-No permission required.
-historical aquifer mapping and groundwater/ hydrogeology characterization (good background).
add to NTS.

INVESTIGATION NORTH OKANAGAN

WATER REQUIREMENTS

GROUND WATER STUDIES

by H. Nasmith
Dept. of Mines,
Victoria.

January, 1959.

PREFACE

This Problem was presented to Mr. H. Nasnith, as part of the Investigations for the North Okanagan Water Requirements, being made by the Water Rights Branch in the period 1958 - '59.

Mr. Nasmith has for many years made a study of groundwater conditi in various parts of the Province, and undertook compilation of this repo in his spare time.

The Branch therefore express their gratitude to Mr. Nasmith for th preparation of this report.

Hedley K. Joyce,
Hydraulic Engineer,
Water Rights Branch.

CONTENTS

THE PROBLEM

1. To advise qualitatively, whether any ground water reservoirs, aquifers etc, exist which could be utilized to provide water, for any portion or portions of the area delineated on Drg. #4253, sufficient for:

   (a) For domestic, municipal and livestock requirements, and /or

   (b) For irrigation requirements.

2. If so, what further investigations would be required to provide a quantitative answer, and at approximately what cost.

INTRODUCTION

This brief report is an attempt to answer the questions posed in the letter from Hedley Joyce of the Water Rights Branch, a copy of which is attached to this report.

The groundwater conditions in any area are a function of a variety of factors, the two most important of which are the climate and the local geologic conditions. The total amount of precipitation, its form, the distribution of the precipitation throughout the year, factors of evaporation and use of water by plants, govern the total amount of water which is available for infiltration to groundwater reservoirs. The groundwater reservoirs in which the surplus precipitation is stored and from which it can be withdrawn by wells, are a function of the local geologic conditions.

The north Okanagan Valley is an area of moderate to low rainfall, the climate is essentially transitional between the semi-desert climate in the south Okanagan and the high precipitation of areas to the north and east of the Okanagan Valley. In general, there is probably little surplus precipitation to infiltrate to groundwater reservoirs in the north Okanagan Valley. Replenishment of groundwater reservoirs is therefore largely accomplished by infiltration from surface streams which bring excess precipitation from the areas of high precipitation on the plateau and the mountainous areas to the north and east. Because surface streams are the main source of groundwater infiltration, the majority of groundwater reservoirs are adjacent to the streams and usually consist of sands and gravels deposited by the stream itself. Although there are abundant gravel and sand deposits laid down during late stages of glaciation in the north Okanagan, only those adjacent to streams from which groundwater can be infiltrated and which are also near the valley bottom and accordingly not too rapidly drained, can supply a useful supply of groundwater. In addition, large parts of the valley bottom are mantled by thick silt deposits laid down in post-glacial lakes. These silt deposits are fine grained and it is not possible to obtain water supplies from them by means of wells.

These factors of geology and climate, therefore, eliminate large areas of the north Okanagan as potential groundwater areas. The potential groundwater reservoirs in the north Okanagan are either alluvial stream deposits adjacent to present streams, or glacial gravels deeply buried beneath the post-glacial lacustrine deposits in the Valley bottom.

Domestic and livestock requirements for water can be supplied either by individual wells or by some form of communal water system. I think it can be assumed that in well established farming districts, sufficient groundwater investigations have been made by the farmers themselves in the form of drilled or dug wells to establish the presence or absence of readily accessible groundwater aquifers and that studies in such areas should be conducted not with the hope of finding new aquifers, which can be utilized by individual wells, but rather merely to gain information with which to assess the possibilities of obtaining a well to supply a communal system.

Municipal and irrigation water requirements imply the development of some communal water system. Two types of investigations are required to evaluate the feasibility of utilizing groundwater as a source for such a communal water system. In the first place, the need for/and the economics of such a water system should be investigated to determine whether such a system is economically feasible at the present time. If such a system is found to be economically feasible and desirable at the present time, the possibility of using groundwater as a source can be further investigated, first by a rapid reconnaisance of possible groundwater sources within the economic area of the proposed system and second by means of test drilling or other subsurface investigation. Present knowledge of groundwater conditions in the North Okanagan is probably adequate at the present time to point out possible groundwater reservoirs within any area of interest. Drilling and other types of subsurface investigation are much more expensive and cannot generally be undertaken until the economic feasibility and need for a communal water system is established. Extremely rapid changes in subsoil occur within short distances even in areas where there are favourable indications of ground water. If any test drilling is undertaken the location should be examined in the field before drilling is started even though the general area is believed to be favourable.

