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BOWSER LAKE

M.U. 6-16

1988

Photo plates Dec 1988

REPORT Bowsa Lake

AUTHOR David Coombes

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A RECONNAISSANCE SURVEY OF BOWSER LAKE

WATERSHED: Nass River

DATE OF SURVEY: October 2, 1988

FIELD CREW LEADER: D.M.V. Coombes

FIELD ASSISTANT: Sigurd P. Hatlevik

REPORT PREPARED BY: D.M.V. Coombes

REPORT EDITED BY: J.A. Balkwill

J. A. Balkwill

ACCEPTED FOR RELEASE BY:

FISHERIES BRANCH
B.C. ENVIRONMENT

LAKE: Bowser SYSTEM NAME: Bowser River
A.S.A.P. REFERENCE NO.: - R.A.B. SYSTEM NO.: 76-0300
M.O.E. SYSTEM NO.: 500-2321

DATA ON FILE FOR THIS SURVEY

Location	X	Dissolved O_2 and Temp. Profiles	X
Physical Data	X	Netting Record	X
Bench Mark	X	Lake Catch Summary	X
Terrain Features	X	Individual Fish Data	X
Access	X	Fish Preserved	-
Resorts and Campsites	X	Stomach Contents	X
Other Developments	X	Scale Reading	-
Obstructions and Pollutions	X	Location of Inventory Sites	X
Special Restrictions	X	Photograph Directory	X
Aquatic Plants	X	Appendices:	
Wildlife Observations	X	A: Water Chemistry Analysis	X
Miscellaneous Comments	X	B: Bottom Sediment Analysis	-
Lake Drainage	X	C: Fish Tissue Analysis	-
Fisheries Management Comments	X	D: Tributary Stream Data	X
History of Previous Surveys	X	Bathymetric Map Reduction	X
Water Chemistry Summary	X	Bathymetric Map	X

LOCATION

Location: 65 km northeast of Stewart, B.C.
Elevation: 368 m±
Latitude/Longitude: 56°26'50":129°34'10" U.T.M.: 9.4650.62558
Management Unit: 6-16 N.T.S. Map No.: 104 A/5,6

Drainage: Bowser Lake, expansion of Bowser R---→Bell-Irving R---→Nass R

PHYSICAL DATA

Lake Drainage Area: 1266 km^2 Volume: n/a m^3
Water Surface Area: 36 100 000 m^2 Flushing Rate: n/a
Area above 6 m contour: n/a m^2 Perimeter of Islands: 10.3 km
Shoreline Perimeter: 78.5 km Number of Islands: 17
Maximum Depth: 95 m sounded, 152 m est. Mean Depth: m
Filterable Residue (T.D.S.): 60 mg/L Secchi Disc: 0.25
Sounding Device: Lowrance X-16 Elevation Source: Given on N.T.S. topographic map.

BENCH MARK

(Iron spike, centre of red circle) located 2.0 m above the water line at the time of survey in a 90 cm Alpine fir tree, on the south side of the outlet arm. This tree had a navigation marker on it, and was approximately 200 metres upstream from the first narrows on the lake (going upstream from the outlet proper).

High water mark: The lake appeared to be 0.6 m below the recent high water mark. Historic jökulhlaup* events would be 5-15 m above this.

* A jökulhlaup, or "glacier outburst flood", occurs when a glacier that has dammed up a river, floats, or gives way, allowing the dammed water to escape.

TERRAIN FEATURES

Immediate Shoreline:

Bowser Lake had an extremely abrupt drop-off around almost the entire circumference of the lake. Only the main inlet area, the extreme southeast bay, and the shallow bay pointing to the northwest off the outlet arm, had a gentle drop-off. Above the waterline most of the shoreline is a bouldery strand derived from the shallow to bedrock till, with outcroppings frequent on both sides of the main body of the lake and in the outlet arm. The inlet end has a cobble and gravel beach (with a substantial amount of fines) and there are several long mud beaches along the outlet arm. There are many rocks and shoals (mainly rocky) among the bays and islands of the northern side of the southeastern end and in the outlet arm. Except for the inlet end and the constructed access on the outlet arm, access to the water's edge is very poor, due to the thick undergrowth, steep slope, large boulders, or a combination of these factors. Access to the shore was fairly good, but extremely hazardous due to vast numbers of hidden boulders just beneath the surface. Some of the islands and points had small beaches which gave somewhat better access along the shore, but the factors mentioned previously hampered access to the backshore. Forest cover was quite variable, with numbers of Engelmann spruce, alpine fir, cottonwood, amabilis fir, white birch, alder, and aspen.

The understorey was quite sparse in the Bowser Valley flats upstream of the lake, due to a jökulhlaup which devastated the area in 1931, but it was thick elsewhere along the lake shore and outlet arm. This understorey consisted of green alder, red osier dogwood, highbush cranberry, elderberry, Vaccinium spp., devils' clubs, thimbleberry, baneberry, and others, with a varied ground cover. The ground cover in the valley above the lake was mainly lichens and mountain avens. Sedges, grasses, and mosses were common in the ground cover throughout the rest of the surrounding area, along with many other plant types in minor amounts.

The lake is too cold and glacial flour laden to be attractive for swimming. Angling is poor, but Dolly Varden are trolled for among the islands (pers. comm. from the ferry master). Few aquatic plants are present to hinder any recreational activities. Because of the very poor underwater visibility, the many rocks which are just below the surface, frequent strong winds, heavy wave action, and the dearth of pleasant locations available to land and camp, boating is not a favoured recreational activity either.

Surrounding Country:

Bowser Lake is in a long, steep-sided valley which is cut through the eastern side of the Coast Mountains, between Mt. Anderson to the north, Wildfire Ridge to the northeast, and the Longview Range to the south. Most of Bowser Lake lies within rocks of the Bowser Basin assemblage which consists of interbedded turbidites and shales (some carbonaceous) belonging to the Bowser Group (mid-Jurassic to upper Jurassic epoch in age). These rocks are deformed by echelon folds and faults, with up to 7 km of offset in the faults. Natural gas may be present, but no other minerals are believed present in economic quantities (although coal is found to the east by Mt. Klappan). The rocks do not

contain sufficient pyrite for them to constitute an acid drainage source if disturbed by road construction, and most beds are not sufficiently competent to be used as road metal or rip-rap (pers. comm. Dr. Jahak Koo, Geological Survey Branch; Bob Geragh, Thurber Consultants). However, the western end of the lake and much of the watershed upstream of the lake lies in an area of Hazelton Volcanics. These rocks were laid down in a volcanic island arc in the lower and middle Jurassic epochs. They consist of volcanic tuffs, various andesitic flows, some basalt flows, with some sections of sandstones and argillites. The latter are mainly but not entirely marine. In these rocks the possibility of massive disseminated sulphides or sulfides and pyrite veins is high, and some beds contain disseminated pyrites. If these rocks are disturbed, they will produce acid drainage, which could cause difficulty, as there is very little carbonate present to neutralize or buffer acids.

The area was covered in Engelmann spruce, amabilis and alpine fir, grading into krummholz, alpine tundra, and occasional glaciers with increasing elevation. Many avalanche tracks cut from the alpine tundra through the tree cover to near the level of the lake, becoming more numerous the further west, on up into the Bowser River valley, where many avalanche tracks run down to the valley floor, and there are also some glaciers which reach the floor of the valley, the first one being the Knipple Glacier.

Bowser Lake itself is in the very wet cold variant of the Interior Cedar Hemlock biogeoclimatic zone. There are other zones near the lake.

ACCESS

Directions:

Starting at the Meziadin Junction on the Stewart-Cassiar Highway (Highway 37), drive 30.4 km north on Highway 37, and turn left onto a logging road (the road was marked "CP 24194 BOWSER"). Staying on the main logging road, the Bowser River Bridge is reached 5.3 km from Highway 37, and 0.9 km further on, there is a turn-off to the right (6.2 km from Highway 37). Take this turn-off and drive 0.8 km to the outlet arm of Bowser Lake. This access point (which was in use as a ferry dock at the time of survey and of writing) is 37.4 km from the origin at Meziadin Junction. There is another ferry dock and a road going up the Bowser Valley to Knipple Lake.

Road Type and Conditions:

Highway 37, the Stewart-Cassiar Highway, was paved and in good condition for a few kilometres from the Meziadin Junction. The rest of the highway was good to excellent all-weather gravel road. The logging road was good all-weather gravel road, but the spur down to the outlet arm of Bowser Lake and the ferry dock was rutted, muddy, and in very poor condition at the time of survey. Re-routing of the last section could change the figures given above, and there were hopes that the ferry dock could be moved to the main body of the lake, or at least to the large bay on the north side of the lake near the east end.

Restrictions:

The road off Highway 37 is a private industrial road, and restrictions may be placed on it.

At the time of writing, the only restrictions (on gear, limits, times, etc.), were the general ones applying to the management area.

RESORTS AND CAMPSITES

There are numerous rough campsites on the lake, set up by: the staff of government agencies when working in the area and not intended for the recreating public; hunters; or prospectors. These are found on the convoluted peninsula towards the eastern end, on the outlet arm, on the islands, on the alluvial fans, on Cache Point, on Graveyard Point, on the inlet end, and on the shore near the inlet end. None seemed especially pleasant, and the activities of grizzly bears and black bears have caused damage at many sites in the past.

OTHER DEVELOPMENTS

The ferry docks on the lake at the time of survey were to be found on the outlet arm and just north of the main inlet. These may change, and roads may be extended along the lake shore from either end.

There are some trappers' cabins in the area (one on the westernmost of the peninsulas at the eastern end of the lake and another on the large island east of that peninsula). Some radio repeaters are also located near the lake.

