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PROGRESS REPORT

SQUAMISH RIVER ESTUARY
MORPHOLOGICAL SURVEY

INLAND WATERS DIRECTORATE,
WATER RESOURCES BRANCH,
OTTAWA, CANADA, 1976.

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PROGRESS REPORT SQUAMISH RIVER ESTUARY MORPHOLOGICAL SURVEY

SEDIMENT SURVEY SECTION
APPLIED HYDROLOGY DIVISION
WATER RESOURCES BRANCH
OTTAWA, CANADA, 1976.

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PREFACE

In 1972, a Task Force, known as the "Squamish Task Force" was established within the Department of the Environment, Pacific Region, to study the effects of a proposed coal port development by the Pacific Great Eastern Railway near the town of Squamish. This development would occur around the Mamquam channel in the estuary. The concern on the part of the Department of the Environment was the effects such a development would have on the Squamish River estuary which has an active, growing delta of prime importance to the anadromous fisheries.

This report presents the methods used and the results obtained from morphological surveys conducted on the Squamish River estuary in November of 1973 and October of 1974.

PROGRESS REPORT
SQUAMISH RIVER ESTUARY
MORPHOLOGICAL SURVEY

I. INTRODUCTION

The morphological survey of the Squamish River estuary is a joint undertaking between the Sediment Survey Section of the Applied Hydrology Division, Ottawa and the Water Survey of Canada, Pacific Region. A recently developed hydrographic data acquisition system known as Hydac-100 was used to provide the data necessary to determine estuarine sedimentation rates and distribution. The surveyed area consisted of approximately a three mile stretch of the Squamish River between its junction with the Mamquam River and Howe Sound. Surveys were conducted in November of 1973 and again in October of 1974. A direct comparison of the reduced and computed data provides an initial evaluation of the sedimentation process of the estuary.

II SURVEY CONTROL

i) Vertical Control

Since the Squamish River within the surveyed reach is tidal, all depth measurements had to have a common reference elevation. In order to accomplish this, two water level recorders were installed by the Vancouver District. One was located on the Squamish terminals in the immediate vicinity of the downstream end of the surveyed reach and the second recorder was installed approximately $\frac{1}{2}$ mile downstream of the Mamquam River junction. For computational purposes, a linear relationship was assumed for synchronous water level elevations at these stations.

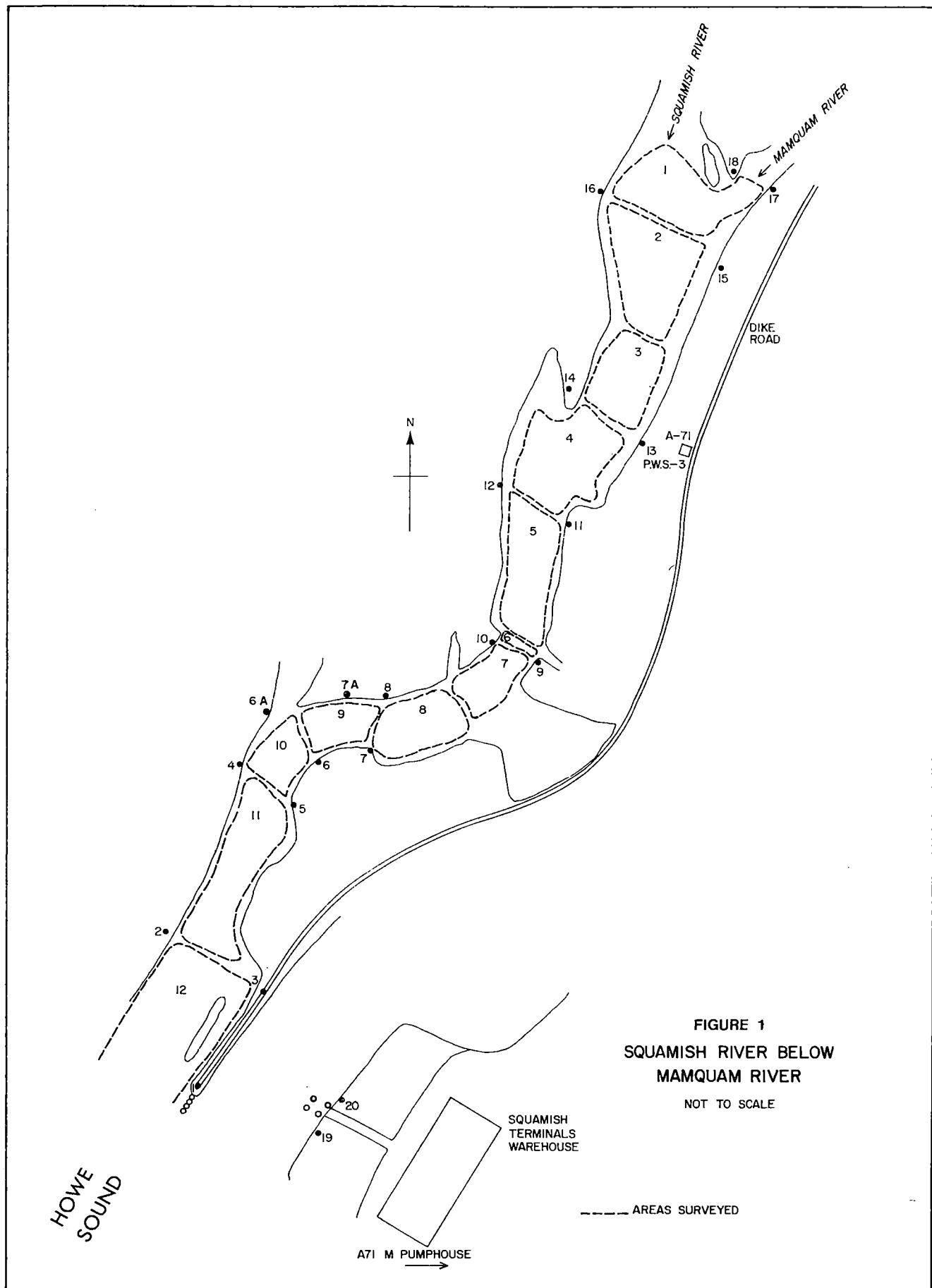


FIGURE 1
SQUAMISH RIVER BELOW
MAMQUAM RIVER

NOT TO SCALE

— AREAS SURVEYED

ii) Horizontal Control

Twin sets of MRB 201 tellurometers were used to fix the position of the survey vessel. However, since the tellurometers are limited to "line of sight" operation, a total of 18 shore positions had to be established in 1973 as illustrated on Figure 1.

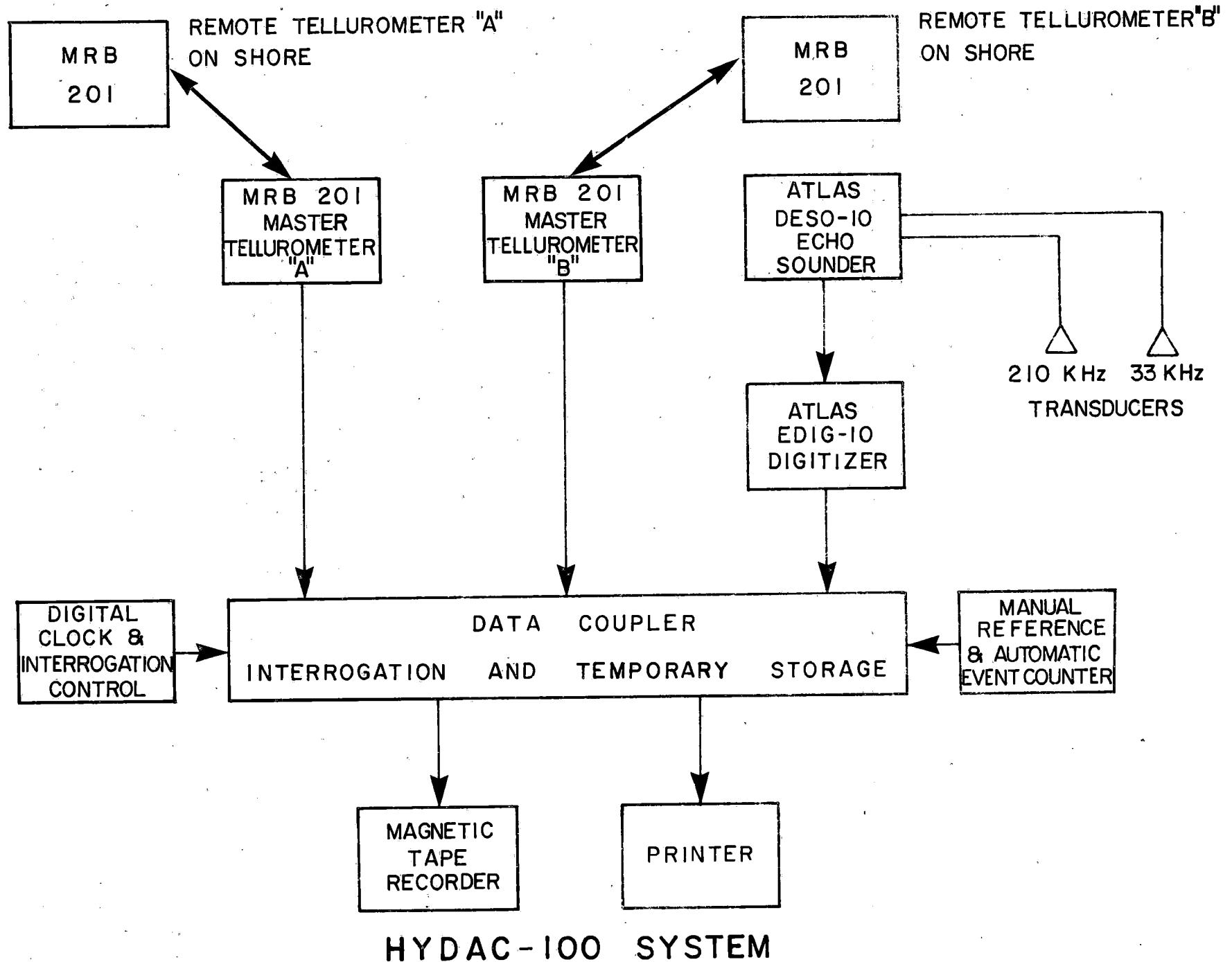
For the 1974 survey positions 6 and 7 were replaced by 6A and 7A as shown. Stations 14 and 17 had to be relocated since they had been destroyed. All original 1973 positions and those replaced or added in 1974 were referenced to a common coordinate system with its origin at the extreme downstream end of the dyke. The required triangulation work was performed by the New Westminster staff of the Vancouver District.

III SURVEY METHODS

The survey methods used during the 1973 and 1974 surveys were virtually identical. The only alterations made were system hardware improvements which made it possible to improve the accuracy of the survey during 1974.

i) Equipment

The equipment used on the survey was Hydac-100, an automated hydrographic data acquisition system which was developed for and in cooperation with the Sediment Survey Section by Computing Devices of Canada Ltd. The principal components of the system are illustrated on the following block diagram:



A complete description of the system is given in the report entitled, "A Description of the Hydac-100 System and its Application"¹.

The 1973 survey was conducted through the use of a modified 26 foot jet boat. The main disadvantage was that the transducers had to be suspended outside of the hull of the boat and were virtually unprotected. In 1974, the Sediment Survey Section acquired a 32 foot jet boat which was designed specifically to accommodate the Hydac-100 system. The transducers were buried inside the hull and soundings were conducted through ports which were flush mounted with the outside of the hull. This installation made it possible to run a survey line extremely close to shore and hence extended to overall surveyed area.

The other alteration to the system was the replacement of the Digitec Model 691 printer for a Scope Data Series 200 printer. The Scope Data printer is a high speed (133 character per second) printer and made it possible to interrogate the peripheral devices at two (2) second intervals instead of the four (4) second interval used during the 1973 survey.

ii) Survey Procedure

The object of the survey was to obtain sufficient data of the estuary bottom to enable the reproduction of the bottom in the form of contour maps and to monitor storage capacity increases and/or decreases. Since the Hydac-100 system provides

continuous horizontal and vertical control with respect to the shore stations and the water surface, the only additional requirement was a relatively good coverage of the area in question. This was accomplished by making the initial run around the circumference of the region controlled by the shore stations. After this run was completed, a rough grid pattern was followed with the majority of the grid lines being perpendicular to the flow.

Data was obtained by an automatic interrogation of all peripheral devices at two (2) second intervals. Each interrogation scan consisted of the following:

- a) the point number (3 digits),
- b) the run number, sector number, and year (6 digits),
- c) tellurometer distance "A" (5 digits),
- d) tellurometer distance "B" (5 digits),
- e) depth (4 digits) and,
- f) the hour and minute in P.S.T. (4 digits).

Between the Mamquam River and the mouth of the Squamish River, twelve sectors were surveyed as illustrated on Figure 1. To achieve the largest possible surface area coverage during the survey, all sectors were surveyed at or near high tide conditions.

IV DATA ANALYSES AND EVALUATION METHODS

Data computation methods for the 1974 survey were changed considerably to obtain increased accuracy and efficiency.

To ensure compatibility for comparison, the 1973 field data was recomputed using the same methods. The main steps of the computation procedure are shown on the following block diagram:

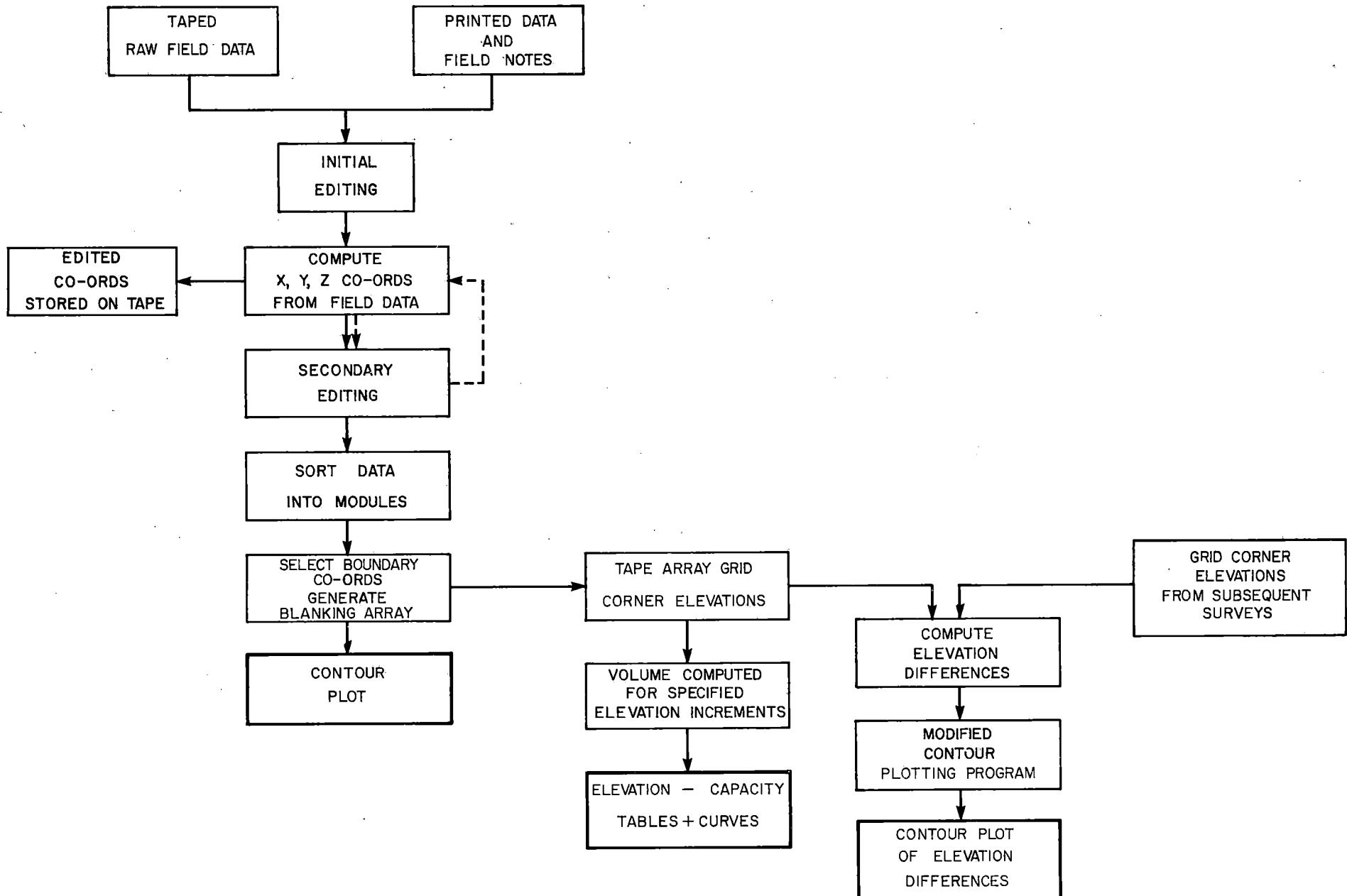
i) Initial Editing

The preliminary data editing procedure was streamlined considerably. Field tape records were examined for character shifts or omissions as well as parity error through the use of a Digital PDP-11 mini-computer. The corrected data was then retaped and all further computations were conducted on Cyber-74, a large core CD series computer owned and operated by the Department of Energy, Mines and Resources.

The next step in the procedure was to automatically remove all erroneous depth recordings. This is achieved by setting limits within which consecutive depth have to appear. Since the echo sounder automatically blanks out a preset band width above and below the actual soundings, the erroneous soundings which do appear, are third or fourth multiples of the actual sounding. These then fall outside the programmed limits and are removed from the record.

ii) x, y, z Coordinate Computation

The x, y coordinates for each of the 18 shore positions were computed from triangulation data supplied by the Vancouver District of the Water Survey of Canada. All position coordinates were referenced to the origin at shore position 1 (see Figure 1) and the magnetic north heading as the ordinate.



COMPUTERIZED DATA REDUCTION AND
ANALYZING PROCEDURE

The x, y coordinate for each data point were calculated by the following procedure:

- a) the length and angle of deflection (angle θ) of the baseline (the imaginary line between the two shore positions used for each sector) was computed,
- b) each sector was given a designation depending on the orientation of the sector with respect to its baseline. If the sector lay to the right of the baseline (positive x direction) it was designated as "0" and if it lay to the left of the baseline (negative x direction) it was given a designation of "1",
- c) the cosine law was used to determine the angle between the leading tellurometer distance (line a) and the baseline (line L) as shown on Figures 2 and 3,

Note: the leading tellurometer position is the position exhibiting the higher ordinate value.

The cosine law used was as follows:

$$\cos \beta = \frac{a^2 + L^2 - b^2}{2aL}$$

where: β is the angle between the imaginary line from the boat to the leading tellurometer and the baseline

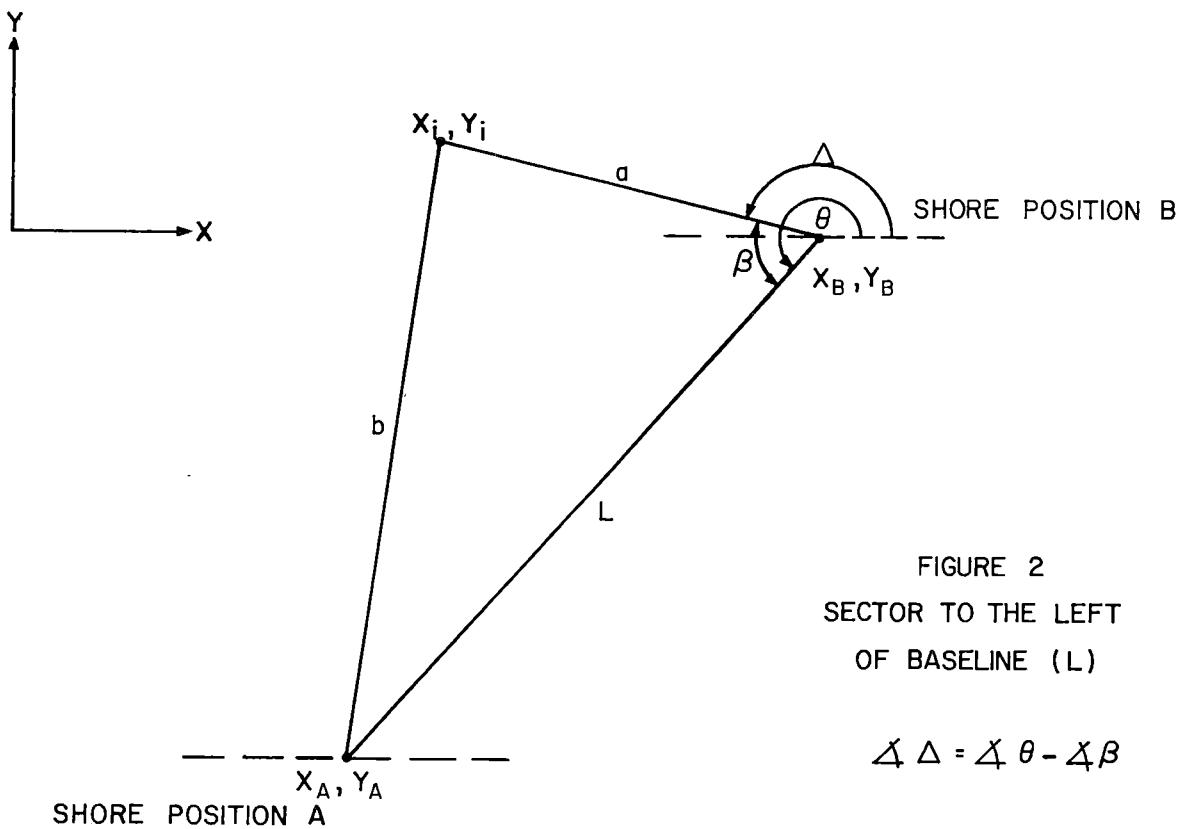


FIGURE 2
SECTOR TO THE LEFT
OF BASELINE (L)

$$\Delta\Delta = \Delta\theta - \Delta\beta$$

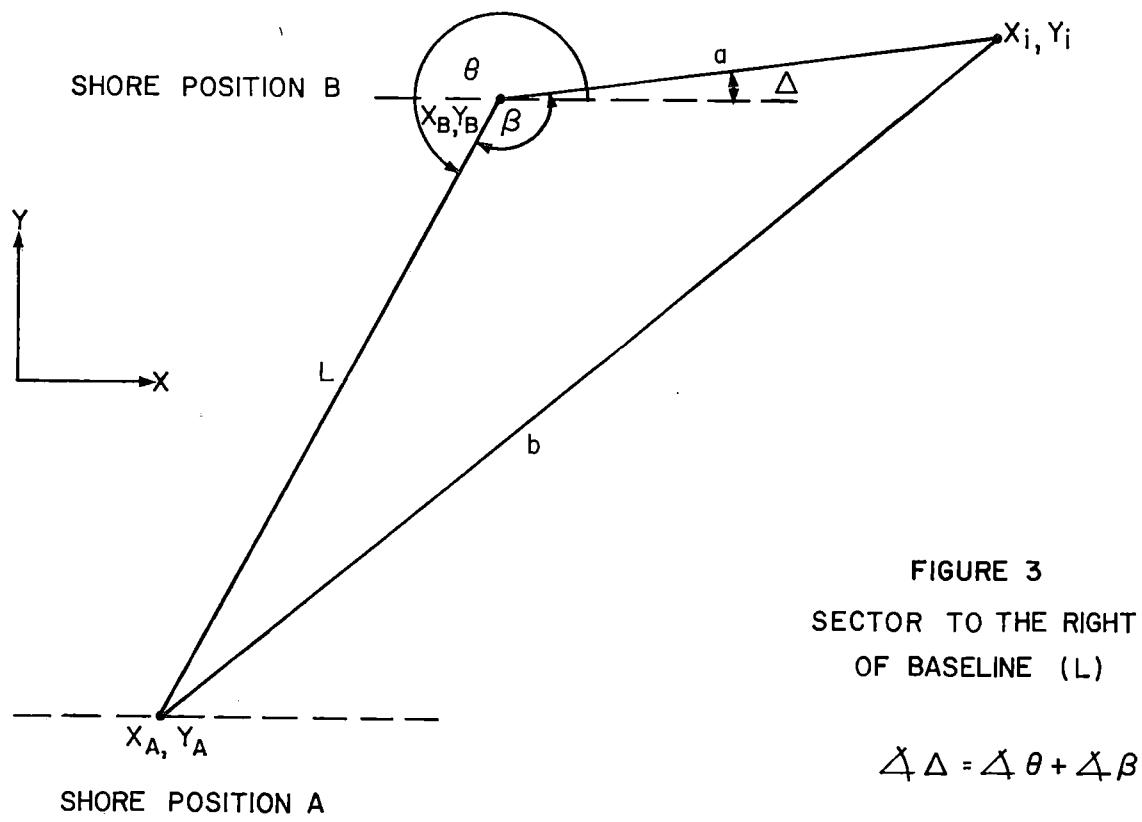


FIGURE 3
SECTOR TO THE RIGHT
OF BASELINE (L)

$$\Delta\Delta = \Delta\theta + \Delta\beta$$

a is the line distance between the boat and the leading tellurometer position

b is the line distance between the boat and the trailing tellurometer position, and

L is the line distance between the two tellurometer shore positions.

