

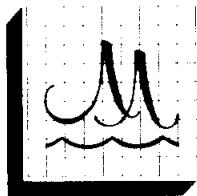
HISTORICAL FLOODING REVIEW AND  
FLOOD RISK MAPPING STUDY  
FOR PARSON'S POND

Report to:

Canada-Newfoundland Flood Damage  
Reduction Program  
c/o Water Resources Division  
Department of Environment and Lands  
4th Floor  
Confederation Building West Block  
P.O. Box 4750  
St. John's, Newfoundland  
A1C 5T7

MARTEC LIMITED  
Halifax Insurance Building, Suite 805  
5670 Spring Garden Road  
Halifax, Nova Scotia  
B3J 1H6

December 1988



## Martec Limited

Contract Research in  
Engineering and Ocean Science

5670 Spring Garden Road  
Halifax, Nova Scotia  
Canada B3J 1H6

Telephone (902) 425-5101  
Telex via New York 760-1304  
Envoy MARTEC.LTD  
Facsimile (902) 421-1923

December 16, 1988

Canada-Newfoundland Flood Damage  
Reduction Centre  
c/o Water Resources Division  
Department of Environment and Lands  
4th Floor  
Confederation Building West Block  
P.O. Box 4750  
St. John's, Newfoundland  
A1C 5T7

Attention: Mr. Robert Picco

Gentlemen:

We are pleased to submit the final report entitled "Historical Flooding Review and Flood Risk Mapping Study for Parson's Pond". The comments and suggestions from the Technical Committee on the previous draft report have been incorporated in this final report.

We would like to express our sincere thanks to you and other members of the Committee for your cooperation and assistance throughout this study.

Yours very truly,

MARTEC LIMITED

Dr. J.L. Warner, PEng  
Vice-President

## TABLE OF CONTENTS

	Page
Letter of Transmittal	
Table of Contents	
List of Tables	
List of Figures	
1.0 INTRODUCTION	1.1
2.0 PHYSIOGRAPHY	2.1
3.0 CLIMATOLOGY	3.1
4.0 HISTORICAL FLOODING	4.1
5.0 METHODOLOGY	5.1
6.0 THE FIELD PROGRAM	6.1
7.0 DATA PROCESSING	7.1
8.0 DATA ANALYSES	8.1
8.1 Tidal Analysis	8.1
8.2 Correlation Analysis	8.11
8.3 Extremal Analysis	8.20
8.4 Fresh Water Influence	8.26
8.5 Wave Runup and Overtopping	8.31
9.0 FLOOD LEVEL CONTOURS	9.1
10.0 REMEDIAL MEASURES	10.1
11.0 CONCLUSIONS AND RECOMMENDATIONS	11.1
REFERENCES	
APPENDIX A Water Level Data at Parson's Pond and Lark Harbour	
APPENDIX B Barometric Pressure Data at Daniel's Harbour	
APPENDIX C Parson's Pond Fresh Water Inflow Surcharge Prediction	
APPENDIX D Parson's Pond Hydrology	
APPENDIX E Flood Risk Map for Parson's Pond	

## LIST OF TABLES

		Page
Table 3.1	Wind Statistics at Parson's Pond	3.2
Table 8.1.1	Principal Tidal Constituents Derived from Lark Harbour Data	8.3
Table 8.1.2	Tidal Constituents Derived from Parson's Pond Data	8.4
Table 8.3.1	Tests for Independence, Trend, Homogeneity and Randomness	8.25
Table 8.3.2	Extremal Analysis of Parson's Pond Water Level Data	8.27
Table 8.3.3	Water Level at Parson's Pond for Selected Return Periods	8.28
Table 8.5.1	Overtopping Rates ( $m^3/s$ per metre of shoreline)	8.42
Table C.1	Parson's Pond Water Levels from Various Scenarios	C.4
Table D.1	Parson's Pond Flood Frequencies	D.2

## LIST OF FIGURES

		Page
<b>Figure 1.1</b>	<b>Location Map</b>	1.2
<b>Figure 2.1</b>	<b>Parson's Pond Region</b>	2.2
<b>Figure 2.2</b>	<b>Sea Level Statistics for West Coast of Newfoundland</b>	2.4
<b>Figure 4.1</b>	<b>Historical Flood Plain at Parson's Pond</b>	4.2
<b>Figure 5.1</b>	<b>Flowchart of Solution Methodology</b>	5.2
<b>Figure 6.1</b>	<b>Float Gauge Instrumentation</b>	6.3
<b>Figure 6.2</b>	<b>Instrument Locations - Parson's Pond</b>	6.4
<b>Figure 7.1</b>	<b>Water Level Measured at Parson's Pond</b>	7.2
<b>Figure 8.1.1</b>	<b>Surge at Lark Harbour - Oct</b>	8.5
<b>Figure 8.1.2</b>	<b>Surge at Lark Harbour - Nov</b>	8.6
<b>Figure 8.1.3</b>	<b>Surge at Lark Harbour - Dec</b>	8.7
<b>Figure 8.1.4</b>	<b>Surge at Parson's Pond - Oct</b>	8.8
<b>Figure 8.1.5</b>	<b>Surge at Parson's Pond - Nov</b>	8.9
<b>Figure 8.1.6</b>	<b>Surge at Parson's Pond - Dec</b>	8.10
<b>Figure 8.2.1</b>	<b>Difference in Surge at Parson's Pond and Lark Harbour - Oct</b>	8.12
<b>Figure 8.2.2</b>	<b>Difference in Surge at Parson's Pond and Lark Harbour - Nov</b>	8.13
<b>Figure 8.2.3</b>	<b>Difference in Surge at Parson's Pond and Lark Harbour - Dec</b>	8.14
<b>Figure 8.2.4</b>	<b>Cross Correlation Between Lark Harbour and Parson's Pond Surge</b>	8.16
<b>Figure 8.2.5</b>	<b>Lark Harbour Versus Parson's Pond Surge</b>	8.19
<b>Figure 8.3.1</b>	<b>Distribution of Water Levels at Lark Harbour</b>	8.21
<b>Figure 8.3.2</b>	<b>Extreme Events at Parson's Pond</b>	8.29