OBSTRUCTIONS AND POLLUTIONS

There are no obstructions on the Bowser River downstream from Bowser Lake, and upstream, there are no obstructions until the Frank Mackie Glacier. The main source of pollution is glacial flour naturally produced by the action of the glaciers on the bedrock and released as the glaciers melt. Tailings from Granduc Mine when it was in operation were released into the Bowser River, and these contained a high amount of phosphate, as well as metals. At the moment, these tailings appear to offer no problems, but a change in the climate (warmer) or a decrease in the pH of the Bowser River could bring some of these into solution.

At the time of survey, some oil and fuel was observed flowing into the lake from the vicinity of the ferry dock near the inlet end. Also, there was some silt from road building or exploration work that would find its way into the lake.

There have been a number of spills into the lake. Ammonium nitrate (for ammonium nitrate-fuel oil explosives) bags and nitroglycerine have been lost in the lake. Most of the former was recovered, but the latter is still in the lake (pers. comm. Colleen LaViolette, Waste Management Branch, Smithers). Allegedly, this will pose no problem.

There were other natural sources of pollution (birds, mammals, etc.), but these would be very minor.

SPECIAL RESTRICTIONS

There were no special restrictions at the time of writing.

AQUATIC PLANTS

There were no areas noted where aquatic plants would affect the recreational use of the lake. However, please note that the water was so murky, that aquatic plants were very difficult to see. Information on the aquatic plants of Bowser Lake is stored in the Water Management Lake files under lake number 1626.

Plants noted and/or collected

Potamogeton natans
Nuphar polysepalum
Ranunculus aquatilis

Identifications were by the author.

Many more plant species likely grow here, but there was little time available, and they were not visible.

WILDLIFE OBSERVATIONS

Common merganser, California gulls, and bald eagles were seen. Ravens, other gull species, and crows are known to frequent the area. Mountain goats were seen, and grizzly bear, black bear, and moose have been reported from the area. The presence of the trappers' cabins would indicate that there are numbers of fur-bearing animals as well.

MISCELLANEOUS COMMENTS

The lake outline (eastern end) was done using an aerial photo, B.C. 82018:117, taken July 28,1982.

The lake was named by C.P. Hickman in 1912, when he was inspecting the salmon spawning areas of the Nass. Mr. Bowser was Premier of B.C. 1915-1916 (Toponymy Section Files, Ministry of Crown Lands).

Simon Gun-a-noot, a native of Kispiox, was accused of murdering two men in June of 1906. He was hunted by the police for many years without result, but finally surrendered in 1919, when he was tried and acquitted. During his time as a fugitive, his father, Nah-Gun, died in 1908. Simon buried his father on Graveyard Point. When Simon died in October of 1933, his body was buried beside that of his father (D.R. Williams, Trapline Outlaw, Sono Nis Press, Victoria, B.C., 1982).

LAKE DRAINAGE

General:

Bowser Lake is the largest lake on the Bowser River, and the second largest lake on the Nass system after Meziadin Lake. It is a long, narrow lake 23 km long and from 0.9 km to 1.7 km wide. The western 7 km is oriented southwest to northeast, and the eastern 16 km is oriented northwest to southeast. There is an outlet arm 3.0 km long, with 4.0 km of the Bowser River downstream to its confluence with the Bell-Irving River. From this confluence, the Bell-Irving flows 33 km to the Nass River. The Nass flows 172 km from its confluence with the Bell-Irving to the sea near Greenville. The Bowser, the Bell-Irving, and the Nass rivers all have a heavy load of glacial flour and silt.

Upstream of the lake there are 17.1 km of bouldery, braided stream to Knipple Lake at the foot of the Knipple Glacier. Upstream of Knipple Lake there are two unnamed lakes, the toe of the Frank Mackie Glacier, Tide Lake, and many rapids to the source of the Bowser River at the toe of Berendon Glacier.

Note that no stream surveys were done, as the mining company (Newhawk) had engaged a number of consultants to examine all the streams that could be impacted by road construction, mine waste, or other developments associated with the exploitation of the "Sulphurets " ore body.

Major Systems:

Bowser River -Outlet (RAB System Code 76-0300, MOE 560-2086)

Bowser River is a large swift river with a moderate slope and high turbidity. See photo plates 27 and 28. Four traps set for approximately 10 hours captured one 245 mm Dolly Varden. There were four large set lines below the bridge in the large pool there. The water temperature was 5.5°C, and the turbidity was 0.15 m, with a substrate of 20% small gravels, 40% large gravels, and 40% cobbles. The wetted width was from 35 to 55 m, and the channel width was 75 to 95 m, with some wide sections of approximately 150 m. There were multiple channels. Time constraints prevented the collection of any other data (Oct. 1, 1988, pers. comm. D. Deleeuw).

Bowser River -Main Inlet (RAB System Code 76-0300, MOE 560-2086)

Bowser River is a large, swift, turbid river with a low slope, armoured bed (the cobbles and boulder substrate are highly compacted in the main channel) and many side channels (much of the river from the source to Bowser Lake is braided). There were many distributaries into Bowser Lake (see the aerial photograph). Many of the side channels are fed by groundwater filtered through the valley bottom sediments, and would be suitable habitat for rearing salmonids, and, in some cases, spawning. See plates 9 and 10.

Scott Creek- Tributary to the Bowser River (RAB System Code 76-0300-070, MOE Code 560-2086-393)

Scott Creek is a large tributary of the Bowser upstream of Bowser Lake. A point sample upstream of the road crossing gave a wetted width of 10 m, channel width of 30 m, depth of 35 cm, 90 % gravels and larges (D_{90} 40 cm). Two Dolly Varden 45 cm in size (along with eleven much smaller ones) were captured by electroshocking (1976 RAB point card).

Todd Creek- Tributary to the Bowser River (RAB System Code 76-0300-080, MOE Code 560-2086-407)

Todd Creek is a large creek (it could easily be called a river) tributary to the Bowser upstream of Scott Creek. It had an 18 m wetted width, 40 m channel width, 30 % gravels and 60 % larges in the substrate (D_{90} 40 cm), and a depth of over 15 cm. The water temperature (Oct. 5, 1976) was 2.5°C. No fish were captured (1976 RAB point card).

Surveyors Creek- Tributary to the Bowser River (RAB System Code 76-0300-010, MOE Code 560-2086-050)

Surveyors Creek is a large active tributary of the Bowser River downstream of Bowser Lake. Coho, rainbow, and Dolly Varden were captured in the creek by electroshocking in 1976. DFO records suggest that the stream is used for spawning by coho and steelhead. Two of the tributaries of this creek also had fish in them (DV only in one, DV and RB in the other- data from the 1976 survey). At the point sample site, the creek was 12 m wetted width, 40 m channel width, with an average depth of 35 cm. The water temperature was 4° C (Oct. 5, 1976). The substrate was 20% gravels, 70% larges, and 10% unspecified (D_{90} 30 cm)(1976 RAB point card). At the road crossing downstream of this point, the wetted width was 30-40 m, with a channel width of 85-105 m. The substrate here was 10% small gravels, 20% large gravels, 50% cobbles, and 20% boulders. There were multiple channels here, and flow velocity ranged from 0.3 to 0.8 m/sec. (est.). Turbidity was approximately 0.25-0.35 m. Two traps set for approximately 10 hours caught 5 rainbow trout from 106 to 147 mm in length. The stream channel is very mobile, and at the time of survey there was very little cover, with only a little "Large Organic Debris" and some cut bank cover. (Oct. 1, 1988, pers. comm. D. Deleeuw)

Minor Systems:

There are many minor systems. Most are too steep to offer any fish habitat, but a few have short reaches on their alluvial fans offering some salmonid spawning habitat. The stations where minnow traps (Gee traps) were set follow, but note that these are well upstream from Bowser Lake.

Unnamed Creek- inlet/trib. (RAB System Code 76-0300-***, MOE Code 560-2086-580)

A minor tributary flows into Knipple Lake through a culvert road crossing. The water temperature was 2°C with an air temperature of -7°C. Some possible rearing habitat for salmonids was considered to exist. See Plate 2 of area. Four minnow traps here caught nothing in 20 hours.

Unnamed Creek- inlet/trib. (RAB System Code 76-0300-***, MOE Code 560-2086-534)

Downstream of the above, with a confluence at UTM 9.4428.62507, there was a small stream with a water temperature of 4.5°C, turbidity of 30+ cm, est. max. depth of 50 cm, est. stream velocity of 0.1 m/sec., wetted width 17 m. The substrate was 10% fines, 70% gravels, and 20% cobbles, with low compaction. This is partly a side channel of the Bowser River. Two traps caught one Dolly Varden (19.5 cm) in twenty hours. See Plate 3.

Unnamed Creek- inlet/trib. (RAB System Code 76-0300-***, MOE Code 560-2086-509)

This creek was in a series of beaver ponds with a silt substrate and clear water at the time of survey, with a water temperature of 6°C and no discernable water movement. There might be no access to fish, due to the beaver dams. See Plate 4. Three traps here caught nothing in twenty hours, and a trap put in at the confluence with the Bowser River, U.T.M. 9.4455.62505 at road crossing, caught nothing in the same time period.

Unnamed Creek- inlet/trib. (RAB System Code 76-0300-***, MOE Code 560-2086-4**)

This creek was similar to the above, and in a series of beaver ponds with a silt substrate and clear water at the time of survey, with a water temperature of 6°C and no discernable water movement. There might be no access to fish, due to the beaver dams. See Plate 5, from U.T.M. 9.4465.62494. Three traps here caught nothing in twenty hours, and a trap put in at the confluence with the Bowser River caught nothing in the same time period.

Unnamed Creek- inlet/trib. (RAB System Code 76-0300-***, MOE Code 560-2086)

This creek was a side channel of the Bowser River which was not occupied by the river at the time of the investigation, and was fed by underground drainage. Beaver dams may prevent fish access. The water temperature was 6°C, turbidity approximately 30 cm, and the substrate was silt. At the confluence with the mainstem Bowser, the substrate was cobbles, turbidity 1 cm, and the water temperature 2°C. See Plate 7, from U.T.M. 9.4503.62511. Three traps here caught nothing in twenty hours.

