7-4. APPENDIX D

LETTERS REGARDING ECONOMIC DAMAGE

TO C.P.R. AND C.N.R. PROPERTIES

0281792-C1

COPY

August 4, 1971

Regional Engineer Canadian National
Railways 777 Hornby Street,
Vancouver, B.C.

Dear Sir:

You are no doubt aware of the federal-provincial study in the Okanagan as described briefly in the attached information brochure.

In connection with this, the Water Resources Service has undertaken to carry out certain water quantity studies including the regulation of Okanagan Lake. Under the Okanagan Flood Control Act of 1949, the normal regulation of Okanagan Lake was set at four feet (elevation 1119.8 to 1123.8) but can, in drought periods, be drawn down an additional foot to 1118.8.

In the computer model testing of Okanagan Lake, the range in elevations of the lake have been considered between elevations 1116.8 and 1125.8. The effect of these extremely high or low elevations on your wharves' and barges' operations must be evaluated and we would appreciate your advice regarding the following:

1. Can the present CNR water transport system on Okanagan Lake operate satisfactorily within the present maximum five-foot range (elevation 1118.8 to 1123.8) and if not, what would be the cost of modifications required to achieve this?

2. Similarly, what would be the additional cost to make the system operate over a seven-foot range between elevation 1116.8 and 1123.8?

3. Finally, what would be the additional cost to make the system operable from the present minimum elevation of the lake of 1118.8 to a maximum of 1125.8?

Any other observations you might have regarding the effects of the above-mentioned elevations on any of your structures would be most helpful.

Since this particular problem, as well as others, will be considered in some detail in the near future, we would appreciate your reply as soon as possible.

Yours very truly,
(signed)
B.E. Marr
Chief Engineer

(initialed)
TAJL/ls

C O P Y

CPRail

Vancouver, B.C.
July 2nd, 1971
File No. 73929.

Mr. B.E. Marr,
Chief Engineer
Water Investigations Branch
Parliament Buildings,
Victoria, B.C.

Dear Sir,

Your letter June 21st, 1971, file 0281792-C-l, in connection with Federal Provincial Study in the Okanagan.

In regard to operating over our four Okanagan Lake Wharves (Kelowna, Westbank, Summerland and Penticton) considerable difficulty is encountered whenever water level approaches either the maximum or minimum with the present four foot spread. Records of the lake levels are not readily available in this office but during low levels of the lake at times it has been necessary to shim up the track immediately on the shore side of the apron hinge to reduce the angle at this point. The shimming of the track is required to provide clearance above the rails for cars regularly handled with underslung equipment (insulated heated box cars with underslung heaters, some covered hoppers, long flat cars, etc). Other measures are also taken which give slightly improved operation over these slips at low lake levels such as pumping water into the stern ballast tanks of the barge marshalling loads in order that they are loaded first and pulled last when deck level of the barge will be slightly higher.

These problems appear to be aggravated since the early 1950's although great difficulty was encountered in 1948 or 1949 with high lake levels.

2.

An increased apron length of 50 feet instead of the present 32 feet would improve the CP Rail operation but this would not be sufficient for lake levels varying by more than a total of about 5 feet as it is believed that the Canadian National with aprons 50'6" at Penticton, Naramata and Westbank have had difficulties operating at extreme lake levels in the past.

In regard to cost of making changes to have a better operation with various lake levels, following are very preliminary costs:

1. The operation is not satisfactory at present with the 32 ft. aprons for a range of 1118.8 to 1123.8. It is estimated that installing and removing shims costs approximately $1,000 at each location each time it is necessary. To replace the 32 ft. timber apron with a 50 foot steel apron would now cost between $100,000 and $125,000. it is not practical to modify the existing timber apron and supporting structures.
2. To provide car ferry slips for a seven-foot range between 1116.8 and 1123.8 would require an apron approximately 75 feet in length and to lower the rail elevation at the apron hinge about 18 inches, rough estimate for this installation would be $225,000 to $250,000.
3. To provide car ferry slips for seven-foot range from 1118.8 to a maximum of 1125.8 may be possible without changing rail elevation at the apron hinge and a rough estimate of this cost would be $215,000 to $240,000 if 75 foot apron is used.

   It is considered that 75 foot aprons would be preferable and more economical than providing cradle type aprons and moving these on sloping railway tracks as is done with the operation on the Slocan and Kootenay Lakes.

The use of 75 ft. aprons may pose problems because of the greater reaction on the nose of the barge when loading heavy cars coupled together which would then require rail car barge slips similar to those used on the Slocan and Kootenay Lakes, at, I believe, increased cost.

C O P Y

I trust this will assist you in your study.

Yours truly,

(signed)

W.W. Stinson

Regional Manager, Operation and Maintenance.

C O P Y

August 4, 1971

Mr. W.W. Stinson
Regional Manager
Operation & Maintenance
Canadian Pacific Railway Company
Granville & Cordova
Vancouver, B.C.

Dear Sir:

In your letter of July 2, 1971, you kindly provided us with an estimate of the cost of changes in your four Okanagan Lake wharves (Kelowna, Westbank, Summerland, and Penticton) to accommodate greater lake fluctuations than presently exist.