The following notes give a brief discussion of the areas delineated on your Map, Dwg. 4253.

Area A1: Groundwater may be available from shallow alluvial deposits on the flood plains of Cherry Creek and the Shuswap River. If direct pumping from either Shuswap River or Cherry Creek was found to be undesirable, a brief investigation of dug wells in any area of interest would probably give sufficient information to assess the feasibility of a development similar to that at Lumby.

Area A2: I have no specific information on this area, but the soils map indicates that the land adjacent to the Shuswap River in this area is underlain by a clay sub-soil. Possibly there are shallow alluvial gravels on top of this clay in places and if it was found uneconomic to pump from the river, a rapid reconnaisance should indicate whether or not shallow gravel deposits are present.

Area A3: I have only limited information on this area. East of Enderby there are gravelly deposits in the narrow valley adjacent to the Shuswap River and possibly water could be obtained from these gravel deposits. However, pumping directly from the river would have to be considered as an alternative possibility. North of Enderby, the land adjacent to the Shuswap River is reported to be underlain by a clay or silty sub-soil. Locally there may be shallow gravel deposits on top of the clay sub-soil. A reconnaisance of the wells used by farms in this area could probably give information on this matter. For a large development, however, it would probably be simpler to draw water directly from the Shuswap River.

Area B1: This area includes the town of Lumby, where a water well was drilled in 1954. This well obtained about 25 gallons per minute from a gravel aquifer at a depth of110 to 115 feet. (See log of this drilling attached). The water had an objectionable smell and taste, due to the presence of dissolved hydrogen sulphide and would have required considerable treatment to make it acceptable for a domestic water system. The quantity of water provided from this relatively thin aquifer was scarcely adequate for a domestic water system. The drilling was stopped at 116 feet on some hard bottom but whether or not it was rock is not clear from the drillers log. If the drilling was stopped on a hard glacial till, there is the possibility that deeper drilling would encounter another gravel aquifer at greater depth. This is the only test of a drilled well of 100 feet or more that I know of in this area. Throughout much of the area B1, the local streams have spread thin sand and gravel alluvium on top of fine-grained lacustrive silt and clay. These shallow granular alluvial deposits could provide reservoirs for groundwater which could be developed in a manner similar to the present development at Lumby. Obviously the amount of water which could be developed from these deposits is controlled not only by the available storage in the gravelly deposits, but also by the amount of surplus run-off from the streams which can replenish storage in the gravel flood plain deposits. You mentioned that there was particular interest in water supplies in the vicinity of Rawlings Lake. The soils map shows that this area is underlain by a lacustrine clay which would not be a ready source of groundwater A rapid reconnaisance of the present water wells in this area would give some indication as to whether or not a shallow source of groundwater could be developed for a community water system. Otherwise, it would be necessary to test the possibilities of deep groundwater by means of a drilled well. I am not familiar with this area in detail, but you might expect to find conditions somewhat similar to those encountered in the drilled well at the town of Lumby. Before undertaking the expense of test drilling, I would suggest that someone look at the topography of the area to see whether or not there is not any hope of success.

Area B2: This area, occupying the main Okanagan trench for several miles north and south of the village of Armstrong, is underlain by extensive silty clay deposits. Several drilled wells indicate that this silty clay is more than 600 feet deep. In 1954 and 1955, Enderby Oil Wells drilled 3 test holes in an area north east of Armstrong. Attached to this report is a log of Enderby No.1 well, which I made up from the samples sent in to the Department of Mines. The Test Hole drilled by the same company in 1954 encountered extensive flows of artesian water according to local report. On the basis of this occurence of ground water, a Mr. R.A. Maddox, farmer in this area, had 2 test wells drilled, one of which was 600 feet deep and the other 200 feet. Both of these test holes were dry and did not provide any supply of water. The attached sketch shows my interpretation of the sub-surface conditions at this site.