Unnamed Creek- inlet/trib. (RAB System Code 76-0300-***, MOE Code 560-2086-427)

This unnamed creek was a medium-sized creek, with many areas of potential spawning and rearing habitat. Above the road crossing, the channel width was 9 m, wetted width was 7 m, and the velocity was 0.6 m/sec., with a depth of 40 cm. The substrate was a mixture of cobbles and small gravels, and the water temperature was 6°C. Three traps caught one Dolly Varden (6.5 cm) in twenty hours. See Plate 8, taken from U.T.M. 9.4506.62515.

FISHERIES MANAGEMENT COMMENTS

Bowser Lake has a low level of phosphorous (.006 mg/L surface, .006 mg/L at 26 m), and a moderately low "Total Dissolved Solids" (60 mg/L surface, 64 mg/L at 26 m), which would suggest a fairly low productivity. The TDS figures are likely inflated by the rock flour in the water, and would probably relate to a lower figure in a more "typical" lake, without the glacial input. The level of phosphorous is lower than expected, as information provided by the Smithers office of the Ministry of Energy, Mines, and Petroleum Resources (confirmed by pers. comm. by D. Hora, Industrial Minerals Section, M.E.M.P.R., Victoria) indicated that the tailings of the Granduc Mine were "high" in phosphates (0.22%, Butrenchuk, 1991, p. 49, and also Grove, 1986), and these were partially disposed of into the Bowser River watershed. Further tests, and sampling in other areas of the lake, might show that phosphate is being removed by biological activity. However, the phosphate-containing mineral was apatite, which is a heavy mineral and might be deposited in the lakes upstream of Bowser Lake. Apatite is relatively insoluble in cold neutral water, but its solubility increases rapidly with decreasing pH. Apatite also contains fluoride ions which are extremely toxic in low amounts. Phosphate,nitrate, total nitrogen, potassium, and fluoride were not tested for in the minewater, sediments, tailings, or waste water. The final water quality report (Doran, 1984) gave results for arsenic, chromium, cadmium, copper, iron, lead, nickel, and zinc. None were high enough to cause acute toxicity problems. but there are substantial amounts of arsenic, chromium,copper, iron, lead, and zinc in the tailings which are finely comminuted and would allow a substantial amount of leaching to occur if the water chemistry changed in a direction to encourage such a process.

The Sulphurets property of Newhawk is not yet in production at the time of writing and a final road location has not been settled upon. However, the mines inspectors in Smithers stated that there were no plans to use anything other than local rock for rip-rap or road metal (they have no information about the sulphide content of the local rock along the proposed road locations) and mine waste would not be used on any roads which would be draining into the Bowser River.

The fish species known from Bowser Lake are: Longnose suckers, Dolly Varden char, rainbow trout, sockeye salmon, coho salmon, and mountain whitefish. No sculpins were captured, but they may be present, as both Cottus asper and Cottus aleuticus are found in the Nass system. However, a check with the U.B.C. collections and the Royal B.C. Museum did not turn up any evidence for cottids in that area, and Tripp (1987,1988) did not find any cottids, either.

DFO records suggest that sockeye spawn near Graveyard Point, and note that Beak Consultants captured a salmon 3.2 km up the Bowser River from the lake, in an investigation to discover if salmon used the river above the lake (Poulin, 1979). Coho were not caught in the test fisheries prior to 1981. However, they were well established in 1988 (Tripp, 1988) and there is anecdotal evidence (Tripp, pers. comm.) that the test nettings simply did not coincide with the presence of coho. Coho were found to spawn near the outlet confluence and on a small tributary into Bowser Lake (Tripp, 1988). Other inlets into the lake were also used by sockeye in small numbers (they spawn on the alluvial fans), as well as most areas of gravel along the shoreline, including the Bowser River Delta (Tripp, 1988; and D.F.O.

observations). Many schools of juvenile salmonids were noted at the inlet end (the delta area) of Bowser Lake (also noted in Tripp, 1987).

There are indications that the Bowser River upstream of Bowser Lake is used for spawning and rearing area by mountain whitefish and feeding by Dolly Varden, principally in the clear side channels fed by ground water (Tripp, 1987).

The ferry master stated that some people trolled for Dolly Varden at the upstream end of the outlet arm, with poor success, but occasionally large fish were caught.

It should be noted that one of the net sets was not the usual experimentally-hung gang, but had an extra panel of 104 mm mesh size, and the panels were hung in order of size. Future net-sets should be of the standard format. The other was of standard order, but of opaque twisted-filament line. It is doubtful that there would have been any difference encountered with the substitution of a monofilament net-set, as the visibility in the waters of Bowser Lake was very low.

This lake is an important fisheries resource, as the salmon runs, particularly for sockeye, range from a low of 6235 in 1980 to a high of 120 645 in 1977, according to the D.F.O. escapement records, and interesting for the fairly high production of salmon from a very silty environment. Much more work should be done on this system, and the 1959 bathymetric map produced by Withler was done with very few points, so the actual littoral area is not accurately known. This investigation looked at the outlet arm and the extreme western end, but there were not enough points collected to contour this area. However, there did seem to be a fairly abrupt drop-off in the outlet arm as well as most of the rest of the lake (with the few exceptions noted in the terrain description). All the minor inlets along the lake should be examined during the peak spawning periods to determine if they are used, and if so, by what species. This should be done before the next jökulhlaup (glacier outburst flood) scours out the valley and lake again, to give a baseline data set.

Phytoplankton should also be investigated, as the lake may be more productive than it appears. It was also suggested that light penetration, as tested by the use of a Secchi disc, might be grossly in error, and that there might be layering of silt-rich layers over clearer layers (Deleeuw, pers. comm.). This seems unlikely in this lake, considering the low temperature differential in the lake and the effects of wind and wave action, but it might occur at other times of the year, and should be checked before being dismissed.

HISTORY OF PREVIOUS SURVEYS

Lake Surveys:

1988 Tripp, D. Report on Fish Surveys in the Bowser Lake and Todedada-Treaty Creek Areas, October 7-10, 1988. Rescan Environmental Services Ltd., Vancouver, B.C.; available from Newhawk Gold Mines, Ltd., Rescan, and M.O.E. Habitat Protection, Terrace, B.C.

1987 Tripp, D. Fish and Limnological Surveys of Brucejack Lake and the Unuk, Bowser, and Bell-Irving River Systems, 1987. Rescan Environmental Services Ltd.,

Vancouver, B.C.; available from Newhawk Gold Mines, Ltd., Rescan, and M.O.E. Habitat Protection, Terrace, B.C.

1956-1957 Anon. June, 1958. Results of Nass River Biological Surveys for the Years 1956 and 1957, Including a Preliminary Assessment of the Possible Effects of the Proposed Hydro-Electric Project. Department of Fisheries, Canada, Vancouver, B.C. Available from D.F.O. Vancouver; Inventory and Data Systems Unit, Victoria.

1956 Withler, I.L. November, 1956. A Survey of the Sport-fish Potential of the Lakes of the Nass River System with Particular Reference to Their Use as Water Storage Reservoirs. Fisheries Management Report #24. British Columbia Game Commission. Available from Inventory and Data Systems Unit, Victoria; MOE Library, and Fish and Wildlife files, Smithers.

Other Related Surveys:

1991 Butrenchuck, S.B. Phosphate Deposits in British Columbia. Occasional Papers Series. Available from Ministry of Energy, Mines and Petroleum Resources, Victoria.

1986 Grove, E.W. Geology and Mineral Deposits of the Unuk River-Salmon River-Anyox Area. Bulletin 63. Available from Ministry of Energy, Mines and Petroleum Resources.

1984 Hancock, M.J. and D.E. Marshall. Catalogue of Salmon Streams and Spawning Escapements of Statistical Area 3 (Nass River) including adjacent streams. Canadian Data Report of Fisheries and Aquatic Sciences No. 429. Available from Department of Fisheries and Oceans, Enhancement Services Branch, Vancouver; and from B.C. Environment Fisheries Branch, Conservation Section, Victoria.

1979-1984 Doran, G.V. Granduc Mine Water Quality Study- Final Report. Available from Waste Management Branch (Smithers office).

1979-1984 Water Quality Interim Reports. Available from Waste Management Branch, Smithers.

1979 Poulin, V.A., and Rosberg, G.E. Investigations of the Potential Salmon Utilization of the Upper Bowser River System, 1979. Available from Esso Minerals Canada, Waste Management Branch (Smithers office), and D.F.O. Vancouver.

WATER CHEMISTRY SUMMARY

Limnology Station No. 1

Field Conditions:

Date: Sept. 30,1988 Time: 1515 Air Temperature: 9.5° C
Wind Velocity: 5-10 km/h Wind Direction: West
Cloud Cover: 9/10 O.C. Surface Condition: Small ripples.
Secchi Disc: 0.25 m Water Colour: Glacial flour grey, v. slight greenish colour.