We are not certain from your letter if the cost quoted applies only to one wharf or is an overall cost. Would you please clarify this point.

We also understand that some difficulties are occurring now at the present Okanagan Lake level which is some 0.4 feet below maximum regulation. Any comments you have with regard to this would also be appreciated.

Yours very truly,

(signed)

B.E. Marr Chief Engineer

(Initialed)
TAJL/ls

C O P Y

CPRail

VANCOUVER, B. C.
August 10, 1971

File: 73929

Mr. B.E. Marr
Chief Engineer
Water Investigations Branch
Parliament Buildings,
VICTORIA, B.C.

Dear Sir:

Your letter August 4th, file 0281792-C1, in connection with estimated cost of changes in our four Okanagan Lake Wharves.

The costs quoted are per location and if changes were made at the four points mentioned, it would be four times the amount quoted in my letter of July 2nd.

Yours truly,

(signed - T.G. Benedetti for)
Regional Manager, Operation and Maintenance

Environment Canada | Environnement Canada

Our File No
Notre dossier

Your File No
Votre dossier

c/o Planning Division,
Water Planning & Operations Branch,
Dept. of the Environment,
Room 404, 1001 W. Pender St.,
Vancouver 1, B.C.

10 September 1971

Mr. T.A.J. Leach, Co-chairman, Okanagan Study Committee,
Mr. A.M. Thomson, Study Director, Okanagan Basin Study
Mr. C.H.Thomas, Water Resources Service
Mr. M. Fumalle, Socio Economic Task Force

Re: Effect of Fluctuations on Okanagan Lake Levels on the C.N.R. and C.P.R. Navigational Wharfs

As agreed with Mr. Leach in a discussion on 7 September 1971, I have contacted C.P.R. and C.N.R. direct by telephone with regard to the effect of extreme fluctuations on the railway navigation facilities on Okanagan Lake.

These conversations were extremely helpful and placed the matter in a somewhat different light than has been indicated to date by C.P.R. in its communications with the B.C. Water Investigations Branch. I stressed in my discussions with the two railway companies that I was mainly interested in action they would take in the event of emergency situations (such as the flood of 1948) when the lake levels fluctuate outside the normal four-foot operating range. It seems that C.P.R. had interpreted Mr. Marr's letter of 21 June 1971 to mean that the lake levels would regularly fluctuate over a seven-foot range each year rather than the present four-foot range. Consequently, C.P.R. had felt that structural changes in the navigation facilities were necessary.

When it was emphasized that extreme fluctuations would only occur infrequently and not on an annual basis, both companies were emphatic that no structural changes would be required. In the case of C.P.R., because its aprons are only 32 feet long, it is necessary to place shims in the track on the shore side of the ramp whenever the range is greater than four feet. These shims plus other adjustments such as careful loading of the barges and ballasting the barges with water tanks, seem to allow the barges to operate over a six-foot range (elevation 1124.8 to 1118.8 feet) quite effectively. If the lake fell below 1118.8 feet C.P.R. would likely arrange to use the C.N.R. docks which have longer aprons. The cost of shimming the tracks is $1,000 for each of four locations.

C.N.R. did adjust the length of its aprons to 50 feet in length after the Okanagan Flood Control Project was built. Apparently the company shims the track slightly each spring as a precautionary measure at no significant cost to minimize the angle between the apron and the main track. This shimming operation has been completely successful in the past 15 years and it appears that with larger shims C.N.R. could operate effectively over a six to seven foot range. Because larger shims have not been used to date, C.N.R. could not estimate costs but it appears reasonable to assume that when the lake fluctuates over a greater range than the present five feet (elevation 1123.8 to 1118.8), $1,000 per dock will be required. At present, because of the low volume of traffic at Westbank, Peachland and Naramata, only the docks at Penticton and Kelowna would likely be adjusted.

Both companies agreed that, barring unforeseen circumstances, the future operation of the barge service was open to question. Already a marginal operation, increasing competition from trucking and the large expense involved in keeping pace with technological changes in transportation will likely result in the disappearance of barge traffic from the Okanagan within the next 20 years. Both companies are presently considering the possibility of combining all operations within the next few years, in which case the C.N.R. docking facilities with their ability to sustain a greater fluctuation will be used. Currently, both companies use the wharfs at Summerland and Naramata respectively.

Accordingly, for the evaluation of shoreline damage for Task 23, I will assume that $4,000 is required in each year the lake fluctuates outside the present four-foot range but within a five-foot range, and $6,000 is required for larger fluctuations. No large-scale structural changes to wharfing facilities will be considered.

Yours sincerely,

J. O'Riordan, Co-chairman,

Okanagan Study Committee

APPENDIX E

SOCIO-ECONOMIC IMPACTS OF A RECURRENCE OF THE 1930-33 DROUGHT ON EXISTING SHORELINE LANDUSE AROUND OKANAGAN LAKE

J. O'Riordan

WATER MANAGEMENT SERVICE,

DEPARTMENT OF THE ENVIRONMENT

VANCOUVER, B.C.

