Fisheries and Oceans
Pêches et Océans

#330 - 80 Sixth Street
New Westminster, B.C.
V3L 5B3

Your file Votre référence

Our file Notre référence

December 22, 1987

Mr. P.M. Brady
Director, Water Management Branch
Ministry of Environment
765 Broughton Street
Victoria, B.C.
V8V 1X5

Dear Sir:

Re: WATER RELEASES FROM OKANAGAN LAKE FOR SOCKEYE SALMON

As you are aware, drought conditions in the Okanagan Lake region this year have resulted in lower than normal lake elevations and this poses a threat to the eggs of beach spawning kokanee. In November 1987, C.J. Bull, Fish and Wildlife, had requested that the present lake discharge of 175 cfs into the Okanagan River be reduced to 100 cfs. This would reduce the winter drop in lake elevation from 6 inches to 3.5 inches, thereby reducing the dehydration and freezing risk to kokanee eggs by up to 30%. To address this problem, a survey was carried out November 19-20 to determine what flow release from Okanagan Lake would allow Okanagan Lake kokanee downstream and Okanagan River sockeye eggs to share the same risks of dewatering and/or freezing.

Two sites were chosen to resolve the problem; a prime kokanee beach spawning site at Carrs Point on Okanagan Lake, north of Kelowna, and a representative sockeye spawning area on the Okanagan River near Oliver. The beach at Carrs Point had a gentle slope of 1:22.7. Flow releases from the Vaseux Lake dam were manipulated - lowered to 100 cfs for 16 hours - to measure the areal extent of exposed sockeye redds at 175 cfs and 100 cfs.

This survey indicated that if the discharge of Okanagan Lake is reduced from 175 cfs to 150 cfs the egg loss by dewatering and/or freezing will be shared equally by kokanee and sockeye salmon with each stock having 7 million eggs at risk.

In view of our decision to cooperate with Fish and Wildlife and balance or equalize the rate of mortality of kokanee and sockeye eggs, it is recommended that the discharge from Okanagan Lake be temporarily reduced from 175 cfs to 150 cfs until winter inflow (December to March) balances or reverses the present downward trend in Okanagan Lake elevation. This information was passed on to D. Narver two weeks ago and it is my understanding that this adjustment to the river flows was to be implemented at that time.

This memorandum and attached field report will confirm the position we have taken on this flow problem.

Yours truly,

O.E. Langer
Head, Habitat Management Unit
Fraser River, Northern B.C.
and Yukon Division

WF/cs
WF1/Brady

Attachment

cc: C. Bull
D. Narver
F. Fraser
B. Kurtz
G. Kosakoski
B. Zook
D. Deans

Government of Canada / Gouvernement du Canada

MEMORANDUM **NOTE DE SERVICE**

TO / A: O.E. Langer

FROM / DE: W.J. Field

SECURITY - CLASSIFICATION - DE SÉCURITÉ
OUR FILE — N / RÉFÉRENCE
YOUR FILE — V / RÉFÉRENCE
DATE: December 18, 1987

SUBJECT / OBJET

DETERMINATION OF FLOW IN THE OKANAGAN RIVER THAT WILL ALLOW KOKANEE AND SOCKEYE EGGS TO SHARE EQUALLY THE RISK OF EXPOSURE TO DROUGHT CONDITIONS

The request by Fish and Wildlife to reduce flows in the Okanagan River from 175 cfs to 100 cfs for the purpose of reducing the risk to kokanee eggs along the shore of Okanagan Lake was the subject of an on-site meeting on November 19, 1987. The meeting at Oliver was attended by C.J. Bull, Fish and Wildlife, Fishery Officer S. Coultish, C. Edge, Water Management and W. Field, Habitat Management.

Two survey sites were selected (by mutual agreement) on the Okanagan River near Oliver (see location map). The first site, 2.7 km downstream from the Highway 97 bridge crossing, was used to monitor river discharge by flow metering (figure 1). The second site, 3.1 km downstream from the bridge, was used for mapping the channel bed and surveying the elevation of redds above and below the water surface. The second site was an area of channel measuring 310 feet long and 90 feet wide (figure 2) that would serve to represent the increase in the exposure of river gravel with decreasing channel flow in the Okanagan River.