Method(s) Used:

Dissolved Oxygen: Y.S.I. Model 57 Oxygen Meter
Water Temperature: Y.S.I. Model 57 Oxygen Meter
Air Temperature: Thermometer
pH (field): Taylor Colour Comparator
H_2S (field): Hach kit.
Laboratory Used: Ministry Of Environment, at U.B.C.
Water Sampler: Alpha Vertical Sampler
Substrate Sampler: Ekman Dredge

Water Sample Chemistry:

Seam Site No. **E207625**

	Sampling Depths	
	Surface (0 m)	Lower (26 m)
pH (field)	7.0	7.2
pH (lab)*	7.8	7.9
Specific Conductance (lab)	94 umhos/cm	91 umhos/cm
Filterable Residue 105°	60 mg/l	64 mg/l
H_2S	-	0 mg/l

Bottom Depth: 29.0 m
Substrate Depth: 29.0 m

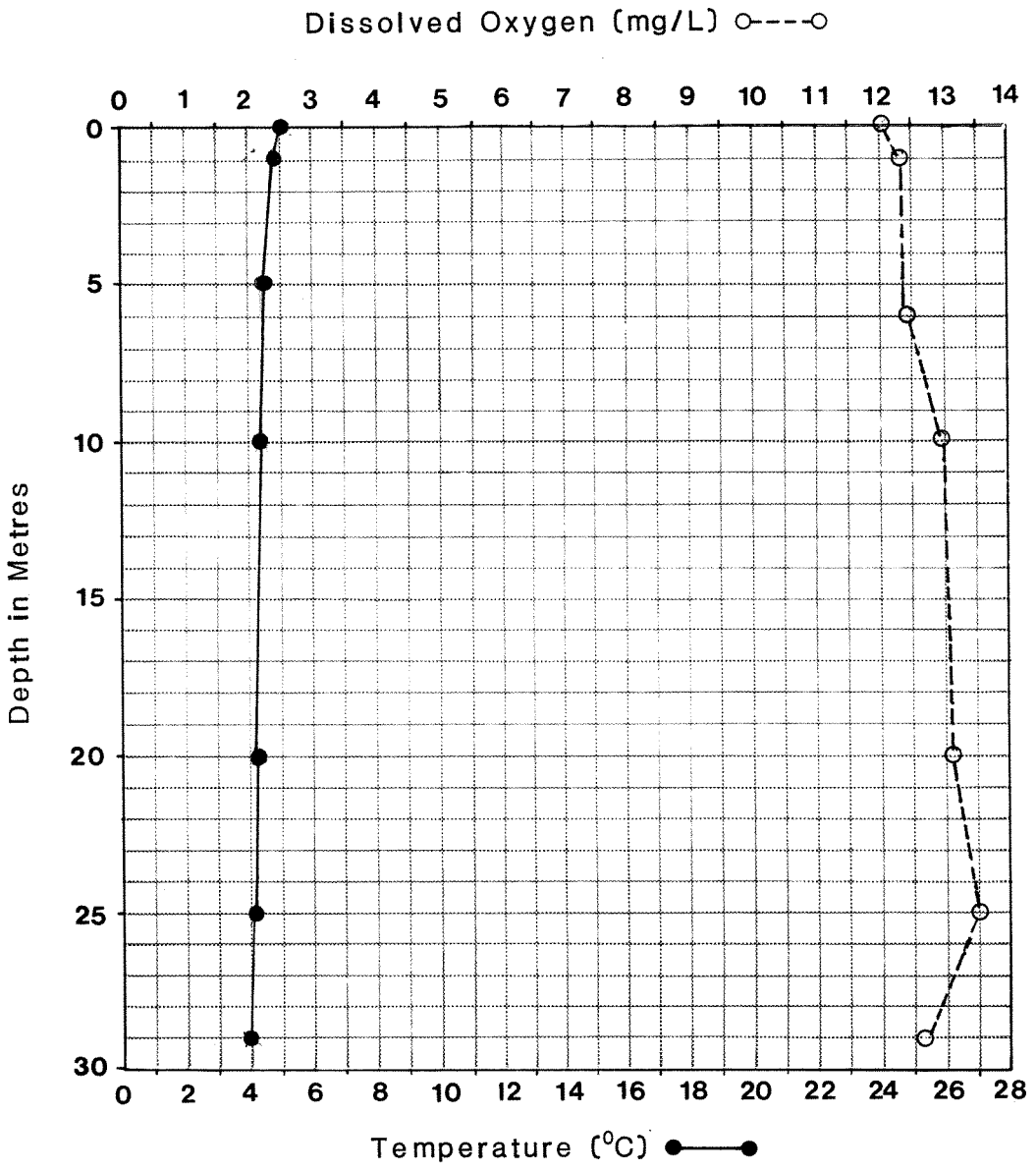
*The sample was too long in transit for the laboratory to guarantee the accuracy of the results.

Temperature/Oxygen Table

Depth (m)	Oxygen (mg/l)	Temp. (°C)
Surface	12.0	5.0
1.0	12.3	4.9
5.0	12.4	4.5
10.0	12.9	4.3
20.0	13.1	4.2
25.0	13.5	4.1
29.0	12.6	4.0
	Bottom	

Bowser Lake

DISSOLVED OXYGEN AND TEMPERATURE PROFILE



NETTING RECORD

Mesh sizes in order of size: 25, 38, 51, 64, 76, 89, 104 mm.

NETTING SITE #1

Type: Sinking monofilament gill net
Date Set: Sept. 30, 1988 Time: 1050
Date Lifted: Sept.30, 1988 Time: 1830
Net Dimensions: Length: 106.7 m Depth: 2.4 m
Shallow End Mesh Size: 25 mm Depth: 2 m Substrate: Cobbles and rocks, waterlogged wood.
Deep End Mesh Size: 104 mm Depth: 4 m Substrate: mud, waterlogged wood

Comments: Note non-standard net set.

Mesh sizes experimental order: 25, 76, 51, 89, 38, 64 mm.

NETTING SITE #2

Type: Sinking twisted gill net
Date Set: Sept. 30, 1988 Time: 1110
Date Lifted: Sept.30, 1988 Time: 1645
Net Dimensions: Length: 91.4 m Depth: 2.4 m
Shallow End Mesh Size: 64 mm Depth: 2.5 m Substrate: Gravels and waterlogged wood.
Deep End Mesh Size: 25m Depth: 4 m Substrate: mud, waterlogged wood.

Comments: Note this was a standard net set in mesh sizes, but that the net was not monofilament, as has been standard practice.

LAKE CATCH SUMMARY

Species	Netting Site No. 1	2	Angled	Other (MT)	Total Number Sampled		Number Preserved	Size Range (mm)
Longnose suckers	17	7	0	0	24	0	0	190-320
Sockeye salmon	0	13	0	0	13	0	0	500+
*Dolly Varden	5	7	0	2	14	12	0	65-426
Mountain whitefish	11	3	0	0	14	0	0	190-310

*Three Dolly Varden escaped from the first net set, and two from the second, while two were captured in the minnow traps.

Minnow Traps:
Bait: Salmon Roe

SITE	HOURS	DEPTH (m)	SUBSTRATE	SPECIES
1	20	0.5	gravel, silt	nothing caught, very turbulent water.
2	20	0.5	gravel, silt	1 195 mm Dolly Varden
3	20	0.5	silt	nothing caught
4	20	0.5	silt	nothing caught
5	20	0.5	silt	nothing caught
6	20	0.5	gravels, and cobbles	1 65 mm Dolly Varden

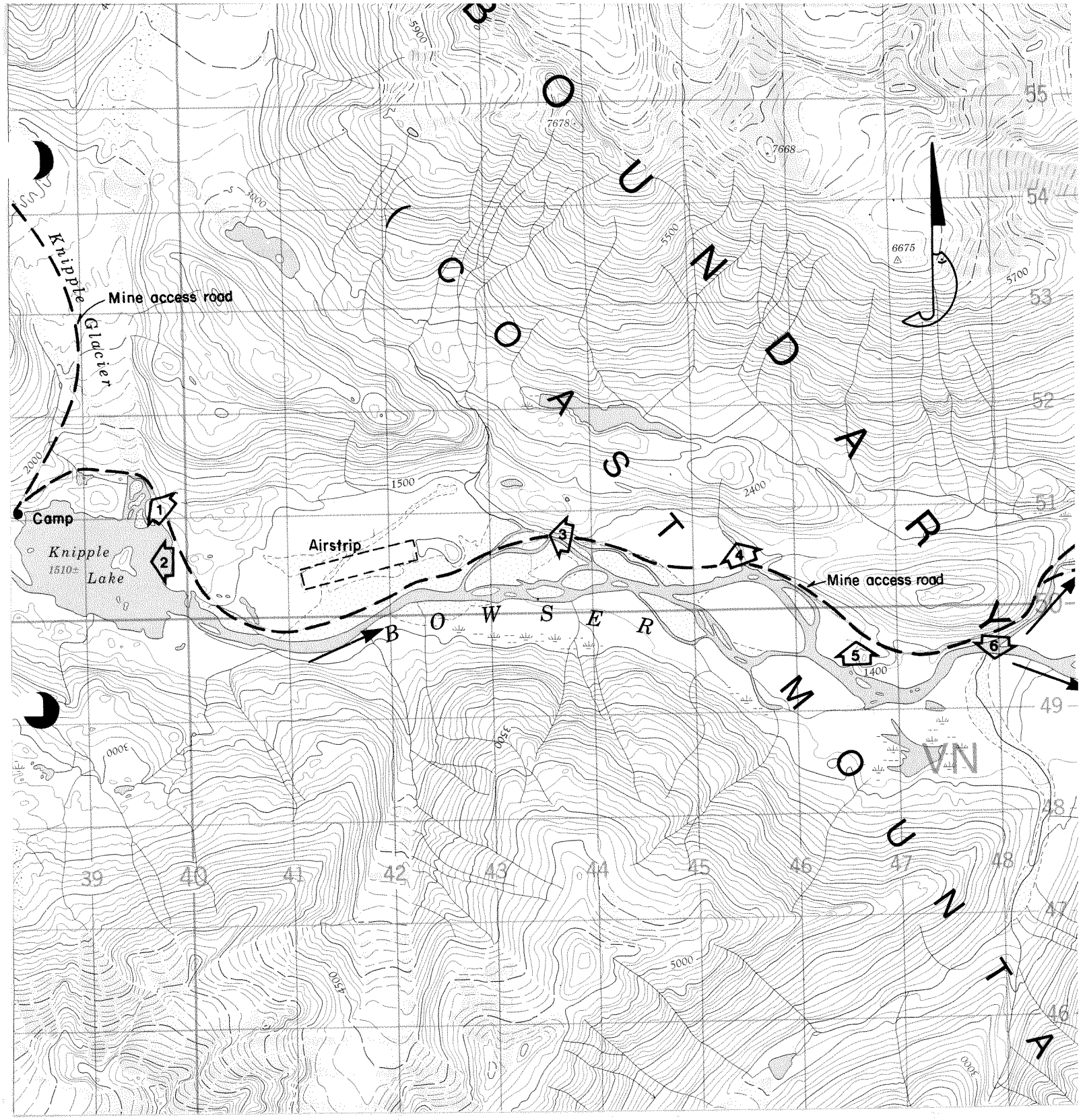
Site 1 had 4 traps, site 2 had 2 traps, sites 3 and 4 both had 3 traps in their respective creeks, and one in the Bowser River, while sites 5 and 6 had 3 traps each.