- d) the appropriate angle Δ was then calculated using the following combination:

angle Δ = angle θ - angle β when the sector lies to the left or negative x direction of the baseline (see Figure 2), and

angle Δ = angle θ + angle β when the sector lies to the right or positive x direction of the baseline (see Figure 3).

where: θ and β are as previously defined and Δ is the angle of deflection of the line from the leading tellurometer position to the boat.

The x_i , y_i coordinate for each data point then is:

$$(x_B + a \cos \Delta, y_B + a \sin \Delta)$$

with reference to the configurations illustrated in Figures 2 and 3.

The z coordinate computations were based on the assumption that the slope of the water surface between the Mamquam River junction and Howe Sound was linear. This assumption should be valid since the surveys were conducted at or near high tide levels and the observed differences in elevation between the two stations, a distance of a little more than $2\frac{1}{2}$ miles, was not greater than $\frac{1}{2}$ foot.

The strip charts from the two recorders were digitized through the use of a Gradacon pencil follower and water surface elevations adjusted to the G.S.C. mean sea level datum were obtained at 15 minute intervals for each station. Interpolations were made to obtain elevations at each station at one (1) minute intervals again on the assumption that a linear increase or decrease in water surface elevation occurred during the 15 minute intervals. The slope of the water surface was then computed for each one (1) minute time interval. The z coordinate for each data point was calculated by computing the resultant distance between the data point and the governing water level recorder and multiplying the distance by the slope. The results were added or subtracted as required to the recorded water level and the water depths as determined by echo sounding were subtracted to provide river bed elevations.

iii) Secondary Editing

The secondary editing consist of a visual examination of a data point plot for each sector. Data points as obtained

in the field must plot consecutively in a continuous pattern. It is this pattern which is examined, any points which deviate from the pattern, or any breaks in the pattern indicate data error. If the data has a systematic error e.g. a continuous 100 metre distance error, they are corrected. However, data exhibiting random error are uncorrectable and hence are removed.

iv) Data Sorting

This procedure was included to reduce the number of plot outputs and thereby facilitate the evaluation of survey results. The 12 sectors surveyed on the Squamish River estuary in 1973 and again in 1974 were condensed to 6 modules by sorting the data with respect to 6 equal y increments. Sorting with respect to the y axis is a standard procedure since all plots are carried out by a Calcomp plotter which has scale restrictions along the y axis but has no practical restrictions along the x axis.

v) Boundary Coordinate Selection and Generating a
Blanking Array

After the field data has been sorted into modules, a gridded rectangular field is set up with the boundaries of the field being the minimum and maximum coordinates previously selected for the end boundaries of the module in question. The computer generated grid which is superimposed on the rectangular field has grid increments Δx and Δy as specified by the user. For all 6 modules of the Squamish River estuary, both Δx and Δy have been

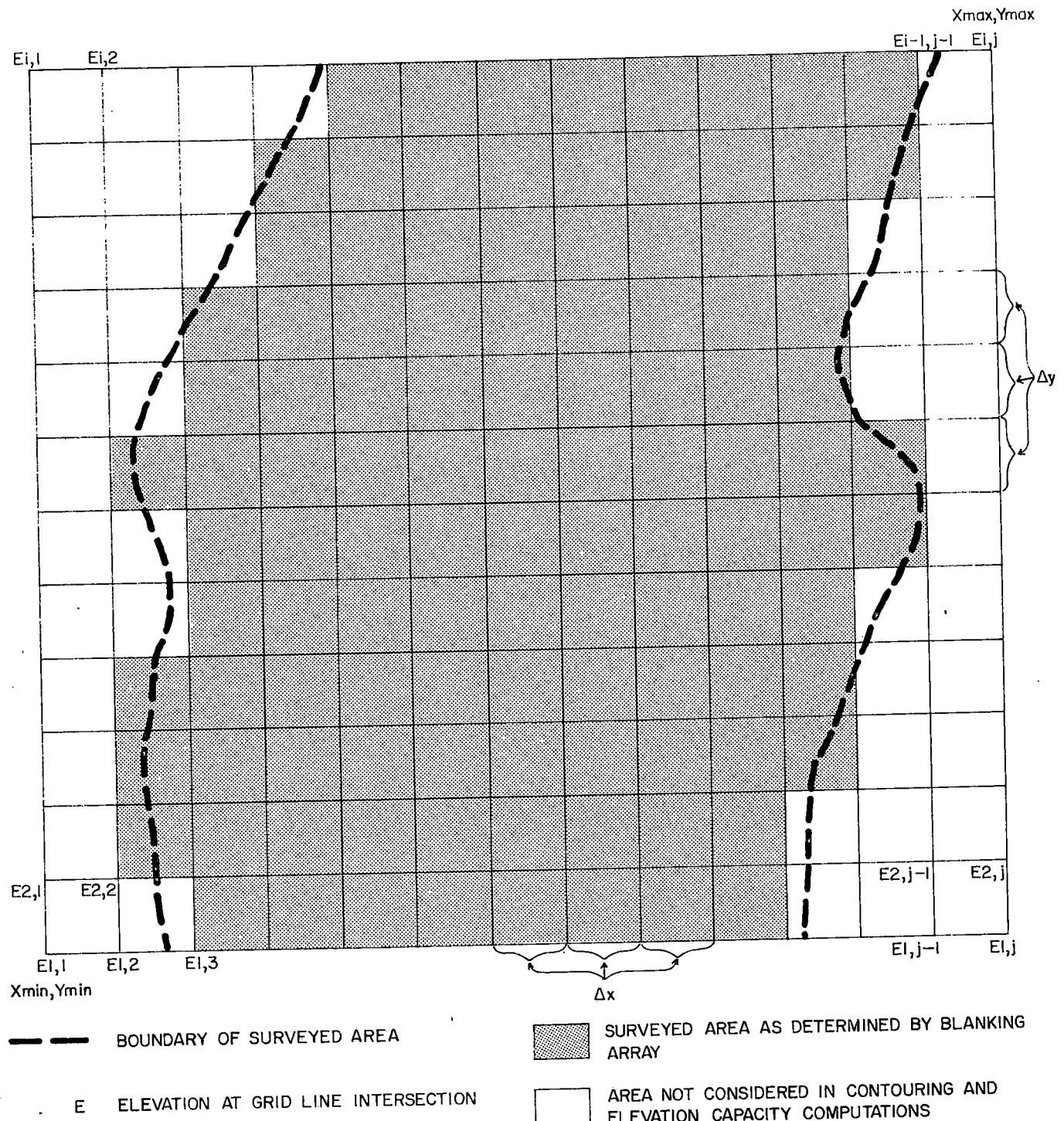


FIGURE 4

COMPUTER GENERATED BLANKING ARRAY

set equal to 50 feet. Elevations are then computed for each of the grid line intersections as shown on Figure 4. All computations are based on field data input and follow the procedure outlined in the Calcomp manual of the "General Purpose Contouring Program (GPCP)"².

Since elevations are computed for all grid line intersections within the rectangular field and contouring and elevation-capacity relationships are to be restricted to the surveyed area, the area has to be defined. This is accomplished by determining the coordinates of the boundary in a counterclockwise direction and attaching them to the field data file. The GPCP then includes or excludes grid squares based on whether the centroid of the grid square is inside or outside the boundary as illustrated on Figure 4. For identification and computation purposes the grid squares are assigned a value of "0" if they are inside the boundary and a "1" if outside the boundary as illustrated on Figure 5 which is a computer generated blanking array of Module 1.

vi) Contour Plot

The contours are plotted according to GPCP formulation. Briefly, each grid square is further subdivided by a subgrid. Mesh point values for the subgrid are obtained by interpolation from the main grid and contour lines are drawn by straight lines joining equal values within the subgrid.

vii) Elevation-Capacity Computation

The capacity of a surveyed body of water is computed

1 GRID SQUARES OUTSIDE SURVEYED BOUNDARY

O GRID SQUARES INSIDE SURVEYED BOUNDARY

FIGURE 5

COMPUTER GENERATED BLANKING ARRAY OF MODULE I

by subdividing the body of water into horizontal slices with the thickness of the slice or elevation increment ΔZ defined by the user. Figure 6 illustrates this approach and gives the mathematical formulation used. Briefly, the points with elevations located in the slice under consideration are counted, assigned an area (the area is equal to the area of one grid square and depends on grid interval selected) and multiplied by half the elevation increment ($\frac{1}{2} \Delta Z$). The reason for this is that half the points are below and half above the mean elevation of the increment, assuming random scatter about the mean. The volume obtained for the above is then added to the volume obtained by multiplying the full elevation increment to the area obtained from the sum of all points whose elevation is below the elevation of the increment under consideration as given by equation (1). The total capacity of the body of water is obtained by summing up the volumes of all horizontal slices as given by equation (2).

As stated earlier the area normally assigned to each elevation point is equal to the area of a grid square. However since each elevation point is at a grid intersection, the area assigned to each elevation point comprises $\frac{1}{4}$ of the area of each of the four squares surrounding the point. This formulation is not necessary for points located in positions other than at the water-land boundary or at the interface between two modules. At the boundaries however, this formulation provides a greater degree of

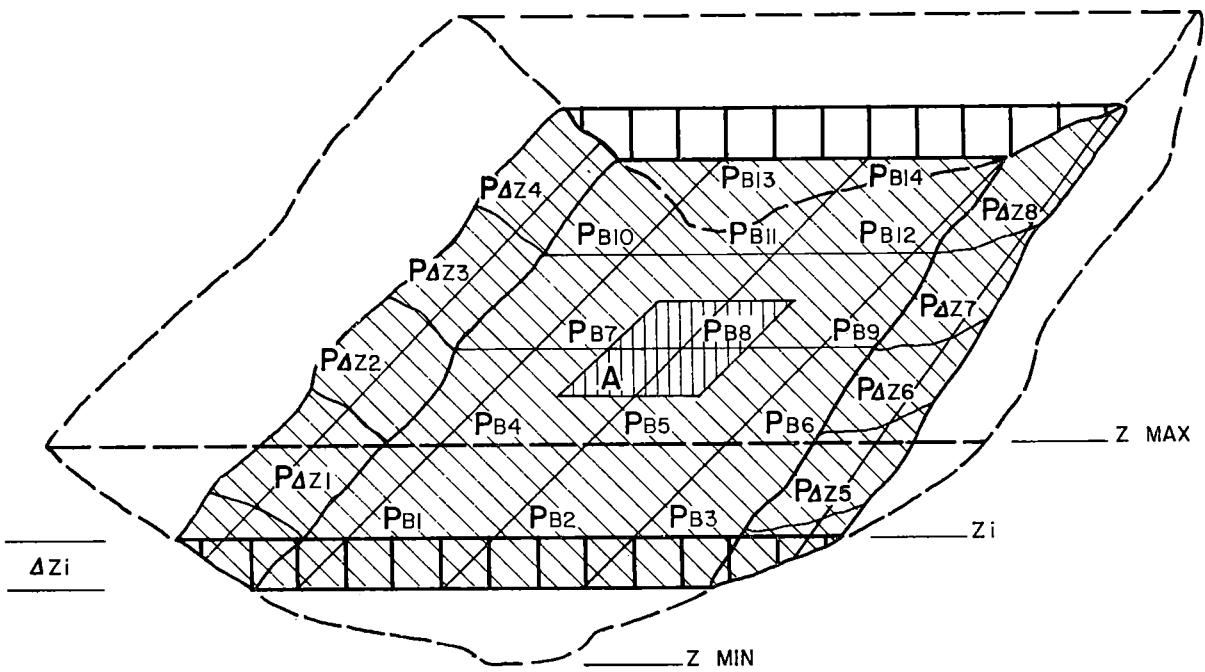


FIGURE 6
ELEVATION-CAPACITY COMPUTATION

$$V_{\Delta z_i} = \gamma_2 \Delta z_i \left(\sum_{z_i - \Delta z_i}^{z_i} A P_{\Delta z_i} \right) + \Delta z_i \left(\sum_{z \text{ MIN}}^{z_i - \Delta z_i} A P_B \right) \quad (1)$$

$$\text{and } V_{\text{TOT}} = \sum_{z \text{ MIN}}^{z \text{ MAX}} V_{\Delta z_i} \quad (2)$$

where $V_{\Delta z_i}$ — the volume of the horizontal slice under consideration.

Δz_i — elevation increment defined by the user.

A — Area assigned to each elevation point.

$P_{\Delta z_i}$ — elevation point residing within the elevation increment under consideration.

P_B — elevation points below the elevation $z_i - \Delta z$

V_{TOT} — total volume of water beneath the surveyed area considered.

accuracy. Figure 7 illustrates the water-land boundary condition and Figure 8 illustrates the condition at the interface between two modules. As shown in either case, the total area assigned to each elevation point under these conditions depends on whether the four grid squares surrounding the point are considered inside or outside the survey boundary.

Based on the above computation the results are readily depicted in the form of tables or curves or both.

viii) Contour Plot of Elevation Differences

This procedure utilizes the grid intersection elevations interpolated by the computer from the field data of two consecutive surveys, compares coincident elevations and generates an array of elevation differences. This array is then used as direct input to contour plotting without any further interpolation.

The prime stipulation in this procedure is that boundary coordinates, grid intervals and scales for each set of data compared are identical. Any deviation, will give erroneous results.

V. DISCUSSION OF RESULTS

As stated earlier, for computation and evaluation convenience the twelve (12) surveyed sectors on the Squamish River estuary were combined into six (6) modules. The boundaries of the individual modules are shown on Figure 9. The results are given in terms of the individual modules with a summary of total

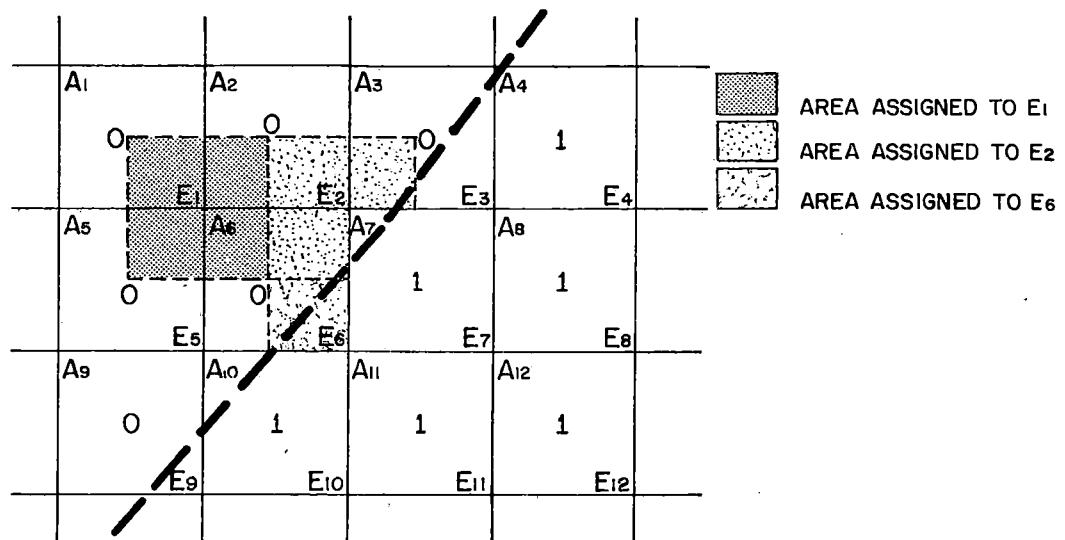


FIGURE 7

AREAS ASSIGNED TO ELEVATIONS AT SHORE LINE BOUNDARY

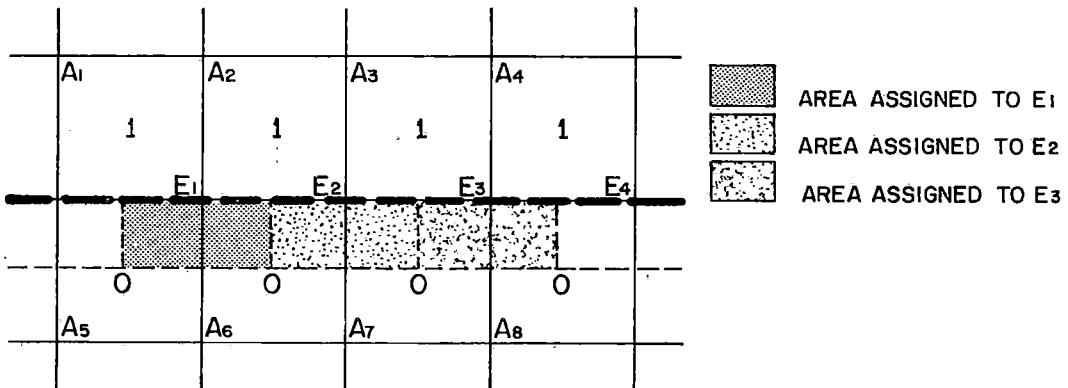


FIGURE 8

AREAS ASSIGNED TO ELEVATIONS AT BOUNDARY BETWEEN MODULES

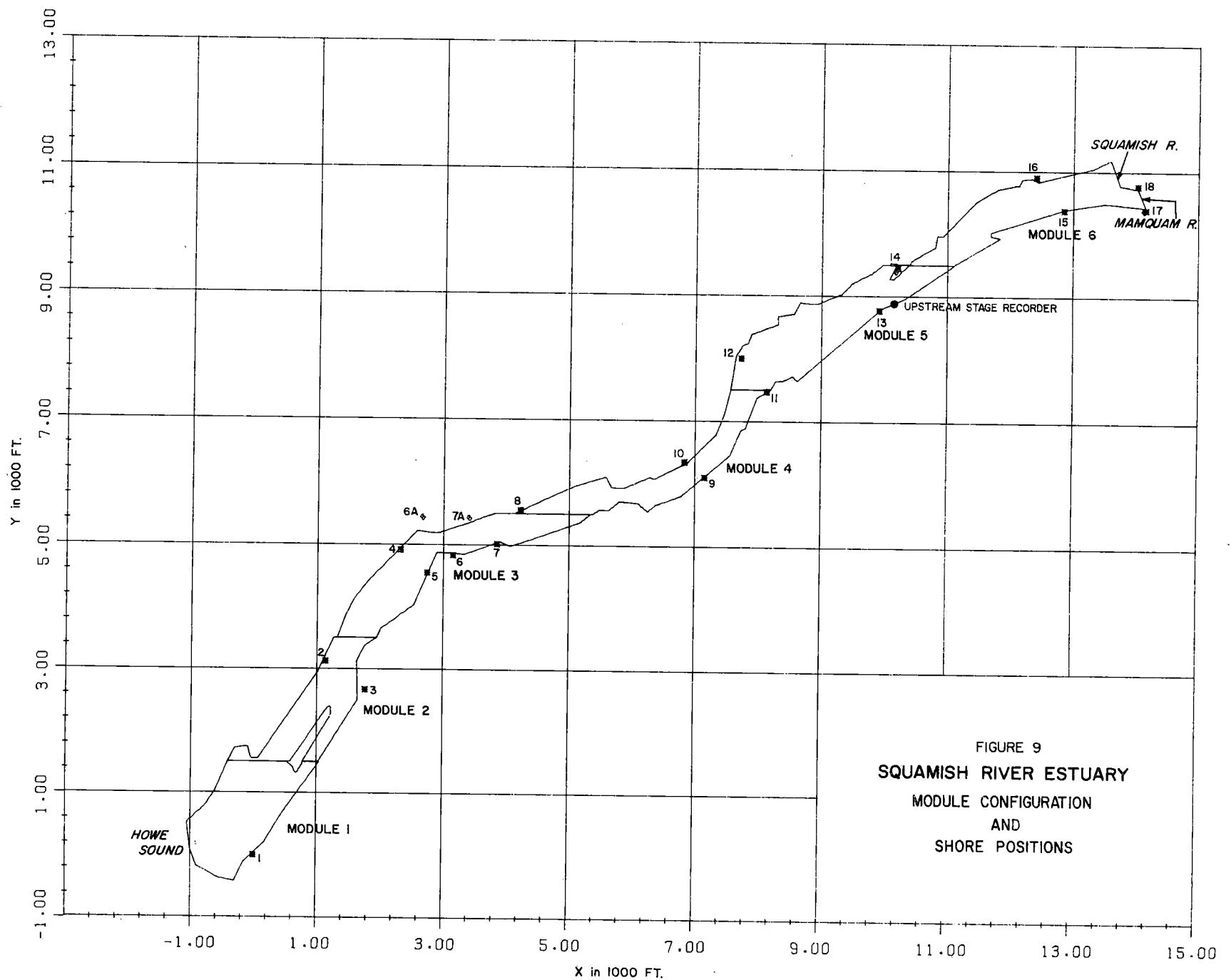


FIGURE 9
SQUAMISH RIVER ESTUARY
MODULE CONFIGURATION
AND
SHORE POSITIONS

alterations shown on Table 1. The format for presenting the results for each individual module is:

- a) a contour map from 1973 data and one from 1974 data.
These show the estuary geometry at the time of the surveys.
- b) a contour map of elevation differences. This is a comparison between the elevations of November 1973 and October 1974 and provides a qualitative evaluation of estuary aggradation and degradation in the horizontal plane.
- c) elevation-capacity curves. The 1974 curve is superimposed on the 1973 curve. The elevation-capacity curves provide a qualitative evaluation of estuary aggradation and degradation in the vertical plane; and
- d) elevation-capacity tables (one for each of the two surveys). The tables provide the quantitative values for aggradation or degradation within the individual modules.