## LIST OF FIGURES (Continued)

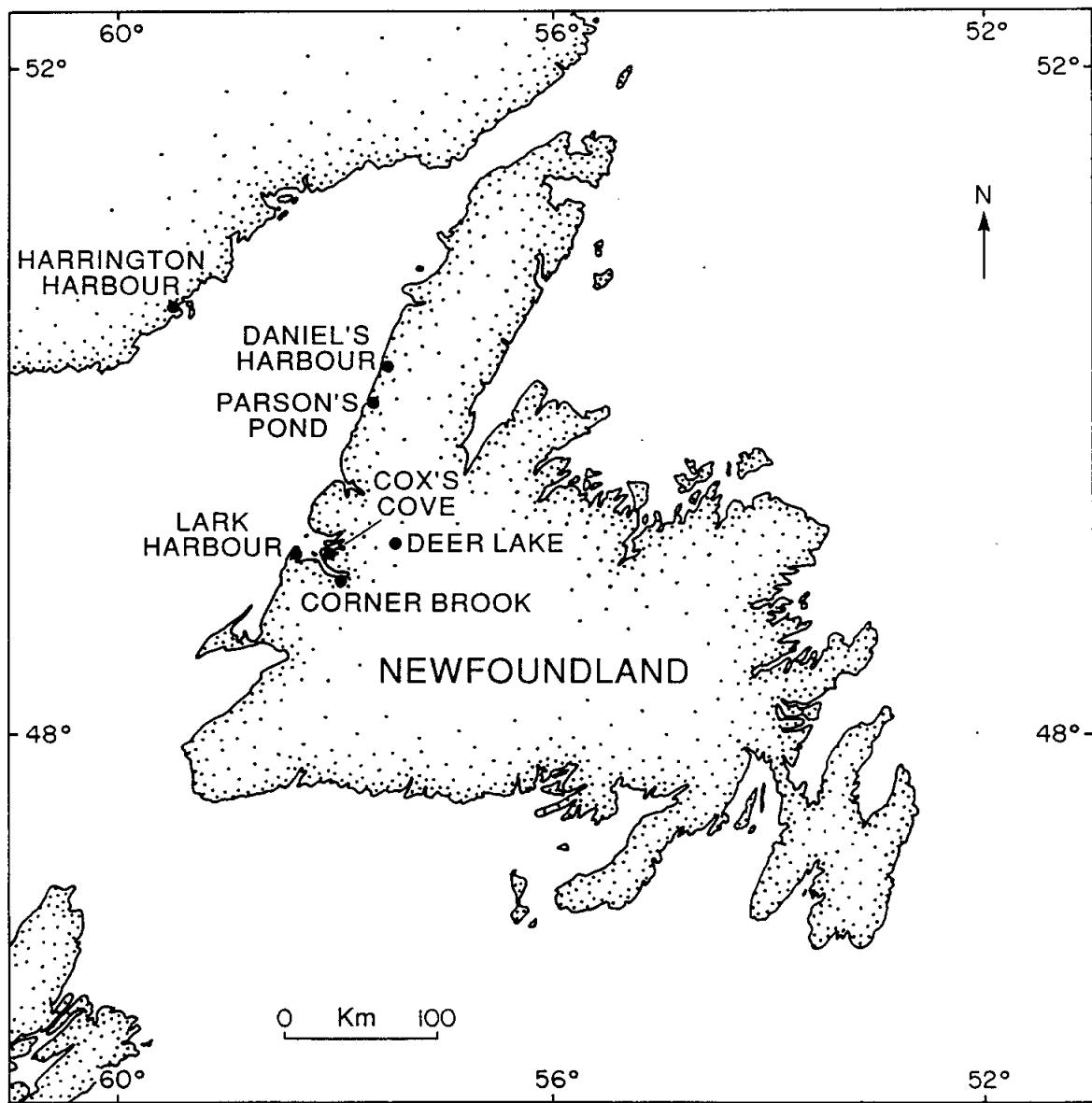
	Page
Figure 8.5.1      Schematic Diagram of Waves in the Breaker Zone (from Figure A-2 of SPM, 1977)	8.33
Figure 8.5.2      Deepwater Wave Forecasting Curves as a Function of Wind Speed, Fetch Length, and Wind Duration (for Fetches 1 to 1,000 Miles) (from Figure 3-15 of SPM, 1977)	8.34
Figure 8.5.3      Dimensionless Design Breaker Height Versus Relative Depth at Structure (from Figure 7-4 of SPM, 1977)	8.35
Figure 8.5.4      Breaker Height Index $H_b/H'^o$ Versus $H_b/gT^2$ (from Figure 7-5 of SPM, 1977)	8.36
Figure 8.5.5      Wave Runup on Smooth, Impermeable Slopes when $d_s/H'^o = 0.80$ (from Figure 7-10 of SPM, 1977)	8.38
Figure 8.5.6      Wave Runup on Smooth, Impermeable Slopes when $d_s/H'^o = 2.0$ (from Figure 7-11 of SPM, 1977)	8.39
Figure 8.5.7      Runup Correction for Scale Effects (from Figure 7-13 of SPM, 1977)	8.40
Figure 8.5.8      Overtopping Parameters $\alpha$ and $Q_{\star o}$ (from Figure 7-27 of SPM, 1977)	8.41
Figure D.1      Winter Flood Hydrograph (1:20 Year)	D.3

## 1.0 INTRODUCTION

Under the auspices of the governments of Canada and the Province of Newfoundland, the Flood Damage Reduction Program has identified several locations throughout Newfoundland that warrant a flood risk study. Two of these locations are Parson's Pond and Cox's Cove. This report deals with the flooding at Parson's Pond and corresponding documentation for Cox's Cove can be found in a separate report.

The flooding characteristics of Parson's Pond ( $52^{\circ}02'N$ ,  $57^{\circ}43'W$ ), located just to the north of Gros Morne National Park, have been examined and the 1 in 20 year and 1 in 100 year flooding events determined. Information on historical flooding of the community and the technical methodology used to calculate and map the flood plain is also included in this report.

A location map of the study area is presented in Figure 1.1.



**FIGURE 1.1**  
**LOCATION MAP**

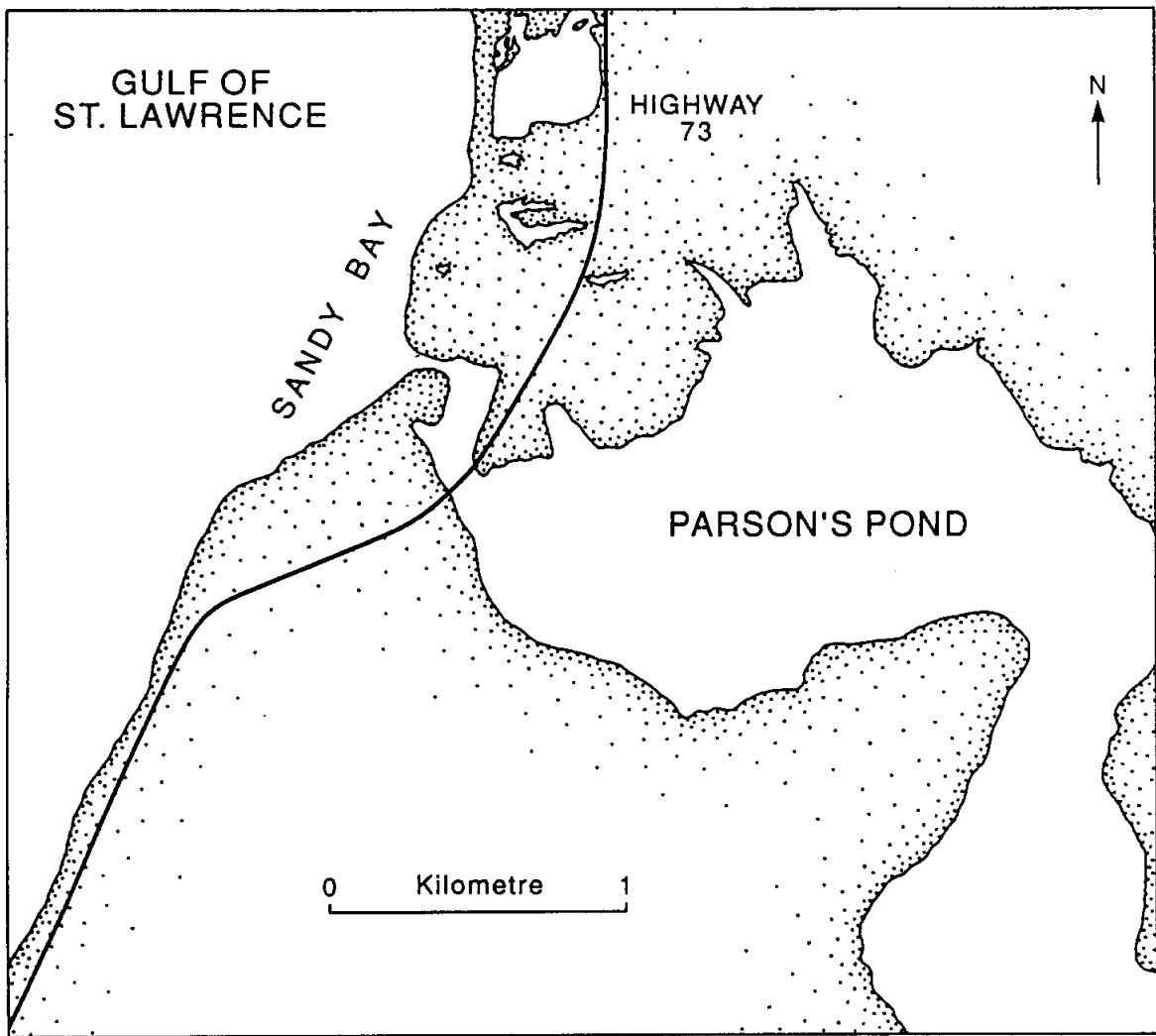
## 2.0 PHYSIOGRAPHY

The Community of Parson's Pond is situated just north of Gros Morne National Park on the west coast of Newfoundland's Northern Peninsula (see Figure 2.1). The central part of the community, including both residential and business property, is located in the area on the south side of the channel that connects the Pond to the sea.

The mouth of Parson's Pond River lies near the southern end of a 2 km beach on Sandy Bay. This coastline is fully exposed to the marine conditions of the northeast Gulf of St. Lawrence. The beach is made up of coarse shingle, stones, and sand. It has a steep beach front (1:10 slope) and a gentler slope of 1 in 100 out to the 60 m isobath (Canadian Hydrographic Service 1986).

There is low lying land to both the north and south of the mouth of the channel. Along the beach a natural breakwater, consisting of loose stones, rises to a height of 2-3 m above mean sea level. In the winter shore-fast ice rafted up along the beach affords further protection to the beach material by reducing the erosive effect of the waves. Spring tides reach levels of 1.2 m above mean sea level leaving only a .8 to 1.8 m margin against flooding. The addition of large waves to a storm surge in excess of this margin can cause flooding. Past flooding has resulted when storm conditions have breached the barrier allowing sea water to inundate this area. The long-term stability of this natural breakwater is uncertain as the community has arranged for dredge spoil and beach material to be deposited along the barrier to increase its effectiveness.