INDIVIDUAL FISH DATA

Date Captured: Sept. 30, 1988
Method of Capture: Sinking monofilament or twisted-filament gill nets

SPEC	FORK LGTH (mm)	WT (g)	SEX	GON MAT	SAMPLE TYPE	AGE	STOMACH CONTENTS CODE	STOMACH CONTENTS	COMMENTS
DV	65	-	-	IMM	-	-	-		
DV	166	45	-	IMM	-	-	-		
DV	195	-	-	-	-	-	-		
DV	255	140	F	IMM	-	-	-		
DV	280	230	?	IMM	OT	-	-		
DV	306	350	M	IMM	-	-	-		
DV	345	425	F	IMM	OT	-	0		
DV	364	475	?	IMM	-	-	-		
DV	367	550	M	IMM	-	-	-		
DV	378	525	M	IMM	-	0	Eating salmon eggs		
DV	380	575	F	IMM	-	-	-		
DV	384	500	F	IMM	OT	-	-		
DV	386	525	F	IMM	OT	0	-		Tapeworms in gut, round-worms in swim bladder
DV	426	675	M	IMM	OT	-	-		

B-Bottom organisms
CO-Coho
CT-Cutthroat trout
DV-Dolly Varden
F-Female
FI-Fish
GV-Gravid
I-Insects
IMM-Immature
KO-Kokanee
LT-Lake Trout
M-Male
MG-Maturing
MT-Mature
MW-Mountain whitefish
O-Other
OT-Otolith
P-Plankton
RB-Rainbow trout
SC-Scale
SP-Spent
T#-Tissue sample
UN-Unknown
WF-Whole fish



