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# Biophysical Stream Survey of the Upper Nahmint River and Nahmint Lake

by

K.W. Bond

M.J. Brownlee

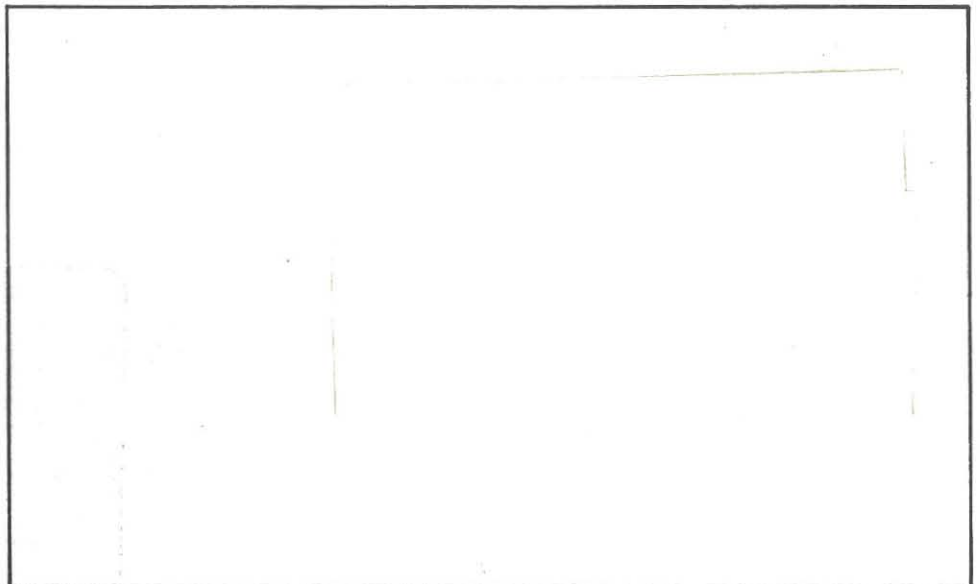
T.W. Chamberlin

J.M. Lamb

Technical Report Series No. PAC/T-75-3

Southern Operations Branch

Pacific Region



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BIOPHYSICAL STREAM SURVEY  
OF THE UPPER NAHMINT RIVER AND NAHMINT LAKE

by

K.W. Bond  
M.J. Brownlee  
T.W. Chamberlin  
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February, 1975

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Department of the Environment  
Fisheries Marine Service  
Pacific Region  
Southern Operations Branch  
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ACKNOWLEDGMENTS

The co-operation of MacMillan Bloedel Ltd. in supplying helicopter transportation into the watershed is greatly appreciated.

The support and advice of District and Sub-District Fisheries Officers contributed substantially to both the ideas in this report, and the field activity involved in it.

## INTRODUCTION

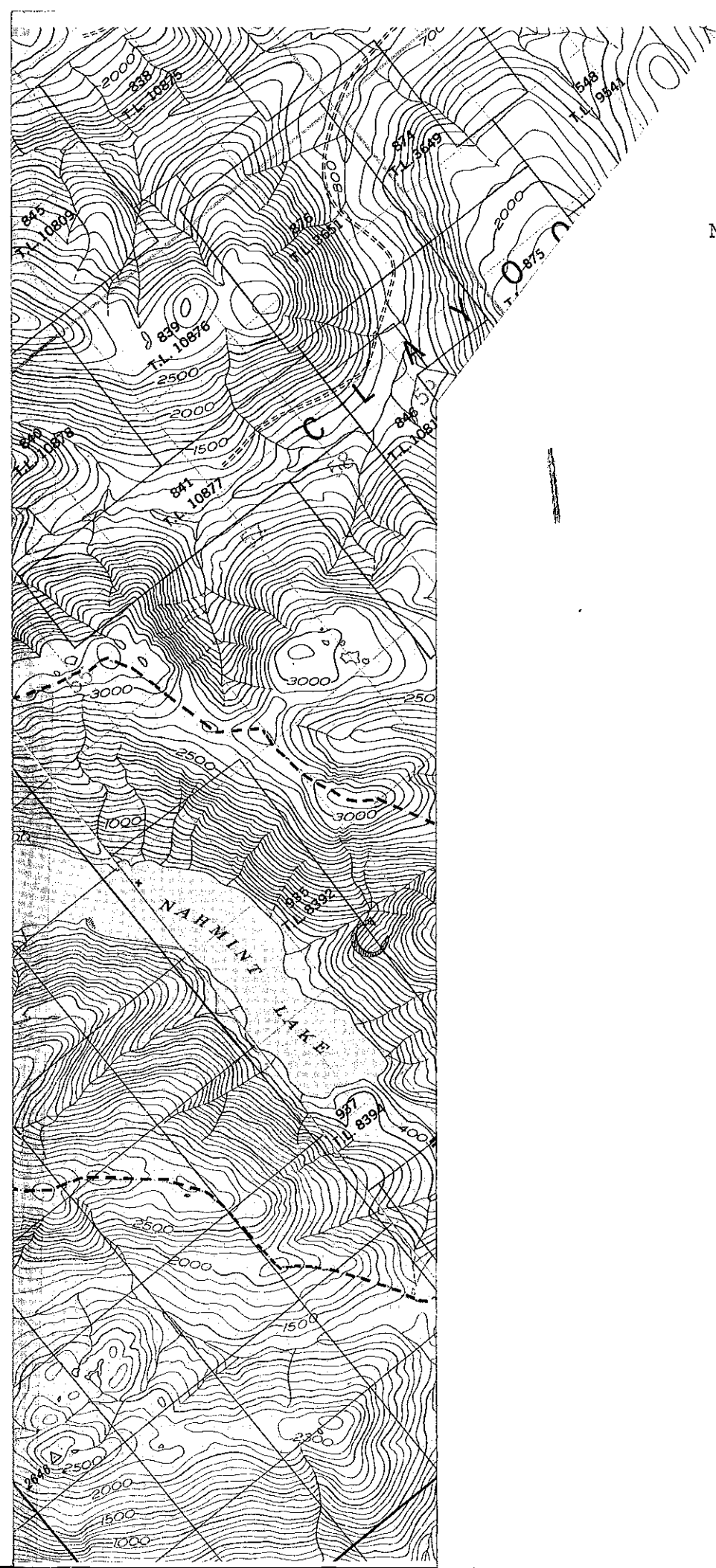
The Nahmint watershed is located 21 km. (13 mi.) southwest of Port Alberni on the north side of Alberni Inlet (Figure 1). The drainage is approximately 44 km. (27 mi.) in length, extending from the Mackenzie Range to Nahmint Bay.