The source of the largest variation in the sea level in the area is the tide, which is classified as a mixed, mainly semidiurnal type. Details of the tidal regime have been calculated by the Canadian Hydrographic Service from water level data collected at Harrington Harbour ( $50^{\circ}31'N$ ,  $59^{\circ}29'W$ ) on the south coast of Labrador. This tidal regime is



**FIGURE 2.1**  
**PARSON'S POND REGION**

characterized by two highs and two lows each lunar day (about 24 hr. 50 min.) with a noticeable difference in height between two successive high, or two successive low tides. A fortnightly cycle dominates the variations giving high water levels at new and full moon (fortnightly) increasing the tidal range from a mean value of 1.5 m up to 2.2 m.

Figure 2.2 shows the annual variations in the water level regime along the west coast of Newfoundland. The tidal information was derived from the tides at Harrington Harbour, the regional reference port, for an 11 year period (1976-1987). The water level data gathered by the Canadian Hydrographic Service at Lark Harbour (1966-1986) was analyzed to provide the average monthly water level due to both tides and surge. It is evident from these data that there is a greater probability of having higher tides, and greater storm surges, in the October to February period.

It should be noted that while Harrington Harbour is the principal reference port for tides in the region, its long term water level (i.e. tides plus surge) is not a suitable database for examining the water level regime along Newfoundland's west coast. This is due to its location on the western side of the Gulf of St. Lawrence where the prevailing winds are from the west. In other words, the long term water level at Harrington Harbour would not adequately reflect the storm surge experienced at a site on the opposite shore, where Parson's Pond is located.

The Parson's Pond watershed comprises nearly 400 km<sup>2</sup>, with the Pond and the Channel making up about 20 km<sup>2</sup>. The influence of fresh water flooding has been determined using regional flood frequency analyses (Appendix D) and, while storm surge is the dominant driving force, fresh water flow effects have been included in the particular area of the town of Parson's Pond where there is some fresh water influences on flood levels.

MEAN  $\pm$  1 STANDARD DEVIATION

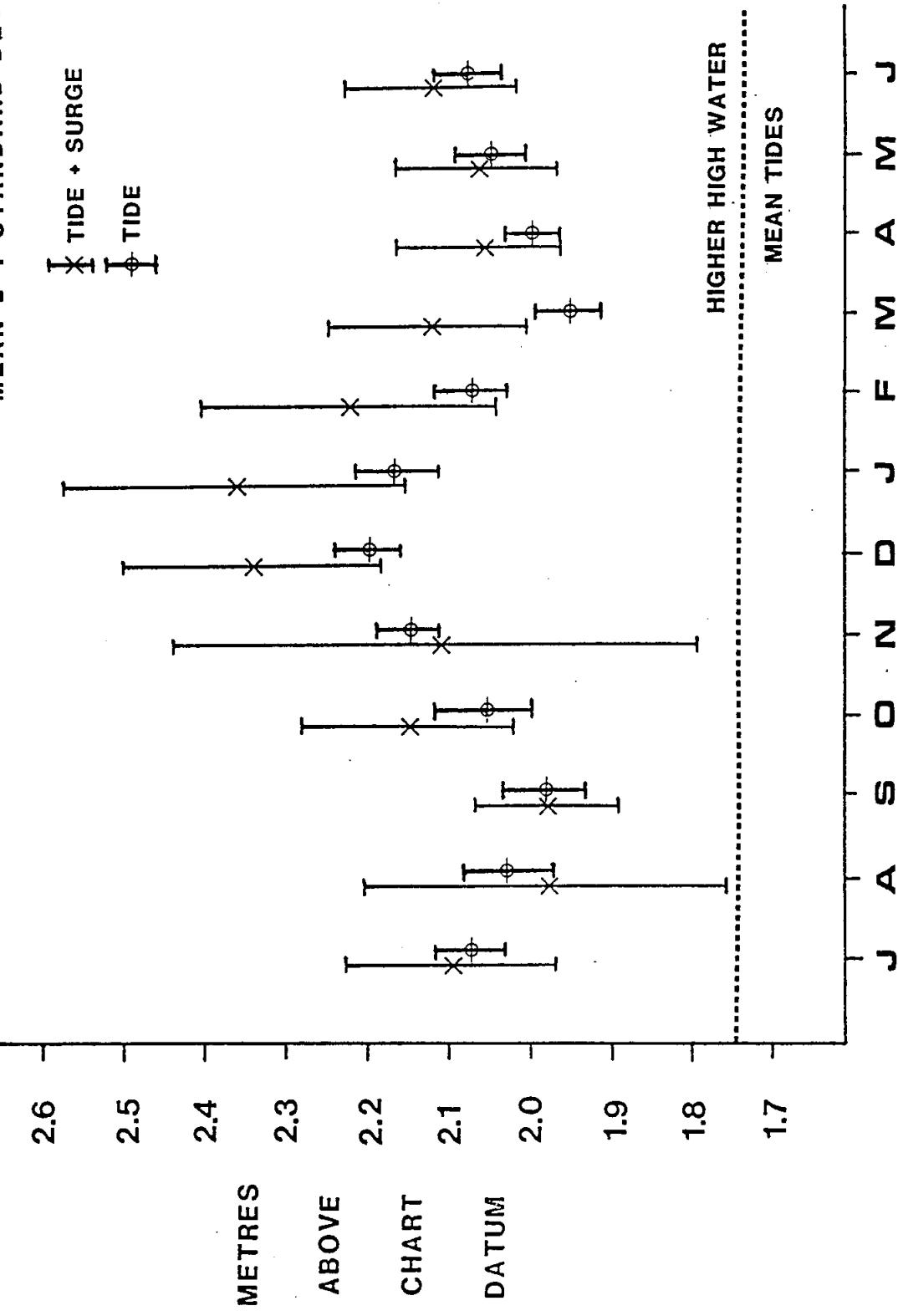


FIGURE 2.2

SEA LEVEL STATISTICS FOR WEST COAST OF NEWFOUNDLAND

There is a narrow opening, approximately 300 m long by 30 m wide, across the beach where the channel meets the sea. The northern side of this channel is cribbed to a height of roughly 0.5 m above Geodetic Datum for a stretch of 150 m. This narrow channel presents a constriction to water flow that results in tidal currents up to 5 knots during large tides (A. Payne, pers. comm.). The tidal range in Sandy Bay is 2.2 m during large tides and 1.4 m during mean tides. The constriction attenuates the tidal wave such that the range within Parson's Pond is reduced by about 25 percent, according to the local fishermen.

The water exchange between Sandy Bay and Parson's Pond is driven by the difference in water level along the channel between the two regions. At high tide this head difference causes water to flow into the Pond whereas when the tide falls, water flows from the Pond back into the sea. On the incoming tide there is thus a gradient in water level from the sea to the inner pond.

Any increase in the constrictive effect at the Pond end of the channel will result in a reduced volume of water able to flow into the Pond and thus a reduction in the surface water level gradient through the channel. Thus, on a large tide and surge, the constriction will cause slightly higher water levels near the constriction, which would allow water to flow over the low-crib work region adjacent to the upper channel.

This constriction to water flow in the channel, and hence the flooding potential in the area adjacent to the channel, is governed primarily by two mechanisms; channel dredging and ice jams. During periods when the channel has accumulated sediment, the reduced hydraulic radius reduces the surface gradient between the constriction and the sea which increases the probability of overtopping the cribwork. A similar result can also occur when pack ice from the Gulf becomes jammed under the bridge at Parson's Pond. As the tide rises and sea water is forced through the channel and into the Pond, the constriction reduces the

volume of water able to flow into Parson's Pond. The backup effect in the channel, between the bridge and the sea, can cause the low elevation cribwork on the north side to be overtapped.

### 3.0 CLIMATOLOGY

A climatological station, maintained by the Atmospheric Environment Service, has been operating at Daniel's Harbour, 22 km north of Parson's Pond, for over 15 years. This meteorological data is considered representative for the Parson's Pond area. The data in Table 3.1 show that there is a slight increase in the percentage frequency of winds blowing from the west during the flooding season. There is also an associated increase in the monthly mean wind speed during this period. The absence of a more significant change in the monthly mean statistics indicates that the onshore winds that cause flooding are due more to isolated events rather than prolonged, seasonally varying, wind conditions.

Storm surges are due to the combined influence of physiographic and climatological factors. Flooding events can result from any or all of three processes that cause surges: the stress of storm winds on the sea surface causing it to pile up, the inverted barometric effect near the low pressure storm centre causing the sea surface to rise, and a long surface wave that is generated by the two previous effects which can refract and steepen as it travels shoreward.

