CHAPTER 11

Kelowna Creek

11.1 GENERAL DESCRIPTION

Reference is made to the Key Map, Figure 11.1 and Schematic 11.2. Kelowna Creek has a small watershed of only 86 square miles, but, after Ver-non and Mission, contains the largest amount of irrigated land. For this reason, of all the creeks under study it is the most susceptible to water shortage.

In 1970, the area included a population of 10,420 and contained 4,848 Irrigated acres. Although much of the City of Kelowna lies within the Kelowna Creek watershed. It is served by Okanagan Lake.

The headwaters of Kelowna Creek are located about seven miles north-east of the City of Kelowna at an elevation of 5,300 feet. Drainage soon reaches Postill Lake (CP1) from whence Kelowna Creek proper commences. Flows are increased, in order, by Conroy Creek, (MP1), issuing from Morrison Creek originating from South Lake (CP2), and Bulman Creek issuing from Moore Lake. The first major diversion is to Ellison Irrigation District, shown as UPI on Figure 6A. Next, at UP 2, the largest water withdrawal in the system is taken by flume to Glenmore Irrigation District.

The largest tributary In the system, Scotty Creek, rises at Trapper Lake (CP4) and supplies diversion (UP 5) to Scotty Creek Irrigation District before reaching Kelowna Creek. The last major diversion (to Bank head Irrigation District) is located on Kelowna Creek below its confluence with Scotty Creek at UP6.

As shown by the area-elevation curves on Figure 14.2, the median elevation of Kelowna Creek is 3,400 feet. Although not well pronounced, the lower benchlands tend to occupy about 30% of the watershed at a median elevation of 1,600 feet. The upper plateau occupies about 35% of the watershed at a median elevation of 4,500 feet.

The profile of Kelowna Creek shown in Figure 14.3 has a relatively flat gradient of 30 feet per mile for the first 11 miles upstream from its mouth. Thereafter, the gradient increases markedly to 386 feet per mile for the next seven miles to its confluence with Bulman Creek. For the final five miles,

as the creek approaches its source at Hereron Lake, the creek gradient is reduced to 146 feet per mile.

There are a number of hydrometric meteorological and snow course stations on the Kelowna Creek system and these are located on Figure 11.1. Many of the Hydrometric records are of short duration and often cover only the summer months. The most significant hydrometric station is 8NM53, located near the creek mouth. Hydrographs of mean monthly flows passing this station have been plotted on Figure 14.4.

11.2 HISTORICAL BACKGROUND

Historical data on the major organized areas are as follows:

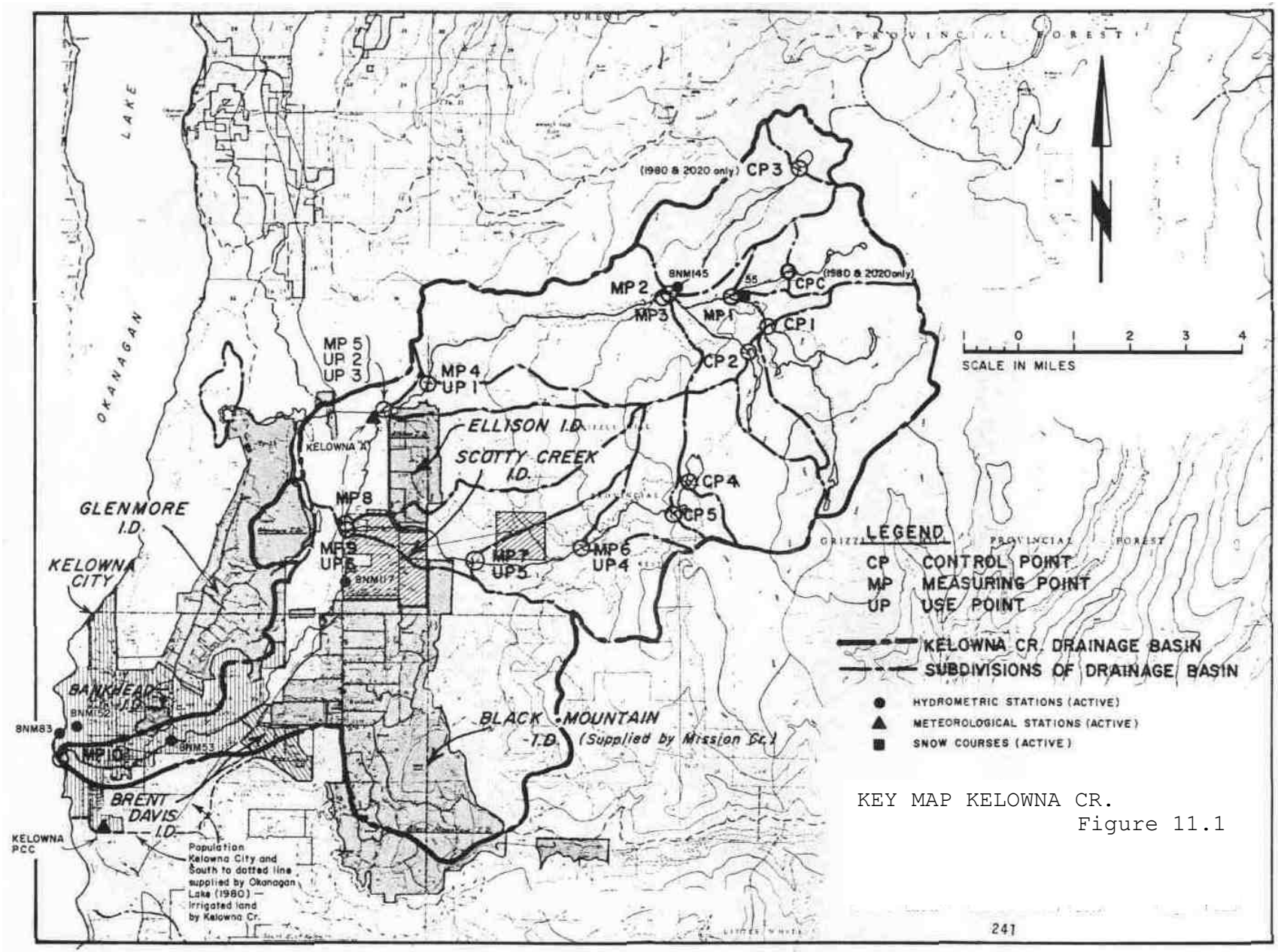
a) Glenmore Irrigation District was formed in 1910, and supplies irrigation and domestic water to an area just north of the City of Kelowna, as shown on the Key Map. In 1967, the existing open distribution system was replaced by an enclosed gravity and pumped pressure system financed under the ARDA programme. This system was designed to supply irrigation water to 2,009 acres within the District plus 200 acres within the City of Kelowna and 80 acres at Kelowna Golf and Country Club. In combination with a rehabilitated domestic system, it also serves some 230 domestic connections.

By July 1971, the area being supplied with irrigation water within the City of Kelowna had been reduced by subdivision to 113 acres and the District had regraded 75 acres of land, within its boundaries, to receive irrigation water. Also as of July 1971, the District had applications for water for some 1,200 additional acres within its boundaries.

b) The Ellison Irrigation District saw its beginnings when Thomas Bulman bought the land in 1906 and then subdivided the area, selling lots and supplying them with irrigation water.