Fisheries Service records indicate that up to 1,200 chinook salmon (Oncorhynchus tshawytscha), 35,000 chum salmon (O. keta), and 650 coho salmon (O. kisutch), annually spawn in the lower 4.8 km. (3 mi.) of river. An unknown number of summer and winter steelhead trout (Salmo gairdneri), frequent the upper Nahmint River.

The lower Nahmint River contains two obstructions to anadromous fish, one located 0.8 km. (0.5 mi.), (Figure 1) below the lake and the other 4.8 km. (3 mi.) from tide water. At present, the lower falls impede all salmonid migration except steelhead trout.

The estuary is used for rearing by the anadromous species and supports an intensive sport fishery (Cameron and Fuchs, 1975). Studies conducted by Goodman (1972) and Levings (1972) have documented the importance of similar environments for salmonid rearing and invertebrate production.

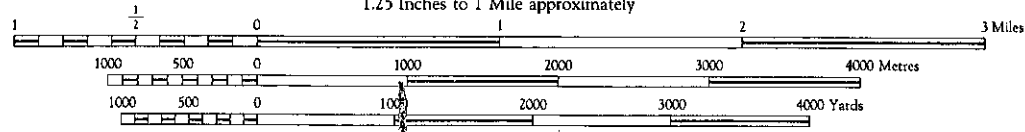
FIGURE NO. 1  
NAHMINT WATERSHED 1:50000



