INTERIM REPORT

1975

HYDROLOGIC REGIMES

FRESHWATER PROJECT No.1

EASTERN ARCTIC ISLANDS PIPELINE PROJECT

SPENCE BAY TO SABINE PENINSULA

J.H. WEDEL & J.G. WAY

WINNIPEG

22 JANUARY 1976

TABLE OF CONTENTS

Continued .....

TABLE OF CONTENTS (CONT'D)

LIST of FIGURES

LIST of TABLES

ACKNOWLEDGEMENTS

The authors are grateful for the assistance received from many people at different stages in this study. For assistance during the conceptual planning phase, we wish to thank personnel of the Western Region, Water Survey of Canada; Water Quality Branch; the Ottawa Sedimentation lab personnel, Applied Hydrology Division, Water Resources Branch, Ottawa, and Terrain Sciences Division, Geological Survey of Canada, Ottawa. The Atmospheric Service, Environment Canada, provided the loan of equipment for snow surveys during the fuel caching trip. For logistical support, we wish to acknowledge the assistance of the Resolute base staff of the Polar Continental Shelf Project. We wish to thank the Fisheries and Marine Service, FP-2 Project, for allowing one of our personnel to accompany their survey trip. We are grateful for the data analysis and reporting by the Sediment Surveys Section and Network Planning and Forecasting Section of the Applied Hydrology Division, Water Resources Branch, Ottawa; Glaciology Division, Water Resources Branch, Ottawa, and Water Quality Branch, Winnipeg. In particular, we are appreciative for the help and critical reviews extended to us by Dr. G. Kite, Applied Hydrology Division; Dr. T. Day of the Terrain Sciences Division, Geological Survey of Canada, and by Mr. P.W. Strilaeff, District Engineer, Water Survey of Canada, Winnipeg. In addition, we would be remiss if we did not thank Miss P. Finnen and Mrs. M. Gagne for their secretarial services.

1. SUMMARY

This report summarizes the work carried out during 1975 by the Hydrologic Regimes component of the Freshwater Program of the Arctic Islands Pipelines Study Group, under the auspices of the Environmental-Social Program of the Department of Indian Affairs and Northern Development. The objective of the Hydrologic Regimes component (FP-1) was to obtain an overview of hydrology along the pipeline corridor north of Spence Bay, in order to provide data for an adequate assessment of the proponent's application. Because of the paucity of knowledge concerning hydrologic processes and events in the study area and because of the uncertainties of pipeline routing, it was deemed necessary in 1975 to collect data over a broad geographic base. This spatial distribution is Phase One of FP-1's study and will be related to Phase Two, planned for 1976 (the chronologic distribution of hydrologic events).

As fluvio-morphometric concerns are inextricably linked to hydrologic parameters, they must become part of any data set. For this report, it was possible to make only qualitative assessments of these concerns as a minimum of field time was spent on site in order to provide extensive geographic coverage. In any case, attempts have been made to relate the hydrologic and geomorphic data to pipeline concerns, both environmental and those of engineering design. The subjective conclusions and qualitative assessments made in this interim report will no doubt be revised as more data becomes available.

Appended to this report are a survey equipment listing, a detailed catalogue, and an FP-1 funded report on water quality parameters from the Water Quality Branch, Environment Canada, Winnipeg. Because of time constraints, snow reports from Glaciology Division will appear as independent papers.

One major recommendation that the authors of this report would like to make is the need for the establishment of a user-oriented centralized hydrologic data bank. Since the greatest volume of hydrologic data for the study area is in scientific research papers and many times is only peripheral information necessary to the development of the papers' main theme, a

centralized data bank would perform a useful function. The writers feel the establishment of a data bank could best be accomplished by the incorporation of research data from universities and other in-government agencies and departments into the central data banks of the Inland Waters Directorate, Environment Canada.

2. INTRODUCTION

2.1 General Nature and Scope of Study

Discovery of substantial natural gas reserves along the ancient Franklinian geosyncline, from Melville Island in the west to Ellesmere Island in the east, has created interest in construction of a pipeline to the southern market. Polar Gas Project, a consortium, is currently preparing a proposal to construct such a pipeline. Their plan calls for a large-diameter chilled pipe buried in the permafrost horizon.

Investigations in support and defence of an application for a gas pipeline from the Arctic Islands are the responsibility of the proponent. Research specifically undertaken by the Government of Canada is restricted to the collection of information and development of expertise required for an adequate assessment of the proponent's application from a position of independence.

Freshwater Project #1 (Hydrologic Regimes), established under the auspices of Environmental Social Program, Northern Pipelines, was charged with determining what effects such a project would have on stream crossings along the proposed route. In the region of interest, data on hydrologic regimes and their associated fluvio-morphologic characteristics appears to be quite minimal. Because so little was known of stream specifics on the proposed route, it was decided to conduct an initial reconnaissance survey of selected streams. Undetermined routing south of Spence Bay, Boothia Peninsula, confined our investigations to sites north of that settlement. A total of 31 stream reaches were visited in 1975 field season, 25 in the initial survey, and the remaining six visits in conjunction with Fisheries' Freshwater Program, FP. 2.

2.2 Relationship of Freshwater Project 1 (FP-1) to Concerns about Pipeline Development

The relationship of FP-1 to pipeline development and use might be indicated by answering two questions:

In what way will construction and operation of a pipeline affect the hydrologic environment as it relates to rivers and lakes?

What aspects of fluvio-morphology and hydrology will affect routing, design, construction and safe operation of a pipeline?

To answer these questions, data must be obtained prior to construction so that the effects of man's activities can be measured against a reasonable yardstick, and to permit qualified assessments to be made of the proponent's application. Requirements include data information on water quality, discharge, sediment transport, groundwater regimes, streambed percolation, icings, ice-runs and estimates of flood flows. Geomorphic information should describe the stream-associated land forms: valley walls, valley plain, floodplain, channel banks; and identify unstable conditions such as slides, slump, creep, solifluction, ground ice, thermal or dynamic riverbank erosion and channel instabilities - aggradation, degradation and migration.

2.3 Objectives

Overall Objective: To accelerate engineering, scientific and technical investigations in the Arctic Islands so that the Government of Canada will be able to discharge effectively its responsibilities to ensure that a possible Arctic Islands gas pipeline would be built with due regard to the well-being of the northern people, to the protection of the natural environment, and to acceptable engineering standards.

Specific Objectives: To provide an overview of hydrology along the pipeline corridor north of Spence Bay, in order to provide data for an adequate assessment of the proponent's application.

Goals

1. To catalogue the hydrologic characteristics of the streams.
2. To provide baseline data for associated disciplines. (Fisheries and Water Quality)
3. To assess the geomorphology of the investigated reaches.
4. To monitor the proponent's activities in obtaining hydrologic data.

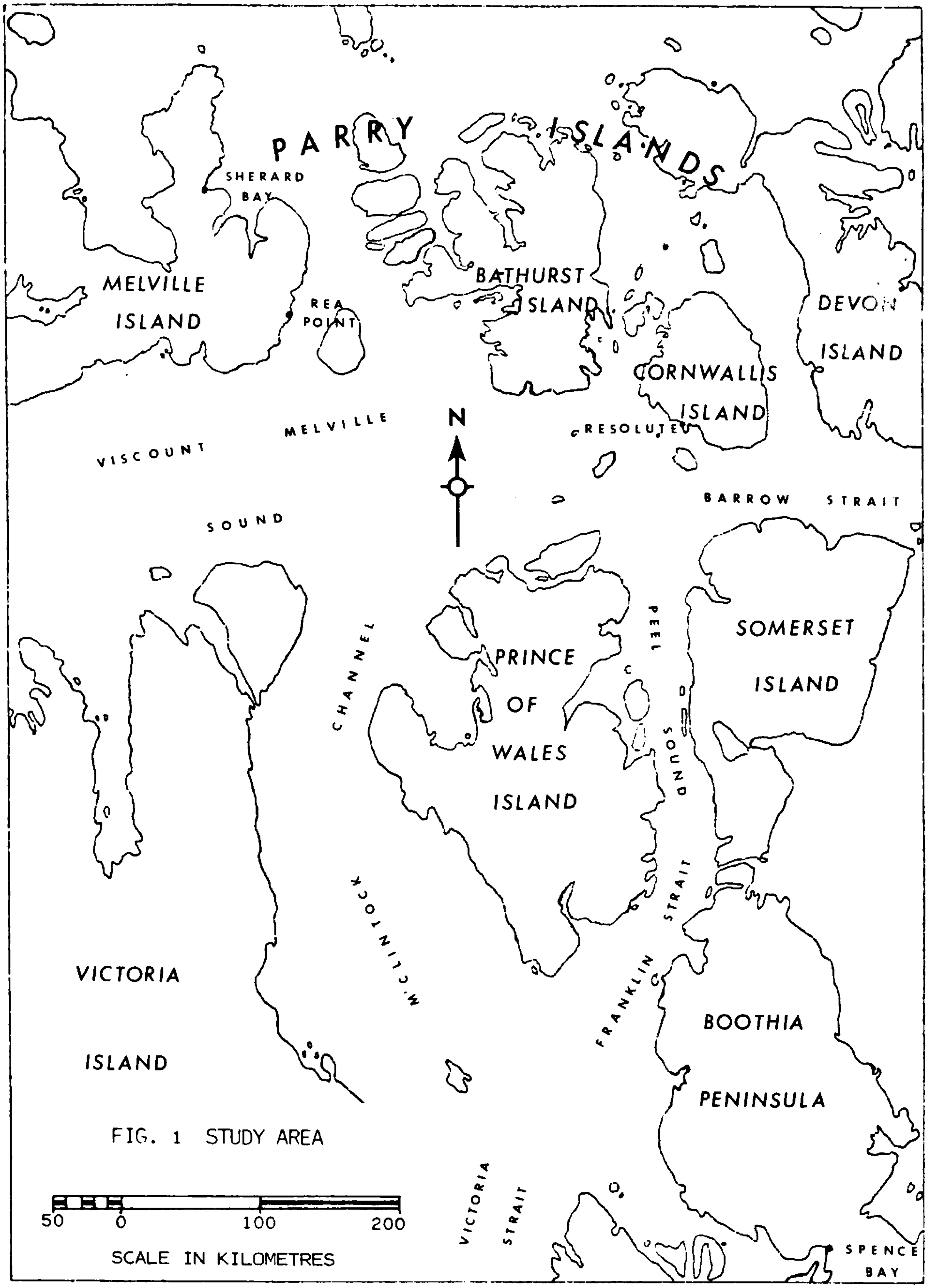


FIG. 1 STUDY AREA

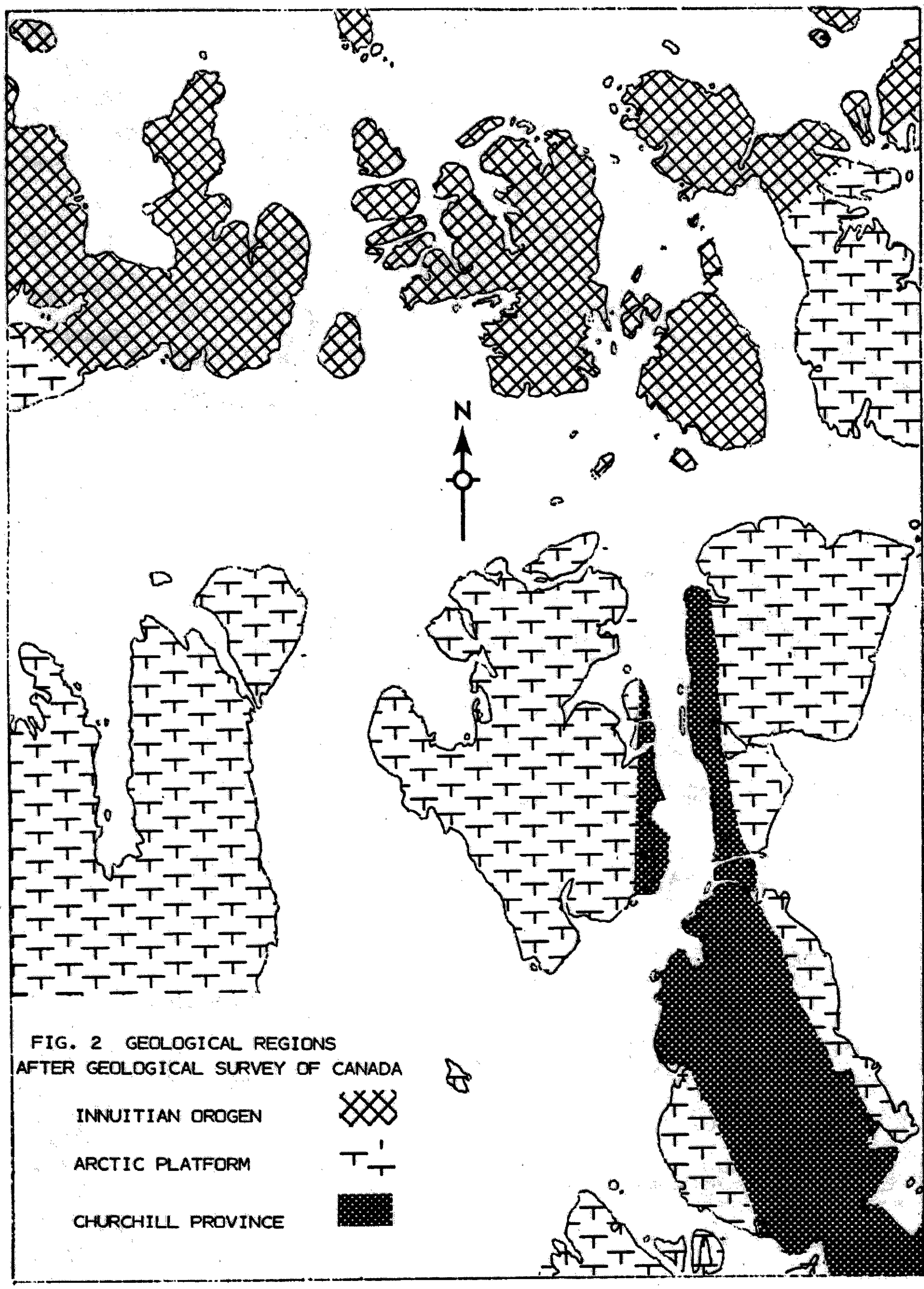


FIG. 2 GEOLOGICAL REGIONS
AFTER GEOLOGICAL SURVEY OF CANADA

3. GEOGRAPHIC ASPECTS

3.1 Location

To the north of mainland Canada lies a vast archipelago having a land area of 1,360,000 square kilometres or approximately 14 percent of the total land area of Canada. This Canadian Arctic Archipelago generally extends from 68° N. to 83° N. latitude, and 60° W. to 140° W. longitude. Occupying the central portion of this region is the study area investigated by the FP-1 project during 1975. Because the hydrology of this area is generally unknown and pipeline routings are relatively uncertain, a broad-based survey was initiated. The study area consisted of eastern Melville Island, Bathurst Island, Prince of Wales Island, Cornwallis Island, Somerset Island and Boothia Peninsula. Figure 1 illustrates the relative locations of the islands visited and the primary settlements.

3.2 Geology

Geologically, the study area is comprised of three distinct regions. These geological regions are the Churchill Province of the Canadian Shield, the Arctic Platform and the Innuitian Orogen. Figure 2, after the Geological Survey of Canada, defines their boundaries within the study area.

The Churchill Province is composed mainly of exposed granites and granitic gneisses laid down during Precambrian eras. Outliers of Paleozoic sedimentary strata occur within this area. The Arctic Platform is composed of a chain of lowlands, plains and plateaus of generally flat-lying sedimentary rocks overlying the gently sloping Precambrian rock basement. These rocks, such as sandstone, limestone, dolomite and shale were laid down in shallow seas bordering the Canadian Shield in ancient geologic ages. Lying to the north of the Arctic Platform is the Innuitian Orogen, composed basically of rocks similar to those of the Arctic Platform. However, these rocks have undergone faulting, folding and deformation, and thus present a more varied topography than the older Arctic Platform; they are in a geological youthful stage of development. How the various geologic regions affect the hydrology is described in the following section on physiography and drainage.

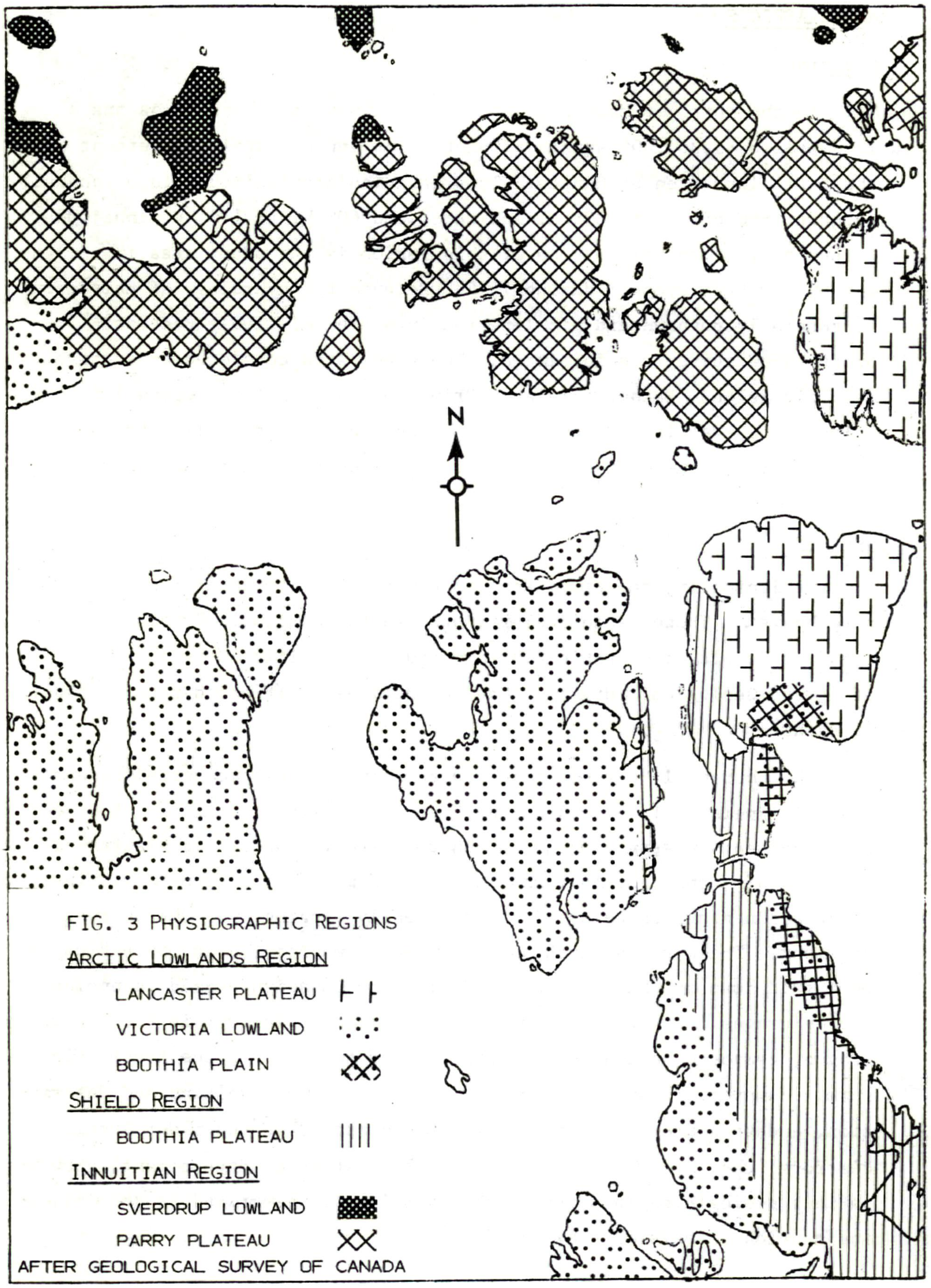


FIG. 3 PHYSIOGRAPHIC REGIONS

3.3. Physiography and Drainage

Three physiographic regions occur within the study area: the Arctic Lowlands, the Innuitian and the Shield (Kazan). Based on topographic and geologic variances, sedimentary areas such as the Arctic Lowlands and the Innuitian may be subdivided into smaller units. Thus, Within the area of concern, the former is comprised of Victoria Lowland, Lancaster Plateau and Boothia Plain, while the latter contains Sverdrup Lowland and Parry Plateau. Rock-dating techniques are the usual basis for subdividing regions in the Canadian Shield. However, within the study area, Boothia Plateau is the only unit present. Figure 3, after the Geological Survey of Canada, delineates the boundaries of these units.

Boothia Plateau exists as a north-trending finger of the Kazan Region of the Canadian Shield through Boothia Peninsula, the east coast of Prince of Wales Island and the western part of Somerset Island. In the vicinity of Spence Bay, large lake systems bordered by isolated hills very nearly dissect Boothia Peninsula. These lakes extend from the till plains in the west to the rugged uplands of the east. In this portion of the peninsula, some sediments appear to be of marine origin. Rivers flow in rather ill-defined valleys. The major, central portion of Boothia Peninsula is comprised of a relatively smooth-rolling plateau about 500 m. above sea level bounded by two Precambrian upland areas. The interior plateau gives rise to a number of fairly well-developed, large river systems. Occasional rapids and falls created by outcrops occur. In northern Boothia Peninsula and southern Somerset Island, the rugged upland areas have been dissected into massive square blocks along north-south and east-west joint and fault lines which structurally control drainage. Lakes are long and narrow with steep rocky sides and flow to the sea through rivers of a tumbling mountain nature.

In the Arctic Lowland Region horizontally bedded sedimentary rock overlies the dipping Precambrian rock basement. Lancaster Plateau, covering most of Somerset Island, exists as a low-relief surface about

400 m. above sea level. Rivers draining this central watershed become incised, exhibiting dendritic patterns, and are braided in their lower reaches in extensive floodplains. Within Boothia Plain (see Fig. 3), an area of low elevation, the rivers are braided and wander through extensive floodplains. Victoria Lowland, constituting most of Prince of Wales Island, has drainage patterns typical of glaciated areas with ill-defined rivers and many shallow lakes.

The Parry Plateau extends over Cornwallis, Bathurst and eastern Melville Islands. Although Cornwallis Island appears to be very similar to northern Somerset, it belongs to the Innuitian Region. In this region, sedimentary rocks have been folded, faulted and deformed. On Cornwallis Island, the folds have been generally eroded down to a smooth peneplain, slightly dome-shaped. A radial drainage pattern predominates and the rivers are incised as they flow off the upland areas. On the east side of the island they flow in narrow deep-walled valleys to the coast while the west-flowing rivers have slightly wider flat-floored valleys.

On Bathurst Island the Parry Plateau is strongly ridged. Broad, flat-topped ridges separate wide, flat-floored valleys linked to each other by rugged, ravine-like cross valleys. The ridges impose strong structural controls on river patterns. In eastern Bathurst Island, drainage patterns parallel the axis of folding, reflecting east-west alignment. On eastern Melville Island, there exists a well-developed system of rivers with very few lakes. The ridging predominating on Bathurst Island is not as evident, and the rivers flow from a central area of elevation 200 m. above sea level. In the southeastern portion, the rivers follow beds of soft rocks along the folds and in places dissect folded ridges. In the north and northwest, low elevated uplands and dissected plateaus occur, marking a zone of more intensive folding.

Sabine Peninsula, in northeastern Melville Island, belongs to the Sverdrup Lowland. This low relief area is developed on a structural basin of generally soft, poorly consolidated rock. The rivers flow to the east or west from the centre of the narrow peninsula. Marked instability in river channels and valley walls occurs.

3.4. Climate

The climate of the study area in the Arctic Archipelago is best defined as modified Maritime Arctic. Dominant climatic factors are the extreme latitudinal control of incoming solar radiation, the areal distribution of land and water and atmospheric circulation endemic to central polar regions.

Since the areas studied are located geographically north of the Arctic Circle, continuous daylight in summer and continuous darkness in winter are distinctive features of the climate. During the cool brief summer, the surrounding seas and channels — which may be partially or wholly ice-covered — cool the lower levels of the atmosphere. Thus, the temperatures average only about 6°C during the warmest month of July. In winter, the annual ice covering the channels and ocean is usually thin enough to allow radiation from the water below to have a slight modifying influence on the temperature. January temperatures average about -33°C. It should be noted that although extremes in the order of -50°C have occurred at Spence Bay and Resolute Bay, the record minimum extremes in North America have occurred in "continental" mainland areas to the south. The following table of precipitation and temperature values for Resolute Bay and Spence Bay may be of interest:

	Mean Annual Temp.	Mean January Temp.	Mean July Temp.	Mean Annual Rainfall	Mean Annual Snowfall	Mean Annual Precip.
Spence Bay	-15.7°C	-34.4°C	7.1°C	7.3 cm	7.1 cm	14.4 cm
Resolute Bay	-16.6°C	-32.7°C	4.3°C	5.7 cm	7.8 cm	13.5 cm

The study area generally lies north of the primary tracks of cyclonic activity. Thus the rainfall events during the June-September period normally occur in the form of light rain or drizzle rather than intense thunder showers. Annual snowfall is quite light and most frequently occurs during the first two months and last two months of the winter period which extends from October to May. Climatically, geographers describe this area as a frigid desert.

The characteristics of this climate have a profound effect on the hydrology of the study area. In this region of continuous permafrost, the cryergic processes create an ample, constant supply of source material for erosion and transport. The lowland areas which exhibit a water-logged appearance due to the annual thaw of the active layer belie the actual annual amount of precipitation received.

A primary characteristic of great importance is the physical deposition of winter precipitation on the terrain. The sparseness of the vegetation, the fairly constant, moderate winds and the nature of the dry, hard snow create well-packed, dense snow drifts on the lee sides of obstructions and in river channels. It is common to find exposed areas with little or no snow while the river channels and its tributaries are completely filled. Thus the availability of snow for runoff could produce greater flood events than the average snowfall records would suggest. It is believed that this peak runoff occurs prior to streambed thaw, thus retarding the erosive nature of this flow. Some snow beds persist beyond the summer melt period and nivation processes will continue throughout the year.

4. METHODS and SOURCES OF DATA

4.1. Literature

In the considerable body of writing on arctic hydrology very little is geographically relevant to this report's needs. Of interest to the writers was:

1. Discharge of Allen River, Cornwallis Island, open water only (Water Survey of Canada 1975).
2. Reconnaissance of Little Cornwallis Island (Hollinshead 1974).
3. Fluvial Processes in the High Arctic (F.A. Cook 1965).
4. Surface Runoff Characteristics of an Arctic Nival Catchment (J.V.G. Cogley & S.B. McCann 1975).
5. Water Balance of Arctic River Regimes (G. Holecek 1975).
6. Physico-chemical Characteristics and Post-glacial Desalination of Stanwell-Fletcher Lake, Arctic Canada (B.R. Rust & J.P. Coakley 1970).
7. Sedimentation in an Arctic Lake (J.P. Coakley & B.R. Rust 1968).
8. Rivers and Coasts - Yukon Coastal Plain (B.C. McDonald & C.P. Lewis 1973).

Of the hydrologic data from the periphery of the investigative area, the report (Item 8 above) was particularly helpful since the basic objectives of Phase One of their investigations were similar to ours.

4.2. Field Techniques (see Appendix A for equipment list)

Essentially, four field surveys in the Arctic Islands were conducted in the period May-September 1975. Although the primary purpose of the May expedition was to cache fuel in preparation for the summer's activity, some snow survey data was assembled for the cache sites at Sanagak Lake, Boothia Peninsula; Stanwell Fletcher Lake, Somerset Island; and Schomberg Point, Bathurst Island.

The June-July survey began on 18 June and spanned 25 days. The two-man field party investigated 25 sites from Spence Bay on Boothia to Sherrard Bay on Melville. The initial visit to site assembled the following data set: discharge measurement, direct water level, recent high water mark elevation, longitudinal river slope over 300 metres, surveyed cross section, water quality grab sample, pH, conductivity and water temperature, permafrost horizons (where possible), suspended sediment sample, grid-by-photograph surficial bed material sample, photographic set, geomorphic data sheet. The survey was prepared to collect bed-load transport but the relative low-flow regimes encountered precluded any sample collection. Sites were revisited to measure changed data sets - notably flows and water levels. It did not prove necessary to utilize indirect methods for flow measurements, although we were prepared to do so.

In the period 12 August to 01 September, an FP-1 staff member accompanied FP-2 investigative reconnaissance and obtained data from five sites on Prince of Wales Island and one additional site on south Somerset Island.

The original 25 sites were revisited in the low flow period August 22 to September 3. Discharge measurements, water quality samples and bed material samples were collected.

4.3 Office Techniques

Much data of hydrologic and geomorphologic significance is available from published 1:250000 map sheets as outlined by Strahler in "The Handbook of Applied Hydrology" (ed. Chow, U.T., 1964) and demonstrated by Thakur and Lindeijer (1974) in their analysis of flood flow parameters for MacKenzie River tributaries. In preparation for subsequent analysis, morphometric data was assembled for investigated basins, and is included in this report as Table 1, Section 5.

4.4 Data Analysis

4.4.1 Geomorphologic assessment

The 1975 goal was to provide a description of the physiography for each study basin, and for the valley and river reach selected. Field observations were recorded on a standard reporting form patterned after previous work by Church, Kellerhals and Bray - the most recent reference being the suggested format by Kellerhals et al (1975). Information from the form and from photo files allowed the writers, in consultation with Dr. Terry Day of

Terrain Sciences, G.S.C., to compile a generalized description of geomorphic features. Data appears in tabular format in Table 3, Section 5, and as a précis in the Stream Catalogue, Appendix B, of this report.

4.4.2. Regression analysis

Under the direction of Dr. G.W. Kite, Applied Hydrology Division, regression analyses for study watersheds was attempted. Of the normal inputs such as precipitation, temperature, drainage area, river slope, soil type and vegetation, only precipitation, mean June temperature, drainage area and latitude were utilized as independent variables—this restriction the result of insufficient data for associated, gauged basins. Use of a stepwise regression program, BMDO2R, and a first regression of the type $Q_J = f(MC, PC)$, where Q_J is mean June flow, MC and PC are meteorological and physiographic characteristics respectively, produced the simple relationship, $Q_J = 2.78A$, where A is drainage area in square miles. This regression, the first of a series aimed at generating peak flows synthetically, is as far as this process will be carried this year.

4.4.3. Surveyed and computed hydraulic data

Discharge measurements, associated water levels, high water marks, surveyed reach profiles and surveyed cross-sections allowed for development of hydraulic data necessary as inputs into the Manning equation and into log-log extensions of stage-discharge relationships. Generally, information from field notes was calculated on in-house computers, then hydraulic data extracted by graphical analysis. The source of data on Table 2, Section 5, and its derivation is as follows:

- Q - measured discharge - computed from field notes.
- A - measured area - computed from field notes.
- V - mean velocity - Q/A.
- W - measured width - from field notes, approximates wetted perimeter.
- D.W.L. - measured water level for time of discharge, from field notes.
- S_r - best-fit line of graphed survey note elevations over an average distance of 300 metres.

A_{hw} - area of cross-section calculated from plot of cross-section to the high water mark.

W_{hw} - width at high water measured on plot of high water cross-section.

HWMk - Surveyed high water strand line.

n_s - roughness co-efficient, calculated from Strichler's formula, $n = 0.013 (D_{50})^{1/6}$

Q_m - calculated discharge from Manning's equation,
$$Q = \frac{AR^{2/3}S^{1/2}}{n}$$

Q_{11} - graphical estimate of flows for surveyed high water mark from a plot of the logarithm of discharge vs. the logarithm of water elevation above point of zero flow.

Q_{be} - best estimate of maximum 1975 discharge based on calculated values and a rational assessment of watershed characteristics.

V_t - threshold velocity required to move particles of bed material finer than D_{35}, based on Hjulstrom's diagram.

S_{1r} - the long river slope calculated from map data, expressed as a ratio.

Further attempts were made to generate high flows according to techniques outlined by Einstein and Barbarossa (1951). When our available data was plugged into this family of equations, the results were not consistent with Manning values or those from log-log extension techniques. Possibly the use of particle size values other than D_{35} and D_{65} might produce acceptable data (personal communication - Day, 1975). For this interim report, the use of this technique for high flow generation was not used.

4.4.4 Sediment and particle size data

Of particular interest to us was the bed material sampling technique, grid-by-number from photos, outlined by Kellerhals and Bray (1971). Use of these procedures resulted in substantial saving of field time by the transfer of analysis from the field to the office.

Two methods of analysis were applied to suspended sediment samples made in the 1975 survey. Because the survey was made by helicopter, space restrictions precluded the assembly of conventional bottle samples with the exception of Melville Island sites. On Melville Island, bottle samples were saved for lab analysis, allowing for dissolved concentrations to be obtained as well as suspended concentrations. All other sediment samples were collected in Millipore filters. Samples of bed, bank and sub-surface materials, too fine to allow for grid-by-number technique, were run through standard sieve analyses in the lab. The laboratory work mentioned here was conducted by the Sediment Survey Section of Applied Hydrology Division, Inland Waters Directorate, Ottawa.

5. RESULTS

The information acquired in the 1975 field season is presented in this section in tabular format, each table dealing with specific data. It allows the user to obtain an overview of the entire study area for five data fields; the sixth, water quality information, appears in the Appendix report received from Water Quality Division, Inland Waters Directorate. The stream catalogue, Appendix B, provides site specific data in greater detail. All known data for a specific site was included in the catalogue, excluding data contained in Appendix C.

In the absence of names and standard WSC coding for the selected research sites, it was decided to code name them to provide an identification system. Streams were assigned code numbers from south (Spence Bay) to north (Cornwallis Island), then east to west. A letter-number system was utilized; thus, for Boothia, we used letter "B" with numbers 1, 2, 3, etc. to identify specific sites. Somerset was "S", Cornwallis "C", Bathurst "BT", and Melville "M". Prince of Wales Island, visited once only in August, was identified by "PW. The stream catalogue, Appendix B, identifies particular sites by code number, WSC identifier, and name.

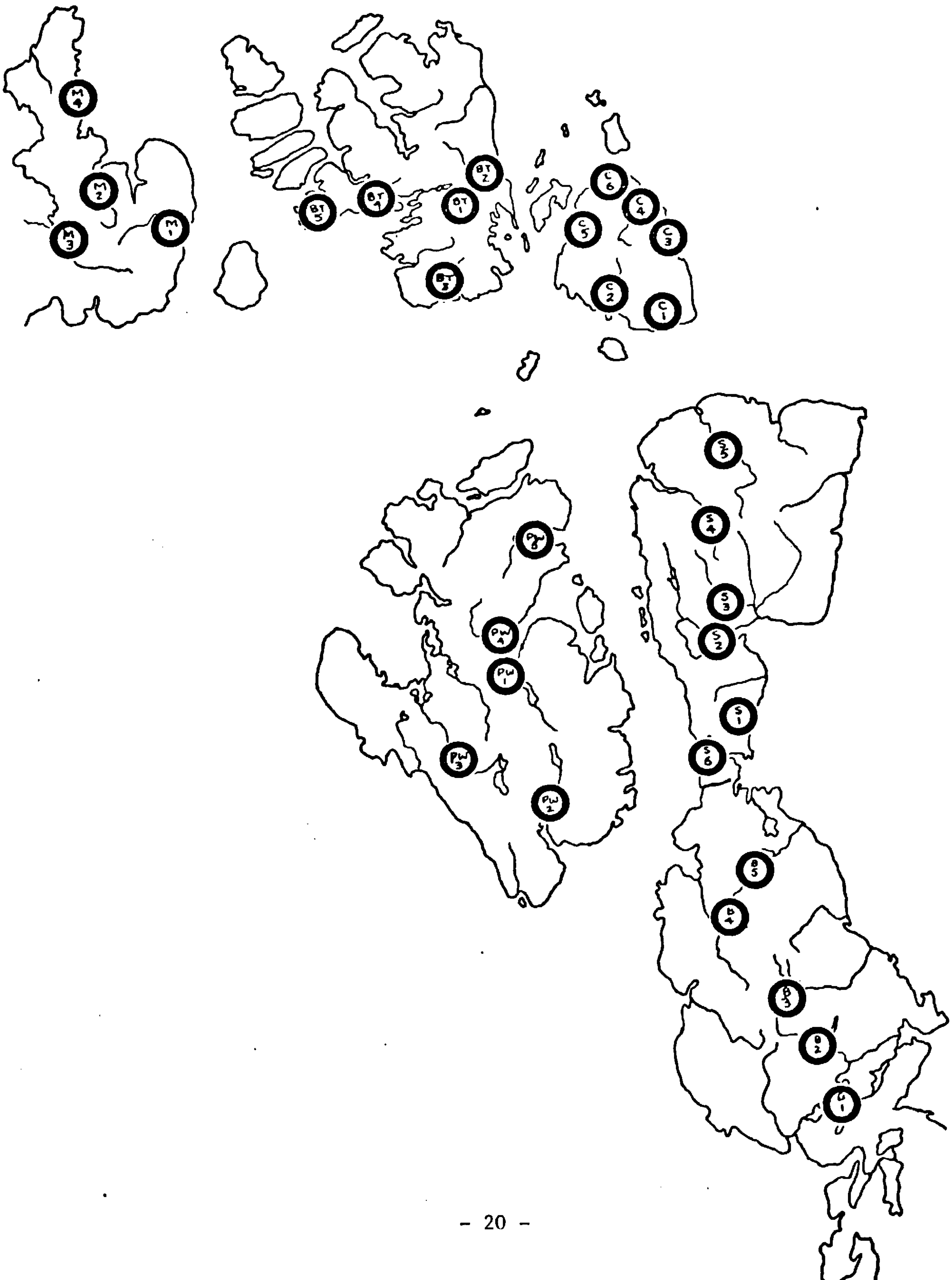


TABLE 1 MORPHOMETRIC DATA

BASIN CODE	DRAINAGE AREA	BASIN PERIMETER	CIRCULARITY RATIO	STREAM ORDER	BIFURCATION RATIO	LENGTH OF PRINCIPAL CHANNEL	SLOPE OF PRINCIPAL CHANNEL	BASIN WIDTH	BASIN LENGTH	ELONGATION RATIO	HYPSOMETRIC INTEGRAL	HYPSOMETRIC COEFFICIENT	BASIN RELIEF	MINIMUM ELEVATION	MAXIMUM ELEVATION	AVERAGE ELEVATION	MEDIAN ELEVATION	BASIN ASPECT
	KM^2	KM				KM		KM	KM				KM	KM	KM	KM	KM	
B-1	1479	259	.273	4	5.41	94	0.001	33.0	71.0	.608	.207	+.145	358	0	358	179	57	NE
B-2&3	3717	451	.230	5	5.38	169	0.003	59.0	.110	.630	.544	-.597	555	0	556	277	323	SE
B-4	2828	328	.330	5	4.15	12	0.01	55.9	92.7	.646	.566	-.394	564	0	564	282	358	SE
B-5	2002	267	.352	4	5.05	22	0.007	52.7	78.2	.646	.490	-.328	594	0	594	297	303	NW
S-6	223	70.8	0.557	4	3.43	33.8	0.013	14.6	24.8	.680	.542	-.330	442	0	442	221	229.8	SW
S-1	278	92	.410	4	4.61	30	0.01	20.9	28.6	.652	.585	-.411	472	0	472	236	248	E
S-2	2077	307	.275	4	4.25	83	0.003	39.4	80.3	.641	.405	+.224	442	0	442	221	167	E
S-3	958	169	.422	4	4.29	40	0.008	30.5	58.4	.591	.538	-.504	472	30	503	267	247	S
S-4	1823	243	.324	4	4.87	62	0.006	52.0	59.9	.736	.580	-.759	503	0	503	251	294	NW.
S-5	2634	319	.326	5	4.42	94	0.004	51.4	83.7	.692	.678	-.659	411	0	411	206	291	N
C-1	124	55	.514	3	3.52	18	0.01	9.5	21.2	.591	.757	-.628	259	0	259	130	210	S
C-2	549	75	.469	4	3.68	48	0.004	19.0	42.3	.624	.621	-.487	290	0	290	145	173	SW
C-3	471	109	.502	4	5.29	43	0.007	19.7	33.8	.724	.499	-.584	351	0	351	575	168	NE
C-4	857	137	.579	5	4.91	51	0.004	30.5	40.7	.810	.501	-.346	247	0	247	123	122	W
C-5	324	85	.553	4	4.18	33	0.006	18.4	30.1	.674	.622	-.579	209	0	209	105	126	NE
C-6	114	81	.540	3	4.40	21	0.009	7.6	21.1	.571	.486	-.585	229	0	229	114	112	N
BT-1	344	106	.384	4	4.52	40	0.005	16.5	34.1	.614	.535	-.513	255	0	255	128	130	N
BT-2	650	126.0	.161	4	4.81	48	0.006	25.6	46.3	.622	.475	-.238	289	0	289	145	154	SE
BT-3	324	92	.483	4	4.21	26	0.01	16.5	25.4	.798	.617	-.533	290	0	290	145	183	SW
BT-4	635	146	.372	5	4.71	58	0.004	14.6	50.8	.859	.480	-.227	351	0	351	175	170	SW
BT-5	104	55	.445	4	3.98	18	0.007	12.7	17.1	.673	.432	-.386	241	0	241	120	104	S
M-1	1204	174	.500	5	4.49	77	0.002	51.5	46.5	.841	.452	-.487	259	0	259	130	116	E
M-2	578	114	.580	5	4.55	43	0.003	24.5	38.1	.711	.515	-.417	259	0	259	130	130	NW
M-3	1492	196	.486	5	3.86	75	0.002	43.8	66.3	.657	.403	-.389	290	0	290	145	119	NW
M-4	212	98	.277	5	3.29	35	0.004	20.0	27.7	.591	.412	-.231	168	0	168	83.8	66	SE
PW-1	2494	335	.280	5	4.02	100	0.0006	48.3	81.3	.693	.305	-.198	158	0	158	79.2	41.1	N
PW-2	1935	262	.353	5	4.57	103	0.002	49.5	64.1	.773	.509	-.179	168	0	168	83.8	67.1	S
PW-3	2949	325	.350	5	5.48	148	0.001	48.0	105.6	.577	.262	-.145	150.5	0	150.5	79.2	57.3	NW
PW-4	873	166	.399	4	4.38	63	0.0002	41.8	39.4	.846	.446	-.069	198	0	198	99.1	75.3	E
PW-5	764	158	.386	4	5.72	63	0.003	53.3	38.1	.818	.488	-.268	247	0	247	123	119	E

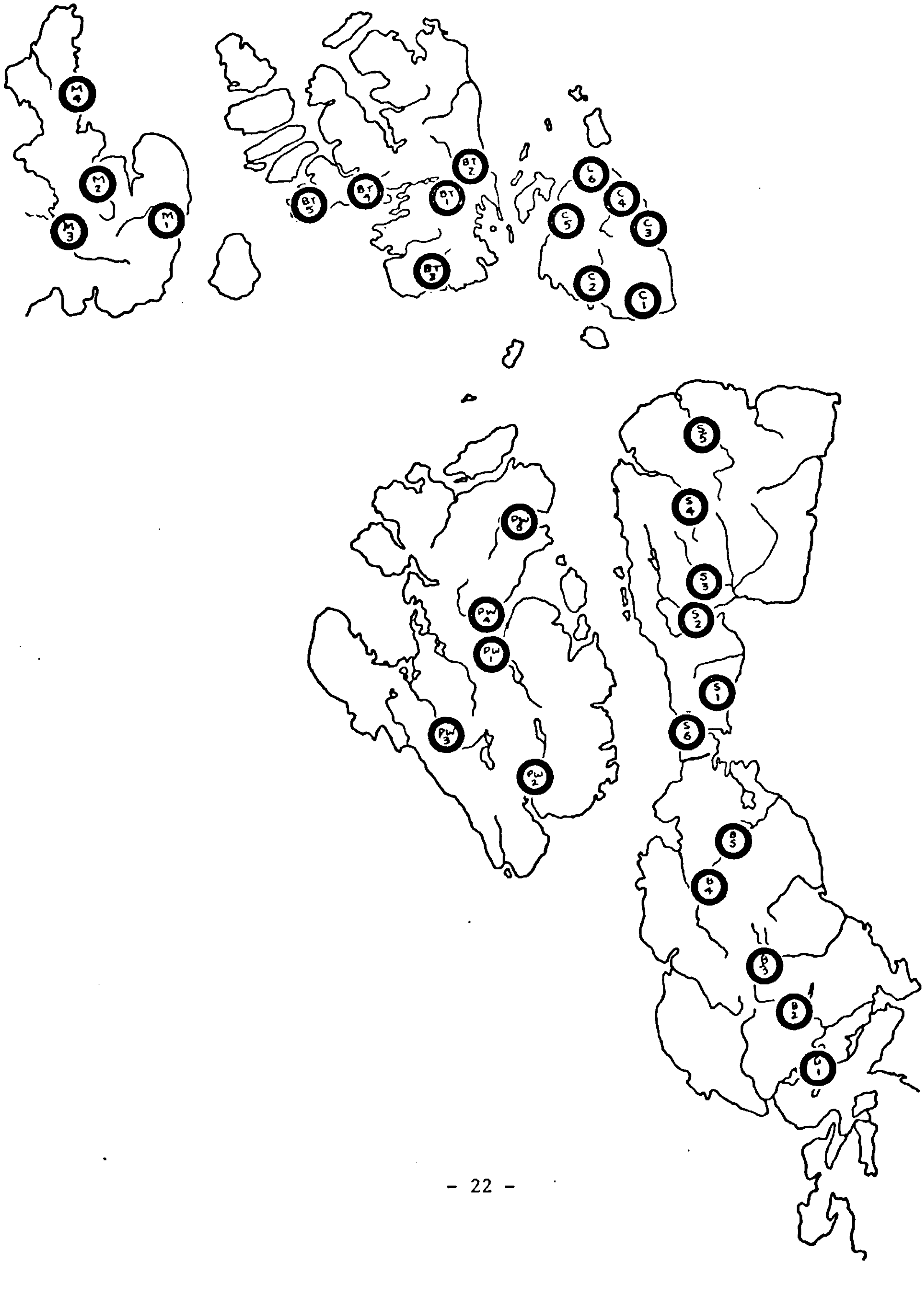

M 4
M 2
M 3
M 1
BT 5
BT 4
BT 1
BT 2
BT 3
C 6
C 4
C 5
C 3
C 2
C 1
S 5
S 4
S 3
S 2
S 1
S 6
PW 4
PW 1
PW 3
PW 2
B 5
B 4
B 3
B 2
B 1

TABLE 2 HYDROLOGIC DATA 1975

CODE NAME	DATE OF MEASUREMENT	Q M^3/S	A M^2	V M/S	W M	DWL M	S_R M/M	A_{HW} M^2	W_{HW} M	HWMK M	N_S	Q_M M^3/S	Q_{LL} M^3/S	Q_{BE} M^3/S	V_T M/S	S_{LR} M/M
BATHURST ISLAND																
BT-1	02 JUL 75	2.0	3.2	0.62	13.4	0.39	0.002	19.9	42.1	0.94	0.024	22.4	83.6	40	3.7	0.005
	11 JUL 75	0.3	0.8	0.43	7.3	0.24										
	23 AUG 75	0.1	0.3	0.21	5.5	0.16										
BT-2	02 JUL 75	12.9	24.1	0.53	94.2	0.27	0.003	91.1	97.8	0.98	0.022	216	110	100	3.1	0.005
	10 JUL 75	6.5	15.3	0.42	89.9	0.17										
	23 AUG 75	0.3	3.0	0.10	12.5	0.03										
BT-3	02 JUL 75	3.8	11.0	0.35	23.2	0.47	0.003	22.5	26.8	1.00	0.027	40.6	19.3	25	4.5	0.006
	09 JUL 75	1.3	7.3	0.18	23.2	0.28										
	23 AUG 75	0.2	3.2	0.06	8.2	0.11										
BT-4	06 JUL 75	4.4	6.0	0.73	33.5	0.33	0.002	63.2	64.0	1.60	0.024	110	272	150	3.9	0.004
	23 AUG 75	0.3	1.4	0.24	15.8	0.13										
BT-5	06 JUL 75	1.4	2.0	0.69	8.2	0.28	0.003	11.3	27.7	0.80	0.021	16.3	3.7	15	2.0	0.003
	10 JUL 75	0.8	2.3	0.37	9.1	0.18										
	23 AUG 75	0.1	0.5	0.12	5.5	0.01										
MELVILLE ISLAND																
M-1	07 JUL 75	7.2	18.1	0.40	37.8	0.31	0.0008	142	106	2.12	0.022	222	207	200	3.1	0.002
	09 JUL 75	9.2	20.6	0.45	39.0	0.36										
M-2	07 JUL 75	3.1	8.1	0.38	25.0	0.34	0.0001	45.6	78.0	1.42	0.023	13.5	65.2	50	3.1	0.003
	09 JUL 75	7.1	10.8	0.66	30.5	0.52										
M-3	07 JUL 75	6.9	18.8	0.37	34.7	0.24	0.0005	78.9	157	0.76	0.022	50.5	147	70	3.2	0.002
	09 JUL 75	9.9	20.3	0.49	35.7	0.28										
	24 AUG 75	0.7	9.8	0.13	28.0	0.10										
M-4	07 JUL 75	0.8	3.7	0.21	14.3	0.19	0.001	10.4	32.9	0.63	0.018	8.6	6.9	10	1.9	0.004
	09 JUL 75	1.1	3.8	0.58	17.7	0.23										
	24 AUG 75	0.04	0.2	0.20	3.0	0.04										
PRINCE OF WALES ISLAND																
PW-1	16 AUG 75	15.7	33.5	0.47	55.2	--										
PW-2	17 AUG 75	3.7	16.0	0.23	32.0	--										
PW-3	18 AUG 75	6.0	15.1	0.40	57.3	--										
PW-4	18 AUG 75	0.7	2.1	0.36	12.2	--										
PW-5	18 AUG 75	0.6	2.2	0.26	8.4	--										

Q - MEASURED DISCHARGE

A - AREA FROM DISCHARGE MEASUREMENT

V - MEAN VELOCITY (Q/A)

W - MEASURED WIDTH

DWL - SURVEYED WATER LEVEL (ZERO FLOW = ZERO DATUM)

S_R - SURVEYED SLOPE IN REACH

A_{HW} - AREA OF HIGH WATER CROSS-SECTION

W_{HW} - SURVEYED WIDTH AT HIGH WATER

HWMK - HIGH WATER MARK (1975)

N_S - ROUGHNESS COEFFICIENT (STRICHLER)

Q_M - HIGH WATER DISCHARGE (MANNING)

Q_{LL} - HIGH WATER DISCHARGE (LOG-LOG EXTENSION)

Q_{BE} - HIGH WATER DISCHARGE - BEST ESTIMATE

V_T - THRESHOLD VELOCITY FOR D_{35} (HJULSTROM)

S_{LR} - LONG RIVER SLOPE

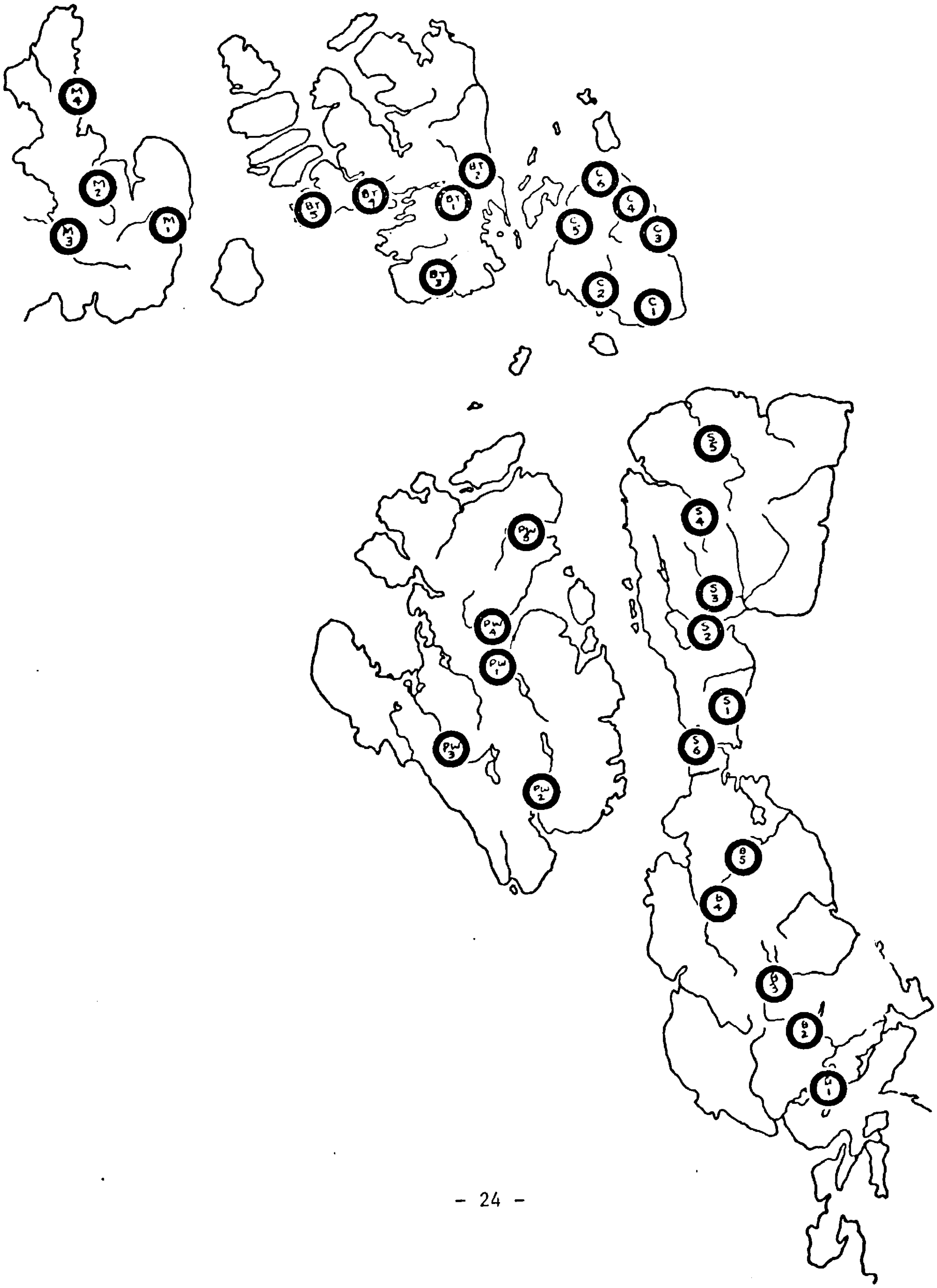


TABLE 2		HYDROLOGIC DATA		1975												
CODE NAME	DATE OF MEASUREMENT	Q M^3/S	A M^2	V M/S	W M	DWL M	S_R M/M	A_{HW} M^2	W_{HW} M	HWMK M	N_S	Q_M M^3/S	Q_{LL} M^3/S	Q_{BE} M^3/S	V_T M/S	S_{LR} M/M
BOOTHIA PENINSULA																
B-1	25 JUN 75	11.3	21.3	0.53	67.1	0.58	0.008	35.0	75.6	0.88	0.026	71.3	46.5	60	3.8	0.001
	27 AUG 75	4.8	11.2	0.43	53.6	0.44										
B-2	26 JUN 75	13.7	22.3	0.61	40.2	1.20	0.0006	--	--	--	0.025	--	--	--	4.2	0.003
	27 AUG 75	4.3	19.4	0.22	38.4	1.03										
B-3	25 JUN 75	12.8	18.4	0.70	86.3	0.43	0.005	126	123	1.43	0.028	310	150		[illegible]	0.003
	27 AUG 75	2.1	7.3	0.29	47.5	0.37										
B-4	24 JUN 75	12.7	27.2	0.47	108	0.41	0.017	122	136	0.79	0.025	599	70.8		[illegible]	0.002
	26 JUN 75	6.3	17.9	0.35	85.3	0.30										
	26 AUG 75	3.5	21.4	0.17	94.5	--										
B-5	24 JUN 75	10.8	87.0	0.12	51.5	1.00	0.0001	110	50.9	1.17	0.025	73.6	21.2			0.002
	27 JUN 75	6.4	74.5	0.09	52.1	0.78					(EST.)					
	26 AUG 75	4.0	18.5	0.21	32.0	0.74										
SOMERSET ISLAND																
S-6	19 AUG 75	1.7	4.1	0.42	10.8	--										
S-1	23 JUN 75	9.2	18.1	0.51	33.5	0.65	0.006	21.3	34.7	0.71	0.025	--	12.7		4.0	0.013
	27 JUN 75	7.6	18.0	0.42	35.0	0.55										
	19 AUG 75	1.0	6.2	0.16	22.9	0.18										
S-2	23 JUN 75	47.3	83.2	0.57	76.2	0.40	0.0008	--	--	--	0.031	--	--		7.0	0.004
	23 AUG 75	33.4	79.4	0.42	76.2	0.22										
S-3	23 JUN 75	22.3	32.2	0.69	63.1	0.75	0.004	103	88.7	1.72	0.027	265	227	230*	4.0	0.008
	27 JUN 75	9.8	16.6	0.59	65.5	0.59										
	26 AUG 75	0.5	2.4	0.20	25.6	0.16										
S-4	22 JUN 75	39.7	37.0	1.07	45.7	1.34	0.006	--	--	4.08	0.026	--	--	--	4.2	0.006
	28 JUN 75	11.2	20.3	0.55	39.0	0.79										
	26 AUG 75	0.4	1.6	0.27	8.8	0.21										
S-5	22 JUN 75	48.7	36.9	1.32	47.2	1.00	0.004	315	85.3	1.78	0.029	105	175	200	6.0	0.005
	26 AUG 75	1.0	3.4	0.28	28.7	0.21										
CORNWALLIS ISLAND																
C-1	01 JUL 75	6.5	7.7	0.84	18.0	0.50	0.009	28.6	33.2	0.79	0.026	92.4	17.3	30	4.2	0.010
	31 AUG 75	0.04	0.2	0.20	1.8	0.05										
C-2	04 JUL 75	10.9	16.6	0.66	31.1	0.63					0.028				5.0	
	08 JUL 75	3.7	8.3	0.45	22.6	0.34										
	31 AUG 75	1.6	9.6	0.17	16.2	0.21										
C-3	30 JUN 75	9.8	12.6	0.77	25.0	0.67	0.004	80.9	84.1	2.20	0.022	234	285	250	3.1	0.007
	08 JUL 75	3.2	7.9	0.41	23.5	0.52										
	31 AUG 75	0.8	5.0	0.16	10.1	0.32										
C-4	30 JUN 75	8.8	11.7	0.75	30.5	1.53	0.005	214	396	2.43	0.022	452	27.2	50	3.1	0.007
	08 JUL 75	3.5	7.2	0.49	28.0	1.08										
	31 AUG 75	0.3	7.4	0.04	15.2	0.39										
C-5	01 JUL 75	2.5	4.0	0.62	14.6	0.40	0.003	53.9	54.9	1.63	0.025	117			3.9	0.004
	08 JUL 75	1.4	2.8	0.48	14.0	0.33										
	31 AUG 75	0.13	1.2	0.11	9.1	0.15										
C-6	01 JUL 75	1.2	2.6	0.45	14.3	0.26	0.006	20.9	37.8	1.13	0.025	43.5	17.0	25	3.8	0.009
	08 JUL 75	1.3	2.6	0.48	14.0	0.25										
	31 AUG 75	0.08	0.6	0.15	6.1	0.05										

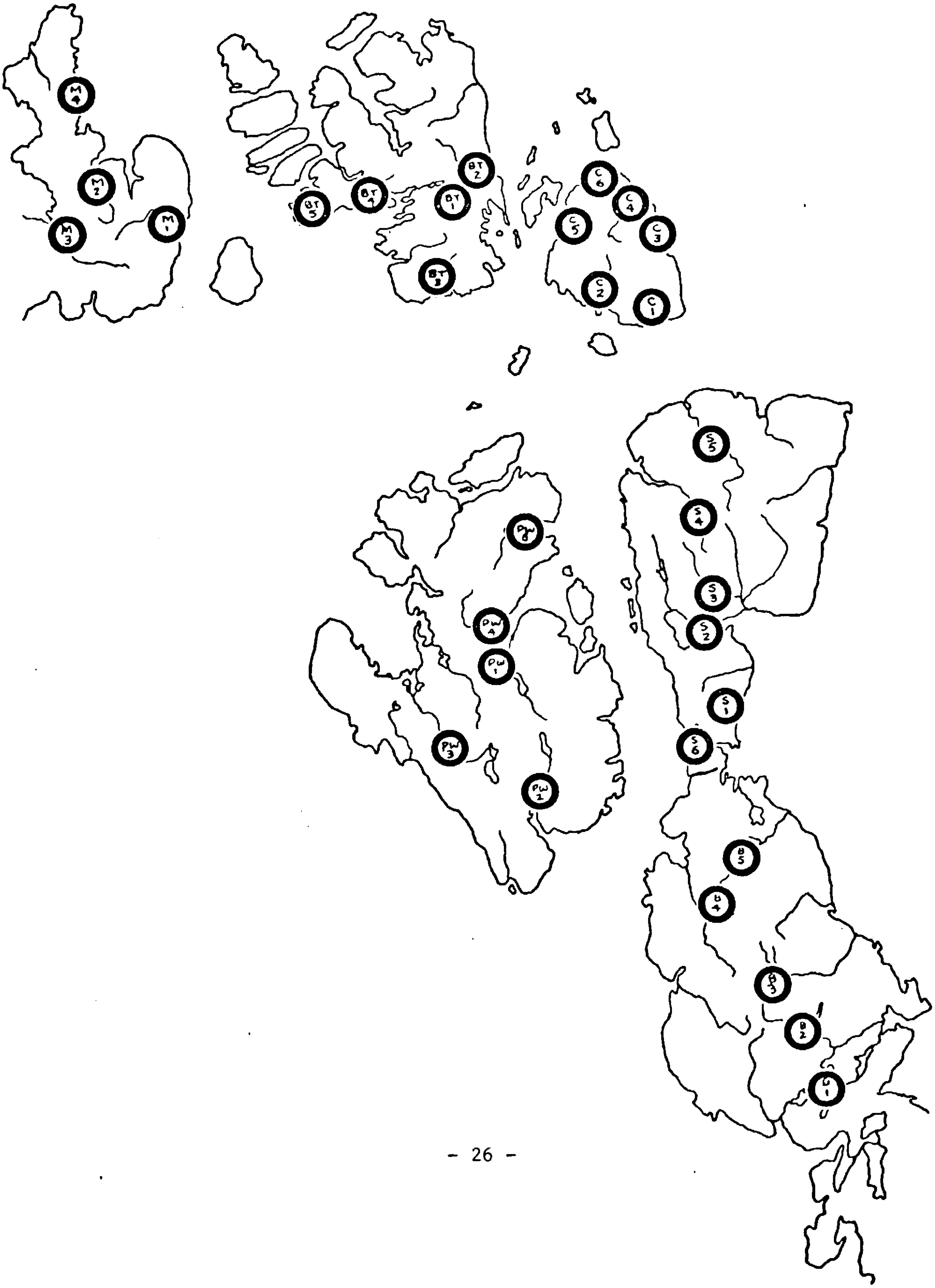


TABLE 3 SEDIMENT TABLE

	BED MATERIAL			SUSPENDED SED. CONC.	DISS. SED. CONC.	DEPTH TO PERMAFROST	
	D_{35} MM	D_{50} MM	D_{65} MM	MG/L	MG/L	JUN-JUL M	AUG-SEPT. M
B-1	30	58	113	14		0.5	>1.0
B-2	40	53	66	10		0.8	
B-3	50	98	165	7		0.6	
B-4	24	43	73	6		–	
B-5				12		0.9	
S-1	34	44	54	23		–	
S-2	149	186	235	--		–	
S-3	34	66	107	22		0.5	
S-4	43	64	91	26		–	
S-5	84	115	148	29		0.4	
S-6							
C-1	39	54	73	15		–	
C-2	58	94	137	16		–	
C-3	17	24	34	21		–	
C-4	18	22	30	20			0.7
C-5	27	43	55	14		–	
C-6	30	47	73	18		0.3	
BT-1	25	41	64	18		–	
BT-2	14	20	29	19		0.5*	0.6
BT-3	43	71	105	15		–	
BT-4	27	36	47	30			0.8
BT-5	6	18	27	43		0.8*	0.8*
M-1	14	21	34	19	41	0.5	
M-2	18	27	38	10	36	0.6	
M-3	15	19	24	33	35	0.4	0.6
M-4	<3	5	8	164	115	0.2	0.6*

* SEE PROFILE

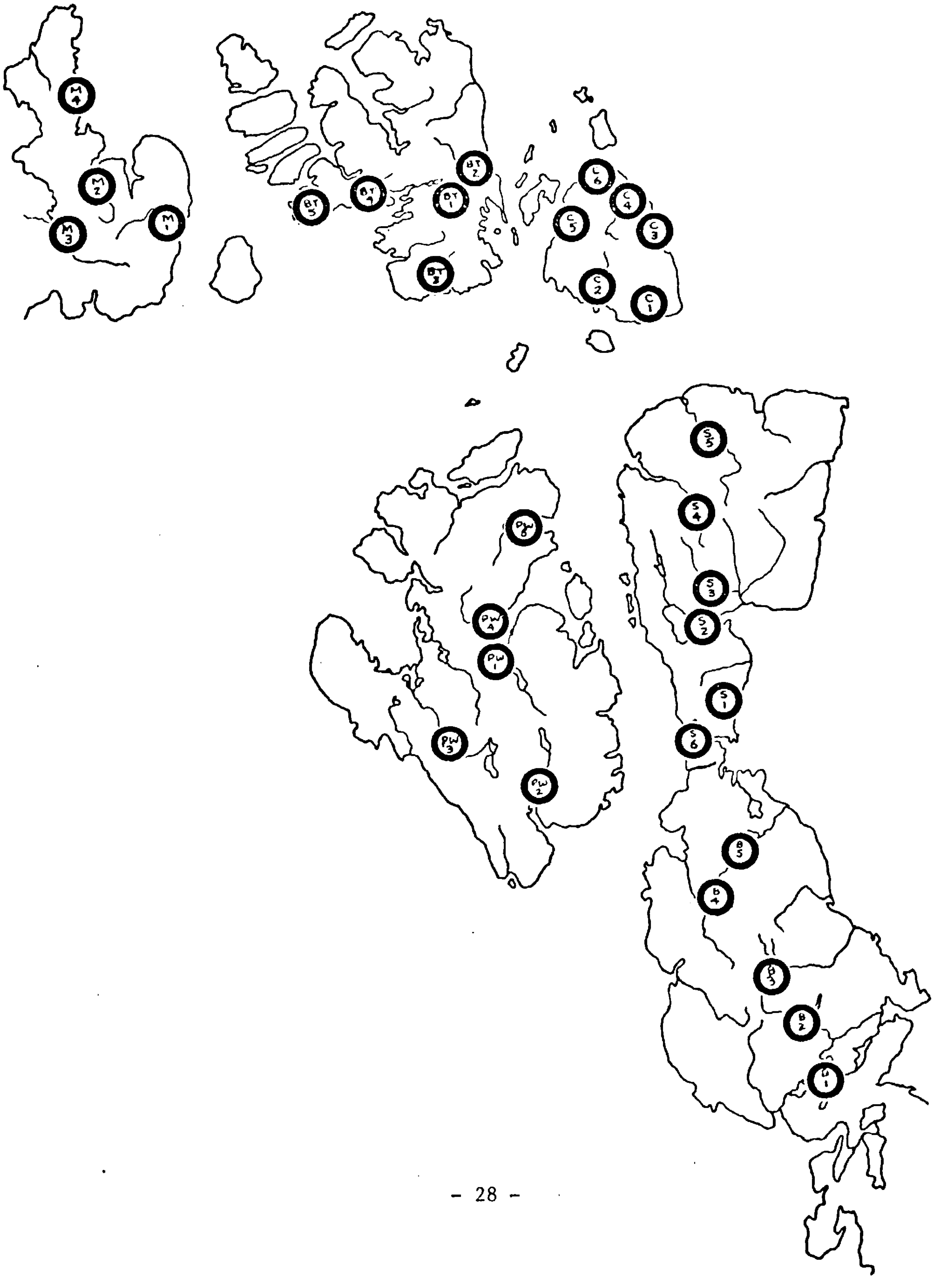


TABLE 4 VALLEY GEOMORPHOLOGY

CODE NAME	SETTING	VEGETATION	LOCAL RELIEF	VALLEY WALL SLOPE	VALLEY WALL MOVEMENT	SURFICIAL MATERIAL	TERRACES
	BOOTHIA PENINSULA						
B-1	HILLS	EXTENSIVE	LOW	<15°	STABLE	BEDROCK, TILL,	FRAGMENTARY
B-2	PLATEAU-HILLS	MODERATE	MODERATE	<15°	WASH	SILT,SAND	PAIRED
B-3	PLATEAU	SPARSE	LOW	<10°	WASH	SILT,GRAVEL ,SNOW*	INDEFINITE
B-4	PLATEAU	SPARSE	LOW	5°	STABLE	GRVEL,SILT ,SNOW*	INDEFINITE
B-5	HILLS	MODERATE	HIGH	<20°	STABLE	BEDROCK	PAIRED
	SOMERSET ISLAND						
S-6	HILLS	SPARSE	HIGH	<25°	ROCKFALL	BEDROCK	NONE
S-1	HILLS	MODERATE	MODERATE	<15°	STABLE	GRAVEL,BEDROCK	NONE
S-2	HILLS	MODERATE	MODERATE	5-20°	STABLE	BEDROCK,BOULDER,GRAVEL	FRAGMENTARY
S-3	PLATEAU	SPARSE	LOW	5-20°	WASH	SILT,GRAVEL ,SNOW*	NONE
S-4	PLATEAU	SPARSE	HIGH	32°	ROCKFALL	GRAVEL,COBBLE ,SNOW*	UNPAIRED
S-5	PLATEAU	SPARSE	HIGH	>30°	ROCKFALL	GRAVEL,COBBLE ,SNOW*	FRAGMENTARY
	CORNWALLIS ISLAND						
C-1	PLATEAU	SPARSE	MODERATE	>30°	ROCKFALL WASH	BEDROCK,SILTY GRAVEL	INDEFINITE
C-2	PLATEAU	SPARSE	MODERATE	15-90°	ROCKFALL WASH	BEDROCK,GRAVEL,SNOW*	NONE
C-3	PLATEAU-HILLS	SPARSE	MODERATE	>15°	WASH	GRAVEL,SILT ,SNOW*	FRAGMENTARY
C-4	HILLS	SPARSE	MODERATE	10-15°	WASH	GRAVEL,SILT	PAIRED,CONTINUOUS
C-5	HILLS	SPARSE	MODERATE	≅30°	ROCKFALL,WASH	BEDROCK,GRAVEL ,SNOW*	NONE
C-6	HILLS	SPARSE	MODERATE	>15°	SLIDE,WASH	SILT,GRAVEL,SNOW*	FRAGMENTARY
	BATHURST ISLAND						
BT-1	HILLS	SPARSE	MODERATE	5-15°	WASH	GRAVEL,SILT	NONE
BT-2	PLAIN-HILLS	EXTENSIVE	LOW	--	--	SAND,GRAVEL	FRAGMENTARY
BT-3	PLATEAU	SPARSE	LOW	5-15°	STABLE	GRAVEL ,SNOW*	NONE
BT-4	HILLS	MODERATE	MODERATE	20-30°	SOLIFLUCTION, SLIDE,WASH	SILT,SAND,GRAVEL,SNOW*	FRAGMENTARY
BT-5	HILLS	SPARSE	LOW	10-20°	SLIDE,MUDFLOW	SILT,GRAVEL	FRAGMENTARY
	MELVILLE ISLAND						
M-1	HILLS	SPARSE	MODERATE	15-25°	WASH,CREEP	SILT,GRAVEL	FRAGMENTARY
M-2	HILLS	SPARSE	MODERATE	10-20°	WASH	GRAVEL,SILT	PAIRED,CONTINUOUS
M-3	HILLS	SPARSE	LOW	10-25°	MUDFLOW,WASH	SILT,GRAVEL	NONE
M-4	HILLS	SPARSE	LOW	--	SLIDE,WASH	SILT , SNOW*	NONE
	PRINCE OF WALES ISLAND						
PW-1	LOWLAND	EXTENSIVE	LOW	--	--	GRAVEL,SAND	NONE
PW-2	HILLS	MODERATE	MODERATE	15-25°	WASH	GRAVEL,SAND	FRAGMENTARY
PW-3	LOWLAND	EXTENSIVE	LOW	--	--	GRAVEL,SAND	NONE
PW-4	LOWLAND	SPARSE	MODERATE	10-30°	WASH	GRAVEL,SAND	FRAGMENTARY
PW-5	PLATEAU	SPARSE	MODERATE	15-25°	ROCKFALL,WASH	GRAVEL	NONE

* - EXTENSIVE SNOWBEDS ON VALLEY WALLS AT THE END OF JUNE, 1975

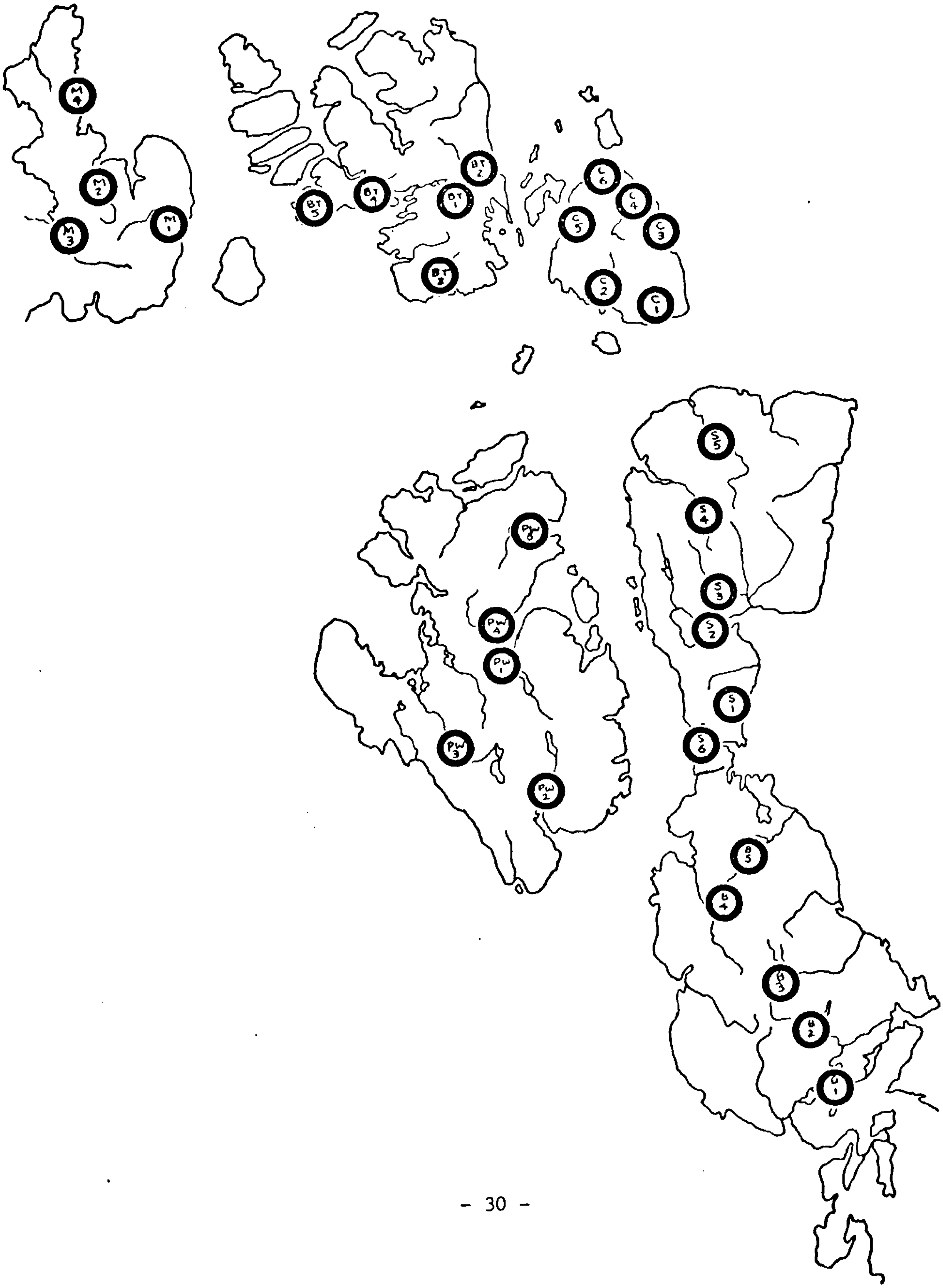

M4
M2
M3
M1
BT5
BT4
BT1
BT2
BT3
C6
C4
C5
C3
C2
C1
S5
S4
S3
S2
S1
S6
PW6
PWA
PW1
PW3
PW2
B5
B4
B3
B2

TABLE 5 FLUVIAL GEOMORPHOLOGY

CODE NAME	FLOODPLAIN WIDTH (M)	FLOODPLAIN MATERIAL	RIVER LATERAL ACTIVITY	RIVER PATTERN	SURFICIAL BED MATERIAL	CHANNEL BARS
		BOOTHIA PENINSULA				
B-1	70	TILL BEDROCK	NONE	S*.-CONFINED	COBBLE BOULDER	SUB SURFACE SILT
B-2	90	COBBLE	ACTIVE-IN F.P.*, BANK EROSION	S.-CONFINED LOW BANKS	COBBLE	
B-3	35	BOULDER-GRAVEL	SLIGHT BANK EROSION	S.	BOULDER	
B-4	80	BOULDER-GRAVEL	NONE	S.	BOULDER, GRAVEL	
B-5	20	GRAVEL	BANK EROSION-SLIGHT	S.-CONFINED BY TERRACE RISERS	SAND	
		SOMERSET ISLAND				
S-1	15	BOULDER	NONE	S.-CONFINED	BOULDER-COBBLE	
S-2	27	BOULDER	NONE	S.-CONFINED	BOULDER	
S-3	30	COBBLE	NONE OUTSIDE F.P.	S.-CONFINED	COBBLE	
S-4	30	BOULDER GRAVEL	SOME BANK EROSION	S.-ENTRENCHED	BOULDER-COBBLE	
S-5	20	COBBLE	SOME BANK EROSION	ENTRENCHED MEANDER	COBBLE	
S-6	125	BOULDER COBBLE	NONE	S.-CONFINED	BOULDERS	NONE, BOULDERS
		CORNWALLIS ISLAND				
C-1	12	COBBLE-GRAVEL	ON F.P.	S.-ENTRENCHED	COBBLE	SIDE, DIAG.
C-2	15	BOULDER	NONE	S.-ENTRENCHED	BEDROCK-BOULDER	SIDE
C-3	50	GRAVEL-COBBLE	MOVES ABOUT IN F.P.	S.	GRAVEL	SIDE, MID, DIAG.
C-4	300	GRAVEL	MOVES IN F.P.	S.-BRAIDED	GRAVEL	SIDE, MID, DIAG.
C-5	12	GRAVEL-COBBLE	ON F.P.	S.-ENTRENCHED	COBBLE	SIDE, DIAG.
C-6	20	COBBLE	ON F.P.	S.-CONFINED	GRAVEL COBBLE	SIDE, MID, DIAG.
		BATHURST ISLAND				
BT-1	12	COBBLE-GRAVEL	BANK PARTICLE EROSION	S.-CONFINED	GRAVEL	SIDE, MID, DIAG.
BT-2	175	GRAVEL	BANK EROSION-ACTIVE ON F.P.	S.-SPLIT	GRAVEL	MID, DIAG.
BT-3	30	COBBLE	NONE-THERMAL NICHING DOWNSTREAM	S.-CONFINED	COBBLE	
BT-4	25	COBBLE	BANK EROSION	S.-CONFINED	GRAVEL, COBBLE	POINT, MID, DIAG.
BT-5	50	GRAVEL SAND	BANK EROSION, ACTIVE ON F.P.	S.	GRAVEL	POINT, DIAG.
		MELVILLE ISLAND				
M-1	50	GRAVEL SAND	THERMAL NICHING, ACTIVE ON F.P. BANK EROSION	S.	GRAVEL	SIDE, MID.
M-2	30	GRAVEL	THERMAL NICHING, BANK PARTICLES	S.-CONFINED	SAND-GRAVEL	SCOUR HOLES, DIAG.
M-3	50	SILT-GRAVEL	ACTIVE IN F.P.	S.-LOW BANKS	SAND	MID, DIAG.
M-4	20	SILT	ERODING LEFT BANK	S.-BRAIDED	SAND	DIAG.
		PRINCE OF WALES ISLAND				
PW-1	150	GRAVEL SAND	ACTIVE IN F.P., BANK EROSION	IRREGULAR MEANDERS	GRAVEL	TRIB. OUTWASH FAN
PW-2	75	"CEMENTED" COBBLES GRAVEL SAND	NONE	S.-CONFINED	GRAVEL, COBBLE	POINT
PW-3	70	GRAVEL SAND	NONE	S.-SPLIT	GRAVEL	ISLAND
PW-4	80	GRAVEL COBBLES	NONE	S.-CONFINED	GRAVEL COBBLES	DIAG.
PW-5	165	BOULDER GRAVEL COBBLES	SOME BANK EROSION	CONFINED	BOULDERS	NONE, BOULDERS

S* - SINUOUS , F.P. * - FLOODPLAIN

6. DISCUSSION

6.1. Geomorphology

The June-July trip was planned to coincide with the year's near maximum snowmelt discharge; however, earlier-than-expected snowmelt prevented documentation of geomorphic activity at the height of spring runoff. Assessments of activity are therefore largely subjective and the writers hesitate to make firm statements regarding this period. Hopefully, a much more complete understanding of sediment transport, the inhibiting effect of snow-lined channels on erosion, and the stabilizing effects of permafrost in the river beds will be obtained in 1976. Some generalized statements could, however, be inferred from what was observed in the June-July reconnaissance. Fairly extensive snowbeds in small tributaries were still present. The occurrence of snow tunnels, particularly in the uplands of Melville Island, might be taken as indicative of conditions as they existed on the investigated sites some weeks previous to our visit. A considerable portion of the spring freshet would appear to flow in snow and over bottom ice, thus preventing particle movement. Depths to permafrost recorded in the stream bed at the end of June and in July were generally equal to or less than depths to frozen ground outside the river channel. The inference here of course is that, in the spring freshet, permafrost at or near the stream bed locks in sediments that would otherwise move downstream. MacDonald and Lewis (1973), in their report on Yukon coastal rivers, suggest similar phenomena.

In reviewing the route by region, some distinct features suggest geomorphic instability in river systems. In southern Boothia Peninsula, glacial and fluvial materials apparently are underlain by grey-white silt which could be of marine origin. On the stream draining Lake Jekyll, this material (in the quick condition) supports cobbles and boulders on its surface, yet collapses when distrubed; for example, a person walking on this surface falls through to permafrost level. Similar material occurs at the permafrost horizon on the lower Lord Lindsay River.

In northern Boothia, conditions appeared to be generally stable. The ill-defined valley systems of the upper Lord Lindsay basin and the Wrottesley River tributary lie in regions of low relief, thus hiding sub-surface instabilities. From Wrottesley River north to Stanwell-Fletcher Lake on Somerset Island, the high relief terrain exhibits localized pockets of instability. Numerous lakes, trapped between ridges of Pre-cambrian uplands are connected by reaches of tumbling water in boulder beds with many knickpoints.

Rivers in the plateau regions of northern Somerset, Cornwallis and southeastern Bathurst Island exhibit enough similarities that they can be conveniently discussed as a single group. Headwaters of streams on the plateau are typically dendritic in pattern, with ill-defined valleys and wide, shallow boulder-strewn river channels. Gradually these rivers incise into the plateau in northern Somerset to a depth of more than 100 metres. As the rivers exit from the uplands, channels become filled with alluvium and the streams exhibit complex braided patterns terminating in a broad fan-like estuary (Figure 4).

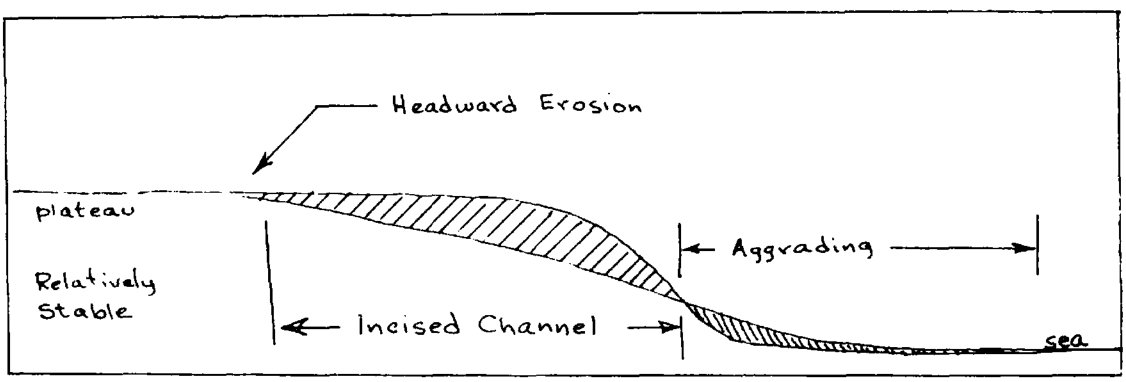


Figure 4 Typical long river profile for northern Somerset, Cornwallis, southeastern Bathurst.

One of the problems in assessing streams in this region is to decide whether the obvious channel characteristics are relict or currently active and, if current, what the magnitude of activity is. It appears that most of the answers here can result only from long-term observation. In the portions of incised river channels, active downslope movement of colluvium was apparent. It is not known whether such channel portions carry sufficient flood flows to transport all supplied material downstream or not. MacDonald and Lewis, 1973, indicate steep valley wall degradation occurs through the winter period as well as in the melt season. This is corroborated by Cook, 1965, who describes valley wall colluvium on the Mecham River as being deposited directly on river ice. Our survey indicated fairly continuous colluvium production throughout the summer.

In the downstream areas, characterized by broad alluvial flood plains and braided river systems, lateral channel shifting in the unconsolidated fill appears to be common. This type of movement is occasionally initiated by thermal niching when massive ice is exposed in eroding river banks. Examples of this were noted on Eleanor River, Cornwallis Island, the Allison Inlet drainage on southern Bathurst, and on Melville Island.

The region of greatest geomorphic activity is in central and western Bathurst and Melville Island. Heavy unconsolidated mantles of fairly fine materials are dominant. Thermokarst ponds are prevalent in bogs. Solifluction lobes, mud slide scars and substantial low-flow suspended sediment all provide indications of instability. Permafrost appears to be one of the dominant stabilizing influences in this region.

6.2. Stream Hydrology and Channel Hydraulics

6.2.1. Dendritic drainage basins

With the exception of Union, Krusenstern, MacGregor Laird, Dolphin River and Fisher River, the rivers investigated had no lakes of any significance; this fact has a significant effect on runoff hydrograph. The gauging station on Allen River near Resolute on Cornwallis Island, provides excellent data on diurnal fluctuation in flow (Figure 5). The existence of diurnal fluctuations is well documented by Cook (1965) and Cogley (1975) in their papers on the Mecham River by McDonald & Lewis (1973); by Holecek (1975) in his paper on Devon Island drainage; by McDonald and Lewis (1973) discussing Yukon coastal rivers; and by Church (1972) in his discourse on Baffin Island sandurs.

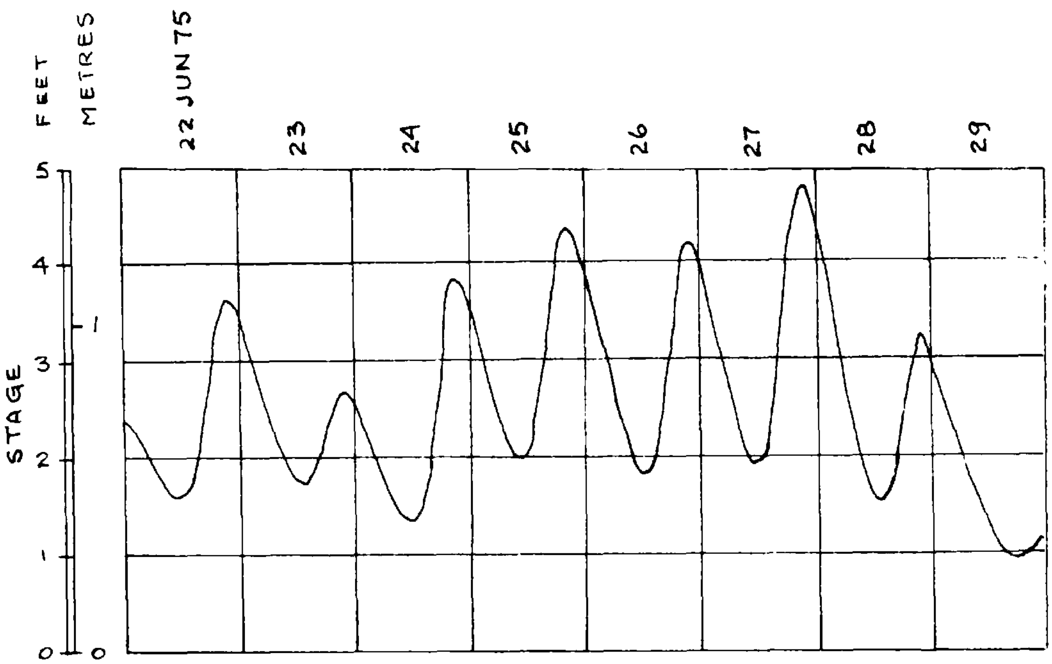


FIG. 5 - DIURNAL FLUCTUATION ON ALLEN RIVER, CORNWALLIS I.

During the writer's mid-day visit to Cunningham River, Somerset Island, groundwater suddenly commenced to discharge from a southeast-facing slope. It appears that increased stream flow in mid afternoon, the exact time dependent on basin lag, is a feature common to small arctic catchments.

On a seasonal basis, the increase in flows as a result of mid-August precipitation was noteworthy and appears to be typical of High Arctic streams, occurring when nearby seas go clear of ice (personal communication, Holecek, 1975). The Allen River hydrograph substantiates this.

6.2.2. Lake Systems

Substantial lake storage above a gauging site attenuates diurnal flow phenomenon. At Union River, immediately below Stanwell-Fletcher Lake, no significant variations in a typical

24-hour period were observed. Indeed the whole open water flow regime follows a regular pattern with a relatively slow response to snowmelt events and the development of a very gradual recession limb on the annual hydrograph. Fisheries staff (Eddy 1975, personal communication) document the fact that the Union River did not flow through the winter of 1974-75 although local Eskimo hunters state that it frequently maintains mid-winter discharges.

Rust and Coakley (1970) indicate year-round flows for the winter of 65-66 and assume them to occur again in the next freeze period. Farther south on Boothia, considerable quantities of aqueous growth in the stream bed at the outlet of Lake Jekyll would seem to indicate the presence of flowing water through the winter.

6.2.3. Icing and ice runs

Although the field party was on particular lookout for ice effects in their reconnaissance in June-July, no pronounced landforms readily attributable to ice were observed on river systems. Documented, extensive ice-push effects occurred on the eastern shoreline of Stanwell-Fletcher Lake, and on Crooked Lake — these effects apparently caused by wind-generated ice movement. On Stanwell-Fletcher an extensive boulder drift 3 metres high extended some hundreds of metres along the shoreline south of Union River channel. The ice push on the shores of Crooked Lake was not as extensive as the forementioned, and consisted of a number of minor gravel ridges.

The smaller bead lakes on Union River itself release ice downstream, leading to development of armoured chutes connecting these lakes. Ice-Push ridges (not recent) were noted on Lang River and on the Cape Aughterston system. These last two were quite small (approximately one metre high and ten metres long). No icings were noted. Cook (1965) makes mention of an ice-run occurring on the Mecham River, Cornwallis Island, from ice beds in upstream pools. However, no ice scars or stranded floes were observed in 1975.

6.2.4. Hydraulic calculations

Standard hydraulic formulae were applied to 1975 field survey data in an attempt to obtain best estimates of peak flow in the snowmelt season. It is recognized that errors are inherent in the application of typical, uniform discharge flow formulae, such as Manning's equation, to natural river systems — resulting values contained in this report should be viewed with some caution. A few parameters capable of introducing error in such calculations are listed as follows:

6.2.4.1. High water marks

It was assumed that the high water mark was created by a free-flowing channel. Its validity is therefore subject to the absence of ice jams, snow dams and snow bed restrictions in the surveyed cross-section and reach.

6.2.4.2. Slope measurements

The slopes measured in the reach were, for the most part, measurements of water surface profiles as they existed at the time of our visit. In the absence of suitable high-water marks for flood slope determination, slopes were assumed to be applicable to 1975 peak discharges.

6.2.4.3. "n" values

The roughness co-efficient determination haunted us as it does every hydrologist. Comparison of Barnes' values with Strichler's seemed to be reasonable. Strichler's "n" based on grid-by-number photography was used, since D_{50} particle sizes were readily available, and the procedure has the appearance of being more scientific.

These comments put into perspective the considerable inaccuracies inherent in a "first-look", high flow calculation. It is expected that these difficulties will be experienced to the same degree by the proponent. Generally it is expected that the calculated flows are on the high side.

The calculated data was tested against values obtained from log-log extensions of actual measured discharges. Theoretically this plot, logarithm of discharge versus logarithm of water stage above zero flow on arithmetic paper, or alternately, numerical values of these parameters on log-log paper, should produce a straight line. Where the extension is short, and where the developed portion of the curve is well-defined, considerable confidence can be placed in this method. Unfortunately, these two criteria were unobtainable in most situations.

A a further check of peak flows, at least for 1975, an empirical in-house formula was designed to fit known peak flows on Allen River. It states that $Q_{75m} = \frac{45A}{\log A}$, where Q_{75m} is maximum flow in 1975 (cubic feet per second) and A drainage area of watershed upstream of measurement section (square miles). The log A denominator weights the constant according to size of basin and thus accounts to some degree for basin lag and the resultant attenuation of peak flow. It can apply only to 1975 flow, since to make it otherwise, modifiers for degree day accumulation and precipitation values would have to be incorporated. Further, it would be applicable only to regimes similar to Allen River — that is, dendritic drainage, no lakes, and roughly the same basin slopes. A plot of Q_{75m} versus Manning values and versus log-log values appears in Figure 6.

