Sylvester Q. Cannon
Journal

REPORT
ON
SALT LAKE CITY WATER SUPPLY

SYLVESTER Q. CANNON,
CITY ENGINEER.

DECEMBER 31, 1913.

R E P O R T

ON

S A L T L A K E C I T Y

W A T E R S U P P L Y

SYLVESTER Q. CANNON,
City Engineer.

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I L L U S T R A T I O N S

S U M M A R Y

REPORT ON SALT LAKE CITY WATER SUPPLY

-GENERAL INFORMATION-

Introductory:-

One of the most important problems before the people of Salt Lake City today is that relating to the municipal water supply. That an adequate supply of water of suitable supply is vitally necessary, not only for the present municipal needs, but for prospective rapid growth, is a self-evident proposition. It is, therefore, highly desirable that a comprehensive plan for the improvement of the water supply which will provide for a large increase of population be adopted, and the details be worked out so that the improvements can be made either in units in advance of the City's growing requirements, or as a united whole. In accordance with the instructions of the Board of Commissioners by resolution adopted April 7, 1913, this report is respectfully submitted.

Salt Lake City is somewhat peculiarly and very favorably situated with relation to sources of water supply. In a distance of approximately twenty miles extending from the northerly end of the City southward, there are seven fairly large mountain streams discharging through defiles in the Wasatch range, besides springs and other sources issuing from the base of the range. These streams emerge from the canyons at elevations such that they can be conducted by gravity to all parts of the City. They are fed from the direct run-off of the snows on the mountain slopes and from the underground sources, and are

permanent and fairly regular in discharge. Due to the character of the sources of supply and the comparative facility with which the watershed can be protected from pollution, these streams are of excellent purity and quality and can be maintained relatively free of contamination. In addition to these sources of potable, mountain water, Utah Lake and Jordan River, at a distance of approximately twenty-seven miles, furnish an abundant supply of water which, though not suitable for domestic consumption, is satisfactory for irrigation and other needs. This water can be delivered to a large part of the City by gravity. All of the various streams and sources above mentioned supply water not only for the City but for the irrigation of a large portion of Salt Lake County.

The plan under which the City was laid out and the manner in which it has been built provides for considerable parking, both within the property lines and also on the streets, outside of the business district. This feature, taken with the semi-arid climate of this region, requires that a great deal of sprinkling of lawns and gardens be done during the summer season. Also, considerable water is used for sprinkling the unpaved streets. The mean annual rainfall for Salt Lake City based on Weather Bureau Records for the past 38 years is 16.15 inches. On account of these conditions the average consumption of water during the summer is greatly in excess of the needs in winter.

Extent of City's Water Rights:-

At present Salt Lake City has water rights in five of the mountain streams. The extent of this ownership is as follows:-

City Creek- 100 per cent.
Red Butte Creek - Surplus (secondary to Ft. Douglas).
Emigration Creek- 5/7 = 71.43 per cent.
Emigration Tunnel- approximately 1,700,000 gals. daily.
Parley's Creek- 85 per cent of primary flow
(primary flow is 15,000,000 gals. daily).
All surplus over 47,000,000 gals. daily).

Big Cottonwood Creek- 38.15 per cent of primary flow in summer.
(primary flow is 120 sec. ft.).
25.58 per cent of flow above primary stage.
31.70 per cent ofwinter flow.

Utah Lake & Jordan River-
Jordan & Salt Lake City Canal- 150 sec. ft. = 94,000,000 gals.daily.
37 sec. ft. = 24,000,000 " "

The location of the various sources of supply is shown on Plate 1.

Present Supply and Distributing System:-

The supply conduits and canals are indicated on Plate 1. They consist of the following:-

City Creek: Brick tank-	24-inch pipe) 30-inch pipe)	7,000,000	gals.daily	(apprx
20th Ward Pipe Line-	12-inch pipe	1,900,000	"	"	"
Capitol Hill Line-	12-inch pipe	2,300,000	"	"	"
New High Line-	18-inch pipe	5,800,000	"	"	"
Total-		17,000,000	"	"	"
Emigration Tunnel Line-	14-12-inch pipe	1,700,000	gals. daily		
Parley's Conduit	36-inch pipe	17,500,000	"	"	
Big Cottonwood Conduit		38,000,000	"	"	
GRAND TOTAL-		74,200,000	"	"	
JORDAN & SALT LAKE CITY CANAL:-		60,000,000	"	"	

Of this total capacity, however, the Big Cottonwood Conduit is not, at present, directly available, for the reason that the supply from that source is dropped into the Parley's Reservoir and carried thence through the Parley's Conduit. The present avail-

*Additional old -12-inch wood stave pipe still in use.