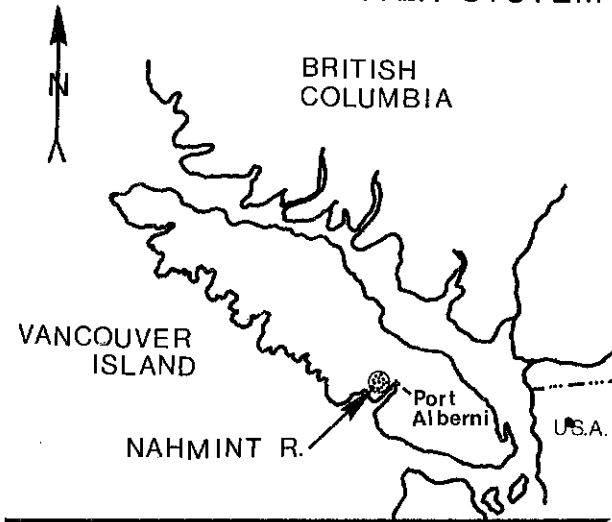
# NAHMINT RIVER SYSTEM

Figure No.1

Scale 1:50,000  
1.25 Inches to 1 Mile approximately

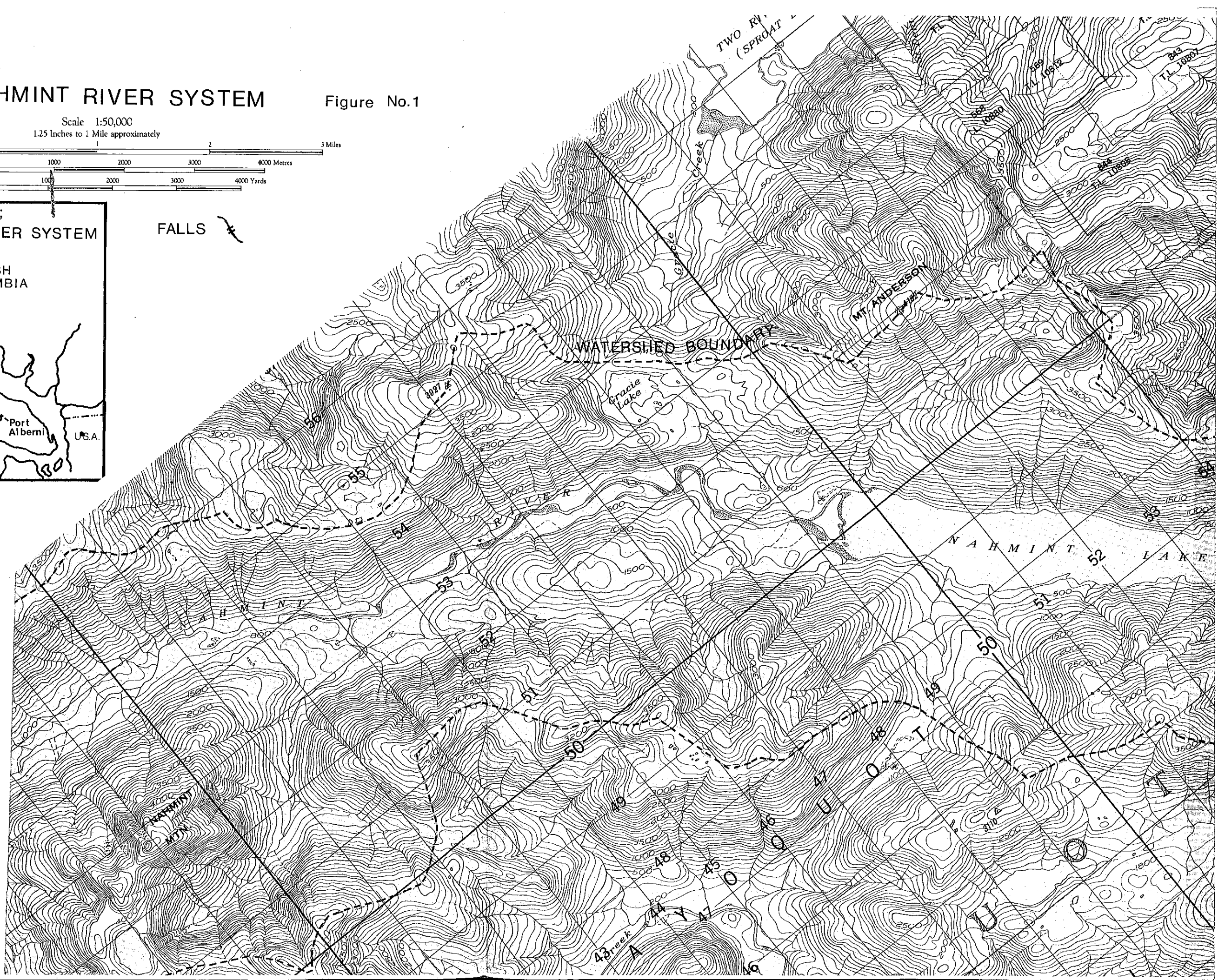


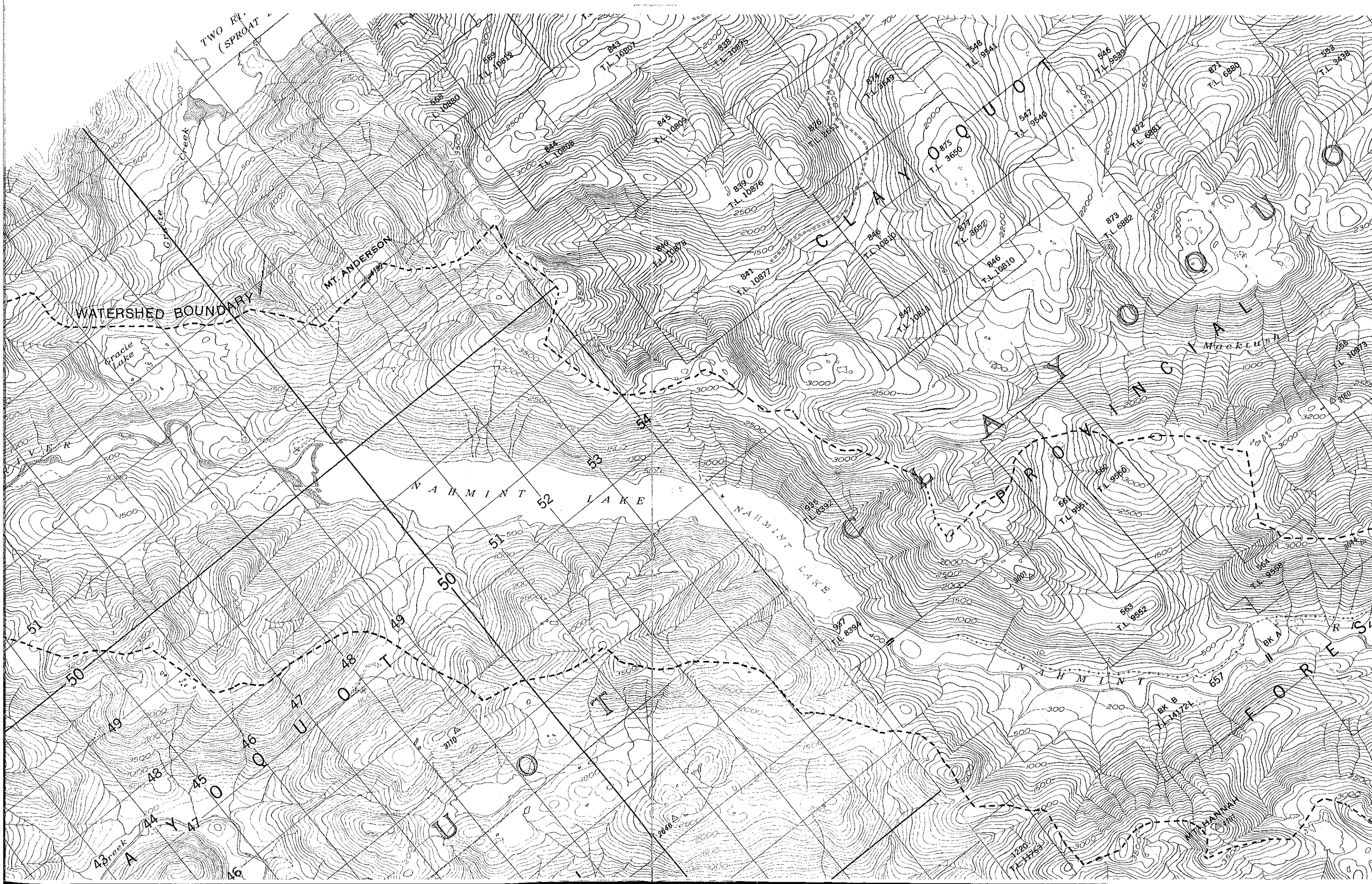
## LOCATION MAP; NAHMINT RIVER SYSTEM



FALLS

10% OF WATERSHED  
AREA OUTSIDE OF  
MAP BOUNDARY





TWO RV.  
(SPROAT)

MT. ANDERSON

WATERSHED BOUNDARY

Gracie Lake

NAHMINT LAKE

NAHMINT LAKE

Mackush

V.E.R.

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Annual precipitation in the Nahmint watershed has been estimated at over 5,000 mm. (200 in.) by Cheng (1972). Measurements near Nahmint Lake from June to December, 1975, have included maximum 1 hour precipitation intensities of 20 mm./hr. and in excess of 125 mm. for 24 hr. maximums. (E.L.U.C. Secretariat, unpub.).

An unknown but substantial portion of the runoff is derived from snow melt, and the upper reaches of the watershed have demonstrated avalanche conditions.

The watershed is located within MacMillan Bloedel Limited's Tree Farm Licence #21 under the management of their Sproat Lake Logging Division. In 1973, the British Columbia Forest Service placed a two year moratorium on logging activity in the watershed to permit an integrated resource study. Subject to the study results, proposed road construction will commence in 1975, and forest harvesting in 1976.

Existing information describing the Nahmint watershed is listed in the bibliography.

Objectives:

The Nahmint survey was designed with three major objectives.