Table 1 summarizes the net aggradation and degradation for each module of the Squamish River estuary and the total and net alterations for the surveyed stretch of river from Howe Sound to the junction of the Squamish and Mamquam rivers.

Since 1972, the Swan Wooster Engineering Co. Ltd.³ has

TABLE 1
SQUAMISH RIVER ESTUARY
AGGRADATION AND DEGRADATION
NOVEMBER 1973 to OCTOBER 1974

MODULE	AGGRADATION (ACRE-FT)	DEGRADATION (ACRE-FT)
1	111.0	
2	25.7	
3	24.3	
4	10.6	
5		43.1
6		5.6
TOTAL	171.6	48.7
NET	122.9	

been monitoring the Squamish River estuary for British Columbia Railways on a twice annual basis. Their surveys were restricted to the delta face and approximately one (1) mile upstream thereof. The area which is covered by Modules 1 and 2 of this report. The Swan Wooster surveys of February and October 1974 are of particular interest since that time interval falls within the survey interval of this report which is November 1973 and October 1974. Therefore, this overlap provides an opportunity to compare conventional survey and volume computing methods as used by Swan Wooster to the automated survey, computing and charting techniques as used by the Sediment Survey Section.

The results for individual modules are as follows:

- i) Module 1: Prior to comparing the results of this report to those of the Swan Wooster surveys it must be pointed out that Swan Wooster used a tide and chart datum for elevations which was -8.79 feet below G.S.C. datum, the datum used for elevation values shown in this report.

The delta face has aggraded by an amount of 98.4 acre-ft (approx. 160,000 cu.yds.) if alterations below the -15.0 ft contour line (Module 1, 1973 contour map) are considered. The Swan Wooster report is vague in their boundary definition for the delta face but a value for aggradation of 93 acre-ft (approx.

150,000 cu.yds.) is quoted. If Swan Wooster used their -10 ft contour line as is insinuated, it would correspond to the -18.79 elevation of this report and would give a value for aggradation of the delta face (Elevation-Capacity Tables - Module 1) equal to approximately 88.2 acre-ft (approx. 140,000 cu.yds.). In any case, the difference is approximately ± 5 percent which incidentally is an excellent agreement considering that the surveys were conducted independently and survey and computing methods were entirely different. An additional net aggradation of 30.0 acre-feet occurs between elevations -15.0 and -10.0 feet. Between elevations -10.0 and 0.0 the results show a net degradation of 17.4 acre-feet, for an overall net aggradation for Module 1 of 111.0 acre-feet.

- ii) Module 2: This stretch of the estuary exhibits net aggradation of 25.7 acre-feet with the major portion of this amount being deposited on the outer (northwest) bank of the channel. Aggradation also occurred on the northwest side of the existing island (see Difference Contours - Module 2). Minor degradation occurred between these two areas.
- Again, these results correspond to the findings of Swan Wooster. They state that infill depth from

10 to 20 feet occurred along the outside bend between their stations 75+00 and 95+00, which correspond to the region covered by Module 2.

iii) Module 3: The aggradation along the outer bank, noted in Module 2, continues and again constitutes the major amount of the 24.3 acre-feet net aggradation shown for this region.

The cause of the aggradation could be either bank slumping or lateral accretion. The former appears to be the more likely cause since the 1973 survey indicates the existence of very steep banks in this area. However, without data from bed material sampling, it is difficult to establish the exact nature of the deposits. The other areas of aggradation are on the inside bend at the upper end of the module, which is almost definitely lateral accretion and minor volumes further downstream also along the inner bank. The major portion of the channel depicted by Module 3 is in fact relatively stable.

iv) Module 4: This region is reasonably stable as indicated by a value of 10.6 acre-feet aggradation. As shown on the difference contours, the upper reaches of Module 4 exhibits very little alterations and only the narrows at the lower end show definite alterations with

degradation at the narrows and aggradation along the outer bank immediately downstream.

- v) Module 5: This area is the first to exhibit net degradation with an amount equal to 43.1 acre-feet. The greater portion of this volume is the downstream shift of a gravel bar which was located in the lower central portion of this module and presented a hazard to navigation in 1973 but presented no serious obstacle in 1974. The Difference Contours for Module 5 clearly define the area in question as a series of depressions across the channel which is the expected configuration for gravel bar shifting.
- The outer bank of the upper portion of the module also exhibits degradation whereas the opposite bank and the outer bank at the extreme downstream end of the module shows aggradation, undoubtedly due to lateral accretion.

- vi) Module 6: As indicated by the volume of 5.6 acre-feet net degradation, this portion of the surveyed area is essentially stable. The alterations shown by the Difference Contours are as expected for a river with a gravel bed.

vii) GENERAL

The variety of formats in which the results of Hydac-100

acquired data can be presented, as shown in this report, makes it a rather simple task to evaluate estuarine regime alterations.

The upper portion of the Squamish River estuary is relatively stable. It is in the lower reaches where the major alterations are occurring. The aggradation along the outer bank of Modules 2 and 3 gives rise to some speculation. If the aggradation is due to bank slumping, it would indicate that the bend is moving downstream and as such will force the downstream flow diagonally across the existing channel towards the downstream end of the dyke. This trend in the flow seems to be in existence already since the delta face is advancing at the highest rate near the dyke side (see contour maps Module 1). Presumably if the trend continues and exaggerates with time and given favourable current and tide action in Howe Sound, the delta could extend diagonally across the mouth of the proposed Squamish harbour.

VI. RECOMMENDATION

On the basis of the results available to date, the following recommendations can be made:

- a) the surveys should continue on an annual basis until such a time as definite trends can be established,
- b) the survey area should be extended further (approx. $\frac{1}{2}$ mile) into Howe Sound in order to measure the rates and direction of future delta advances, and,

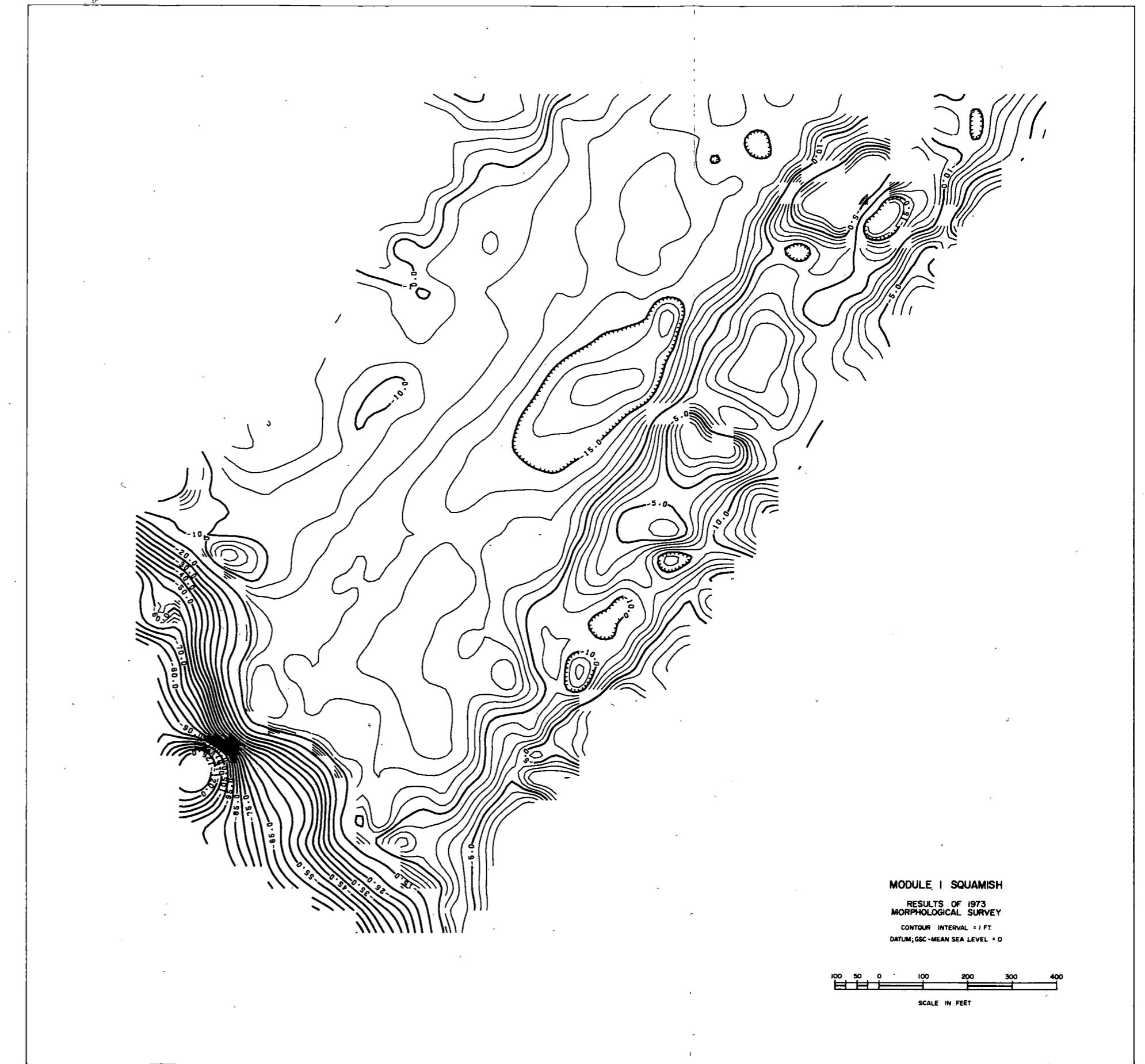
c) bed material samples should be obtained throughout the surveyed area to determine the origin of deposited sediment and to establish the condition of the bed with respect to sediment particle size distribution.

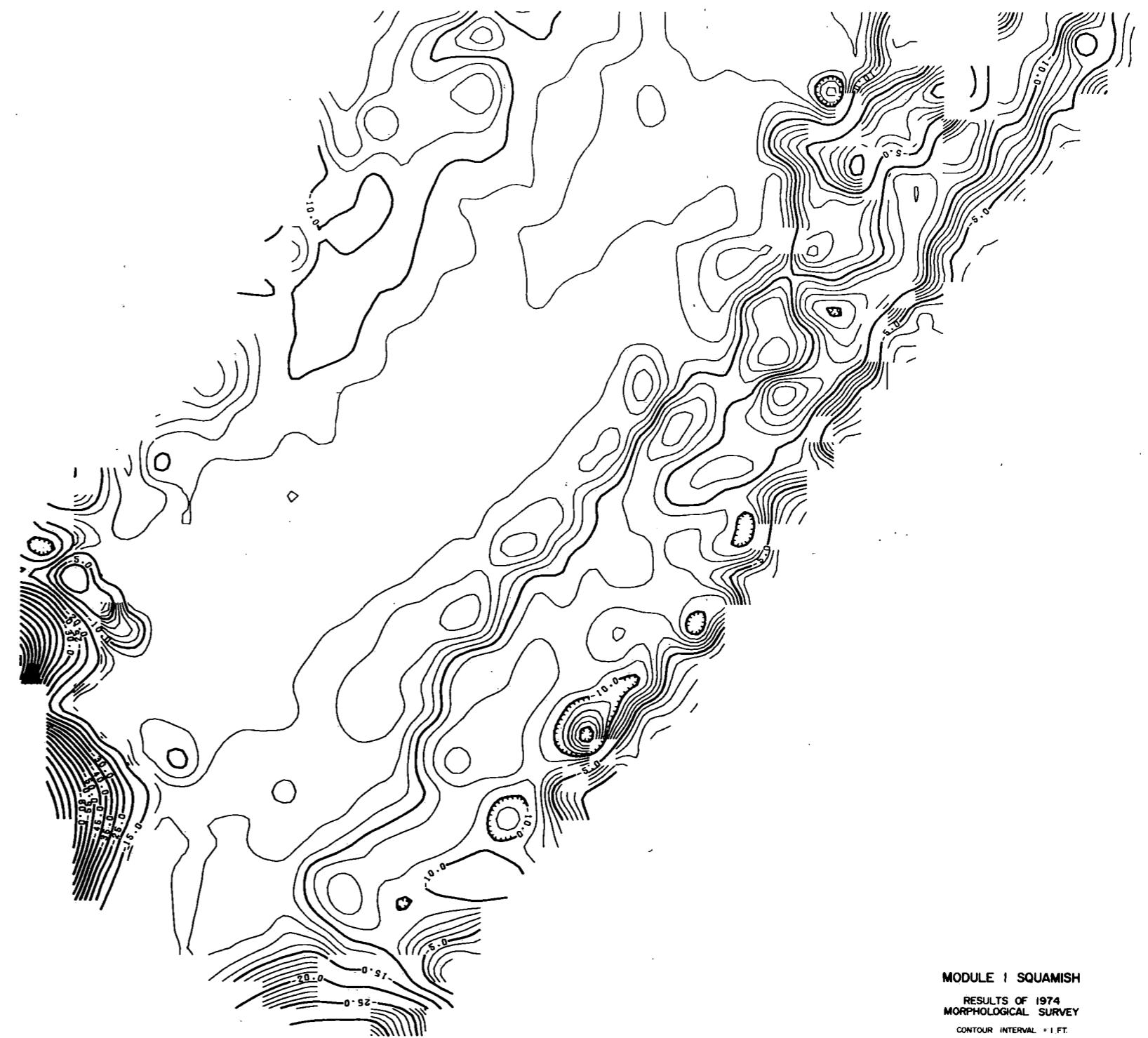
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1. Wiebe, K. (1974) A Description of the Hydac-100 System and its Application. Internal report of the Sediment Survey Section, Applied Hydrology Division, Water Resources Branch, Department of Environment, Canada.
2. Calcomp (1971) A General Purpose Contouring Program. User's Manual (Revised 1973). Anaheim, California.
3. Swan Wooster Engineering Co. Ltd. (1975) Report on Sounding Program Lower Squamish River Training Works at Squamish, B.C. Vancouver, B.C.

MOD. 1

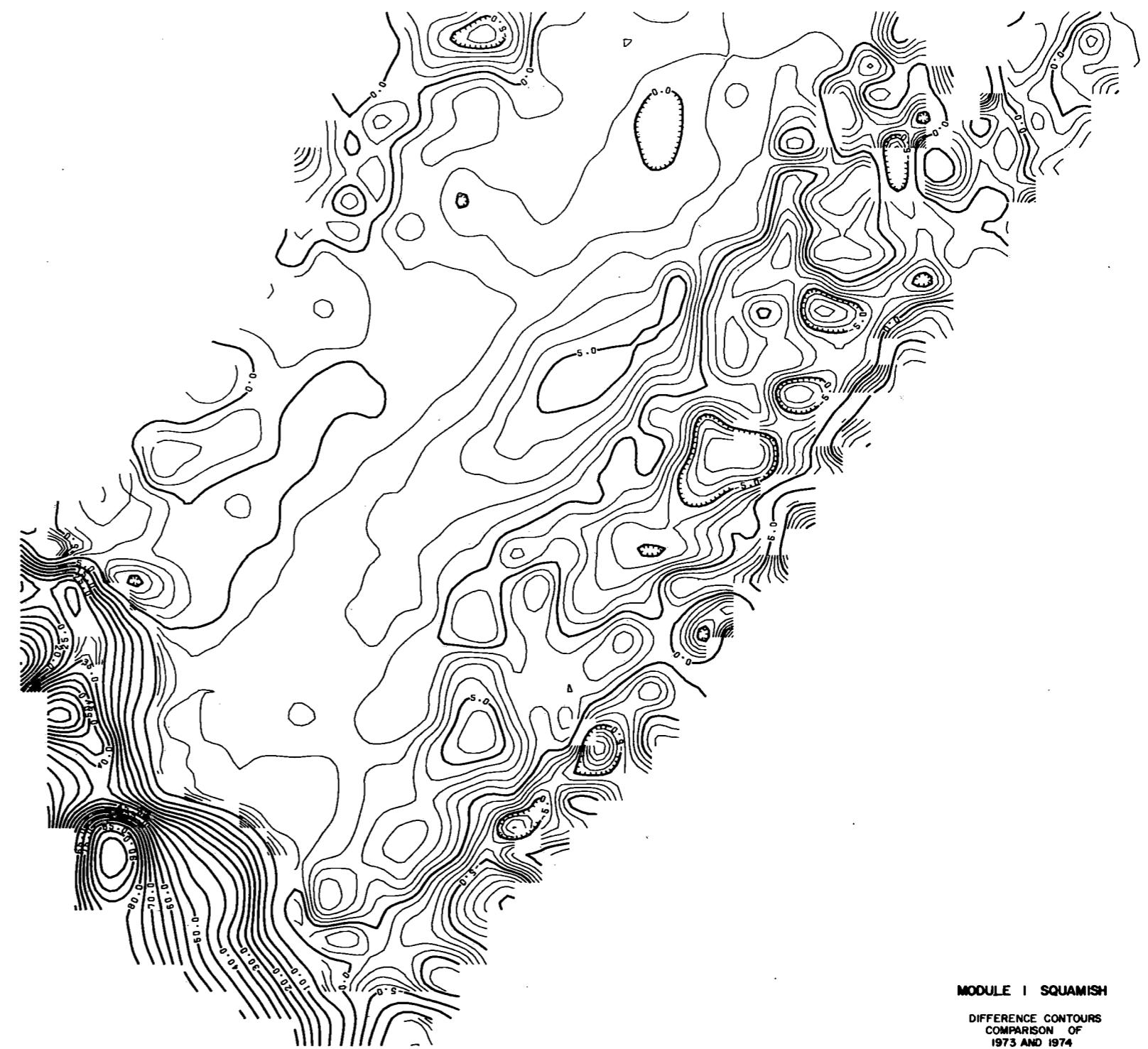






MODULE I SQUAMISH
RESULTS OF 1974
MORPHOLOGICAL SURVEY
CONTOUR INTERVAL = 1 FT.
DATUM : GSC-MEAN SEA LEVEL = 0

100 50 0 100 200 300 400
SCALE IN FEET



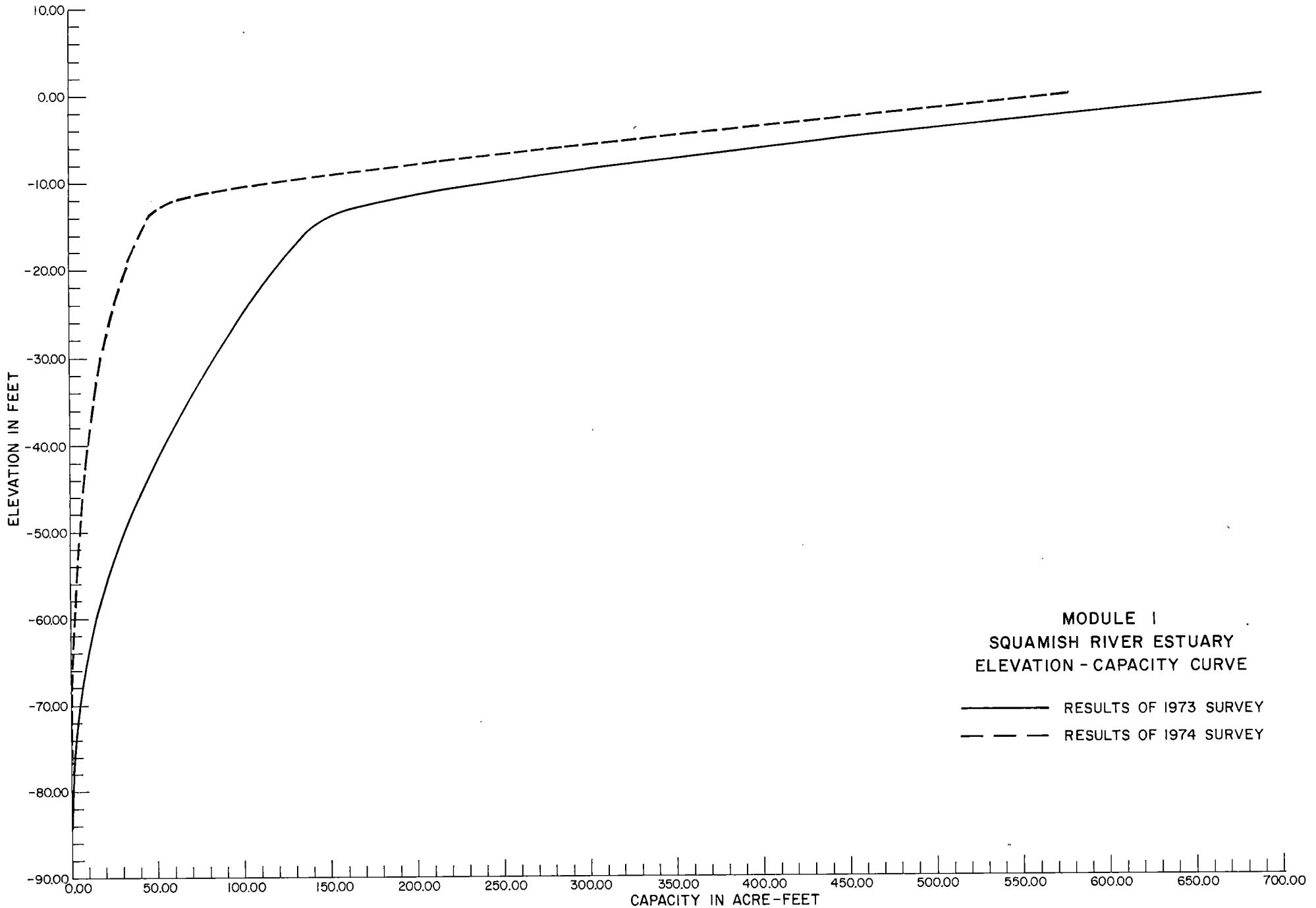
MODULE I SQUAMISH

DIFFERENCE CONTOURS
COMPARISON OF
1973 AND 1974
RESULTS

CONTOUR INTERVAL = 1 FT.