Since the test holes drilled by the Enderby Oil Wells were prospect holes in search of oil, it is difficult to interpret the samples and logs of the drilling in terms of the occurence of ground water. Samples from

Enderby No.1, between depths of 760 and 1000 feet, consist of fine gravel and coarse sand. Many of the fragments were well rounded and it could be inferred that this material is a washed sand and gravel deposit which could potentially be a suitable ground water aquifer. However, no record of the occurence of ground water is contained in the drilling log and since the well was drilled using a heavy mud and the objective of the drillers was to pass through the unconsolidated material and reach solid rock as soon as possible, the fact that they do not report any ground water occurence is not regarded as significant. These drill logs suggest that there may be a considerable thickness of washed sand and gravel beneath as much as 700 feet of glacial lake deposits. It would therefore be necessary to drill a hole in search of ground water as much as 1000 feet in order to properly test the occurence of ground water aquifer in this area. Much of the area north and northeast of Armstrong is underlain at shallow depths by bedrock and the most likely occurence of a deep ground water aquifer is in the main Okanagan trench extending from the head of Okanagan Lake through Armstrong and into the valley of the Shuswap River at Enderby. In addition to this possible deep aquifer, ground water might be recovered from sand and gravel alluvial deposits of a number of creeks which enter the Okanagan Valley in the vicinity of Armstrong from the east. These include Glenhayes Creek, Joyce Creek, Kendry Creek, Glanzier Creek and others. The occurence of ground water in the first shallow test hole of the Enderby Oil Wells is believed to be of the type illustrated in the attached drawing and similar conditions may exist opposite the mouths of these various creeks.

a B3 I have no particular subsurface information in this area in the vicinity of Deep Creek. The soils map indicates that there is a variety of subsoils in the area, including some granular soils. It is in an area of low relief and there is therefore some possibility for the development of ground water from creek alluvium. A small amount of field work would prove or disprove the possibility of ground water in any area where other studies indicated that a communal water system was economically desirable.

a B4 This area, known as Grandview, is underlain by deep sand and gravelly deposits, however, it is in general, extremely well drained, because the surface of the area stands several hundred feet above the valley bottom of the main Okanagan Valley. There is therefore very little liklihood of obtaining ground water from these sand and gravel deposits. There may be some granular material adjacent to Deep Creek along the eastern edge of this area and it would appear possible that there may be some subsurface flow of groundwater in this area. I do not know of any springs along the eastern edge of this area and I think test drilling would be necessary to assess the possibility of groundwater from this source.

a B5 Vernon - Commonage. There is little hope of obtaining groundwater supplies from this area of rolling bench land which stands several hundred feet above the Okanagan valley bottom. The subsoil consists of glacial lake silts and clays which rest on glacial sand and gravel deposits. The sands and gravels probably lie on an irregular bedrock surface and are too well drained to provide supplies of groundwater except at elevations near the valley bottom. No ~~springs~~ flow across the area to provide significant infiltration to groundwater reservoirs.

a B6 I do not have any information of groundwater possibilities in this area. The soils map indicates that much of the area is underlain by a glacial lake clay from which there would be little hope of obtaining supplies of water. In addition, there are evidently granular deposits adjacent to the two creeks which flow into the Shuswap River past the north and south boundary of this area. Some groundwater may be stored in the alluvium along these creeks and a development similar to the present development at Lumby might be feasible.

a B7 I have no information on the wells in this area. The soils map shows it to be underlain by a large area of glacial lake clay. Only small creeks

flow across the area and the soils map does not indicate any extensive amount of alluvium adjacent to these creeks. If other studies indicate the need for a communal water system in this area, a brief reconnaisance of the available wells should indicate whether or not shallow wells could provide a source of water for such a water system.

Vernon Irrigation District

Within the Vernon irrigation district, most of the flow of the surface streams is licensed and controlled. There maybe some storage in the alluvial deposits adjacent to B.X. Creek and Vernon Creek. However, utilization of ground water from these alluvial deposits would have to be closely integrated with the use of surface water. Some deep drilling has been done in the valley between the town of Vernon and the head of Okanagan Lake at Okanagan Landing. This drilling indicates that in places there is a thin granular aquifer underneath the glacial lake deposit. The wells, so far developed, do not provide large quantities of water but this may be because of the type of well construction, rather than any limitation in the aquifer itself. During the summer of 1958, a well was drilled in the city of Vernon for a new store for Eatons of Canada. I have no information on what formations the driller encountered, but if the log of this well could be obtained, it would give some idea of the availability of groundwater from deep drilled wells in this area.