1. To provide an aquatic resources data base leading to recommendations for forest management.
2. To further refine stream inventory methodology applicable to the developing B.C. Forest Service resource folio planning system.
3. To present stream inventory data in a form which can be easily adapted to computer-based data management systems.

## PROCEDURES

Two trips were made into the system, the first on August 6-9, 1974, via float plane with access to the upper Nahmint River by helicopter, and the second via helicopter on September 11, 1974 to Nahmint Lake.

Information was recorded in the following categories: stream bottom substrate type and extent, bank-stream interface type and extent, fish habitat, pool/riffle ratio, stream gradient, mean stream width, discharge estimation, obstructions, location of secondary channels and flood channels, water temperature, and fish density and species diversity. Appendix A describes the code used to record these data.

It should be recognized that many of these data must be interpreted in the context of a single survey. In particular, flow estimations and water temperatures should be used relative to the time of survey.

### Upper Nahmint River

The upper Nahmint River and tributaries were surveyed using an inflatable rubber boat for access. Reaches displaying similar physical parameters were summarized in coded form (Figure 2). Fish species, distribution, and density

FIGURE NO. 2

UPPER NAHMINT RIVER 1:25000



were determined from samples taken at Station 0, and at the mouth of the upper Nahmint River using a Smith-Root Type V Electrofisher.

#### Nahmint Lake

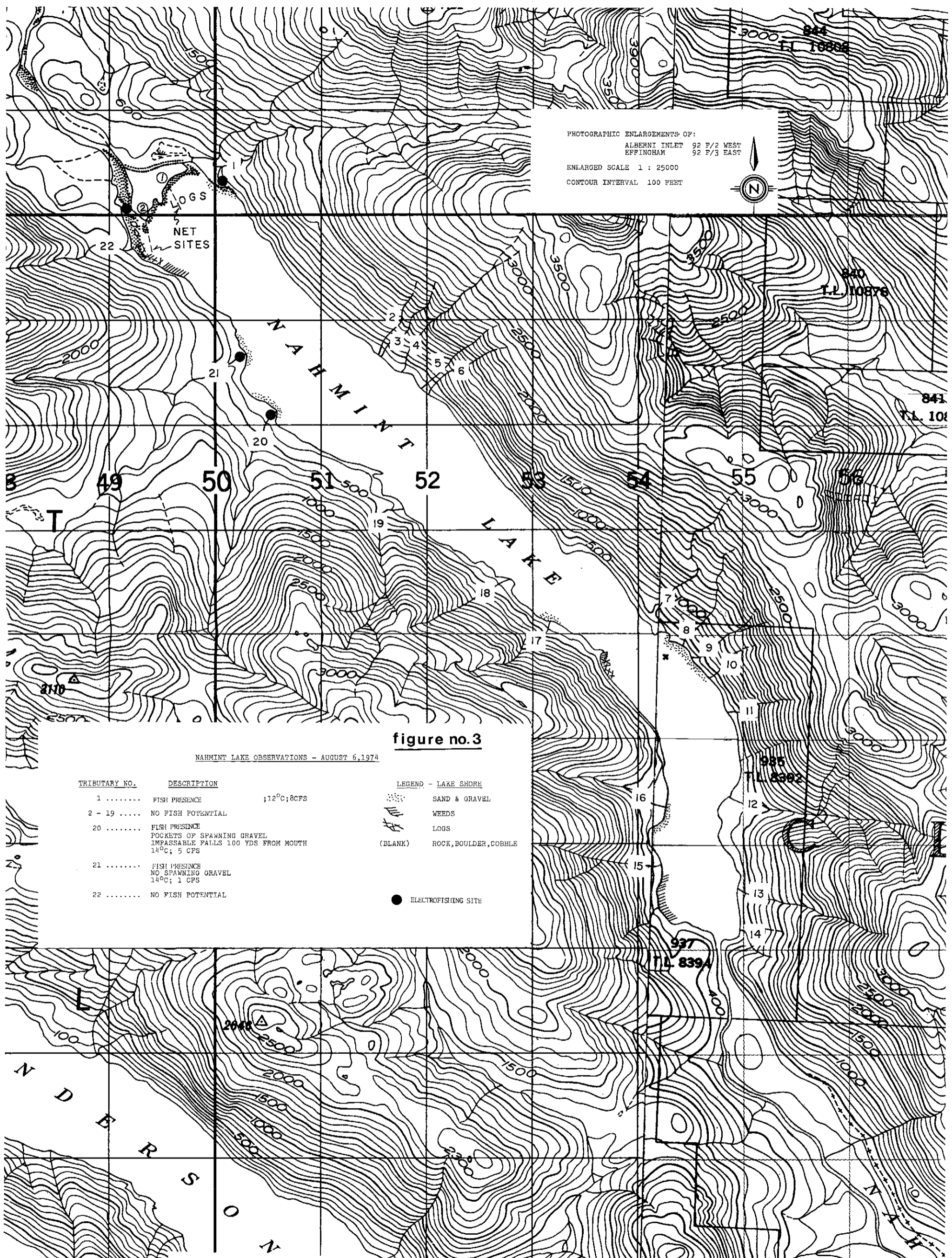
The periphery of the lake was mapped (Figure 3), and tributaries were inspected for fish potential. A portable Furuno Sounder was used to determine lake morphometry (Figure 4). Fish species, distribution, and density were similarly determined in three of the tributaries. Two night gill net sets of 10 hour duration were made using a gang (5 m. x 77 m.) of five sinking gill nets (mesh 5.0 cm. - 12.50 cm.) to acquire information on diversity and density of fish species.

#### Lower Nahmint River

The lower Nahmint River, 12.1 km. (7.5 mi.) long, was observed from helicopter to determine the location and extent of obstructions. The detailed inventory used for the upper Nahmint and Nahmint Lake was not applied to the lower Nahmint because existing information was considered adequate. (see Bibliography).

