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CAMROSE WATER SUPPLY

by: J. A. Allen

1942

C A M R O S E   W A T E R   S U P P L Y

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CAMROSE WATER SUPPLY

The water supply for the town of Camrose is supplied by the Calgary Power Company, Limited, and is obtained from a reservoir constructed in Camrose creek and from two wells within the town. The water for the reservoir is obtained from the watershed of the creek. There has been no surface runoff into the reservoir for several months on account of dry climatic conditions, and the loss by evaporation is high. In the first 24 days in May 1942, 115,800 gallons per day were lost by evaporation alone within the reservoir. The average daily consumption in the town of Camrose, including the militia camp, in April 1942, was 102,000 gallons, of which approximately 82,000 gallons were obtained from the reservoir and the balance of approximately 20,000 gallons came from two wells #3 and #11.

Since the establishment of the military camp in October 1940, the water pumped to the mains has increased as indicated below:-

June 1939 - May 1940 (inclusive)	19,498,750 gallons
" 1940 - " 1941 "	26,005,700 "
" 1941 - " 1942	36,427,700 ".

During the first five months of 1942, 14,882,000 Imp. gallons were pumped to the mains. Comparing the militia requirements for the five-month period, January to May 1941, with a similar five-month period in 1942, we have respectively 3,538,600 Imp. gallons and 5,865,350 Imp. gallons.

The increase in consumption is indicated by the attached twelve months summation curve and tablefrom 20,580,300 gallons as at January 1940, 22,752,800 gallons as at January 1941, 33,664,600 gallons as at January 1942, and 36,426,700 gallons as at May 31st, 1942.

The drain on the Camrose water supply is proceeding at an alarming rate and steps must be taken without delay to increase the present water supply. There are two problems to be considered. There is the present emergency that requires immediate attention, and there is a long term problem of water supply. It is estimated that under present climatic conditions the reservoir supply will last for only 78 days. If evaporation is reduced one half the supply in the reservoir will be sufficient only for about 110 days. (See footnote at end of report)

The water from two wells is being pumped at present into the system. No. 3 well, 156' deep, with water level at 127' is supplying 10,500 gallons per day, and No. 11 well, 170' deep, is supplying 9,300 gallons per day. Both wells are producing at maximum capacity. No. 4 well, the old gas well, surface elevation 2,427 feet, drilled in 1911 to a depth of about 1,650 feet, produced water at 127 feet, but it is not being used now. It would produce about 5,000 gallons per day but when pumped it reduces the flow in No. 3 well by 2,000 to 3,000 gallons per day. No. 8 well at the water tower is 260' deep and originally produced 18,000 gallons per day, but the capacity now is about 2,000 gallons/day and the well is not being used. It is almost certain that if this well was cleaned out it would produce several times the present capacity, but possibly less than the initial flow. There is so much silt in the water-bearing formations in the Camrose district, that all wells should be cleaned out periodically to maintain the flow.

The Camrose water supply problem is so serious that it is necessary to increase the present water supply, not within months, but within days. It is not advisable to take a chance on increased precipitation in the near future.

There are two ways on increasing the water supply - (1) by drilling new wells, (2) by obtaining a new source of surface water.

The drilling of a sufficient number of new wells would be the more expensive programme, but unless increased precipitation in the near future raises the water table sufficiently to form surface water, then the drilling programme would be the most economical. We have made a survey of a large number of wells in the immediate vicinity of Camrose and the results are shown below.

Elevations. Three elevations are given within the town of Camrose according to the Dominion Government Publication "Altitudes of Canada." These elevations are as follows:-

Canadian Pacific station	2431'
Grand Trunk Pacific "	2427'
Canadian Northern "	2443'

The elevation of the surface at #4 well drilled for gas in Camrose is 2427'.

The elevations obtained from the files of the Calgary Power Company for the reservoir situated in Camrose creek are as follows:-

Top of spillway	2390.00
Canadian Pacific culvert	2388.00
Floor of spillway	2386.00
Upper intake	2381.00
Bottom of dam	2370.00
Water level in reservoir June 1st	2385.31

The surface is practically flat around Camrose, rising slowly to the north. The lake three miles north of Camrose in Sections 23 and 24, Township 47, Range 20, has an elevation of 2410'. Dinant station, eight miles north of Camrose, has an elevation of 2477'. Ohaton station, seven miles southeast of Camrose, has an elevation of 2396'. The surface rises gently to the west and southwest of the town to 2455' within a distance of two miles. Five miles south of Camrose, the Battle river valley forms a trench, the bottom of which at Driedmeat Lake has an elevation of 2246', or almost 200' below the level at Camrose. This trench and the tributary Camrose creek valley have been responsible for draining considerable water from the strata above the level of the Battle river valley.

The geology in the Camrose district related to water supply will only be briefly summarized. The unconsolidated surface deposits vary considerably in thickness, from a few feet to at least 20 feet. These deposits consist largely of sorted glacial drift and a smaller amount of moraine. There are also various old drainage courses where finer sediments, including clays, occur.

Underneath the unconsolidated mantle the lower beds of the Edmonton formation occur and consist of sandstones interbedded with shales and coal seams, all of fresh-water deposition. Underneath the Edmonton formation occurs the Bearpaw shales formation of marine deposition. The Bearpaw contains water in places but it is salty. No fresh water has been found in the Bearpaw formation in any part of Alberta. The Belly River formation underlies the Bearpaw, and like the Edmonton is of fresh-water deposition.

The underground water supply in the Camrose district is confined to the Edmonton formation which is uppermost Cretaceous in age.

The gas well at Camrose and at least one other well has been drilled into the Bearpaw formation at a depth of about 400 feet. According to the record of gas well #4, the top of the Bearpaw formation was encountered at 414' below the surface which is 2427' and immediately below a 14' bed of coal and shale carrying some water. According to this well record, there were three other coal seams encountered above the marine shales, as follows:-

5' coal seam between 110' and 115' from the surface,
1' " " " 165' " 166' " " "
.A thin coal seam at 255' from the surface.

This means that the Edmonton formation from which water can be obtained is about 400 feet thick and, therefore, it is not necessary to drill over 400 feet in this district.

The strata in this part of Alberta are dipping in a southwesterly direction at a rate of about 20 feet to the mile. This means that the strata are rising to the surface toward the northeast from Camrose. It is indicated on the geological map that the beds that are encountered at about 400 feet in Camrose, that is, the lower beds on the Edmonton formation occur at the surface about twenty to twenty-five miles to the northeast of Camrose. All the water that is contained in the Edmonton strata at Camrose has entered the beds at the surface within 25 miles to the east of Camrose. Since all of the underground water in the Camrose district has come from the surface, it is a fact that if the surface water is drained before it enters the strata then the underground supply of water will become reduced. The extensive drainage programme that has been carried out during the past number of years east of Camrose, has depleted materially the underground water supply in the Camrose district. The water well survey made during the past week gives accurate information on the underground water supply in the Edmonton formation. A list of these wells is attached to this report with data obtained on each well.

There are three possible water-bearing horizons in the Edmonton formation in the vicinity of Camrose as follows:-

(1) Shallow zone - Between 40 and 90 feet, hard water, usually small flow and not important to a town water system.

(2) Medium zone - Between 100 and 180 feet, generally soft, slight soda taste, should produce 10,000 gal./day wells. More apt to be contaminated with hard shallow water.

(3) Deep zone - Between 210 and 280 feet, always soft. Hardness 10 to 70 P.P.M. No chance of contamination from the shallow zone if wells are properly drilled. Wells to this horizon should produce 10,000 to 20,000 gals./day if wells are kept clean of silt

and clay which will reduce flow.