SOCIO-ECONOMIC IMPACTS OF THE

1930-33 DROUGHT ON EXISTING SHORELINE LANDUSE

AROUND OKANAGAN LAKE

SUMMARY

According to the U.B.C. mathematical model of the present operation of the main-stem Okanagan system, a recurrence of the 1930-33 drought could reduce Okanagan Lake levels continuously below the present minimum level of 1119.8 feet for a period of 30 months. The purpose of this background paper is to evaluate in socio-economic terms the consequences of such a prolonged drought on existing shoreline landuse. The main results are presented in Table 1 and summarized below. It should be noted that the impacts vary from year to year during this drought and have been totalled for the entire 30 month period.

TABLE 1

Summary of Socio-Economic Impacts

on Selected Shoreline Landuses Around Okanagan Lake Assuming

a Recurrence of the 1930-33 Drought

Year LandUse	Public Boating (Ramp Days Affected)	Private Boating (Boat-Dock Days Affected)	Potential Moorage Fees Loss $	Potential Gas Sales Loss $	Railway Dock Adjustments $
1930	330	41,525	3,600	4,800	2,000
1931	2,510	112,015	10,860	26,800	0
1932	200	78,965	9,430	4,800	2,000
1933	0	7,075	2,110	0	0
TOTAL	3,040	239,580	$26,000	$36,400	$4,000

Economic Damage

Estimated economic costs associated with potential loss in moorage fees, gas sales and boat rentals total $62,400 over the 30 month period. Costs of adjustments to the two C.N.R. railway warfs are estimated at $4,000. These figures do not include possible damage to the Kelowna Floating Bridge or potential loss of tourist visitor days and their associated expenditures

Social Damage

The major social costs is represented by loss of convenience, launching and mooring boats at private docks. Over the 30 month period, a total of 240,000 boat-dock-days would be thus affected. These social costs are not considered large as a number of short term adjustments are possible to enable recreational use of private boats. In addition, private lakeshore residences would suffer negative aesthetic values associated with exposed beaches and lake bottom sediments.

Environmental Costs

Some problems would be encountered at launching boats on public ramps and a total maximum inconvenience is estimated at 3040 boat ramp days. During the second year of drought (l93l) all public launching sites around the lake would be completely out of water. Lake drawdowns of over 2 feet below present minimum would expose 500-1000 feet of bottom sediment at public beaches near Kelowna and Summerland. The impact of such low water levels on wildlife resources is thought to be small, but has not yet been assessed in the case of sports fisheries.

BACKGROUND PAPER - TASK 101 WORKSHOP

SOCIO-ECONOMIC IMPACTS OF A RECURRENCE

OF THE 1930-33 DROUGHT ON EXISTING SHORELINE

LANDUSE AROUND OKANAGAN LAKE

During the summer of 1971, the socio-economic group undertook a shoreline survey of Okanagan Lake. The purpose of the task was to evaluate in social and economic terms damage that might occur to shoreline landuse should Okanagan Lake fluctuate outside its present operating range. The survey assessed potential damage to several types of shoreline landuse including recreational, residential, transportation and commercial uses. The nature and extent of damage was measured for 0.5 foot increments up to 2 feet above the present maximum of 1123.8 feet and for 0.5 foot increments down to 3 feet below the present minimum of 1119.8 feet.

Detailed results of this survey have been presented elsewhere.[1/] Due to the relatively infrequent occurrence of lake level fluctuations outside the normal four foot operating range (1123.8-1119.8 feet), the annual damage associated with the "null" or present operation of the system is small.[2/] In actual dollar terms, the annual economic damage to existing shoreline landuse averaged over the last 50 years and assuming present operating conditions is estimated at approximately $3,000. Social costs associated with drawdowns of the lake below 1119*8 feet comprise of a reduction in the general quality of water-based recreation experience and aesthetics. Such costs are considered to be small if the duration of drawdown is short (i.e. a few months), but could be important, if the lake remained below minimum elevation for a period of a few years.

1/ Fumalle, M.J. & O'Riordan, J " Social and Economic Aspects of the Shoreline Survey of Okanagan and Osoyoos Lakes", Water Management Service, Dept. of the Environment, Vancouver, B.C. January 1972.

2/ 0'Riordan, J. "Preliminary Evaluation of Shoreline Damage around Okanagan Lake", Water Management Service, Dept. of Environment, Vancouver B.C.,Sept.1971.

The main purpose of this paper is to examine in some detail the economic and social consequences of a recurrence of the drought of 1930-33 on existing shoreline landuse. This drought is the only event in the 50 years of record when the lake level would be drawndown for an extended period of time assuming present operating conditions and relaxation of an arrangement under the Okanagan Flood Control Act to maintain lake levels between

1118.8 and 1123.8 feet. According to the U.B.C. mathematical model which simulated this event for present operating conditions,[3/] the lake would have dropped below its minimum elevation in July 1929 and apart from May and June, 1932, would remain below this level until April 1933 (Figure l). The rest of this paper examines the economic, environmental and social implications of this prolonged drawdown.

Economic Damage

Actual dollar costs of lake drawdowns comprise potential loss of revenue at marinas, boat rental stalls, possible reductions in tourist visits and adjustments to railway navigation warfs.