FIGURE NO. 3

NAHMINT LAKE 1:25000



PHOTOGRAPHIC ENLARGEMENTS OF:  
 ALBERNI INLET 92 F/2 WEST  
 EFFINGHAM 92 F/3 EAST  
 ENLARGED SCALE 1 : 25000  
 CONTOUR INTERVAL 100 FEET



**figure no.3**

NAHMINT LAKE OBSERVATIONS - AUGUST 6, 1974

TRIBUTARY NO.	DESCRIPTION	
1	FISH PRESENCE	12°C; 8CFS
2 - 19	NO FISH POTENTIAL	
20	FISH PRESENCE POCKETS OF SPAWNING GRAVEL IMPASSABLE FALLS 100 YDS FROM MOUTH	14°C; 5 CFS
21	FISH PRESENCE NO SPAWNING GRAVEL	14°C; 1 CFS
22	NO FISH POTENTIAL	

LEGEND - LAKE SHORE	
	SAND & GRAVEL
	WEEDS
	LOGS
(BLANK)	ROCK, BOULDER, COBBLE
	ELECTROFISHING SITE

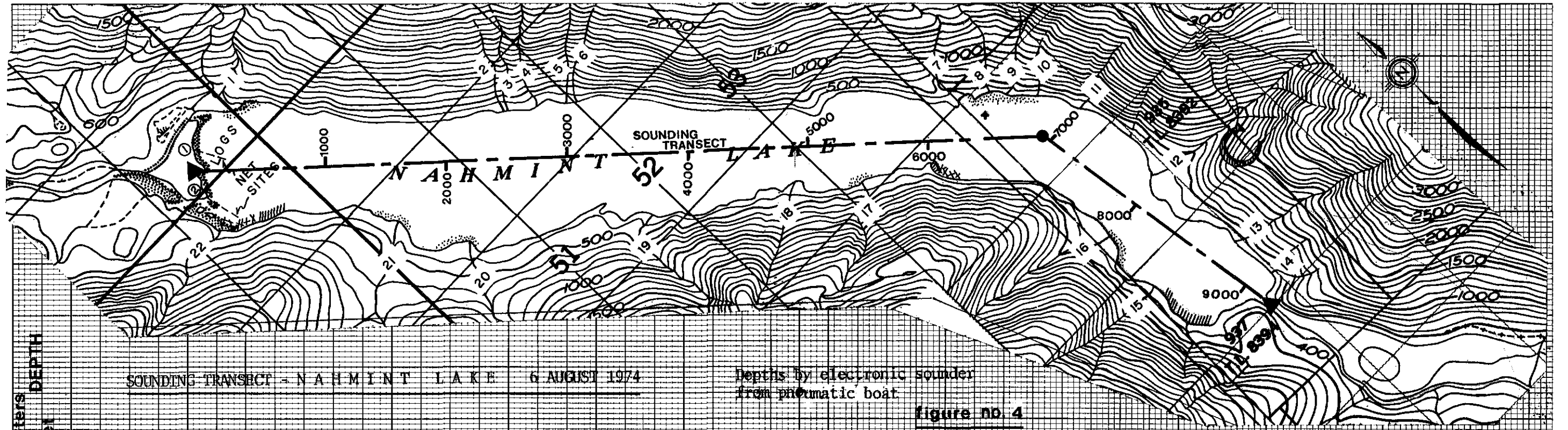
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FIGURE NO. 4

