12-inch L, at $0.57	5.70
Total	$845.77

Correct, attest: J. WISNER, Street Commissioner.

Annual report of Board of Public Works received and ordered printed in minutes and filed.

From Special Water Committee.

Moved by Mr. Mills: That this committee recommends to the council that the option on the purchase of the water works plant, as here presented, be accepted, and the clerk ordered to draw a warrant for one dollar in favor of said Ann Arbor Water Co. Adopted by committee.

(Option on plant as per offer made June 3rd, 1911, to be open until Aug. 1st, 1912.)

(Action of Council.)

Ald. Sherk moved adoption of recommendation. Adopted as follows: Yeas, Ald. Pipp, Sherk, Koernke, Sweet, Goodyear, Hochrein, Ramsay, Murray, Lutz, Schmid, Lindenschmitt, Pres. Mills, 12. Nays, none.

Petition to Pave Hill St.

To the Honorable, the Common Council of the City of Ann Arbor: Gentlemen—We, the undersigned owners of property upon Hill st. in the city of Ann Arbor, hereby request your honorable body to cause said street to be graded and paved, from the east line of State st., to the easterly line of Washtenaw av. (Cement pavement similar to that laid on Maynard st. being preferred.) This petition is signed upon the understanding that the city will pay 20 per cent of the cost of such pavement.

Name of Property Owner	Number of Foot Frontage
J. J. Goodyear, Mrs. Leila C. Goodyear	77.46
C. A. Vernou	59 1-2
Jean M. Vallette	77.43
Arthur Brown, Cora Brown	66.00
Thomas C. Trueblood	132.00
Joseph A. Polhemus, Mrs. Jos. A. Polhemus	74.25
Mrs. Lillian E. Smith	157.75
Walter C. Mack	132.00
Claudius B. Kinyon	184.00
Mrs. Stella E. Sturtz	74.00
L. D. Wines, Mrs. L. D. Wines	50.00
Arthur E. Shaw, Henrietta Shaw	90.23
L. E. Wenzel, A. R. Cole	132
A. A. Williams, R. L. Williams	66.00
H. S. Doan	132.00
Caroline P. Ellis	77.46
Josephine D. Peterson	157.10
S. Lawrence Bigelow	74.50
Mrs. A. B. Prescott	132.00
Mrs. L. H. Cornwell	66.00
Mrs. L. Andrews	43.00
Eddie M. Sheehan	
Alice I. Kidd	99.00
E. E. Calkins	66.00
Margaretta Lydecker	77.46
Brice Wooley	
R. I. Judson	66.00
Edith N. Prentiss, Jas. H. Prentiss,	76.43
Lucy Parker Huber, G. Carl Huber	88.92
James A. Craig, Marion I. Craig	111.98
Thomas A. Bogle, Alice Bogle	80.50
Edwin C. Goddard Lillian R. Goddard	214.00
Louis P. Hall	178.2
Henry C. Adams, Bertha H. W. Adams	132
M. E. Cooley	165.00

"O. K." E. W. Groves, City Engineer.

By Ald. Goodyear: Whereas, this common council has been applied to in writing, by a majority of the owners of the lands, which are liable to be assessed for the payment of the contsruction of the same, praying for the grading and paving of Hill st. from east line of State st. to easterly line of Washtenaw av., within the corporate limits of the city of Ann Arbor, Michigan; and

Whereas, the grading and paving of that part of Hill st., within the limits aforesaid, is deemed and declared to be a necessary public improvement; therefore

Resolved, that it is hereby declared to be the purpose of the common council to cause Hill st., within the limits aforesaid, to be graded and paved under the charter and ordinances of the city of Ann Arbor, and in pursuance of the prayer of said petitioners.

Resolved, further, that the cost and expense of the construction of such public improvement shall be charged, assessed and paid as follows: All street and public alley intersections, engineering expenses and twenty per cent. of the remainder shall be paid by the city, and the remainder shall be assessed and paid by special assessment levied and assessed according to benefits on and against all the lands, tenements and premises lying on or fronting Hill st., within the limits aforesaid.

Resolved, further, that the said petition, along with this determination, be and the same is hereby referred to the Board of Public Works with directions to report to the council with all convenient dispatch suitable plans with specifications for the said proposed improvement, the kind and quality of material to be used therefor, together with an estimate of the probable cost and expenses of such public improvement.

Adopted as follows: Yeas, Aldermen Pipp, Sherk, Koernke, Sweet, Goodyear, Hochrein, Ramsay, Murray, Lutz, Schmid, Lindenschmitt, Pres. Mills; 12. Nays, none.

FINANCE REPORT.

Ann Arbor, Mich., Jan. 11th, 1912.

To the Finance Committee of the Common Council: Gentlemen—I have examined the following accounts against the city of Ann Arbor, and I hereby certify that they are correct to the best of my knowledge.

Respectfully submitted, ROSS GRANGER, City Clerk.

Fire Fund.

Chas. Andrews salary	$ 41.66
Eugene Williams salary	36.30
Fred Jolly salary	36.30
Ralph Edwards salary	36.30
Henry McLaren salary	34.37
Geo. Hoelzle salary	34.37
Jacob Gwinner salary	33.00
Arthur Clark salary	33.00
Max Wittlinger salary	33.00
Harley Wise salary	30.00

Martin Noll salary	30.00
Geo. Isbell, salary	30.00
Fred Nordman, salary	30.00
Mat. Heininger, salary	30.00
John Behr, salary	30.00
James Smith, salary	27.50
Frank Markey, salary	27.50
Harold Darling, salary	27.50
Chas. Carroll, salary	22.00
Frank Kapp salary	22.00
Total salaries for 1-2 month of January	$624.80

Police Fund.

Theo. C. Apfel, salary	$ 41.66
Thos. O'Brien salary	37.40
Zenus Sweet, salary	33.00
Wm. Blackburn, salary	33.00
Wm. J. April, salary	33.00
Gustave Meyer, salary	33.00
Rex Burnett, salary	33.00
Reuben Armbruster, salary	33.00
Total salaries for one-half month of January	$277.06

Bridge, Culvert & Crosswalk Fund.

Geo. Boettger, labor	$ .75
Wm. Bury, labor	5.75
Wm. Clark, labor	2.00
Geo. Coats, labor	4.00
Fred Gakle, labor	4.20
Geo. Heselschwerdt, labor	4.50
Michael Hession, labor	10.90
John Howard, labor	3.63
Wm. Kuehn, labor	4.75
Julius Loerke, labor	10.00
George Miley, labor	2.00
W. A. Miller, labor	4.00
Albert Nordman, labor	2.00
Henry Norgard, labor	3.25
Geo. Schaible, labor	4.25
Wm. Wild, labor	2.50
R. S. Ellis, team, plowing snow	2.50
S. A. Elsifor, team, plowing snow	58.50
John W. Herrst, team, plowing snow	20.00
Jos. Wallacker, team, plowing snow	14.75
Jos. Williams, team, plowing snow	7.50
Total labor	$171.73

Recapitulation.

Fire fund	$624.80
Police	277.06
Bridge, culvert and crosswalk	171.73
Total	$1,073.59

Ann Arbor, Mich., Jan. 15th, 1912.

To the Honorable, the Common Council:

Gentlemen—Your Finance committee have reviewed the foregoing report of the city clerk. We recommend that same be approved and that warrants be ordered drawn for the foregoing accounts.

Geo. Lutz, Wm. Goodyear, Wm H. Murray, Finance Committee.

Ald. Lutz moved the adoption of the report. Adopted as follows: Yeas, Aldermen Pipp, Sherk Koernke, Sweet, Goodyear, Hochrein, Ramsay, Murray, Lutz, Schmid, Lindenschmitt, Pres. Mills; 12. Nays, none.

OFFICERS' REPORTS.

CITY FUNDS—To the Common Council of the City of Ann Arbor:

Treasurer's Report for Month Ending Dec. 31st, Money Received—

B. C. and C. W. Fund—	
Transfer from lab. pav. 18	$8,450.80
Transfer from lab. pav. 24	884.52
Driveway construction	315.37
Material sold	10.95
Cement sold	11.50
Total	$9,673.14
Street Fund—	
Transfer from lab. pav. 19	$ 49.20
Repair work	72.10
Total	$121.30
Contingent Fund—	
Fees on taxes	$ 646.59
Int. on bank balance	51.92
City scales	12.60
Peddlers' licenses	12.00
Dray licenses	.50
Total	$723.61
Police Fund—	
Officers' fees	$ 30.45
Ritchie's fines	20.00
Doty's fines	55.00
Total	$105.45
Building Sidewalk Fund—	
Sidewalk construction	$90.39
Cemetery Fund—	
Burial permits	$ 21.00
Care of lots	1.00
Total	$22.00
Dog License Fund—	
Dog license	$1.25
Park Fund—	
Rent of house	$5.00
Uncollected City Tax Fund—	
Taxes collected	$13,134.70
School Tax Fund—	
Taxes collected	$70,041.00
State Tax Fund—	
Taxes collected	$28,516.00
County Tax Fund—	
Taxes collected	$12,257.00
Judgment Tax Fund—	
Taxes collected	1,125.00
Total	$135,815.84
Overdrawn Dec. 1st	9,407.38
Balance	$126,408.46
Warrants paid	40,702.41
On hand Jan. 1st	$85,706.05
Disbursed, Warrants Paid—	
Bridge, cul. and crosswalk fund	$ 2,404.76
Contingent fund	1,725.45
City cemetery fund	40.00
Fire department fund	1,964.90
Poor fund	291.69
Police fund	611.66
Street fund	53.49
Park fund	393.23
Street lighting fund	1,217.23
School tax fund	32,000.00
Total	$40,702.41

Condition of City Funds on the First Day of January, 1912—

On Hand—	
Contingent fund	$ 4,905.67
City cemetery fund	471.69
Dog license fund	334.48
State dog tax fund	100.00
Fire department fund	1,117.26
Poor fund	1,017.73
Police fund	3,611.73
Street fund	76.81
Water fund	4,497.55

Park fund	107.33
Street lighting fund	4,475.38
Sidewalk fund	890.18
State tax fund	28,516.00
County tax fund	12,257.00
School tax fund	38,041.00
City hall tax fund	20.00
Rejected tax fund	59.07
Total	$100,498.88

Overdrawn—

Bridge, cul. and crosswalk fund	$ 3,564.73
Exinger judgment	560.50
Sidewalk building fund	754.69
Sprinkling tax dist. No. 11	147.73
Sprinkling tax dist. No. 12	47.68
Uncollected city tax fund	5,548.55
Delinquent tax fund	4,168.95
Total	$14,792.83

Warrants Outstanding—

Bridge, cul. and crosswalk fund	$171.53
Contingent fund	510.63
City cemtery fund	40.00
Fire department fund	157.60
Poor fund	20.00
Police fund	276.66
Park fund	20.31

PAVING FUNDS—To the Common Council of the City of Ann Arbor—

Treasurer's Report for Month Ending Dec. 31, Money Received—

Tax Acct. Pav. No. 5—	
Taxes collected	$234.31
Tax Acct. Pav. No. 7—	
Taxes collected	57.61
Tax Acct. Pav. No. 8—	
Taxes collected	27.22
Tax Acct. Pav. No. 9—	
Taxes collected	22.14
Tax Acct. Pav. No. 10—	
Taxes collected	36.43
Tax Acct. Pav. No. 11—	
Taxes collected	10.46
Tax Acct. Pav. No. 12—	
Taxes collected	35.91
Tax Acct. Pav. No. 13—	
Taxes collected	9.46
Tax Acct. Pav. No. 14—	
Taxes collected	123.94
Tax Acct. Pav. No. 15—	
Taxes collected	222.72
Total	$780.20
On hand Dec. 1st	$22.978.51
Total	$23,758.51
Warrants paid	9,589.75
On hand Jan. 1st	$14,168.96

Disbursed, Warrants Paid—

Labor acct. paving dist. No. 16	$ 26.50
Labor acct. paving dist. No. 18	8,610.31
Labor acct. paving dist. No. 19	49.20
Labor acct. paving dist. No. 20	10.00
Labor acct. paving dist. No. 24	893.74
Total	$9,589.75

Condition of Paving Funds on the First Day of January, 1912—

On Hand—

Tax acct. paving dist. No. 4	$ 138.80
Tax acct. paving dist. No. 5	3,253.19
Tax acct. paving dist. No. 6	368.52
Tax acct. paving dist. No. 7	972.57
Tax acct. paving dist. No. 8	403.29
Tax acct. paving dist. No. 9	586.95
Tax acct. paving dist. No. 10	883.64
Tax acct. paving dist. No. 11	728.33
Tax acct. paving dist. No. 13	580.18
Tax acct. paving dist. No. 14	1,418.74
Tax acct. paving dist. No. 15	1,417.65
Tax acct. paving dist. No. 16	474.21
Tax acct. paving dist. No. 17	79.16
Tax acct. paving dist. No. 18	751.19
Labor acct. paving dist. No. 18	18.22
Tax acct. paving dist. No. 19	281.74
Tax acct. paving dist. No. 20	45.78
Labor acct. paving dist. No. 20	3,174.50
Tax acct. paving dist. No. 21	285.35
Total	$15,861.81

Overdrawn—

Labor acct. paving dist. No. 11	$ 807.55
Tax acct. paving dist,. No. 12	109.83
Labor acct. paving dist. No. 22	155.76
Labor acct. paving dist. No. 23	577.29
Labor acct. paving dist. No. 25	42.42
Total	$1,692.85

Warrants Outstanding—

Labor acct. paving dist. No 18	$18.22

LATERAL SEWER FUNDS—To the Common Council of the City of Ann Arbor—

Treasurer's Report for Month Ending Dec. 31st, 1911. Money Received—

Tax Acct. Sewer No. 21—	
Taxes collected	$ 18.32
Tax Acct. Sewer No. 22—	
Taxes collected	23.76
Tax Acct. Sewer No. 25—	
Taxes collected	5.81
Tax Acct. Sewer No. 26—	
Taxes colllected	68.38
Tax Acct. Sewer No. 27—	
Taxes collected	154.87
Tax Acct. Sewer No. 28—	
Taxes collected	62.94
Tax Acct. Sewer No. 29—	
Taxes collected	40.95
Tax Acct. Sewer No. 32—	
Taxes collected	41.10
Tax Acct. Sewer No. 33—	
Taxes collected	15.27
Tax Acct. Sewer No. 34—	
Taxes collected	174.13
Tax Acct. Sewer No. 35—	
Taxes collected	16.40
Tax Acct. Sewer No. 36—	
Taxes collected	84.43
Tax Acct. Sewer No. 38—	
Taxes collected	30.05
Tax Acct. Sewer No. 39—	
Taxes collected	40.73
Tac Acct. Sewer No. 40—	
Taxes collected	7.80
Tax Acct. Sewer No. 41—	
Taxes collected	145.57
Total	$930.51
Overdraft, Dec. 1st	$2,781.35
Total overdraft	$1,850.84
Warrants paid	358.24
Overdraft, Jan. 1st	$2,209.08

Warrants Paid—

Labor acct. lateral sewer No. 36	$ 35.86
Labor acct. lateral sewer No. 37	43.85
Labor acct. lateral sewer No. 38	49.90
Labor acct. lateral sewer No. 39	39.89
Labor acct. lateral sewer No 40	32.34
Labor acct. lateral sewer No. 41	156.40
Total	$258.24

Condition of Lateral Sewer Funds on the First day of January, 1912—

On Hand—

Tax acct. lateral sewer No. 14	$ 50.75

Tax acct. lateral sewer No 17.....	50.80
Tax acct. lateral sewer No. 19.....	279.69
Tax acct. lateral sewer No. 20.....	50.89
Tax acct. lateral sewer No. 21.....	30.89
Tax acct. lateral sewer No. 27.....	881.92
Tax acct. lateral sewer No. 30.....	142.74
Tax acct. lateral sewer No. 31.....	21.67
Labor acct. lateral sewer No. 32..	719.51
Tax acct. lateral sewer No. 33.....	29.13
Labor acct. lateral sewer No. 33...	73.31
Labor acct. lateral sewer No. 34...	889.55
Tax acct. lateral sewer No. 35.....	163.54
Tax acct. lateral sewer No. 36.....	93.18
Labor acct. lateral sewer No. 36..	217.80
Tax acct. lateral sewer No. 37.....	137.59
Labor acct. lateral sewer No. 37..	115.14
Tax acct. lateral sewer No. 38.....	32.81
Labor acct. lateral sewer No. 39..	259.57
Tax acct. lateral sewer No. 40.....	44.23
Labor acct. lateral sewer No 40..	414.73
Tax acct. lateral sewer No. 41....	637.09
Tax acct. lateral sewer No. 42	18.17
Tax acct. lateral sewer No. 43.....	5.37
Total $5,360.07	
Overdrawn—	
Tax acct. lateral sewer No. 15....$	6.57
Tax acct. lateral sewer No. 16.....	20.68
Tax acct. lateral sewer No 18	38.50
Labor acct. lateral sewer No. 19...	253.96
Tax acct lateral sewer No. 22.....	59.15
Tax acct. lateral sewer No. 24.....	10.01
Tax acct. lateral sewer No. 25.....	36.78
Tax acct. lateral sewer No. 26.....	746.63
Tax acct. lateral sewer No. 28.....	14.52
Tax acct. lateral sewer No. 29 ...	114.60
Tax acct. lateral sewer No 32.....	1,224.43
Tax acct. lateral sewer No. 34.....	2,780.50
Labor acct. lateral sewer No. 35..	240.69
Labor acct. lateral sewer No. 38...	11.22
Tax acct. lateral sewer No. 39...	10.53
Labor acct. lateral sewer No. 41 ..	286.89
Labor acct. lateral sewer No. 42..	136.74
Labor acct. lateral sewer No. 43 ..	130.05
Labor acct. lateral sewer No. 44..	194.05
Labor acct. lateral sewer No. 45..	234.96
Labor acct. lateral sewer No. 46..	511.61
Labor acct. lateral sewer No. 47..	506.08
Total $7,569.15	
Recapitulation—Jan. 1st, 1912—	
City funds on hand $85.706.05	
Paving funds on hand 14,168.96	
Total $99,875.01	
Sewer funds overdrawn 2,209.08	
Balance on hand $97,665.93	
Bank balance $97,499.72	
Cash on hand 166.21	
Total $97,665.93	

Respectfully submitted: E. G. MANN, City Treasurer.

Farmers' and Mechanics' Bank, Ann Arbor, Michigan, Jan. 9th, 1912.

I hereby certify that the city of Ann Arbor, E G. Mann, Treasurer. had on deposit in the Farmers' and Mechanics' bank at the close of business, Dec. 31. 1911, the sum of ninety-seven thousand and four hundred ninety-nine and 72-100 dollars. ($97,499.72.)

H. A. WILLIAMS, Cashier.

Office of Street Commissioner, Ann Arbor, Mich., Jan. 2, 1912.

Hon. Board of Public Works, Wirt Cornwell, Esq., President: Gentlemen—I herewith submit the following report of the work done under my direction and control during the month of December, 1911:

Taking care of snow—	
Dec. 3-7; 16; 18; 28; 30—Cleaning snow from crosswalks, gutters, etc., labor .....$	55.95
Dec. 3-4; 16; 28; 30—Cleaning snow from park walks, labor	4.29
Dec. 3; 30—Plowing snow from sidewalks, labor	72.00
Dec. 4—Plowing snow from gutters, labor	3.50
Total $135.74	
Dec. 1-2; 8-13; 14-15; 19-30—Cleaning paved streets, labor $223.80	
Cleaning alleys, labor	3.17
Dec. 1-7; 12-13; 18-21; 27—Making street sweeper brooms, labor.....	20.56
Dec. 1-2—Building manhole sanitary sewer Liberty st. west of A. A. R. R., labor	8.90
Dec. 1-2; 6-7—Work at city yard, $5.29; work on snow plows, $2.69; labor	7.94
Dec. 12—Cleaning inlets and gutters, labor	8.28
Dec. 7; 14-15; 18-19; 26-29—Patching holes in streets, labor	18.89
Dec. 7—Removing ashes basement city hall, labor	1.75
Dec. 9-13; 20-23—Cleaning crosswalks, labor	12.73
Dec. 12; 22; 28—Tile Chubb road, $4.45; repairs tile Dewey av., $2.34; flushing sanitary sewer Ashley and Ann, $0.75, labor	7.54
Dec. 11-13; 21-22; 26-27—Hauling cinders on defective sidewalks, labor	18.37
Dec. 15—Tieing up and shipping empty cement sacks, labor	1.42
Total $469.09	

Respectfully submitted: J. WISNER, Street Commissioner.

Quarterly report of Justice Frank Ritchie received and ordered on file. Reports of City Treasurer, City Clerk and Street Commissioner for month of December, received, and ordered printed in minutes and filed.

Gardner S. Williams' report on water works presented and ordered on file.