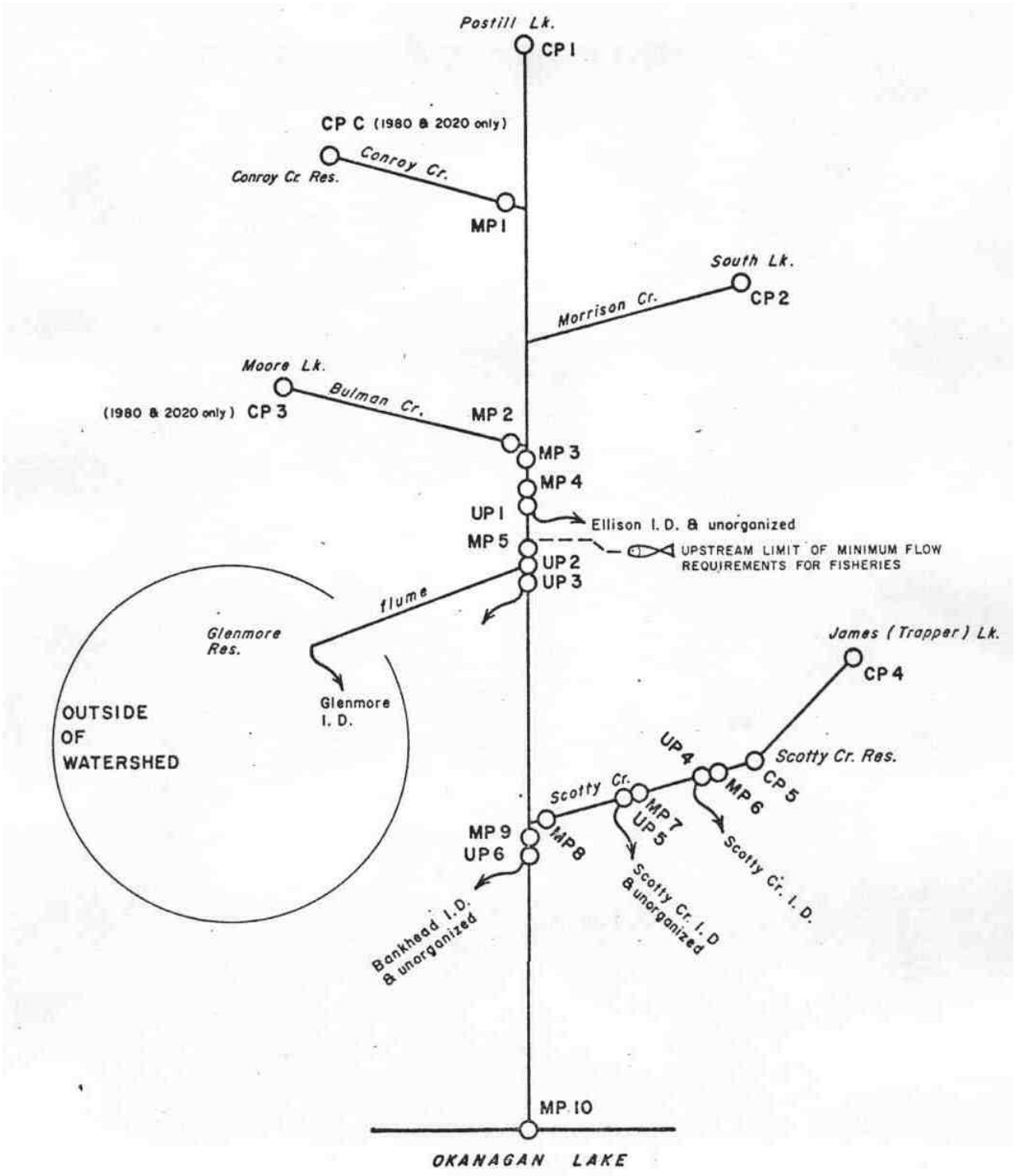
In 1926, the landowners unsuccessfully attempted to form an irrigation district. Further efforts were begun in 1945, and after considerable ligiga-tion the Ellison Irrigation District was formed, the irrigation system being purchased for $22,500.00. The original system was designed as a gravity system, and over the years individual growers added their own pressure systems, using gravity flow or pumps. In 1955 the distribution system at the north end required renewal, and by general consent of those concerned, a pressurized system was installed which served 100 acres.

In 1963 the south end of the system was replaced by a pressurized system, largely following the design made by the B.C. Water Resources Service.



KEY MAP KELOWNA CR.

Figure 11.1



KELOWNA CR. SCHEMATIC Figure 11.2

This system now serves 251 acres.

By 1970, the old gravity system had been replaced by more permanent works suitable for pressure irrigation of up to 660 acres.

c) The Scotty Creek Irrigation District was formed in 1918. The existing system at that time was generally in poor condition and some portions of the system required immediate replacement. An inherent disadvantage of the old system was its design for furrow irrigation and hence a lack of adequate pressure without booster pumping. In 1966 and 1967, a new distribution pipework system and intake were completed. Then, out of a total of 1,317 acres of irrigable land, 824 were under irrigation.

11.3 LAND USE AND WATER REQUIREMENTS.

The Kelowna watershed supplies the water needs of many local users, but it is to be noted that its largest user, Glenmore Irrigation District, is located outside the watershed boundary. Conversely, a large area which lies inside the watershed (Black Mountain Irrigation District) is supplies by Mission Creek. Further, the City of Kelowna meets its water needs by pumping directly from Okanagan Lake.

Irrigation water requirements diverted from Kelowna Creek have been estimated as follows: (Table 11.1):

TABLE 11.1

IRRIGATION DIVERSIONS FROM KELOWNA CREEK WATERSHED (1970)

Area Served	Area Irrigated (acres)	Irrigation (ac. ft.)	Total (ac.ft.)
Glenmore I.D.	530	4708	4708
Ellison I.D.	2140	1606	1606
Scotty Cr. I.D.	908	2752	2752
Bankhead I.D.	40	121	121
Others	1230	3701	3701
TOTALS	4848	12888	12888

NOTE: Details of Domestic Water Services on Kelowna Creek are not available but are not considered significant compared to irrigation diversions (See Table 6P)

Consumptive use diversions as listed above are assumed to result in no return flow within the Kelowna Creek sub-basin. However, consumptive use diver-

sions are assumed to provide a return flow to Okanagan Lake. The amount of return flow varies with the type of use and is estimated as follows:

a) For "Irrigation" return flow = 50% of diversion.
b) For "Domestic and Waterworks", return flow = 65% of diversion.
c) For "Industry", return flow = 90% of diversion.

From the above, water utilization in terms of the amounts of consumed water and return flow with the Okanagan Lake Basin may be tabulated as follows:
(Table 11.2).

TABLE 11.2
WATER UTILIZATION IN KELOWNA CREEK (1970)

	Diversion for Consumptive Use (acre-feet)	Consumed Water (acre-feet)	Return Flow to Okanagan Lake (acre-feet)
Irrigation	12,888	6,444	6,444
Domestic and Water Works*	464	161	299
Industry	0	0	0
TOTALS	13,352	6,605	6,743

* Based on licensed values

A detailed breakdown of the diversion requirements for the various organized and unorganized areas at the 1970 stage of development is as shown on Table 11.3.

In order to acquire rights over the use of water, most users, acting either individually or collectively in an irrigation district, have maintained water licenses for storage and diversion granted by the Crown, in right of the Province. Licenses provide their holder with rights over the stated amount of water and, in cases of a shortage, the older license takes precedence over the newer.