WATERSHED MAP
OF THE
STREAMS IN THE VICINITY OF SALT LAKE CITY

CITY ENGINEER'S OFFICE

SCALE, 1 MILE TO 1 INCH

Sylvester D. Cannon
CITY ENGINEER

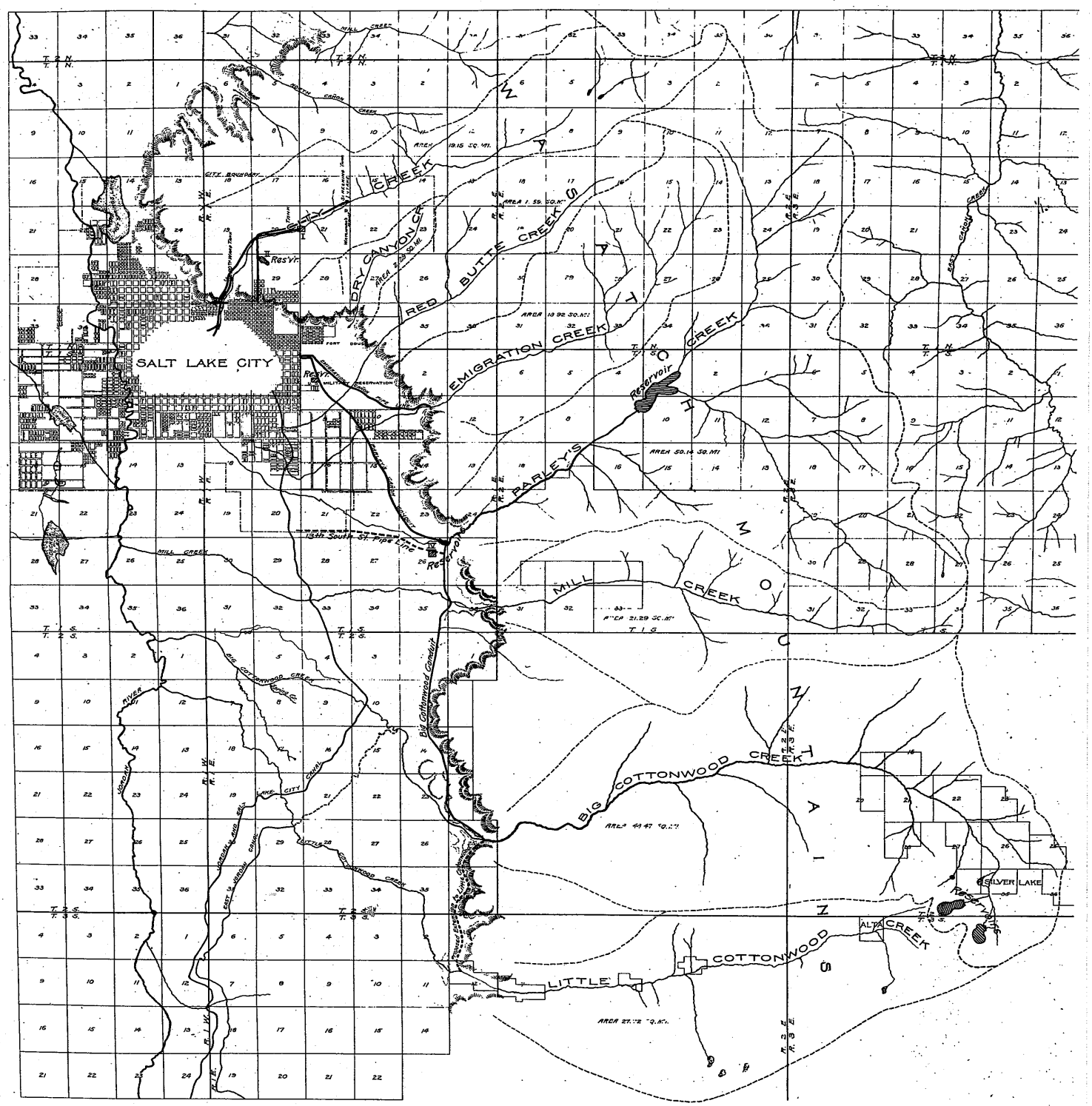


PLATE 1

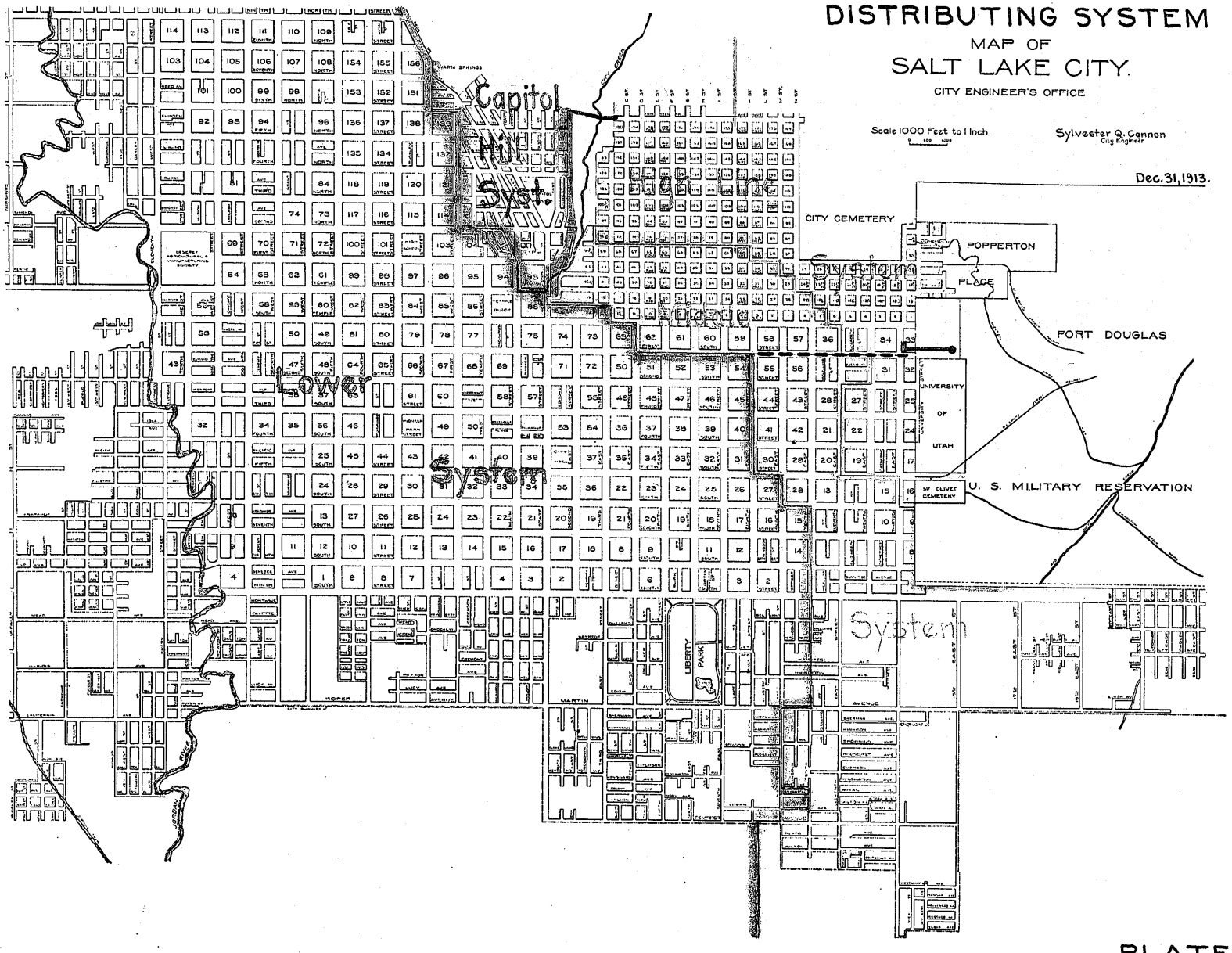
able capacity is, therefore, 36,200,000 gallons daily. The total length of the supply mains is approximately 22 miles.

The arrangement of the distributing system throughout the City is shown in Plate 2. It is subdivided into four systems-- the High Line system (shown in yellow), the Capitol Hill system (shown in blue), the Middle system (shown in green) and the Lower system (shown in red). It consists of 210 miles of cast iron mains ranging in size from 4-inch to 36-inch pipe. Most of the 3-inch and 4-inch pipe, which was formerly a part of the system has now been replaced with 6-inch pipe.

Available Supply:-

The supply of water based on the City's present rights in the various streams varies, naturally, with the seasons and with the varying run-off in various years. In order to present the matter in a conservative manner and as a means of comparison, the computations have been based upon the flow of the various streams during a year of very low supply (1905), and during an average year, as determined by taking the mean of the years 1905-6-7-8- and 11, the records for other years being incomplete. Consequently, it may be understood that the estimates and calculations in this report will provide for times of scarcity, and that under ordinary conditions there will be an excess of supply.

The available supply to the City during a year of scarcity (minimum year) and during an average year are given in Table 1. This is the total quantity to which the City is entitled. From the table it is evident that during the spring and early summer, there is a considerable decrease of discharge over the average flow. All of this surplus cannot be carried directly through the


DISTRIBUTING SYSTEM
MAP OF
SALT LAKE CITY.
CITY ENGINEER'S OFFICE
Scale 1000 Feet to 1 Inch.
Sylvester Q. Cannon
City Engineer
Dec. 31, 1913.
Capitol Hill System
Upper Bench System
Lower System
System
CITY CEMETERY
POPPERTON PLACE
FORT DOUGLAS
UNIVERSITY OF UTAH
U. S. MILITARY RESERVATION
MT. OLIVET CEMETERY
LIBERTY PARK
HOOPER
MARTIN
AVENUE
PLATE 2

SALT LAKE CITY WATER SUPPLY

Table 1.

Available Supply During Minimum Year and Average Year, Etc., Based on City's Present Rights.

Month	Supply During Low Year Gals. per day	Approximate Supply Available Direct or By Conservation During Low Year. Gals. per day.	Supply During Average Year Gals. per day	Average Needs for 100,000 Population. Gals. per day	Average Needs for 200,000 Population Gals. per day
January	13,791,000 *(3,000,000)	13,791,000 *(3,000,000)	16,800,000 * (3,200,000	16,000,000	32,000,000 .....
February	13,430,000 *(3,000,000)	13,430,000 *(3,000,000	17,200,000 *(3,500,000)	16,000,000	32,000,000 .....
March	13,824,000 *(3,500,000)	13,824,000 *(3,500,000)	22,700,000 *(4,300,000)	16,000,000	32,000,000 .....
April	34,950,000	34,950,000	47,300,000	20,000,000	40,000,000
May	56,924,000	50,000,000	70,900,000	25,000,000	50,000,000
June	61,932,000	52,000,000	74,600,000	25,000,000	50,000,000
July	33,445,000	33,445,000	40,600,000	25,000,000	50,000,000
August	21,580,000	21,580,000	36,100,000	25,000,000	50,000,000
September	18,600,000	18,600,000	27,100,000	22,000,000	44,000,000
October	13,527,000 *(3,500,000)	13,527,000 *(3,500,000)	18,800,000 *(4,200,000)	19,000,000	38,000,000 .....
November	11,691,000 *(2,000,000)	11,691,000 *(2,000,000)	16,700,000 *(3,300,000)	16,000,000	32,000,000 .....
December	12,075,000 *(3,000,000)	12,075,000 *(3,000,000)	15,600,000 *(3,400,000)	16,000,000	32,000,000 .....
AVERAGE	25,480,600	24,076,000		20,000,000	40,000,000
Total for yr.	9,300,200,000 *(547,500,000)	8,787,700,000+ *(547,500,000)	**12,133,600,000 *(666,100,000)	7,300,000,000	14,600,000,000

*Additional supply in litigation with Progress Co., Big Cottonwood.

+Sufficient with addition (*) for 128,000 people.

** With possible conservation there is sufficient for approximately 150,000.

Note:- Since this table was prepared the court rendered its decision (Dec. 23, 1913) relative to the water in litigation whereby the city obtains practically all the water in question.

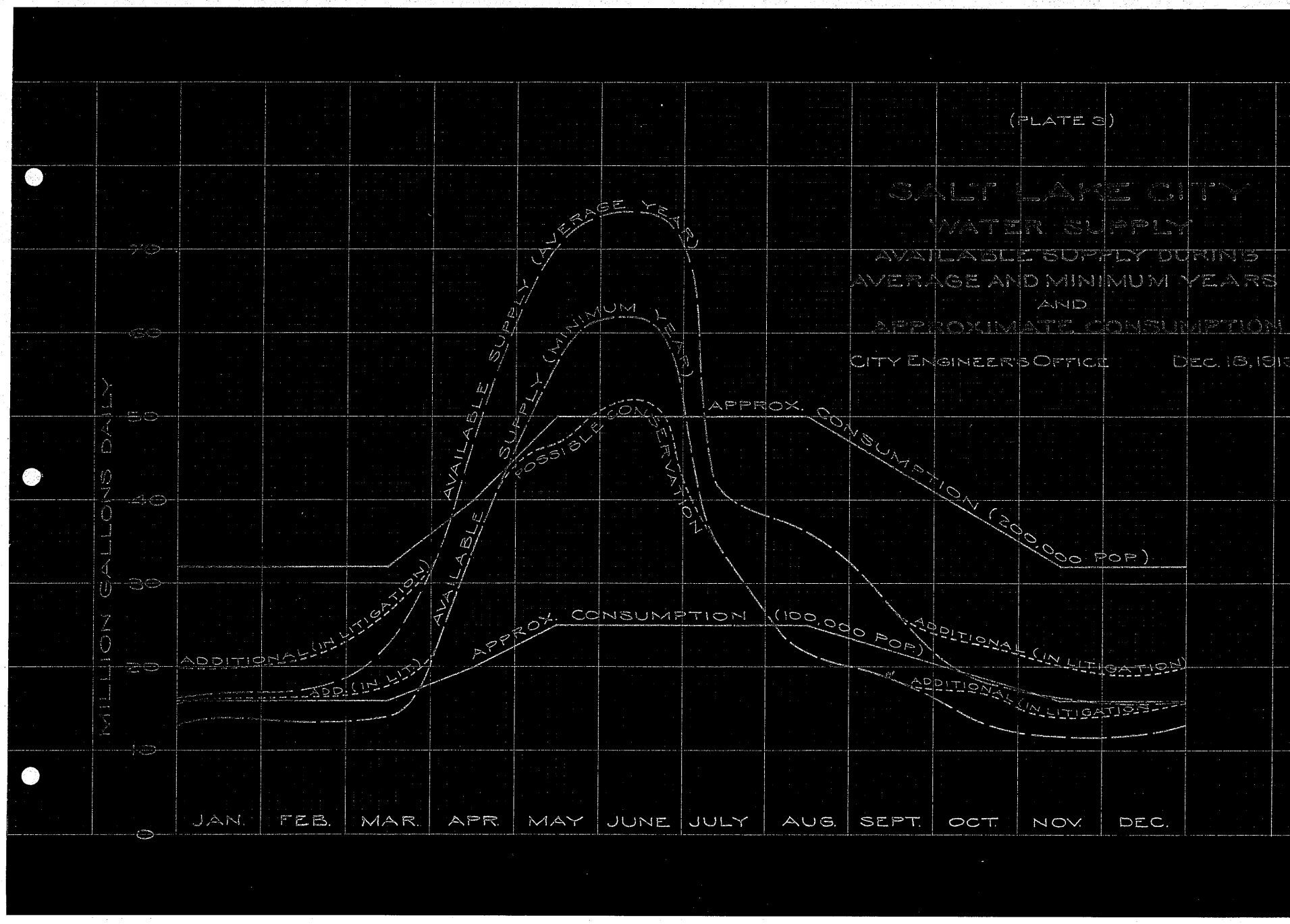
(PLATE 3)