Special Water Committee.

To the Common Council: Gentlemen—Your special water committee recommends to your honorable body that the reports of Gardner S. Williams on "Valuation of Ann Arbor Water Works," "Extensions and Improvements of Ann Arbor Water Works" and "Cost of a new system of Water Works," as here presented, be published in detail in the council proceedings, excepting body of tables, which together with report in full, shall be placed on file in the City Clerk's office and be open to the public at any time during office hours.

William L. Walz, W. S. Mills, Henry

Hochrein, Henry G. Pipp, Erwin E. Schmid, John Lindenschmitt, C. J. Sweet, Jas. D. Ramsay, Special Water Committee.

Ald. Ramsay moved the adoption of committee report. Adopted as follows: Yeas, Aldermen Pipp, Sherk, Koernke, Sweet, Goodyear, Hochrein, Ramsay, Murray, Lutz, Schmid, Lindenschmitt, Pres. Mills; 12. Nays, none.

(Note—The report will be published in full, as ordered, in next Thursday's (Jan. 25) issue of The Times News.)

The Council adjourned.

Ross Granger,
Clerk.

Report of the City Clerk and Comptroller.

CITY FUNDS.	Dec. 31st, 1911. On Hand	Overdrawn	Liabilities	Available	Deficit. July Next
Bridge, Culvert and crosswalk		$ 3,736.26	$ 2,939.93	.....	$ 6,676.19
Contingent	$ 4,395.04	.....	4,993.24	.....	598.20
City Cemetery	431.69	.....	280.00	151.69	.....
Dog License	334.48	.....	.....	334.48	.....
State Dog Tax	100.00	.....	.....	100.00	.....
Fire Department	959.66	.....	8,747.20	.....	7,787.54
Poor	997.73	.....	140.00	857.73	.....
Police	3,335.07	.....	3,878.84	.....	543.77
Street	76.81	.....	.....	76.81	.....
Water	4,497.55	.....	4,887.50	.....	389.95
Park	87.02	.....	.....	87.02	.....
Street Lighting	4,475.38	.....	8,520.61	.....	4,045.23
Sidewalk	890.18	.....	.....	890.18	.....
Sidewalk Building		754.69	.....	.....	.....
City Hall Tax	20.00	.....	20.00	.....	.....
City Hall Labor		5,548.55	.....	.....	.....
Uncollected City Tax		4,168.95	.....	.....	.....
Delinquent Tax	59.07	.....	.....	.....	.....
Sprinkling Dist. No. 11		147.73	.....	.....	.....
Sprinkling dist. No. 12		47.68	.....	.....	.....
Exinger judgment		1,685.50	.....	.....	.....
Totals	$20,659.68	$16,089.36	$34,407.32	$ 2,497.91	$20,040.88

Respectfully submitted: ROSS GRANGER, City Clerk and Comptroller.

Valuation and Extension

OF THE

ANN ARBOR WATER WORKS

BY

GARDNER S. WILLIAMS,

Consulting Engineer.

Ann Arbor, Mich., Jan. 2, 1912.

To the Honorable, the Mayor and Common Council of the City of Ann Arbor, Michigan:

Sirs—

"In accordance with an agreement entered into on July 14, 1911, with Alderman Manwaring, representing your water works committee, I have the honor to submit herewith, a report showing the estimated value of the plant, business and franchise of the Ann Arbor Water company on December 31, 1911, exclusive of values due to anticipated growth, cash on hand and in banks, and bills receivable, and assuming indebtedness paid, to be not less than $600,000.

"I find the cost of reproduction of the physical property of the Ann Arbor Water company, new as of December 31, 1911, including stores, tools and supplies on hand, but exclusive of cash on hand and in banks, and bills receivable, to be $531,934.

"I find the present value of the physical property of the Ann Arbor Water company based on the cost of reproduction less depreciation to be $504,873.

"I find the cost of developing the going concern to have been not less than $34,879, which, added to the value by reproduction less depreciation, gives a present value of the physical properties exclusive of earnings, of not less than $539,752.

"I find the cost of the physical plant as shown by the vouchers and annual reports of the company to be $538,517.

"I find the value of the physical plant as shown by the books of the company to be $529,528.86.

"I find the value of the plant, business and franchise of the Ann Arbor Water company, based on the earning of the fiscal year, ending March 31, 1911, to be $555,590.

"I find the value of the plant, business and franchise of the Ann Arbor Water company based on the earnings for the calendar year 1911, to be $676,217.

"These findings are presented in detail in the accompanying report which is sirs,

Very respectfully submitted, GARDNER S. WILLIAMS, Consulting Engineer.

THE VALUATION

Of the Plant, Business and Franchise of the Ann Arbor Water Co.,

Introduction.

This report embraces an inventory of the Physical Property of the Ann Arbor Water Company, which is presented in detail in Tables I to XVII inclusive, and an analysis and estimate of the intangible value of its

developed Business and its Franchise presented on pages 7 to 51.

The sources of information utilized in the preparation of this report have been:

(1) The books, vouchers and records of the Ann Arbor Water Company.

(2) The records of the Office of the City Engineer of Ann Arbor.

(3) Investigations and Reports of Professor M. E. Cooley to the Ann Arbor Water Company.

(4) Surveys and investigations made by the writer for the Eastern Michigan Edison Company.

(5) Personal examination of Plant and surroundings by the writer and his corps of assistants.

Acknowledgements.

The writer would take this opportunity for expressing his appreciation of the uniform courtesy with which he and his assistants have been met by all with whom they have come in contact during the investigation, and would testify particularly to the fact that no reluctance has been shown to furnishing all information for which request has been made, even though some of it might be very properly considered of a purely personal nature.

CHRONOLOGY.

Construction Period, 1885-1886.

Franchise and Contract agreed upon .....May 6th, 1885.
Franchise and Contract adopted by City .....June 1st, 1885.
Plant Constructed .....1885-1886.
Station No. 1.
Brick Building.
75 foot Brick Stack.
1.8 Mil. Gal. Knowles Pump.
125 H. P. Boiler.
Reservoir.
About 14 miles of distributing Mains.
Plant began operation .....1886.

Hamilton's Management, 1886-1893.

Bonded Indebtedness, $$150,000 1886.
Stock paid up, $50,000 ....Jan. 1889.
Additions to Station No. 1. 1889-1890.
2 Mil. Gal. Gordon Pump.
125 H. P. Boiler.
15 feet added to stack.
Gordon Condenser.
Gordon Condenser Room.
Additional Water Supply.
New Collecting Basin.
Stock increased to $100,000 Jan. 1890.
Additional Bonds Authorized..... Mar.. 1891.
13.47 Miles of Mains added 1887-1893.

The Receivership, 1893-1898.

Bonded Indebtedness, $163,000 1893.
Stock Authorized, $100,000 ....1893.
Additions to Station No. 1. ....1894.
1.5 Mil. Gal. Blake Pump in Basement.
Sewer system constructed and flush tanks connected, 1894-5.
Shaft at Station No. 1, 1895.
Station No. 2 (Washington St.) constructed .....1896-7.
Frame Building.
1.5 Mil. Gal. Deane Pump.
125 H. P. Boiler.
100 foot Iron Stack.
5.2 Miles of Street Main added 1893-8.
Reorganization of Company ...1898.

The Present Management, 1898-1912.

Bonded Indebtedness, $225,000 1898.
Stock paid up, $87,500, ...1898.
Additions to Station No. 2 1900-1
2 Mil. Gal. Deane Pump.
125 H. P. Boiler.
New Bond Issue of $350,000 authorized .....1901.
New Main from Station No 2 to Main St. 1902
New Stack at Station No. 2. ....1904.
River Shaft at Station No. 1. ..1905.
Shafts Nos. 1-6 at Station No. 2..... 1904-1907.
Stock increased to $100,000,..... April, 1906.
Replaced large Deane by Laidlaw-Dunn-Gordon in Station No. 2.1907.
Replaced 2nd Boiler in Station No. 1, ... 1908.
Replaced 1st Boiler in Station No. 2, ...1908.
New Main from Main St. to State St., ... 1909.
Bond Issue of $650.000 authorized, ...Mar., 1910.
Purification Plant installed, Dec. 1910.
Additions to Statior No. 1, ...1910.
Ozone and Compressor Room.
Filter Pump Room.
3 Mil. Gal. Blake Pump.
Site for Auxilliary Reservoir purchased ..... 1911.
Additions to Station No. 1, ...1911.
3 Mil. Gal. Laidlaw-Dunn Gordon Pump.
New Pump Room.
125 Horsepower Boiler.
Added 1 foot to Stack.
14.9 miles of Street Mains added, ... 1898-1912.
Bonded Indebtedness, $401,000 ....Jan., 1912.
Stock paid up, $100,000 ..Jan., 1912.

HISTORY

Construction and Early Management.

The Ann Arbor water works plant

was built in 1885-6 by the Ann Arbor Water company, in pursuance of a contract agreed to May 6, 1885, and incorporated in "An ordinance relative to waterworks" passed by the city council June 1, 1885; a copy of which ordinance is appended hereto as Appendix 1.

Goodhue and Birnie of Springfield, Mass., were the contractors, and Prof. Charles E. Greene of the University of Michigan was the engineer. Prior to and during construction Charles L. Goodhue of Goodhue and Birnie, was president, but shortly thereafter the management was left to the local stockholders, Goodhue and Birnie gradually disposing of their holdings, and Alexander W. Hamilton became president and superintendent.

The bonded indebtedness of the original plant was $150,000, bearing six per cent interest, and there was an issue of stock of $50,000. The original contract was for 14 miles of pipe and for this Goodhue and Birnie received $190,000 and there were $10.000 of bonds unsold when the works were turned over to the company. It appears, therefore, that the bonds were sold at par, and the stock was fully paid.

The records of the original construction remained in the possession of Goodhue and Birnie, and were ultimately destroyed by a fire, which visited their offices in Springfield prior to 1893. From the completion of the plant until 1894 the information regarding its operation can only be derived from the reports of Mr. Hamilton, the president and superintendent, and from an examination of the books made in 1894, which data, though in some particulars incomplete, give a reasonable record of the progress, both structurally and financially.

The charges to construction were as follows:

1885, original contract...	$190,000.00
1886, extension by report.	15,109.31
1887, extension by report.	6,466.05
1888, extension by report.	2,905.63
1889, extension by report.	12,761.81
1890, extension by report.	5,886.52
1891, extension by report.	9,739.62
1892, extension by report.	9,232.96
Total to Jan. 1, 1893,..	$252,101.70

The distribution system at that time, according to the superintendent's report for January, 1893, embraced, 27.47 miles of street mains, showing that the pipe in the streets had been practically doubled since the completion of the original contract. A second pumping engine had been installed at Station No. 1, during this period, and considerable sums expended in developing additional sources of water.

In January, 1889, an increase of stock to $75,000 was authorized, and in January, 1890, a further increase to $100,000 was approved. In March, 1891, a second issue of bonds was provided for, of which $13,000 was sold prior to September, 1893.

The Hamilton Assignment.

This subject is one which the writer would gladly omit, but for the fact that reference is frequently made to it, and that he has himself on many occasions been the recipient of information concerning it from apparently reliable sources, which in the majority of cases, when traced to its origin is found to be based upon the recollection of a more or less intimate connection with events occurring some 18 years ago, or to be derived wholly from conversations on the street or casually overheard, and which information, it may be added, has usually proven to be incorrect.

In order therefore to remove so far as possible, such erroneous impressions as may exist regarding this unfortunate episode, the writer now, once and for all, presents such facts in the matter, gathered from authoritative sources, as should place it in a correct light.

During the latter part of his connection with the water works, Mr. Hamilton, the president, whose holdings were the largest in the company, amounting to over one-fourth of the entire stock, became interested in mining ventures in the south, and invested therein whatever funds he could secure. As the amount he was able to raise by putting up his stock in the company as collateral was insufficient to meet the needs of the enterprise, he resorted to the expedient of issuing additional stock crtificates and selling them, or putting them up to secure loans wherever they would be accepted. In August, 1893, it became apparent to Mr. Hamilton that he could no longer continue these operations and he accordingly assigned

to Dr. A. K. Hale, the next largest shareholder, his stock to the par value of $27,000, which was then held as collateral by various creditors, the assignment being subject to the prior claims of such creditors.

Mr. John R. Miner was at once engaged to make an expert examination of the books, and the following five years were devoted by Dr. Hale as receiver, to straightening out the tangle into which Hamilton had gotten the affairs of the company. While the method of keeping the books was far from what would be desired, there was nothing found by a most careful examination to indicate that Hamilton had in any way attempted to cover up the diversion of funds from the company or the pledging of its credit. No claims were ever authenticated of payments to Hamilton on the company's account for which the books did not show proper credits. As a result of Mr. Miner's investigations there was found an apparent amount due the company from Hamilton, chiefly in stock held as collateral, of $38,471.54. Of this amount the receiver, with Mr. Hamilton's assistance, secured stock and bonds to the value of $24,050. This left a balance still due from Hamilton of $14,421.54. The receiver then made settlements with various creditors of the company by which he cancelled $2,425.82 of outstanding indebtedness. This leaves the net loss to the plant as a result of Hamilton's management $11,995.72. Of the accounts cancelled $1,828.14 was chargeable to construction, $63.67 to maintenance, and $534.01 to operation.

It appears then that instead of a loss to the company of nearly $40,000 as commonly supposed, the actual deficit was less than $12,000, or slightly over two per cent of the cost of the property. None of the deficit appears as a charge against construction or a part of the value of the plant on the books of the company.

The Receivership.

From September 11th, 1893, to May 5th, 1898, the property was operated by Dr. A. K. Hale as receiver, at which latter date the company was reorganized, and the stock reduced to $87,500, after which the original six per cent bonds were refunded in five per cents from an issue of $225,000, the balance of which was taken by the local banks.

At the close of the receivership the cost of the plant appeared as $286,624.17, to which might properly be added the value of materials going to construction for which settlement was made as before stated, amounting to $1,828.14, making the true cost of construction $288,452.31. The amount of bonds outstanding was $174,000 and the stock paid in was $108,450, of which $23,050 was surrendered by Hamilton for cancellation, leaving the total of bonds and stock outstanding as $259,400 or $29,052.31 less than the charges to plant on the company's books.

At this time the original source of supply had been outgrown and considerably increased in the vicinity of the old station, and the new station on West Washington street was in service. Of street mains 21,477 feet had been laid since January, 1893, by which 3200 feet of small pipe was replaced by six and four inch; 2007 feet of mains were also laid to supply flush tanks, which brought the total mileage of pipe in the system to 32.67 miles, with 1833 service connections attached.

1898 to 1912.

In December, 1901, a new bond issue of $350,00 at five per cent was authorized, of which $225,000 was deposited with a trustee to retire the outstanding bonds of previous issues, and the balance placed with local banks at a small discount.

Since the reorganization in 1898, the stock has been increased to $100,000 by the declaration on April 30th, 1906, of a stock dividend of $12,500, which amount was at that time more than covered by the previous additions to the plant from earnings.

On March 30th, 1910, a new issue of five per cent bonds amounting to $650,000 was authorized and approved by the state railroad commission. for the retirement of existing obligations, and to provide for further extensions of the works. The provision of the mortgage securing these bonds is such that they can only be issued up to 85 per cent of the value of the additions to the plant as certified to by Prof. M. E. Cooley, acting as the appraiser of the railway commission.

At the present time there are outstanding against the plant $401,000 of five per cent bonds, and $100,000 of fully paid stock. The total cost of

marketing bonds from the beginning of the receivership to date, including all discounts, has been only $4,256.19, or practically one per cent of the value of the securities outstanding, and this amount appears on the company's books as a charge against operation. When it is recalled that properties of this kind ordinarily show promotion and bonding charges amounting to anywhere from five to 15 per cent of the face value of the securities, and that these charges usually appear as a part of the cost of the plant, the utter senselessness of any suggestion of watered securities in the present case must be apparent to all.

Since the beginning of the receivership there has been charged to maintenance, exclusive of taxes and insurance, the sum of $26,691.89, which charges in many works, particularly those of municipalities, are incorrectly placed in the construction account.

Under the new organization the distribution system has been largely extended and strengthened; small pipe to an amount representing an original cost of over $10,000 has been replaced by larger sizes; the water supply at both stations has been increased and new machinery installed, and lands acquired for a reservoir in the eastern part of the city.

The present system comprises a distribution of 45 1-2 miles, a reservoir of 2,000,000 gallons capacity, two pumping stations with machinery of 10,000,000 gallons daily capacity, 3,630 service connections, 310 meters set, 252 fire hydrants and four standpipes; and a water supply capable of yielding about 1,600,000 gallons of water daily, exclusive of that passing through the purification plant. To the mains are also connected 157 flush tanks operated by the city for the benefit of its sewer system, and four hydrants belonging to the University of Michigan.

Contemplated Improvements.

During 1910 the company caused an investigation of the condition of its plant to be made by Prof. M. E. Cooley, who devoted several weeks with a corps of assistants, to the gathering and digesting of information as to pressures, amount of water supplied, losses of head in mains, etc. As a result of his investigations, extensions and improvements to the system estimated to cost $100,000 were recommended. In pursuance of the carrying out of these recommendations a new high duty pumping engine of 3,000,000 gallons daily capacity was installed at Station No. 1, and began service June 22, 1911, and land was acquired as previously stated, for the erection of an elevated tank in the eastern part of the city. Bids for this tank were in hand when negotiations opened by the city for the acquisition of the plant caused a suspension of pending operations.

PHYSICAL PROPERTY TO BE VALUED

Distribution System.

The distribution system of the Ann Arbor Water Works is shown on Plate 1 and covers practically the full length of all the streets within the city limits. It consists of about 38 1-2 miles of cast iron pipe and specials and about 7 miles of wrought iron pipe and fittings in active use in the streets of the city together with the gates, fire hydrants, services, flush tank connections, stand pipes, meters, etc., incidental thereto.

The cast iron pipe and specials vary in size from 4 in. to 16 in., and are all of standard medium weight, bell and spigot pipe with lead joints. The pipe and specials are coated with the standard preservative coating. The wrought iron pipes and fittings vary in size from 3-4 inch to 2 inches and are used only for service in sparsely populated districts or for interior lines in streets where the main pipe lines enclose the district but do not pass through that particular street.

This use of wrought pipe and fittings is regarded in the former case as a temporary expedient to give service to the few residents while waiting for the growth of the district to such proportions as will warrant district fire hydrants and additional water supply.

One or more gates are located at practically every corner in the city allowing isolation for repairs or extension of any section of the system. At each new branch from an existing main it has been for several years the practice to use a tapping machine by means of which an opening is cut in the main without turning off the water, and a gate installed in connection with a special fitting called a sleeve which is placed on the existing main. A cast iron gate stem exten-

sion box with cover is placed over each gate in order that it may be operated from the surface of the street.

The number and location of fire hydrants is under the direction of the City Council, there being 240 six inch and 12 eight inch hydrants installed. The fire hydrants are for the most part the Holyoke pattern with two hose and one steamer connection. There are at the present time about 3,680 service connections in use or ready for use from the mains. These service connections are made by the company on request by the customer and consist, for the residence and store customer, of a standard corporation cock 3-4, 1, 1 1-4, or 1 1-2 inch in size, a lead connection and a length of pipe of the same size to the curb line terminating in a curb stop and box at which point the customer attaches his house or store service. For services where considerable water will be used the size of the connection varies from 2-inch up to a 6-inch and is in these cases similar to a branch connection of the mains themselves, as it is necessary to use a sleeve and valve in place of the corporation cock.

There are 157 flush tank connections to the mains. These connections are in general similar to the ordinary house service connection and supply water continuously to an automatically operating tank which when full discharges its contents as a flush into the city sanitary sewer system, thereby furnishing the additional water necessary to carry off the sewage and to produce a scouring and cleaning effect in the sewers.

There are 4 stand pipes for sprinkling carts which are connected in the same manner as branch connections.

The services for the various public uses such as school houses, courthouse, city hall, fire engine and hose houses, etc., are similar to the ordinary services and are included in the service tabulation. Meters to the number of 310, varying in size from 5-8 to 6-inch are installed in the service connections of customers whose usage of water is such that the customary rates cannot be applied or would not be satisfactory. These meters are installed in basements in meter boxes, outside of the building, or other convenient places and the meters are periodically read and a charge made by the thousand gallons indicated.

All the pipes, valves, fittings, etc., are laid at an average depth of five and one-half feet, to the top of the pipe which affords ample protection from freezing in this climate.

Reservoir.