NOTE: NEGATIVE CONTOURS ARE EROSION
POSITIVE CONTOURS ARE DEPOSITION

0 50 100 150 200 FEET



SEDIMENT SURVEY SECTION
OTTAWA, ONT.
MAY 3 1976

SQUAMISH ESTUARY 1973 MODULE 1

PAGE 1

* ELEVATION - CAPACITY TABLE *

* ELEVATION * (FT)	ACC. VOLUME * (ACRE-FT)						
* -87.50	.6	* -75.00	2.8	* -62.50	12.3	* -50.00	31.6
* -87.00	.8	* -74.50	3.1	* -62.00	12.8	* -49.50	32.6
* -86.50	.8	* -74.00	3.4	* -61.50	13.3	* -49.00	33.7
* -86.00	.1	* -73.50	3.6	* -61.00	13.9	* -48.50	34.7
* -85.50	.1	* -73.00	3.9	* -60.50	14.4	* -48.00	35.7
* -85.00	.1	* -72.50	4.1	* -60.00	15.0	* -47.50	36.8
* -84.50	.2	* -72.00	4.4	* -59.50	15.6	* -47.00	37.8
* -84.00	.3	* -71.50	4.7	* -59.00	16.3	* -46.50	38.9
* -83.50	.4	* -71.00	4.9	* -58.50	17.0	* -46.00	40.0
* -83.00	.5	* -70.50	5.2	* -58.00	17.7	* -45.50	41.1
* -82.50	.5	* -70.00	5.5	* -57.50	18.5	* -45.00	42.2
* -82.00	.6	* -69.50	5.8	* -57.00	19.2	* -44.50	43.3
* -81.50	.7	* -69.00	6.2	* -56.50	19.9	* -44.00	44.5
* -81.00	.8	* -68.50	6.6	* -56.00	20.7	* -43.50	45.8
* -80.50	.9	* -68.00	7.0	* -55.50	21.5	* -43.00	47.0
* -80.00	1.1	* -67.50	7.4	* -55.00	22.3	* -42.50	48.2
* -79.50	1.2	* -67.00	7.9	* -54.50	23.1	* -42.00	49.5
* -79.00	1.3	* -66.50	8.3	* -54.00	24.0	* -41.50	50.8
* -78.50	1.5	* -66.00	8.8	* -53.50	24.9	* -41.00	52.0
* -78.00	1.6	* -65.50	9.3	* -53.00	25.8	* -40.50	53.3
* -77.50	1.8	* -65.00	9.7	* -52.50	26.8	* -40.00	54.6
* -77.00	2.0	* -64.50	10.2	* -52.00	27.7	* -39.50	56.0
* -76.50	2.2	* -64.00	10.7	* -51.50	28.7	* -39.00	57.3
* -76.00	2.4	* -63.50	11.2	* -51.00	29.6	* -38.50	58.7
* -75.50	2.6	* -63.00	11.7	* -50.50	30.6	* -38.00	60.0

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SQUAMISH ESTUARY 1973 MODULE 1

PAGE 2

* ELEVATION - CAPACITY TABLE *

* ELEVATION * (FT)	* ACC. VOLUME * (ACRE-FT)	* ELEVATION * (FT)	* ACC. VOLUME * (ACRE-FT)	* ELEVATION * (FT)	* ACC. VOLUME * (ACRE-FT)	* ELEVATION * (FT)	* ACC. VOLUME * (ACRE-FT)
*	*	*	*	*	*	*	*
* -37.50	61.4	* -25.00	99.9	* -12.50	173.5	* 0.00	689.3
*	*	*	*	*	*	*	*
* -37.00	62.8	* -24.50	101.6	* -12.00	185.2	*	*
*	*	*	*	*	*	*	*
* -36.50	64.2	* -24.00	103.3	* -11.50	198.2	*	*
*	*	*	*	*	*	*	*
* -36.00	65.6	* -23.50	105.1	* -11.00	212.5	*	*
*	*	*	*	*	*	*	*
* -35.50	67.0	* -23.00	106.9	* -10.50	227.9	*	*
*	*	*	*	*	*	*	*
* -35.00	68.5	* -22.50	108.7	* -10.00	244.3	*	*
*	*	*	*	*	*	*	*
* -34.50	70.0	* -22.00	110.6	* -9.50	261.7	*	*
*	*	*	*	*	*	*	*
* -34.00	71.5	* -21.50	112.4	* -9.00	280.0	*	*
*	*	*	*	*	*	*	*
* -33.50	73.0	* -21.00	114.3	* -8.50	299.1	*	*
*	*	*	*	*	*	*	*
* -33.00	74.6	* -20.50	116.3	* -8.00	318.9	*	*
*	*	*	*	*	*	*	*
* -32.50	76.1	* -20.00	118.2	* -7.50	339.4	*	*
*	*	*	*	*	*	*	*
* -32.00	77.6	* -19.50	120.2	* -7.00	360.5	*	*
*	*	*	*	*	*	*	*
* -31.50	79.1	* -19.00	122.2	* -6.50	382.1	*	*
*	*	*	*	*	*	*	*
* -31.00	80.7	* -18.50	124.2	* -6.00	404.1	*	*
*	*	*	*	*	*	*	*
* -30.50	82.2	* -18.00	126.2	* -5.50	426.5	*	*
*	*	*	*	*	*	*	*
* -30.00	83.8	* -17.50	128.4	* -5.00	449.4	*	*
*	*	*	*	*	*	*	*
* -29.50	85.4	* -17.00	130.6	* -4.50	472.6	*	*
*	*	*	*	*	*	*	*
* -29.00	86.9	* -16.50	133.1	* -4.00	496.1	*	*
*	*	*	*	*	*	*	*
* -28.50	88.5	* -16.00	135.7	* -3.50	519.7	*	*
*	*	*	*	*	*	*	*
* -28.00	90.1	* -15.50	138.5	* -3.00	543.5	*	*
*	*	*	*	*	*	*	*
* -27.50	91.7	* -15.00	141.6	* -2.50	567.5	*	*
*	*	*	*	*	*	*	*
* -27.00	93.3	* -14.50	145.2	* -2.00	591.7	*	*
*	*	*	*	*	*	*	*
* -26.50	94.9	* -14.00	149.8	* -1.50	615.9	*	*
*	*	*	*	*	*	*	*
* -26.00	96.5	* -13.50	155.9	* -1.00	640.3	*	*
*	*	*	*	*	*	*	*
* -25.50	98.2	* -13.00	163.7	* -.50	664.8	*	*
*	*	*	*	*	*	*	*

SEDIMENT SURVEY SECTION
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SQUAMISH ESTUARY 1974 MODULE 1

PAGE 1

* ELEVATION - CAPACITY TABLE *

* ELEVATION * (FT)	* ACC. VOLUME * (ACRF-FT)	* ELEVATION * (FT)	* ACC. VOLUME * (ACRF-FT)	* ELEVATION * (FT)	* ACC. VOLUME * (ACPE-FT)	* ELEVATION * (FT)	* ACC. VOLUME * (ACPE-FT)
*	*	*	*	*	*	*	*
* -82.50	.3	* -70.00	.8	* -57.50	3.4	* -45.00	7.9
*	*	*	*	*	*	*	*
* -82.00	.6	* -69.50	.9	* -57.00	3.5	* -44.50	8.1
*	*	*	*	*	*	*	*
* -81.50	.0	* -69.00	.9	* -56.50	3.6	* -44.00	8.4
*	*	*	*	*	*	*	*
* -81.00	.1	* -68.50	1.0	* -56.00	3.8	* -43.50	8.6
*	*	*	*	*	*	*	*
* -80.50	.1	* -68.00	1.0	* -55.50	3.9	* -43.00	8.9
*	*	*	*	*	*	*	*
* -80.00	.1	* -67.50	1.1	* -55.00	4.1	* -42.50	9.2
*	*	*	*	*	*	*	*
* -79.50	.1	* -67.00	1.1	* -54.50	4.2	* -42.00	9.5
*	*	*	*	*	*	*	*
* -79.00	.1	* -66.50	1.2	* -54.00	4.4	* -41.50	9.8
*	*	*	*	*	*	*	*
* -78.50	.2	* -66.00	1.3	* -53.50	4.6	* -41.00	10.2
*	*	*	*	*	*	*	*
* -78.00	.2	* -65.50	1.3	* -53.00	4.8	* -40.50	10.5
*	*	*	*	*	*	*	*
* -77.50	.2	* -65.00	1.4	* -52.50	5.0	* -40.00	10.8
*	*	*	*	*	*	*	*
* -77.00	.3	* -64.50	1.5	* -52.00	5.2	* -39.50	11.1
*	*	*	*	*	*	*	*
* -76.50	.3	* -64.00	1.7	* -51.50	5.4	* -39.00	11.5
*	*	*	*	*	*	*	*
* -76.00	.3	* -63.50	1.8	* -51.00	5.6	* -38.50	11.8
*	*	*	*	*	*	*	*
* -75.50	.3	* -63.00	1.9	* -50.50	5.7	* -38.00	12.1
*	*	*	*	*	*	*	*
* -75.00	.4	* -62.50	2.1	* -50.00	5.9	* -37.50	12.4
*	*	*	*	*	*	*	*
* -74.50	.4	* -62.00	2.2	* -49.50	6.1	* -37.00	12.8
*	*	*	*	*	*	*	*
* -74.00	.4	* -61.50	2.3	* -49.00	6.3	* -36.50	13.1
*	*	*	*	*	*	*	*
* -73.50	.5	* -61.00	2.5	* -48.50	6.5	* -36.00	13.4
*	*	*	*	*	*	*	*
* -73.00	.5	* -60.50	2.6	* -48.00	6.7	* -35.50	13.7
*	*	*	*	*	*	*	*
* -72.50	.6	* -60.00	2.7	* -47.50	6.9	* -35.00	14.1
*	*	*	*	*	*	*	*
* -72.00	.6	* -59.50	2.8	* -47.00	7.0	* -34.50	14.5
*	*	*	*	*	*	*	*
* -71.50	.7	* -59.00	2.9	* -46.50	7.2	* -34.00	14.9
*	*	*	*	*	*	*	*
* -71.00	.7	* -58.50	3.1	* -46.00	7.4	* -33.50	15.3
*	*	*	*	*	*	*	*
* -70.50	.8	* -58.00	3.2	* -45.50	7.6	* -33.00	15.7
*	*	*	*	*	*	*	*

SEDIMENT SURVEY SECTION
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SQUAMISH ESTUARY 1974 MODULE 1

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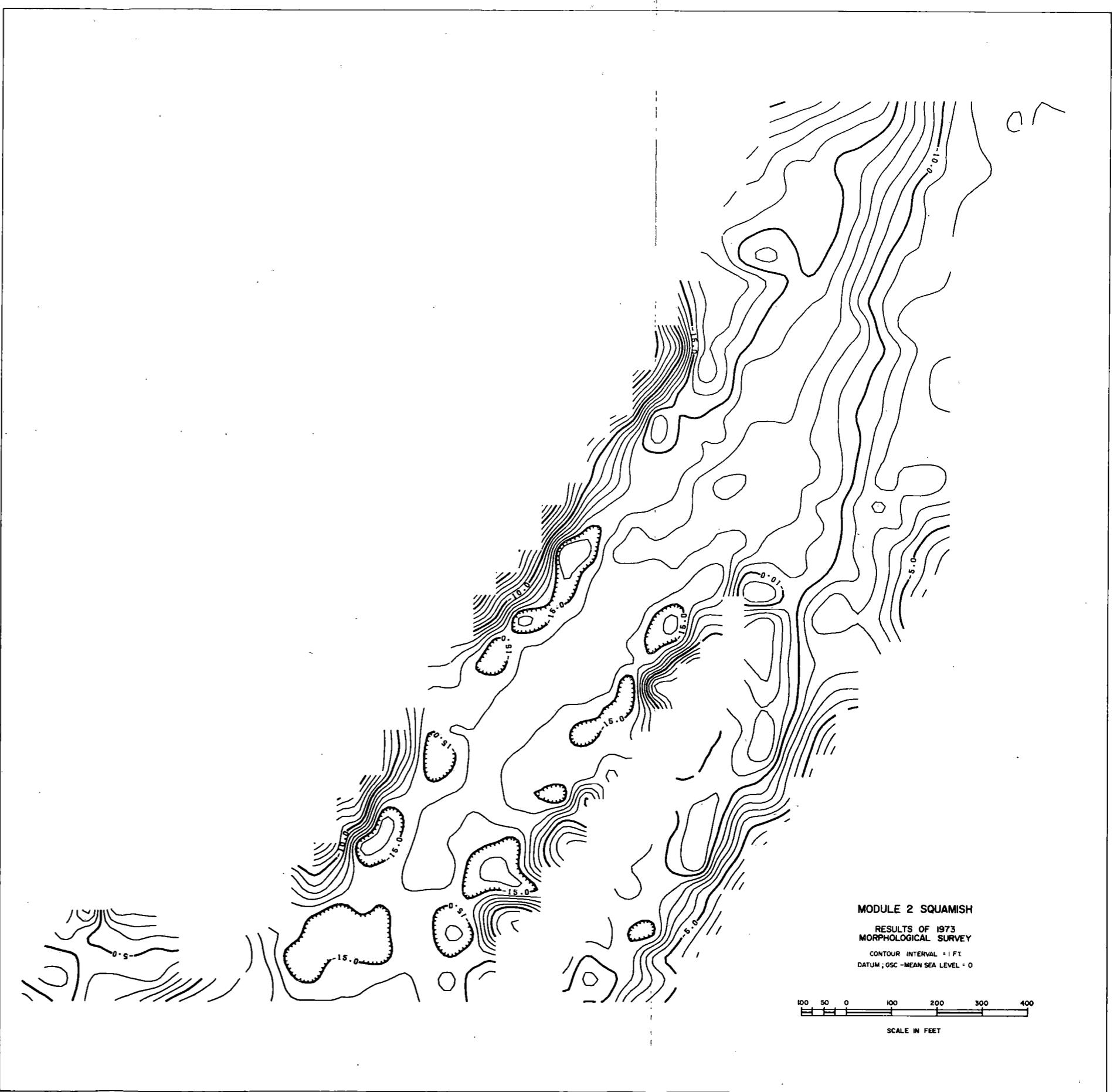
* ELEVATION - CAPACITY TABLE *

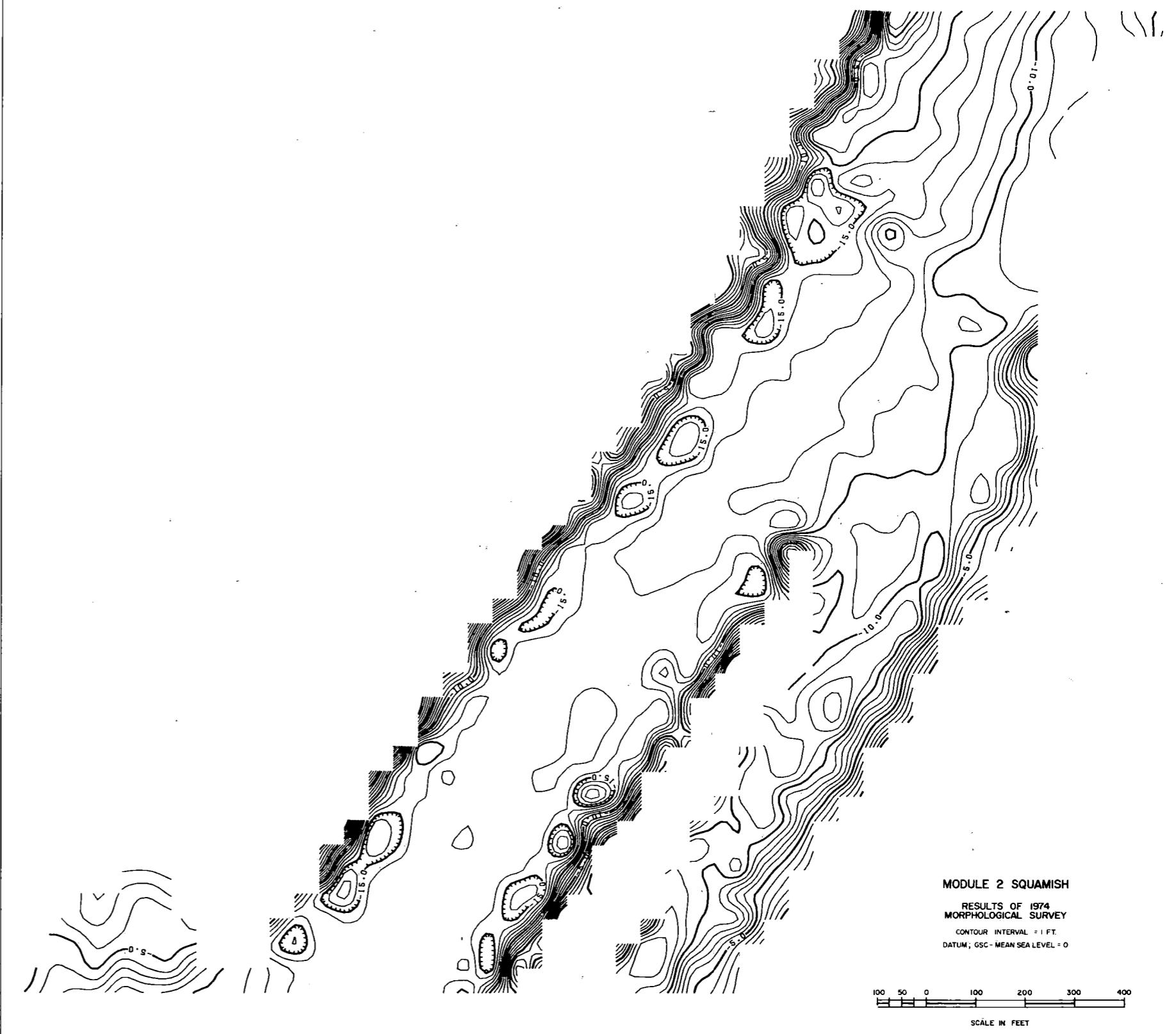
* ELEVATION * (FT)	ACC. VOLUME * (ACRE-FT)						
*	*	*	*	*	*	*	*
* -32.50	16.1	* -26.60	32.6	* -7.50	216.6	* -	*
* -32.00	16.6	* -19.50	33.5	* -7.00	239.2	* -	*
* -31.50	17.0	* -19.00	34.5	* -6.50	262.4	* -	*
* -31.00	17.5	* -18.50	35.5	* -6.00	285.7	* -	*
* -30.50	18.0	* -18.00	36.5	* -5.50	309.3	* -	*
* -30.00	18.4	* -17.50	37.5	* -5.00	332.9	* -	*
* -29.50	18.9	* -17.00	38.6	* -4.50	356.8	* -	*
* -29.00	19.4	* -16.50	39.7	* -4.00	380.8	* -	*
* -28.50	20.0	* -16.00	40.9	* -3.50	405.0	* -	*
* -28.00	20.5	* -15.50	42.0	* -3.00	429.4	* -	*
* -27.50	21.0	* -15.00	43.2	* -2.50	454.0	* -	*
* -27.00	21.6	* -14.50	44.6	* -2.00	478.7	* -	*
* -26.50	22.2	* -14.00	46.1	* -1.50	503.5	* -	*
* -26.00	22.9	* -13.50	48.0	* -1.00	528.3	* -	*
* -25.50	23.6	* -13.00	50.8	* -.50	553.3	* -	*
* -25.00	24.3	* -12.50	55.1	* 0.00	578.3	* -	*
* -24.50	25.0	* -12.00	61.3	* -	*	*	*
* -24.00	25.8	* -11.50	70.7	* -	*	*	*
* -23.50	26.6	* -11.00	83.8	* -	*	*	*
* -23.00	27.4	* -10.50	99.2	* -	*	*	*
* -22.50	28.2	* -10.00	115.9	* -	*	*	*
* -22.00	29.0	* -9.50	133.9	* -	*	*	*
* -21.50	29.9	* -9.00	153.1	* -	*	*	*
* -21.00	30.7	* -8.50	173.3	* -	*	*	*
* -20.50	31.6	* -8.00	194.6	* -	*	*	*