Water Well Supply

The deep horizon is the best source of a water supply in this district. There are no indications to suggest that large wells can be expected. Favorable conditions might be encountered to produce a larger flow but about 20,000 gals./day is about the best that can be expected. Wells in this area within a radius of two miles of Camrose should not be drilled beyond 325 feet, or possibly 350 feet, as there is a chance of getting salt water below that depth.

The middle horizon is also important and should be thoroughly tested in all wells drilled, to determine quantity and chemical composition, before drilling to the lower horizon. Some of the best water in the wells examined comes from the middle horizon. It is quite possible to greatly increase the flow of a well drilled to the deeper horizon by obtaining also the water from the middle horizon.

It is not advisable to utilize in this system any water obtained from the shallow horizon within a radius of two miles of Camrose, as it can be expected to be hard and the flow small.

The underground water in the Camrose district, like most districts, is not confined to subterranean rivers, or channels, or lakes, as is so frequently thought. The water is associated with rocks sufficiently pervious to permit the water to move through the rock. The water is usually in sandstone strata or closely associated with coal seams. The water horizon is tabular or lensy and may be irregular in lateral extent and may vary greatly in thickness. These conditions have been observed on exposures in the lower part of the Edmonton formation in many districts. These tabular rock bodies or lenses will follow in general the dip of the formation, but irregularities in the form of rolls or thicker parts, may be expected to occur on the surface of any water horizon encountered in this district. Local rolls or traps might contain a larger supply of water.

The middle and upper horizons in the Camrose district south of the town and east of Camrose creek have no doubt been drained of part of the water supply by Camrose creek and by Battle river. This is no doubt the reason why most of the wells to the southeast are located in the lower horizon.

With the exception just cited, namely to the southeast of the town, where the water from the middle horizon has been partly drained off by Camrose creek and Battle river, it would appear that the chances of getting an equally good supply from both the deeper and middle horizons within a radius of about four miles from Camrose are equally favorable in any locality.

If the necessary water supply is going to be obtained by drilling wells, it is not advisable to drill within the town or at least within a radius of half a mile from the old gas well, because there is no accurate information on the effect of this old gas well (which was not properly abandoned), nor from the several private wells within the town.

A water supply from the lower horizon at a depth less than 300 feet, can be expected by drilling in any direction from the town within a radius one to three miles. The base of the water-bearing formation occurs at about 400 feet below the surface.

A combined water supply from both the lower horizon and the middle horizon, if the water in the middle horizon is suitable for the system, can be expected by drilling west of Camrose creek or northeast of the town within a radius of one to three miles. The depth to a given horizon will increase towards the southwest, at the rate of about 20 feet to the mile, depending of course on the surface relief.

Sections 10 and 11 in township 47, range 20, immediately north of the town, and adjacent to Camrose creek and the reservoir are favorably located to obtain water from the lower and middle horizons.

The east half of sections 34 and 27 are favorably located southeast from the town for a supply from the lower horizon.

The well in the militia camp ground on the west of Camrose creek in section 33 should be completed to the lower horizon as soon as possible. This well is expected to materially augment the supply for the camp requirements.

If a well drilling programme is decided upon, it would be necessary to drill at least five wells with the least possible delay as the supply from each well will not be large according to the interpretation given. The cost of drilling will be about $1500. per well without cost of casing, equipment and pipe line.

Under present conditions, when casing, pipe and other equipment may be difficult to obtain, wells should be drilled as close as possible to the present distribution system.

Water from drilled wells would be piped and would not be put in the reservoir. If by drilling it is possible to obtain as much as 20,000 gals./day from each well, as can be expected from the deeper horizon, then five or six wells might eliminate the treating plant entirely, whereby the cost of chemicals now amounting to about $5,000. annually would be saved. This is a factor worth considering in favor of a supply from drilled wells.

Surface Water Supply

The other source of water is from the surface. Surface water is scarce in this district and is becoming decidedly scarcer each month due to rapid evaporation. The only supply in the immediate vicinity of the town is from a shallow lake, almost a slough, two and one half miles north of town in sections 23 and 24, township 47, range 20. The surface of this lake is given as 2410 feet above sea level or 20 feet above the top of the spillway to the reservoir. This shallow body of water, about one foot in depth, covers 161 acres. It is estimated that this shallow basin contains about 39 million gallons of water, but due to rapid evaporation the volume will be greatly reduced, unless there is heavy precipitation at an early date. A survey of this lake on June 5th showed that it contained 24.7 million gallons in open water and 14.5 million gallons in swamp area which is part of the lake. This lake is only a remnant of a much larger basin which extends northwest through the southwest half of section 26, the northeast quarter of section 27, about one half of section 34, and northeast into sections 2 and 3 in township 48. This basin is indicated on the accompanying map, and may be associated with a few small lakes in sections 2 and 3, township 48, range 20, including the flowing well (No. 44) in legal subdivision 9, section 3. The water table in parts of this old basin is now within a foot of the surface. It is possible that a considerable quantity of water could be drained from this basin if the outlet of the present lake could be lowered sufficiently. The water from this lake could be taken to the reservoir by open ditch or by pumping, The loss by evaporation or by absorption will be high if the water is carried to the reservoir by a ditch and by the depression formerly occupied by Camrose creek.

It is recommended that this surface water should be used to overcome the immediate emergency situation in the water supply for Camrose, but it should be a temporary project only. It is decidedly bad practice in this district, and in many others, throughout the plains of Alberta, to drain surface water, when that water is the only source of the underground water supply. It must be definitely understood that this lake and its basin, supply the water to the water-bearing horizons to the west. It is almost certain that wells to the west of this lake will be affected by draining the water from this lake. There is no doubt that some surface water could be obtained more quickly from this source, possibly by pumping from this lake to overcome the approaching emergency, than by drilling wells to increase the supply. This surface water would only be temporary relief, and unless annual precipitation increases in this part of Alberta it will be necessary to obtain water from wells, unless a more distant source, like Battle river, is developed.

There is a water supply in Driedmeat lake, in the Battle river valley about eight miles south of Camrose. The surface of the lake is 197 feet lower than the town. With the present population of Camrose, and with the possibility of an adequate water supply from drilled wells in the immediate vicinity of the town it is not considered that this is a feasible source of water in the near future.

Most of the lakes shown on the map of this district have disappeared, including Demay lake east of Dinant in township 48. The lake shown on the map in Camrose creek in section 5, township 48, range 20, has become dried up.

There is a small lake in section 2, township 48, range 20, reported to be fed by springs, which might be considered for use if the volume is large enough. This lake should be examined more closely as a possible source of water. The surface of the lake is given as 2428 feet or 38 feet above the spillway in the reservoir, and 18 feet above the lake in sections 23 and 24, about two and a half miles north of Camrose which is recommended for immediate use. It is possible that the lake in section 2, township 48, range 20, is maintained by springs. I have just received the information that there is a spring-fed well in the southeast quarter of this section 2. This water is coming from a coal seam at a depth of nine feet. A test in this flowing well shows that the flow is about 6.13 gals./minute or 8827 I. G. D. This well is only about one mile southeast from flowing well No. 44 shown on the accompanying map. It is quite possible that a considerable quantity of water could be obtained in the immediate vicinity of this lake from a shallow depth. Information on this possible source would be valuable but I am recommending the drilling of wells closer to Camrose at the present time where water at less cost and of better quality can be expected.

The water in upper Miquelon lake, 18 miles north of Camrose is condemned as unsuitable for domestic use, but might be treated in some way. Most of the water from the lower Miquelon lake has already been utilized for the Camrose supply. Further examination should be made of Miquelon lake as a possible future supply.

Data on the wells examined in the Camrose district are given on the following pages. The information on each well was obtained from the owner, or occupant of the land on which the well is located, or from well drillers, so must be regarded as only approximately accurate.