The reservoir of the Ann Arbor Water company shown on Plate 2 is located within the city limits about 1 1-4 miles in an air line, northwesterly from the courthouse, on the top of a hill and fronting the Chubb road. It is of an open type, constructed by excavating an area of about 90 feet square and using the excavated earth with additional borrow in forming enclosing bankments with a slope of 1 on 3 feet on the inside, 1 on 1 1-2 on the outside and a top width of ten feet. The basin is paved with cobble stone to above the water line and the remainder of the enbankment is sodded. The area at the water surface is about 225,000 square feet and has an estimated capacity of 2,000,000 gallons when full and of a little over 1,000,000 gallons at the ordinary water level. The elevation (City datum) of the inlet pipe at the reservoir is 989.05; the elevation of the water in the reservoir varies from something above to 2 feet below the top of this inlet pipe. The water falls over a pyramid of field stone built around the pipe for the purpose of aeration.

The main to the city is located at the bottom of the reservoir and takes water at a point about one foot above the floor. A by-pass connecting the inlet from Station No. 1 to the outlet to the city permits of direct pressure being carried on the distribution, and the cutting out of the reservoir for cleaning.

In the ordinary operation of the system the pumps deliver simultaneously into the mains and the reservoir, and by means of a check valve on the outlet of the reservoir the pressure on the system is maintained at that due to the elevation of the reservoir inlet, whenever the pump delivery is in excess of the consumption. At night or during periods of small use of water when the station pumps are not operating, the pressure is that due to the elevation of the water surface of the reservoir.

The elevation of the intersection of Huron and Main streets is about 832.5 so that the pressure at that point (neglecting friction) will be due to a head of about 156.5 feet when the pump is operating and averaging 155.5 feet with reservoir alone. These heads are equivalent to a pressure of 68 and 67 1-2 pounds per square inch

respectively.

Pumping Station No. 1.

Pumping Station No. 1 as shown on Plates 3 and 4 is located on the Huron river and Michigan Central Railroad tracks just below the old town site of Barton. It is about eight-tenths of a mile north of the reservoir and is connected to it by a 12-inch cast iron water pipe laid over a private right of way one rod wide. This pipe is of three different weights, extra heavy at station end, heavy in the middle section and medium at the reservoir end, and is laid underground similarly to those in the streets.

The station building was originally constructed in 1885 and is a brick structure with stone sills, and a slate roof over timber framing. A square brick stack 75 feet high was built adjacent to the station. The original station contained 1.8 million gallon Knowles Tandem Compound Duplex Pump and Condenser, a 125 horse power boiler, and the necessary accessories such as boiler feed pump etc.

In 1889-90 a 2 million gallon Gordon Tandem Compound Duplex Pump and Condenser, a 125 horse power boiler, a Gordon Condenser Pump capable of handling the steam from both pumping engines, and the necessary auxilliary appliances were added. A 15-foot addition was made to the stack, and a brick addition with a composition roof was made to the station building to house the Gordon Condenser Pump.

In 1894, a 1 1-2 million gallon Duplex Non-condensing Pump was placed in the basement of the old station. In 1904 the original boiler was replaced by a new one of similar capacity.

There is no evidence of further material changes in Station or machinery beyond the repair of boilers and machinery, and the addition of a wooden coal shed, until 1910-11 when a 3 million gallon Laidlaw-Dunn-Gordon Cross-Compound Duplex Flywheel Type Pump and Condenser, a 125 horse power boiler, a feed water heater, etc., were added. Brick additions with composition roofs were made to house the pump and the additional boiler. A steel breeching was necessary to connect the last boiler to the stack. The stack was raised a foot by the addition of a concrete cap in 1911, making its total height 91 feet.

The concrete Ozone Treating House and an addition to the Station for the Electrical Plant were made in 1910, and also an addition for housing the Blake Pump which handles the water to the filter. The filter and its house was constructed in 1910 to work in conjunction with the Ozone plant.

Coal is delivered at the station on the company's siding from the Michigan Central Railroad tracks, and is stored in coal sheds at the rear of the Boiler House.

The present method of operating at this plant is to do all the pumping with the Laidlaw-Dunn-Gordon Pump, holding the Knowles and Gordon pumps in reserve. Two boilers are generally in use with one held as a reserve.

For purifying the water, the new Blake Pump draws the water from the river shaft and delivers it to the filter. After passing through the sand and gravel filter bed, it flows by gravity through the Ozone treating house where the Ozone gas is forced upwards through the water. This treating house is a concrete structure of three units, the deepest chamber being 29 feet. The water in passing through is baffled in order that an intimate mixture with the gas may result. The capacity of the Ozone generators is at present sufficient for two units of 1,000,000 gallons each, but electrical machinery and other apparatus is designed for three.

From the treating house the water flows into the collecting basin and suction well. The Ozone gas is formed by passing air at a pressure of about 5 pounds through the electric Ozone generators.

The station is piped and interconnected in such a manner that practically all of the auxiliary machinery is available to perform any function necessary to the operation of the plant.

Water Supply of Station No. 1.

The pump placed at Station No. 1 in 1885 took water from a collecting basin located on the westerly side of the station which is now abandoned. The water was collected by tile underdrains from the territory immediately west of this basin and flowed by gravity into it.

In 1887-8 several wells were driven to an average depth of 78 feet and a collecting gallery built over them. A tile line conducted this water to the old basin. About this time the water rights were purchased of a

spring near Fosters and a tile line was laid from the spring along the Michigan Central tracks to the collecting basin. This supply did not prove to be a success and was soon abandoned. Water rights were also purchased to a spring on the Towar farm and a 6-inch cast iron line was laid from the spring (located in a gully a little above Towar's barn) crossing under the Huron river and railroad tracks to the collecting basin, a distance of about one-half mile.

In 1889, after the installation of the Gordon pump it was found necessary to abandon the old collecting basin and construct a new one and a suction shaft on the opposite side of the station from the old one. The wells, tiles and pipes were all connected to this new basin. In 1895 a shaft was sunk between the collecting gallery and the old basin in the bottom of which two 6-inch wells 48 feet deep were driven. This shaft discharges into the collecting basin through a 12-inch cast iron main and is also connected directly to the pump suction. Wells were put down from time to time to augment the supply and to this end a 12-inch cast iron suction pipe line was laid into the sand and gravel bed under the Cornwell Manufacturing company's mill pond. This pipe has been used as a blow off since the removal of the dam of that company.

In 1905, the river shaft was sunk and connected into the suction well by means of 8 and 10 inch cast iron pipe lines. In the bottom of the river shaft a 6-inch well was driven to a depth of 127 feet.

In 1910-11 a 12 and 16 inch cast iron main was laid to take the water from the river to supply the Ozone Treating Plant.

At the present time all the water is taken from the suction well which receives water from the collecting basin (ground water from the wells in the immediate vicinity of the station) and the treated water from the Ozone Treating Plant. The collecting basin is about 75 feet by 110 feet at the water surface and is about 10 feet deep. This basin is constructed in the same manner as the reservoir.

The well shafts are steel casings up to the ground surface, lined on the inside with common brick and have vitrified brick outside above the ground line. They are roofed and provided with a top ventilator and a door.

The wells proper are of wrought iron pipe with copper strainers.

Pumping Station No. 2.

Pumping Station No. 2, shown on Plates 5 and 6, is located on the south side of Washington street near Seventh street. The original station building was a frame structure with a composition roof, constructed in 1896-7. A 1 1-2 million gallon Deane Tandem Compound Duplex Non-condensing Pump, 125 horse power boiler with a 100-foot iron stack, and auxiliary machinery was installed at that time. In 1898 a second Deane Pump similar to the original but a little larger was installed, and another boiler and iron breeching to the stack added.

An addition to the boiler house was necessary to accommodate this second boiler. The present stack was built in 1904 and the frame pumping station was rebuilt at this time. In 1907 the Deane pump that was last placed was removed and sold, being replaced by a Laidlaw-Dunn-Gordon Cross Compound Duplex Flywheel type Pump and condensing outfit. The coal for this station is hauled by wagon and stored adjacent to the boiler room.

In normal operation of this station the Laidlaw-Dunn-Gordon Pump is run exclusively, the Deane Pump being held ready for emergency service, and for use while repairing the larger pump. The boiler capacity is such that one boiler carries easily the load allowing of frequent cleaning. By use of rain water and the returned condensed steam the boilers are kept in excellent condition. The two pumps take their supply from the 18-inch suction to Shaft No. 1, and pump directly into the distribution mains.

Water Supply at Station No. 2.

When the station was built in 1896, an 8-inch cast iron collecting main was run towards Washington street and was connected directly to some 20 odd wells driven in the yard between the building and the street. At about this time or shortly after a 12 inch cast iron suction line was run west from station to Seventh street and wells were driven along this line and connected with it. In about 1900 this line was extended across Seventh and about 1905 across Eighth street wells being driven and connected into the line up to and across Eighth street.

In 1905-6 Shaft No. 1 was sunk and is now used as a suction well. From 1905 to 1907 shafts No. 2 to 6 inclusive have been sunk and the wells not depended upon entirely for

the water supply. Upon the completion of shaft No. 2 a separate 8-inch cast iron pipe line was run from it to the suction well.

At the time of the installation of the Laidlaw-Dunn-Gordon pump, an 18 inch suction line was laid to the suction well and the old 12 inch suction line was disconnected at the Station and a 10 inch cast iron branch line run into the suction well. This old 12 inch line was also connected by a 12 inch by pass to the 18 inch suction main for use in event of accident to the suction well. The shafts and wells are constructed in similar manner to those at Station No. 1.

PRINCIPLES OF VALUATION.

Rules.

When property is taken for the benefit of the public, by the exercise of the so-called right of eminent domain, certain rules have been established by court decisions which are here presented, being largely abstracted from briefs on the subject by the Honorable Nathan Matthews, of Boston, one of the foremost valuation attorneys in America.

Constitutional Provision.

The underlying condition of valuation was expressed in Article XVIII of the old constitution of this state as follows:

"Section I. The property of no person shall be taken for public use without just compensation therefor."

And Article XIII of the new constitution further elucidates it thus:

"Section 1. Private property shall not be taken by the public nor by any corporation for public use, without the necessity therefor being first determined and just compensation therefor being first made or secured in such manner as shall be prescribed by law."

Market Value.

When the property taken is such as to be subject to frequent sale, just compensation is held to be the fair market value for its most valuable use, and the reasonable probabilities of the future are to be considered in so far as they affect the use and value of the property.

Incomplete Property.

If the property be incomplete when taken, the cost of completion and its then completed value are to be taken into account, and from such completed value the cost of completion is to be deducted to arrive at the present or incomplete value.

No Market Value.

When property has no market value in the strict sense of the term,—that is, where it is of such a nature as not to be the subject of so frequent sales as to give it a current price,— the ordinary rule that the measure of compensation is the market value of the property, fails of direct application and in such cases it is the intrinsic value of the property, or its value to its owner, that is the measure.

Actual Cost.

The actual cost is an important but not a conclusive indication of value, of physical property, but its importance varies inversely as the elapsed time since the construction.

Reproduction Cost.

Since it is seldom that the actual cost within a reasonable period of the date of valuation can be presented, the test of reproductive cost is frequently applied to the valuation of physical property. Reproductive cost, is, however, by no means conclusive no account at all of the value of incorporeal rights of property, such as water rights or franchises.

Substitution.

Another frequently used indication of value of physical property is the cost of substitution, and it is generally accepted that the market value of physical property cannot be greater than the value of some other physical property which is its equivalent. This is one of the most common methods of arriving at the value of a water supply as distinguished from the plant itself.

Going Concern.

The "going concern" value is a frequently misapplied term, but in its proper significance is an element to be considered. Strictly speaking it is the special value which attaches to physical property by reason of the fact that it has performed the functions for which it was designed. This value is recognized by every investor though frequently passing unnamed. In a Massachusetts case, (179 Mass. 365) the court sustained an award which allowed $75,000 out of $600,000 for going concern value, when franchises and earning capacity were excluded, because as stated by the commissioners, "the cost of duplication, less depreciation, of the different

features of the physical plant * * * * does not represent a fair valuation of this plant, welded together, not only fit and prepared to do business, but having brought that business into such a condition that there is an enhanced value created thereby, so that the city in purchasing it, without considering its income or right to do business, but having the power to carry it on on its own account, should pay more for the property as such than as if this consideration did not obtain."

Earning Capacity.

The earning capacity of a property is always an important and usually the chief, element or test of value. When the subject of valuation is physical property with no franchise, it is the net income of the property by way of rent, that is, the rental value, which is to be considered, but when the earning capacity is dependent upon the use of the franchise as well as physical plant, as in the case of the property of a public service company, the question as to the consideration of the earning capacity of the entire property depends on whether or not the franchises are included in the valuation. Where they are not included the question of earning capacity other than rental is eliminated, but when they are included, the earning capacity of the whole is competent as evidence of the value of the entire property. This latter is the ordinary situation in the condemnation of the property of public service corporations and the law applicable thereto has been set forth by the United States supreme court in the case of Monongahela v. United States, 148 U. S. 312, wherein it is stated (p. 328.)

"The value therefore, is not determined by the mere cost of construction, but more by what the completed structure brings in the way of earnings to its owner."

In considering earning capacity, however, it is necessary to consider the probability of its continuance, the adequacy of the service rendered, and the reasonableness of the compensation therefor.

SERVICE AND RATES.

Quality of the Supply.

The first question involved in the subject of service is that of the quality of the water supplied. The average consumption of water during the past year has been at the rate of about two and one-quarter million gallons per day, of which about 1,600,000 gallons have been ground water, and the rest ozonized river water. Although the ground water is much harder than is desireable for household use, no one has questioned the service on that account, and many citizens who do not wish to use the public supply, avail themselves of a similarly hard water from private wells. As to the ozonized river water the situation is somewhat different. The use of unpurified river water has been and is justly condemned, and to meet this condemnation the water company in 1910 installed an ozone purification plant to treat the river water. It was not till December, 1910, that this plant passed out of the experimental state and it is only since that time that its performance can properly be judged. During the past year there have been weekly analyses made in the Laboratory of Hygiene of the University of Michigan, of the tap water supplied to the city. In the entire 52 analyses, there has not been found a single positive indication of the presence of a germ known or supposed to produce disease in man. In six out of the 52 analyses the colon germ has appeared in small quantities but not sufficiently numerous to cause the water to be condemned. In 16 of the 52 cases a guinea pig inoculated with the water died, but in no case did it appear that the cause of the death was anything inimical to the health of man. The presence of colon has been explained in part by the putting in of a new suction at the river station, during which operation it was extremely difficult to prevent some contamination of the supply by raw river water, and also by the laying of a considerable length of new mains which were liable to carry with them into the system colon germs accumulated on the streets, after which the Medical Building fire caused a general disturbance of the system in that vicinity, and the circulation of all accumulations in the pipe toward the place where samples are taken for analysis. It seems quite safe to assume that the occurrence of colon will be less frequent in the future. The significance of the colon germ in an analysis is simply the presence of contamination from animal sources, the germ itself is harmless. But the inference is that where colon could occur other and dangerous germs from similar sources might penetrate.

Pressures.

During the sprinkling season particularly, the pressure has for sev-

eral years been deficient in the southeastern part of the city and the cause of much complaint. The subject has received the attention of the company during the past three years and after an examination already referred to, by Prof. M. E. Cooley, plans were adopted which would have relieved the trouble during the past season had it not been for the expressed desire of the city to have an opportunity to acquire the plant before further expenditures were made.

Fire Protection.

The same plans were designed to provide increased fire protection to the city and would unodubtedly have done so if carried out.

Rates.

The contract with the city provides that the water shall be furnished "at reasonable rates, and not exceeding in amount the average sums paid by inhabitants of other cities of Michigan simlarly stuated and of like populaton and supplied by private companies."

To find a privately managed works in the state in a similar situation to those under consideration is not easy. Ann Arbor is peculiar in several particulars:

First, as to the uncertainty of the underground supplies of water; two borings only a few feet apart frequently turn out, one a flowing well and the other a dry hole.

Second, as to the difference of elevation to be surmounted within the limits of the distribution, the variation being equal to the difference of pressure of 60 pounds; and

Third, as to the character of the consumers, the community being a very large user of water, the consumption averaging more than 100 gallons daily for each inhabitant, students included, and the number of fixtures using water on second floors is much greater than in ordinary towns of the same size.

In a report on the valuation of this property by Messrs. Riggs and Sherman of Toledo, made some ten years ago, a comparison is made between the then existing rates in Ann Arbor and in 13 privately owned plants located in cities ranging in population from 5,000 to 87,000, from which it was concluded that the local rates were slightly above the average of the 13. Since that time the local rates have been materially reduced and several of the companies included have gone out of business through bankruptcy or municipal acquisition.

Of all the cities in the country the conditions most nearly approaching those in Ann Arbor probably exist in Madison, Wisconsin, and Ithaca, New York, the seats respectively of the Universty of Wisconsin and Cornell University. The former has always been a municipally operated works and the latter has recently become so, but the rates in vogue prior to the acquisition of the plant by the city, when the population was 14,615, and which rates were held, on condemnation, to be reasonable, were, as shown in comparison with the Ann Arbor rates, as follows:

Assessed Annual Water Rates.

Ithaca, N. Y.:	
Kitchen with a single tap	$ 8.00
Hot and cold taps	6.00
Bath tubs	4.00
Water closets	5.00
Wash basins	2.00
Total	$25.00
Ann Arbor, Mich.:	
Kitchen with a single tap	$2.50 to $5.50
Hot and cold taps	no charge.
Bath tubs	$2.00
Water closets	3.00
Wash basins	no charge.
Total	$7.50 to $10.50

The pumping at Ithaca was largely done by water power at an expense not greater than in Ann Arbor. The water was purified adding an expense of about 50 per cent to the ordinary charges, so that the Ann Arbor rates would by comparison be about two-thirds of the Ithaca rate, whereas they appear to be less than one-half.

Though the cost of supplying water in this city is very much greater than in Detroit, probably fully three times as much, it is nevertheless a fact, though not generally known, that while the minimum family rate in Detroit is $3.30, that in Ann Arbor is only $2.50.

Assuming a dwelling equipped with the ordinary kitchen fixtures, a wash bowl, water closet and bath tub, the assessment in Detroit would be $6.28, and in Ann Arbor $7.50 to $10.50 depending on the size of the house. In the lawn sprinkling charge alone is there a marked difference and on this item Detroit has for years stood at the bottom of the list.

The writer concludes the existing rates to be reasonable.

THE VALUATION.

The Cost of Reproduction.

Tables I to XVII inclusive present in detail the cost of reproduction of the physical property new on December 31st, 1911, and embrace:

The distribution system and appurtenances	$347,647.38
The reservoir	8,965.00
Station No. 1	54,997.80
Station No. 2	18,028.11
Water supply	75,000.00
Real estate	18,305.00
Office records	2,500.00
Office furniture, fixtures and supplies	1,800.00
Tools and materials on hand	4,691.02
Estimated cost of reproduction	$531,934.31

Depreciation.

The condition of the cast iron pipe has been established by the examination of 36 cores that have been cut from the pipes in the process of tapping, the record of which is presented in Appendix II, covering pipe in service from two years to 26 years. As a minute examination fails to show an appreciable difference in them, and all appear in the same condition as pipe a few weeks in service, an allowance of one per cent has been considered sufficient to cover the depreciation of the cast iron pipe. On hydrants, valves, and stand pipes, a depreciation of five percent has been allowed. On service connections, flush tanks, and meters set, a depreciation of ten per cent has been allowed. On wrought iron street mains a depreciation of 25 per cent has been allowed. On the reservoir a depreciation of two per cent has been allowed. On the pumping stations a depreciation varying from two per cent on the suction wells to 75 per cent on parts of the machinery has been allowed.

On meters and construction supplies in stock, paving, water supply, real estate, and records no depreciation has been allowed. On office furniture, fixtures, and supplies a depreciation of 50 per cent has been allowed; and on the items of construction, tools etc., shown in tables XVI and XVII and marked "depreciating" 50 per cent has been allowed.

The depreciations then are:

Cast iron pipe	$1,976.00
Hydrants, valves and stand pipes	1,282.00
Services, flush tank connections and meters in service	6,255.00
Wrought iron pipe	3,297.00
Reservoir	163.00
Station No. 1	8,875.00
Station No. 2	3,455.00
Office furniture, etc	900.00
Construction tools, etc	858.00
Total	$27,061.00

The Going Concern.

The value due to going concern has been arrived at by placing it at the amount of interest accruing at six per cent per annum on the paid up stock of the company from the beginning of 1886 until the works were regularly paying dividends in 1900, less all payments of dividends during that period and less the amount of the Hamilton shortage.

The interest so compiled is as follows:

1886-9 4 yrs. on $50,000 at 6 per cent	$12.000.00
1890 1 yr. on $75,000 at 6 per cent	4,500.00
1891-2 2yrs. on $100,000 at 6 per cent	12,000.00
1893-9 7 yrs. on $87,500 at 6 per cent	36,750,00
Total interest	65,250.00

Dividends were paid during the periods as follows:

1889	$2,000.00
1890	3,750.00
1891	5,000.00
1892	5,000.00
1899	2,625.00
Total dividends	$18,375.00
Leaving unpaid interest	46,875.00
Hamilton's shortage was	11,996.00
Making the going concern cost	$34,879.00

The Voucher Cost.