SALT LAKE CITY

WATER SUPPLY

AVAILABLE SUPPLY DURING AVERAGE AND MINIMUM YEARS AND APPROXIMATE CONSUMPTION

CITY ENGINEER'S OFFICE DEC. 18, 1913



supply mains. It is therefore, only available for City use as it may be conserved by storage. Natural conditions are such that it is not practicable to store all of the high water. Column 2 of the Table shows the total available supply if it be conserved. In addition, there are shown the needs for 100,000 and 200,000 population. This information is graphically indicated on Plate 3. The average needs are computed on the basis of 200 gallons per capita daily. On this basis, during a minimum year, the available supply is sufficient if the surplus water be conserved, for a population of 128,000. During an ordinary year the supply would be sufficient, if conserved, for a population of approximately 150,000.

With the present capacity of the supply system and without any storage of surplus water, the City's present rights, in a year of low water, would provide for less than 90,000 people, based on an average per capita consumption of 200 gallons daily through the year.

Present Consumption of Water:-

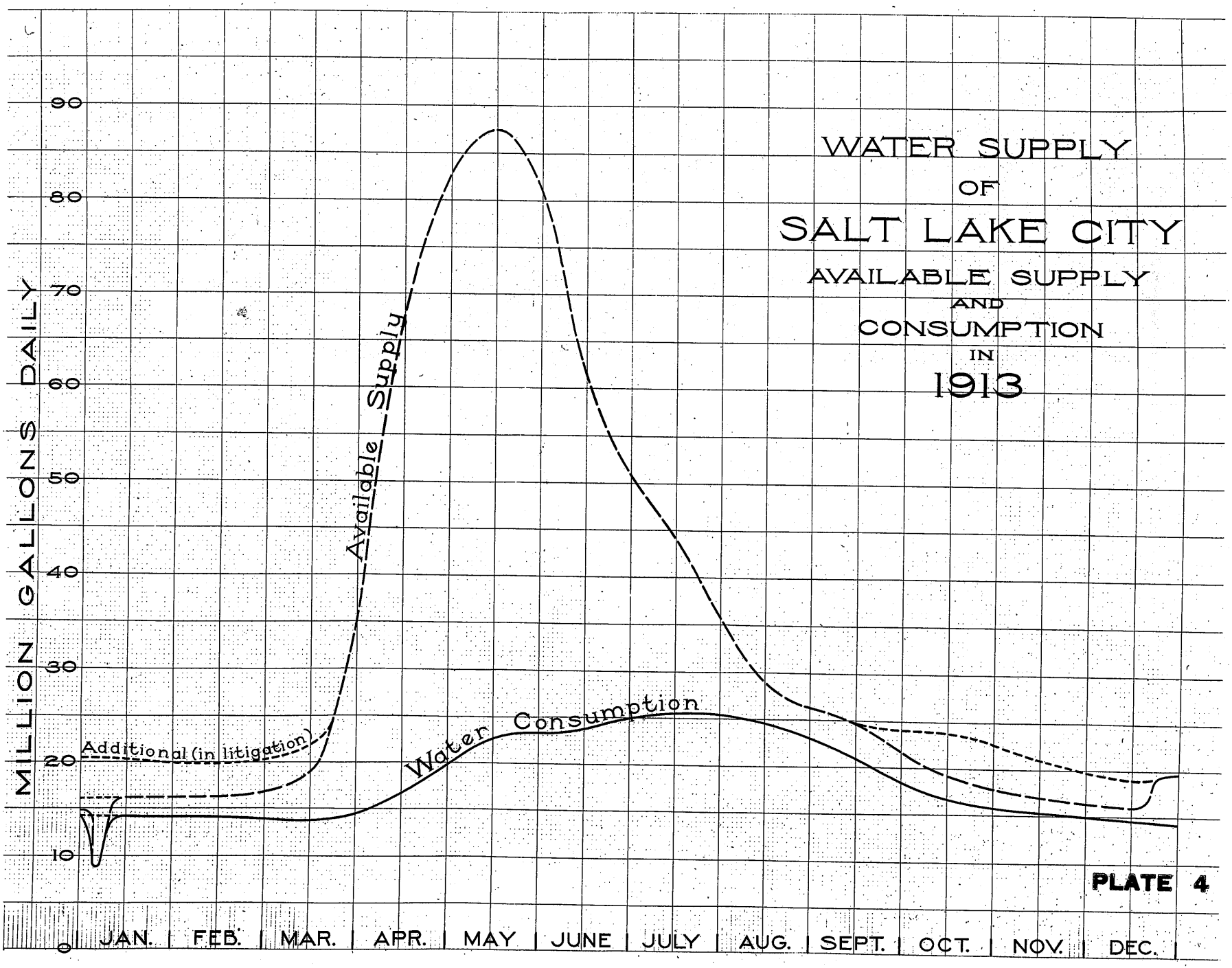
Until the present year there has never been any means whereby an accurate continuous record could be kept of the actual quantity of water coming into the City through the various supply mains, from which the average consumption could be determined. Even yet the methods and means of measurement are not entirely complete, but they are such that a fairly accurate daily record has been obtained of the actual consumption. The average daily consumption and the average daily available supply during each month of this year are given in Table II. The same information is shown graphically in Plate 4. From the Table and the

Table II.

AVAILABLE WATER SUPPLY AND WATER CONSUMPTION, SALT LAKE CITY, 1913, in MILLION GALLONS PER DAY

Month	CITY CREEK Consumption Mil. Gals.	CITY CREEK Available Mil. Gals.	EMIGRATION Consumption Mil. Gals.	EMIGRATION Available Mil. Gals.	BARLEY'S - BIG COTTONWOOD Available Mil. Gals.	BARLEY'S - BIG COTTONWOOD Consumption Mil. Gals.	BARLEY'S - BIG COTTONWOOD Available Mil. Gals.	Average Daily Consumption Mil. Gals.	Available Daily Supply Mil. Gals.
January	3.865	3.865	1.282	1.500	6.140	9.067	4.721	14.214	* 16.227
February	3.871	3.871	.677	1.500	5.686	9.436	5.229	14.184	16.287
March	4.466	4.466	.375	1.000	7.277	8.885	6.107	13.726	18.850
April	8.378	15.306	.732	1.000	29.919	7.527	21.973	16.634	68.198
May	9.694	26.986	1.216	1.654	21.204	11.840	37.548	22.750	87.394
June	9.694	15.460	1.744	1.744	12.730	12.242	31.674	23.680	61.355
July	8.882	9.274	1.744	1.744	12.189	14.770	20.893	25.560	44.108
August	6.521	6.521	1.551	1.670	9.629	16.700	11.236	24.777	29.056
September	5.295	5.295	1.674	1.674	7.826	13.920	9.860	20.889	24.662
October	4.740	4.740	1.570	1.570	6.208	10.262	4.654	16.572	19.172
November	4.410	4.410	1.516	1.516	6.799	9.462	+ 4.441	15.388	17.165
December	3.751	3.751	1.486	1.486	5.822	9.543	5.612	14.670	16.871
Average	6.131	8.662	1.314	1.505	11.119	11.138	13.680	18.587	34.945

*Water from Upper Canal, Progress Co., etc.
+ Approx. 1,450,000 gals. daily from Upper Canal from November 13.


WATER SUPPLY
OF
SALT LAKE CITY
AVAILABLE SUPPLY
AND
CONSUMPTION
IN
1913
MILLION GALLONS DAILY
90
80
70
60
50
40
30
20
10
0
Available Supply
Additional (in litigation)
Water Consumption
JAN.
FEB.
MAR.
APR.
MAY
JUNE
JULY
AUG.
SEPT.
OCT.
NOV.
DEC.
PLATE 4

diagram, it is evident that the average consumption varies considerably between summer and winter, due mainly to the lawn and street sprinkling in summer.

Based upon an estimated population at present of 100,000, the per capita consumption ranges from about 250 gallons daily in the height of summer to approximately 140 gallons (daily) in winter. The average consumption on this basis during the entire year is less than 200 gallons per capita daily. Even then the consumption for all purposes is rather high. A comparison with Denver and Los Angeles shows that the former averages about 213 gallons and the latter about 140 gallons per capita daily. In Los Angeles sprinkling is carried on to some extent the entire year. Both cities have, however, a lower annual rainfall than this city. The mean annual precipitation for Denver is 13.7 inches and of Los Angeles 15.6 inches, whereas the average for this city is 16.2 inches.

It appears evident from the figures of consumption during the winter season that there must be losses of water by leakage from the underground system or from domestic plumbing fixtures, or both. What the loss acutally amounts to can be determined only by a water waste survey of the system.

-PRESENT NEEDS-

Improvements in Distributing System:-

At the present time there are certain sections of the City where, for lack of suitable feeder mains, the water pressure and supply for those localities are considerably reduced. It is quite essential that such conditions be remedied by laying out such feeder lines as are necessary for an equitable distribution of the water.