The writers, after due examination of values for high flows in 1975, agreed on a Q_{BE} (discharge - best estimate) included in the hydraulic table.

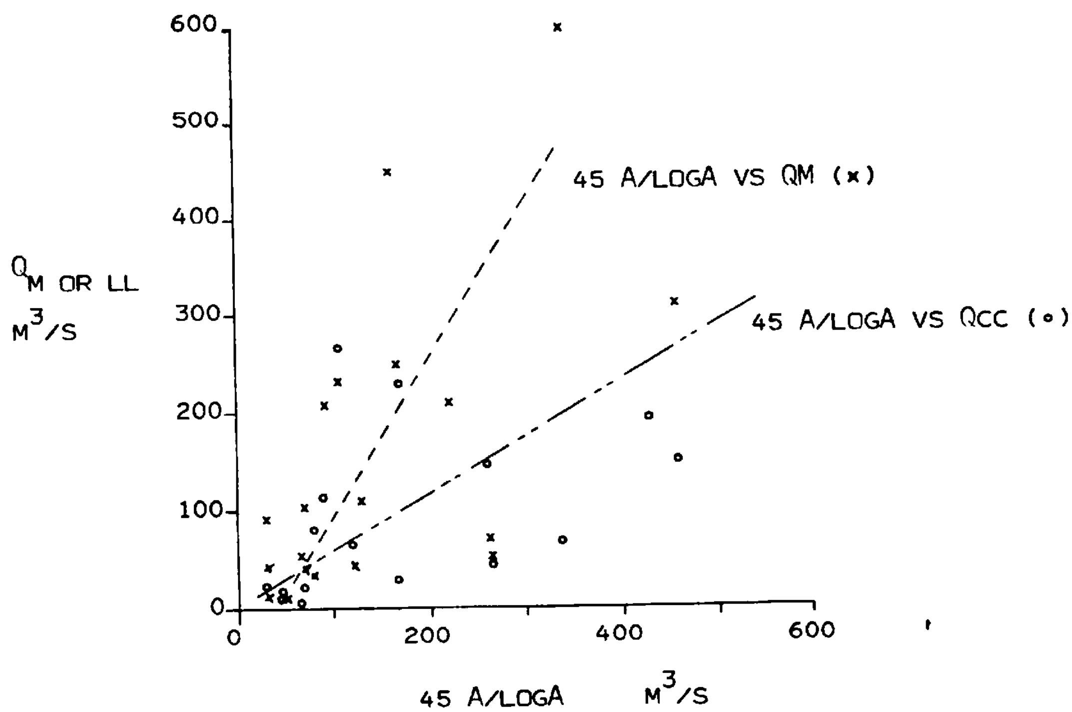


Figure 6

6.3. Sediment

Extremely low values for suspended sediment concentrations in the southeastern portion of the study area were the rule at mid-summer flows. Indeed, values were sufficiently low to make results questionable, being perilously close to limits of accuracy of weighing procedures used for filter membranes. Sediment concentrations are higher on Bathurst and on Melville Islands compared to Cornwallis, Somerset Island and Boothia Peninsula. Please see Table 3.

7. CONCLUSIONS

MacDonald and Lewis (1973) mention in their conclusion that much data can be obtained from a single year's working reconnaissance in a hydrologic region. The writers agree wholeheartedly but do not discount the value of continuing, systematic data collection. A single season's investigation may identify areas of instability — but rates of erosion and their seasonal variability are not possible to obtain. Similarly, existing hydrologic analysis procedures, applied to a single year's data, do not lend themselves to techniques of accurate flood assessments, essential to engineering design for such projects as pipelines. Estimates may be made, but without long-term data the tendency to over-design structures exists, thus increasing the ultimate cost. In view of accelerating exploration and development in the North, the obvious need is to establish a network of stations on streams in the High Arctic to collect geomorphic and hydrologic data systematically. A further need is to assemble fluvio-morphologic data already contained in research papers, seminar reports, theses or other writings in archives of federal agencies and universities into a centralized data bank, and thus make it accessible to everyone.

7.1. Survey Data

Based on 1975 reconnaissance survey data the following conclusions might be drawn:

1. With possible exceptions of the Union River downstream of Stanwell-Fletcher Lake, and the Krusenstern system downstream of Lake Jekyll, all investigated streams have seasonal discharge. Union River was reported not flowing in the winter of 1974-75.

2. For the most part, drainage systems are of simple, dendritic pattern of low stream order (3 to 5). Allen River on Cornwallis Island, with five years' data, exhibited marked diurnal flow patterns in spring. High velocities, capable of supporting significant sediment discharges would occur for short time periods only.

3. Ice runs are not a dominant characteristic of the spring freshet although snow bed remnants on river banks indicate that in-channel snow beds restrict cross-sectional areas at the commencement of spring flow.

4. Mid-August and subsequent rainfall associated with open sea lanes, generates significant high flows capable of sediment movement which are sustained over long periods than in snowmelt period.

5. Judging by thicknesses of active layers beneath stream beds encountered in June-July, it appears likely that permafrost inhibits channel degradation in spring freshet.

6. In gravel-bed river reaches, considerable lateral channel migration occurs.

7. Of the regions investigated, the greatest area of geomorphic activity is on western Bathurst and Melville islands.

8. GENERAL BIBLIOGRAPHY

Baird, P.D. 1964. The Polar World, Longman Group Ltd., London.

Barnes, H.H. Jr. 1967. Roughness Characteristics of Natural Channels, U.S. Government Printing Office, Washington.

Bird, J. Brian. 1972. The Natural Landscapes of Canada, Wiley Publishers of Canada Ltd., Toronto.

Blench, T. 1966. Mobile Bed Fluviology, A Regime Theory Treatment of Rivers for Engineers and Hydrologists, University of Alberta, Edmonton.

Canadian Hydrographic Service. Department of Energy, Mines & Resources, 1970. Pilot of Arctic Canada, Vol. I, II, III, 2nd edition, Ottawa.

Carlson, A. and Gross, P.W., 1967. Measurement of Physical Characteristics of Drainage Basins, Inland Waters Branch Technical Bulletin No. 5, Ottawa.

Carlson, R.F. and Kane, D.L. 1973. Hydraulic Influences on Aufeis Growth, First Canadian Hydraulics Conference, Edmonton.

Chow, V.T. editor. 1964. Handbook of Applied Hydrology, McGraw-Hill, New York.

Church, M. 1972. Baffin Island Sandurs, Geological Survey of Canada Bulletin 216, Ottawa.

Church, M. and Kellerhals, R. 1970. Stream Gauging Techniques for Remote Area Using Portable Equipment, Department of Energy, Mines & Resources, Inland Waters Branch, Technical Bulletin No. 25 , Ottawa.

Coakley, J.P. and Aust, B.R. 1968. Sedimentation in an Arctic Lake reprinted from the Journal of Sedimentary Petrology for December 1968.

Douglas, R.J.W. 1970. Geology and Economic Minerals of Canada, Department of Energy, Mines and Resources, Geological Survey of Canada, Ottawa.

Dunbar, M. and Greenaway, K.R. 1956. Arctic Canada from the Air, Queen's Printer, Ottawa.

Easterbrook, D.J. 1969. Principles of Geomorphology, McGraw-Hill, New York.

Einstein, H.A. and Barbarossa, N.L. River Channel Roughness A.S.C.E. Transactions Paper No. 2528.

Environmental Protection Board. 1944. Environmental Impact Assessment of the Portion of the Mackenzie Gas Pipeline from Alaska to Alberta, Volume IV.

Environmental - Social Committee, Northern Pipelines Task Force on Northern Oil Development. 1974. Hydrologic Aspect of Northern Pipeline Development.

Environmental Social Committee. Northern Pipeline Task Force on Northern Oil Development. Report No. 74-17, 1974. Mackenzie Valley and Northern Yukon Pipeline, Socio-economic and Environmental Aspects.

____________________ Northern Pipeline Task Force on Northern Oil Development. Report No. 73-3, 1974. Hydrologic Aspects of Northern Pipeline Development.

Galay, V.J. and Cheung, J.M. 1973. Predicting Depth-Discharge Relationships for Sand Bed Rivers, First Canadian Hydraulics Conference, Edmonton.

Galay, V.J.,Kellerhals, R., Bray, D.F. 1973. Diversity of River Types in Canada, Hydrology Symposium No. 9.

Graf, W.H. 1971. Hydraulic of Sediment Transport, McGraw-Hill.

Gray, D.M. editor. 1970. Handbook on the Principles of Hydrology, Secretariat, Canadian National Committee for the Hydrological Decade, Ottawa.

Harlan, R.L. 1971. Water Transport in Frozen and Partially-Frozen Porous Media - Hydrology Symposium No. 8, Runoff From Snow and Ice.

Ives, J.D., Barry, R.G. editors. 1974. Arctic and Alpine Environments, Methren & Co. Ltd., London.

Kellerhals, R., Church, M., Bray, D.I. 1975. Classification and Analysis of River Processes from Air Photos and Maps, presented at Hydraulic Engineering for Optional Use of Water Resources, A.S.C.E. Hydraulic Division 23rd annual specialty conference, University of Washington, Seattle.

Kellerhals, R., Neill, C.R., Bray, D.I. 1933. Hydraulic and Geomorphic Charactistics of Rivers in Alberta, Research Council of Alberta River Engineering and Surface Hydrology Report 72-1. Edmonton.

Kinsley, R.K. and Franzini, J.B. 1664. Water Resources Engineering, McGraw-Hill, New York.

Mollard, J.D. 1973. Airphoto Interpretation of Fluvial Feature, Hydrology Symposium No. 9.

Neill, C.R. editor. 1973. Guide to Bridge Hydraulics, University of Toronto Press.

Neill, C.R. 1973. Hydraulic Geometry of Sand Rivers in Alberta, Hydrology Symposium No. 9.

Neill, C.R. 1973. Observations on River Channel Processes in Alberta. Hydraulogy Symposium No. 9.

Pipeline Application Assessment Group. 1974. Mackenzie Valley Pipeline Assessment, Environment and Socio-Economic Effects of the Proposed Canadian Arctic Gas Pipeline of the Northwest Territories and Yukon, Department of Indian Affairs and Northern Development, Ottawa.

Russell, S.O. 1971. Short-Term Forecasting of Runoff from Snowmelt and Rain-or-Snow Hydrology Symposium No. 8, Runoff From Snow and Ice.

Rust, B.R. and Coakley, J.P. 1970. Phisico-chemical Characteristics and Postglacial Desalination of Stanwell-Fletcher Lake, Arctic Canada reprinted from the Canadian Journal of Earth Sciences Volume 7, Number 3, 1970. National Research Council of Canada.

Sekerak, A.D. and Graves, F.F. 1975. Investigation of Aquatic Resources Along Proposed Polar Gas Pipeline Routes North of Spence Bay N.W.T., preliminary Interim Report. Aquatic Environments Limited, Crossfield, Alberta.

Sher, Dr. H.W. 1973. Regime Problems of Rivers Formed in Sediment Ch. 5 Regime Problem of Rivers formed in Sediment by T. Blench. Colorado.

Thornbury, W.D. 1966. Principles of Geomorphology, Wiley, New York.

Williams, G.P. 1971. The Effect of Lake and River Ice on Snowmelt Runoff, Hydrology Symposium No. 8, Runoff From Snow and Ice.

Wonders, William C. 1971. Canada's Changing North, McClelland and Stewart Ltd. Toronto.

9. GLOSSARY of TERMS

aeolian deposit - sediments deposited by the wind.

alluvial deposit - sediment deposited by a river or stream.

armouring - a condition when an underlying fine earth material is mantled by a thin surface layer of coarser material.

bankfull discharge - discharge of a river at a water level equal to the height of the lowest bank

bed load transport - the transport of sediment along the bed of a river channel (as opposed to suspended or dissolved sediment transport).

braid scar - a relict channel of a braided river which has shifted from one channel to another.

channel patterns -
1) aggrading - a channel where sediment is being deposited.
2) bedrock - a channel bounded by bedrock, usually having no floodplain.
3) confined - river is confined by valley walls or terraces but is free to move within these boundaries.
4) degrading - a channel from which bed material is being carried away .
5) entrenched - a river whose lateral movement is totally restricted.
6) erosional - a river at a young stage which is cutting its own valley.

chute and pool sequence - a sequence of deeps and shallows in a river with a boulder or bedrock bed.

cryergic process - any process taking place at low temperatures.

dendritic river pattern - a river which exhibits a pattern similar to the branching of a tree is said to be dendritic.

detachment creep - the steady downslope movement of material—from small particles to large boulders — resting on the ground surface and made unstable by frost heave of the surface.

detritus - the product of erosional processes, i.e., broken up rock.

direct water level (D.W.L.) - a water level measured directly from a benchmark using an engineer's level.

drumlins - small oval hills formed of glacially deposited material; a form of ground moraine.

floodplain - the area on each side of a river which is regularly inundated.

ground ice - ice in pores, cavities, voids or other openings in soil or rock, including massive ice.

ice wedges - wedges of ground ice, from less than 10 cm. to more than 3 m. wide at the top, tapering to a feathered edge at the apex at a depth of one to ten m. or more.

icing (aufeis) - a layer of new ice formed when water flows over the existing ice or a river or lake (flood ice) or ice formed on the ground surface by the freezing of spring water.

kame terrace - a terrace left by streams between the side of a shrinking glacier and the enclosing valley wall.

knickpoints - a point at which a stream is confined by a bedrock outcrop or other obstruction.

nivation - erosional process due to the action of snow or snowmelt runoff.

orogen - a region that has, at some geological time, experienced a period or cycle of mountain-building.

outwash fan - a fan-shaped sedimentary deposit produced where the slope of a river abruptly lessens, i.e., where a river leaves a mountainous region and flows out onto a plain.

polygons - a type of patterned ground consisting of a closed, roughly equidimensional figure bounded by several more or less straight sides.

pool and riffle sequence - a sequence of deeps and bars in a gravel or sand bed river.

quick condition - condition where the ground is completely saturated with water.

rill - a very small stream or gully.

scour pool - a pool that has been hollowed out by fast-flowing water.

slide - the sliding of relatively dry detritus down a slope.

slump (block) - sliding of material, often as a block, along a rotary slip plane. The rotation is such that the back edge of the block slides forward and under the blocks.

solifluction - the downslope flow of nonfrozen, saturated earth material over an impervious surface, usually the permafrost horizon. Rate of flow is approximately 1-10 cm. per year.

stone rings - a patterned ground feature consisting of circles, $\frac{1}{5}$ to 3 cm. in diameter, of stones which have been sorted according to size by frost action.

thalweg - the deepest continuous part of a river channel.

thermal niching - the undercutting of a riverbank as the warm water of the river melts massive ground ice in the bank.

thermokarst features - depressions caused by the melting of ground ice.

valley plain - the complete floor of a valley extending from the toe of one valley wall to the toe of the other valley wall.

A.1. TRANSPORT

An Aerospatiale "Gazelle" SA 341G cruises at 165-170 mph. Fuel consumption runs at 35-40 gal/hr. Preferred fuel is JP-4 although fuel ranging from Arctic diesel to automotive gasoline is acceptable. The lefthand rear seat folds down, thus creating interior space for long articles. The cabin is considerably larger than in other commonly-used machines. In many parts of the world, this aircraft is fully licensed for IFR flight, the only single-engined, commercially-used vehicle enjoying this status. This indicates the reliability of its power train.

A.2. LIFE SUPPORT SYSTEMS

- Gerry "Himalayan" double wall nylon tents.
- Gerry eiderdown sleeping bags - 10" loft.
- Standard lightweight camping gear.
- 50-50 split of "freeze-dry" and conventionally canned food.

A.3. SCIENTIFIC EQUIPMENT

A.3.1. Water Quality

- Mercury bulb thermometer - 12-inch length.
- Metrohm E488 pH meter c/w extra probe, buffer solution.
- Beckman RA-2A specific conductivity meter.
- 100 sample bottle sets (3 bottles per set) c/w sampler and shipping cases.

A.3.2. Sediment

- D-48 hand-held sediment sampler, modified to fit on standard C-30 lead weight to allow for deep water sampling.
- Four dozen 1-imperial-pint milk bottles.
- Filtering kit - in scratch-built case utilizing:
  Millipore - Swinnex 47 mm. filter holders.
  \- Filter membranes #SSWPO 4700.
  Mityrac hand-operated vacuum pump .0-30 psi.
- Bogardi hand-held bed load sampler.
- OHaus triple-beam balance Model 700.

A.3.3. Stream Flow Measurement

- Gurley-Price pattern 622 current meter.
- Water Survey of Canada "dry-hand" wading rod.
- Tagline - 500 feet 1/16" D. 6 x 7 aircraft steel cable, beaded with solder points.
- Support equipment:
  - Canova "Scout" inflatable dinghy c/w foot pump.
  - Evinrude 9.9 H.P. outboard engine c/w tank.
  - Chest waders.

A.3.4. Survey Equipment

- Wild N-10 level c/w collapsible aluminum tripd.
- Hultafors folding 12-foot level rod.
- Brunton compass-transit c/w adaptor to mount on Wild tripod.

A.4. PHOTOGRAPHIC

- Canon 814-E Super 8 Auto Zoom movie camera.
- Konica
  - Autoreflex, A-3 body.
  - Hexanon Varifocal AR 35-100 mm. f2.8 lens.

APPENDIX B

STREAM CATALOGUE

OF

1975 INVESTIGATED

SITES

APPENDIX B - STREAM CATALOGUE

TABLE OF CONTENTS

Continued ......

TABLE OF CONTENTS (CONTINUED)

STATION NO. 10SA001 UNNAMED RIVER AT OUTLET OF LAKE JEKYL B-1

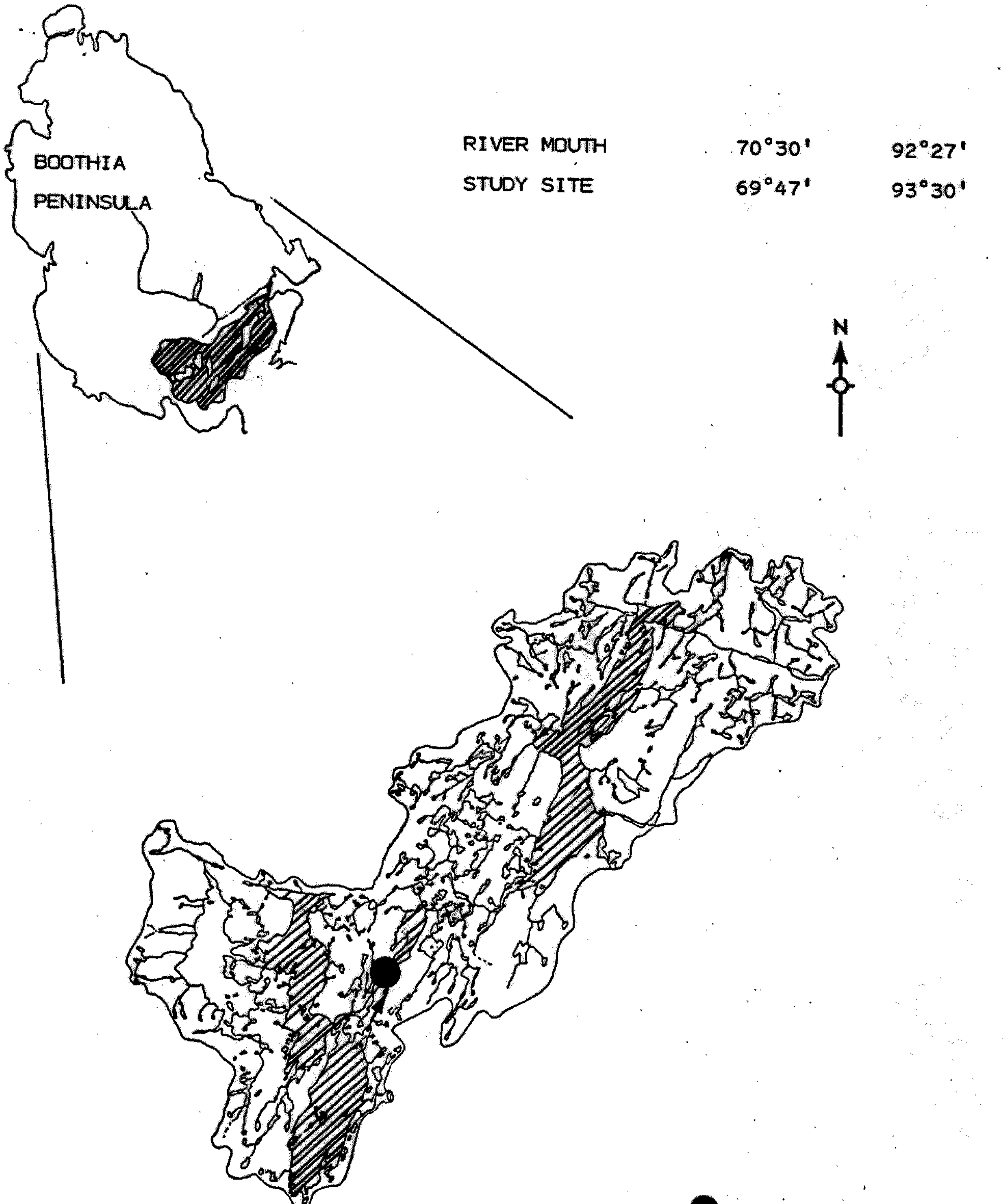
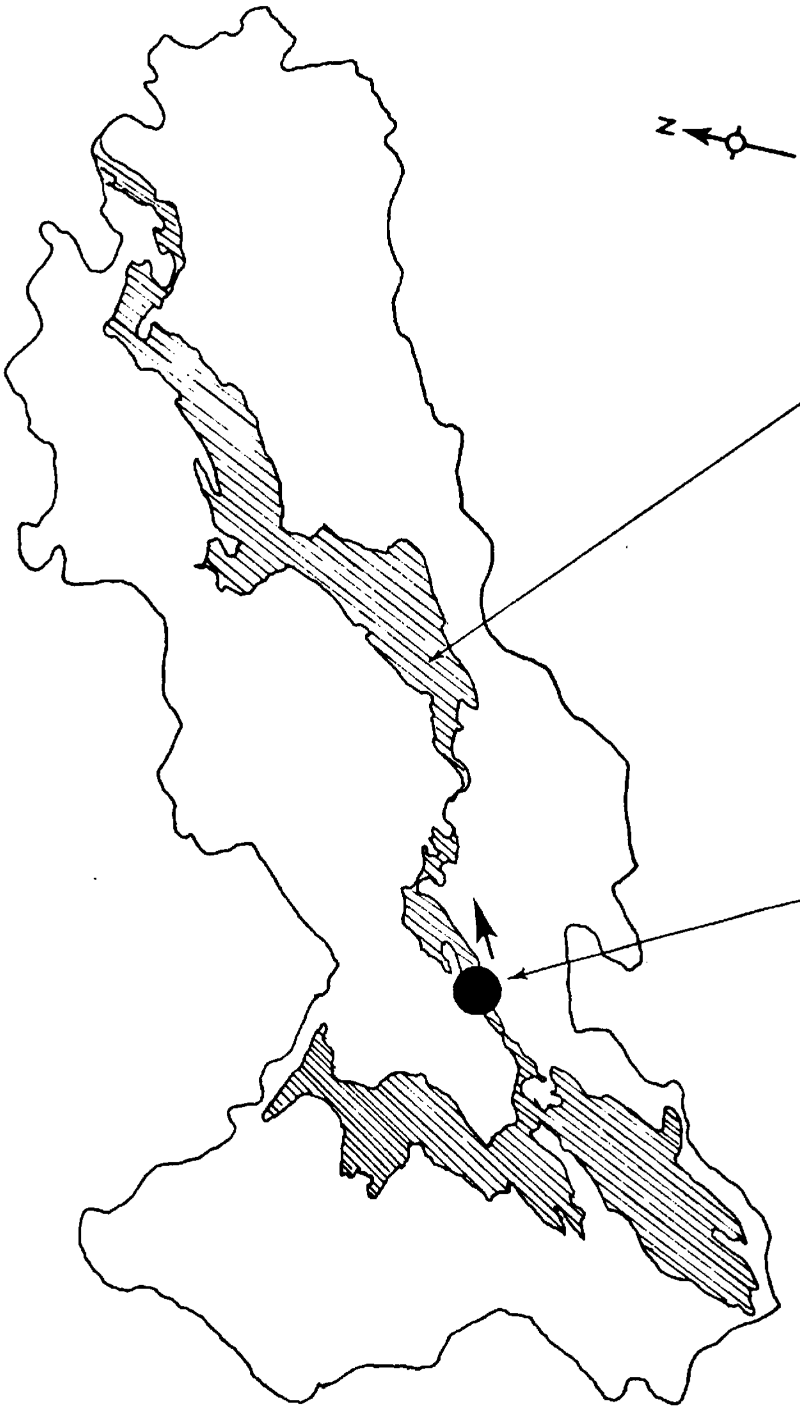


PHOTO FILE B-1



7:17 KRUSENSTERN - UPSTREAM

7:18 KRUSENSTERN - OBLIQUE

STUDY REACH

8:4 UPSTREAM VIEW

8:3 DOWNSTREAM VIEW

7:19 ACROSS

7:20 BED MATERIAL

28:12 CROSS-SECTION

28:13 UPSTREAM VIEW

28:14 DOWNSTREAM VIEW

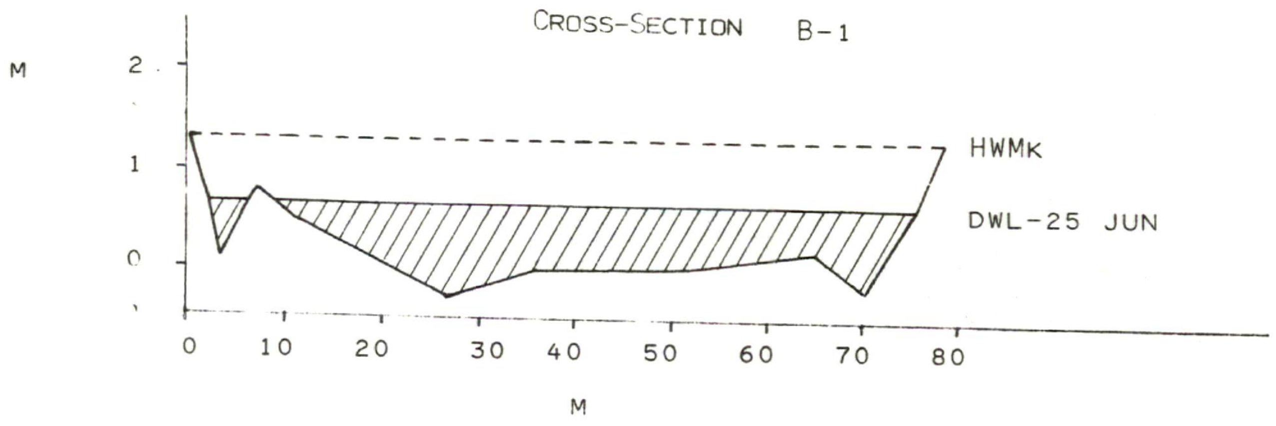
28:15 WEATHERING

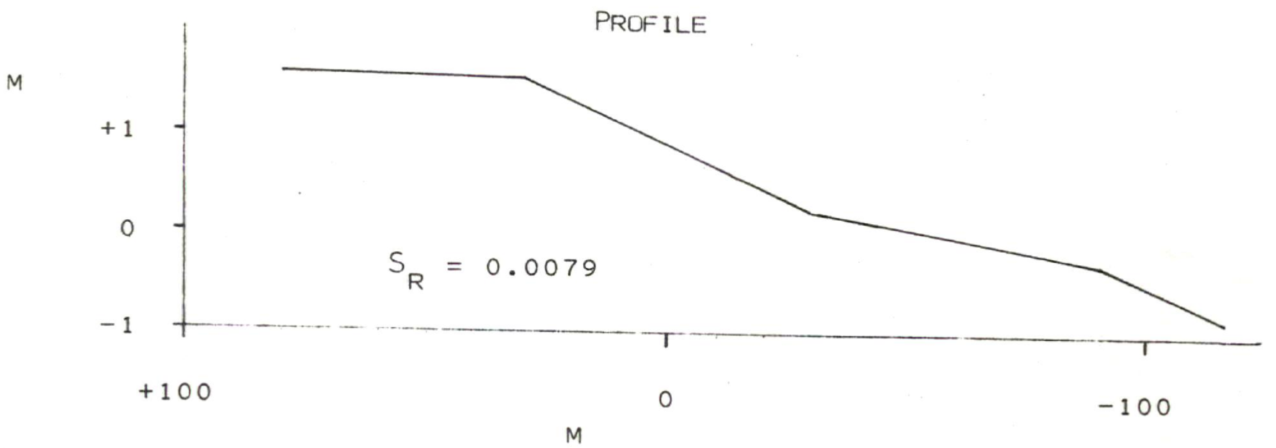
KRUSENSTERN RIVER B-1

The Krusenstern River at our study reach is set in low hills of Precambrian origin, largely overlain by glacio-fluvial and marine deposits. Vegetation includes mosses, lichens, dwarf willow scrub and grasses. Some visible permafrost features were stone rings, ice wedges and polygons. There is no obvious river valley. The channel itself is confined and is controlled by bedrock outcrops. It is a single channel. Flow is uniform except for a small rapid in the reach. There is a fragmentary terrace on the left bank and narrow flood plains. Bank material is a well graded mixture of silt, sand, gravel and boulders. The river bed itself consists of larger boulders with most of the gravel and finer material evidently having been washed away. The boulders are underlain by bedrock in most places, but near the left bank they are "floating" on a layer of grey white silt. A boulder can actually sink out of sight in this clay if it is disturbed. Walking across the bed was enough to cause this to happen. No bars were visible and the surficial bed seemed to be quite resistant. Depth to bedrock was about one to two feet on the right bank. Depth to permafrost on August 27 in the silt on the left bank was greater than our one-metre probe. Channel appears to be quite stable but substantial scouring could occur if the boulders overlying the marine clay are disturbed in the summer when the silt is unfrozen. The banks show evidence of block slump but no substantial lateral activity occurred.

LATITUDE AT BASIN MOUTH[1]	70° 05'
LONGITUDE AT BASIN MOUTH[1]	92° 27'
DRAINAGE AREA	1479 KM^2
BASIN PERIMETER	259 KM
CIRCULARITY RATIO	0.273
STREAM ORDER	4
BIFURCATION RATIO	5.41
LENGTH OF PRINCIPAL CHANNEL	94 KM
SLOPE OF PRINCIPAL CHANNEL	0.001
BASIN WIDTH	33.0 KM
BASIN LENGTH	71.0 KM
ELONGATION RATIO	0.608
HYPSOMETRIC INTEGRAL	0.207
HYPSOMETRIC COEFFICIENT	+0.145
BASIN RELIEF	358 M
MINIMUM ELEVATION	0 M
MAXIMUM ELEVATION	358 M
AVERAGE ELEVATION	179 M
MEDIAN ELEVATION	57 M
BASIN ASPECT	N E

1 - BASED ON 1:250,000 MAPS





HYDRAULIC MEASUREMENTS

DATE	WIDTH	AREA	MEAN VELOCITY	GAUGE HEIGHT	DISCHARGE
25JUN75	67.1M	$21.3M^2$	0.53M/S	0.58M	$11.3M^3/S$
27AUG75	53.6M	$1.1M^2$	0.43M/S	0.44M	$4.8M^3/S$

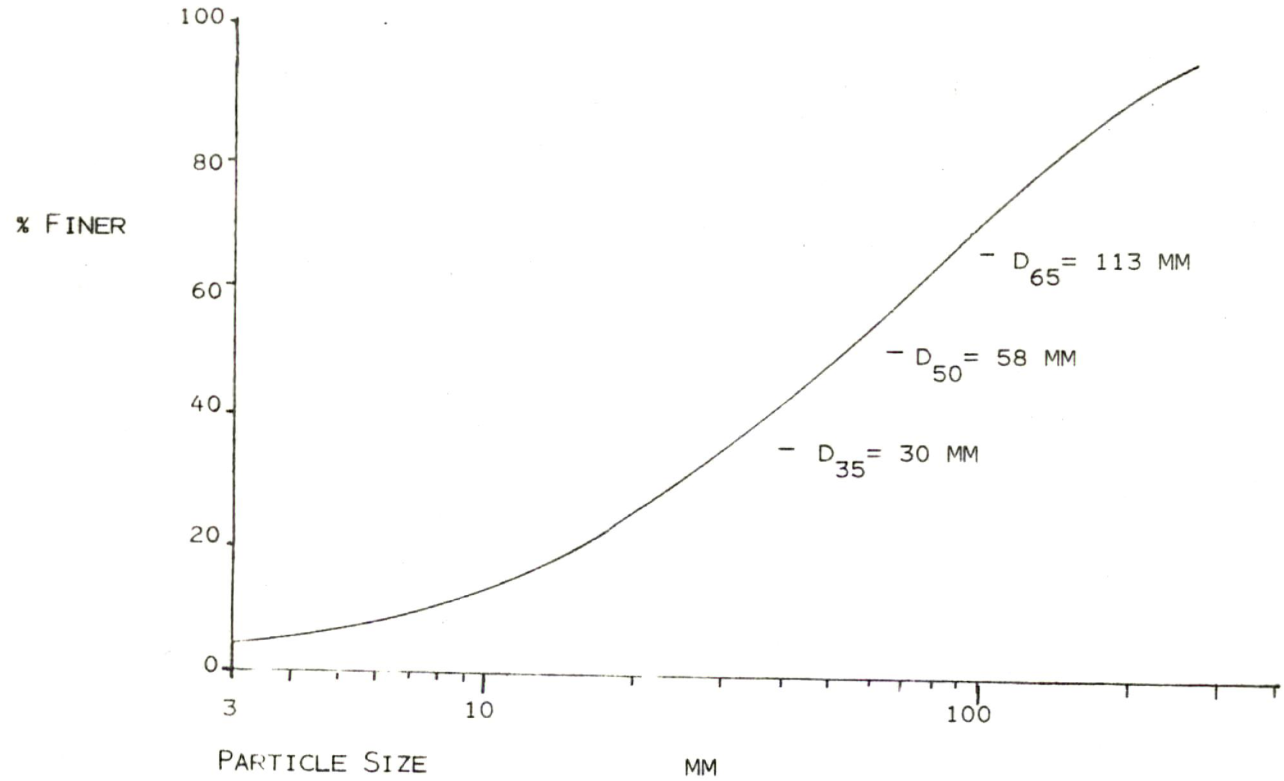
	STAGE	AREA	HYDRAULIC RADIUS
HWMK	0.88M	$35.0M^2$	0.46 M

PERMAFROST

25 JUN - 0.3 M @ LB, 0.6 M IN THALWEG

27 AUG - > 1.0 M

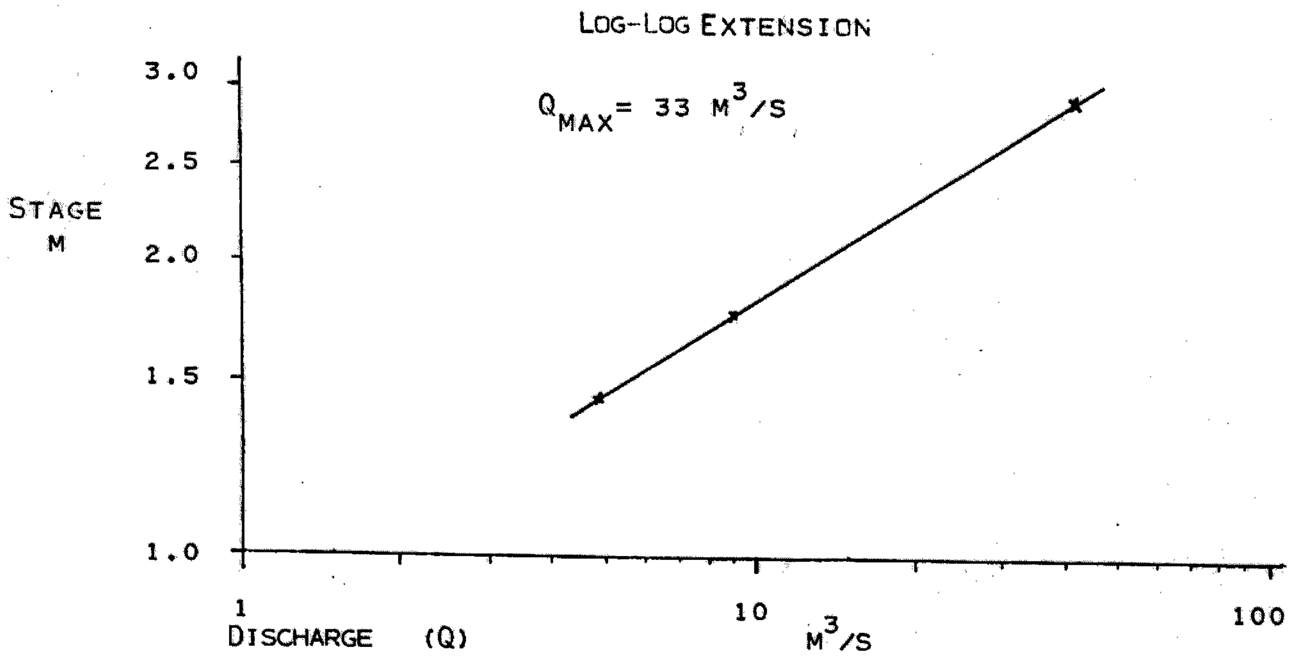
PARTICLE SIZE DISTRIBUTION (BED MATERIAL) B-1



STRICHLER'S ''N'', N = 0.013 $(D_{50})^{1/6}$ 0.026

SUSPENDED SEDIMENT CONCENTRATION 25JUN75 14 MG/L

ESTIMATED DISCHARGE AT HIGH WATER MARK B-1



MANNING EQUATION

$$Q = \frac{A\,R^{2/3}\,S^{1/2}}{N} = \frac{(35)(0.46^{2/3})(.008^{1/2})}{0.026}$$

$$= 71.3\ M^3/S$$

BEST ESTIMATE

60 M^3/S

STATION NO. 10SA002 LORD LINDSAY RIVER ABOVE SANAGAK LAKE B-2

RIVER MOUTH -	70°08'	92°25'
STUDY SITE -	70°13'	93°57'

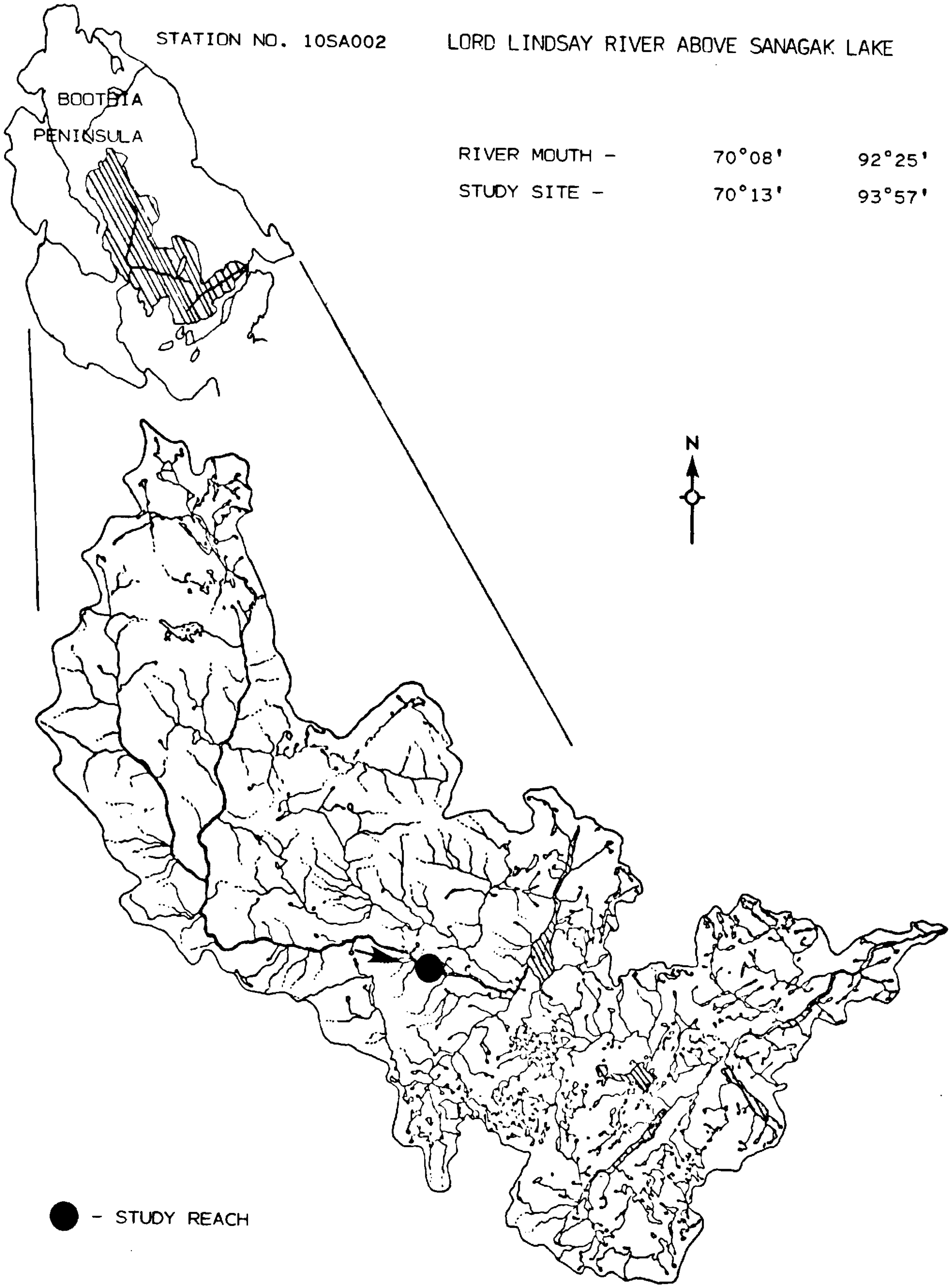
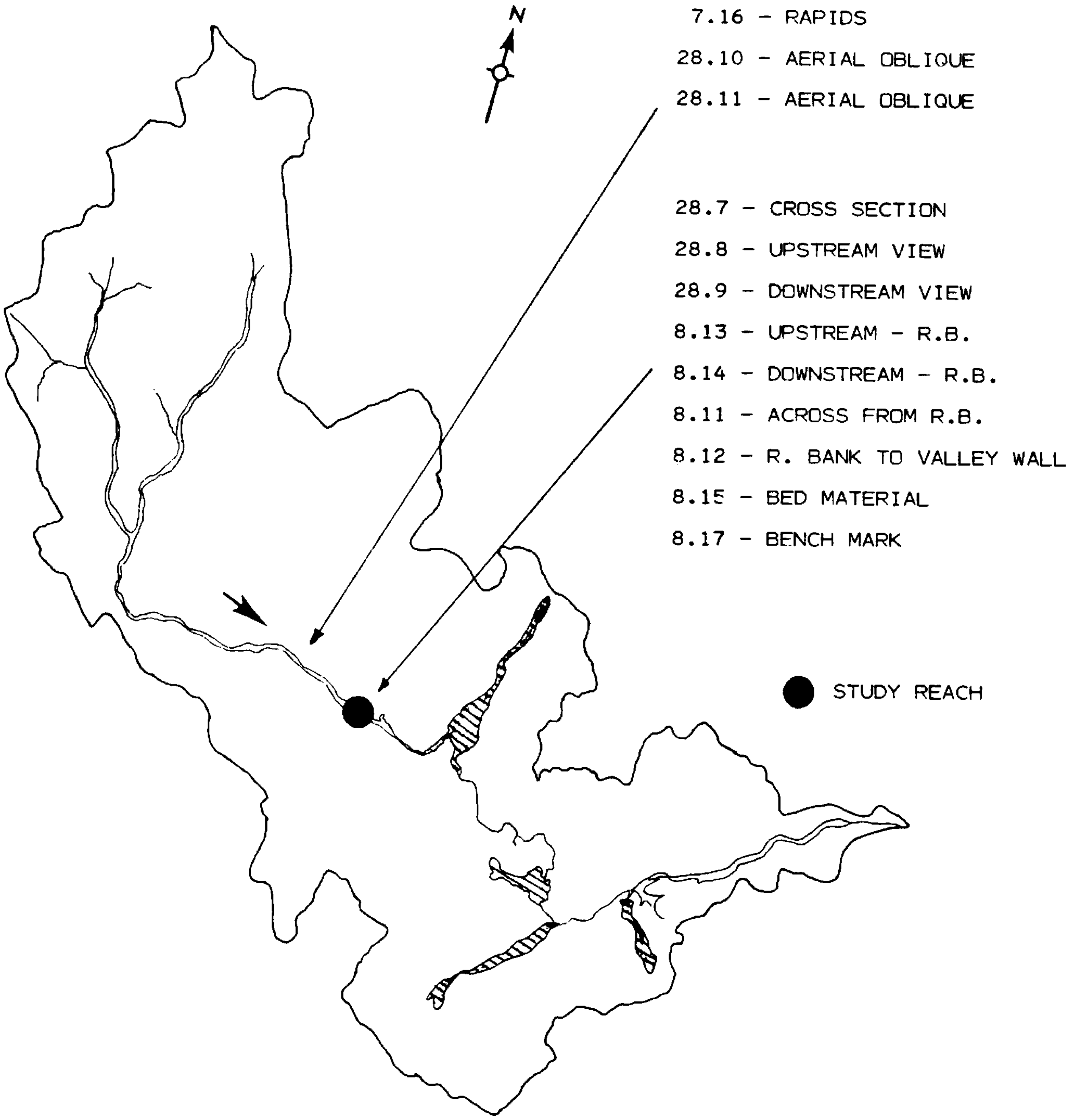


PHOTO FILE B-2

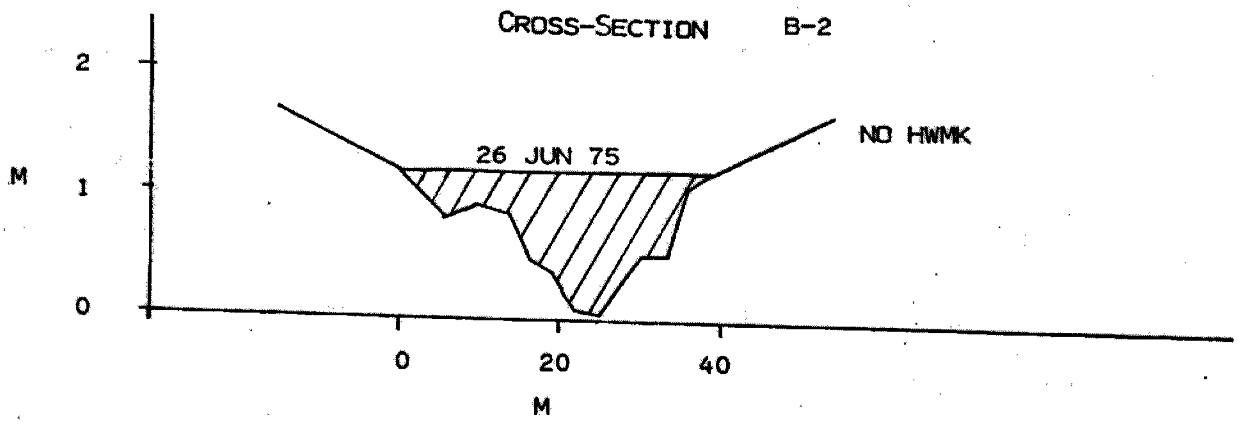


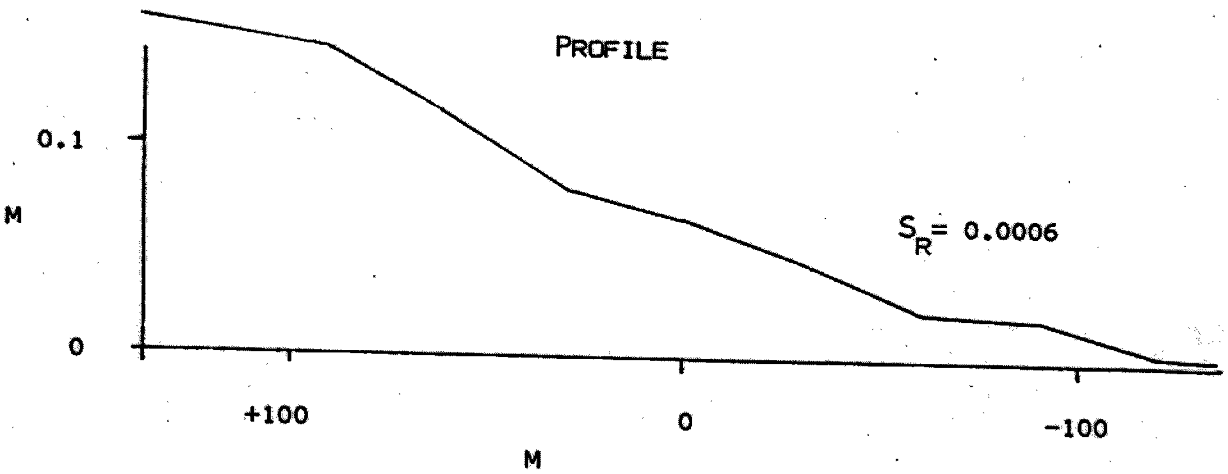
LOWER LORD LINDSAY B-2

In the general area of the study reach, the Lord Lindsay flows through the interior plateau of Boothia Peninsula. Local relief is generated by series of low hills with substantial, unconsolidated mantles. Knickpoints occur both above and below the study section where underlying sedimentary bedrock ridges break the land surface. At the investigated site, two hill systems create a valley in excess of one kilometre in width. The valley plain, a well-vegetated, paired terrace, restricts the flood plain channel. Unconsolidated gravels in the risers are being eroded, with the resultant collapse of the vegetated cover of the terrace onto the flood plain, thus actively extending the flood plain width. Surficial flood plain material is well-rounded by fluvial action, is of cobble size and is underlain by well-graded gravel. The permafrost horizon, measured at 0.6 metres beneath the surface in June, was the boundary layer between surficial gravels and grey-white, silty sand. Islands occur occasionally; mid-channel and diagonal bar formations create a pool-riffle flow pattern. Scour holes and pools in the flood plain indicate that bed material transport occurs in high flow periods. Extensive sand bar development at Sanagak Lake, 10 kilometres downstream, tends to substantiate this. Lateral channel shifting would appear to be the dominant instability at the study site.

LATITUDE AT BASIN MOUTH[1]	70° 08'
LONGITUDE AT BASIN MOUTH[1]	92° 25'
DRAINAGE AREA	3717 KM^2
BASIN PERIMETER	448 KM
CIRCULARITY RATIO	0.230
STREAM ORDER	5
BIFURCATION RATIO	5.38
LENGTH OF PRINCIPAL CHANNEL	169 KM
SLOPE OF PRINCIPAL CHANNEL	0.003
BASIN WIDTH	59.0 KM
BASIN LENGTH	110 KM
ELONGATION RATIO	0.630
HYPSOMETRIC INTEGRAL	0.544
HYPSOMETRIC COEFFICIENT	-0.597
BASIN RELIEF	555 M
MINIMUM ELEVATION	0 M
MAXIMUM ELEVATION	555 M
AVERAGE ELEVATION	277 M
MEDIAN ELEVATION	323 M
BASIN ASPECT	S E

1 - BASED ON 1:250,000 MAPS





HYDRAULIC MEASUREMENTS

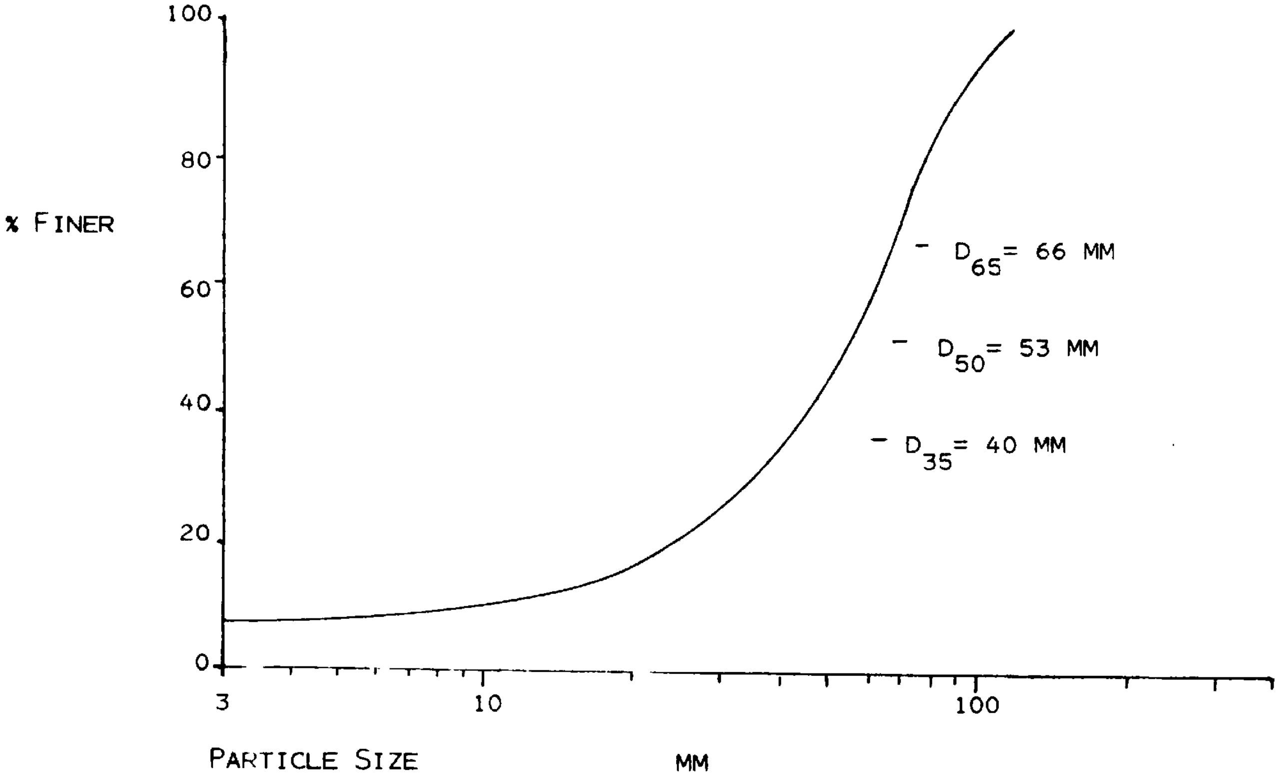
DATE	WIDTH	AREA	MEAN VELOCITY	GAUGE HEIGHT	DISCHARGE
26JUN75	40.2 M	22.3 M^2	0.61 M/S	1.20 M	13.7 M^3/S
27AUG75	38.4 M	19.4 M^2	0.22 M/S	1.03 M	4.3 M^3/S

	STAGE	AREA	HYDRAULIC RADIUS
HWMK	--	--	N/A

PERMAFROST

26 JUN 75 - 0.6 M

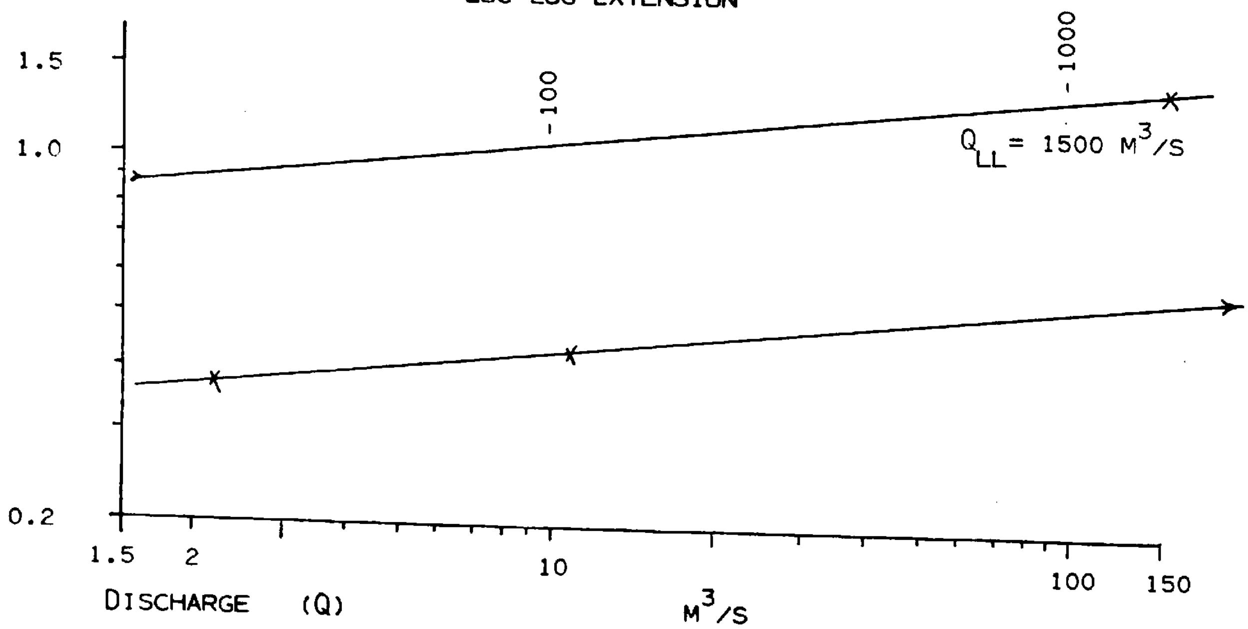
PARTICLE SIZE DISTRIBUTION (BED MATERIAL) B-2



STRICHLER'S ''N'', $N = 0.013\ (D_{50})^{1/6}$		0.025
SUSPENDED SEDIMENT CONCENTRATION	26JUN75	10 MG/L

ESTIMATED DISCHARGE AT HIGH WATER MARK B-3

LOG-LOG EXTENSION



MANNING EQUATION

$$Q = \frac{A\ R^{2/3}\ S^{1/2}}{N} = \frac{(126)(1.02)^{2/3}(0.005)^{1/2}}{0.028}$$

$$= 310\ M^3/S$$

BEST ESTIMATE

STATION NO. 10SA003 LORD LINDSAY RIVER ABOVE WESTERN TRIBUTARY B-3

RIVER MOUTH -	70°08'	92°25'
STUDY SITE -	70°29'	94°28'

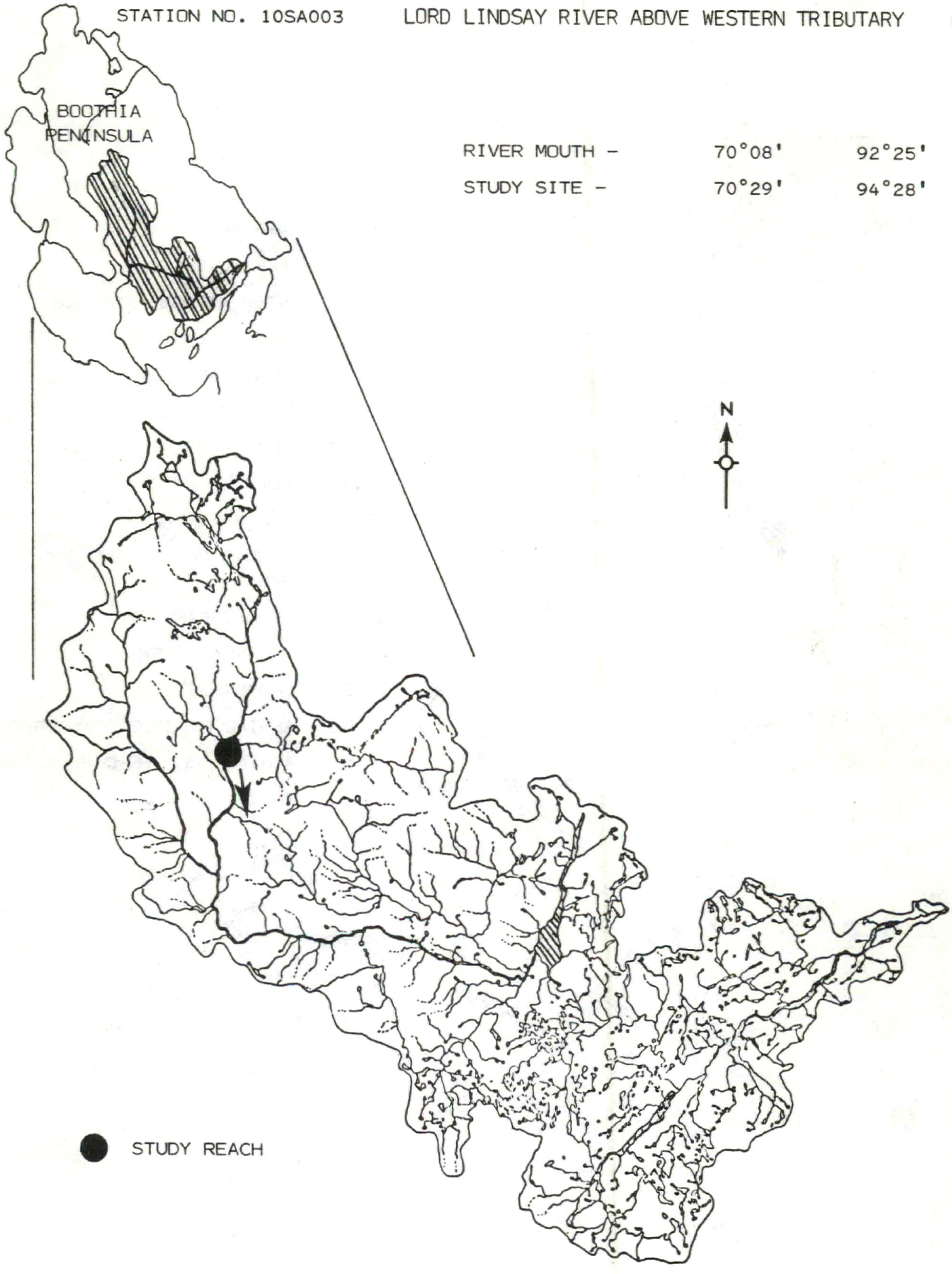
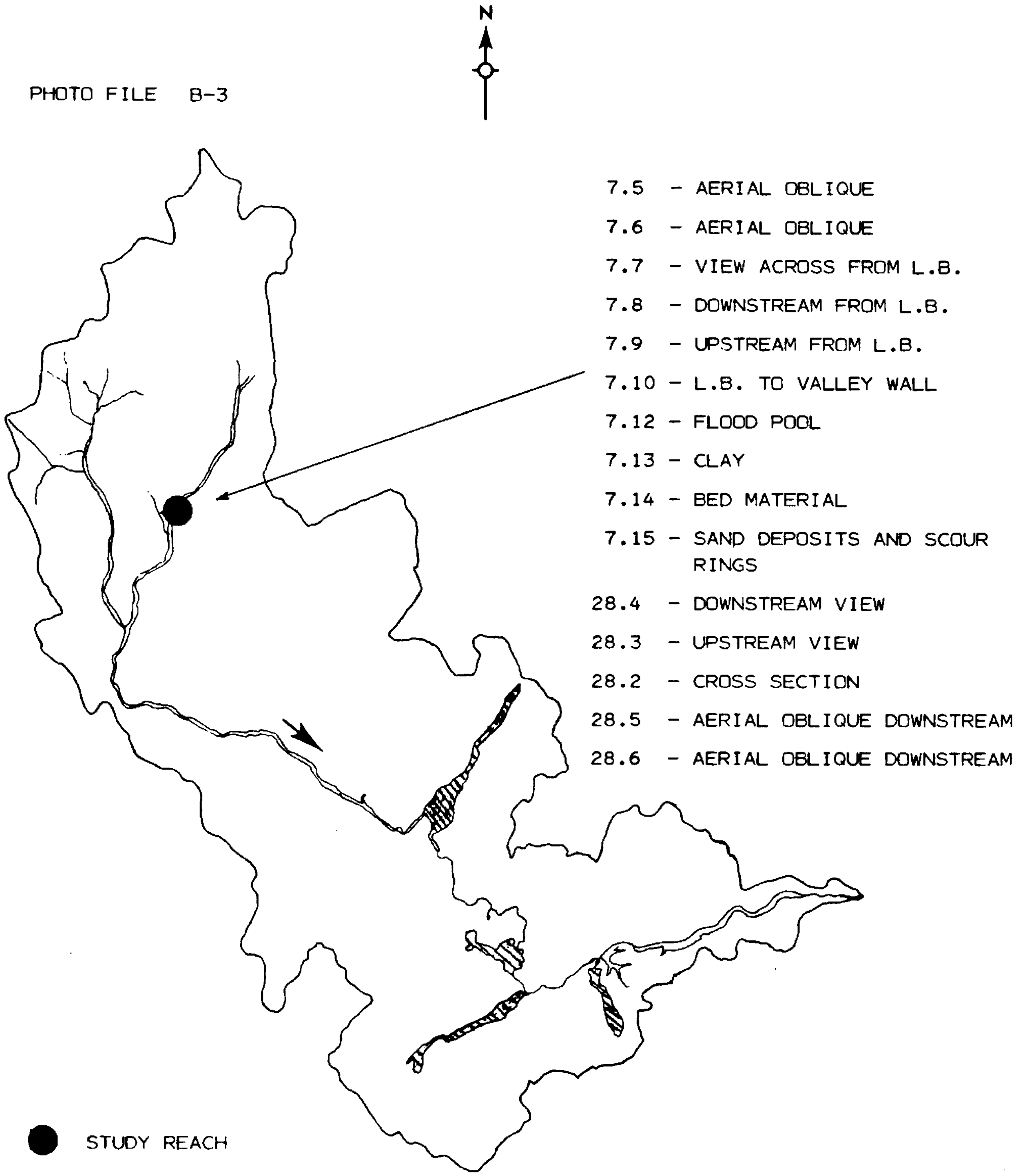


PHOTO FILE B-3

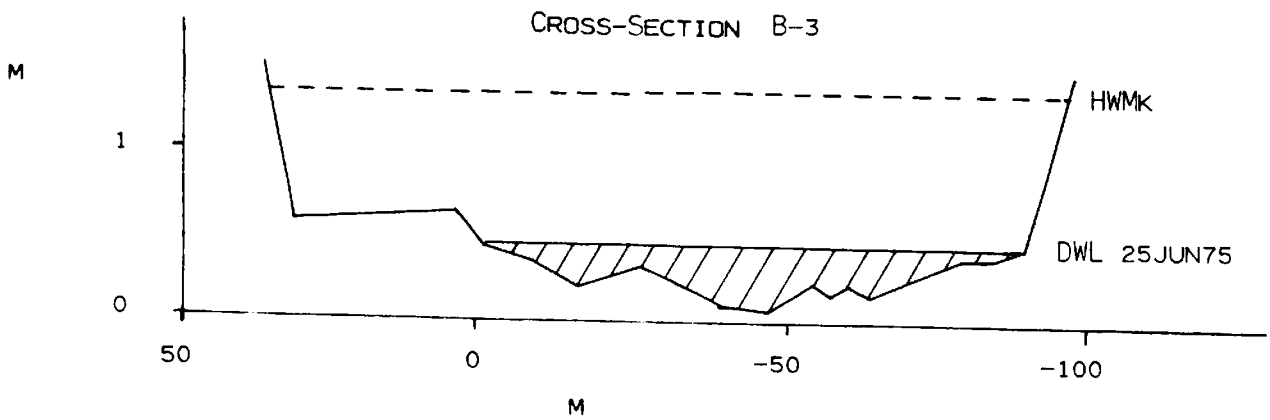


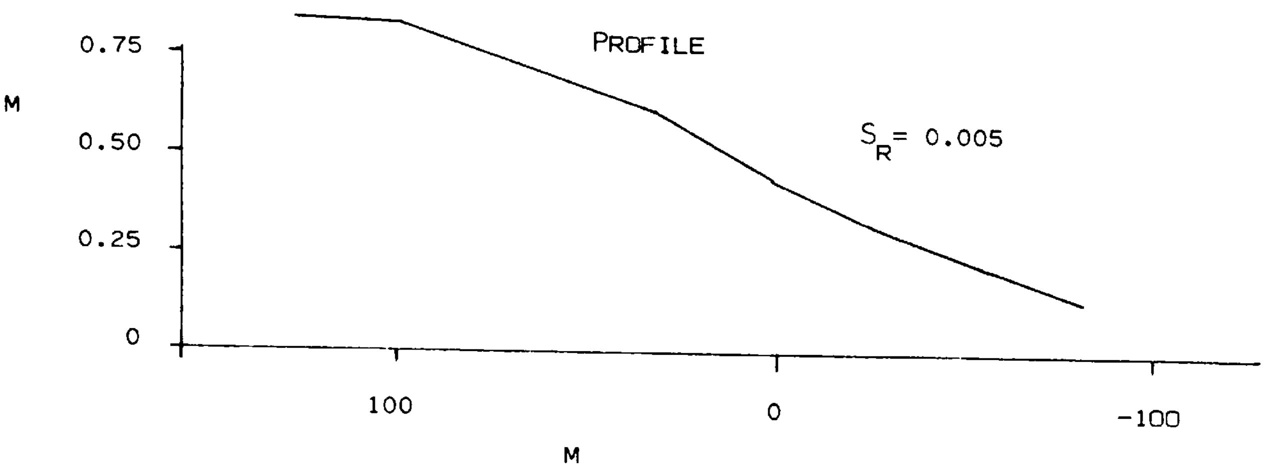
UPPER LORD LINDSAY B-3

A shallow valley, 10 to 15 metres in depth and approximately 250 metres wide, is confined by low outcroppings of sedimentary bedrock mantled by weathered detritus. Highest relief in this region, the interior plateau of Boothia Peninsula, is afforded by isolated hills. Exposed flood plain is narrow on either river bank and its materials of boulder-cobble sizes are quite angular. In the study reach, the flood plain banks consist of a surficial rock veneer overlying a substantial sand - silt layer. Much of this bank material was in the quick condition especially in proximity to snowbeds along the left bank. These fines occur also as "filler" in the coarse grained river bed. Typical gravel river bars, evident from the air, give rise to a riffle-pool flow pattern. The site investigated would appear to be quite stable.

LATITUDE AT BASIN MOUTH[1]	70° 08'
LONGITUDE AT BASIN MOUTH[1]	92° 25'
DRAINAGE AREA	3717 KM^2
BASIN PERIMETER	448 KM
CIRCULARITY RATIO	0.230
STREAM ORDER	5
BIFURCATION RATIO	5.38
LENGTH OF PRINCIPAL CHANNEL	169 KM
SLOPE OF PRINCIPAL CHANNEL	0.003
BASIN WIDTH	59.0 KM
BASIN LENGTH	110 KM
ELONGATION RATIO	0.630
HYPSOMETRIC INTEGRAL	0.544
HYPSOMETRIC COEFFICIENT	-0.597
BASIN RELIEF	555 M
MINIMUM ELEVATION	0 M
MAXIMUM ELEVATION	555 M
AVERAGE ELEVATION	277 M
MEDIAN ELEVATION	323 M
BASIN ASPECT	S E

1 - BASED ON 1:250,000 MAPS





HYDRAULIC MEASUREMENTS

DATE	WIDTH	AREA	MEAN VELOCITY	GAUGE HEIGHT	DISCHARGE
25JUN75	86.3 M	18.4 M^2	0.70 M/S	0.43 M	12.8 M^3/S
27AUG75	47.5 M	7.3 M^2	0.29 M/S	0.37 M	2.1 M^3/S

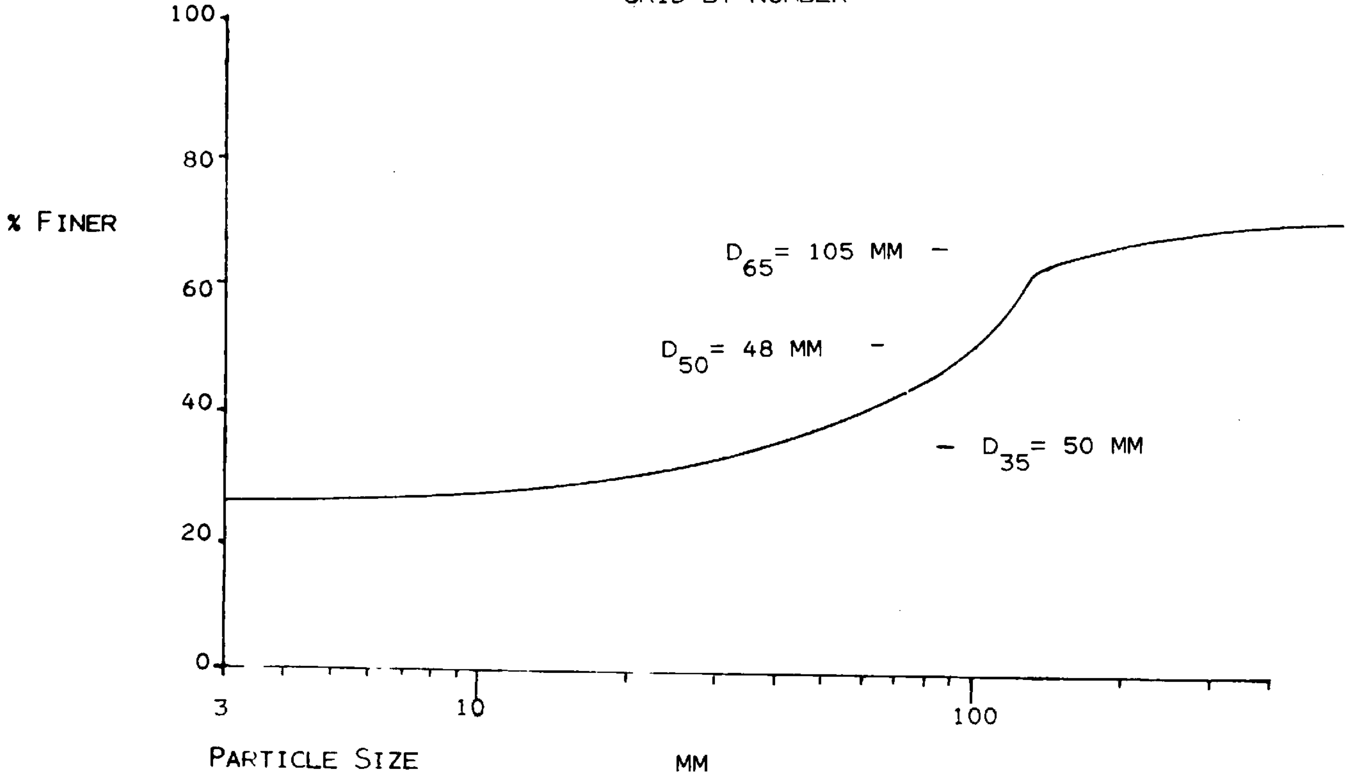
	STAGE	AREA	HYDRAULIC RADIUS
HWMK	1.43 M	126 M^2	1.02 M

PERMAFROST

27 AUG 75 - 0.9 M AT EDGE OF VALLEY WALL L.B.

PARTICLE SIZE DISTRIBUTION (BED MATERIAL) B-3

GRID BY NUMBER

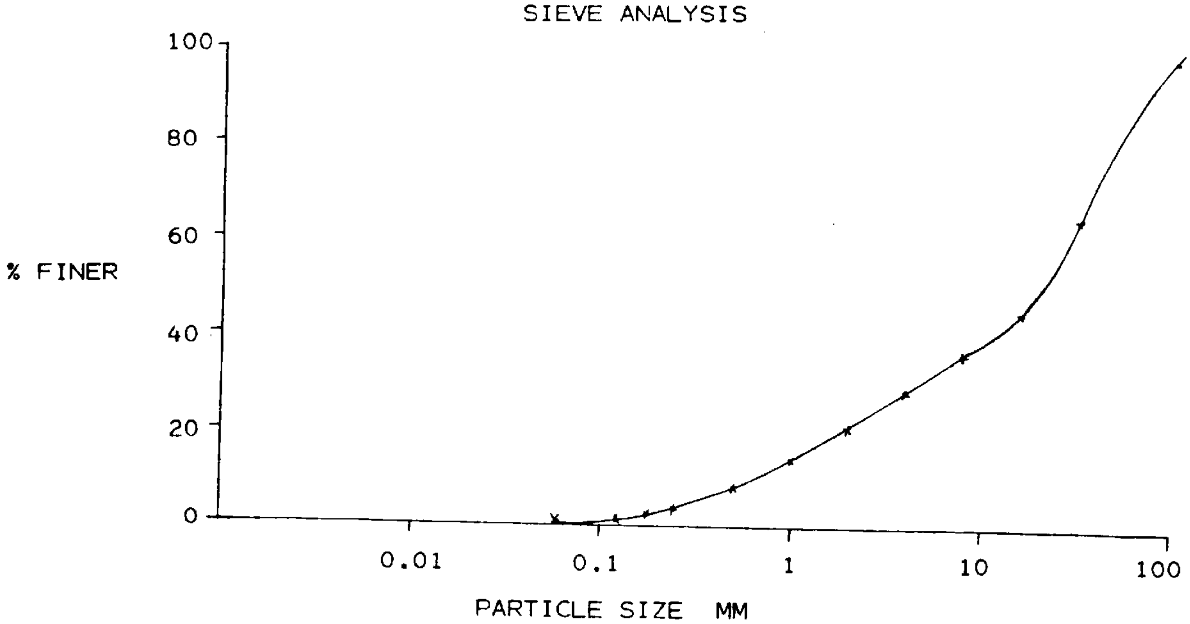


STRICHLER'S ''N'', N = 0.013 $(D_{50})^{1/6}$ 0.028

SUSPENDED SEDIMENT CONCENTRATION 25JUN75 7 MG/L

PARTICLE SIZE DISTRIBUTION (0-1.1 M BELOW SURFACE)

SIEVE ANALYSIS



STATION NO. 10SA004 UNNAMED EASTERN TRIBUTARY OF WROTTESLEY RIVER B-4

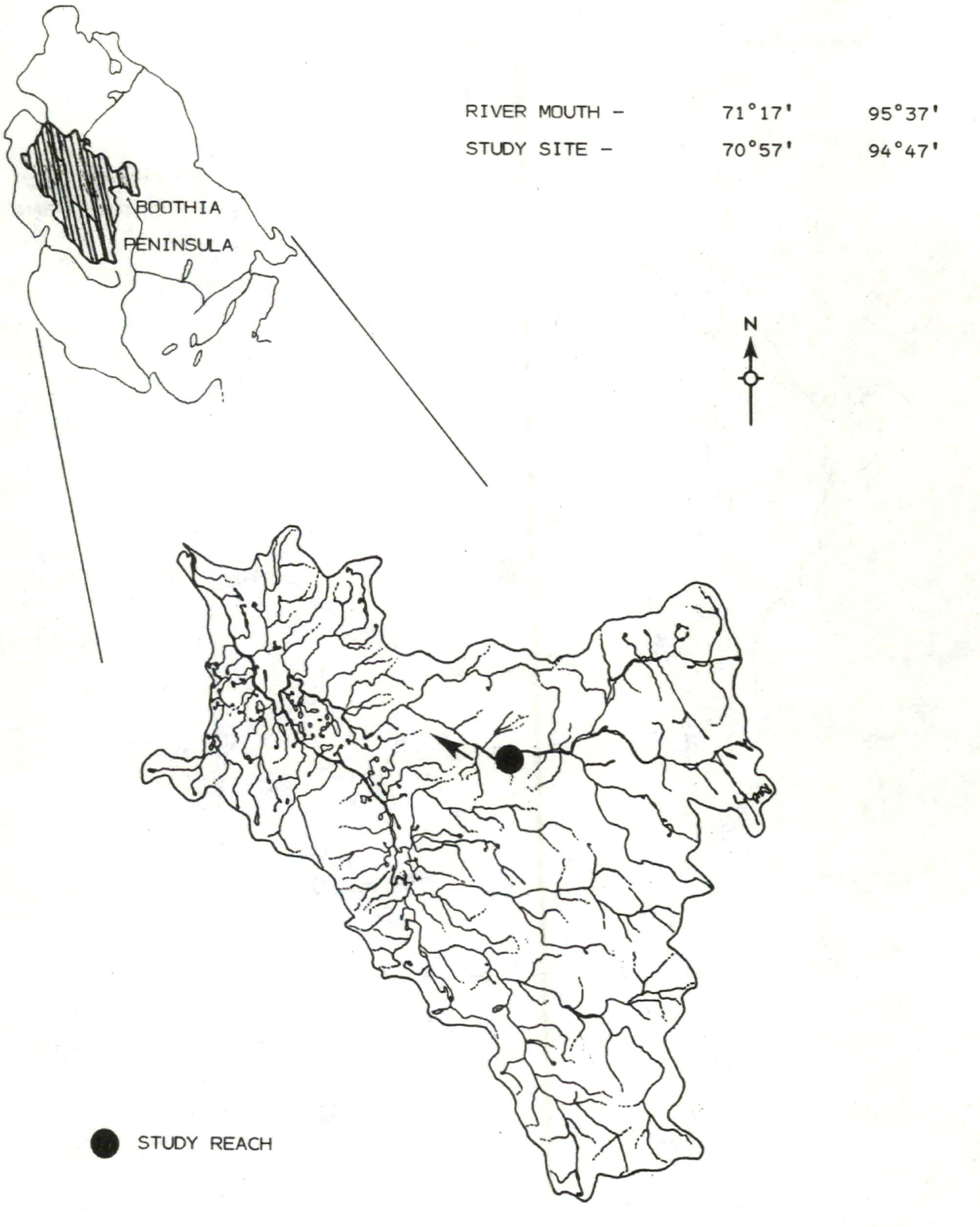
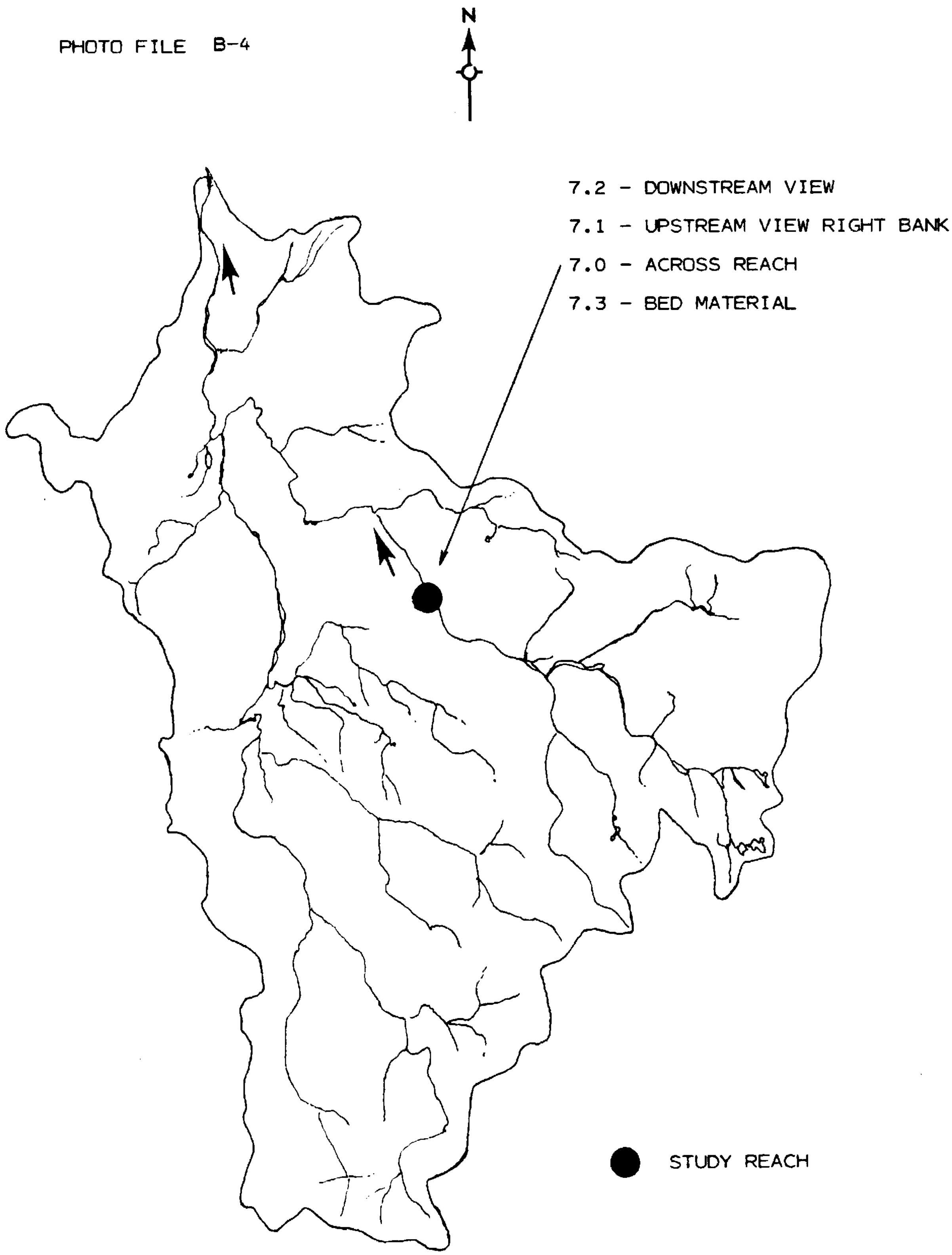


PHOTO FILE B-4

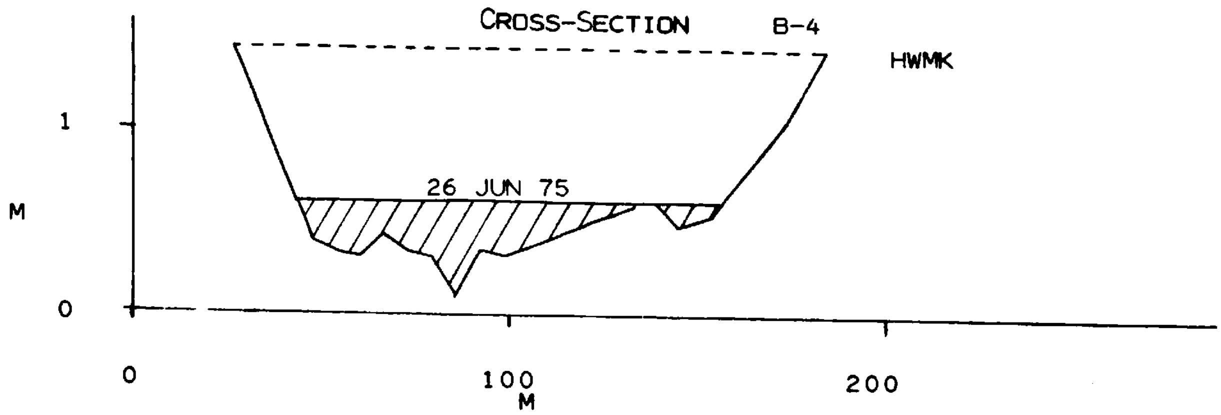


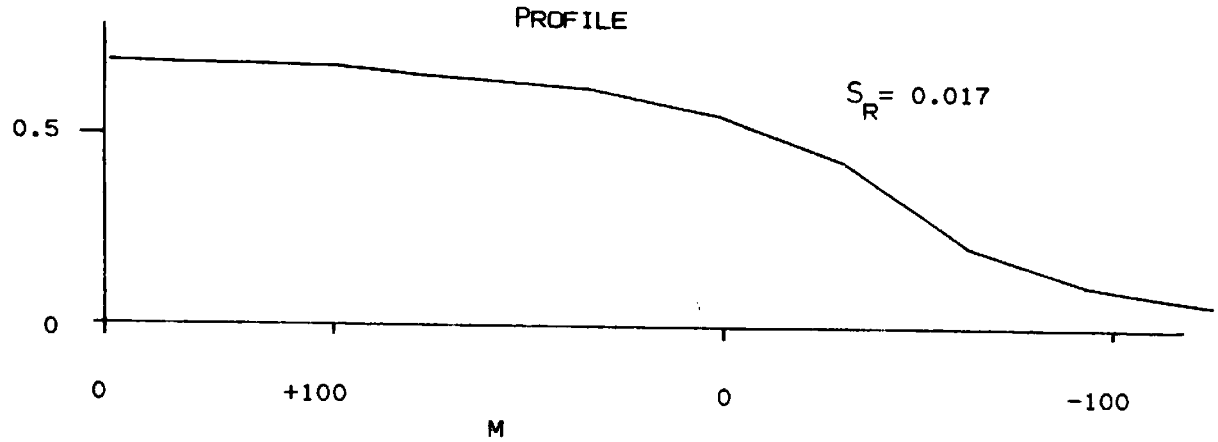
WROTTESLEY RIVER TRIBUTARY B-4

The basin of this stream system in the northwestern section of the Boothia plateau is characterized by low relief and gentle slopes. The river pattern is sinuous in a shallow, poorly-defined valley. Angular dolomitic boulders on the flood plain and across the low water channel create the impression of substantially stable river conditions. Stream bed and flood plain materials are poorly graded with particle sizes mainly sand, cobble or boulder sizes and few intermediate particles. Flow pattern appears fairly uniform with no real pools evident although riffles occurred over boulder bars.

LATITUDE AT BASIN MOUTH[1]	71° 17'
LONGITUDE AT BASIN MOUTH[1]	95° 37'
DRAINAGE AREA	2828 KM^2
BASIN PERIMETER	326 KM
CIRCULARITY RATIO	0.330
STREAM ORDER	5
BIFURCATION RATIO	4.15
LENGTH OF PRINCIPAL CHANNEL	92 KM
SLOPE OF PRINCIPAL CHANNEL	0.01
BASIN WIDTH	55.9 KM
BASIN LENGTH	92.2 KM
ELONGATION RATIO	0.646
HYPSOMETRIC INTEGRAL	0.566
HYPSOMETRIC COEFFICIENT	-0.394
BASIN RELIEF	564 M
MINIMUM ELEVATION	0 M
MAXIMUM ELEVATION	564 M
AVERAGE ELEVATION	82 M
MEDIAN ELEVATION	358 M
BASIN ASPECT	N W

1 - BASED ON 1:250,000 MAPS





HYDRAULIC MEASUREMENTS

DATE	WIDTH	AREA	MEAN VELOCITY	GAUGE HEIGHT	DISCHARGE
24JUN75	108 M	27.2 M^2	0.47 M/S	0.41 M	12.7 M^3/S
26JUN75	85.3 M	17.9 M^2	0.35 M/S	0.30 M	6.3 M^3/S
26AUG75	94.5 M	21.4 M^2	0.17 M/S	--	3.5 M^3/S

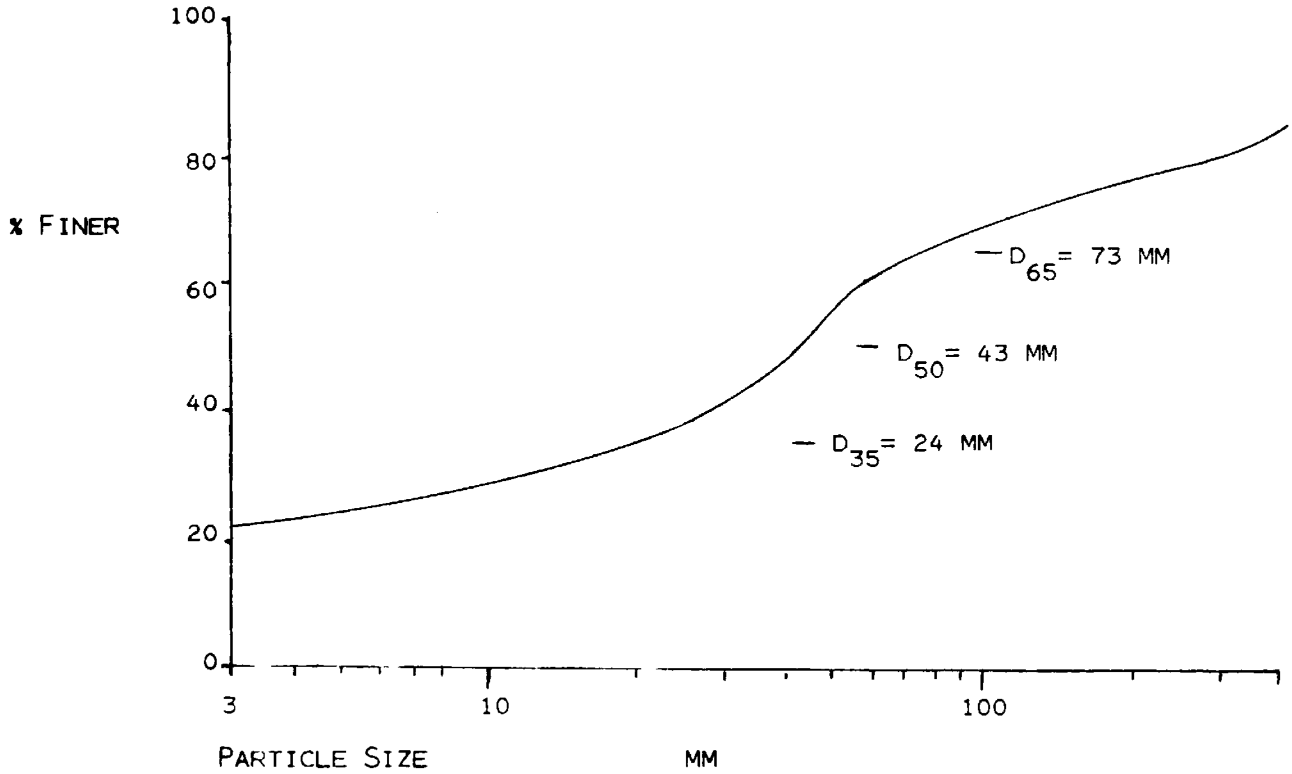
	STAGE	AREA	HYDRAULIC RADIUS
HWMK	0.79 M	122 M^2	0.90 M

PERMAFROST

26 JUN 75 - 0.6 M ON R.B. NEAR WATER'S EDGE. GRAVEL WITH SILT SUBSURFACE

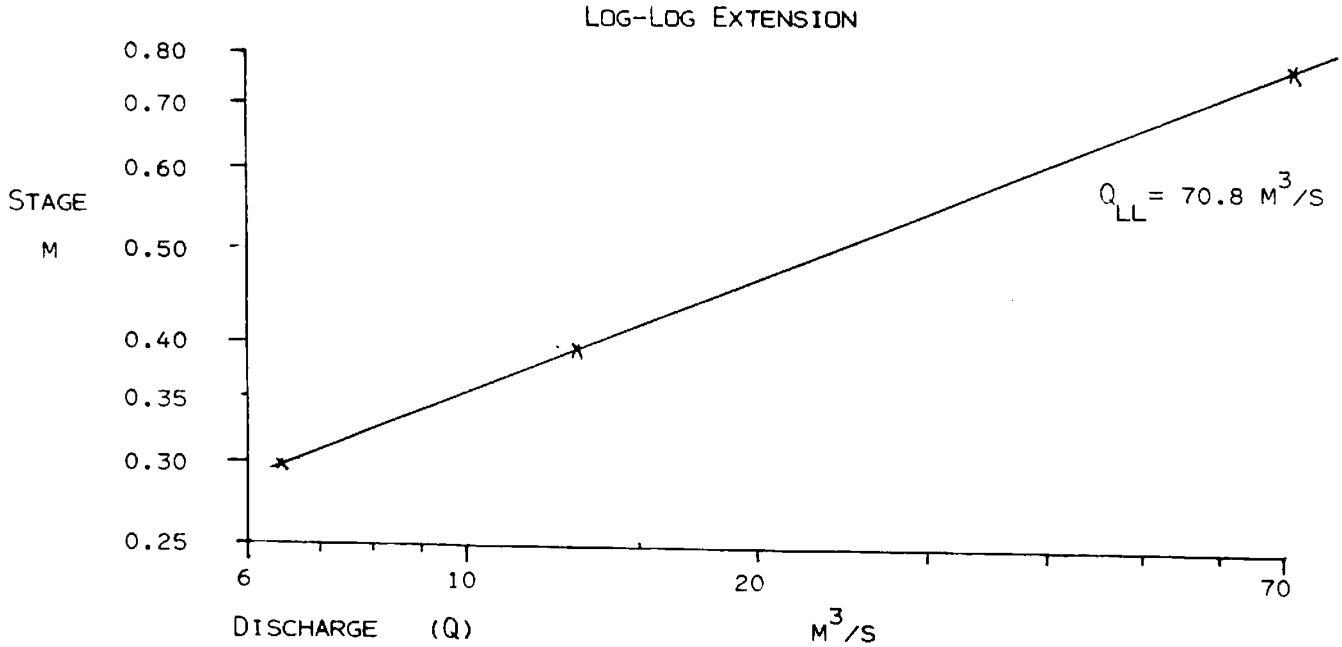
- 0.5 M R.B. ABOUT 20 M FROM WATER'S EDGE IN SANDY SILT.