The vouchers of the Ann Arbor Water company have been examined to determine the cost of its physical plant.

Prior to September, 1893, no vouchers exist and the data of cost for that period is taken from the annual reports on file. From January 1, 1893 to September 1, 1893, no records exist, and the cost of construction during that period has been taken as one half the average of the preceding six years. From September, 1893, to December 31, 1911. the items have been taken from the vouchers. To this has been added the book entries on account of office furniture

and fixtures, the amount of the discounts on construction invoices in the receiver's settlements which were taken from the invoices themselves, the inventoried value of the office records, which are charged to operation on the books, and 80 per cent of the salary of the superintendent since 1893, which in the vouchers is charged to operation.

The cost so determined is as follows:

Item	Amount	Authority
Original construction	$190,000.00	Contract
Hamilton's construction	62,101.70	Reports
1893 construction	2,312.09	Estimated
Receiver's settlements	1,828.14	Invoices
1893 to date		
Distribution mains	106,887.51	Vouchers
Services	24,959.03	Vouchers
Meters	12,938.05	Vouchers
Sta. No. 1 and Real Est.	30,106.68	Vouchers
Sta. No. 2 and Real Est.	65,391.66	Vouchers
Filter plant	3,308.80	Vouchers
Ozone plant	14,874.00	Vouchers
Stand pipe lots	1,810.00	Vouchers
Office furniture and fixtures	1,800.00	Inventory
Office records	2,500.00	Inventory
80 per cent of Supt's salary	17,700.00	Books
Total	$538,517.66	

The Book Value.

The books of the Ann Arbor Water company have been examined to ascertain the distribution of charges to operation, maintenance and construction or plant. The charges to construction have in no case been found to embrace items not properly belonging there; and some items have been placed in maintenance and operation that might properly appear in construction; and depreciations have from time to time been written off as portions of the plant have been replaced. The value of the physical plant, as shown on the books of the company on December 31. 1911, was $529,528.86..

Values from Earnings.

The books of the company show the gross income for the fiscal year ending March 31, 1911 to have been:

Assessed rates	$43,967.36
Metered water	16,722.48
Mason work	736.04
Meter rentals	172.44
Off and on	71.75
Total	$61,670.07

The annual charges were as follows:

Operation pumping station expenses	$ 6,402.54
Fuel	5,061.46
Office and distribution expenses	10,072.88
Rebates and stoppages	605.76
Total	$22,142.64
Maintenance:	
Repairs to distribution	607.35
Repairs to pumping station	644.19
Repairs to meters	581.50
Total	1,833.04
Taxes and insurance	4,914.88
Total	$28,890.56

To this an amount for depreciation should be added, and taking $5,000 as a reasonable allowance the total annual charges become $33,890.56, which when deducted from the gross income of $61,670.07 leaves $27,-779.51 as the amount available for interest. Capitalizing $27,779.51 at 5 per cent since the latter is the interest which the securities now draw, the value of the plant, business and franchise appears to have been, $555,590.

During the calendar year 1911 some economies have been effected at the pumping stations due to the installation of new machinery, and a considerable added revenue has been derived from extensions during the preceding year. As a result the gross income has increased to $69 300.21, while the operation, maintenance and taxes have amounted to only $30,-489.33, though considerably more water has been handled. Making the same allowance for depreciation as before, the total annual charges become $35,489.33, which when deducted from the gross income of $69,300.-21 leaves $33,810.88 as the amount available for interest, and this when capitalized as before at 5 per cent, gives the value for the plant, business and franchise of $676,217.

It does not seem to the writer that this latter surplus can be relied upon continually, though at the same time it is evident that the plant will show better earnings hereafter than during the last fiscal year, and he therefore adopts as the just compensation for the plant, business and franchise of the Ann Arbor Water company, without considering the value of future growth, and omitting cash on hand and in bank, and bills receiv-

able, but assuming all debts to be paid, the sum of $600,000.

CAST IRON PIPE.

Table I.

Ann, 4th av. to State, 1897, 4 in. 1188, total 1188
Ann, Main to 4th av., orig., 8 in. 339, Total 339
Ann, 5th av. to Div., orig., 4 in. 594, Total 594
Ann, State to Ingalls, orig., 6 in. 660, Total 660
Ann, 14th to Observ., 1892, 6 in., 690, Total 690
Ashley, Wash. to Sth., 1899, 4 in. 100, Total 100
Ashley, Huron to Sth., 1904, 4 in. 528, Total 528
Ashley, Miller av., to Huron, 1907, 6 in. pipe, 700, Total 700
Baldwin, Israel to Sth., 1909, 6 in. 700, Total 700
Belser, Observ. to Wash., 1898, 6 in. 850, Total 850
Fourteenth, Observ. to Wash., 1907, 6 in. 200, Total 200
Broadway, Mill to East, 1886, 6 in. 1442, Total 1442
Broadway, End of line to East, 1889, 6 in. 712, Total 712
Broadway, Depot to Mill, Orig., 6 in. 2520, Total 2520
Brooks, Miller av., to North, 1895, 6 in. 700, Total 700
Brooks, End of line to North, 1909, 6 in. 700, Total 700
Brown, Hill to Phillip, 1910, 6 in. 828, Total 828
Cambridge, Hill to South, 1910, 6 in. 447, Total 447
Cambridge, Washtenaw to North, 1911, 6 in. 528, Total 528
Catherine, Div. to State, 1900, 6 in. 800, Total 800
Catherine, State to Ingalls, 1906, 6 in. 700, Total 700
Catherine, (service) Catherine to Hospitals, 1891, 6 in. 140, Total 140
Catherine, Fourth av. to Div., orig., 8 in. 925, Total 925
Catherine, Thirteenth to Hospital, 1891, 6 in. 326, Total 326
Clark and Catherine, Ann to Hospital, 1898, 6 in. 700, Total ... 700
Chubb Road, Spring to Main, orig., 14 in. 1960, Total 1960
Chubb Road, Reservoir to Spring, orig., 16 in. 3010, Total 3010
Church, Washtenaw to College, orig., 6 in. 297, Total 297
Church, Hill to Oakland, 1902, 6 in. 660, Total 660
Church, Hill to North, 1902, 4 in. 385, Total 385
College, E. Univ. av. to Church, orig., 6 in. 333, Total 333
Cornwell Pl., Ingalls to Twelfth, 1906, 6 in. 300, Total 300
Depot, Main to Beaks, orig., 8 in. 1318. Total 1318
Detroit, Kingsley to Beaks, orig., 6 in. 1265, Total 1265
Dewey, Packard to State, 1910-1, 6 in. 1429, Total 1429
Dexter av., Huron to West, 1903, 6 in., 814, total 814
Division, Jefferson to Williams, orig., 4 in. 595, Total 595
Division, Packard to Jefferson, orig., 6 in. 670, Total 670
Division, William to Liberty, orig., 6 in. 595, Total 595
Division, Lawrence to Kinglsey, 1905, 6 in. 300, Total 300
Division, Kingsley to Detroit, 1897, 6 in. 638, Total 638
Division, Ann to Lawrence, orig., 6 in., 614. Total 614
Division, Hill to Edwin, 1909, 6 in. 790, Total 790
Edwin, Division to West, 1909, 6 in. 200, Total 200
Edwin, State to Sybil, 1906, 6 in. 750, Total 750
Elizabeth, Fuller to Kingsley, orig., 4 in. 701, Total 701
Elm, Geddes to S. Univ. av., 1905, 6 in. 750, Total 750
Felch, Main to Ashley and Ashley South, 1910, 6 in. 700 Total 700
Ferdon Road, Washt. to South, 1910, 6 in. 1421, Total 1421
Fifth av., Kingsley to North, orig., 6 in. 565, Total 565
Fifth av., Kingsley to Huron, 1906, 6 in. 1400, Total 1400
Fifth av., Packard to Jefferson, orig., 6 in. 244, Total 244
Fifth av., William to Liberty, orig., 6 in. 595, Total 595
Fifth av., Washington to South, 1910, 4 in. 240, Total 240
Fifth av., Liberty to North, 1911, 6 in. 110, Total 110
Fifth av., Jefferson to William, orig., 6 in. 596, Total 596
Fifth St., Jefferson to Madison, 1911, 6 in. 566, Total 566
Fifth St., Liberty to Jefferson, 1910, 6 in. 865, Total 865
Fifth st., Miller av., to North, 1909, 6 in., 550. Total 550
Force Main, Station No. 1 to Reservoir, orig., 12 in., 4127. Total 4127
Forest, fm. Washtenaw to So. U. av., orig., 4 in. 541, Total 541
Forest, Hill to South, 1903, 6 in. 700, Total 700
Forest, End of line to South, 1905, 6 in. 1200, Total 1200

Forest, S. Univ. av. to Hill, 1908, 6 in. 1100. Total 1100
Forest, Wells to South, 1910, 6 in. 700, Total 700
Fountain, Miller to Hiscock, 1909, 6 in. 1000, Total 1000
Fourteenth, Huron to Ann, 1901, 6 in. 363, Total 363
Fourth av., Packard to Liberty, orig., 4 in. 896, Total 896
Fourth av., Packard to Liberty, orig., 6 in. 328, Total 328
Fourth av., Packard to Madison, 1901, 6 in. 836, Total 836
Fourth av., Hill to Phillip, 1910, 6 in. 843, Total 843
Fourth av., Liberty to Ann, 1903, 4 in. 1056, Total 1056
Fourth av., Depot to Summit, 1911, 6 in. 232, Total 232
Fourth av. Beaks to North, 1911, 6 in. 315, Total 315
Fourth av., Ann to Catherine, orig., 8 in. 331, Total 331
Fourth av., Kingsley to Beaks, orig., 6 in. 200, Total 200
Fourth St., Jefferson to Liberty, orig., 4 in. 500, 6 in. 490, Total 990
Fuller, Elizabeth to Thirteenth, 1904, 6 in. 1675, Total 1675
Fuller, Detroit to Elizabeth, orig. 6 in. 475, Total 475
Geddes av., Washtenaw to Observatory, orig., 6 in. 904, Total 904
Geddes av., Oxford Rd. to East, 1905, 6 in. 1130, Total 1130
Geddes av., Observatory to Oxford Rd., 1905, 6 in. 1400, Total 1400
Gott, Miller av. to Summit, 1892, 6 in. 1200, Total 1200
Greendwood, E. Univ. av. to Packard, 1901, 6 in. 825, Total 825
Hill, Twelfth to Olivia, 1890, 6 in. 1542, Total 1542
Hill, Oswego to Oxford, 1910, 6 in. 693, Total 693
Hill, Main to Packard, 1905, 6 in. 2000, Total 2000
Hill, Olivia to Washtenaw, 1892, 6 in. 824, Total 824
Hill, State to Packard, 1911, 6 in. 300, Total 300
Hill, State to Twelfth, orig. 6 in. 994, Total 994
Hiscock, Spring to Fountain, orig., 6 in. 460, Total 460
Huron, State to Thirteenth, 1897, 6 in. 1452, Total 1452
Huron, Thirteenth to Fourteenth, 1901, 6 in. 572, Total 572
Huron, A. A. R. R. to Seventh, orig., 6 in. 1752, Total 1752
Huron, Main to A. A. R. R., orig., 8 in. 988, Total 988
Huron, Seventh to West, 1895, 6 in. 1862, Total 1862
Huron, State to Main, orig., 12 in. 2064, Total 2064
Ingalls, N. Univ. av. to Washington, orig., 6 in. 621, Total 621
Ingalls, Kingsley to Lawrence, 1906, 6 in. 300, Total 300
Ingalls, Ann to Lawrence, orig., 4 in. 670, Total 670
Ingalls, Hill to S. Univ. av., orig., 6 in. 1088, Total 1088
Israel, Lincoln to Washtenaw, 1905, 6 in. 1230, Total 1230
Israel, Lincoln to West, 1900, 6 in. 700, Total 700
Jackson, Huron to West, 1903, 6 in. 814, Total 814
Jefferson, Fourth St. to West, 1886, 6 in. 712, Total 712
Jefferson and Hamilton, Fifth av. to William, 1900, 6 in. 900, Total 900
Jefferson, Maynard to Thompson, orig., 4 in. 331, Total 331
Jefferson, First to Fourth St., orig., 6 in. 1000, Total 1000
Kingsley, Main to Detroit, orig., 6 in. 847, Total 847
Kingsley, Division to Elizabeth, orig., 4 in. 515, Total 515
Kingsley, Elizabeth to State, orig., 6 in. 194, Total 194
Kingsley, State to Ingalls, 1906, 6 in. 700, Total 700
Lawrence, Division to State, orig., 4 in. 731, Total 731
Lawrence, State to Ingalls, orig., 6 in. 660, Total 660
Liberty, Eight to West, 1907, 6 in. 700, Total 700
Liberty, Division to Fifth av., orig., 4 in. 562, Total 562
Liberty, State to Division, orig., 6 in. 890, Total 890
Liberty, Fifth av. to 400 ft. West of Fifth St., orig., 6 in. 3132, Total 3132
Liberty, end of Main to West, 1895, 6 in. 700, Total 700
Lincoln, Hill to South, 1896, 6 in. 300, Total 300
Lincoln, End of Main to Wells, 1901, 6 in. 1595, Total 1595
Madison, Main to West, 1889, 6 in. 1886, Total 1886
Madison, end of Main to Seventh, 1911, 6 in. 736, Total 736
Madison, State to Packard, orig., 6 in. 936, Total 936
Main, Hill to South, 1889, 6 in. 1484, Total 1484
Main, Chubb Road to Huron, orig., 14 in. 3259, Total 3259
Main, Huron to Liberty, orig., 10 in. 668, Total 668
Main, Liberty to Packard, orig., 8 in. 1010, Total 1010

Main, Packard to Hill, orig., 6 in. 1922, Total 1922
Martin, Wells to North, 1910, 6 in. 709, Total 709
Mary & Benamin, Packard to West 1895, 6 in. 700, Total .. 700
Maynard, Jefferson to William, orig., 4 in. 597, Total 597
Michigan, E. Univ. av. to Wells, 1909, 6 in. 1200, Total 1200
Miller av., Spring to West, orig., 6 in. 1480, Total 1480
Miller av., Main to Spring, orig., 8 in. 1100, Total 1100
Summit & Miner, Gott to East & North, 1910, 6 in. 700, Total .. 700
Minerva, Olivia to Forest, 1911, 6 in. 460, Total 460
Moore, Broadway to Pontiac, orig., 6 in. 540, Total 540
Mosley, Main to West, 1910, 6 in. 700, Total 700
Murray, Liberty to North, 1909, 6 in. 400, Total 400
Oakland, Tappan to West, 1899, 4 in. 275, Total 275
Oakland, End of line to West, 1900, 4 in. 450, Total 450
Oakland, Hill to End of line, 1909, 4 in. 400; 6 in. 200, Total 600
Oakland, E. Univ. av. to Church, 1904, 4 in. 330, Total 330
Oakland, Church to Forest, 1905, 4 in. 300, Total 300
Observatory, Ann to Belser, 1892, 6 in. 1166, Total 1166
Observatory, Belser to Geddes, 1902, 6 in. 638, Total 638
Olivia, Israel to South, 1899, 4 in. 150, Total 150
Olivia, Wells to South, 1910, 6 in. 704, Total 704
Olivia, Cambridge to Minerva, 1911, 6 in., 676. Total 676
Oswego, Geddes to Hill, 1907, 6 in. 800, Total 800
Oxford Rd., Hill to S. Univ. av., 1907, 6 in. 800, Total 800
Oxford Rd., Washtenaw to Hill, 1901, 6 in. 715, Total 715
Packard, Mary to Wells, 1895, 6 in. 2667, Total 2667
Packard, Fifth av. to Monroe, orig., 6 in. 1190, Total 1190
Packard, Main to Fifth av., orig., 6 in. 798, Total 798
Packard, Wells to East, 1908, 6 in. 700, Total 700
Packard, Monroe to Mary, 1895, 6 in. 909, Total 900
Phillip, Brown to Climax Fcty, 1910, 6 in. 1298, Total 1298
Moore & Pontiac, Broadway to Kellogg, orig., 6 in. 1240, Total 1240
Pontiac, Kellogg to North, 1891, 6 in. 844, Total 844
Prospect, E. Univ. av. to Wells, 1904, 6 in. 1045, Total 1045
Second, William to Jefferson, orig., 6 in. 730, Total 730
Seventh, Huron to North, 1907, 6 in. 400, Total 400
Seventh, End of line to North, 1910, 6 in. 337, Total 337
Seventh, Jefferson to Madison, 1890, 6 in. 760, Total 760
Seventh, Liberty to Jefferson, 1910, 6 in. 741, Total 741
Seventh, Huron to Liberty, 1896, 6 in. 1210, Total 1210
Spring, Chubb Rd. to Miller av., orig., 8 in. 3570, Total 3570
State, Hill to Monroe, orig., 4 in. 517, Total 517
State, Monroe to Jefferson, orig., 6 in. 1057, Total 1057
State, Jefferson to N. Univ. av., orig., 10 in. 879, Total 879
State, Arch & Thayer, Edwin to S. of Arch, 1909, 6 in. 800, Total 800
State, Packard to Edwin, 1899, 6 in. 385, Total 385
State, Arch to Dewey, 1911, 6 in. 1208, Total 1208
State, N. Univ. av. to Huron, orig., 12 in. 937, Total 937
State, Huron to Kingsley, orig., 6 in. 1329, Total 1329
Station No. 2, Station to Washington, 1896, 12 in. 253. Total .. 253
Summit, Main to Spring, 1910, 6 in. 1450, Total 1450
Sybil & Edwin, Benjamin to Division, 1900, 6 in. 1000, Total..1000
Tappan, Hill to Oakland, 1896, 6 in. 803, Total 803
Thayer, Hill to Monroe, 1903, 4 in. 594, Total 594
Thayer, Washington to Huron, 1906, 10 in. 350, Total 350
Thayer, S. Univ. av. to Monroe, orig., 4 in. 596, Total 596
Thayer, N. Univ. to Washington, orig., 4 in. 614, Total 614
Third, Washington to South, 1902, 4 in. 550, Total 550
Thirteenth, Ann to Catherine, 1891, 6 in. 739, Total 739
Thirteenth, Fuller to Catherine, 1906, 6 in. 800, Total 800
Thirteenth, Huron to Ann, 1897, 6 in. 363, Total 363
Thompson, Liberty to William, 1902, 4 in. 583, Total 583
Thompson, Madison to William, orig., 4 in. 1325, Total 1325
Thompson Ct., Thompson to East, 1899, 4 in. 275, Total .. 275
Traver, Moore to North, 1909, 6 in. 2150, Total 2150

Twelfth, Washington to N. Univ. av., 1907, 8 in. 700, Total 700
E. Univ. av., College to Washtenaw, 1902, 6 in. 652, Total .. 652
E. Univ. av., Packard to Oakland, 1899, 6 in. 1100, Total ..1100
E. Univ. av., College to Oakland, 1904, 6 in. 1880, Total 1880
E. Univ. av., S. Univ. av. to S. of Willard, orig., 6 in. 486, Total 486
N. Univ. av., State to Ingalls, orig., 8 in. 665, Total 665
N. Univ. av., Ingalls to Washtenaw, orig., 6 in. 634, Total .. 634
S. Univ. av., State to Forest, orig., 6 in. 2036, Total 2036
S. Univ. av., Washtenaw to Geddes, 1895, 6 in. 1700, Total 1700
Vaughn, E. Univ. av to Packard, 1900, 4 in. 825, Total 825
Volland & Fourteenth, Washtenaw to Belser, 1900, 6 in. 850, Total 850
Wall, Broadway to East, orig., 6 in. 580, Total 580
Washington, Seventh to Eight, 1909, 6 in. 700, Total 700
Washington, Twelfth to Fourteenth, 1907, 6 in. 1400, Total..1400
Washington, Thayer to Twelfth, 1907, 10 in. 700, Total 700
Washington, State to Thayer, 1906, 10 in. 350, Total 350
Washington, Fifth av. to State, orig., 6 in 1418, Total 1418
Washington, Main to Fifth av., orig., 6 in. 670, Total 670
Washington, Main to Station No. 2, 1902, 12 in. 2255, Total 2255
Washington, Station No. 2 to Seventh, 1896, 8 in. 506, Total 506
Washington, Main to State, 1909, 12 in. 2200, Total, ...2200
Washtenaw, Ferdon to Wayne, 1908, 6 in. 700, Total 700
Washtenaw, S. Univ. to Hill, 1889, 6 in. 1252, Total 1252
Washtenaw, Oxford to Israel, 1905, 6 in. 300, Total 300
Washtenaw, Hill to Oxford Road, 1901, 6 in. 660, Total 660
Washtenaw, N. Univ. av to S. Univ. av., orig., 6 in. 1815, Total 1815
Wells, Lincoln to Baldwin, 1906, 6 in. 700, Total 700
Wells, Packard to Lincoln, 1890, 6 in. 1518, Total 1518
William, State to Maynard, orig., 6 in. 331, Total 331
William, Division to Fifth av., orig., 4 in. 561, Total 561
William, Second to Fourth, 1906, 6 in. 700, Total 700
William, Main to Second, orig., 6 in. 1010, Total 1010
Campus, State to East, 1891, 6 in. 1400, Total 1400
Ann, Ingalls to Fourteenth, 1900, 6 in. 1320, Total 1320
State, Hill to Packard, 1899, 6 in. 356, Total 356
Washtenaw, Israel to Ferdon, 1905, 6 in. 196, Total 196
Total feet of 4 in. pipe 19075
Total feet of 6 in. pipe 150670
Total feet of 8 in. pipe 11452
Total feet of 10 in. pipe 2947
Total feet of 12 in. pipe 11836
Total feet of 14 in. pipe 5219
Total feet of 16 in. pipe 3010

Grand total 203809

WROUGHT IRON PIPE.