Current water licenses in 1970 for both storage and consumptive use are as listed on Table 11.4.

Comparison between the licenses and the computed diversion requirements show that, in general, licensed amounts exceed estimated current water use by a considerable margin.

TABLE 11.3

DIVERSION REQUIREMENTS ON KELOWNA CREEK (1970)

GIVEN IN ACRE-FEET

Month	Type	Glenmore I.D.	Ellison I.D.	Scotty I.D.	Bankhead	Other	Total
J	Agric.	0	0	0	0	0	0
	Dom.	18	5	0	0	1	24
	Ind.	0	0	0	0	0	0
F	Agric.	0	0	0	0	0	0
	Dom.	14	4	0	0	1	19
	Ind.	0	0	0	0	0	0
M	Agric.	0	0	0	0	0	0
	Dom.	18	5	0	0	1	24
	Ind.	0	0	0	0	0	0
A	Agric.	0	0	0	0	0	0
	Dom.	21	5	0	0	1	27
	Ind.	0	0	0	0	0	0
M	Agric.	706	240	412	18	557	1,933
	Dom.	35	9	0	0	0	46
	Ind.	0	0	0	0	0	0
J	Agric.	1,177	401	686	30	928	3,222
	Dom.	46	12	0	0	3	61
	Ind.	0	0	0	0	0	0
J	Agric.	1,177	401	686	30	928	3,222
	Dom.	56	14	0	0	3	73
	Ind.	0	0	0	0	0	0
A	Agric.	1,177	401	686	30	928	3,222
	Dom.	56	14	0	0	3	73
	Ind.	0	0	0	0	0	0
S	Agric.	471	160	275	12	371	1,289
	Dom.	28	7	0	0	2	37
	Ind.	0	0	0	0	0	0
O	Agric.	0	0	0	0	0	0
	Dom.	25	6	0	0	1	32
	Ind.	0	0	0	0	0	0
N	Agric.	0	0	0	0	0	0
	Dom.	18	5	0	0	1	24
	Ind.	0	0	0	0	0	0
D	Agric.	0	0	0	0	0	0
	Dom.	18	5	0	0	1	24
	Ind.	0	0	0	0	0	0
	TOTAL	5,061	1,694	2,745	120	3,732	13,352

Domestic demands based on licensed values

TABLE 11.4

WATER LICENSES ON KELOWNA CREEK (1970)

Area Served	Total Licensed Storage (ac.ft.)	Licensed Diversion			Total (ac.ft.)	Computed Diversion Requirements from Table 11.1
		Agriculture (ac.ft.)	Domestic (ac.ft.)	Industry (ac.ft.)		
Glenmore I.D.	5,107	6,400	350	0	6,750	4,708
Ellison I.D.	1,100	2,400	90	0	2,490	1,606
Scotty I.D.	1,480	2,225	0	0	2,225	2,752
Kelowna City	0	249	0	0	249	3,701
Other	48	4,747	20	0	4,767	
TOTAL	7,735	16,021	460	0	16,481	12,888

11.4 ESTIMATED NATURAL WATER SUPPLY

Natural water yields for the area are shown on computer print-out sheets, reproduced on Figure 11.3 (Dry Year), Figure 11.4 (Average Year), and Figure 11.5 (Wet Year).

In summary, the annual precipitation and natural runoff of the Kelowna Creek Basin under the three types of year is as follows:

TABLE 11.5

ESTIMATED NATURAL WATER YIELDS FOR KELOWNA SUB-BASIN

Type of Year	Kilo Acre-Feet	Inches Over Basin	Average Precipitation (inches)	Remarks
Dry	9.9	2.1	-	Area = 86.6 Square Miles Abstracted from Computer Print-Out Data
Average	17.0	3.7	21.1	
Wet	34.4	7.5	-	

11.5 STORAGE

Reference is made to Figure 11.2. In a climate of spring floods and summer droughts it is necessary to store a high proportion of total available water so that it may be used when needed. To this end, the Kelowna Creek water users have developed one large reservoir (Postilt Lake) and three smaller reservoirs by 1970.

Date Of Print - out:
Dec. 7, 1972

FLOWS IN AC. FT.

LOCATION	AREA IN K. AC.	J	F	M	A	M	J	J	A	S	O	N	D	YEAR
CPDA 1	5.0	32.	44.	51.	82.	1237.	696.	100.	49.	44.	44.	44.	44.	2466.
MPDA 1	2.2	13.	18.	22.	37.	436.	228.	40.	18.	18.	18.	18.	18.	863.
CPDA 2	1.0	6.	9.	10.	17.	230.	126.	19.	9.	9.	9.	9.	9.	462.
CPDA 3	0.7	4.	6.	7.	12.	144.	76.	13.	6.	6.	6.	6.	6.	292.
MPDA 2	3.8	22.	28.	36.	63.	689.	354.	67.	28.	28.	28.	28.	28.	1400.
MPDA 3	13.9	84.	111.	137.	229.	2919.	1572.	260.	117.	111.	111.	111.	111.	5875.
MPDA 4	20.1	100.	129.	160.	288.	3303.	1753.	311.	134.	127.	127.	127.	127.	6488.
MPDA 5	21.3	101.	131.	162.	296.	3334.	1767.	316.	135.	129.	129.	129.	129.	6756.
CPDA 4	2.9	18.	25.	30.	48.	671.	369.	57.	27.	25.	25.	25.	25.	1343.
CPDA 5	3.3	21.	28.	34.	55.	753.	412.	64.	30.	28.	28.	28.	28.	1510.
MPDA 6	5.1	30.	40.	49.	84.	1032.	552.	94.	42.	40.	40.	40.	40.	2081.
MPDA 7	8.8	39.	50.	63.	117.	1251.	654.	123.	51.	49.	49.	49.	49.	2543.
MPDA 8	11.3	44.	55.	69.	132.	1362.	708.	136.	56.	54.	54.	54.	54.	2776.
MPDA 9	38.5	149.	191.	238.	443.	4797.	2521.	467.	195.	187.	187.	187.	187.	9748.
MPDA 10	55.4	152.	195.	243.	459.	4872.	2554.	480.	198.	190.	190.	190.	190.	9912.

KELOWNA CR. DRY YEAR (NATURAL FLOW) Figure 11.3

Date Of Print - out:
Dec. 7, 1972

FLOWS IN AC. FT.

LOCATION	AREA IN K. AC.	J	F	M	A	M	J	J	A	S	O	N	D	YEAR
CPDA 1	5.0	49.	67.	78.	127.	1892.	1061.	154.	75.	67.	67.	67.	67.	3773.
MPDA 1	2.2	21.	28.	34.	54.	693.	362.	64.	28.	28.	28.	28.	28.	1403.
CPDA 2	1.0	10.	13.	16.	26.	357.	195.	30.	14.	13.	13.	13.	13.	715.
CPDA 3	0.7	7.	9.	12.	18.	228.	120.	21.	9.	9.	9.	9.	9.	461.
MPDA 2	3.8	36.	45.	59.	102.	1109.	569.	109.	45.	45.	45.	45.	45.	2254.
MPDA 3	13.9	134.	175.	216.	364.	4579.	2459.	410.	184.	175.	175.	175.	175.	9222.
MPDA 4	20.1	164.	211.	263.	466.	5319.	2803.	515.	216.	207.	207.	207.	207.	10802.
MPDA 5	21.3	168.	215.	267.	501.	5390.	2834.	528.	219.	210.	210.	210.	210.	10961.
CPDA 4	2.9	28.	39.	46.	75.	1038.	569.	88.	42.	39.	39.	39.	39.	2079.
CPDA 5	3.3	32.	44.	53.	85.	1168.	637.	100.	47.	44.	44.	44.	44.	2362.
MPDA 6	5.1	49.	63.	79.	134.	1628.	867.	149.	66.	63.	63.	63.	63.	3267.
MPDA 7	8.8	66.	83.	105.	203.	2050.	1063.	209.	84.	81.	81.	81.	81.	4187.
MPDA 8	11.3	75.	94.	118.	217.	2266.	1166.	239.	93.	90.	90.	90.	90.	4647.
MPDA 9	38.5	254.	323.	402.	790.	7911.	4115.	811.	324.	311.	311.	311.	311.	16176.
MPDA 10	55.4	274.	347.	428.	867.	8274.	4272.	891.	341.	328.	328.	328.	328.	17026.