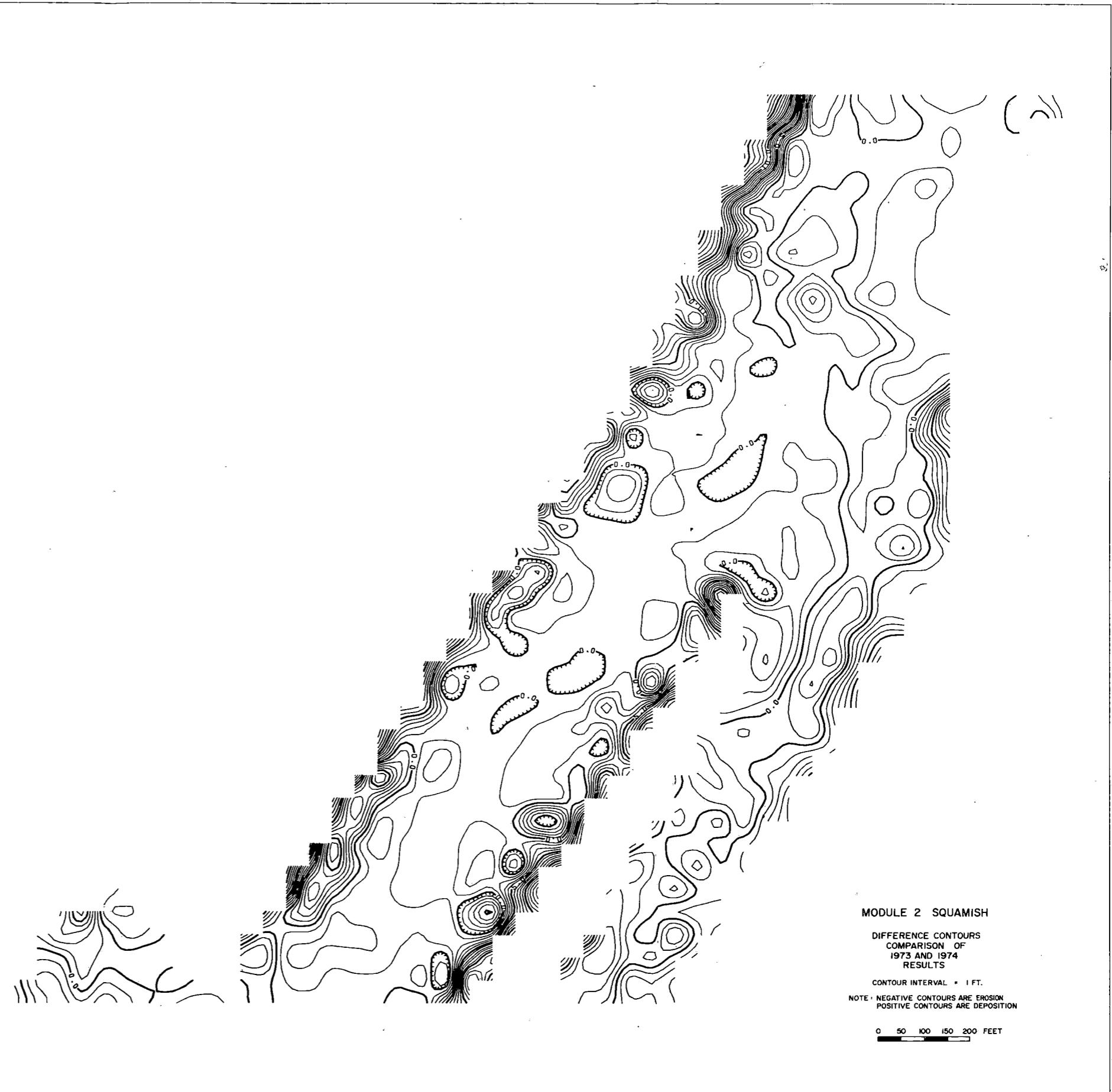
100. 2

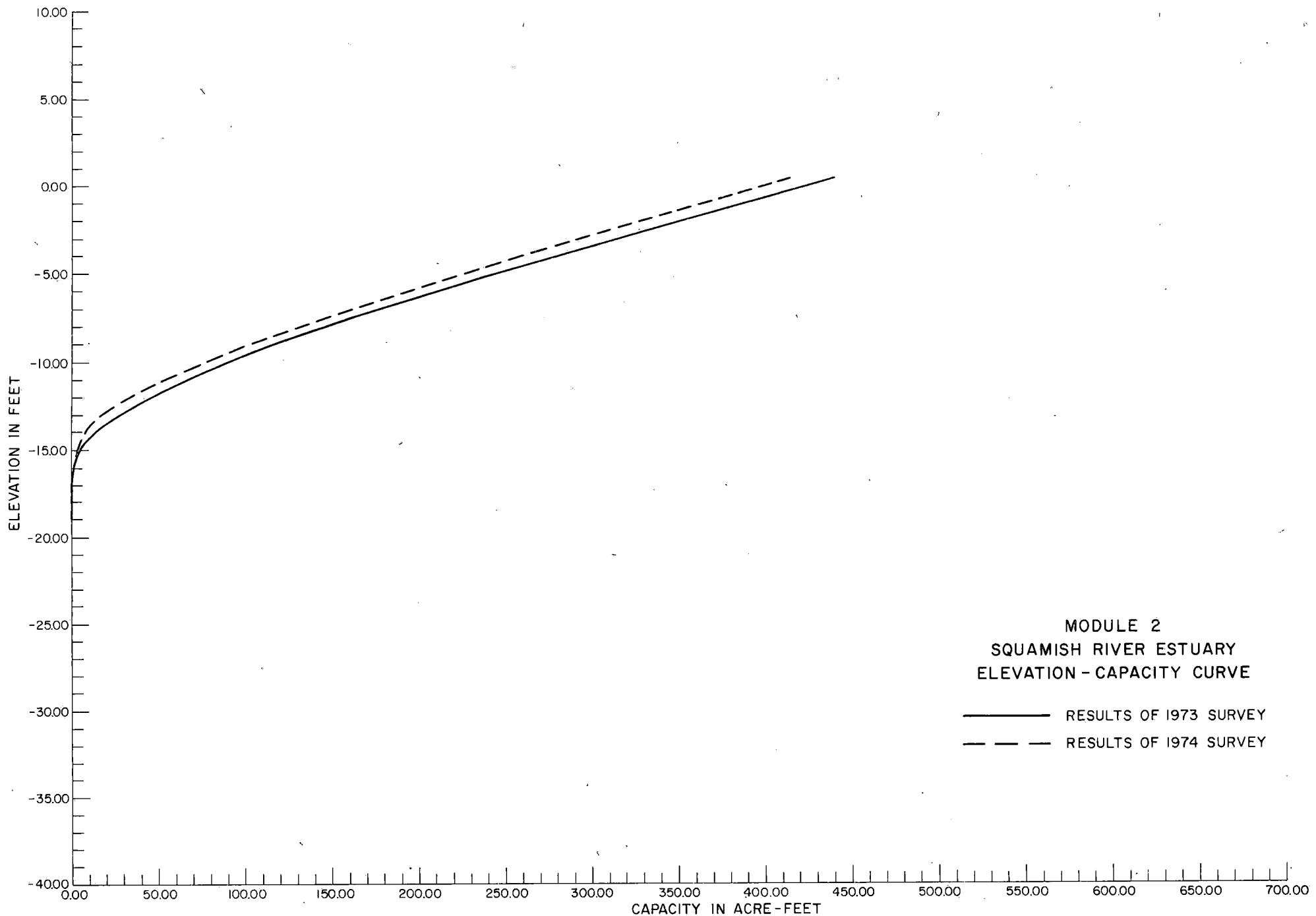
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SEDIMENT SURVEY SECTION
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SQUAMISH ESTUARY 1977 MODULE 2

PAGE 1

* ELEVATION - CAPACITY TABLE *

* ELEVATION * (FT)	* ACC. VOLUME * (ACRE-FT)	* ELEVATION * (FT)	* ACC. VOLUME * (ACRE-FT)	* ELEVATION * (FT)	* ACC. VOLUME * (ACRE-FT)	* ELEVATION * (FT)	* ACC. VOLUME * (ACRE-FT)
*	*	*	*	*	*	*	*
* -20.00	.0	* -7.50	161.0	*	*	*	*
*	*	*	*	*	*	*	*
* -19.50	.0	* -7.00	177.0	*	*	*	*
*	*	*	*	*	*	*	*
* -19.00	.0	* -6.50	193.3	*	*	*	*
*	*	*	*	*	*	*	*
* -18.50	.1	* -6.00	209.8	*	*	*	*
*	*	*	*	*	*	*	*
* -18.00	.2	* -5.50	226.7	*	*	*	*
*	*	*	*	*	*	*	*
* -17.50	.3	* -5.00	243.8	*	*	*	*
*	*	*	*	*	*	*	*
* -17.00	.5	* -4.50	261.2	*	*	*	*
*	*	*	*	*	*	*	*
* -16.50	1.0	* -4.00	278.7	*	*	*	*
*	*	*	*	*	*	*	*
* -16.00	1.9	* -3.50	296.4	*	*	*	*
*	*	*	*	*	*	*	*
* -15.50	3.4	* -3.00	314.2	*	*	*	*
*	*	*	*	*	*	*	*
* -15.00	5.9	* -2.50	332.0	*	*	*	*
*	*	*	*	*	*	*	*
* -14.50	9.4	* -2.00	349.9	*	*	*	*
*	*	*	*	*	*	*	*
* -14.00	14.4	* -1.50	367.8	*	*	*	*
*	*	*	*	*	*	*	*
* -13.50	20.3	* -1.00	385.8	*	*	*	*
*	*	*	*	*	*	*	*
* -13.00	26.6	* -.50	403.7	*	*	*	*
*	*	*	*	*	*	*	*
* -12.50	37.5	* 0.00	421.7	*	*	*	*
*	*	*	*	*	*	*	*
* -12.00	47.0	* .50	439.7	*	*	*	*
*	*	*	*	*	*	*	*
* -11.50	57.2	*	*	*	*	*	*
*	*	*	*	*	*	*	*
* -11.00	68.0	*	*	*	*	*	*
*	*	*	*	*	*	*	*
* -10.50	79.8	*	*	*	*	*	*
*	*	*	*	*	*	*	*
* -10.00	91.5	*	*	*	*	*	*
*	*	*	*	*	*	*	*
* -9.50	104.1	*	*	*	*	*	*
*	*	*	*	*	*	*	*
* -9.00	117.3	*	*	*	*	*	*
*	*	*	*	*	*	*	*
* -8.50	131.1	*	*	*	*	*	*
*	*	*	*	*	*	*	*
* -8.00	145.7	*	*	*	*	*	*
*	*	*	*	*	*	*	*

SEDIMENT SURVY SECTION
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SQUAMISH ESTUARY 1974 MODULE 2

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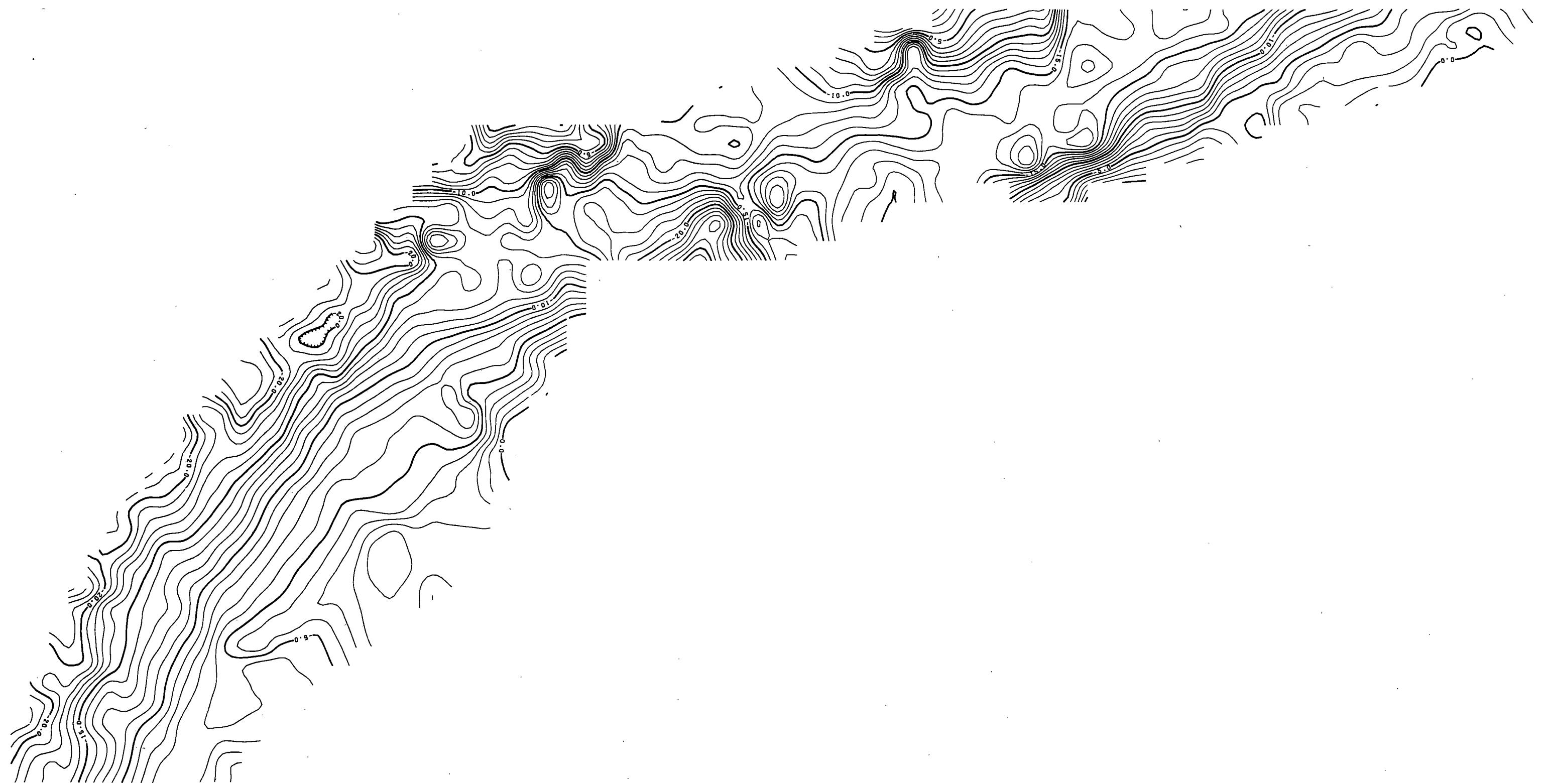
* ELEVATION - CAPACITY TABLE *

* ELEVATION * (FT)	* ACC. VOLUME * (ACRE-FT)	* ELEVATION * (FT)	* ACC. VOLUME * (ACRE-FT)	* ELEVATION * (FT)	* ACC. VOLUME * (ACRE-FT)	* ELEVATION * (FT)	* ACC. VOLUME * (ACRE-FT)
*	*	*	*	*	*	*	*
* -20.50	.0	* -8.00	131.3	* 131.3	*	*	*
* -20.00	.0	* -7.50	146.2	* 146.2	*	*	*
* -19.50	.1	* -7.00	161.4	* 161.4	*	*	*
* -19.00	.1	* -6.50	176.8	* 176.8	*	*	*
* -18.50	.2	* -6.00	192.4	* 192.4	*	*	*
* -18.00	.3	* -5.50	208.3	* 208.3	*	*	*
* -17.50	.4	* -5.00	224.4	* 224.4	*	*	*
* -17.00	.7	* -4.50	240.7	* 240.7	*	*	*
* -16.50	1.1	* -4.00	257.3	* 257.3	*	*	*
* -16.00	1.7	* -3.50	274.1	* 274.1	*	*	*
* -15.50	2.6	* -3.00	291.1	* 291.1	*	*	*
* -15.00	3.8	* -2.50	308.3	* 308.3	*	*	*
* -14.50	5.5	* -2.00	325.7	* 325.7	*	*	*
* -14.00	8.0	* -1.50	343.1	* 343.1	*	*	*
* -13.50	11.8	* -1.00	360.8	* 360.8	*	*	*
* -13.00	17.8	* -.50	378.5	* 378.5	*	*	*
* -12.50	25.6	* 0.00	396.2	* 396.2	*	*	*
* -12.00	34.5	* .50	414.0	* 414.0	*	*	*
* -11.50	44.2	*	*	*	*	*	*
* -11.00	54.6	*	*	*	*	*	*
* -10.50	65.6	*	*	*	*	*	*
* -10.00	77.3	*	*	*	*	*	*
* -9.50	89.7	*	*	*	*	*	*
* -9.00	102.8	*	*	*	*	*	*
* -8.50	116.7	*	*	*	*	*	*

MOD. 3



LIBRARY
ENVIRONMENT CANADA
CONSERVATION AND PROTECTION
PACIFIC REGION



MODULE 3 SQUAMISH

RESULTS OF 1973

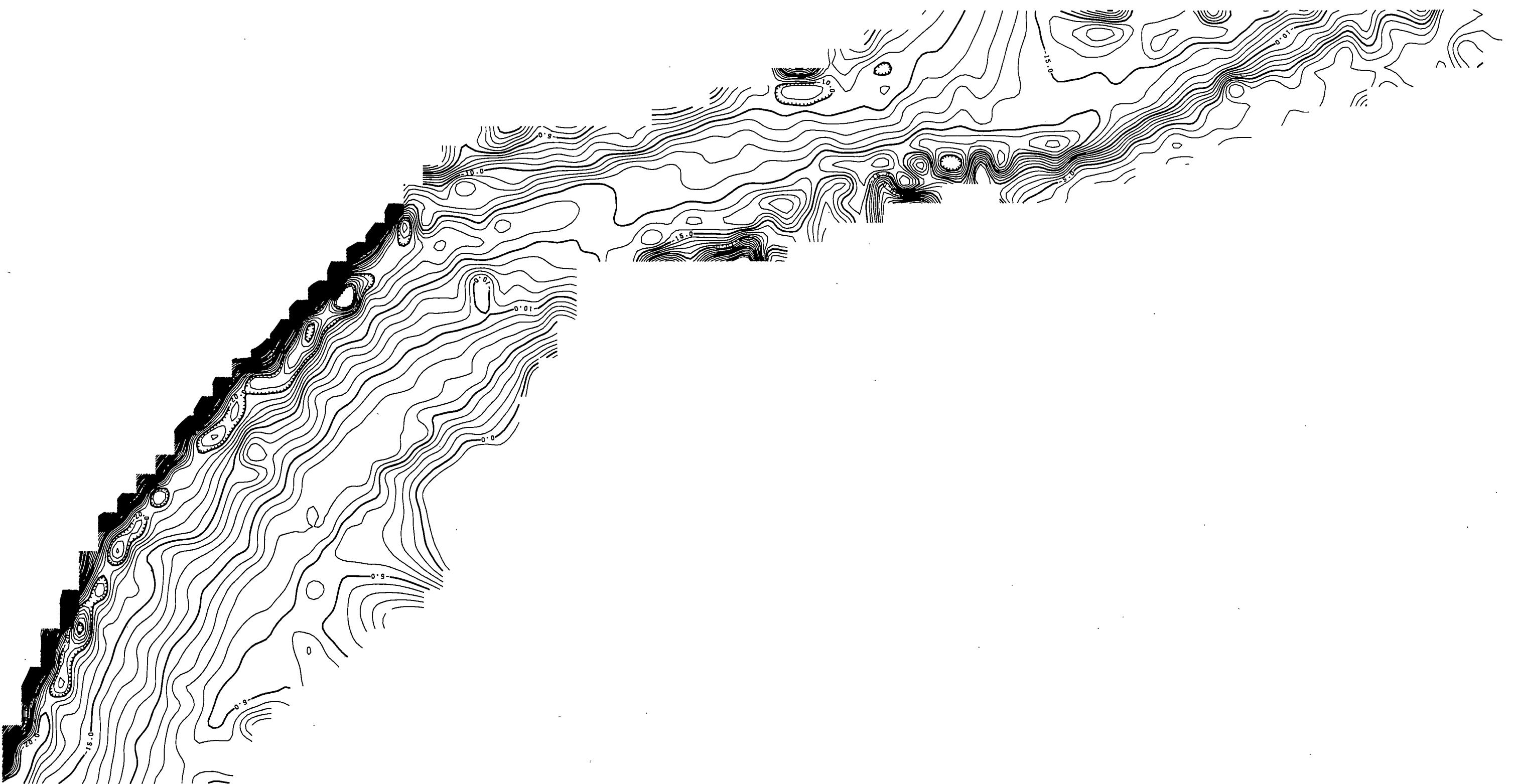
MORPHOLOGICAL SURVEY

CONTOUR INTERVAL = 1 FT.

DATUM; GSC - MEAN SEA LEVEL = 0

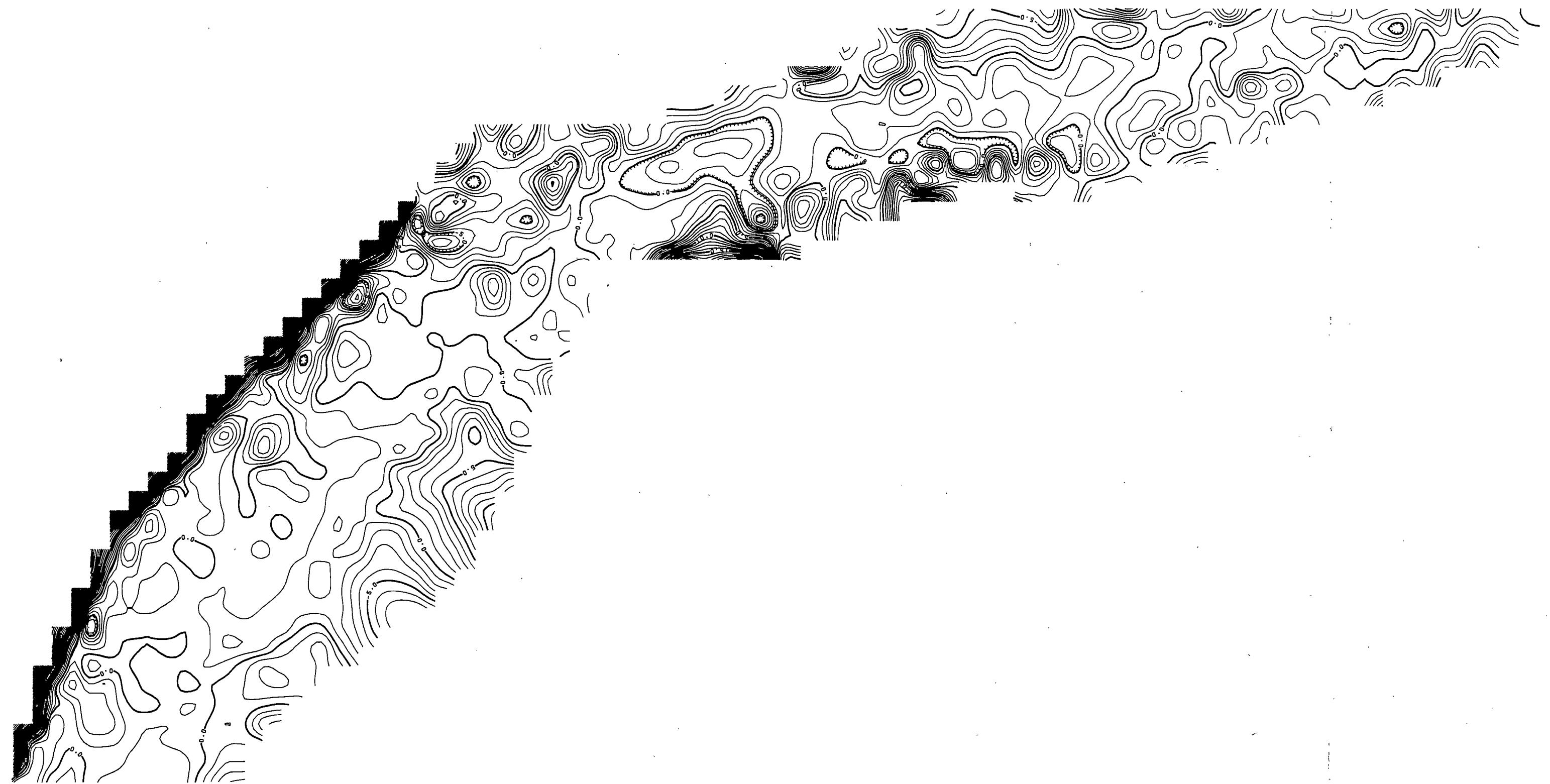
100 50 0 100 200 300 400

SCALE IN FEET



MODULE 3 SQUAMISH
RESULTS OF 1974
MORPHOLOGICAL SURVEY
CONTOUR INTERVAL = 1 FT.
DATUM; GSC - MEAN SEA LEVEL = 0

A horizontal scale bar with tick marks at intervals of 50 feet, ranging from 100 to 400. The labels are 100, 50, 0, 100, 200, 300, and 400. Below the scale bar is the text "SCALE IN FEET".