Table II.

Ann, Main to Opera House, 1886, 2 in. 207, Total 207
Ann, Main to Jail, 1886, 1 in. 290, Total 290
Ann, Ashley to West, 1907, 1 1-2 in. 187, Total 187
Arbor, State to East, 1898, 1 1-4 in. 411, Total 411
Arbor, Oakland to West, 1903, 1 1-2 in. 85, Total 85
Arch, Oakland to South, 1904-1908, 1 1-2 in. 254, Total 254
Ashley, Liberty to Madison, 1890-1909, 1 in., 186; 1 1-4 in., 422; 1 1-2 in., 612; 2 in., 282; Total, ...1502
Ashley, Washington to Liberty, 1899, 1 in. 100, Total 100
Ashley, Catherine to North, 1886, 1 1-2 in. 492, Total 492
Beaks, Kingsley to Northeast, 1909, 1 in., 308; 1 1-4 in., 202; 2 in., 507; Total 1017
Broadway, End 6 in. line to East, 1889, 2 in. 327, Total 327
Catherine, Ingalls to East, 1887, 1 in. 29, Total 29
Catherine, Main to East, 1886, 2 in. 58, Total 58
Catherine, Clark to Observatory, 1886, 1 1-4 in. 550, Total 550
Catherine, Thirteenth to West, 1892, 1 1-4 in., 40; 1 1-2 in., 196; Total 236
Chapin, Miller to South, 1896, 1 in. 243, Total 243
Cherry, Spring to West, 1891, 1 1-4 in. 181, Total 181
Church, Willard to North, 1891-1898, 1 1-2 in. 263, Total 263
Church, Prospect to Oakland, 1906, 1 1-2 in., 240; 2 in. 583; Total 823
Church, Willard to South, 1886, 1 in. 211, Total 211

Church, S. Univ. av. to College, 1892, 1 in., 356; 1 1-4 in., 79; 2 in., 198; Total 633
Cross, Packard to West, 1906, 1 1-4 in. 66, Total 66
Detroit, Kingsley to South, 1886, 1 in. 185, Total 185
Detroit, Fifth av. to South, 1886, 1 in. 218, Total 218
Division, Washington to South, 1886, 1 in. 59, Total 59
Division, Packard to South, 1905, 1 1-4 in. 335. Total 335
Division, Huron to South, 1886, 1 in. 141, Total 141
Division, Ann to South, 1886, 1 in. 81, Total 81
Felch, Spring to East, 1897, 1 in. 167, Total 167
Ferdon Road, Washtenaw to South, 1905, 2 in. 227, Total .. 227
Fifth av., Catherine to Ann, 1892, 1 1-2 in. 136, Total 136
Fifth av., Catherine to North, 1886, 1 1-4 in., 54; 1 1-2 in., 195; Total 249
Fifth av., Huron to South, 1886, 1 in., 92; 2 in., 123; Total, ... 215
First, Washington to South, 1886, 1 1-4 in. 272, Total 272
First, Huron to Washington, 1886, 3-4 in., 123; 1 in., 221; Total.. 344
First, Miller av. to South, 1904, 1 1-4 in. 90, Total 90
First, Huron to Ann, 1889, 1 1-2 in. 370, Total 370
First, Jefferson to Madison, 1887. 2 in. 623, Total 623
Forest Crt., Forest to East, 1910, 2 in. 414, Total 414
Fountain, Summit to Hiscock, 1886, 1 1-4 in. 527, Total 527
Fourteenth, Huron to Washington, 1892, 2 in. 396, Total 396
Fourth av., Catherine to North, 1898, 1 in. 41, Total 41
Fourth av., Kingsley to South, 1888, 1 in. 182, Total 182
Fourth av., Catherine to North, 1886, 2 in. 133, ... 133
Fourth st., Jefferson to South, 1889, 1 in., 407; 1 1-2 in., 90; Total 497
Hamilton Pk., Packard to State, 1890, 1 1-2 in. 2448, Total 2448
Ingalls, Washington to Huron, 1890, 1 in. 155, Total 155
Ingalls, Huron to South, 1886, 1 in. 410, Total 410
Ingalls, Ann to Huron, 1886, 1 in., 122; 1 1-4 in., 211, Total 333
Jefferson, Division to West, 1886, 1 in., 328; 1 1-4 in., 236; Total 564
Jefferson, State to West, 1889-1904, 1 in., 79; 1 1-4 in., 125; Total 204
Jefferson, Division to East, 1886, 1 in. 78, Total 78
Jefferson, First to East, 1898-1901, 1 in. 172, Total 172
Kellogg, Pontiac to Cemetery, 1889, 1 in., 400; 2 in., 346; Total 746
Kingsley, Detroit to East, 1886-1889, 1 in. 340, Total 340
Linden, S. Univ. av. to Geddes, 1905-1909, 1 1-2 in., 233, 2 in., 257; Total 490
Mack Road, Elm to Wilmot, 1905,.... 2 in. 395, Total 395
Madison, Main to East, 1889, 1 1-2 in. 94, Total 94
Madison, Packard to Fifth av., 1886-1906, 1 in., 103; 1 1-4 in., 209; 2 in., 200; Total 512
Hanover Sq., Madison to Packard, 1886, 1 1-4 in. 274, Total.. 274
Mary, Benjamin to South, 1896-1909, 2 in. 354, Total 354
Mill & Jones, Broadway to Brewery, 1886, 2 in. 585, Total 585
Monroe, State to East, 1888, 1 in. 195, Total 195
Monroe, Ingalls to West, 1892, 1 in. 177. Total 177
Monroe, Twelfth to East & West, 1886-1888, 1 in. 347, Total 347
Monroe, State to Packard, 1886, 1 1-4 in., 130; 2 in., 583; Total 713
Monroe, Ingalls to East, 1905, 2 in. 156, Total 156
Murray, Washington to South, 1908, 1 in. 192, Total 192
Observatory, Ann to North, 1886, 1 in. 469, Total 469
Olivia, Hill to South, 1891-1892, 1 1-2 in. 664, Total 664
Park Terra, Washington to North, 1907 1 in. 146, Total.. 146
Second, Madison to Jefferson, 1889, 2 in. 724, Total 724
Second, William to North, 1895-1909, 1 1-2 in., 88; 2 in., 210; Total 298
Second, Madison to South, 1888, 1 1-2 in. 350, Total 350
Sixth, Jefferson to Madison, 1886, 1 1-4 in., 172; 1 1-2 in., 384; 2 in., 412; Total..... 968
State, Kingsley to Fuller, 1903-1908, 1 1-2 in., 450; 2 in., 217;; Total 667
Summit, Main to East, 1888, 1 1-2 in. 268, Total 268
Thayer, Huron to North, 1886-1903, 1 in., 845; 1 1-4 in., 226; 1 1-2 in., 204; Total 1275
Third, Jefferson to Madison, 1889, 1 in. 772, Total 772
Third, Jefferson to North, 1893, 1 1-4 in. 316, Total 316
Twelfth, S. Univ av. to Monroe, 1886, 2 in. 576, Total 576

Twelfth, Monroe to South, 1886-1891, 1 in., 50; 2 in., 280; Total 330
Twelfth, Washington to Huron, 1900-1901, 1 1-2 in., 134; 2 in., 230; Total 364
S. Univ. av., Washtenaw to West, 1894, 2 in. 153, Total 153
Volland, Observatory to West, 1894-1903, 1 1-4 in. 315, Total 315
Volland, Fourteenth to East, 1908, 1 1-2 in., 55. Total..... 55
Walnut, S. Univ. av. to Northeast, 1894-1895, 1 1-2 in. 335, Total 335
Willard, E. Univ. av. to Forest, 1886, 2 in. 721, Total 721
William, Maynard to West, 1886, 1 in., 207. Total 721
William, Division to East, 1905, 1 1-4 in. 142, Total 142
William, Main to East, 1896, 1 in. 119, Total 119
Wilmot, Elm to West, 1887-1894, 1 1-2 in., 372; 2 in., 461; Total 833
Alley bet. Fifth av. & Division, Depot to Summit, —— 3-4 in. 197, Total 197
Gates Alley, Huron to North, —— 1 in. 350, Total 350
Myrtle, Oxford to East, —— 1 in. 300, Total 300
Roosevelt, Church to East, —— 1 1-4 in. 200, Total 200
William, Fifth to West, —— 1 in. 170, Total 170
Broadway, End of line to Wheeler's, 1908, 2 in. 16, Total 16
Catherine, Ingalls to Thirteenth, 1886-1894, 1 in., 85; 1 1-4 in., 344; Total 429
Fifth av., Washington to North, 1886, 1 in. 107, Total 107
Maynard, William to Liberty, 1886, 1 in. 600, Total 600
Monroe, 1898, 1 in. 74, Total 74
Second, Madison to South, 1892, 2 in. 193, Total 193
Second, 1890, 1 1-4 in. 24, Total 24
Summit, 1889-1890, 1 1-2 in. 182, Total 182

Total 3-4 in. pipe ..... 320 ft.
Total 1 in. pipe 10909
Total 1 1-4 in. pipe. 6153
Total 1 1-2 in. pipe 9381
Total 2 in. pipe 11147

Grand total 37910

Total number of 1 in. gates 1
Total number of 1 1-4 in. gates .. 4
Total number of 1 1-2 in. gates .. 2
Total number of 2 in. gates 10

Grand total of gates 17

SERVICES.

Table VI.

E. Ann, 3-4 in. 81; 2 in. 2; Total 83
W. Ann, 3-4 in. 8, Total 8
N. Ashley, 3-4 in. 18, Total..... 18
S. Ashley, 3-4 in. 51, Total 51
Arbor, 3-4 in. 11, Total 11
Arch, 3-4 in. 18, Total 18
Baldwin, 3-4 in. 6, Total 6
Beaks, 3-4 in. 22, Total 22
Belser, 3-4 in. 3, Total 3
Benjamin, 3-4 in. 12, Total 12
Broadway, 3-4 in. 42, Total 42
Brooks, 3-4 in. 6, Total 6
Brown, 3-4 in. 1, Total 1
Cambridge Road, 3-4 in. 16, Total 16
Catherine, 3-4 in. 70, Total 70
Cedar, 3-4 in. 1, Total 1
Chapin, 3-4 in. 1, Total 1
Cherry, 3-4 in. 7, Total 7
Cheever Court, 3-4 in. 11, Total 11
Chubb Road, 3-4 in. 8, Total 8
Church, 3-4 in. 83, Total 83
Clark, 3-4 in. 1, Total 1
College, 3-4 in. 2, Total 2
Cornwell Place, 3-4 in. 7, Total 7
Cross, 3-4 in. 5, Total 5
Depot, 3-4 in. 18, Total 18
Detroit, 3-4 in. 30, Total 30
Dewey Ave., 3-4 in. 1, Total 1
N. Division, 3-4 in. 34, Total 34
S. Division, 3-4 in. 79, Total 79
Edwin, 3-4 in. 8, Total 8
Elizabeth, 3-4 in. 13, Total 13
Elm, 3-4 in. 12, Total 12
Felch, 3-4 in. 5, Total 5
Ferdon Road, 3-4 in. 7, Total .. 7
N. Fifth av., 3-4 in. 38, Total .. 38
S. Fifth av., 3-4 in. 64, Total .. 64
Fifth st., 3-4 in. 11, Total 11
N. First st., 3-4 in. 8, Total 8
S. First st., 3-4 in. 26, Total 26
Forest av., 3-4 in. 71, Total 71
Forest Court, 3-4 in. 6, Total .. 6
Fountain, 3-4 in. 17, Total 17
N. Fourth av., 3-4 in., 33; 1 1-2 in., 1. Total 34
S. Fourth av., 3-4 in., 66; 1 1-4 in., 1. Total 67
Fourth st., 3-4 in. 16, Total 16
Fourteenth, 3-4 in. 18, Total 18
Fuller, 3-4 in. 9, Total 9
Geddes av., 3--4 in. 46, Total 46
Geddes Heights, 3-4 in. 2, Total .. 2
Glenn av., 3-4 in. 14, Total 14
Gott, 3-4 in. 9, Total 9
Greenwood, 3-4 in., 25, Total .. 25
Hamilton Place, 3-4 in. 16, Total 16
Hanover Square, 3-4 in. 5, Total 5
Hill, 3-4 in. 70, Total 70
Hiscock, 3-4 in. 2, Total 2
E. Huron, 3-4 in., 102; 1 1-4 in., 1; 2 in. 5; 4 in., 1; Total 109
W. Huron, 3-4 in., 83; 1 1-2 in., 1; 4 in., 1; Total 85
N. Ingalls, 3-4 in. 33, Total 33

S. Ingalls, 3-4 in 52 Total 52
Jackson av., 3-4 in. 1, Total 1
E. Jefferson, 3-4in.,38. Total.... 38
W. Jefferson, 3-4 in., 24. Total . 24
Kellog, 3-4 in. 1, Total 1
E. Kingsley, 3-4 in. 43, Total .. 43
W. Kingsley, 3-4 in. 3, Total.... 3
Lawrence, 3-4 in. 27, Total 27
E. Liberty, 3-4 in., 64; 1 in., 1; 2 in., 2; Total 67
W. Liberty, 3-4 in. 68, Total 68
Lincoln av., 3-4 in. 16, Total .. 16
Linden av., 3-4 in. 4, Total 4
Mack Road, 3-4 in., 4. Total.... 4
E. Madison, 3-4 in., 27, Total 27
W. Madison, 3-4 in. 16, Total .. 16
N. Main, 3-4 in., 108; 1 1-2 in., 1; 2 in., 4; 4 in., 1; Total 114
S. Main, 3-4 in., 145; 2 in., 2, 3 in., 1; 4 in., 4; 6 in., 1; Total .. 153
Martin, 3-4 in. 3, Total 3
Mary Court, 3-4 in. 8, Total 8
Mary, 3-4 in. 15, Total 15
Maynard, 3-4 in. 24, Total 24
Michigan av., 3-4 in. 21, Total .. 21
Mill, 3-4 in. 2, Total 2
Miller av., 3-4 in. 35, Total 35
Minerva, 3-4 in. 4, Total 4
Moore, 3-4 in. 1, Total 1
Monroe, 3-4 in. 36, Total 36
Murray av., 3-4 in. 14, Total 14
Oakland av., 3-4 in. 35, Total .. 35
N. Observatory, 3-4 in. 3, Total 3
S. Observatory, 3-4 in. 17, Total 17
Olivia, 3-4 in. 22, Total 22
Oswego, 3-4 in. 8, Total 8
Oxford Road, 3-4 in. 11, Total .. 11
Packard, 3-4 in., 144; 2 in., 1; Total 145
Park Terrace, 3-4 in. 2, Total .. 2
Phillip, 3-4 in. 3, Total 3
Pontiac, 3-4 in. 12, Total 12
Prospect, 3-4 in. 21, Total 21
Second, 3-4 in., 34; 4 in., 1; Total 35
N. Seventh, 3-4 in. 6, Total 6
S. Seventh, 3-4 in. 27, Total 27
Sixth, 3-4 in, 8, Total 8
Spring, 3-4 in. 28, Total 28
N. State, 3-4 in. 37, Total 37
S. State, 3-4 in., 129; 1 in., 3; 1 1-4 in., 1; 2 in., 1; 4 in., 1; 6 in., 1; Total 136
E. Summit, 3-4 in. 9, Total 9
W. Summit, 3-4 in. 4, Total 4
Sybil, 3-4 in. 4, Total 4
Tappan, 3-4 in., 8, Total 8
N. Thayer, 3-4 in. 26, Total 26
S. Thayer, 3-4 in. 55, Total 55
Third, 3-4 in. 31, Total 31
Thompson, 3-4 in. 52, Total 52
Traver, 3-4 in. 6, Total 6
Twelfth, 3-4 in. 42, Total 42
E. Univ. av., 3-4 in. 87, Total .. 87
S. Univ. av., 3-4 in. 51, Total .. 51
N. Univ. av., 3-4 in., 14; 2 in. 1; 4 in., 2; Total 17
Vaughn, 3-4 in. 14, Total 14
Vinewood Boulevard, 3-4 in. 3, Total 3
Volland, 3-4 in. 16. Total 16
Wall, 3-4 in. 6, Total 6
Walnut, 3-4 in. 7, Total 7
E. Washington, 3-4 in., 88; 1 in., 2; 2 in., 3; Total 93
W. Washington, 3-4 in., 65; 4 in., 1; Total 66
Washtenaw av., 3-4 in., 54; 1 1-4 in., 4; 2 in., 1; Total 59
Wells, 3-4 in. 16, Total 16
Willard, 3-4 in. 15, Total 15
E. Williams, 3-4 in. 28, Total .. 28
W. Williams, 3-4 in., 12; 3 in., 1; 6 in., 1. Total 14
Wilmot, 3-4 in. 20, Total 20
Wright, 3-4 in. 3, Total 3
Total 3-4 in. services 3575
Total 1 in. services 6
Total 1 1-4 in. services 7
Total 1 1-2 in. services 3
Total 2 in. services 22
Total 3 in. services 2
Total 4 in. services 12
Total 6 in. services 3

Grand total 3630
Under pavement, 3-4 in. 994
Under pavement, 1 in. 6
Under pavement 1 1-4 in. 7
Under pavement, 1 1-2 3
Under pavement, 2 in..... 22
Under pavement, 3 in. 2
Under pavement, 4 in. 11
Under pavement, 6 in. 2

Grand total 1047

SUPPLEMENTARY SERVICES.

The preceding table is a record of the services in use up to October 1, 1911. From October 1 to December 31,, 1911 there were added the following:

Size, 3-4 in. 42
Size 1 in. 3
Size 1 1-4 in. 6
Size 1 1-2 in. 1
Size 2 in. 1
Size 6 in. 1

Making the record complete to January 1, 1911 as follows:

Total 3-4 in. services 3617
Total 1 in. services 9
Total 1 1-4 in. services 13
Total 1 1-2 in. services 4
Total 2 in. services 23
Total 3 in. services 2
Total 4 in. services 12
Total 6 in services 4

Grand total of services 3684
Under pavement, 3-4 in. 994
Under pavement, 1 in. 9
Under pavement, 1 1-4 in. 13

Under pavement, 1 1-2 in.	4
Under pavement, 2 in.	23
Under pavement, 3 in.	2
Under pavement, 4 in.	11
Under pavement, 6 in.	3
Grand total	1059

METERS SET.

Table VII.

Crown, 5-8 in., 46; 3-4 in., 52; 1 in., 41; 1 1-2 in., 4; 2 in., 20; 4 in., 4; 6 in., 1; Total	168
Crown "5-8X," 5-8 in., 3, Total	3
Crown, Ext. Dial, 5-8 in., 1; 3-4 in., 1; Total	2
Standard, 5-8 in., 1; 3-4 in., 96; 1 in., 1; 2 in., 2; 3 in., 2; Total	102
Union, 5-8 in., 1; 3-4 in., 1; 1 in., 2; 2 in., 14; 3 in. 1; Total	19
Nilo, 2 in. 4, Total	4
Hersey, 3-4 in. 1, Total	1
Gem, 3 in. 3, Total	3
Empire, 5-8 in., 1; 3-4 in., 3; 1 in., 1; Total	5
Trident, 2 in. 2, Total	2
King Disc., 3-4 in., 1. Total	1
Total 5-8 in.	53
Total 3-4 in.	155
Total 1 in.	45
Total 1 1-2 in.	4
Total 2 in.	42
Total 3 in.	6
Total 4 in.	4
Total 6 in.	1
Grand total	310

DISTRIBUTION SYSTEM.

Table IX.

CAST IRON SUMMARY.