Table 2 shows the potential loss of revenue at marinas and boat rental stalls around Okanagan Lake. These data are based on total gas sales and are estimates of the number of mooring stalls that would be inoperable at various minimum lake levels. Because many short term adjustments are possible, these figures should be regarded as maximum estimates of loss, based on the data presented in Table 2, the total potential loss of revenue to moorage boat rentals and gas sales during the 1930-33 drought would be $62,400 (See Table l).

[3/] Russell, S.O. and McNeill, R.J. "Output from U.B.C. Mathematical Model of the Operation of the Main-Stem Okanagan River. University of British Columbia, July 1971.

Fig. 1

OKANAGAN LAKE LEVELS
DURING THE 1930-33 DROUGHT
As Plotted by U.B.C. Model
For Present Operating Conditions

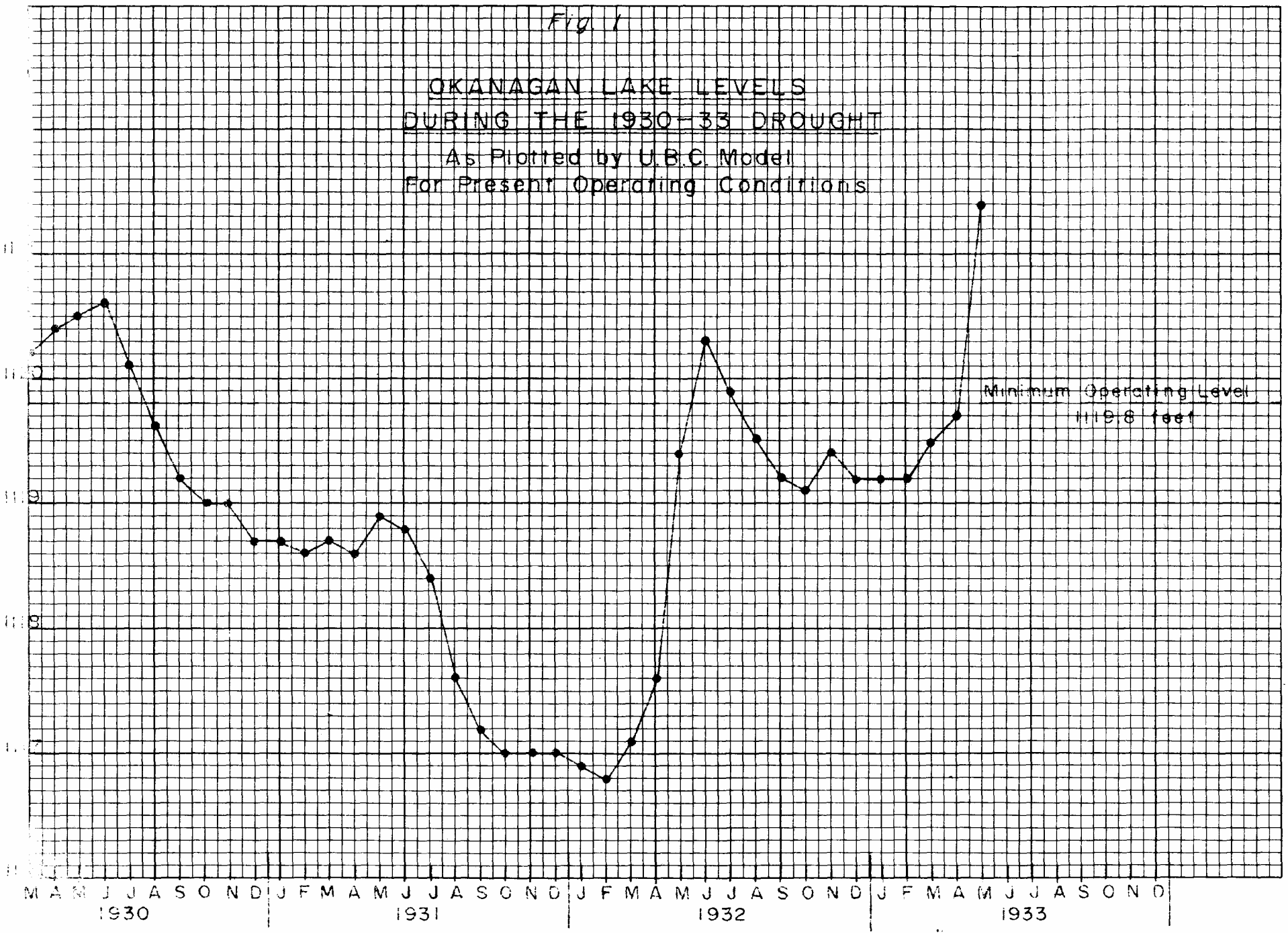


TABLE 2

Potential Loss of Revenue

(Cumulative)

Increment (Below 1119.8 feet)	Gas Sales (Loss/Season	Boat Dock and Marina Rentals(loss per month)
0.0' - 0.5'	$4,800.	$ 685.
0.5'-- 1.0'	4,800.	740.
1.0' - 1.5'	4,800.	775.
1.5' - 2.0'	16,800.	1,010.
2.0' - 2.5'	26,800.	1,090.
2.5' - 3.0'	26,800.	1,135.