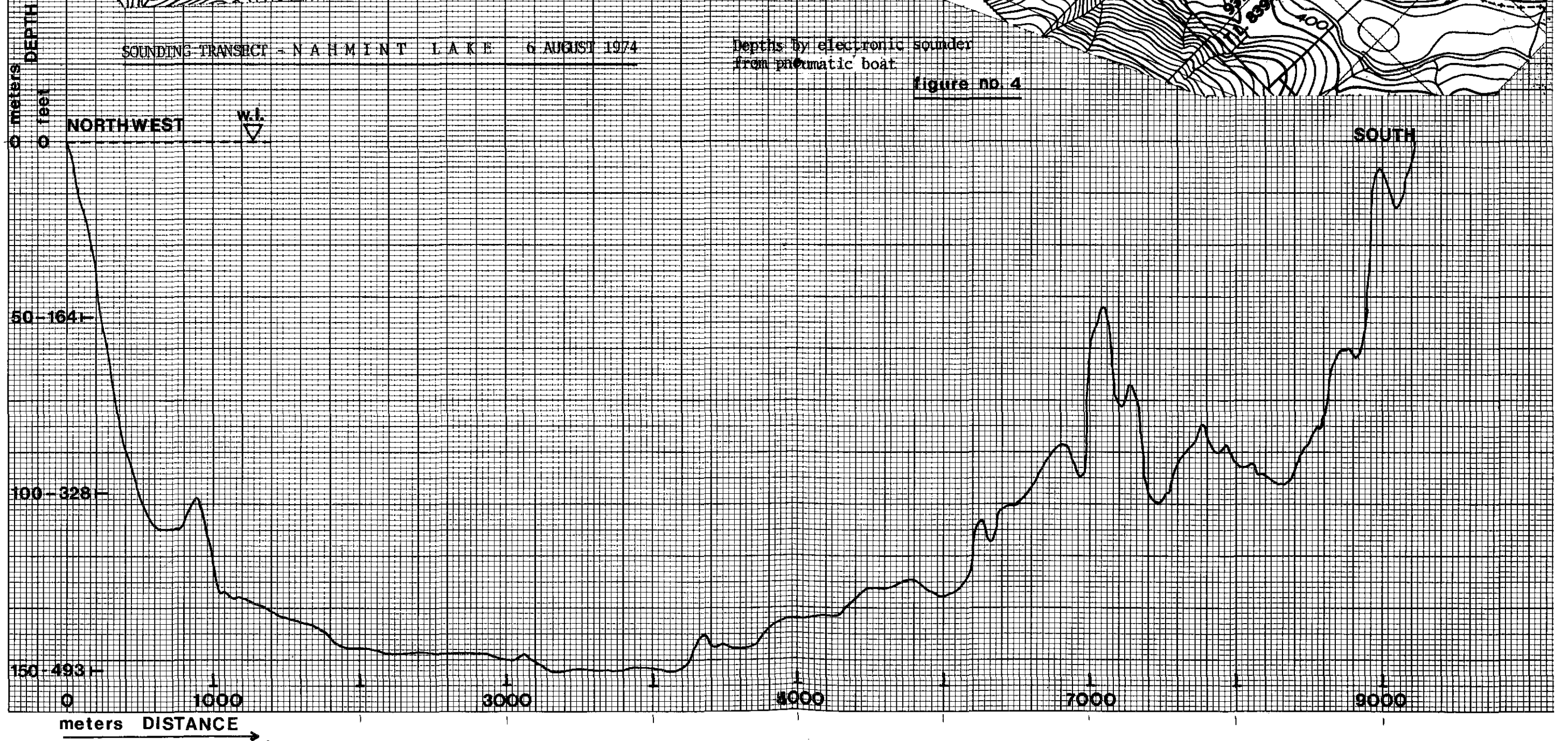
NAHMINT LAKE MORPHOMETRY 1:25000



SOUNDING TRANSECT - NAHMINT LAKE 6 AUGUST 1974

Depths by electronic sounder  
from pneumatic boat

figure no. 4



## SUMMARY OF OBSERVATIONS AND DISCUSSION

### Upper Nahmint River

The stream bottom substrate in the upper reaches of the Nahmint River consists predominately of bedrock, boulders, and cobbles extending to within about 13 km. (8 mi.) of the lake. Between 13 km. (8 mi.) and 3.2 km. (2 mi.) from the lake, the substrate is principally comprised of cobble and large gravel (10 cm. - 15 cm.). The 3.2 km. (2 mi.) of substrate immediately upstream from the lake is mainly comprised of (5 cm. - 10 cm.) spawning gravel. Cut banks, on the outside of stream meander curves, are stabilized by deciduous and coniferous root growth through the upper Nahmint River.

Two sets of falls exist in the upper Nahmint River; the larger (unknown size) is 12.9 km. (8 mi.) from the lake and the other, consisting of 6 falls up to 13 m. high, is 4.8 km. (3 mi.) from the lake. Several trout fry were observed above this lower set of falls. Water temperature ranged from 9° to 14° C., and the estimated flow at the lake confluence was approximately 225 cfs. at survey time.

Secondary and flood channels along with extensive flood plains are present throughout the lower 9.7 km. (6 mi.) of the stream. A major tributary (No. 1, Figure 2), flowing into the upper Nahmint River on the right bank exhibits good fish potential with good spawning gravel, low gradient and a 40 cfs flow at the time of observation. A second tributary (No. 3, Figure 2) entering on the left bank, 2.4 km. (1.5 mi.) from the lake also offers good fish potential, with spawning gravel, low gradient for 500 m., and a 13 cfs flow at observation time.

The upper Nahmint River provides excellent potential for production of coho and sockeye salmon (O. nerka), although indications from electrofishing are that neither species presently utilize this section of watershed. However, the river does support a population of juvenile rainbow and/or steelhead trout (Table 1). No information is available to establish the race of salmonid observed.

Table 1

ELECTROFISHING RESULTS - SEPTEMBER 17, 1974Tributary #1 (Figure 3 - 100 m. reach)

<u>Weight (gm.)</u>	<u>Length (mm.)</u>	<u>Species</u>	<u>Age (Yr.)</u>
9.49	90	Rainbow	1+
11.37	97	"	1+
6.33	82	"	1+
0.70	38	"	0+
0.49	33	"	0+
0.43	34	"	0+
12.18	95	Prickly Sculpins	
4.55	76	"	
3.34	70	"	
3.00	66	"	
1.75	55	"	

Tributary #20 (Figure 3 - 60 m. reach)

5.52	76	Rainbow	1+
1.50	49	"	0+
1.52	48	"	0+
0.35	32	"	0+
4.70	72	Prickly Sculpins	
3.72	69	"	
2.28	59	"	
2.20	59	"	
1.76	54	"	

Table 1  
(continued)Tributary #21 (Figure 3-75 m. reach)

<u>Weight (gm.)</u>	<u>Length (mm.)</u>	<u>Species</u>	<u>Age (Yr.)</u>
16.66	109	Rainbow	1+
6.10	79	"	1+
0.51	34	"	0+
0.32	32	"	0+
15.57	108	Prickly Sculpins	
6.09	84	"	

Upper Nahmint River (Figure 2)Lake Confluence (150 m. reach)

14.63	110	Rainbow	1+
11.84	100	"	1+
6.60	80	"	1+
6.45	80	"	1+
5.78	74	"	1+
5.17	75	"	1+
2.75	58	"	0+
2.19	58	"	0+
1.30	46	"	0+
1.30	48	"	0+
1.11	45	"	0+
0.60	36	"	0+
0.39	32	"	0+
0.36	32	"	0+
0.32	31	"	0+
0.23	26	"	0+

Station 0 (120 m. reach)

0 fish

### Nahmint Lake

The lake is 11.3 km. (7 mi.) long and 0.8 km. (0.5 mi.) wide with a maximum depth of 150 m. The littoral area is limited, associated productivity is low, and the lake evidences an oligotrophic condition.

Salmonids supported in low-to-moderate densities (compared to other areas on coast) are cutthroat trout (Salmo clarki clarki), dolly varden char (Salvelinus malma), steelhead and/or rainbow trout (Salmo gairdneri), and kokanee salmon (O. nerka). The prickly sculpin (Cottus asper) was also observed. (Table 2).

Tributaries 1, 20, 21 (Figure 3) have limited salmonid potential with rainbow trout present in low densities. Minor areas of potential spawning gravel exist at lake-tributary confluences but the major spawning area is located at the confluence of the upper Nahmint River and the lake.

In August, the surface temperature of the lake was 20°C and the thermocline was located approximately 3.4 m. below the lake surface at the time (Table 3).

