CHAPTER 19

Conclusions

19.1 OBJECTIVES

The water quantity studies described in this Technical Supplement and Technical Supplement 3 - Water Quantity data were carried out to meet the following objectives contained in the Canada— British Columbia Okanagan Basin Agreement namely:

a) To evaluate the existing hydrologic regime of the Basin.
b) To evaluate means of regulating flows through storage and diversion.
c) To evaluate means of augmenting and conserving the surface water supply within the Okanagan Basin.

The conclusions which follow are based for the most part on the data presented in this report. However, where necessary additional evaluation data contained in Technical Supplement 3 has been referred to in order to provide a more comprehensive summary.

19.2 EXISTING HYDROLOGIC REGIME

A definition of the existing hydro-regime of the Basin required not only the determination of the total net inflow each year over the study period 1921 to 1970 inclusive, but also a breakdown of this flow according to principle tributaries and within each tributary according to elevation. At the start of the study it was recognized that such details could not be obtained accurately from existing records, and that if a reasonable understanding of the hydrological regime of the Basin was to be realized, improvements to the existing hydrometric and meteorological networks were required. Such instrumentation has been carried out and arrangements have been made for the continuation of this monitoring after the end of the study on March 31, 1974 with a proviso that it receive a further review in 1980.

It is fortunate that during the period of the study (October 1969 to March 1974) some extreme hydrological events occurred including a drought year in 1970, and a flood year in 1972.

This recent data has provided the opportunity to check the results obtained from simulated monthly inflow models which supply data on the average precipitation, evaporation, evapotranspiration and runoff for each point on a five kilometre grid over the whole basin.

An additional tributary model was also developed based on runoff from 500 foot elevation bands to simulate natural monthly flows for dry, average and wet years at a number of points on each stream. These first estimates of natural flows as well as the grid square modelling are described in detail in Technical Supplement II - Water Quantity Computer Models while the results are contained in part in this Technical Supplement. However, for a complete set of data the reader is referred to Technical Supplement III - Water Quantity Data.

19.3 MEANS OF REGULATION THROUGH STORAGE AND DIVERSION

While the major portion of the water consumed is diverted from tributary sources and amounts to about 20% of the net inflow to Okanagan Lake the latter provides the major regulation for the Basin with respect to flood control. and water conservation.

Water quantity modelling of the reservoir over the 50 year study period assuming present day structural arrangements and present day (1970) water requirements has provided a monthly tabulation of simulated Okanagan Lake elevations and Okanagan River discharges at Penticton and Oliver.

Alternative methods of operating this mainstem system using the historic net inflows modified by present day use have been compared with the above mentioned basic model to arrive at the benefits and disbenefits of the particular operation. This Technical Supplement covers only the basic model under present day requirements while Technical Supplement 3 provides computer data for the various alternatives.

Conclusions are that water supplies in the principle tributaries are sufficient to meet a two year drought providing the normal practice is observed where approximately 50% of storage is carried over in headwater reservoirs. However, a repetition of the three year 1929-32 drought would result in severe shortages under present day development. The tributary studies have been limited to water conservation measures and the problem of floods have not been assessed other than to derive the probable monthly flood flows.

Some 244,000 acre-feet of water (exclusive of evaporation from Okanagan Lake) are required each year along the mainstem Okanagan River (Okanagan Lake to Osoyoos Lake) to meet non-consumptive uses including recreation, fisheries and aesthetic needs. Only about 32,000 acre-feet of this are required for consumptive uses while 212,000 are needed to meet evaporation losses from Skaha and Osoyoos Lake as well as minimum flow requirements for intake submergence, flushing, aesthetics and Salmon fishery flows.

Net inflows to Okanagan Lake of less than 244,000 referred to as drought years in this report occur on the average about one year in four. The occurrence of a drought year does not necessarily mean a water shortage because it has been assumed that Okanagan Lake could be drawn down as necessary to meet these requirements.

The basic model has been operated according to the above assumption over the 50 year study period which includes the most severe drought of this century namely 1929-1932. Under these extreme conditions Okanagan Lake would drop below its normal low water elevation of 1119.8 in August 1930, remain below this elevation for the next 18 months reaching a minimum elevation of 1116.6 feet in February 1932 and not regaining its normal summer elevation of 1122 feet until June 1933. Only one such drought has occurred in this century and because of its infrequent occurrence (estimated at one year in 200) the average annual damage is not significant.