During the afternoon of November 19, the flow was metered at 180 cfs and the area of exposed gravel (redds) was found to be 8% (Table 1) of the total site area of 27,000 ft^2. At 4 pm the discharge from Vaseux Lake dam was reduced to 100 cfs overnight. The next day at 9 am, the flow water was metered at 131 cfs and the area of exposed gravel increased to 22% of the site area. From the metering data and survey results, it was estimated that all redds would be covered by water at 240 cfs (figure 3). Assuming a uniform distribution of redds in the river gravel, a river discharge of 150 cfs would expose 16% of the redds to the direct effects of drying and/or freezing.

According to Bill Zook, Washington Department of Fisheries, a reliable count of 35,000 sockeye spawners moved upstream in the

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Okanagan River above the Similkameen confluence. An estimated 15,000 of these are above Drop Structure #13 at Oliver. If the flow in the Okanagan River is maintained at 150 cfs and 17,500 sockeye at 2,500 eggs/fish produce 43,750,000 eggs, a loss of 16% of the redds translates into a loss of 7,000,000 eggs. These results are summarized in the following table:

TABLE 1
OKANAGAN RIVER

Discharge (cfs)	Area exposed (%)	Number of eggs at risk
240	NIL	NIL
180	8	3,500,000
160	13	5,687,500
150	16	7,000,000
135	22.5	9,843,750
100	36	15,750,000
0	100	43,750,000

Currently, 175 cfs is released from Okanagan Lake for sockeye salmon in the Okanagan River and this discharge, with no winter inflow, will lower the lake elevation by 6 inches during the period December to March inclusive. B.C. Fish and Wildlife has requested that the discharge be reduced to 100 cfs in order to reduce the drop in lake elevation to 3.5 inches which, they estimate, would save 30% of the eggs or 7 million eggs. According to the 1987 escapement estimates, 75% (Table 2) of the spawning took place along the lake shore, leaving 25% for stream spawning. Studies show (Table 3) that an average of 33.5% of the eggs are deposited very close to shore at depths ranging from 0 to 0.5 feet.

TABLE 2
KOKANEE ESCAPEMENTS - OKANAGAN LAKE (x 1,000)

Year	Stream Spawners	Shore Spawners	Percent Spawning on Shore
1977	59	545	57
1978	153	54	26
1979	203	108	35
1980	148	180	55
1981	113	214	65
1983	69	55	44
1984	152	5	3
1985	205	29	12
1986	87	17	16
1987	55	165	75

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TABLE 3
KOKANEE EGG DEPOSITION BY DEPTH
According to Matthews and Bull (1981) and Halsey and Lea (1973)

Water Depth (ft)	Percent of Eggs	
	Matthews/Bull	Halsey/Lea
0-0.5	23	44
0.5-1.0	53	62
1.0-1.5	60	79
1.5-2.0	78	96
2.0-2.5	100	100

On November 20, the slope of the beach at Carrs Point, a prime kokanee spawning area on Okanagan Lake, was surveyed and found to be 1:22.7 (figure 4). In 1987, 82,500 kokanee deposited 25 million eggs along the shoreline or 303 eggs/female. If, for example, the lake discharges at 175 cfs during the next four months, the lake drawdown of 6 inches (figure 5) will expose the kokanee redds at lake depths between 0 and 0.5 feet and place some 8.4 million eggs or 34% of the total spawn at risk. If the lake discharge is reduced to 100 cfs the drawdown of 3.5 inches will expose redds at depths from 0 to 0.29 feet and place some 5 million eggs or 20% of the total spawn at risk. Table 4 is a summary of risks to kokanee and sockeye spawners at various flows in the Okanagan River.

TABLE 4

Okanagan River Discharge (cfs)	Okanagan Lake Drawdown (inches)	Eggs Exposed (Millions)	
		Kokanee (82,500 fem.) Shore spawning	Sockeye (17,500 fem.) River spawning
100	3.5	5.0	15.8
135	4.6	6.4	9.8
140	4.8	6.7	8.3
145	5.0	7.0	7.4
150	5.2	7.2	7.0
155	5.3	7.4	6.1
160	5.5	7.7	5.7
165	5.65	7.9	5.3
170	5.85	8.2	4.6
175	6.0	8.4	3.5

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According to Table 4, the risk to kokanee should approximate the risk to sockeye eggs if the discharge from Okanagan Lake is 150 cfs. Under the present flow regime, a flow reduction from 175 cfs to 150 cfs will result in a loss of some 7 million eggs each; ie. the kokanee will lose 29% of the run and the sockeye will lose 16% of the run.