KELOWNA CR. AVERAGE YEAR (NATURAL FLOW) Figure 11.4

Date of Print-out:
Dec. 7, 1972

LOCATION	AREA IN K. AC.	FLOWS IN AC. FT. J	F	M	A	M	J	J	A	S	O	N	D	YEAR
CPDA 1	5.0	83.	114.	133.	216.	3186.	1782.	261.	127.	114.	114.	114.	114.	6359.
MPDA 1	2.2	36.	49.	62.	103.	1218.	635.	113.	49.	49.	49.	49.	49.	2465.
CPDA 2	1.0	17.	23.	28.	44.	609.	333.	52.	24.	23.	23.	23.	23.	1222.
CPDA 3	0.7	12.	16.	20.	32.	398.	209.	36.	16.	16.	16.	16.	16.	805.
MPDA 2	3.8	65.	80.	105.	163.	1973.	1011.	194.	80.	80.	80.	80.	80.	4012.
MPDA 3	13.9	234.	305.	379.	640.	7931.	4244.	716.	320.	305.	305.	305.	305.	15987.
MPDA 4	20.1	301.	384.	478.	917.	9495.	4964.	953.	387.	372.	372.	372.	372.	19368.
MPDA 5	21.3	310.	396.	491.	962.	9666.	5048.	990.	396.	381.	381.	381.	381.	19802.
CPDA 4	2.9	49.	66.	80.	128.	1771.	968.	151.	71.	66.	66.	66.	66.	3550.
CPDA 5	3.3	56.	76.	91.	147.	1999.	1088.	171.	80.	76.	76.	76.	76.	4010.
MPDA 6	5.1	85.	110.	138.	237.	2836.	1505.	262.	115.	110.	110.	110.	110.	5729.
MPDA 7	8.8	125.	156.	196.	399.	3739.	1920.	400.	154.	149.	149.	149.	149.	7685.
MPDA 8	11.3	147.	183.	227.	491.	4240.	2153.	480.	176.	171.	171.	171.	171.	8782.
MPDA 9	38.5	497.	627.	772.	1642.	14709.	7546.	1629.	608.	588.	588.	588.	588.	30383.
MPDA 10	55.4	593.	744.	891.	2118.	16367.	8259.	2026.	687.	667.	667.	667.	667.	34354.

KELOWNA CR. WET YEAR (NATURAL FLOW)

Figure 11.5

The Postill Lake reservoir impounds water by means of an earth dam, having a spillway at elevation of 4,400 feet and an outlet control with invert at elevation 4,464.5 feet. It is operated by and for both Ellison and Glenmore Irrigation Districts.

Similarly, South Lake reservoir is operated mainly by Glenmore and Ellison Irrigation Districts. Its spillway is at elevation 4517 feet and outlet invert at 4500 feet approximately.

The James (Trapper) Lake reservoir is operated by Scotty Creek Irrigation District. Its spillway and invert elevations are at 4,563.8 and 4,550.0 feet approximately, respectively.

The small Scotty Creek reservoir, spillway elevation 4,520 feet. Is also operated by Scotty Creek Irrigation District.

Hydrologic information on the four reservoirs is given by Table 11.6.

TABLE 11.6
1970 STORAGES IN THE KELOWNA CREEK SYSTEM

Reservoir	Drainage Area (Acres)	Live Storage (Acre-Feet)	Surface Area (Acres)	Annual Natural Runoff (Acre-Feet)		
				Dry Year	Average Year	Wet Year
Postill Lake	5,000	4,063	226	2,466	3,773	6,359
South Lake	1,000	400	25	462	715	1,222
James Lake	2,900	1,112	140	1,343	2,079	3,550
Scotty Creek Reservoir	3,300	140	20	1,510	2,342	4,010
TOTALS	12,200	5,715	411	5,781	8,909	15,141

By 1972, Moore Lake reservoir at the headwaters of Bulman Creek with a storage capacity of 1,000 acre-feet had been added to the system. It is, of course, excluded from calculations pertaining to the year 1970.

With the exception of Postill Lake, the above reservoirs have an annual dry year runoff at least equal to the live storage.

Storages are currently operated in a manner which seems best to the owners for the purposes of irrigation or other consumptive use. Methods of operation are by no means rigid, but generally follow the pattern outlined in Table 11.7.

Photo 43 DOREEN LAKE - Looking South (Sept. 12, 1973)
Vernon Creek System

Photo 44 POSTILL LAKE - Looking South (Sept. 12, 1973)
Kelowna Creek System

TABLE 11.7.

RULE CURVE VALUES FOR KELOWNA CREEK RESERVOIRS

Reservoir Name	Reservoir Capacity	Rule Curve Values Expressed as a Percentage of Reservoir Capacity											
		J	F	M	A	M	J	J	A	S	O	N	D
Postill	4,063	60	60	60	80	100	100	87	73	60	60	60	60
South	400	60	60	60	80	100	100	87	73	60	60	60	60
James	1,112	30	30	30	50	100	100	77	53	30	30	30	30
Scotty	140	0	0	0	0	100	100	67	33	0	0	0	0
TOTAL	5,715												

EXPLANATION: For any given month -

1) Percentages shown refer to active storage occupied by water at end of month. e.g. 30% storage occupied by water at end of March.
2) When rule curve value is exceeded, all excess water is released.
3) When rule curve value is not achieved, only stated water requirements are released.
4) Information based on local records of water users for period 1964 to 1971.

The above rule curve values have been used in computer programming for the production of print-outs showing regulated flows.

At the 1970 stage of development little or no consideration is given to the operation of storage for Fisheries or other non-consumptive use.

11.5.1 Residual Flows

When natural flow is affected by storage changes, diversions to or from the area and withdrawals for irrigation, domestic or industrial purposes, the resulting flow is called the "residual flow". These regulated flows, for various selected points and three types of weather year are shown on computer print-outs. They are reproduced as Figure 11.6 (Dry Year), Figure 11.7 (Average Year), and Figure 11.8 (Wet Year).