PARTICLE SIZE DISTRIBUTION (BED MATERIAL) B-4



STRICHLER'S ''N'', $N = 0.013\ (D_{50})^{1/6}$		0.025
SUSPENDED SEDIMENT CONCENTRATION	24JUN75	6 MG/L

ESTIMATED DISCHARGE AT HIGH WATER MARK B-4



MANNING EQUATION

$$Q = \frac{A\ R^{2/3}\ S^{1/2}}{N} = \frac{(122)(0.9)^{2/3}(0.017)^{1/2}}{0.025}$$

$$= 599\ M^3/S$$

BEST ESTIMATE

STATION NO. 10SA005 UNNAMED RIVER ABOVE CAPE AUGHTERSON B-5

RIVER MOUTH –	71°33'	93°25'
STUDY SITE	71°15'	94°31'

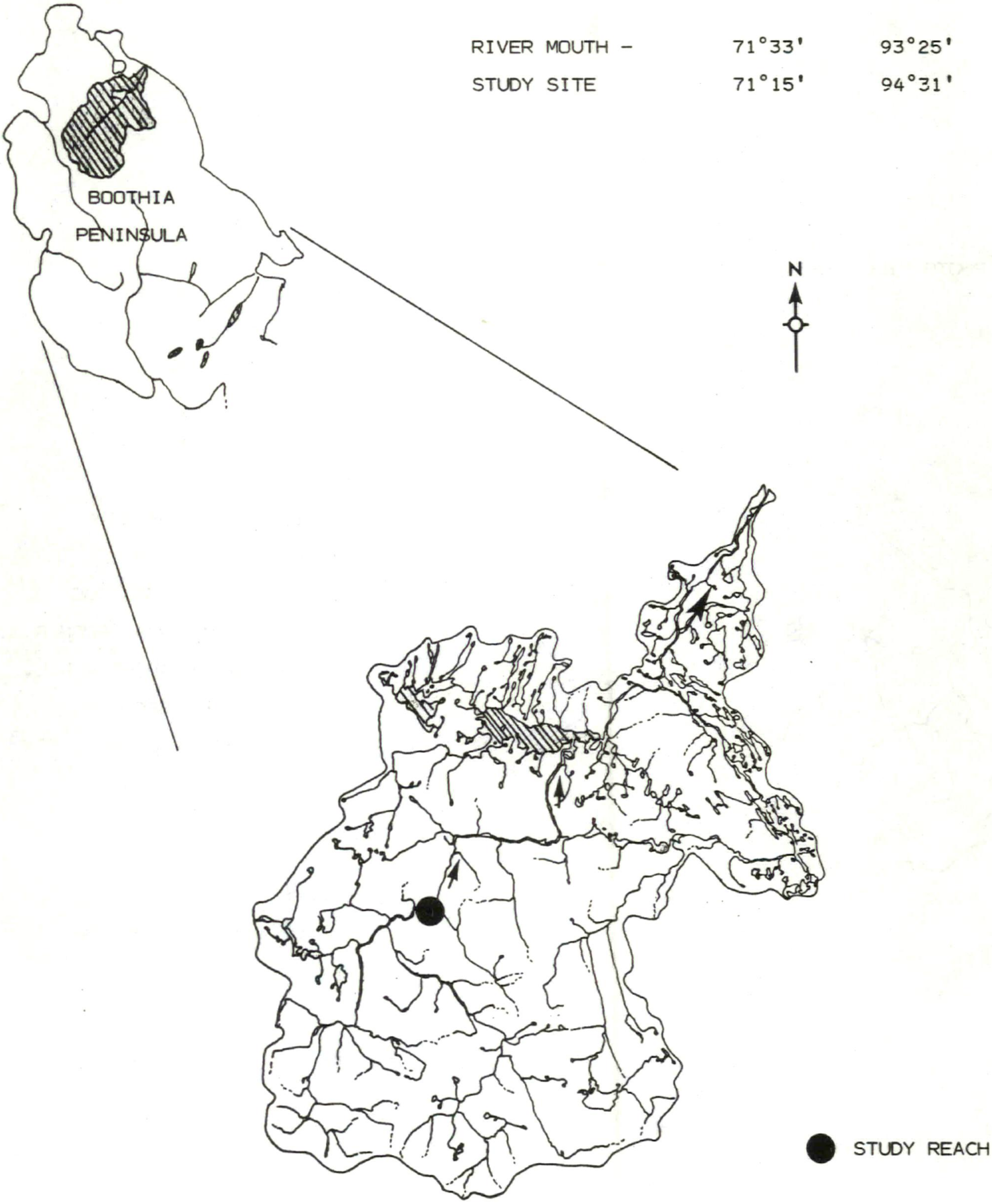
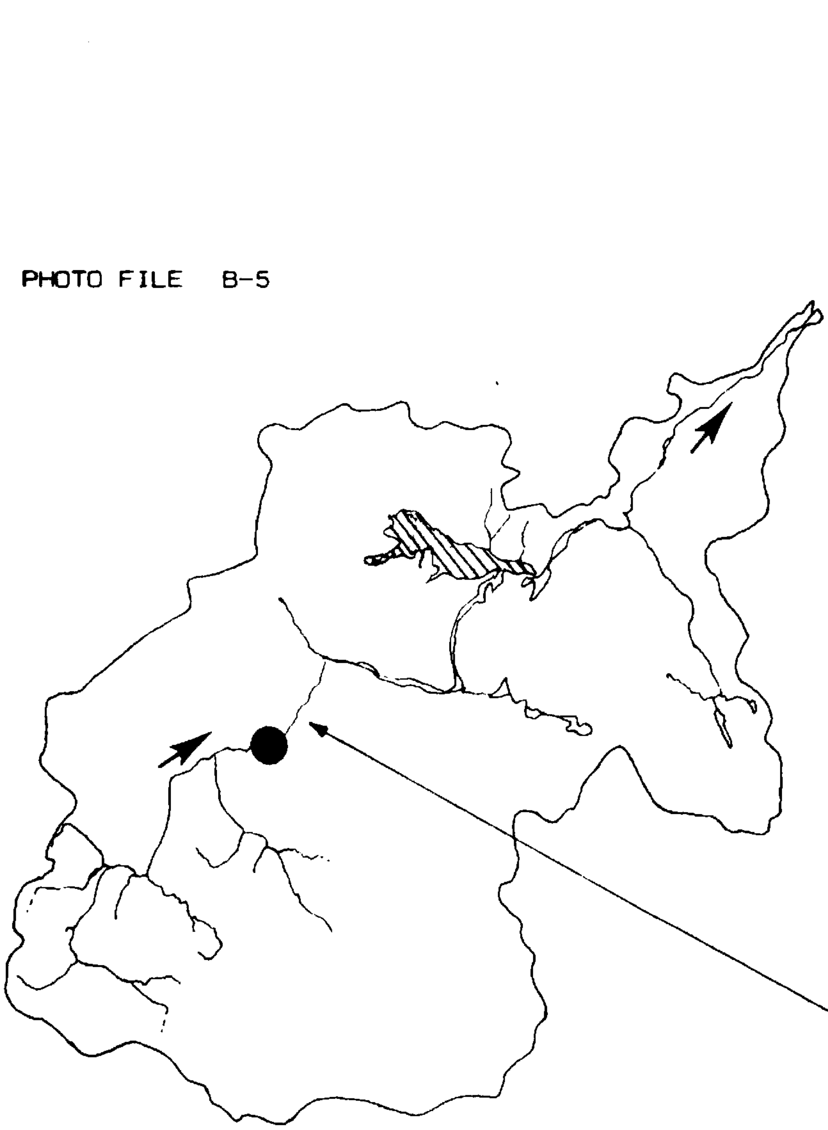


PHOTO FILE B-5



UPSTREAM OF REACH

9.0 - BARS

6.10 - ICE PUSH

27.18 - UPSTREAM

27.19 - DOWNSTREAM

27.17 - CROSS SECTION

6.5 - VALLEY WALLS

6.4 - AERIAL OBLIQUE

6.9 - DOWNSTREAM FROM R.B.

6.8 - UPSTREAM FROM R.B.

6.7 - CROSS SECTION

6.11 - BED MATERIAL

6.23 - RIPPLES

DOWNSTREAM OF REACH

6.16 - TRIBUTARY

6.15 - BLOCK SLUMPING

● - STUDY REACH

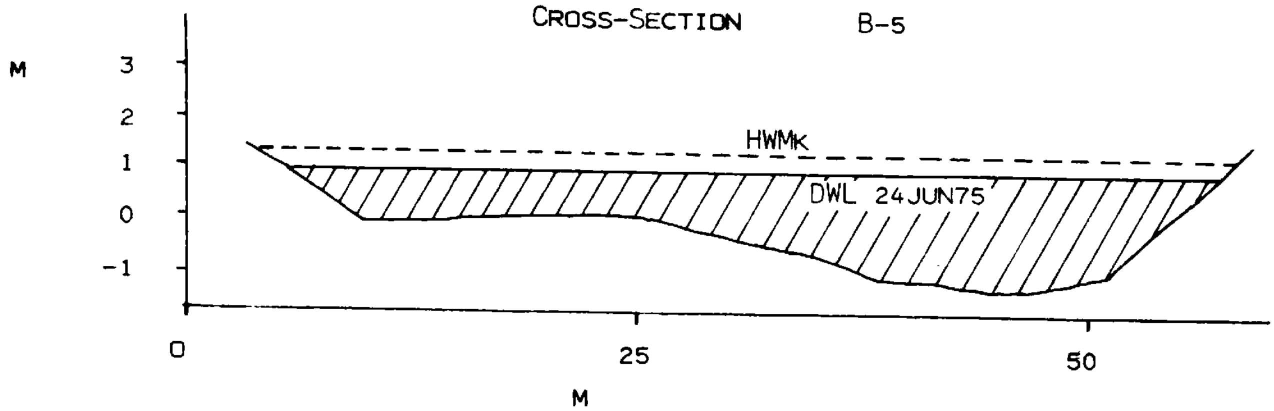
UNNAMED RIVER B-5

This stream, draining northern Boothia Peninsula, flows eastward and lies wholly in Precambrian uplands. Sharp local relief, bare rock hilltops, frost-shattered bedrock, and vegetated till in lowland areas are predominant characteristics of the basin. The valley, floored by alluvium, is fairly well defined with medium to steep slopes on valley walls. Terrace systems, some of them paired, are noted along both walls and confine the river flood plain. Terrace materials are of unconsolidated river-worked gravels. At the end of June the permafrost was 0.9 metres below the right terrace surface in well-graded gravel. Some localized downslope movement of terrace gravels and organic root mat occurs. A cobble ridge (not newly worked) approximately one metre high against the right bank terrace riser indicates that ice runs occur periodically. Knickpoints exist in the channel at numerous places along its length. Between knickpoints, the river exhibits a pool-riffle sequence common to sand, gravel rivers. One such rapids, just upstream of the study reach has deposited below it an extensive sand channel with bottom dunes and mid-channel bars extending through the investigated reach. Aside from localized erosion along terrace risers the river condition is apparently stable.

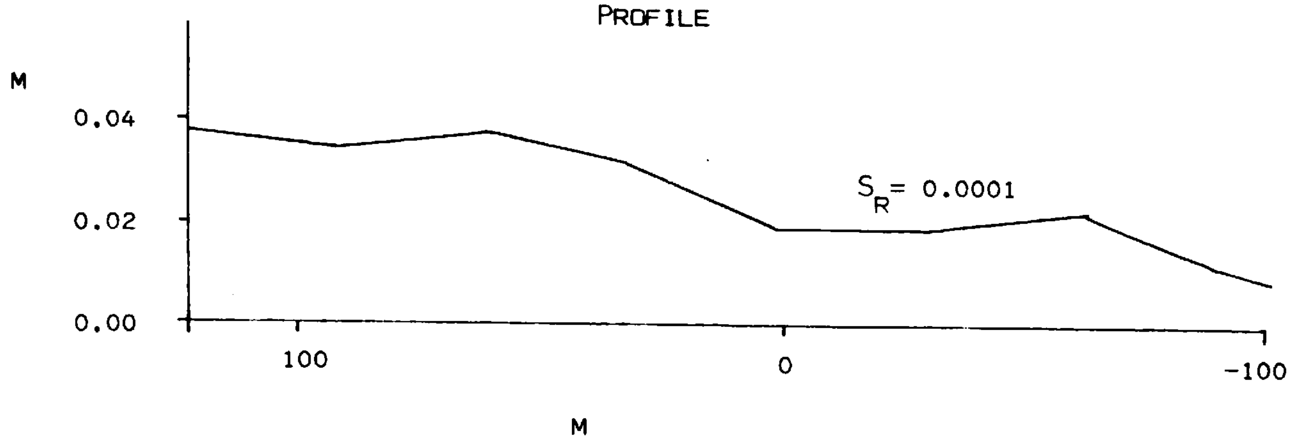
LATITUDE AT BASIN MOUTH[1]	71° 33'
LONGITUDE AT BASIN MOUTH[1]	93° 25'
DRAINAGE AREA	2002 KM^2
BASIN PERIMETER	266 KM
CIRCULARITY RATIO	0.352
STREAM ORDER	4
BIFURCATION RATIO	5.05
LENGTH OF PRINCIPAL CHANNEL	23 KM
SLOPE OF PRINCIPAL CHANNEL	0.007
BASIN WIDTH	52.7 KM
BASIN LENGTH	77.8 KM
ELONGATION RATIO	0.646
HYPSOMETRIC INTEGRAL	0.490
HYPSOMETRIC COEFFICIENT	-0.328
BASIN RELIEF	594 M
MINIMUM ELEVATION	0 M
MAXIMUM ELEVATION	594 M
AVERAGE ELEVATION	297 M
MEDIAN ELEVATION	303 M
BASIN ASPECT	E

1 - BASED ON 1:250,000 MAPS

CROSS-SECTION B-5



PROFILE



HYDRAULIC MEASUREMENTS

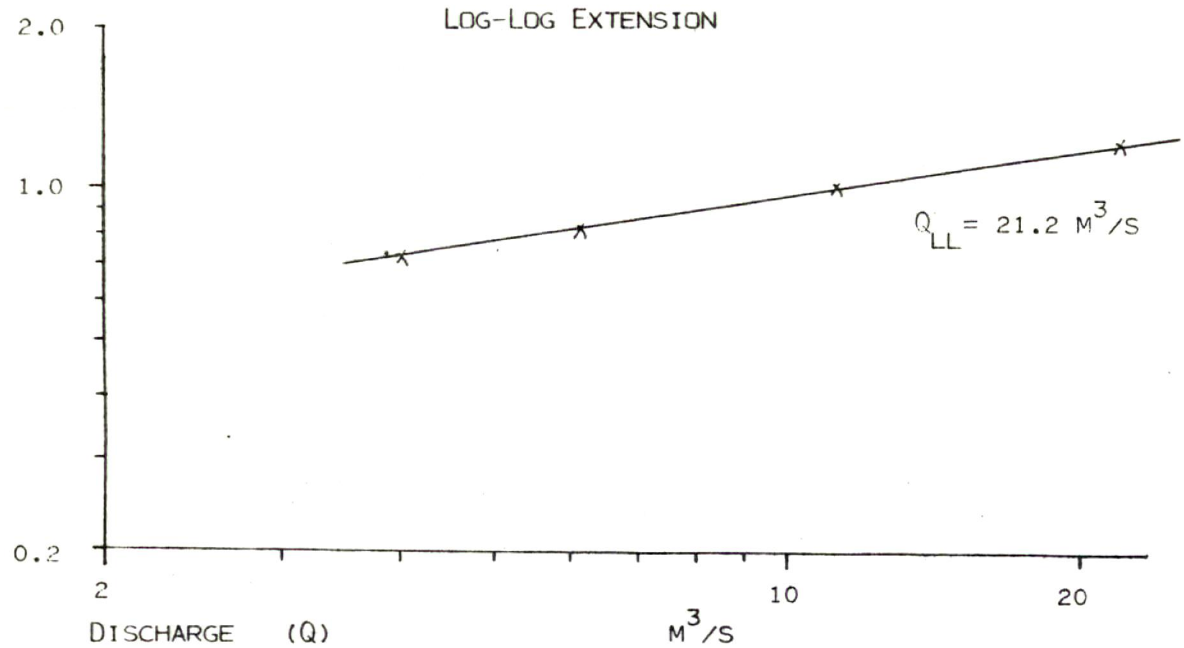
DATE	WIDTH	AREA	MEAN VELOCITY	GAUGE HEIGHT	DISCHARGE
24JUN75	51.5 M	87.0 M^2	0.12 M/S	1.00 M	10.8 M^3/S
27JUN75	52.1 M	74.5 M^2	0.09 M/S	0.78 M	6.4 M^3/S
26AUG75	32.0 M	18.5 M^2	0.21 M/S	0.74 M	4.0 M^3/S

	STAGE	AREA	HYDRAULIC RADIUS
HWMK	1.17 M	110 M^2	2.16 M

PERMAFROST

24 JUN 75 - 0.3 M ON R.B. UNDER GRASS COVER
- 0.9 M AT EDGE OF A MELTWATER POOL ON TERRACE, R.B. UNDER 50% GRASS COVER

ESTIMATED DISCHARGE AT HIGH WATER MARK B-5



MANNING EQUATION

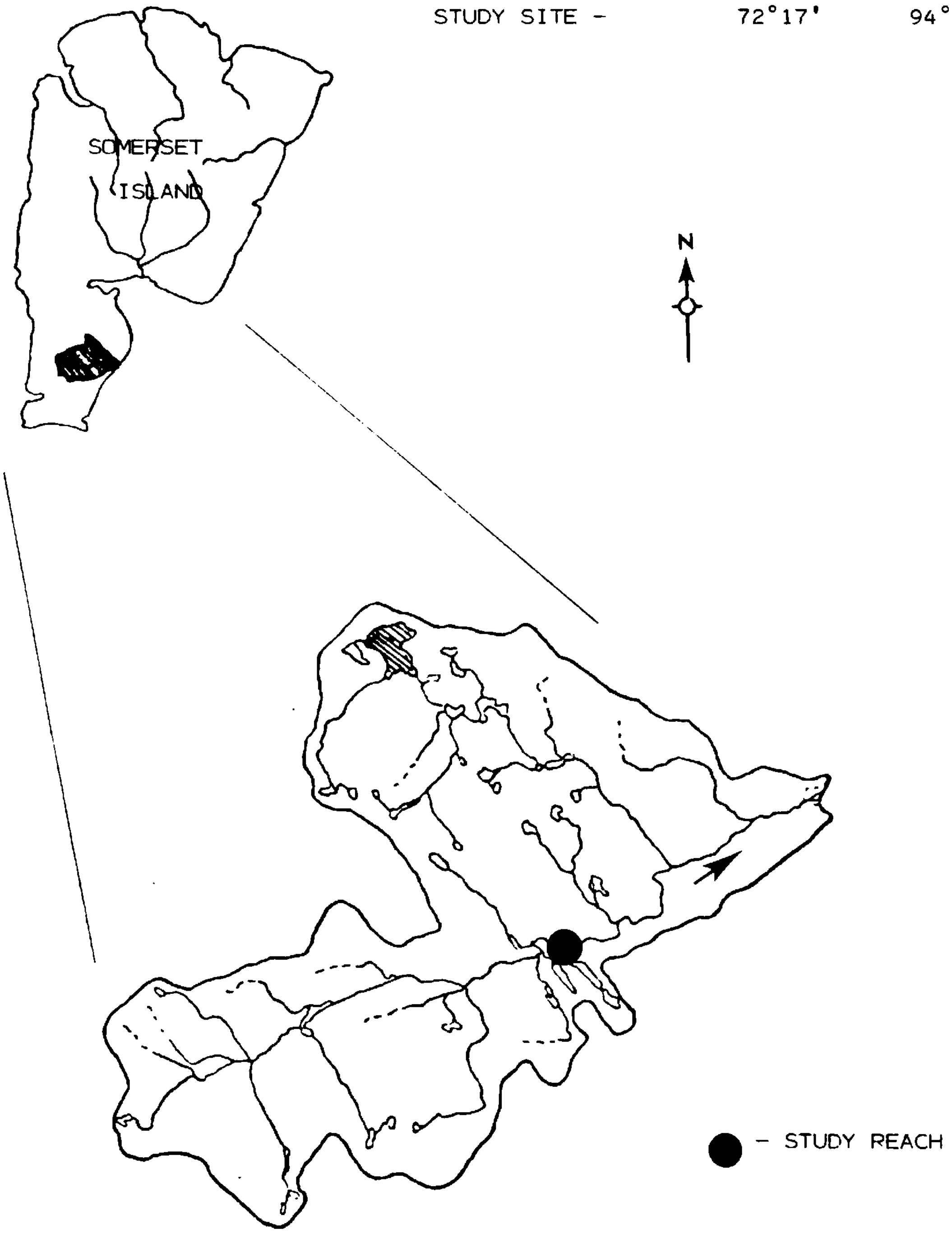
$$Q = \frac{A\ R^{2/3}\ S^{1/2}}{N} = \frac{(110)(2.16)^{2/3}(0.0001)^{1/2}}{0.025 \text{ (ESTIMATED)}}$$

$$= 73.6\ M^3/S$$

BEST ESTIMATE

STATION NO. 10TD001 LANG RIVER ABOVE PRINCE REGENT INLET S-1

RIVER MOUTH -	72°15'	93°55'
STUDY SITE -	72°17'	94°12'



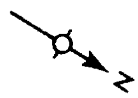
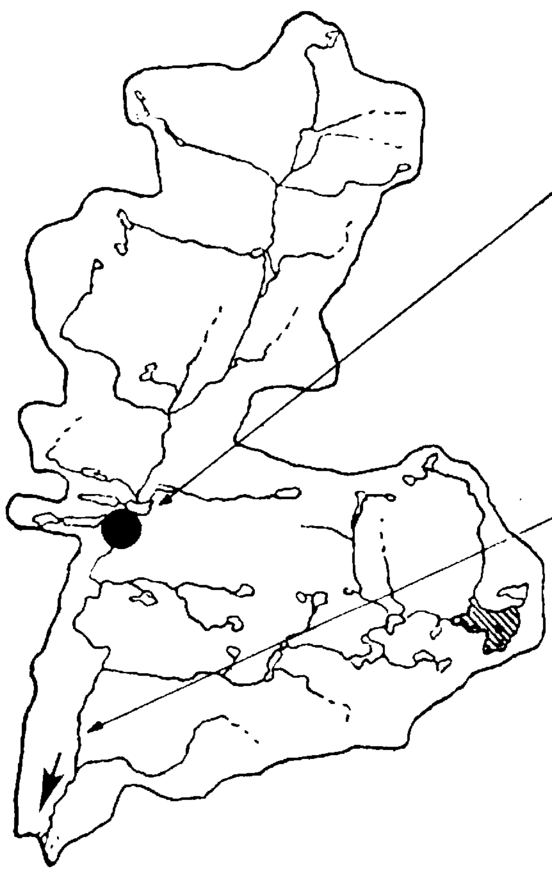


PHOTO FILE S-1



5.1 - CROSS SECTION
5.2 - UPSTREAM VIEW
5.3 - DOWNSTREAM VIEW
5.7 - BED MATERIAL

5.4 - ICE PUSH

4.17 - CANYON - UPSTREAM
5.14 - AERIAL VIEW
5.17 - LANG CANYON
5.8 - UPSTREAM VIEW
5.9 - DOWNSTREAM VIEW

4.12 - LANG RIVER
-BELOW CANYON

● - STUDY REACH

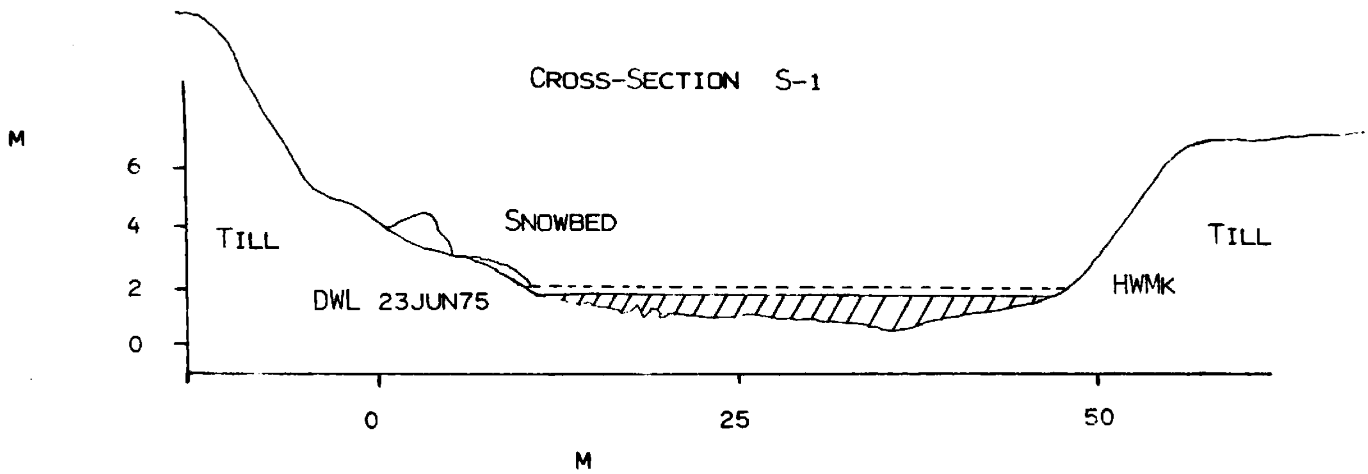
LANG RIVER S-1

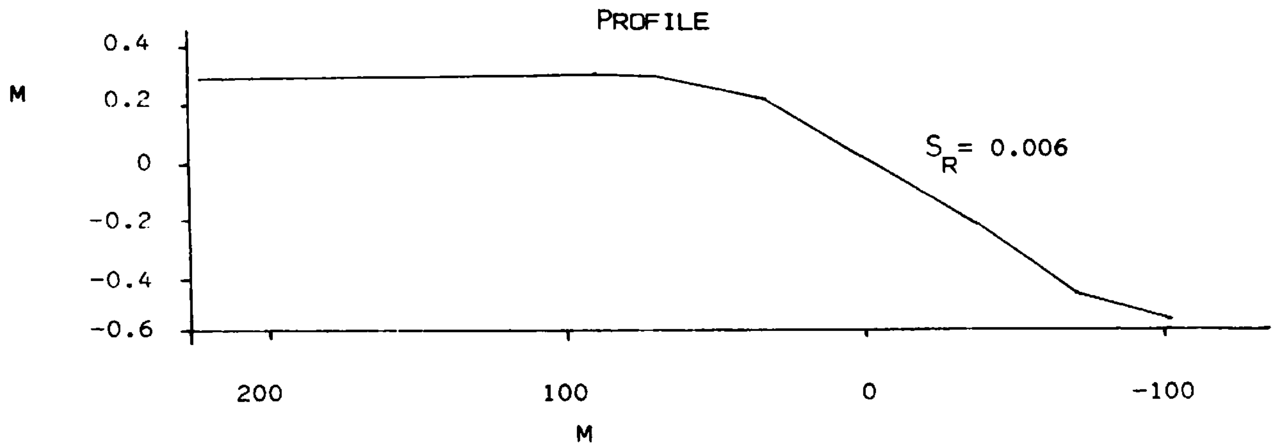
The headwater reaches of this drainage basin lie in Precambrian hill terrain and the land areas upstream, and for some distance downstream of the study reach, are typical of Shield country with exposed, knobby, granitic hills interspersed with lower till plains and slopes. Some few miles downstream of the investigated reach the stream is sharply incised through a north-south trending, limestone-dolomite ridge. A spectacular canyon has been created here and the character of the river changes completely — the uplands systems contain rapids and lakes; the downstream channel is entrenched with much tumbling flow. Approximately 50% of the basin is vegetated by sedges, mosses and some willow scrub in sheltered, poorly drained areas. Where unconsolidated materials exist in depth, some ground-ice features, i.e., polygons and stripes are evident. The study reach, below a small lake, has no definite valley. Bedrock outcrops on either bank indicate the deeper underlying bed material may well be consolidated bedrock. The visible bed consists of boulder-cobble material. The channel is bordered by a narrow (approximately 5 metres) floodplain which in turn is bordered by elevated flats which could be ancient, fragmentary terraces. The channel is irregular in width and pattern, and gives every appearance of being quite stable, both laterally and vertically. Some minor ice activity in the reach was noted — a raised boulder ridge on the right bank would seem to be created by ice push, probably by ice-pan discharge from the upstream lake.

MORPHOMETRIC DATA S-1

LATITUDE AT BASIN MOUTH[1]	72° 15'
LONGITUDE AT BASIN MOUTH[1]	93° 55'
DRAINAGE AREA	275 KM^2
BASIN PERIMETER	91.7 KM
CIRCULARITY RATIO	0.410
STREAM ORDER	4
BIFURCATION RATIO	4.61
LENGTH OF PRINCIPAL CHANNEL	30 KM
SLOPE OF PRINCIPAL CHANNEL	0.01
BASIN WIDTH	20.9 KM
BASIN LENGTH	28.5 KM
ELONGATION RATIO	0.652
HYPSOMETRIC INTEGRAL	0.585
HYPSOMETRIC COEFFICIENT	-0.411
BASIN RELIEF	472 M
MINIMUM ELEVATION	0 M
MAXIMUM ELEVATION	472 M
AVERAGE ELEVATION	236 M
MEDIAN ELEVATION	248 M
BASIN ASPECT	E

1 - BASED ON 1:250,000 MAPS





HYDRAULIC MEASUREMENTS

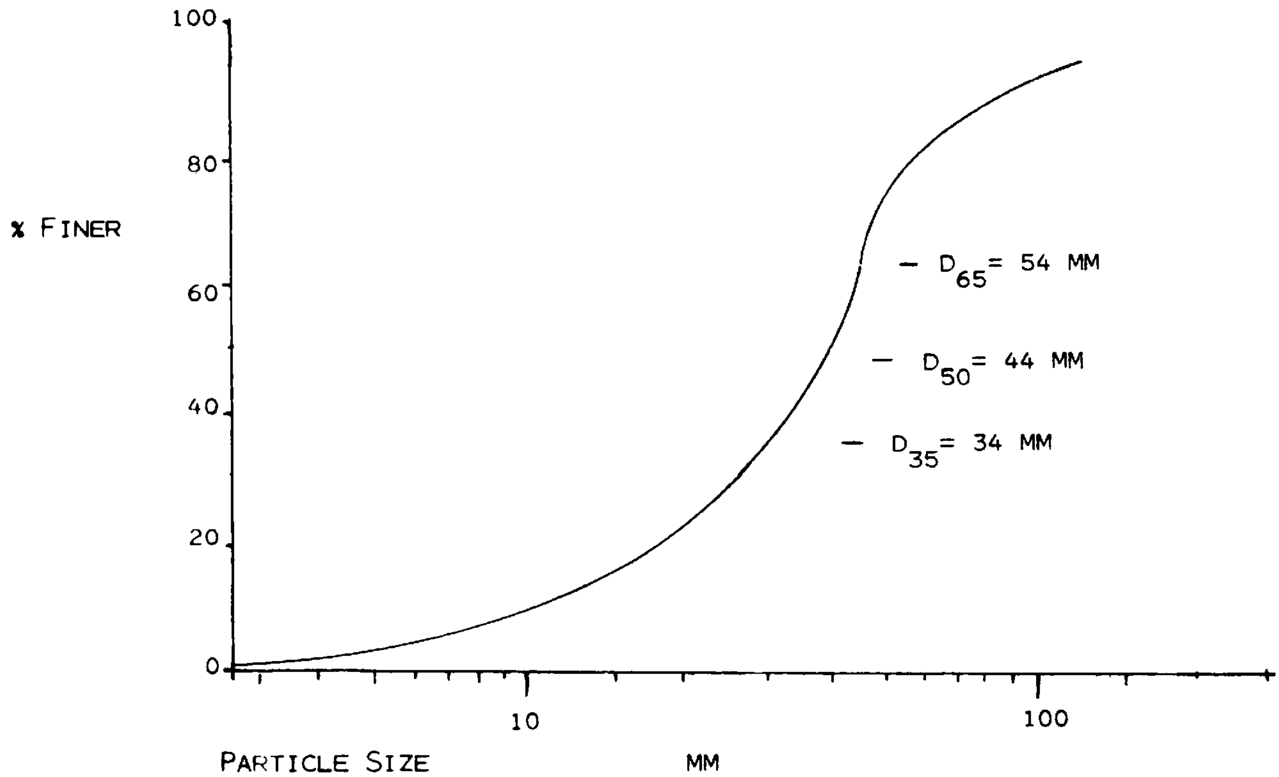
DATE	WIDTH	AREA	MEAN VELOCITY	GAUGE HEIGHT	DISCHARGE
23JUN75	33.5 M	18.1 M^2	0.51 M/S	0.65 M	9.2 M^3/S
27JUN75	35.0 M	18.0 M^2	0.42 M/S	0.55 M	7.6 M^3/S
19AUG75	22.9 M	6.2 M^2	0.16 M/S	0.18 M	1.0 M^3/S

	STAGE	AREA	HYDRAULIC RADIUS
HWMK	0.71 M	21.3 M^2	0.61 M

PERMAFROST

23 JUN 75 - 1.1 M IN THALWEG

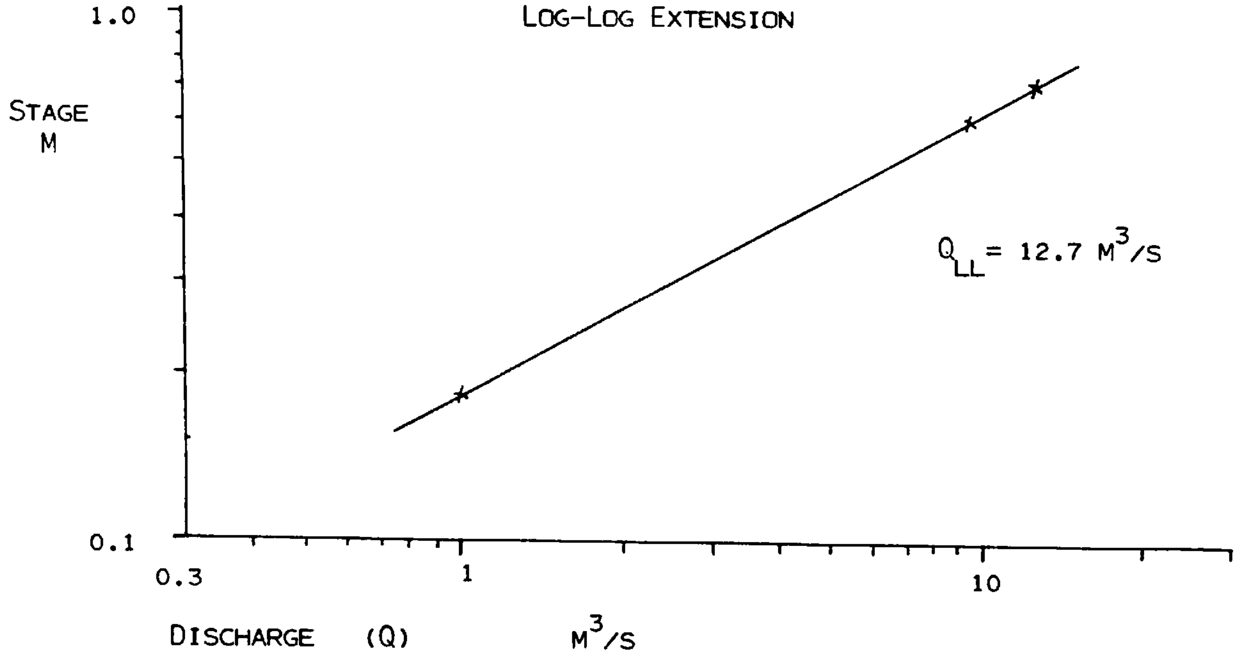
PARTICLE SIZE DISTRIBUTION (BED MATERIAL) S-1



STRICHLER'S ''N'', $N = 0.013\ (D_{50})^{1/6}$ 0.025

SUSPENDED SEDIMENT CONCENTRATION 23JUN75 23 MG/L

ESTIMATED DISCHARGE AT HIGH WATER MARK S-1



MANNING EQUATION

$$Q = \frac{A\ R^{2/3} S^{1/2}}{N} \doteq \frac{(21.3)(0.61)^{2/3}(0.006)^{1/2}}{0.025}$$

$$= 47.5\ M^3/S$$

STATION NO. 10TD002 UNION RIVER AT OUTLET OF STANWELL - FLETCHER LAKE S-2

RIVER MOUTH -	72°45'	94°20'
STUDY SITE -	72°44'	94°26'

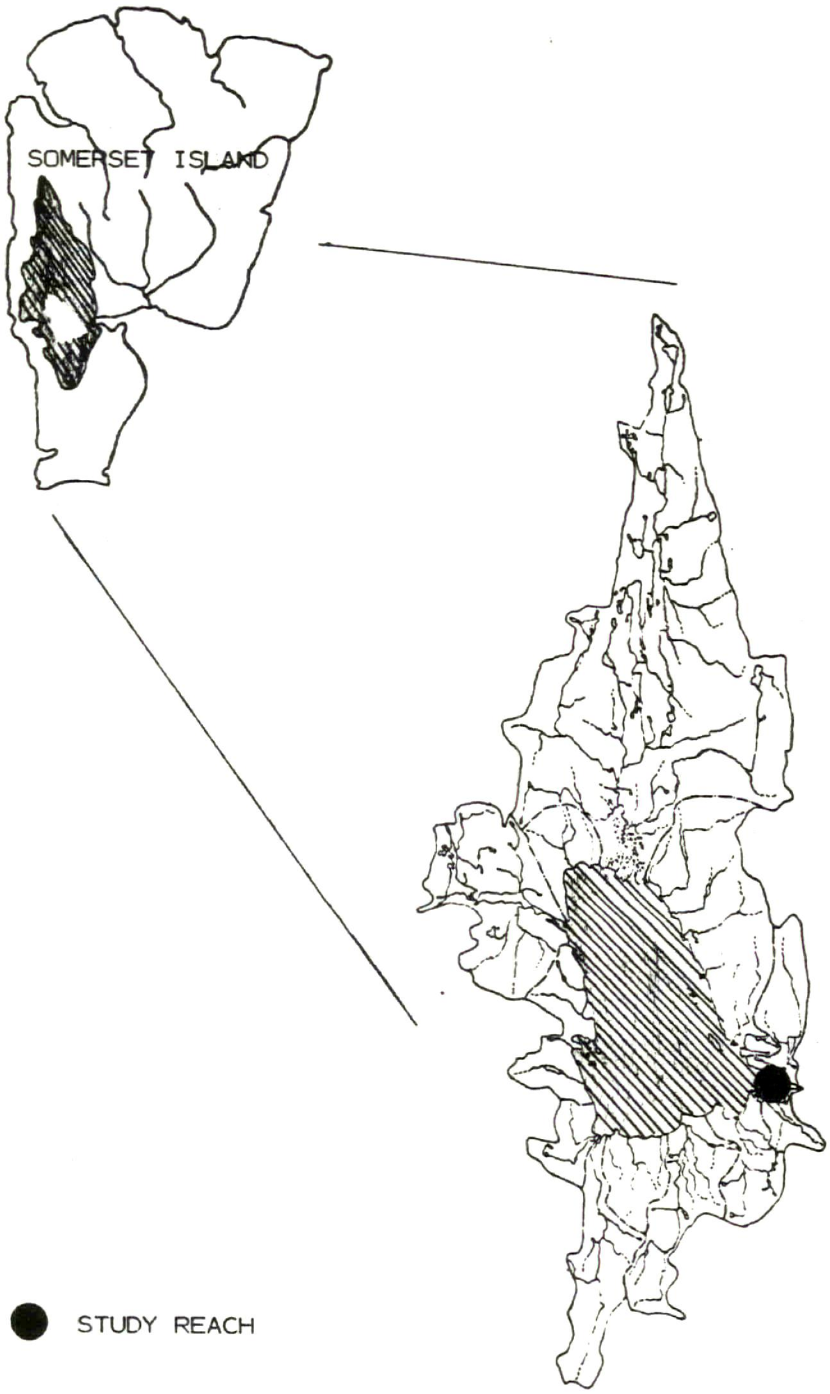
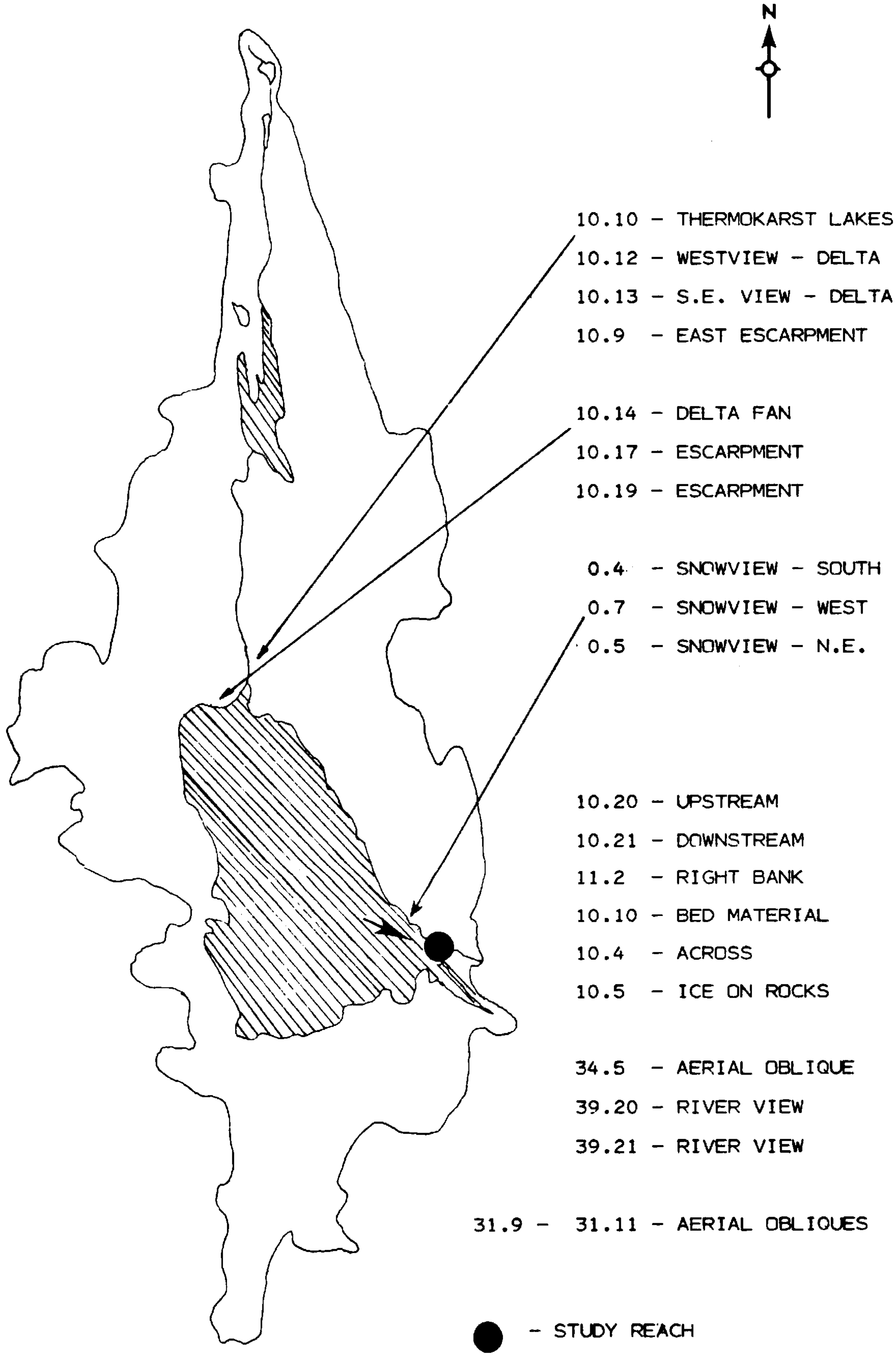


PHOTO FILE S-2



UNION RIVER S-2

The dominant geographic feature of this drainage basin is Stanwell Fletcher Lake, one of the larger freshwater lakes in the Arctic Archipelago. The Union River connects the lake to the sea at Cresswell Bay and is only 5 kilometres in length. The broad indeterminate valley through which it flows, at one time the sea floor, is marked by numerous levels of unconsolidated materials which could be old marine beaches; kame terraces or more recent alluvial terraces. Terrain structure is further modified by Precambrian outcrops of granitic bedrock. The escarpment forming the northern valley wall marks the edge of the Somerset plateau and is quite steep. Small streams draining the escarpment have incised deeply into the valley wall and deposited erosinal detritus in outwash fans in the valley plain. The river channel from the lake to the sea is irregular and consists of a number of small lakes connected by rapids and chutes of fast water. No regular flood plain was observed and vegetation extends to the water's edge. Low-lying areas are faily well vegetated by sedges, mosses, lichens and some scrub willow. An extensive boulder drift from ice-push occurs at the outlet from Stanwell Fletcher. Apparently, the Union River frequently flows all winter although in 1975 it did not do so. Daily flow increments or decrements are quite small because of the regulating effect of the large upstream lake. Some ice-block runoff occurs from the lake throughout the summer. The channel in the study reach had a boulder-bedrock bed and appeared to be quite stable both laterally and vertically.

MORPHOMETRIC DATA S-2

LATITUDE AT BASIN MOUTH[1]	72° 45'
LONGITUDE AT BASIN MOUTH[1]	94° 20'
DRAINAGE AREA	2077 KM^2
BASIN PERIMETER	306 KM
CIRCULARITY RATIO	0.275
STREAM ORDER	4
BIFURCATION RATIO	4.25
LENGTH OF PRINCIPAL CHANNEL	83 KM
SLOPE OF PRINCIPAL CHANNEL	0.003
BASIN WIDTH	39.4 KM
BASIN LENGTH	79.8 KM
ELONGATION RATIO	0.641
HYPSOMETRIC INTEGRAL	0.405
HYPSOMETRIC COEFFICIENT	+0.224
BASIN RELIEF	442 M
MINIMUM ELEVATION	0 M
MAXIMUM ELEVATION	442 M
AVERAGE ELEVATION	221 M
MEDIAN ELEVATION	167 M
BASIN ASPECT	E

1 - BASED ON 1:250,000 MAPS

EXCERPTS FROM W. EDDY'S DIARY - re UNION RIVER, 1975

FISHERIES MARINE SERVICE CAMP

May 30 - Arrival Stanwell-Fletcher.
- Ice approximately 8 feet thick at sampling sites on lake near Union River outflow.
- Small amount of snow on lake, 6 inches to 1-foot drifts with extensive clear patches.
- River ice has more snow in sheltered areas.

May 31 - Approximately one inch of water on lake and river ice.

Je 1 - Light rain - maximum temperature 12.2 C.
- Lot of free water on river and lake margins.

Je 2 - Water on ice increasing

Je 3 - 0700 - Surface of ice 2 to 3 inches of water.
- 2100 - Ice surface candled to depth of 6 inches, standing water gone from surface of lake.
- River has extensive overflow, ice in channel starting to float up and crack.

Je 6 - George Iqalook camped at mouth of river reports little flow in river there.
- He says the river was frozen solid this year, an unusual occurrence. It usually flows all winter.

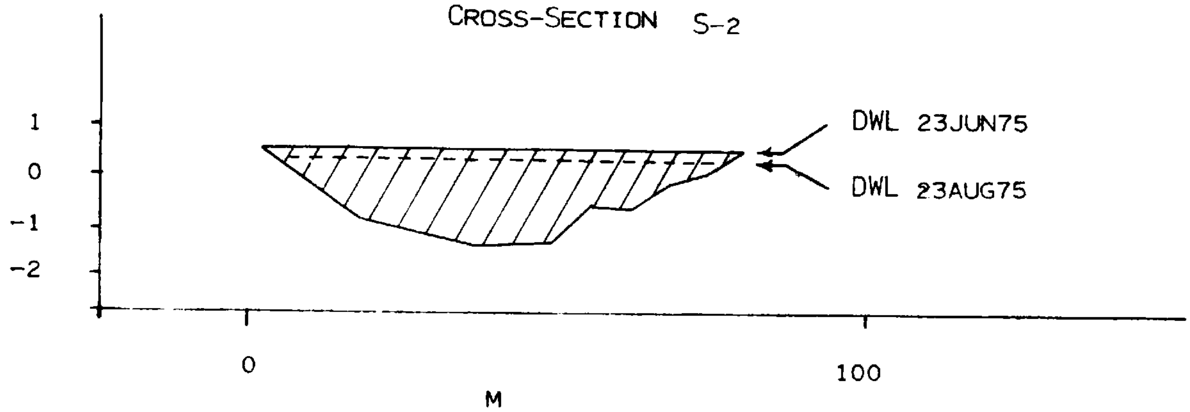
Je 7 - 4-inch diameter holes in ice at outflow from lake, whirlpools of water draining through them from surface puddles into river.

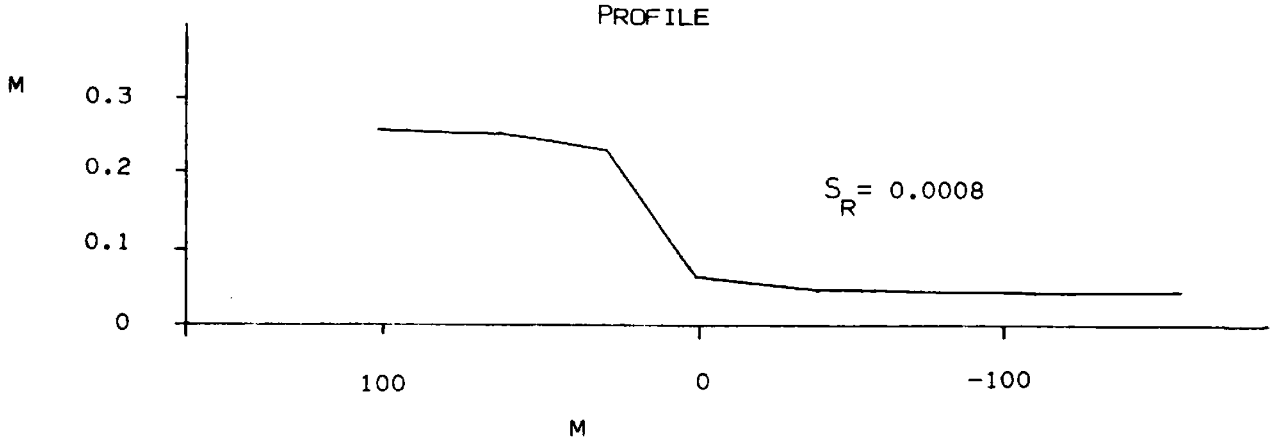
Je 8 - River appears to be flowing at low rate under the ice, ice is floating up from bottom of river.
- Extensive surface flow at edges.

Je 12 - Large amount of flow through channels beneath river and lake ice at outflow but main flow from lake appears to be blocked.

Je 13 - River flowing fully at outflow, downstream pools still ice-covered but swifter areas all ice-free.

Je 18 - Pools still covered with ice thick enough to walk on.





HYDRAULIC MEASUREMENTS

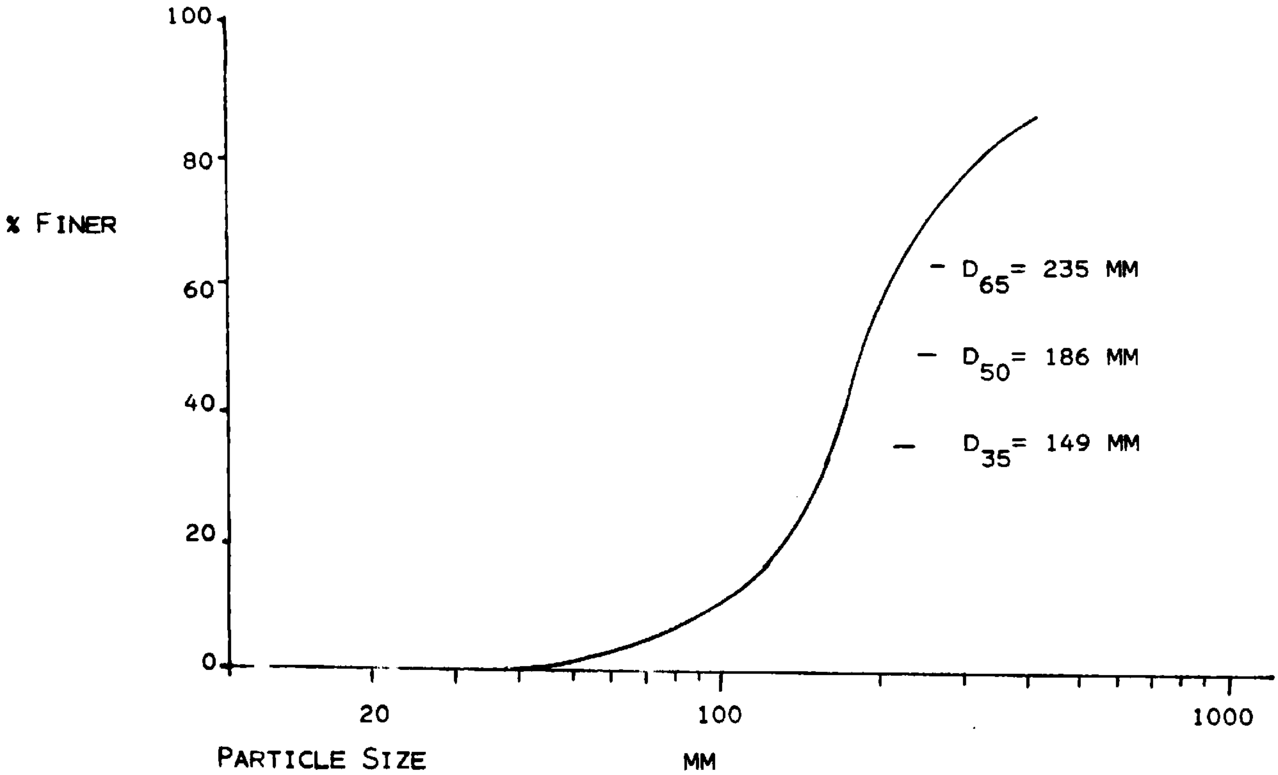
DATE	WIDTH	AREA	MEAN VELOCITY	GAUGE HEIGHT	DISCHARGE
23JUN75	76.2 M	83.2 M^2	0.57 M/S	0.40 M	47.3 M^3/S
23AUG75	76.2 M	79.4 M^2	0.42 M/S	0.22 M	33.4 M^3/S

	STAGE	AREA	HYDRAULIC RADIUS
HWMK	--	--	N/A

PERMAFROST

NO PROBE TAKEN

PARTICLE SIZE DISTRIBUTION (BED MATERIAL) S-2

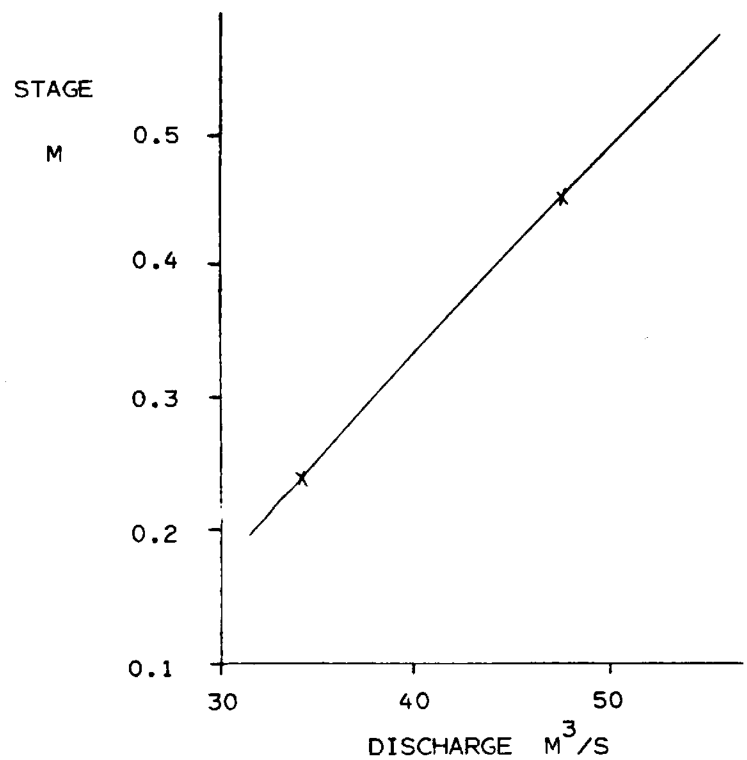


STRICHLER'S ''N'', $N = 0.013\ (D_{50})^{1/6}$ 0.031

DAILY DISCHARGE (M^3/S) S-2

DAY	JUN 75	JUL 75	AUG 75
1			
2			
3			38.2
4		46.4	
5			
6			
7			
8		45.9	37.1
9			
10			
11		46.4	
12			
13			
14		44.7	
15			
16		44.2	
17			35.7
18			
19			35.1
20			34.8
21	43.3		34.3
22	44.7		33.4
23	47.3		33.1
24	46.4		34.0
25	46.4		
26			
27	47.0		
28	47.3		32.6
29			32.8
30			
31			

STAGE - DISCHARGE CURVE



HYDRAULIC MEASUREMENTS

DATE	WIDTH	AREA	$DEPTH_{MAX}$	DISCHARGE
23JUN75	73.5 M	83 M^2	1.8 M	47.3 M^3/S
23AUG75	74.4 M	79 M^2	1.8 M	32.8 M^3/S

STATION NO. 10TD003 WEST CRESWELL RIVER ABOVE CRESWELL BAY S-3

RIVER MOUTH -	72°54'	93°31'
STUDY SITE -	73°02'	94°13'

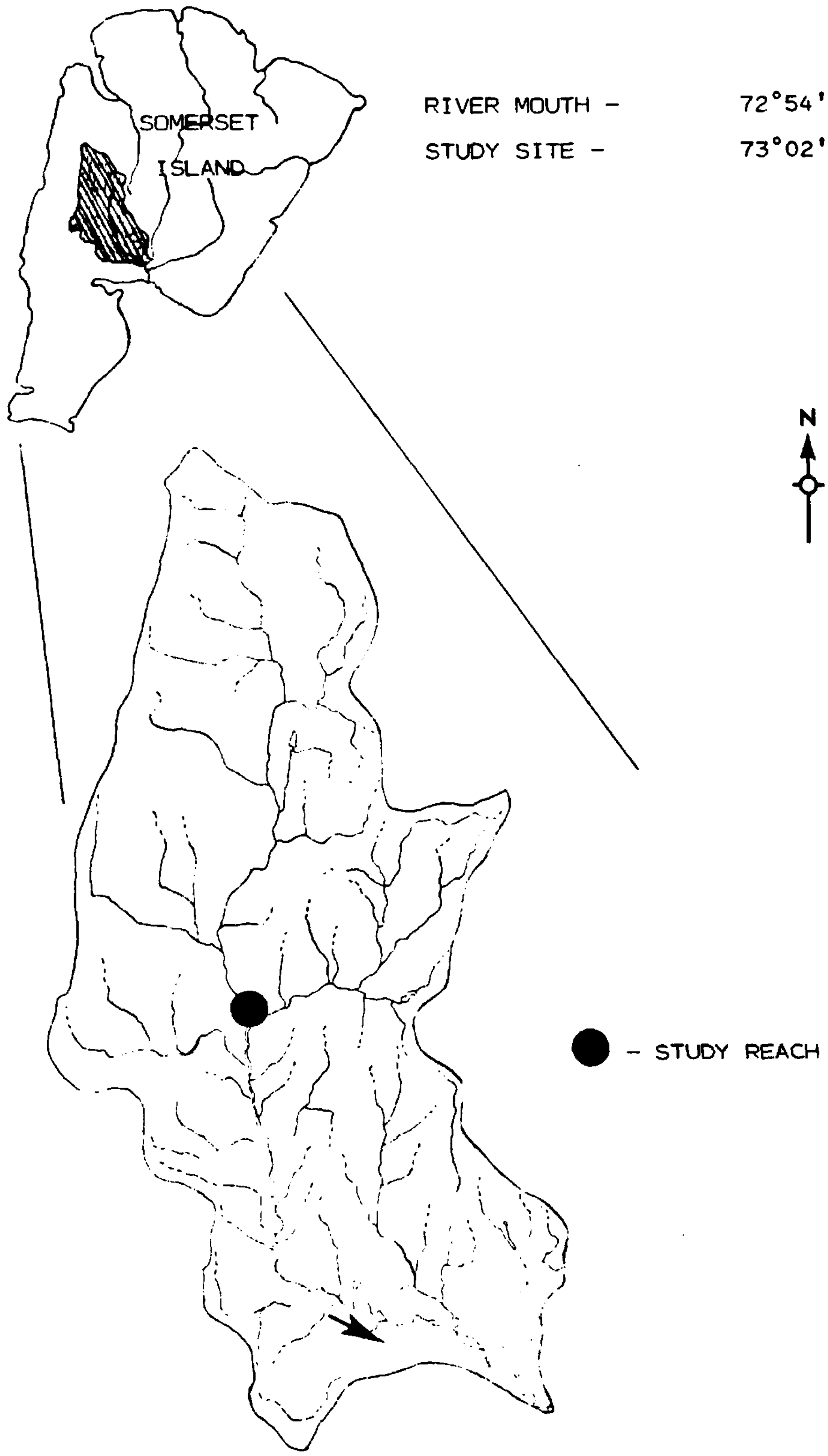
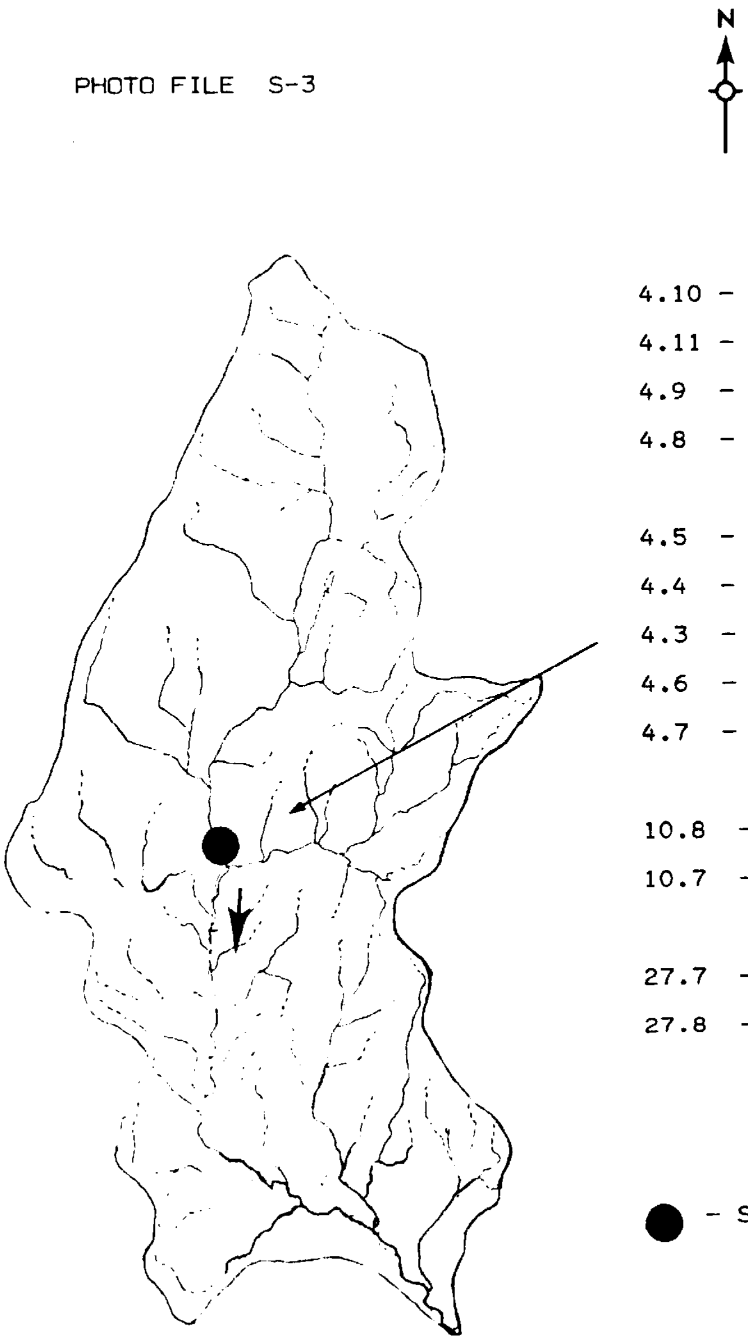


PHOTO FILE S-3



4.10 - AERIAL OBLIQUE
4.11 - AERIAL OBLIQUE
4.9 - AERIAL OBLIQUE
4.8 - AERIAL OBLIQUE

4.5 - DOWNSTREAM VIEW
4.4 - UPSTREAM VIEW
4.3 - CROSS SECTION
4.6 - BED MATERIAL
4.7 - VALLEY PLAIN

10.8 - CLAY BED
10.7 - CLAY BED

27.7 - UPSTREAM VIEW
27.8 - DOWNSTREAM VIEW

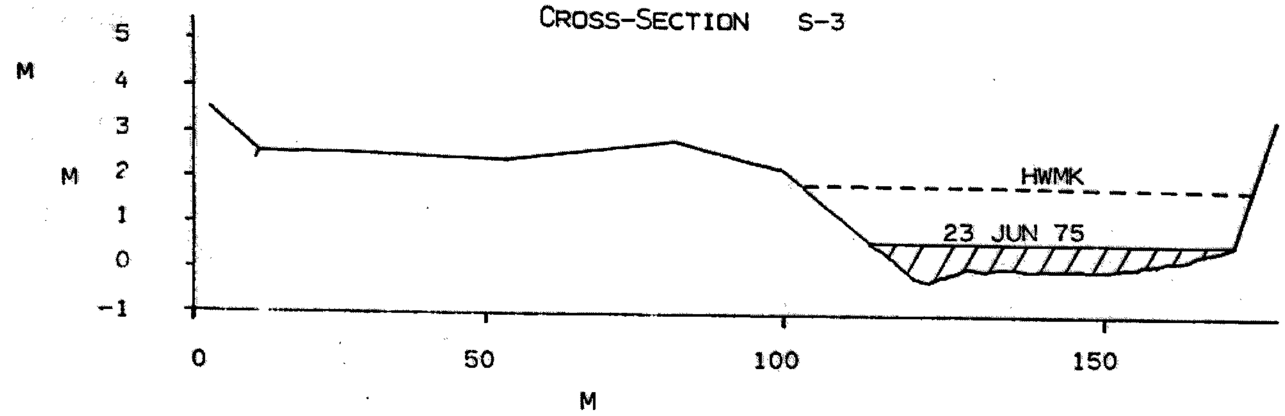
● - STUDY REACH

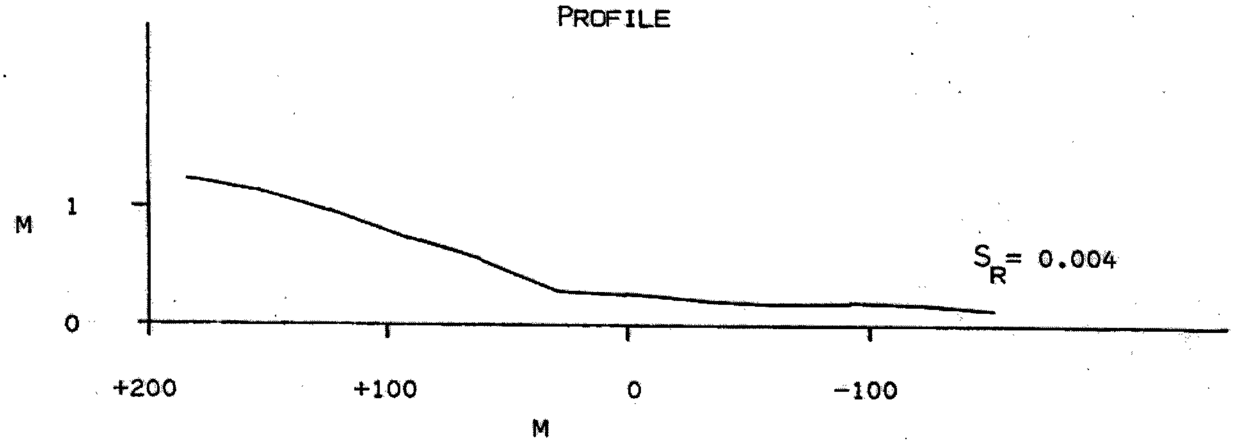
WEST CRESWELL RIVER S-3

Most of this river basin lies on the interior plateau of central Somerset Island. Immediately to the west is the northerly trending remnant of the Canadian Shield with its much greater relief. Surface features in the basin lead one to assume morainic origin for materials. Although the area is of fairly low relief, several higher hills dominate the landscape. In the vicinity of the study reach, no apparent valley exists and local relief is less than 50 metres. The sinuous river channel is armoured with cobble size material — much finer materials exist in the banks. Slopes are variable although they generally are quite gentle. A snowbed, on a hillside bordering the channel, has impeded downslope mass movement and delineated the perennial lower border of the bed as a change in slope of the channel wall. In comparing aerial photography made ten years ago with 1975 aerial obliques, snowbed location and their extent were remarkably similar; indeed, they were the dominant surficial feature and allowed us to locate our study reach precisely on vertical photography, and thus on a standard 1:250000 map. Rill wash and dry particle movement was noted on the steeper channel banks. Some moss and lichen growth occurred upslope of the active flood plain. In the same area, a frost boil, of fine silts with free-standing water on its surface (quick condition), was investigated. On June 27, the permafrost horizon in the boil was 0.5 metres below the surface. Data such as this suggests the presence of ground ice although none was seen. The overall impression is one of vertical and lateral stability.

LATITUDE AT BASIN MOUTH[1]	72° 54'
LONGITUDE AT BASIN MOUTH[1]	93° 31'
DRAINAGE AREA	947 KM^2
BASIN PERIMETER	168 KM
CIRCULARITY RATIO	0.422
STREAM ORDER	4
BIFURCATION RATIO	4.29
LENGTH OF PRINCIPAL CHANNEL	40 KM
SLOPE OF PRINCIPAL CHANNEL	0.008
BASIN WIDTH	30.5 KM
BASIN LENGTH	58.7 KM
ELONGATION RATIO	0.591
HYPSOMETRIC INTEGRAL	0.535
HYPSOMETRIC COEFFICIENT	-0.504
BASIN RELIEF	472 M
MINIMUM ELEVATION	30 M
MAXIMUM ELEVATION	503 M
AVERAGE ELEVATION	267 M
MEDIAN ELEVATION	247 M
BASIN ASPECT	S

1 - BASED ON 1:250,000 MAPS





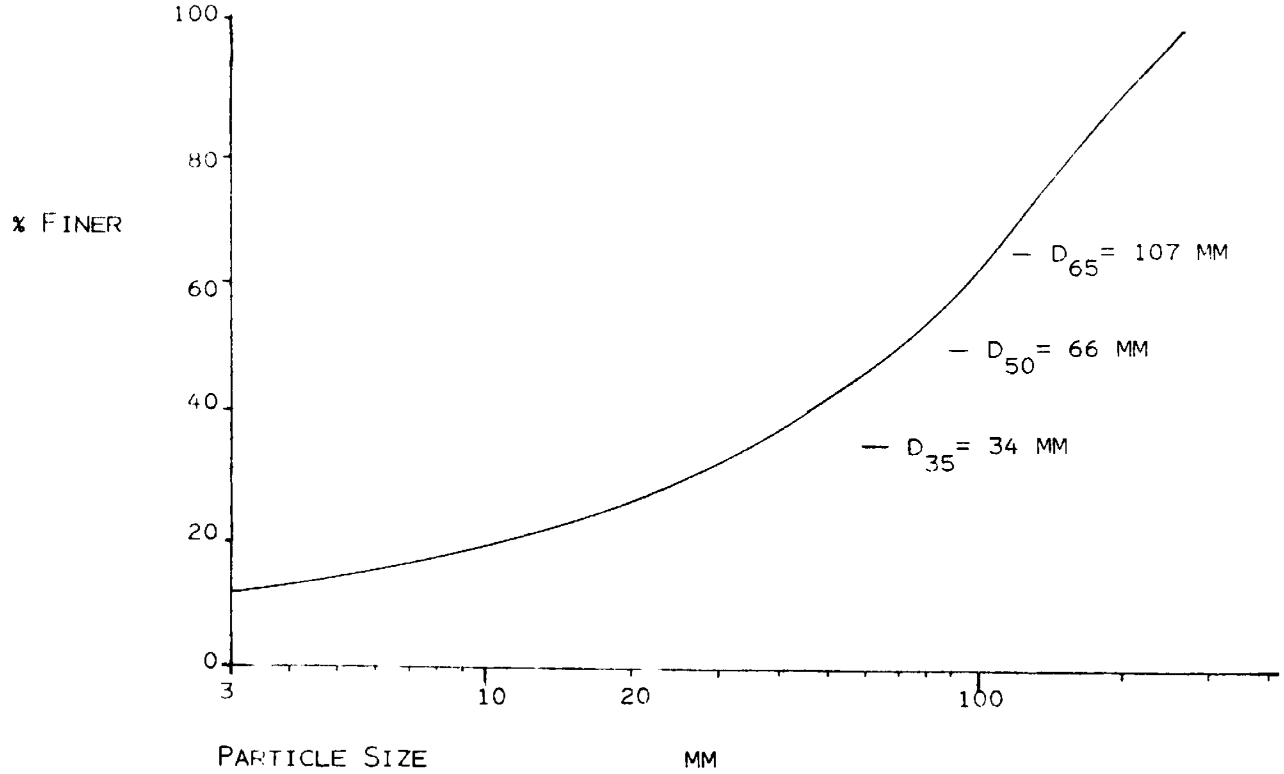
HYDRAULIC MEASUREMENTS

DATE	WIDTH	AREA	MEAN VELOCITY	GAUGE HEIGHT	DISCHARGE
23JUN75	63.1 M	32.2 M^2	0.69 M/S	0.75 M	22.3 M^3/S
27JUN75	65.5 M	16.6 M^2	0.59 M/S	0.59 M	9.8 M^3/S
26AUG75	25.6 M	2.4 M^2	0.20 M/S	0.16 M	0.5 M^3/S

	STAGE	AREA	HYDRAULIC RADIUS
HWMK	1.72 M	103 M^2	1.16 M

PERMAFROST 27 JUN 75 - 0.5 M IN FROST BOIL ON VALLEY PLAIN

PARTICLE SIZE DISTRIBUTION (BED MATERIAL) S-3

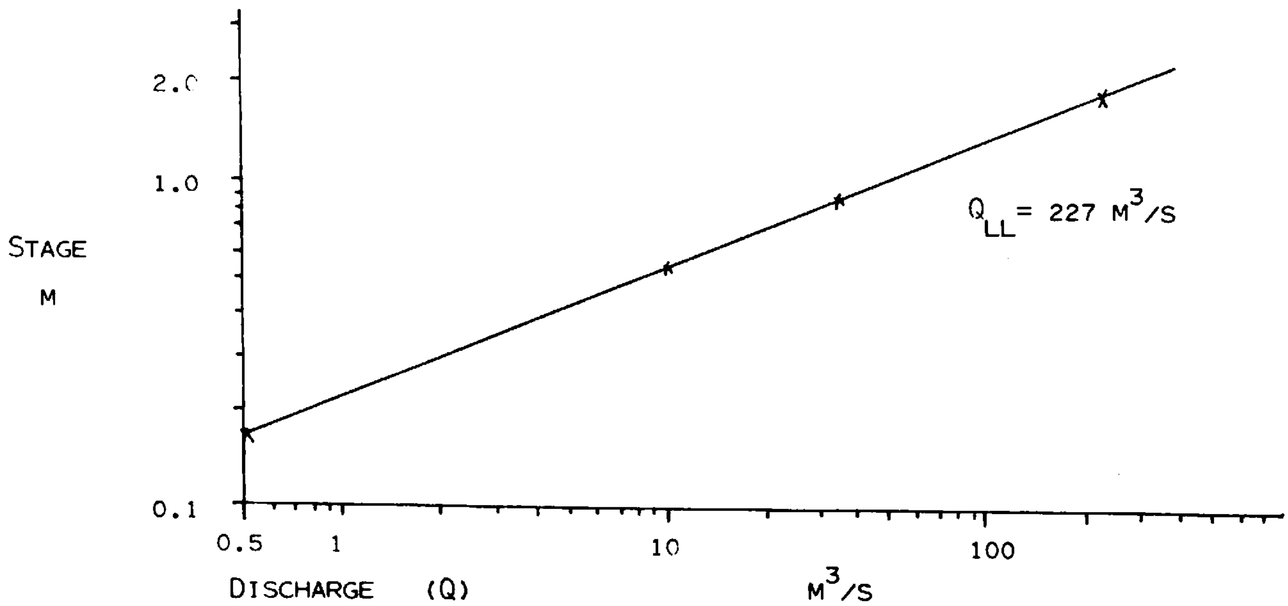


STRICHLER'S ''N'', $N = 0.013\ (D_{50})^{1/6}$ 0.027

SUSPENDED SEDIMENT CONCENTRATION 23JUN75 22 MG/L

ESTIMATED DISCHARGE AT HIGH WATER MARK   S-3

LOG-LOG EXTENSION



MANNING EQUATION

$$Q = \frac{A\,R^{2/3}\,S^{1/2}}{N} = \frac{(103)(1.15)^{2/3}(0.004)^{1/2}}{0.027}$$

$$= 265\ M^3/S$$

BEST ESTIMATE

230 M^3/S

STATION NO. 10TD004 ASTON RIVER ABOVE ASTON BAY S-4

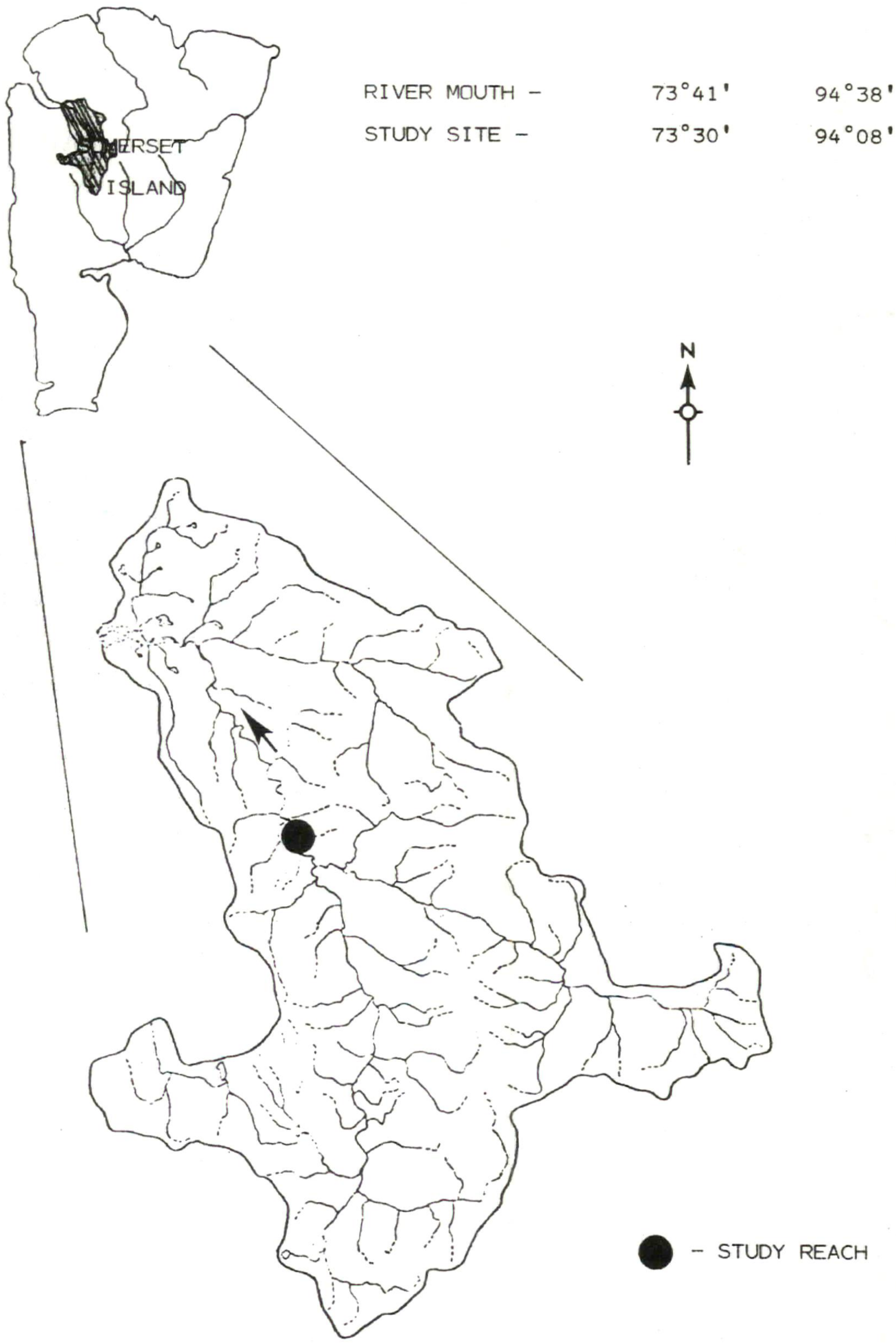
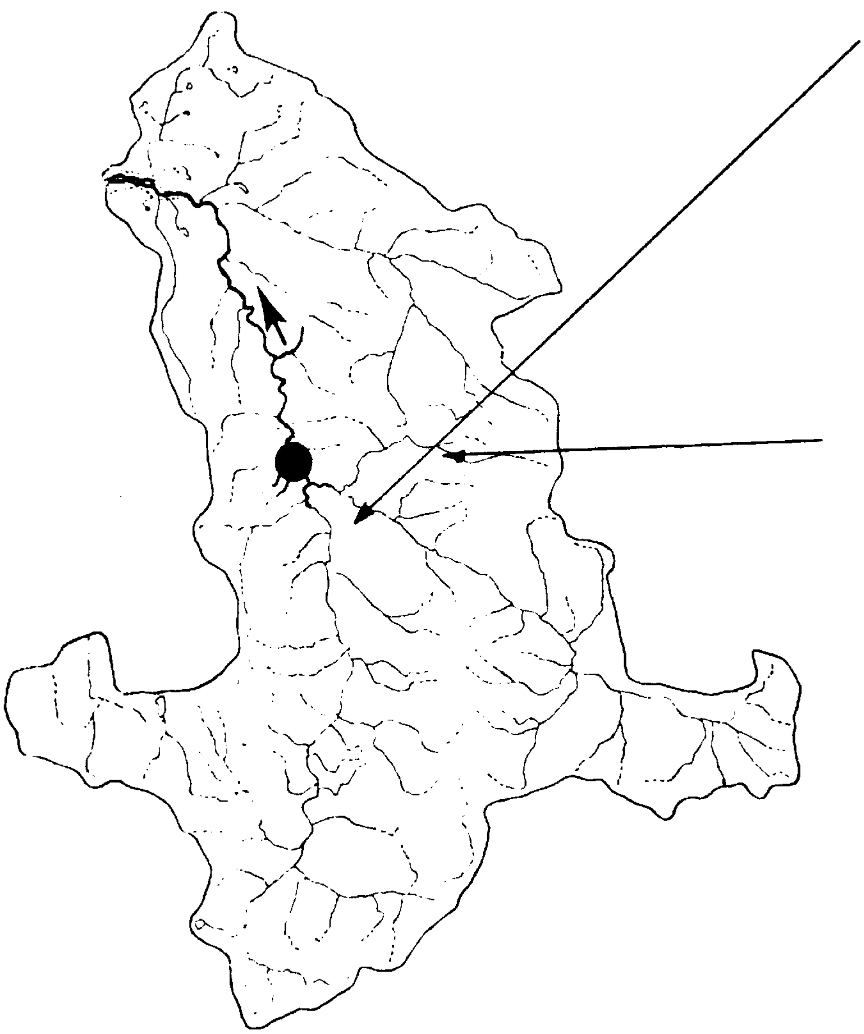


PHOTO FILE S-4



3.20 - HEADWATER REACH
3.21 - HEADWATER REACH

37.6 - DOWNSTREAM VIEW
27.5 - UPSTREAM VIEW
27.4 - CROSS SECTION

3.15 - AERIAL OBLIQUE
3.16 - AERIAL OBLIQUE
3.17 - STRUCTURAL FAULT
2.21 - UPSTREAM VIEW
2.19 - CROSS SECTION
2.20 - DOWNSTREAM VIEW
3.5 - RAPIDS - UPPER END OF REACH
3.2 - ACROSS FLOOD PLAIN

3.10 - BED MATERIAL
3.1 - L.B. TO VALLEY WALL

● - STUDY REACH

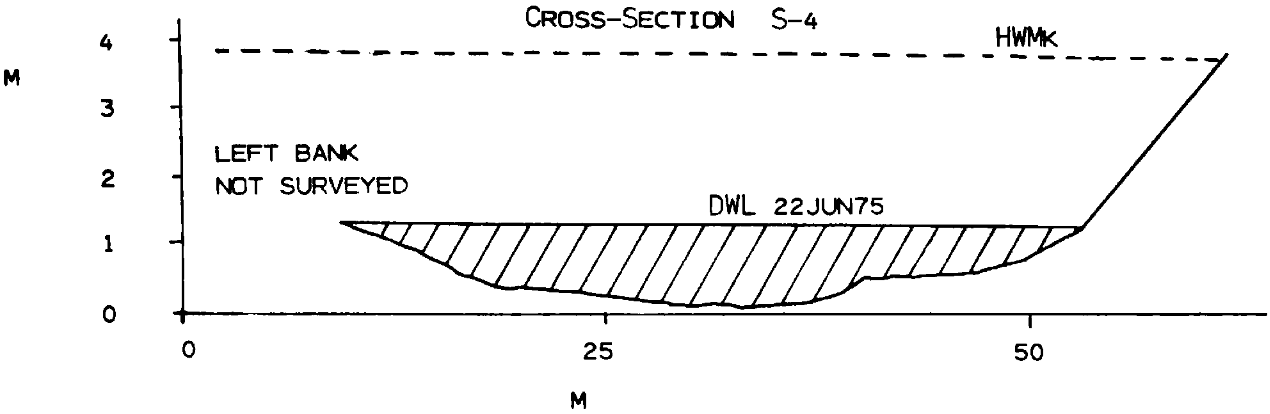
ASTON RIVER S-4

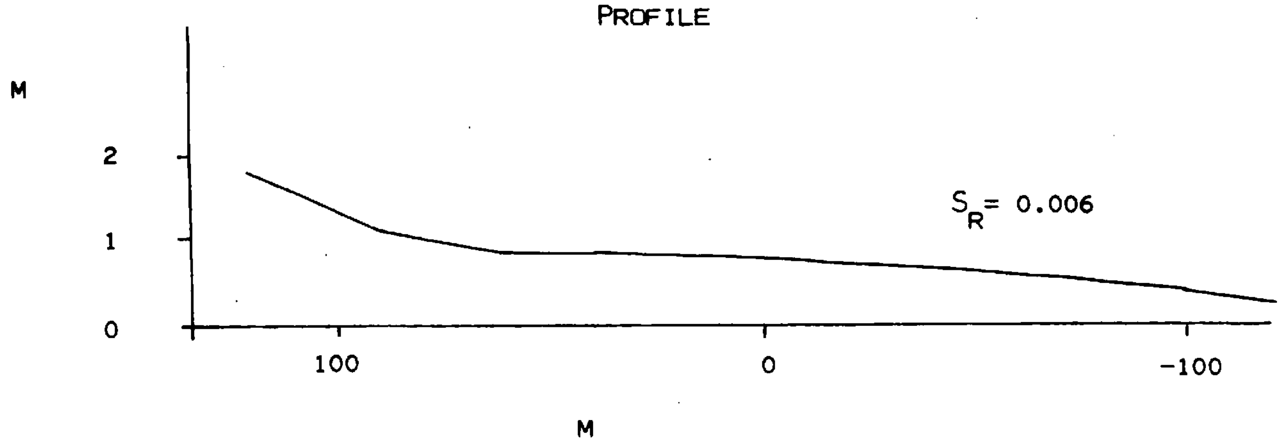
The young V-valley containing the Aston River is incised into the interior Somerset plateau of limestone-dolomite to a depth of 100-150 metres in the vicinity of our study reach. Valley walls of colluvium, sloped at roughly 32-34° alternate with bedrock cliffs. Downslope particle movement is evident. Stream channel flows could generally be described as turbulent where colluvial detritus has been deposited on the channel bed. Alluvial material was also present in our study reach just below a sharp bend in the river. A substantial floodplain on the inside of the bend was surfaced by coarse gravels and cobbles, mainly limestone or dolomite. A tributary on the right bank has developed a bar of cobble-gravel material in the main channel. The right river bank in the reach is restricted by the riser of a fragmentary terrace. The river pattern is irregular and where flow is not of turbulent nature, exhibits a riffle-pool sequence, typical of gravel bed rivers. Valley walls appear to be the area of greatest instability.