Of the 36 severe storms catalogued in the Gulf of St. Lawrence between 1957 and 1983, just over one third occurred during the period between late October and early January (Lewis and Moran, 1984). These storms are centred over areas of low pressure. Consequently, in addition to the direct influence of the wind on the sea surface causing the sea level to rise as it approaches the coast, the decreased atmospheric pressure also results in an increased sea level. For example, taking normal atmospheric pressure as 101 kPa, a storm with a central pressure of 95 kPa allows the sea level to rise as much as 6 cm. Parson's Pond, being located on an exposed coastal section of the Gulf of St. Lawrence, is therefore subject to both of these influences.

TABLE 3.1  
WIND STATISTICS AT PARSON'S POND

Percentage Frequency	J	F	M	A	M	J	J	A	S	O	N	D
Winds from SSW-NNW	64	64	58	55	52	57	61	61	65	60	65	61
Winds from due W	17	15	12	9	9	8	11	12	14	14	14	16

Mean Wind Speed (km/hr)	J	F	M	A	M	J	J	A	S	O	N	D
NW	23	24	24	25	22	20	20	20	20	21	21	21
W	27	26	25	21	21	19	18	18	20	22	24	25
SW	24	24	23	22	20	21	19	19	21	21	23	23
All directions	24	24	23	22	20	19	17	17	19	21	22	23

Source: Atmospheric Environment Service, 1982

#### 4.0 HISTORICAL FLOODING

Figure 4.1 illustrates the flood plain at Parson's Pond based on the flood events described in this section.

##### a) December 1976

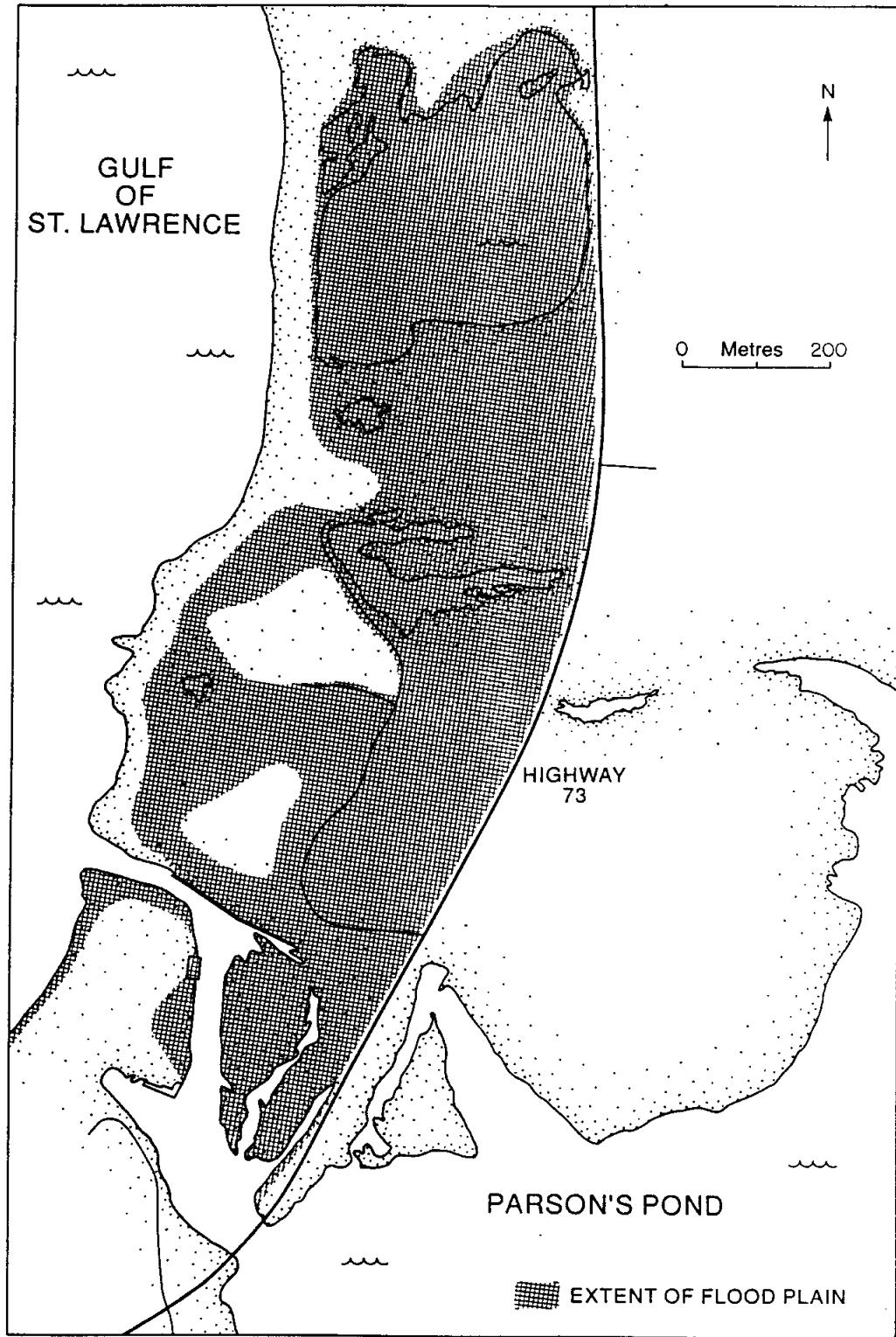
This flood event marked the first such incident in many years. Onshore winds and high tides during the 5-6 of December destroyed the protective natural beach barrier allowing sea water to flood the area north of the channel. Over 1 km<sup>2</sup> of land was affected. The area that experienced the most severe flooding was the low lying land bordered by the channel to the south, the road (Highway 430) to the east, and a small ridge about 1.2 km north of the channel.

The flooding took place over a 24 hour period which corresponds to the typical time scale of storm surges for this region.

##### b) December 1977

Under similar circumstances to the previous year's flood, that is high tides and strong onshore winds, Parson's Pond was again flooded during the 11 and 12 of December. Because the protective beach had suffered from washout in the flood of 1976 it presented less of a barrier to the seas in the Gulf. Consequently more severe flooding was experienced even though the storm conditions may not have been much worse.

In addition to the land flooded during the previous year the flood waters during this event rose to the extent that the banks of the channel, up to the bridge, experienced a minor overflow.



**HISTORICAL FLOOD PLAIN AT PARSON'S POND**

**FIGURE 4.1**

The Canadian Hydrographic Service (C.H.S.) maintains a permanent water level gauge at Lark Harbour, about 130 km south of Parson's Pond, which provides records of water levels at one hour intervals. This water level gauge was, however, out of service during the 1977 flooding event and consequently there is no means to calibrate the flood levels during this storm with the remainder of the Lark Harbour 20 year record. Other data exists, however, such as tides and winds, which confirms the relative severity of physical factors that were experienced during this storm.

A catalogue of severe storms off Canada's east coast (Lewis and Moran, 1984) identifies the storm of December 1977 as having a central pressure of 97 kPa over Anticosti Island at midday on the 10th. A high pressure ridge showed its movement eastwards allowing the storm to intensify rapidly over the following 24 hours reaching its lowest central pressure of 95.6 kPa. Winds in the area, as recorded at Daniel's Harbour on Newfoundland's west coast, exceeded 80 km/hr for a 12 hour period from 1700 hrs 10 December to 0500 hrs 11 December, with a maximum value of 100 km/hr at 2000 hrs 10 December. The wind direction remained relatively steady, from the southwest, during the storm.

The tides at Lark Harbour during the 10th-12th December 1977 were also larger than usual due to astronomical forcing. A water level of 1.04 m above mean water level due to tides alone has been determined by using the known tidal characteristics of the area (see Section 5.3). This value slightly exceeds the high water level of 1.03 m above mean water usually generated by large tides in this area.