Reference to these figures will show that residual flows immediately upstream and immediately downstream from the selected point are given. The difference is the amount diverted at the point for consumptive use. It will be noted that a consumptive "demand deficiency" is recorded for August and

Date of Print-out:
Dec. 4, 1972

STORAGES GIVEN ARE FOR THE END OF THE MONTH
UNITS FOR DEMANDS, STORAGES, FLOWS, AND DEFICIENCIES ARE ACRE FEET

		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	ANNUAL
CONTROL POINT	1													
STORAGE		2438.	2438.	2438.	2520.	3757.	3587.	1333.	0.	0.	44.	88.	132.	
CONTROL POINT	2													
STORAGE		240.	240.	240.	257.	400.	0.	0.	0.	0.	9.	18.	27.	
CONTROL POINT	4													
STORAGE		334.	334.	334.	362.	1053.	1086.	804.	0.	0.	25.	50.	75.	
CONTROL POINT	5													
STORAGE		0.	0.	0.	0.	82.	0.	0.	0.	0.	0.	0.	0.	
MEASURING POINT	3													
FLOW		84.	112.	136.	131.	1537.	2223.	2433.	1450.	112.	59.	59.	59.	8395.
DEFICIENCY		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	
MEASURING POINT	8													
FLOW		43.	56.	69.	84.	188.	56.	14.	3.	3.	28.	28.	28.	599.
DEFICIENCY		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	
MEASURING POINT	10													
FLOW		151.	195.	242.	312.	803.	33.	13.	3.	3.	111.	111.	111.	2088.
DEFICIENCY (FISH)		89.	45.	0.	0.	0.	207.	227.	237.	237.	189.	129.	129.	1489.
USE POINT	1													
DEMAND, IRRIGATION		0.	0.	0.	0.	240.	401.	401.	401.	160.	0.	0.	0.	1603.
DEMAND, DOMESTIC		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DEMAND, INDUSTRIAL		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DEMAND, TOTAL		0.	0.	0.	0.	240.	401.	401.	401.	160.	0.	0.	0.	1603.
FLOW, UPSTREAM		99.	130.	160.	190.	1921.	2404.	2484.	1466.	128.	75.	75.	75.	9207.
FLOW, DOWNSTREAM		99.	130.	160.	190.	1681.	2003.	2083.	1065.	0.	75.	75.	75.	7636.
DEMAND, DEFICIENCY		0.	0.	0.	0.	0.	0.	0.	0.	32.	0.	0.	0.	32.
DEFICIENCY		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	
USE POINT	2													
DEMAND, IRRIGATION		0.	0.	0.	0.	706.	1177.	1177.	1177.	471.	0.	0.	0.	4708.
DEMAND, DOMESTIC		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DEMAND, INDUSTRIAL		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DEMAND, TOTAL		0.	0.	0.	0.	706.	1177.	1177.	1177.	471.	0.	0.	0.	4708.
FLOW, UPSTREAM		(SAME AS UP 3)												
FLOW, DOWNSTREAM														
DEMAND, DEFICIENCY														
DEFICIENCY														
USE POINT	3													
DEMAND, IRRIGATION		0.	0.	0.	0.	314.	524.	524.	524.	210.	0.	0.	0.	2096.
DEMAND, DOMESTIC		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DEMAND, INDUSTRIAL		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DEMAND, TOTAL		0.	0.	0.	0.	314.	524.	524.	524.	210.	0.	0.	0.	2096.
FLOW, UPSTREAM		108.	132.	162.	196.	1712.	2017.	2088.	1065.	1.	76.	76.	76.	7702.
FLOW, DOWNSTREAM		100.	132.	162.	196.	692.	316.	387.	0.	0.	76.	76.	76.	2213.
DEMAND, DEFICIENCY		0.	0.	0.	0.	0.	0.	0.	635.	680.	0.	0.	0.	1315.
DEFICIENCY (FISH)		140.	108.	78.	44.	0.	0.	0.	240.	240.	224.	164.	164.	1402.
USE POINT	4													
DEMAND, IRRIGATION		0.	0.	0.	0.	206.	343.	343.	343.	137.	0.	0.	0.	1372.
DEMAND, DOMESTIC		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DEMAND, INDUSTRIAL		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DEMAND, TOTAL		0.	0.	0.	0.	206.	343.	343.	343.	137.	0.	0.	0.	1372.
FLOW, UPSTREAM		30.	39.	49.	36.	239.	601.	675.	545.	39.	14.	14.	14.	2335.
FLOW, DOWNSTREAM		30.	39.	49.	36.	73.	258.	332.	202.	0.	14.	14.	14.	1061.
DEMAND, DEFICIENCY		0.	0.	0.	0.	0.	0.	0.	0.	98.	0.	0.	0.	98.
DEFICIENCY		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	
USE POINT	5													
DEMAND, IRRIGATION		0.	0.	0.	0.	217.	361.	361.	361.	145.	0.	0.	0.	1445.
DEMAND, DOMESTIC		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DEMAND, INDUSTRIAL		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DEMAND, TOTAL		0.	0.	0.	0.	217.	361.	361.	361.	145.	0.	0.	0.	1445.
FLOW, UPSTREAM		39.	49.	62.	69.	292.	361.	361.	211.	9.	23.	23.	23.	1522.
FLOW, DOWNSTREAM		39.	49.	62.	69.	75.	0.	0.	0.	0.	23.	23.	23.	363.
DEMAND, DEFICIENCY		0.	0.	0.	0.	0.	0.	0.	150.	136.	0.	0.	0.	286.
DEFICIENCY		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	
USE POINT	6													
DEMAND, IRRIGATION		0.	0.	0.	0.	250.	416.	416.	416.	166.	0.	0.	0.	1664.
DEMAND, DOMESTIC		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DEMAND, INDUSTRIAL		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DEMAND, TOTAL		0.	0.	0.	0.	250.	416.	416.	416.	166.	0.	0.	0.	1664.
FLOW, UPSTREAM		148.	191.	237.	297.	979.	416.	416.	9.	9.	108.	108.	108.	3076.
FLOW, DOWNSTREAM		148.	191.	237.	297.	729.	0.	0.	0.	0.	108.	108.	108.	1926.
DEMAND, DEFICIENCY		0.	0.	0.	0.	0.	0.	0.	407.	157.	0.	0.	0.	564.
DEFICIENCY (FISH)		92.	49.	3.	0.	0.	240.	240.	240.	240.	192.	132.	132.	1560.
GRAND TOTALS FOR ALL THE USE POINTS!														
DEMAND, IRRIGATION		0.	0.	0.	0.	1933.	3222.	3222.	3222.	1289.	0.	0.	0.	12888.
DEMAND, DOMESTIC		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DEMAND, INDUSTRIAL		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DEMAND, TOTAL		0.	0.	0.	0.	1933.	3222.	3222.	3222.	1289.	0.	0.	0.	12888.
DEMAND, DEFICIENCY		0.	0.	0.	0.	0.	0.	0.	1193.	1103.	0.	0.	0.	2296.