To provide for existing needs, a 10-inch main should be laid North on 3rd West Street from 1st North to about 9th North Street. When the 13th South supply main is laid to 9th East a 12-inch main should be laid northward on that street to 13th South.

Further investigation of the pressure and supply should be made in different sections of the City to determine what additional feeders are needed.

Supply Mains:-

In order to add to the effective capacity of the supply mains and increase the supply to the southeastern part of the City, a large main is needed leading from the Big Cottonwood Conduit just South of Parley's Canyon westward along 13th South Street to 9th East Street. (See Plate 1.)

Additional Distributing Reservoirs:-

In connection with the distributing mains it is very important that ample provision be made for distributing reservoirs as near the place of use as possible and of sufficient capacity to tide over any temporary shortage of water, and to equalize the day and night supply. The capacity of such basins should be sufficient for the City's total needs for at least 48 hours. At the present time the total capacity of the distributing reservoirs is 9,000,000 gallons, or sufficient only to supply the City's needs for approximately 11 hours. There is immediate need of a reservoir of 10,000,000 gallons capacity on the East Bench. A reservoir is also needed on the City Creek System.

Additional Water Supply:-

From the curves shown in Plate 3, it is evident that in a year of minimum supply there would be a considerable period of the year when the natural flow based on the City's rights would be insufficient for present needs. This period occurs from August to the close of the year. Of course, during years of ordinary supply there would be no shortage at any season for present needs. For proper provision in times of scarcity it is necessary, therefore, that surplus water be conserved by storage, or that additional water rights be acquired.

It is essential that surplus water be stored mainly for late summer and partial winter supply. Besides, in order to preserve the City's rights to the reservoir sites in Big Cottonwood and Parley's Canyon, construction work must be prosecuted on them with reasonable diligence. It is, therefore, proposed that work be continued on the Lake Phoebe-Mary dam, and that construction be initiated also on the Twin Lakes and Parley's Canyon dams.

Summary of Proposed Improvements for Present Needs:-

(Details on Following Pages)

	Capacity		Cost
13th South Supply Main	10,000,000	gals.daily	$ 100,000
Distribution Mains			27,000
East Bench Distributing Reservoir (1 Unit)	10,000,000	gals.	33,000
Lake Phoebe-Mary Reservoir	170,000,000	"	45,000
Twin Lakes Storage Reservoir	270,000,000	"	75,000
Old High Line Distributing Reservoir (City Creek)	4,600,000	"	22,000
Parley's Storage Reservoir (Part)	250,000,000	"	80,000
TOTAL COST-			$ 382,000
Storage	690,000,000	gals.	
Distributing Reservoirs	14,600,000	gals.	

The carrying out of these improvements would properly protect the City's rights, correct the present deficiencies in the distributing system, and provide for storage of surplus water, whereby in a minimum year there would be sufficient water directly available to supply 125,000 people, based on an average per capita consumption of 200 gallons daily. These improvements should be taken care of within the next four years.

-PROVISION FOR FUTURE GROWTH-

Future Needs:-

The importance of providing ample water supply in advance of the City's growth is apparent. That the increase in population will be proportionately much greater in the future than in the past appears certain. Consequently, due provision should be made not only for the pressing needs of the growing population, but also for a reasonably large increase. With such increase there will be necessary further improvements in the distributing system, additional distributing reservoirs and an increase of supply.

At this point it may be well to suggest that with the growth of the City eastward on the bench, it will eventually be necessary to build a high line supply main from a connection with the end of the Big Cottonwood Conduit at Parley's Canyon northward to a point opposite Emigration Canyon. This will probably have to be considered as an eventual need, and is not included in the proposed improvements for future needs.

These improvements considered essential to provide for reasonable future growth are given in the succeeding section. It will probably be desirable to arrange for their completion within ten years.

Summary of Proposed Improvements for Future Needs:-

	Capacity-Gals.	Cost
Completion of Parley's Storage Reservoir	753,000,000	150,000
Spring Valley Distributing Reservoir (City Creek)	37,000,000	84,000
Extension of East Jordan Canal	*65,000,000 gals. daily	115,000
Acquirement of Additional Water Rights		100,000
East Bench Distributing Reservoir (2nd Unit)	10,000,000	33,000
Auxiliary Supply from City Canal, etc. (Approximate)		30,000
Additional Distributing Mains (Approximate)		40,000
13th South Distributing Reservoirs (Approximate)	30,000,000	75,000
TOTAL		$ 627,000
Storage	753,000,000 gals.	
Distributing Reservoirs	77,000,000 gals.	
Approximate Additional Supply	10,000,000 gals. daily	

Available Supply Following These Improvements:-

As a result of these proposed improvements there would be a considerable increase in the water supply available to the pipe system, and a marked advance in the efficiency and the regulation of the distributing system. By these additions the supply would be sufficient for a population of approximately 200,000, during a year of low supply, and for a population of 240,000 during an average year. Upon the basis of a mean daily consumption of

*In addition to present City Canal capacity.

140 gallons per capita which could be brought about by reduction of losses and waste, and by the use of City Canal and other auxiliary supplies for sprinkling and, to some extent, for lawn sprinkling, there would be sufficient in a low year for 250,000, and in an average year for 290,000 people.

Possible Supply from Various Sources:-

In making provision for an adequate supply for the City, it is relevant to consider not only present needs and reasonable future needs, but also to determine the limit of population that can be served by the possible supply from all the various sources near at hand. Also to determine whether alternative sources of supply at greater distances with larger stream discharges would be more feasible and economical. It is not the purpose of this report to consider this question in detail.

It may be stated that the interests of Salt Lake City and Salt Lake County in the matter of water supply and conservation are, or should be, in general, practically identical. From either point of view due consideration should be given to the other. By working together in a spirit of co-operation results can be obtained that will be mutually profitable.

On Plate 5, is shown, graphically, the combined discharge of City, Emigration, Parley's, Mill, Big and Little Cottonwood Creeks during a year of low supply, as also other curves showing available supply based on the City's present rights, and

Table III.

COMBINED FLOW OF CITY, EMIGRATION, PARLEY'S, MILL, BIG COTTONWOOD AND LITTLE COTTONWOOD CREEKS DURING A MINIMUM YEAR. (1905).

Month	Total Flow Gals. per day	Possible Supply by Conservation Gals. per day	Average Needs for 500,000 Gals. per day	Average Needs for 500,000 Gals. per day
January	41,200,000	41,200,000	*80,000,000	+ 50,000,000
February	40,700,000	40,700,000	80,000,000	50,000,000
March	47,300,000	47,300,000	80,000,000	50,000,000
April	90,900,000	90,900,000	100,000,000	60,000,000
May	212,800,000	142,000,000	125,000,000	90,000,000
June	270,800,000	163,000,000	125,000,000	100,000,000
July	115,900,000	115,900,000	125,000,000	100,000,000
August	61,700,000	61,700,000	125,000,000	100,000,000
September	50,100,000	50,100,000	110,000,000	90,000,000
October	50,000,000	50,000,000	95,000,000	50,000,000
November	36,500,000	36,500,000	80,000,000	50,000,000
December	38,300,000	38,300,000	80,000,000	50,000,000
Average-	88,020,000	73,130,000	100,420,000	70,000,000
Total for yr.	32,127,000,000	26,702,000,000	36,653,000,000	25,550,000,000

*Based on 200 gals. daily consumption per capita.
+Based on 140 gals. daily consumption per capita.