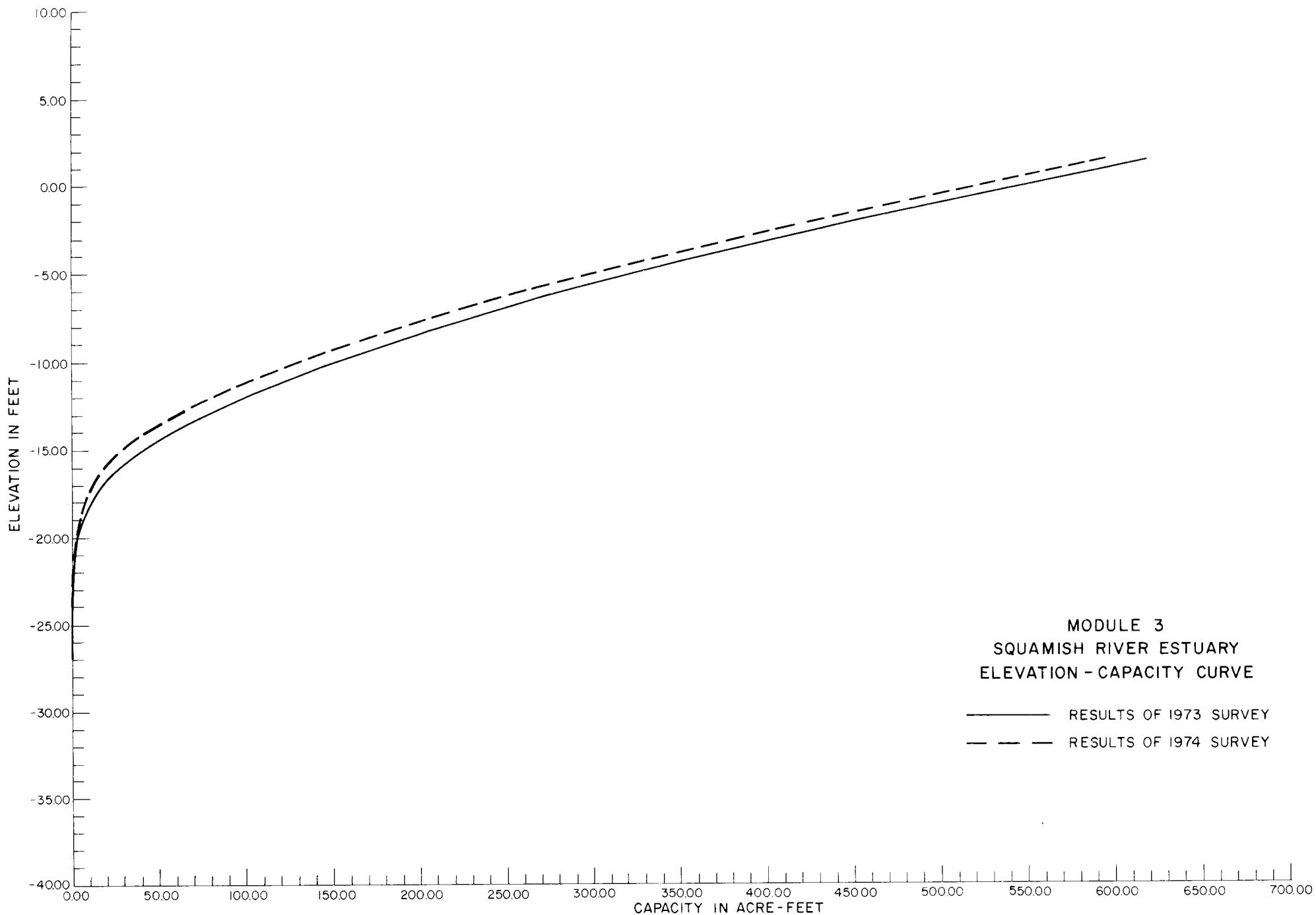
MODULE 3 SQUAMISH

DIFFERENCE CONTOURS
COMPARISON OF
1973 AND 1974
RESULTS

CONTOUR INTERVAL = 1 FT.

NOTE : NEGATIVE CONTOURS ARE EROSION
POSITIVE CONTOURS ARE DEPOSITION

0 50 100 150 200 FEET



SEDIMENT SURVEY SECTION
OTTAWA, ONT.
MAY 3 1976

SQUAMISH ESTUARY 1973 MODULE 3

PAGE 1

* ELEVATION - CAPACITY TABLE *

* ELEVATION * (FT)	* ACC. VOLUME * (ACRE-FT)	* ELEVATION * (FT)	* ACC. VOLUME * (ACRE-FT)	* ELEVATION * (FT)	* ACC. VOLUME * (ACRE-FT)	* ELEVATION * (FT)	* ACC. VOLUME * (ACRE-FT)
*	*	*	*	*	*	*	*
* -26.50	.0	* -14.00	58.0	* -1.50	473.0	*	*
*	*	*	*	*	*	*	*
* -26.00	.0	* -13.50	67.7	* -.00	496.7	*	*
*	*	*	*	*	*	*	*
* -25.50	.0	* -13.00	77.5	* -.50	520.8	*	*
*	*	*	*	*	*	*	*
* -25.00	.1	* -12.50	86.4	* 0.00	545.2	*	*
*	*	*	*	*	*	*	*
* -24.50	.1	* -12.00	99.8	* .50	569.8	*	*
*	*	*	*	*	*	*	*
* -24.00	.1	* -11.50	111.9	* 1.00	594.5	*	*
*	*	*	*	*	*	*	*
* -23.50	.2	* -11.00	124.8	* 1.50	619.2	*	*
*	*	*	*	*	*	*	*
* -23.00	.3	* -10.50	138.3	*	*	*	*
*	*	*	*	*	*	*	*
* -22.50	.5	* -10.00	152.3	*	*	*	*
*	*	*	*	*	*	*	*
* -22.00	.7	* -9.50	166.8	*	*	*	*
*	*	*	*	*	*	*	*
* -21.50	1.1	* -9.00	181.7	*	*	*	*
*	*	*	*	*	*	*	*
* -21.00	1.7	* -8.50	197.0	*	*	*	*
*	*	*	*	*	*	*	*
* -20.50	2.5	* -8.00	212.7	*	*	*	*
*	*	*	*	*	*	*	*
* -20.00	3.6	* -7.50	229.0	*	*	*	*
*	*	*	*	*	*	*	*
* -19.50	4.9	* -7.00	245.7	*	*	*	*
*	*	*	*	*	*	*	*
* -19.00	6.6	* -6.50	263.1	*	*	*	*
*	*	*	*	*	*	*	*
* -18.50	8.7	* -6.00	281.4	*	*	*	*
*	*	*	*	*	*	*	*
* -18.00	11.3	* -5.50	300.5	*	*	*	*
*	*	*	*	*	*	*	*
* -17.50	14.4	* -5.00	320.2	*	*	*	*
*	*	*	*	*	*	*	*
* -17.00	18.1	* -4.50	340.5	*	*	*	*
*	*	*	*	*	*	*	*
* -16.50	22.7	* -4.00	361.4	*	*	*	*
*	*	*	*	*	*	*	*
* -16.00	28.2	* -3.50	382.8	*	*	*	*
*	*	*	*	*	*	*	*
* -15.50	34.5	* -3.00	404.6	*	*	*	*
*	*	*	*	*	*	*	*
* -15.00	41.6	* -2.50	427.0	*	*	*	*
*	*	*	*	*	*	*	*
* -14.50	49.5	* -2.00	449.8	*	*	*	*
*	*	*	*	*	*	*	*

SEDIMENT SURVEY SECTION
OTTAWA, ONT.
MAY 3 1976

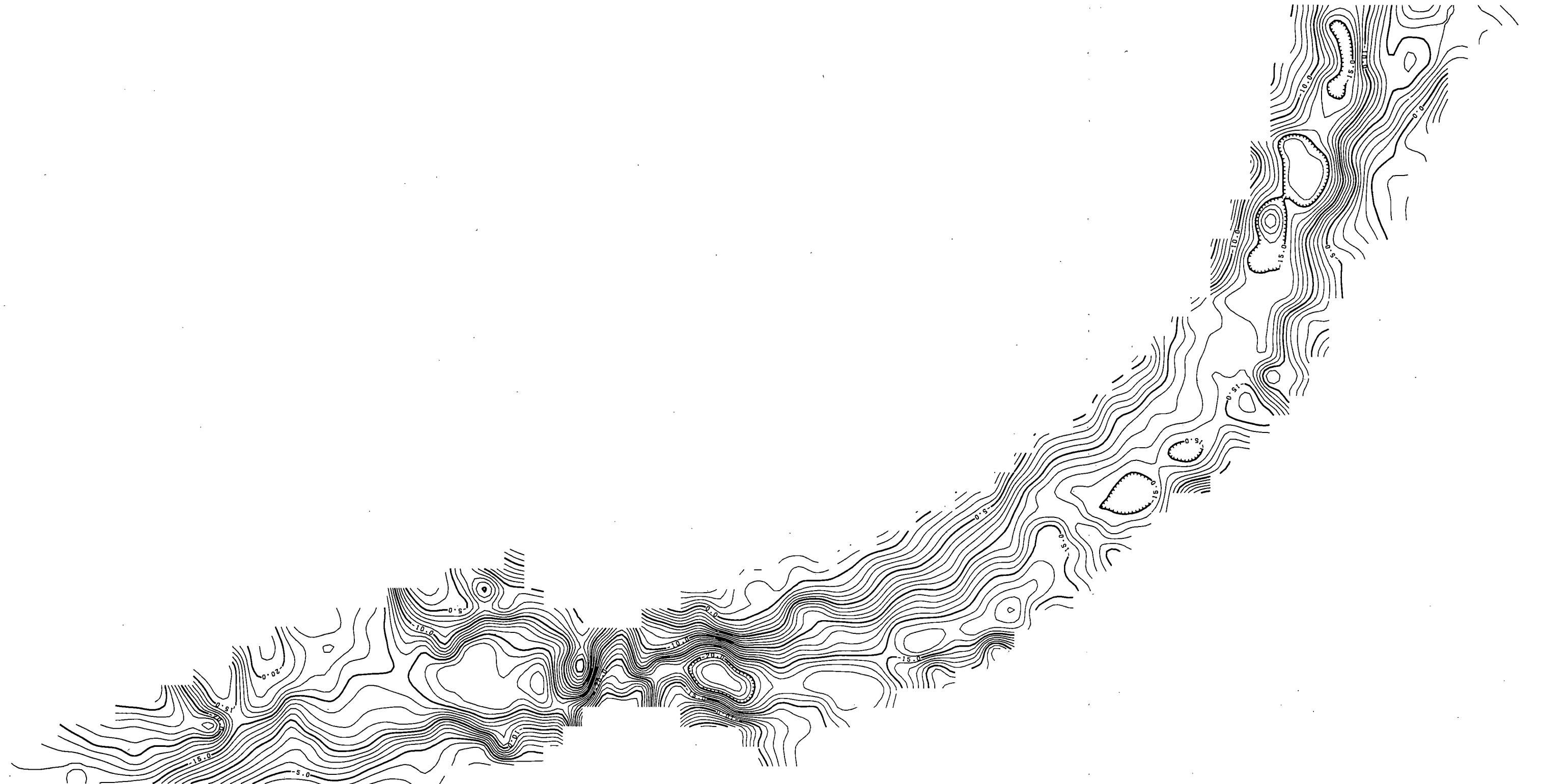
SQUAMISH ESTUARY 1974 MODULE 3

PAGE 1

* ELEVATION - CAPACITY TABLE *

* ELEVATION * (FT)	* ACC. VOLUME * (ACRE-FT)	* ELEVATION * (FT)	* ACC. VOLUME * (ACRE-FT)	* ELEVATION * (FT)	* ACC. VOLUME * (ACRE-FT)	* ELEVATION * (FT)	* ACC. VOLUME * (ACRE-FT)
*	*	*	*	*	*	*	*
* -25.50	.0	* -13.00	60.1	* -.50	498.9	*	*
*	*	*	*	*	*	*	*
* -25.00	.1	* -12.50	70.0	* 0.00	522.7	*	*
*	*	*	*	*	*	*	*
* -24.50	.1	* -12.00	80.7	* .50	546.7	*	*
*	*	*	*	*	*	*	*
* -24.00	.2	* -11.50	92.0	* 1.00	570.8	*	*
*	*	*	*	*	*	*	*
* -23.50	.2	* -11.00	103.9	* 1.50	594.9	*	*
*	*	*	*	*	*	*	*
* -23.00	.4	* -10.50	116.6	*	*	*	*
*	*	*	*	*	*	*	*
* -22.50	.5	* -10.00	129.8	*	*	*	*
*	*	*	*	*	*	*	*
* -22.00	.8	* -9.50	143.7	*	*	*	*
*	*	*	*	*	*	*	*
* -21.50	1.1	* -9.00	158.4	*	*	*	*
*	*	*	*	*	*	*	*
* -21.00	1.5	* -8.50	173.7	*	*	*	*
*	*	*	*	*	*	*	*
* -20.50	2.0	* -8.00	189.5	*	*	*	*
*	*	*	*	*	*	*	*
* -20.00	2.8	* -7.50	205.9	*	*	*	*
*	*	*	*	*	*	*	*
* -19.50	3.7	* -7.00	223.1	*	*	*	*
*	*	*	*	*	*	*	*
* -19.00	4.7	* -6.50	241.0	*	*	*	*
*	*	*	*	*	*	*	*
* -18.50	6.1	* -6.00	259.6	*	*	*	*
*	*	*	*	*	*	*	*
* -18.00	7.8	* -5.50	278.9	*	*	*	*
*	*	*	*	*	*	*	*
* -17.50	9.7	* -5.00	298.6	*	*	*	*
*	*	*	*	*	*	*	*
* -17.00	12.2	* -4.50	318.8	*	*	*	*
*	*	*	*	*	*	*	*
* -16.50	15.4	* -4.00	339.7	*	*	*	*
*	*	*	*	*	*	*	*
* -16.00	19.1	* -3.50	361.1	*	*	*	*
*	*	*	*	*	*	*	*
* -15.50	23.6	* -3.00	383.0	*	*	*	*
*	*	*	*	*	*	*	*
* -15.00	29.0	* -2.50	405.3	*	*	*	*
*	*	*	*	*	*	*	*
* -14.50	35.4	* -2.00	428.2	*	*	*	*
*	*	*	*	*	*	*	*
* -14.00	42.7	* -1.50	451.4	*	*	*	*
*	*	*	*	*	*	*	*
* -13.50	51.1	* -1.00	475.0	*	*	*	*
*	*	*	*	*	*	*	*

MOD. 4



MODULE 4 SQUAMISH

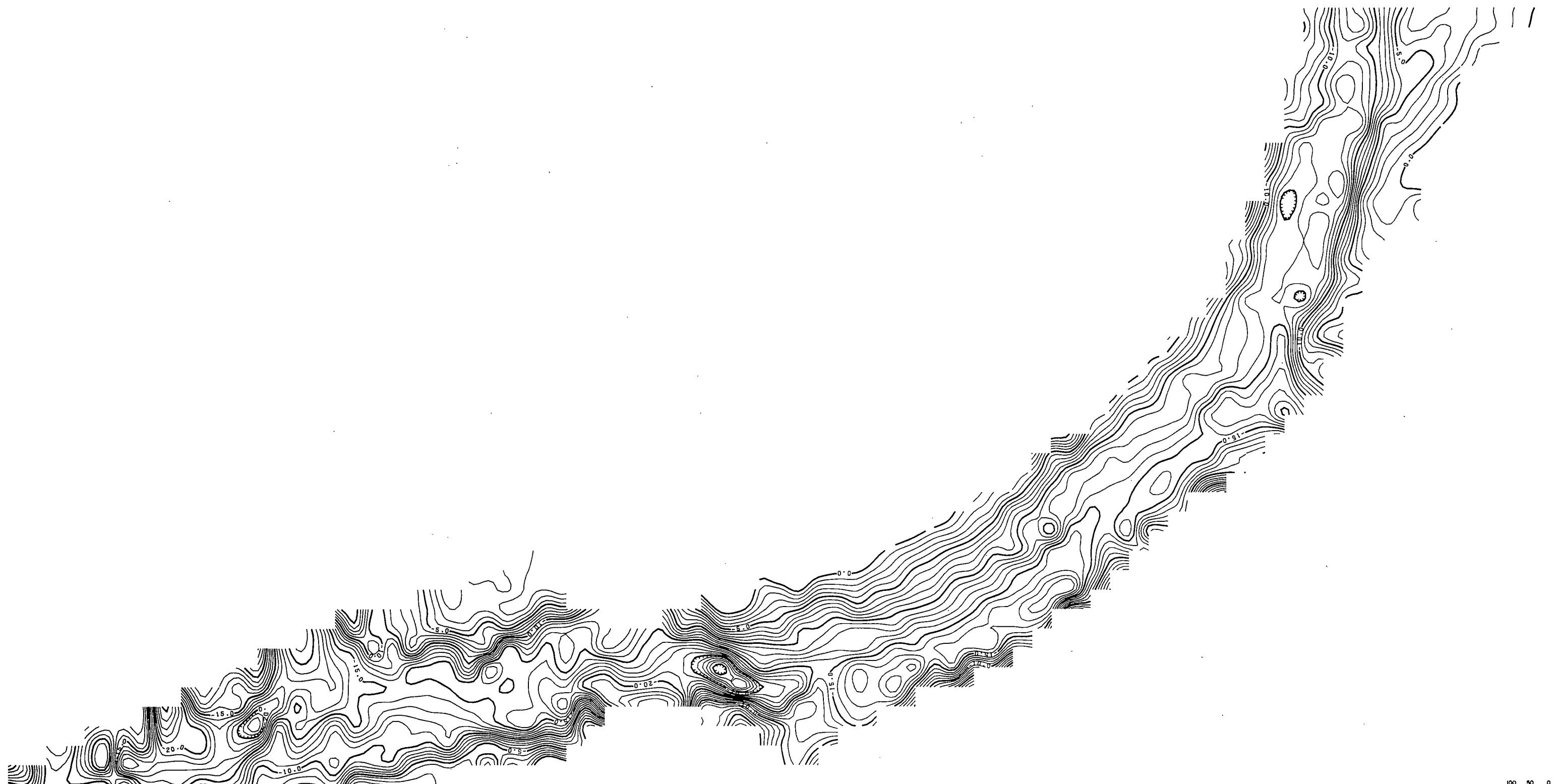
RESULTS OF 1973
MORPHOLOGICAL SURVEY

CONTOUR INTERVAL = 1 FT.

DATUM : GSC - MEAN SEA LEVEL = 0

100 50 0 100 200 300 400

SCALE IN FEET



MODULE 4 SQUAMISH

RESULTS OF 1974

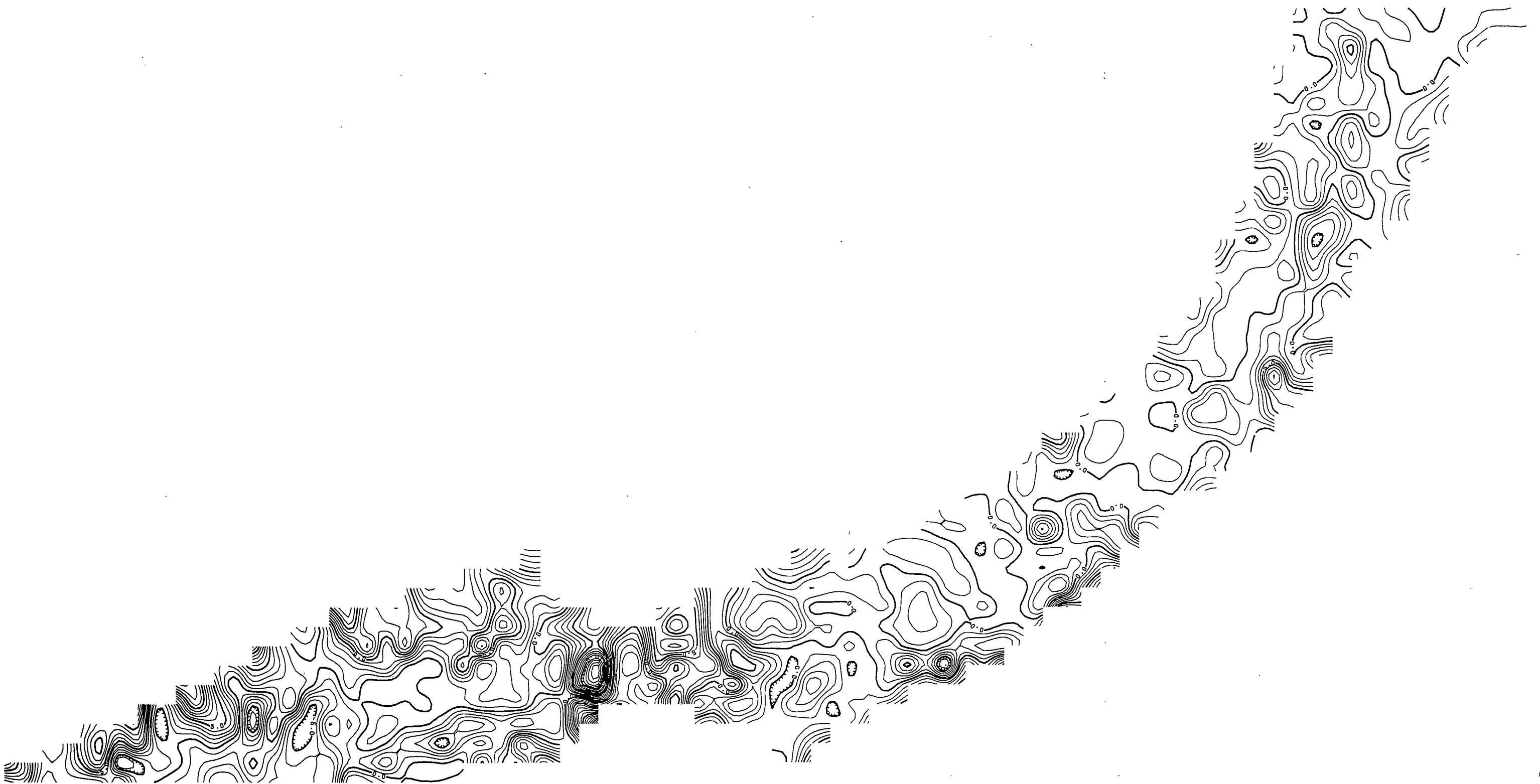
MORPHOLOGICAL SURVEY

CONTOUR INTERVAL = 1 FT.