KELOWNA CR. DRY YEAR (1970)

Figure 11.6

Date of Print-out:
Dec. 4, 1972

STORAGES GIVEN ARE FOR THE END OF THE MONTH
UNITS FOR DEMANDS, STORAGES, FLOWS, AND DEFICIENCIES ARE ACRE FEET

		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	ANNUAL
CONTROL POINT	1													
STORAGE		2438.	2438.	2438.	2565.	4063.	4063.	2547.	268.	0.	67.	134.	201.	
CONTROL POINT	2													
STORAGE		240.	240.	240.	266.	400.	400.	0.	0.	0.	13.	26.	39.	
CONTROL POINT	4													
STORAGE		334.	334.	334.	409.	1112.	1112.	757.	137.	0.	39.	78.	117.	
CONTROL POINT	5													
STORAGE		0.	0.	0.	0.	130.	140.	0.	0.	0.	0.	0.	0.	
MEASURING POINT	3													
FLOW		134.	174.	217.	211.	2948.	2459.	2326.	2463.	442.	94.	94.	94.	11056.
DEFICIENCY		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	
MEASURING POINT	8													
FLOW		75.	93.	118.	162.	1010.	452.	30.	9.	9.	51.	51.	51.	2111.
DEFICIENCY		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	
MEASURING POINT	10													
FLOW		276.	345.	428.	658.	3839.	1040.	80.	17.	17.	208.	208.	208.	7324.
DEFICIENCY (FISH)		0.	0.	0.	0.	0.	0.	160.	223.	223.	92.	32.	32.	762.
USE POINT	1													
DEMAND, IRRIGATION		0.	0.	0.	0.	240.	401.	401.	401.	160.	0.	0.	0.	1803.
DEMAND, DOMESTIC		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DEMAND, INDUSTRIAL		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DEMAND, TOTAL		0.	0.	0.	0.	240.	401.	401.	401.	160.	0.	0.	0.	1803.
FLOW, UPSTREAM		165.	210.	263.	332.	3688.	2803.	2431.	2495.	474.	126.	126.	126.	13239.
FLOW, DOWNSTREAM		165.	210.	263.	332.	3448.	2402.	2030.	2094.	314.	126.	126.	126.	11036.
DEMAND, DEFICIENCY		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DEFICIENCY		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	
USE POINT	2													
DEMAND, IRRIGATION		0.	0.	0.	0.	706.	1177.	1177.	1177.	471.	0.	0.	0.	4708.
DEMAND, DOMESTIC		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DEMAND, INDUSTRIAL		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DEMAND, TOTAL		0.	0.	0.	0.	706.	1177.	1177.	1177.	471.	0.	0.	0.	4708.
FLOW, UPSTREAM		(SAME AS UP 3)												
FLOW, DOWNSTREAM														
DEMAND, DEFICIENCY														
DEFICIENCY														
USE POINT	3													
DEMAND, IRRIGATION		0.	0.	0.	0.	314.	524.	524.	524.	210.	0.	0.	0.	2096.
DEMAND, DOMESTIC		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DEMAND, INDUSTRIAL		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DEMAND, TOTAL		0.	0.	0.	0.	314.	524.	524.	524.	210.	0.	0.	0.	2096.
FLOW, UPSTREAM		168.	214.	268.	347.	3519.	2434.	2042.	2097.	317.	129.	129.	129.	11795.
FLOW, DOWNSTREAM		168.	214.	268.	347.	2499.	733.	341.	396.	0.	129.	129.	129.	5353.
DEMAND, DEFICIENCY		0.	0.	0.	0.	0.	0.	0.	0.	364.	0.	0.	0.	364.
DEFICIENCY (FISH)		72.	26.	0.	0.	0.	0.	0.	0.	240.	171.	111.	111.	731.
USE POINT	4													
DEMAND, IRRIGATION		0.	0.	0.	0.	206.	343.	343.	343.	137.	0.	0.	0.	1372.
DEMAND, DOMESTIC		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DEMAND, INDUSTRIAL		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DEMAND, TOTAL		0.	0.	0.	0.	206.	343.	343.	343.	137.	0.	0.	0.	1372.
FLOW, UPSTREAM		48.	63.	79.	60.	795.	857.	644.	686.	200.	24.	24.	24.	2508.
FLOW, DOWNSTREAM		48.	63.	79.	60.	589.	514.	301.	343.	63.	24.	24.	24.	2132.
DEMAND, DEFICIENCY		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DEFICIENCY		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	
USE POINT	5													
DEMAND, IRRIGATION		0.	0.	0.	0.	217.	361.	361.	361.	145.	0.	0.	0.	1445.
DEMAND, DOMESTIC		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DEMAND, INDUSTRIAL		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DEMAND, TOTAL		0.	0.	0.	0.	217.	361.	361.	361.	145.	0.	0.	0.	1445.
FLOW, UPSTREAM		86.	83.	105.	129.	1010.	710.	361.	361.	81.	42.	42.	42.	3832.
FLOW, DOWNSTREAM		86.	83.	105.	129.	793.	349.	0.	0.	0.	42.	42.	42.	1651.
DEMAND, DEFICIENCY		0.	0.	0.	0.	0.	0.	0.	0.	64.	0.	0.	0.	64.
DEFICIENCY		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	
USE POINT	6													
DEMAND, IRRIGATION		0.	0.	0.	0.	250.	416.	416.	416.	166.	0.	0.	0.	1664.
DEMAND, DOMESTIC		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DEMAND, INDUSTRIAL		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DEMAND, TOTAL		0.	0.	0.	0.	250.	416.	416.	416.	166.	0.	0.	0.	1664.
FLOW, UPSTREAM		256.	321.	403.	562.	3763.	1299.	416.	416.	20.	191.	191.	191.	8029.
FLOW, DOWNSTREAM		256.	321.	403.	562.	3513.	883.	0.	0.	0.	191.	191.	191.	6511.
DEMAND, DEFICIENCY		0.	0.	0.	0.	0.	0.	0.	0.	146.	0.	0.	0.	146.
DEFICIENCY (FISH)		0.	0.	0.	0.	0.	0.	240.	240.	240.	109.	49.	49.	927.
GRAND TOTALS FOR ALL THE USE POINTS:														
DEMAND, IRRIGATION		0.	0.	0.	0.	1933.	3222.	3222.	3222.	1289.	0.	0.	0.	12888.
DEMAND, DOMESTIC		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DEMAND, INDUSTRIAL		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DEMAND, TOTAL		0.	0.	0.	0.	1933.	3222.	3222.	3222.	1289.	0.	0.	0.	12888.
DEMAND, DEFICIENCY		0.	0.	0.	0.	0.	0.	0.	0.	574.	0.	0.	0.	574.

KELOWNA CR. AVERAGE YEAR (1970)