## 5.0 METHODOLOGY

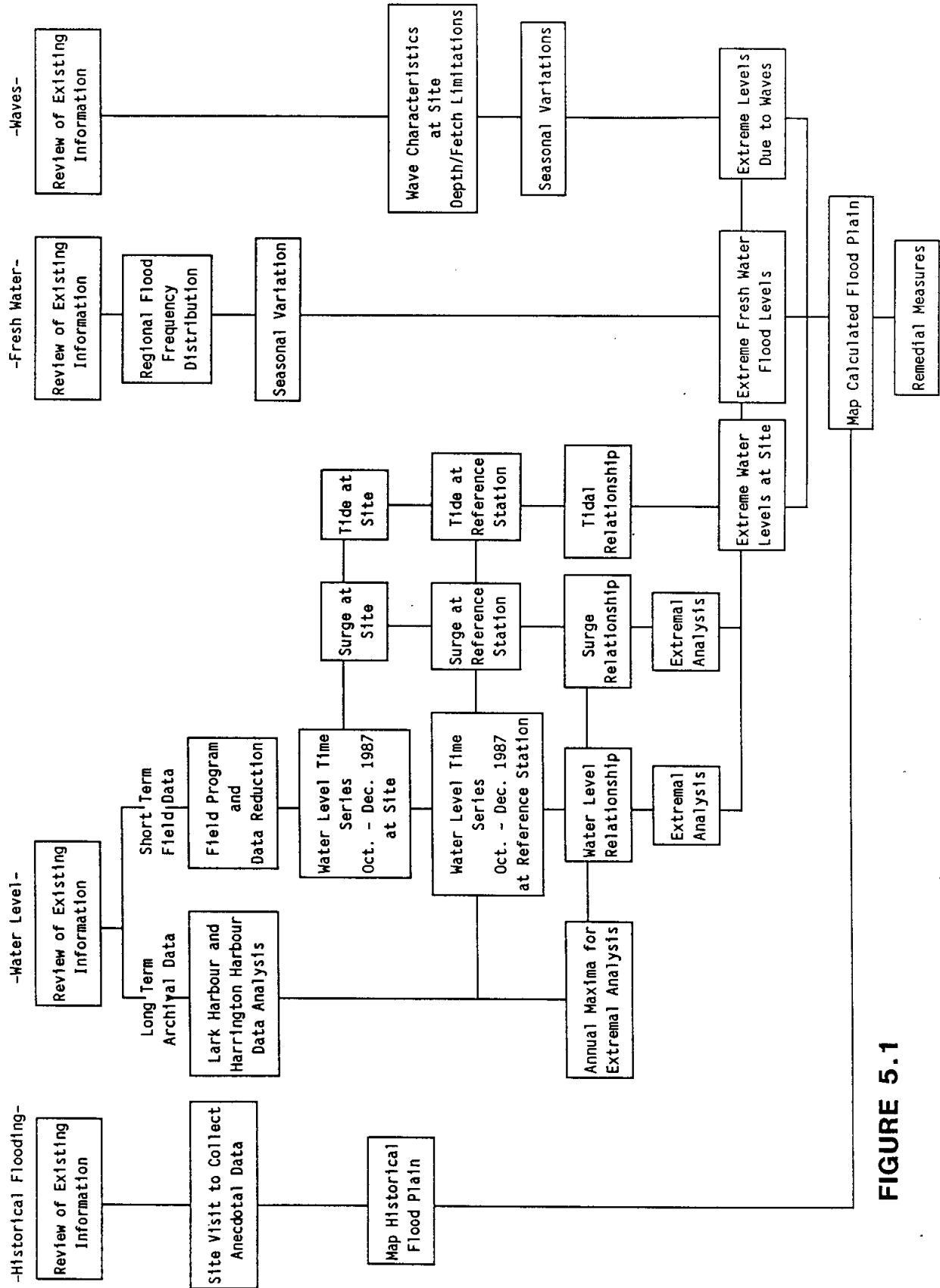
The variations of the water levels, and hence the flooding characteristics, of Parson's Pond are due to the interaction of meteorological, hydrological, and oceanographic processes and their modification by local conditions. Maximum water levels, corresponding to the 1 in 20 and 1 in 100 flood events, are calculated by determining the rise in water level from all of the relevant contributing factors and fitting them to an appropriate flood frequency distribution.

The methodology used to determine the extreme water levels is a two step process. The first includes the collection, analysis and interpretation of the appropriate physical information. The second stage involves the extrapolation of these data to the 1 in 20 and 1 in 100 flood limits and their associated confidence intervals.

Figure 5.1 shows a flowchart of the methodology.

The main physical factors that govern the flooding at Parson's Pond have been identified as:

- a) extreme sea levels;
- b) runup and overtopping of high waves.



**FIGURE 5.1**

**FLOWCHART OF SOLUTION METHODOLOGY**

## 6.0 THE FIELD PROGRAM

In order to acquire sufficient data from which to obtain the necessary information concerning the water level regime at Parson's Pond, a field program was designed and implemented. The objective of the field program was twofold; first a site visit was required to collect anecdotal information relating to the flooding characteristics of Parson's Pond. The second purpose was to collect sufficient water level data at the location in order to relate the water level regime at Parson's Pond to that of Lark Harbour. Lark Harbour was chosen as a reference location because it is the closest suitable point to the study site at which a long term water level record (required for the extremal analysis) is available. The long term data base of water levels collected at Harrington Harbour was used as a reference station for tidal information only. The storm surge signal contained in the Harrington Harbour record is inappropriate for the study at Parson's Pond as discussed in Section 2.0.

A monitoring period of at least 10 weeks, from October to December 1987, was chosen. This allowed sufficient water level data to be collected in order to carry out the analyses required to establish the relationship between Lark Harbour and Parson's Pond. In addition, water levels would be gathered during the season of the year when the flooding potential has been shown, historically, to be the greatest.

The actual work in the field was carried out during October 2-8, 1987 and January 7-10, 1988, which mark the deployment and recovery dates for the instrumentation.

During both visits anecdotal information, relevant to the flooding at Parson's Pond, was gathered. Regional insight into the situation was provided by officials of the Departments of Environment and Lands, and Municipal Affairs (R. Saunders, and M. Stratton). Members of the Parson's Pond Community Council, G. Payne and A. Payne, and residents

having, or having had, property within the historical flood plain also contributed to the identification of probable flooding mechanisms and their limits.

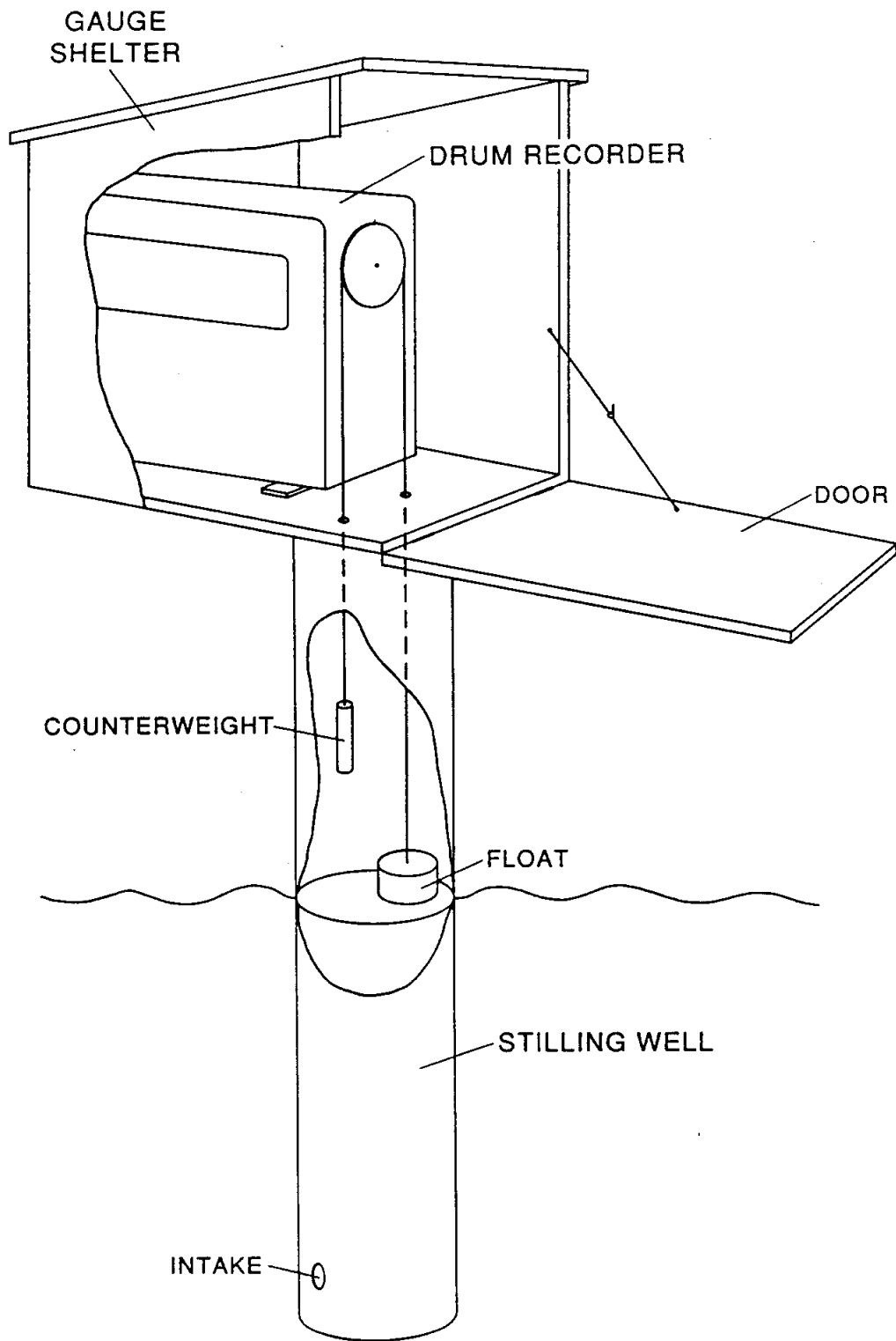
In order to promote the probability of a good data return a backup system of data collection was included in the monitoring program. This entailed the installation of two automatic recording instruments, as well as an individual from the local community to document 'events' using a scale fastened to the breakwater as a reference.

