

IMPROVED AND ENLARGED WATER SUPPLY FOR THE CITY OF MEDFORD

A Report Made By F. C. Dillard, Engineer, and D. C. Henny, Consulting Engineer.

To the Citizens of Medford: Your Board of Water Commissioners, after a most careful study and survey of the water situation in Medford, covering a period of more than three years, now believes it to be to the best interest of the city to do the following things:

FIRST: Build to the natural springs on Big Butte Creek for your water supply. This is the best supply of water that it is possible for the city to obtain.

SECOND: Build a steel pipe line of treble the capacity of the present line, with an estimated life of forty years.

THIRD: Build a new cross-town main to improve general city service.

FOURTH: Bond the city for \$750,000, serial bonds, all to be paid off during the life time of the proposed water system.

An ample supply of mountain spring water brought to Medford will be the largest contributing factor in our future growth.

We submit the above recommendations, based upon the advice of the best engineers obtainable, together with long and careful study on our part.

You have the report of the engineers which we ask you to read carefully that you may get the facts. The matter is now in your hands for decision at the coming election on October 8th.

WATER COMMISSION, CITY OF MEDFORD. By H. L. Walther, Chairman. E. C. Gaddis, H. A. Hren, A. L. Hill, H. V. Lumsden.

September 1, 1925. Board of Water Commissioners, Medford, Oregon. Gentlemen: The following is a report which you instructed us to make on an improved and enlarged water supply for the City of Medford.

BRIEF HISTORY. The City of Medford was first settled in 1883 and was incorporated by Act of the Legislative Assembly of the State of Oregon, February 24, 1885, as the "Town of Medford," and reincorporated February 7, 1905, as the "City of Medford."

The population as given by the U. S. Census was 967 in 1890, 1791 in 1900, 8840 in 1910, and 6760 in 1920. The population at the present time is estimated at 9000. The peak of the Jackson County boom was reached about 1910 and the census figure for that year must have included large numbers of floaters, laborers and transients, and undoubtedly did not represent the true condition.

The assessed valuation of the City in 1906 was \$1,048,959; in 1916, \$4,033,185, and in 1924, \$4,935,183. The assessor advised that the valuation for 1925 will be not less than \$5,329,000.

The first water system was installed in Medford in 1889. An open ditch about three miles long was constructed from Bear Creek, delivering water to a well in the City from which it was pumped into two wooden tanks having a capacity of 32,000 gallons each. The tanks had an elevation of about 77 feet above the center of the business portion of west Medford. The water was distributed from the tanks by gravity. In 1902 the ditch was abandoned and a pumping plant installed on the west bank of Bear Creek. Steam power was first used in 1904. A ten year contract was entered into with the Condon Water and Power Co. which supplied electric power for pumping. The water was obtained from a well on the banks of Bear Creek and soon proved to be unsuitable for domestic use. Accordingly steps were taken to secure a pure gravity supply from some stream or springs.

PRESENT SUPPLY. Various sources were proposed and investigated. Little Butte Creek was finally selected as the source of supply and on December 5, 1908, a contract was entered into with the Fish Lake Water Company whereby the City agreed to pay the company \$254,100 for construction of a gravity supply line and for perpetually supplying the City with 7 1/2 sec. ft. of water. The amount to be paid above total for the purchase of the 7 1/2 sec. ft. of water was \$15,000. The work was completed and water served from the new gravity line in 1910. The line has been in constant use since that time.

Subsequently the City purchased 348 acres of land (Slinger ranch) above the pipe intake with a water right of 1 1/2 sec. ft.

Since the purchase of the 7 1/2 sec. ft. of water in 1908 and the building of the present pipe line, the Fish Lake Water Company was sold to the Rogue River Valley Canal Company, now Mt. Pitt Irrigation Company, which constructed a storage dam at Fish Lake. The lands in the reservoir formed by the dam were left uncleared of its timber and brush growth, causing the water to have a woody taste and odor. In the fall of the year when the lake is drained, the water becomes discolored and contains an algae growth which causes a very pungent smell. The water at this time is very unpalatable and hardly suitable for domestic use. It has been expected that by this time after the lapse of years the water would be clear at all times, but this has not so far been the case, nor is there any assurance that it will ever be the case.