Figure 11.7

Date of Print-out:
Dec. 4, 1972

STORAGES GIVEN ARE FOR THE END OF THE MONTH
UNITS FOR DEMANDS, STORAGES, FLOWS, AND DEFICIENCIES ARE ACRE FEET

		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	ANNUAL
CONTROL POINT STORAGE	1	2438.	2438.	2438.	2654.	4063.	4063.	3174.	1110.	542.	656.	770.	884.	
CONTROL POINT STORAGE	2	240.	240.	240.	284.	400.	400.	0.	0.	0.	23.	46.	69.	
CONTROL POINT STORAGE	4	334.	334.	334.	462.	1112.	1112.	856.	397.	263.	329.	334.	334.	
CONTROL POINT STORAGE	5	0.	0.	0.	0.	140.	140.	92.	0.	0.	0.	0.	0.	
MEASURING POINT FLOW	3	235.	304.	378.	379.	6406.	4244.	2005.	2393.	872.	167.	167.	167.	17707.
DEFICIENCY		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	
MEASURING POINT FLOW	8	147.	182.	228.	362.	3078.	1450.	80.	22.	22.	104.	165.	170.	5960.
DEFICIENCY		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	
MEASURING POINT FLOW	10	595.	742.	891.	1729.	12118.	5038.	397.	79.	79.	463.	924.	529.	23184.
DEFICIENCY (FISH)		0.	0.	0.	0.	0.	0.	0.	161.	161.	0.	0.	0.	322.
USE POINT	1													
DEMAND, IRRIGATION		0.	0.	0.	0.	240.	401.	401.	401.	160.	0.	0.	0.	1603.
DEMAND, DOMESTIC		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DEMAND, INDUSTRIAL		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DEMAND, TOTAL		0.	0.	0.	0.	240.	401.	401.	401.	160.	0.	0.	0.	1603.
FLOW, UPSTREAM		302.	384.	477.	656.	7969.	4964.	2242.	2451.	980.	235.	235.	235.	21090.
FLOW, DOWNSTREAM		302.	384.	477.	656.	7729.	4563.	1841.	2050.	780.	235.	235.	235.	19487.
DEMAND, DEFICIENCY		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DEFICIENCY		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	
USE POINT	2													
DEMAND, IRRIGATION		0.	0.	0.	0.	706.	1177.	1177.	1177.	471.	0.	0.	0.	4708.
DEMAND, DOMESTIC		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DEMAND, INDUSTRIAL		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DEMAND, TOTAL		0.	0.	0.	0.	706.	1177.	1177.	1177.	471.	0.	0.	0.	4708.
FLOW, UPSTREAM														
FLOW, DOWNSTREAM		(SAME AS UP 3)												
DEMAND, DEFICIENCY														
DEFICIENCY														
USE POINT	3													
DEMAND, IRRIGATION		0.	0.	0.	0.	314.	524.	524.	524.	210.	0.	0.	0.	2096.
DEMAND, DOMESTIC		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DEMAND, INDUSTRIAL		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DEMAND, TOTAL		0.	0.	0.	0.	314.	524.	524.	524.	210.	0.	0.	0.	2096.
FLOW, UPSTREAM		311.	396.	490.	701.	7920.	4647.	1878.	2059.	790.	244.	244.	244.	19923.
FLOW, DOWNSTREAM		311.	396.	490.	701.	6900.	2946.	177.	358.	108.	244.	244.	244.	13119.
DEMAND, DEFICIENCY		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DEFICIENCY (FISH)		0.	0.	0.	0.	0.	0.	63.	0.	132.	56.	0.	0.	251.
USE POINT	4													
DEMAND, IRRIGATION		0.	0.	0.	0.	206.	343.	343.	343.	137.	0.	0.	0.	1372.
DEMAND, DOMESTIC		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DEMAND, INDUSTRIAL		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DEMAND, TOTAL		0.	0.	0.	0.	206.	343.	343.	343.	137.	0.	0.	0.	1372.
FLOW, UPSTREAM		86.	110.	138.	108.	2047.	1506.	566.	665.	243.	43.	104.	109.	5725.
FLOW, DOWNSTREAM		86.	110.	138.	108.	1841.	1163.	223.	322.	106.	43.	104.	109.	4353.
DEMAND, DEFICIENCY		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DEFICIENCY		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	
USE POINT	5													
DEMAND, IRRIGATION		0.	0.	0.	0.	217.	361.	361.	361.	145.	0.	0.	0.	1445.
DEMAND, DOMESTIC		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DEMAND, INDUSTRIAL		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DEMAND, TOTAL		0.	0.	0.	0.	217.	361.	361.	361.	145.	0.	0.	0.	1445.
FLOW, UPSTREAM		125.	156.	196.	270.	2744.	1578.	361.	361.	145.	82.	143.	148.	6309.
FLOW, DOWNSTREAM		125.	156.	196.	270.	2527.	1217.	0.	0.	0.	82.	143.	148.	4864.
DEMAND, DEFICIENCY		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DEFICIENCY		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	
USE POINT	6													
DEMAND, IRRIGATION		0.	0.	0.	0.	250.	416.	416.	416.	166.	0.	0.	0.	1664.
DEMAND, DOMESTIC		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DEMAND, INDUSTRIAL		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DEMAND, TOTAL		0.	0.	0.	0.	250.	416.	416.	416.	166.	0.	0.	0.	1664.
FLOW, UPSTREAM		500.	626.	772.	1253.	10710.	4741.	416.	416.	166.	384.	445.	450.	20872.
FLOW, DOWNSTREAM		500.	626.	772.	1253.	10460.	4325.	0.	0.	0.	384.	445.	450.	19215.
DEMAND, DEFICIENCY		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DEFICIENCY (FISH)		0.	0.	0.	0.	0.	0.	240.	240.	240.	0.	0.	0.	720.
GRAND TOTALS FOR ALL THE USE POINTS!														
DEMAND, IRRIGATION		0.	0.	0.	0.	1933.	3222.	3222.	3222.	1289.	0.	0.	0.	12888.
DEMAND, DOMESTIC		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DEMAND, INDUSTRIAL		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
DEMAND, TOTAL		0.	0.	0.	0.	1933.	3222.	3222.	3222.	1289.	0.	0.	0.	12888.
DEMAND, DEFICIENCY		0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.

KELOWNA CR. WET YEAR (1970) Figure 11.8

September at UP 3, UP 5, and UP 6 for a "dry" and "average" year. This indicates the estimated shortage of consumptive use water at those points and also a dry creek bed.

A column registering "deficiency (fish)" will also be noted. This records the amount by which the residual stream flow falls short of a roughly estimated desirable minimum. For Kelowna Creek, minimum flow requirements are estimated to be 240 acre-feet per month for all months, except May and October, when the desirable residual flow is increased to 300 acre-feet per month.

Consumptive and non-consumptive water deficiencies are shown graphically in the diagrams on Figure 11.9. The consumptive use deficiencies are shown to approach 60 to 80 percent of actual demand. This is due primarily to large diversions to Glenmore Irrigation District and would be relieved, by 1972, by Moore Lake reservoir, (CP3).

Non-consumptive (fisheries) deficiencies are evident in nearly all but the freshet months. The results of an attempt at theoretical modification of storage operation is also shown in Figure 11.9. As will be seen, considerable improvements are possible, but in the rough modification attempted, an undesirable result was for the depletion of available water for irr-gation purposes.

A detailed look at water deficiencies under the present method of operation is provided by the hydrographs on Figure 11.10.

In conclusion, the contribution which Kelowna Creek makes to the gross inflow to Okanagan Lake may be evaluated for various types of year as shown on Table 11.8.