The possibility of the fall drought extending through the winter months is considered remote. The last winter drought (November-February) when no lake inflow occurred was during the winters of 1929, 1930 and 1931. In recent years, low winter inflows have been recorded, ie. 1962 - 6,000,000 m^3, 1979 - 8,000,000 m^3. To put this into perspective, 1/10 of an inch of rain falling in one day on the Okanagan Lake surface of 84,200 acres will produce 701.7 acre feet of storage which is sufficient to supply an extra 10 cfs of discharge for 35 days. Any rainfall will work to the advantage of the kokanee eggs by slowing the rate of drawdown of Okanagan Lake.

In view of our decision to balance or equalize the rate of mortality of kokanee and sockeye eggs, at 7 million each, it is recommended that the discharge from Okanagan Lake be temporarily reduced from 175 cfs to 150 cfs until winter inflow (December-March) balances or reverses the downward trend in Okanagan Lake elevation.

W. Field

WF/cs
WF1/Kokanee

Attachment

PENTICTON

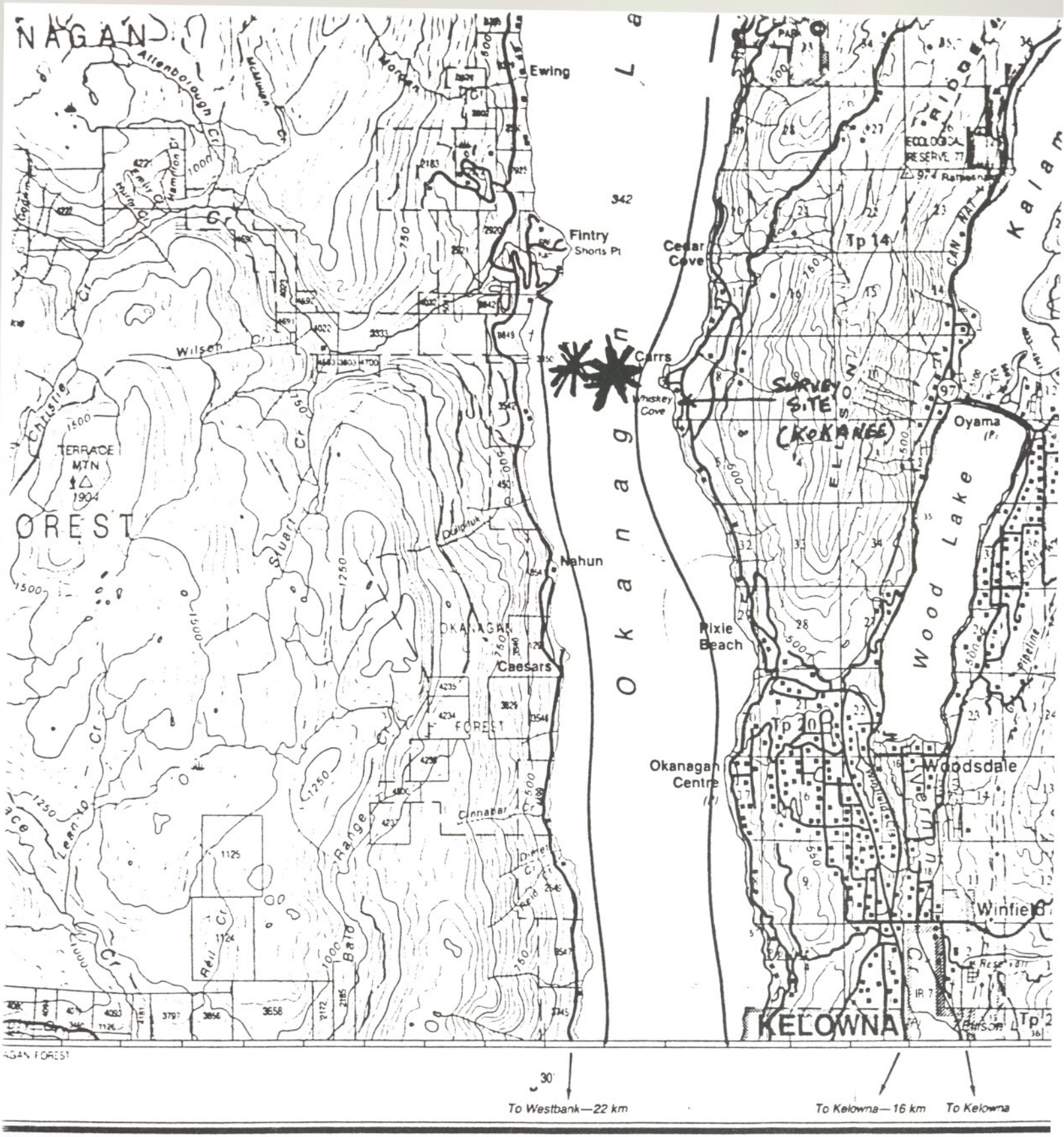
BRITISH COLUMBIA

WEST OF SIXTH MERIDIAN - OUEST DU SIXIÈME MÉRIDIEN

Scale 1:250 000 Échelle

Miles 5 0 5 10 15 20 Miles

10 15 20 25 30 Kilomètres

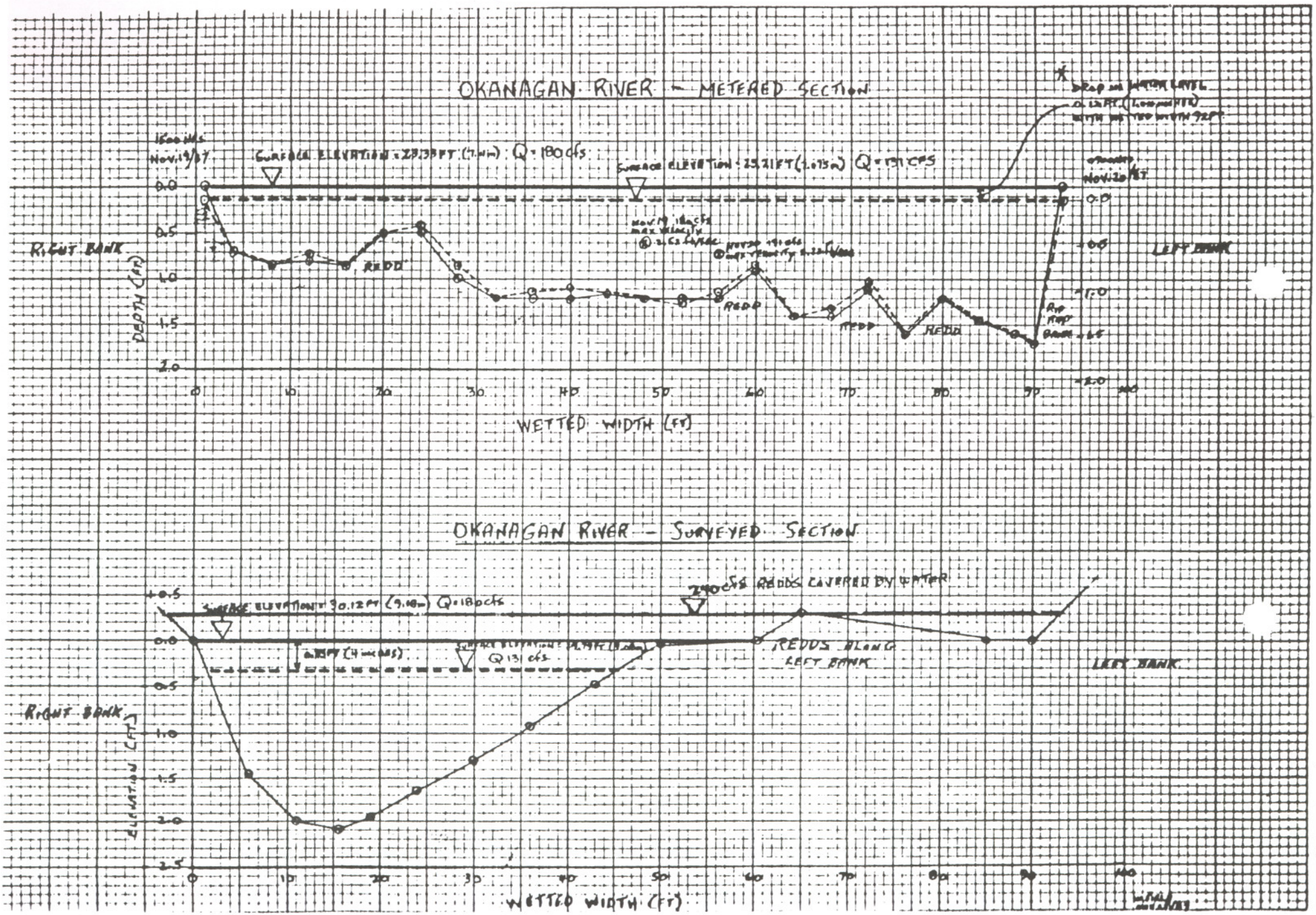


VERNON

Scale 1:100 000

(1 cm = 1 km)