WELL DATA - CAMROSE DISTRICT

No.

1 Gardiner Ls 17-47-20
90' drilled 1922
Water rises to 22" from surface
Slight soda taste - 8 P.P.M.

2 Middlestadt Ls 8-18-47-20
132' drilled 1908 Rises to 16' from surface
Good water - 15 P.P.M.
Went through 10' coal at 90'

3 C. F. Hilgartner Ls 13-18-47-20
80' - rises to 42' Drilled about 3 years ago
Strong soda and high iron content - 135 P.P.M.
(Witched by Nelson)

4 Jasmine S.E. 24-47-21
145' - drilled 1920 - water rises to 40'
Very soft - not good for tea or coffee - 10 P.P.M.
Can pump dry. Present flow 7½ gals./min.
10,800 gals./day

5. R. Lampricht N.E. 14-47-21
85' Water level 40' Drilled about 1900
Slight soda (will not quench thirst)

6 Otto Lemke S.W. 25-47-21
110' Drilled 1940 Water level 15'
Soft 10 P.P.M.

7 Walter (Thumberg) 4-36-47-21
Shallow - wells no good - very little water
Very hard (not deep enough)

8 Johnston S.W. 1-48-21
175'
Slight soda - like Armena well
One of best wells in district

9 Armena School S.W. 11-48-21
130' Drilled 1942 Water level 27'
Slight soda 12 P.P.M.
Was merky at first

10 Elliott (Capt. H.C.) N.W. 33-46-20
40' small capacity
Hard

11 Pratt, J. S.W.3-47-20
119' new well north side of highway Water level 30'
Sulphur taste - very hard

12 White, (Campbell) S.W. 3-47-20
213' Water level 95'
Slight soda 60 gal./hr.
Also water at 150'

No.

13 O. E. Hilliard N.E. 4-47-20
100' Water level 40'
Soft - never pumped dry

14 E. Kehoe S.E. 21-46-20
80' - water level 40'
Medium soft - coal at 80'

15 C. Duggan N.E. 32-46-20
189' - drilled 1910-11
Soft - slight smell to water at first
Pumped 5 hrs. - no reduction

16 Martin Erickson N.W. 28-46-20
260' - about 3 bbls. per day
Poor supply

17 R. Hurlbert (old Byers farm) S.E. 29-46-20
150-200' drilled by Loveseth
Good supply - soft

18 C. Chant N.W. 20-46-20
175' - water horizon 132'
Good well - soft

19 Walton (Chant) N.W. 18-46-20
100-150' Drilled 1920 Some gas
Good well - soft 4gals./min. Coal above water

20 J. Kehoe S.E. 16-46-20
240' pumped into house
Good water - slight iron content
Excellent well - very soft

21 Ellsworth Hill N.E. 4-46-20
Overlooking Battle valley and Driedmeat lake
217' Drilled 1920 Water level 60' now 95'
Soft - good supply

22 Church S.E. 15-46-20
210' - Drilled 1937 (In barnyard)
Soft - good supply
4 gals./min. or 250 gals./hr. or 6000 gals./dy.

23 Peterson N. 10-46-20
Similar to Church

24 A. Shermak N.E. 15-46-20
220' Water level 100'
Slight soda - soft
Good well

25 Dr. Shay S. W. 23-46-20
130' - drilled about 1917
Very soft
Medium well

26 P. Duggan (Capt.) N.E. 22-46-20
403½' hit cylinder at 240'
Drilled by Ed. Hoyme - did not know when he had water
Soft - good supply (Plant growth in container)

27 Ed. Hoyme S.E. 22-46-20
325' - water at 225' Several coal seams
Good well - soft

28 J. S. Noble N.W. 24-46-20 (house burnt down)
Reported about 240'
Hard and iron content

29 J. S. Noble N.W. 24-46-20
240-260' Went through coal seam
Soft, some sulphur Good supply 4 gals.-min.

30 T. Duggan N.W. 3-47-20
260'
Soft 2 gals./min. 30 P.P.M.
(Uses shallow well as refuse dump)

31 B. Duggan S.W. 11-47-20
130' 580 gals./hr.
Soft 215 P.P.M.

32 Stan Bailey S.W. 14-47-20
135' Water level 8.F' (has been at 22')
Good supply

33 Geo. Shea S.E. 14-47-20
235'
Soft, strong supply 30 P.P.M.

34 Peterson N.E. 2-47-20
115' (105') water level 5'
Good supply - soft 30 P.P.M.

35 Kerstad (Ls 6) S.W. 13-47-20
245' Water level 30' 50 P.P.M.
Soft - good strong supply - iron content

36 Middlestadt N.E. 12-47-20
275' - water level 100'
Soft - slightly salty - good supply
Flow 10,450 gals./day

37 Shaw (old dairy farm) S.E. 12-47-20
280' - water level 50
Slightly salty
Two other wells 175' - no supply - 205' - poor supply with soda

38 W. McGee N.W. 6-47-19
276' - water level 75' (Had water at 185')
Good supply - no decline - 50 P.P.M.
Not good taste (iron) like 35,36,37

No.

39 M. Marker N.W. 36-46-20
198'
Soft - good supply

40 R. Bowes S.W. 6-47-19
68' and 4' coal - water level 4'
Medium - soft - soda - 90 P.P.M.
10,000 gals./day

41 Carl Anderson S.E. 1-47-20
128' Water level 30' 2/ 3' coal above water
Soft, similar to town well
Good supply

42 S. Ness (dairy farm) N.E. 35-46-20
212' - water level 80' - drilled 1941
Good, soft 15 P.P.M.
Slightly merky

43 Lovesetn 12 N.W. 23-47-20- (Mr. Schielke)
240' - drilled in 1917
Sufficient - medium soft

44 Olsen 9 N.E. 3-48-20
40-50' Flowing well
Good, slight soda 150 gals./min.

45 Sunderman N.W. 2-47-20
320'
Soft (slightly salty) may be from old gas well

46 John Hanson S.E. 15-47-20
240' Water level 90'
Good - soft

47 Stover N.E. 16-47-20
245'
Soft - good (Analysis:

48 Lake in 23 & 24 - 47-20
161 acres average 1 foot. Volume 40,000,000 gals.
Recommended to be used under control to replenish reservoir.

49 P. Cobryk S.E. 2-48-20
9' to coal
Flowing well 6.13 gals./min. or 8827 I.G.D.

50 E. Anderson Ls 9 - N.E. 2-48-20
5' soft
Spring

Conclusions and Recommendations

A most serious emergency has arisen at Camrose in the present water supply which is sufficient for two and a half to three months at the present rates of consumption and evaporation.

The rapidly increased population within the last two years, due to the militia camp, combined with low annual precipitation, have increased the consumption without any addition to the available supply.

It is recommended that some temporary curtailment in the use of water in the town and camp be established until an increased supply is available.

The drainage practise in this district in former years is largely responsible for the reduced supply of surface and undersurface water.

There is an amply supply of underground water within about 300 feet from the surface, provided a sufficient number of wells are drilled, because the supply to individual wells is small.

Most of the surface water in the district has been removed by natural or artificial causes, except one slough-like lake, about one foot in depth, covering 161 acres, two and a half miles north of the town. The volume of available water at the present date in this lake is estimated at about 40 million gallons.

It is recommended that this small supply of surface water be utilized immediately as a temporary measure in this approaching emergency, by the quickest possible means, either by pumping to Camrose creek or by open ditch. Pumping would be more economical because of the high absorption loss that would occur along an open ditch.

It is pointed out that this surface water supplies underground water in the rock formations that occur under this lake basin and dip to the west, so that if this surface supply is depleted, the underground water to the west in the horizons affected will also be depleted.