Table 2

Nahmint Lake Netting ResultsSite No. 1 (refer to Figure 3)

Catch Period: 2000-0600  
August 6/7, 1974

<u>Weight (gm.)</u>	<u>Length (mm.)</u>	<u>Species</u>	<u>Age (yr.)</u>
16.5	110	Cutthroat	2
19.0	131	Kokanee	3
26.4	148	"	3
16.0	125	"	2
15.5	125	"	3
26.0	142	"	3
26.0	143	"	3
20.0	130	"	2
20.5	131	"	2
23.0	143	"	2
29.5	148	"	3
24.5	142	"	2
17.0	125	"	2
23.5	127	"	-
24.5	141	"	-
27.5	145	"	3
16.5	123	"	2

Table 2  
(continued)Site No. 2

Catch Period: 2000-0600

August 8/9, 1974

<u>Weight (gm.)</u>	<u>Length (mm.)</u>	<u>Species</u>	<u>Age (yr.)</u>
730	410	Dolly Varden	-
17.0	110	Cutthroat	2
10.5	100	"	2
18.5	125	"	2
13.0	112	"	2
* --	300	"	-
* --	110	"	-
31.0	157	Kokanee	4
29.5	154	"	3
27.5	150	"	3
* -- (3)	--	"	-
9.0	95	Prickly Sculpin	-
7.0	85	"	-

\* Partly eaten by Dolly Varden  
while in net.

Table 3Nahmint Lake Temperatures (August, 1974)

<u>Location</u>	<u>Temperature ( °C)</u>	<u>Depth (m.)</u>	<u>Thermocline (m.)</u>
Near Outlet	20.0	Surface	
	17.7	1.5	
	17.2	3.0	
	14.7	4.5	3.4
	14.5	6.0	
	13.2	9.0	
Mid-lake	20.0	1.5	
	18.5	3.0	3.4
	15.0	4.5	

### Lower Nahmint River

The upper falls consist of a 1.8 m. vertical drop and a narrow cut approximately 6.2 m. long. The lower falls consist of two 2.5 m. vertical drops in a horizontal distance of 9.2 m. created by the presence of a large rock slab. The removal of this slab and accompanying remedial work on the upper obstruction would permit coho and sockeye access to the extensive spawning gravel present in the upper Nahmint River, greatly enhancing Nahmint salmonid production.

(see Kasmer, 1971; Wilson and Rapp, 1971 for details)

## RECOMMENDATIONS

The following recommendations are divided into four sections: general, upper Nahmint River, Nahmint Lake, and lower Nahmint River. We have attempted to relate the recommendations for each sub-watershed to its particular characteristics.

### General

Because of the high present fisheries values represented in the Nahmint system, all tributaries and the main stream must be managed for high water quality. Additionally, consideration must be given to the probability of additional production resulting from salmon utilization of the upper system if obstructions in the lower river are removed.

1. Access systems should be designed for minimum disturbance and maximum drainage capacity. Culvert and bridge design should use 50-100 year return periods, and include the necessity for debris as well as water transport (e.g. Hetherington, 1974) and the probability of rain on snow events. Box or bridge-type culverts are preferred.

2. A long-distance yarding system should be considered wherever appropriate to minimize road mileage. All yarding should be away from the Nahmint River and major tributaries. In particular, uphill yarding is strongly recommended.

3. Cutting patterns and landing locations should be oriented to minimize the introduction of sediment or debris into tributary systems. All falling should be away from such tributaries.

4. Logging debris which enters tributary streams should be removed at the time of yarding if possible without bank damage.

5. Cutting patterns should be dispersed along an altitude gradient to avoid the unfavourable synchronization of snow melt. Similarly, the total area of "new" openings (regrowth less than 3 m. high) should not exceed 10% of the total watershed.

6. Cutting patterns and scheduling should be designed to ensure continuous vegetative cover by woody species on the banks of side channels, the lower reaches of fish potential tributaries, and the main stream. Hence, immature coniferous, and all deciduous growth should be left within a distance from the stream bank to be determined by terrain, but to be not less than 20 m. Permanent uncut blocks of mature timber, of a size consistent with windfirmness, may be required.

7. The Silvicultural standards should be at the highest level and include:

- a) Immediate restocking of cut areas, preferably using jumbo stock.
- b) Minimize slashburning area, particularly on southern aspects.

8. Remedial measures should be used to stabilize raw cut and fill slopes, tributary crossings, and discontinued spurs. These may include revegetation to grass or brush species, rip-rap, special drainage controls or buttressing, as appropriate to the site.

#### Upper Nahmint River

The upper Nahmint is occupied by trout to at least 12.9 km. above the lake, contains at least 3.2 km. of good spawning gravel, and provides excellent rearing potential throughout the lower 9.7 km. in the form of back channels and stabilized cut banks.

Excellent potential exists for coho and sockeye salmon if access is provided. The river drains a high relief topography with thin soils and displays corresponding rapid response characteristics. Extreme runoff may result from

either intense rain, or rain on snow events.

1. The south side of the upper Nahmint is recommended for mainline access, with a preferred crossing location between 8+300 and 8+530 (Figure 2).
2. Tributaries 1, 2 and 3 are fish-producing, and should be bridged. General recommendation 6 would also apply.
3. The lower 500 to 1,000 m. of the river combines good spawning gravel with the instability of a flood plain. Hence extreme care will be required if development is to impinge on the area.

#### Nahmint Lake

Nahmint Lake is presently in an oligotrophic state, littoral area for invertebrate production is low, and large fluctuations in water level have been noted. Slopes to the lake are steep and very rapidly drained, and hence the potential for sediment and debris transport is very high.

1. In tributaries 1, 20 and 21 (Figure 3), present gravel pockets must not be degraded, riparian vegetation must be maintained (see general recommendation 6), and water quality and quantity maintained within natural limits.

2. All other tributaries must be managed for high water quality to avoid introducing debris or sediment into the lake.
3. A permanent boom should be established at the lake outlet and periodically cleaned (when access permits) to prevent debris from entering the lower Nahmint River.
4. The north side of the lake is preferred for mainline access, bearing in mind 2, above. Road location at least 100 m. from the lakeshore and the maintenance of riparian vegetation for at least 20 m. is recommended.

#### Lower Nahmint River

The extensive use of the lower Nahmint River by anadromous salmonids and intensive recreational fishing warrants a high level of development care. In particular, access systems should be designed to minimize road mileage and avoid sensitive zones.