LOCATION OF INVENTORY SITES

Figure 1

Lake: Bowser

Reference No.: 104 A/5

Reference Date: 1978

Scale: 1:50 000

(1) Plate number, area, and direction

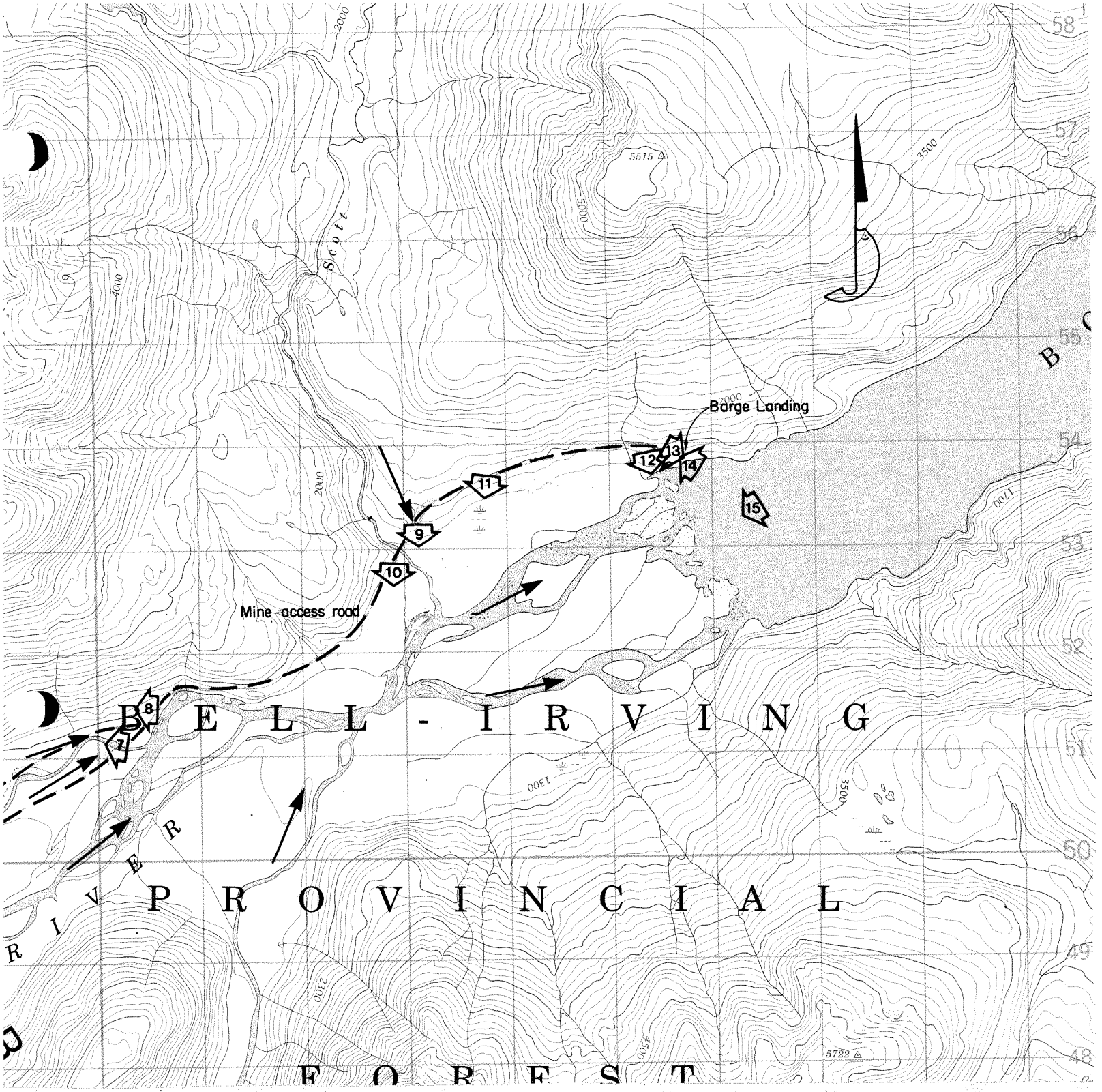
(2) Point sample, number, and location

Bench mark

LS_1 Limno station location and number

$O-NS_1-O$ Netting site location and number

Stream flow direction and number



LOCATION OF INVENTORY SITES

Figure 2

Lake: Bowser

Reference No.: 104 A/5

Reference Date: 1978

Scale: 1:50 000

(1) Plate number, area, and direction

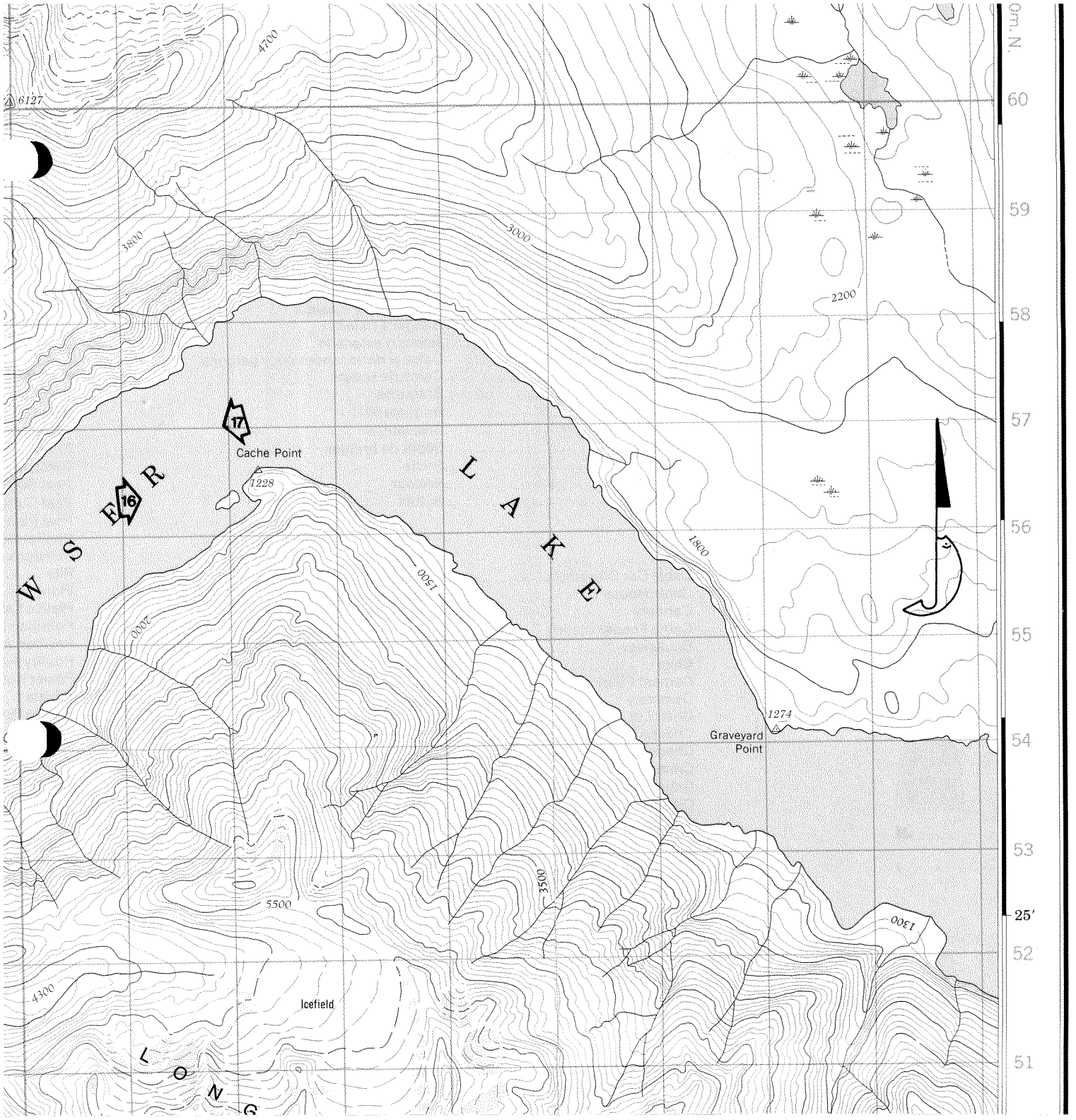
(2) Point sample, number, and location

Bench mark

LS 1 Limno station location and number

O–NS 1–O Netting site location and number

1 Stream flow direction and number



LOCATION OF INVENTORY SITES

Figure 3

Lake: Bowser

Reference No.: 104 A/5

Reference Date: 1978

Scale: 1:50 000

(1) Plate number, area, and direction

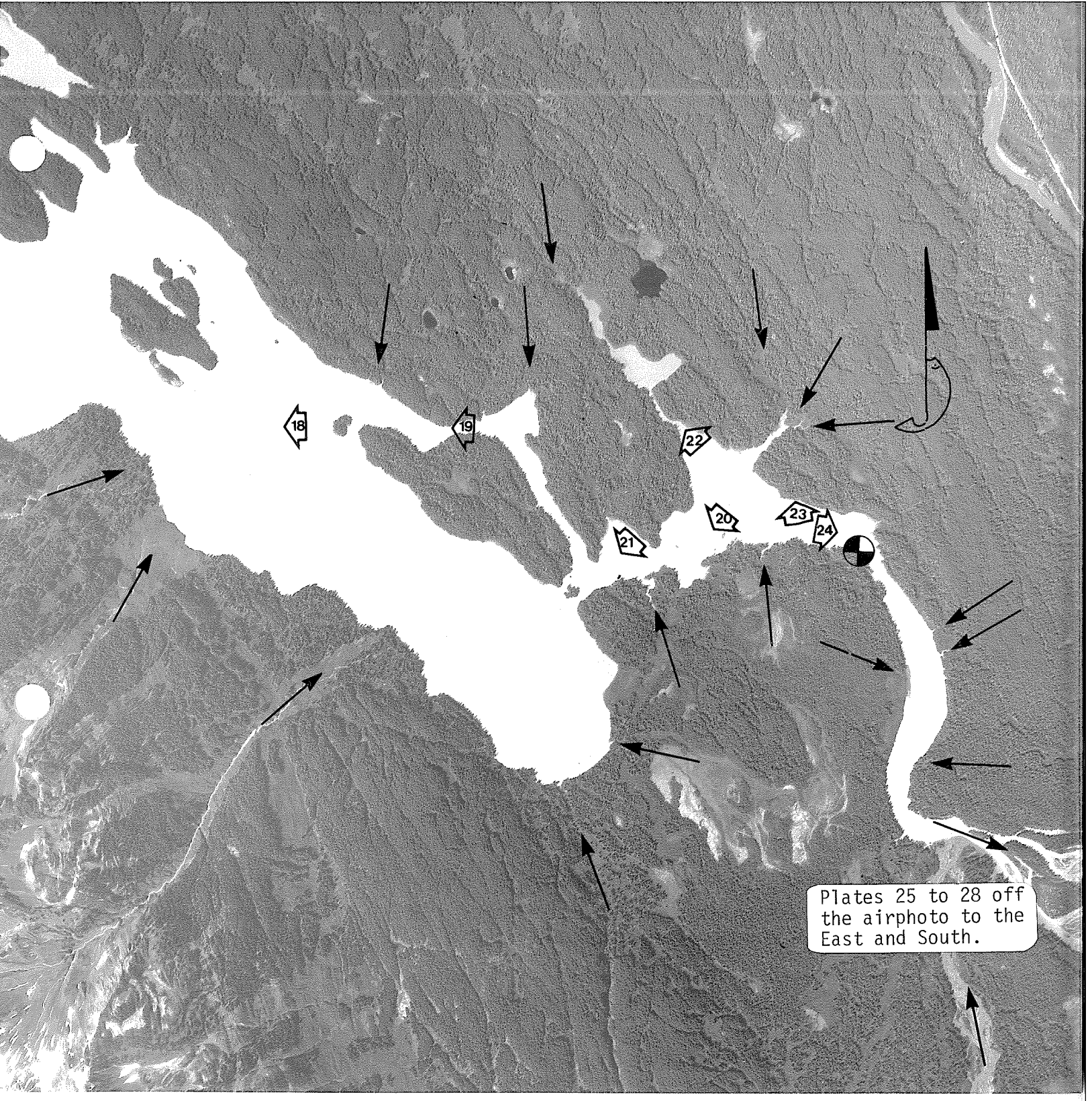
(2) Point sample, number, and location

Bench mark

LS 1 Limno station location and number

O–NS 1–O Netting site location and number

1 Stream flow direction and number



LOCATION OF INVENTORY SITES

Figure 4

Lake: Bowser

Reference No.: B.C. 82018:117

Reference Date: July 28,1982

Scale: 1:34 578± 1%

1	Plate number, area, and direction
2	Point sample, number, and location
	Bench mark
LS 1	Limno station location and number
O–NS 1–O	Netting site location and number
1	Stream flow direction and number

PHOTOGRAPH DIRECTORY

Roll 1

Neg#	Plate#	Description
1	19	Bowser Lake from the outlet end near Hickman Bay, looking towards the large island.
2	18	Bowser Lake, looking west from east of "Trapper Point".
3	17	View west down Bowser Lake.
4	16	View to the east of Cache Point.
5,6	15	View to west and southwest of the west end of Bowser Lake.
7	13	Looking down to the barge dock at the west end of Bowser Lake. Note oil and diesel fuel running down the road.
8	10	A view south across the Bowser River from near Scott Creek on the mine access road.
9	9	View southwest of the Bowser River from east of Scott Creek.
10	6	View across Bowser River to glacier (due north of American Creek Valley).
11	1	Knipple Glacier toe and culverted road section.
12	2	View west across Knipple Lake.
13	-	Toe of Knipple Glacier.
14	3	Side channel of Bowser River, looking upstream from U.T.M. 9.4428.62507.
15	4	Small tributary looking upstream from road crossing at U.T.M. 9.4455.62505.
16	5	Small tributary looking upstream from road crossing at U.T.M. 9.4465.62494.
17	7	Side channel of Bowser River looking upstream from road crossing at U.T.M. 9.4503.62511.
18	8	Looking upstream on a small tributary of the Bowser River from the road crossing at U.T.M. 9.4506.62515.
19	12	View south across west end of Bowser Lake and the distributaries of the Bowser River.

PHOTOGRAPH DIRECTORY (cont.)

Roll 1 (cont.)

Neg#	Plate#	Description
20	11	View southwest over the Bowser River, upstream of Bowser Lake.
21	14	View of the hill above the barge dock, west end of Bowser Lake. Note the oil and fuel spill (See also Plate 13).
22	-	Bowser Queen, coming into West Bowser Dock.
23	20	View southwest to the Longview Range from the outlet arm of Bowser Lake.
24	23	View north to the north shore of Bowser Lake's outlet arm.

Roll 2.

Neg#	Plate#	Description
1	24	"Bowser Queen" on outlet arm of Bowser Lake.
2	22	View to the northwest of entrance to shallow arm of Bowser Lake extending off outlet arm of Bowser Lake.
3	21	Looking west-southwest from the outlet arm towards the islands at east end of Bowser Lake.

Roll 3 (Frame Numbers conjectural)

Neg#	Plate#	Description
32	25	View upstream from road crossing on Surveyor's Creek.
33	26	View downstream from road crossing on Surveyor's Creek.
34	27	View upstream from road crossing on Bowser River.
35	28	View downstream from road crossing on Bowser River.

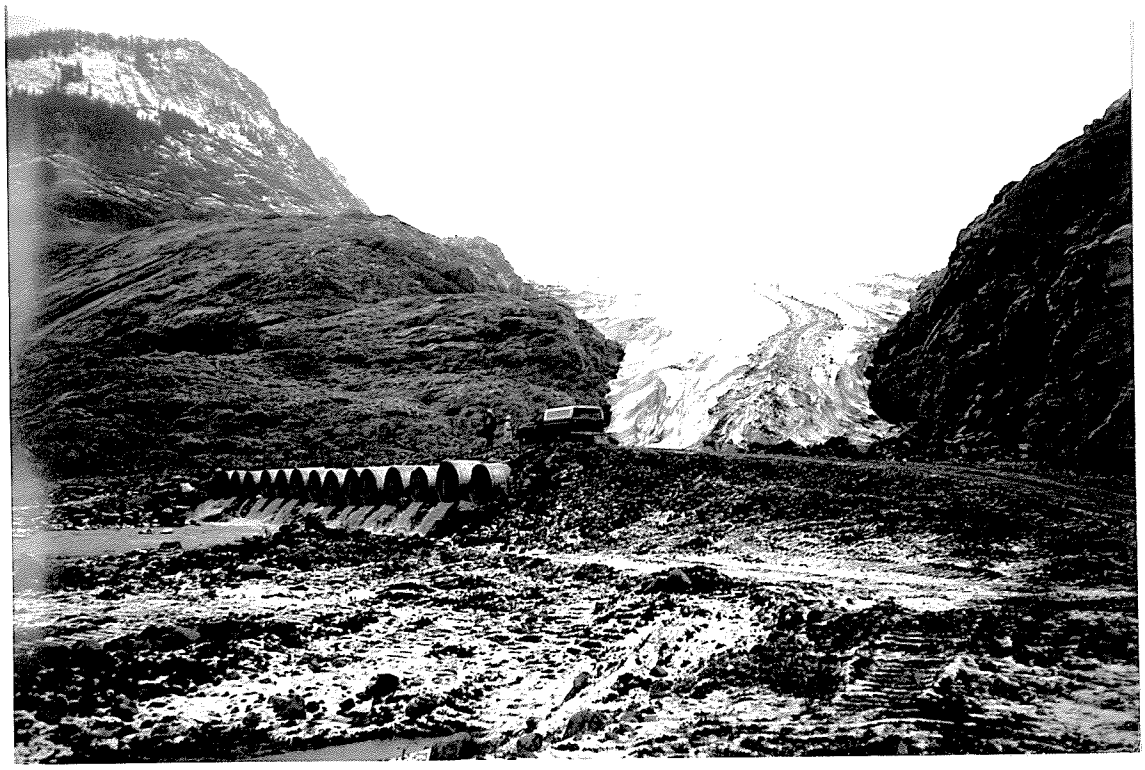


Plate 1: Knipple Glacier toe and culverted road section.