Total length of pipe in feet, 4 in., 19,075; 6 in., 150,670; 8 in., 11,452; 10 in., 2,947; 12 in., 11,836; 14 in., 5,219; 16 in., 3,010. Grand total	203,809
Total weight of pipe in tons, 4 in., 209.04; 6 in., 2504.02; 8 in., 294.06; 10 in., 90.50; 12 in., 478.03; 14 in., 233.81; 16 in., 192.13; Grand total	4001.59
Weight of specials in tons	100.04
Weight of lead in pounds	147,629

SOIL.

Easy digging, in feet, 4 in., 17128; 6 in., 84798; 8 in., 6439; 10 in., 2947; 12 in., 6989; 14 in., 339; Total	118,640
Medium digging, in feet, 6 in., 38728; 8 in., 1318; 12 in., 4847; 14 in., 980; 16 in., 3010; Total	48,883
Hard digging, in feet, 4 in., 1947; 6 in., 27144; 8 in., 3695; 14 in., 3900; Total	36,686
Under Concrete Pavement, in feet, Total	24,024
Under other pavement, in feet, Total	15,214
Gates, 4 in., 29; 6 in., 178; 8 in., 16; 10 in., 4; 12 in, 11; 14 in., 4; Total	242
Hydrants, 6 in., 240; 8 in., 12; Total	252
Stand pipes, Total	4
Flush tank connections, Total	157
Services, Total	3,684
Meters, set, Total	310
Meters, on hand, Total	97

CROSSINGS.

Under D. J. & C. Track, Total	19
Under City Car Track, Total	35
Under A. A. R. R. Track, Total	10
Under M. C. R. R. Track. Total	1
Under Huron River, Total	1
Under culverts, Total	13

COST SUMMARY.

Table X.

Pipe and specials	$ 113,500.15
209.04 tons 4 in. pipe	5,539.56
3366.61 tons 6 in.—12 in., (incl.)	82,481.95
425.94 tons 14 in.—16 in., (incl.)	10,222.56
100.04 tons specials	5,002.00
Freight on 4101.63 tons	6,152.45
Cartage on 4101.63 tons	4,101.63
Total	$ 113,500.15
Lead, (147,629 lbs.)	7,382.00
Gates, (259)	$ 5,860.50
17 only 3-4 to 2 in. gates, set,	$ 200.00
29 only 4 in. gates, set	353.50
178 only 6 in. gates, set	3,854.00
16 only 8 in. gates, set	696.00
4 only 10 in. gates, set	132.00
11 only 12 in. gates, set	385.00
4 only 14 in. gates, set	240.00
Total	$ 5,860.50
Hydrants (252) set complete	19,500.00
240 only 6 in. hydrants, with pipe	18,000.00
12 only 8 in. hydrants, with pipe	1,500.00
Total	$ 19,500.00
Stand pipes, (4)	280.00
Flush tank connections, (157)	1,334.50
Crossings (79) track, river and culvert	2,500.00

Labor and superintendence	74.255.00
17,128 ft. 4 in. pipe in easy digging	4,282.00
1,947 ft. 4 in. pipe in hard digging	739.86
84,798 ft. 6 in. pipe, easy digging	25,439.40
38,728 ft. 6 in. pipe, medium digging	13,554.80
27,144 ft. 6 in. pipe, hard digging	11,400.48
6,439 ft. 8 in. pipe, easy digging	2,253.65
1,318 ft. 8 in. pipe, medium digging	527.20
3,695 ft. 8 in. pipe, hard digging	1,773.60
2,947 ft. 10 in. pipe, easy digging	1,326.15
6,989 ft. 12 in. pipe, easy digging	3,843.95
*4,847 ft. 12 in. pipe, medium digging	2,908.20
339 ft. 14 in. pipe, easy digging	220.35
980 ft. 14 in. pipe, medium digging	686.00
3,900 ft. 14 in. pipe, hard digging	3,042.00
3,010 ft. 16 in. pipe, medium digging	2,257.50
Total	$74,255.15
Cutting through and replacing pavement	$23,422.50
24,024 ft. trench, Concrete	12,012.00
15,214 ft. trench, other kinds	11,410.50
Total	$23,422.50
Services, total cost of pipe and laying	$ 50,583.00
2623 only 3-4 in. not under pavement	$ 28,853.00
994 only 3-4 in. under pavement	19,880.00
9 only 1 in. under pavement	189.00
13 only 1 1-4 in. under pavement	286.00
4 only 1 1-2 in. under pavement	96.00
23 only 2 in. under pavement	575.00
2 only 3 in. under pavement	58.00
11 only 4 in. under pavement	429.00
1 only 4 in. not under pavement	30.00
1 only 6 in. not under pavement	40.00
3 only 6 in. under pavement	147.00
3684 services	$ 50,583.00
Wrought iron pipe, total cost of pipe and laying.	$ 13,188.59
320 ft. 3-4 in. pipe	80.00
10,909 ft. 1 in. pipe	3,054.52
6,153 ft. 1 1-4 in. pipe	2,030.49
9,381 ft. 1 1-2 in. pipe	3,564.78
11,147 ft. 2 in. pipe	4,450.80
Total	$ 13,188.59
Water meters, set	$ 11,391.00
53 only 5-8 in. meters	$ 893.50
155 only 3-4 in. meters	3,566.00
45 only 1 in. meters	1,676.50
4 only 1 1-2 in. meters	240.00
42 only 2 in. meters	2,810.00
6 only 3 in. meters	620.00
4 only 4 in. meters	1,060.00
1 only 6 in. meter	525.00
Total	$ 11,391.00
Water meters, on hand	$ 2,122.00
1 only 1-4 in. meter	$ 8.00
1 only 1-2 in. meter (hot water)	30.00
27 only 5-8 in. meters	300.00
44 only 3-4 in. meters	824.00
10 only 1 in. meters	210.00
2 only 1 1-2 in. meters	75.00
8 only 2 in. meters	425.00
1 only 4 in. meter	250.00
Total	$ 2,122.00
Grand total	$325,319.38
Engineering and Contingencies	22,328.00
Estimated reproduction cost	$347,647.38

CHUBB ROAD RESERVOIR.

Estimated Reproduction Cost.

Table XI.

Reservoir complete	$ 8,965.00

Open type earth basin, 90 ft. by 90 ft. on the bottom, 197 ft. by 197 ft. on the inside at the top of the embankment and nearly 18 ft. deep. The embankment has inside slopes of about 1 on 3 ft., outside slopes of about 1 on 1-2 or 2 ft., and top width of 10 ft. The inside is paved with cobble stone and the outside sodded. The inlet pipe is surrounded by a cobble stone rockery nearly to its height. The check valve in the outlet pipe is contained in a masonry box on the bottom of the basin. The basin is surrounded by a fence, and an observation tower has been constructed by the Company in order that sightseers may look into it without lia-

bility of contaminating the supply.
The estimated quantities are:
Embankment, including excavation, ... 5437 cu. yd.
Cobble stone paving ..4423 cu. yd.
Cobble stone rockery .. 122 cu. yd.
Masonry ..... 11.7 cu. yd.
Sodding .....2137 sq. yd.
Fencing .....15.55 M ft.
Building for spectators 1

NO. 1 PUMPING STATION

Building, Machinery and Equipment. Reproduction Cost.

Table XII.

Building .....$ 6,361.80
Foundations and excavation .....$ 652.00
1150 cu. ft. stone
1290 cu. ft. concrete
100 cu. yd. excavation
Floor paving 312.40
650 sq. ft. vitrified brick
580 sq. ft. common brick
940 sq. ft. concrete
Walls, roofs and partitions 4,086.40
15.7 M Sills, Studding, joists, etc.
11.9 M. Sheathing
.75 M. Flooring
8760 cu. ft. Brick
182 cu. ft. Stone Sills
600 lbs. Steel
Roofing 246.00
10.7 sqs. slate
17.3 sqs. shingle
26.25 sqs. composition
Doors (11) .....$ 225.00
Windows (24) 190.00
Painting and Varnishing 75.00
Sundries and miscellaneous 575.00
Boilers and Equipment ..$ 6,190.50
Stephen - Pratt Boiler (1904) 72 in. by 16 ft. (set) 1,406.70
990 cu. ft. concrete foundation
16.1 M common brick in setting
3.7 M fire brick in setting
Lump, erection, frieght, etc.
Brennen Boiler (1910) 72 in. by 16 ft. (set).. 1,406.70
990 cu. ft. concrete foundation
16.1 M common brick in setting
3.7 M fire brick in setting
Lump, erection, freight, etc.
Lansing Boiler (1889) 72 in. 16 ft. (set) 1,406.70
990 cu. ft. concrete foundation
16.1 M common brick in setting
3.7 M fire brick in setting
Lump, erection, freight, etc.
Smoke stack, 3 ft. by 3 ft. by 91 ft. 1,446.40
61.4 M common brick
8.4 M fire brick
Breeching (in place) 3 ft. diam. by 17 ft. long . 84.00
Boiler feed pump (1889).. 150.00
Knowles, duplex, 5 in. by 3 in. by 7 in. (in place)
Feed water heater (1885) 75.00
Knowles (in place)
Feed water heater (1911) . 215.00
Cochrane (in place)
Pumping equipment .....$ 23.972.90
Gordon pump, 2 mil. gal. (1889) overhauled 1910. Tandem compound duplex condensing, 14 by 26 by 14 by 18, and Gordon pump, 7 by 8 1-2 by 9 duplex condensing, etc. (set) .. 5,224.90
16.4 M brick foundation
612 cu. ft. stone foundation
115 cu. ft. cap stone
Lump, erection, freight, etc.
Knowles pump, 1.8 mil. gal. (1885) overhauled 1910. Tandem compound duplex condensing, 13 by 24 by 12 by 18, and Knowles pump, 7 by 11 by 12, condensing, etc., (set) 5,666.50
14.2 M brick foundation
460 cu. ft. stone masonry
98 cu. ft. cap stone
Lump, erection, freight, etc.
Blake pump, 3 mil. gal. (1910) low pressure, duplex non-condensing, 12 by 16 by 18, (set) 1,065.00
80 cu. ft. concrete foundation
Lump, erection, freight, etc.
Laidlaw - Dunn - Gordon pump, 3 mil. gal. (1910) cross compound, duplex condensing, 16 1-2 by 32 by 10 by 30, and Knowles pump, 5 1-2 by 8 by 7, duplex, etc. 9,592.00
2250 cu. ft. concrete foundation
Lump, erection, freight, etc.
Gordon condensing pump 1890) overhauled 1910. 12 by 17 by 12 fly wheel pattern, (set) .. 1,005.00
75 cu. ft. stone foundation
Lump, erection, freight, etc.
Blake pump, 1.5 mil. gal. (1894) rebuilt 1910. Duplex, non-condensing, 10 by 12 by 12, (set) .. 453.50
54 cu. ft. concrete foundation
Lump, freight, erection, etc.
Vacuum oil separator (in place) 266.00
Gauge boards and gauges 200.00

Miscellaneous machinery and fittings	500.00
Lighting equipment	$ 135.00
Station lights and wiring.	
Piping, see table in appen.	1,959.40
All wrought iron piping installed except for wells, etc.	
Collecting basin	2,345.00
Suction well	1,327.00
River shaft	945.00
Total	$4,617.00
Suction piping	5,357.00
All piping to suction well, river and purification plant.	
Side track	1,254.00
Ditch and fences	150.00
Total	$ 49,998.00
Engineering and contingencies, 10 per cent.	4,999.80
Estimated reproduc- cost	$ 54,997.80

NO. 2 PUMPING STATION.

Building, Machinery and Equipment. Reproduction Cost.

Building	$ 2,235.25
Foundations and excavations	518.00
144 cu. ft. concrete	
176 cu. ft. stone	
2.64 M brick	
lump, grading and excavation	
Floor paving	110.60
1580 sq. ft. vitrified brick	
Walls, roof and partitions	1,002.45
9.10 M sills, sttudding, joists, etc.	
16.50 M sheating	
1.65 M Brick	
530 lbs. pipe columns	
Roofing	74.50
3.80 sqs. shingle	
27.75 sqs. composition	
Doors, (8)	94.00
Windows, (28)	107.70
Painting and varnishing	125.00
Sundries and miscellaneous	203.00
Boilers and equipment	$ 4,987.20
Dayton boiler (1898) 72 in. by 16 ft. (set)	1,423.10
990 cu. ft. concrete foundation	
16 M common brick in setting	
3.6 M fire brick in setting	
lump erection, freight, etc.	
Brennen boiler (1908) 66 in. by 16 ft. (set)	1,423.10
990 cu. ft. concrete foundation	
16 M common brick in setting	
3.6 M fire brick in setting	
lump erection, freight, etc.	
Smoke stack, (1904) 3 ft. 9 in. by 100 ft. high	1,750.00
Boiler breeching (in place) 36 in. by 36 in. by 16 1-2 in. weight 1810 lbs.	115.00
Boiler feed pump (1898) in place	35.00
Cornwell Belt drive	
Boiler feed pump (1900) 5 in. by 3 in. by 6 in.	93.50
Foundation, freight, erection, etc. (lump)	
Upright engine, C. C. Wormer, 4 by 5, 4 H. P.	72.50
Foundation, freight, erection, etc. (lump)	
Feed water heater, 20 in. by 12 in. home make	75.00
Pump equipment	$ 7,158.50
Deane pump, 1.5 mil. gal. (1896), tandem compound duplex non-condensing, size, 12 by 20 by 11 by 18 (set)	1,340.50
204 cu. ft. concrete foundation	
42 cu. ft. bed stone	
lump erection, freight, etc.	
Laidlaw - Dunn - Gordon pump, 2 mil. gal. (1907) cross compound duplex condensing, size, 14 by 26 by 8 3-4 by 24, rebuilt in 1911, and Knowles condensing pump,, 5 by 8 by 7 (set)	5,628.00
1054 cu. ft. concrete foundation	
lump erection, freight, etc.	
Miscellaneous machinery and fittings (lump)	190.00
Lighting equipment	97.00
Dynamo, 120 volt, belted (1906) 1 K. W., 1425 R. P. M.	
Station lights and wiring (lump)	
Foundation and erection(lump)	
Piping	$ 841.74
All wrought iron piping except for wells, etc.	
Suction piping	1,069.50
356.5 ft. 18 in. cast iron pipe	
Total	$ 16,389.19
Engineering and contingencies, 10 per cent.	1,638.92
Estimated reproduction cost	$ 18,028.11

THE WATER SUPPLY.

The company is possessed of a water supply from ground sources amounting to about 1,600,000 gallons daily, and during the past year has supplied an average of 2,148,780 gallons per day, the surplus being made up of ozonized river water. The ozonizing plant, the cost of which is pre-

sented in Table 4 of Appendix IV has been very largely developed in its present location, and the development cost would not appear in a duplicate installation. The ground water supply has been secured at a large expense, and no inventory of the now existent physical property can possibly indicate the cost of this supply, as many wells have been bored without securing water and considerable investments have been made for very small returns. These experiences are the natural and usual accompaniments of the development of ground water supplies and render it next to impossible to appraise them directly. Appendix IV gives in detail the estmated reproductve cost of the construction and rights now existing, appurtenant to the water supply, but do not include the water itself.

For the purposes of this investigation it has been determined to make use of the commonly accepted method of duplication to establish the values of the water supply. The values in Appendix IV above indicated, have therefore been excluded from the estimated cost of reproduction and in their place a value of the water supply, delivered at the pump suctions has been substituted. To arrive at this value it has been assumed, as the least expensive method of procuring water of equivalent character, that a slow sand filtration plant would be constructed at Station No. 1, which would supply 1,600,000 gallones daily of filtered water to replace the ground water, and that the plant similarly located and using hypo-chlorite of lime would supply the water to replace that coming from the present ozone plant.

The cost of a filtration plant of 1,600,000 gallons daily capacity has been estimated from plans prepared in the office of the writer to be $60,000, and the cost of operation is estimated at $3.50 per million gallons delivered. An annual allowance of six per cent for interest and depreciation is estimated on the cost, amounting to $3,600. It is also estimated that the cost of the hypo-chlorite treatment including interest and depreciation, would be $1 per million gallons.

From the records of the company it appears that the present costs of pumping water are as follows:

At Station No. 1.

For fuel alone, $8.25 per million gallons.

For attendance $7.28 per million gallons.

Total station expenses $15.53 per million gallons.

At Station No. 2.

For fuel alone, $4.96 per million gallons.

For attendance $9.87 per million gallons.

Total station expenses, $14.83 per million gallons.

Of the water pumped during the past year 475.3 million gallons was handled at Station No. 1, and 309 million gallons at Station No. 2. To have pumped all the water at Station No. 1 would have affected the expenses there to the extent of the fuel only, as the present attendance is sufficient for the work.

To add 309 million gallons to the output of Station No. 1 would therefore cost 309 by $8.25 equals $2,550. Under the assumed conditions of the duplicate supply the annual charges would be:

Pumping 475.3 million gallons at $15.53	$7,402
Pumping 309 million gallons at $8.25	$2,550
Filtering 584 million gallons at $3.50	$2,044
Chloriting 200.3 million gallons at $1	$200
Total operation	$12,196
Interest and depreciation on filter at 6 per cent.	$3.600
Total annual charges	$15,796

Under the present conditions the corresponding charges have been:

Pumping 475.3 mil. gal	$7,402
Pumping 309 mil. gal	4,585
Total annual charges	$11,987

The difference between these charges is $3,809 which, when capitalized at five percent, gives $76,180 as the value of the water supply system, and the value of $75,000 is therefore adopted.

This sum replaces in the inventory the following items:

Water rights at Sta. No. 2	$3,500.00
Piping and well at Sta. No. 1,	9,157.40
Piping and wells atSta. No. 2,	25,773.05
Ozone plant and filter, at Station No. 1,	19,287.18
Total	$57.717.63

Deducting this sum from the value adopted for the water supply as a whole, would leave the value of the water alone at $17,282.37 which is certainly low enough for a supply of 2,000,000 gallons of water daily.

Real Estate.

The present worth real estate valation is summarized as follows:

Station No. 1.

One piece containing 12.25 acres, ...	$1,225.00
One piece containing about 2.2 acres, ...	220.00

Station No. 2.

City lots Jewett's addition	$ 6,500.00
More lots, Jewett's addition,	1,200.00
Parts secs. 29 and 30, Ann Arbor, 6.75 acres	5,000.00
Two and 3-10ths acres, ...	460.00
Three and 1-3 acres, ...	1,000.00
Reservoir site, 4 acres, ...	400.00
Force main right-of-way, 2 acres	500.00
Stand pipe location, ...	1,800.00
Total	$18.305.00

Office Equipment.

Estimated reproduction cost, ...	$ 1,800.00
Estimated value, ...	2,500.00

NO. 1 PUMPING STATION

Supplies—Reproduction Cost.

Table XVI.

Cast iron pipe	$ 421.62
Specials	159.78
Valves	88.04
Bends	6.89
Wrought iron pipe fittings	21.04
Specials	14.55
Couplings	8.42
Bushings	.45
Unions, iron, black	1.38
Miscellaneous (non-depreciating	632.15
Miscellaneous (depreciating	779.50
Total	$ 2,133.82

NO. 2 PUMPING STATION.

Supplies and Equipment—Reproduction Cost.

Table XVII.

Cast iron pipe	507.25
Gates, etc.	109.00
Specials	164.50
Wt. iron pipe and fittings..	76.21
Vitrified sewer crock	14.21
Miscellaneous (non-depr.).	749.53
Miscellaneous (depr.)	936.50
Total	$ 2.557.20

APPENDIX I.

AN ORDINANCE relative to Water Works. (Passed June 1, 1885. Contract agreed to May 6, 1885.).

Whereas, The mayor, recorder, and aldermen of the City of Ann Arbor have by resolution declared it expedient to have constructed works for the purpose of supplying the City of Ann Arbor and the inhabinants thereof with water; and that it is expedient for said city to build such works; and

Whereas, The Ann Arbor Water Company has been organized under the statutes of the State for the construction of such works; and

Whereas, It has thereby become the duty of the common council of this city to grant to such company such right to the use of the streets, sidewalks, lanes, alleys and public grounds in such city as shall be necessary for the supply of water for the use of this city and its inhabitants; and

Whereas, The said Ann Arbor Water Company have made and executed with the common council of this city, a contract bearing date the sixth day of May, A. D. 1885, whereby the said company agree to furnish water for said city and its inhabitants upon the terms and conditions in said contract mentioned; therefore,

Be it Ordained by the Mayor, Recorder and Aldermen of the City of Ann Arbor:

That the exclusive right and privilege of executing and constructing water works within the city, and of laying and continuing water pipes along and across any and all of the streets, sidewalks, lanes, alleys and public grounds in said city, and of supplying water for the city and for its inhabitants, be and is hereby granted and secured to the Ann Arbor Water Company, upon the condition and under the restrictions in such contract mentioned, so long as said company shall continue to supply water for said city and for the inhabitants thereof, and shall comply with the restrictions and conditions in such contract named and imposed. Which contract is as follows, to-wit:

The Contract.