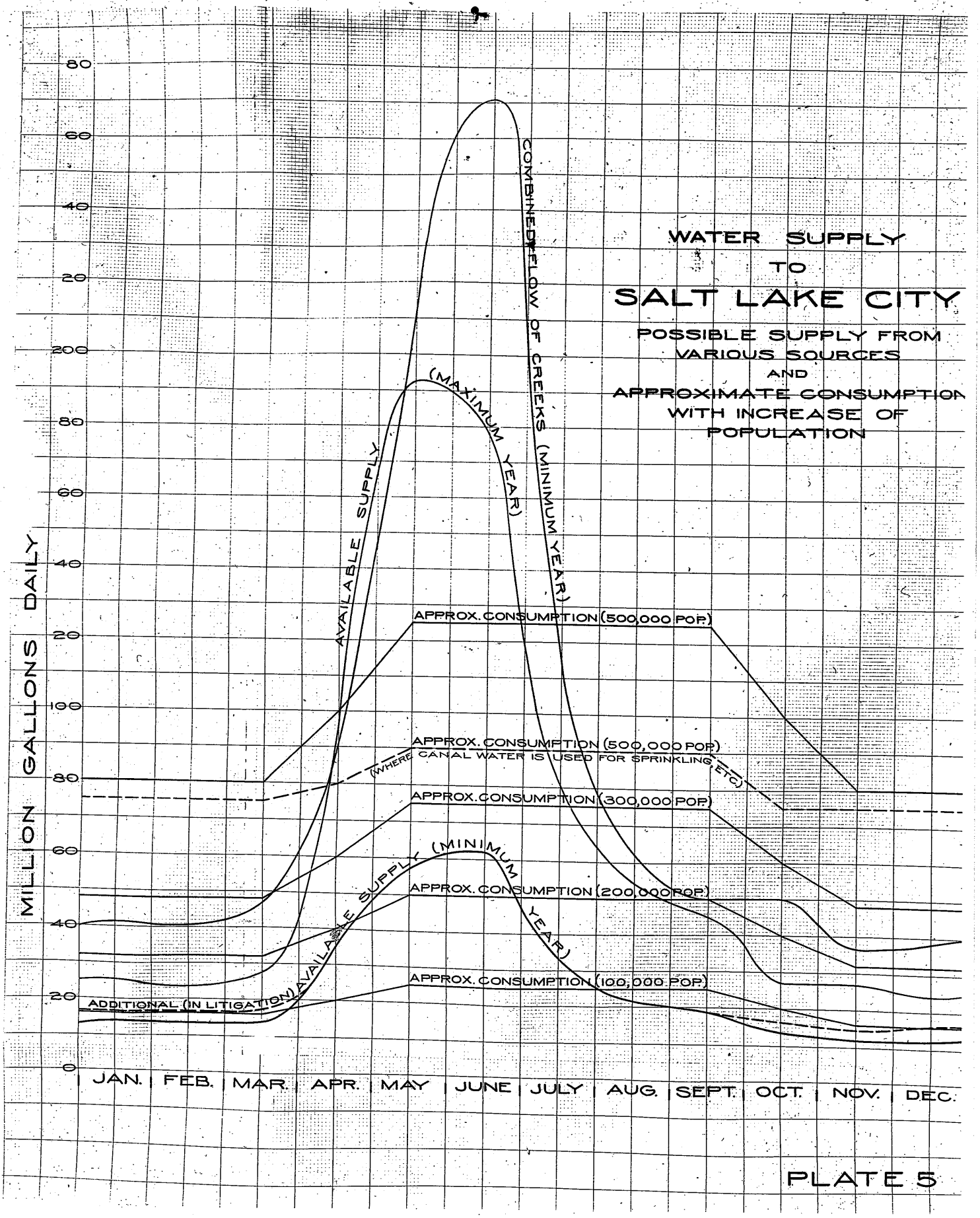

WATER SUPPLY
TO
SALT LAKE CITY
POSSIBLE SUPPLY FROM VARIOUS SOURCES
AND
APPROXIMATE CONSUMPTION
WITH INCREASE OF POPULATION
MILLION GALLONS DAILY
80
60
40
20
200
80
60
40
20
100
80
60
40
20
0
COMBINED FLOW OF CREEKS (MINIMUM YEAR)
AVAILABLE SUPPLY (MAXIMUM YEAR)
APPROX. CONSUMPTION (500,000 POP.)
APPROX. CONSUMPTION (500,000 POP.)
(WHERE CANAL WATER IS USED FOR SPRINKLING, ETC.)
APPROX. CONSUMPTION (300,000 POP.)
AVAILABLE SUPPLY (MINIMUM YEAR)
APPROX. CONSUMPTION (200,000 POP.)
APPROX. CONSUMPTION (100,000 POP.)
ADDITIONAL (IN LITIGATION) AVAILABLE SUPPLY
JAN. FEB. MAR. APR. MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC.

PLATE 5

approximate consumption with increase of population. The figures of the combined flow of the streams, etc., as given in Table III. In Column 1 is shown the total flow of the streams in a year of low supply; Column 2 gives roughly the quantity available by conservation; Column 3, the approximate consumption based on an average of 200 gallons per capita daily, and Column 4, the approximate consumption based on an average of 140 gallons per capita daily. It will be evident from this table that with conditions, as given in Column 3, the possible supply in a low year would be insufficient for 500,000 population, whereas, with the conditions as given in Colwun 4, there would be more than sufficient for 500,000 people. In fact, if meters were generally employed, and canal water more generally used for sprinkling purposes, the per capita consumption, with reasonable use, could doubtless be reduced to an average of 100 gallons per capita daily. In this event, the supply would be adequate for a population of 730,000.

This investigation has not been pursued relative to alternative sources of supply, since other sources of adequate supply are situated at such distances that, with the natural difficulties to be overcome, the cost would probably be considerably greater.

-DETAILS OF PROPOSED IMPROVEMENTS-

The improvements suggested in the foregoing pages are herewith presented more fully.

13th South Supply Main:- (See Plate 1.)

To be diverted from the Big Cottonwood Conduit just South of Parley's Canyon, thence Westward along 13th South Street to 9th East Street.

Estimate of Cost	Capacity Gals. Daily	Cost
12000 cu. yds.- Excavation	.....	$ 6,000.00
8256 feet of 18-inch Cast iron pipe	13,000,000	33,113.00
8424 feet of 20-inch Cast iron pipe (to Highland Drive)	9,500,000	41,282.00
2777 feet of 16-inch Cast iron pipe (to 9th East St.)	5,500,000	9,999.00
Pressure regulators		7,700.00
Special castings		991.00
		99,085.00
Engr., Adv. & Insp. 5%		5,215.00
	TOTAL-	104,300.00

In the event that the 8256 feet of 18-inch pipe were of Matheson Joint Steel Pipe with National coating instead of cast iron, the total cost would be reduced approximately $13,000.00.

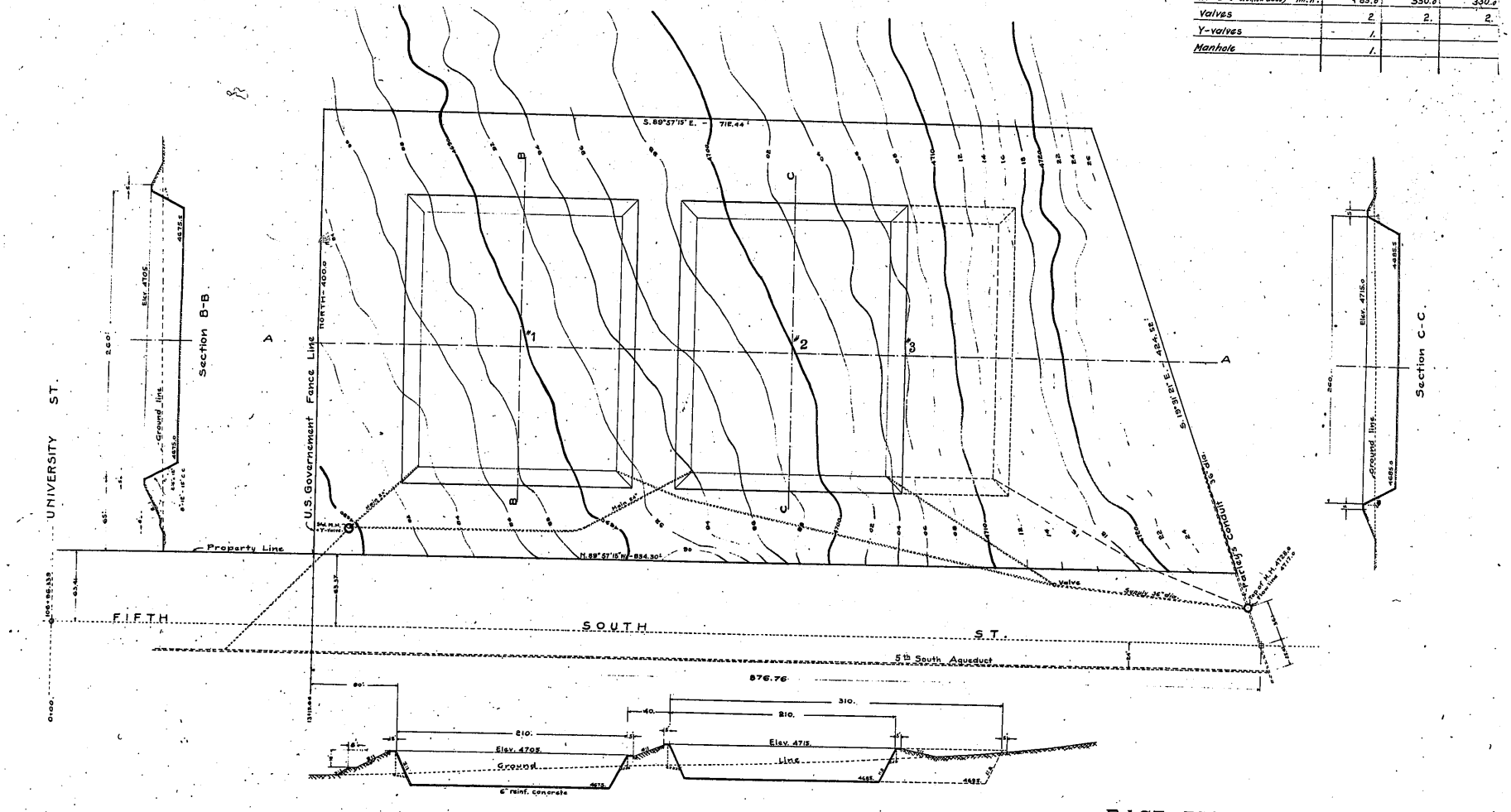
Distributing Mains:-

9th East Street between 12th and 13th South Streets (4650 ft. 12-inch pipe)	$ 13,000
3rd West Street between 1st North and 9th North Streets	14,000
Additional Mains (proposed location not yet determined)	40,000

East Bench Distributing Reservoirs
(See Plate 1 (XII) and Plate 6)

The proposed site for this reservoir is at the head of the 5th South Street supply main where it takes out of the Parley's Conduit on the U. S. Military Reservation. For this purpose the City Commission has already petitioned Government authorities for a permanent grant of the 7.193 acres necessary. This has not yet been acted upon. This location is the ideal one for the purpose, and, in fact, the only one suitable for that part of the City without considerable additional expense. It is proposed to construct first

Reservoir, No.	1.	2.	3.
Capacity, Million Gls.	10.	10.	15.
Excavation, cub.yds.	26,575.0	26,400.0	49,350.0
Reinf. concrete, cub.yds.	1,625.0	1,625.0	2230.0
36" pipe, corr. or cem. lin.ft.	620.0	150.0	280.0
24" " C.I.(flow lines) lin.ft.	185.0	330.0	330.0
Valves	2.	2.	2.
Y-valves	1.		
Manhole	1.		



Section A-A.

EAST BENCH RESERVOIRS.

PROPOSED RESERVOIRS AT 5th SOUTH & RESERVATION.

SCALE: 1" = 50'-0"

CITY ENGINEER'S OFFICE. SALT LAKE CITY, UTAH.

DECEMBER 10, 1913.