The possible dollar costs to a reduction in tourism are extremely difficult to calculate, since it is impossible to predict how tourists would react to a continuous period of low lake levels. It seems likely that lake-shore resorts dependent upon lake levels would suffer some loss in revenue, but according to information on tourist recreation behaviour patterns [4/] many tourists have established holiday plans in the Okanagan and most would probably return for the second year of the drought period. Some beaches with steep gradients would not be greatly affected (for example, Penticton Beach and Sunoka Beach) and tourists preferring deeper water would probably search these out. Undoubtedly, if the drought continued into a third season, some tourists would fail to return and the dollars they would spend should be accounted as a cost.

The possibility that water quality in shallow lake benches would be affected by low water levels should be carefully evaluated by the Limnology group. Even at high lake levels, deteriorating water quality in certain accessible recreation beaches such as the Vernon Arm, Kelowna and Powell beach has been commented upon by some recreationists. The relationship between

[4/] 0'Riordan, J. and Oliver. D.W. "A Survey of Water-Based Outdoor Recreation in the Okanagan", Water Management Service, Dept. of Environment, Vancouver, B.C., May 1972.

tourist behaviour and water quality will be carefully evaluated this summer by the socio-economic group. Preliminary studies on Wood Lake last summer indicated that even during a major algae bloom, many tourists were satisfied with their recreation experiences and only those sensitive to water quality moved elsewhere.

Because railway barge "traffic is gradually disappearing from Okanagan Lake, the economic implications of low lake levels on such resources would be minimal. On May 31, 1972 C.P.R. ceased its lake barge traffic so only C.N.R, operates on the lake, and the Company can adjust its tracks with shims whenever the lake fluctuates outside the normal four-foot range. Costs of shimming are estimated at $1,000 per dock per season and because of low traffic volumes at Westbank, Peachland and Naramata only the docks at Penticton and Kelowna would be adjusted. In the event of a prolonged drawdown, the shims would remain in the tracks all the time, thus reducing operational costs:

no large-scale structural changes to warfing facilities would be considered. As barge traffic appears to be an economically marginal enterprise, alternative transportation by truck during extremely low drawdown would not appear to be a large additional cost.

The most important potential cost of low water levels on Okanagan Lake involves possible structural adjustments to the Kelowna Floating Bridge. It is understood that the bridge is presently designed to withstand lake levels down to 1118.8 feet, but that detailed analysis would be required to estimate the extent of possible structural alterations which would enable the bridge to withstand lake levels down to 1117.0 feet.

Social Damage

The most important social costs comprise of private boat docks and ramps that would be left high and dry by low water levels. Figure 2 indicates that in fact many docks would be exposed before the minimum level of 1119.8 feet was reached and almost 900 docks would be inconvenienced when the lake fell 3 feet below the minimum level.

Potential damage can be assessed by the number of days that boat-docks are exposed - known as boat-dock days.[5/] Again, this figure represents the maximum estimate of inconvenience due to low lake levels as many boaters would simply moor their boats in the deeper water and walk out to them. To account for seasonal variation in use, as boat-docks are mainly used during the summer months, the total number of boat-dock days affected by low water levels is adjusted by a monthly weighting factor (Table 3). Applying these monthly weighting factors to the stage damage curve developed in Figure 9,(main text) the total number of boat-dock days affected during the 1930-33 drought is estimated at approximately 240,000 (See Table l).

TABLE 3

Monthly Weightings in Days For Shoreline Damage

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept	Oct.	Nov.	Dec.
Private Boat Docks & Public Boat Access Ramps	0	0	5	10	15	20	31	31	20	10	5	0

The other factor of social damage associated with low lake levels is exposure of foreshore adjacent to private property. The extent of such exposure has been mapped at lake levels of 1119.8, 1118.3 and 1116.8 feet respectively, and an attempt at assessing the reaction of a sample of private property owners around the lake is planned this summer.

[5/] For example, if 10 private boat docks were rendered inoperable by high water for two months (60 days), a total of 600 boat-dock-days would be affected.

Environmental Damage

Environmental damage associated with low water levels comprised of foreshore exposure in public recreation areas, inconvenience of launching boats from public ramps and impacts of fishery and wildlife resources.

It is difficult to make quantitative estimates of the areas exposed at public recreation sites. Because many sites are developed on shallow bays, exposure of lake bottom would be considerable, especially south of Kelowna at Okanagan, Mission, near Summerland and in the Vernon and Armstrong Arms, where exposures of 500 to 1000 feet are indicated as the lake drops to three feet below the present minimum level.

Fig.2(main text)indicates a linear relationship between the number of boat-docks affected and lowering lake levels. All 22 public launching sites would be exposed when the lake dropped to 1117.8 feet. The total number of boat-ramp days that would be affected, adjusted by the monthly weightings shown on Table 3 are estimated at 3040, 84 per cent of this total occurring during 1931.

To date, the author is unaware of any studies undertaken to assess the impact of low water levels on sports fishery resources in the Okanagan. Potential damage may occur as a result of obstructed access to tributary spawning habitats when the lake is over 1.5 feet below present minimum. The implications of fluctuating water levels on lake-spawning habitats of kokanee is being investigated this summer.