Indian Reserves

Most of the Indian Reserves lie in area B2 and groundwater conditions within the Indian reserves are probably essentially similar to those in that area. The eastern part of Enderby Indian Reserve No.2 might be supplied by a deep drilled well if it encountered conditions indicated by the Enderby No.1 Well drilled fairly close to this Indian reserve. The Indian reserve along the north arm of Okanagan Lake could possibly best be supplied by water pumped from the lake itself. Groundwater might be obtained, however, from the alluvial deposits near the mouth of the Equesis Creek and Whiteman Creek.

WESTERN WATER WELLS LTD.

1817 Ninth Ave. East,
Calgary, Alberta.

Town of Lumby - Drill Hole No. 1 Water Well

July - August 1954.

0 - 3	Black top soil
3 -13	Brown sandy silt - surface water
13 -22	Blue sandy silt clay binder
22 -34	Blue sand with pebbles
34 -44	Fine to Med. Gravel and sand (silty) blue wash
44 -53	Bluish black silt (slum)
53 -82	Grey silty clay - plastic
82 -98	Grey sandy silty clay
98 -101	Fine running sand
101 -109	Grey silty clay
109 -111'	Fine sand Water bearing (flowing)
111 -115'	Bluish coarse sand, some large gravels, water continuing to flow at app. 3 gallons per minute.
115 -116	Jagged gravel bound in a blue clay. Large amount of Iron pyrite at 115'. Strong sulfur smell.

5 inch I.D. production casing installed with a 5 ft. section of pre cast gravel packed screen on bottom.

Pump tested for 24 hrs. @ a continuous rate of 25 gallons per minute with a draw down of 45 ft. Recovery time after pump shut down was 8 minutes to flow.

Sample of water sent to Victoria for Bacteria test and complete chemical analysis. Water clear after ½ hr. of pumping.

Copy of Clipping from Vernon News 9/9/54

City Water For Lumby Draws Near.

LUMBY, Sept.9 - Reports from the North Okanagan Health Unit and Department of Agriculture read here last night, showed water from the artesian well to be completely satisfactory for domestic use.

A slight smell of sulphur attached to the water will disperse when the water has been exposed to the air, trustees learned. A reservoir will probably be built on a hill in the vicinity of the Catt subdivision.