NUMBER 6063
ACCOUNT 34-D
DRAWING 25

PLATE 6

one unit of 10,000,000 gallons capacity, and later on, as necessity requires, an additional unit of 10,000,000 gallons. They will be concrete-lined.

-ESTIMATES OF COST-

		RESERV. #1		RESERV. #2		RESERV. #3	
Material	Price	Quantities	Cost	Quantities	Cost	Quantities	Cost
Capacity M. gals.		10		10		15	
Exc.cu.yds.	.30	26575	$ 7972.50	26400	$ 7920.00	49350	$14805.00
Reinf.Concrete, cu. yds.	12.00	1625	19500.00	1625	19500.00	2230	26760.00
36" pipe, lin. ft. (Corr. or Cem.)	3.00	620	1860.00	150	450.00	280	840.00
24" pipe c. i., lin. ft. (low class)	5.50	85	467.50	330	1815.00	330	1815.00
Valves	500.00	2	1000.00	2	1000.00	2	1000.00
Y Valves	500.00	1	500.00				
Manholes	50.00	1	50.00				
			$31350.00		$30685.00		$45220.00
Engineering, etc. 5%			1650.00		1615.00		2380.00
			$33000.00		$32300.00		$47600.00

Note:- Estimates are made with assumption that Reservoir No. 1 will be constructed first.

Reservoirs No. 2 and No. 3 are alternates.

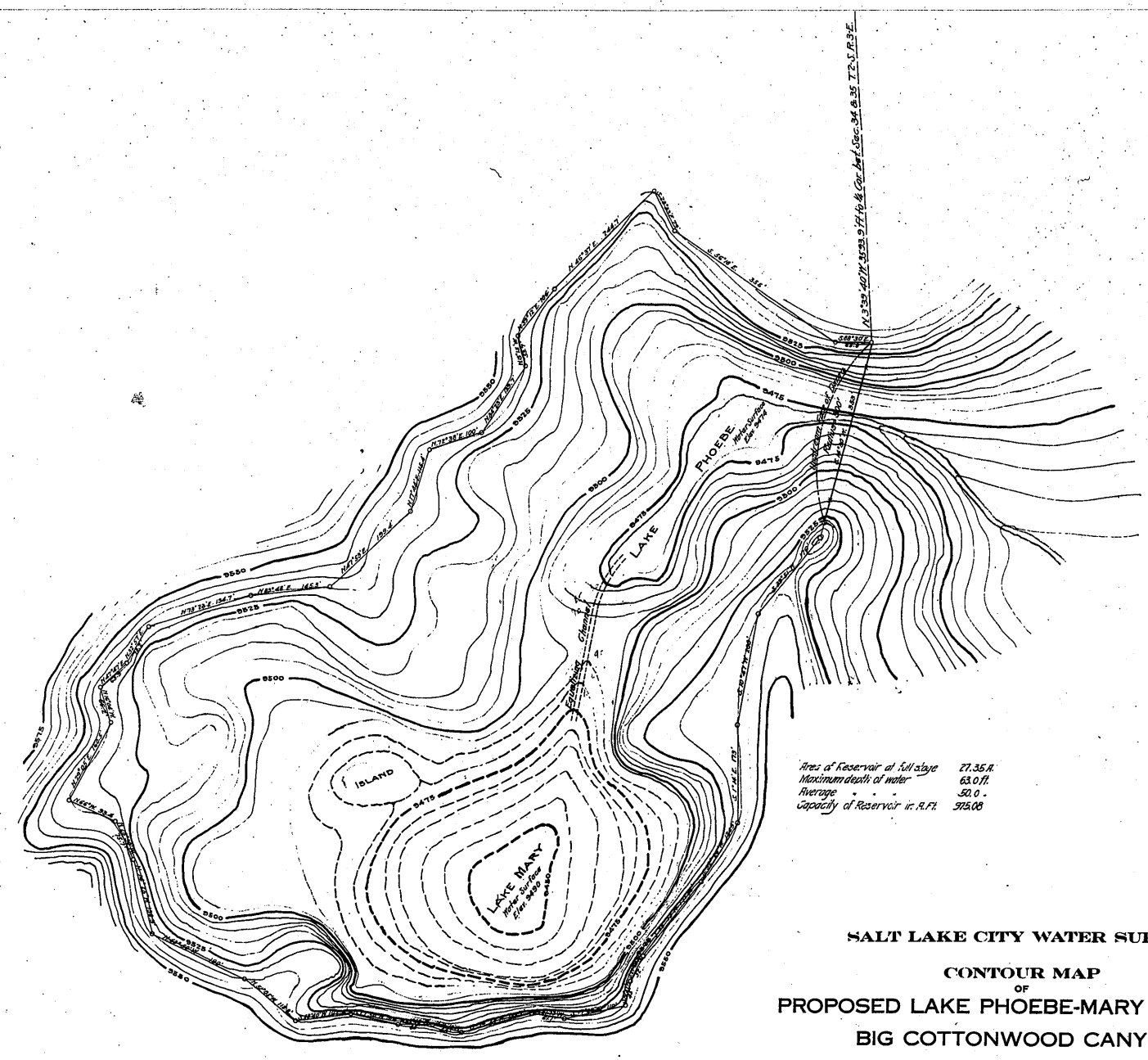
Lake Phoebe-Mary Storage Reservoir:-
(See Plate 1 and Plate 7.)

The reservoir site is located at the head of Big Cottonwood Canyon above Brighton's. It covers the present Lakes Phoebe and Mary. The elevation of the water surface of Lake Mary is 16 feet higher than that of Lake Phoebe. The contract has already been let for the construction of this dam and the work is under way. Provision has been made whereby the work may be stopped if desired by the City, at a level of 20 feet below the top as designed. If this be done the top of the dam will be 45 feet above the present level of Lake Phoebe. The reason for this is that, for lack of accurate and complete discharge measurements of the drainage area tributary to these lakes prior to the present year, there is a question whether the run-off will be sufficient in low years to fill it to the higher level.

Estimate of Cost	45 ft. Level	65 ft. Level
Capacity	170,000,000	318,000,000 gals.
Estimated cost	$45,000.00	$66,000.00

Twin Lakes Storage Reservoir
(See Plate 1 and Plate 8)

The site for this reservoir is located about one mile Northwesterly from the Lake Phoebe-Mary reservoir, and covers the Twin Lakes. Cost estimates have not been worked out in detail as yet, but will approximate $75,000. It is proposed to raise the water level to a height of 50 feet above the level of the lower lake. The capacity of the reservoir at this elevation will be 270,000,000 gallons.



SALT LAKE CITY WATER SUPPLY

CONTOUR MAP
OF
PROPOSED LAKE PHOEBE-MARY RESERVOIR
BIG COTTONWOOD CANYON.

SCALE: 1 IN. = 100 FT.

CITY ENGINEER'S OFFICE SALT LAKE CITY.

APRIL 4, 1913.

PLATE 7

Received ..... May 15, 1913.
Examined and Filed ..... Aug. 18, 1913.
Approved .....
W. D. T. Bennett
State Engineer

NUMBER 5524
ACCOUNT 26-D
DRAWING 17

Parley's Storage Reservoir:-

(See Plate 1 and Plate 9)

The location of this proposed reservoir is just at and below the junction of the Main and Dell Forks of Parley's Creek and about 6 miles above the mouth of the Canyon. The drainage area tributary to the reservoir site is 38 square miles. Some years ago plans were prepared for this reservoir, and two different dams designed. Investigations have been made recently to check the work done previously. It is probable that a saving in cost can be made by some changes in the dam design without effecting the stability. The proposed dam will be, when completed, 106 feet in height above the stream bed of Parley's Creek, and will have a capacity of 1,002,809,000 gallons. The estimated cost is $250,000, including all expense except rights-of-way. Approximately 19 acres of private meadow land would be inundated, if this were filled to its capacity. The reservoir full will cover approximately 82 acres. It is proposed to build a timber or other inexpensive dam in each branch of Parley's Creek above the reservoir to collect much of the sediment during the high water season. It may be advantageous to arrange first for the partial construction of the dam to one-third or one-half the proposed height. Then, later on, the construction could be pushed forward to completion.

Old High Line Distributing Reservoir:- (Plate 1 and Plate 10)

The site for this reservoir is at the head of the Capitol Hill line in City Creek Canyon, approximately 3.5 miles

SALT LAKE CITY CORPORATION

WATERWORKS IMPROVEMENTS.

PARLEY'S CAÑON DAM

MAP OF STORAGE RESERVOIR

City Engineer's Office, Salt Lake City.