A second and more lasting water supply can be obtained from the drilling of wells in the vicinity of the town.

There are three water horizons in the Edmonton formation which underlies the unconsolidated deposits, within 300 feet from the surface. This formation at Camrose is about 400 feet thick. The lower horizon, over 200 feet from the surface, and possibly the middle horizon, if the water is suitable chemically, between one and two hundred feet from the surface, constitute the water reserve for the Camrose system.

A sufficient number of wells could be drilled within a radius of two miles of the town to supply the requirements. It is recommended that possibly five wells would have to be drilled at the start to obtain sufficient water for the immediate needs. If 20,000 gals./day can be obtained from each well, and this can be reasonably expected, then it might be possible to eliminate the treating plant entirely, in which the cost of chemicals alone now amounts to about $5,000. per year. This factor alone favors a supply from several wells for the future supply.

No wells should be drilled at present within the town, as the data on the condition of the present wells are incomplete.

The areas recommended for drilling are the east half of sections 34 and 27, immediately south of the town to the lower horizon; or in section 10 northwest of the town to produce water from the lower horizon and possibly the middle horizon if the water is suitable for the purpose; or in section 11, north of the town. The last two are adjacent to Camrose creek and the present reservoir, but it is not recommended that the reservoir should be used for water from drilled wells.

It is recommended that the well in the militia camp ground should be completed to the lower horizon.

The tower well, No. 8, should be cleaned out as soon as convenient and surged with the possibility of increasing production. The silt and bentonite clay in the Edmonton formation will in time reduce the flow of water in any well.

The old gas well requires attention to prevent saline water from reaching the water horizon in No. 3 and No. 11 and possibly in No. 8 wells.

Temporary relief is necessary and can be obtained from surface water by drainage, but a more lasting supply will have to be obtained from wells, unless the annual precipitation increases greatly over that during the past few years.

Edmonton, Alberta,

June 6th, 1942.

John A. Allan

Consulting Geologist

APPENDIX

I have just received additional data from Mr. H. Randle on the present available supply in the reservoir.

According to the reservoir storage curve on June 11th the reservoir contained only 24,800,000 Imperial Gallons, but since it would not be practical to drain the reservoir below 2378 feet which is 3.5 above the lower intake, there would be a loss of at least 2,500,000 gals. This would leave only 22,300,000 gallons available in reservoir.

The following figures apply to the period May 31st to June 11th, 1942:-

1,026,000 I.G. pumped from reservoir
1,274,000 I.G. assumed evaporation loss
93,500 I.G. average pumpage per day
116,000 I.G. average evaporation loss per day
209,500 I.G. total daily depletion of reservoir supply.

At this rate of daily depletion, namely, 209,500 I.G., the remaining 22,300,000 gallons represent a supply of 106 days or until September 25th. No allowance is made in this estimate for rainfall. In this period of 11 days there were 0.8 inches of rain on June 10th, which added to the reservoir an estimated 400,000 gallons, with no run-off except along the immediate margin of the reservoir.

At the reservoir level on June 11th with no allowance for run-off two inches of rain are required to produce one million gallons in the reservoir. According to the precipitation data given on the attached sheet the average rainfall for the months June to September during the period 1931 to 1941 inclusive, was 7.8 inches, with a maximum of 12.6 inches in 1931 and a minimum of 4.83 inches in 1939.

On this basis unless we get heavy and long rainfalls in the next three and a half months sufficient to cause Camrose creek to flow, we cannot expect to get more than four million gallons added to the reservoir from direct rainfall.

Even if the rainfall reached the maximum of the June-September 1931 period, the supply would still be inadequate without the supply it is necessary to obtain from wells drilled in the near future.

Edmonton, Alberta,

June 22nd, 1942.

John A. Allan

Consulting Geologist

RECORD OF PRECIPITATION IN CAMROSE DISTRICT FOR YEARS NOTED

Month	1942	1941	1940	1939	1938	1937	1936	1935	1934	1933	1932	1931
Jan.	.16	.56	.56	.57	.48	.92	1.85	1.06	.38	.26	.43	
Feb.	.34	.53	.84	.75	.65	.27	1.10	Nil	.02	.68	.03	
Mar.	.14	.47	1.86	.38	.80	.35	.96	.20	.60	1.37	.75	1.00
Apr.	1.57	.32	2.48	.35	1.07	.68	1.63	1.61	2.18	.95	1.80	Nil
May	1.46	.44	1.19	4.10	xx	2.38	2.38	3.05	2.24	1.33	1.95	.79
June		3.20	2.81	2.33	xx	1.27	1.58	3.25	3.17	2.16	2.49	5.01
July		.69	4.11	1.20	xx	5.07	2.28	2.55	1.19	2.47	2.00	2.52
Aug.		1.48	.53	.06	xx	1.89	1.86	2.25	.18	.55	.65	3.80
Sept.		1.33	.33	1.24	.53	2.13	1.60	.36	2.14	2.20	.81	1.27
Oct.		.30	1.35	1.36	1.50	.83	.75	1.30	Nil	1.06	..25	.78
Nov.		1.08	.92	.37	1.07	1.45	1.01	2.72	.40	1.00	1.22	.20
Dec.		.62	.58	.09	.45	.65	.63	1.37	.13	1.36	.05	.85
TOTALS ...		11.02"	17.56	12.80		17.89	17.63	19.72	12.63	15.39	12.43	

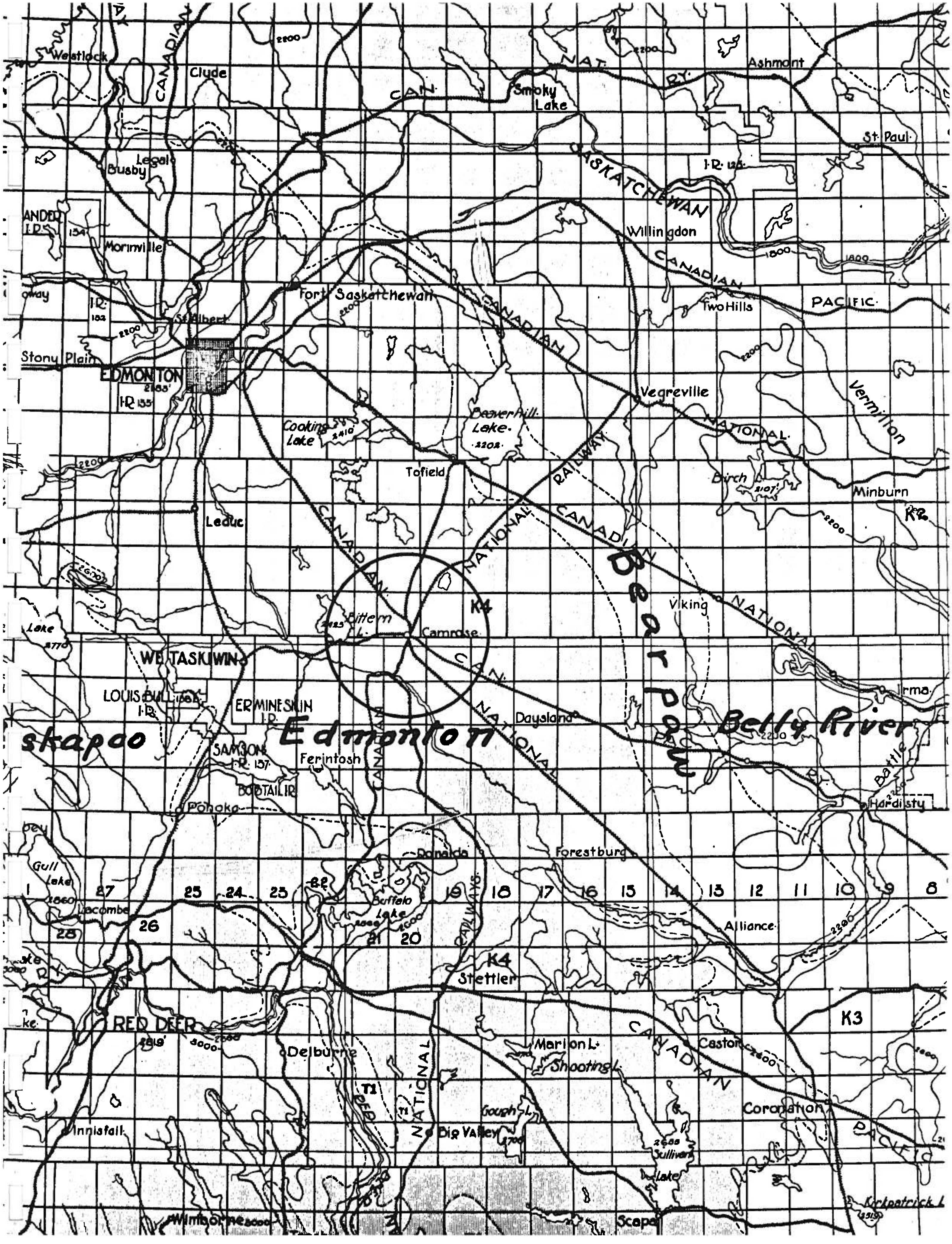
The figures for the last ten months in 1930 are as follows:-