Diamond Lake is a mountain lake very similar to Fish Lake. There are two seasons during the year when the decaying vegetable growth of this lake lets loose and is flushed out. The algae here resemble those at Fish Lake, and make the water unfit for domestic use or bathing. This condition has existed at Diamond Lake for many years and as far as is known does not improve.

As long as Fish Lake is used

as a storage basin for irrigation purposes the City cannot expect a satisfactory condition during the irrigation season. Each time the flow from the lake is increased the water will be muddy and carry sediment. Filter beds would remedy this condition, but they would be very expensive to install and operate.

On July 23rd, 1925, temperature tests were taken in the present pipe line with the following results:

Distance	Temperature	From Inlet
At Intake	64	0 miles
At Pipe Line Bridge	63 1/2	6.0 miles
At Stand Pipe	62	7.6 miles
At Mrs. McDonald's	62	8.9 miles
At Tunnel	62	10.1 miles
At Jansen's	62	15.0 miles
At Well-City Reservoir	64	21.9 miles
At Reservoir No. 1	72	
At House Faucet in West Medford	71	

It is not necessary to point out that the water is too warm for drinking in the summer without being cooled. The present pipe line consists of 21.9 miles of 16-in. machine banded wood stave pipe. All pipe was dipped but not cross-tapped under pressure. Banded collars were used. The maximum head on the pipe is 375 feet. The pipe is built with a fall of 4.333 feet per 1,000 feet, having a carrying capacity of 6.11 cu. ft. per sec.

During July of this year, a careful examination was made of the physical condition of the present gravity pipe line. Mr. C. W. Davis, the City Superintendent, had test holes dug along the pipe line. The City employees who regularly work on the line were questioned and their idea is confirmed by a first hand examination of the pipe itself by Mr. F. C. Dillard. The pipe was examined in fifty places, selected at random, with the following results:

Good	20
Fair	20
Poor	7
Very poor	3

By very poor, it is meant that a stove is decayed in some place and apt to fail at any time, although the failure would not be sufficient to put the line out of use for any great length of time. These irregular sections of pipe may last from one to three years, but the necessity of their early replacement is certain. The portion of the pipe under high head was usually found in better condition than the low head portion.

If the examination made can be used as a criterion, then 350 of the line is in very poor shape, or 1.3 miles, which is rather alarming. We believe, even though the pipe line may give service for the next three years without many failures, before long, however, the upkeep may be expected to become very heavy. The City in the past eighteen months has expended \$38,798.51 in renewing collars, about one-third having required renewal. All the remaining collars will have to be renewed within three years, after which the pipe line may give service for the next three years without many failures, before long, however, the upkeep may be expected to become very heavy.

REQUIREMENTS OF NEW SUPPLY. QUALITY. 11. Advance in sanitary science has greatly raised the demands made upon domestic supply systems as to purity of water. The general tendency is towards either filtering or bringing in pure mountain water from protected drainage areas. The present supply no longer meets the ordinary qualifications of domestic water. The present standard can be maintained, but it cannot be improved in the future by policing. Moreover no amount of supervision can affect the color and taste of the water, which at certain times of the year becomes very objectionable. A certain degree of freedom from excessive amounts of alkalis is also insisted on partly for economic reasons.

QUANTITY. 15. The question of quantity of water to be figured on is largely governed by the needs of the early future as measured by water consumption of the past and by expected growth.

The consumption in Medford may be divided into three groups—domestic, industrial, and irrigation. The later makes the largest demands upon the system and for that reason local consumption cannot be readily compared with that of other cities where irrigation is confined to lawn sprinkling or where summer rains occur.

The mid-summer consumption in Medford has become greater than the capacity of the main supply pipe. On August 3, the volume of flow into the reservoir was measured for a period of one hour and found to be 3,900 cubic feet per second or about 3,900 gallons per day. Approximately the same amount has been delivered during the entire summer season.

The number of water taps at the present time is 2500, which number includes the commercial taps. If there were four persons to each tap, the population of the city would be 10,000 and the daily per capita use 38.4 gallons.