Preliminary results from a survey of wildlife resources around Okanagan Lake indicated that a large proportion of the natural shoreline habitat has already been destroyed by public and private land development.[6/]

6/ Brooks, A.C. "Preliminary Evaluation: Wildlife", Appendix C3 Task 23, Penticton, B.C., Sept. 1971.

Apparently short-term fluctuations (one-two years) in lake levels would not create significant impacts on the biological systems of existing shoreline habitats while longer-term fluctuations would alter vegetation patterns and consequently affect such habitats. Thus, it does not appear that a recurrence of the 1930-33 drought would create a long-term negative impact on existing wildlife resources.

Conclusion

A recurrence of the 1930-33 drought would not incur large economic costs with the possible exception of damage to the Kelowna Bridge. There would undoubtedly be considerable inconvenience to shoreline users (residents and tourists) associated with water-based recreation (swimming, boating, fishing) and aesthetic resources. Only part of these social and environmental costs could be mitigated by short-term adjustments.

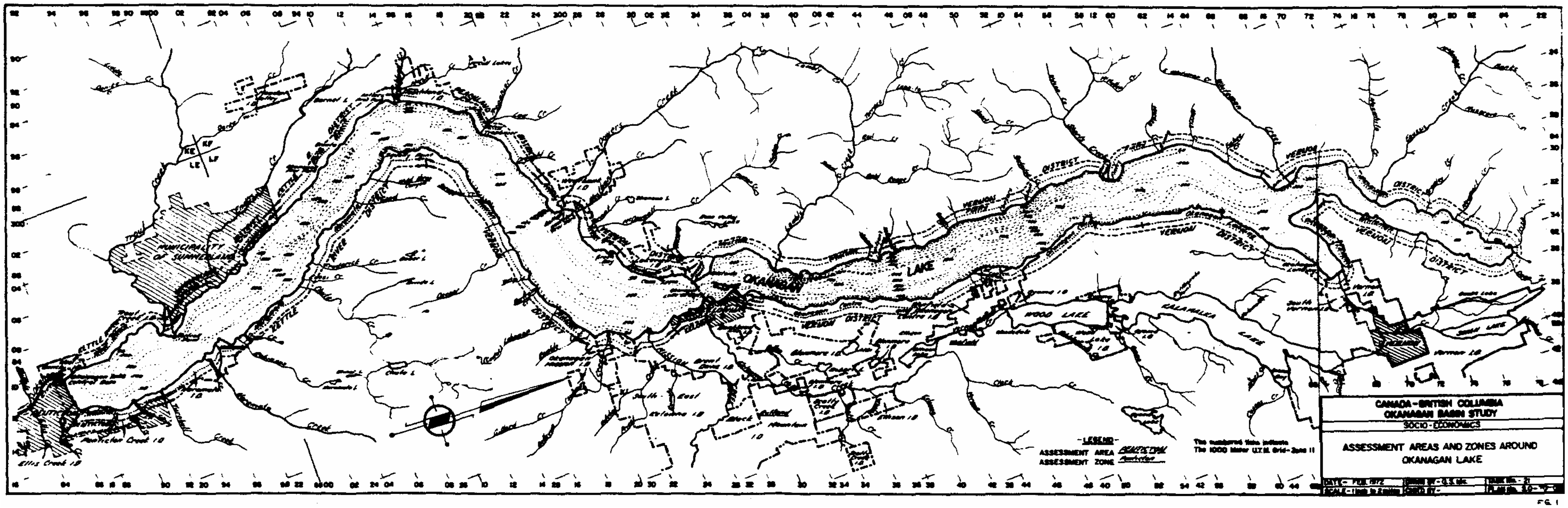

CANADA-BRITISH COLUMBIA
OKANAGAN BASIN STUDY
SOCIO-ECONOMICS
ASSESSMENT AREAS AND ZONES AROUND
OKANAGAN LAKE
-LEGEND-
ASSESSMENT AREA
ASSESSMENT ZONE
MUNICIPALITY OF SUMMERLAND
OKANAGAN
LAKE
WOOD LAKE
KALAMALKA
VERNON DISTRICT
Ellis Creek I.D.