TABLE 11.8

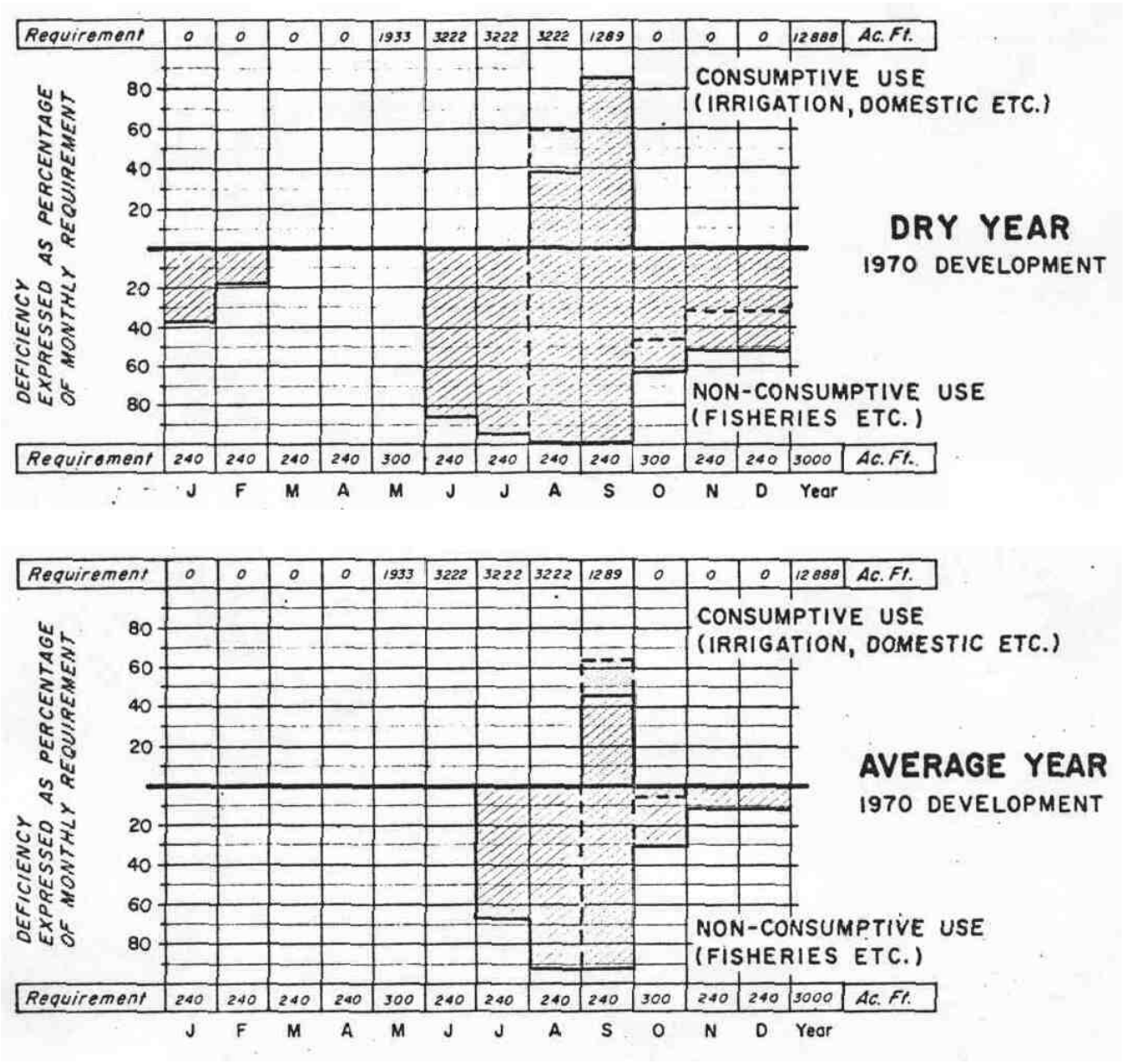
COMPARISON BETWEEN ESTIMATED INFLOWS

to

KELOWNA CREEK AND OKANAGAN LAKE

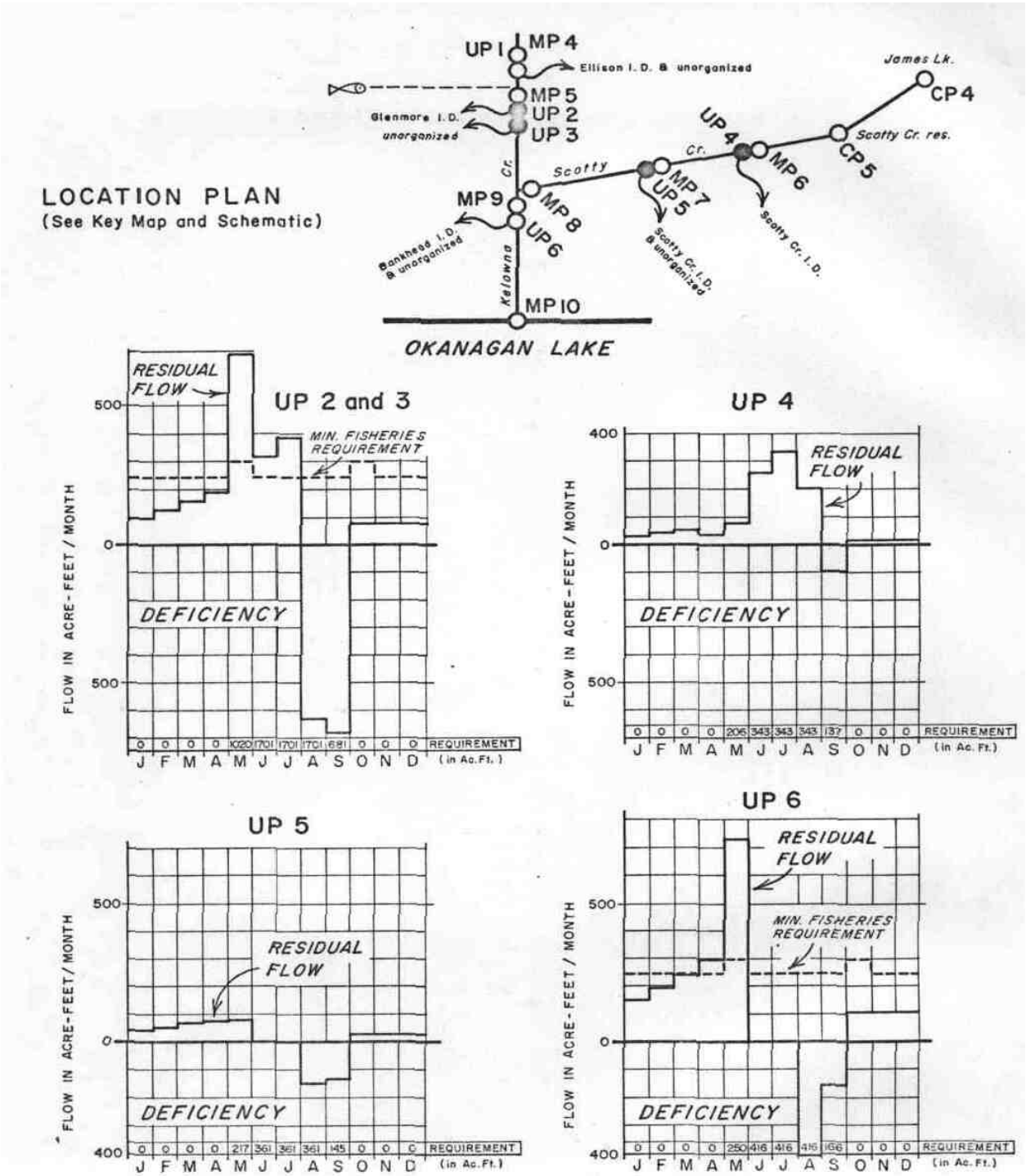
Type of Year	Inflow to Okanagan Lake from Kelowna Creek* (acre-feet)	Total Tributary Inflow to Okanagan Lake from All Sources* (acre-feet)	Percentage Contribution by Kelowna Creek to Okanagan Lake Inflow
Dry	2,100	279,200	0.8
Average	7,300	576,000	1.4
Wet	23,200	796,700	2.9

* Regulated Flows at 1970 Development.



NOTES: 1. Consumptive Use deficiencies are totals for whole basin.
2. Non-Consumptive deficiencies are those extant at creek mouth.
3. In a Wet Year, a *fisheries deficiency* of 161 (Hist) / 0 (Mod) ac. ft. exists at mouth in each Aug. & Sept.

KELOWNA CR. (1970) DEFICIENCY DIAGRAM Figure 11.9



CONSUMPTIVE USE DEFICIENCY IN
DRY YEAR (1970)

DEFICIENCY HYDROGRAPHS
KELOWNA CREEK Figure 11.10