Articles of Agreement: Made this 6th day of May, A. D. 1885, between the "Mayor, Recorder and Aldermen of the city of Ann Arbor," parties of the first part, and "The Ann Arbor Water Company," a corporation organized and existing by virtue of Chapter 84, of Howell's Annotated Statutes of Michigan, party of the second part.

Witnesseth: The party of the second part, hereby agrees and contracts with the parties of the first part, to build in the city of Ann Arbor, in the State of Michigan, a complete system of water works, on the reservior and pumping plan. The top of the reservoir shall be located not less than one hundred and fifty-five feet above the intersection of Main and Huron streets in said city, or at the point designated on the map and plans of Professor C. E. Greene, now on file in the office of the recorder of the city of Ann Arbor. The reservoir shall be made of earth, shall be puddled with clay, paved on the bottom and (on) the sides with cobblestones, and shall hold not less than two million gallons.

The party of the second part shall maintain in said reservoir from one million to eighteen hundred thousand gallons of water, and at no time shall allow it to fall below seven hundred and fifty thousand gallons, except when necessary to cleanse the same, or in case of unavoidable accident, and during such time or times it shall maintain by direct pressue a sufficient supply of water for fire and domestic use, and shall keep up steam and also an engineer on hand ready to act in case of fire.

The reservoir shall be cleansed whenever necessary.

The inlet pipes to the reservoir shall be one foot above the bottom thereof, and shall be so arranged that the water pumped into said reservoir shall pass in a pipe up through the same above the level of the water, and then fall on a stone rockery so as to give the water more aeration.

A drain pipe shall be provided to empty the reservoir.

The banks of the reservoir shall be seeded and sodded.

The party of the second part shall furnish and set up pumping machinery capable of pumping fifty thousand gallons of water per hour into the reservoir, and of ample power and capacity for all requirements. A connection between the force main and the distributing main shall be put in to allow a direct pressure from the pump in case of emergency.

The works shall at all times be capable of throwing by reservoir pressure, six streams eighty feet high at the court house at one time; and by direct pressure, the same number of streams at the same place one hundred and ten feet high. And again five streams fifty-four feet high at the University campus, and the same number of streams at the same place by direct pressure, ninety feet high.

In the construction of these works, the party of the second part shall follow the plans submitted by Prof. C. E. Greene, for the sizes and location of the distributing pipes, except so far as they have been or may hereafter be changed by the mutual consent of the parties thereto.

The said plans and maps so as aforesaid submitted by Prof. C E. Greene, now on file in the office of the city recorder and marked exhibit "A" are hereby made a part of this contract.

The party of the second part shall lay pipes sixteen inches to four inches inclusive, not less than fourteen miles in length; and any excess of said fourteen miles as shown on the said plans and maps, shall be laid down within the territory now covered by said plan, unless the parties hereto otherwise mutually agree.

Not more than one mile of four inch pipe shall be laid down, and for the change so made in the plan of Prof. C. E. Greene, from four to six inch pipe, the parties of the first part shall pay to the party of the second part the sum of two hundred and fifty dollars every six months after the rent of said work commences.

The said pipes shall be first-class cast iron pipes and shall be laid below freezing point.

On the length of the pipes so constructed as aforesaid, the party of the second part shall locate and maintain one hundred fire hydrants, for which they shall furnish at all times the necessary supply of water, and shall keep the same in good order and at all times ready for use.

The said hydrants shall be either Chapman, Ludlow or Pattee & Perkins hydrants, and shall all be three nozzled, one steamer and two leading hose, and on these fourteen miles of pipe the parties of the first part may locate as many additional hydrants as they may see fit which shall be set and maintained by the parties of the first part on the terms hereinafter named.

The parties of the first part shall have the right to send an expert to the foundry at which the pipes are being cast to inspect the same, and the material from which they are made. The party of the second part agrees that such pipe shall be subjected to a hydraulic pressure of three hundred pounds to the square inch at the foundry aforesaid, and that such tests shall be made in the presence of an

expert so to be sent as aforesaid. The expense of the said expert shall be borne by the parties of the first part. But in case the parties of the first part should decide not to send such expert, the party of the second part shall furnish the parties of the first part a sworn statement that the pipes have been tested as provided for in this contract.

The said party of the second part shall subject the entire system of pipes, gates and hydrants to a pressure of one hundred and fifty pounds to the square inch, after the same are laid, constructed or put in, before the rental of the same shall commence.

The party of the second part shall also set valves or gates not less than seventy-five in number, and all double faced, which shall all open one way and which shall be of uniform size in nut that shall fit one wrench.

The party of the second part shall cause the pipes to be laid on such side of the streets of said city as may be directed by said first parties or their representatives; and all gate boxes are to be adjusted so as to fit the grade of any street.

Every hydrant on the main pipe shall have a gate until a point is reached that gives two mains to the city aforesaid.

The said second party shall lay at its own expense a service pipe to the curb stone for all persons that may make application for water this season.

The said second party on the completion of said works, shall make a map showing the size and location of all pipes, gates, hydrants, etc., and deposit the same with the city recorder, for the use of the said parties of the first part. The location of the gates and hydrants shall be subject to the approval of the parties of the first part.

The said entire works shall be first-class in every respect, suitable for all these requirements, full, efficient, and ready to respond at all times, unavoidable accidents excepted: **Provided however,** In case of a temporary failure to supply such water for a period exceeding one week, all compensation shall cease until the works are again in operation, under this contract.

No hydrants shall be located on a four inch pipe.

The parties of the first part shall have the right to use the water to test their hose and to afford them a reasonable practice for their firemen.

The said water works shall be completed and water turned on, on or before the first day of January, A. D. 1886.

For the service, and continued supply of water, as above specified, the parties of the first part hereby agree to pay to the party of the second part the sum of four thousand dollars per annum, payable semi-annually, from and after the time when said water works shall be completed and in operation, in addition to the five hundred dollars above named, and when further hydrants shall be established by direction of the parties of the first part to pay to the parties (party) of the second part the first cost in place for such additional hydrants. and the party of the second part shall supply such additional hydrants with water without further charge. Similar hydrants on the same terms and conditions shall be put in on the line of said water pipes on the public streets at the request of private parties and at the expense as aforesaid.

The depth at which the pipes are to be laid shall be below the freezing point of the grade of the streets through which they may be laid, as now established and of record.

The party of the second part shall extend the pipes above specified beyond the said fourteen miles, whenever ordered by the parties of the first part, and for every seven hundred feet of six inch pipe so ordered in such extension, the party of the second part shall erect and maintain one hydrant; and for each hydrant so maintained the party of the second part shall receive therefor at the rate of forty dollars per annum, payable as aforesaid. The party of the second part shall furnish at all times a sufficient supply of water, suitable for domestic purposes to the inhabitants of the city of Ann Arbor along the lines of their water pipes, when requested so to do by such inhabitants at reasonable rates, and not exceeding in amount the average sums paid by inhabitants of other cities of Michigan similarly situated and of like population, and supplied by private companies.

The said party of the second part shall furnish such water as aforesaid for manufacturing purposes, and for railroad companies on as reasonable terms as is furnished by the average of other companies in this State and at a sum not to exceed two cents for one hundred gallons.

The party of the second part further agrees to so arrange the pipes,

gates and relief valves that while cleansing the reservoir or for any other purpose the supply can be changed at any time from the reservoir to direct supply from the pump.

All pipes and special castings shall be subjected to a bath of coal tar and linseed oil, according to Dr. Angus Smith's formulas.

The party of the second part further agrees to furnish water as aforesaid for the Michigan Central railroad company for depot and engine purposes at a sum not to exceed six hundred dollars per annum, and for the Toledo, Ann Arbor and Northern railroad company such water at the same rates.

The party of the second part, in consideration of the premises agreed when requested so to do, to furnish water for the seven public school houses, of the said city, and the three fire engine houses, for the sum of two hundred and fifty dollars per ennum; also to furnish water for two public drinking fountains for the sum of one hundred and fifty dollars per annum; also to furnish water for washing gutters and flushing sewers, whether now constructed or hereafter to be built, and for the city council room for the sum of one hundred dollars per annum; also that they will furnish water for any school house or houses, that are now in process of construction, or that may hereafter be built for the sum of twenty-five dollars per annum each. It is hereby understood that for the prices above mentioned, the parties of the first part are to have the use of all the water that they may require, at the places above mentioned, for water closets, urinals, drinking purposes, washing, washing hose, for supplying steam boilers and for the use of hand hose, for washing windows in all the above buildings and for sprinkling the lawns, including the court house lawn, connected with the same. The said first parties shall not allow the water to be used in and about the buildings aforesaid to run to waste, or to be used for motive power except when generated into steam, or the water at the public drinking fountains to be taken therefrom for private use.

The party of the second part shall protect the party (parties) of the first part from and against all suits and demands on account of any injury resulting from any defect in highways, or anything connected with the construction or existence of said water works, by the said party of the second part; and they (it) shall protect their (its) excavations and restore the streets promptly to as good condition, practically, as before the works were begun; and they (it) shall secure the performance of this agreement set forth in this paragraph by a good and sufficient bond to be approved by the parties of the first part.

The parties of the first part do hereby grant to the party of the second part the right to lay pipes as above provided for water supply in any and all streets of the city of Ann Arbor. The said parties of the first part shall not grant such rights to any other party or parties until such time as the parties of the first part may purchase said water works; or the right of said party of the second part shall have expired by its articles of incorporation; or it shall have lost its rights and privileges by forfeiture, or its failure to perform its part of this contract: **Provided however**, That all rights of laying pipes already granted by the parties of the first part shall be respected and remain in force.

The parties of the first part shall have the right to purchase the entire water works at any time they choose, and if the parties hereto cannot agree in the price to be paid therefor, the judge of the supreme court of the State of Michigan may appoint three commissioners who shall award the price to be paid, and said award shall be binding upon the parties. The grant to the party of the second part of the rights and privileges herein named is established by an ordinance of the said parties of the first part duly adopted.

In witness whereof the parties hereto by their respective officers have hereunto set their hands and affixed their corporate seals the day and year first above written.

(L. S.) The Mayor, Recorder and Aldermen of the City of Ann Arbor, by George H. Pond, Recorder.

(L. S.) The Ann Arbor Water Company, by Charles L. Goodhue, President.

This ordinance shall be in force from and after its passage.

APPENDIX II.

PIPE CUTTINGS

Examined in Determining the Depreciation of the Pipe in the Distribution System.

PIPE CUTTINGS Examined in Determining the Depreciation of the Pipe

in the Distributing System.

Size, 6 inch; laid, 1885; cut out, 1906. On S. Main opposite Gill Lumber yard.

Size, 6 inch; laid, 1885; cut out, 1906. At corner Fourth ave. and E. Liberty.

Size, 6 inch; laid, 1885; cut out, 1906. At corner Liberty and Ashley.

Size, 6 inch; laid, 1885; cut out, 1906. At corner Fourth St. and William.

Size, 6 inch; laid, 1885; cut out, 1907. At Huron and Seventh.

Size, 6 inch; laid, 1885; cut out, 1908. At New Dental Bldg. on N. University.

Size, 6 inch; laid, 1885; cut out, 1908. At New Memorial Bldg on S. University.

Size, 6 inch; laid, 1885; cut out, 1908. At New Dental Bldg. on N. University.

Size, 6 inch; laid, 1885; cut out, 1909. At Fountain and Miller Ave.

Size, 6 inch; laid, 1885; cut out, 1911. On Liberty at Mack & Co.

Size, 6 inch; laid, 1885; cut out, 1911. At Mill on N. Main. Supply pipe to hydrant.

Size, 6 inch; laid, 1890; cut out, 1908. At Corner Wells and Packard.

Size, 6 inch; laid, 1890; cut out, 1909. At Wells and Michigan Aves.

Size, 6 inch; laid, 1891; cut out, ——. On Campus in rear of Law Building.

Size, 6 inch; laid, 1897; cut out, 1906. Corner Huron and Thayer.

Size, 6 inch; laid, 1898; cut out, 1907. On Fourteenth between Belser and Washington.

Size, 6 inch; laid, 1900; cut out, 1906. Corner Clark and Catherine.

Size, 6 inch; laid, 1902; cut out, 1908. At Waterman Gymnasium on E. University.

Size, 6 inch; laid, 1904; cut out, 1906. Opposite Engine House on E. University.

Size, 6 inch; laid, 1905; cut out, 1909. Corner Baldwin and Israel Ave.

Size, 8 inch; laid, 1885; cut out, 1906. Corner W. Huron and First.

Size, 8 inch; laid, 1885; cut out, 1906. Corner Miller Ave. and N. Main.

Size, 8 inch; laid, 1885; cut out, 1906. Corner Liberty and Main.

Size, 8 inch; laid, 1885; cut out, 1906. On East side of Main between Liberty and Williams.

Size, 8 inch; laid, 1885; cut out, 1908. Corner Main and Ann.

Size, 8 inch; laid, 1885; cut out, 1909. At Miller Ave and First

Size, 10 inch; laid, 1885; cut out, 1907. At Goodyear's Store.

Size, 12 inch; laid, 1885; cut out, 1906. On Huron between Main and Fourth Ave., opposite court house.

Size, 12 inch; laid, 1885; cut out, 1906. Discharge Main at Station No. 1.

Size, 12 inch; laid, 1885; cut out, 1906. At corner State and Washington.

Size, 12 inch; laid, 1885; cut out, 1906. At High School between Huron and Washington.

Size, 12 inch; laid, 1885; cut out, 1906. Corner Huron and Fifth Ave.

Size, 12 inch; laid, 1885; cut out, 1909. Corner State and Washington.

Size, 12 inch; laid, 1902; cut out, 1906. Corner Washington and Main.

Size, 12 inch; laid, 1902; cut out, 1906. On W. Washington opposite Ann Arbor Organ Co.

Size, 14 inch; laid, 1885; cut out, 1906. On Main W. Side court house.

APPENDIX III.

Table I.

NO. 1 PUMPING STATION

Miscellaneous Machinery and Fittings —Reproduction Cost.

Item No. 34 Steam gauges	$ 19.60
Item No. 35 Water columns	40.00
Item No. 36 Lubricators, sight feed	42.70
Item No. 37 Steam traps	75.00
Item No. 38 Miscellaneous	204.20
Item No. 39 Flue cleaners	125.00
Total	$ 506.50

TABLE II.

No. 2 Pumping Station. Miscellaneous machinery and fittings. Reproduction cost.

Item No. 34 Steam gauges	$ 13.00
Item No. 35 Water columns	42.00
Item No. 36 Lubricators, sight feed	25.40
Item No. 37 Steam traps	31.00
Item No. 38 Miscellaneous	78.60
Total	$ 190.00

TABLE III.

No. 1 Pumping Station. Pipes, valves, fittings, etc. Reproduction cost.

Item No. 1 pipe	$ 432.32
Item No. 2 Elbows	61.71
Item No. 3 Tees	39.71
Item No. 4 Nipples	31.65
Item No. 5 Unions, screw	12.17
Unions, flange	15.19
Item No. 6 Bushings	3.96
Item No. 7 Plugs	1.44
Item No. 8 Reducing coups.	1.12
Item No. 9 3-way elbows.	.69

Item No. 10 Straight elbows	1.64
Item No. 11 45 deg. elbows	13.64
Item No. 12 Crosses	5.66
Item No. 13 R. & L. coups.	2.06
Item No. 14 Gate valves ...	176.89
Item No. 15 Angle valves .	78.52
Item No. 16 Globe valves .	120.61
Item No. 17 Check valves, hor. swing	12.30
Check valves, horiz. lift ..	2.95
Item No. 18 Safety valves .	47.30
Item No. 19 Bk. pres. valves	33.00
Item No. 20 Faucet valves .	.50
Item No. 21 Cocks	3.68
Item No. 23 Flange elbows	.60
Item No. 24 S. O. Tees.....	1.57
Item No. 25 Knobs	8.72
Item No. 26 Flanges	23.00
Item No. 27 Lock nuts	.05
Item No. 28 Floor flanges .	.30
Item No. 30 Soil pipe	6.56
Item No. 31 Soil elbow...	.14
Item No. 32 Soil tees	.37
Item No. 33 Pipe covering	11.97
Total .....$	1 152.59
Installation, 70 per cent.	806.81
Estimated reproduction cost .....$	1 959.40

TABLE IV.

No. 2 Pumping Station. Pipes, valves, fittings, etc. Reproduction cost.

Item No. 1 Pipe .....$	117.65
Item No. 2 Elbows	11.29
Item No. 3 Tees	12.62
Item No. 4 Nipples	17.84
Item No. 5 Union, screw ..	7.73
Item No. 5 Union, flange ..	5.40
Item No. 6 Bushings	1.70
Item No. 7 Plugs	.83
Item No. 8 Reduced coupls.	.51
Item No. 9 3-way elbows ..	.11
Item No. 10 Straight elbows	.90
Item No. 11 45 deg. elbows	5.18
Item No. 12 crosses	2.23
Item No. 14 Gate valves ..	75.17
Item No. 15 Angle valves ..	91.16
Item No. 16 Globe valves ..	50.69
Item No. 17 Check. valves, horiz. swing	11.91
Check valves horiz lift	3.00
Item No. 18 Safety valves .	34.20
Item No. 19 Bk. pres. valves	22.00
Item No. 20 Faucet valves	.50
Item No. 21 Cocks	6.04
Item No. 22 45 deg. angle valves	5.40
Item No. 27 Lock nuts	.34
Item No. 28 Floor flanges .	.10
Item No. 29 Ceiling plates .	.40
Item No. 33 pipe covers ..	10.24
Total .....$	495.14
Installation, 70 per cent.	346.60
Estimated reproduction cost .....$	841.74

TABLE V.

No. 1 Pumping Station. Piping to Suction Well, River Shaft and Purification Plant. Reproduction cost.

Pipe .....$	3.496.50
Gates	1.152.00
Specials (9 tons)	450.00
Manholes (6)	180.00
Tile	78.90
Total .....$	5,357.40

APPENDIX IV.

Table I.

WATER RIGHTS

Right of Ingress and Egress Over the Following Property Conveyed to Ann Arbor Water Co.

Station No. 1.

1. Cornwell Property: Exclusive right for purpose of sinking wells and laying pipe upon a piece of land in Sec. 17, bounded on the North by East and West highway running across the west half of the said section; on the East by the Huron River, on the West by the Old Railroad grade running southward from said highway 300 feet, and on the South by a line drawn from said grade at a point 300 feet south from said highway and East to the Huron River.

2. To Spring Across River. Right to lay and maintain a water pipe extending from the basin near the Engine house across parts of Sections 8 and 17 in Town 2 South Range 6 East, extending from the Huron River in a northeasterly direction to a point about twenty-five feet northwest of a stone culvert, and just above intersection of the two streams of water which there meet, with the right to lay and maintain ateral branches to said main line, with the right to take and use water flowing in the natural channel along the line of piping on said lands.

3. To O'Brien Spring near Foster's: Right to lay tile in Michigan Central Railroad Right of Way from 650 feet east of Fosters Station in the South half of Section 7 in Town 2 South Range 6 East; thence easterly along tracks through the south half of Section 7, the northeast quarter of Section 18, the northwest quarter of Section 17 to a point in the last mentioned tract opposite the Pumping Station.

Station No. 2.

1. Herdman: The right of entering

upon all that part of land described from Martin P. Gott to William J. Herdman, recorded in Liber 314 of Deeds, Page 109.

2. Allmendinger: The right of laying and maintaining lines of piping across the property of Mary W. Allmendinger.

3. Jewett's Addition: The right of entering upon lots 32, 34, 84 and east rod of lot 86 in Samuel P. Jewett's Addition to the City of Ann Arbor.

4. Crookston: The right to lay and maintain pipe within 300 feet of the creek across the lot owned by Mary L. Crookston, fronting one hundred ten feet on West Liberty Street and running north 35 rods and upwards.

5. Buehler: Water rights on lands owned by Charles N. Buehler Commencing at a point on the east and west quarter of Section 30, 7 chains and 50 links from the east quarter post at the northwest corner of lot sold by Eber White to Fitch Hill, thence west along the quarter line 18 chains and 75 links to a stake from which a hickory bears South 40 degrees West thirty and one half links, also one east thirty-one links, thence south parallel to the east section line 13 chains, 53 links to the center of the Eber White road, thence north 73 degrees East along the center of the said road 19 chains and 45 links, thence north along the line parallel to the East section line 8 chains and 42 links to the place of beginning, except 6 acres of land on the east side thereof heretofore conveyed to John Rousenberger, John Koch and George Laubengayer. The lands hereby conveyed being 14 and 57-100 acres.

Total value of water rights, $3,500.

Table II.

NO. 1 PUMPING STATION.

Outside Piping to Wells—Reproduction Cost.