FIG 1

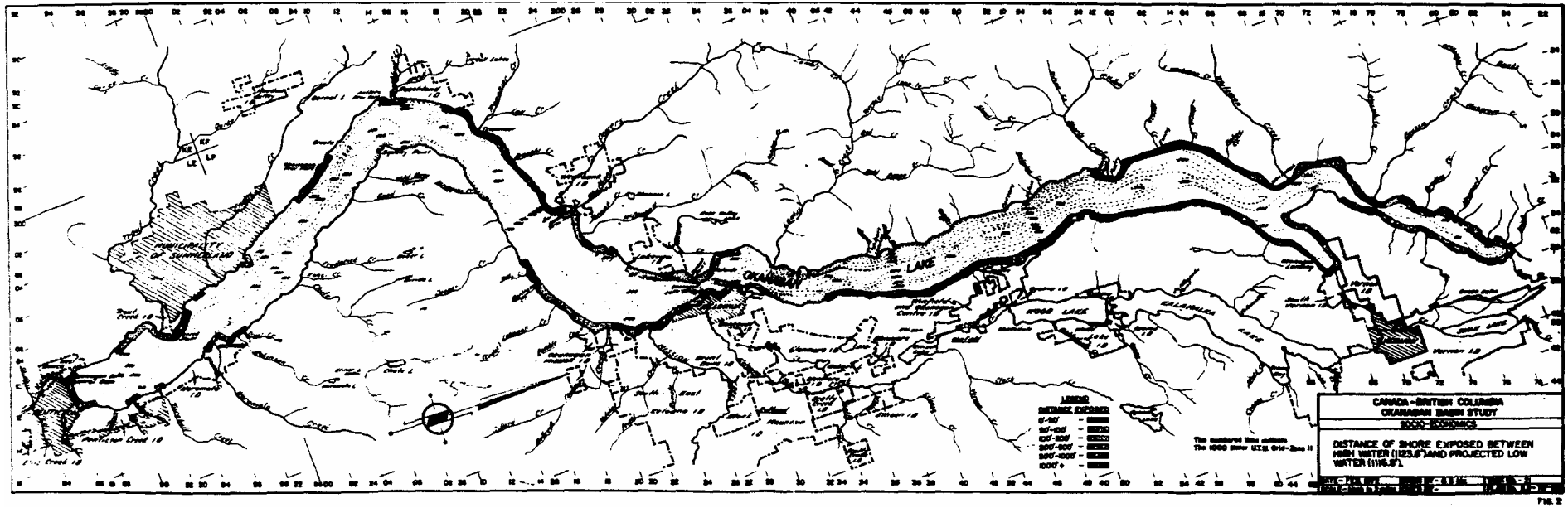

CANADA - BRITISH COLUMBIA
OKANAGAN BASIN STUDY
SOCIO-ECONOMICS
DISTANCE OF SHORE EXPOSED BETWEEN HIGH WATER (1123.8') AND PROJECTED LOW WATER (1116.8').
LEGEND
DISTANCE EXPOSED
0'-50'
50'-100'
100'-200'
200'-500'
500'-1000'
1000'+
OKANAGAN LAKE
FIG. 2