Mar.	1.00
Apr.	Nil
May	.79
June	5.01
July	2.52
Aug.	3.80
Sept.	1.27
Oct.	.78
Nov.	.20
Dec.	.85

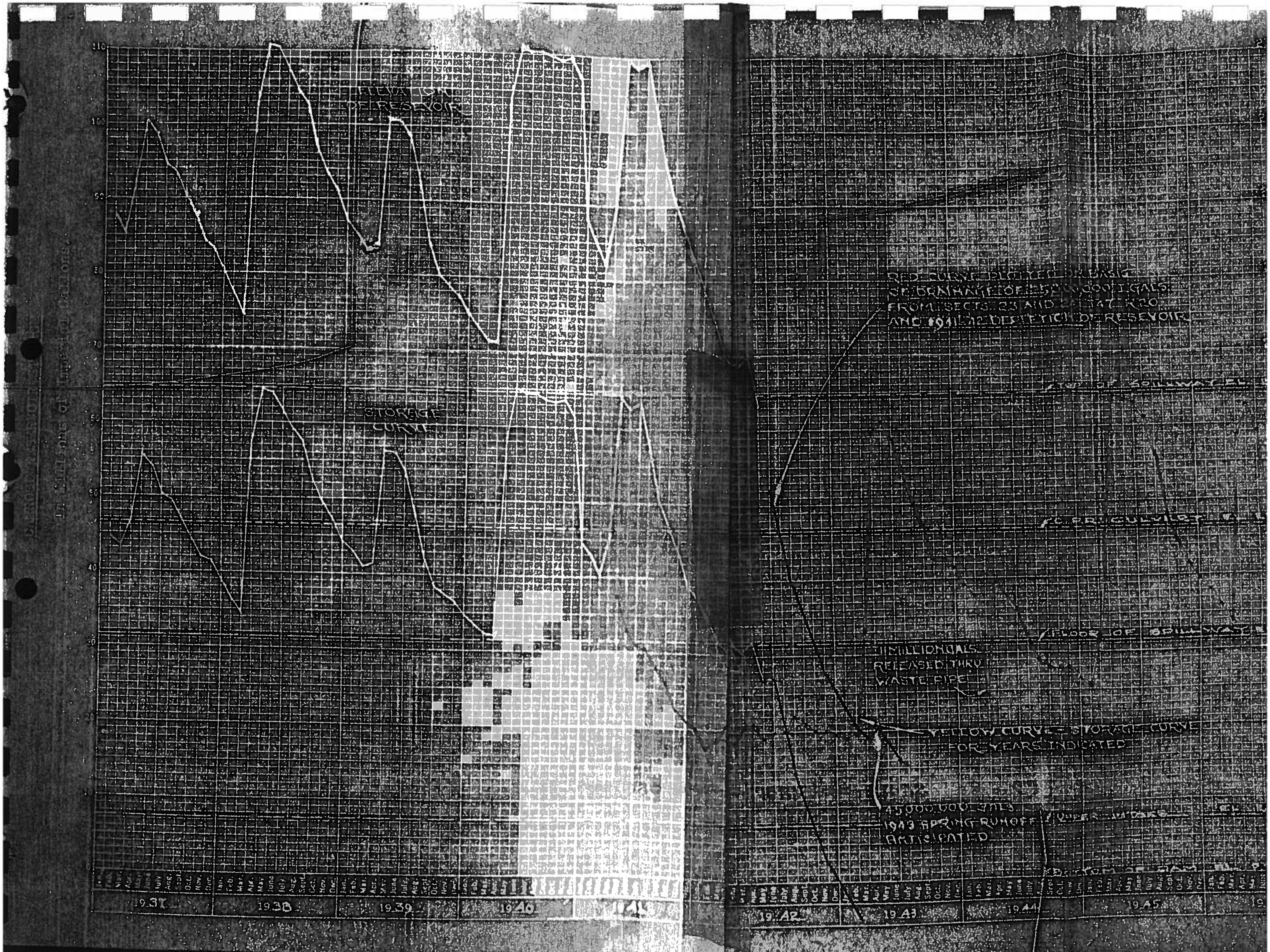
These figures are in inches of rainfall, the snowfall being recorded in rainfall equivalent.

xx In part of 1938 there is no record for the reason that the rain gauge was taken away at this time and no one kept a record.

J. S. Eby.



Westlock
Clyde
Smoky Lake
Ashmont
St. Paul
Legal
Busby
I.R. 125
Morinville
Willingdon
Fort Saskatchewan
Two Hills
St. Albert
Stony Plain
EDMONTON
Vegreville
Cooking Lake
Beaverhill Lake
Tofield
Birch
Minburn
Leduc
Vermilion
Viking
K4
Bittern L.
Camrose
WETASKIWIN
LOUIS BULL I.R.
ERMINESKIN I.R.
Daysland
Irma
Edmonton
Bearpaw
Belly River
skapoo
SAMSON I.R. 157
Ferintosh
BOBTAIL I.R.
Ponoka
Hardisty
Battle
Donalda
Forestburg
Gull Lake
Lacombe
Buffalo Lake
Alliance
Stettler
K3
RED DEER
Marion L.
Shooting L.
Castor
Delburne
Gough L.
Coronation
Innisfail
Big Valley
Sullivan Lake
Kirkpatrick L.
Wimborne
Scapa
CANADIAN NATIONAL RAILWAY
CANADIAN PACIFIC
SASKATCHEWAN


ELEVATION OF RESERVOIR
STORAGE CURVE
In Millions of Imperial Gallons
RED CURVE PLOTTED ON BASIS
OF DRAINAGE OF
FROM SECTS. 23 AND
AND 1941-42 DEPLETION OF RESERVOIR
FLOOR OF SPILLWAY
MILLION GALS.
RELEASED THRU
WASTE PIPE
YELLOW CURVE = STORAGE CURVE
FOR YEARS INDICATED
45,000,000 GALS.
1943 SPRING RUNOFF
ANTICIPATED
1937
1938
1939
1940
1941
1942
1943
1944
1945

[illegible] RESERVOIR

SURFACE ELEVATION

(Figure given for end of month in each case)