0 100 200 300 400

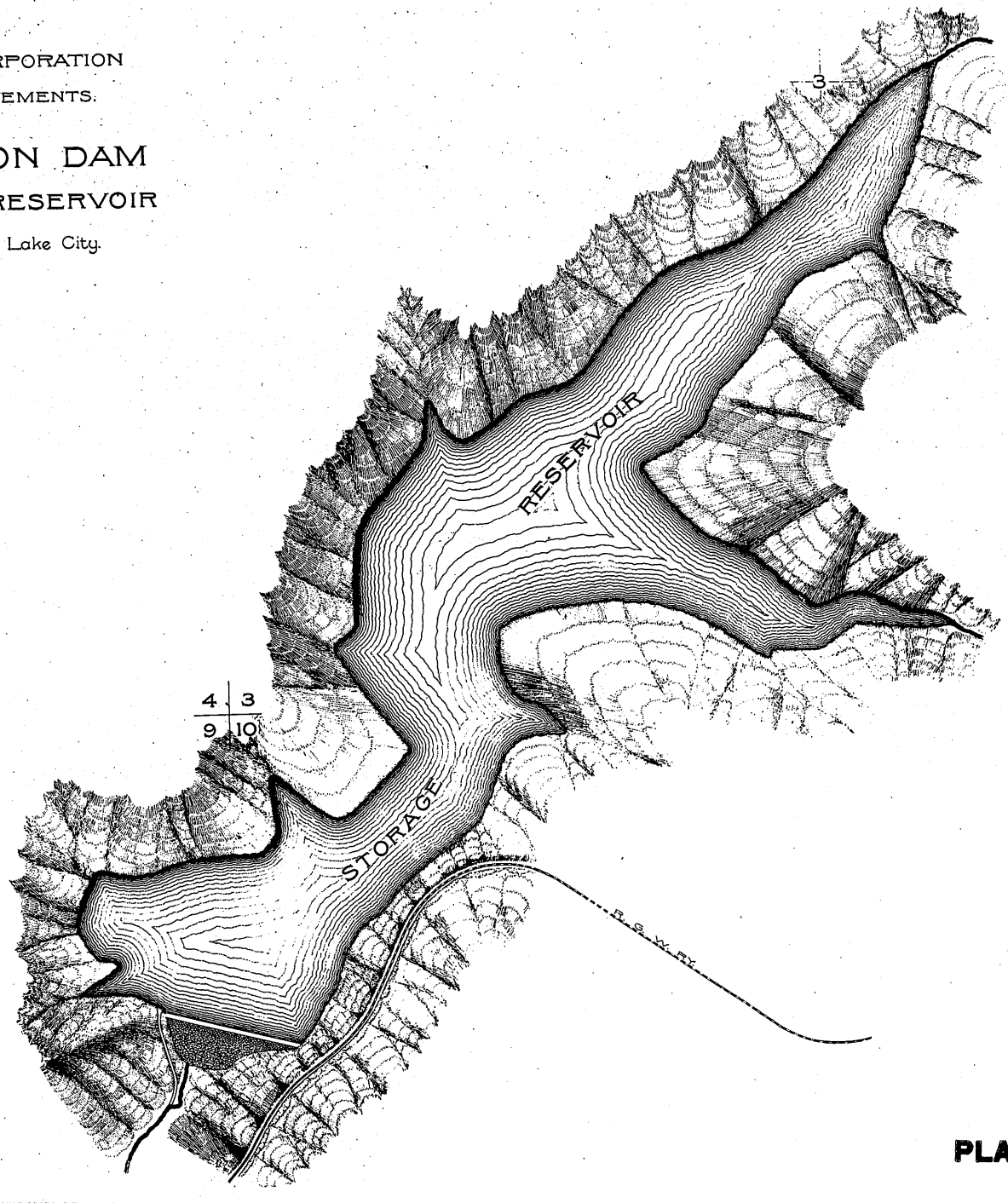
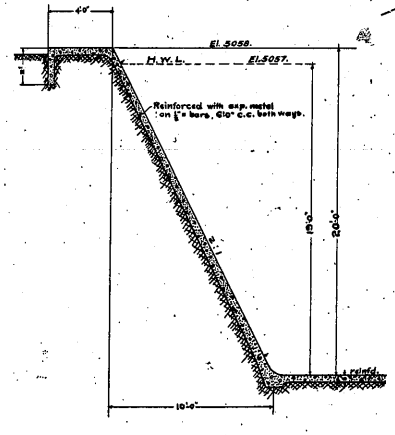
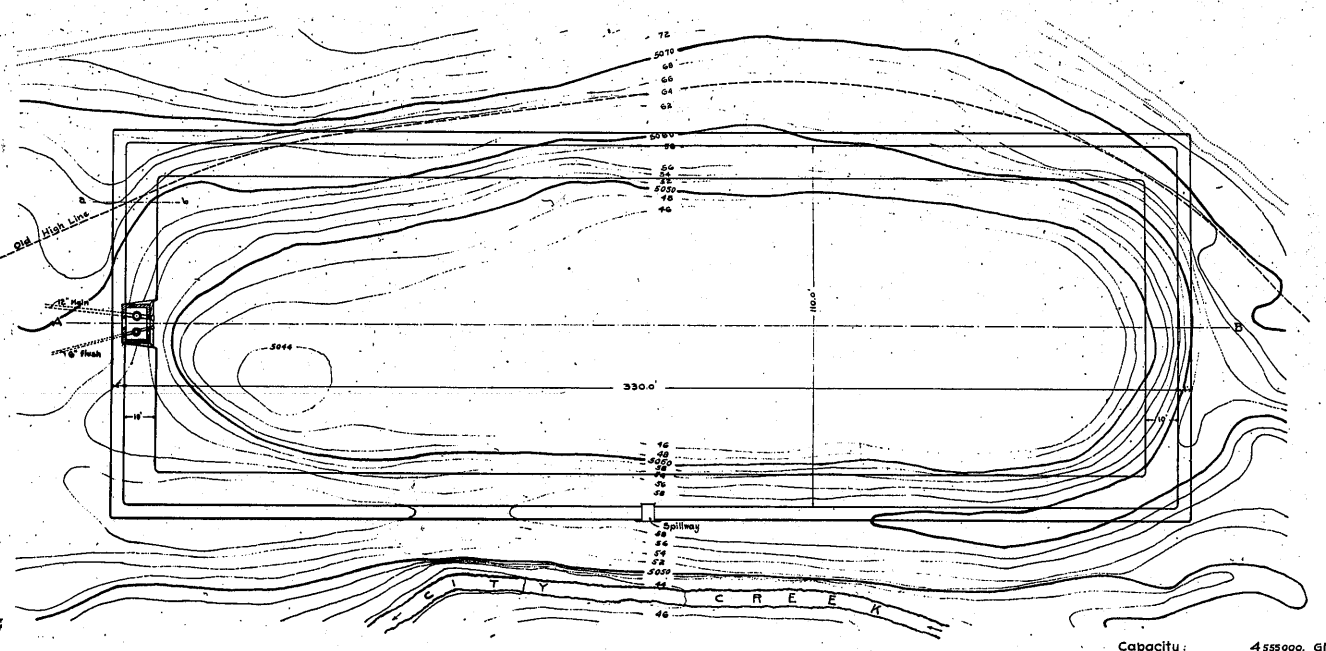


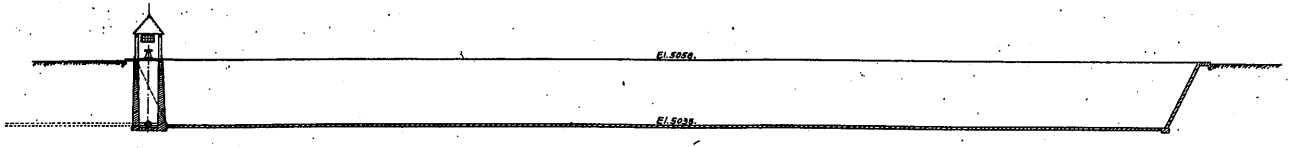
PLATE 9



Section a-b
scale: 1" = 4'-0"



Capacity: 4555000. Gls.
Discharge:
At H.W. 55. Gls. per sec.
" normal 41. " "
n = .015 for pipes already in use.
Excavation 16200. cub. yds.
Concrete reinforced 960. " "
Valve House "



Section A-B

PROPOSED RESERVOIR

AT INTAKE OF OLD HIGHLINE CITY CREEK.

SCALE 1 IN. = 20 FT.

CITY ENGINEER'S OFFICE, SALT LAKE CITY.

DECEMBER 31, 1913.

PLATE 10

NUMBER
ACCOUNT
DRAWING

above the Eagle Gate. There is already a basin there which, with some additional excavation, will furnish a capacity of 4,600,000 gallons. The reservoir will be concrete-lined.

Estimate of Cost

Excavation	-- 16300 cu. yds. at $ .40	$ 6520.00
Concrete	810 cu. yds. at 12.00	9720.00
Fittings		205.00
Valve House		740.00
Relaying Pipe Line	1190 ft. 12" pipe at $2.50	2975.00
Incidentals		250.00
		$20410.00
Engr., Insp. & adv. 5%		1020.00
		$21430.00