DATUM; GSC - MEAN SEA LEVEL = 0

100 50 0 100 200 300 400

SCALE IN FEET



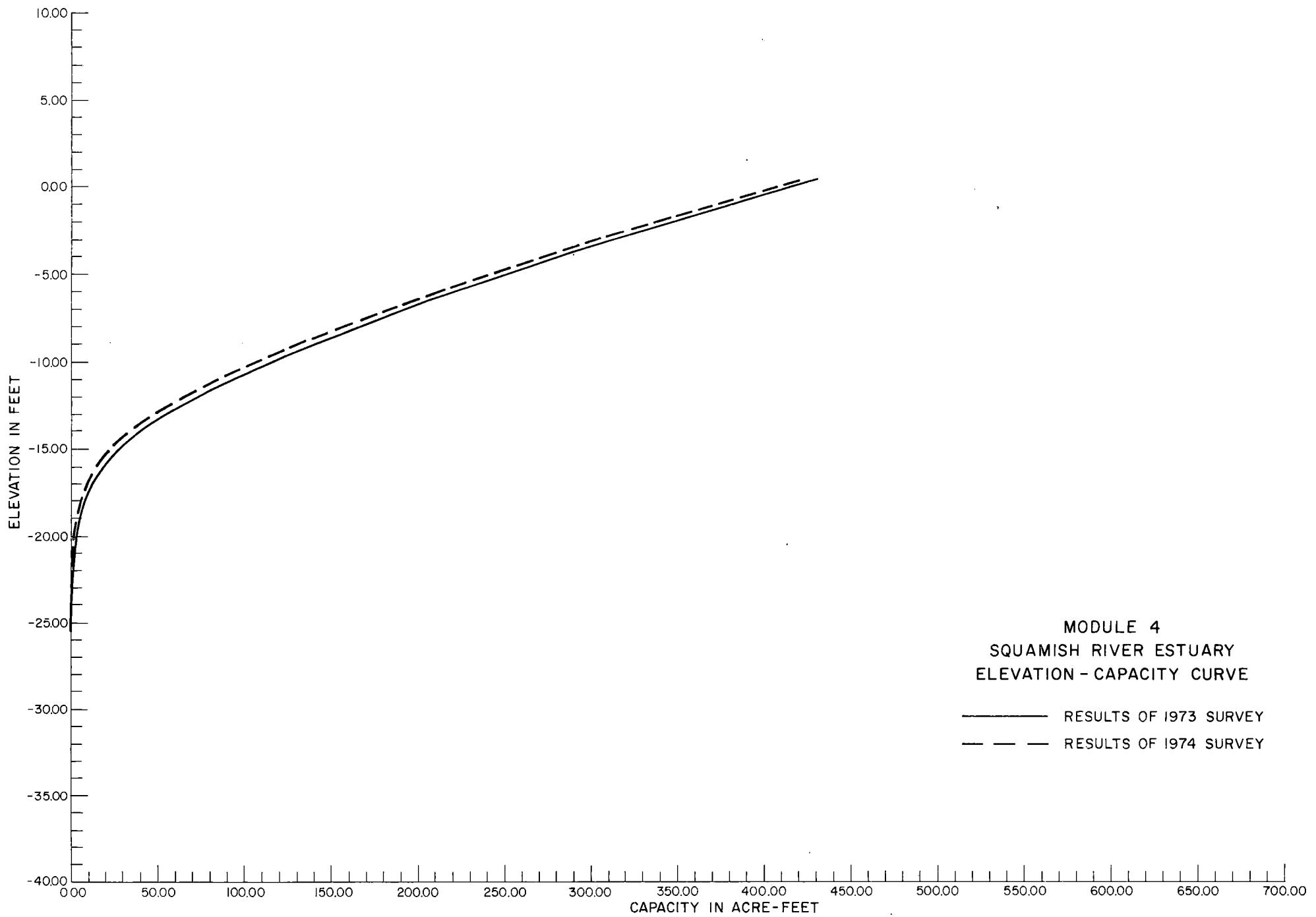
MODULE 4 SQUAMISH

DIFFERENCE CONTOURS
COMPARISON OF
1973 AND 1974
RESULTS

CONTOUR INTERVAL • 1 FT.

NOTE : NEGATIVE CONTOURS ARE EROSION
POSITIVE CONTOURS ARE DEPOSITION

0 50 100 150 200 FEET



SEDIMENT SURVEY SECTION
OTTAWA, ONT.
MAY 3 1976

SQUAMISH ESTUARY 1973 MODULE 4

PAGE 1

* ELEVATION - CAPACITY TABLE *

* ELEVATION * (FT)	* ACC. VOLUME * (ACRE-FT)	* ELEVATION * (FT)	* ACC. VOLUME * (ACRE-FT)	* ELEVATION * (FT)	* ACC. VOLUME * (ACRE-FT)	* ELEVATION * (FT)	* ACC. VOLUME * (ACRE-FT)
*	*	*	*	*	*	*	*
* -25.50	.0	* -13.00	55.4	* -.50	395.3	*	*
* -25.00	.1	* -12.50	64.0	* 0.00	412.7	*	*
* -24.50	.1	* -12.00	73.2	* .50	430.1	*	*
* -24.00	.2	* -11.50	83.1	*	*	*	*
* -23.50	.3	* -11.00	93.4	*	*	*	*
* -23.00	.5	* -10.50	104.2	*	*	*	*
* -22.50	.8	* -10.00	115.4	*	*	*	*
* -22.00	1.2	* -9.50	127.1	*	*	*	*
* -21.50	1.7	* -9.00	139.1	*	*	*	*
* -21.00	2.2	* -8.50	151.5	*	*	*	*
* -20.50	2.8	* -8.00	164.3	*	*	*	*
* -20.00	3.5	* -7.50	177.4	*	*	*	*
* -19.50	4.4	* -7.00	190.9	*	*	*	*
* -19.00	5.4	* -6.50	204.6	*	*	*	*
* -18.50	6.6	* -6.00	218.7	*	*	*	*
* -18.00	8.1	* -5.50	233.2	*	*	*	*
* -17.50	10.0	* -5.00	248.1	*	*	*	*
* -17.00	12.5	* -4.50	263.4	*	*	*	*
* -16.50	15.5	* -4.00	279.1	*	*	*	*
* -16.00	19.1	* -3.50	295.0	*	*	*	*
* -15.50	23.4	* -3.00	311.2	*	*	*	*
* -15.00	28.3	* -2.50	327.6	*	*	*	*
* -14.50	33.8	* -2.00	344.3	*	*	*	*
* -14.00	40.2	* -1.50	361.1	*	*	*	*
* -13.50	47.4	* -1.00	378.1	*	*	*	*

SEDIMENT SURVEY SECTION
OTTAWA, ONT.
MAY 3 1976

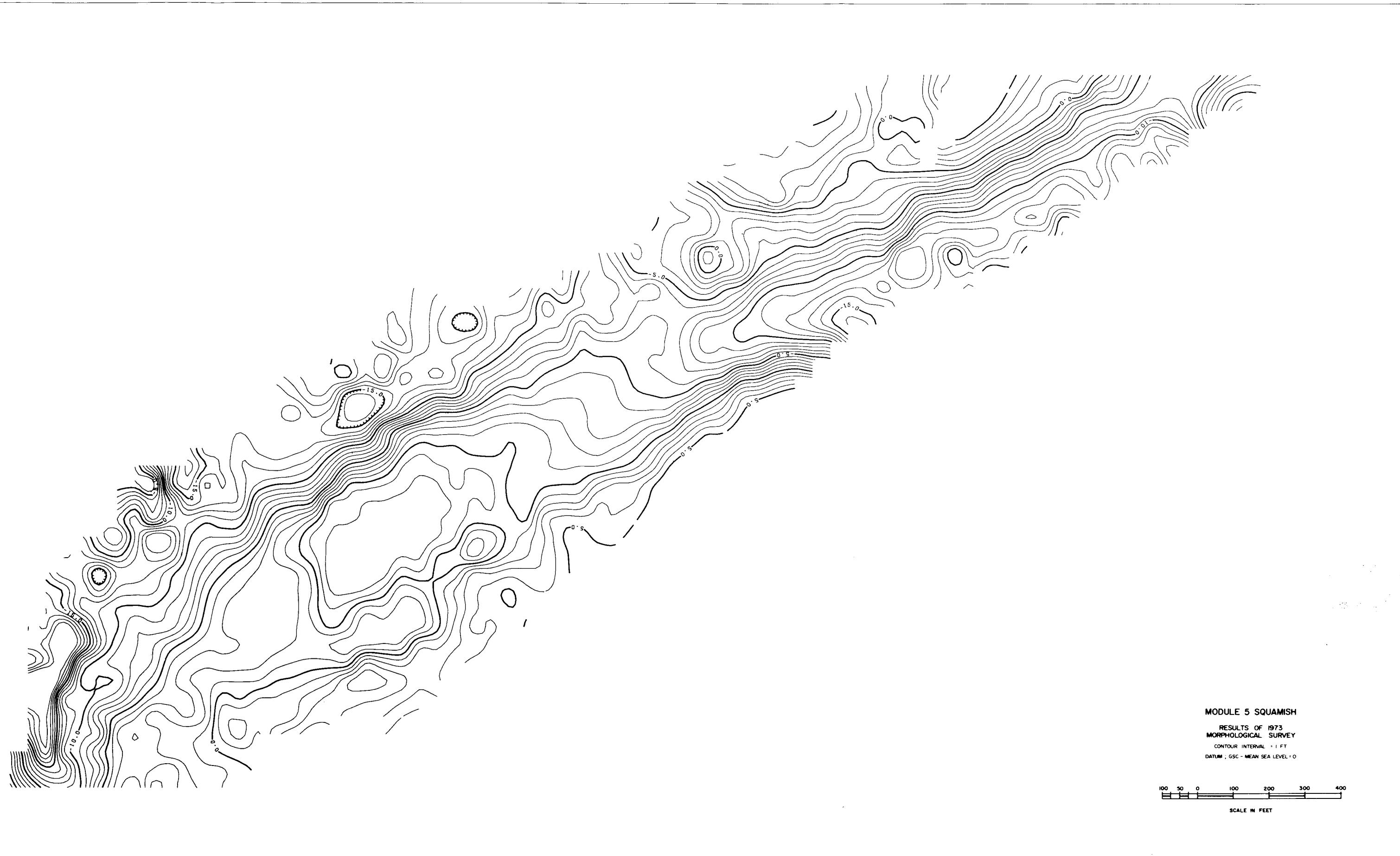
SQUAMISH ESTUARY 1974 MODULE 4

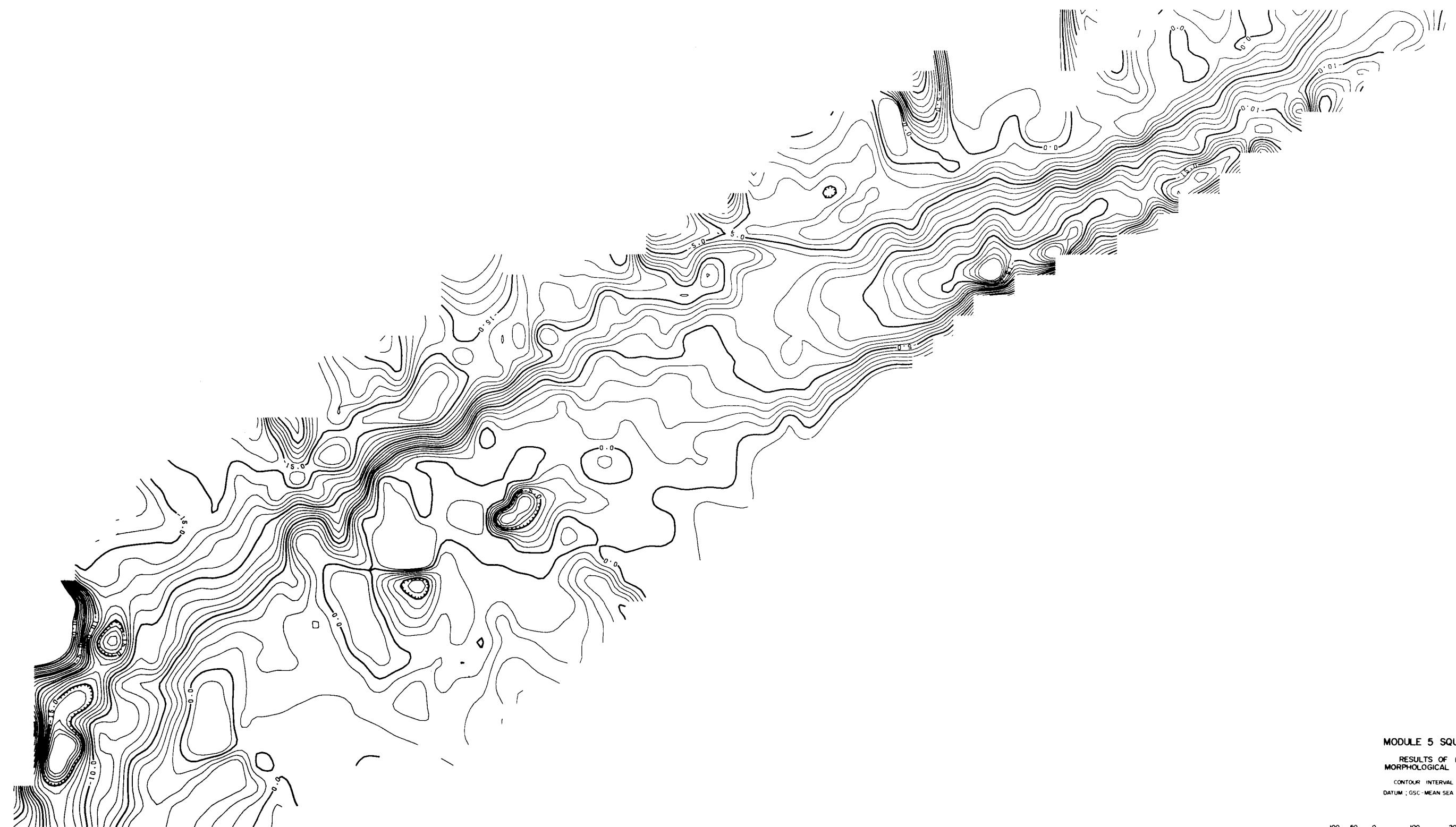
PAGE 1

* ELEVATION - CAPACITY TABLE *

* ELEVATION * (FT)	* ACC. VOLUME * (ACRE-FT)	* ELEVATION * (FT)	* ACC. VOLUME * (ACRE-FT)	* ELEVATION * (FT)	* ACC. VOLUME * (ACRE-FT)	* ELEVATION * (FT)	* ACC. VOLUME * (ACRE-FT)
*	*	*	*	*	*	*	*
* -24.50	.0	* -12.00	64.1	* .50	419.5	* .50	*
*	*	*	*	*	*	*	*
* -24.00	.1	* -11.50	73.6	*	*	*	*
*	*	*	*	*	*	*	*
* -23.50	.2	* -11.00	83.8	*	*	*	*
*	*	*	*	*	*	*	*
* -23.00	.3	* -10.50	94.5	*	*	*	*
*	*	*	*	*	*	*	*
* -22.50	.4	* -10.00	105.5	*	*	*	*
*	*	*	*	*	*	*	*
* -22.00	.5	* -9.50	117.0	*	*	*	*
*	*	*	*	*	*	*	*
* -21.50	.7	* -9.00	128.9	*	*	*	*
*	*	*	*	*	*	*	*
* -21.00	.9	* -8.50	141.3	*	*	*	*
*	*	*	*	*	*	*	*
* -20.50	1.2	* -8.00	154.1	*	*	*	*
*	*	*	*	*	*	*	*
* -20.00	1.6	* -7.50	167.3	*	*	*	*
*	*	*	*	*	*	*	*
* -19.50	2.2	* -7.00	180.8	*	*	*	*
*	*	*	*	*	*	*	*
* -19.00	3.1	* -6.50	194.4	*	*	*	*
*	*	*	*	*	*	*	*
* -18.50	4.2	* -6.00	208.5	*	*	*	*
*	*	*	*	*	*	*	*
* -18.00	5.5	* -5.50	222.9	*	*	*	*
*	*	*	*	*	*	*	*
* -17.50	7.0	* -5.00	237.6	*	*	*	*
*	*	*	*	*	*	*	*
* -17.00	9.0	* -4.50	252.6	*	*	*	*
*	*	*	*	*	*	*	*
* -16.50	11.5	* -4.00	268.0	*	*	*	*
*	*	*	*	*	*	*	*
* -16.00	14.4	* -3.50	283.6	*	*	*	*
*	*	*	*	*	*	*	*
* -15.50	18.0	* -3.00	299.6	*	*	*	*
*	*	*	*	*	*	*	*
* -15.00	22.3	* -2.50	315.9	*	*	*	*
*	*	*	*	*	*	*	*
* -14.50	27.4	* -2.00	332.6	*	*	*	*
*	*	*	*	*	*	*	*
* -14.00	33.2	* -1.50	349.6	*	*	*	*
*	*	*	*	*	*	*	*
* -13.50	39.9	* -1.00	366.8	*	*	*	*
*	*	*	*	*	*	*	*
* -13.00	47.3	* -.50	384.3	*	*	*	*
*	*	*	*	*	*	*	*
* -12.50	55.3	* 0.00	401.8	*	*	*	*
*	*	*	*	*	*	*	*