1937

Jan.	2387.77
Feb.	2387.51
Mar.	2388.21
Apr.	2389.02
May	2388.88
June	2388.47
July	2388.37
Aug.	2388.03
Sept.	2387.77
Oct.	2387.46
Nov.	2387.21
Dec.	2387.04

1938

Jan.	2386.75
Feb.	2386.44
Mar.	2389.25
Apr.	2390.09
May	2390.03
June	2389.74
July	2389.47
Aug.	2389.27
Sept.	2388.69
Oct.	2388.35
Nov.	2388.12
Dec.	2387.71

1939

Jan.	2387.54
Feb.	2387.32
Mar.	2387.37
Apr.	2389.09
May	2389.07
June	2388.87
July	2388.23
Aug.	2387.44
Sept.	2387.00
Oct.	2386.87
Nov.	2386.75
Dec.	2386.50

1940

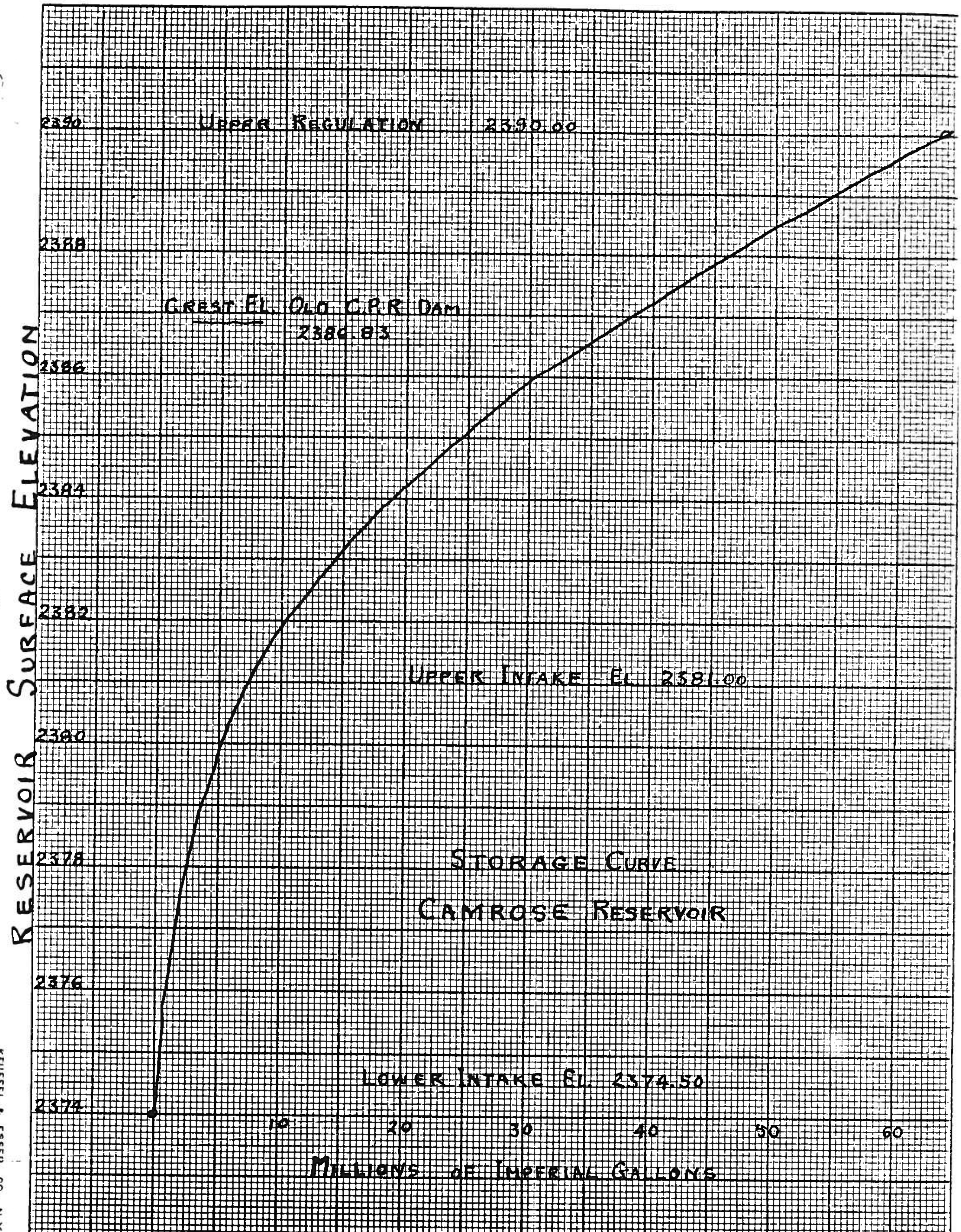
Jan.	2386.21
Feb.	2386.14
Mar.	2388.12
Apr.	2389.77
May	2390.09
June	2390.02
July	2390.02
Aug.	2389.97
Sept.	2389.93
Oct.	2389.95
Nov.	2389.70
Dec.	2387.80

1941

Jan.	2387.50
Feb.	2387.21
Mar.	2387.94
Apr.	[illegible]
May	[illegible]
June	2389.92
July	2389.30
Aug.	2388.55
Sept.	2388.03
Oct.	2387.67
Nov.	2387.21
Dec.	2386.84

1942

Jan.	2386.45
Feb.	2385.98
Mar.	2385.84
Apr.	[illegible]
May	2385.21
June	
July	


Reservoir Surface Elevation
2390
2388
2386
2384
2382
2380
2378
2376
2374
Upper Regulation 2390.00
Crest El. Old C.P.R. Dam 2386.83
Upper Intake El. 2381.00
Storage Curve
Camrose Reservoir
Lower Intake El. 2374.50
10
20
30
40
50
60
Millions of Imperial Gallons
Keuffel & Esser Co. N.Y.

GALLONS WATER CONSUMPTION

TWELVE MONTH INTEGRATION CURVE DATA

Year	Month	Gallons	12-Month Total
1940	January	1,684,500	20,580,300
	February	1,362,[illegible]	20,040,300
	March	1,459,400	19,787,900
	April	1,539,200	19,725,900
	May	1,600,400	19,476,700
	June	1,681,900	19,401,600
	July	1,775,900	19,266,500
	August	1,695,800	[illegible],11,300
	September	1,671,400	19,937,900
	October	2,461,600	19,768,300
	November	2,389,600	20,632,600
	December	2,543,000	21,364,500
1941	January	2,572,900	22,752,800
	February	2,016,600	23,4[illegible]6,600
	March	2,100,200	24,[illegible]7,400
	April	2,264,700	24,773,900
	May	2,832,200	26,009,700
	June	2,975,800	27,299,500
	July	3,486,400	29,010,100
	August	3,241,400	30,555,700
	September	3,067,700	31,952,000
	October	2,898,300	32,388,700
	November	2,889,500	32,388,600
	December	2,985,200	33,330,900
1942	January	2,906,500	33,664,600
	February	2,682,200	34,330,200
	March	2,977,500	35,307,500
	April	3,159,600	36,102,400
	May	3,156,500	36,426,700