Public opinion as expressed through the media and through various public task forces have indicated their preference for the towering of Okanagan Lake rather than the importation of water in drought years which would maintain Okanagan Lake elevations.

The Mainstem model has also been operated through the 1928 and 1948 floods resulting in maximum elevations of some 0.9 and 0.5 feet respectively above the normal high water elevation of 1123.8 feet. This compares with the 1972 flood when Okanagan Lake exceeded its high water elevation by 0.9 feet. The volume of the April to July inclusive inflow in 1972 of nearly 700,000 acre-feet has an average re-occurrence interval of one year in 70.

Structural improvements to existing intakes, dams and river channels which will allow water conservation in drought years through reduced residual flows and improve flood control measures through higher sustained discharges are discussed in Technical Supplement 3.

Equivalent measures of water conservation and flood control on Osoyoos Lake are not available because of the limited control at the Zosel Dam at Oroville, Washington. Moreover, it is not economically feasible to build the large flood storage necessary on the Similkameen to reduce to eliminate the high water in the lower Okanagan River which obstructs the outflow from Osoyoos Lake.

The Zosel Dam is of no value for flood control because of its very limited control range and even under normal water elevations appears to lose considerable water through seepage. Hence, the maintenance of desirable

elevations in Osoyoos Lake under drought conditions when water must be conserved is difficult.

19.4 MEANS OF AUGMENTING AND CONSERVING SURFACE MATER SUPPLIES

Two means of augmenting the surface water supply within the Basin have been investigated - namely ground water and vegetation management.

19.4.1 Ground Water (Section B of Technical Supplement 1)

Groundwater investigations in 1971 included the testing of a number of wells drilled during the previous year under the Study program. The prime objective of this work was to determine whether ground water represents an appreciable source should surface water supplies be found inadequate or too expensive to meet present and future demands in the Okanagan Basin.

This work was concentrated in the northeast portion of the Basin in the area between the north arm of Okanagan Lake and the Shuswap River at Enderby, and in the O'Keefe Valley. The results of seismic soundings and deep well drilling, followed by selected well tests, gave no indication of any substantial groundwater inflow from the Shuswap River into the Okanagan Basin.

It is difficult to state with any degree of accuracy the actual amount of groundwater available in the North Okanagan. The general conclusion can be drawn that there is sufficient for small local domestic and waterworks purposes. However, there is not enough for irrigation or to provide a supplementary water supply to Okanagan Lake in an drought period even assuming groundwater withdrawals far in excess of the annual recharge capability.

19.4.2 Vegetation Management

A study of the effects of watershed deforestation on Pearson Creek and Tree Farm Licence No. 13 (both within the Okanagan Lake Basin) indicate that there may be some temporary increases in local yield but if totalled it is not of significant amount when compared to the requirements of the Basin. Further, the reliability and predictability of these increases are not adequate for water supply planning purposes.

19.4.3 Improved Inflow Forecasts to Okanagan Lake

More accurate inflow forecasts would in effect augment surface supplies by providing more efficient management of water stored in Okanagan Lake. Such forecasts should include both the volume and timing of inflow expected during spring freshet.

Water quantity budgeting models which integrate all the physical data available at any time during the freshet period and which provide both short and long term forecasts have been tried as outlined in Technical Supplement 2. While they have been of limited success, they do point out the need for better understanding of the hydrological cycle, particularly with respect to soil moisture, precipitation, evaporation and evapotranspiration.

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Mr. T.A.J. Leach assisted by Messrs. H.I. Hunter, A.R.D. Robertson and W.W.K. Smyth supervised the surface water supplies while Dr. J.C. Foweraker and Mr. E.G. Le Breton coordinated the groundwater studies. Other participating groundwater authors included Mr. P.L. Hall, Water Investigations Branch and Mr. E.G. Halstead, Inland Waters Branch, Environment Canada.

Contributors within the Water Investigations Branch included Mr. W. Obedkoff who developed the grid square precipitation runoff model for the whole basin and Mr. D.E. Reksten who investigated the relationship between runoff and basin characteristics and climatic data. Computer modelling for the tributaries was developed by Mr. J.G. Zalanfy while Mr. R. Wyman set up the basic modelling for the grid square approach as well as the inflow forecasting model.

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Investigations Branch established a number of new meteorological stations in the basin during the early part of the Study.

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