MORPHOMETRIC DATA S-4

LATITUDE AT BASIN MOUTH[1]	73° 41'
LONGITUDE AT BASIN MOUTH[1]	94° 38'
DRAINAGE AREA	1523 KM^2
BASIN PERIMETER	241 KM
CIRCULARITY RATIO	0.324
STREAM ORDER	4
BIFURCATION RATIO	4.87
LENGTH OF PRINCIPAL CHANNEL	62 KM
SLOPE OF PRINCIPAL CHANNEL	0.006
BASIN WIDTH	52.0 KM
BASIN LENGTH	59.5 KM
ELONGATION RATIO	0.736
HYPSOMETRIC INTEGRAL	0.580
HYPSOMETRIC COEFFICIENT	-0.759
BASIN RELIEF	503 M
MINIMUM ELEVATION	0 M
MAXIMUM ELEVATION	503 M
AVERAGE ELEVATION	251 M
MEDIAN ELEVATION	294 M
BASIN ASPECT	N W

1 - BASED ON 1:250,000 MAPS





HYDRAULIC MEASUREMENTS

DATE	WIDTH	AREA	MEAN VELOCITY	GAUGE HEIGHT	DISCHARGE
22JUN75	45.7 M	37.0 M^2	1.07 M/S	1.34 M	39.7 M^3/S
28JUN75	39.0 M	20.3 M^2	0.55 M/S	0.79 M	11.2 M^3/S
26AUG75	8.8 M	1.6 M^2	0.27 M/S	0.21 M	0.4 M^3/S

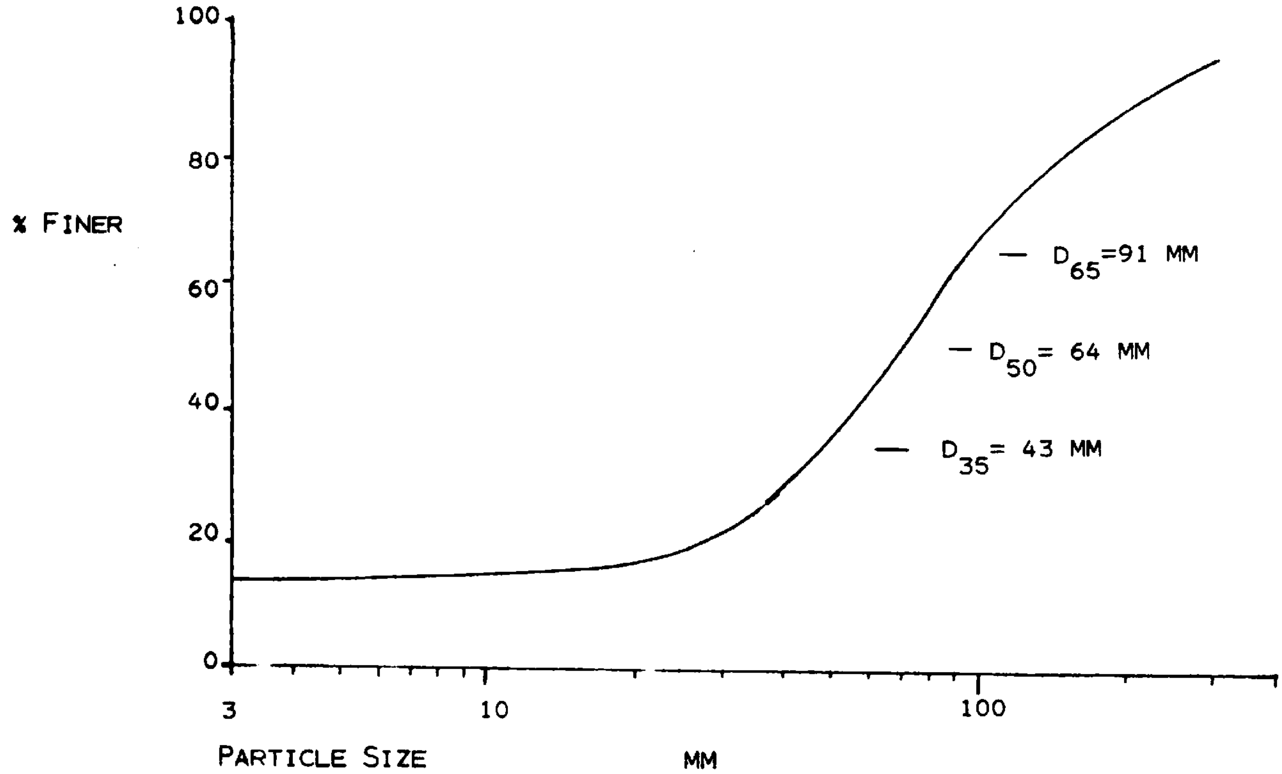
	STAGE	AREA	HYDRAULIC RADIUS
HWMK	4.08 M	--	--

PERMAFROST

22 JUN 75 - 0.5 M AT WATER'S EDGE , L.B.

PARTICLE SIZE DISTRIBUTION (BED MATERIAL) S-4

GRID BY NUMBER

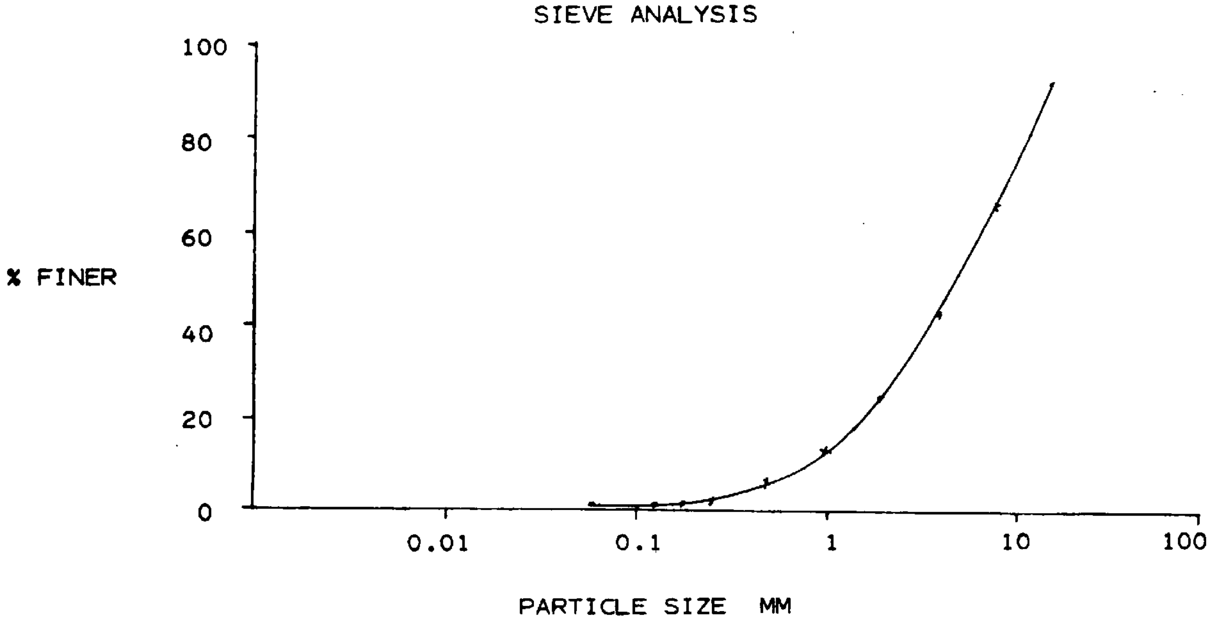


STRICHLER'S ''N'', $N = 0.013 (D_{50})^{1/6}$ 0.026

SUSPENDED SEDIMENT CONCENTRATION 22JUN75 26 MG/L

PARTICLE SIZE DISTRIBUTION (0.3 M BELOW SURFACE)

SIEVE ANALYSIS



STATION NO. 10TD005 CUNNINGHAM RIVER ABOVE CUNNINGHAM INLET S-5

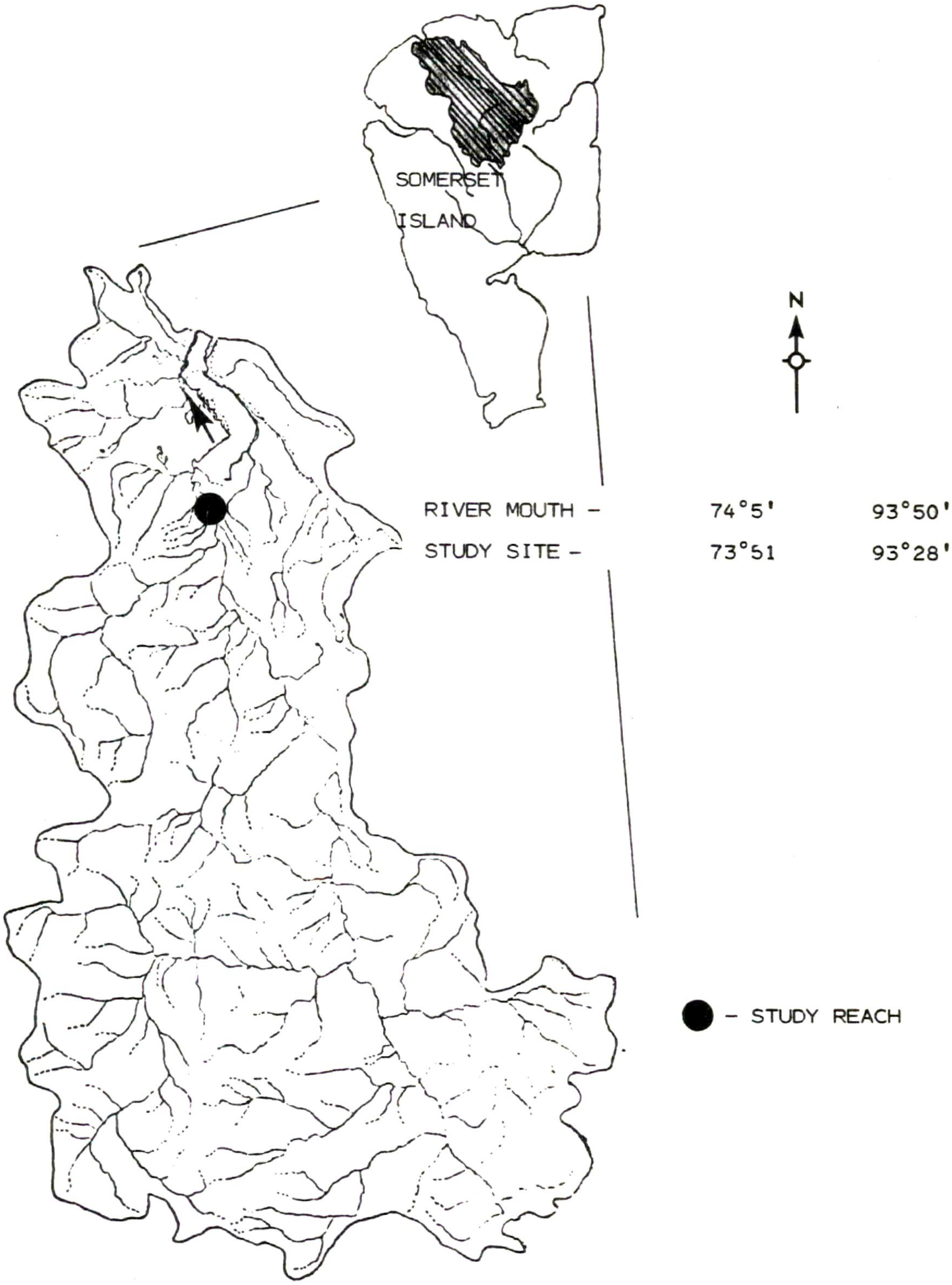
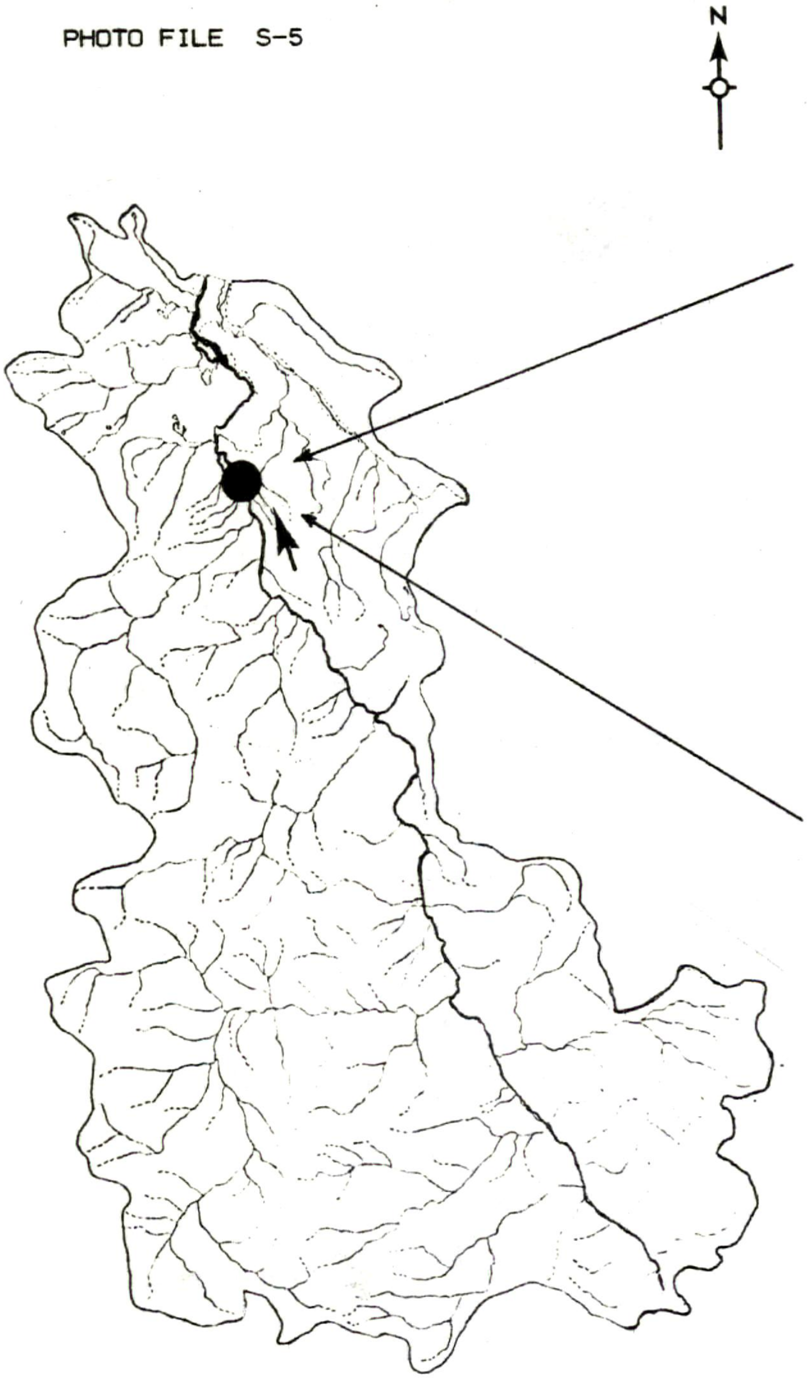


PHOTO FILE S-5



27.1 - UPSTREAM VIEW

27.3 - CROSS SECTION

27.2 - DOWNSTREAM VIEW

1.16 - AERIAL OBLIQUE
UPSTREAM

1.15 - AERIAL OBLIQUE
DOWNSTREAM

1.18 - DIAGONAL DOWNSTREAM
L.B. TO R.B.

1.17 - AERIAL OBLIQUE
L.B. TO R.B.

2.3 - UPSTREAM FROM R.B.

2.2 - DOWNSTREAM FROM R.B.

2.10 - COULEE IN L.B.
AT CROSS SECTION

2.11 - BED MATERIAL

2.13 - SAND DEPOSIT R.B.

1.14 - CUNNINGHAM VALLEY

1.12 - TRIBUTARY
(ENTRENCHED MEANDER)

● - STUDY REACH

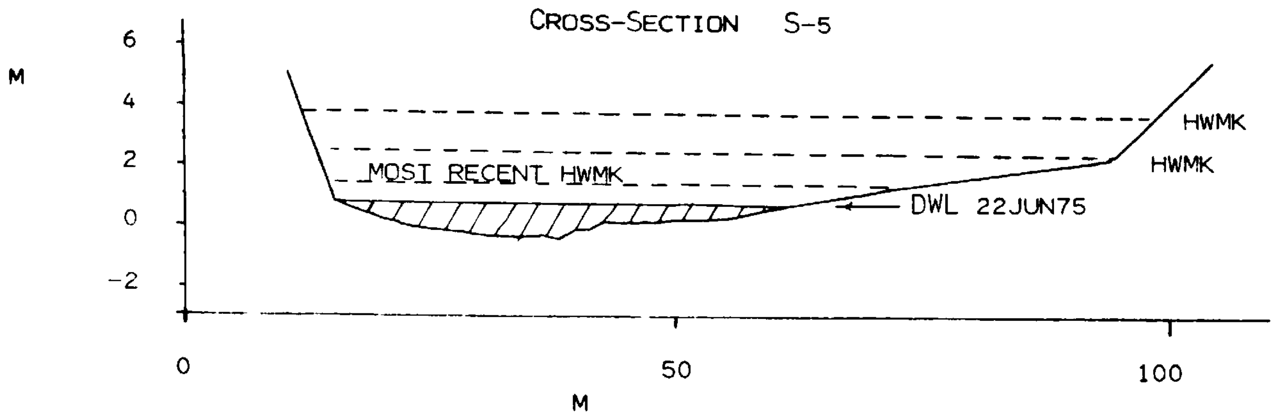
CUNNINGHAM RIVER S-5

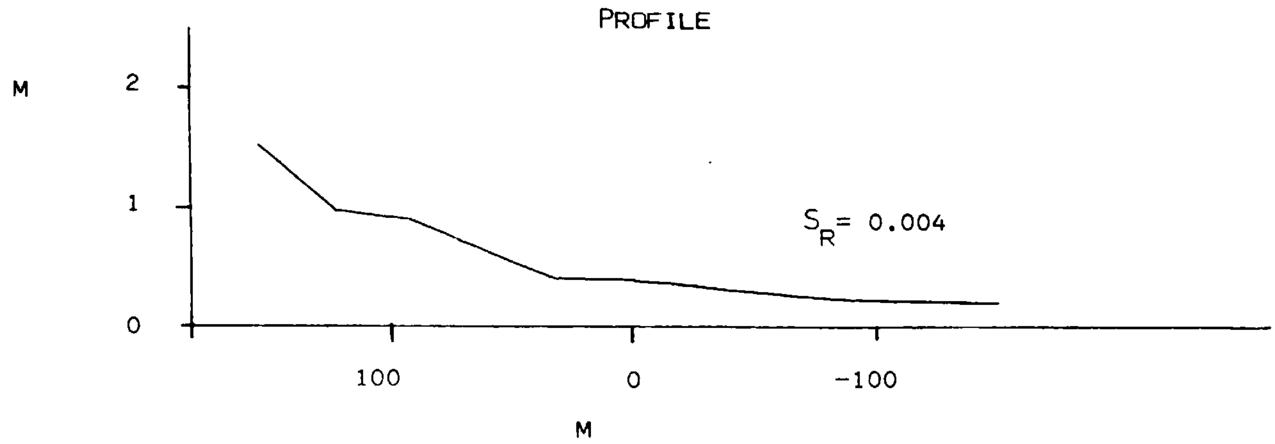
This stream drains the northern Somerset plateau composed mainly of limestone-dolomite in the investigated reach. Weathered detritus thinly mantles this consolidated bedrock. Vegetation is limited to isolated clumps of saxifrage — a desert-like appearance. The river has incised the plateau to a depth in excess of 100 metres, and upstream of our study reach exhibits textbook samples of entrenched meander systems. The characteristic young valley has many vertical bedrock walls with lower talus slopes extending directly into the river channel. Angle of repose of the colluvium approximates 32°. Downslope particle movement was constant in June. Fragmentary terraces, possible paired, indicate continued post-glacial channel degradation. On the terrace at site, nivation hollows were observed at the foot of the talus slope. Terrace material, apparently alluvial in origin, graded as sand pebble mixtures and was dramatically different from the colluvium on valley walls. The left riverbank consisted of bedrock — the right bank contained a narrow flood plain bordered by the terrace riser. Floodplain surface material was coarse gravel to large cobble in size and contained many stone types (unlike valley walls). The flow pattern was quite uniform with boils and irregularities. Of interest was the commencement of ground-water discharge through fissures of the bedrock left channel bank during the course of our survey (early afternoon). This no doubt would be the principal operative process producing diurnal flow fluctuations of the magnitude observed on Allen River, Cornwallis Island. The areas of greatest instability appear to be the valley walls.

MORPHOMETRIC DATA S-5

LATITUDE AT BASIN MOUTH[1]	74° 05'
LONGITUDE AT BASIN MOUTH[1]	93° 50'
DRAINAGE AREA	2634 KM^2
BASIN PERIMETER	319 KM
CIRCULARITY RATIO	0.326
STREAM ORDER	5
BIFURCATION RATIO	4.42
LENGTH OF PRINCIPAL CHANNEL	94 KM
SLOPE OF PRINCIPAL CHANNEL	0.004
BASIN WIDTH	51.4 KM
BASIN LENGTH	83.2 KM
ELONGATION RATIO	0.692
HYPSOMETRIC INTEGRAL	0.678
HYPSOMETRIC COEFFICIENT	-0.659
BASIN RELIEF	411 M
MINIMUM ELEVATION	0 M
MAXIMUM ELEVATION	411 M
AVERAGE ELEVATION	206 M
MEDIAN ELEVATION	291 M
BASIN ASPECT	N

1 – BASED ON 1:250,000 MAPS





HYDRAULIC MEASUREMENTS

DATE	WIDTH	AREA	MEAN VELOCITY	GAUGE HEIGHT	DISCHARGE
22JUN75	47.2 M	36.9 M^2	1.32 M/S	1.00 M	48.7 M^3/S
26AUG75	28.7 M	3.4 M^2	0.28 M/S	0.21 M	1.0 M^3/S

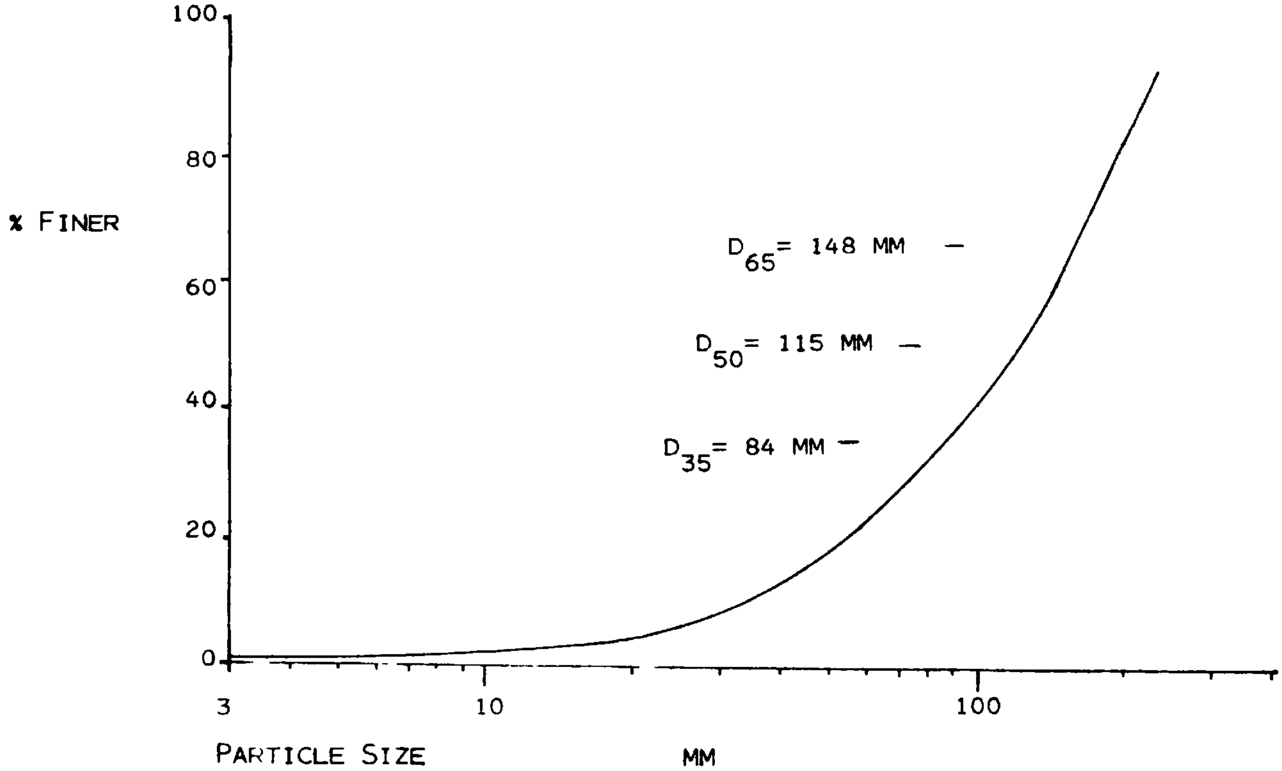
	STAGE	AREA	HYDRAULIC RADIUS
HWMK (MOST RECENT)	1.78 M	40 M^2	1.33 M
HWMK	3.12 M	92 M^2	2.13 M
HWMK	4.85 M	315 M^2	3.69 M

PERMAFROST

22 JUN 75 - 0.3 M ON TERRACE L.B.

PARTICLE SIZE DISTRIBUTION (BED MATERIAL) S-5

GRID BY NUMBER

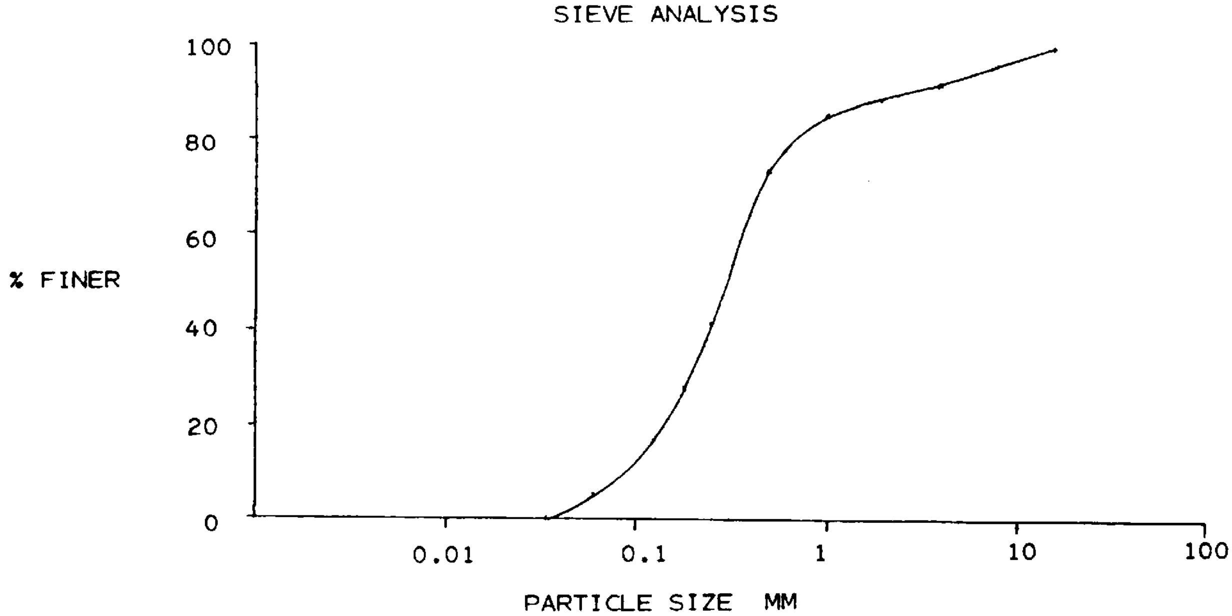


STRICHLER'S ''N'', $N = 0.013\ (D_{50})^{1/6}$ 0.029

SUSPENDED SEDIMENT CONCENTRATION 22JUN75 29 MG/L

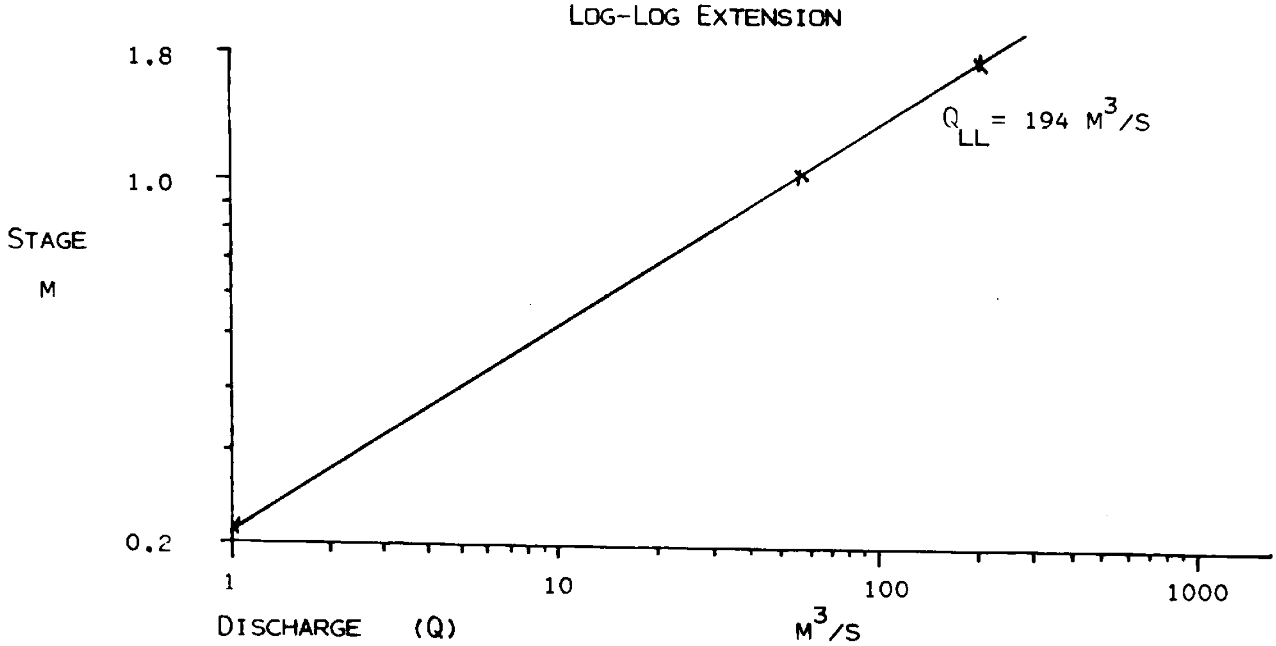
PARTICLE SIZE DISTRIBUTION (0.3 M BELOW SURFACE)

SIEVE ANALYSIS



ESTIMATED DISCHARGE AT HIGH WATER MARK S-5

LOG-LOG EXTENSION



MANNING EQUATION

$$Q = \frac{A\ R^{2/3}\ S^{1/2}}{N} = \frac{(40)(1.33)^{2/3}(0.004)^{1/2}}{0.029}$$

$$= 105\ M^3/S$$

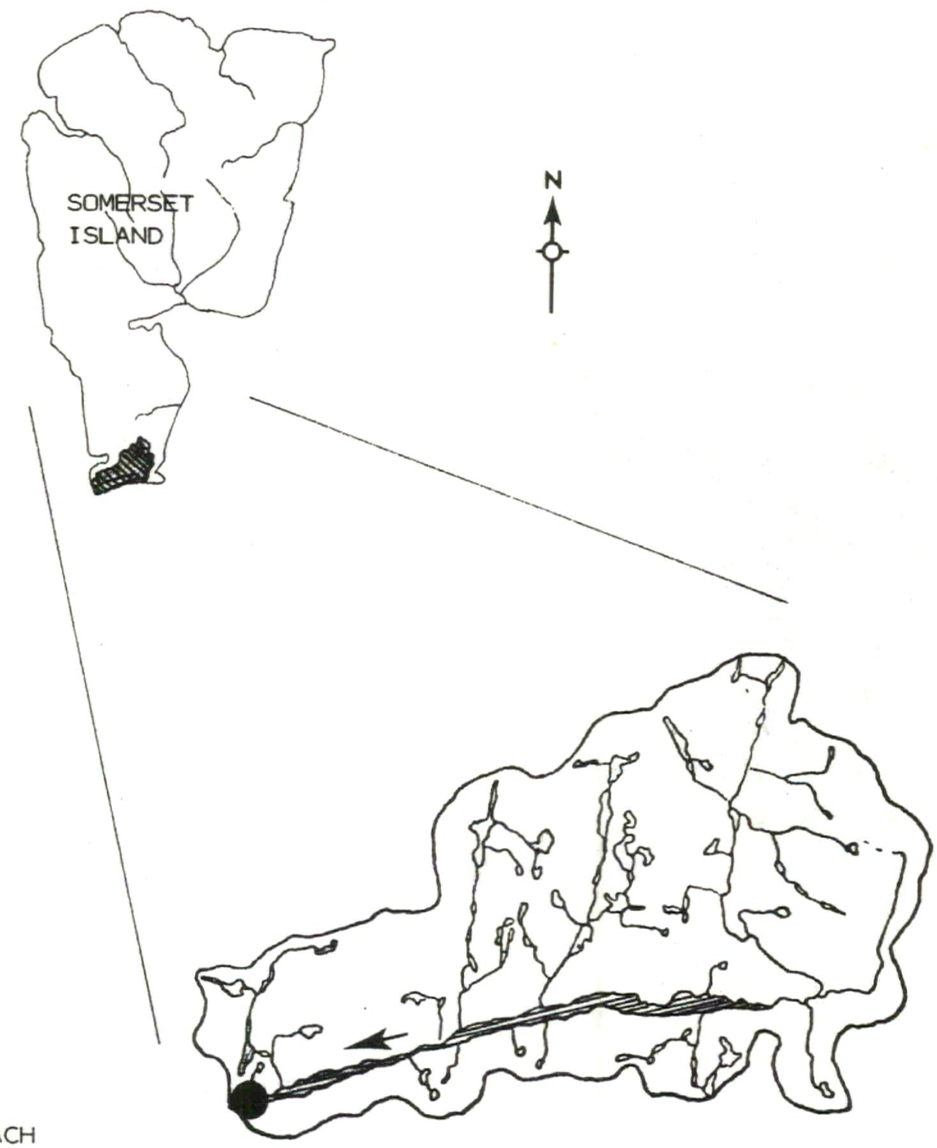
BEST ESTIMATE

175 M^3/S

STATION NO. 10TD006 UNNAMED RIVER BELOW MACGREGOR LAIRD LAKE S-6

RIVER MOUTH – 72°00' 95°03'

STUDY SITE – 72°00' 95°03'



● – STUDY REACH

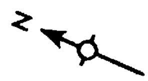
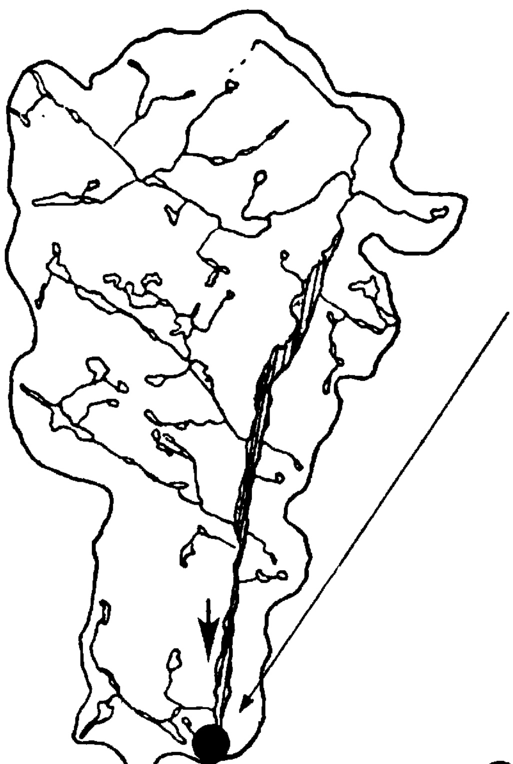


PHOTO FILE S-6



36.20 - AERIAL OBLIQUE

37.21 - CROSS SECTION

37.31 - UPSTREAM VIEW

37.41 - DOWNSTREAM VIEW

37.51 - CROSS SECTION FROM R.B.

37.61 - FLOOD PLAIN

37.71 - UPSTREAM VIEW

37.81 - DOWNSTREAM VIEW

37.91 - FLOOD PLAIN

37.10 - STRANDED ICE FLOES

37.11 - UPSTREAM VIEW

● - STUDY REACH

MacGREGOR LAIRD LAKE OUTFLOW S-6

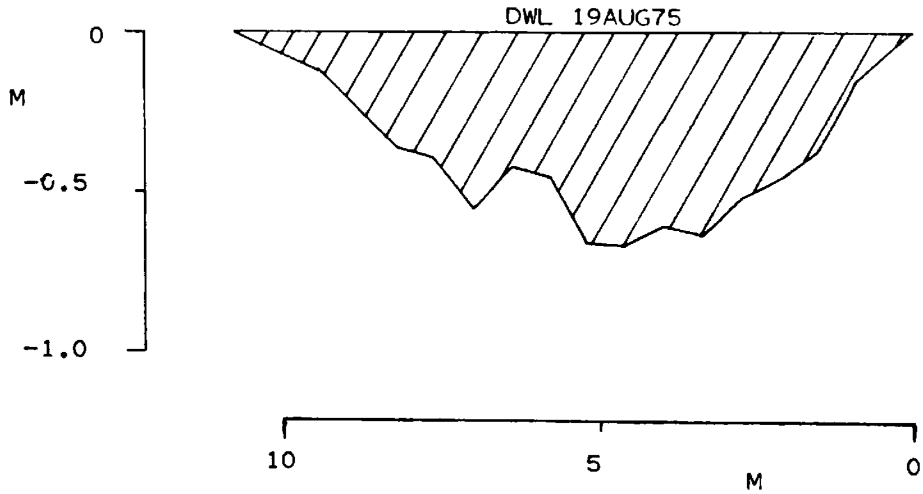
The lake and its outflow stream are located in an area of Precambrian upland with crystalline and sedimentary rocks present. The bold, many times vertical cliffs surrounding the lake and stream reach elevations of more than 200 metres above sea level. The drainage throughout the basin is structurally controlled by joint or fault lines. The lake, its outflow stream and False Strait, where the stream enters the ocean, lie in a well-developed northeast-southwest trough. Tributary streams, entering the lake or river, flow in north-south joint or fault lines. In the northeastern portion of the drainage basin, the uplands and dissected "plateaus" reach elevations of more than 400 metres above sea level. Within the study reach, the stream exhibits tumbling flow over a boulder bed and is contained by high banks of the same material. The entire outlet stream is approximately one kilometre in length and falls 32 metres from lake to ocean level as measured by altimeter. Along the stream's boulder banks, finer particles have been removed from the boulder riverbanks, but on the floodplain, gravels are found mixed with the boulders. In the estuary, local areas of sand deposition occur on the floodplain. However, as patches of moss and lichen grow in these areas of sand, it may be assumed that high water covers the floodplain for short durations only and is accompanied by low velocities. The valley plain is covered with cobbles and gravels and dispersed boulders which are derived from the valley walls. Some extensive scree slopes were observed — apparently quite stable. Fragmentary, indistinct terraces, probably of marine rather than alluvial origin, were situated along the right bank. Minor rill wash and gullying was noted along the terrace risers.

MORPHOMETRIC DATA S-6

LATITUDE AT BASIN MOUTH[1]	72°00'
LONGITUDE AT BASIN MOUTH[1]	95°03'
DRAINAGE AREA	223 KM^2
BASIN PERIMETER	70.8 KM
CIRCULARITY RATIO	0.557
STREAM ORDER	4
BIFURCATION RATIO	3.43
LENGTH OF PRINCIPAL CHANNEL	33.8 KM
SLOPE OF PRINCIPAL CHANNEL	0.013
BASIN WIDTH	14.6 KM
BASIN LENGTH	24.8 KM
ELONGATION RATIO	0.680
HYPSOMETRIC INTEGRAL	0.542
HYPSOMETRIC COEFFICIENT	-0.330
BASIN RELIEF	442 M
MINIMUM ELEVATION	0
MAXIMUM ELEVATION	442 M
AVERAGE ELEVATION	221 M
MEDIAN ELEVATION	229.8 M
BASIN ASPECT	S W

1 - BASED ON 1:250,000 MAPS

CROSS-SECTION S-6



PROFILE NOT TAKEN

HYDRAULIC MEASUREMENTS

DATE	WIDTH	AREA	MEAN VELOCITY	DISCHARGE
19AUG75	11 M	4.12 M^2	0.42 M/S	1.72 M^3/S

STATION NO. 10TC013 MARSHALL RIVER ABOVE ASSISTANCE BAY C-1

RIVER MOUTH -	74°40'	94°15'
STUDY SITE -	74°41'	94°12'

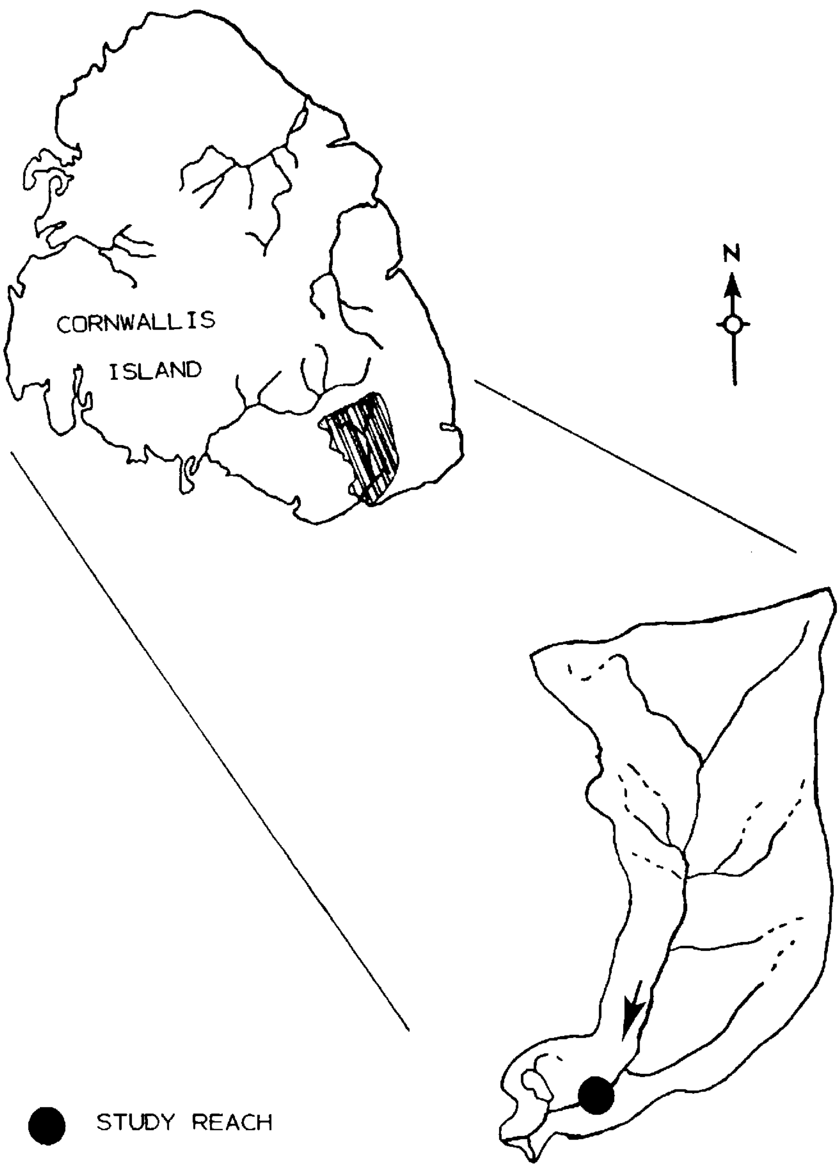
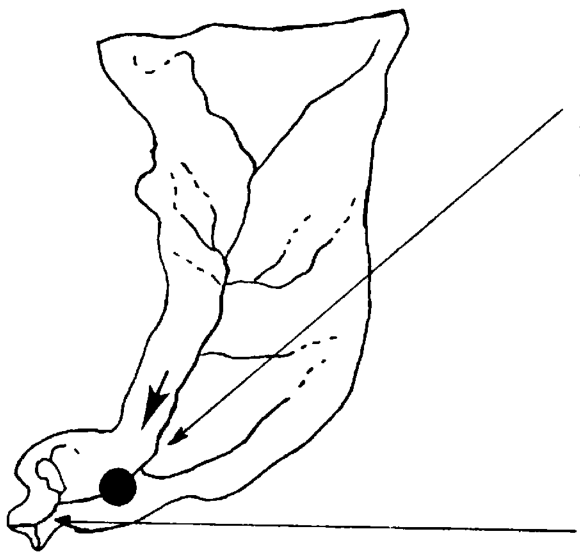


PHOTO FILE C-1



14.5 - DOWNSTREAM VIEW
14.6 - UPSTREAM VIEW
14.7 - ACROSS CHANNEL
14.9 - BED MATERIAL
29.12 - CROSS SECTION
29.13 - UPSTREAM
29.14 - UPSTREAM

14.12 - CROSS SECTION
14.11 - AERIAL OBLIQUE DOWNSTREAM
14.10 - AERIAL OBLIOUE UPSTREAM

14.14 - UPSTREAM FROM DELTA
14.13 - ALLUVIAL FAN

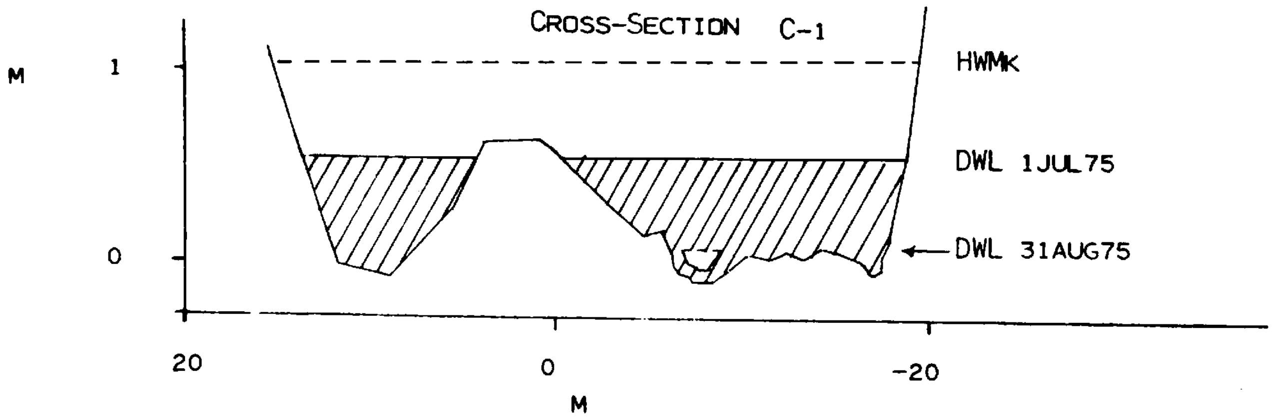
● - STUDY REACH

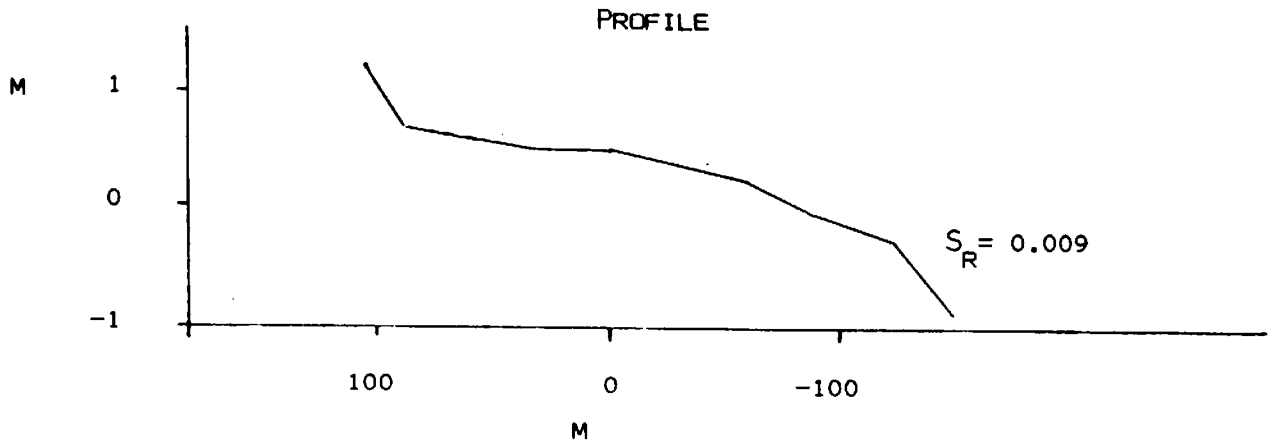
MARSHALL RIVER C-1

The headwaters of this stream drains the interior plateau region of Cornwallis Island. The upper reaches are areas of low relief and the river valley is shallow with poorly defined walls. As we approach the coast, the stream becomes sharply incised into the land surface and the resultant alluvium is deposited in the coastal lowland area in a broad, completely braided floodplain. Vegetal cover, except in poorly drained lowland, is minimal. Sedimentary rock (limestone-dolomite) on the plateau is thinly mantled by weathered, unconsolidated parent rock material. The study reach, in the incised portion of the stream system described earlier, contains a sinuous river channel, entrenched to a depth of less than 100 metres. A narrow floodplain, surfaced with gravel-cobble material, is exposed at median flows. Colluvium from the valley walls collects directly on the floodplain or in the live channel. Walls are quite steep — nearly vertical where bedrock is exposed. In the surveyed cross-section, some bedrock was noted in the stream bed. An extensive snow bed on the left channel wall promoted particle erosion by maintaining soil moisture. Considerable slide and rill wash activity was noted along the reach. Lateral and vertical movement of the channel is inhibited by bordering bedrock.

LATITUDE AT BASIN MOUTH[1]	74° 40'
LONGITUDE AT BASIN MOUTH[1]	94° 15'
DRAINAGE AREA	124 KM^2
BASIN PERIMETER	54 KM
CIRCULARITY RATIO	0.514
STREAM ORDER	3
BIFURCATION RATIO	3.52
LENGTH OF PRINCIPAL CHANNEL	18 KM
SLOPE OF PRINCIPAL CHANNEL	0.01
BASIN WIDTH	9.5 KM
BASIN LENGTH	21.1 KM
ELONGATION RATIO	0.591
HYPSOMETRIC INTEGRAL	0.757
HYPSOMETRIC COEFFICIENT	-0.628
BASIN RELIEF	259 M
MINIMUM ELEVATION	0 M
MAXIMUM ELEVATION	259 M
AVERAGE ELEVATION	130 M
MEDIAN ELEVATION	210 M
BASIN ASPECT	S

1 - BASED ON 1:250,000 MAPS





HYDRAULIC MEASUREMENTS

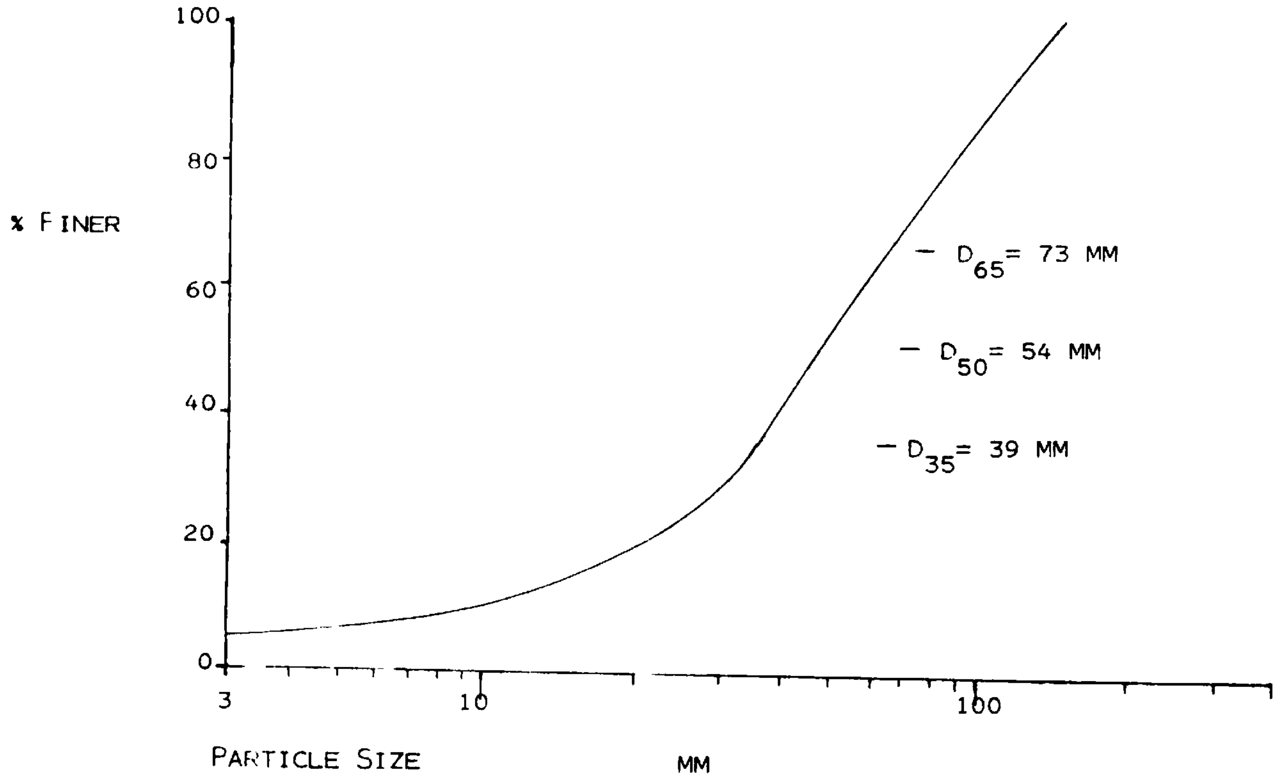
DATE	WIDTH	AREA	MEAN VELOCITY	GAUGE HEIGHT	DISCHARGE
01JUL75	18.0 M	7.7 M^2	0.84 M/S	0.50 M	6.5 M^3/S
31AUG75	1.8 M	0.2 M^2	0.20 M/S	0.05 M	0.04 M^3/S

	STAGE	AREA	HYDRAULIC RADIUS
HWMK	0.79 M	28.6 M^2	0.86 M

PERMAFROST

NO PROBE TAKEN

PARTICLE SIZE DISTRIBUTION (BED MATERIAL) C-1

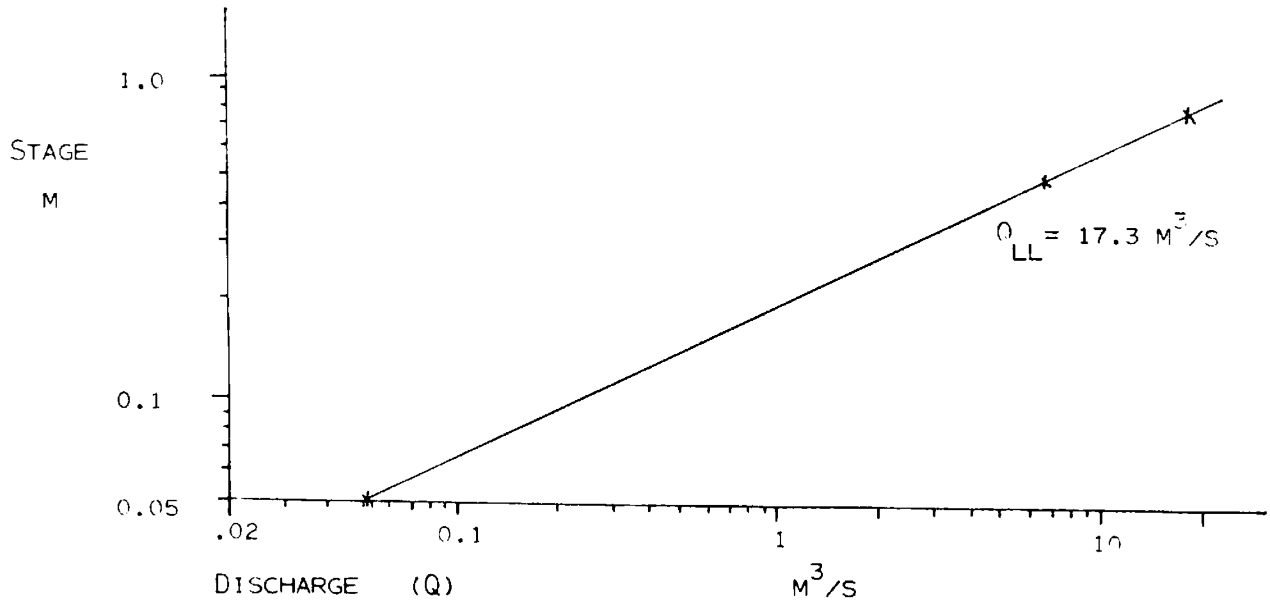


STRICHLER'S ''N'', $N = 0.013\ (D_{50})^{1/6}$ 0.026

SUSPENDED SEDIMENT CONCENTRATION 01JUL75 15 MG/L

ESTIMATED DISCHARGE AT HIGH WATER MARK C-1

LOG-LOG EXTENSION



MANNING EQUATION

$$Q = \frac{A\ R^{2/3}\ S^{1/2}}{N} = \frac{(28.6)(0.86)^{2/3}(0.009)^{1/2}}{0.026}$$

$$= 92.4\ M^3/S$$

BEST ESTIMATE

30 M^3/S

STATION NO. 10TC001 ALLEN RIVER NEAR MOUTH C-2

RIVER MOUTH - 74°50' 95°20'

STUDY SITE - 74°50' 95°04'

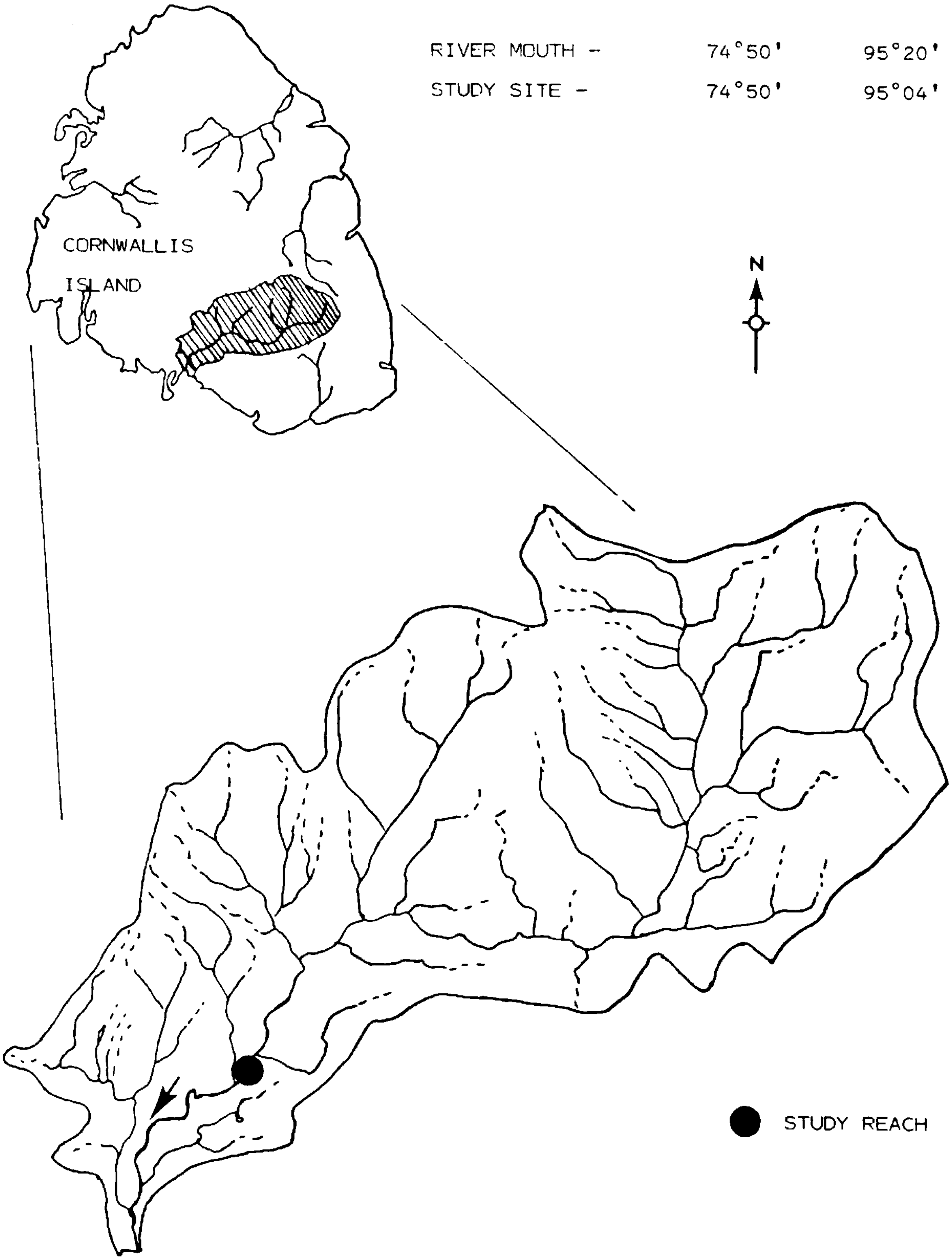
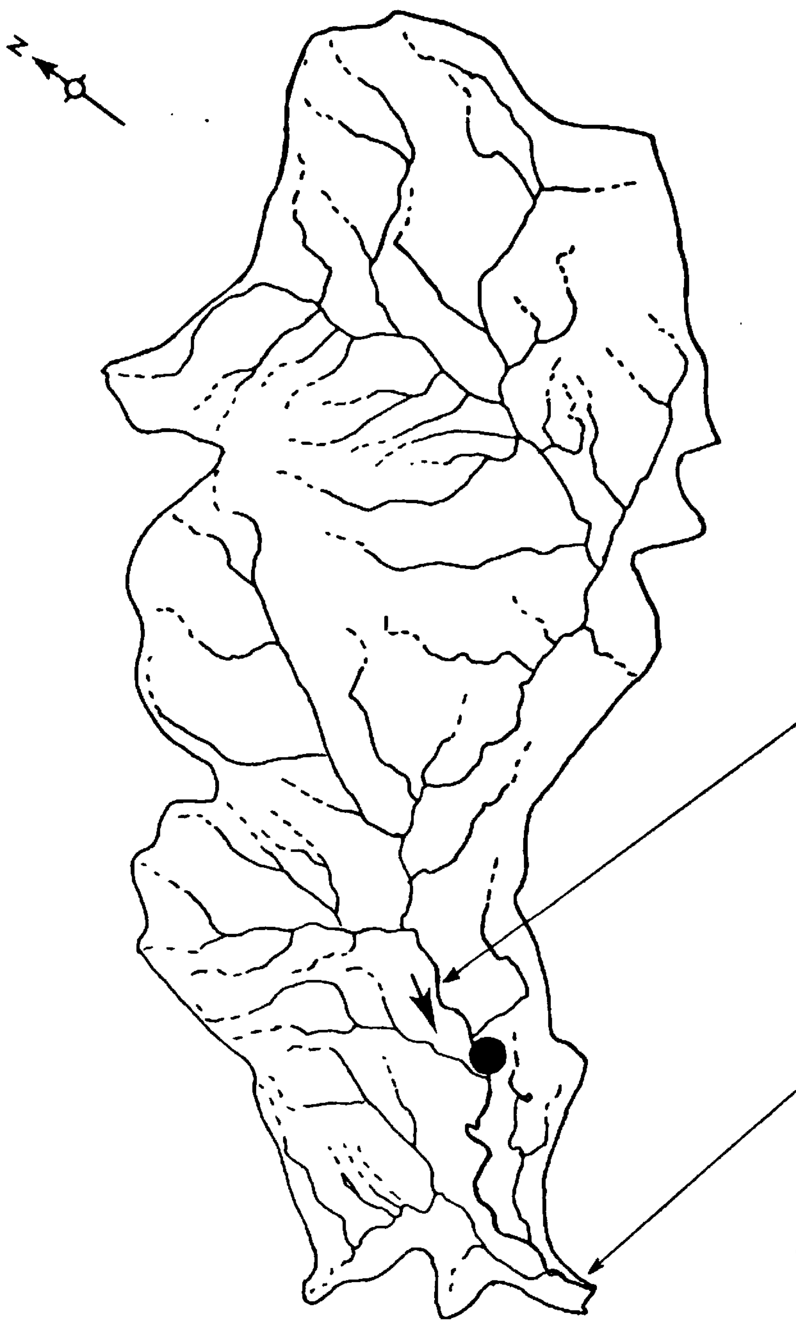


PHOTO FILE C-2



16.20 - CALGARY STATION

1.6 - GAUGE POOL

17.0 - BED MATERIAL
17.1 - VIEW ACROSS
17.2 - VIEW UPSTREAM
17.3 - VIEW DOWNSTREAM

1.2 - MID REACH DOWNSTREAM

16.19 - HIGH WATER CHANNEL

16.18 - POINT
16.15 - VALLEY
16.14 - BANK FAILURE
16.13 - BANK FAILURE
1.4 - RAPIDS

16.11 - ESTUARY

● - STUDY REACH

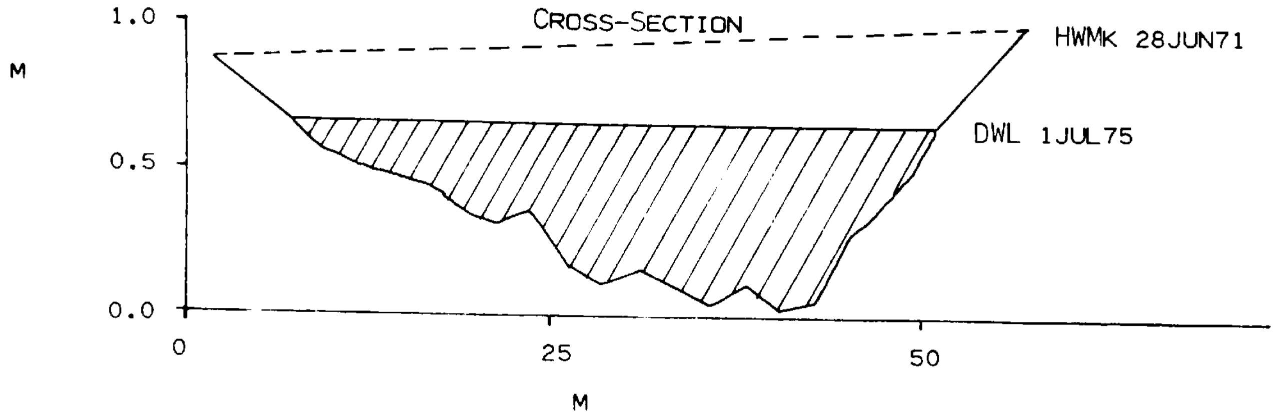
ALLEN RIVER C-2

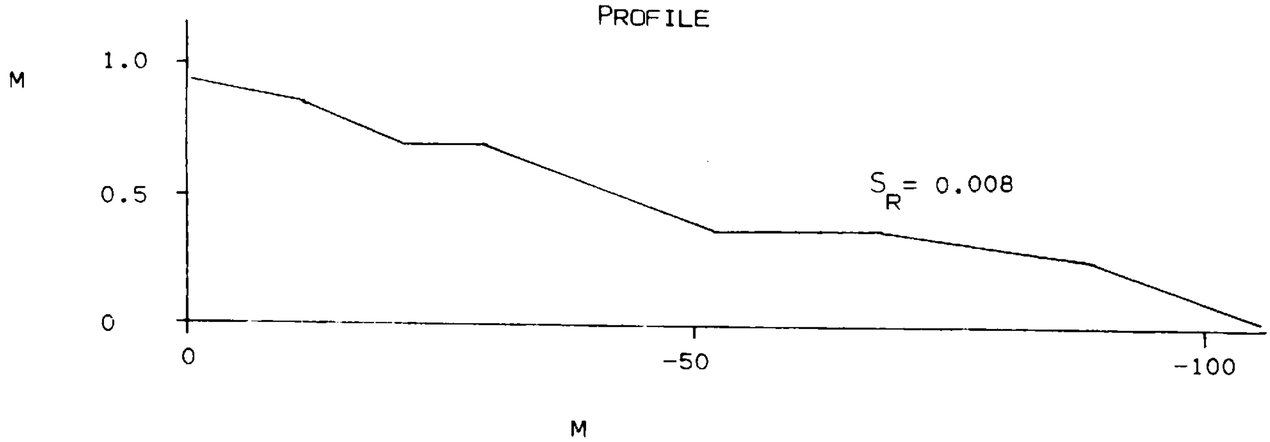
The terrain surrounding our study reach could be described as a gently rolling plateau composed of limestone-dolomite bedrock mantled by colluvium, the latter produced by weathering and being of quite fine texture. The channel is incised into the surface to a depth of less than 30 metres. Exposed bedrock produces nearly vertical valley walls. Vegetation is almost totally absent with only a few isolated clumps of saxifrage and, in low-lying areas, sedges - but not sufficiently numerous to alter the completely barren appearance of the countryside. The principal erosional feature appears to be frost-shattering with resultant down-slope movement. The coarser elements of this colluvium generate very turbulent flow in many confined reaches of the stream. Downstream movement of the fines has created pool and riffle sequences with characteristic gravel-river bars. In our study reach the stream bed is consolidated bedrock mantled by cobble and boulder-sized colluvium. A tributary just downstream has generated a fan of slightly smaller material. The reach exhibits both lateral and vertical stability. Continuous water level and discharge data is available for this site from Water Survey of Canada, Calgary Office. Pronounced diurnal fluctuations in flow occur, the magnitude of this cycle being greatest in the early portion of the runoff season.

LATITUDE AT BASIN MOUTH[1]	74° 50'
LONGITUDE AT BASIN MOUTH[1]	95° 20'
DRAINAGE AREA	549 KM^2
BASIN PERIMETER	120 KM
CIRCULARITY RATIO	0.469
STREAM ORDER	4
BIFURCATION RATIO	3.68
LENGTH OF PRINCIPAL CHANNEL	48 KM
SLOPE OF PRINCIPAL CHANNEL	0.004
BASIN WIDTH	19.0 KM
BASIN LENGTH	42.1 KM
ELONGATION RATIO	0.624
HYPSOMETRIC INTEGRAL	0.621
HYPSOMETRIC COEFFICIENT	-0.487
BASIN RELIEF	290 M
MINIMUM ELEVATION	0 M
MAXIMUM ELEVATION	290 M
AVERAGE ELEVATION	145 M
MEDIAN ELEVATION	173 M
BASIN ASPECT	S W

1 – BASED ON 1:250,000 MAPS

C-2





HYDRAULIC MEASUREMENTS

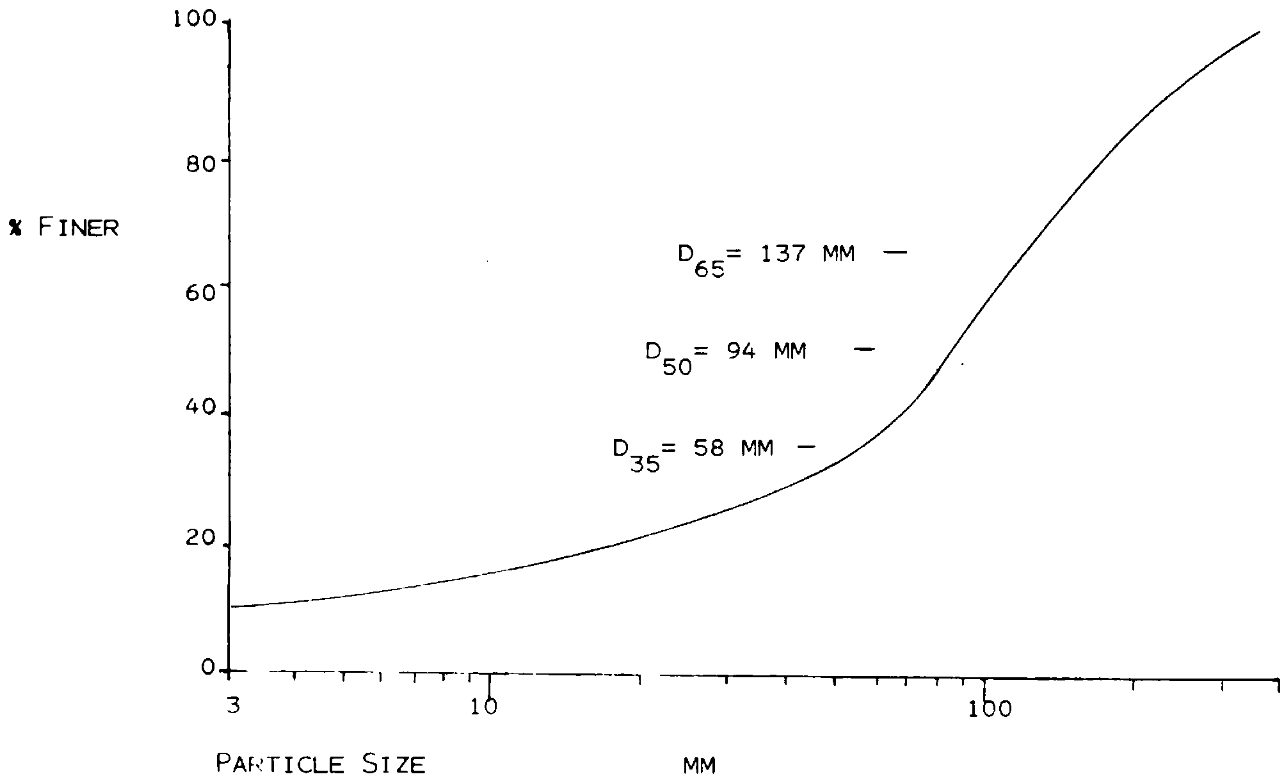
DATE	WIDTH	AREA	MEAN VELOCITY	GAUGE HEIGHT	DISCHARGE
04JUL75	31.1 M	16.6 M^2	0.66 M/S	0.63 M	10.9 M^3/S
08JUL75	22.6 M	8.3 M^2	0.45 M/S	0.34 M	3.7 M^3/S
31AUG75	16.2 M	9.6 M^2	0.17 M/S	0.21 M	1.6 M^3/S

	STAGE	AREA	HYDRAULIC RADIUS
HWMK			N/A

PERMAFROST

NO PROBE TAKEN

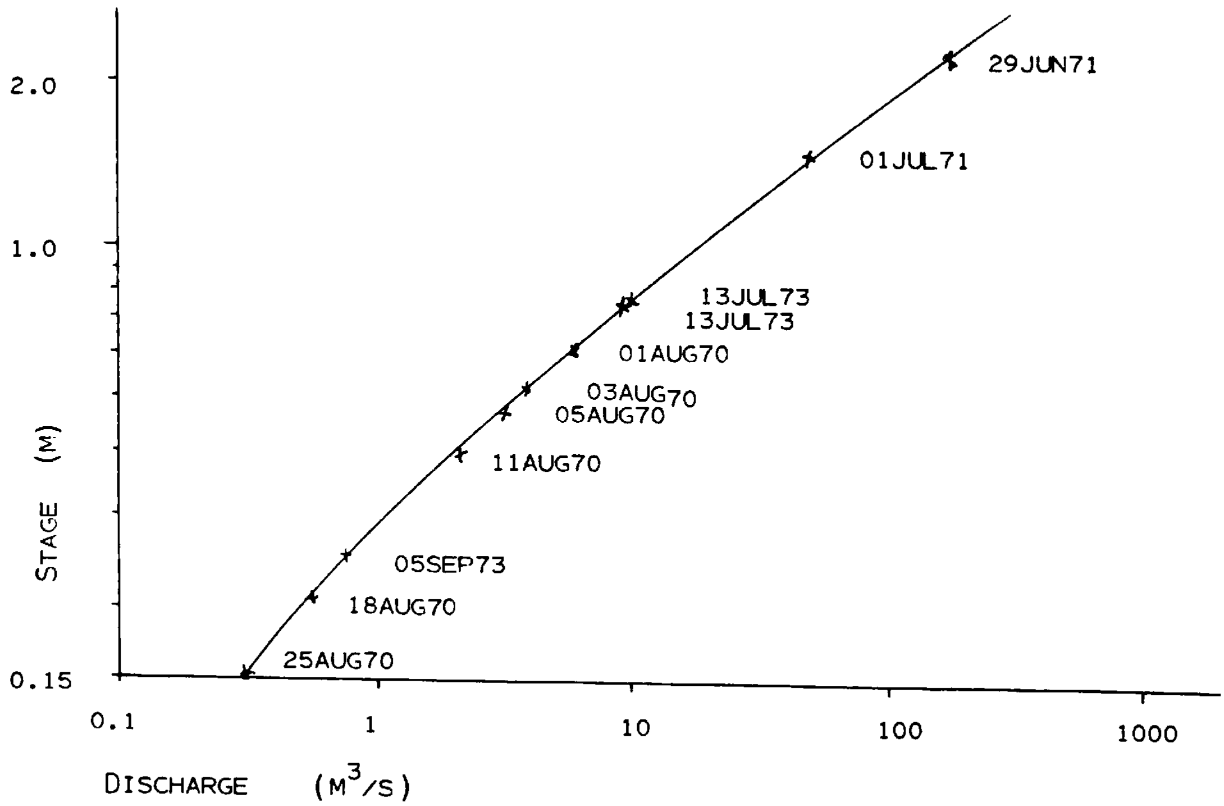
PARTICLE SIZE DISTRIBUTION (BED MATERIAL) C-2



STRICHLER'S ''N'', $N = 0.013\ (D_{50})^{1/6}$ 0.028

SUSPENDED SEDIMENT CONCENTRATION 04JUL75 16 MG/L

RATING CURVE C-2



STAGE-DISCHARGE TABLE C-2 DISCHARGES IN M^3/S

METRES	0.1	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0	0.00	0.14	0.46	0.99	1.79	2.89	4.36	6.09	8.24	10.87
1	14.13	17.87	22.43	27.58	33.70	39.64	45.87	52.39	59.47	67.11
2	72.77	84.67	95.14	166.2	118.6	145.0	160.6			

DAILY DISCHARGES C-2 (M^3/S)

DAY	1971 JUN	1971 JUL	1971 AUG	1971 SEPT	1972 JULY	1972 AUG	1973 JUL	1973 AUG	1973 SEPT
1	0	76.45	1.95	0.14	0.07	4.73		5.83	1.85
2	0	62.30	1.73	0.08	0.09	6.00		5.92	1.55
3	0	44.74	1.64	0.06	0.12	4.87		7.19	1.07
4	0	31.43	15.46	0.06	0.18	4.96		9.00	0.85
5	0	39.36	9.32	0.03	0.26	5.72		9.26	1.24
6	0	35.46	4.25	0.03	0.54	3.96		9.03	
7	0	30.01	9.83	0.03	2.27	4.50		9.12	
8	0	22.77	6.03	0	4.53	8.16		9.85	
9	0	14.61	3.51	0	7.36	11.27		7.84	
10	0	9.91	1.87	0	11.61	12.91		5.72	
11	0	8.75	2.30		22.65	5.61		11.81	
12	0	9.34	3.17		45.31	7.50		23.53	
13	0	11.44	2.16		38.23	4.30	10.62	12.20	
14	0.28	10.62	5.66		31.15	1.70	6.77	8.21	
15	0.42	8.55	6.37		29.73	1.10	4.42	3.96	
16	0.57	10.00	2.62		45.59	0.73	4.25	2.20	
17	0.71	9.09	2.24		56.35	0.45	5.32	1.42	
18	0.85	5.46	1.14		64.56	1.08	7.08	0.85	
19	1.13	7.50	0.90		44.46	1.69	8.75	0.85	
20	1.98	6.63	0.54		43.61	1.13	9.68	1.05	
21	5.10	7.14	0.62		36.53	0.47	10.48	0.85	
22	8.78	8.10	0.99		32.28	0.23	14.64	0.85	
23	14.16	6.06	1.55		33.70	0.29	7.53	0.71	
24	19.82	5.52	6.43		17.81	0.40	6.54	0.85	
25	28.32	5.21	8.78		15.86	0.23	3.99	2.08	
26	42.47	4.67	3.54		10.31	0.13	3.51	2.86	
27	59.46	3.65	2.04		7.53	0.09	2.59	4.67	
28	90.61	4.08	1.36		11.89	0.06	2.13	8.89	
29	104.77	3.23	0.86		9.37	0.05	2.80	5.80	
30	90.61	3.00	0.51		3.09	0.04	3.54	3.88	
31		2.58	0.25		5.97	0.03	4.70	2.45	

STATION NO. 10TC014 SNOWBLIND CREEK ABOVE LAURA LAKES C-3

RIVER MOUTH - 75°13' 93°40'

STUDY SITE - 75°11' 93°54'

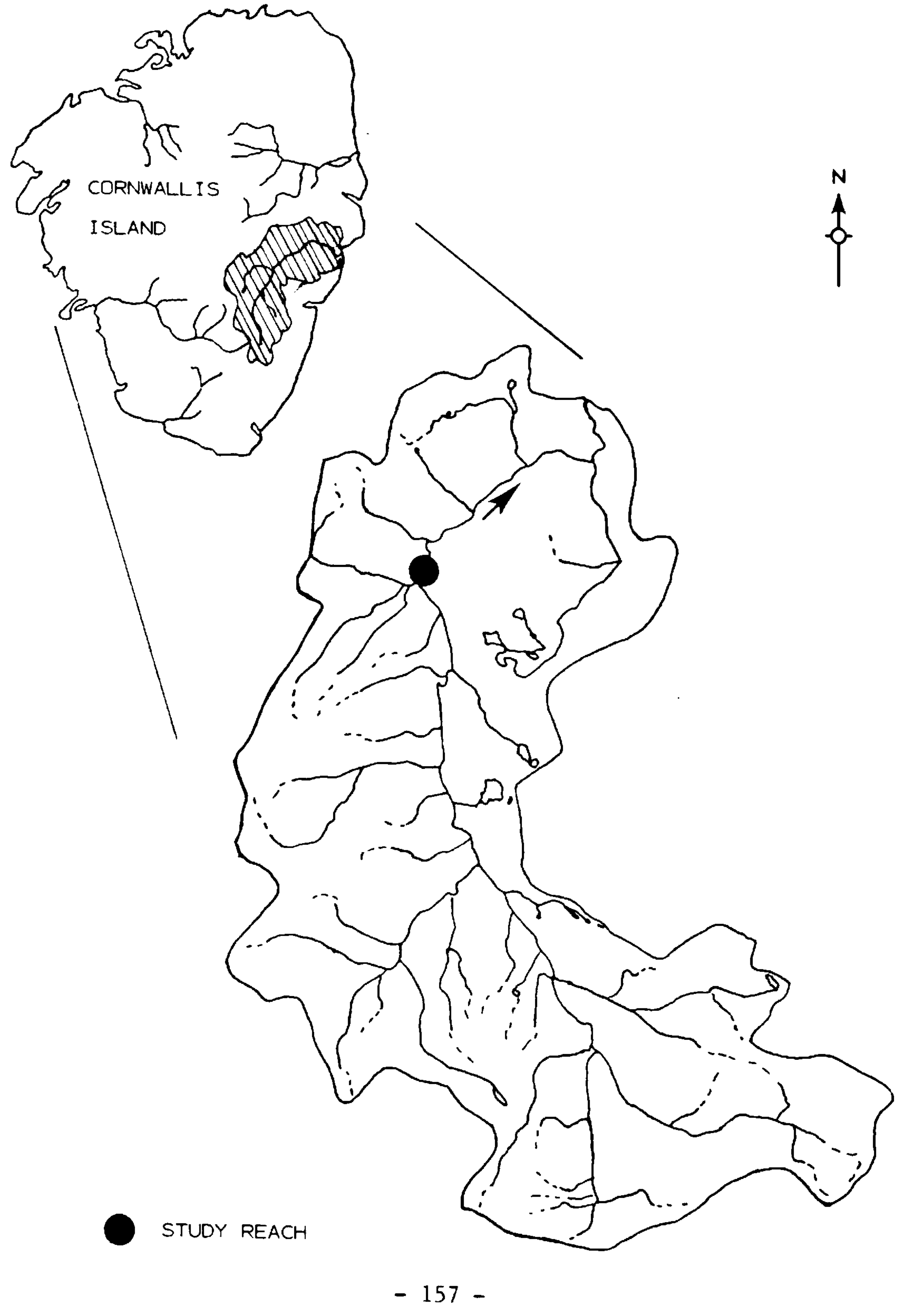
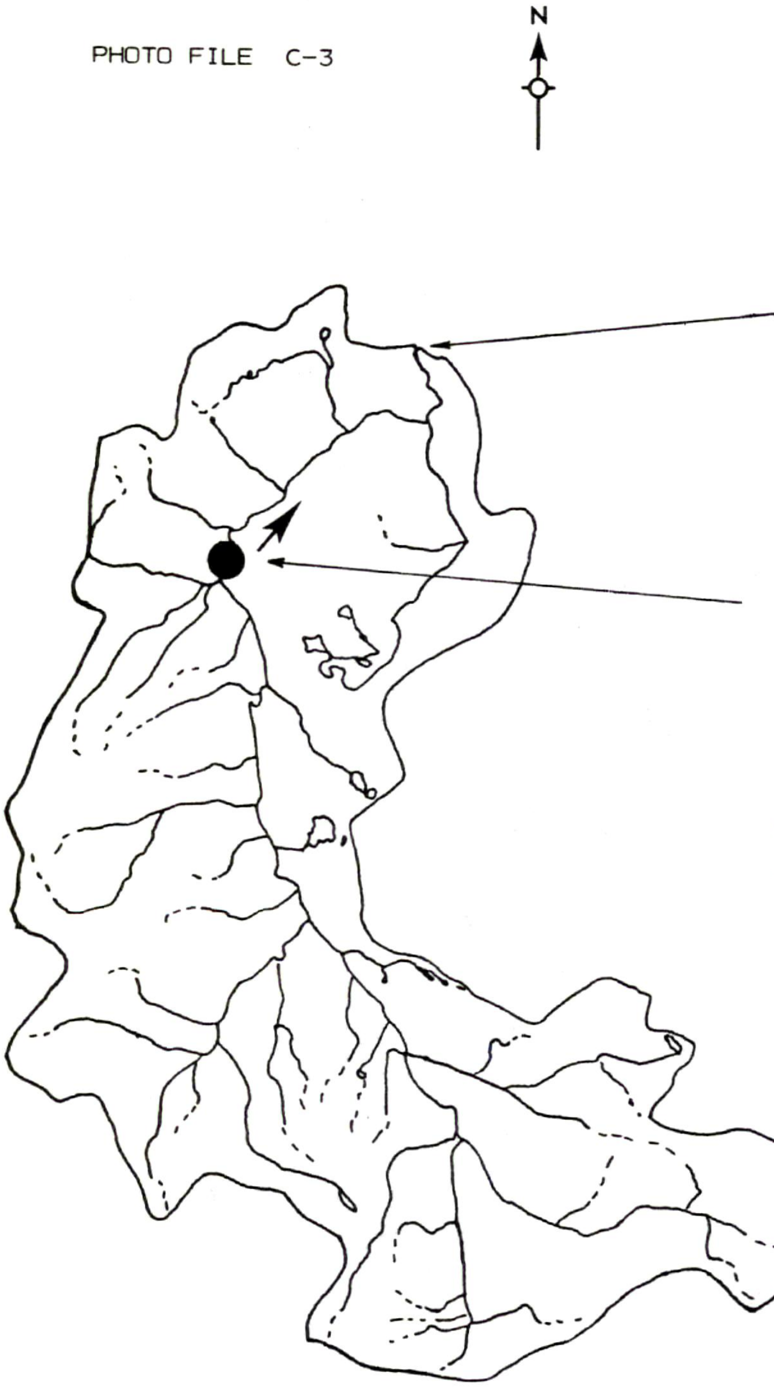


PHOTO FILE C-3



11.14 - HEADWATERS
12.5 - ENTRENCHED CHANNEL
11.15 - PLATEAU DROP OFF
11.16 - ESTUARY
11.17 - ESTUARY

11.18 - AERIAL OBLIQUE
11.20 - UPSTREAM VIEW
11.19 - DOWNSTREAM VIEW
11.21 - VIEW ACROSS
12.3 - BED MATERIAL
12.0 - FLOOD PLAIN L.B.
12.4 - LEFT VALLEY WALL
29.9 - CROSS SECTION
29.10 - DOWNSTREAM VIEW
29.11 - UPSTREAM VIEW

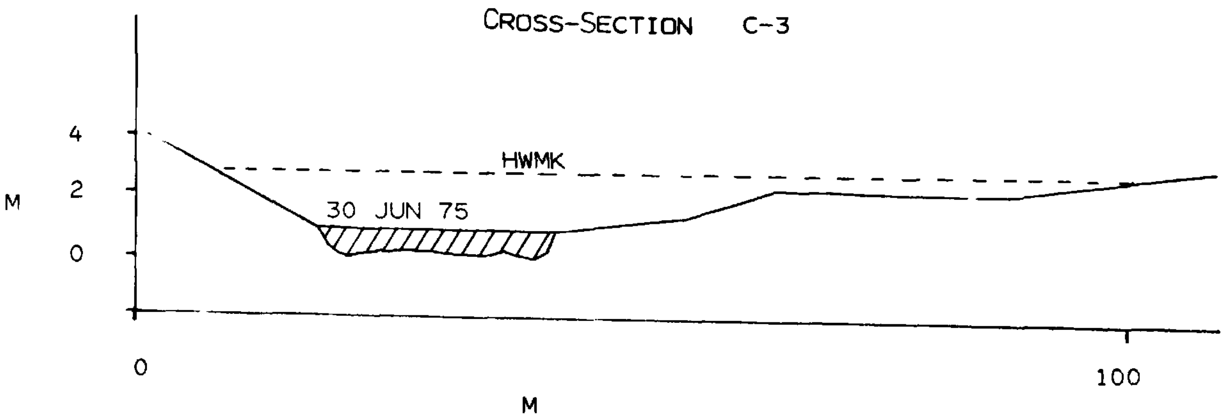
● - STUDY REACH

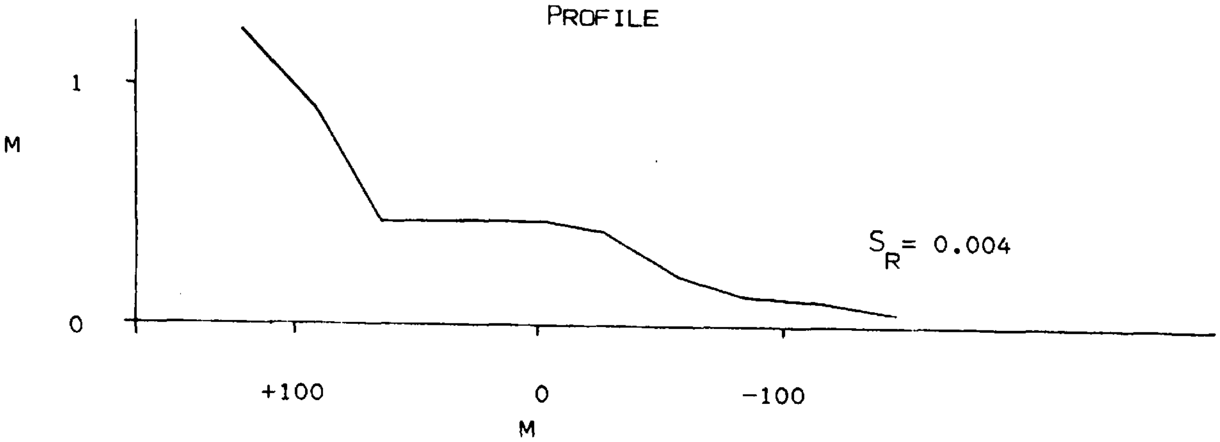
SNOWBLIND CREEK C-3

This stream drains the interior plateau of Cornwallis Island and is incised 50 to 75 metres into the limestone-dolomite surficial bedrock. In the plateau reach the channel exhibits irregular, entrenched meander patterns. The study section was located in a broader channel approximately one kilometre downstream of its exit from the plateau. The wider valley at site is floored by alluvium - predominantly silty gravel. Several terrace structures line the valley walls. Bedrock outcrops, not yet buried, occur in the valley and appear to underly some of the terrace structures - two of these in the reach confined the channel at points. A dry wash on the northern slope has deposited an outwash fan across one terrace level and into the valley plain. The active flood plain, a hundred metres or so in width at the study section, widens downstream and the river assumes a braided configuration. Relict scars on the flood plain indicate lateral movement of the thalweg within the plain - a lateral thalweg movement of 10 to 20 metres occurred in seven weeks in 1975. A riffle-pool sequence, controlled by mid-channel and diagonal bars is characteristic. Snowbeds occur on valley walls and the resultant meltwater promotes downslope movement of sediments and rill development. With the exception of this activity and that in the flood plain, the valley in cross-section could be considered as quite stable.