Date	No. 3 Well	No. 11 Well	Total Well Output	Reservoir	Reservoir & Well Output	% Increase over Previous Year
1940						
Jan.	420,000	279,000	699,000	1,026,100	1,725,100	16.1 %
Feb.	350,000	221,200	571,200	921,400	1,492,600	[illegible]
Mar.	278,000	279,000	557,000	1,0[illegible]8,200	1,[illegible],2[illegible]0	14.[illegible]
Apr.	350,000	279,000	629,000	1,[illegible]	1,6[illegible]7,[illegible]	[illegible].3
May	40[illegible],[illegible]00	279,000	682,000	1,050,400	1,7[illegible],400	[illegible]
June	355,000	279,000	634,000	1,164,000	1,79[illegible],[illegible]00	[illegible]
July	375,000	279,000	654,000	1,241,700	1,[illegible],700	[illegible]
Aug.	360,000	279,000	639,000	1,20[illegible],100	1,[illegible],100	1.7
Sept.	3[illegible],000	279,000	6[illegible],000	1,221,[illegible]00	1,[illegible]	[illegible].1
Oct.	365,000	279,000	644,000	1,9[illegible],000	[illegible],6[illegible]6,000	[illegible]
Nov.	360,000	279,000	639,000	1,920,700	2,55[illegible],7[illegible]	48.1
Dec.	372,000	279,000	651,[illegible]	2,061,200	2,712,200	[illegible],4
1941						62.[illegible]
Jan.	370,000	279,000	649,000	2,0[illegible]6,400	2,725,400	[illegible].1 %
Feb.	335,000	252,000	587,000	1,56[illegible],700	[illegible],150,700	44.7 %
Mar.	360,000	279,000	6[illegible],[illegible]00	1,611,200	2,250,[illegible]	4[illegible]
Apr.	351,000	279,000	630,000	1,789,700	[illegible],4[illegible],700	40.[illegible]
May	325,000	279,000	604,000	2,421,400	[illegible],0[illegible],400	7[illegible]
June	275,000	270,000	545,000	2,57[illegible],700	[illegible],121,70[illegible]	7[illegible]
July	290,000	270,000	560,000	[illegible],099,500	[illegible],05[illegible],500	9[illegible].1
Aug.	348,000	279,000	627,000	2,772,900	[illegible],[illegible],900	[illegible]
Sept.	340,000	279,000	619,000	2,602,500	[illegible],221,500	[illegible]
Oct.	279,000	361,000	640,000	2,43[illegible],[illegible]00	[illegible],07[illegible],000	1[illegible].7
Nov.	315,000	279,000	594,000	[illegible],467,000	[illegible],0[illegible],000	1[illegible]
Dec.	280,500	270,000	550,500	2,[illegible],100	[illegible]	1[illegible].1
1942						
Jan.	330,000	279,000	609,000	2,460,[illegible]00	[illegible],069,500	12.[illegible]
Feb.	288,000	252,000	540,000	2,29[illegible],[illegible]00	[illegible]	31.[illegible]
Mar.	32[illegible],000	279,000	599,000	2,546,100	[illegible],14[illegible],100	[illegible]
Apr.	315,000	279,000	594,000	2,731,500	[illegible],325,500	37.[illegible]
May			690,500	2,62[illegible],0[illegible]0	[illegible],315,500	[illegible].9

CAMROSE WATER - METERED CONSUMPTION and LOSSES

	Total Pumped to Mains I.G.	Total Consumers (Including Militia Camp) Cu. ft.	I.G.	Total Militia Camp Meters Cu. ft.	I.G.	Estimated Losses and other Consumption	Total Accounted For	% Sold	% Accounted For
1941									
Jan.	2,[illegible],[illegible]0	314,010	1,956,600	117,990	735,[illegible]00	45,000	2,001,600	76.0	77.8
Feb.	2,016,600	287,690	1,792.600	101,920	635,100	12,000	1,804,600	88.9	89.6
Mar.	2,100,2[illegible]0	266,600	1,661,200	76,430	476,600	56,000	1,717,200	79.1	81.7
Apr.	2,264,700	325,850	2,030,400	121,410	756,500	20,000	2,050,400	89.7	90.5
May	2,832,200	371,952	2,317,600	150,080	935,200	39,000	2,356,600	81.9	83.3
June	2,975,800	457,470	2,850,500	202,560	1,262,200	-	2,850,500	9[illegible].3	9[illegible].3
July	3,436,400	432,083	2,690,000	161,960	1,008,000	87,000	2,777,000	77.1	79.6
Aug.	3,241,400	433,926	2,708,000	203,030	1,256,000	65,000	2,773,000	83.[illegible]	85.5
Sept.	3,067,700	331,201	2,065,000	116,320	725,000	10,000	2,075,000	67.3	67.6
~~Oct.~~	2,898,300	426,019	2,650,000	185,2[illegible]0	1,154,000	17,200	2,667,200	91.4	92.2
Nov.	2,889,500	467,020	2,910,100	176,600	1,100,400	13,000	2,923,100	100.9	101.1
Dec.	2,985,300	431,960	2,691,700	199,740	1,244,500	-	2,691,700	90.1	90.1
	33,530,900	4,545,781	28,323,700	1,814,090	11,288,700	364,300	28,687,900	85.2	8[illegible].5
1942									
Jan.	2,906,500	367,570	2,290,400	170,100	1,059,900	11,000	2,301,400	78.8	79.8
Feb.	2,682,200	376,770	2,347,800	164,900	1,027,500	-	2,347,800	87.5	87.5
Mar.	2,977,500	394,980	2,461,200	185,600	1,156,500	10,000	2,471,200	8[illegible].6	8[illegible].9
Apr.	3,159,600	455,450	2,838,000	228,500	1,405,200	10,000	2,848,000	89.1	9[illegible].0
May	3,156,500			194,600	1,216,250				