km 2 0 2 4 6 8 10 12 14 km


OKANAGAN RIVER – METERED SECTION
Nov. 13/87
SURFACE ELEVATION = 28.13 FT (7.7m) Q = 180 cfs
SURFACE ELEVATION = 25.21 FT (7.67m) Q = 131 CFS
REDD
REDD
REDD
REDD
RIGHT BANK
LEFT BANK
DEPTH (FT)
WETTED WIDTH (FT)
OKANAGAN RIVER – SURVEYED SECTION
SURFACE ELEVATION = 30.12 FT (9.18m) Q = 180 cfs
Q 131 cfs
REDDS ALONG LEFT BANK
RIGHT BANK
LEFT BANK
ELEVATION (FT)
WETTED WIDTH (FT)

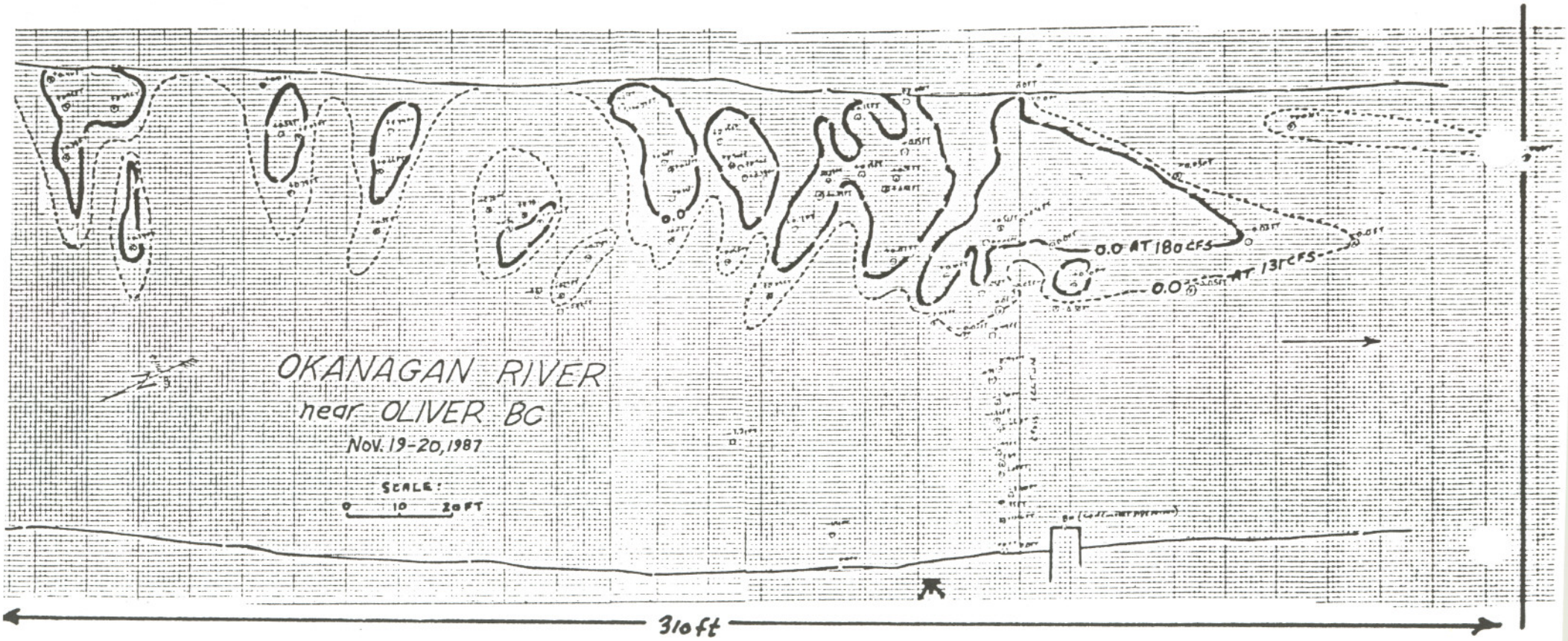
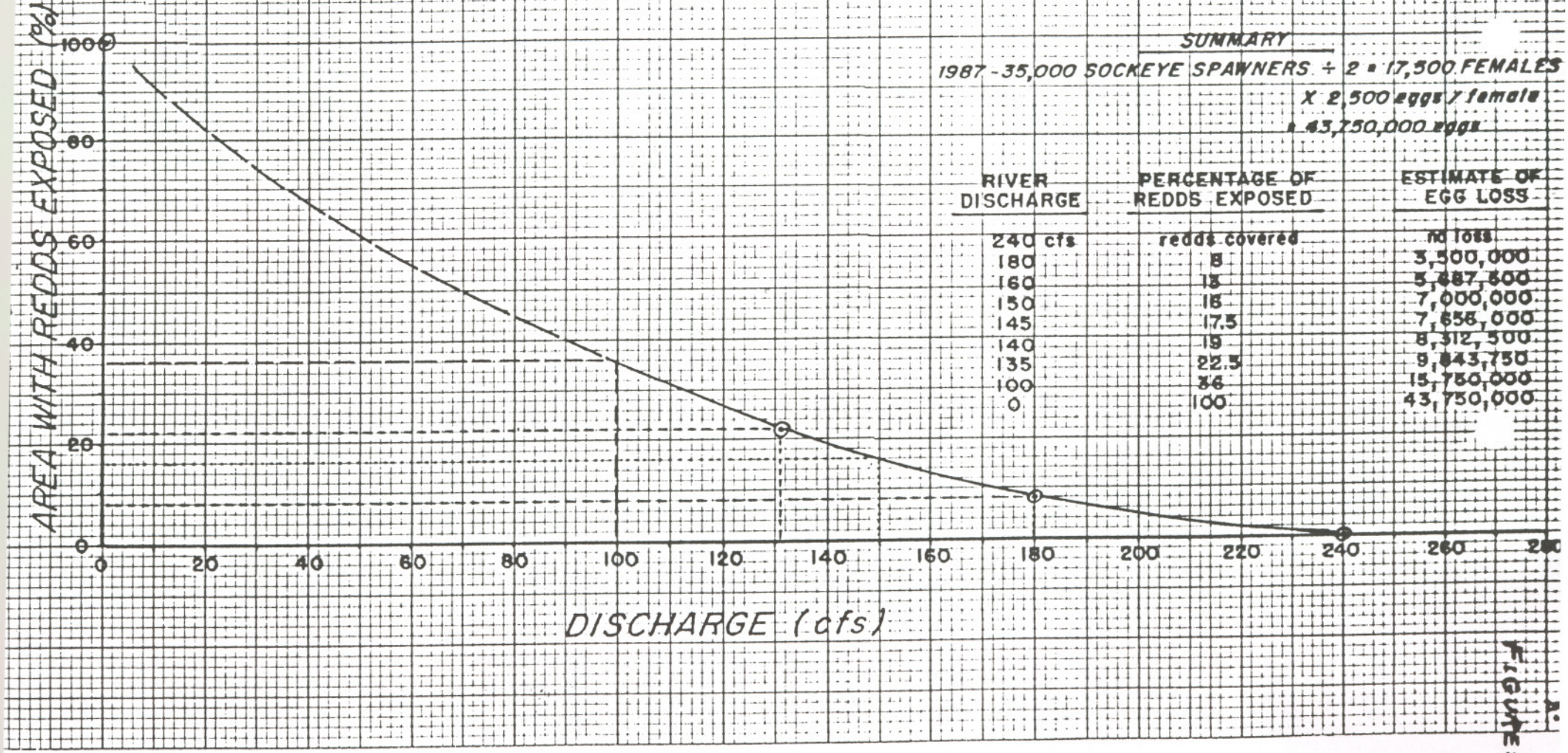

OKANAGAN RIVER
near OLIVER BC
NOV. 19-20, 1987
SCALE:
0 10 20 FT
0.0 AT 180 CFS
0.0 AT 137 CFS
310 ft

FIGURE 2.