LATITUDE AT BASIN MOUTH[1]	75° 13'
LONGITUDE AT BASIN MOUTH[1]	93° 40'
DRAINAGE AREA	471 KM^2
BASIN PERIMETER	109 KM
CIRCULARITY RATIO	0.502
STREAM ORDER	4
BIFURCATION RATIO	5.29
LENGTH OF PRINCIPAL CHANNEL	43 KM
SLOPE OF PRINCIPAL CHANNEL	0.007
BASIN WIDTH	19.7 KM
BASIN LENGTH	33.6 KM
ELONGATION RATIO	0.724
HYPSOMETRIC INTEGRAL	0.499
HYPSOMETRIC COEFFICIENT	-0.554
BASIN RELIEF	351 M
MINIMUM ELEVATION	0 M
MAXIMUM ELEVATION	351 M
AVERAGE ELEVATION	175 M
MEDIAN ELEVATION	168 M
BASIN ASPECT	N E

1 - BASED ON 1:250,000 MAPS





HYDRAULIC MEASUREMENTS

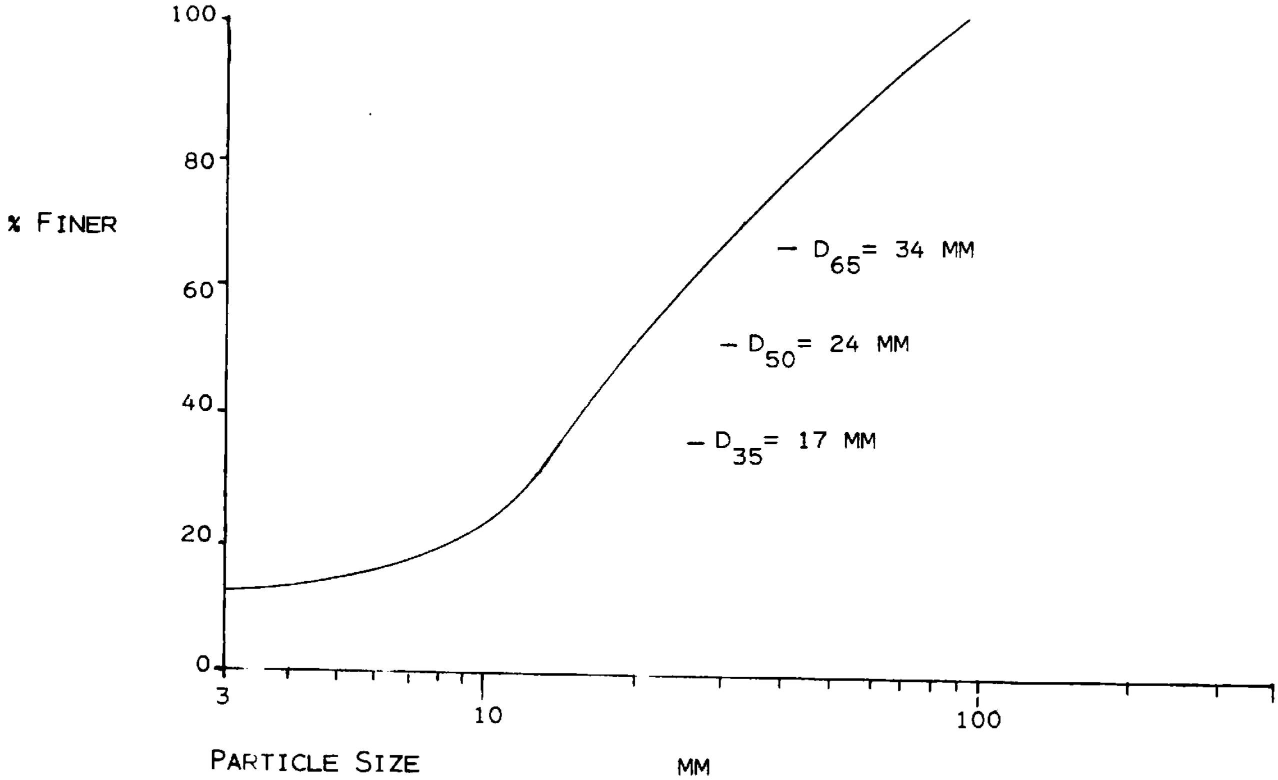
DATE	WIDTH	AREA	MEAN VELOCITY	GAUGE HEIGHT	DISCHARGE
30JUN75	25.0 M	12.6 M^2	0.77 M/S	0.67 M	9.8 M^3/S
08JUL75	23.5 M	7.9 M^2	0.41 M/S	0.52 M	3.2 M^3/S
31AUG75	10.1 M	5.0 M^2	0.16 M/S	0.32 M	0.8 M^3/S

	STAGE	AREA	HYDRAULIC RADIUS
HWMK	2.20 M	80.9 M^2	0.96 M

PERMAFROST

NO PROBE TAKEN

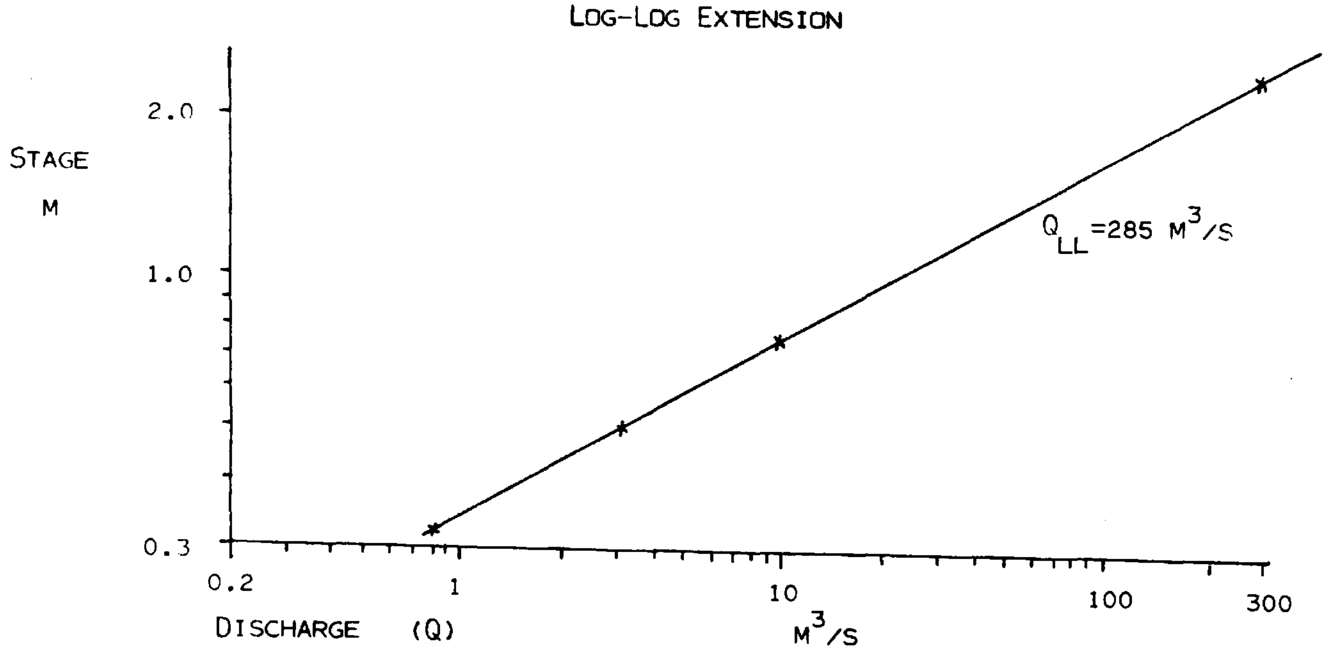
PARTICLE SIZE DISTRIBUTION (BED MATERIAL) C-3



STRICHLER'S ''N'', $N = 0.013\ (D_{50})^{1/6}$ 0.022

SUSPENDED SEDIMENT CONCENTRATION 30JUN75 21 MG/L

ESTIMATED DISCHARGE AT HIGH WATER MARK C-3



MANNING EQUATION

$$Q = \frac{A\ R^{2/3}\ S^{1/2}}{N} = \frac{(80.9)(0.95)^{2/3}(0.004)^{1/2}}{0.022}$$

$$= 234\ M^3/S$$

BEST ESTIMATE

$250\ M^3/S$

STATION NO. 10TC015 ELEANOR RIVER ABOVE ELEANOR LAKE C-4

RIVER MOUTH -	75°25'	93°55'
STUDY SITE -	75°20'	94°13'

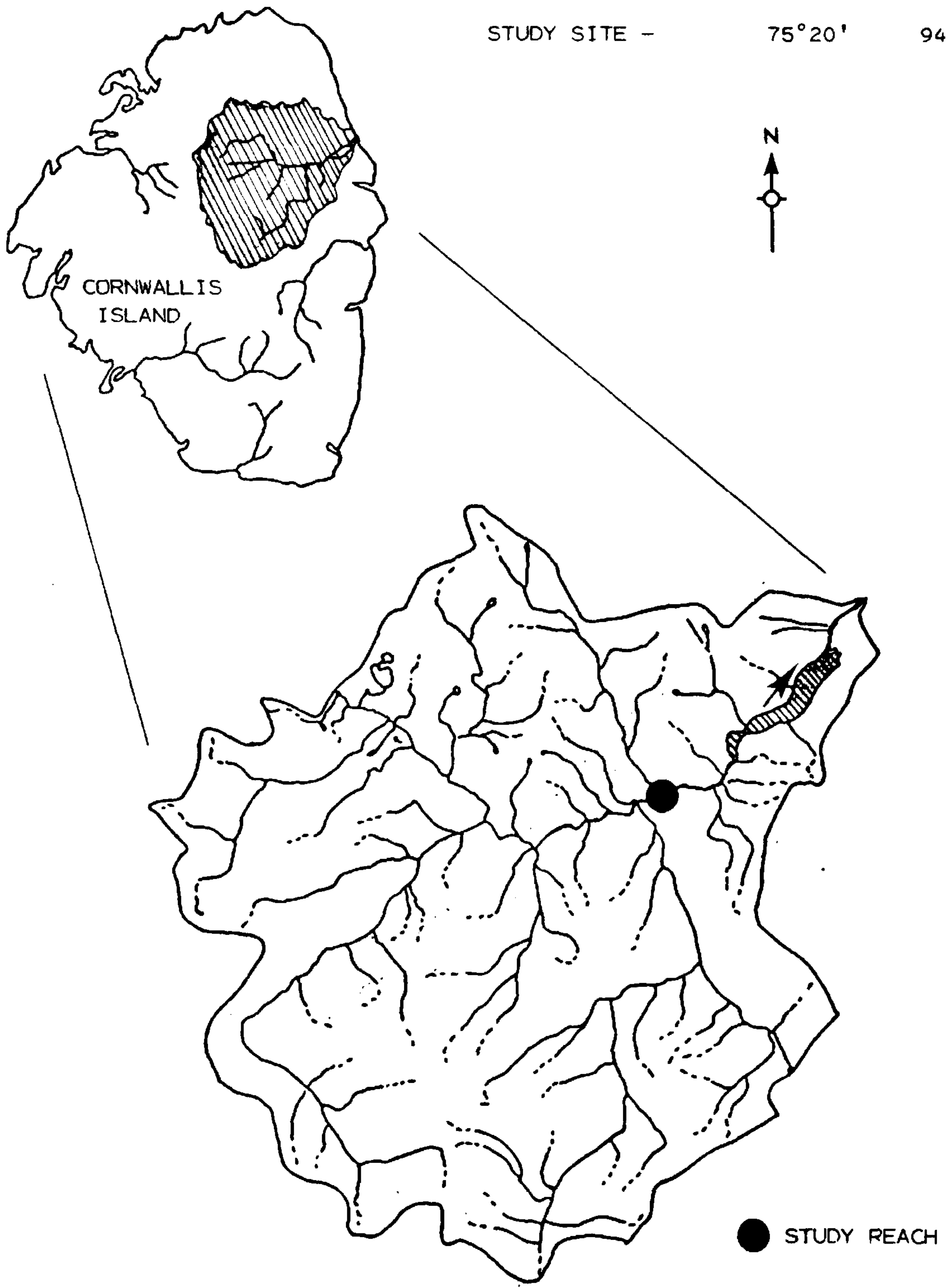
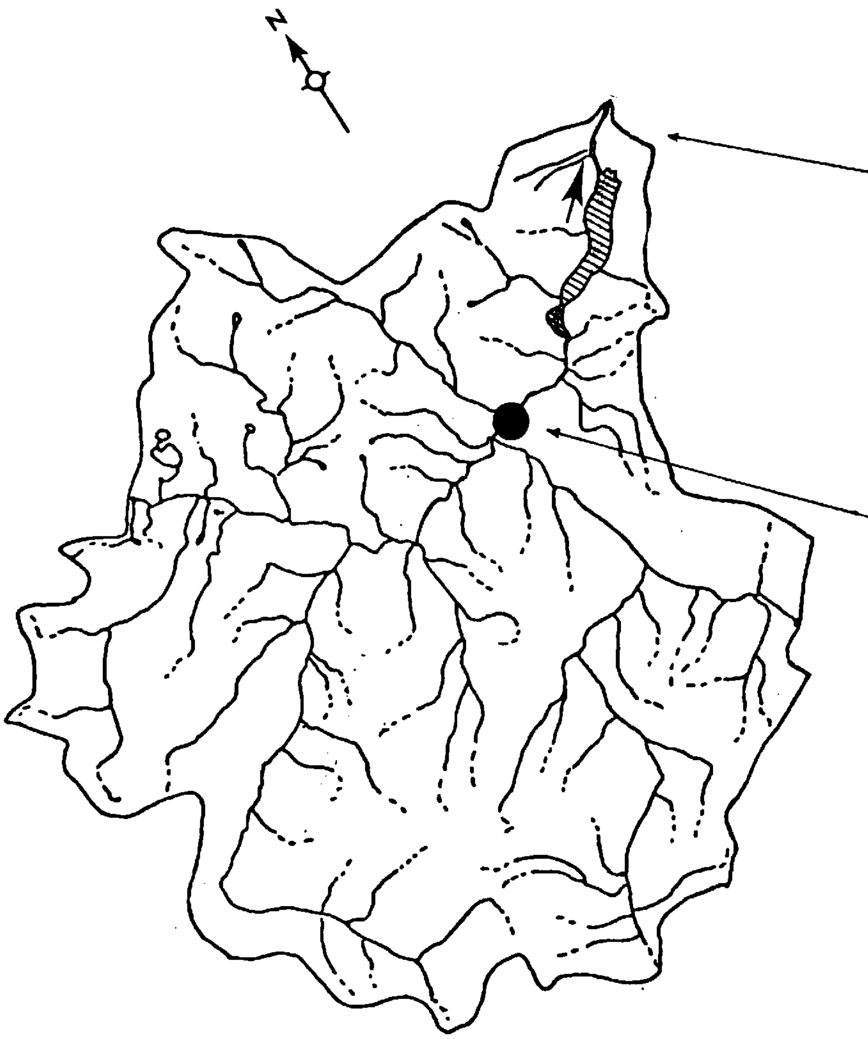


PHOTO FILE C-4



12.7 - ESTUARY
12.8 - ABOVE ELEANOR LAKE
12.9 - OUTLET
12.10 - OUTWASH

12.13 - UPSTREAM VIEW
12.14 - DOWNSTREAM VIEW
12.15 - ACROSS SECTION
12.16 - BED MATERIAL
12.17 - FLOOD PLAIN
12.18 - THERMAL EROSION
12.19 - GROUND ICE

29.5 - CROSS SECTION
29.6 - DOWNSTREAM VIEW
29.8 - UPSTREAM VIEW
29.4 - RUNNING WATER (THROUGH GRAVEL)

● - STUDY REACH

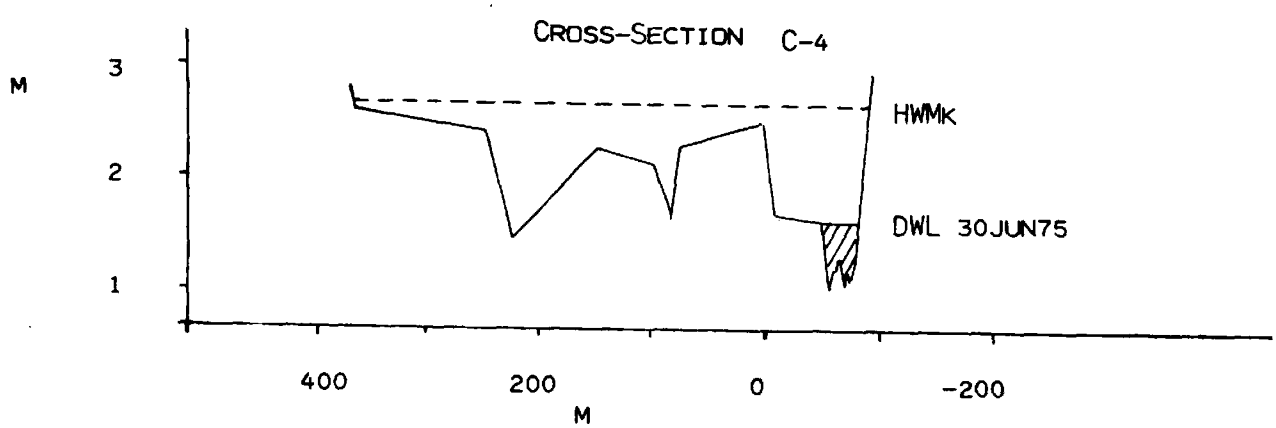
ELEANOR RIVER C-4

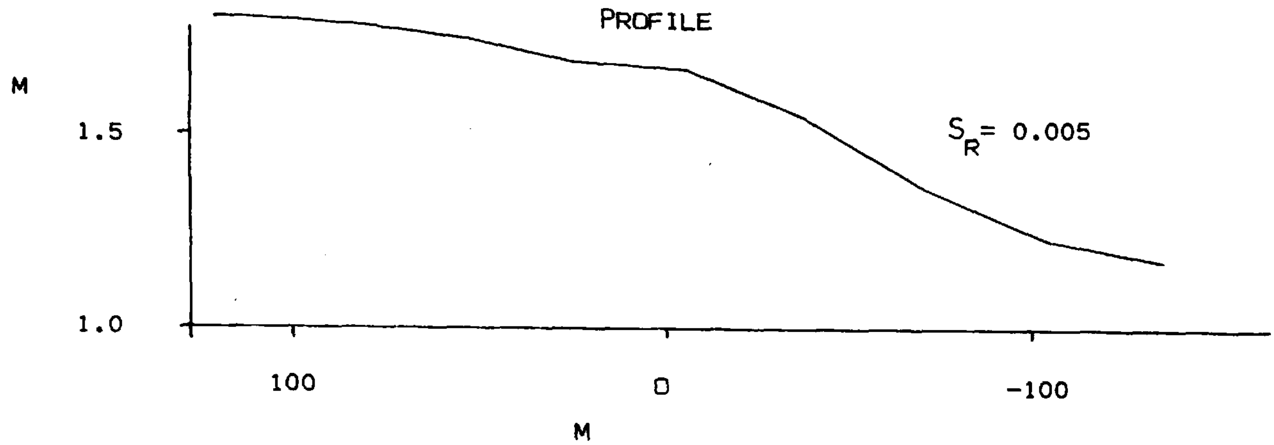
Geographically, the terrain in the vicinity of our study reach could be described as a rolling plateau of fairly gentle relief. Material is mainly sedimentary bedrock mantled by weathered fines. The valley floor consists of alluvial materials. Isolated pockets of vegetation (sedges, mosses) occur in depressions and low-lying areas outside the flood plain; the general appearance is one of bare rather than vegetated terrain. The side is located downstream of the main drop from the plateau and is characteristic of such reaches; it has a flood plain in excess of 300 metres in width with many old channel scars evident throughout. Depending on seasonal runoff, the live channel could be located anywhere in the flood plain. Lateral activity through particle erosion of thermal niching with subsequent bank collapse is evident wherever the stream impinges on the valley walls. At a downstream tributary, thermal niching into the tributary fan exposed a slab of ground ice approximately 5 metres long and a metre in thickness. The valley wall slopes measured approximately 15 degrees. Localized instances of mass movement were noted on valley slopes. Fragmentary terraces exist along both valley walls with occasional pools in the valley plain. The live channel exhibited a pool and riffle sequence. Bed material consisted of well-graded gravel.

MORPHOMETRIC DATA C-4

LATITUDE AT BASIN MOUTH[1]	75° 25'
LONGITUDE AT BASIN MOUTH[1]	93° 55'
DRAINAGE AREA	857 KM^2
BASIN PERIMETER	136 KM
CIRCULARITY RATIO	0.579
STREAM ORDER	5
BIFURCATION RATIO	4.91
LENGTH OF PRINCIPAL CHANNEL	51 KM
SLOPE OF PRINCIPAL CHANNEL	0.004
BASIN WIDTH	30.5 KM
BASIN LENGTH	40.5 KM
ELONGATION RATIO	0.810
HYPSOMETRIC INTEGRAL	0.501
HYPSOMETRIC COEFFICIENT	-0.346
BASIN RELIEF	247 M
MINIMUM ELEVATION	0 M
MAXIMUM ELEVATION	247 M
AVERAGE ELEVATION	123 M
MEDIAN ELEVATION	122 M
BASIN ASPECT	W

1 - BASED ON 1:250,000 MAPS





HYDRAULIC MEASUREMENTS

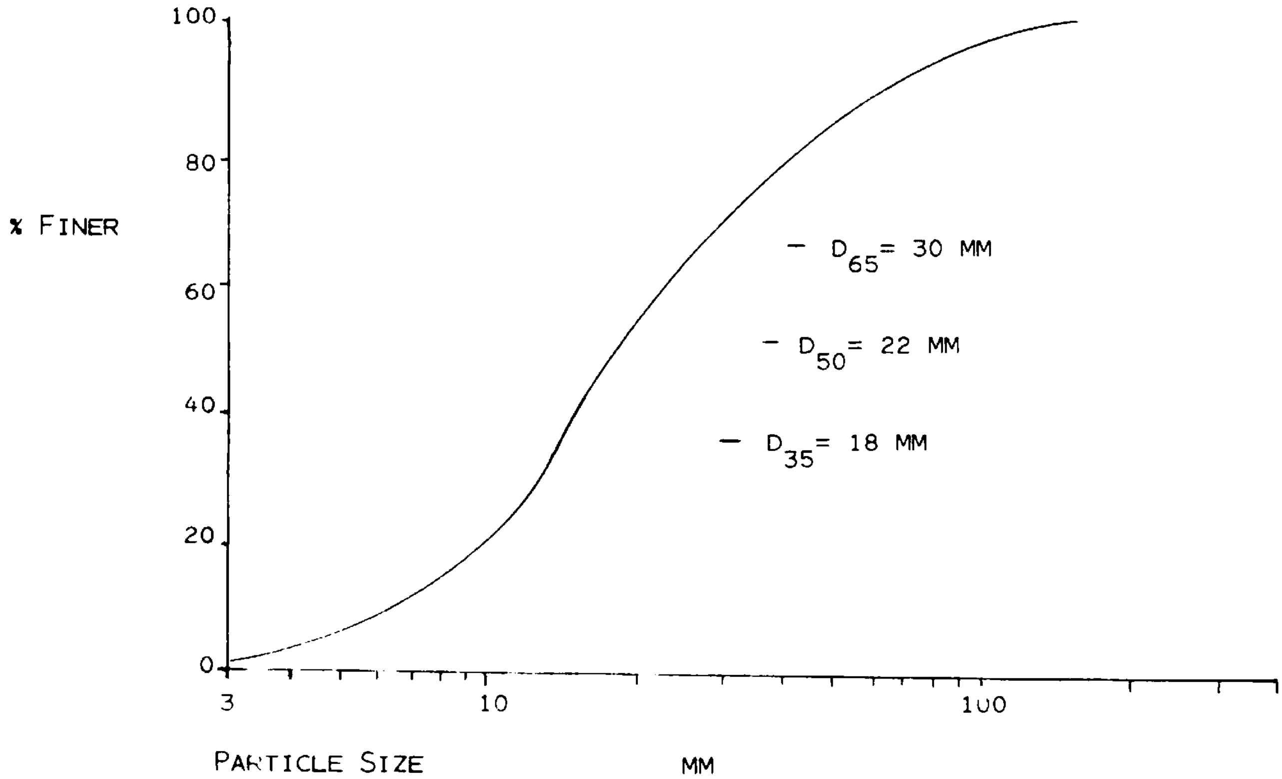
DATE	WIDTH	AREA	MEAN VELOCITY	GAUGE HEIGHT	DISCHARGE
30JUN75	30.5 M	11.7 M^2	0.75 M/S	1.53 M	8.8 M^3/S
08JUL75	28.0 M	7.2 M^2	0.49 M/S	1.08 M	3.5 M^3/S
31AUG75	15.2 M	7.4 M^2	0.04 M/S	0.39 M	0.3 M^3/S

	STAGE	AREA	HYDRAULIC RADIUS
HWMK	2.43 M	214 M^2	0.54 M

PERMAFROST

31 AUG 75 - 0.7 M AT WATER'S EDGE R.B.
- 0.6 M EDGE OF FLOODPLAIN R.B.

PARTICLE SIZE DISTRIBUTION (BED MATERIAL) C-4

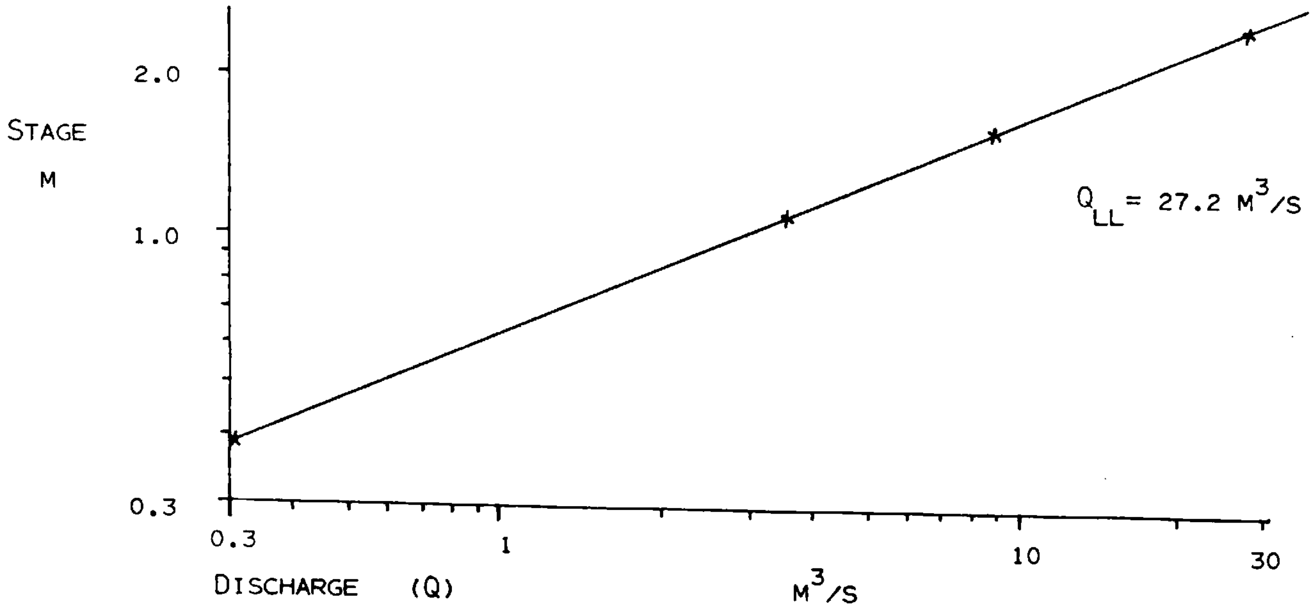


STRICHLER'S ''N'', $N = 0.013\ (D_{50})^{1/6}$ 0.022

SUSPENDED SEDIMENT CONCENTRATION 30JUN75 20 MG/L

ESTIMATED DISCHARGE AT HIGH WATER MARK C-4

LOG-LOG EXTENSION



MANNING EQUATION

$$Q = \frac{A\ R^{2/3}\ S^{1/2}}{N} = \frac{(214)(0.54)^{2/3}(0.005)^{1/2}}{0.022}$$

$$= 452\ M^3/S$$

BEST ESTIMATE
50 M^3/S

STATION NO. 10TC016 ABBOTT RIVER ABOVE MIDSHIPMAN BAY C-5

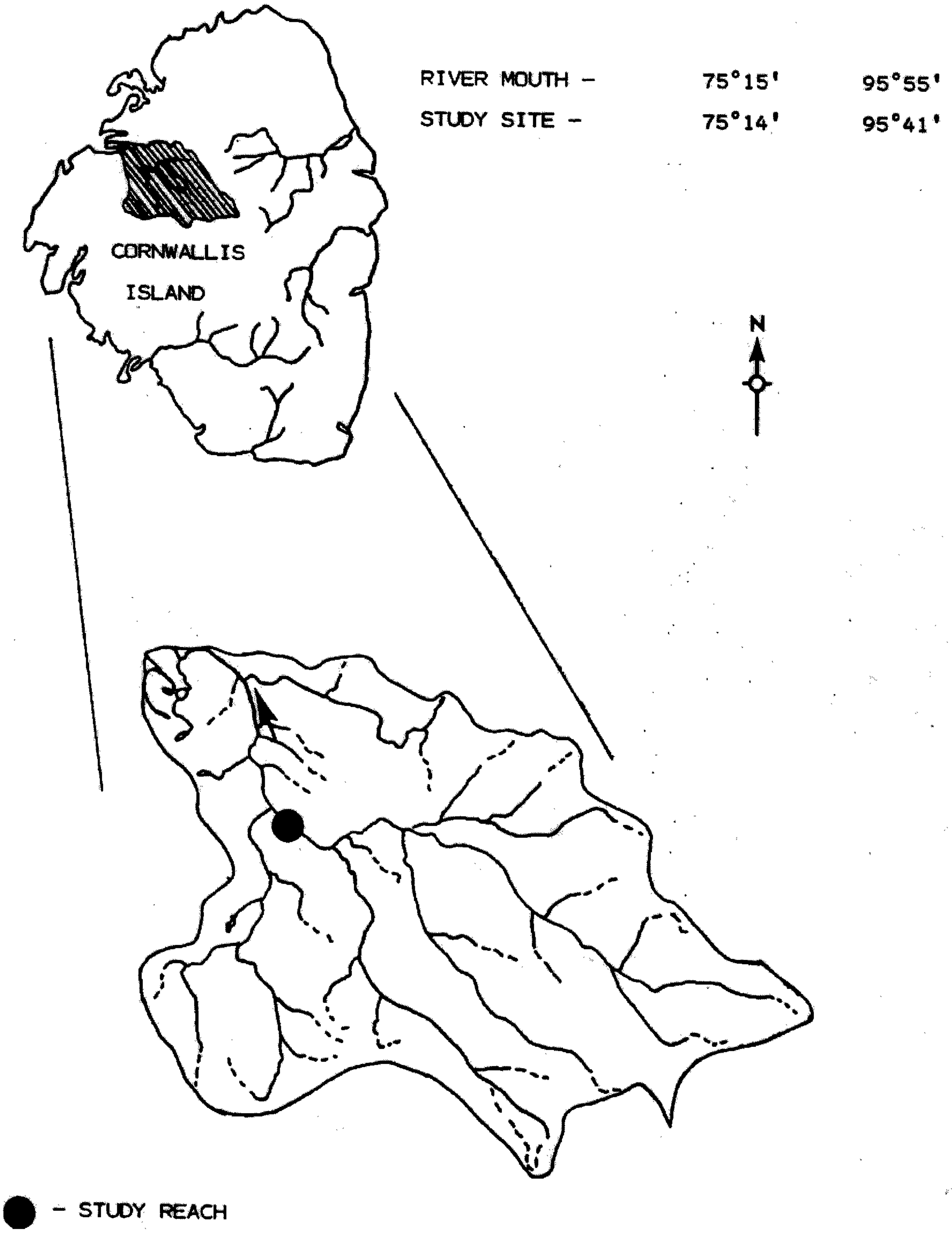
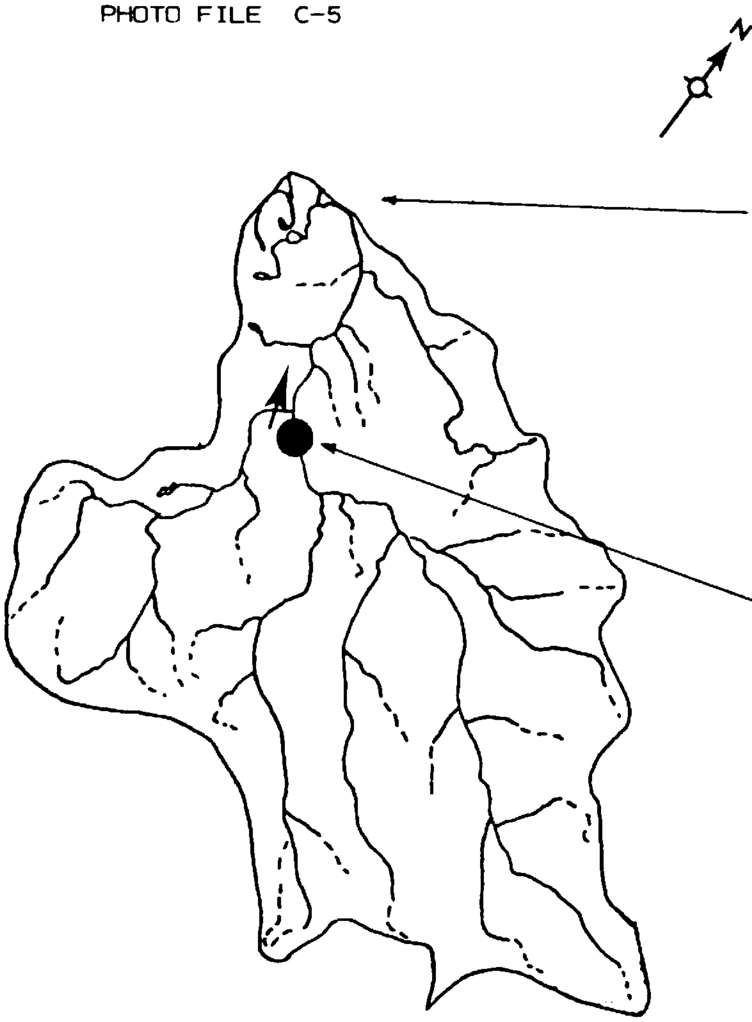


PHOTO FILE C-5



13.10 - ESTUARY

13.13 - UPSTREAM OF REACH

13.20 - PERCOLATION

14.0 - RIGHT WALL

13.12 - AERIAL OBLIQUE (DOWNSTREAM VIEW)

13.11 - AERIAL OBLIQUE

13.16 - DOWNSTREAM VIEW

13.15 - UPSTREAM VIEW

13.14 - CROSS SECTION

13.2L - BED MATERIAL

13.19 - RAPIDS (UPSTREAM)

28.16 - CROSS SECTION

28.17 - UPSTREAM VIEW

28.18 - DOWNSTREAM VIEW

● - STUDY REACH

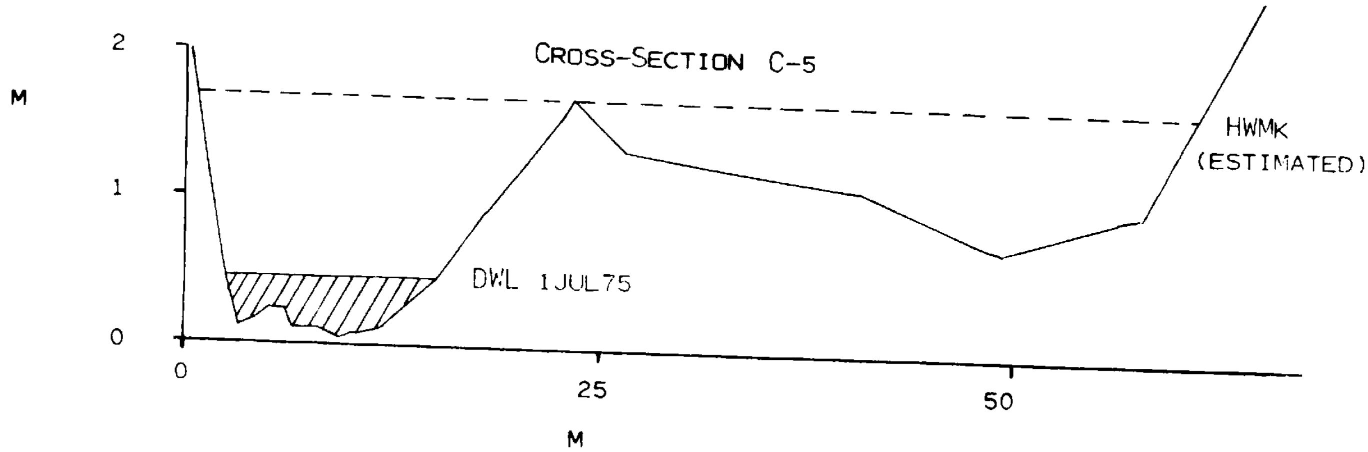
ABBOTT RIVER C-5

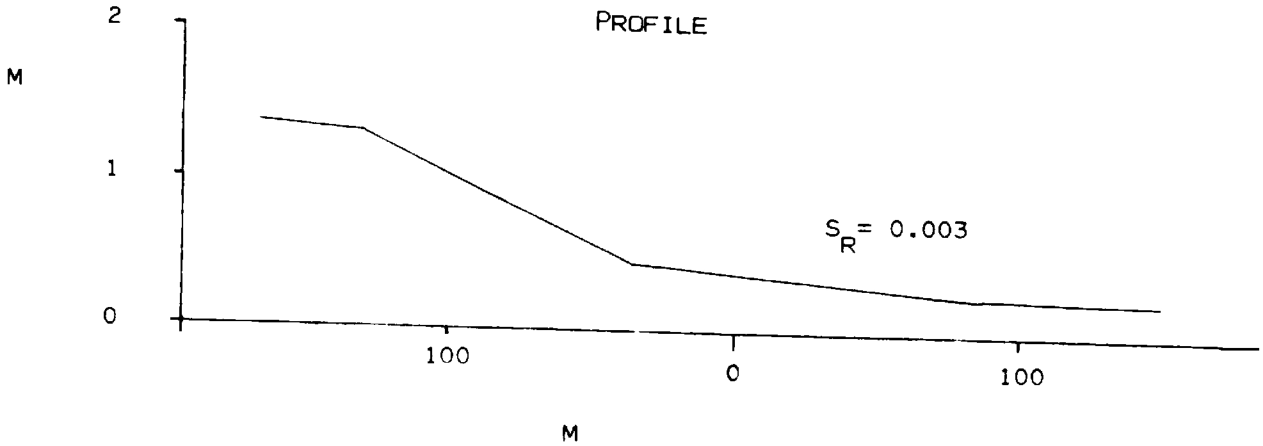
The upland plateau region of Cornwallis Island degenerates into low-relief hill topography in the general area of the study reach. Underlying sedimentary bedrock is mantled by weathered fines. Vegetation is minimal with less than 5% cover and consists of sedges and mosses. In the immediate vicinity of the investigated river reach, slates and shales were the dominant surficial rock and detritus from these structures paved the stream bed. The flood plain is confined by the valley walls and the live channel wanders over this relatively narrow active zone (less than 150 metres). Valley walls are fairly steep, particularily so where the stream impinges directly on the valley walls. The thalweg appears to be capable of lateral movement within the flood plain and the live channel exhibits a pool and riffle sequence. Except for localized down-slope mass movement generated by weathering, the lateral and vertical activity of this study reach is minimal. The bed pavement consists of vari-sized plate-like particles common to slate and shale. Consolidated bedrock was noted in the stream bed near its left bank. No ice effects were observed.

MORPHOMETRIC DATA C-5

LATITUDE AT BASIN MOUTH[1]	75° 15'
LONGITUDE AT BASIN MOUTH[1]	95° 55'
DRAINAGE AREA	324 KM^2
BASIN PERIMETER	85 KM
CIRCULARITY RATIO	0.553
STREAM ORDER	4
BIFURCATION RATIO	4.18
LENGTH OF PRINCIPAL CHANNEL	33 KM
SLOPE OF PRINCIPAL CHANNEL	0.006
BASIN WIDTH	18.4 KM
BASIN LENGTH	29.9 KM
ELONGATION RATIO	0.674
HYPSOMETRIC INTEGRAL	0.622
HYPSOMETRIC COEFFICIENT	-0.519
BASIN RELIEF	209 M
MINIMUM ELEVATION	0 M
MAXIMUM ELEVATION	209 M
AVERAGE ELEVATION	105 M
MEDIAN ELEVATION	126 M
BASIN ASPECT	N E

1 - BASED ON 1:250,000 MAPS





HYDRAULIC MEASUREMENTS

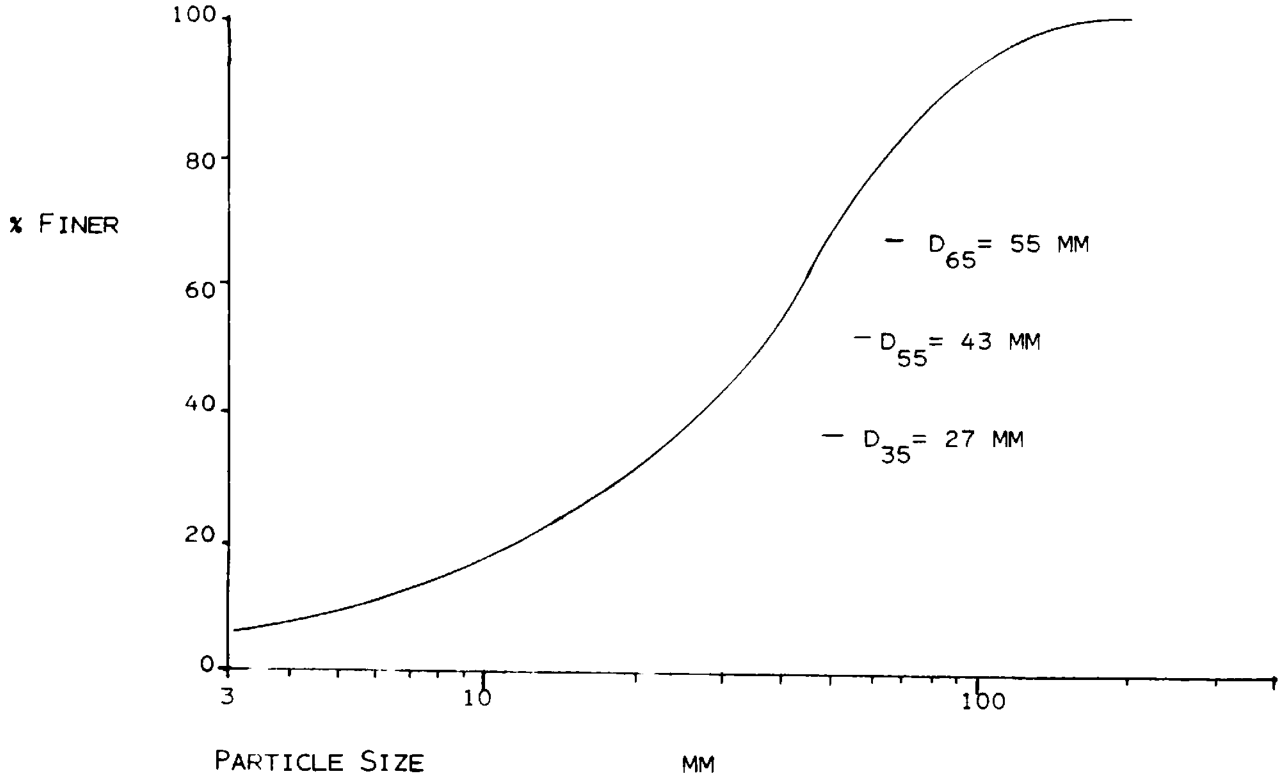
DATE	WIDTH	AREA	MEAN VELOCITY	GAUGE HEIGHT	DISCHARGE
01JUL75	14.6 M	4.0 M^2	0.62 M/S	0.40 M	2.5 M^3/S
08JUL75	14.0 M	2.8 M^2	0.48 M/S	0.33 M	1.4 M^3/S
31AUG75	9.1 M	1.2 M^2	0.11 M/S	0.15 M	0.13 M^3/S

	STAGE	AREA	HYDRAULIC RADIUS
HWMK	1.63 M	53.9 M^2	0.98 M

PERMAFROST

NO PROBE TAKEN

PARTICLE SIZE DISTRIBUTION (BED MATERIAL) C-5



STRICHLER'S ''N'', N = 0.013 $(D_{50})^{1/6}$ 0.025

SUSPENDED SEDIMENT CONCENTRATION 01JUL75 14 MG/L

ESTIMATED DISCHARGE AT HIGH WATER MARK C-5

LOG LOG EXTENSION N/A

MANNING EQUATION

$$Q = \frac{A R^{2/3} S^{1/2}}{N} = \frac{(53.9)(0.98)^{2/3}(0.003)^{1/2}}{0.025}$$

$$= 117 \; M^3/S$$

NO HWMK AT THIS STATION. ESTIMATED DISCHARGE IS FOR BANKFULL CONDITION.

STATION NO. 10TC017 UNNAMED RIVER NEAR CAPE GELL C-6

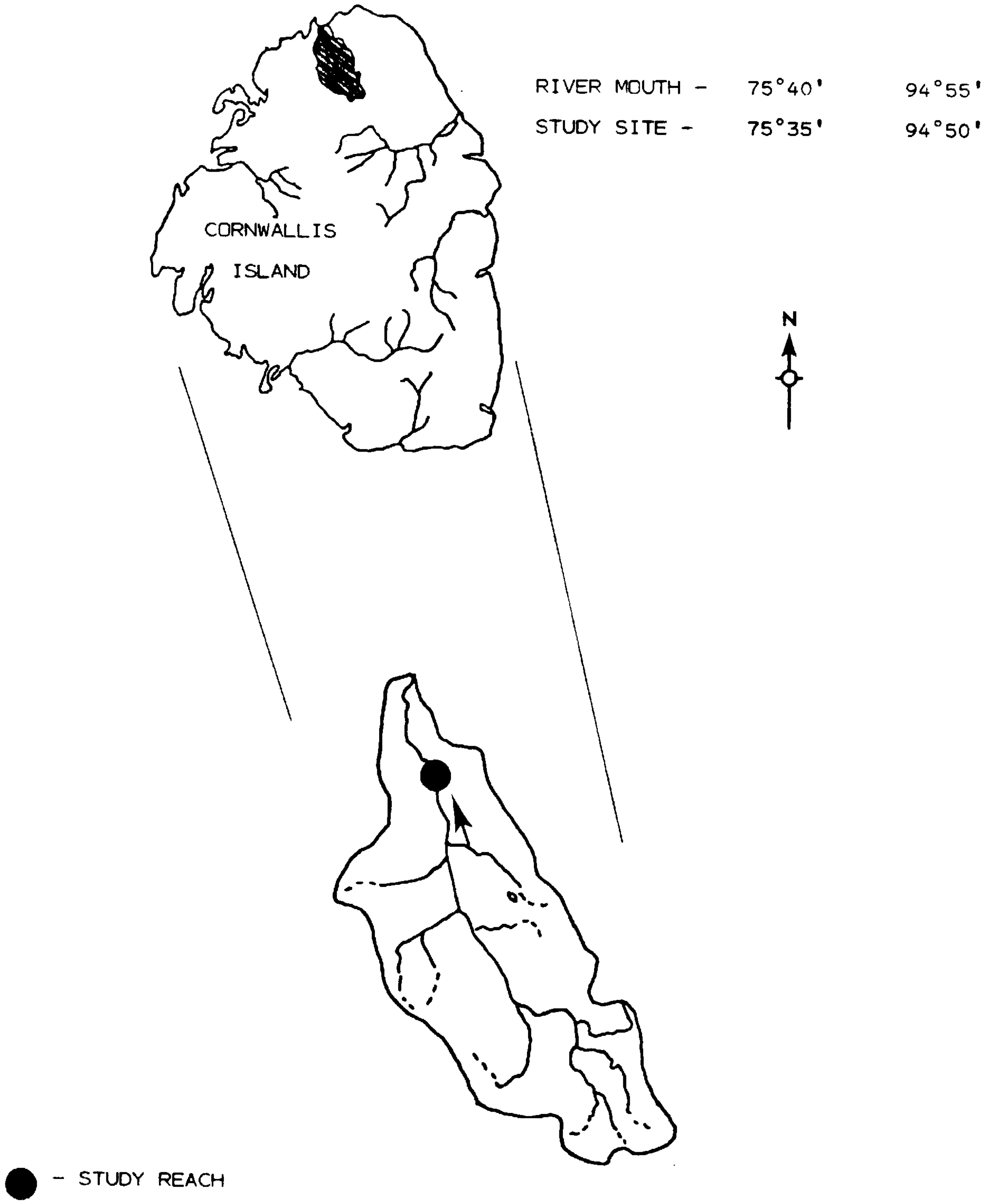
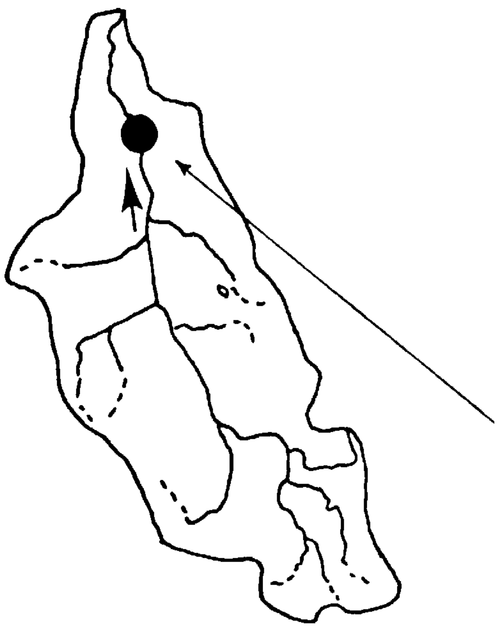


PHOTO FILE C-6



28.19 - AERIAL OBLIQUE
29.2 - DOWNSTREAM VIEW
29.2 - UPSTREAM VIEW
28.20 - CROSS SECTION

13.8 - AERIAL OBLIQUE
R.B. TO L.B.
13.9 - AERIAL OBLIQUE (DIAGONAL)
13.1 - DOWNSTREAM R.B.
13.2 - UPSTREAM R.B.
13.4 - RIGHT B. TO LEFT B.
13.7 - BED MATERIAL
13.3 - R.B. TO VALLEY WALL
13.5 - EROSION GULLIES
13.6 - EROSION GULLIES

● - STUDY REACH

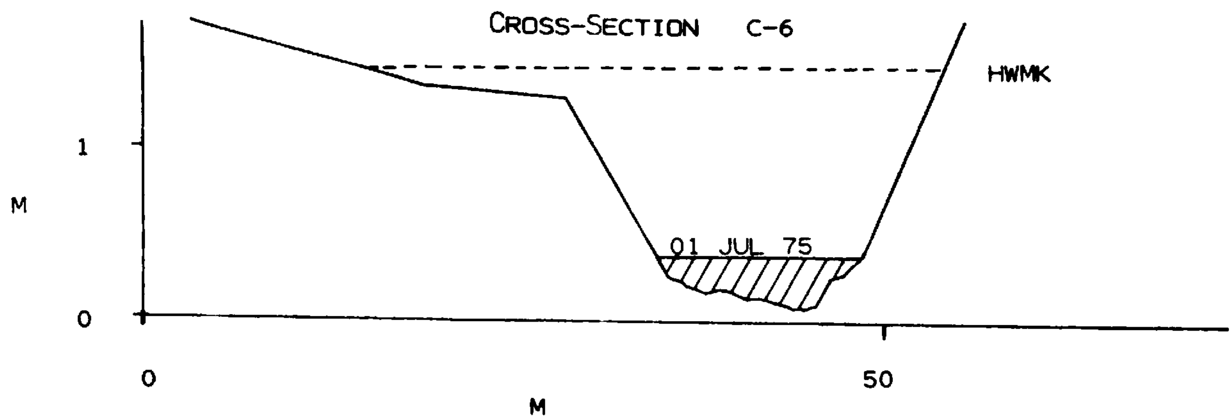
CAPE GELL C-6

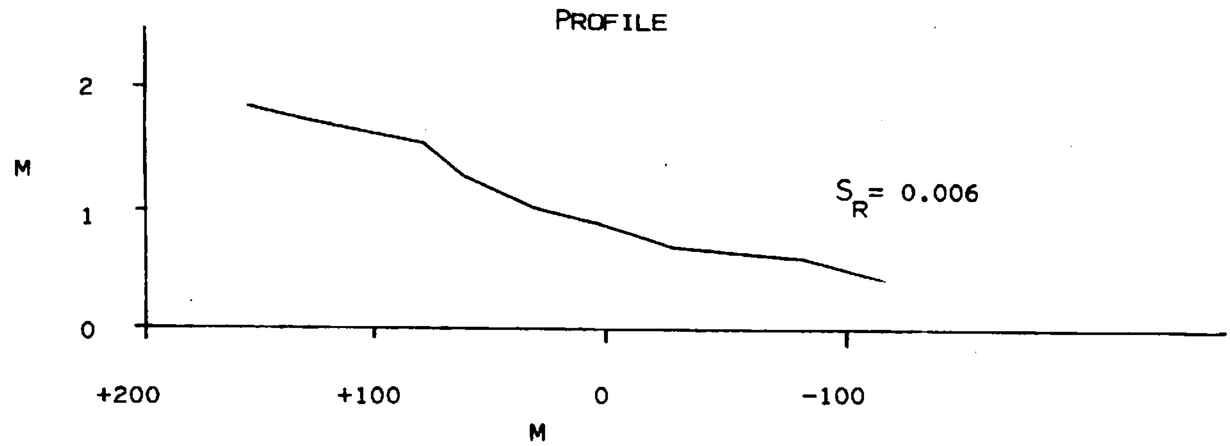
The rolling upland region of central Cornwallis slopes rather gently to the north and in this basin highest elevation is generally lower than 200 metres. Underlying bedrock is completely mantled by unconsolidated gravels and silts. Valley slopes and uplands are very nearly devoid of vegetation although sheltered areas such as the valley plain within our study reach sustains a reasonable vegetal cover of sedges, mosses and lichens. The channel pattern is sinuous and is confined by valley walls or terrace risers. Local relief is quite moderate, less than 30 metres. Valley flat width approximates 100 metres and the active flood plain varies from 50 to 75% of that value. Bed material is sand-gravel-cobble size, mainly of limestone-dolomite. Several fragmentary terrace levels were identified in the study reach. Sediment materials would be provided to the main channel by downslope particle movement and from outwash fans of tributary streams and from gullies. Meltwater from valley wall snowbeds promotes particle transport in sheet flow and rill wash well into the summer season. Relict channel scars on the exposed flood plain indicate lateral thalweg activity. Aside from this, the overall impression is one of lateral and vertical stability.

MORPHOMETRIC DATA C-6

LATITUDE AT BASIN MOUTH[1]	75° 40'
LONGITUDE AT BASIN MOUTH[1]	94° 55'
DRAINAGE AREA	114 KM^2
BASIN PERIMETER	51 KM
CIRCULARITY RATIO	0.540
STREAM ORDER	3
BIFURCATION RATIO	4.40
LENGTH OF PRINCIPAL CHANNEL	21 KM
SLOPE OF PRINCIPAL CHANNEL	0.009
BASIN WIDTH	7.6 KM
BASIN LENGTH	21.0 KM
ELONGATION RATIO	0.571
HYPSOMETRIC INTEGRAL	0.486
HYPSOMETRIC COEFFICIENT	-0.585
BASIN RELIEF	229 M
MINIMUM ELEVATION	0 M
MAXIMUM ELEVATION	229 M
AVERAGE ELEVATION	114 M
MEDIAN ELEVATION	112 M
BASIN ASPECT	N

1 - BASED ON 1:250,000 MAPS





HYDRAULIC MEASUREMENTS

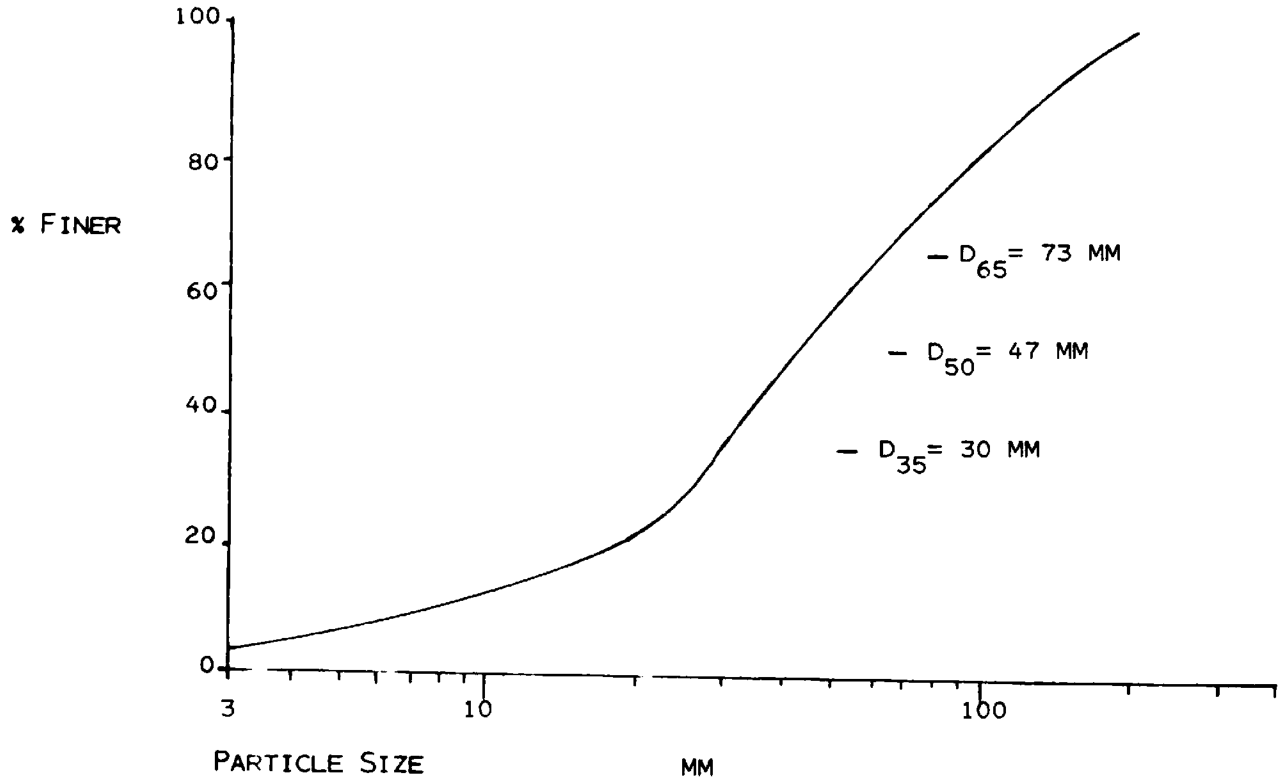
DATE	WIDTH	AREA	MEAN VELOCITY	GAUGE HEIGHT	DISCHARGE
01JUL75	14.3 M	2.6 M^2	0.45 M/S	0.26 M	1.2 M^3/S
08JUL75	14.0 M	2.6 M^2	0.48 M/S	0.25 M	1.3 M^3/S
31AUG75	6.1 M	0.6 M^2	0.15 M/S	0.05 M	0.08 M^3/S

	STAGE	AREA	HYDRAULIC RADIUS
HWMK	1.13 M	20.9 M^2	0.55 M

PERMAFROST

1 JUL 75 - 0.3 M IN STREAMBED

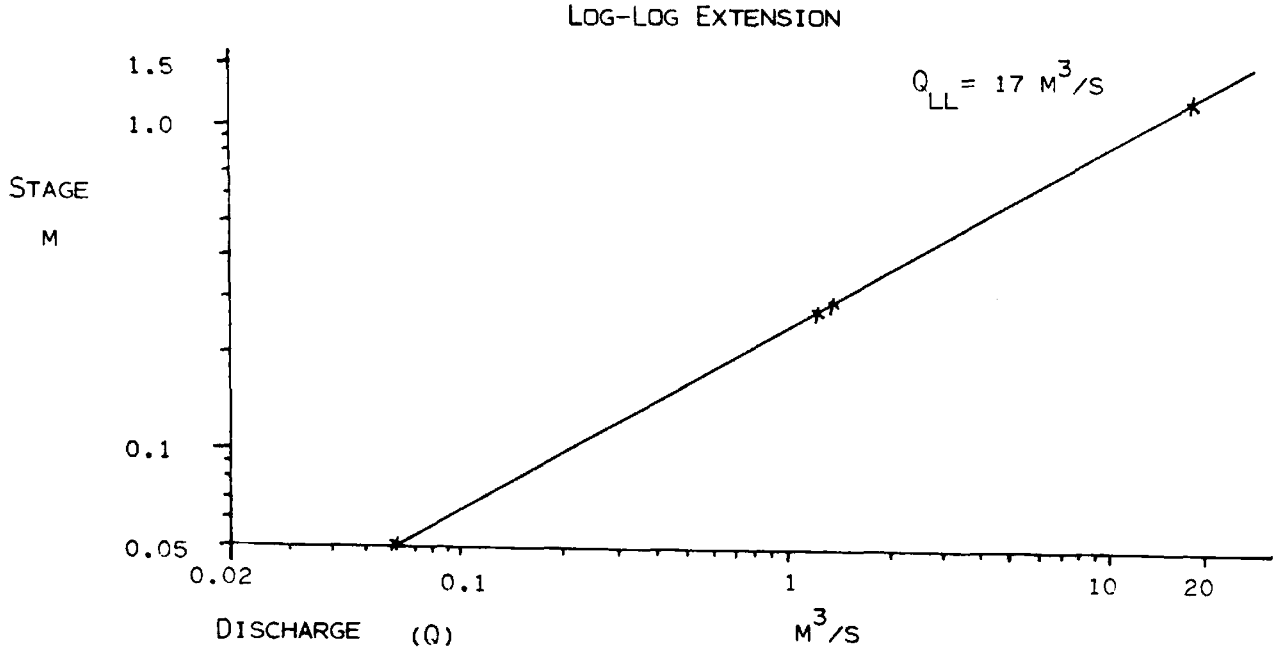
PARTICLE SIZE DISTRIBUTION (BED MATERIAL) C-6



STRICHLER'S ''N'', $N = 0.013\ (D_{50})^{1/6}$ 0.025

SUSPENDED SEDIMENT CONCENTRATION 01JUL75 18 MG/L

ESTIMATED DISCHARGE AT HIGH WATER MARK C-6



MANNING EQUATION

$$Q = \frac{A\ R^{2/3}\ S^{1/2}}{N} = \frac{(20.9)(0.55)^{2/3}(0.006)^{1/2}}{0.025}$$

$$= 43.5\ M^3/S$$

BEST ESTIMATE

25 M^3/S

STATION NO. 10TC008 CALEDONIAN RIVER ABOVE BRACEBRIDGE INLET BT-1

RIVER MOUTH -	75°40'	98°50'
STUDY SITE -	75°37'	98°35'

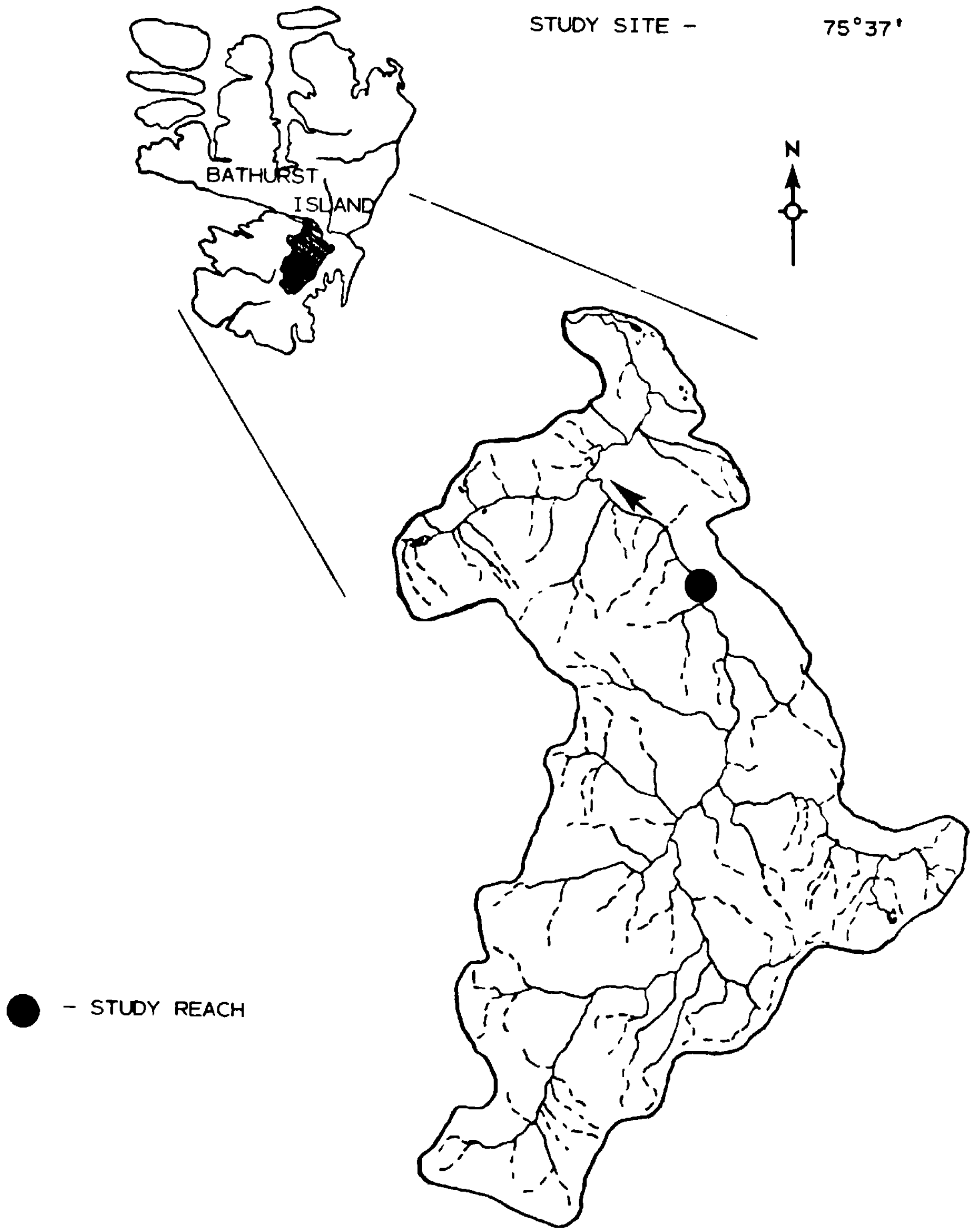
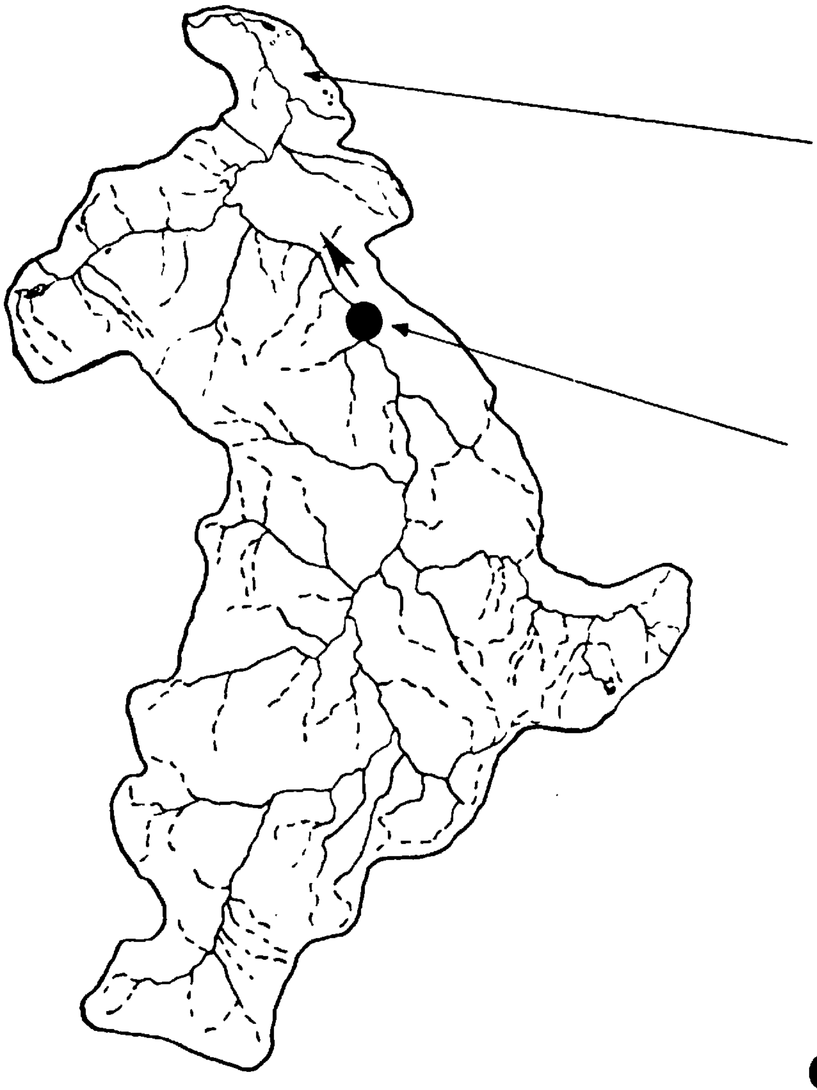


PHOTO FILE BT-1



15.4 - AERIAL OBLIQUE
15.6 - AERIAL OBLIQUE
15.7 - AERIAL OBLIQUE
15.8 - AERIAL OBLIQUE

15.14 - UPSTREAM VIEW FROM L.B.
15.12 - UPSTREAM VIEW
15.15 - VIEW ACROSS
15.9 - DOWNSTREAM FROM L.B.
15.11 - CROSS SECTION
15.10 - BED MATERIAL
15.13 - POLYGONS

25.9 - DOWNSTREAM VIEW
25.8 - UPSTREAM VIEW
25.7 - CROSS SECTION

● - STUDY REACH

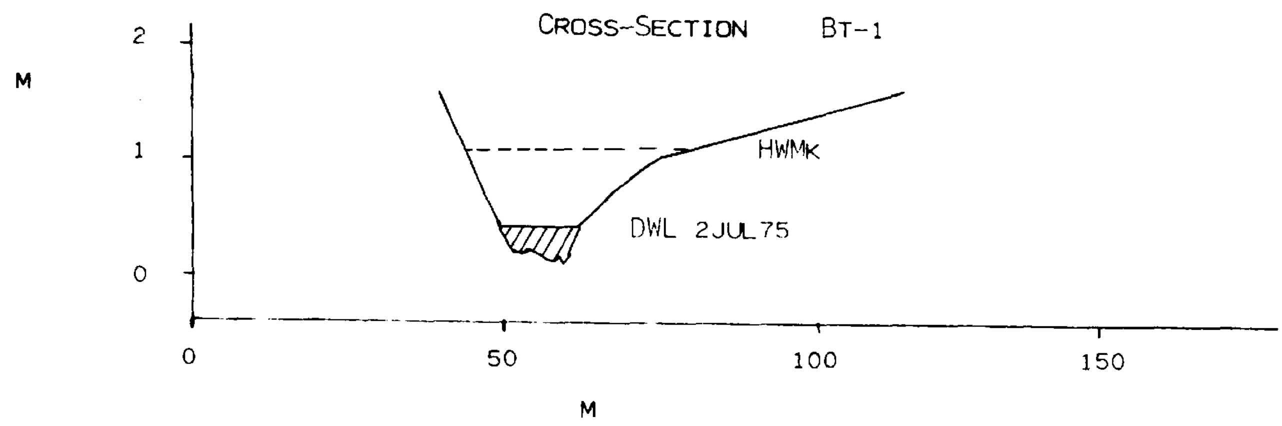
CALEDONIAN RIVER BT-1

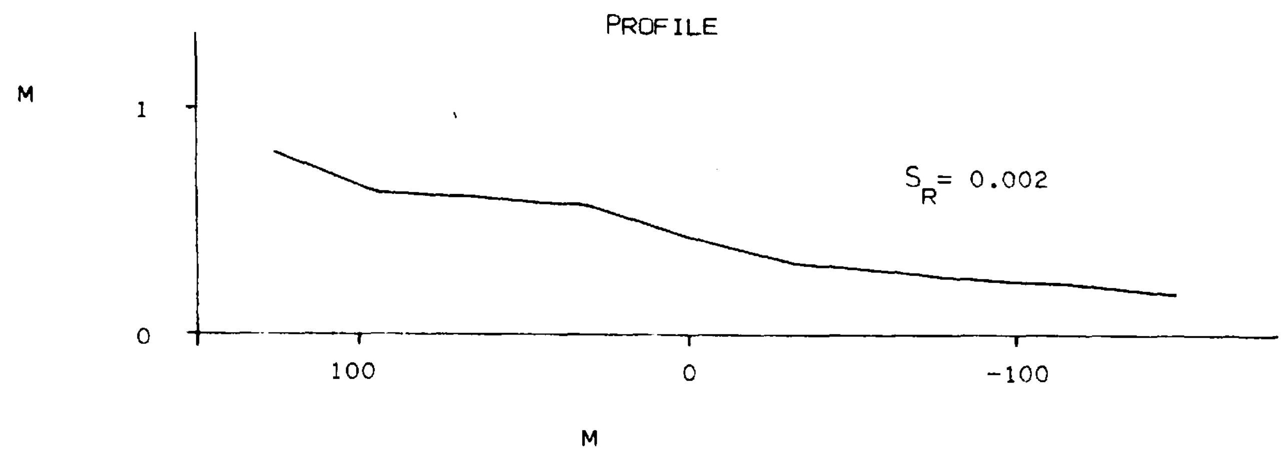
Low hill country with gentle slopes and a total relief less than 300 metres characterizes this basin. No bedrock is exposed through the unconsolidated mantle and low-lying areas are vegetated by mosses and sedges. Frost-patterned ground (polygons) occurs on significant portions of the terrain. The valley is less than 30 metres deep - valley wall material is gravelly silt, with little mass movement evident. The channel pattern is sinuous in the reach and flow is contained in a single, undivided channel. The flood plain is continuous, 60 to 100 metres wide. Absence of vegetation on the flood plain indicates seasonal overflow. Typical gravel river bed formations and a sequential riffle-pool flow pattern indicate possible lateral thalweg movement within the flood plain. Flood channel banks in the study area appear stable and not subject to any significant lateral migration.

MORPHOMETRIC DATA BT-1

LATITUDE AT BASIN MOUTH[1]	75° 40'
LONGITUDE AT BASIN MOUTH[1]	98° 50'
DRAINAGE AREA	345 KM^2
BASIN PERIMETER	106 KM
CIRCULARITY RATIO	0.384
STREAM ORDER	4
BIFURCATION RATIO	4.52
LENGTH OF PRINCIPAL CHANNEL	40 KM
SLOPE OF PRINCIPAL CHANNEL	0.005
BASIN WIDTH	16.5 KM
BASIN LENGTH	34 KM
ELONGATION RATIO	0.614
HYPSOMETRIC INTEGRAL	0.535
HYPSOMETRIC COEFFICIENT	-0.513
BASIN RELIEF	255 M
MINIMUM ELEVATION	0
MAXIMUM ELEVATION	255 M
AVERAGE ELEVATION	128 M
MEDIAN ELEVATION	130 M
BASIN ASPECT	N

1 - BASED ON 1:250,000 MAPS





HYDRAULIC MEASUREMENTS

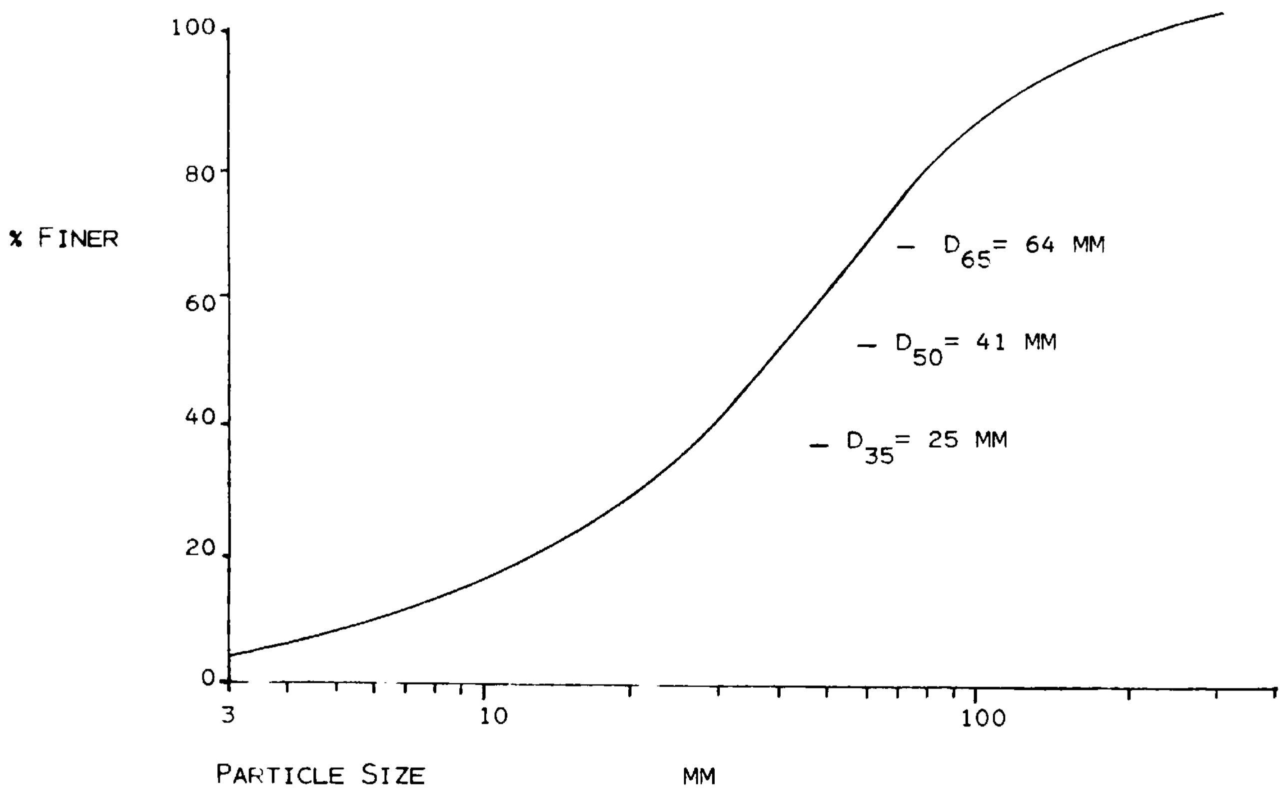
DATE	WIDTH	AREA	MEAN VELOCITY	GAUGE HEIGHT	DISCHARGE
02JUL75	13.4 M	3.2 M^2	0.62 M/S	0.39 M	2.0 M^3/S
11JUL75	7.3 M	0.8 M^2	0.43 M/S	0.24 M	0.3 M^3/S
23AUG75	5.5 M	0.3 M^2	0.21 M/S	0.16 M	0.1 M^3/S

	STAGE	AREA	HYDRAULIC RADIUS
HWMK	0.94 M	19.9 M^2	0.47 M

PERMAFROST

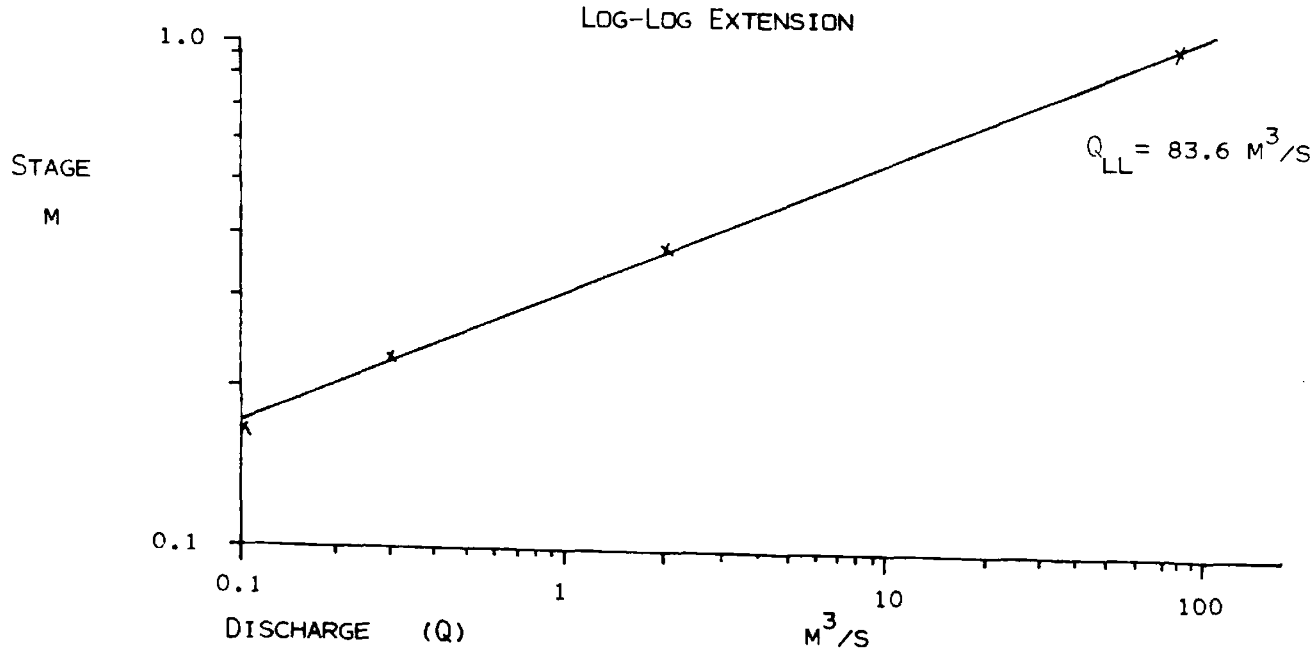
NO PROBE TAKEN

PARTICLE SIZE DISTRIBUTION (BED MATERIAL) BT-1



STRICHLER'S ''N'', $N = 0.013\ (D_{50})^{1/6}$		0.024
SUSPENDED SEDIMENT CONCENTRATION	02JUL75	18 MG/L

ESTIMATED DISCHARGE AT HIGH WATER MARK BT-1



MANNING EQUATION

$$Q = \frac{A\ R^{2/3}\ S^{1/2}}{N} = \frac{(19.9)(0.47)^{2/3}(0.002)^{1/2}}{0.024}$$

$$= 22.4\ M^3/S$$

BEST ESTIMATE

40 M^3/S

STATION NO. 10TC009 UNNAMED RIVER ABOVE GOODSIR INLET BT-2

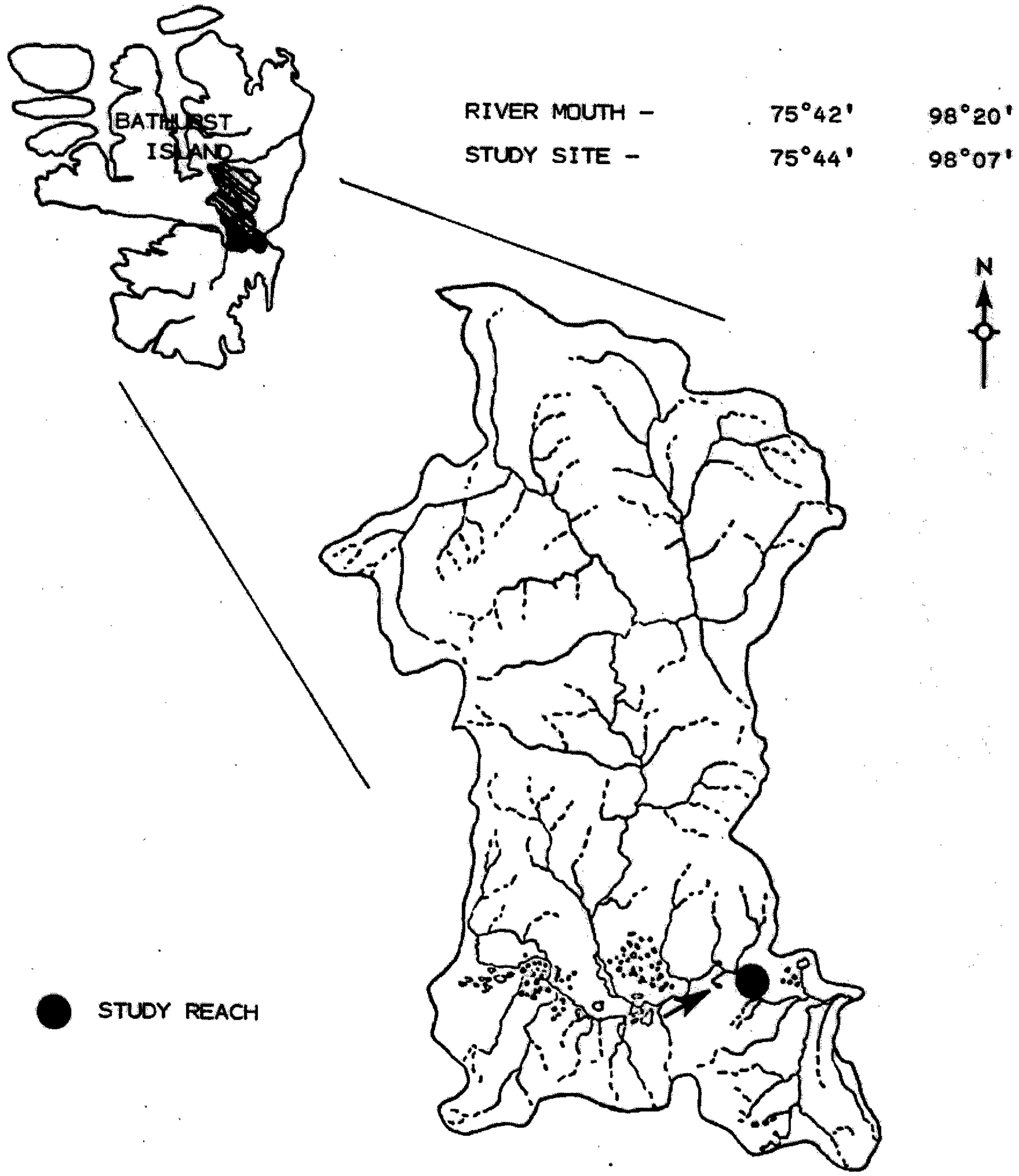
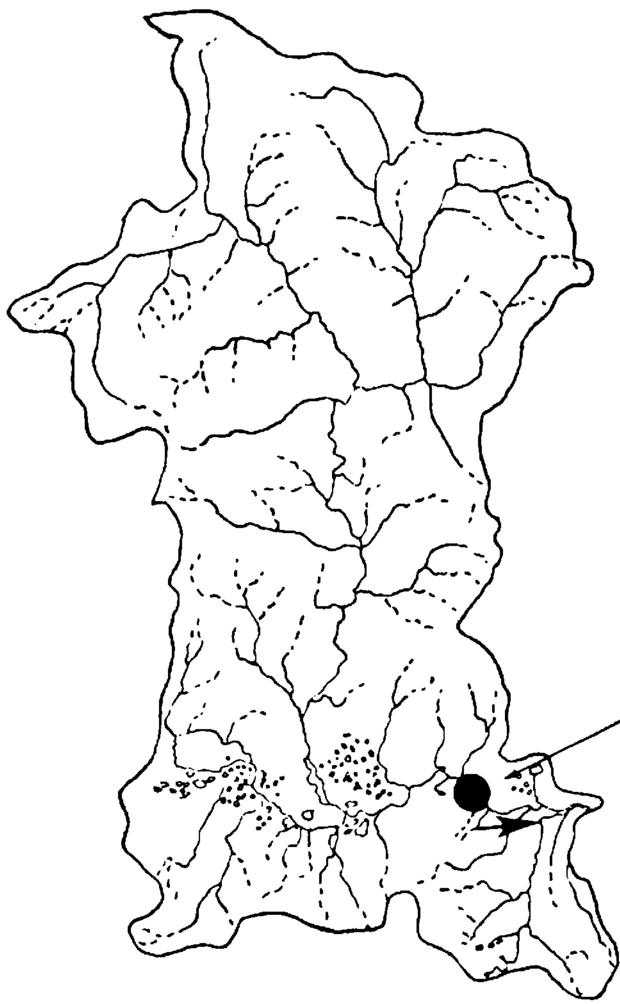


PHOTO FILE BT-2



15.3 - AERIAL OBLIQUE
25.2 - AERIAL OBLIQUE
25.6 - AERIAL OBLIQUE
25.5 - UPSTREAM VIEW
25.4 - DOWNSTREAM VIEW
25.3 - PERMAFROST PROBE

14.20 - UPSTREAM VIEW
14.19 - DOWNSTREAM VIEW
15.1 - BED MATERIAL
15.2 - BLOCK SLUMP

● - STUDY REACH

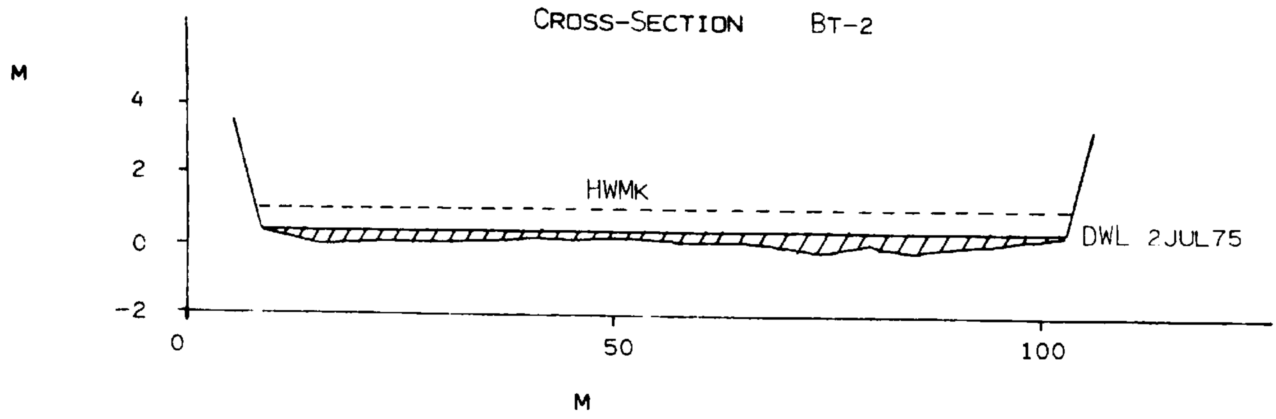
GOODSIR INLET BT-2

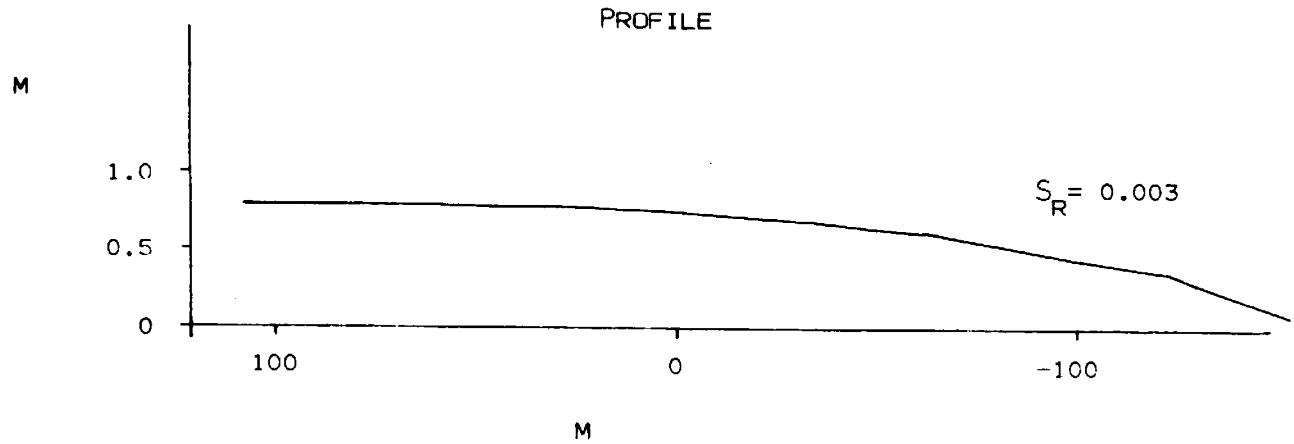
This drainage basin separates easily into two distinct areas—the upstream portion drains an area of fairly sharp local relief known as the Scoresby Hills while the downstream area flows through a poorly-drained plain several kilometres in width, extending from Bracebridge Bay in the west to Goodsir Inlet in the east. The plain, thought to be an uplifted sea floor, is bordered by low-relief hills (less than 300 metres). Numerous lakes, mostly of a size and shape associated with thermokarst activity, are surrounded by well-vegetated flat land, much of it patterned with polygons. Vegetation consists mostly of sedges and mosses. The river channel winds across this plain in a sinuous fashion with no identifiable meander patterns and is shallowly incised to an approximate 3-metre depth. Channel bed and banks are composed of silty gravel with some scattered cobble-sized rock. The banks are sloped at roughly 30 degrees and exhibit erosional features such as block slump, thermal niching and particle slide in uncompacted gravels and silts. The flood plain is approximately 150 metres in width and typical gravel bed river patterns indicate lateral thalweg instability. A shallow permafrost horizon in the stream bed would appear to inhibit vertical activity, particularly in the spring freshet.