1. It is highly recommended that the existing railway grade location be utilized for mainline access to the lake and the east side of the watershed. Separate spur access to the lower and upper portions of the west side of the watershed is recommended to avoid mainline road construction through the

high drainage density slope between 5 and 8 km. from tide-water. Crossing should be located in the vicinity of the falls where the banks are composed of bedrock.

2. It is recommended that no road construction take place on the west side between 5 and 8 km. until further engineering and soils studies are completed.

3. The Nahmint estuary should not be used for log storage, handling or transport. It is recommended that the existing Macktush dump be so employed.

### Bibliography

1. Burns, J.E. and Hazeldine, W.R. 1970. Field notes on a prelogging inventory of the Nahmint River watershed. Province of British Columbia, Fish & Wildlife Branch, Nanaimo, B.C.
2. Burns, J.E. and Hazeldine, W.R. 1973. Upper Nahmint River snorkel observations. Province of British Columbia, Fish & Wildlife Branch, Nanaimo, B.C.
3. Cameron, E.M. and I.H. Fuchs, 1975. Nahmint Watershed Recreation Survey. B.C. Forest Service, Vancouver District, Mimeo.
4. Cheng, Jie-Dar, 1974. Nahmint River Watershed Hydrology Study. B.C. Water Resourced Service, Water Investigations Branch, Preliminary Report, unpub. mimeo.
5. E.L.U.C. Secretariate. Unpublished data on Nahmint Watershed precipitation on file. Climate and Data Services Division, Resource Analysis Unit, Victoria, B.C.
5. Goodman, D. and P. Vroom, 1972. Investigations into fish utilization of the inner estuary of the Squamish River. Environment Canada, Fisheries Service Technical Report 1972-12. In Department of Environment, 1972. Effects of existing and proposed industrial development on the aquatic ecosystem of the Squamish Estuary. Appendix G.
6. Hetherington, E.H. 1974. The 25 year storm and culvert size - a critical appraisal. Environment Canada Forestry Service. Report BC-X-102. 28 pp.
7. Kasmer, E.J. 1971. Salmon stream obstruction report, Nahmint River. Government of Canada, Fisheries Service, Pacific Region.
8. MacMillan, Bloedel Ltd. 1974. Proposal for the development of the Nahmint watershed. MacMillan Bloedel (Alberni) Ltd.
9. Levings, C.D. 1972. Benthos on the intertidal flats of the Squamish estuary. In Dept. of Environment, 1972. Effects of existing and proposed industrial development on the aquatic ecosystem of the Squamish Estuary. Appendix E.
10. Wilson, A.C. and Rapp, O. 1971. Nahmint river obstructions and potential for enhancement. Memorandum, Government of Canada, Fisheries Service, Pacific Region.

ERRORS

Bond et al

Biophysical Stream Survey of the Upper  
Nahmint River and Nahmint Lake

p. 9 (Fig. 2)

(SEE APPENDIX A for Code Description)

p. 29 (Appendix A)

12-21 Temperatures 0-99

°C

APPENDIX A

NAHMINT RIVER INVENTORY

CODE DESCRIPTION

(refers to Figure 2)

<u>Card No.</u>	<u>Cols.</u>	<u>Definition</u>	<u>Code</u>	<u>Definition</u>
3	1-11	Substrate Type	0	0% extent
	1	Bedrock	1	1-15
	2	Boulder/cobbles	2	16-30
	3	Gravel 4-6" (clean)	3	31-45
	4	Gravel 4-6" (silted)	4	46-60
	5	Gravel 2-4" (clean)	5	61-75
	6	Gravel 2-4" (silted)	6	76-90
	7	Gravel 1/4-2" (clean)	7	91-100
	8	Gravel 1/4-2" (silted)		
	9	Sand		
	10	Silt/mud/clay		
	11	Organic		
<hr/>				
	12-21	Temperatures	0 <del>X</del> to 99	<del>X</del> C
	12-13	At Time of Survey		
	14-15	Max Recorded	0 to 12	month
	16-17	Min Recorded		
	18-19	Month Records Start		
	20-21	Month Records End		

<u>Card No.</u>	<u>Cols.</u>	<u>Definition</u>	<u>Code</u>	<u>Definition</u>
3. (contd.)	22-27	Bank Interface (Low to High Water)	0	0% extent
	22	Bedrock	1	1-15
	23	Boulders/Cobbles	2	16-30
	24	Gravel	3	31-45
	25	Sand	4	46-60
	26	Silt-Mud	5	61-75
	27	Clay	6	76-90
			7	91-100
	28-31	Cover (High Water to Level Ground)	0 to 7	% extent (as above)
	28	Vegetation		
	29	Pavement		
	30	Buildings		
	31	Bare Soil		
	32-36	Fish Habitat	0	none
	32	Overhang	1	trace
	33	Weedbeds	2	some
	34	Logs	3	intermittent
	35	Man-made	4	continuous
	36	Other (pools, etc.)		
N.B.	End of general parameters. Parameters unique to a given environment (i.e. flow in streams) follow.			
	37-38	Mean Stream Width from Wetted Edge	0 to 99	feet
	39-41	Flow at Time of Survey	0 to 900	0-900 CFS
			901	900 + CFS

<u>Card No.</u>	<u>Cols.</u>	<u>Definition</u>	<u>Code</u>	<u>Definition</u>
3. (contd.)	42-53	Obstructions	1 to 99	No. of Obstructions
	42-44	Log	1 to 9	Max. height in feet
	45-47	Waterfall		
	48-50	Cascade		
	51-53	Manmade		
	55-56	Pool-Riffle Ratio	0	1:0
			1	1:1
			2	1:2
			3	1:3
			4	1:4
			5	1:5
			6	1:6
			7	1:7
			8	1:8
			9	1:9
			10	1:10
			11	10:1
			12	9:1
			13	8:1
			14	7:1
			15	6:1
			16	5:1
			17	4:1
			18	3:1
			19	2:1
			20	0:1
	57-58	Slope	0 to 99	%
59-60	Maximum Lake Depth		0 to 90 91	FATHOMS 90 Fms+
61	Presence of Side/Back Channels		0 1	Absent Present
62	Lake Productivity		1 2 3	Oligotrophic Eutrophic Dystrophic