Plate 2: View west across Knipple Lake.

Plate 3: Side channel of Bowser River, looking upstream from 9.4428.62507 (U.T.M.).

Plate 4: Small tributary looking upstream from road crossing at 9.4455.62505 (U.T.M.).

Plate 5: Small tributary looking upstream from road crossing at 9.4465.62494 (U.T.M.).

Plate 6: View across Bowser River to glacier (due north of American Creek Valley).

Plate 7: Side channel of Bowser River, looking upstream from road crossing at 9.4503.62511(U.T.M.).

Plate 8: Looking upstream on a small tributary of the Bowser from the road crossing at U.T.M. 9.4506.62515.

Plate 9: View southwest of Bowser River from east of Scott Creek.

Plate 10: A view south across Bowser River from near Scott Creek on the mine access road.

Plate 11: View southwest over the Bowser River, upstream of Bowser Lake.

Plate 12: View south across the west end of Bowser Lake and the distributaries of the Bowser River.

Plate 13: Looking down to the barge dock at the west end of Bowser Lake. Note oil and diesel fuel running down the road.

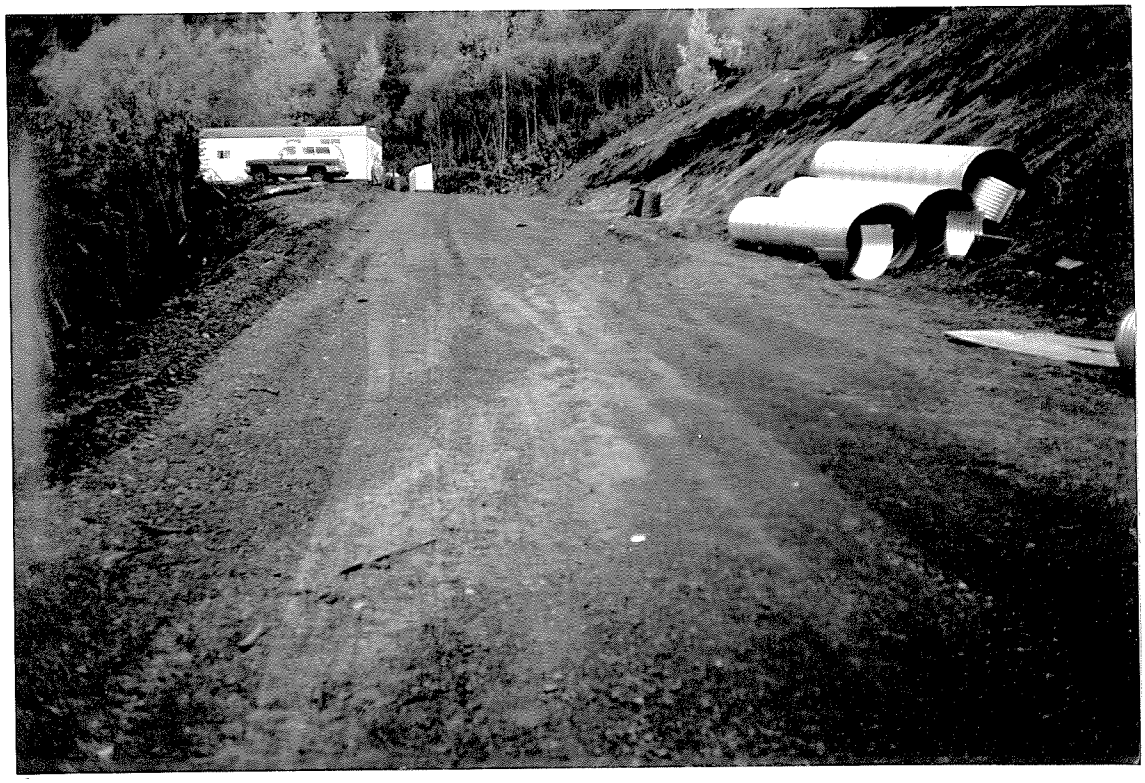


Plate 14: View of the hill above the barge dock, west end of Bowser Lake. Note fuel and oil spill (see also Plate 13).

Bowser Lake

Plate 15: View to the west and southwest of the west end of Bowser Lake.

Plate 16 View to the east of Cache Point.

Plate 17: View west on Bowser Lake.

Plate 18: A Bowser Lake view, looking west from east of "Trapper Point".

Plate 19: Bowser Lake from near Hickman Bay, looking towards the large island.

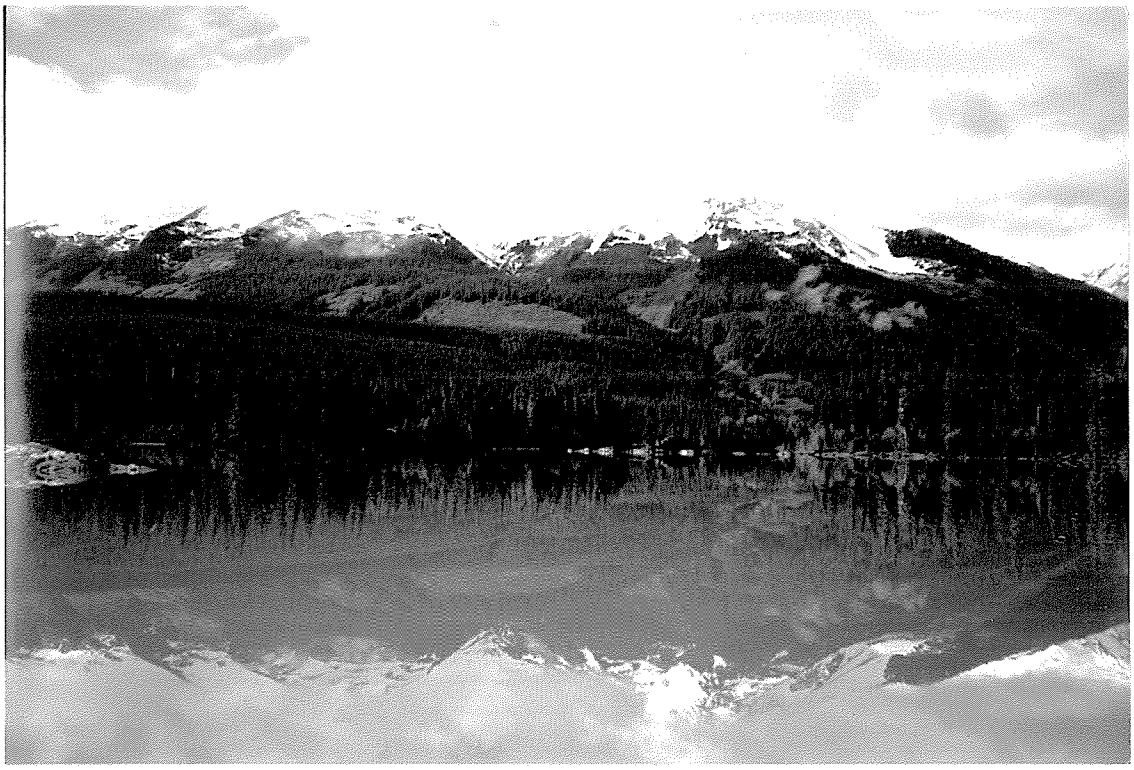


Plate 20: View southwest to the Longview Range from the outlet arm of Bowser Lake.

Plate 21: Looking west southwest from the outlet arm towards the islands at the east end of Bowser Lake.

Plate 22: View to the northwest of the entrance to a shallow arm of Bowser Lake which extends north off the outlet arm of Bowser Lake.

Plate 23: View north to the north shore of Bowser Lake's outlet arm.

Plate 24: "Bowser Queen" on the outlet arm of Bowser Lake.