MORPHOMETRIC DATA BT-2

LATITUDE AT BASIN MOUTH[1]	75° 42'
LONGITUDE AT BASIN MOUTH[1]	98° 20'
DRAINAGE AREA	440 KM^2
BASIN PERIMETER	102 KM
CIRCULARITY RATIO	0.522
STREAM ORDER	4
BIFURCATION RATIO	5.39
LENGTH OF PRINCIPAL CHANNEL	96 KM
SLOPE OF PRINCIPAL CHANNEL	0.005
BASIN WIDTH	25.6 KM
BASIN LENGTH	35.5 KM
ELONGATION RATIO	0.663
HYPSOMETRIC INTEGRAL	0.624
HYPSOMETRIC COEFFICIENT	-0.597
BASIN RELIEF	275 M
MINIMUM ELEVATION	15 M
MAXIMUM ELEVATION	290 M
AVERAGE ELEVATION	152 M
MEDIAN ELEVATION	173 M
BASIN ASPECT	S E

1 - BASED ON 1:250,000 MAPS





HYDRAULIC MEASUREMENTS

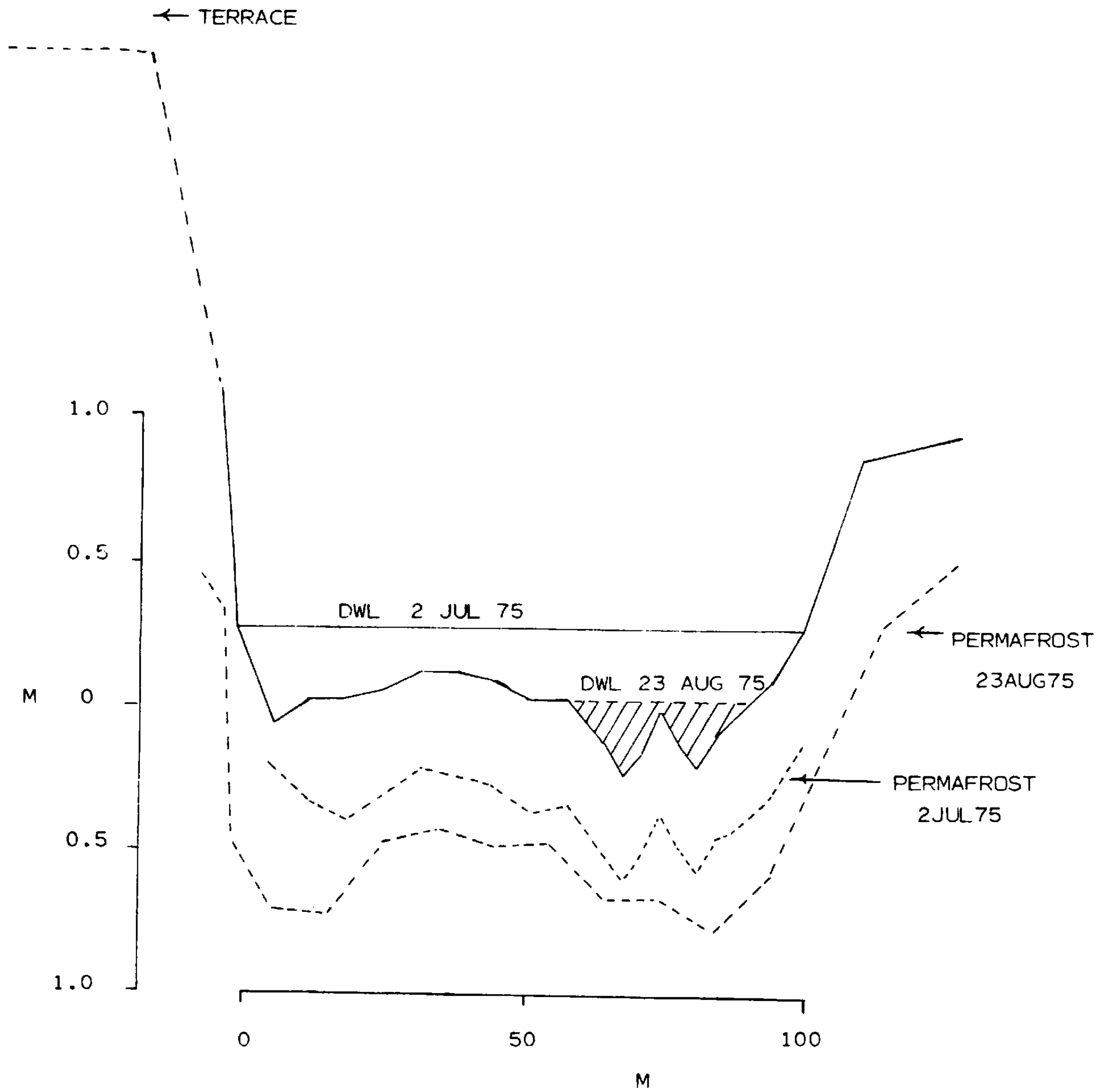
DATE	WIDTH	AREA	MEAN VELOCITY	GAUGE HEIGHT	DISCHARGE
02JUL75	94.2 M	24.1 M^2	0.53 M/S	0.27 M	12.9 M^3/S
10JUL75	89.9 M	15.3 M^2	0.42 M/S	0.17 M	6.5 M^3/S
23AUG75	12.5 M	3.0 M^2	0.10 M/S	0.03 M	0.3 M^3/S

	STAGE	AREA	HYDRAULIC RADIUS
HWMK	0.98 M	91.1 M^2	0.93 M

PERMAFROST

SEE PERMAFROST CROSS-SECTION

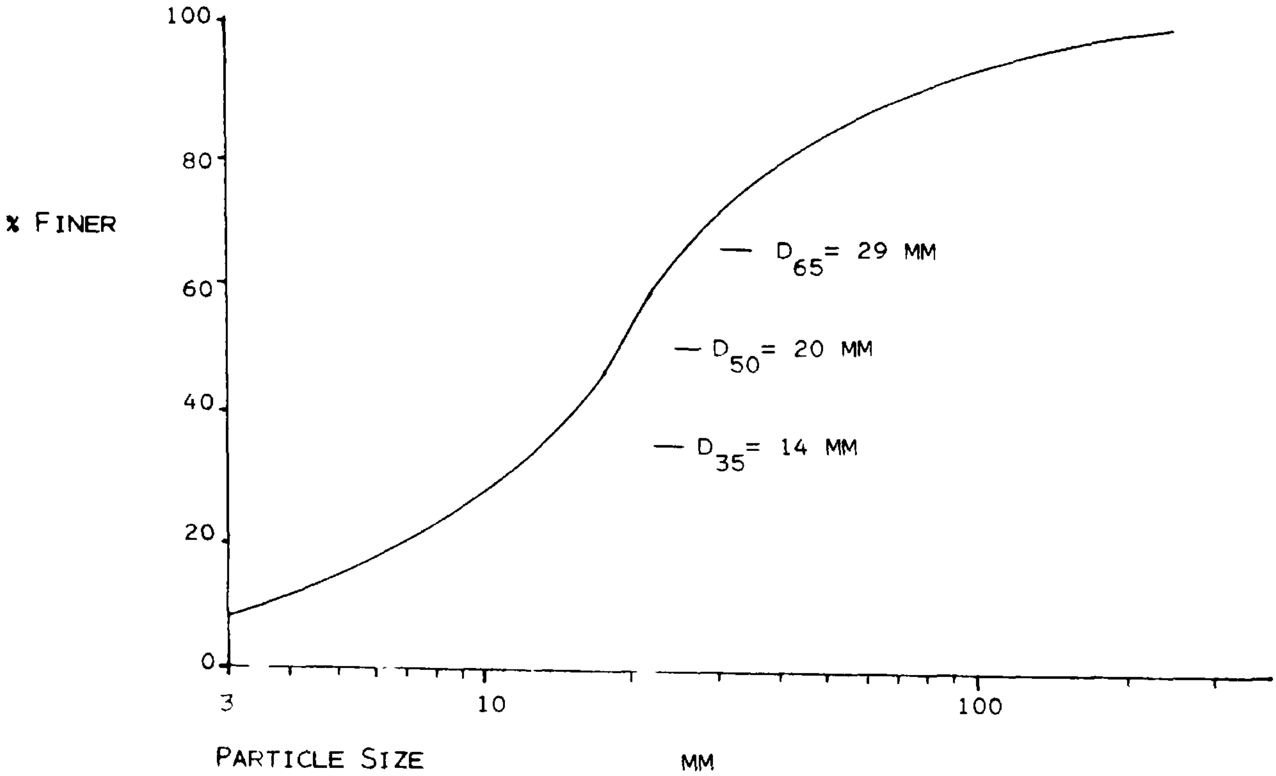
PERMAFROST CROSS-SECTION BT-2



NOTE: 23 AUG 75 – PERMAFROST DEPTH WAS 0.4 M ON THE TERRACE IN A SMALL THERMOKARST POOL

– PERMAFROST DEPTH WAS 0.6 M AT THE TOP OF L.B.

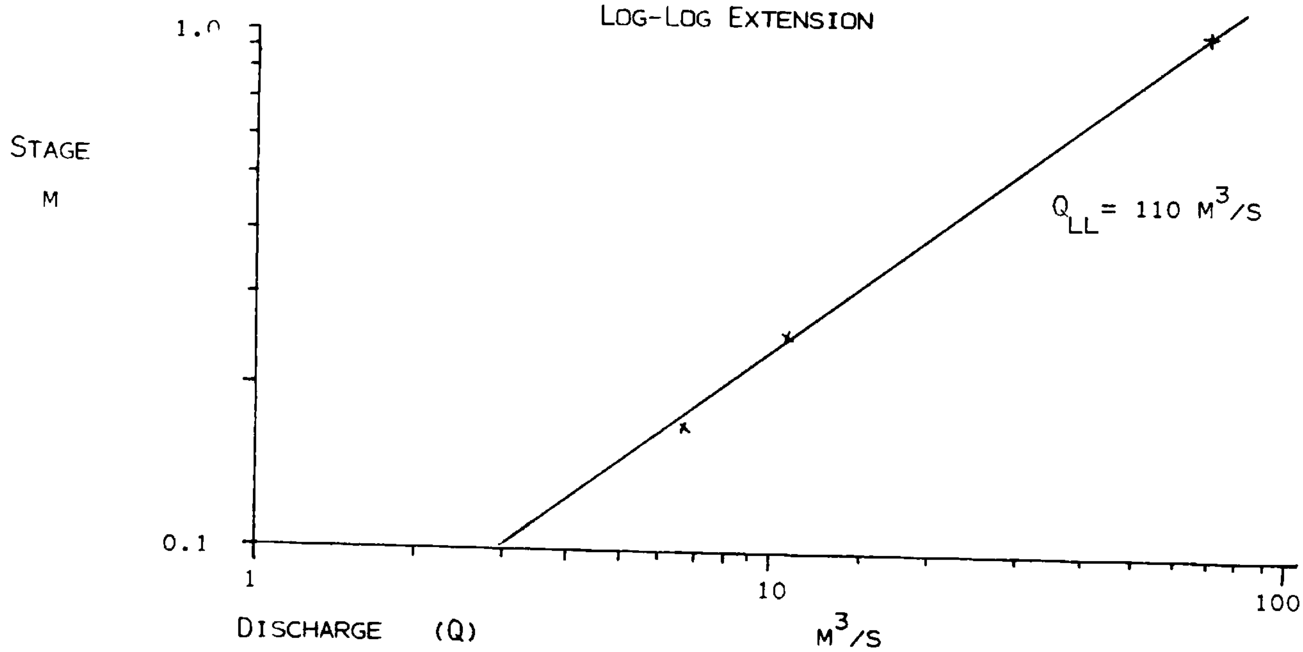
PARTICLE SIZE DISTRIBUTION (BED MATERIAL) BT-2



STRICHLER'S ''N'', $N = 0.013\ (D_{50})^{1/6}$ 0.022

SUSPENDED SEDIMENT CONCENTRATION 02JUL75 19 MG/L

ESTIMATED DISCHARGE AT HIGH WATER MARK BT-2



MANNING EQUATION

$$Q = \frac{A\ R^{2/3}\ S^{1/2}}{N} = \frac{(91.1)(0.93)^{2/3}(0.003)^{1/2}}{0.022}$$

$= 216\ M^3/S$

BEST ESTIMATE

$100\ M^3/S$

STATION NO. 10TC010 UNNAMED RIVER ABOVE ALLISON INLET BT-3

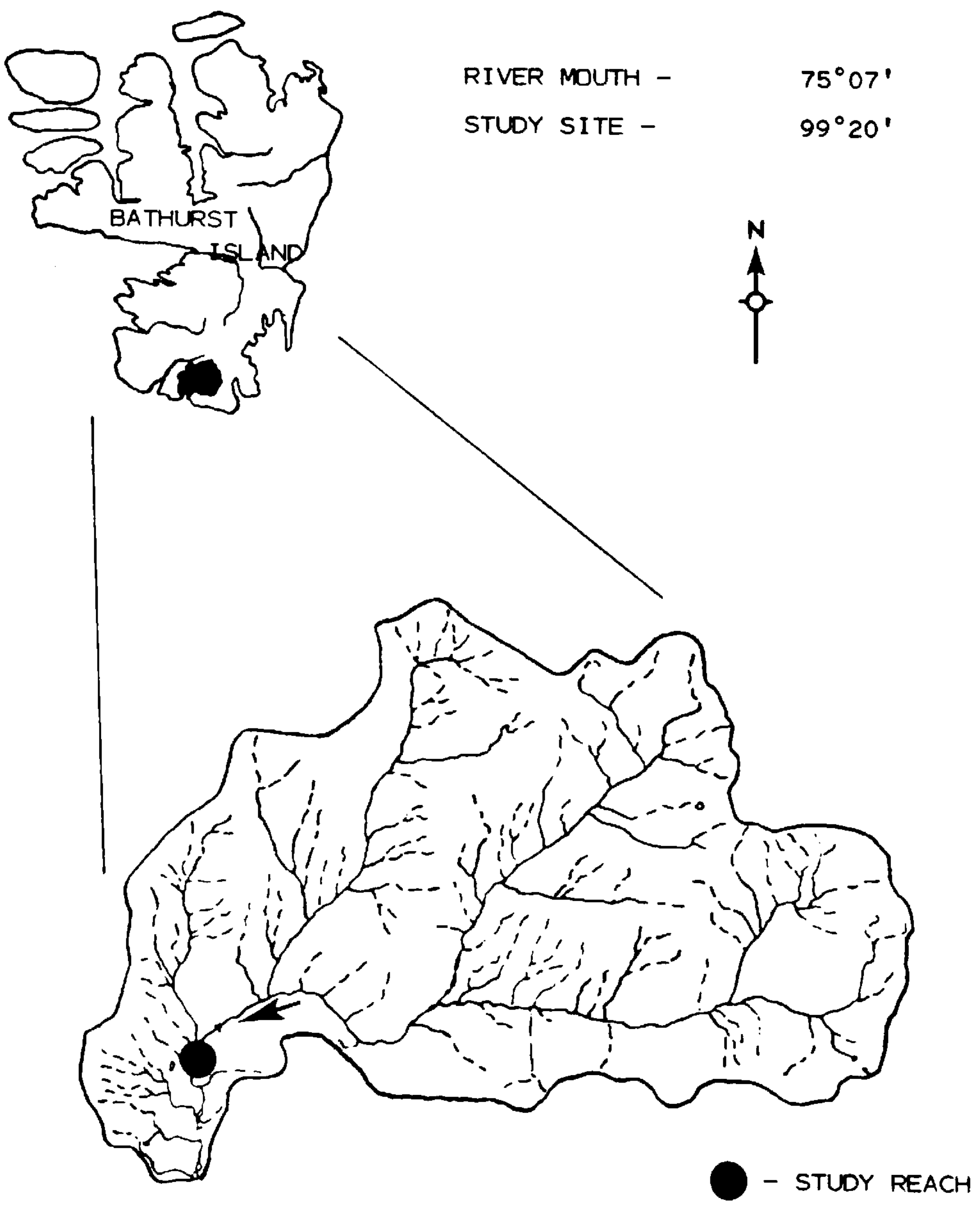
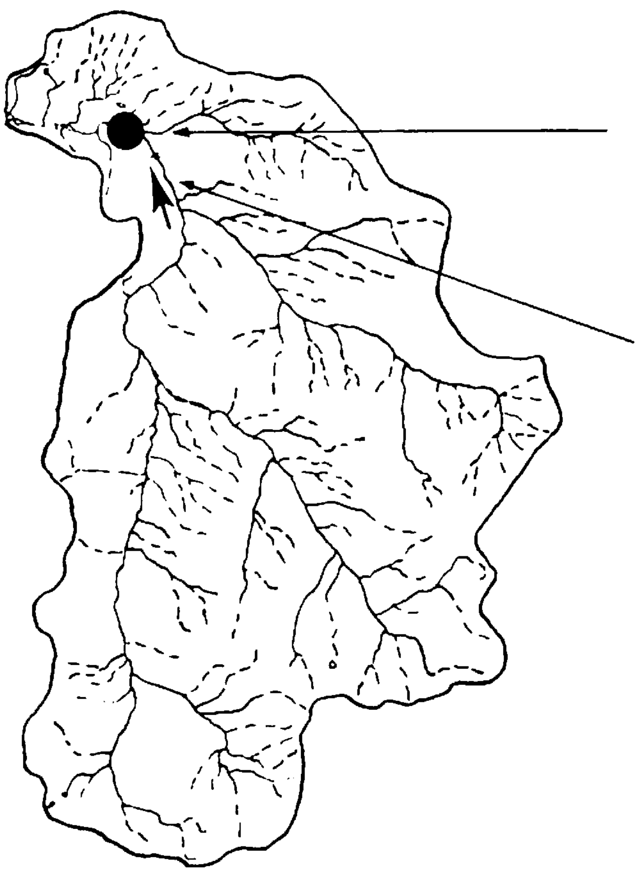


PHOTO FILE BT-3



16.0 - VIEW ACROSS
16.1 - VIEW UPSTREAM
16.2 - VIEW DOWNSTREAM
16.3 - BED MATERIAL
16.4 - FLOOD PLAIN

15.18 - AERIAL OBLIQUE
15.19 - AERIAL OBLIQUE
15.20 - ESCARPMENT
15.21 - POOL AND RIFFLE

16.5 - LATERAL EROSION
16.7 - ERODING BANK
16.8 - UNDERCUTTING

26.3 - AERIAL OBLIQUE (DOWNSTREAM)

● - STUDY REACH

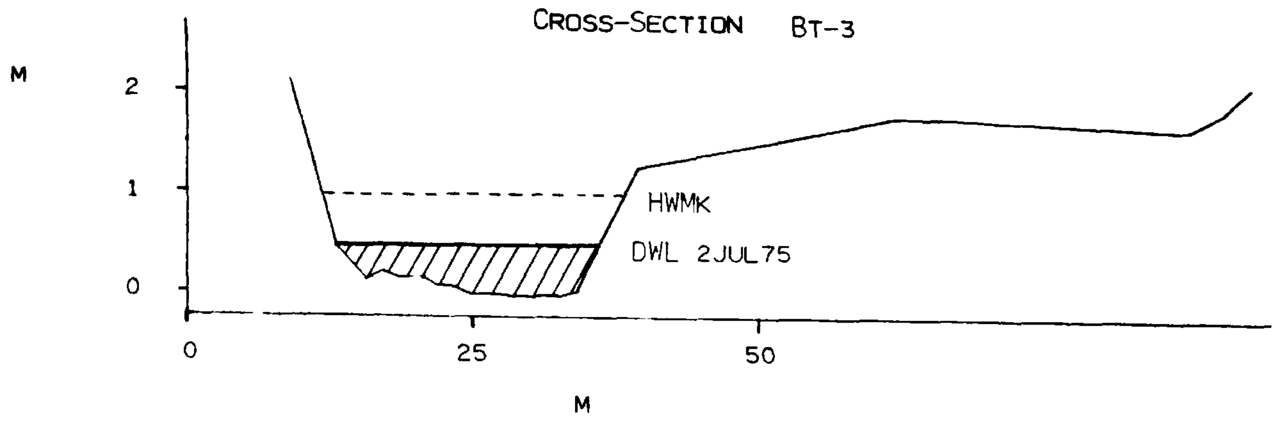
ALLISON INLET BT-3

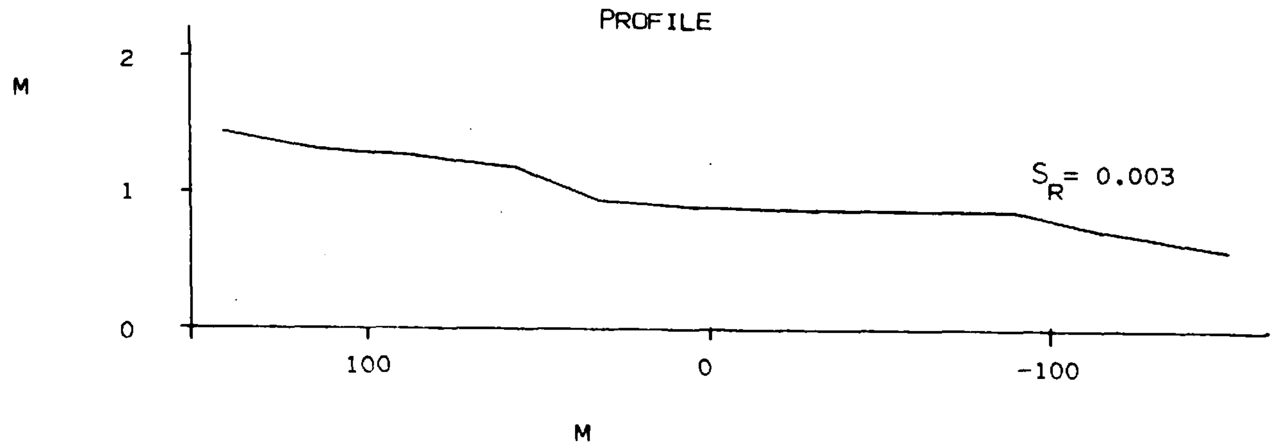
This stream drains a low level, bedrock plateau region mantled by unconsolidated gravels and silts. Poorly drained bog areas are vegetated by sedges and mosses - these areas also exhibited patterned ground features (polygons). The channel becomes entrenched where the river exits from the upland, numerous knick points exist here. The study reach was approximately one kilometre below the last knickpoint in a fairly shallow valley (less than 50 metres deep) with variable slopes. Fragmentary terraces were noted on both valley walls although their infrequent occurrence prevented us from defining their sequences without extensive surveys. Localized mass movement on valley walls occurs in the form of rill wash. The live channel was undivided and exhibited a riffle-pool sequence typical of gravel rivers although bed material (surficial) graded into cobble sizes. The predominant particle sizes, proximity of bedrock to surface and gentle slopes in the area indicate a fairly stable geomorphic condition, both laterally and vertically. Downstream of the study reach by approximately three kilometres, the stream is actively niching a terrace riser of much finer material. Fairly massive ground ice lenses (1 metre thick and 30 metres long) were exposed in this actively eroding bank. Continuous particle movement and deposition of fines in the live channel were apparent at the time of our short stop there.

MORPHOMETRIC DATA BT-3

LATITUDE AT BASIN MOUTH[1]	75° 07'
LONGITUDE AT BASIN MOUTH[1]	99° 20'
DRAINAGE AREA	324 KM^2
BASIN PERIMETER	91 KM
CIRCULARITY RATIO	0.483
STREAM ORDER	4
BIFURCATION RATIO	4.21
LENGTH OF PRINCIPAL CHANNEL	26 KM
SLOPE OF PRINCIPAL CHANNEL	0.01
BASIN WIDTH	16.5 KM
BASIN LENGTH	25.3 KM
ELONGATION RATIO	0.798
HYPSOMETRIC INTEGRAL	0.617
HYPSOMETRIC COEFFICIENT	-0.533
BASIN RELIEF	290 M
MINIMUM ELEVATION	0
MAXIMUM ELEVATION	290 M
AVERAGE ELEVATION	145 M
MEDIAN ELEVATION	183 M
BASIN ASPECT	S W

1 - BASED ON 1:250,000 MAPS





HYDRAULIC MEASUREMENTS

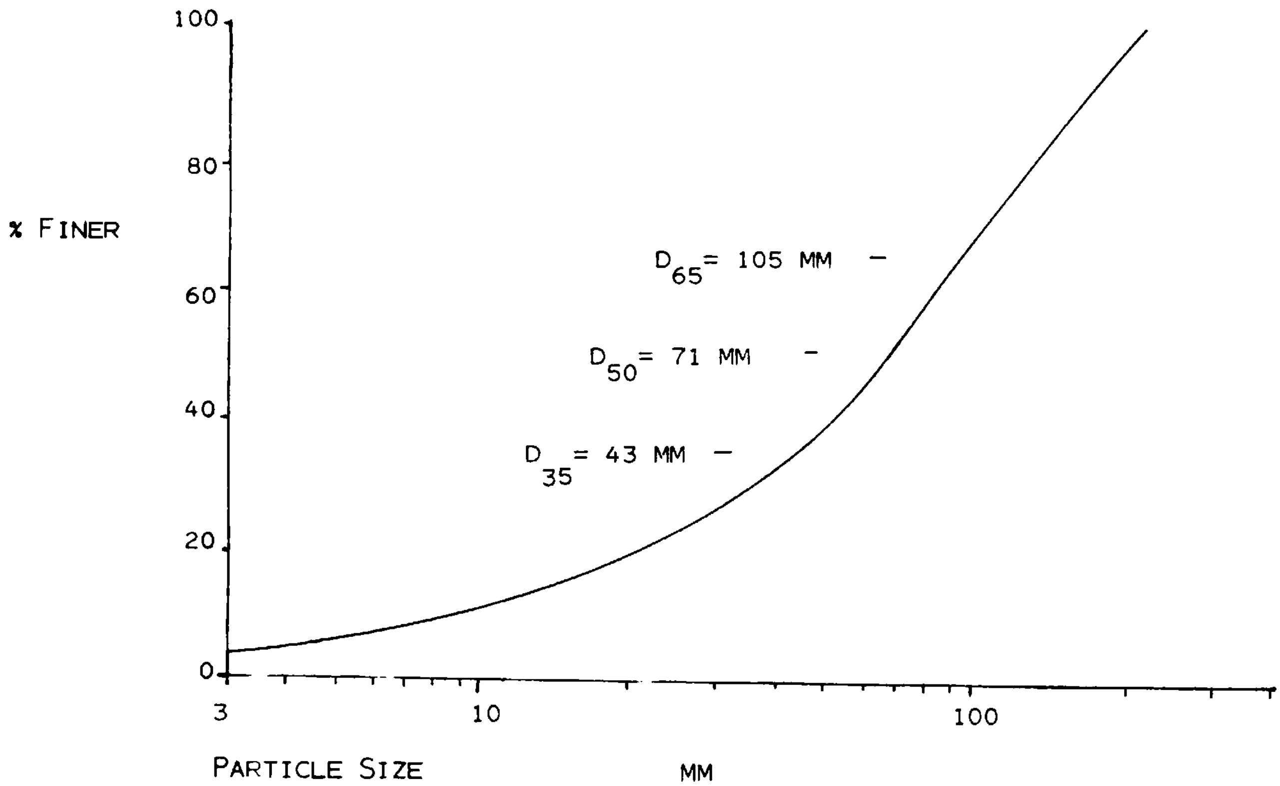
DATE	WIDTH	AREA	MEAN VELOCITY	GAUGE HEIGHT	DISCHARGE
02JUL75	23.2 M	11.0 M^2	0.35 M/S	0.47 M	3.8 M^3/S
09JUL75	23.2 M	7.3 M^2	0.18 M/S	0.28 M	1.3 M^3/S
23AUG75	8.2 M	3.2 M^2	0.06 M/S	0.11 M	0.2 M^3/S

	STAGE	AREA	HYDRAULIC RADIUS
HWMK	1.00 M	22.5 M^2	0.84 M

PERMAFROST

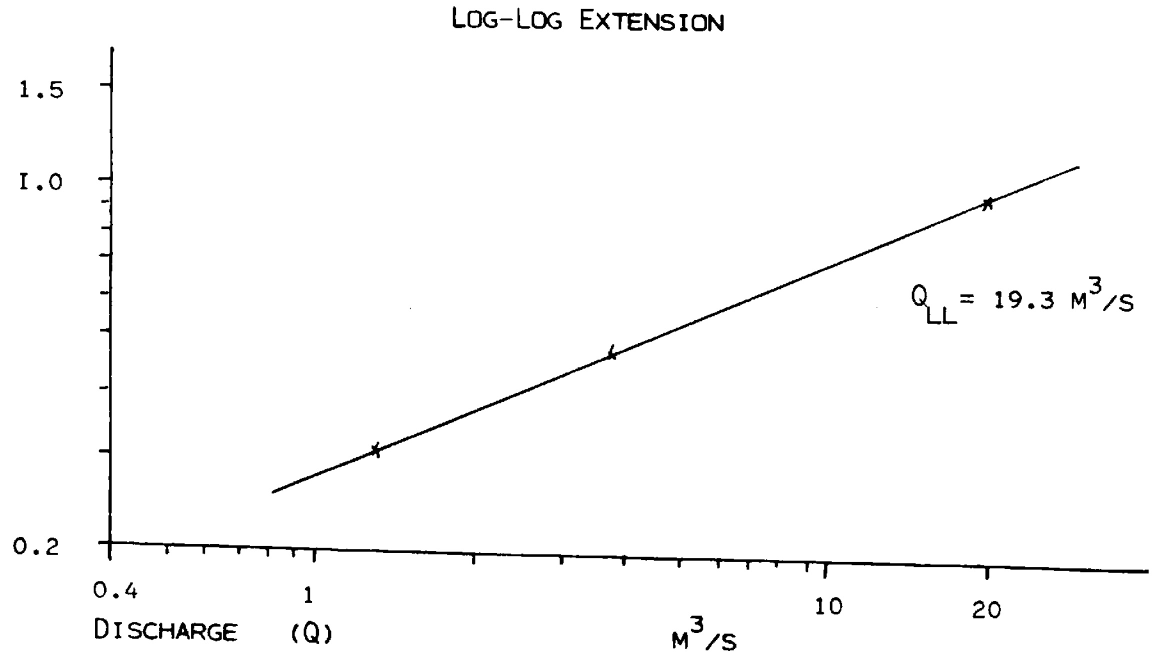
NO PROBE TAKEN

PARTICLE SIZE DISTRIBUTION (BED MATERIAL) BT-3



STRICHLER'S ''N'', N = 0.013 $(D_{50})^{1/6}$		0.027
SUSPENDED SEDIMENT CONCENTRATION	02JUL75	15 MG/L

ESTIMATED DISCHARGE AT HIGH WATER MARK BT-3



MANNING EQUATION

$$Q = \frac{A\ R^{2/3}\ S^{1/2}}{N} = \frac{(22.5)(0.84)^{2/3}(0.003)^{1/2}}{0.027}$$

$$= 40.6\ M^3/S$$

BEST ESTIMATE

25 M^3/S

STATION NO. 10TC011 UNNAMED RIVER ABOVE BRACEBRIDGE INLET BT-4

RIVER MOUTH - 75°43' 100°30'

STUDY SITE - 75°42' 100°33'

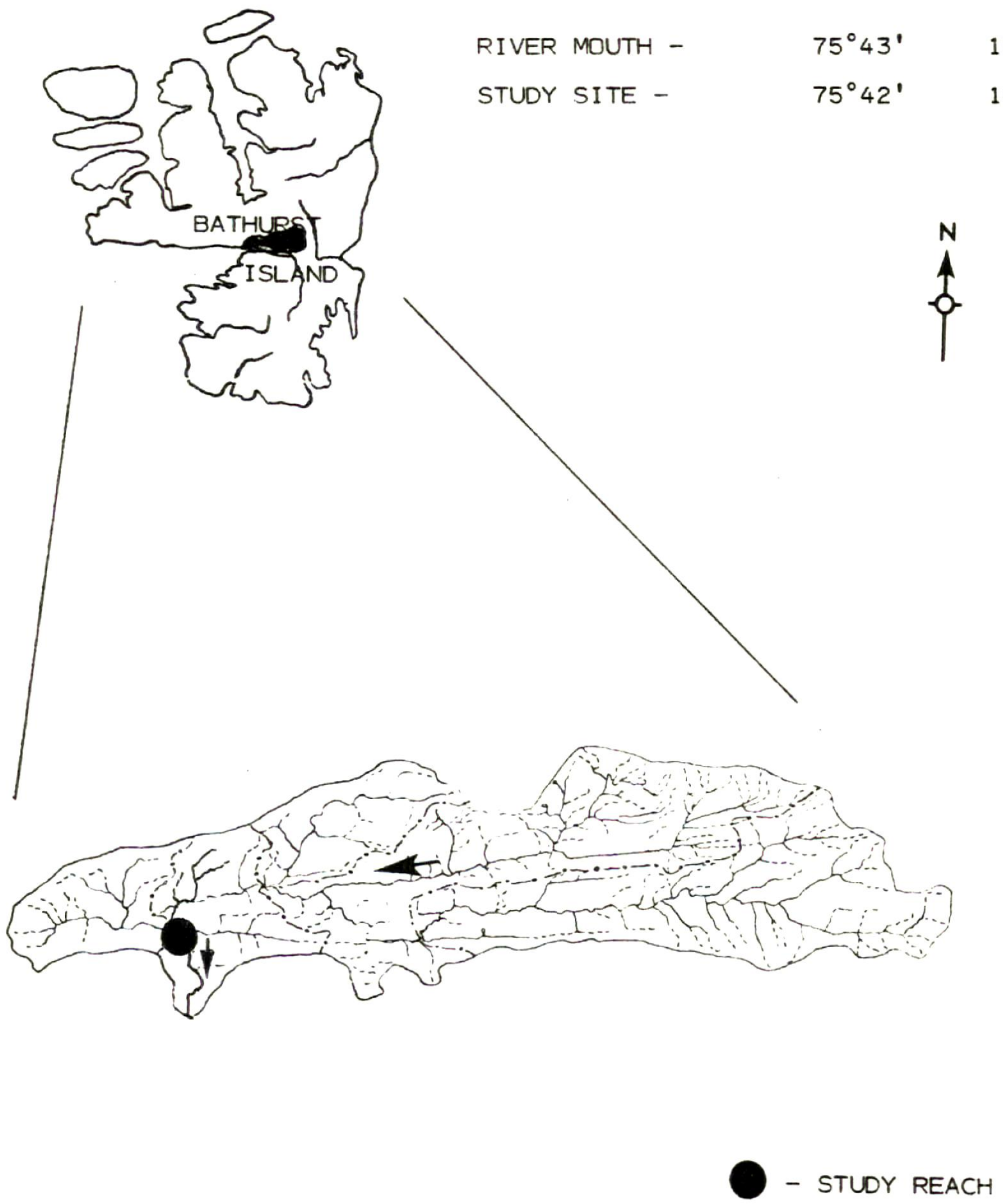
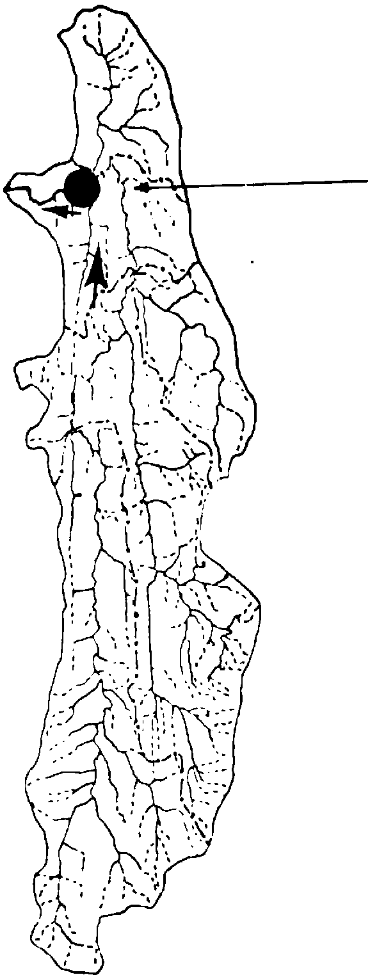


PHOTO FILE BT-4



17.8 - VIEW ACROSS
17.9 - VIEW UPSTREAM
17.10 - VIEW DOWNSTREAM
17.5 - BED MATERIAL

17.4 - SHALE, CLAY HILLS
17.11 - SOLIFLUCTION LOBE
17.12 - SOLIFLUCTION LOBE

25.11 - CROSS SECTION
25.12 - DOWNSTREAM VIEW
25.13 - UPSTREAM VIEW

25.15 - AERIAL OBLIQUE
25.16 - AERIAL OBLIQUE

● - STUDY REACH

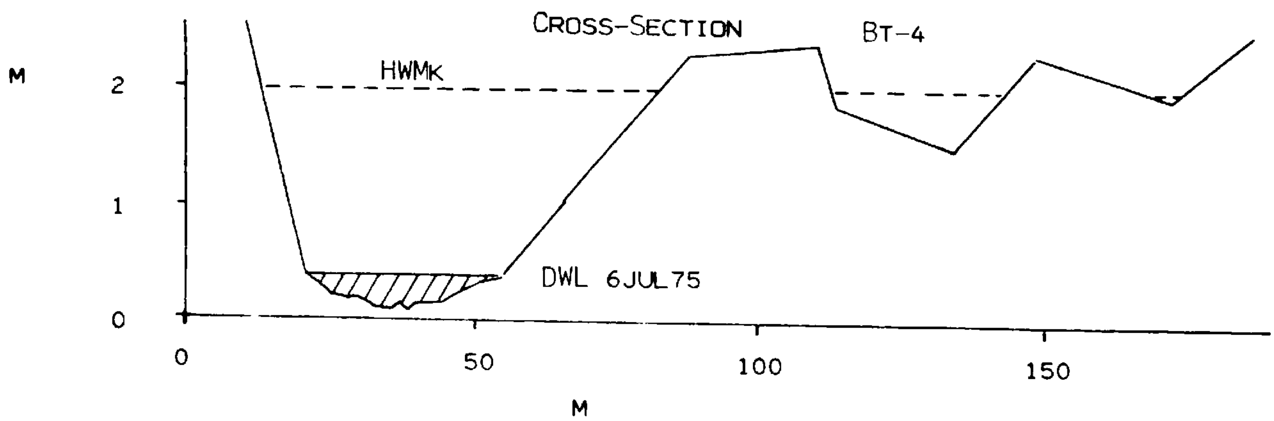
BRACEBRIDGE BAY BT-4

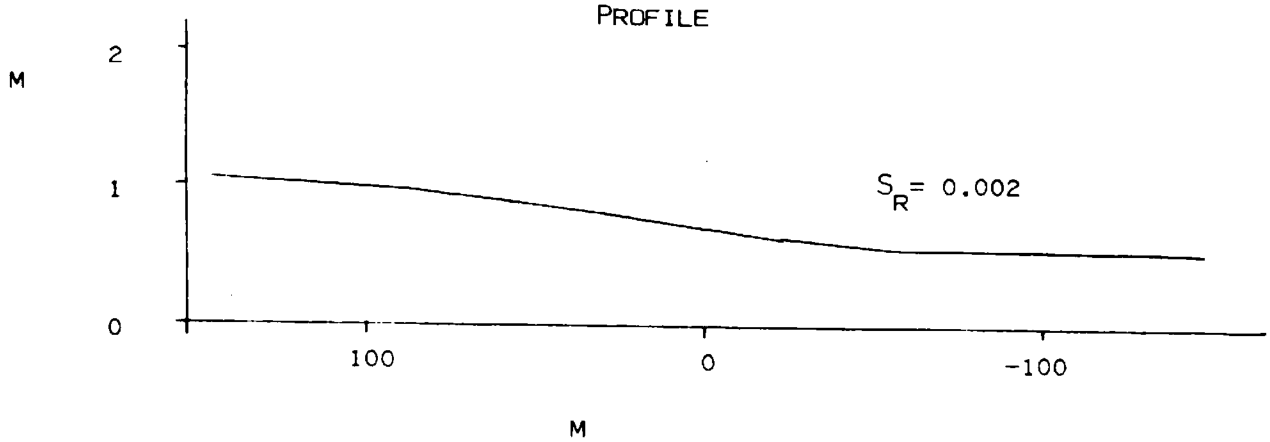
After trending westerly between two lines of folded sedimentary highlands the stream bends abruptly southwards and empties into the sea. The channel is sharply incised into the southern fold belt and steep valley walls result, with some exposed bedrock and scree slopes. The valley is confined by bordering hills. The alluvial flood plain widens where the stream exits from the highlands and nearer the sea assumes a braided character. In the study reach, at the outlet of the highland region, the flood plain width is variable of generally moderate dimensions, approximately 150 metres at maximum. Fragmentary terraces border the flood plain and low hills behind these form the valley walls. Substantial overburden of bouldery gravel and silt mantle the parent rock. Low-lying areas outside the flood plain are vegetated by sedges, mosses and some isolated patches of scrub willow. Where the river abuts hillsides some downhill mass movement by sliding or rill wash occurs. On shallower gradients solifluction lobes were noted - appreciable portions of the valley wall area exhibited surficial soil instability. The flood plain bears recent scars evidencing the fact of lateral thalweg migration throughout its width. Some further lateral activity could occur when the live channel impinges on terrace risers or valley walls. The stream is a typical gravel river with riffle pool sequences in the study reach.

MORPHOMETRIC DATA BT-4

LATITUDE AT BASIN MOUTH[1]	75° 43'
LONGITUDE AT BASIN MOUTH[1]	100° 30'
DRAINAGE AREA	635 KM^2
BASIN PERIMETER	146 KM
CIRCULARITY RATIO	0.372
STREAM ORDER	5
BIFURCATION RATIO	4.71
LENGTH OF PRINCIPAL CHANNEL	58 KM
SLOPE OF PRINCIPAL CHANNEL	0.004
BASIN WIDTH	14.6 KM
BASIN LENGTH	50.6 KM
ELONGATION RATIO	0.559
HYPSOMETRIC INTEGRAL	0.480
HYPSOMETRIC COEFFICIENT	-0.227
BASIN RELIEF	351 M
MINIMUM ELEVATION	0 M
MAXIMUM ELEVATION	351 M
AVERAGE ELEVATION	175 M
MEDIAN ELEVATION	170 M
BASIN ASPECT	S W

1 - BASED ON 1:250,000 MAPS





HYDRAULIC MEASUREMENTS

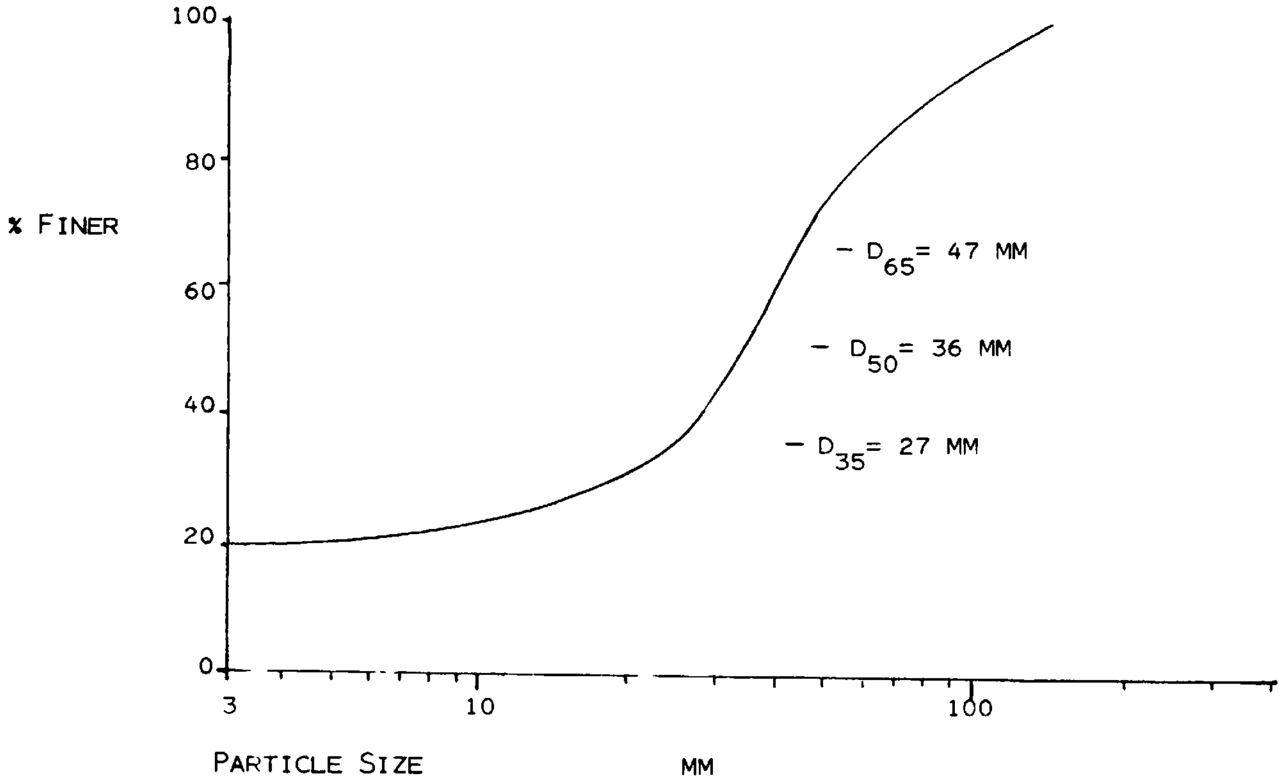
DATE	WIDTH	AREA	MEAN VELOCITY	GAUGE HEIGHT	DISCHARGE
06JUL75	33.5 M	6.0 M^2	0.73 M/S	0.33 M	4.4 M^3/S
23AUG75	15.8 M	1.4 M^2	0.24 M/S	0.13 M	0.3 M^3/S

	STAGE	AREA	HYDRAULIC RADIUS
HWMK	1.60 M	63.2 M^2	0.99 M

PERMAFROST

23 AUG 75 - 0.7 M AT WATER'S EDGE , R.B.
- 0.9 M AT THALWEG

PARTICLE SIZE DISTRIBUTION (BED MATERIAL) BT-4

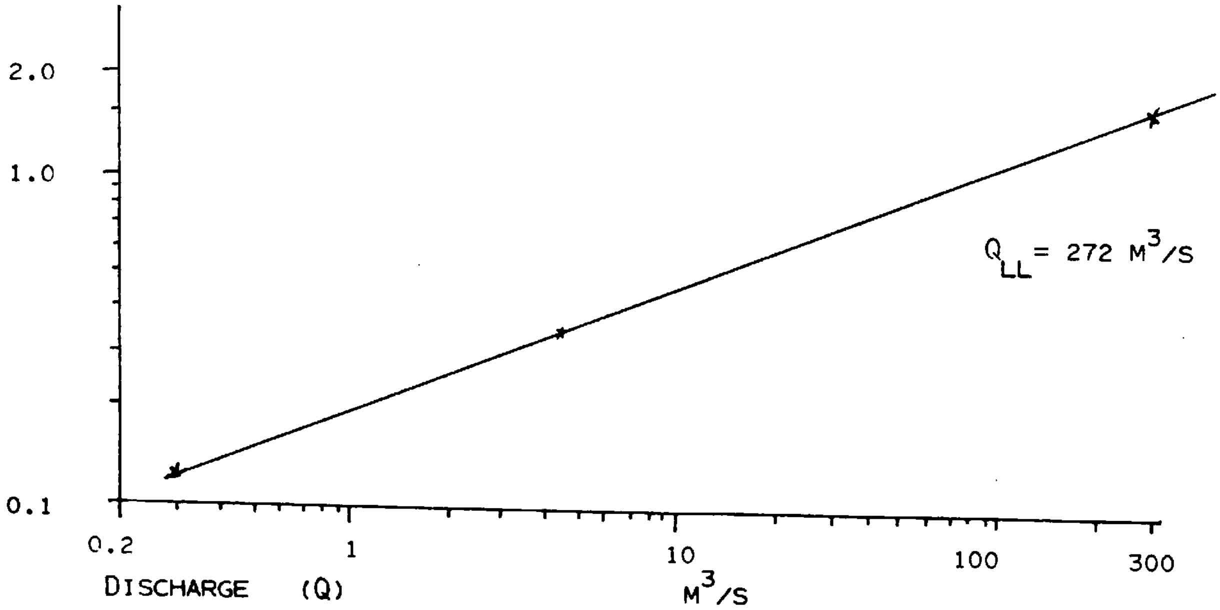


STRICHLER'S ''N'', $N = 0.013\ (D_{50})^{1/6}$ 0.024

SUSPENDED SEDIMENT CONCENTRATION 06JUL75 30 MG/L

ESTIMATED DISCHARGE AT HIGH WATER MARK BT-4

LOG-LOG EXTENSION



MANNING EQUATION

$$Q = \frac{A\,R^{2/3}\,S^{1/2}}{N} = \frac{(63.2)(0.99)^{2/3}(0.002)^{1/2}}{0.024}$$

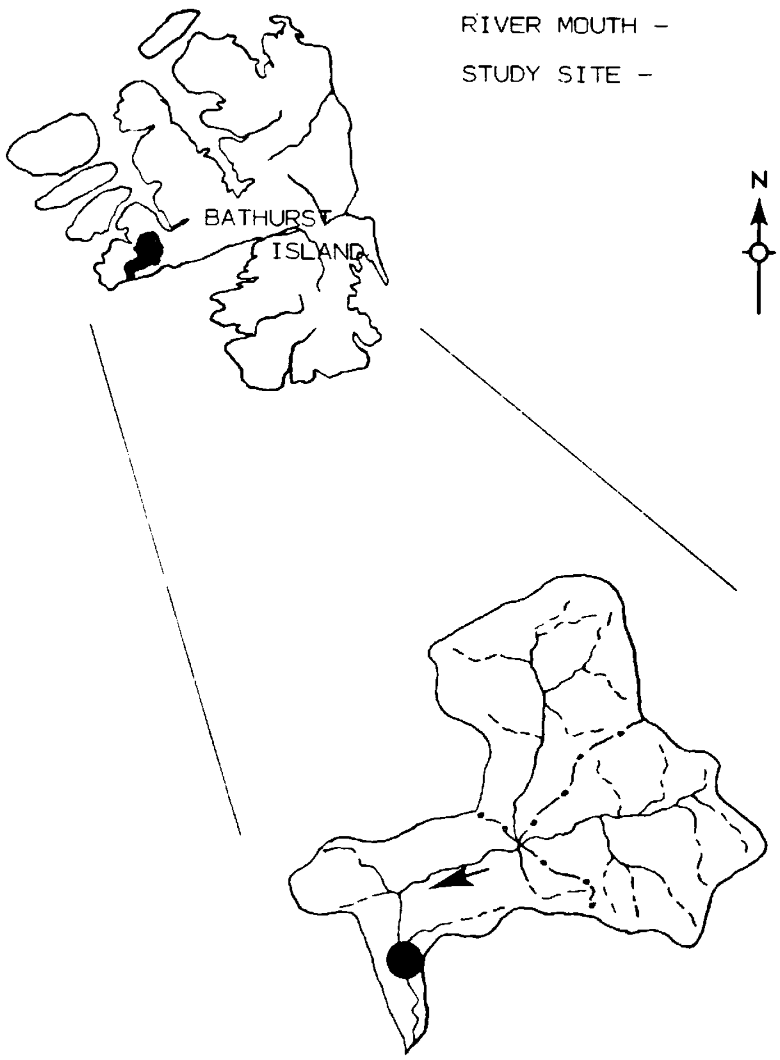
$= 110\ M^3/S$

BEST ESTIMATE

150 M^3/S

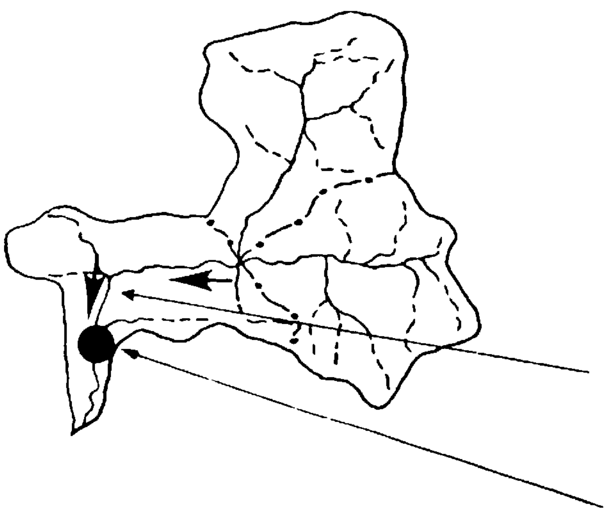
STATION NO. 10TC012 UNNAMED RIVER NEAR SCHOMBERG POINT BT-5

RIVER MOUTH -	75°33'	102°22'
STUDY SITE -	75°34'	102°29'



● - STUDY REACH

PHOTO FILE BT-5



17.15 - VIEW UP REACH
17.16 - VIEW DOWN REACH
17.17 - VIEW ACROSS
17.18 - BED MATERIAL
17.19 - VALLEY WALL
17.14 - SILT KNOLL
17.20 - AEOLIAN MOVEMENT
22.16 - MUD SLIDES
22.13 - MUD SLIDES

25.18 - CROSS SECTION
25.19 - UPSTREAM VIEW
25.20 - AERIAL OBLIQUE

● - STUDY REACH

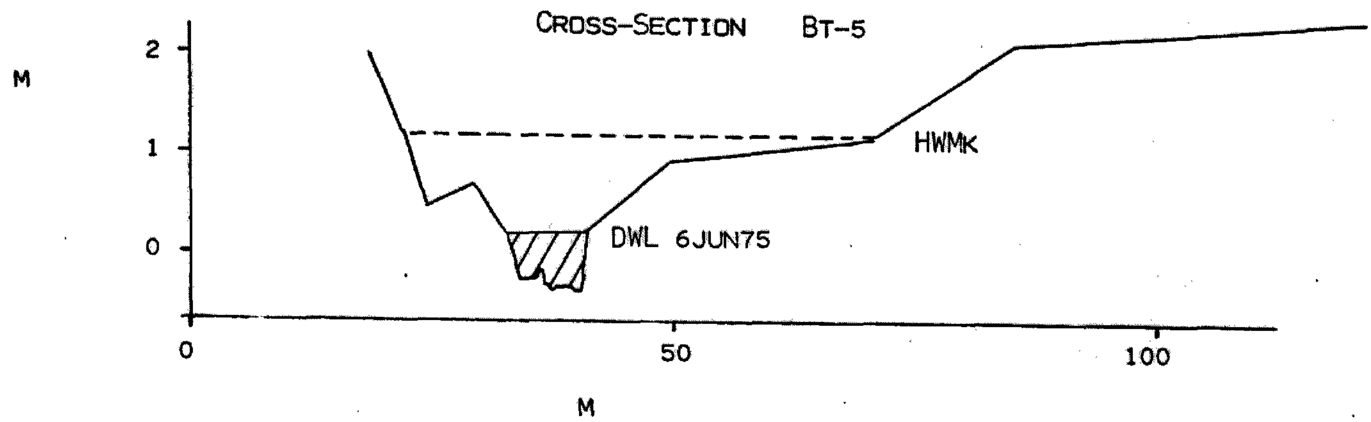
SCHOMBERG POINT BT-5

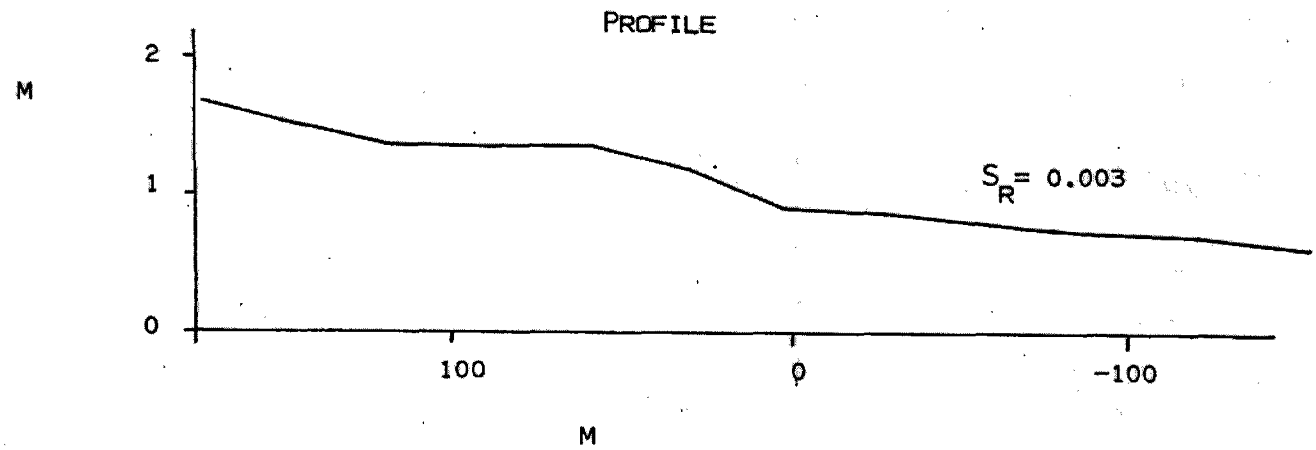
The hill terrain in this area appears to be heavily mantled by unconsolidated materials much of which has been deposited in a relatively broad, poorly defined valley bordered by hills. Three terrace levels within the valley were noted but their extent was difficult to determine. Solifluction lobes, rill outwash fans and some fairly recent mudflows were evident on valley slopes. Some aeolian activity on outwash fan material along the valley wall was apparent. In flat areas both on the valley plain and above the valley, patterned ground and thermokarst activity are visible. The general impression is one of instability. Sedges, mosses and similar vegetation cover 10 to 15% of the area. The active flood plain is variable in width reaching a maximum of some 150 metres. The thalweg is sinuous within this plain and exhibits a riffle pool sequence. Braid scars on the flood plain indicate lateral shifting of the thalweg. Channel banks appear inherently unstable because of thermal niching with resultant block slump, particle erosion and detachment creep. Of interest were the permafrost levels of 0.37 to 0.43 metres in the flood plain and only 0.12 metres in the thalweg.

MORPHOMETRIC DATA BT-5

LATITUDE AT BASIN MOUTH[1]	75° 33'
LONGITUDE AT BASIN MOUTH[1]	102° 22'
DRAINAGE AREA	104 KM^2
BASIN PERIMETER	54 KM
CIRCULARITY RATIO	0.445
STREAM ORDER	4
BIFURCATION RATIO	3.98
LENGTH OF PRINCIPAL CHANNEL	18 KM
SLOPE OF PRINCIPAL CHANNEL	0.007
BASIN WIDTH	12.7 KM
BASIN LENGTH	16.9 KM
ELONGATION RATIO	0.673
HYPSOMETRIC INTEGRAL	0.432
HYPSOMETRIC COEFFICIENT	-0.386
BASIN RELIEF	241 M
MINIMUM ELEVATION	0 M
MAXIMUM ELEVATION	241 M
AVERAGE ELEVATION	120 M
MEDIAN ELEVATION	104 M
BASIN ASPECT	S

1 - BASED ON 1:250,000 MAPS





HYDRAULIC MEASUREMENTS

DATE	WIDTH	AREA	MEAN VELOCITY	GAUGE HEIGHT	DISCHARGE
06JUL75	8.2 M	2.0 M^2	0.69 M/S	0.28 M	1.4 M^3/S
10JUL75	9.1 M	2.3 M^2	0.37 M/S	0.18 M	0.8 M^3/S
23AUG75	5.5 M	0.5 M^2	0.12 M/S	0.01 M	0.1 M^3/S

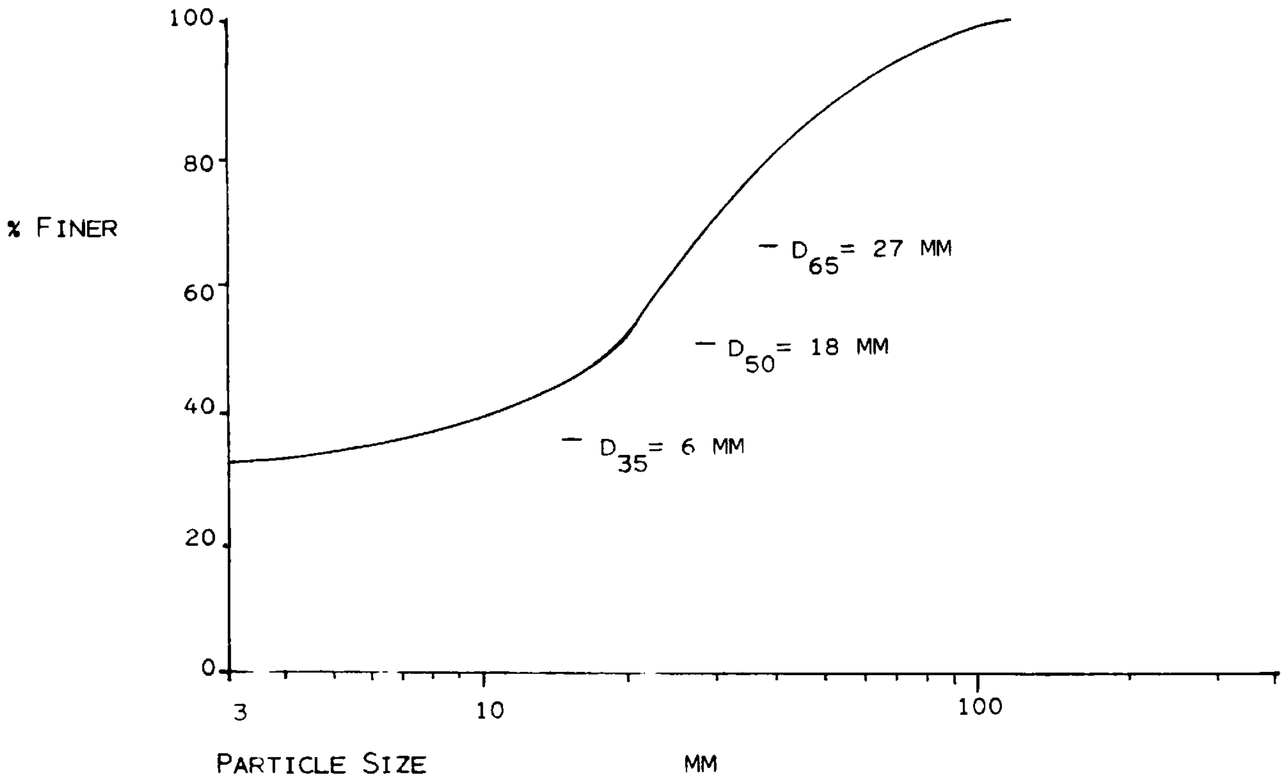
	STAGE	AREA	HYDRAULIC RADIUS
HWMK	0.80 M	11.3 M^2	0.41 M

PERMAFROST

23 AUG 75 – 0.7 M AT R.B.
– 0.7 M IN THALWEG
– 0.8 M AT L.B.

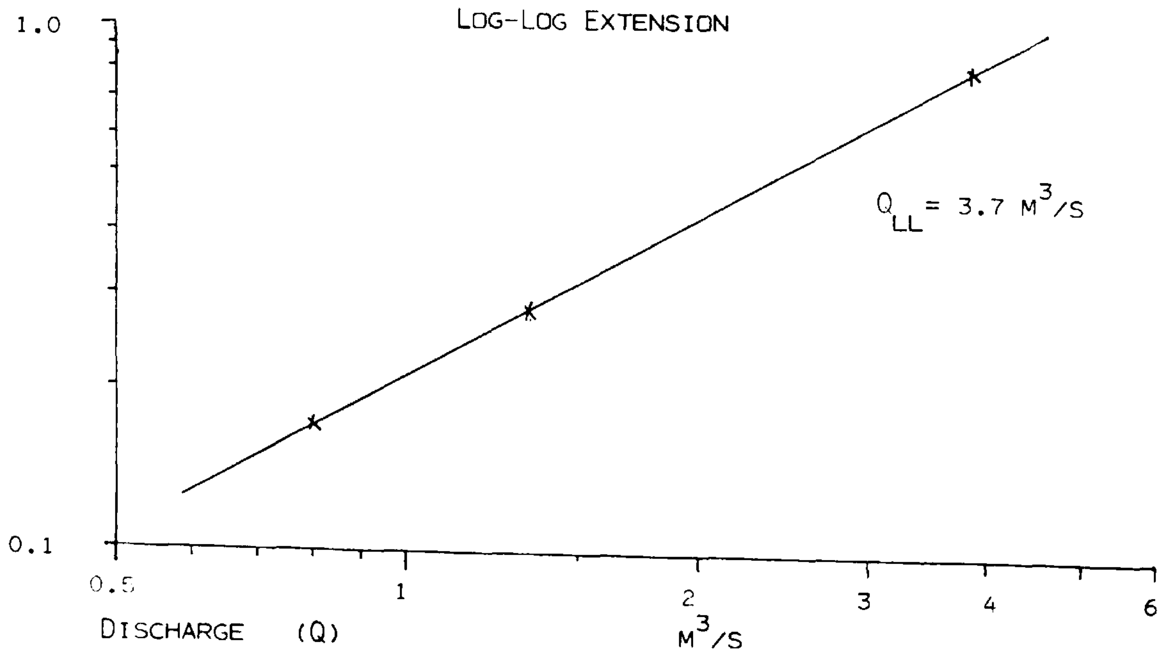
06 JUL 75 – 0.35 – 0.45 M ON FLOODPLAIN
– 0.1 M IN THALWEG

PARTICLE SIZE DISTRIBUTION (BED MATERIAL) BT-5



STRICHLER'S ''N'',	$N = 0.013\ (D_{50})^{1/6}$		0.021
SUSPENDED SEDIMENT CONCENTRATION		06JUL75	43 MG/L

ESTIMATED DISCHARGE AT HIGH WATER MARK BT-5



MANNING EQUATION

$$Q = \frac{A\ R^{2/3}\ S^{1/2}}{N} = \frac{(11.3)(0.41)^{2/3}(0.003)^{1/2}}{0.021}$$

$$= 16.3\ M^3/S$$

BEST ESTIMATE
15 M^3/S

STATION NO. 10TC004 UNNAMED RIVER ABOVE KING POINT M-1

RIVER MOUTH - 75°27' 105°40'

STUDY SITE - 75°29' 105°48'

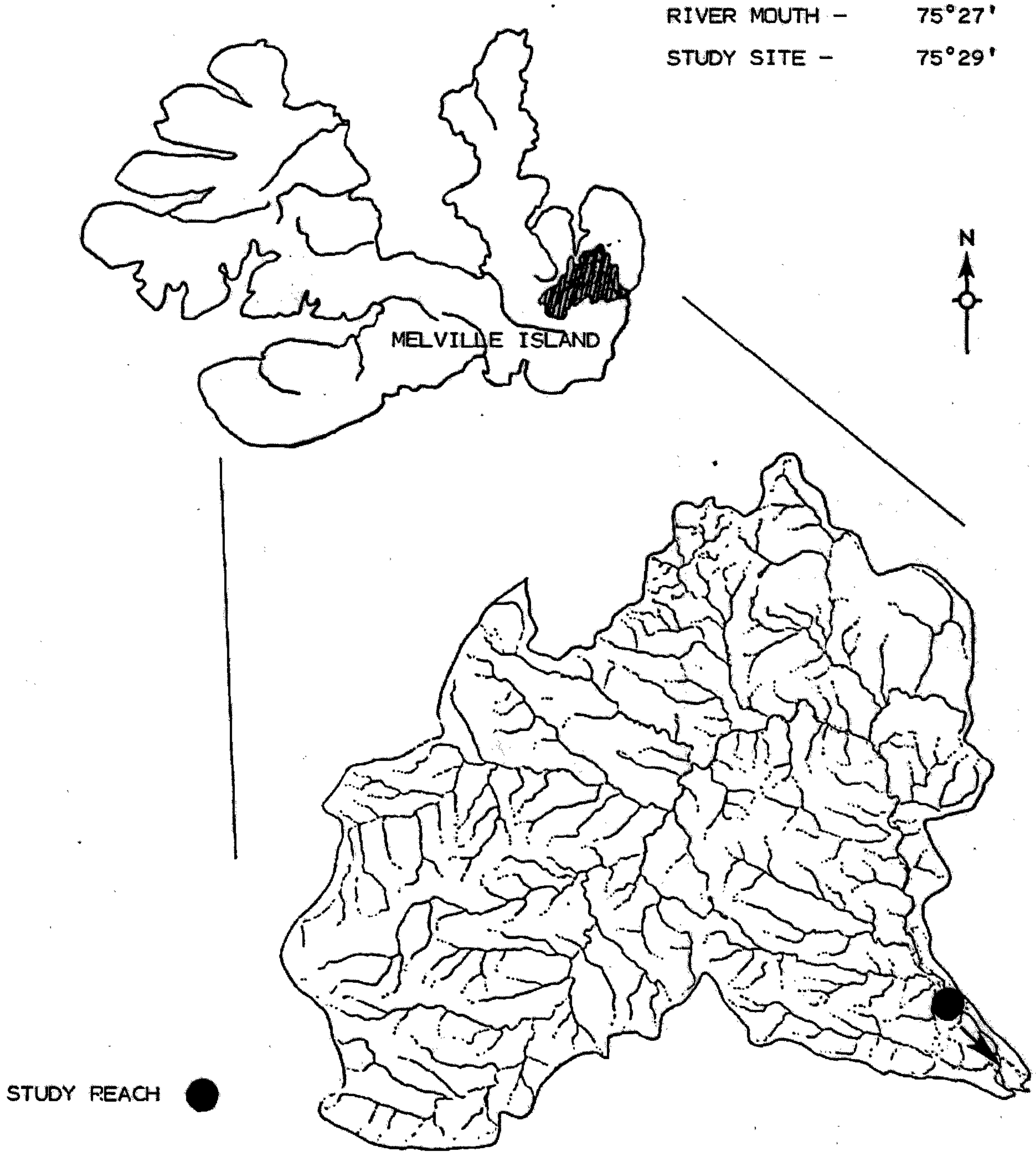
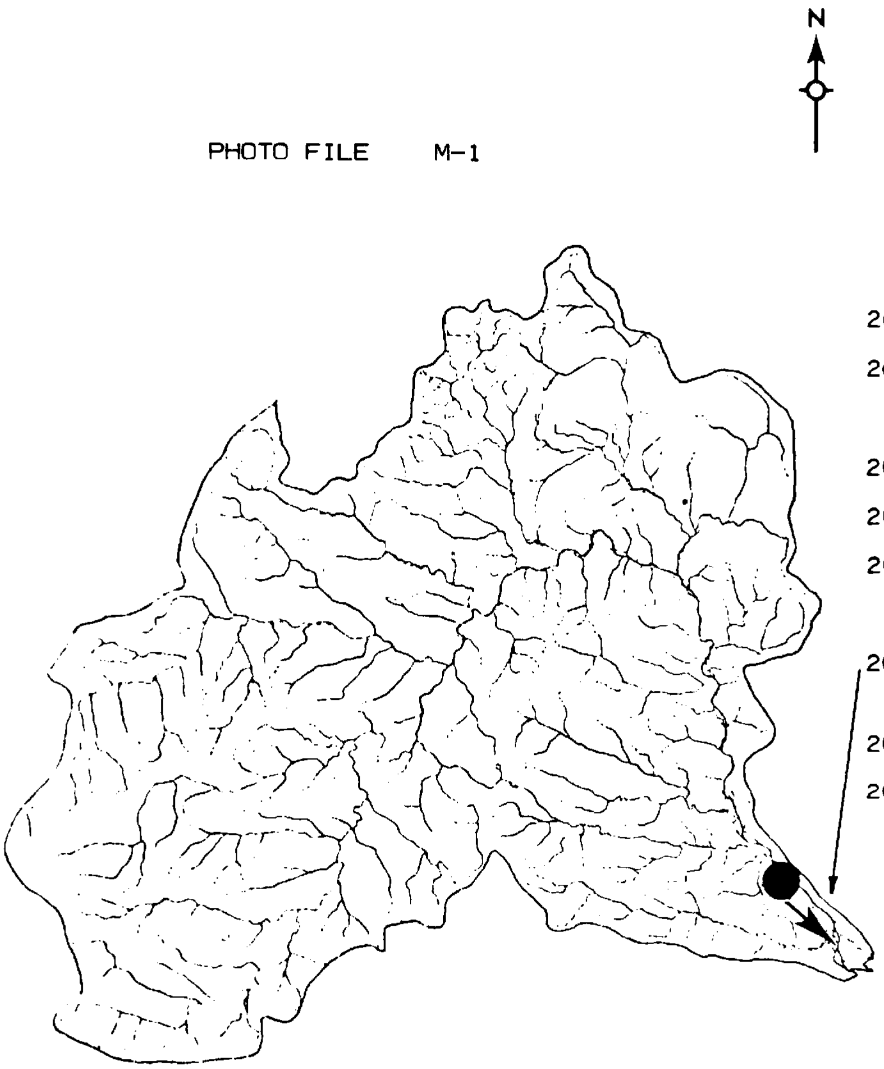


PHOTO FILE M-1



26.7 - RIPPLE MARKS

26.8 - SAND BAR

20.4 - DOWNSTREAM VIEW

20.5 - UPSTREAM VIEW

20.6 - VIEW ACROSS

20.8 - ERODING CHANNEL WALL

20.10 - SHORELINE EROSION

20.9 - SHORELINE EROSION

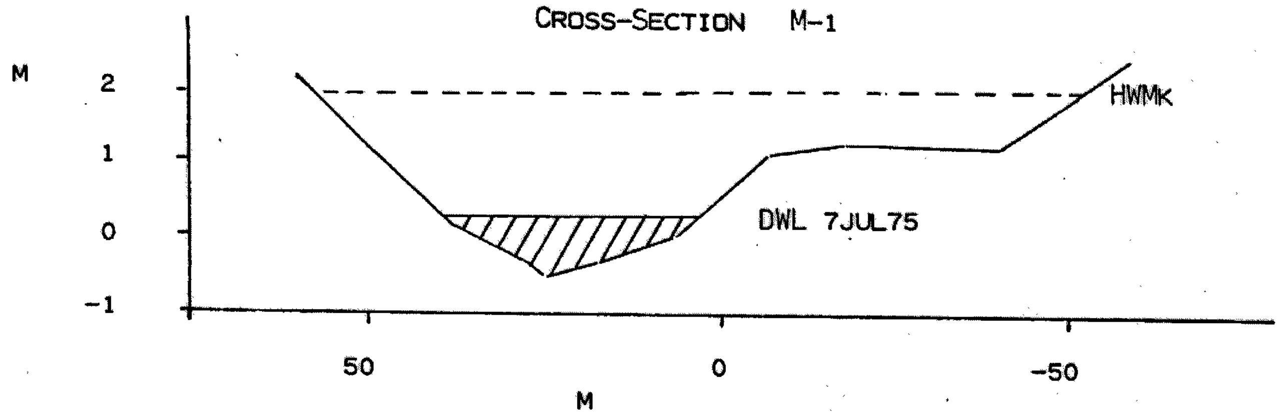
● - STUDY REACH

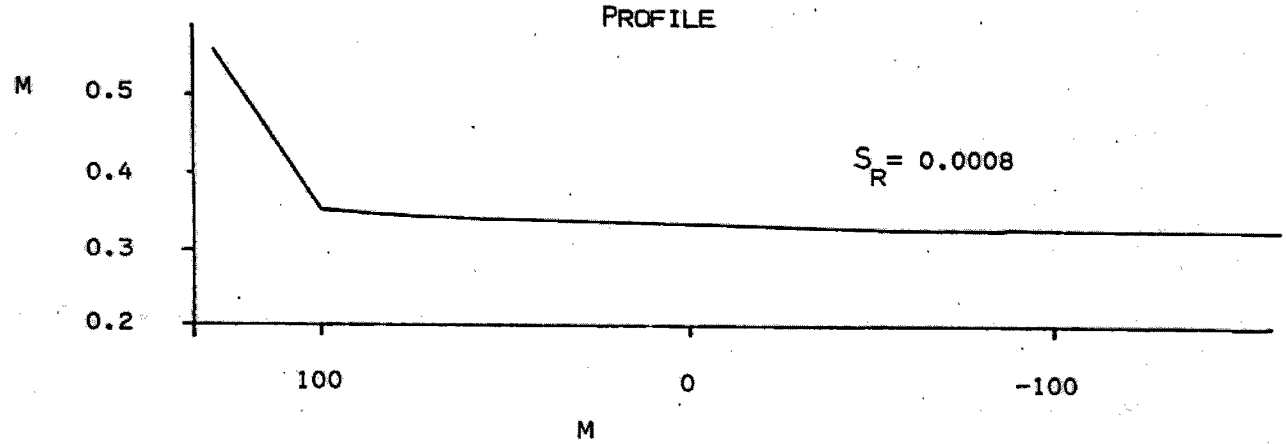
KING POINT M-1

A broad gently sloped valley contains this stream emptying into the sea at King Point on Melville Island. Although higher relief is apparent in the headwaters of the basin, the overall appearance of the study area is that of a gently undulating lowland. Unconsolidated fine materials mantle the landscape and lack of any bedrock exposure indicates a considerable thickness of loose materials. The high silt-sand content of the valley walls has given rise to considerable gullying and rill wash. Steeper slopes promote downslope mass movement in the form of slides or creep. The flood plain and bordering valley plain are wide (in total, approximately 500 metres) and lateral live channel movement on the flood plain is evidenced by braid scars and relict channel banks. The valley plain in the reach below our study section contains many actively eroding segments of river bank. Thermal niching appears to be the prime initiator of bank collapse. Ground ice lensee of considerable size were exposed in these active faces. The flood plain material consists of pebble sized gravels and sands, thus mass transport, as suspended sediment and bed load, would occur at fairly low velocities. Flow over mid channel and diagonal bars creates pool-riffle sequences. The river system in the vicinity of our study reach could be considered laterally unstable.

LATITUDE AT BASIN MOUTH[1]	75° 27'
LONGITUDE AT BASIN MOUTH[1]	105° 40'
DRAINAGE AREA	1204 KM^2
BASIN PERIMETER	173 KM
CIRCULARITY RATIO	0.500
STREAM ORDER	5
BIFURCATION RATIO	4.49
LENGTH OF PRINCIPAL CHANNEL	77 KM
SLOPE OF PRINCIPAL CHANNEL	0.002
BASIN WIDTH	51.5 KM
BASIN LENGTH	46.2 KM
ELONGATION RATIO	0.841
HYPSOMETRIC INTEGRAL	0.452
HYPSOMETRIC COEFFICIENT	-0.487
BASIN RELIEF	259 M
MINIMUM ELEVATION	0 M
MAXIMUM ELEVATION	259 M
AVERAGE ELEVATION	130 M
MEDIAN ELEVATION	116 M
BASIN ASPECT	E

1 - BASED ON 1:250,000 MAPS





HYDRAULIC MEASUREMENTS

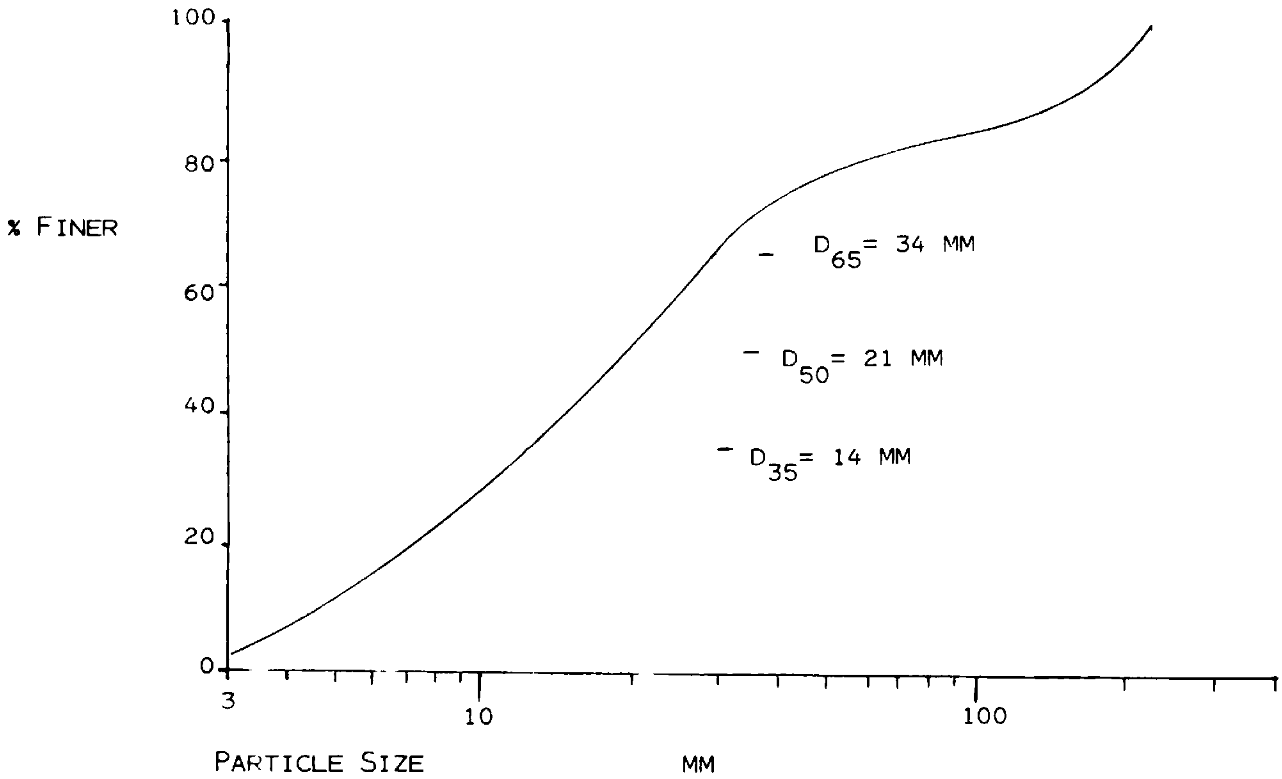
DATE	WIDTH	AREA	MEAN VELOCITY	GAUGE HEIGHT	DISCHARGE
07JUL75	37.8 M	18.1 M^2	0.40 M/S	0.31 M	7.2 M^3/S
09JUL75	39.0 M	20.6 M^2	0.45 M/S	0.36 M	9.2 M^3/S

	STAGE	AREA	HYDRAULIC RADIUS
HWMK	2.12 M	142 M^2	1.34 M

PERMAFROST

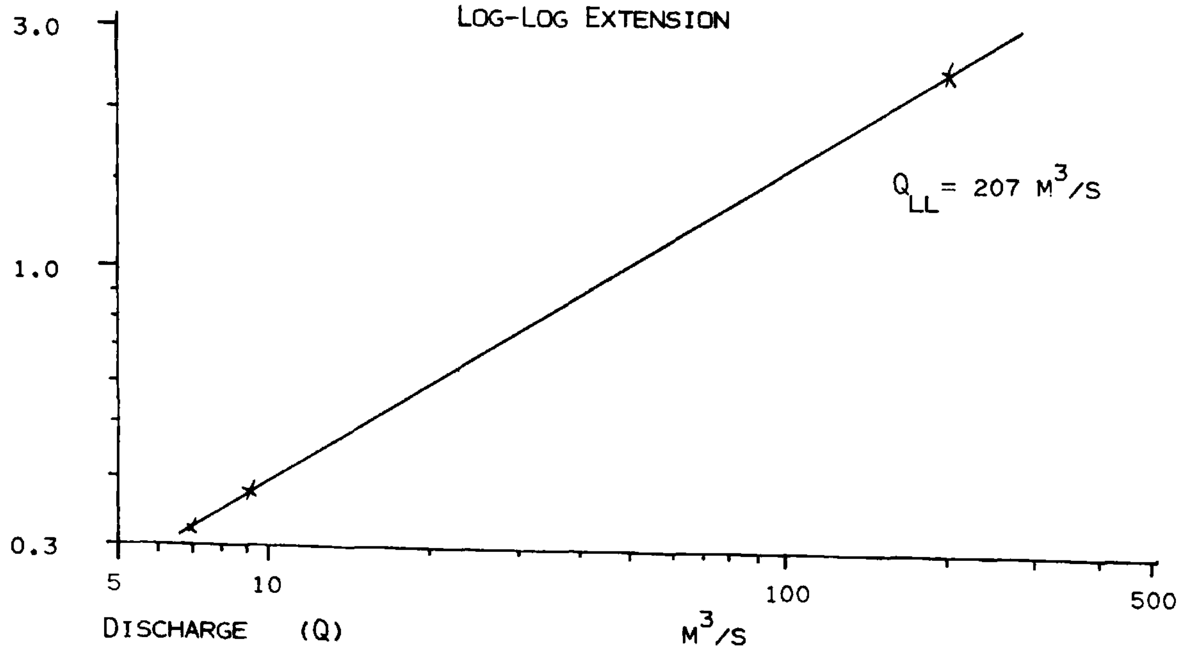
NO PROBE TAKEN

PARTICLE SIZE DISTRIBUTION (BED MATERIAL) M-1



STRICHLER'S ''N'', N = 0.013 $(D_{50})^{1/6}$		0.022
SUSPENDED SEDIMENT CONCENTRATION	07JUL75	19 MG/L
DISSOLVED SEDIMENT CONCENTRATION	07JUL75	41 MG/L

ESTIMATED DISCHARGE AT HIGH WATER MARK M-1



MANNING EQUATION

$$Q = \frac{A\ R^{2/3}\ S^{1/2}}{N} = \frac{(142)(1.34)^{2/3}(0.0008)^{1/2}}{0.022}$$

$$= 222\ M^3/S$$

BEST ESTIMATE
200 M^3/S

STATION NO. 10TC005 UNNAMED RIVER ABOVE WEST ARM OF WEATHERALL BAY M-2

RIVER MOUTH -	75°47'	107°57'
STUDY SITE -	75°43'	107°37'

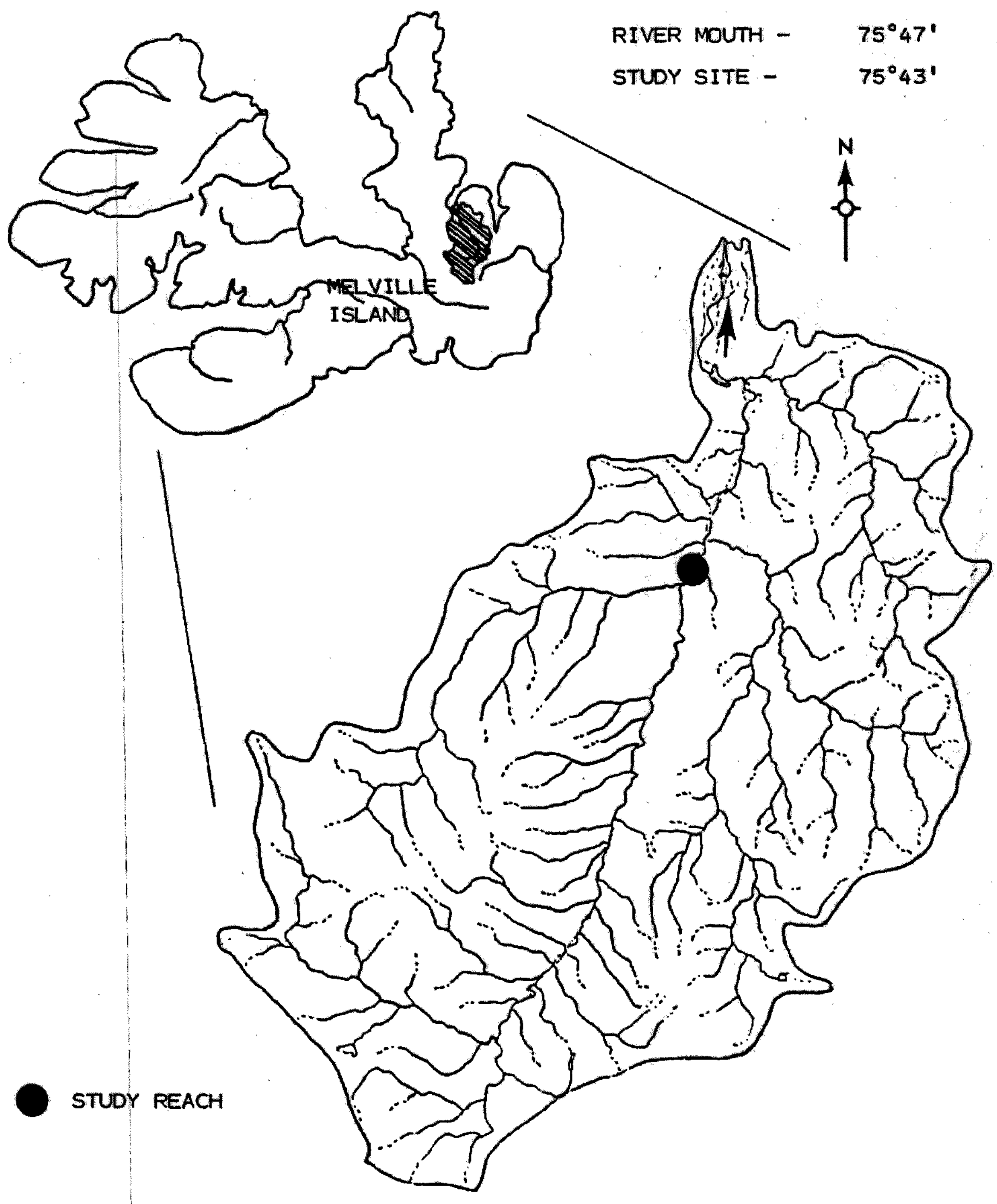
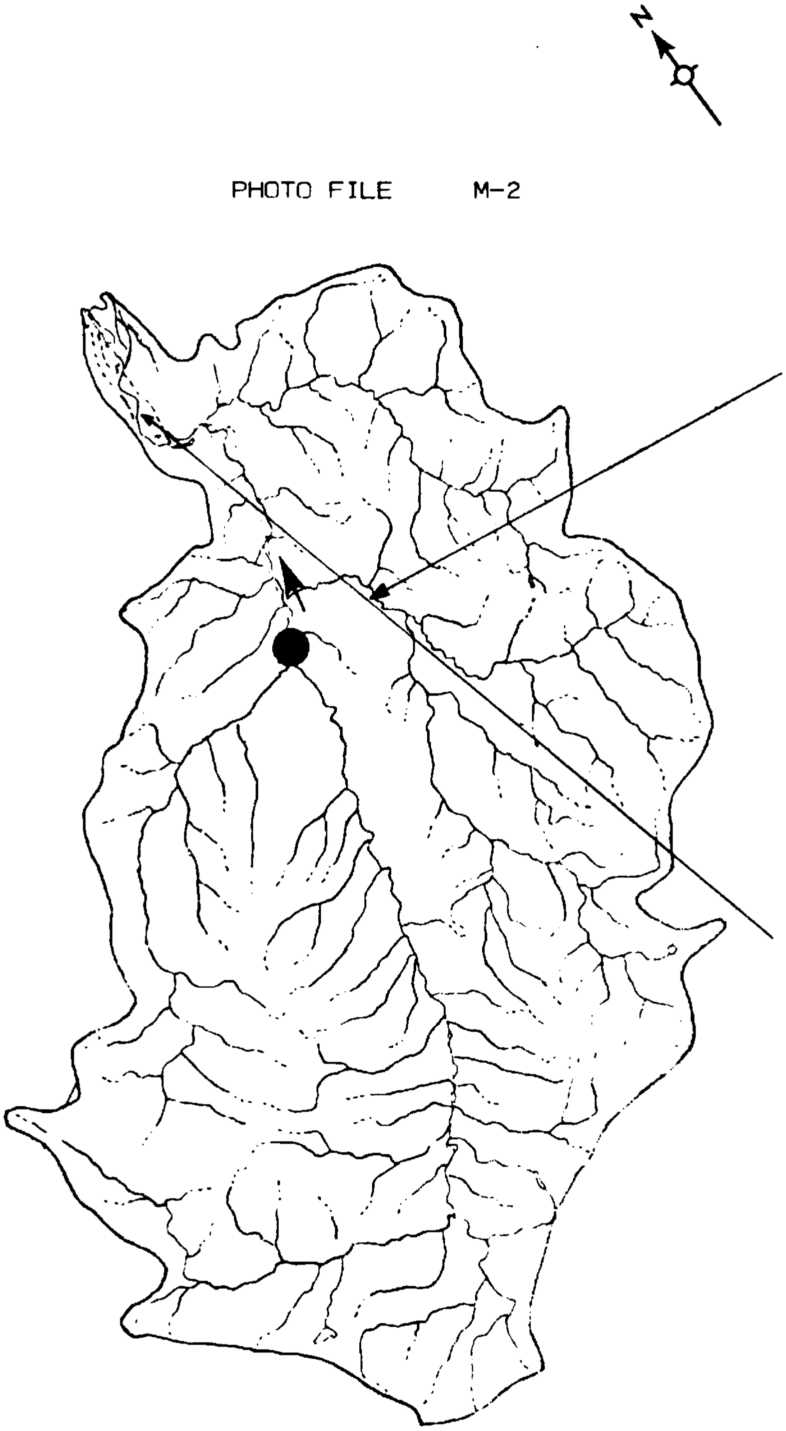


PHOTO FILE M-2



19.2 - ACTIVE TRIBUTARY
19.5 - PERMAFROST PROBE
19.6 - BED MATERIAL
19.7 - UPSTREAM VIEW
19.8 - DOWNSTREAM VIEW
19.9 - ACROSS CHANNEL

20.20 - AERIAL OBLIQUE
18.21 - VALLEY WALL
19.3 - VALLEY VIEW

21.4 - CHANNEL MIGRATION
21.7 - GROUND ICE
21.6 - UNDERCUTTING
21.0 - CHANNEL MIGRATION
20.21 - THERMAL EROSION
21.3 - BANK FAILURE
21.2 - SLUMPING

● - STUDY REACH

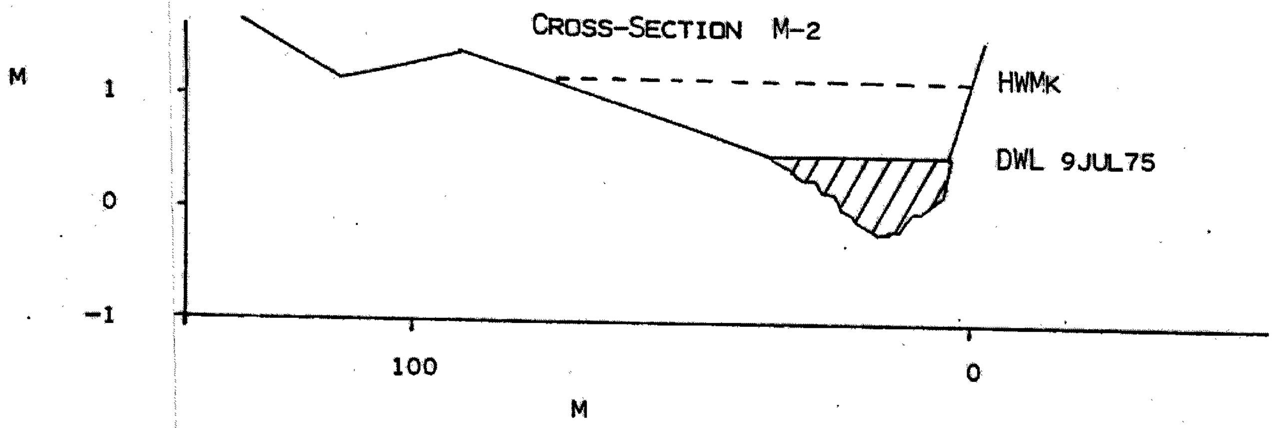
WEATHERALL BAY M-2

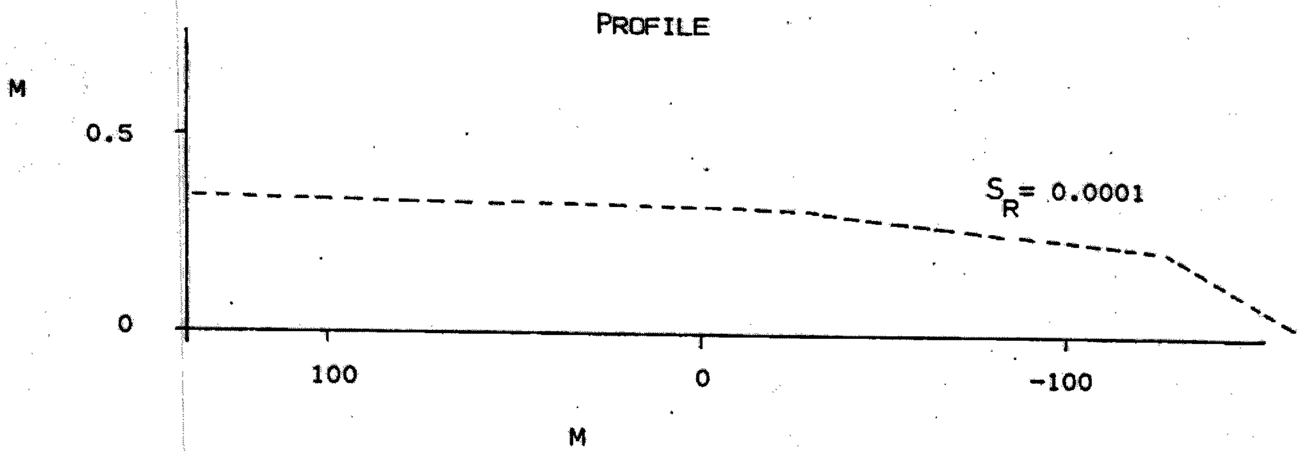
The catchment lies in low hill country and is heavily mantled by sediments. In the downstream region, the unconsolidated material appear to be of both marine and fluvial origin. Sediments are distinctly layered and contain many lenses of massive ground ice, thus giving rise to extensive thermal niching and lateral channel migration. In the study reach, the stream is incised into an ancient gravel floodplain and has created a paired terrace. A fragmentary high terrace could be of marine origin. The lower terrace risers, of well-graded gravel, are being actively eroded in high water. The terrace is fairly well vegetated with tussock grasses, saxifrage, mosses and dwarf willows. Nivation processes are an important feature of valley wall activity and are indicated by areas of very fine deposits below snow beds. A tributary, draining the northern valley wall slope, is actively downcutting the unconsolidated sediments. Fairly substantial suspended sediment concentrations occurred in the main river channel. Scour holes in the streambed indicate bed load transport is appreciable in high water. A gravel-boulder diagonal bar downstream generates a pronounced riffle.