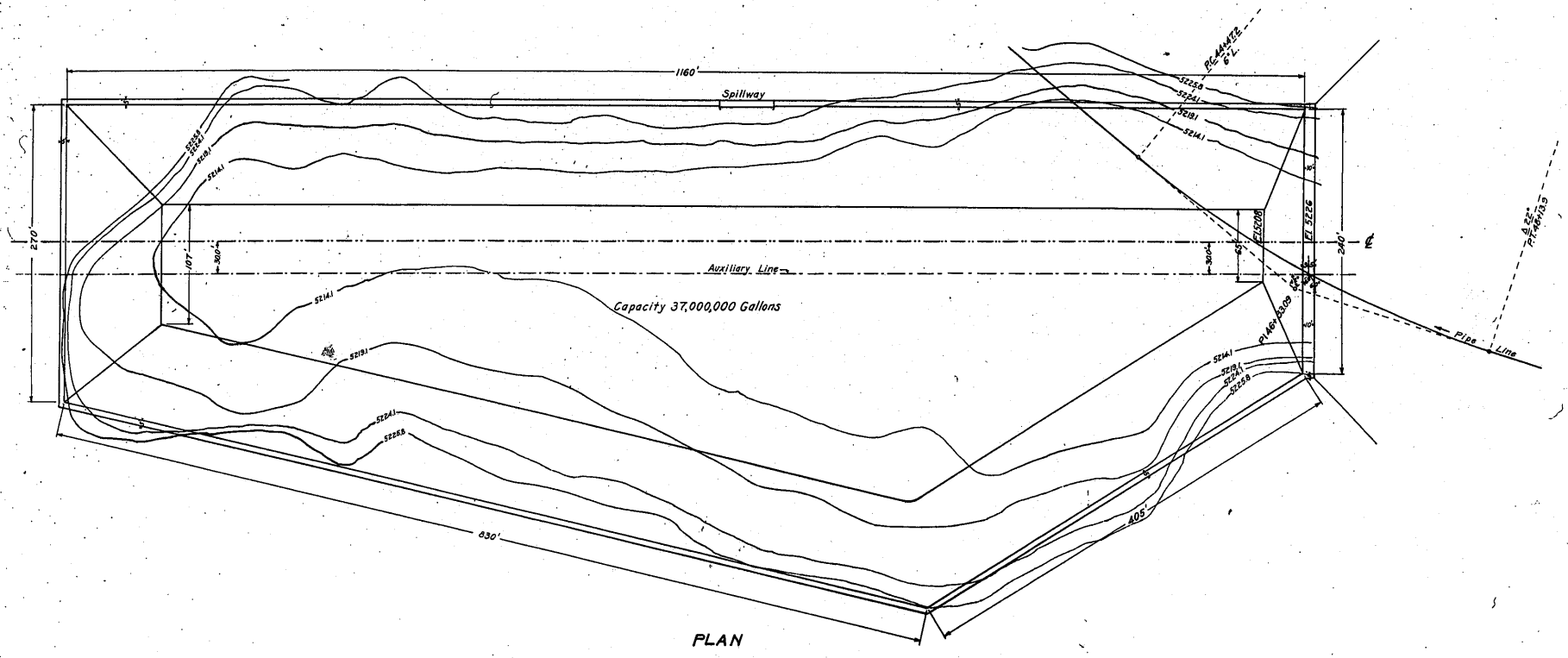
Spring Valley Distributing Reservoir:-

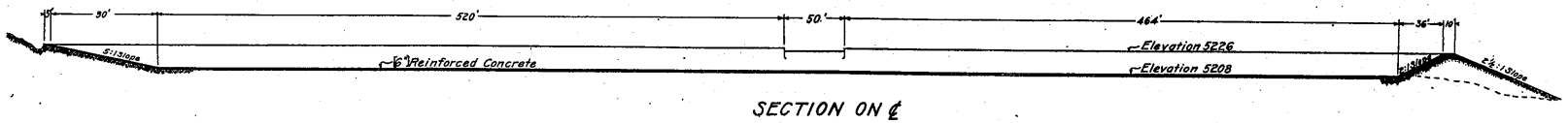
(Plate 1 (II) and Plate 11).

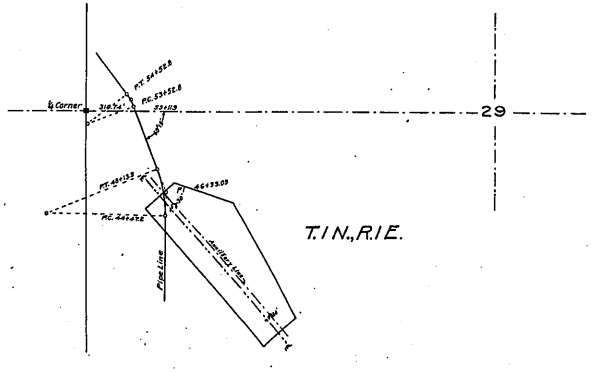
The location of this proposed reservoir is in a natural basin situated on the ridge between City Creek and the North Bench. The present New High supply main passes through it. The capacity will be 57,000,000 gallons. Considerable excavation will have to be made. The reservoir will be lined with concrete.

Estimate of Cost

Excavation	50,000 cu. yds. at $	.25	$ 12,500.00
4" concrete, wire mesh reinforced	416,000 sq. ft. at.	.15	62,400.00
Riprap	300 sq. yds. at	1.50	450.00
Fence	3,000 lin. ft. at.	.10	300.00
Asphaltic waterproofing			5,000.00
			$ 80,650.00
Incidentals 5%			4,032.50
TOTAL			$ 84,682.50







ESTIMATE

Excavation	50,000 Cu.Yds.
4" Concrete wire mesh reinf.	416,000 Sq.Ft.
Rip Rap	300 Sq.Yds.
Fence	3,000 Lin.Ft.
Asphaltic Waterproofing	
Incidentals 5%	
Total Cost	

CITY CREEK

PROPOSED SPRING VALLEY RESERVOIR

SCALE: 1" = 50'

CITY ENGINEER'S OFFICE, SALT LAKE CITY, UTAH.

DECEMBER 9, 1913.

PLATE II

Southeast Bench (13th South) Reservoir:-

(Plate 1 (IV)

The site for this proposed reservoir is shown in Plate 1, marked IV. It is along the line of the proposed 13th South supply main, and lies slightly South of 13th South Street about 3.5 miles East of Highland Park Drive. The City has recently acquired 10 acres of ground for this reservoir. As yet no definite design has been prepared, though the general form will be similar to that of the East Bench reservoir. It will probably need to be in two units of about 15 million gallons each, with an estimated cost of about $75,000 for the whole.

Extension of East Jordan Canal:-

Plans were prepared some years ago for the enlargement of the East Jordan Canal and for its extension to Big Cottonwood Creek. The intention has been to carry all of the City's share of Jordan River water in addition to that now being transported through that channel, and do away with the maintenance of the City Canal from the head to Big Cottonwood Creek. This purpose included, also, making such exchanges of water as might be satisfactorily arranged. Some objection arose on the part of the owners of the East Jordan Canal to the City's proposal and the matter was carried into Court. The final decision made it plain that the City would use this channel by paying for actual damages and by maintaining it in proper condition. It is probable that if the City shall consider favorably the matter of this extension amicable agreement can be made with that Canal Company for that purpose.

The estimate of cost for the enlargement of that canal sufficient to carry also the City's supply would amount to approximately $90,000 for a distance of 18½ miles. For the extension of the canal from its present end to Big Cottonwood Creek sufficient to carry the City's share only, the cost would be approximately $25,000 for the distance of 4.09 miles, including rights-of-way.

In connection with this matter must be considered the alternative of providing the present City Canal with a suitable diverting dam in Jordan River, and a measuring device, as well as the regular cost of maintenance of the canal.

Acquirement of Additional Water Rights:-

Whenever opportunity is offered the City to obtain additional rights at reasonable cost, it is advisable to acquire the same either by exchange or purchase. Some few rights have been acquired during this past year by purchase through the Mayor's contingent fund.

In the event that the East Jordan Canal is extended it may be desirable to make additional exchanges of water from various sources. The Jordan River water is much more suitable for irrigation purposes than the mountain water, and the supply more regular and abundant during the period when most needed. Whenever such exchanges have been made heretofore, they have proved mutually beneficial to the farmers and to the City.

Auxiliary System for Street and Lawn Sprinkling:-

As is evident from the tables and diagrams in the forepart of this report, there is a large increase in the water consumption during the summer months, mainly on account of the

extensive lawn and street sprinkling necessary. During this season of the year there is an abundant supply of Jordan River water available through the City Canal. Without very considerable expense the Canal would be tapped at suitable points through the City and comparatively short pipe lines installed to supply the water necessary for street sprinkling and flushing through a large part of the City. In addition, the question of devising some system whereby the Canal water could be used extensively for lawn sprinkling is worthy of serious consideration. One of the attractive features of this City has been the running water in the gutters on either side of the streets. It might be possible to retain this feature and at the same time make it of use economically, for lawn sprinkling. Owing to the limited time afforded me so far, I am not prepared to make any definite recommendation in this particular matter. Referring again to provisions for street sprinkling, however, there are throughout the City numerous small springs, that at comparatively slight expense, could be piped to suitable points and used for such purposes.

Summary of Cost of Proposed Improvements:-

Storage Reservoirs:-

	Capacity Gallons	Approximate Cost
Lake Phoebe-Mary Reservoir	170,000,000	$ 45,000
Twin Lakes Reservoir (Approx.)	270,000,000	75,000
Parley' Canyon Reservoir	1,003,000,000	230,000
TOTAL-	1,443,000,000	$ 350,000

Distributing Reservoirs:-

East Bench Reservoirs (2 Units)	20,000,000	66,000
Old High Line Reservoir (City Creek)	4,600,000	22,000
Spring Valley Reservoir (City Creek)	37,000,000	84,000
13th South Reservoir (2 Units)	30,000,000	75,000
TOTAL-	91,600,000	$ 247,000

Supply Mains:-	Capacity Gallons per day	Approximate Cost
13th South Main	10,000,000 gals. daily	$ 100,000.00
Distributing Mains:-		
9th East St. (12th to 13th So. Sts.) 12-inch		13,000.00
3rd West St. (1st North to 9th North St.) 10-inch		14,000.00
Other Mains (Not yet decided) (approximate)		40,000.00
Extension of East Jordan Canal	*65,000,000	115,000.00
Acquirement of Addition Rights (approximate)		100,000.00
Auxiliary Supply from City Canal, etc. (approximate)		30,000.00
Total Cost		$1,009,000.00

Relative Costs of Proposed Improvements:-

A comparison of the relative costs of the various improvements shows that the cost of storage ranges from $230.00 to $270.00 per 1,000,000 gallons, and the cost of the distributing reservoirs from $2300.00 to $4800.00 per 1,000,000 gallons. The approximate cost of direct purchase of water rights would probably be between $60.00 and $100.00 per 1,000,000 gallons. Due cognizance must be taken of the fact, however, that the direct stream flow falls off in certain seasons to such an extent that some storage is really necessary. Also, equalizing or distributing reservoirs at the head of the distributing system are important factors in the regulation and sufficiency of the supply.

*Additional to present supply through City Canal.

Recommendations:-

In accordance with the suggestions made in the foregoing pages, it is respectfully recommended that the various improvements be made as given under the heads of Present Needs and Future Needs. The needs for the various improvements are such that, with the probable exception of the first year, the work might be done in units and be prosecuted from year to year at the rate of approximately $90,000 per year, during the next ten years, or if the funds be obtained by bond issued, the work may well be completed in the two installments as designated.

If it be desired that the improvements shall not exceed the sum of $600,000, then it will be necessary to eliminate such portions as are most expensive and likewise least essential. This would, of course, effect some reduction also, in the supply that would be available.