OKANAGAN RIVER

RELATIONSHIP OF DISCHARGE TO SOCKEYE REDD EXPOSURE NEAR OLIVER, B.C.



SUMMARY

1987 - 35,000 SOCKEYE SPAWNERS ÷ 2 = 17,500 FEMALES

X 2,500 eggs / female

= 43,750,000 eggs

RIVER DISCHARGE	PERCENTAGE OF REDDS EXPOSED	ESTIMATE OF EGG LOSS
240 cfs	redds covered	no loss
180	8	3,500,000
160	13	5,687,500
150	16	7,000,000
145	17.5	7,656,000
140	19	8,312,500
135	22.5	9,843,750
100	36	15,750,000
0	100	43,750,000

FIGURE 3.

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OKANAGAN LAKE

KOKANEE SHORELINE EGG DEPOSITION BY DEPTH

SUMMARY: 1987 – 165,000 KOKANEE SHORE SPAWNERS ÷ 2 = 82,000 FEMALES X 303 eggs/female = 24,997,500 eggs

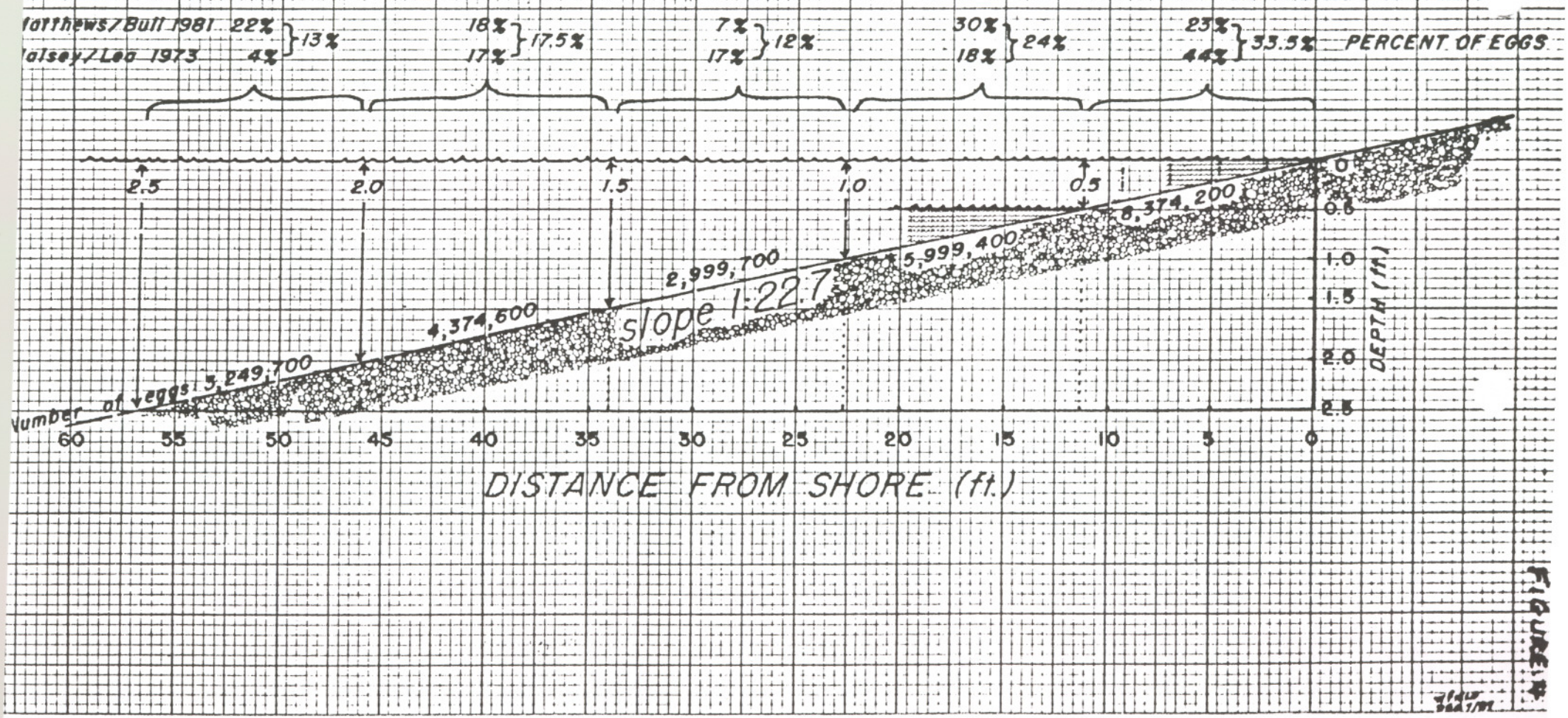

FIGURE 9

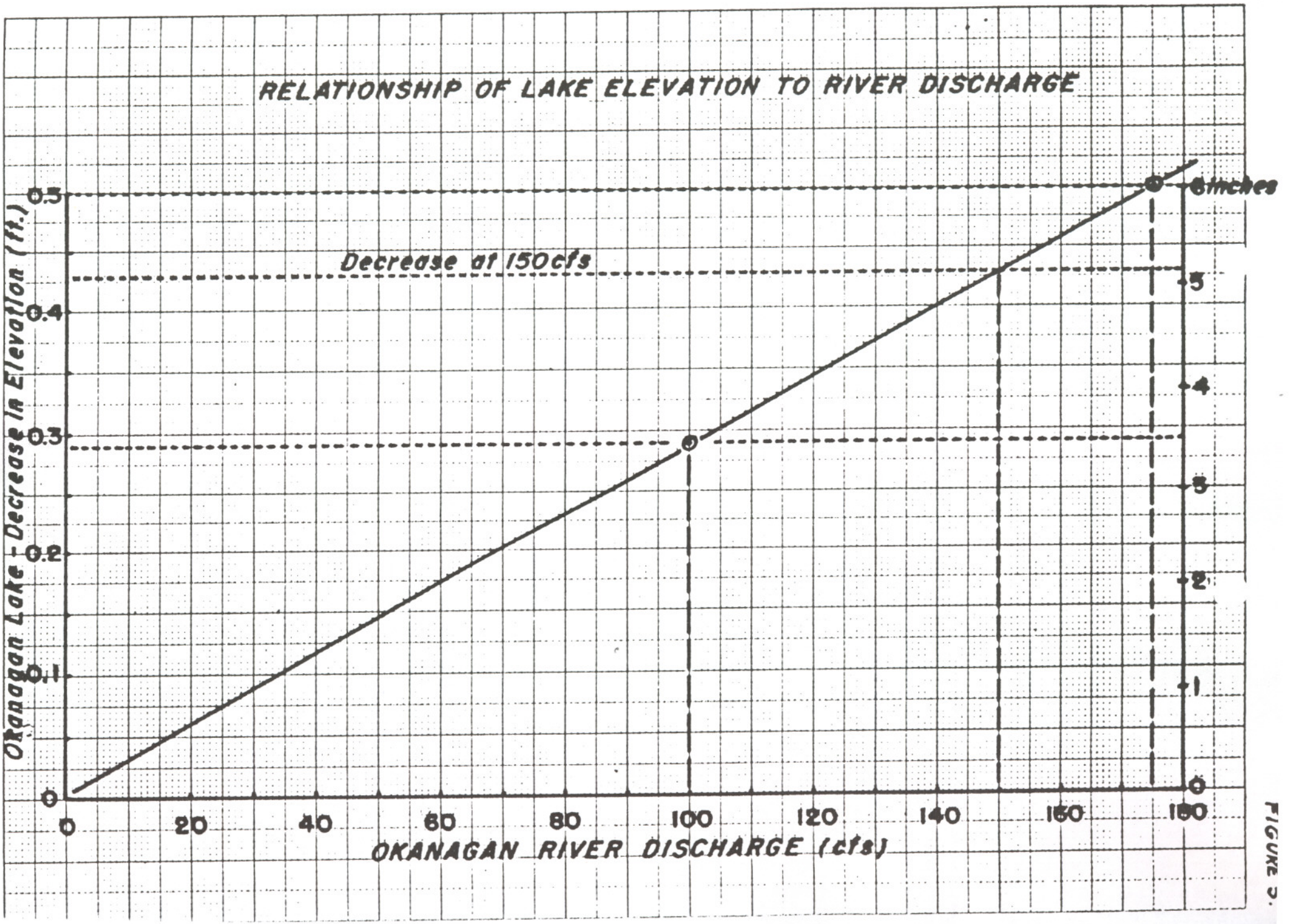

FIGURE 5.