The number of telephone connections in the city is 2400; the telephone company figure one telephone connection to each four persons—this would indicate a population of 9600, or a daily per capita use of 404 gallons. It is our opinion that the number of commercial water taps and telephone users is probably above the average in other cities, and the actual population may therefore be close to 9000. This number would give a maximum daily per capita use of 430 gallons.

The portion of water consumed in house use is not definitely known as the city, except as to industrial consumption, is unmetered. It may, however, be approximated by measurement of the outflow from the septic sewer tank which gives some indication of domestic and industrial consumption. The outflow during July and August averaged about 1.5 sec. ft. The industrial use as found by meters was 0.56 sec. ft. in June and 0.58 sec. ft. in July (nearly 10% of all use). This would leave about 1.03 sec. ft. for domestic consumption, equivalent for a population of 9000 to 74 gallons per capita per day. This amount undoubtedly includes some waste which can largely be eliminated by metering.

The amount consumed by irrigation may be estimated at 6 sec. ft. total summer supply less 1.5 sec. ft. for other purposes, leaving a balance of 4.4 sec. ft. The total area of the City is 1739 acres, of which 24 or about 1300 acres is estimated to be in city lots. On the basis of 2428 domestic taps and 1-6 acre average size of lots, the gross area of dwelling lots served, is about 400 A., of which approximately 2-3 or 270 A. is in home garden and lawn. The use then is about one acre foot per acre per summer month. The usual consumption on meadow land in the

Rogue River Valley is 0.6 A. F. per acre per summer month. This would make 192 A. F. for 270 A., an amount equal to a steady flow of 27 S. F. The very nature of City lawn and garden irrigation makes water demands high because of heavy evaporation. Whether this fact is sufficient to explain the large difference between the figured supply of 4.4 sec. ft. and the ordinary agricultural requirements of 2.7 sec. ft. is uncertain. The large figure undoubtedly contains some waste and some slight loss through main pipe leaks, which may be avoided by close inspection or by metering.

If the estimated domestic consumption of 1.03 sec. ft. should contain 20% waste and if irrigation use could be curtailed a like proportion without detriment, then the summer consumption by the present population of 9000 would drop from 5 to 4.5 gallons. Such improvement could probably not be secured without the general introduction of meters, but would permit the increase of Medford's population to 11,000 without the necessity of increasing the present supply.

The present supply of 6 S. F. during the summer equals 430 gallons per capita per day. A metered supply of 4.5 S. F. would be equivalent to 352 gallons per capita per day, all on the basis of 9000 population. In earlier reports, such as that of Eng. W. J. Roberts of 1908, 150- or 160-gallons per capita per day was estimated as sufficient. The difference in estimates is almost exclusively in the item allowed for irrigation as is evident from the following table:

Domestic use	Second Feet	Gallons per day cap. per day	Gals. per 1000
1.03	665,000	74	115
0.57	363,000	41	315
4.4	2,843,000		430
6.0	3,876,000		415

It will be seen that the present industrial and unmetered domestic use may aggregate 115 gallons per capita per day and that the total requirements must depend to a major extent upon the addition to be made for irrigation which is now seen to be estimated at 1.03 sec. ft. or nearly on the basis of averages elsewhere than on the real needs as they have since developed in the City of Medford.

There is reason to believe, however, that the heavy increase of population for the last five years will be continued for some time and that in 1935 the City may contain over 15,000 people. After that the growth may become somewhat slower, but it is easily possible that this number by 1945 may have reached 20,000.

Such population at the figured increased daily maximum consumption of 460 gallons per capita would in summer require 15 sec. ft. It seems to us that to build at this time for an amount smaller than this, such as would suffice for from ten to fifteen years growth, might be considered as a permissible economy. To build now, however, for a larger amount would place an unnecessary burden on the present generation in requiring it to pay interest and amortization on extra investment which is not likely to be needed for 20 or 25 years.

In considering various sources of supply and acquiring rights thereto, it is of the utmost importance that, if at all possible, a source be selected which is capable of furnishing not only 15 sec. ft. above mentioned but an amount two or three times as great as safeguarded for the future.