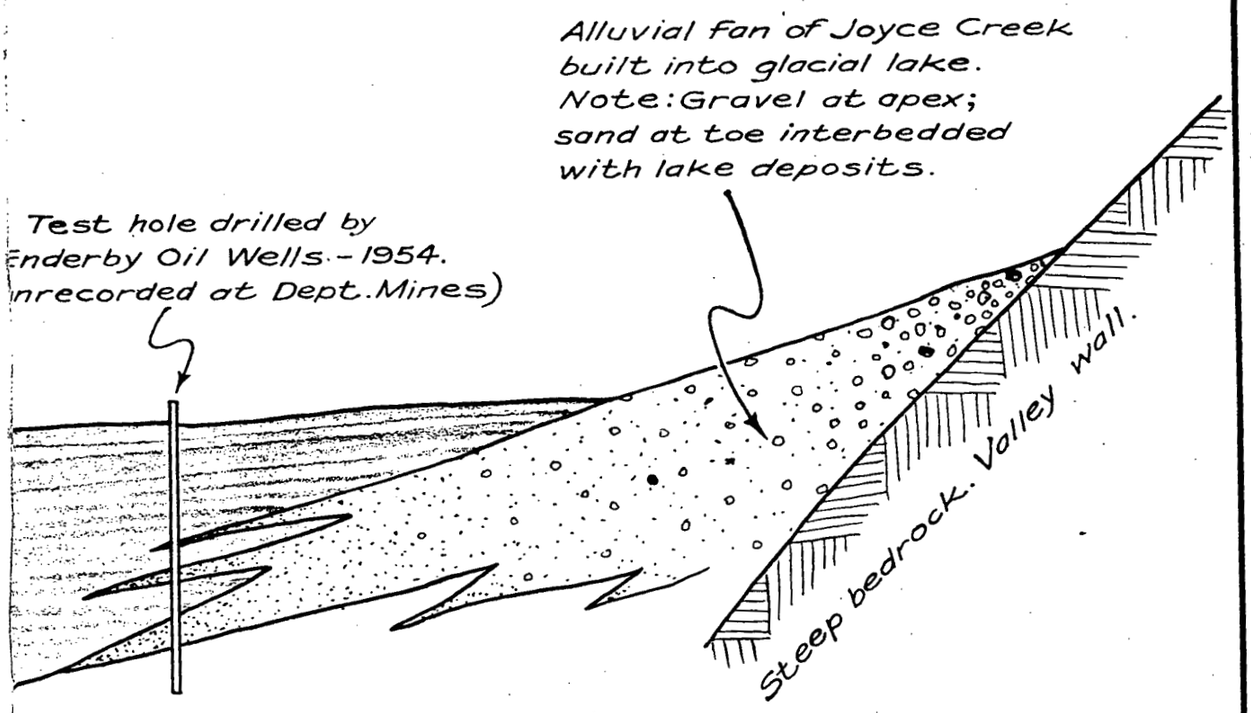
ENDERBY NO.1 OIL WELL

(reference "Schedule of Wells Drilled for Oil and Natural Gas in British Columbia to Jan. 1st, 1956" published by the Department of Mines, Victoria, B.C.

Log from samples (washed below 760') on file in Dept. of Mines lab.

Note: This was drilled as part of an oil exploration program.

0 - 340	No samples
340 - 700	Fine grey silt - very like Okanagan and Kamloops white silts - contains sand and micaceous particles - effervesces briskly with acid somewhat like other while silts - it may be drilling mud.
760 - 1000	Fine gravel and coarse sand - quartz feldspar basalt and pink granite pebbles and a few grains of pink garnet - pebbles and coarser sand are water worn and generally well rounded - apparently completely unconsolidated - broken fragments indicate the presence of larger pebbles but they are not numerous - maybe alternating layers of sand and fine gravel.
1010	Sample of fine grained sand cemented with carbonate. Angular fragmen
1020 - 1330	Similar sand and fine gravel to that between 760 - 1000', but apparently poorly consolidated by calcareous cement. A small fragment of wood showing no sign of coolification in sample at 1150.
1350 - 1415	Percentage of dark basalt fragments rapidly increases.
1415 - 1600	100 percent black fragments some of which are slightly rounded and some of which are composed of aggregates of well cemented finer particles.
1600 - 1840	100 percent of black angular fragments of basalt.
1840- 1956	Varying quantities of white angular quartz and some pink garnets mixed with dark rock fragments suggest that this is metamorphic basement rock.



NOTES:

1. Test hole drilled 600' by Enderby Oils encountered several flaws of water under Artesian pressure - probably sand lenses interbedded with lacustrine clays - water comes from infiltration from Joyce Creek.

2. If this test hole were drilled farther west it would not obtain water, unless deeper than 600'.

3. Tony Maddocks' wells were drilled north of this section beyond the limits of the alluvial fan or delta and encountered only glacial lake silts and clays to depth of 600'.

4. Similar conditions may exist where the following creeks flow from the valley wall to the valley floor - Huntley, Glenhayes, Maid, Meighan, Fortune, Joyce, Kendry, Glanzier, Sneesby, Hussard.