MOD. 5





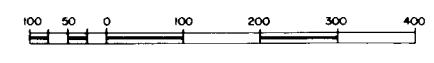
MODULE 5 SQUAMISH

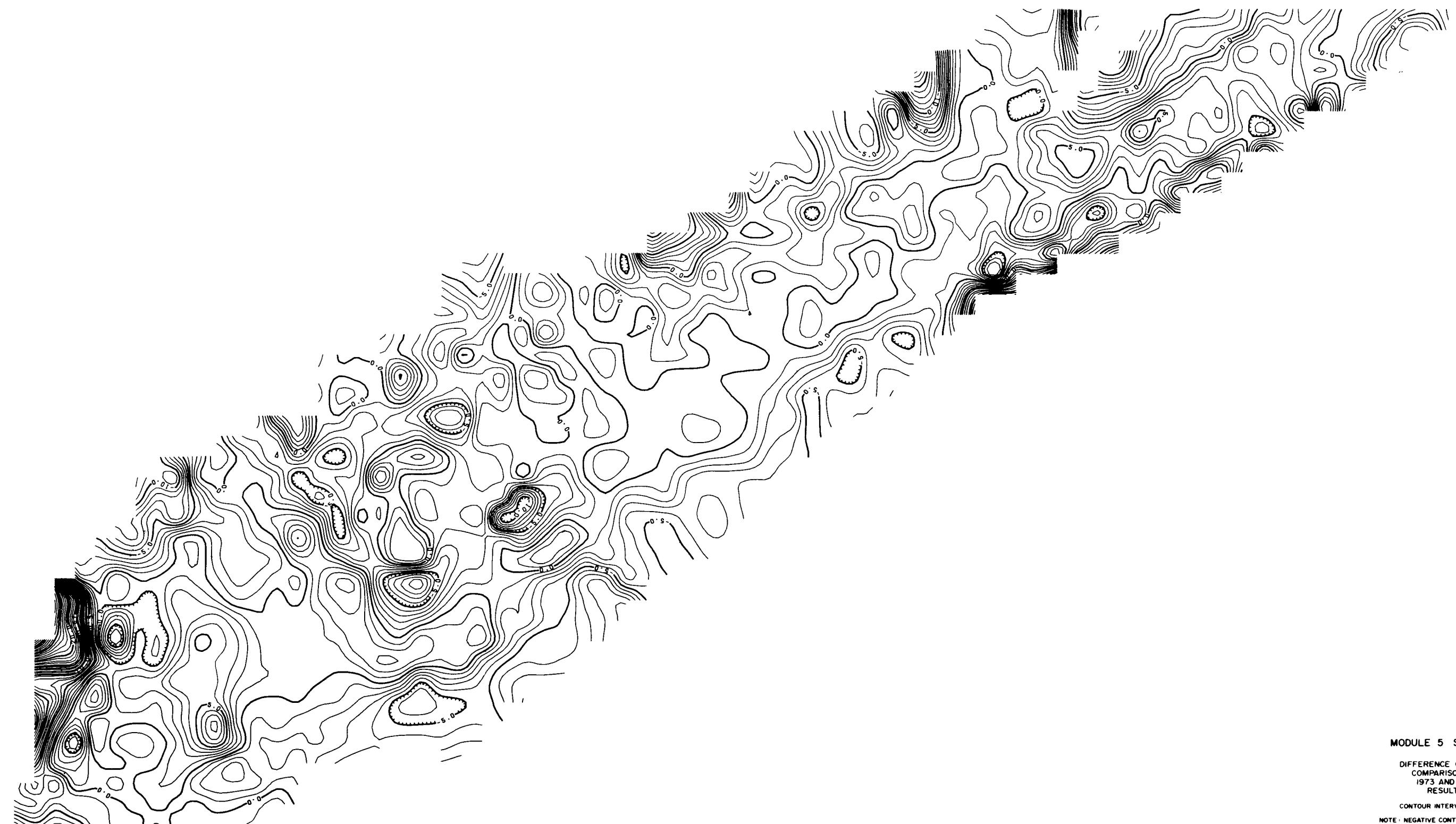
RESULTS OF 1974

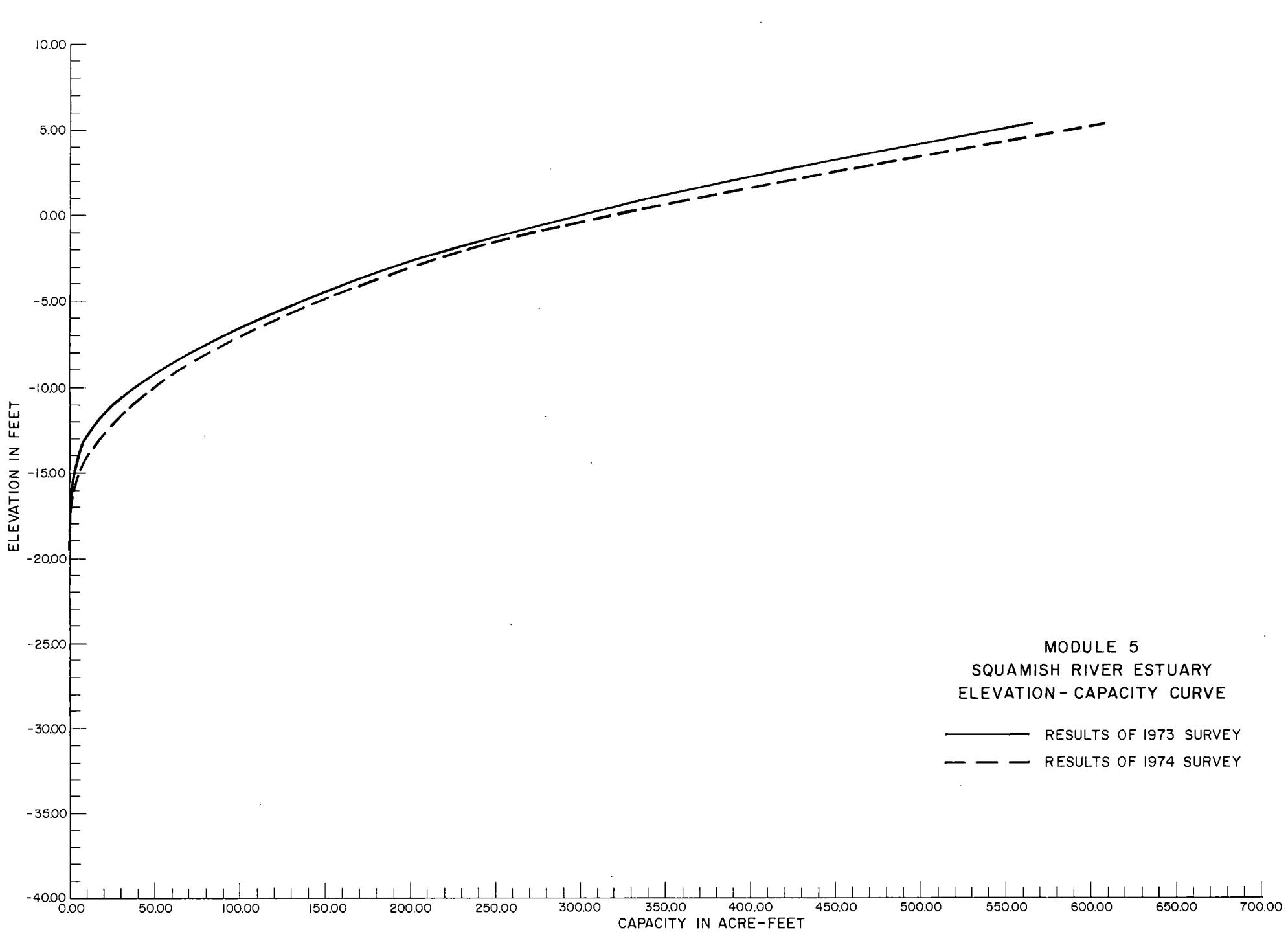
MORPHOLOGICAL SURVEY

CONTOUR INTERVAL = 1 FT

DATUM : GSC-MEAN SEA LEVEL = 0







SEDIMENT SURVEY SECTION
OTTAWA, ONT.
MAY 3 1976

SQUAMISH ESTUARY 1973 MODULE 5

PAGE 1

* ELEVATION - CAPACITY TABLE *

* ELEVATION * (FT)	* ACC. VOLUME * (ACRE-FT)	* ELEVATION * (FT)	* ACC. VOLUME * (ACRE-FT)	* ELEVATION * (FT)	* ACC. VOLUME * (ACRE-FT)	* ELEVATION * (FT)	* ACC. VOLUME * (ACRE-FT)
*	*	*	*	*	*	*	*
* -19.50	.0	* -7.00	88.9	* 5.50	564.6	*	*
*	*	*	*	*	*	*	*
* -19.00	.1	* -6.50	99.2	*	*	*	*
*	*	*	*	*	*	*	*
* -18.50	.2	* -6.00	110.2	*	*	*	*
*	*	*	*	*	*	*	*
* -18.00	.3	* -5.50	121.7	*	*	*	*
*	*	*	*	*	*	*	*
* -17.50	.5	* -5.00	133.9	*	*	*	*
*	*	*	*	*	*	*	*
* -17.00	.7	* -4.50	146.4	*	*	*	*
*	*	*	*	*	*	*	*
* -16.50	1.1	* -4.00	159.5	*	*	*	*
*	*	*	*	*	*	*	*
* -16.00	1.5	* -3.50	173.2	*	*	*	*
*	*	*	*	*	*	*	*
* -15.50	2.1	* -3.00	187.8	*	*	*	*
*	*	*	*	*	*	*	*
* -15.00	2.8	* -2.50	203.2	*	*	*	*
*	*	*	*	*	*	*	*
* -14.50	3.6	* -2.00	219.6	*	*	*	*
*	*	*	*	*	*	*	*
* -14.00	4.9	* -1.50	236.9	*	*	*	*
*	*	*	*	*	*	*	*
* -13.50	6.7	* -1.00	255.1	*	*	*	*
*	*	*	*	*	*	*	*
* -13.00	9.1	* -.50	274.2	*	*	*	*
*	*	*	*	*	*	*	*
* -12.50	12.2	* 0.00	294.1	*	*	*	*
*	*	*	*	*	*	*	*
* -12.00	16.0	* .50	314.8	*	*	*	*
*	*	*	*	*	*	*	*
* -11.50	20.5	* 1.00	336.3	*	*	*	*
*	*	*	*	*	*	*	*
* -11.00	25.7	* 1.50	358.7	*	*	*	*
*	*	*	*	*	*	*	*
* -10.50	31.5	* 2.00	381.9	*	*	*	*
*	*	*	*	*	*	*	*
* -10.00	38.0	* 2.50	405.9	*	*	*	*
*	*	*	*	*	*	*	*
* -9.50	45.0	* 3.00	430.9	*	*	*	*
*	*	*	*	*	*	*	*
* -9.00	52.6	* 3.50	456.6	*	*	*	*
*	*	*	*	*	*	*	*
* -8.50	60.8	* 4.00	482.9	*	*	*	*
*	*	*	*	*	*	*	*
* -8.00	69.7	* 4.50	509.7	*	*	*	*
*	*	*	*	*	*	*	*
* -7.50	79.0	* 5.00	537.0	*	*	*	*
*	*	*	*	*	*	*	*

SEDIMENT SURVEY SECTION
OTTAWA, ONT.
MAY 3 1976

SQUAMISH ESTUARY 1974 MODULE 5

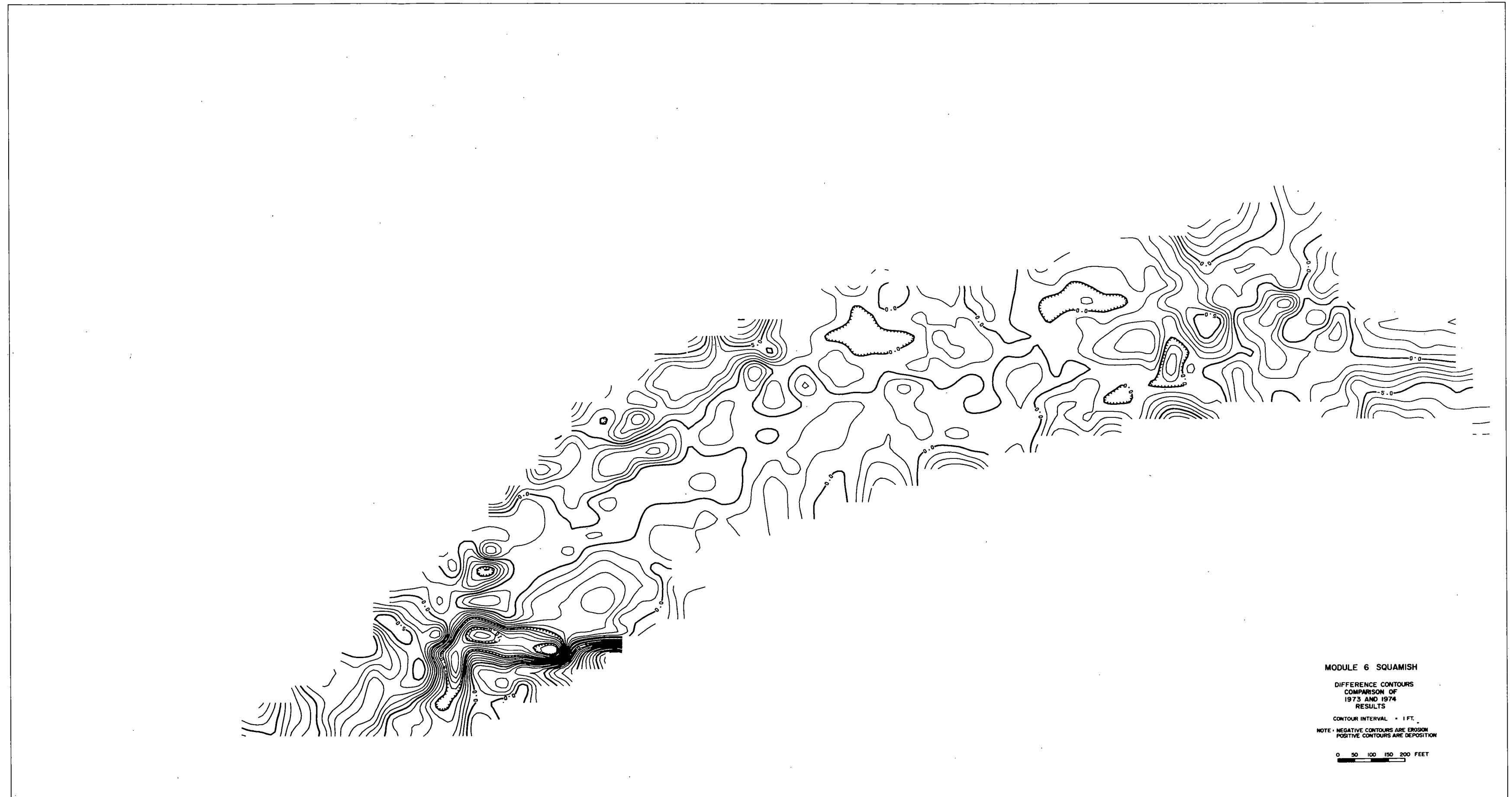
PAGE 1

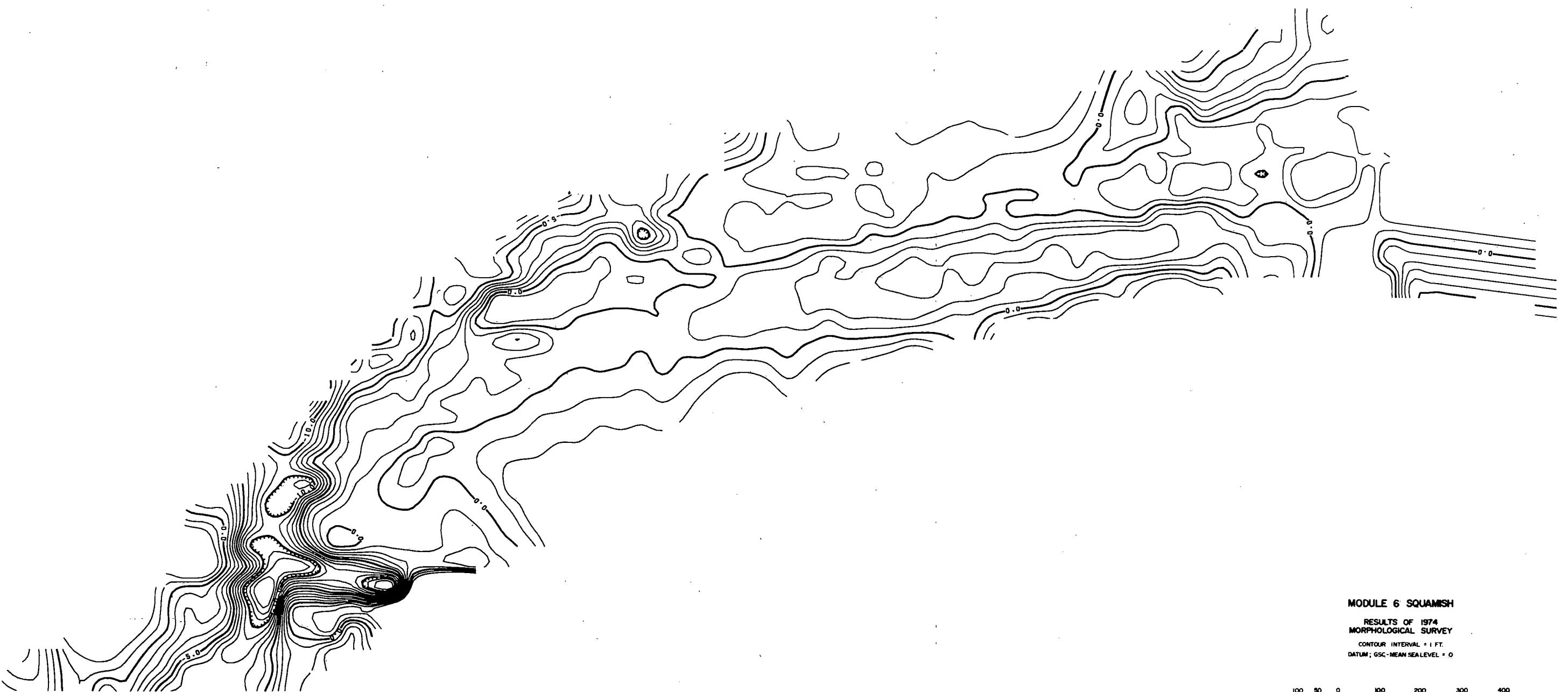
* ELEVATION - CAPACITY TABLE *

* ELEVATION * (FT)	* ACC. VOLUME * (ACRE-FT)	* ELEVATION * (FT)	* ACC. VOLUME * (ACRE-FT)	* ELEVATION * (FT)	* ACC. VOLUME * (ACRE-FT)	* ELEVATION * (FT)	* ACC. VOLUME * (ACRE-FT)
*	*	*	*	*	*	*	*
* -19.50	.0	* -7.00	99.4	* 5.50	607.7	*	*
* -19.00	.1	* -6.50	109.9	*	*	*	*
* -18.50	.2	* -6.00	120.9	*	*	*	*
* -18.00	.4	* -5.50	132.5	*	*	*	*
* -17.50	.7	* -5.00	144.7	*	*	*	*
* -17.00	1.1	* -4.50	157.4	*	*	*	*
* -16.50	1.8	* -4.00	170.7	*	*	*	*
* -16.00	2.6	* -3.50	184.6	*	*	*	*
* -15.50	3.8	* -3.00	199.2	*	*	*	*
* -15.00	5.3	* -2.50	214.6	*	*	*	*
* -14.50	7.4	* -2.00	231.1	*	*	*	*
* -14.00	10.1	* -1.50	248.9	*	*	*	*
* -13.50	13.5	* -1.00	268.1	*	*	*	*
* -13.00	17.3	* -.50	289.2	*	*	*	*
* -12.50	21.6	* 0.00	312.1	*	*	*	*
* -12.00	26.2	* .50	336.5	*	*	*	*
* -11.50	31.1	* 1.00	362.0	*	*	*	*
* -11.00	36.5	* 1.50	388.2	*	*	*	*
* -10.50	42.5	* 2.00	414.9	*	*	*	*
* -10.00	48.9	* 2.50	442.0	*	*	*	*
* -9.50	55.8	* 3.00	469.3	*	*	*	*
* -9.00	63.4	* 3.50	496.8	*	*	*	*
* -8.50	71.6	* 4.00	524.4	*	*	*	*
* -8.00	80.2	* 4.50	552.1	*	*	*	*
* -7.50	89.5	* 5.00	579.8	*	*	*	*

MOD. 6







MODULE 6 SQUAMISH

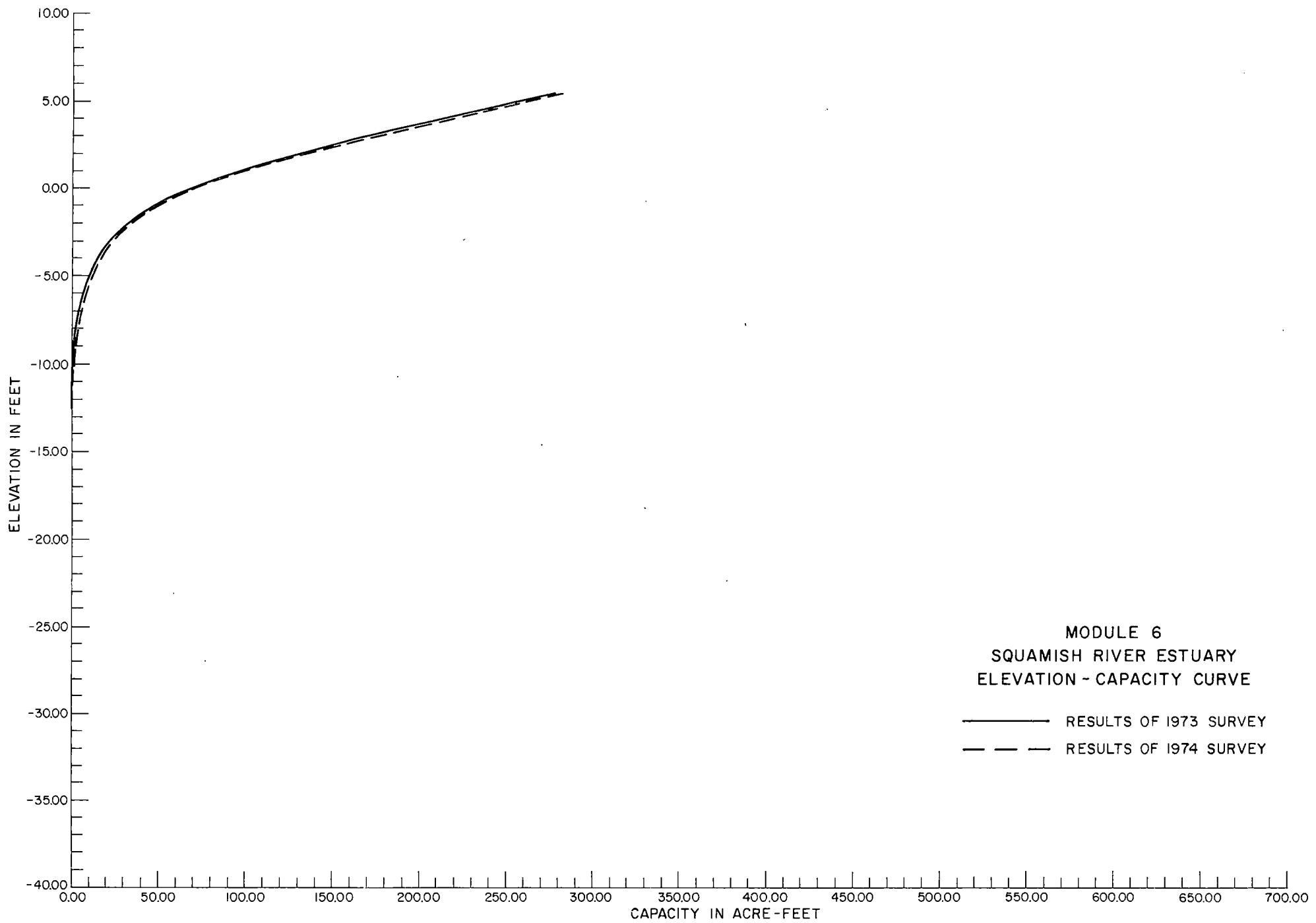
RESULTS OF 1974

MORPHOLOGICAL SURVEY

CONTOUR INTERVAL 1 FT.

DATUM: GSC-MEAN SEA LEVEL = 0

100 50 0 100 200 300 400
SCALE IN FEET



SEDIMENT SURVEY SECTION
OTTAWA, ONT.
MAY 3 1976

SQUAMISH ESTUARY 1973 MODULE 6

PAGE 1

* ELEVATION - CAPACITY TABLE *

* ELEVATION (FT)	ACC. VOLUME (ACRE-FT)						
*	*	*	*	*	*	*	*
* -12.00	.0	* .50	80.7	* *	*	*	*
* -11.50	.1	* 1.00	95.3	* *	*	*	*
* -11.00	.1	* 1.50	111.5	* *	*	*	*
* -10.50	.2	* 2.00	129.1	* *	*	*	*
* -10.00	.3	* 2.50	147.9	* *	*	*	*
* -9.50	.4	* 3.00	167.7	* *	*	*	*
* -9.00	.7	* 3.50	188.6	* *	*	*	*
* -8.50	1.2	* 4.00	210.2	* *	*	*	*
* -8.00	1.7	* 4.50	232.1	* *	*	*	*
* -7.50	2.3	* 5.00	254.3	* *	*	*	*
* -7.00	3.1	* 5.50	276.6	* *	*	*	*
* -6.50	4.2	*	*	*	*	*	*
* -6.00	5.6	*	*	*	*	*	*
* -5.50	7.3	*	*	*	*	*	*
* -5.00	9.2	*	*	*	*	*	*
* -4.50	11.4	*	*	*	*	*	*
* -4.00	14.1	*	*	*	*	*	*
* -3.50	17.2	*	*	*	*	*	*
* -3.00	21.0	*	*	*	*	*	*
* -2.50	25.7	*	*	*	*	*	*
* -2.00	31.5	*	*	*	*	*	*
* -1.50	38.3	*	*	*	*	*	*
* -1.00	46.4	*	*	*	*	*	*
* -.50	56.1	*	*	*	*	*	*
* 0.00	67.5	*	*	*	*	*	*

SEDIMENT SURVEY SECTION
OTTAWA, ONT.
MAY 3 1976

SQUAMISH ESTUARY 1974 MODULE 6

PAGE 1

* ELEVATION - CAPACITY TABLE *

* ELEVATION * (FT)	* ACC. VOLUME * (ACRE-FT)	* ELEVATION * (FT)	* ACC. VOLUME * (ACRE-FT)	* ELEVATION * (FT)	* ACC. VOLUME * (ACRE-FT)	* ELEVATION * (FT)	* ACC. VOLUME * (ACRE-FT)
*	*	*	*	*	*	*	*
* -12.50	.0	* 0.00		69.1	*		
*	*	*	*	*	*	*	*
* -12.00	.1	* .50		82.1	*		
*	*	*	*	*	*	*	*
* -11.50	.3	* 1.00		97.0	*		
*	*	*	*	*	*	*	*
* -11.00	.5	* 1.50		114.0	*		
*	*	*	*	*	*	*	*
* -10.50	.8	* 2.00		133.1	*		
*	*	*	*	*	*	*	*
* -10.00	1.2	* 2.50		153.3	*		
*	*	*	*	*	*	*	*
* -9.50	1.7	* 3.00		174.0	*		
*	*	*	*	*	*	*	*
* -9.00	2.2	* 3.50		195.2	*		
*	*	*	*	*	*	*	*
* -8.50	2.8	* 4.00		216.7	*		
*	*	*	*	*	*	*	*
* -8.00	3.6	* 4.50		238.4	*		
*	*	*	*	*	*	*	*
* -7.50	4.5	* 5.00		260.3	*		
*	*	*	*	*	*	*	*
* -7.00	5.5	* 5.50		282.2	*		
*	*	*	*	*	*	*	*
* -6.50	6.7	*		*	*		
*	*	*	*	*	*	*	*
* -6.00	8.1	*		*	*		
*	*	*	*	*	*	*	*
* -5.50	9.7	*		*	*		
*	*	*	*	*	*	*	*
* -5.00	11.7	*		*	*		
*	*	*	*	*	*	*	*
* -4.50	14.0	*		*	*		
*	*	*	*	*	*	*	*
* -4.00	16.5	*		*	*		
*	*	*	*	*	*	*	*
* -3.50	19.5	*		*	*		
*	*	*	*	*	*	*	*
* -3.00	23.3	*		*	*		
*	*	*	*	*	*	*	*
* -2.50	27.8	*		*	*		
*	*	*	*	*	*	*	*
* -2.00	33.5	*		*	*		
*	*	*	*	*	*	*	*
* -1.50	40.3	*		*	*		
*	*	*	*	*	*	*	*
* -1.00	48.4	*		*	*		
*	*	*	*	*	*	*	*
* -.50	57.9	*		*	*		
*	*	*	*	*	*	*	*