In investigating sources of water supply for Medford, it has seemed useless to us to consider pumping from wells in Bear Creek Valley or from Rogue River. Both sources would be under serious suspicion as to purity and would immediately, or at an early date, demand scientific filtering.

An filtration is an expensive process both in construction and operation and is usually adopted only when no pure supply is available within a reasonable distance. In Medford filtration would be excessively expensive. If irrigation is to be supplied from the same pipe system as domestic water supply, as is the case now, it will require a filtration plant which for every 74 gallons of domestic consumption must necessarily filter an additional amount five times this amount. If irrigation is to be otherwise supplied, a separate costly pipe system must be built and maintained.

All this can be avoided if within a reasonable distance mountain water of unquestioned purity can be found at satisfactory elevation. Our investigation has not revealed any source of pure mountain water supply not already well known, but these

sources have been carefully studied. They consist of Cold Springs near Fish Lake, Mosquito Creek, Wassen Creek, Big Butte Springs, and scattered springs farther up Big Butte Creek.

METERING OF SERVICES. 35. The reduction of waste by metering makes a strong appeal to every economist and engineer and its probable effect was, therefore, taken under first consideration. From the relatively heavy consumption it was preliminarily concluded that an unusually large saving would be possible.

Such a conclusion is not supported, however, by the rough estimates of waste given in Section 21 and tending to show that the saving to be effected by meters may not be greater than 20%. It should be stated, however, that in the absence of a thorough waste survey, which has not yet been made, this estimate had to be based on very scant data, as explained in Sections 19-20.

The possibility seemed attractive of postponing new main pipe line construction for a long time by the introduction of meters. It now seems probable that the time that new construction may thus be put off would be only until the City population has grown to 11,000 (see Section 21).

Postponement in main line construction in this manner would not only involve the expenditure of about \$1,000 for meters and subject to objection as is the present subject to objection, but would also require the maintenance of the present wooden main pipe line. This would necessitate an annual expenditure of \$25,000 for three years for new collars and thereafter the cost of gradual replacement of pipe.

After all this is done the City would still be subject to the present limitation in its water supply and its unsatisfactory quality. It would again soon be confronted with the necessity of enlarging its supply and then, too, delay for any considerable time might render the City's present good title to Big Butte Creek waters questionable, due to not putting the waters to beneficial use.

AVAILABLE SOURCES OF SUPPLY. COLD SPRINGS NEAR FISH LAKE. 40. This spring is located in Section 27, T. 37 S., R. 4 E., of W. M., just south of the North Fork of the Big Butte Creek and about 33 miles from Medford. The source of the spring is unknown, but it would appear that this spring is the outlet for the Big Elk drainage area. No chemical analysis is available. A bacteriological analysis was made and shows the water as now flowing from the spring to be of unquestioned purity. Its elevation is 3100 feet above that of Medford and is obtained in view of the City's fillings on Big Butte Creek and Big Butte Springs.

The flow to Wassen Creek can be claimed by the City under its general right to Little Butte Water Right to 9 S. F. If the creek is used in conjunction with a greater use of Cold Springs, the right of diversion would have to be purchased. If used in conjunction with Mosquito Creek water, the present right of the City to Little Butte Water Right would suffice.

As to the right of the City to use water from Big Butte Springs, which is a tributary of Big Butte Creek, it may be stated that under date of April 25, 1908, the State Engineer made an allotment of 30 S. F. of the water of Big Butte Creek with drawn from appropriation on August 21, 1915, and issued permit No. 1915. The City is also holder of Per-

mit No. 6703, being application No. 3092, granting right to divert and use 30 S. F. of the waters of Big Butte Springs, and has a date of priority of October 29, 1923. The Legislative Assembly for the year 1923 enacted chapter 166 of the General Laws of Oregon which provides for the withdrawal of all the unappropriated waters of Big Butte Creek and tributaries, and holds the same for the future use of the City of Medford.

The Eagle Point Irrigation District has an allotment of 100 cu. ft. per sec. of the waters of Big Butte Creek, which allotment has the same date of priority as the allotment to the City of Medford. The allotment of 100 cu. ft. per sec. is more than the district will be able to use during the next few generations. The Big Butte Springs are located about six miles above the diversion point of the creek at the diversion point of the canal is approximately double that of the Big Butte Springs.