SKETCH OF
LONGITUDINAL SECTION
JOYCE CREEK FAN

DRAWN BY: HUGH NASMITH
DEPT. MINES — JAN. 1959

LEGEND

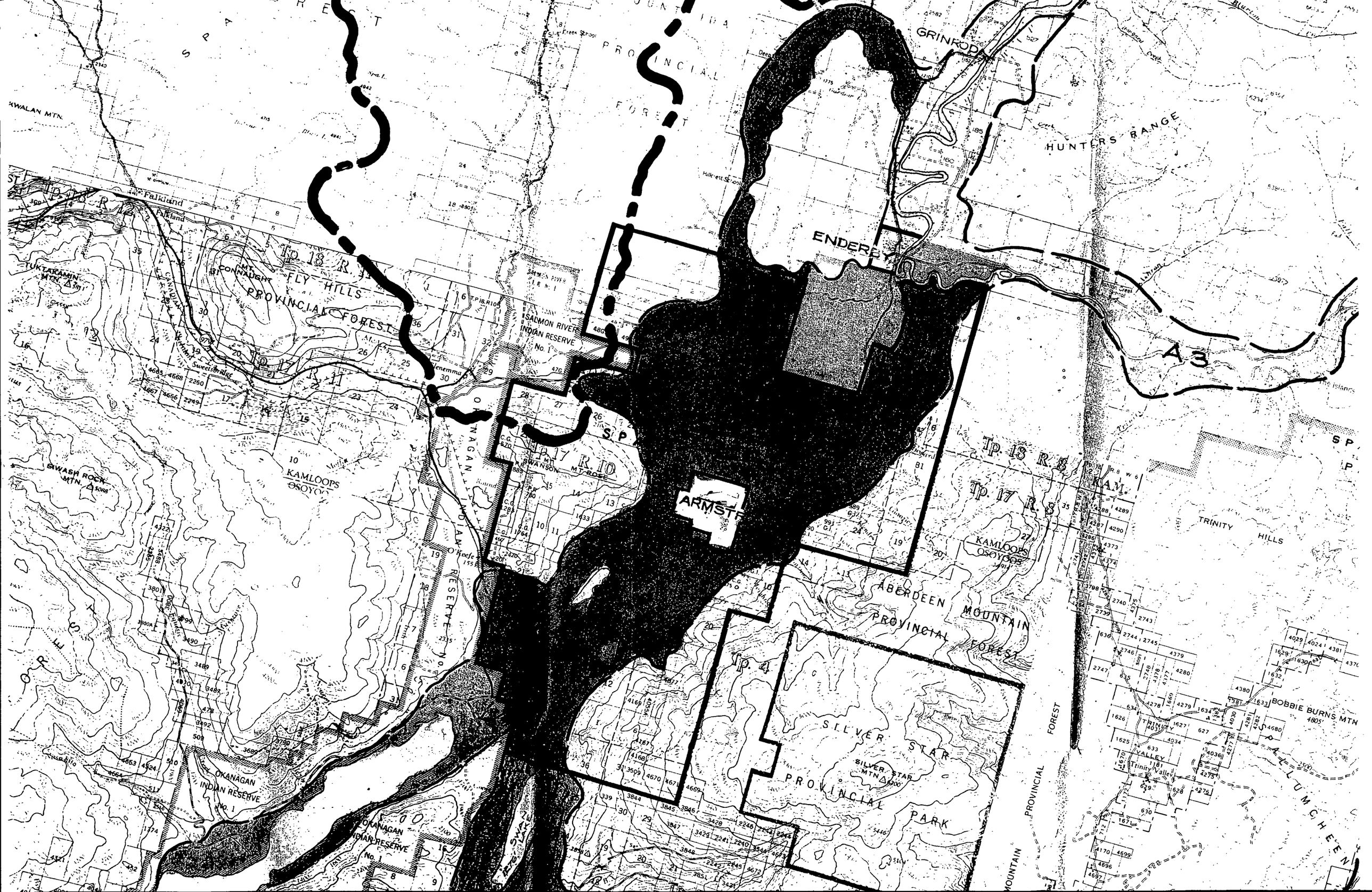
POSSIBLE WATERSHED LIMITS

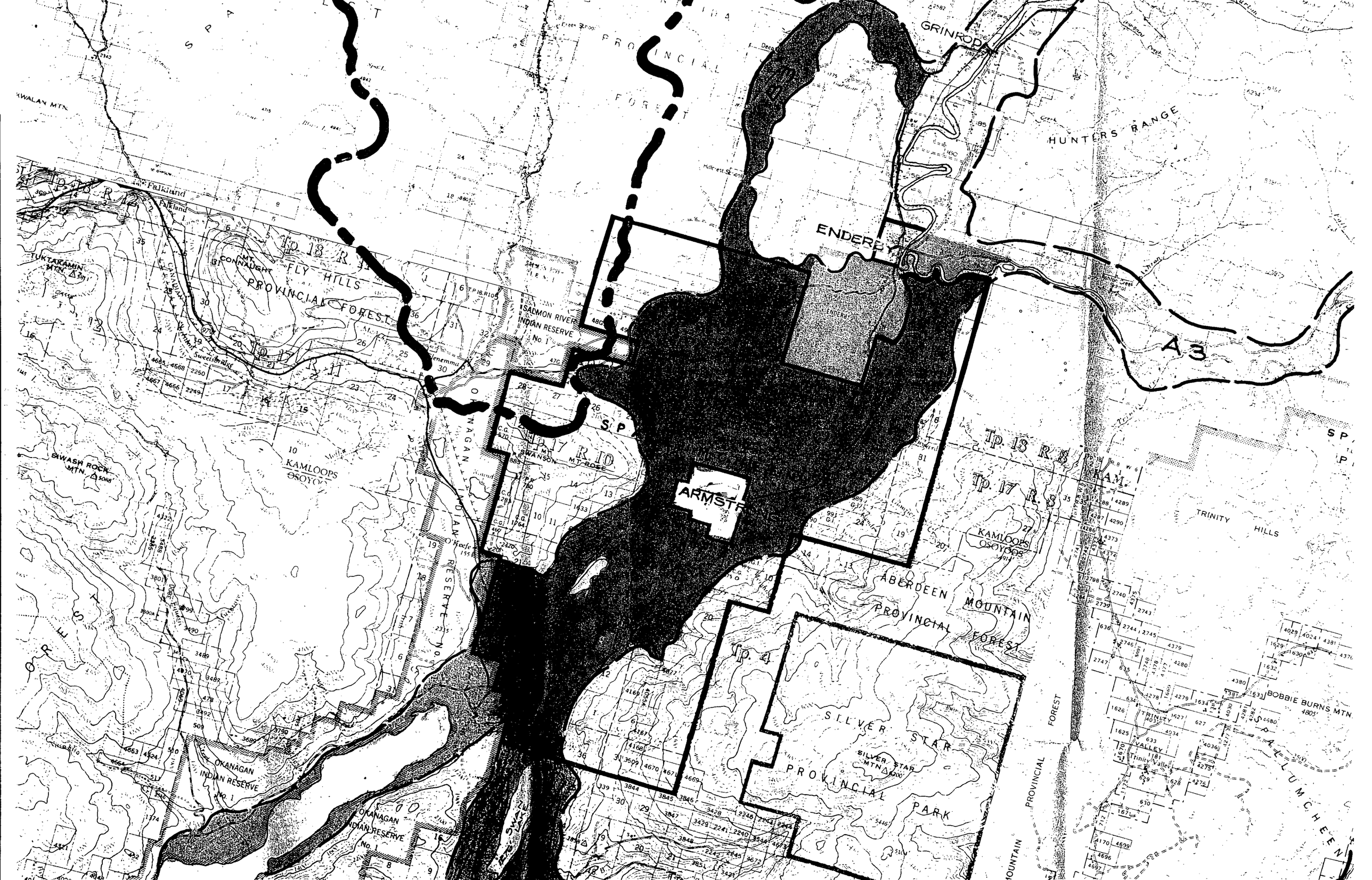
SHUSWAP MARGINAL AREAS

CHERRYVILLE	A1	5130 Acs.
MABEL LAKE	A2	5770 "
DOLLY VARDEN BEACH TO MARA.	A3	24100 "

AREAS TO BE SUPPLIED FROM MAJOR DIVERSIONS

LUMBY	B1	12600 Acs.
SPALLUMCHEEN	B2	34800 "
DEEP CREEK	B3	5300
GRANDVIEW FLATS	B4	1800
VERNON COMMONAGE		


SPALLUMCHEEN FOREST
PROVINCIAL FOREST
GRINROD
HUNTERS RANGE
ENDERBY
A3
Falkland
TP. 18 R. 11
FLY HILLS
PROVINCIAL FOREST
MT. CONNAUGHT
TUKTARAMIN MTN.
SALMON RIVER INDIAN RESERVE No. 1
TP. 17 R. 10
MT. SWANSON