MORPHOMETRIC DATA M-2

LATITUDE AT BASIN MOUTH[1]	75° 47'
LONGITUDE AT BASIN MOUTH[1]	107° 57'
DRAINAGE AREA	578 KM^2
BASIN PERIMETER	114 KM
CIRCULARITY RATIO	0.580
STREAM ORDER	5
BIFURCATION RATIO	4.55
LENGTH OF PRINCIPAL CHANNEL	43 KM
SLOPE OF PRINCIPAL CHANNEL	0.003
BASIN WIDTH	24.5 KM
BASIN LENGTH	38 KM
ELONGATION RATIO	0.711
HYPSOMETRIC INTEGRAL	0.515
HYPSOMETRIC COEFFICIENT	-0.417
BASIN RELIEF	259 M
MINIMUM ELEVATION	0
MAXIMUM ELEVATION	259 M
AVERAGE ELEVATION	130 M
MEDIAN ELEVATION	130 M
BASIN ASPECT	N W

1 - BASED ON 1:250,000 MAPS





HYDRAULIC MEASUREMENTS

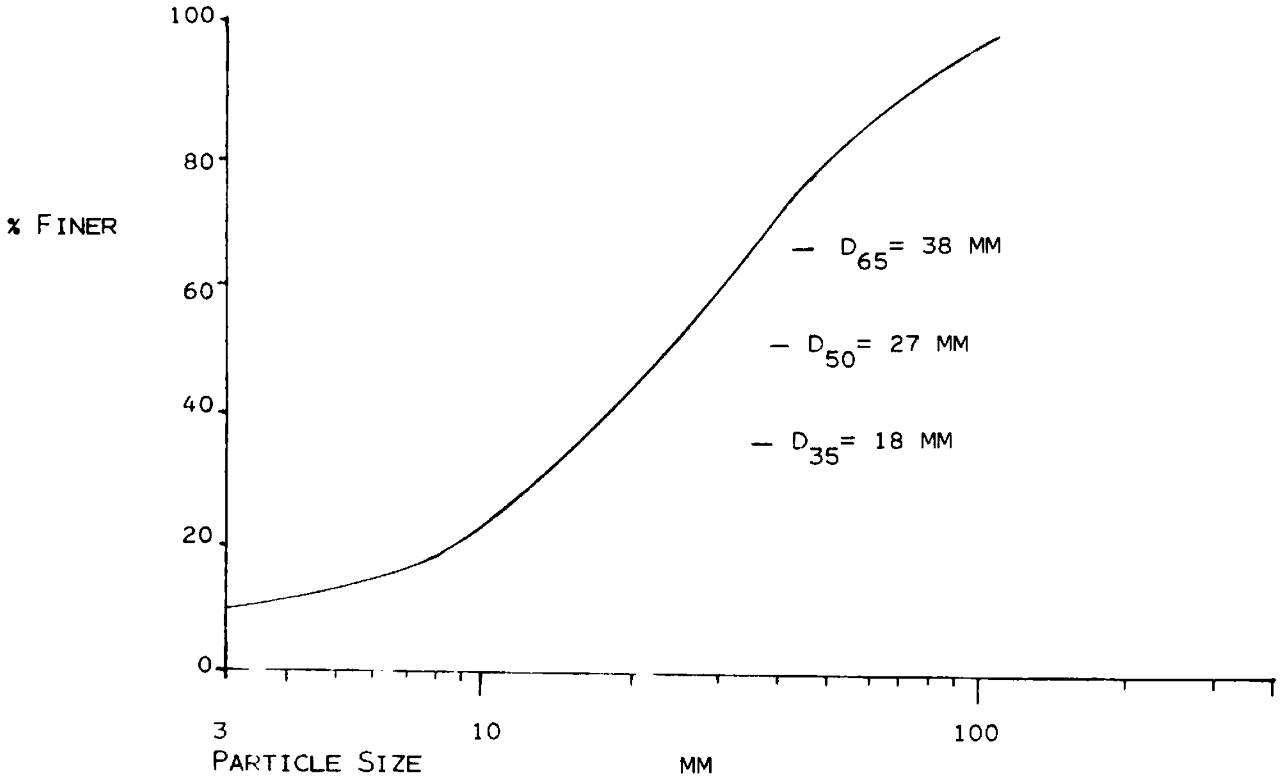
DATE	WIDTH	AREA	MEAN VELOCITY	GAUGE HEIGHT	DISCHARGE
07JUL75	25.0 M	8.1 M^2	0.38 M/S	0.34 M	3.1 M^3/S
09JUL75	30.5 M	10.8 M^2	0.66 M/S	0.52 M	7.1 M^3/S

	STAGE	AREA	HYDRAULIC RADIUS
HWMK	1.42 M	45.6 M^2	0.58 M

PERMAFROST

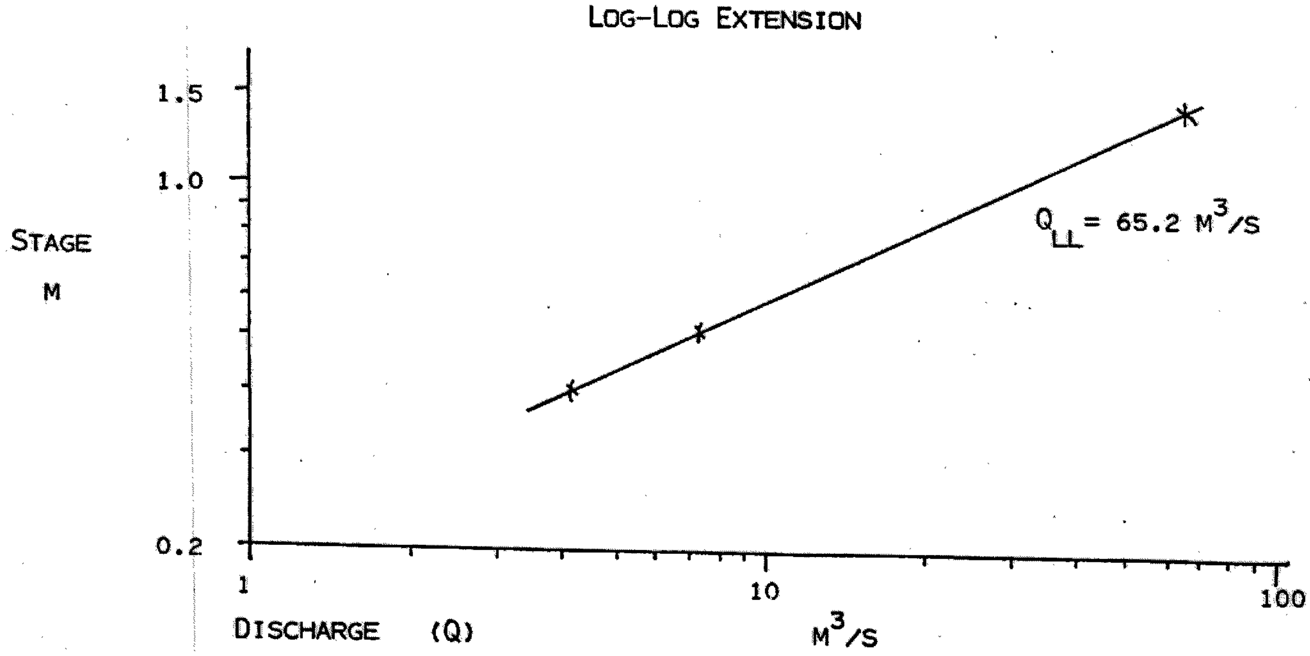
NO PROBE TAKEN

PARTICLE SIZE DISTRIBUTION (BED MATERIAL) M-2



STRICHLER'S ''N'', N = 0.013 $(D_{50})^{1/6}$		0.023
SUSPENDED SEDIMENT CONCENTRATION	07JUL75	10 MG/L
DISSOLVED SEDIMENT CONCENTRATION	07JUL75	36 MG/L

Estimated Discharge at High Water Mark M-2



Manning Equation

$$Q = \frac{A\ R^{2/3}\ S^{1/2}}{N} = \frac{(45.6)(0.58)^{2/3}(0.0001)^{1/2}}{0.023}$$

$$= 13.5\ M^3/S$$

Best Estimate

50 M^3/S

STATION NO. 10TC006 UNNAMED RIVER ABOVE SABINE BAY M-3

RIVER MOUTH - 75°32' 108°50'

STUDY SITE - 75°29' 108°39'

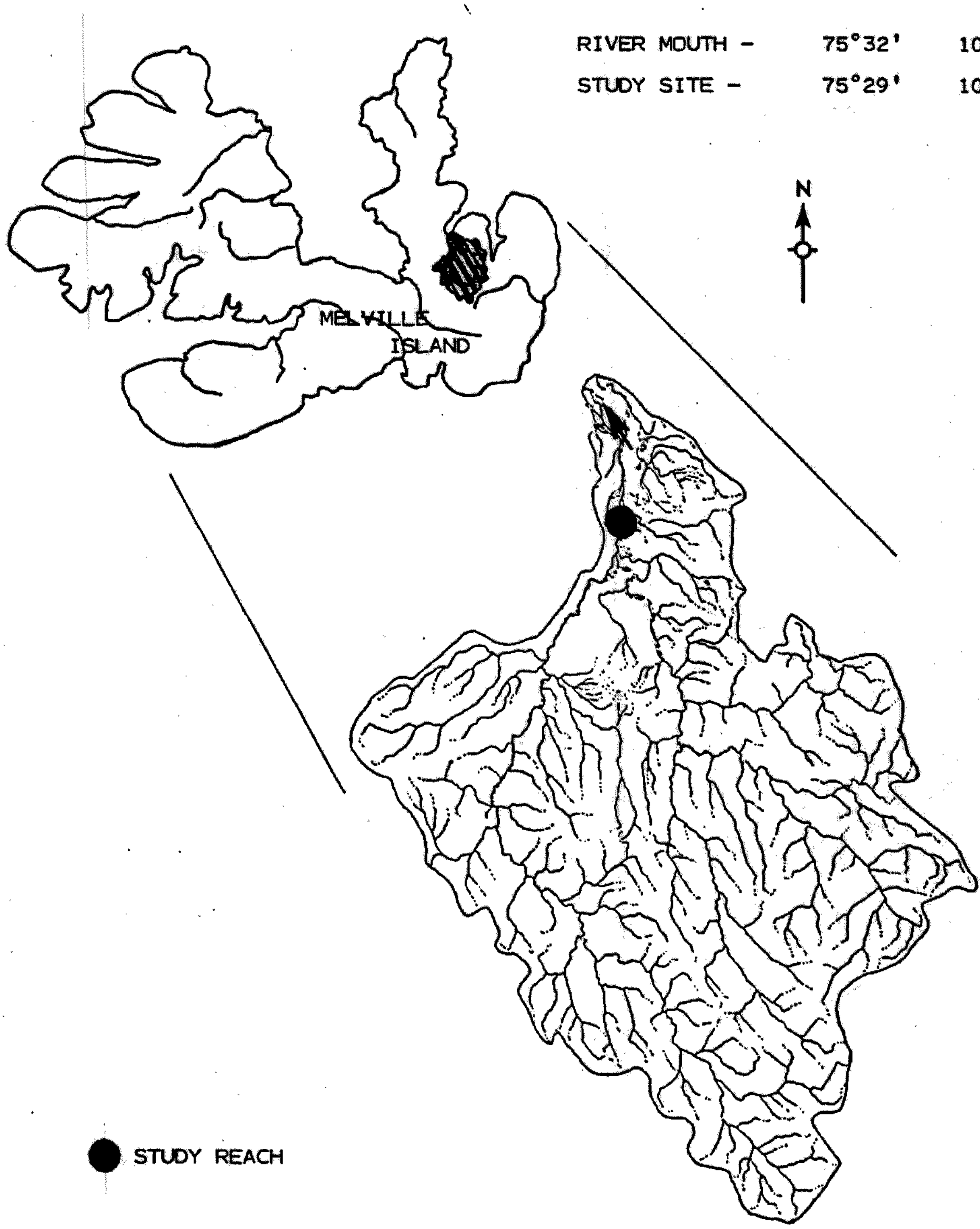
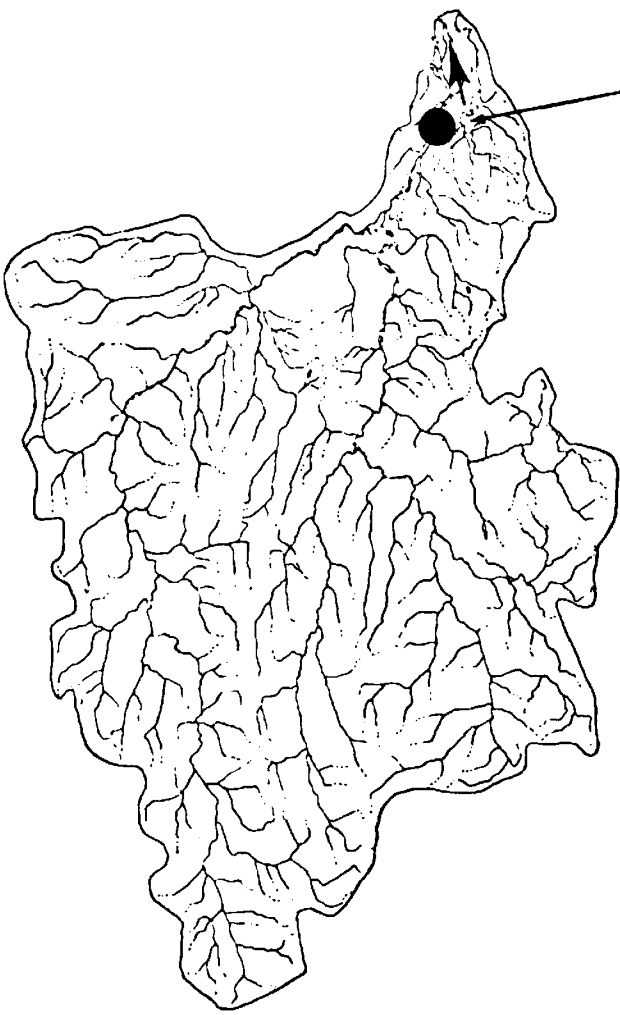


PHOTO FILE M-3



26.9 - CROSS SECTION
26.10 - DOWNSTREAM
26.11 - UPSTREAM VIEW
26.12 - AERIAL OBLIQUE
26.13 - AERIAL OBLIQUE
26.14 - AERIAL OBLIQUE

19.18 - VALLEY VIEW
20.1 - UPSTREAM VIEW
19.21 - DOWNSTREAM VIEW
20.2 - VIEW ACROSS
19.20 - BED MATERIAL

● - STUDY REACH

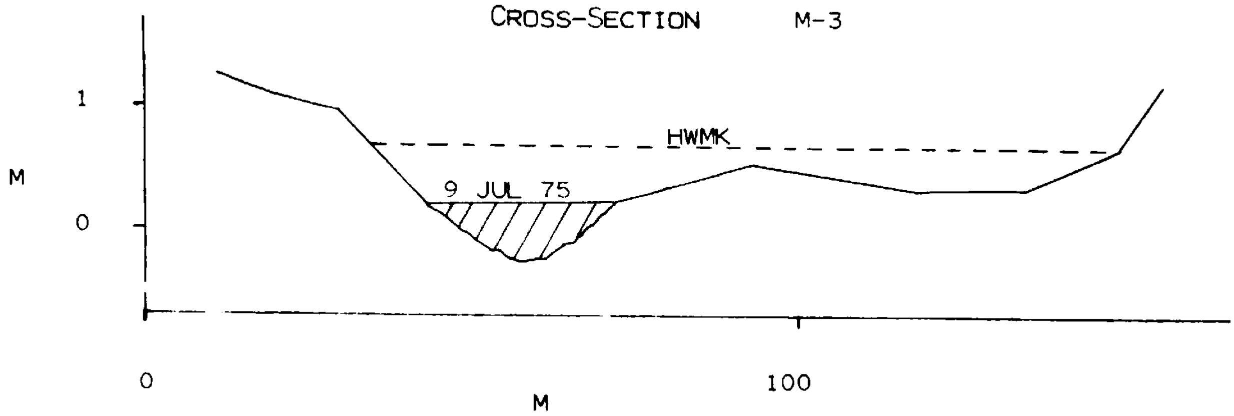
SABINE BAY M-3

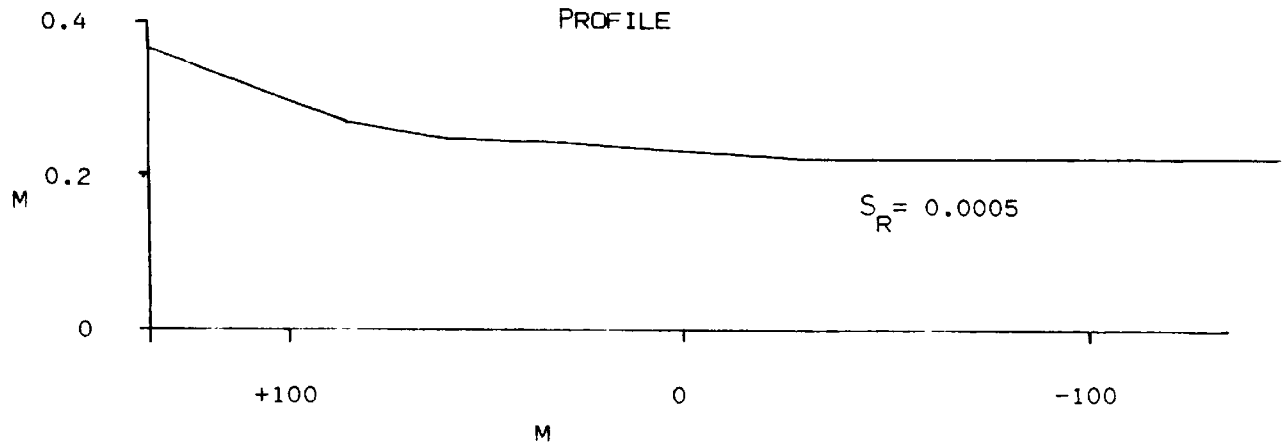
In the area of investigation, this river maintains a sinuous pattern in a fairly level coastal plain of alluvial silts, sands and fine gravel. The valley is very broad (approximately one kilometre) and of low relief - 20-30 metres would be a good estimate of its depth. Valley walls are gullied and subject to downslope mass movement by wash, creep and slide. Standing water pools abutting the valley walls occur fairly frequently and could be nivation hollows. The lightly vegetated valley plain blends into a wide, poorly defined flood plain. Relict braid scars, shallow scour pools and remnants of channel divisions of the high water period make exact definition of the active flood plain quite difficult, although these features indicate that the river channel is laterally unstable - certainly over the limits of the flood plain. Surficial bed material of silt, sand and pebbly gravel would allow sediment transfer processes to occur at fairly low velocities. (At a river bend downstream, the outside channel bank is being actively eroded.) Mid-channel, diagonal, and side bar configurations were noted in our study section.

MORPHOMETRIC DATA M-3

LATITUDE AT BASIN MOUTH[1]	75° 32'
LONGITUDE AT BASIN MOUTH[1]	108° 50'
DRAINAGE AREA	1492 KM^2
BASIN PERIMETER	195 KM
CIRCULARITY RATIO	0.486
STREAM ORDER	5
BIFURCATION RATIO	3.86
LENGTH OF PRINCIPAL CHANNEL	75 KM
SLOPE OF PRINCIPAL CHANNEL	0.002 (TRIB.- 0.003)
BASIN WIDTH	43.8 KM
BASIN LENGTH	65 KM
ELONGATION RATIO	0.657
HYPSOMETRIC INTEGRAL	0.403
HYPSOMETRIC COEFFICIENT	-0.389
BASIN RELIEF	290 M
MINIMUM ELEVATION	0
MAXIMUM ELEVATION	290 M
AVERAGE ELEVATION	145 M
MEDIAN ELEVATION	119 M
BASIN ASPECT	N W

1 - BASED ON 1:250,000 MAPS





HYDRAULIC MEASUREMENTS

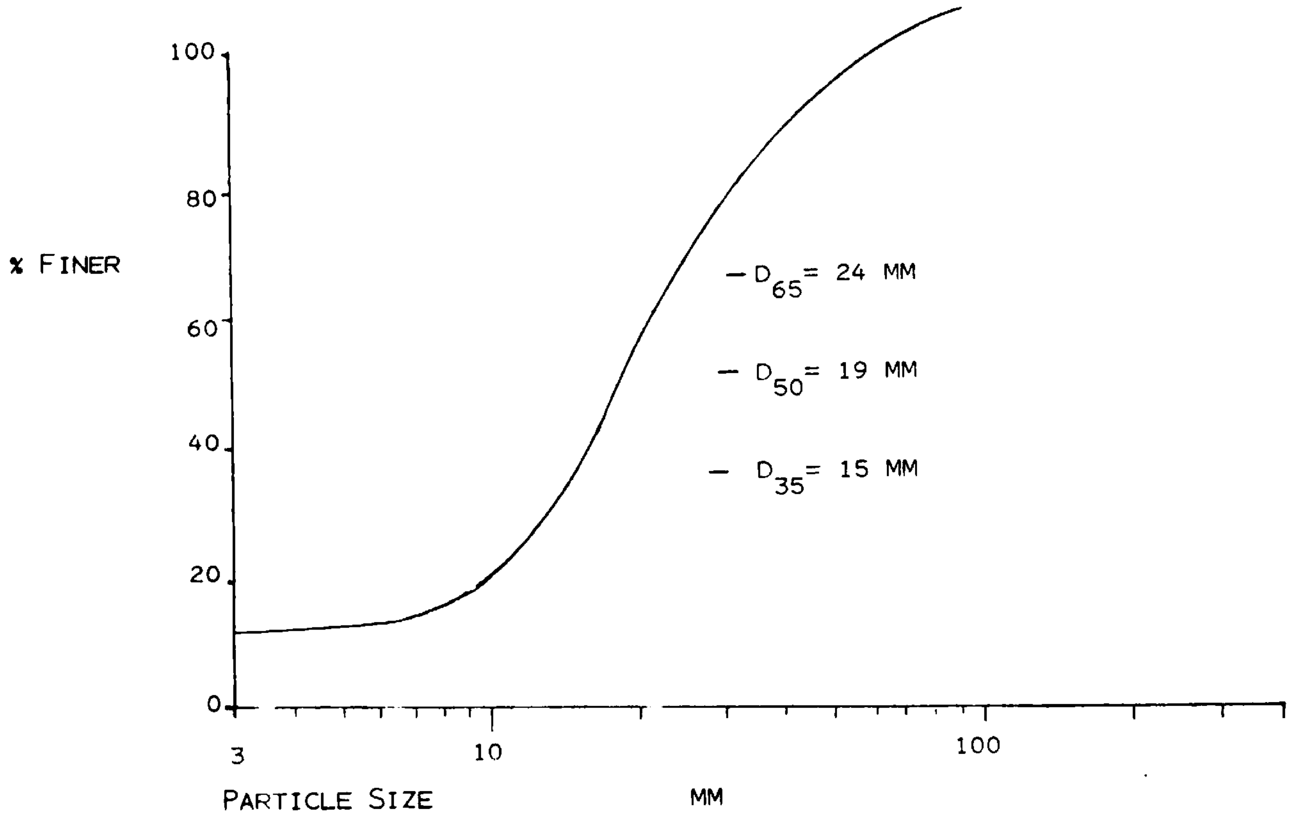
DATE	WIDTH	AREA	MEAN VELOCITY	GAUGE HEIGHT	DISCHARGE
07JUL75	34.7 M	18.8 M^2	0.37 M/S	0.24 M	6.9 M^3/S
09JUL75	35.7 M	20.3 M^2	0.49 M/S	0.28 M	9.9 M^3/S
24AUG75	28.0 M	9.8 M^2	0.13 M/S	0.10 M	0.7 M^3/S

	STAGE	AREA	HYDRAULIC RADIUS
HWMK	0.76 M	78.9 M^2	0.50 M

PERMAFROST

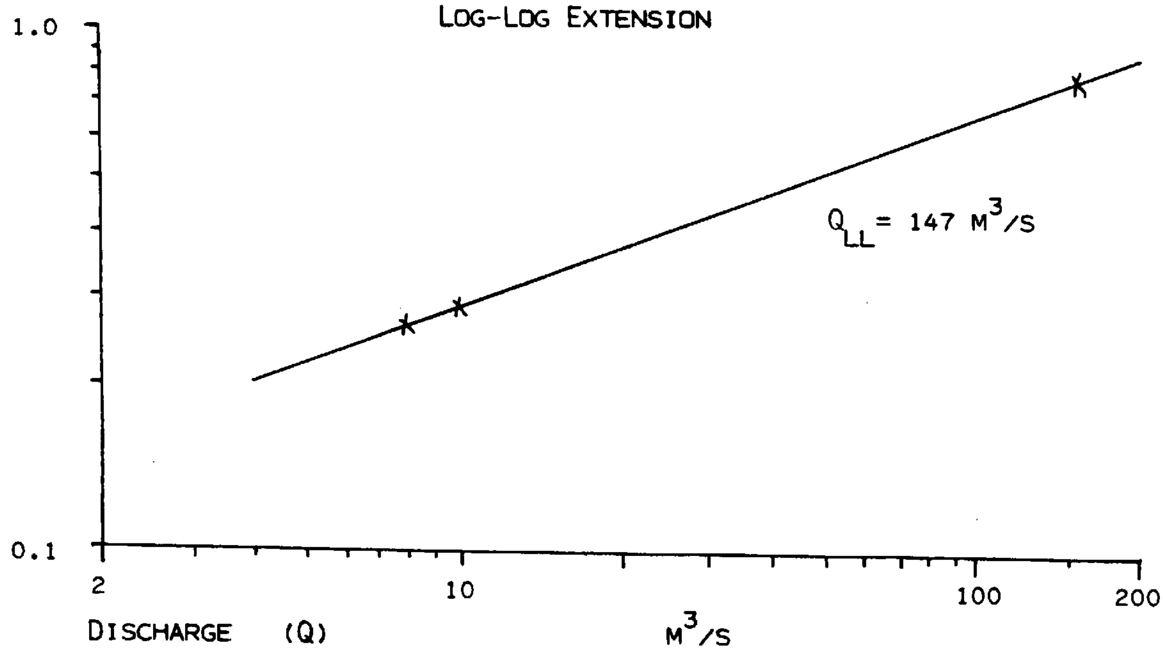
7 JUL 75 - 0.3 M IN THALWEG
24 AUG 75 - 0.7 M AT L.B.
- 0.6 M AT HWMK

PARTICLE SIZE DISTRIBUTION (BED MATERIAL) M-3



STRICHLER'S ''N'', $N = 0.013\,(D_{50})^{1/6}$		0.022
SUSPENDED SEDIMENT CONCENTRATION	07JUL75	33 MG/L
DISSOLVED SEDIMENT CONCENTRATION	07JUL75	35 MG/L

ESTIMATED DISCHARGE AT HIGH WATER MARK M-3



MANNING EQUATION

$$Q = \frac{A\,R^{2/3}\,S^{1/2}}{N} = \frac{(78.9)(0.5)^{2/3}(0.0005)^{1/2}}{0.022}$$

$$= 50.5\ M^3/S$$

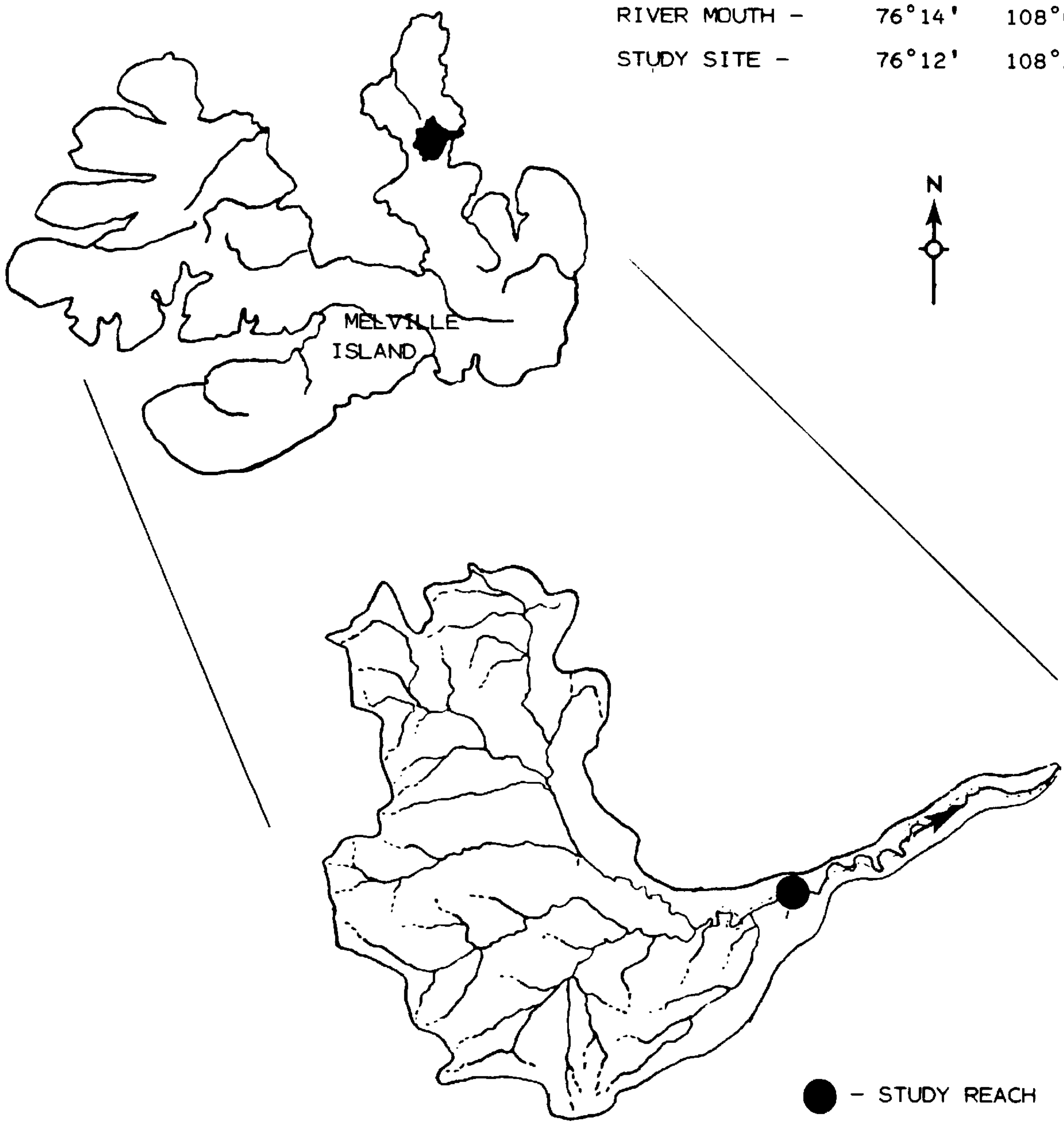
BEST ESTIMATE

70 M^3/S

STATION NO. 10TC007 UNNAMED RIVER ABOVE WARREN POINT M-4

RIVER MOUTH - 76°14' 108°05'

STUDY SITE - 76°12' 108°27'



N

PHOTO FILE M-4

26.19 - AERIAL OBLIQUE

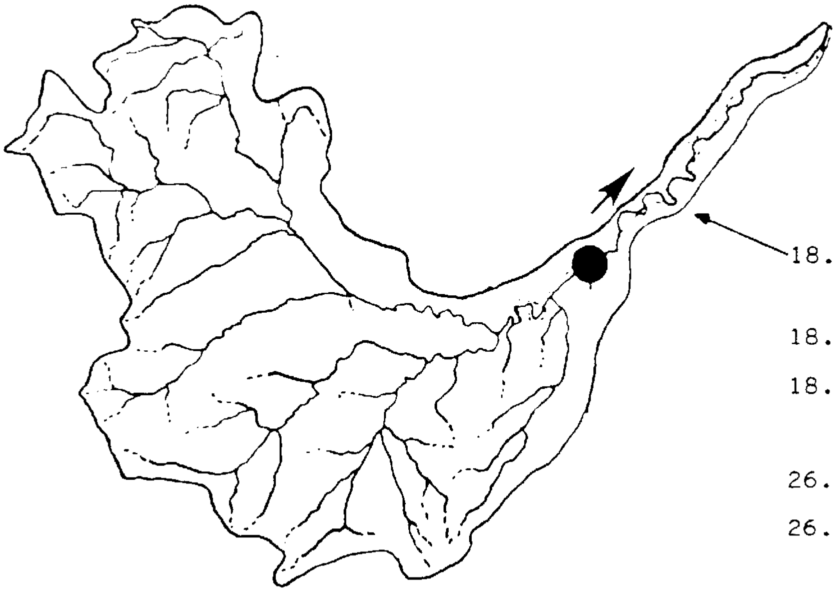
21.21 - HEADWATERS

21.19 - MUD BANKS

21.20 - MUD BANKS

18.5 - FLOOD PLAIN

18.4 - UPSTREAM



18.3 - DOWNSTREAM (ACTIVE BANK)

18.2 - VIEW ACROSS

18.6 - BED MATERIAL

26.18 - AERIAL OBLIQUE

26.19 - AERIAL OBLIQUE

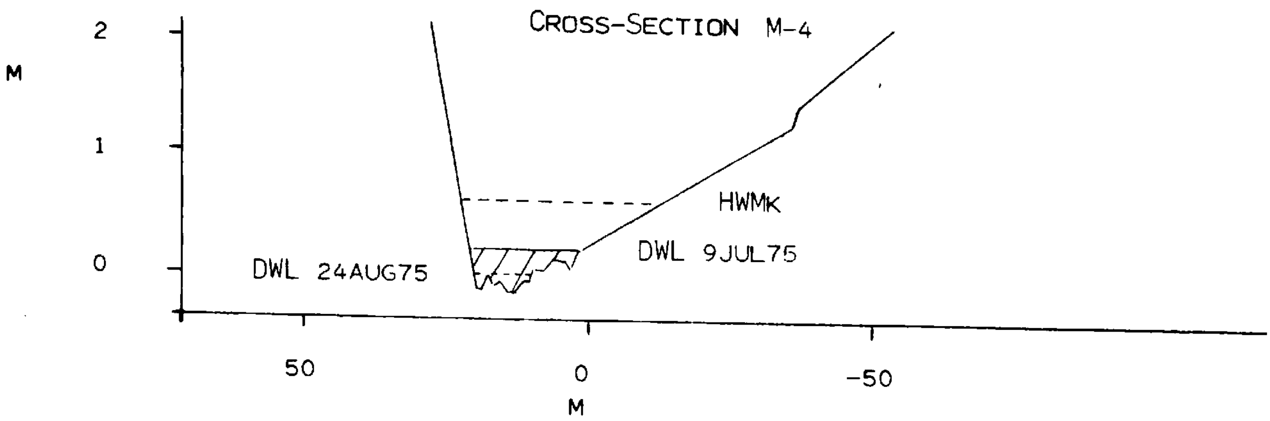
● - STUDY REACH

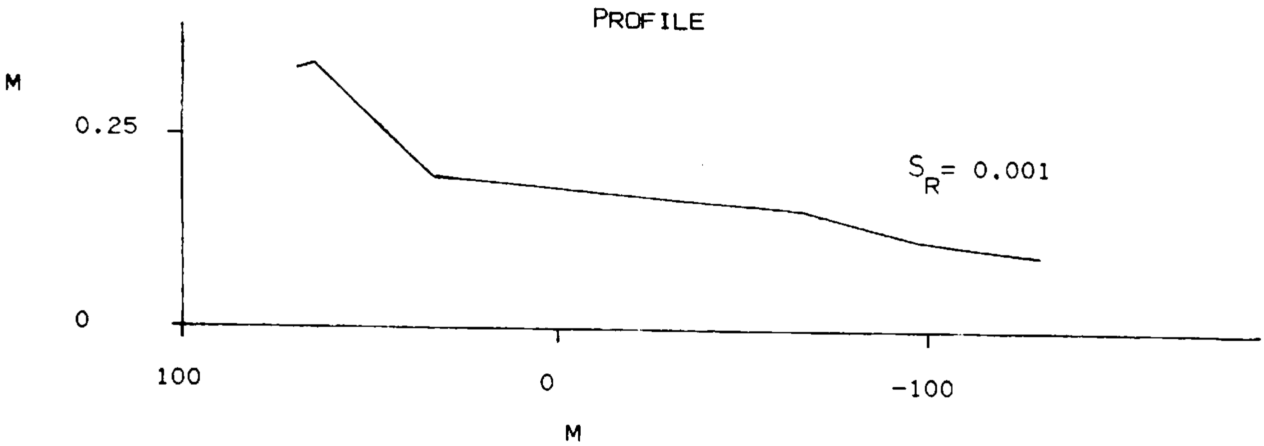
WARREN POINT M-4

This stream winds its way down to the sea through a low relief area characteristic of Sabine Peninsula lowlands. Ridges on ancient fold belts and reasonably well vegetated, lowlying reaches are completely mantled by substantial overburden of silt. Polygon systems are fairly extensive. The channel pattern could be described as irregular meandering with many sections of braided or split river channel being noted. No valley is distinguishable - the flood plain channel being incised directly into the land surface. The study reach, was located on a meander bend. The outside channel bank, composed of very dark colored silts, was being actively eroded by numerous geomorphic processes - those noted were rill wash, gullying, slide, thermal niching and detachment creep. Indeed, the only stabilizing feature of this river bank seemed to be the underlying permafrost. The inside channel bank features a substantial point bar on which is located the active flood plain. The flood plain material was black muddy silt in the quick condition, lightly armoured by a thin gravel layer. The materials and river patterns certainly indicate lateral instability in this system. The proximity of the permafrost horizon to stream bed and flood plain surfaces would seem to inhibit degradation, particularily in spring freshet. Snowbeds, along channel walls would also inhibit erosion. Late summer rainfall events could generate much sediment movement.

LATITUDE AT BASIN MOUTH[1]	76° 14'
LONGITUDE AT BASIN MOUTH[1]	108° 05'
DRAINAGE AREA	212 KM^2
BASIN PERIMETER	98 KM
CIRCULARITY RATIO	0.277
STREAM ORDER	5
BIFURCATION RATIO	3.27
LENGTH OF PRINCIPAL CHANNEL	35 KM
SLOPE OF PRINCIPAL CHANNEL	0.004
BASIN WIDTH	20.0 KM
BASIN LENGTH	27.7 KM
ELONGATION RATIO	0.591
HYPSOMETRIC INTEGRAL	0.412
HYPSOMETRIC COEFFICIENT	-0.231
BASIN RELIEF	168 M
MINIMUM ELEVATION	0
MAXIMUM ELEVATION	168 M
AVERAGE ELEVATION	84 M
MEDIAN ELEVATION	66 M
BASIN ASPECT	S E

1 - BASED ON 1:250,000 MAPS





HYDRAULIC MEASUREMENTS

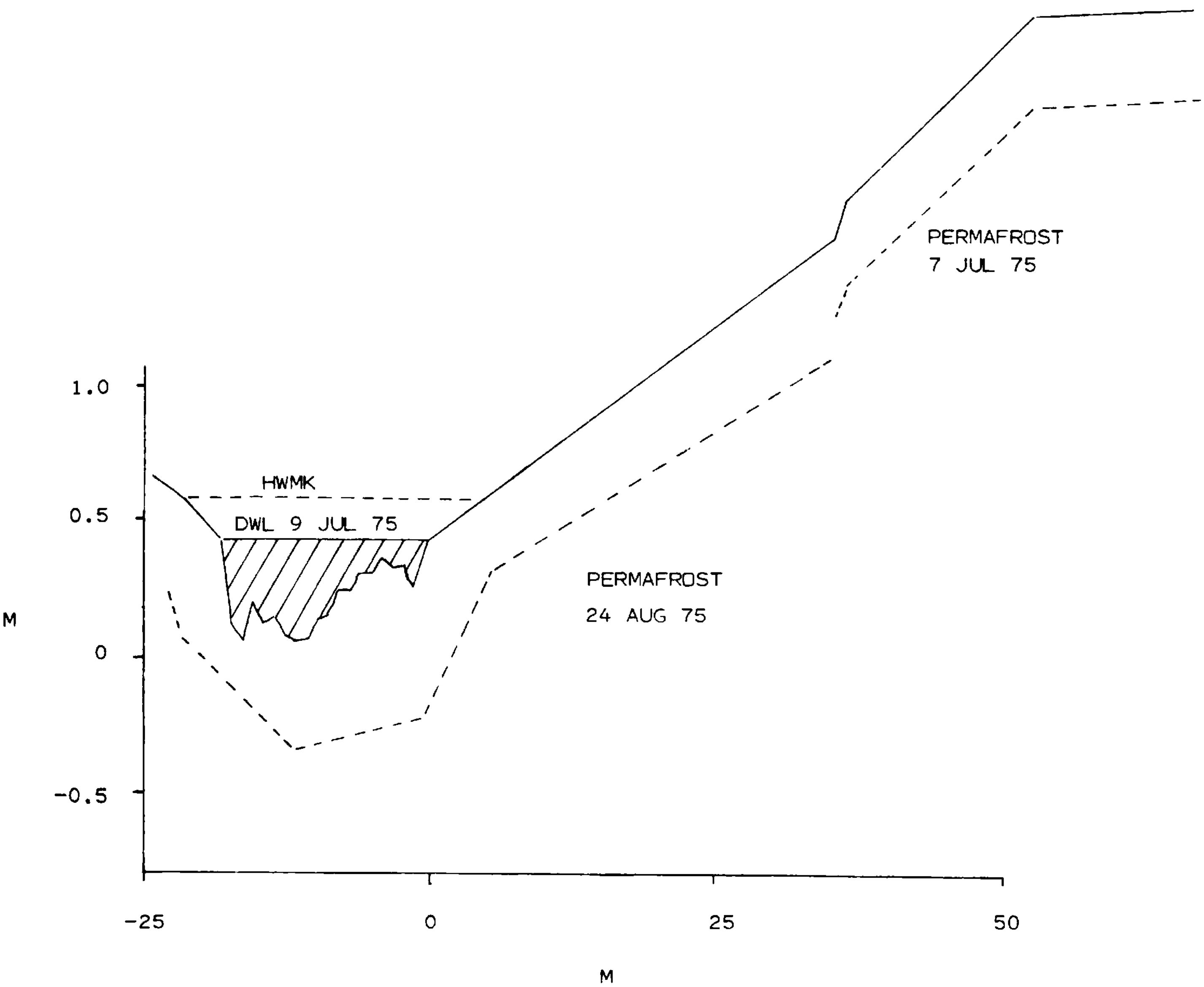
DATE	WIDTH	AREA	MEAN VELOCITY	GAUGE HEIGHT	DISCHARGE
07JUL75	14.3 M	3.7 M^2	0.21 M/S	0.19 M	0.8 M^3/S
09JUL75	17.7 M	3.8 M^2	0.58 M/S	0.23 M	1.1 M^3/S
24AUG75	3.0 M	0.2 M^2	0.20 M/S	0.04 M	0.04 M^3/S

	STAGE	AREA	HYDRAULIC RADIUS
HWMK	0.63 M	10.4 M^2	0.32 M

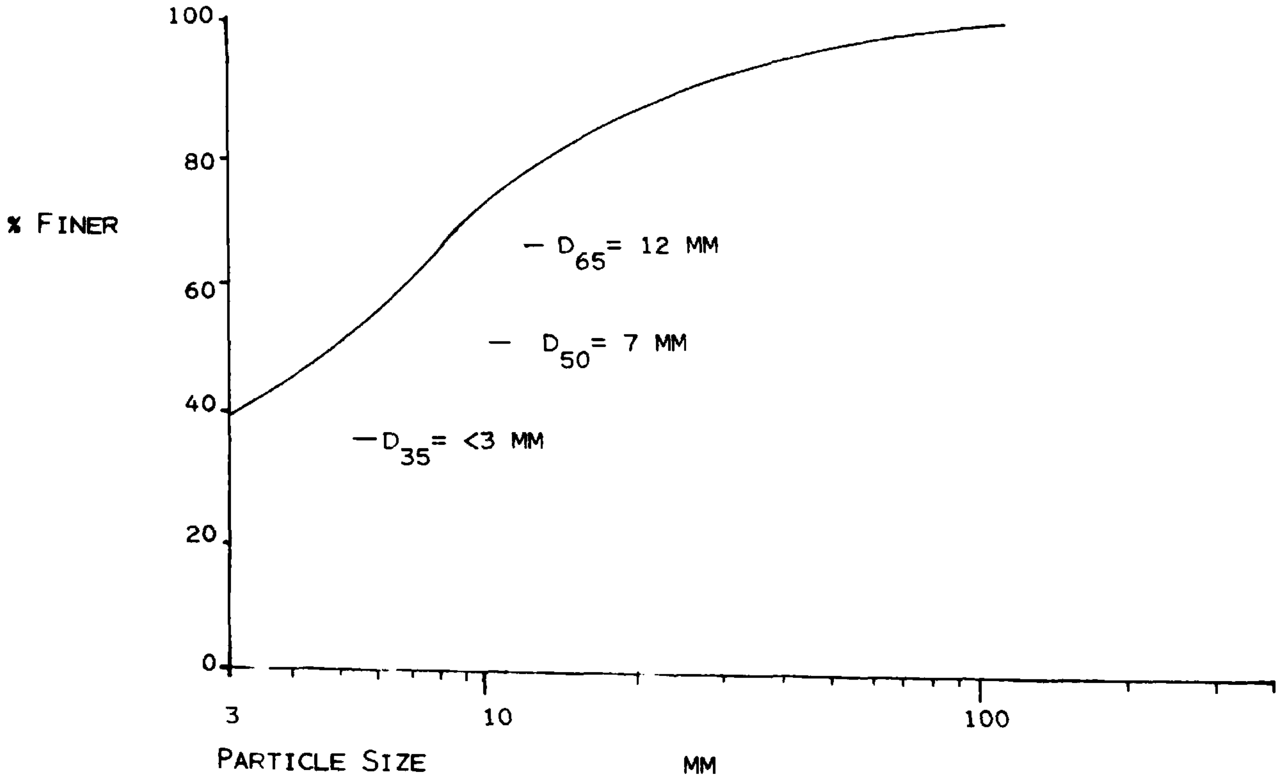
PERMAFROST

SEE PERMAFROST CROSS-SECTION

PERMAFROST CROSS-SECTION M-4



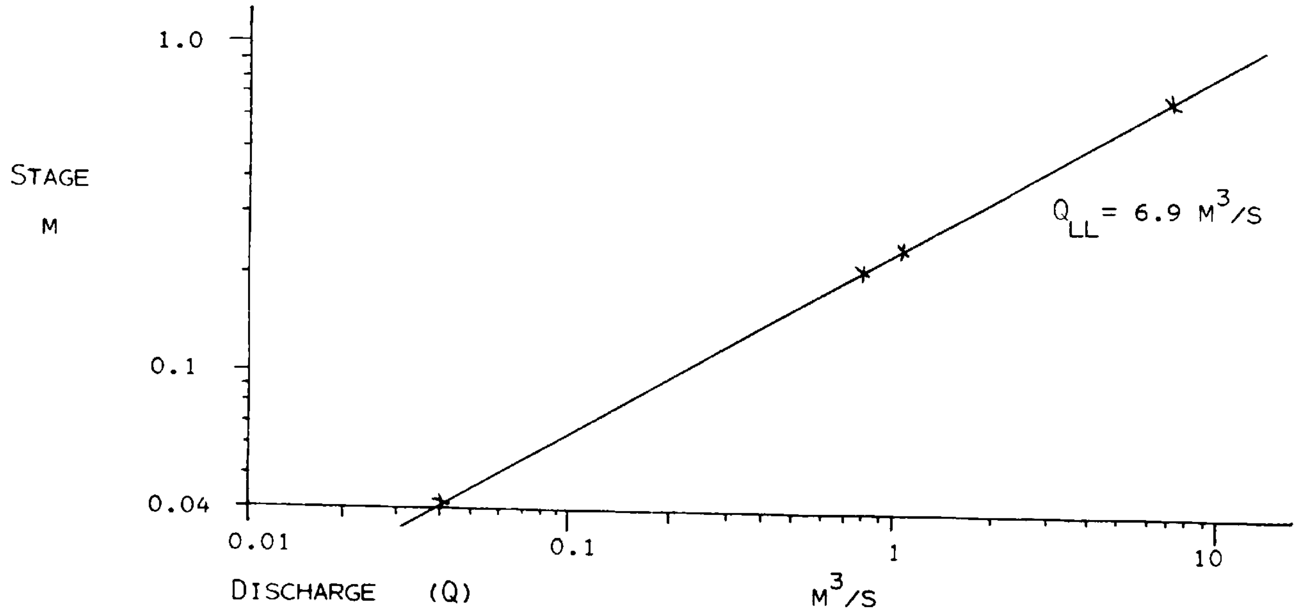
PARTICLE SIZE DISTRIBUTION (BED MATERIAL) M-4



STRICHLER'S ''N'', $N = 0.013\ (D_{50})^{1/6}$		0.018
SUSPENDED SEDIMENT CONCENTRATION	07JUL75	164 MG/L
DISSOLVED SEDIMENT CONCENTRATION	07JUL75	115 MG/L

ESTIMATED DISCHARGE AT HIGH WATER MARK M-4

LOG-LOG EXTENSION



MANNING EQUATION

$$Q = \frac{A\ R^{2/3}\ S^{1/2}}{N} = \frac{(10.4)(0.32)^{2/3}(0.001)^{1/2}}{0.018}$$

$$= 8.6\ M^3/S$$

BEST ESTIMATE

10 M^3/S

STATION NO. 10TD007 DOLPHIN RIVER BELOW CROOKED LAKE PW-1

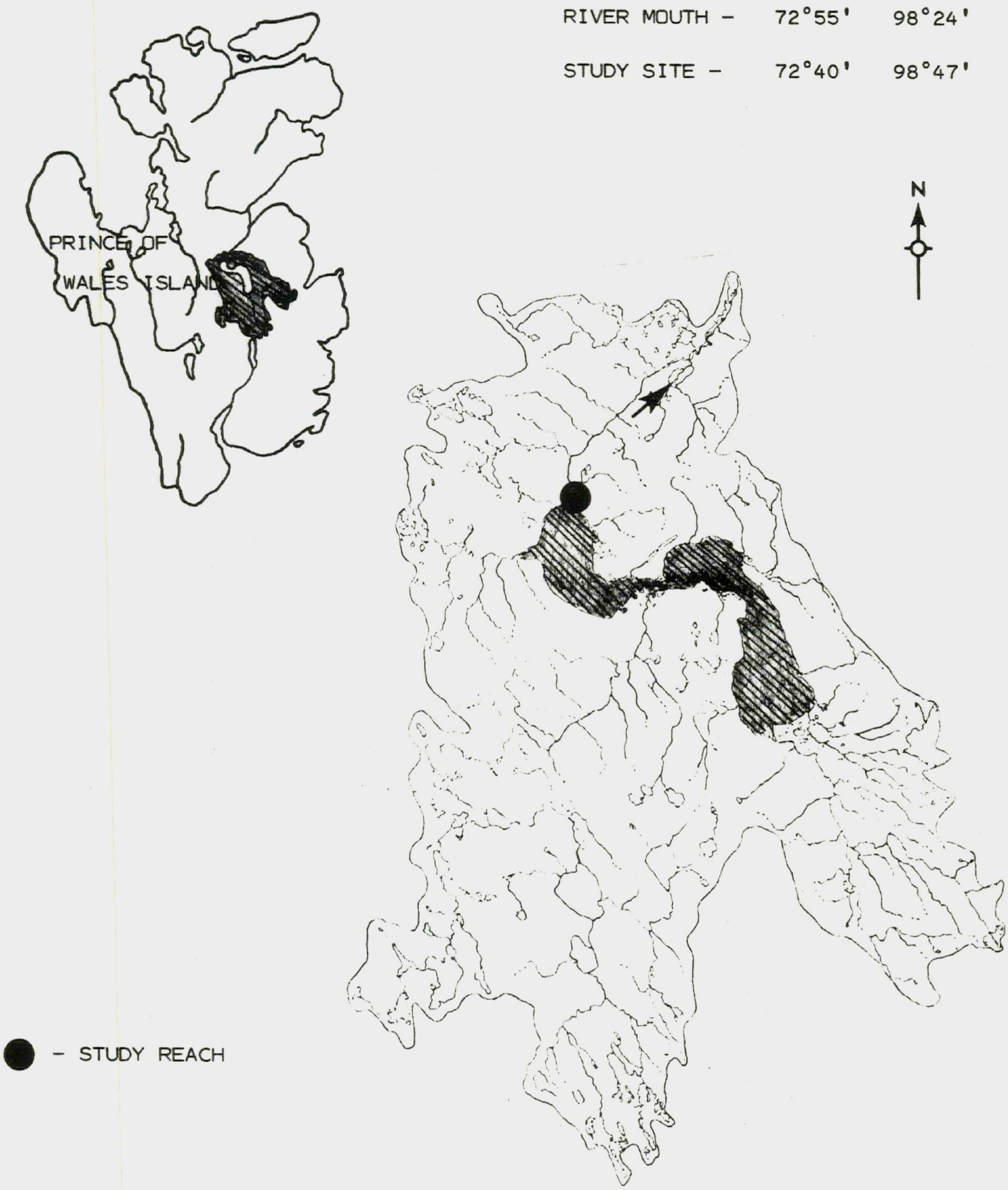
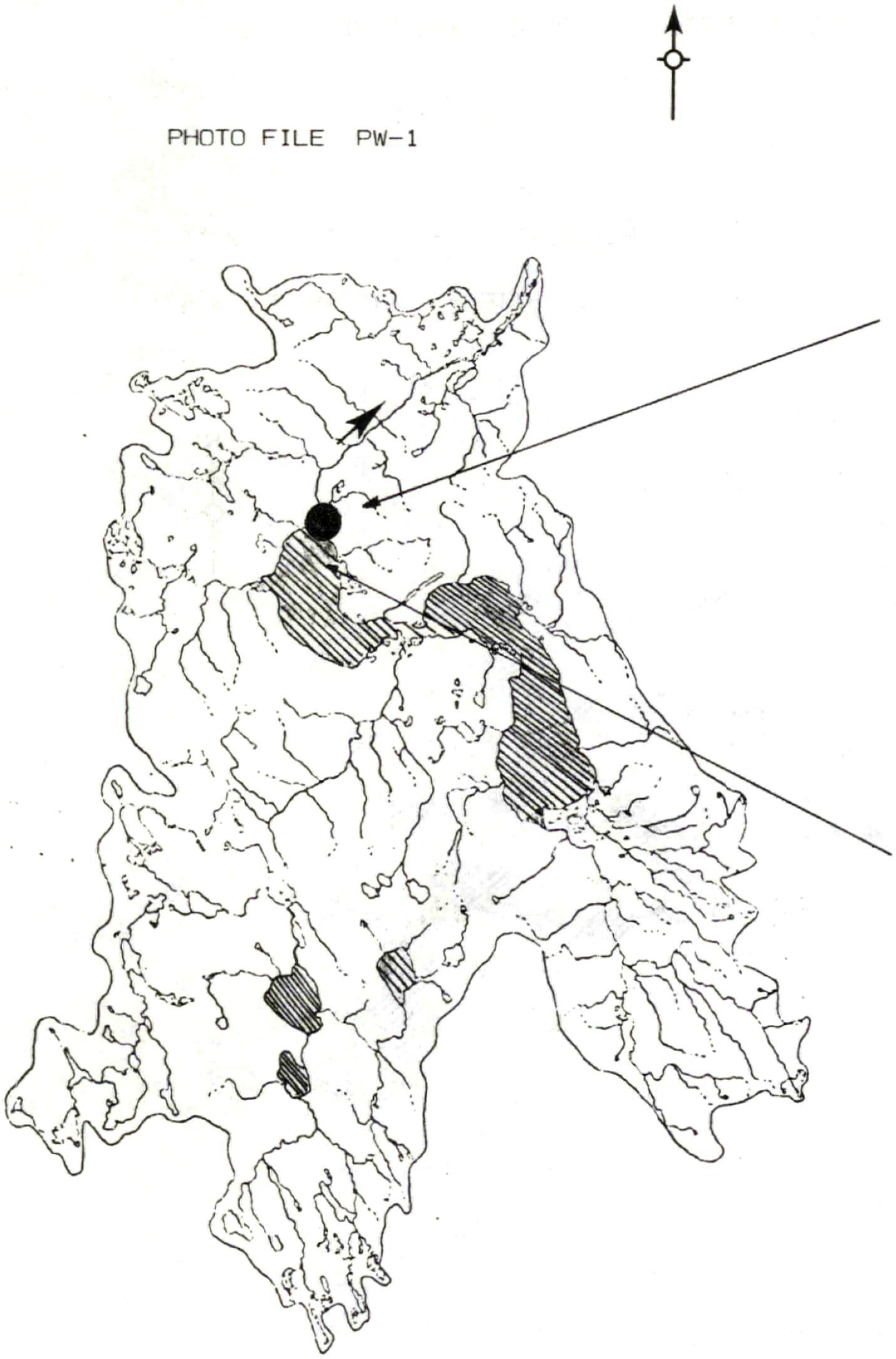


PHOTO FILE PW-1



33.2 - AERIAL OBLIQUE
32.9 - DOWNSTREAM VIEW
32.11 - UPSTREAM VIEW
32.12 - AERIAL OBLIQUE
32.16 - STRAND LINES
31.16 - CROOKED LAKE
31.17 - LAND SPIT
31.18 - TRAPPED LAKES
31.19 - BEACH LEVELS
31.20 - DOWNSTREAM VIEW
31.21 - CROSS SECTION
32.1 - AERIAL OBLIQUE
32.2 - PATTERNED GROUND
32.3 - OUTLET OF DOLPHIN LAKE
32.5 - OUTLET
32.6 - OUTWASH FAN
32.7 - CROSS SECTIONAL VIEW
32.17 - CROOKED LAKE (WEST SHORE)
32.18 - WEST SHORE
32.20 - BANK MATERIAL
32.21 - ERRATIC BOULDERS ON WEST SHORE

● - STUDY REACH

DOLPHIN RIVER PW-1

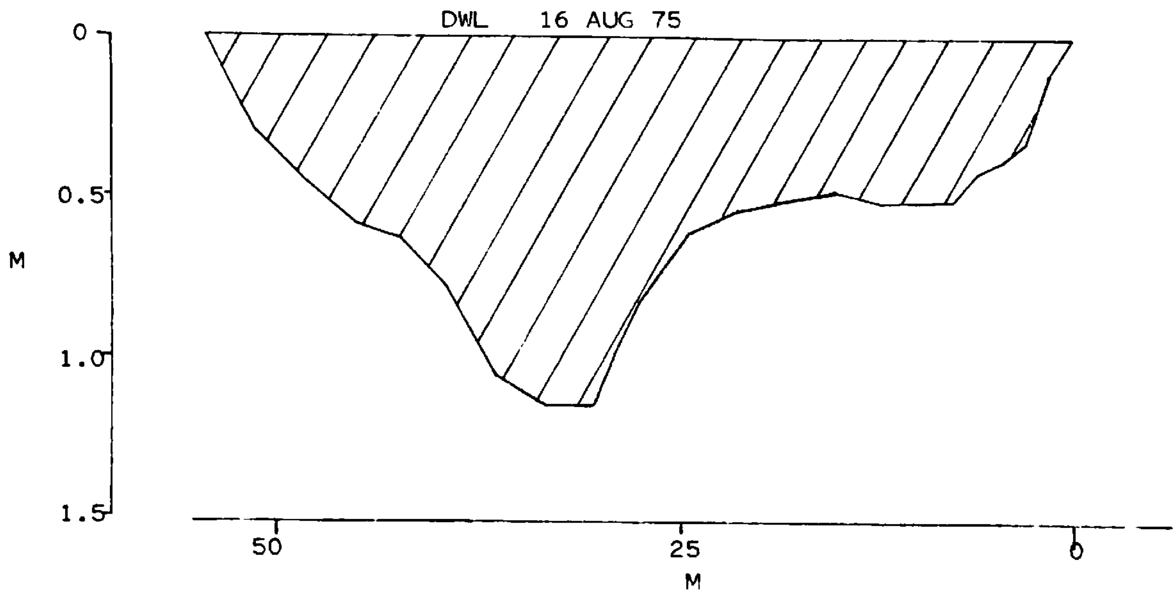
The Dolphin River is the outlet of Crooked Lake, the largest lake on Prince of Wales Island. The general setting of the river system is in a Paleozoic sedimentary lowland area. This previously glaciated lowland is flat or gently undulating with isolated, low, mesa-like hills and small plateaus not exceeding heights of 160 metres above sea level. Crooked Lake, a large S-shaped body, has its two arms trending north-northwesterly and joined by a short narrow section. The eastern arm is quite shallow as was evidenced by extensive areas of vegetation and patterned ground on the bottom, the latter indicating complete freezing. The western arm of the lake is deeper and no evidence of bottom freezing was noted. Extensive raised beaches of marine origin surround the lake and the Dolphin River outlet area. Many shallow lakes are trapped between successive raised beach levels. Within the study reach there exists no distinct valley, typical of sedimentary lowland drainage. A tributary enters the stream within the study reach through the right bank creating an extensive outwash fan. The bed material, bank material and outwash fan material consists of gravels and sands. The low river banks, approximately one metre in height, appear quite stable with no evidence of overtopping visible. The surrounding area is well vegetated with mosses and sedges and contains numerous shallow lakes, most of which do not contribute to the flow of the river. The river has a uniform water surface with an unmeasurable surface slope. Very minor point bars and side bars were noted within the study reach.

MORPHOMETRIC DATA PW-1

LATITUDE AT BASIN MOUTH[1]	72°55'
LONGITUDE AT BASIN MOUTH[1]	98°24'
DRAINAGE AREA	2494 KM^2
BASIN PERIMETER	335 KM
CIRCULARITY RATIO	.280
STREAM ORDER	5
BIFURCATION RATIO	4.02
LENGTH OF PRINCIPAL CHANNEL	100 KM
SLOPE OF PRINCIPAL CHANNEL	0.0006
BASIN WIDTH	48.3 KM
BASIN LENGTH	81.3 KM
ELONGATION RATIO	.693
HYPSOMETRIC INTEGRAL	.305
HYPSOMETRIC COEFFICIENT	-.198
BASIN RELIEF	158 M
MINIMUM ELEVATION	0 M
MAXIMUM ELEVATION	158 M
AVERAGE ELEVATION	79.2 M
MEDIAN ELEVATION	41.1 M
BASIN ASPECT	N

1 - BASED ON 1:250,000 MAPS

CROSS-SECTION PW-1



HYDRAULIC MEASUREMENT

DATE	WIDTH	AREA	MEAN VELOCITY	DISCHARGE
16AUG75	55.2 M	33.5 M^2	0.47 M/S	15.7 M^3/S

STATION NO. 10TD008 FISHER RIVER BELOW FISHER LAKE PW-2

RIVER MOUTH - 71°52' 98°15'

STUDY SITE - 71°59' 98°09'

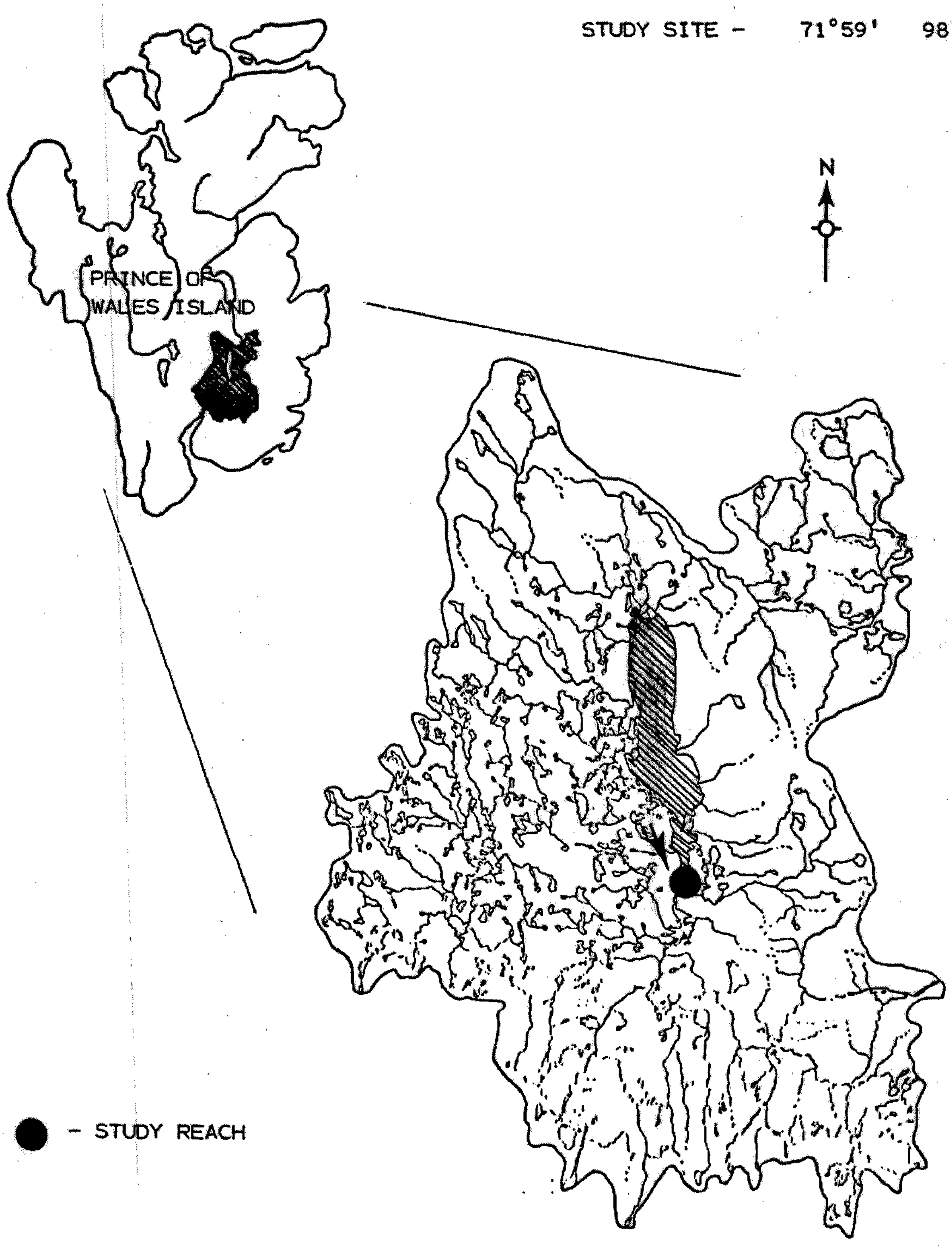
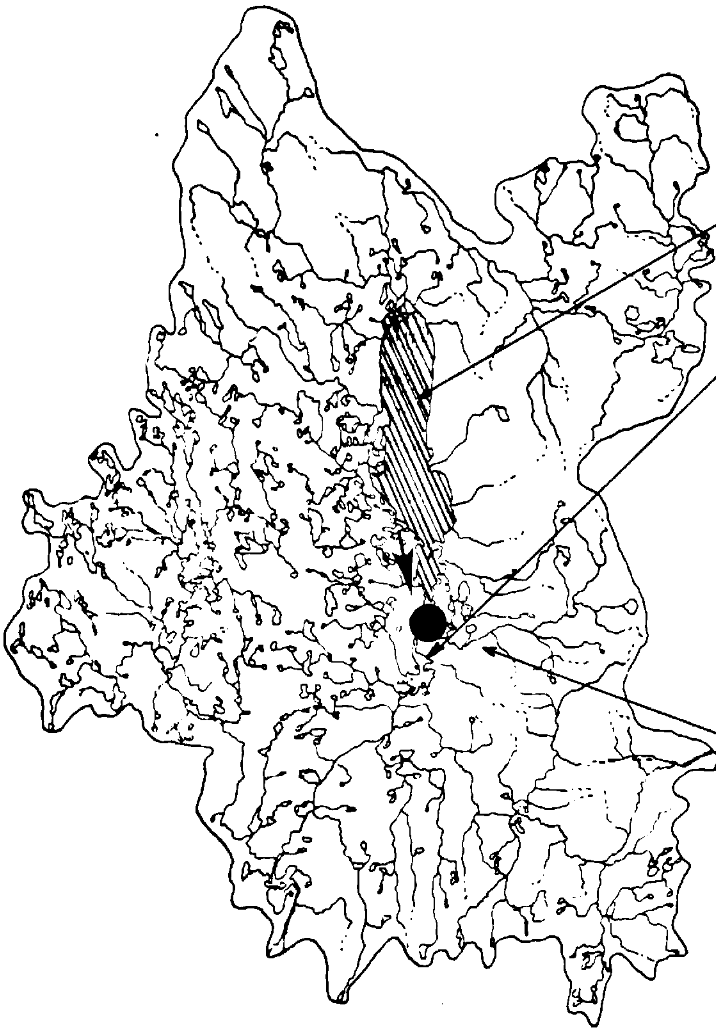


PHOTO FILE PW-2

N



33.3 – FISHER LAKE (WEST SHORE)

33.4 – FISHER LAKE

33.5 – FISHER LAKE (SOUTHEAST VIEW)

33.6 – THERMAL NICHING

33.7 – CROSS SECTION

33.8 – FLOOD PLAIN MATERIAL

33.9 – FLOOD PLAIN

33.11 – FLOOD PLAIN DOWNSTREAM VIEW

33.12 – FLOOD PLAIN FROM R.B.

33.13 – VIEW FROM TERRACE

33.14 – CROSS SECTION FROM TERRACE

33.15 – CROSS SECTION

● – STUDY REACH

FISHER RIVER PW-2

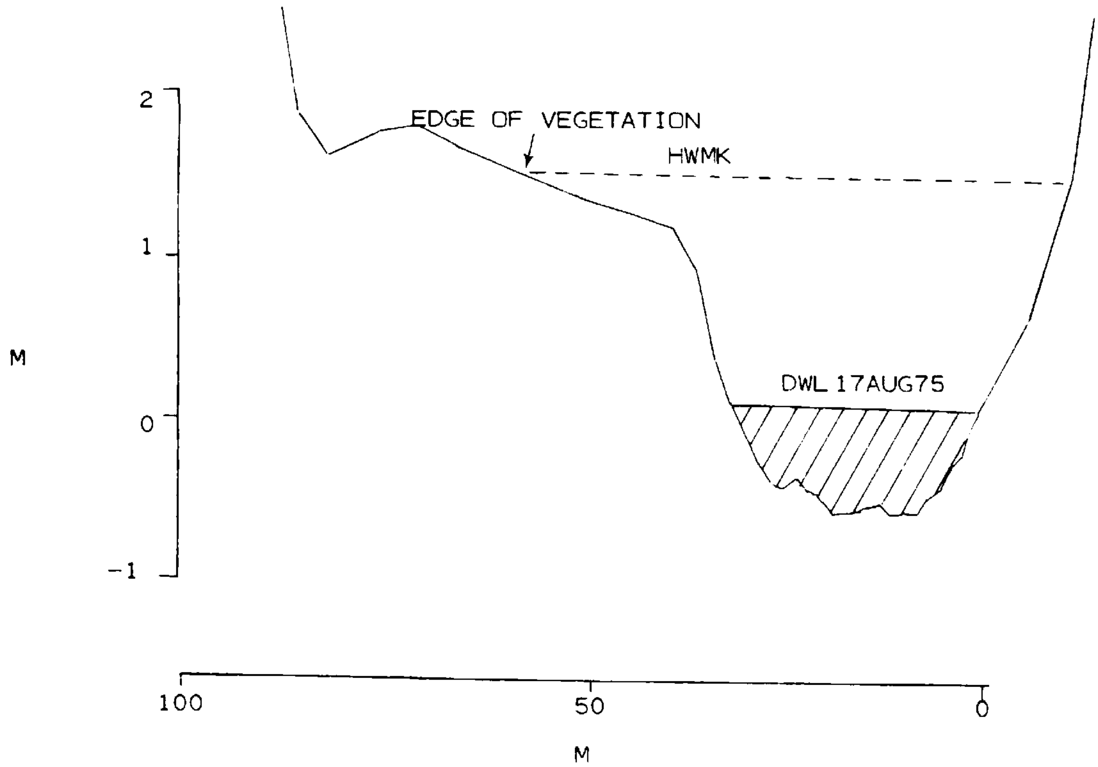
The Fisher River flows in an area generally described as Paleozoic sedimentary lowland. Paralleling the river valley in a north-northwesterly direction is a hilly area designated the Colquhoun Range. These low, round, drumlin-shaped hills, about 120 to 150 metres high, extend from Guillemard Bay at the river's mouth to north of Fisher Lake. Within the study reach, the river flows in a wide but shallow valley with the valley walls being about 30 metres in height and a valley bottom width of approximately 150 metres. The valley walls are mainly gravels and sands with some cobble-sized material present. The slopes of the valley are sparsely vegetated with occasional patches of mosses and grasses. Minor gullying was noted on the right valley wall. The sinuous patterned river flows in an extensive floodplain. Surficial bed material is poorly graded gravel. Surficial floodplain material is sand, gravel and cobble sizes in a well-packed, "cemented" condition having the appearance of a pavement. No vegetation occurred on the floodplain. An unpaired terrace was fairly continuous along the left bank and was covered by mosses and lichens. Nivation hollows were noted along the toe of the terrace riser. In general, the study reach appears to be stable.

MORPHOMETRIC DATA PW-2

LATITUDE AT BASIN MOUTH[1]	71°52'
LONGITUDE AT BASIN MOUTH[1]	98°15'
DRAINAGE AREA	1935 KM^2
BASIN PERIMETER	262 KM
CIRCULARITY RATIO	.353
STREAM ORDER	5
BIFURCATION RATIO	4.57
LENGTH OF PRINCIPAL CHANNEL	103 KM
SLOPE OF PRINCIPAL CHANNEL	0.002
BASIN WIDTH	47.5 KM
BASIN LENGTH	64.1 KM
ELONGATION RATIO	.773
HYPSOMETRIC INTEGRAL	.509
HYPSOMETRIC COEFFICIENT	- .179
BASIN RELIEF	168 M
MINIMUM ELEVATION	0
MAXIMUM ELEVATION	168 M
AVERAGE ELEVATION	83.8 M
MEDIAN ELEVATION	67.1 M
BASIN ASPECT	S

1 - BASED ON 1:250,000 MAPS

CROSS-SECTION PW-2



NO PROFILE TAKEN, WATER SURFACE WAS TOO FLAT

HYDRAULIC MEASUREMENTS

DATE	WIDTH	AREA	MEAN VELOCITY	DISCHARGE
17AUG75	32 M	16 M^2	0.23 M/S	3.71 M^3/S

HIGH WATER MARK

STAGE	WIDTH	AREA	HYDRAULIC RADIUS
1.46 M ABOVE DWL 17 AUG 75	144 M	148 M^2	1.03 M

STATION NO. 10TD009 UNNAMED RIVER ABOVE OMMANEY BAY PW-3

RIVER MOUTH - 72°43' 100°29'

STUDY SITE - 72°21' 100°04'

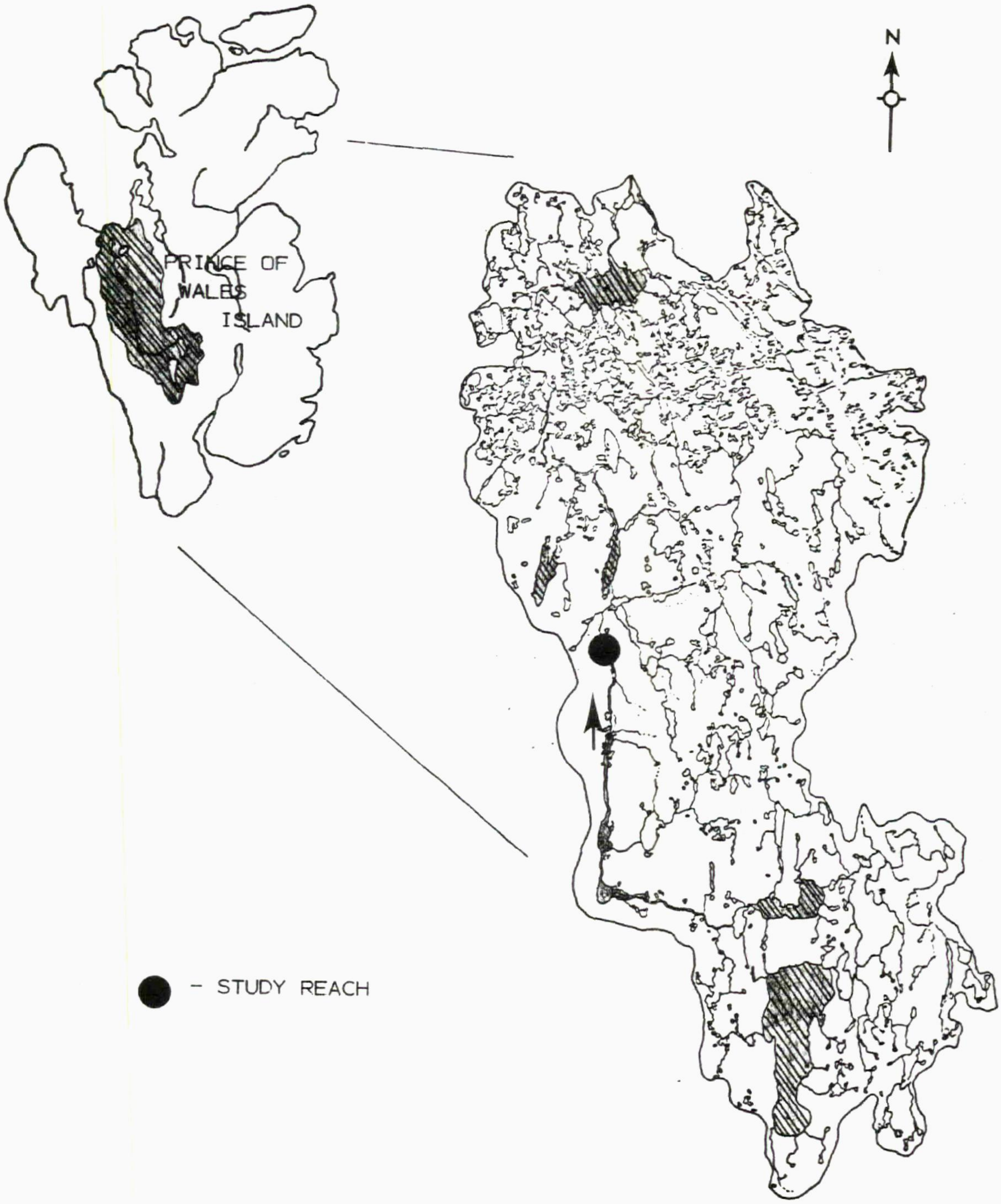
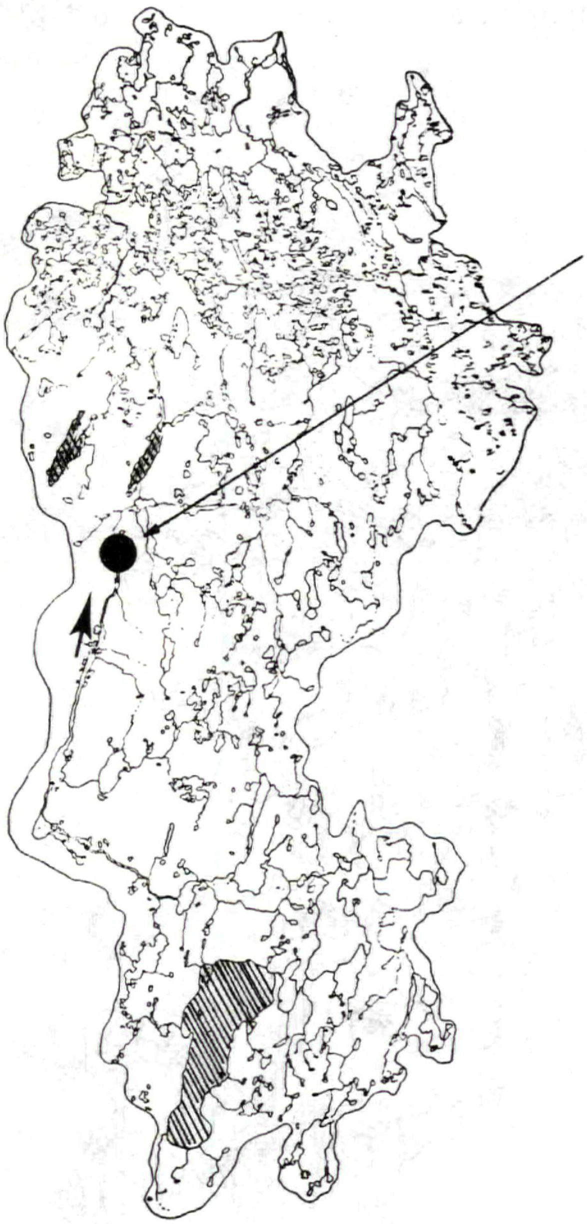


PHOTO FILE PW-3



34.11 – UPSTREAM VIEW

34.12 – DOWNSTREAM VIEW

34.13 – CROSS SECTIONAL VIEW

33.16 – VIEW FROM L.B.

33.17 – VIEW ALONG L.B.

33.19 – CROSS SECTION

33.20 – DOWNSTREAM VIEW

33.21 – CROSS SECTION

34.2 – AERIAL OBLIQUE

34.3 – AERIAL OBLIQUE

34.6 – CROSS SECTIONAL VIEW FROM L.B.

34.7 – DOWNSTREAM VIEW

34.8 – UPSTREAM VIEW

34.9 – NARROW CHANNEL

34.10 – WIDE CHANNEL

● – STUDY REACH

OMMANNEY RIVER PW-3

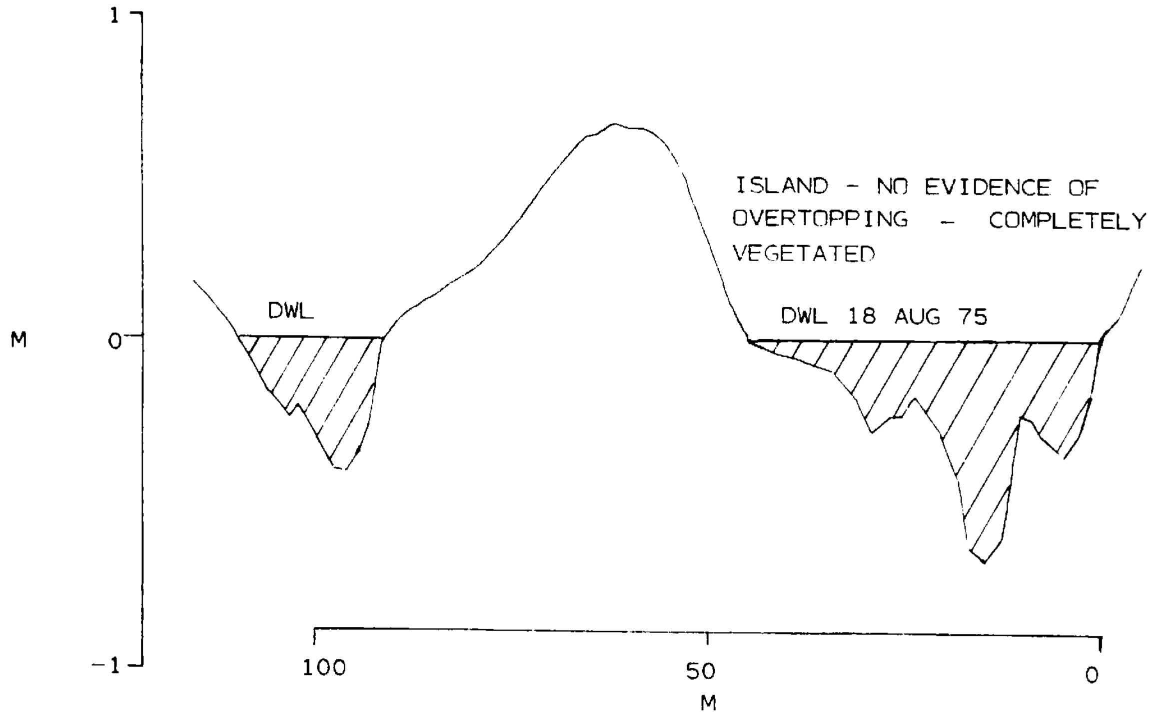
The drainage basin of this river is typical of glacially-worked, sedimentary lowlands of the arctic regions exhibiting confused drainage patterns, ill-defined rivers and multitudinous lakes. The river in the study reach, typical of the basin, gives the appearance of being a continuous narrow elongated lake. The study reach was situated in a split channel river section in order to achieve measurable velocities. No distinct valley is present. The surrounding area was quite flat and completely vegetated with lush growths of grasses, mosses and small flowering plants. Many shallow ponds and lakes are located on both sides of the river. The surficial river bed materials were gravels and sands. The island separating the river channels was heavily vegetated to the water's edge. Although the highest point on the island was less than one metre above the existing water level no evidence of overtopping was found.

MORPHOMETRIC DATA PW-3

LATITUDE AT BASIN MOUTH[1]	72°43'
LONGITUDE AT BASIN MOUTH[1]	100°29'
DRAINAGE AREA	2940 KM^2
BASIN PERIMETER	386 KM
CIRCULARITY RATIO	0.350
STREAM ORDER	5
BIFURCATION RATIO	5.48
LENGTH OF PRINCIPAL CHANNEL	148.0 KM
SLOPE OF PRINCIPAL CHANNEL	.001
BASIN WIDTH	48.0 KM
BASIN LENGTH	105.6 KM
ELONGATION RATIO	0.577
HYPSOMETRIC INTEGRAL	0.262
HYPSOMETRIC COEFFICIENT	0.145
BASIN RELIEF	150.5 M
MINIMUM ELEVATION	0
MAXIMUM ELEVATION	150.5 M
AVERAGE ELEVATION	79.2 M
MEDIAN ELEVATION	57.3 M
BASIN ASPECT	N.W.

1 - BASED ON 1:250,000 MAPS

CROSS-SECTION PW-3



HYDRAULIC MEASUREMENTS

DATE	WIDTH	AREA	MEAN VELOCITY	DISCHARGE
18AUG75	57 M	15 M^2	0.40 M/S	6.0 M^3/S

STATION NO. 10TD010 SCARP BROOK ABOVE INNER BROWNE BAY PW-4

RIVER MOUTH -	73°01'	98°30'
STUDY SITE -	72°58'	98°41'

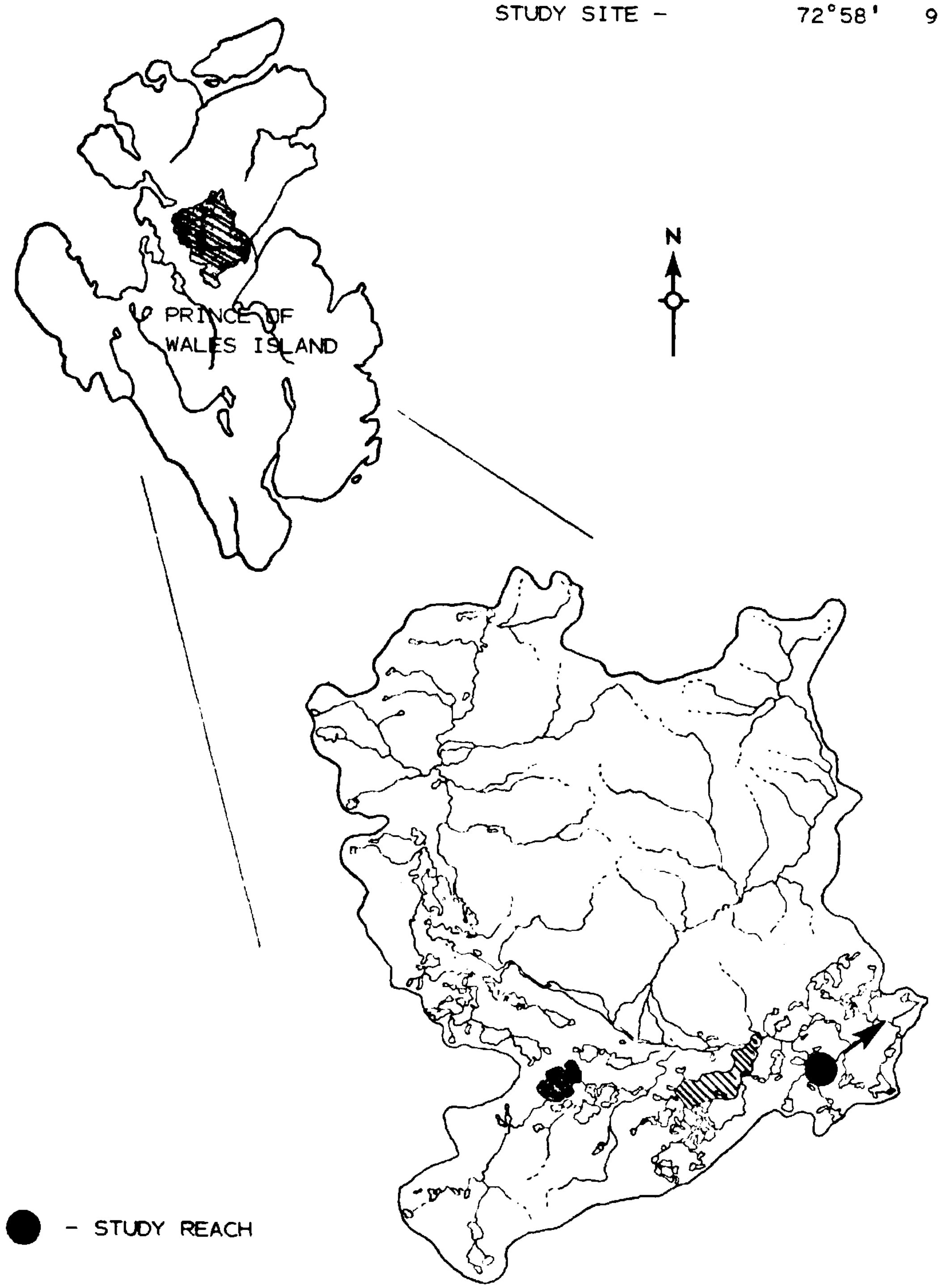
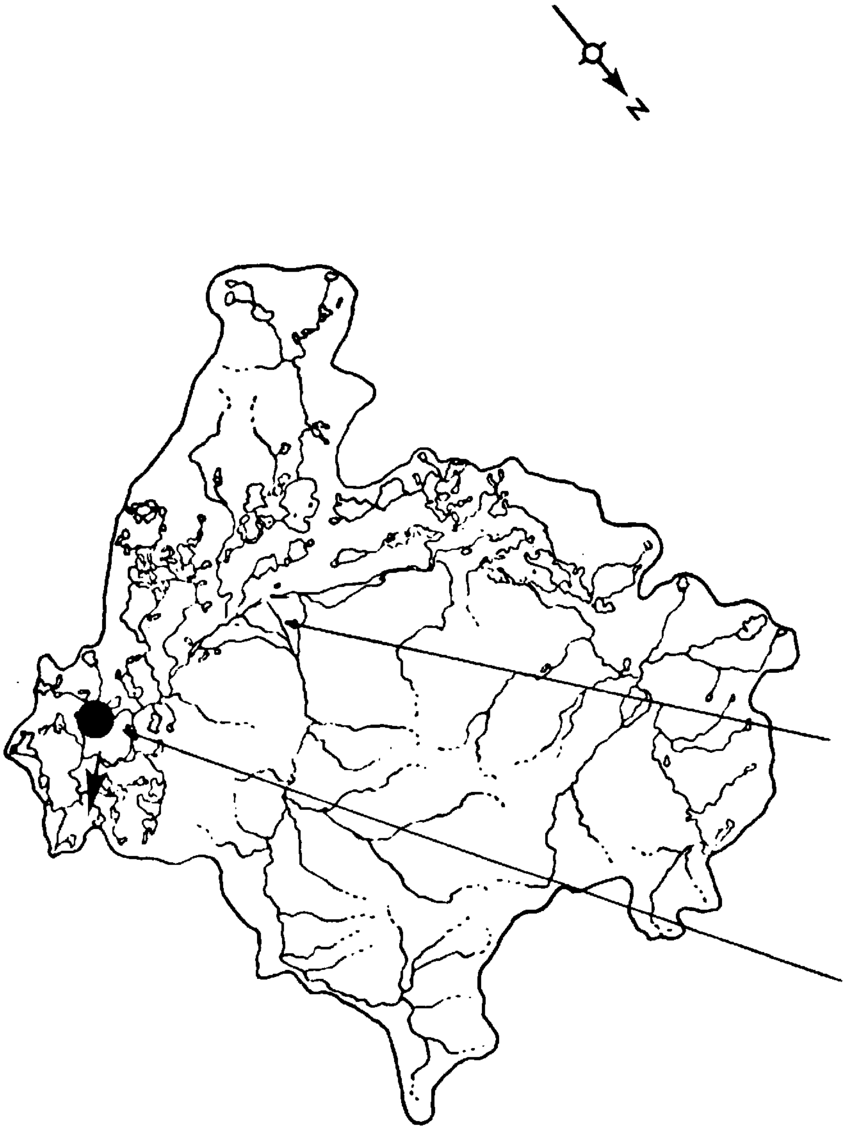


PHOTO FILE PW-4



35.12 - FLOOD PLAIN MATERIAL
35.15 - UPSTREAM VIEW
34.16 - BLOCK SLUMPING
34.17 - SLUMPING
34.18 - HUMMOCHY TERRAIN
34.19 - DOWNSTREAM VIEW
35.1 - AERIAL OBLIQUE
35.2 - SAND AND MUD FLATS
35.3 - AERIAL OBLIQUE
35.4 - SAND FLATS
35.5 - AERIAL OBLIQUE
35.6 - ESCARPMENT RIVERS
35.7 - UPSTREAM VIEW
35.8 - DOWNSTREAM VIEW
35.9 - CROSS SECTIONAL VIEW
35.10 - STRAND LINES
35.11 - STRAND LINES

● - STUDY REACH

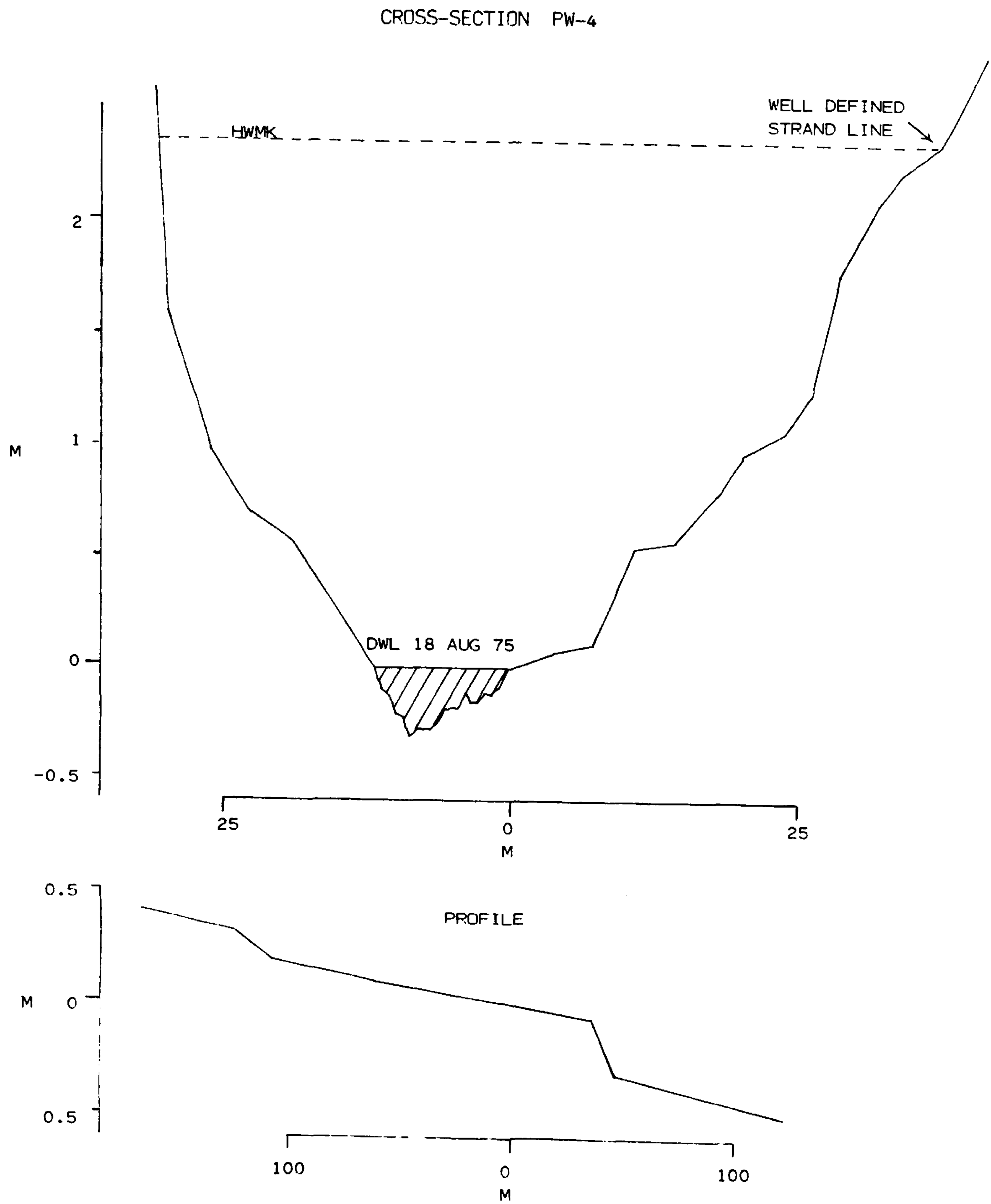
SCARP BROOK PW-4

The drainage basin for this system lies partly in the sedimentary plateau of northeastern Prince of Wales Island and partly within the sedimentary lowland region. From its headwater area to the ocean, the principle channel parallels the escarpment of the plateau region. The deeply incised tributary rivers from the plateau would appear to carry substantial sediment loads, thus creating extensive sand and gravel flats upstream of the study reach. Within the reach, the river flows in an area of moderate relief, adjacent to the escarpment. The valley walls are comprised of sandy gravel, sparsely covered with vegetation. The left valley wall is well defined; the right valley wall exists as a gently sloping surface from the edge of the floodplain up to the level of the surrounding area. A fragmentary terrace occurs along the left valley wall. Three high water marks were noted along the right valley wall, one quite distinct and two indistinct. The distinct strand line, of dead grasses, was located almost three metres above the existing water level. The unvegetated floodplain's surficial material consists of gravel and angular, cobble-sized plates. The single confined channel has a gravel - sand bed and a number of diagonal gravel bars occurred within the study reach. Minor gullying and rill wash on the left valley slope was observed.