The following table of use shows the requirements of the Eagle Point Irrigation District based on 2.41 acre feet delivered on the land, and a total acreage of 7000 net irrigable, which acreage in the opinion of the District Operation Manager is probably the maximum that will be irrigated by the district. It will be noted that a duty of 1.5 acre feet is provided instead of 1.5 acre feet as in the other irrigation districts in the valley:

Month	Net on Land	Net on Land	Net on Land	Net on Land	Net on Land	Net on Land	Net on Land	Net on Land	Net on Land
April 15-30	0.15	250	0.20	1400	47	52	150 S.F.	98	
May	0.25	200	0.94	3080	55	58	114 S.F.	56	
June	0.50	150	0.59	4130	69	77	110 S.F.	33	
July	0.50	150	0.59	4130	67	75	100 S.F.	25	
Aug.	0.45	180	0.55	3850	62	68	93 S.F.	21	
Sept. 1-15	0.16	250	0.20	1400	47	52	93 S.F.	35	
Totals	2.11		2.57	18190					

The above table clearly shows that the flow of Big Butte Creek was sufficient for the maximum needs of the Eagle Point Irrigation District, together with a supply of 25 S. F. for the City of Medford even in 1924. The average flow in July was 105 sec. ft., in August 99, and in September 97 1/2 sec. ft. In average years the minimum available for the city will be about 35 sec. ft.

If at some future time the needs of the City and District grow beyond the natural flow available, then the City can acquire the right to use all the spring water available by providing storage of flood water for the District. The City is assured of its legal rights to intercept and use the entire yield of Big Butte Springs.

Discharge in Cu. Ft. Per Sec. Group No. 1 Measured

Date	Estimated	Estimated	Total
Aug. 7, 1923	13.4	35	48
Sept. 6, 1923	12.5	36	49
May 2, 1924	12.9	36	46
July 21, 1924	12.6	33	46
Aug. 23, 1924	12.8	34	47
Nov. 14, 1924	12.2	33	45
Feb. 18, 1925	16.9	44	61
May 26, 1925	15.4	40	55
July 22, 1925	15.0	39.4	54.4

OTHER SPRINGS ON BIG BUTTE CREEK. 48. There are other springs of apparently equal purity in the Big Butte Creek drainage area. However, they are located farther away from Medford than the Big Butte Springs and are moreover widely scattered and expensive to collect. Their total flow does not exceed that of Big Butte Springs.

COMBINATION OF SOURCES. 49. The flow of Cold Springs may be readily combined with that of Wassen Creek thus making a total of about 16 S. F. of pure spring water. It has been argued that it can also be combined with additional water to be purchased from the Mt. Pitt Irrigation Company. Such purchase would seem inadvisable now or in the future because the addition of water thus secured and its merging with pure spring water would leave the quality of the mixture equally subject to objection as is the present supply.

In any case acquisition is out of the question since the Mt. Pitt Irrigation Co. has advised the Water Commission that "it does not care to furnish the City any additional water at this time." The Board of Directors of the Medford Irrigation District also advise "that they prefer to sell any surplus water they may have to additional users rather than to the City for its use for municipal supply. It is certain that the entire supply of both concerns will be insufficient to irrigate the lands commanded by their canals, from Rogue River. Both sources would be under serious suspicion as to purity and would immediately or at an early date demand scientific filtering.

LEGAL RIGHTS. 51. The city rights to Cold Springs is equal in amount and priority to that of the water collected at the present City intake lower down on Little Butte Creek, the amount being 7 1/2 S. F. plus 1 1/2 S. F. secured by the purchase of the Slinger ranch, making a total of 9 S. F. Additional water would have to be acquired by purchase.

The city has at present no express right to water from Mosquito Creek, but this right could probably be obtained in view of the City's fillings on Big Butte Creek and Big Butte Springs.

The flow to Wassen Creek can be claimed by the City under its general right to Little Butte Water Right to 9 S. F. If the creek is used in conjunction with a greater use of Cold Springs, the right of diversion would have to be purchased. If used in conjunction with Mosquito Creek water, the present right of the City to Little Butte Water Right would suffice.

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