MT. ROSE
ARMSTRONG
TP. 18 R. 8
TP. 17 R. 9
KAM.
TRINITY HILLS
ABERDEEN MOUNTAIN PROVINCIAL FOREST
TP. 4
SILVER STAR PROVINCIAL PARK
SILVER STAR MTN.
BOBBIE BURNS MTN
SWASH ROCK MTN.
KAMLOOPS OSOYOOS
OKANAGAN INDIAN RESERVE No. 1
OKANAGAN INDIAN RESERVE No.
KWALAN MTN.
Swan Lake
Trinity Valley


GRINROD
HUNTERS RANGE
ENDERBY
A3
SALMON RIVER INDIAN RESERVE No. 1
ARMSTRONG
ABERDEEN MOUNTAIN PROVINCIAL FOREST
SILVER STAR PROVINCIAL PARK
SILVER STAR MTN
FLY HILLS PROVINCIAL FOREST
MT. CONNAUGHT
FALKLAND
TUKTAKAMIN MTN
SWASH ROCK MTN
KAMLOOPS
OSOYOOS
OKANAGAN INDIAN RESERVE No. 1
TRINITY HILLS
BOBBIE BURNS MTN
SALMON
Tp. 18 R. 11
Tp. 17 R. 10
Tp. 17 R. 8
Tp. 4
Tp. 18 R. 8