Two types of water level recording devices were used; a float gauge and a pressure gauge.

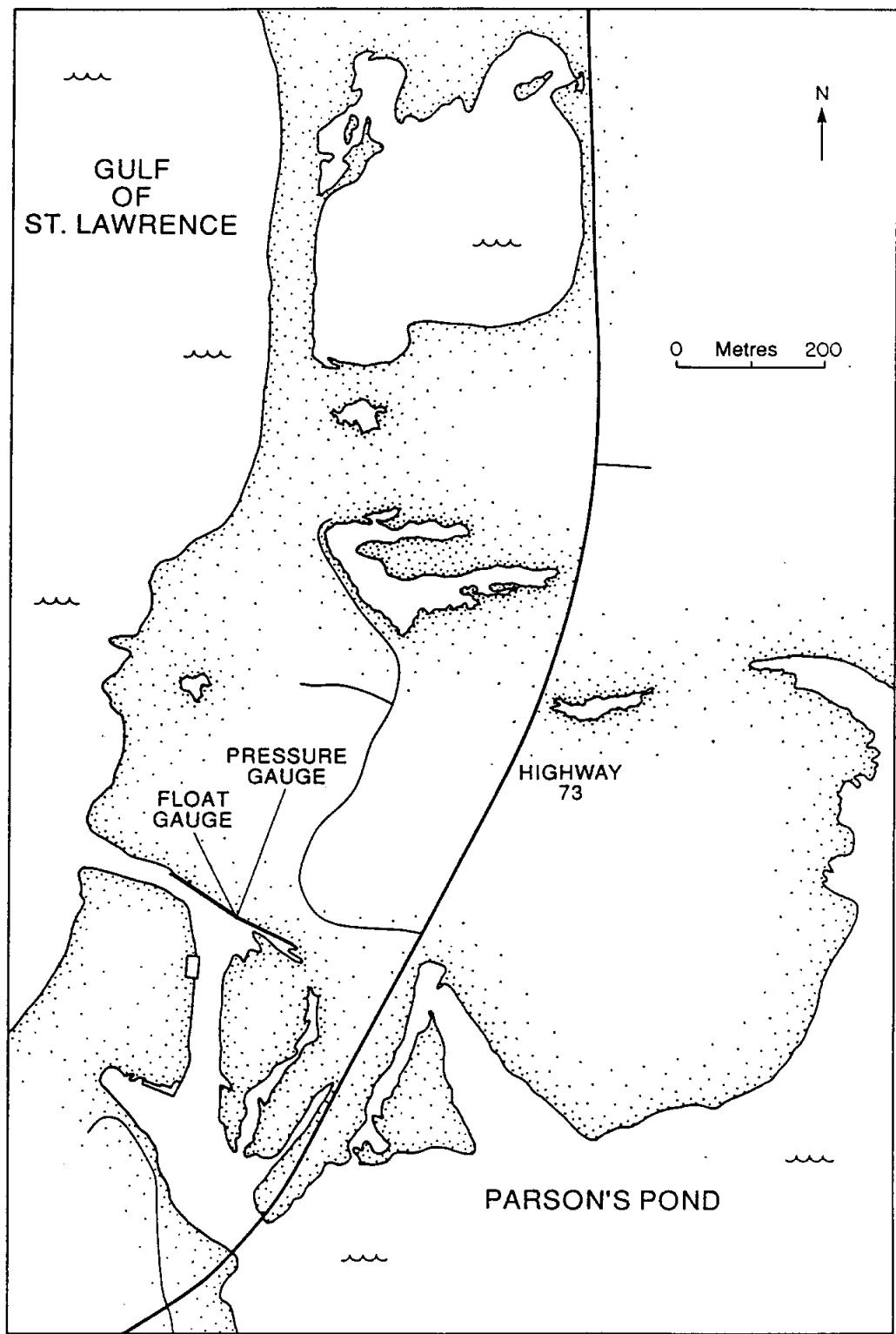
The float gauge instrumentation consists of a float and counterweight located in a stilling well, and the recorder housed in a gauge shelter. A schematic of the arrangement is shown in Figure 6.1.

A thin wire connected to the float passes over a pulley on the recorder and is attached to the counterweight at the other end. As the float rises with the tide, the pen on the recorder scribes a line on the paper which is advancing by means of a clockwork mechanism. The stilling well physically filters out the effect of the high frequency fluctuations of waves on the float by restricting the flow of water into it.

The float gauge instrumentation was installed at the Parson's Pond breakwater (see Figure 6.2). The gauge shelter was attached to the breakwater itself. The stilling well, which was made from 20 cm diameter PVC pipe, sealed at the bottom, and having a 2 cm hole drilled below the water line to filter the wave effects, was positioned in a water depth of 1.5 m below mean sea level. A carpenter's scale was secured to the face of the breakwater. This was used to relate the geodetic datum (in reference to the top of the breakwater) with the water level recorded by the float gauge.



**FIGURE 6.1**  
**FLOAT GAUGE INSTRUMENTATION**



**FIGURE 6.2**  
**INSTRUMENT LOCATIONS - PARSON'S POND**

The pressure gauge used was an Aanderra WLR-5 type recording instrument anchored to the sea floor. A sampling rate of 1 record every 30 minutes was chosen with an integration time of 27 seconds. Because exposure to current flows can affect the accuracy of the data, the sensor on the instrument was sheltered by deploying the gauge within a protective housing at right angles to the predominant flow.

The accuracy of the pressure gauge is 0.01% of the full scale range, and the resolution is 0.001% of the full scale range. The full scale range is determined by the maximum pressure the sensor in the instrument can withstand. The instrument at Parson's Pond was rated to 20 m (0-30 psi) providing an accuracy of  $\pm 0.20$  cm and a resolution to within  $\pm .02$  cm.

Due to the severity of the conditions, such as waves and ice, that could be expected, it was considered imprudent to moor the instruments in Sandy Bay itself. Consequently the relative protection of the channel was exploited by securing the instrumentation to the breakwater. The siting of the instruments in the channel, however, required that the effects of the channel hydraulics on the water level regime (i.e. increase water flow and attenuation of the tidal signal by shallow water) be taken into account during the analysis of the data (see Section 8).