MORPHOMETRIC DATA PW-4

LATITUDE AT BASIN MOUTH[1]	73°01'
LONGITUDE AT BASIN MOUTH[1]	98°30'
DRAINAGE AREA	873 KM^2
BASIN PERIMETER	166 KM
CIRCULARITY RATIO	.399
STREAM ORDER	4
BIFURCATION RATIO	4.38
LENGTH OF PRINCIPAL CHANNEL	63 KM
SLOPE OF PRINCIPAL CHANNEL	0.0002
BASIN WIDTH	41.8 KM
BASIN LENGTH	39.4 KM
ELONGATION RATIO	.846
HYPSOMETRIC INTEGRAL	.446
HYPSOMETRIC COEFFICIENT	-0.069
BASIN RELIEF	198 M
MINIMUM ELEVATION	0 M
MAXIMUM ELEVATION	198 M
AVERAGE ELEVATION	99.1 M
MEDIAN ELEVATION	75.3 M
BASIN ASPECT	E

1 - BASED ON 1:250,000 MAPS


CROSS-SECTION PW-4
HWMK
WELL DEFINED
STRAND LINE
DWL 18 AUG 75
M
2
1
0
-0.5
25
0
25
M
PROFILE
0.5
M
0
0.5
100
0
100
M

HYDRAULIC MEASUREMENTS PW-4

DATE	WIDTH	AREA	MEAN VELOCITY	DISCHARGE
18AUG75	12.2 M	2.05 M^2	0.36 M/S	0.73 M^3/S

HIGH WATER MARK

STAGE	WIDTH	AREA	HYDRAULIC RADIUS
2.3 M ABOVE DWL 18 AUG 75	70.1 M	108 M^2	1.54 M

STATION NO. 10TD011 UNNAMED RIVER BELOW ALLEN LAKE PW-5

RIVER MOUTH -	73°32'	97°40'
STUDY SITE -	73°31'	97°45'

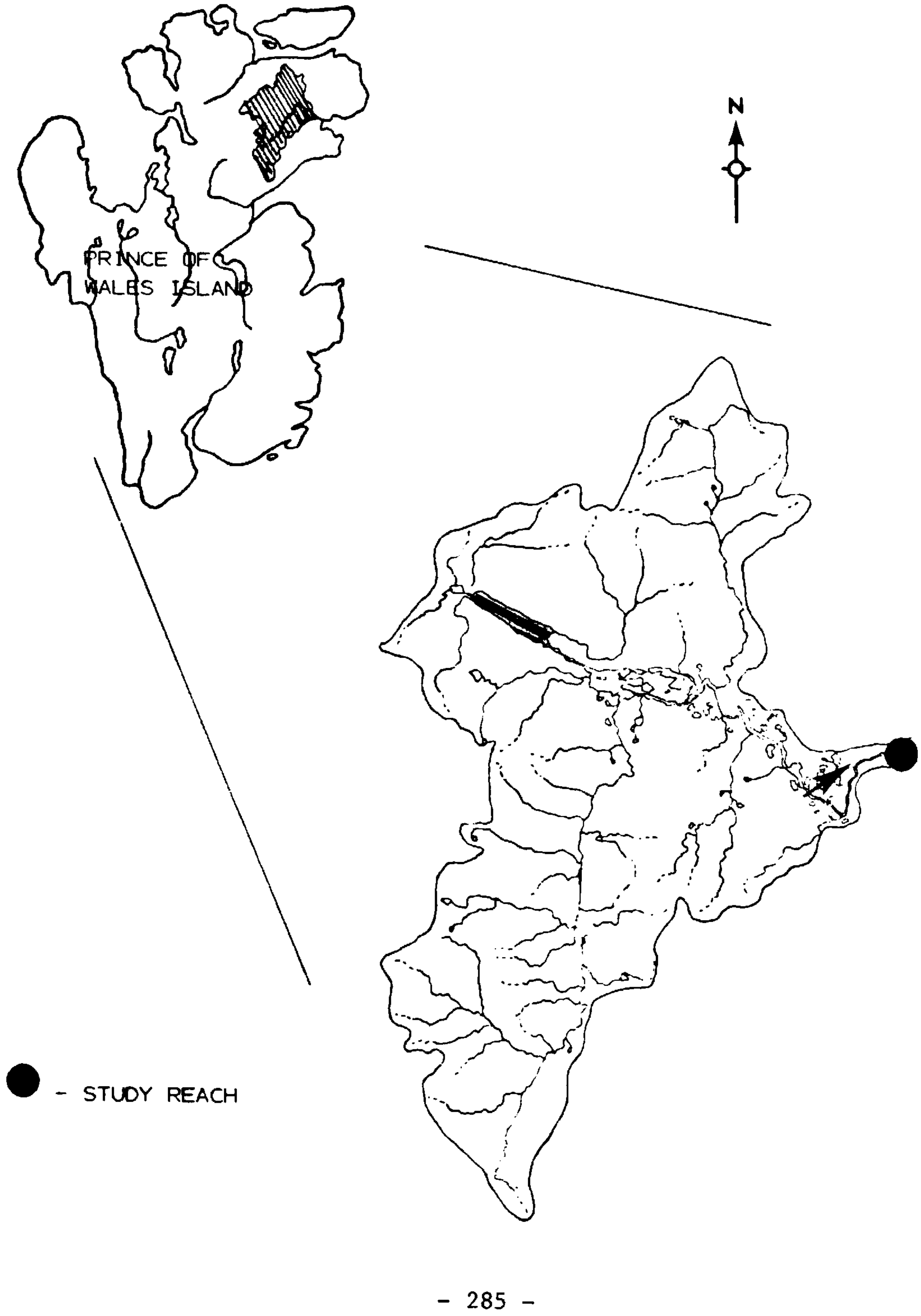
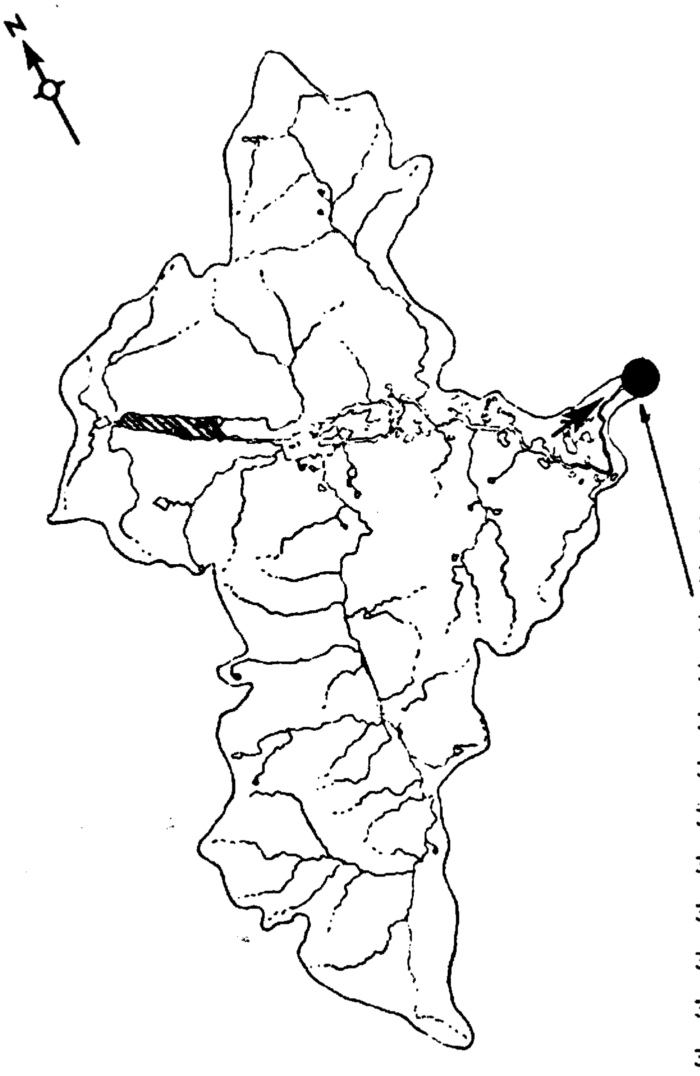


PHOTO FILE PW-5



26.6 - RIGHT VALLEY WALL (ABOVE SECTION)

36.7 - CROSS SECTION

36.8 - UPSTREAM VIEW

36.9 - DOWNSTREAM VIEW

35.15 - AERIAL OBLIQUE

35.16 - DOWNSTREAM VIEW

35.17 - UPSTREAM VIEW

35.18 - DOWNSTREAM VIEW

35.19 - VIEW OF VALLEY

35.20 - VIEW OF VALLEY

35.21 - VIEW OF VALLEY

36.1 - CROSS SECTION FROM R.B.

36.2 - UPSTREAM VIEW

36.3 - DOWNSTREAM VIEW

36.4 - CROSS SECTION FROM L.B.

36.5 - VIEW FROM VALLEY WALL

36.10 - VIEW FROM RIGHT VALLEY WALL

36.11 - DOWNSTREAM VIEW

36.12 - DOWNSTREAM VIEW

36.13 - BED MATERIAL

36.14 - VALLEY FLOOR

36.15 - SNOW BEDS

36.16 - NIVATION HOLLOWS

36.17 - VALLEY FLOOR MATERIAL

● - STUDY REACH

ALLEN RIVER PW-5

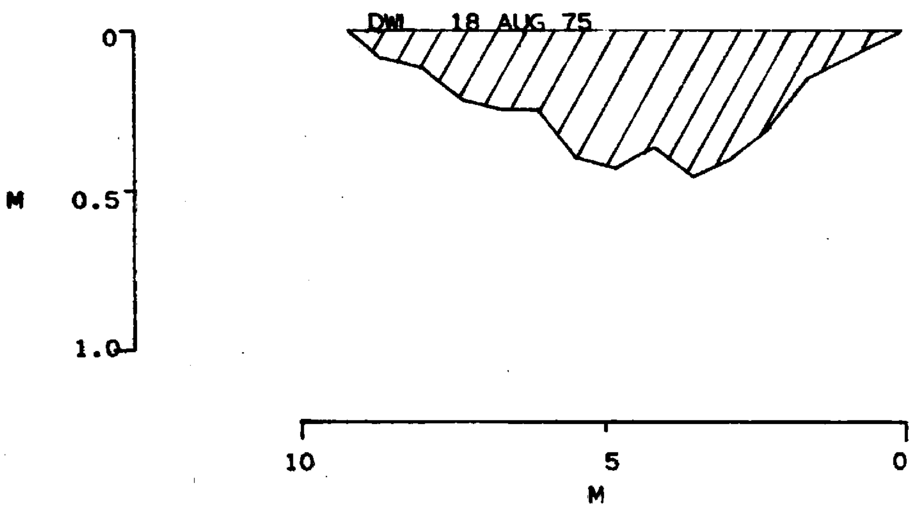
The drainage basin for this river system lies within the sedimentary plateau area of northeastern Prince of Wales Island. Within the study reach, the river flows in a moderately deep incised valley with steep valley walls. The nearly vertical valley walls have been extensively eroded by frost shattering and gullying, thus creating talus slopes along both valley walls. Within the study reach, a number of dry wash tributaries enter the river through both valley walls. The floodplain extends from valley wall to valley wall and is generally composed of boulder sized material. Only along the toes of the valley wall, in areas of snowbed remnants, was the presence of small sized material observed. The valley slopes and floodplain were not vegetated and only sparse moss patches occurred on the terrain surrounding the valley. The river flows on a boulder bed and shifts in the floodplain from side to side through layered boulders. The large size of the floodplain and river bed material creates an impression of stream bed stability, although the valley walls generate colluvium in considerable quantity.

MORPHOMETRIC DATA PW-5

LATITUDE AT BASIN MOUTH[1]	73°32'
LONGITUDE AT BASIN MOUTH[1]	97°40'
DRAINAGE AREA	764 KM^2
BASIN PERIMETER	158 KM
CIRCULARITY RATIO	.386
STREAM ORDER	4
BIFURCATION RATIO	5.72
LENGTH OF PRINCIPAL CHANNEL	63 KM
SLOPE OF PRINCIPAL CHANNEL	0.003
BASIN WIDTH	53.3 KM
BASIN LENGTH	38.1 KM
ELONGATION RATIO	.818
HYPSOMETRIC INTEGRAL	.488
HYPSOMETRIC COEFFICIENT	-0.268
BASIN RELIEF	247 M
MINIMUM ELEVATION	0
MAXIMUM ELEVATION	247 M
AVERAGE ELEVATION	123 M
MEDIAN ELEVATION	119 M
BASIN ASPECT	E

1 - BASED ON 1:250,000 MAPS

CROSS-SECTION PW-5



HYDRAULIC MEASUREMENTS

DATE	WIDTH	AREA	MEAN VELOCITY	DISCHARGE
18AUG 75	8.8 M	2.16 M^2	0.26 M/S	0.56 M^3/S

APPENDIX C

WATER QUALITY OF HIGH ARCTIC STREAMS

EASTERN ARCTIC ISLANDS PIPELINE STUDY

Wm. D. Gummer

G. Dunn

Water Quality Branch

Western and Northern Region

January 2, 1976

TABLE OF CONTENTS

LIST of FIGURES

LIST of TABLES

ACKNOWLEDGEMENTS

We thank the Water Survey of Canada and Fisheries and Marine Service field crews for their assistance in the collection and shipping of water samples to the Yellowknife laboratory. Laboratory work in Yellowknife was performed by Water Quality Branch personnel. We are grateful to the Water Planning and Management staff for drafting the figures and to Water Survey of Canada for their editorial review and typing assistance in preparing this report.

SYNOPSIS

As part of the Eastern Arctic Islands Pipeline Study, a total of fifty-four water samples from thirty-nine stations were collected and analyzed for major ions, metals and nutrients. Sampling frequency was at time of visits to the sites through the cooperation of the Water Survey of Canada, and Fisheries and Marine Service field crews. Stations sampled twice or more were done so under different flow conditions. Although the water quality data base is meagre, an assessment of the existing arctic stream qualities indicates four streams of high nutrient and metal concentrations on Melville Island; and one highly saline stream on Cornwallis Island. The remaining thirty-four stations reflected excellent water quality.

I - INTRODUCTION

A. General

It has been recognized that the Arctic ecosystems are extremely sensitive and susceptible to destruction by the activities of man. Technology related to Arctic development is as yet in an infantile stage, which may result in the exploitation of the receiving environment through "trial and error".

Environmental concerns have been raised regarding the construction of a proposed natural gas pipeline southward from the High Arctic Islands. It is the responsibility of the proponent (Polar Gas) to file an environmental impact statement when making application for the right to construct the pipeline. The Canadian Government, to whom the application is submitted, must possess the expertise and the essential data base from which to adequately assess the impact statement.

In this regard, the Government of Canada initiated a two-year multi-disciplinary environmental data-gathering study covering three broad areas:

1. Terrestrial Environmental Projects
2. Inter-island Channel Projects
3. Freshwater Projects

It is this last project area to which water quality data gathering was delegated.

B. Study Objectives

The objectives of the Freshwater Projects are:

> "To meet Government's need for knowledge in order to assess the accuracy of the proponent's data and conclusions through a reconnaissance of the hydrologic and morphologic characteristics of the major, and of representative minor streams and their flood plains, and to obtain relevant information on fish populations, critical habitat, life history, and water quality."

To meet these objectives, the Freshwater Projects was divided into two sub-project areas:

1. FP-1, Hydrologic Regimes
2. FP-2, Fish Resources and Habitats

Upon the request by Water Survey of Canada (WSC), the Water Quality Branch (WQB) of Environment Canada agreed to partake in a water quality study having the following objective:

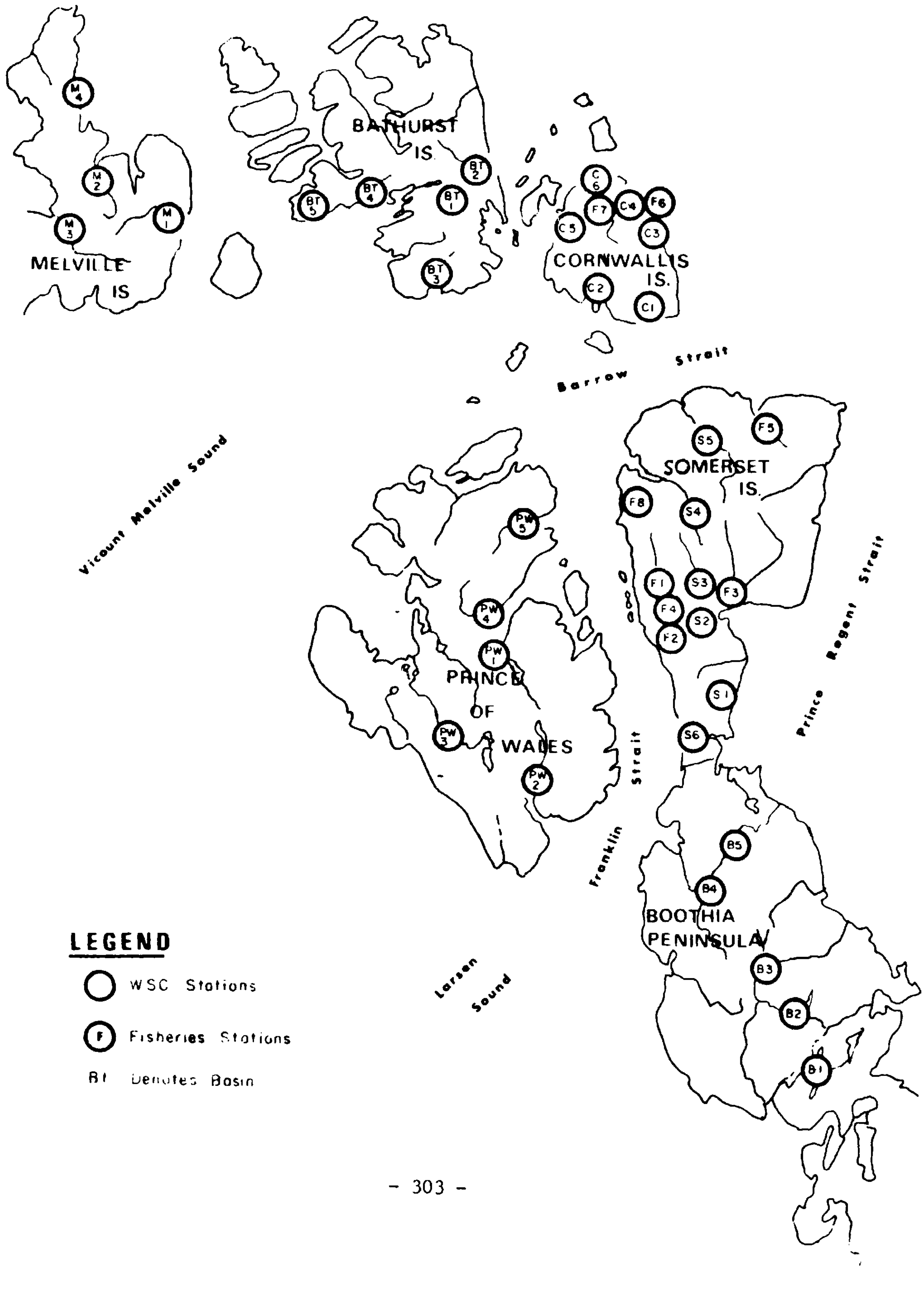
> "To determine the existing quality of the water in a representative number of major and minor streams in the High Arctic Islands."

C. Study Area

The study area for the first year of the two-year study includes Boothia Peninsula, Somerset, Prince of Wales, Cornwallis, Bathurst and Melville islands located approximately between latitude 69°N. and 77°N. (Figure 1).

Boothia Peninsula and the southwestern part of Somerset Island are of igneous origin and are slightly mountainous, having elevations of about 1800 ft. above sea level. The remainder of the study area has little relief, rarely exceeding 1000 ft. elevation, and is composed of sedimentary material (Aquatic Environments, 1975).

FIGURE 1 - STUDY AREA AND SAMPLING LOCATIONS



II - PROCEDURES

A. Station Locations and Sampling Frequency

In accordance with the study plan, the Water Quality Branch provided water quality meters, samplers and bottles, sampling preserving and shipping instructions, and analytical services. Sample collection was made possible through the co-operation of Water Survey of Canada (WSC), and Fisheries and Marine Services (FMS) field staff.

Fifty-four samples were collected at thirty-nine different locations (Figure 1) during June, July and August, thirty-one of which were visited by WSC and eight by FMS personnel. Sampling station co-ordinates are shown in Table 1. Detailed basin maps showing station locations are available from the Water Quality Branch.

B. Sampling Technique

All streams were sampled midstream by wading or by boat, according to the Inland Waters Directorate procedures (Canada, 1974). Water sample degradation with time is inevitable and the extent of such degradation is unknown. To minimize sample degradation, samples were preserved and then shipped air freight to the Branch's laboratory in Yellowknife.

C. Analytical Determinations

Laboratory

All water quality samples were analyzed according to W.J. Traversey's "Methods for Chemical Analysis of Water and Wastewater" for: major ions (calcium, sodium, chloride, fluoride, silica reactive, sulfate); pH, specific conductance, colour, turbidity, total alkalinity, total hardness; extractable metals (aluminum, barium, cadmium, chromium, cobalt, copper, iron, lead, manganese, molybdenum, nickel and zinc); chemical oxygen demand (COD), dissolved arsenic and selenium. Periodic samples were analyzed for total kjeldahl nitrogen, total phosphorus and dissolved nitrate nitrogen.

Field

All stream-flow measurements, slope gradients and geological data were collected by WSC. These data are found in the appropriate tables in Section 5 of the main report and in a site specific format in the stream catalogue, Appendix B.

On-site tests for temperature, pH and specific conductance (Table 2) were conducted utilizing a hand-held mercury bulb thermometer, Metrohm E488 pH meter and a Beckman RA-2A specific conductance meter.

D. Study Limitation

No separate budget was provided for water quality sampling in the High Arctic Islands area. Consequently, the extent and frequency of the sampling program was dependent on the efforts of the WSC and FMS field crews. Some of the study limitations were as follows:

1. Inadequate budget: prevented WQB from directly participating in the actual water sampling thereby limiting "types" and numbers of samples collected.

2. Onsite sample preparation: as a result of (1) above, there was no capability of field filtering for dissolved constituents, therefore, sample selectivity and preservation were limited.

3. Aircraft cargo space: due to the lack of cargo space on the helicopters, some stations were not sampled as frequently as they might have been.

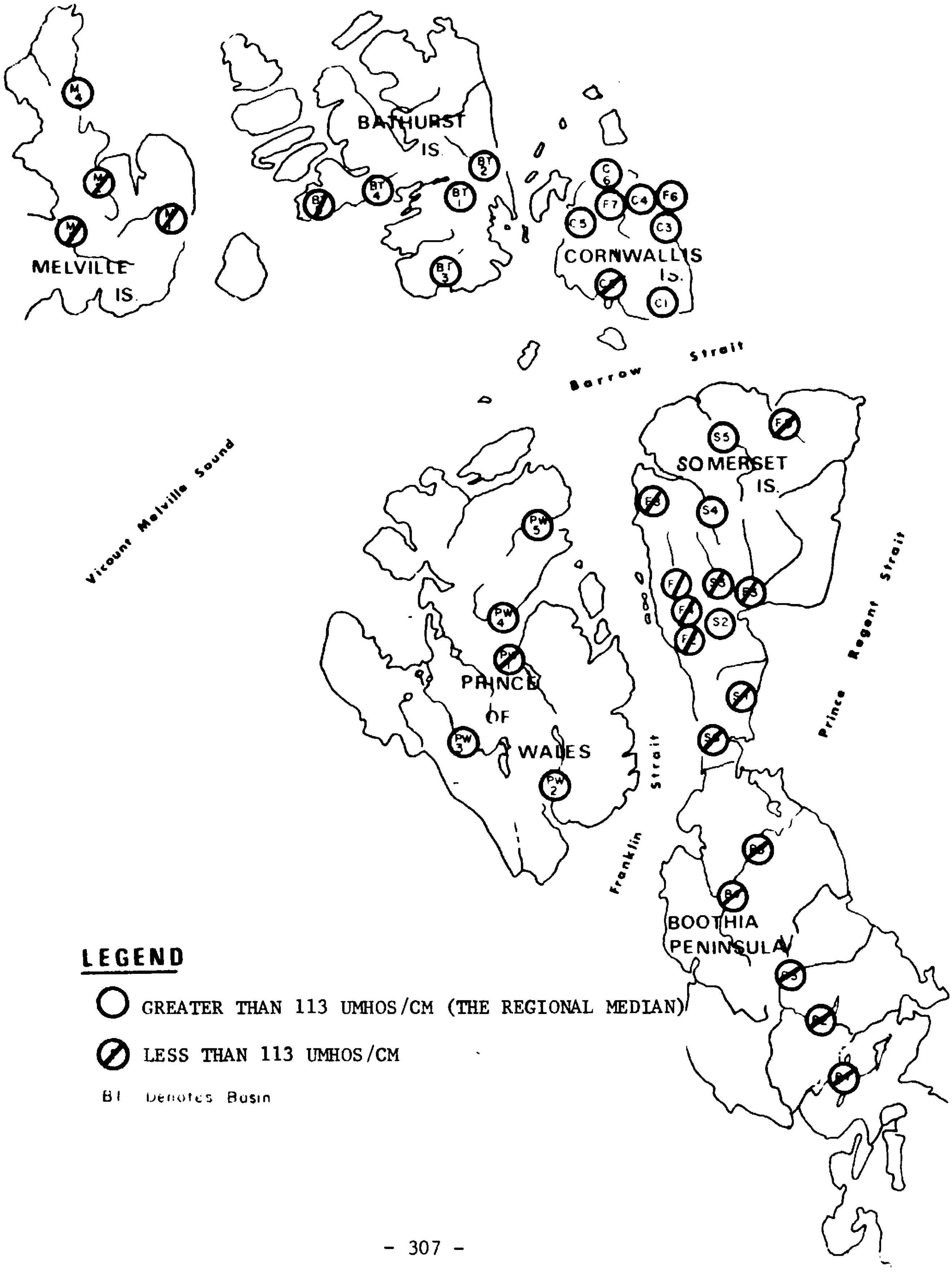
4. Transportation: inclement weather conditions, and sampling remote from the easily accessible air transport centres contributed to delays when samples were shipped to Yellowknife.

5. Sampling sites and sampling frequency: the selection of sampling sites was contingent upon the selection criteria of the WSC and FMS field crews; sampling frequency was simply times of visits by these field parties.

6. Sample degradation: delays between collection and analyses contribute to sample degradation.

7. Data base: at this time, the data base is inadequate for a complete assessment of stream qualities.

FIGURE 2 - COMPARISON OF STATION CONDUCTIVITIES
(Sampled during June-August)



LEGEND

GREATER THAN 113 UMHOS/CM (THE REGIONAL MEDIAN)

LESS THAN 113 UMHOS/CM

B1 Denotes Basin

III - RESULTS AND DISCUSSION

A. General

It is undesirable and statistically unacceptable to predict water quality trends and to portray the existing water quality of streams with an insufficient data base. The grab samples are indicative of the water quality at a particular point in time under a specific set of conditions relating to climate, discharge, ecosystem productivity, etc. This data, if used in an appropriate manner, can provide a baseline reference.

Geological and morphological information, additional water quality data related to varying stream discharges, and more intensive and frequent sampling of the area are required for a complete evaluation of the existing water quality.

B. Water Quality Constituents

No one parameter delineates water quality; consequently, each parameter analyzed is discussed below. Concentrations are reported by range and median, where median denotes that fifty percent of the values are less than the median. Instantaneous Physical data are shown in Table 2, Major Ion data in Table 3, Metal data in Table 4, and Nutrient data in Table 5.

Discharge

Although not a water quality constituent, discharge directly affects stream qualities. Two sets of discharge measurements were taken, one in the Arctic spring, and the other during late summer. Assuming similarity to other rivers, discharge is directly related to seasonal and prevailing meteorological conditions. Peak flows generally coincide with spring runoff with the hydrograph subsequently falling through the summer season, perhaps rising occasionally following local storms. Since the streams were not necessarily sampled under the same flow conditions, it is difficult to relate their qualities without making generalizations. Hydrometric data appears in Section 5, Table 2, of the main report.

Temperature

In-stream temperature varied from 0.0°C in the spring to a maximum of 13.0°C in the summer. The maximum temperatures were obtained from shallow streams in the southwest section of the proposed Arctic Pipeline Corridor.

pH

pH levels in the streams ranged from 6.6 to 9.0 with a regional average of 8.0. All but two streams were alkaline (pH values greater than 7.0). As expected, pH values were lower in the spring (due to snow melt) than those observed during late summer.

Specific Conductance

Specific conductance (adjusted to 25°C), a measure of dissolved solids, varied from < 50 to 2610 umhos/cm. The maximum value was recorded in the Sophia Lake outflow (Station F-6). It appears that this lake is an impoundment of marine waters. Separation of the lake from the ocean may have occurred by isostatic rebound or by fluvial and beach particle movement or a combination of all of them.

Figure 2 identifies the specific conductance for each station in relation to the regional median value of 113 umhos/cm. The lack of geological data prevents correlating conductivity to the substrates within the basins. Generally speaking, conductivity varies inversely with stream discharge.

Turbidity and Colour

Although dependent upon the morphological characteristics of the basins, streams may have higher sediment load during the spring runoff period when the bulk of the bed load material is transported. This is particularly true for ephemeral streams.

The Arctic streams are low turbid waters ranging from 0.4 to 61.0 JTU's with a regional median of 2.4. The maximum was recorded in the Unnamed River above Warren Point during August 1975 when the stream depth was 0.2 feet and velocity 0.67 feet per second (fps).

Colour ranged from < 5.0 to 30.0 Pt-Cobalt units with a regional median of 5.0.

Chemical Oxygen Demand (COD)

It was anticipated that the Arctic streams would have COD's less than the laboratory detection limit of 10 mg/l. At the same time, it was recognized that streams draining muskeg areas may have measureable quantities. Of the fifty-four COD analyses (Table 2), four exceeded the detection limit. These values were 11.1, 26.9, 11.0 and 15.0 mg/l and corresponded with high colours and/or turbidities. For instance, the 26.0 mg/l COD occurred when the stream turbidity (possibly containing organic material) was 61 JTU's. The outflow from Sophia Lake had a value of 15 mg/l which may in fact be incorrect due to a chemical interference caused by high chlorides.

Major Ions

In order of their decreasing relative abundance in the Arctic streams, the major cations (alkali earths) detected were: calcium, magnesium sodium and potassium; the major anions were: bicarbonates, sulfates, chlorides and silicates (see Table 3).

In the Unnamed River above Warren Point and the Sophia Lake outflow, sulfates and chlorides were the predominant anions respectively, and sodium the predominant cation. The high sodium, sulfate and silica concentrations in the Sophia Lake outflow indicate the marine nature of this lake.

The streams with the above two exceptions, were predominantly bicarbonate with little or no carbonates present. Total alkalinity ranged from 1.4 to 122 mg/l as $CaCO_3$ with a regional median of 38.8 mg/l as $CaCO_3$. Hardness ranged from less than 5.0 to 302 mg/l as $CaCO_3$ with a median of 56.3 mg/l as $CaCO_3$.

Calcium levels ranged between less than 1.0 and 42.3 mg/l; sodium between 0.3 and 1390 mg/l and potassium between less than 0.10 and 14.9 mg/l.

The respective medians were 16.8, 1.1 and 0.20 mg/l.

Fluorides were found to be virtually non-existent, appearing in only eight of fifty-one analyses and never exceeding 0.18 mg/l. Unnamed River above Warren Point had 0.12 and 0.18 mg/l fluoride on two separate occasions. Chlorides ranged from less than 0.10 to 849.mg/l. The maximum was observed in the Sophia Lake outflow.

Metals

Findings indicate that the majority of rivers within the pipeline corridor have metal concentrations (Table 4) less than the laboratory detection limits. Of the metals analyzed, zinc was most frequently detected ranging from less than 0.001 to 0.95 mg/l with a regional median of 0.025 mg/l.

The maximum concentrations of the following metals were:

Aluminum	3.30
Copper	0.063
Iron	5.80
Manganese	0.365
Cobalt	0.008
Chromium	0.028
Nickel	0.020
Lead	0.012

All of the above were recorded in the Unnamed River above Warren Point (Station Code M4). The three other stations on Melville Island (M1, M2 and M3) also had significantly high levels aluminum, copper, manganese and zinc, suggesting the presence of ore deposits in the river basins.

Nutrients

Total Kjeldahl Nitrogen (TKN) concentrations (Table 5) were all reported less than the analytical detection limit of 0.5 mg/l N. This limited was established by the Branch on a National Basis and is in the process of being revised lower to 0.10 mg/l N, which will be applicable to the second year of this study.

Data presented as nitrate plus nitrite (NO_3 and NO_2) are essentially nitrate, since nitrite can be assumed negligible in the well oxygenated streams. The lack of TKN data requires that more emphasis be put on nitrate plus nitrite data. However, this must be done with a word of caution, since nitrogen samples were not preserved in the field. Although the net result is the nitrate values reported are slightly higher than stream ambient, they nevertheless show the "relative differences" between the streams.

Bearing the aforementioned in mind, the dissolved nitrogen (NO_3 + NO_2) concentration ranged from less than 0.01 to 0.435 mg/l N with a regional median of 0.033 mg/l N. The maximum was recorded during late August in the Cunningham River above Cunningham Inlet. Stations that have data relating to two different flow periods have higher nitrate levels during late summer periods than during the high flows of spring runoff.

Forty-six samples were analyzed for total phosphorus with results ranging from less than 0.005 to 0.280 mg/l P. The regional median was less than 0.005 mg/l P. Phosphorus concentrations for the Unnamed River above Warren Point are noticeably higher than the other streams. Snow melt dilution during the initial stages of the spring freshet period resulted in lower spring phosphorus concentrations than those found during the late summer.

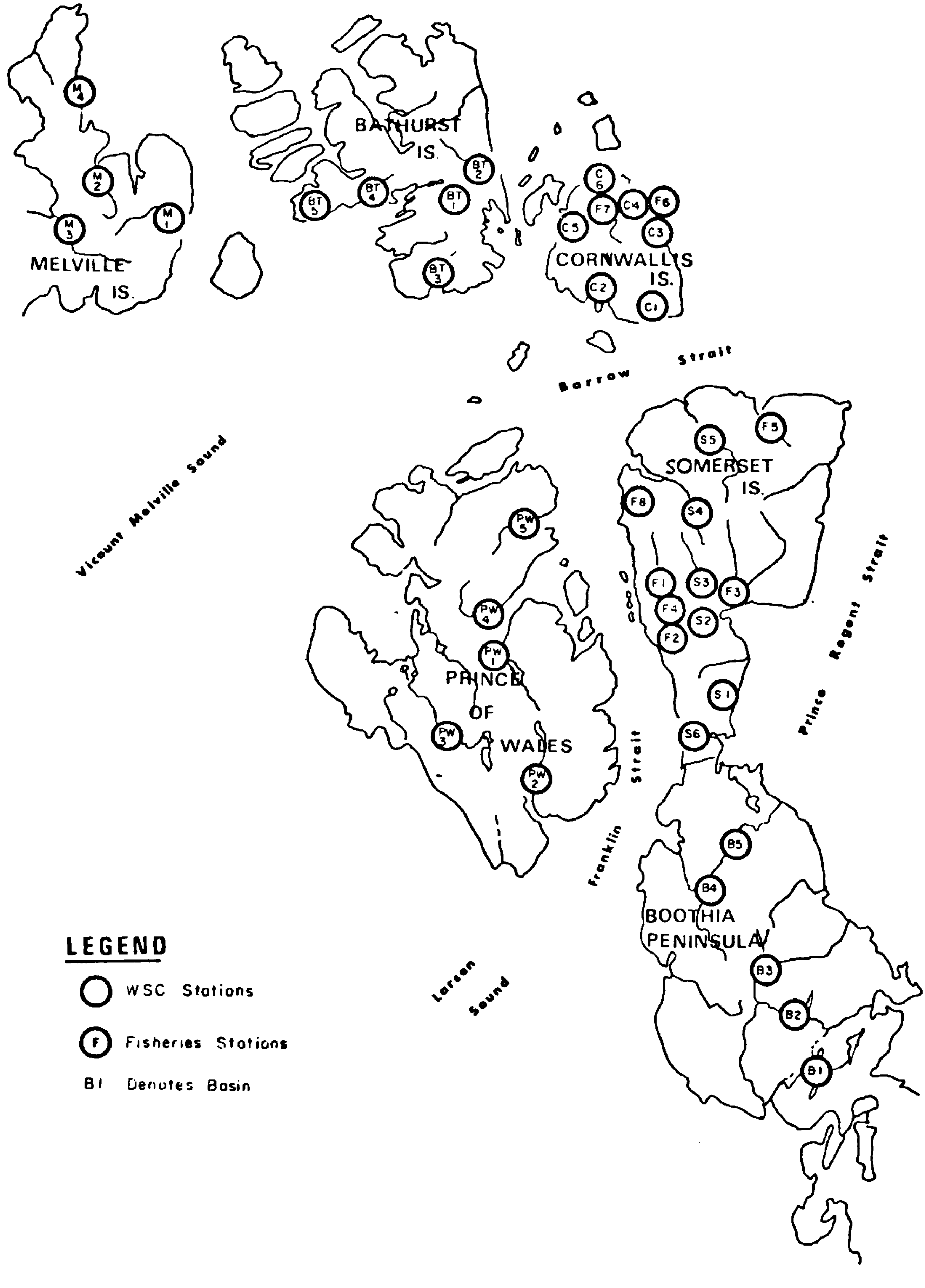

MELVILLE IS.
M1
M2
M3
M4
BATHURST IS.
BT1
BT2
BT3
BT4
BT5
CORNWALLIS IS.
C1
C2
C3
C4
C5
C6
F6
F7
Barrow Strait
Vicount Melville Sound
SOMERSET IS.
S1
S2
S3
S4
S5
S6
F1
F2
F3
F4
F5
F8
PRINCE OF WALES
PW1
PW2
PW3
PW4
PW5
Franklin Strait
Prince Regent Strait
BOOTHIA PENINSULA
B1
B2
B3
B4
B5
Larsen Sound
LEGEND
WSC Stations
F Fisheries Stations
B1 Denotes Basin

TABLE 1 - FIELD DATA SUMMARY

STATION CODE	STATION NAME	STATION LOCATION LATITUDE	LONGITUDE	DATE 1975	PH	COND (25x) UMHO/CM	H_2O TEMP°C
B1	UNNAMED RIVER AT OUTLET OF LAKE JEKYLL	69°47'	93°30'	25 JUNE	7.8	158	8.2
				27 AUG	8.3	155	10.0
B2	LORD LINDSAY RIVER ABOVE SANAGAK LAKE	70°13'	93°57'	26 JUNE	8.0	<50	13.0
				27 AUG	8.6	84	5.0
B3	LORD LINDSAY RIVER ABOVE WESTERN TRIBUTARY	70°29'	94°28'	25 JUNE	8.1	79	11.0
				27 AUG	6.7	115	3.5
B4	UNNAMED EASTERN TRIBUTARY OF WROTTESLEY RIVER	70°57'	94°47	24 JUNE	7.5	<50	13.0
				26 AUG	7.7	<50	5.0
B5	UNNAMED RIVER ABOVE CAPE AUGHTERSTON	71°15'	94°31'	24 JUNE	7.8	60	10.0
				26 AUG	7.9	120	4.0
S1*	LANG RIVER ABOVE PRINCE REGENT INLET	72°16'	93°58'	23 JUNE	7.5	62	3.8
				* 19 AUG	8.5	136	7.4
S2*	UNION RIVER AT OUTLET OF STANWELL-FLETCHER LAKE	72°43'	94°26'	13 JUNE	7.4	-	1.0
				20 JUNE	9.0	-	12.5
				08 JULY	-	-	2.0
S3	WEST CRESWELL RIVER ABOVE CRESWELL BAY	73°02'	94°13'	23 JUNE	7.9	53	9.2
				26 AUG	8.0	79	2.0
S4	ASTON RIVER ABOVE ASTON BAY	72°30'	94°08'	22 JUNE	8.3	124	7.0
				26 AUG	7.3	125	1.5
S5	CUNNINGHAM RIVER ABOVE CUNNINGHAM INLET	73°51'	93°28'	22 JUNE	8.3	160	5.3
				* 23 AUG	7.5	120	3.9
				26 AUG	7.6	160	1.5
S6*	UNNAMED RIVER BELOW MACGREGOR LAIRD LAKE	72°01'	95°03'	19 AUG	7.5	83	5.5
PW1*	DOLPHIN RIVER BELOW CROOKED LAKE	72°40'	98°47'	16 AUG	9.0	136	11.2
PW2*	FISHER RIVER BELOW FISHER LAKE	71°59'	98°09'	17 AUG	8.5	187	11.0
PW3*	UNNAMED RIVER ABOVE OMMONEY BAY	72°23'	100°07'	17 AUG	9.0	175	12.5
PW4*	SCARP BROOK ABOVE INNER BROWNE BAY	72°58'	98°41'	18 AUG	9.0	244	8.5
PW5*	UNNAMED RIVER BELOW ALLEN LAKE	73°31'	97°45'	18 AUG	8.5	206	7.5
M1	UNNAMED RIVER ABOVE KING POINT	75°29'	105°48'	07 JULY	7.2	50	6.0
				24 AUG	7.4	75	1.5
M2	UNNAMED RIVER ABOVE WEST ARM OF WEATHERALL BAY	75°43'	107°37'	07 JULY	6.6	68	6.6
				24 AUG	7.3	50	1.5
M3	UNNAMED RIVER ABOVE SABINE BAY	75°29'	108°39'	07 JULY	7.2	50	6.5
				24 AUG	9.2	50	1.5
M4	UNNAMED RIVER ABOVE WARREN POINT	76°12'	108°27'	07 JULY	7.5	130	4.0
				24 AUG	7.0	235	1.5

* STATIONS COLLECTED BY FISHERIES

CONTINUED ....

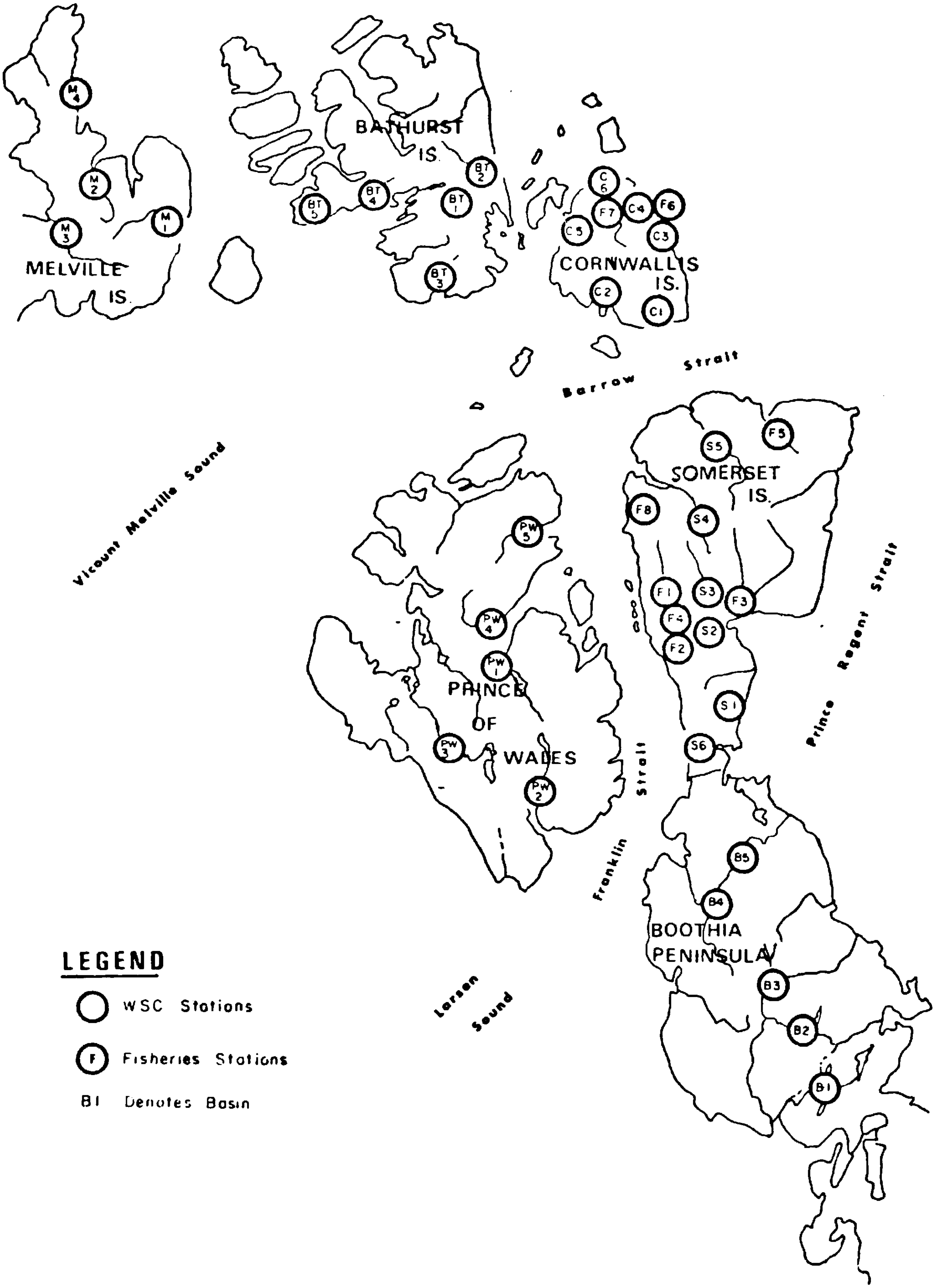

MELVILLE IS.
BATHURST IS.
CORNWALLIS IS.
Barrow Strait
Vicount Melville Sound
SOMERSET IS.
PRINCE OF WALES
Prince Regent Strait
Franklin Strait
BOOTHIA PENINSULA
Larsen Sound
LEGEND
WSC Stations
F Fisheries Stations
B1 Denotes Basin

TABLE 1 - FIELD DATA SUMMARY (CONT'D)

STATION CODE	STATION NAME	STATION LOCATION LATITUDE	STATION LOCATION LONGITUDE	DATE 1975	PH	COND (25%) UMHO/CM	H_2O TEMP°C
BT1	CALEDONIAN RIVER ABOVE BRACEBRIDGE INLET	75°37'	98°35'	02 JULY	8.3	122	10.0
				23 AUG	8.3	198	4.0
BT2	UNNAMED RIVER ABOVE GOOD INLET	75°44'	98°07'	02 JULY	8.0	128	8.0
				23 AUG	8.7	205	2.5
BT3	UNNAMED RIVER ABOVE ALLISON INLET	75°10'	99°18'	02 JULY	8.2	135	9.0
				23 AUG	8.0	170	4.5
BT4	UNNAMED RIVER ABOVE BRACEBRIDGE INLET	75°42'	100°33'	06 JULY	7.7	155	6.0
				23 AUG	7.9	202	4.0
BT5	UNNAMED RIVER NEAR SCHOMBERG POINT	75°34'	102°29'	06 JULY	7.3	58	6.0
				23 AUG	7.5	120	4.5
C1	MARSHALL RIVER ABOVE ASSISTANCE BAY	74°41'	94°12'	01 JULY	8.3	120	4.5
				31 AUG	7.8	188	1.5
C2	ALLEN RIVER NEAR THE MOUTH	74°50'	95°04'	03 JULY	8.2	121	8.0
				08 JULY	8.1	122	5.0
				31 AUG	7.8	140	1.5
C3	SNOWBLIND CREEK ABOVE LAURA LAKES	75°11'	93°54	30 JUNE	8.3	118	5.5
				31 AUG	7.7	163	1.0
C4	ELEANOR RIVER ABOVE ELEANOR LAKE	75°20'	94°13	30 JUNE	8.3	137	5.0
				31 AUG	8.3	210	2.0
C5	ABBOT RIVER ABOVE MIDSHIPMAN BAY	75°14'	95°41'	31 AUG	9.0	208	2.0
C6	UNNAMED RIVER NEAR CAPE GELL	75°35'	94°50'	01 JULY	8.3	122	4.5
				31 AUG	9.2	172	1.5
F1*	GORGE INFLOW TO STANWELL-FLETCHER LAKE, SOMERSET ISLAND	72°50'	95°11'	21 AUG	7.5	50	7.4
F2	UNION RIVER OUTLET STANWELL-FLETCHER LAKE			08 JULY	-	-	2.0
F3	WEST CRESWELL RIVER - SOMERSET ISLAND	72°54'	93°32'	21 AUG	7.5	60	6.4
F4	STANWELL-FLETCHER RIVER - SOMERSET ISLAND	72°55'	95°50'	15 AUG	7.0	60	7.2
F5	LAKE OUTFLOW GARNIER BAY - SOMERSET ISLAND	73°56'	92°14'	23 AUG	8.5	132	4.3
F6	OUTFLOW OF SOPHIA LAKE - CORNWALLIS ISLAND	75°06'	93°30'	07 AUG	8.5	2610	0.0
F7	VICTORY LAKE OUTFLOW - CORNWALLIS ISLAND	74°39'	94°22'	27 AUG	8.5	145	1.0
F8	OUTFLOW OF LAKE AT MCCLURE BAY - SOMERSET ISLAND	73°34'	95°32'	21 AUG	6.8	12	9.2

* STATIONS COLLECTED BY FISHERIES

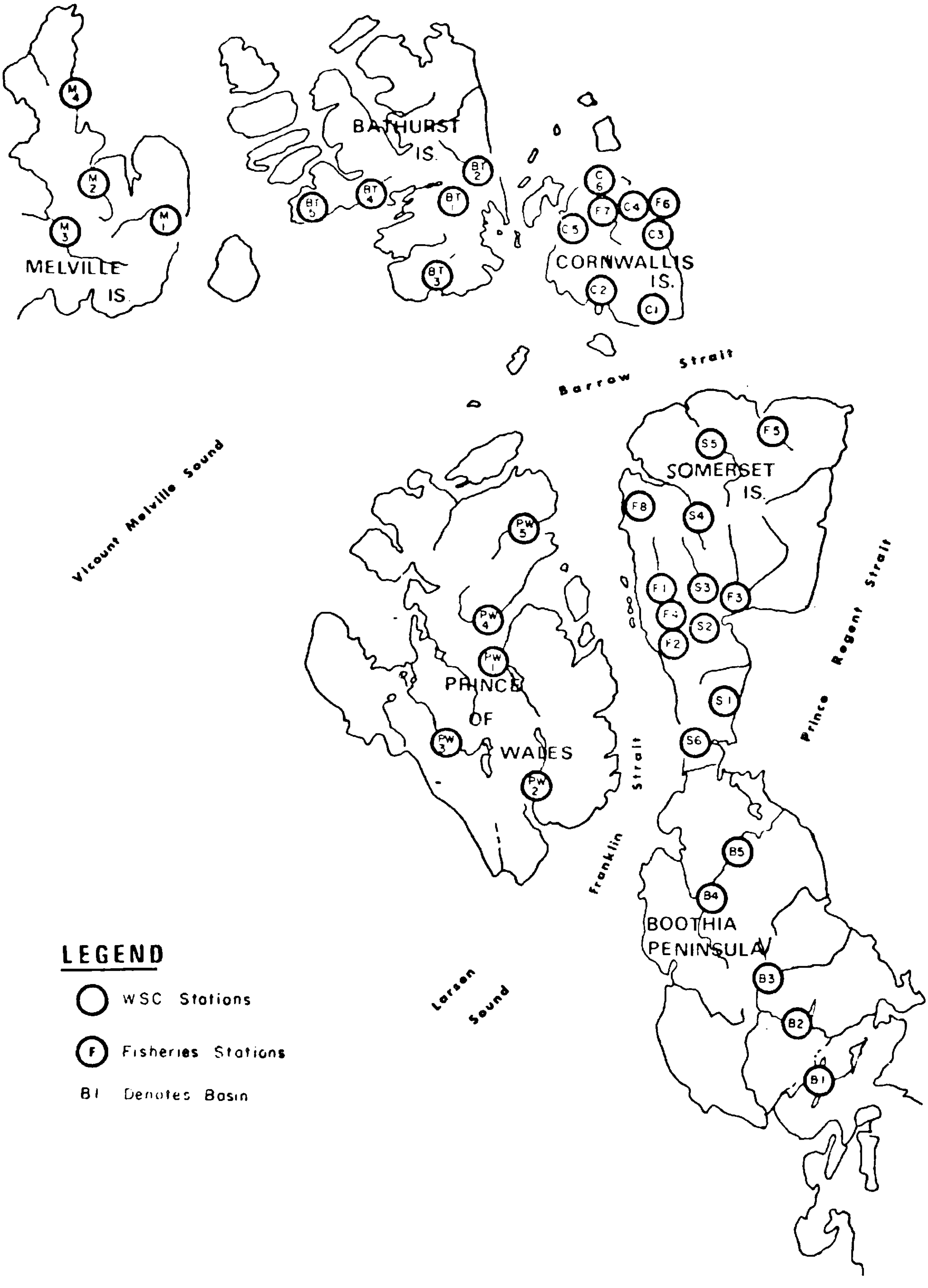

MELVILLE IS.
BATHURST IS.
CORNWALLIS IS.
Barrow Strait
Vicount Melville Sound
SOMERSET IS.
PRINCE OF WALES
Prince Regent Strait
Franklin Strait
BOOTHIA PENINSULA
Larsen Sound
LEGEND
WSC Stations
Fisheries Stations
B1 Denotes Basin

TABLE 2 PHYSICAL DATA (LABORATORY)

STATION CODE	DATE	TEMP °C	PH	SPECIFIC CONDUCTANCE UMHO/CM	TURBIDITY JTU	COLOUR PT-CO	COD** MG/L O_2
B1	25/06/75	26.0	7.6	156.0	2.9	5.4	<10.0
	27/08/75	20.3	8.3	159.0	0.7	5.0	<10.0
B2	26/06/75	25.5	7.1	42.6	2.7	<5.0	<10.0
B3	25/06/75	25.5	7.6	50.2	2.7	<5.0	<10.0
B4	24/06/75	25.5	7.1	17.2	2.8	5.0	<10.0
B5	24/06/75	25.5	7.5	46.8	2.6	7.5	11.1
	26/08/75	20.2	7.9	125.0	0.6	5.0	<10.0
S1	23/06/75	25.5	7.5	48.3	3.0	5.0	<10.0
	19/08/75	19.9	8.1	138.0	0.3	5.0	<10.0
S2*	13/06/75	26.0	7.4	76.7	3.0	5.0	<10.0
	20.06/75	25.0	7.4	75.4	2.7	5.0	<10.0
S3	23/06/75	25.5	6.8	19.1	3.6	<5.0	<10.0
S4	22/06/75	26.0	7.7	77.7	3.2	5.0	<10.0
S5	22/06/75	25.0	8.0	110.0	3.8	<5.0	<10.0
	*23/08/75	19.8	8.1	172.0	1.0	5.0	<10.0
	26/08/75	20.3	8.1	170.0	0.5	5.0	<10.0
S6*	19/08/75	19.8	7.4	83.0	0.6	5.0	<10.0
PW1*	16/08/75	21.1	8.2	157.0	0.4	5.0	<10.0
PW2	17/08/75	20.9	8.3	190.0	1.0	5.0	<10.0
PW3*	17/08/75	19.8	8.3	183.0	[illegible].5	5.0	<10.0
PW4*	18/08/75	20.6	8.4	256.0	0.4	5.0	<10.0
PW5*	18/08/75	19.9	8.2	215.0	0.7	5.0	<10.0
M1*	07/07/75	25.5	6.9	16.0	10.0	30.0	<10.0
	24/08/75	19.6	7.3	84.0	15.0	20.0	<10.0
M2	07/07/75	26.5	6.6	14.0	9.0	20.0	<10.0
M3	07/07/75	25.5	6.7	11.0	22.0	5.0	<10.0
	24/08/75	20.0	6.9	35.0	31.0	5.0	<10.0
M4	07/07/75	25.8	6.5	92.0	10.0	30.0	<10.0
	07/07/75	19.8	6.9	255.0	61.0	20.0	26.0
BT1	02/07/75	28.5	8.2	115.0	3.5	5.0	<10.0
BT2	02/07/75	27.4	8.0	109.0	4.2	20.0	<10.0
	23/08/75	20.1	8.1	231.0	0.6	5.0	<10.0
BT3	02/07/75	28.0	8.1	130.0	4.6	10.0	<10.0
	23/08/75	19.9	8.2	182.0	0.7	5.0	<10.0
BT4	06/07/75	25.7	8.1	115.0	2.2	10.0	11.0
	23/08/75	20.8	8.1	233.0	0.5	5.0	<10.0
BT5	06/07/75	26.5	7.7	48.0	22.0	5.0	<10.0
C1	01/07/75	27.2	8.1	105.0	4.5	5.0	<10.0
C3	30/06/75	26.0	7.8	112.0	3.5	5.0	<10.0
	31/08/75	20.2	8.1	170.0	0.5	5.0	<10.0
C4	30/06/75	26.0	7.8	126.0	4.0	<5.0	<10.0
C5	31/08/75	20.2	8.1	214.0	0.2	5.0	<10.0
C6	01/07/75	26.0	7.9	125.0	3.1	<5.0	<10.0
C2	03/07/75	27.0	8.1	88.1	3.7	10.0	>0.4
	08/07/75	26.1	8.1	119.0	1.0	5.0	<10.0
	31/08/75	20.2	8.0	137.0	0.4	5.0	<10.0
F1*	21/08/75	19.8	7.6	50.0	1.1	5.0	<10.0
F2*	08/07/75	26.5	7.6	72.0	1.5	10.0	<10.0
F3*	21/08/75	20.2	8.1	94.0	1.0	5.0	<10.0
F4*	15/08/75	24.5	7.0	1.7	1.5	10.0	<10.0
F5*	23/08/75	20.1	8.2	138.0	1.1	5.0	<10.0
F6*	07/08/75	20.3	8.0	2570.0	0.6	5.0	15.0
F7*	27/08/75	20.4	8.1	148.0	1.9	5.0	<10.0
F8*	21/08/75	19.8	7.1	9.4	1.7	5.0	<10.0

* STATIONS COLLECTED BY FISHERIES

**CHEMICAL OXYGEN DEMAND

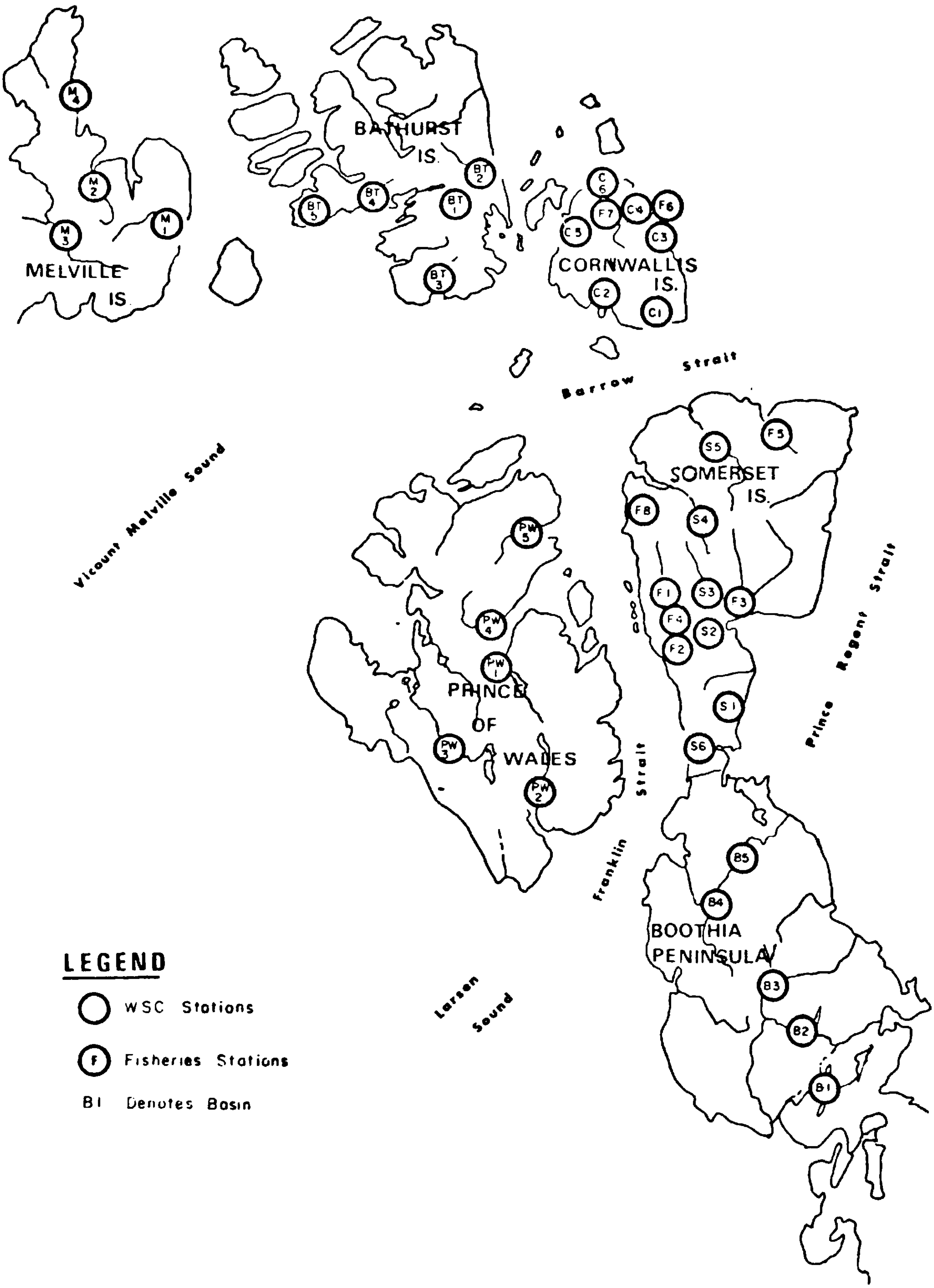
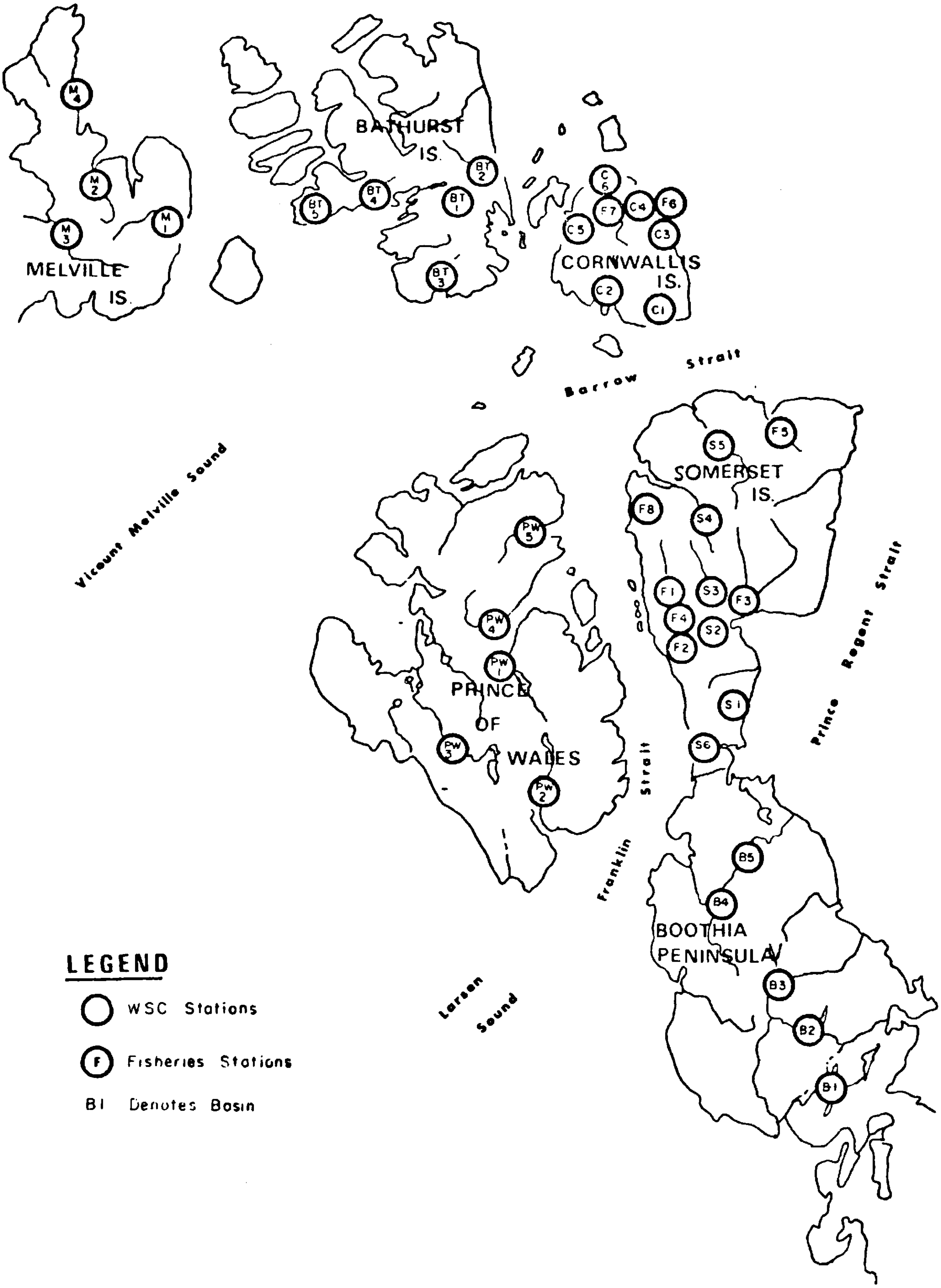

MELVILLE IS.
BATHURST IS.
CORNWALLIS IS.
SOMERSET IS.
PRINCE OF WALES
BOOTHIA PENINSULA
Barrow Strait
Vicount Melville Sound
Prince Regent Strait
Franklin Strait
Larsen Sound
LEGEND
WSC Stations
F Fisheries Stations
B1 Denotes Basin

TABLE 3

MAJOR IONS DATA

Station Code	Date	Alk Total $CaCo_3$ mg/1	Hardness Total $CaCo_3$	Ca Diss mg/1	K Diss mg/1	Na Diss mg/1	Cl Diss mg/1	F Diss mg/1	SiO_2 Reactive mg/1	SO_4 Diss mg/1
B1	25/06/75	77.3	79.0	18.7	0.41	1.8	2.70	0.06	3.2	<1.0
	27/08/75	78.0	81.7	18.2	0.40	2.0	3.93	<0.05	0.65	2.0
B2	26/06/75	20.9	22.6	7.7	0.20	0.5	<.10	-	1.45	1.0
B3	25/06/75	32.4	35.0	11.0	0.18	0.3	<.10	<0.05	1.50	1.0
B4	24/06/75	20.5	21.9	6.5	0.18	0.3	.10	0.05	1.20	<1.0
B5	24/06/75	23.6	26.6	8.4	0.13	0.5	<.10	-	0.90	2.0
	26/08/75	60.6	66.0	17.0	0.13	0.5	.86	<0.05	1.58	5.0
S1	23/06/75	27.3	28.0	10.2	0.18	0.5	0.90	0.08	0.60	2.0
	19/08/75	64.5	72.6	19.7	0.33	1.25	2.70	<0.05	0.40	1.6
S2	18/06/75	22.3	28.0	8.1	0.40	3.75	7.10	<0.05	0.55	2.0
	20/06/75	22.8	21.1	7.7	0.41	4.20	7.35	-	0.55	<1.0
S3	23/06/75	20.5	23.2	6.9	0.13	0.3	1.25	<0.05	1.05	<1.0
S4	22/06/75	38.5	41.5	12.4	0.13	0.5	0.07	<0.05	0.60	7.0
S5	22/06/75	56.8	56.3	19.9	0.13	0.5	0.80	<0.05	0.50	1.9
	23/08/75	81.5	89.5	28.8	0.15	0.7	1.98	<0.05	0.45	1.0
	26/08/75	81.6	88.9	18.6	0.35	1.0	1.62	<0.05	0.35	1.5
S6	19/08/75	39.1	44.5	11.8	0.25	1.1	2.10	<0.05	0.65	1.3
PW1	16/08/75	73.0	77.2	25.7	0.45	3.15	4.73	<0.05	0.25	2.8
PW2	17/08/75	92.0	93.0	29.8	0.40	1.9	4.75	<0.05	0.35	2.2
PW3	17/08/75	91.[illegible]	96.4	32.0	0.15	1.1	2.81	<0.05	0.43	1.8
PW4	18/08/75	112.0	124.0	39.1	0.65	5.55	4.70	<0.05	0.50	4.2
PW5	18/08/75	100.0	115.0	34.7	0.50	2.2	3.37	<0.05	0.20	10.0
M1	27/07/75	3.6	9.1	2.6	0.18	0.4	0.78	<0.05	0.35	2.2
	24/08/75	11.3	22.5	5.8	4.70	8.0	15.50	<0.05	0.60	1.7
M2	07/07/75	2.3	8.9	2.6	0.30	0.40	0.55	<0.05	0.90	5.4
M3	07/07/75	1.4	8.6	<1.0	0.28	0.80	1.00	<0.05	0.50	1.1
	24/08/75	3.2	10.0	2.8	0.39	2.80	3.90	<0.05	0.30	1.6
M4	07/07/75	<2.5	22.5	4.2	1.05	8.75	5.50	0.12	3.30	26.5
	24/08/75	6.2	54.7	12.1	5.00	38.00	21.00	0.18	7.40	87.3
BT1	02/07/75	58.8	60.2	16.5	0.13	0.80	1.90	< 0.05	0.40	1.1
BT2	02/07/75	53.3	56.2	16.6	0.13	1.00	2.10	< 0.05	0.75	0.8
	23/08/75	87.6	105.0	35.9	0.47	7.40	15.50	< 0.05	0.25	9.2
BT3	02/07/75	62.4	62.9	20.1	0.13	1.00	2.05	< 0.05	0.55	0.55
	23/08/75	87.9	94.2	29.8	0.25	1.90	4.75	< 0.05	0.30	2.2
BT4	06/07/75	52.8	57.7	18.3	0.20	0.55	1.00	< 0.05	0.65	1.1
	23/08/75	77.4	107.0	35.2	0.85	5.40	7.01	< 0.05	0.60	22.5
BT5	06/07/75	9.8	13.3	4.2	0.30	2.00	3.20	< 0.05	0.80	2.5
	01/07/75	54.9	56.1	17.9	0.13	0.90	1.80	< 0.05	0.50	<1.0
C1	30/06/75	54.8	56.0	18.5	0.13	1.00	2.0	0.06	0.40	<1.0
C3	31/08/75	81.5	90.5	26.1	0.13	1.70	3.65	0.06	0.35	1.9
	30.06/75	54.7	61.3	17.5	0.13	1.25	2.1	0.05	0.80	2.5
C4	31/08/75	82.4	112.0	33.0	0.35	2.60	5.60	<.05	0.50	17.5
C5	01/07/75	56.3	60.9	19.9	0.14	1.50	2.85	<.05	0.45	<1.0
C6	03/07/75	47.3	44.8	14.2	0.13	0.80	1.70	<.05	0.20	<1.0
C2	08/07/75	10.2	58.8	16.8	<.10	0.80	2.0	<.05	0.20	<1.0
	31/08/75	66.4	70.4	19.1	.30	2.00	3.3	<.05	0.25	2.7
F-1*	21/08/75	20.8	24.8	7.7	0.20	1.00	1.92	<.05	0.50	1.2
F-2*	08/07/75	22.4	25.4	6.9	0.38	4.10	7.15	<.05	0.50	1.5
F-3*	21/08/75	122.0	47.8	13.8	0.13	0.60	1.30	<.05	1.65	1.6
F-4*	15/08/75	3.7	7.9	2.8	0.13	0.70	1.25	.05	0.75	2.1
F-5*	23/08/75	65.3	69.8	23.0	0.15	0.75	2.17	<.05	0.55	1.5
F-6*	07/08/75	13.1	302.1	42.3	14.9	1390.0	849.00	<.05	0.40	4.3
F-7*	27/08/75	68.0	74.8	23.0	0.30	1.8	4.00	<.05	0.30	1.3
F-8*	21/08/75	2.7	<5.0	<1.0	<.10	0.60	1.16	<.05	0.75	1.2

* Stations Collected by Fisheries



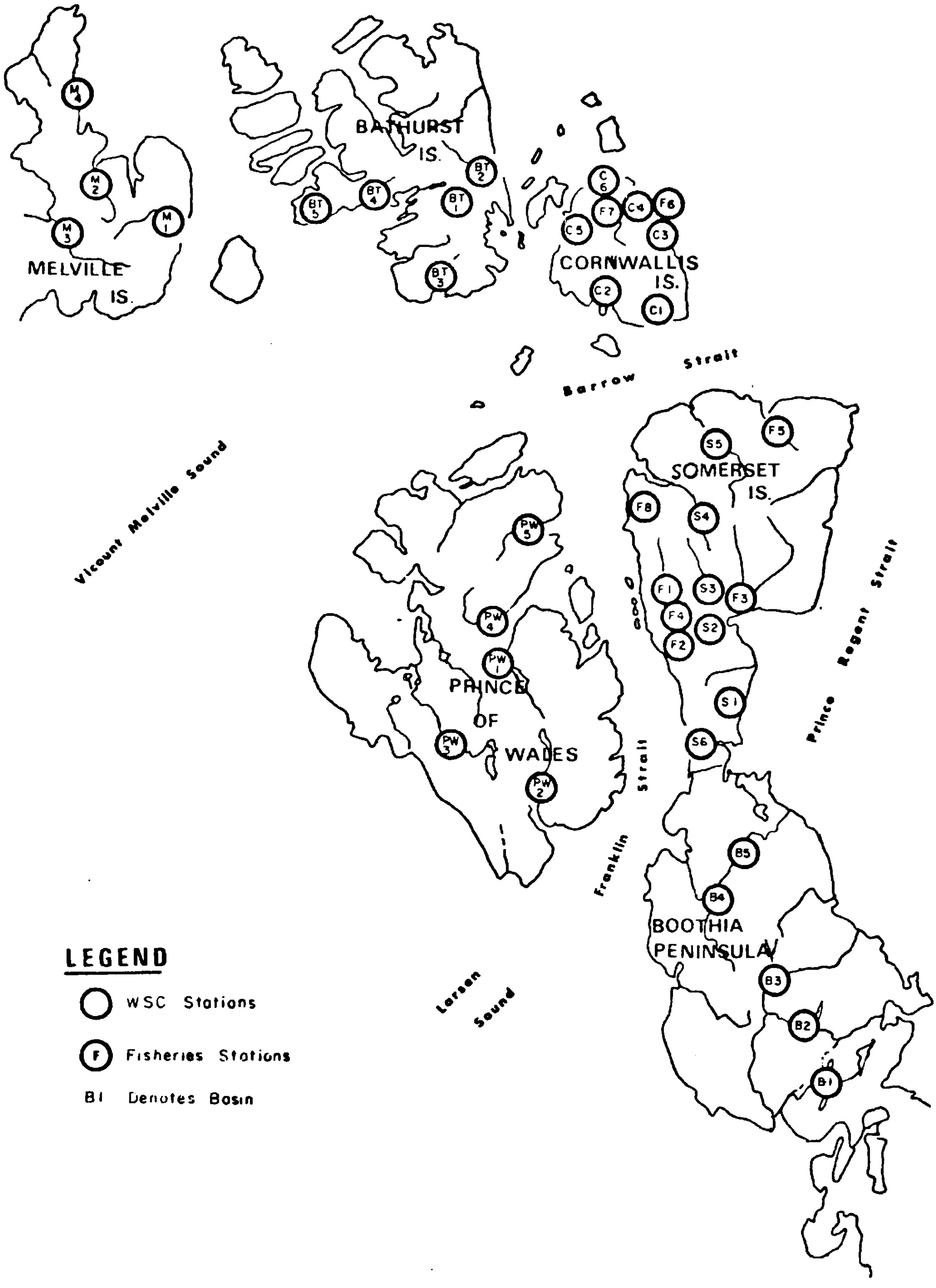
M 4
M 2
M 3
M 1
MELVILLE IS.
BATHURST IS.
BT 2
BT 4
BT 1
BT 5
BT 3
C 6
F7
C4
F6
C5
C3
CORNWALLIS IS.
C2
C1
Barrow Strait
Vicount Melville Sound
S5
F5
SOMERSET IS.
F8
S4
PW 5
F1
S3
F3
F4
S2
F2
PW 4
PW 1
PRINCE OF WALES
S1
S6
PW 3
PW 2
Prince Regent Strait
Franklin Strait
B5
B4
BOOTHIA PENINSULA
B3
B2
B1
Larsen Sound
LEGEND
WSC Stations
F Fisheries Stations
B1 Denotes Basin

TABLE 4

EXTRACTABLE METALS

STATION CODE	DATE	Al mg/l	Ba mg/l	Cd mg/l	Cr mg/l	Co mg/l	Cu mg/l	Fe mg/l	Pb mg/l	Mo mg/l	Ni mg/l	As mg/l	Se mg/l	Mn mg/l	Zn mg/l
B1	25/06/75	<.10	<.1	<.001	.05	<.001	<.001	.070	<.005	<.05	<.005	<.0005	<.0005	<.01	.205
	27/08/75	<.10	<.1	<.001	<.01	<.001	<.001	.064	<.005	<.05	<.005	<.0005	<.0005	<.01	.165
B2	26/06/75	<.10	<.1	<.001	<.01	<.001	<.001	.050	<.005	<.05	<.005	-	-	<.01	.010
B3	25/06/75	<.10	<.1	<.001	<.01	<.001	<.001	<.050	<.005	<.05	<.005	<.0005	<.0005	<.01	.055
B4	24/06/75	<.10	<.1	<.001	<.01	<.001	.04	.060	<.005	<.05	<.005	<.0005	<.0005	<.01	.003
B5	24/06/75	<.10	<.1	<.001	<.01	<.001	.002	.050	<.005	<.05	<.005	-	-	<.01	.025
	26/08/75	<.10	<.1	<.001	<.01	<.001	<.001	.064	<.005	<.05	<.005	<.0005	.0016	<.01	.002
S1	23/06/75	<.10	<.1	<.001	<.01	<.001	<.001	<.050	<.005	<.05	<.005	<.0005	<.0005	<.01	.080
	19/08/75	<.10	<.1	<.001	<.01	<.001	<.001	<.050	<.005	<.05	<.005	<.0005	<.0005	<.01	.165
S2*	13/06/75	<.10	<.1	<.001	<.01	<.001	<.001	<.050	<.005	<.05	<.005	<.0005	<.0005	<.01	<.001
	20/06/75	<.10	<.1	<.001	<.01	<.001	<.001	<.050	<.005	<.05	<.005	<.0005	<.0005	<.01	<.001
S3	23/06/75	<.10	<.1	<.001	<.01	<.001	.003	.060	<.005	<.05	<.005	<.0005	<.0005	<.01	.080
S4	22/06/75	<.10	<.1	<.001	<.01	<.001	<.001	<.050	<.005	<.05	<.005	<.0005	<.0005	<.01	.172
S5	22/06/75	<.10	<.1	<.001	<.01	<.001	<.001	.110	<.005	<.05	<.005	<.0005	<.0005	<.01	<.001
	23/08/75	<.10	<.1	<.001	<.01	<.001	<.001	<.050	<.005	<.05	<.005	<.0005	<.0005	<.01	.950
	26/08/75	<.10	<.1	<.001	<.01	<.001	<.001	<.050	<.005	<.05	<.005	<.0005	<.0005	<.01	<.001
S6*	19/08/75	<.10	<.1	<.001	<.01	<.001	<.001	<.050	<.005	<.05	<.005	<.0005	<.0005	<.01	.050
PW1*	16/08/75	<.10	<.1	<.001	<.01	<.001	<.001	<.050	<.005	<.05	<.005	<.0005	<.0005	<.01	.220
PW2	17/08/75	<.10	.15	<.001	<.01	<.001	<.001	<.050	<.005	<.05	<.005	<.0005	<.0005	<.01	.033
PW3*	17/08/75	<.10	<.1	<.001	<.01	<.001	<.001	<.050	<.005	<.05	<.005	<.0005	<.0005	<.01	.043
PW4*	18/08/75	<.10	<.1	<.001	<.01	<.001	<.001	.050	<.005	<.05	<.005	<.0005	<.0005	<.01	.017
PW5*	18/03/75	<.10	<.1	<.001	<.01	<.001	<.001	<.050	<.005	<.05	<.005	<.0005	<.0005	<.01	<.001
M1	07/07/75	.28	<.1	<.001	<.01	<.001	.002	.450	<.005	<.05	<.005	<.0005	<.0005	.02	
	24/08/75	<.10	<.1	<.001	<.01	<.001	.002	.064	<.005	<.05	<.005	<.0005	<.0005	.02	.003
M2	07/07/75	.15	<.10	<.001	<.010	<.001	<.001	0.250	<.005	<.05	<.005	<.0005	<.0005	.040	.016
M3	07/07/75	.35	<.10	.001	<.010	<.001	<.001	0.790	<.005	<.05	<.005	<.0005	<.0005	.020	.005
	24/08/75	.48	<.10	.001	.020	<.001	.003	0.879	<.005	<.05	<.005	<.0005	<.0005	.026	.004
M4	07/07/75	1.40	<.10	.001	<.010	.003	.007	0.290	<.005	<.05	.010	<.0005	<.0005	.230	.066
	24/08/75	3.30	<.10	.001	.028	.008	.063	5.80	.012	<.05	.020	<.0005	<.0005	.365	.076
BT1	02/07/75	<.10	-	<.001	<.010	<.001	<.001	<.050	<.005	<.05	<.005	<.0005	<.0005	<.010	<.001
BT2	02/07/75	<.10	<.10	<.001	<.010	<.001	.005	.060	<.005	<.05	<.005	<.0005	<.0005	<.010	.250
	23/08/75	<.10	.13	.002	<.010	<.001	<.001	<.050	<.005	<.05	<.005	<.0005	<.0005	<.010	.003
BT3	02/07/75	<.10	<.10	<.001	<.010	<.001	<.001	.050	<.005	<.05	<.005	<.0005	<.0005	<.010	<.001
	23/08/75	<.10	<.10	<.001	.015	<.001	.001	<.050	<.005	<.05	<.005	<.0005	<.0005	<.010	<.001
BT4	06/07/75	<.10	<.10	<.001	<.010	<.001	<.001	.050	<.005	<.05	<.005	<.0005	<.0005	<.010	<.001
	23/08/75	<.10	<.10	<.001	.015	<.001	<.001	.092	<.005	<.05	<.005	<.0005	<.0005	<.010	<.001
BT5	06/07/75	0.30	<.10	<.001	<.010	<.001	<.001	.660	<.005	<.05	<.005	<.0005	<.0005	<.010	.012
C1	01/07/75	<.10	<.10	<.001	<.010	<.001	<.001	.060	<.005	<.05	<.005	<.0005	<.0005	<.010	.140
C3	30/06/75	<.10	<.10	<.001	<.010	<.001	<.001	<.050	<.005	<.05	<.005	<.0005	<.0005	<.010	<.001
	31/08/75	<.10	<.10	<.001	<.010	<.001	<.001	<.050	<.005	<.05	<.005	<.0005	<.0005	<.010	.135
C4	30/06/75	<.10	<.10	<.001	<.010	<.001	<.001	<.050	<.005	<.05	<.005	<.0005	<.0005	<.010	<.001
C5	31/08/75	<.10	<.10	<.001	<.010	<.001	<.001	<.050	<.005	<.05	<.005	<.0005	.0018	<.010	.051
C6	01/07/75	<.10	<.10	<.001	<.010	<.001	<.001	<.050	<.005	<.05	<.005	<.0005	<.0005	<.010	<.001
C2	03/07/75	<.10	<.10	<.001	<.010	<.001	<.001	<.050	<.005	<.05	<.005	<.0005	<.0005	<.010	.070
	08/07/75	<.10	<.10	<.001	<.010	<.001	<.001	<.050	<.005	<.05	<.005	<.0005	<.0005	<.010	<.001
	31/08/75	<.10	<.10	<.001	<.010	<.001	<.001	<.050	<.005	<.05	<.005	<.0005	<.0005	.018	.370
F1*	21/08/75	<.1	<.1	<.001	<.010	<.001	<.001	<.05	<.005	<.05	<.005	<.0005	<.0005	<.01	.008
F2*	08/07/75	<.1	<.1	<.001	<.010	<.001	<.001	<.05	<.005	<.05	<.005	<.0005	<.0005	<.01	<.001
F3*	21/08/75	<.1	<.1	<.001	<.010	<.001	<.001	<.05	<.005	<.05	<.005	<.0005	<.0005	<.01	.019
F4*	15/08/75	<.1	<.1	<.001	<.010	<.001	<.001	<.05	<.005	<.05	<.005	<.0005	<.0005	<.01	.010
F5*	23/08/75	<.1	<.1	<.001	<.010	<.001	<.001	.18	<.005	<.05	<.005	<.0005	<.0005	<.01	<.001
F6*	07/08/75	<.1	<.1	<.001	<.010	<.001	<.001	<.05	<.005	<.05	<.005	<.0005	<.0005	<.01	<.001
F7*	27/08/75	<.1	<.1	<.001	<.010	<.001	<.001	<.05	<.005	<.05	<.005	<.0005	<.0005	<.01	<.001
F8*	21/08/75	<.1	<.1	<.001	.015	<.001	<.001	.083	<.005	<.05	<.005	<.0005	<.0005	<.01	.026

* STATIONS COLLECTED BY FISHERIES



MELVILLE IS.
M1
M2
M3
M4
BATHURST IS.
BT1
BT2
BT3
BT4
BT5
CORNWALLIS IS.
C1
C2
C3
C4
C5
C6
F6
F7
Barrow Strait
Viscount Melville Sound
SOMERSET IS.
S1
S2
S3
S4
S5
S6
F1
F2
F3
F4
F5
F8
Prince Regent Strait
PRINCE OF WALES
PW1
PW2
PW3
PW4
PW5
Franklin Strait
BOOTHIA PENINSULA
B1
B2
B3
B4
B5
Larsen Sound
LEGEND
WSC Stations
F Fisheries Stations
B1 Denotes Basin

TABLE 5 **NUTRIENTS**

Station Code	Date	Total Kjeldahl Nitrogen mg/l N	Nitrogen Diss $NO_3 + NO_2$ mg/l N	Total Phosphorus mg/l P
B1	25/06/75	<5	<0.010	.005
	27/08/75	-	-	-
B2	26/06/75	<.5	0.043	<.005
B3	25/06/75	<.5	0.010	.005
B4	24/06/75	<.5	<0.010	<.005
B5	24/06/75	<.5	0.083	.005
	26/08/75	-	-	-
S1	23/06/75	<.5	0.012	<.005
	19/08/75	-	0.081	<.005
S2*	13/06/75	<.5	0.037	<.005
	20/06/75	<.5	0.064	<.005
S3	23/06/75	<.5	0.012	<.005
S4	22/06/75	<.5	0.037	<.005
S5	22/06/75	<.5	0.020	<.005
	23/08/75	-	0.435	<.005
	26/08/75	-	-	-
S6*	19/08/75	-	0.030	.015
PW1*	16/08/75	-	0.033	<.005
PW2	17/08/75	-	0.035	.005
PW3*	17/08/75	-	<0.010	<.005
PW4*	18/08/75	-	0.084	<.005
PW5*	18/08/75	-	< .010	<.005
M1	07/07/75	<.5	< .010	.013
	24/08/75	-	..035	.017
M2	07/07/75	<.5	.020	.012
M3	07/07/75	<.5	< .010	.026
	24/08/75	-	.022	.027
M4	07/07/75	<.5	.045	.120
	24/08/75	-	.044	.280
BT1	02/07/75	<.5	.011	<.005
BT2	02/07/75	< 5	.060	.006
	23/08/75	-	.080	.007
BT3	02/07/75	<.5	.118	<.005
	23/08/75	-	.150	<.005
BT4	06/07/75	<.5	.021	<.005
	23/08/75	-	.270	.005
BT5	06/07/75	<.5	< .010	<.005
C1	01/07/75	<.5	.030	<.005
C3	30/06/75	<.5	.023	<.005
	31/08/75	-	-	-
C4	30/06/75	<.5	.040	<.005
C5	31/08/75	-	-	-
C6	01/07/75	<.5	.037	<.005
C2	03/07/75	<.5	.020	<.005
	08/07/75	<.5	.025	<.005
	31/08/75			
F-1*	21/08/75	-	.011	<.005
F-2*	08/07/75	<.5	.050	<.005
F-3*	21/08/75	-	.268	<.005
F-4*	15/08/75	-	.025	<.005
F-5*	23/08/75	-	.033	<.005
F-6*	07/08/75	-	-	-
F-7*	27/08/75	-	-	-
F-8*	21/08/75	-	.041	.005

* Samples Collected by Fisheries

Date Due