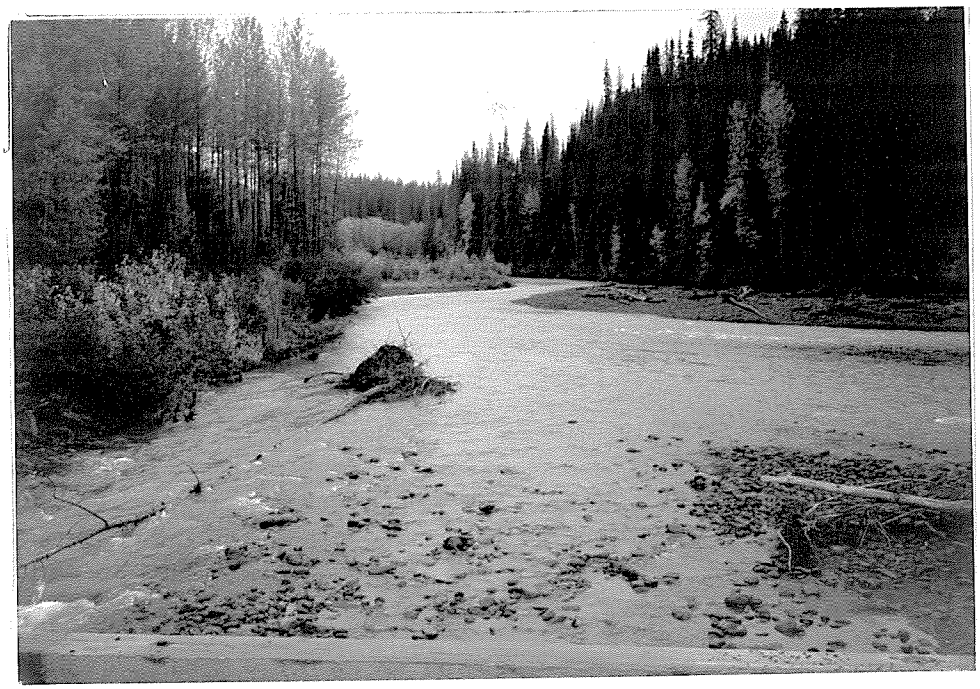


Plate 25: View upstream from road crossing on Surveyor's Creek.

Plate 26: View downstream from road crossing on Surveyor's Creek.

Plate 27: View upstream from road crossing on Bowser River.

Plate 28: View downstream from road crossing on Bowser River.

APPENDICES

APPENDIX A: LABORATORY REPORT

Water Chemistry Analysis

Resource Quality Sect.(RQ)-Water Prog ATTN: COOMBES D M V Sample 88010268

Site: E207625 BOWSER LAKE DEEP STATION

From :88/09/30:1513 To :88/09/30:1513
Depth Range : 0.0 0.0 Tide :
Sample State: Fresh Water
Sample Comment:

Parameter Description	Result	Units	Analytical Technique (Sparcode/Medium/Pres'n)
pH	?	pH units	Automated pH Meter (00041220/02/01)
Result 7.8, pH units. Analyzed outside of optimal time frame.			
Specific Conductance	94	uS/cm	Cond.Meter Siebold (00111160/02/01)
Res. Filterable 1.0u	60	mg/L	Gravimetric 1.0u Filter (007H1032/02/01)
Nitrogen Kjel.Tot(N)	0.04	mg/L	Froz.Dig.Aut.Color (01132660/02/36)
Nitrogen Total	0.09	mg/L	Calculated Result (0114CALC/--/--)
Nitrogen NO3+NO2 Dis	0.05	mg/L	Froz.Aut.Cadmium Red'n (11092670/02/36)
Phosphorus Total	0.006	mg/L	Froz.Dig.Aut.Ascorbic Ac (P--T2710/02/36)

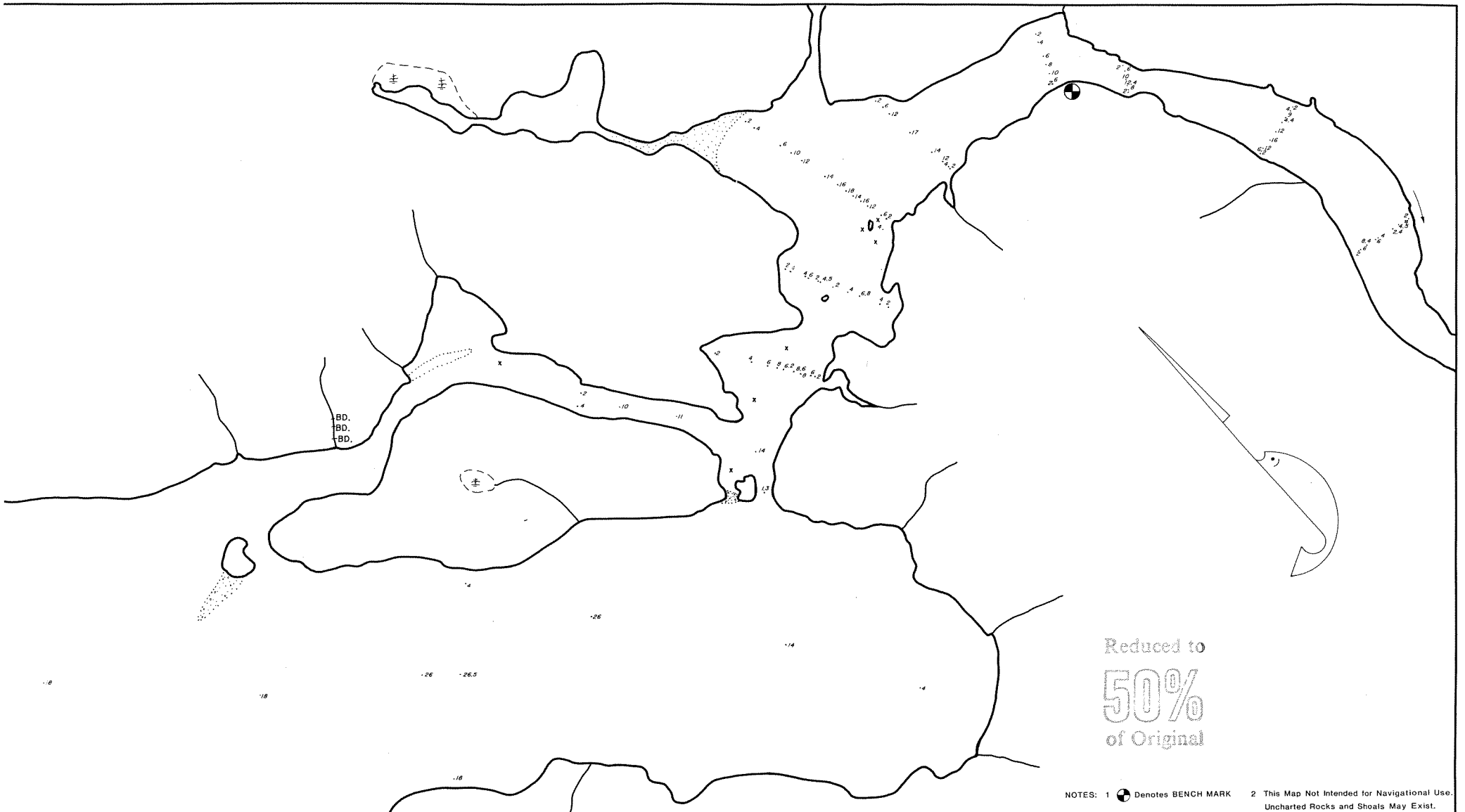
ENVIRONMENTAL LABORATORY
Report for form 00009186

Resource Quality Sect.(RQ)-Water Prog ATTN: COOMBES D M V Sample 88010269

Site: E207625 BOWSER LAKE DEEP STATION

From :88/09/30:1530 To :88/09/30:1530
Depth Range : 26.0 26.0 Tide :
Sample State: Fresh Water
Sample Comment:

Parameter Description	Result	Units	Analytical Technique (Sparcode/Medium/Pres'n)
pH	?	pH units	Automated pH Meter (00041220/02/01)
Result 7.9, pH units. Analyzed outside of optimal time frame.			
Specific Conductance	91	uS/cm	Cond.Meter Siebold (00111160/02/01)
Res. Filterable 1.0u	64	mg/L	Gravimetric 1.0u Filter (007H1032/02/01)
Nitrogen Kjel.Tot(N)	< 0.01	mg/L	Froz.Dig.Aut.Color (01132660/02/36)
Nitrogen Total	0.06	mg/L	Calculated Result (0114CALC/--/--)
Nitrogen NO3+NO2 Dis	0.06	mg/L	Froz.Aut.Cadmium Red'n (11092670/02/36)
Phosphorus Total	0.006	mg/L	Froz.Dig.Aut.Ascorbic Ac (P--T2710/02/36)

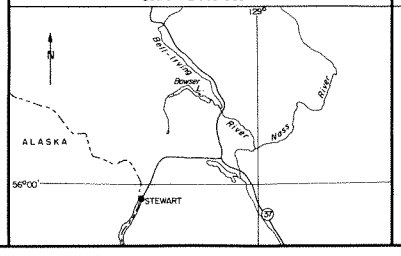


Reduced to 50% of Original

NOTES: 1 ◔ Denotes BENCH MARK 2 This Map Not Intended for Navigational Use. Uncharted Rocks and Shoals May Exist.

INSET MAP

Scale 1:2 000 000



SURVEYED BY: D.M. COOMBES DATE: SEPT. 30, 1988

OUTLINE SOURCE: AIR PHOTO BC 82018:117 (JULY 1982)

STATISTICS AT TIME OF SURVEY

ELEVATION	368	m. ±
SURFACE AREA	* 55 700 000	sq. m.
AREA ABOVE 6m. CONTOUR	–	sq. m.
VOLUME	–	m.
MEAN DEPTH	–	m.
MAX. DEPTH	** 95	m.
PERIMETER, MAIN SHORE	–	m.
PERIMETER, ISLANDS	–	m.
BENCH MARK HEIGHT ABOVE WATER LEVEL	2.0	m.

* 1956 report. ** 152 m estimated max., 1956 report

Province of British Columbia
Ministry of Environment

FISHERIES BRANCH
INVENTORY OPERATIONS

BOWSER LAKE

(EAST END)

DEPTHS IN METERS

WATERSHED CODE: 76-0300		U.T.M. CO-ORDINATE: 9.4650.62558
M.U. 6 - 16	FAIR DWG: B.A.D./R.S.D.	REV. DATE:
PLOTTING: D.M.C.	FAIR DWG. CHECK:	SCALE: 1:10 000
CONTOURS: —	DRAFT DATE: APR 3, 1991	
CALCULATIONS: —	APPROVED: J.A.B. Ward	N.T.S. NO. 104A/5,6
TECH. CHECK: D.M.C.		