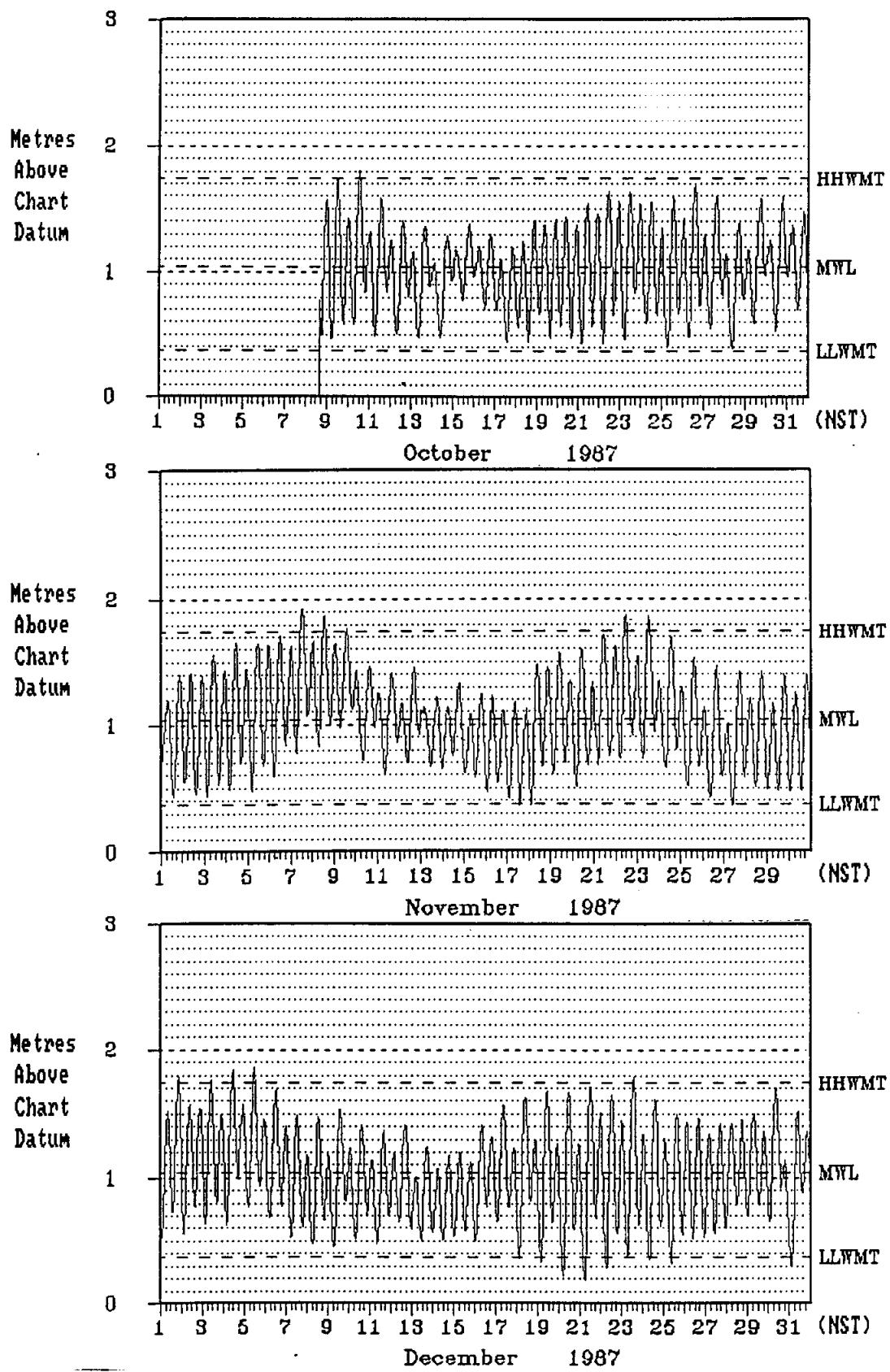
The instruments were recovered, without incident, on January 8, 1988.

## 7.0 DATA PROCESSING

The primary source of water level information available from the Parson's Pond field program is contained in a digitized record of water level from 8 October 1987 to 8 January 1988 collected using the pressure gauge. The influence of atmospheric pressure variations on the pressure sensor of the water level gauge was taken into account by subtracting the sea level barometric pressure recorded by the Atmospheric Environment Service at Daniel's Harbour. As a backup source of water level data, an analogue record provided by the float gauge was also available. Both of these data sources were verified during the monitoring period using observations from the scale on the breakwater. Any effects on the pressure sensor of density changes in the water column (due to fresh water discharge from the Pond) and water movements (due to the limited width of the channel) were not evident when data from these three sources were compared.

Figure 7.1 shows the time series of water levels used to represent the regime at Parson's Pond.

A complete listing of these datasets is provided in Appendices A and B.



**FIGURE 7.1**

**WATER LEVEL MEASURED AT PARSON'S POND**

## 8.0 DATA ANALYSES

Three phases were used to evaluate the water level regime at Parson's Pond for use in establishing the 1 in 20 and 1 in 100 year flood limits. The first phase involved a tidal analysis of the observed water levels at Parson's Pond and at Lark Harbour for a corresponding period. Having established the tidal characteristics, the water level fluctuations due to the tides were subtracted from the observed level record to give a time series of the non-tidal, or surge component. The next phase consisted of a cross correlation analysis between both the observed water levels, and then the calculated surge levels, at Parson's Pond and Lark Harbour. This was done to quantify the relationship between the water levels, and surges, at the two locations. The third phase, an extremal analysis, extrapolated the long term water level from Lark Harbour, appropriately transferred to represent Parson's Pond, to provide water levels at recurrence intervals of 1 in 20 and 1 in 100 year, with their 90% confidence limits. Each of these three phases of the data analyses is described in the following sections of the report.

### 8.1 Tidal Analysis

The time series of actual water levels measured during the field observation period at Lark Harbour and Parson's Pond were analyzed for their harmonic characteristics to determine the tidal constituents at each location.

The harmonic analysis is based on the principle that the tidal component of the water level record consists of the sum of a number of components with known harmonic frequencies. These harmonic frequencies are often called tidal constituents. For example, the principal lunar semi-diurnal constituent (the  $M_2$  tide) has a frequency of 0.0805 cycles/hr, which corresponds to a fluctuation over a 12.42 hour cycle, (i.e. about twice a day).

In carrying out the analysis, the characteristics of 69 known tidal constituents are fitted to the observed water level time series. Amplitudes (which relate to the energy of the constituent) and Greenwich phase lags (which relate to the timing of the constituent) are determined for as many constituents as possible, depending on the length of the record. Shallow water tidal constituents, which arise from the distortion of the tidal regime in shallow water where the crest of the signal propagates faster than the trough, requires the introduction of additional harmonics of the fundamental tidal frequencies. These have been included in the analysis due to the location of the gauge in the channel.

Table 8.1.1 shows the principal tidal constituents that were resolved from the water level records from Lark Harbour and how they combine to give a time series of water level fluctuations due only to tides. The tidal constituents for Parson's Pond are given in Table 8.1.2. These tidal constituents were subsequently used to generate a time series of water level changes due to the tidal potential which, when subtracted from the observed water levels, results in a time series of storm surge (i.e. the fluctuation of water levels due to non-tidal forces).

Figures 8.1.1 to 8.1.6 each shows three curves. Two of the curves are centered on mean water level (MWL), the solid line representing observed water levels and the dashed line representing the tidal potential determined as described above. The third curve, positioned along the bottom axes of the figures, represents the residual storm surge signal that remains after the tides have been removed. It can be seen that the tides provide the principal contribution to the water level fluctuation.

TABLE 8.1.1  
PRINCIPAL TIDAL CONSTITUENTS DERIVED FROM LARK HARBOUR DATA

<u>Constituent</u>	<u>Frequency</u> (hr <sup>-1</sup> )	<u>Amplitude</u> (m)	<u>Greenwich Phase</u> (degrees)
Mean water level, Z <sub>0</sub>	0.0000	1.0963	0.00
Lunar semidiurnal, M <sub>2</sub>	0.0805	0.4961	327.85
Solar semidiurnal, S <sub>2</sub>	0.0833	0.1510	335.55
Lunar elliptic semidiurnal, N <sub>2</sub>	0.0790	0.0888	312.86
Lunisolar diurnal, K <sub>1</sub>	0.0418	0.1438	202.79
Lunar diurnal, O <sub>1</sub>	0.0387	0.1317	199.71