FIG 2

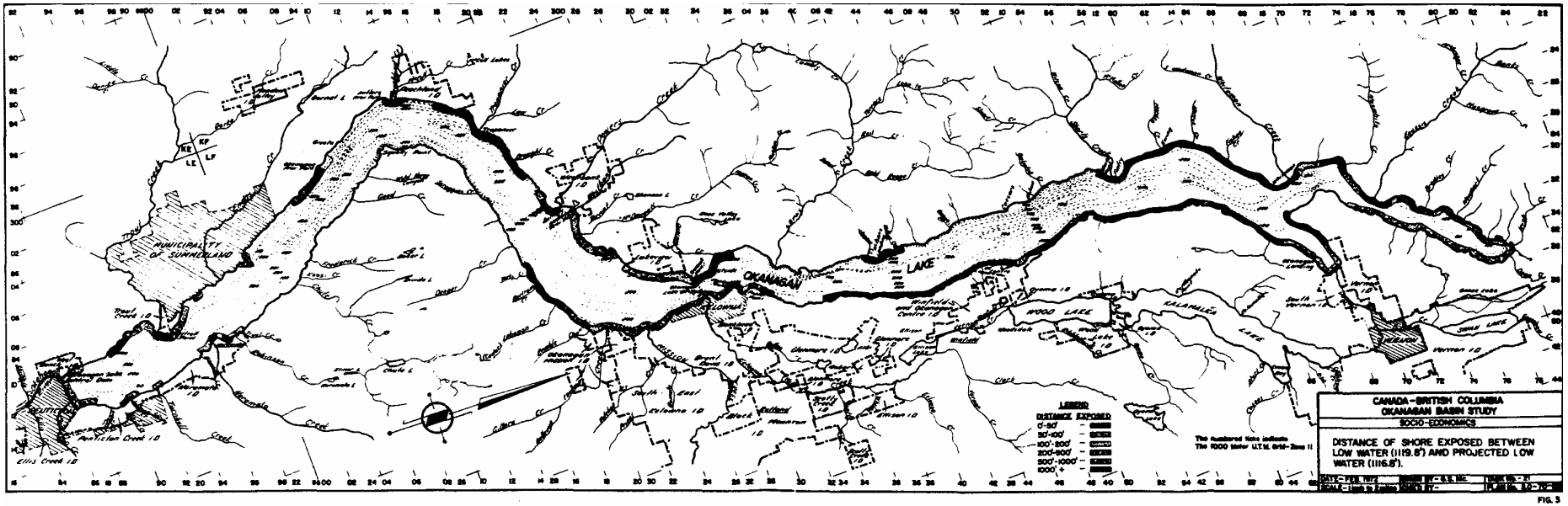
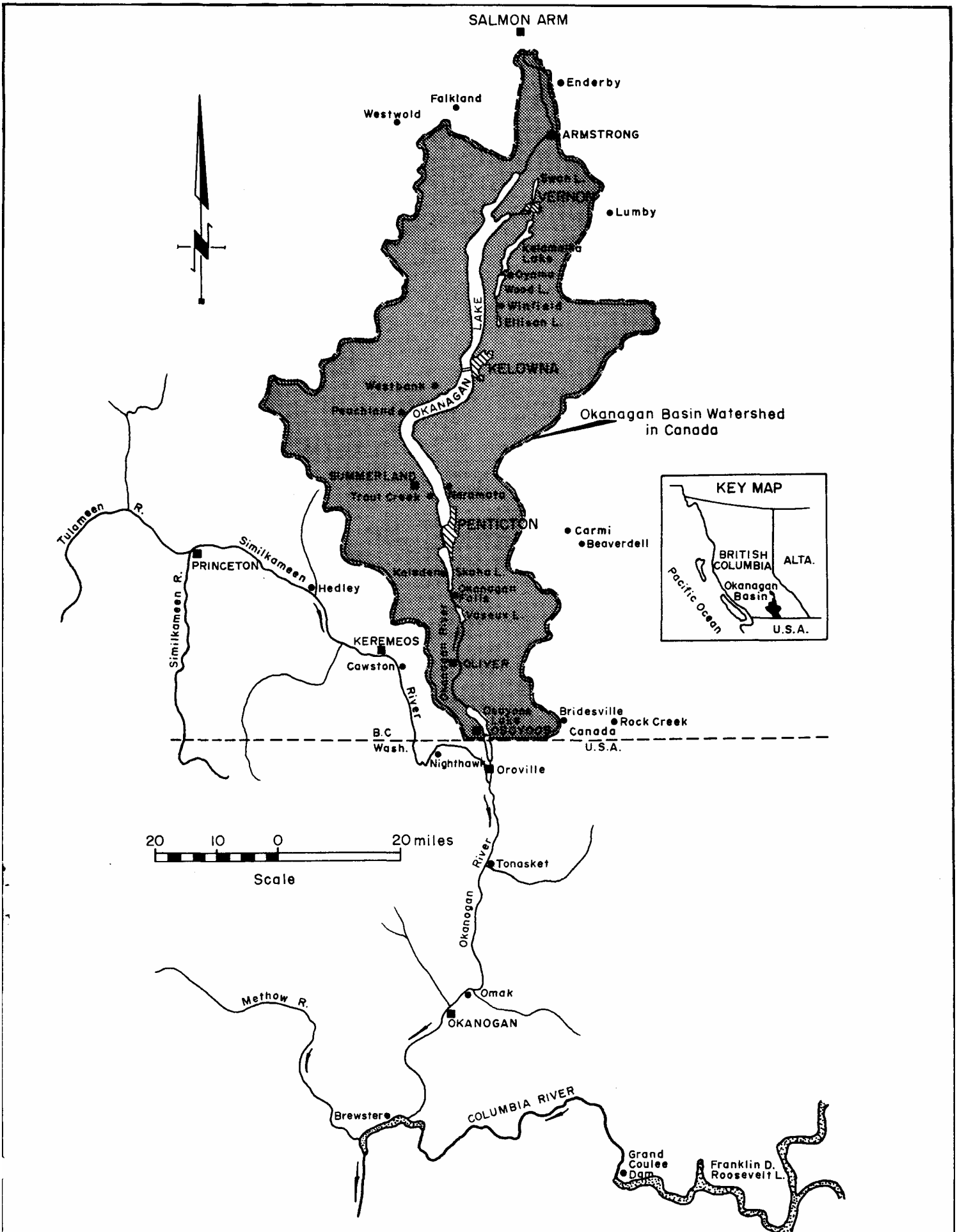

OKANAGAN
LAKE
MUNICIPALITY OF SUMMERLAND
WOOD LAKE
KALAMALKA
LEGEND
DISTANCE EXPOSED
0'-50'
50'-100'
100'-200'
200'-500'
500'-1000'
1000'+
CANADA - BRITISH COLUMBIA
OKANAGAN BASIN STUDY
SOCIO-ECONOMICS
DISTANCE OF SHORE EXPOSED BETWEEN LOW WATER (1119.8') AND PROJECTED LOW WATER (1116.8').

FIG. 3

FIG 3


SALMON ARM
Enderby
Falkland
Westwold
ARMSTRONG
Swan L.
VERNON
Lumby
Kalamalka Lake
Cosens Bay
Wood L.
Winfield
Ellison L.
OKANAGAN LAKE
KELOWNA
Westbank
Peachland
OKANAGAN R.
Okanagan Basin Watershed in Canada
SUMMERLAND
Trout Creek
Naramata
PENTICTON
Carmi
Beaverdell
KEY MAP
BRITISH COLUMBIA
ALTA.
Pacific Ocean
Okanagan Basin
U.S.A.
Tulameen R.
PRINCETON
Similkameen R.
Similkameen
Hedley
Kaleden
Skaha L.
Okanagan Falls
Vaseux L.
Vaseux Creek
KEREMEOS
Cawston
OLIVER
Similkameen River
Osoyoos L.
OSOYOOS
Bridesville
Rock Creek
B.C
Wash.
Canada
U.S.A.
Nighthawk
Oroville
20 10 0 20 miles
Scale
Okanogan River
Tonasket
Methow R.
Omak
OKANOGAN
Brewster
COLUMBIA RIVER
Grand Coulee Dam
Franklin D. Roosevelt L.