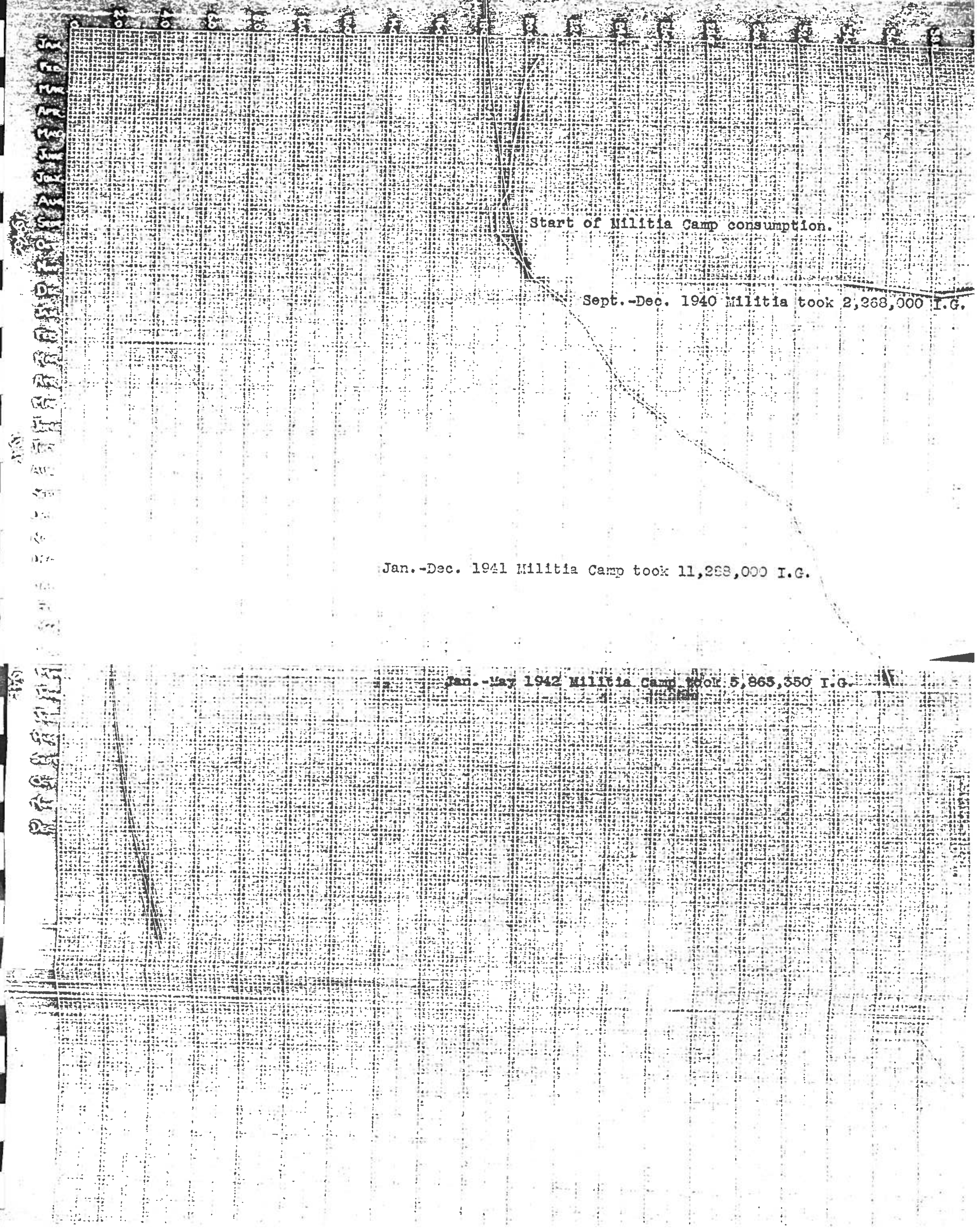
1937-41

Date	No. 3 Well	No. 11 Well	Total Well Output	Reservoir	Reservoir & Well Output	% Increase Over Previous Year
1937						
Jan.	434,000	274,000	708,000	[illegible]	[illegible]	
Feb.	367,200	252,000	619,200	1,072,200	[illegible]	
Mar.	434,000	279,000	713,000	1,179,100	1,892,100	
Apr.	408,000	270,000	676,000	994,700	1,672,700	
May	434,000	279,000	713,000	1,064,500	1,777,500	
June	362,000	270,000	632,000	[illegible]	[illegible]	
July	408,000	279,000	687,000	[illegible]	[illegible]	
Aug.	434,000	279,000	713,000	[illegible]	[illegible]	
Sept.	341,000	270,000	[illegible]	[illegible]	[illegible]	
Oct.	434,000	279,000	[illegible]	[illegible]	[illegible]	
Nov.	415,000	266,000	[illegible]	[illegible]	[illegible]	
Dec.	434,000	279,000	713,000	[illegible]	[illegible]	
1938						
Jan.	398,000	278,000	676,000	1,564,900	[illegible]	21.6 d.
Feb.	369,000	252,000	621,000	[illegible]	2,174,100	[illegible]
Mar.	434,000	279,000	713,000	[illegible]	[illegible]	[illegible]
Apr.	412,000	270,000	682,000	[illegible]	[illegible]	[illegible]
May	417,700	279,000	696,700	1,337,300	[illegible]	[illegible]
June	420,000	266,000	686,000	[illegible]	[illegible]	[illegible]
July	402,000	279,000	681,000	[illegible]	[illegible]	[illegible]
Aug.	375,000	279,000	654,000	1,578,100	2,232,100	34.8 d.
Sept.	420,000	270,000	690,000	[illegible]	2,489,[illegible]	22.4 d.
Oct.	434,000	288,000	722,000	[illegible]	[illegible]	9.07 d.
Nov.	378,000	270,000	648,000	[illegible]	2,226,950	4.74 d.
Dec.	406,000	279,000	685,000	1,557,400	2,242,400	1.51 d.
1939						
Jan.	[illegible]	279,000	689,000	1,364,700	[illegible]	[illegible]
Feb.	[illegible]	245,000	627,000	[illegible]	[illegible]	[illegible]
Mar.	[illegible]	270,000	370,000	1,481,920	[illegible]	[illegible]
Apr.	410,000	270,000	[illegible]	1,051,600	[illegible]	[illegible]
May	415,000	279,000	694,000	[illegible]	[illegible]	[illegible]
June	350,000	270,000	620,000	[illegible]	[illegible]	[illegible]
July	[illegible]	279,000	575,000	1,354,000	[illegible]	7.7 d.
Aug.	406,000	279,000	685,000	[illegible]	[illegible]	[illegible]
Sept.	401,000	270,000	671,000	1,012,400	[illegible]	[illegible]
Oct.	[illegible]	279,000	699,000	[illegible]	[illegible]	[illegible]
Nov.	[illegible]	279,000	689,000	981,400	[illegible]	[illegible]
Dec.	410,000	279,000	689,000	980,000	[illegible]	[illegible]

d. = decrease

CAMROSE WATER - METERED CONSUMPTION and LOSSES

	Total Pumped to Mains I.G.	Total Consumers (Including Militia Camp) Cu.Ft.	I.G.	Total Militia Camp Meters Cu.Ft.	I.G.	Estimated Losses and Other Consumption	Total Accounted For		
1939									
Jan.	1,897,500	195,290	1,217,000			20,000	1,237,000	64.1	65.1
Feb.	1,902,200	194,030	1,208,000				1,208,000	63.5	63.5
Mar.	1,711,300	183,290	1,142,000			20,000	1,162,000	66.7	67.9
Apr.	1,590,200	186,720	1,164,000			68,000	1,232,000	73.3	77.5
May	1,897,600	193,730	1,207,000			100,500	1,307,500	[illegible]	[illegible]
June	1,759,000	186,720	1,164,000			31,000	1,195,000	66.2	[illegible]
July	1,811,000	207,210	1,292,000			40,500	1,332,500	71.3	73.6
Aug.	2,251,000	245,880	1,532,000			147,000	1,679,000	68.1	74.5
Sept.	1,544,800	197,130	1,228,000			14,000	1,242,000	79.5	80.4
Oct.	1,651,200	220,350	1,373,000			8,000	1,381,000	84.2	84.7
Nov.	1,544,100	188,090	1,172,000			22,000	1,194,000	75.9	77.3
Dec.	1,312,300	194,490	1,212,000			[illegible]	1,212,000	92.4	92.4
	20,615,300	2,392,930	14,912,000			471,000	15,383,000	71.7	73.9
1940									
Jan.	1,684,550	187,820	1,170,000			17,000	1,187,000	69.5	70.4
Feb.	1,362,800	200,550	1,250,000			13,000	1,263,000	91.7	92.6
Mar.	1,459,400	179,020	1,115,000				1,115,000	76.4	76.4
Apr.	1,558,200	188,510	1,175,000			37,000	1,212,000	75.4	77.8
May	1,600,400	210,790	1,305,000			52,150	1,357,150	81.5	84.7
June	1,621,900	222,720	1,388,000				1,388,000	[illegible]	[illegible]
July	1,775,900	189,360	1,179,000			47,000	1,226,000	[illegible]	69.1
Aug.	1,695,800	190,940	1,197,000			62,000	1,259,000	70.6	74.3
Sept.	1,671,400	219,440	1,362,000	6150	38,330	30,000	1,392,000	81.5	[illegible]
Oct.	2,461,600	343,320	2,140,000		793,620	19,000	2,159,000	[illegible]	87.7
Nov.	2,337,500	313,140	1,952,000		521,370	12,000	1,964,000	[illegible]	[illegible]
Dec.	2,345,000	316,510	1,975,000		309,190	2,000	[illegible]	84.1	[illegible]
	21,364,550	2,758,160	17,248,000			297,150	17,545,150	[illegible]	[illegible]


Start of Militia Camp consumption.
Sept.-Dec. 1940 Militia took 2,268,000 I.G.
Jan.-Dec. 1941 Militia Camp took 11,288,000 I.G.
Jan.-May 1942 Militia Camp took 5,865,350 I.G.