*NOTE: The Suction Shaft, the River Shaft, the Collecting Basin and the Piping, Gates and Specials connected thereto are not included in the above table but appear in Table Appendix and are included in the Appraisal as a part of the value of Station No. 1.

Pipe	$ 3,535.75
192 ft., 12 in. pipe,	$ 336.00
666 ft., 10 in., pipe,	999.00
11 ft., 8 in., pipe	13.75
2097 ft., 6 in., pipe,	2,097.00
120 ft. 4 in. pipe	90.00
Total	$ 3,535.75
Specials, (1.1 tons)	$ 55.00
Gates, set (8)	191.00
Collecting gallery (1)	390.00
Manholes (7)	210 00
Wells	2,317.15
529 ft. 6 in. wells,	$ 1,322.50
628 ft. 2 1-2 in. wells,	628.00
156 ft. 2 in. wells,	156.00
Total	$ 2,317.15
Shafts, No. 1, 20 ft. diam. by 30 ft. deep	$ 1,663.50
Tile	795.00
1110 ft. 12 in. tile laid	$ 555.00
880 ft. 6 in. tile laid	240.00
Total	$ 9,157.40

Table III

No. 2 Pumping Station. Wells and Piping. Reproduction Cost.

Pipe	$ 9,093.05
1798 ft. 12 in. pipe	$ 3,146.50
114 ft. 10 in. pipe	171.00
3101 ft. 8 in. pipe	3,876.25
955 ft. 6 in. pipe	955.00
810 ft. 4 in. pipe	607.50
240 ft. 2 1-2 in. pipe	108.00
572 ft. 2 in. pipe	228.80
Total	$ 9 039.05
Specials 34 tons	$ 420.00
Gates, 47 set	1,270.00
Manholes, 30	815.00
Wells	6,017.00
1567 ft. 6 in. wells	$ 3,917.50
130 ft. 8 in. wells	390.00
384 ft. 3 & 4 in. wells	576.00
587 ft. 2 & 2 1-2 in. wells	587.00
Total	$ 5,470.00
Add 10 per cent.	547.00
Total	$ 6,017.00

SHAFTS.

No. 1, 20 ft. diam. by 30 ft. deep	$ 1,809.50
No. 2, 20 ft. diam. by 30 ft. deep	1,699.50
No. 3, 10 ft. diam. by 15 ft. deep	473.00
No. 4, 14 ft. diam. by 18 ft. deep	720.50
No. 5, 12 ft. diam. by 17 ft. deep	639.50
No. 6, 30 ft. diam. by 30 ft. deep	2,816.00
Total	$ 8,158.00
Grand total	$25,773.05

Table IV.

No. 1 Pumping Station. Purification Plant. Reproduction Cost.

Ozone plant complete (Company's

books) $14,225.00
1 Concrete treating house.
1 Air Compressor and foundation, size 10 ft. by 11 ft. by 15 ft.
2 Ozone generators, containing tank, generating tubes.
1 American Blower Engine, size 7 inch by 7 inch.
1 Alternating current generator, 20 k. v. a., single phase, 220 volts, 1825 R. P. M.
3 Sing e phase transformers, 13,-500 to 220 volt.
Piping, valves, belts, foundation, wiring, etc.
Filter complete (vouchers) $ 3,308.80

Total $17,533.80
Engineering and contingencies, 10 per cent. 1,753.38

Estimated reproduction cost $19,287.18

REPORT

On the Extension and Improvements of the Ann Arbor Water System. Supplementary to a Report on the Valuation of the Same Dated Dec. 31, 1911. By Gardner S. Williams, Consulting Engineer, Ann Arbor, Mich.

To the Honorable, The Mayor and Common Council, of the City of Ann Arbor: Sirs—In accordance with the agreement entered into on July 14, 1911, with Alderman Manwaring, representing your Water Works Committee, I have the honor to submit herewith a "Report on the Extension and Improvements of the Ann Arbor Water System," showing the estimated cost of the needed extensions and improvements to be Eighty-five thousand ($85,000) dollars, which is

Sirs,

Very respectfully submitted,
GARDNER S. WILLIAMS,
Consulting Engineer.

Supply—Present Sources.

The present supply is obtained from three principal sources: (a) Ground water at the West Washington street station, (Station No. 2); ground water at the River station, (Station No. 1), and river water at Station No. 1. Of the first there appears to be continuously available about 900,000 gallons per day; of the second about 700,000; and of the third an amount practically limited only by the capacity of the purification works.

Present Purification Works.

The water drawn from the river has, during the past year, been purified by treatment with electrically generated ozone, in a plant whose present rated capacity is 2,000,000 gallons per 24 hours. All apparatus and construction included therein, except the ozone generators are of 3,000,000 gallons capacity. A 24 hour test of this plant in April, 1911, prior to its acceptance by the Water company, showed a capacity of 2,000,000 gallons and a reduction of bacteria from 21,400 per cubic centimeter in the raw water to an average of 26 in the purified water, when samples were developed at a temperature of 37 1-2 degrees centigrade for 48 hours. The samples were taken every three hours from a tap at the pumping station, the highest count of bacteria being 35 and the lowest 20. No pathogenic or colon bacteria appeared in the effluent though they were abundant in the river water. This represents a high degree of purification, and in this condition the purified water is probably better than the ground water as usually supplied.

It has not been found possible to determine the cost of purification closely, but it is probably less when fixed charges are considered than the cost of purification by means of filtration, though somewhat higher than by use of calcium hypo-chlorite.

As the ozone plant can hardly be considered out of the experimental stage, it may be that on account of cost of operation, or the possible rapid deterioration of the parts of the apparatus, or for some other now unsuspected reason, its use will not be considered entirely satisfactory in the future, and plans have therefor been made and estimates prepared for a slow sand filtration plant, by which there is no question of obtaining a satisfactory water at a definite cost. This plant is designed to be located at Station No. 1, just south of the station where land is available, and to take its supply of raw water from the river. Plates I. and II. illustrate the design, and the estimated cost of such a plant, of 4,000,000 gallons daily capacity, according to these designs, is $100,000.

Filtration.

The purification of water by slow sand filtration has been in common use in England since 1829 and the city of Poughkeepsie, New York, has successfully purified a water supply from the Hudson river since 1872. The process consists of passing the water slowly through a bed of sand, on the surface of which accumulates

a coating of bacteria which prevent the passage through of such other bacteria as may be in the water. At times this accumulation of bacteria becomes so great that it has to be removed and this causes the chief expense in operating. At the present time the entire supplies of Philadelphia and Washington are so purified, as also a major part of that of Pittsburgh and Albany, and of many smaller places.

It may therefore be safely assumed that for an investment of $100,000 a supply of 4,000,000 gallons of satisfactory water can be obtained if needed.

Other Sources.

The presence of ground water in limited quantities is general throughout this region, but it seems to be confined to the veins and pockets of sand and gravel intermingling with inpermeable clays. This causes great uncertainty to exist as to the supply of ground water at any particular point. During the past two months in examining the foundation for the proposed power plant of the Eastern Michigan Edison company on the Huron river opposite the river station of the Ann Arbor Water company, three drill holes were put down in a straight line across the river, covering a distance between extreme holes of 40 ft. Of these holes, which were each drilled to a depth of 45 feet, the first one struck a small vein of water at a depth of 22 feet, the middle one was dry, and the third struck a similar vein to the first at 23 feet. A fourth hole 40 feet from the last struck, at a depth of 27 feet a vein of water which flowed from the pipe when 6 feet above the river. The experience of the Water company's drillings have been similar, and though many dry holes will be found, it is nevertheless to be expected that additional water can be secured along the river valley within reasonable distances of the present Station No. 1.

The Steere Wells.

Five 8-inch wells have been drilled to a depth of about 38 feet, on the Steere farm, about four miles south of the city near the Ann Arbor railroad, in section 16, town 3 south, range 6 east. If no other supply were available, further investigations in that locality would be warranted, but the supply as originally developed decreased perceptibly when the wells were allowed to flow under their natural head, and to prevent further depletion they have been capped.

Similar experiences are reported with other wells in the region south of the city. Assuming, however, a sufficient supply on the Steere farm, the cost of the pipe line to bring it to the city would be about $26,000. The surface of the ground at the wells is about 50 feet below that at the court house in Ann Arbor, thus necessitating the maintenance of a pumping station at the wells. Such a station would cost not less than $10,000 and assuming the supply to be one million gallons the operating charges would be at least $12.00 per million gallons or $4,380 per year. If water were obtained from this source the cost of pumping at Station No. 1 would be reduced by the coal required to pump a million gallons daily or 365 times $8.25, equals $3,011. making the added annual cost at the Steere farm $1,369 for operation. Capitalizing at 5 per cent this represents $27,380. This added to the costs of the station and pipe line gives as the cost of a one million gallon supply delivered in the city from the Steere farm:

For force main	$26,000
For station	10,000
For operation, capitalized ...	27,380
Total	$63,380

This is fully twice what an equal supply of purified river water will cost at Station No. 1, and it is therefore, concluded that this source may be dismissed from further consideration.

Most Available Supply.

The most available, and the only surely adequate supply is the Huron river. The ozone purification plant seems sufficient both in magnitude and quality of output for present needs, and if this assumption be proven incorrect by further experience, we may be assured that an ample supply for the needs of a city twice the size of Ann Arbor can be obtained and properly purified at a cost of $100,000.

Recommendation.

It is the writer's recommendation that the supply be continued as at present unless it shall later appear that the method of purification is over-expensive or imperfect.

The Present System.

The existing system is well laid out so far as the general features are concerned, and the sizes of the mains are

in general sufficient.

Some criticism has been heard of small pipe in the system and the following comparison with the Detroit system may be interesting:

Detroit.

Size		All Pipe. Per Cent
Less than	4 inches	1.47
	4 inches	20.26
	6 inches	49.39
	8 inches	12.03
	10 inches	5.67
	12 inches	2.80
Above	12 inches	8.38
		100.00

Ann Arbor.

Size	All Pipe Per cent.	Cast Iron Per cen.t
Under 4 in.	15.60	0.00
4 in.	7.85	9.30
6 in.	62.40	74.00
8 in.	4.70	5.60
10 in.	1.20	1.40
12 in.	4.90	5.80
Over 12 in.	3.35	3.90
	100.00	100.00

The Detroit distribution has been proven by its fire service to be an exceptionally efficient one, and considering the relative sizes of the two cities, Ann Arbor does not suffer by comparison.

The hydrants in Ann Arbor have all been connected to six inch pipe or larger sizes, while in Detroit many hydrants are supplied from four inch pipe.

Criticism.

The criticism of the distribution lies in the fact that the growth of the city to the eastward has caused a large consumption of water at high levels with a resulting decrease of pressure, due to lack of provision for supplying the high levels other than through the rest of the distribution.

New Force Main.

To obviate this criticism and also to increase the security against accident, a second main should be laid to the city from Station No. 1. The route proposed for such a main is shown in Plates III and IV, the former of which covers that portion outside of the distribution system.

This main is designed to be 16 inches in diameter and to extend as such from the pumping station to the corner of Main and Depot streets, via a private right of way across the lands of the Eastern Michigan Edison company, and the Whitemore Lake road; thence along Depot street to State street, along State to Lawrence, east on Lawrence to Ingalls and south on Ingalls to Washington, connecting there with the present 12 inch main. At Washington the main would reduce to 12 inches and continue on Ingalls to North University, east on North University and Washtenaw to Church, and south on Church to Hill. This main is designed to supply the Fifth ward and the territory east of State, Thompson and Packard streets and north of Prospect street.

The estimated costs of this main are:

16 inch pipe from Station to Ingalls and Washington sts., 13,950 ft. at $2.30	$32,085
12 inch pipe from Ingalls and Washington to Church and Hill sts., 3,675 ft. at $1.65	6,064
	$ 38,149
Contingencies and engineering	3,851
Total	$42,000

This main would deliver at Washington and Ingalls streets two million gallons daily with a drop of pressure of only about 8 pounds. The elevation at Washington and Ingalls streets is 89 feet above Station No. 1, which is equivalent to about 38 1-2 pounds. The pressure at Station No. 1 is about 102 pounds, and subtracting the decrease due to elevation and friction leaves the pressure in the main at the end of the 16 inch about 55 pounds, which would be a very satisfactory fire pressure in that locality, and which could be raised by increasing the pressure at the station.

The Fifth Ward.

In connection with this main it is recommended to lay an eight inch main through the Michigan Central depot grounds and the park and across the river to Wall street to provide a duplicate supply to the territory in the Fifth ward. This main would be about 600 feet long and is estimated to cost about $1,000 on account of the obstructions encountered.

Elevated Tank.

In addition to the foregoing mains, it is also recommended that an elevated tank of at least 250,000 gallons capacity be located at or about the site acquired by the water company near Geddes avenue, and connected with the previously described main at Hill and Church streets by a 12 inch pipe extending along Hill and

Myrtle streets to the tank, a distance of about 3,000 feet estimated to cost $6,000. The tank itself erected and enclosed in a concrete shell is estimated to cost $20,000. This tank will provide a reserve supply in cases of large demand and will enable pumping to be suspended at night or for limited periods when desired. It possesses the additional advantage that it can be erected quickly and afford relief from the low pressures in the southeastern part of the city before the force main is completed, as it can be filled at night from the present mains when the consumption is light and the pressure up, and feed back during the times of heavy demand.

Minor Improvements.

At various places in the system short lines of pipe are desirable to connect up existing dead ends and improve circulation and fire protection. An allowance of 5,000 feet of 6 inch pipe, estimated to cost $5,000 is considered sufficient for this item.

Replacements.

The mains herein provided for would replace or duplicate 3,900 feet of 6 inch pipe and 1,000 of 4 inch pipe in the present system, representing a value of $4,650. This pipe if replaced would be worth for relaying about $1,500, leaving the net loss by replacement $3,150.

On account of the large size of the proposed mains it would probably be better to leave the present pipes in place for the local supply rather than to transfer the connections to the larger mains.

Cost of Improvements.

The combined estimated costs of these improvements are as follows:

Force Main to Hill and Church streets	$42,000
Elevated tank	20,000
Tank supply main	6,000
Main to Fifth ward	1,000
Sundry minor mains	5,000
Total pipe	$ 74,000
Add 100 hydrants at $75.00	7,500
Total addition to system	$81,500

These additions should place the system in first class condition to meet the requirements for several years to come except for the usual annual extensions due to natural growth of the city.

These extensions during the last fiscal year have amounted to about $17,500, which sum probably exceeds the average annual outlay for additions to the distribution system with the present growth of the city.

MUNICIPAL MANAGEMENT.

The Company's Offer.

As of June 1, 1911, the Water Company offered to sell to the city their entire interests for the sum of $525,000. Since that time there has been added to the physical property.

For street mains	$ 4,163.03
For service connections	1,866.70
For station No. 1	2,517.22
For station No. 2	477.19
For meters	1,213.51
For filter plant	59.55
Total	$ 10,297.20

The present offer may therefore be taken as $535,000.

OUTSTANDING BONDS.

The condition of the outstanding bonds all of which draw 5 per cent. interest is as follows:

Now retireable at par	$225,000
Now retireable at par	99,500
Due in 1930. No retirement provision	76,500
Total outstanding	$401,000

The Company is entitled to issue in January, 1912, about $9,000 more of bonds on account of the construction of the past year.

It is the opinion of the Company that all but $25,000 worth of these bonds can be secured at par.

ANNUAL CHARGES.

In the event of the acquisition of the plant by the City and its improvement as herein recommended, bonds would be issued to the amount of $620,000.

Assuming none of the last issue of the Company's bonds can be retired till maturity the interest charges would be:

$ 76,500 at 5 per cent.	$ 3,825
543,500 at 4 per cent.	21,740
Total interest	$25,565
An allowance of $5,000 annual y for s nking funds to replace depreciation should be provided, preferably by way of an investment in construction taken from income,	5,000
Total annual fixed charges	$30.565

The operating expenses of the Com-

pany for the last fiscal year have been, as shown on page 49 of the writer's Report on Valuation, as follows:

Pumping station, labor, etc	$ 6,402.54
Fuel	5,061.46
Office management	3,010.95
Distribution and General	7,061.93
Rebates and Stoppages	605.76
Total operation	$22 142.64

The maintenance expenses have been:

Repairs to distribution and services	$ 607.35
Repairs to station No. 1	630.41
Repairs to Station No. 2	13.78
Repairs to meters	581.50
Total maintenance	$1,833.04

It does not seem likely that any of these charges can be reduced under municipal management and it is rather to be expected that they will be somewhat increased, as it is practically impossible to get as efficient service from the employees of a city as from those of a private corporation, and few men posses the ability for management requisite to handle such a property as this.

The foregoing annual charges in round numbers are:

Interest and depreciation	$30,565
Operation	22,145
Maintenance	1,850
Total annual charges	$54,560

REVENUES.

The gross revenue under existing rates for the last fiscal year was as stated on page 49 of the previous report, $61,670.07 and the growth of the business since the close of the fiscal year, March 31, 1911, warrants the assumption of an income at present rates of $65,000. Deducting the annual charges as above estimated, $54,560, leaves a surplus of $10,440. Assuming that annual extensions would be provided for by bonds, and making an allowance for greater operating expense under city management, it appears that it may be possible to reduce the rates to the consumers nearly fourteen per cent. under municipal management.

HYDRANT RENTAL.

The foregoing conclusion anticipates the payment from the general tax levy of the same amount for hydrant rental or fire service as heretofore. As this is a point on which municipalities frequently go astray, a brief discussion of the question may not be out of place.

The functions of a water supply system fall under two quite distinct heads. One is naturally a private function, the purveying of water for the useful consumption of the water takers, and is similar to the purveying of coal, bread, meat or any other necessity of life. Under this head the service and the commodity should be paid for by the person receiving it. The other function, fire protection, is essentially public and akin to police protection, health service, or the lighting of streets. The value of the service has no relation to the quantity of water sold, nor to the parties consuming it, but is solely dependent upon the value of the property protected. The cost of fire protection should therefore be paid for from an assessment levied in proportion to the value of the property and not from water rates . Its relation to the income from the sale of water is exactly similar to that existing between the cost of lighting streets and the receipts for light sold to private consumers. No one would think of proposing that to the bills for electric current consumed in private residences should be added the cost of the street lights. To determine the cost of fire protection it is necessary to ascertain the addition to the cost of the works entailed by provision for it, and in the ordinary system these provisions are responsible for from one fourth to one third of the annual charges. Adopting the lower quantity the amount that should be contributed annually from the general tax levy would be, on the basis of the previous estimated annual charges, the sum of $13,640.

The payments for fire protection on the basis of the hydrants now in service will amount to $9710 for the next year which is at least $3900 less than should be paid by the general taxation,, and if this difference were added from the general tax levy, the rates charged consumers might be reduced a total of twenty per cent. under municipal management, assuming always that extensions over and above the $5,000 per year set aside for depreciation, be provided for with bonds.

BONDING AND EXTENSIONS.

In some works it is customary to pay for the annual extensions out of earnings or from the general tax levy. As these extensions have a probable life of anywhere from fifty to one hundred years it is apparent that in jusice to the present generation, it should

not be made to pay the whole cost, and hence the propriety of bonding for these improvements is established.

PERSONNEL

The results of his examination of the plant and its operation leads the writer to take this opportunity to compliment the present Superintendent, Mr. Titus F. Hutzel, and the present Chief Engineer, Mr. Reginald Spokes, upon the very efficient manner in which they have conducted the affairs of their respective departments, and to express the hope, in the interest of the City, that in the event of a change of ownership these gentlemen, whose service with the plant covers nearly its whole existence, may be persuaded to remain in their present positions of responsibility.

The finding of a suitable executive for the office, to replace the present manager will be a problem to tax the best energies of the City authorities, for few plants now in existence can show clearer evidence of capable management than the plant of the Ann Arbor Water Company.

COST OF NEW SYSTEM.

Ann Arbor, Mich., Jan. 9, 1912.

To the Honorable, The Mayor and Common Council, of the City of Ann Arbor. Sirs—In response to the inquiry propounded by the Water Works committee on January 8, 1912, as to the cost of a new system of water works to supply the City of Ann Arbor, I estimate as follows:

For Water Supply	$100,000
For Pumping station	50,000
For distribution system	365,000
For reservoirs	25,000
For force mains	20,000
Total	$560,000
Engineering and contingencies	40,000
Total	$600,000

The system would be an improvement on the present one, when the latter is improved as recommended by the writer, to the extent of the replacement of the wrought iron street mains with cast iron, and the substitution of a filtered river water for the present mixed supply.

The above figures do not include the cost of transferring the service connections from the present to the new system. Such cost may be fairly estimated at $5.00 each for 3,600 connections or $18,000, which sum should be added to the estimate of $600,000 making $618,000 to put the new system in the condition of the present one with reference to the consumers.

Very respectfully submitted,

GARDNER S. WILLIAMS,
Consulting Engineer.