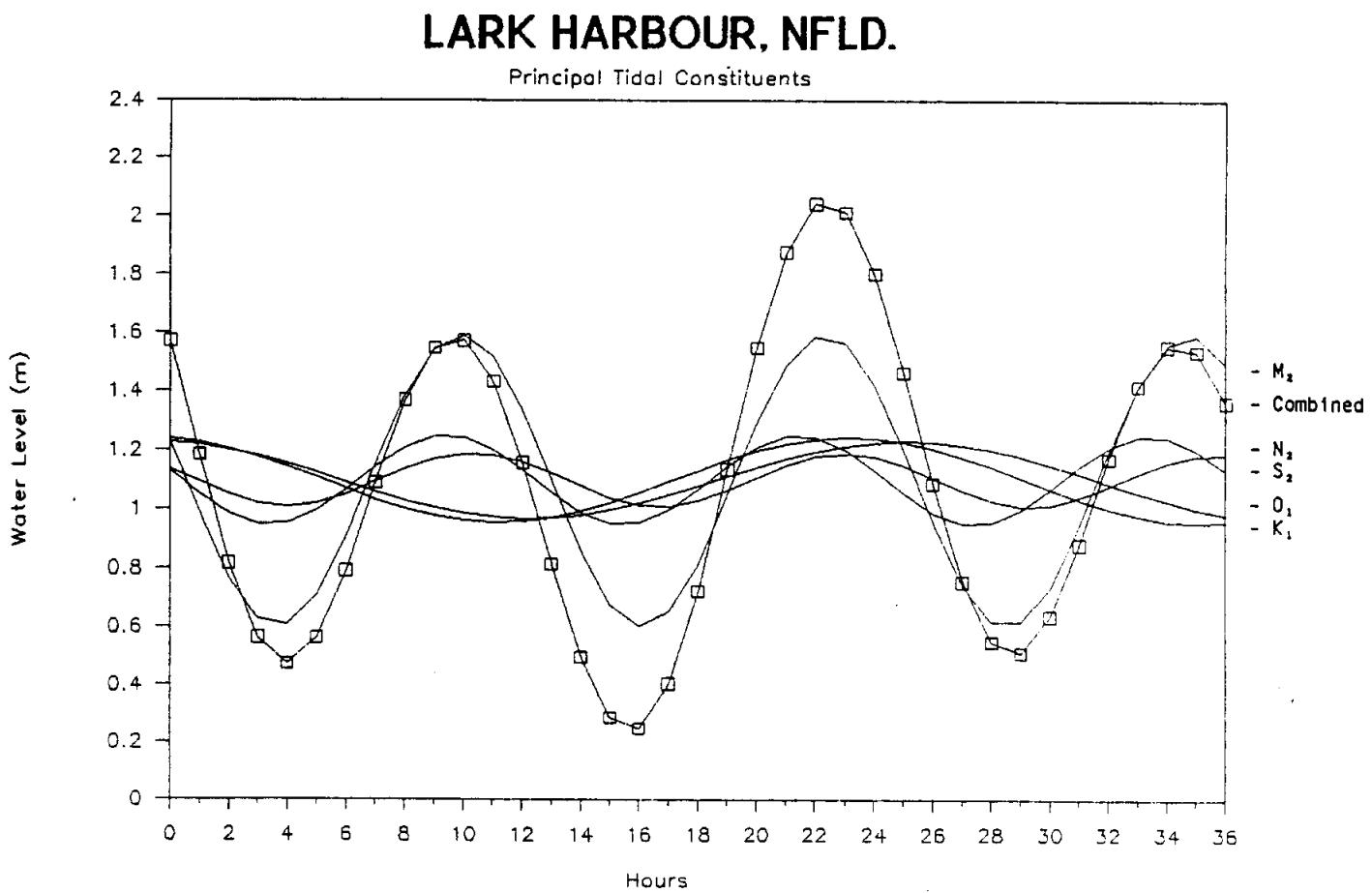
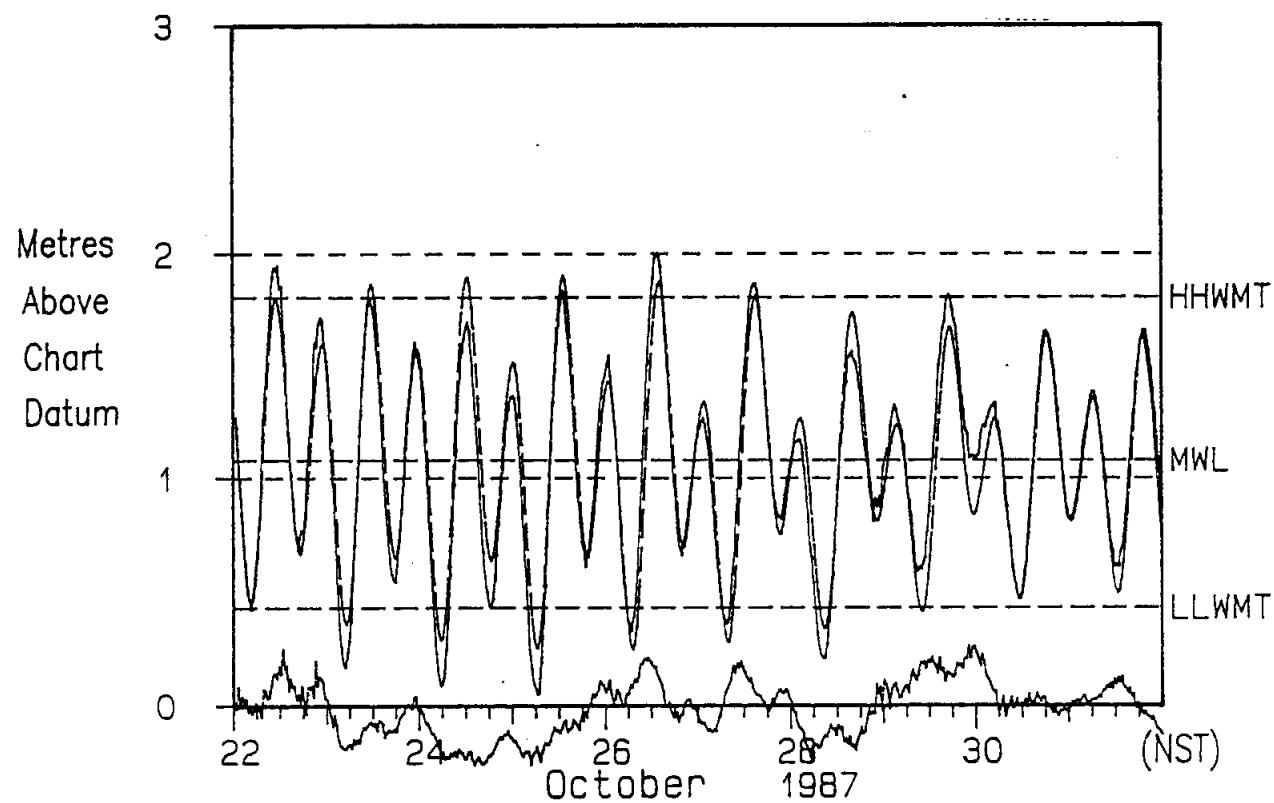
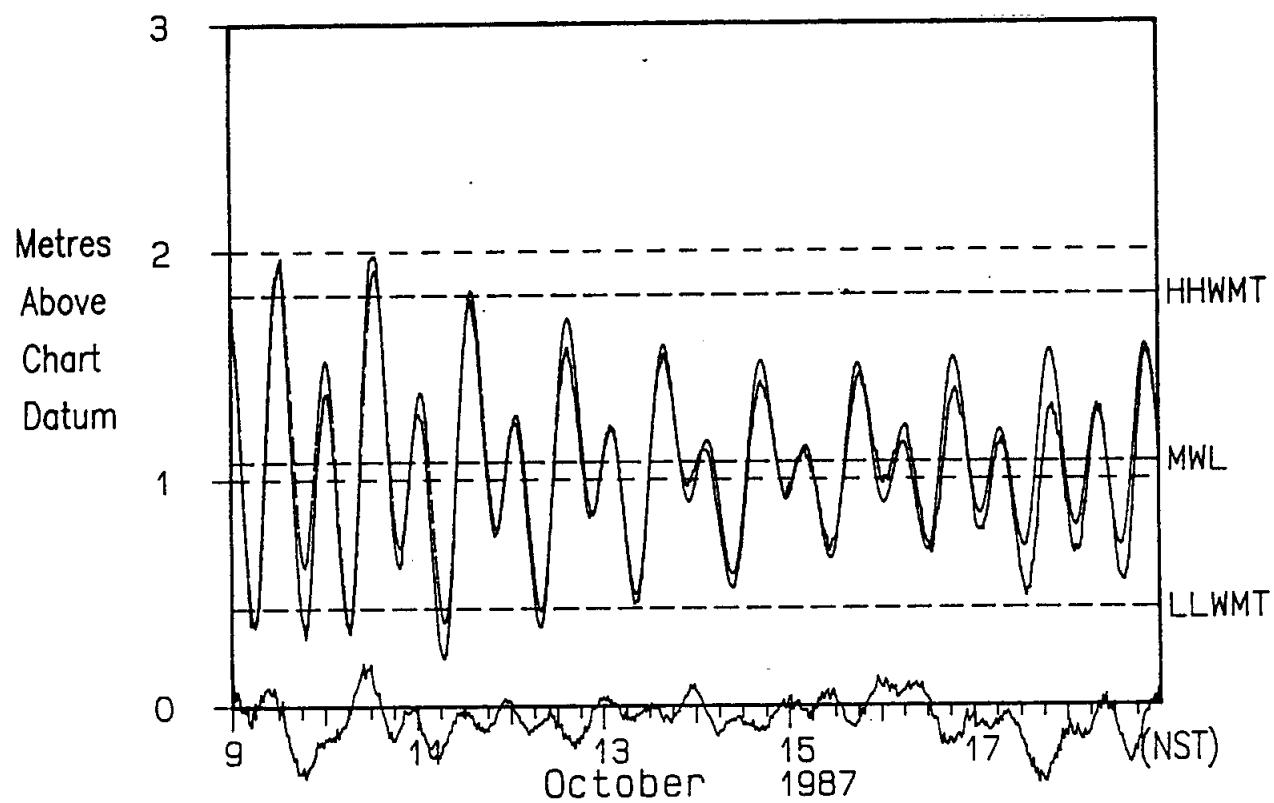


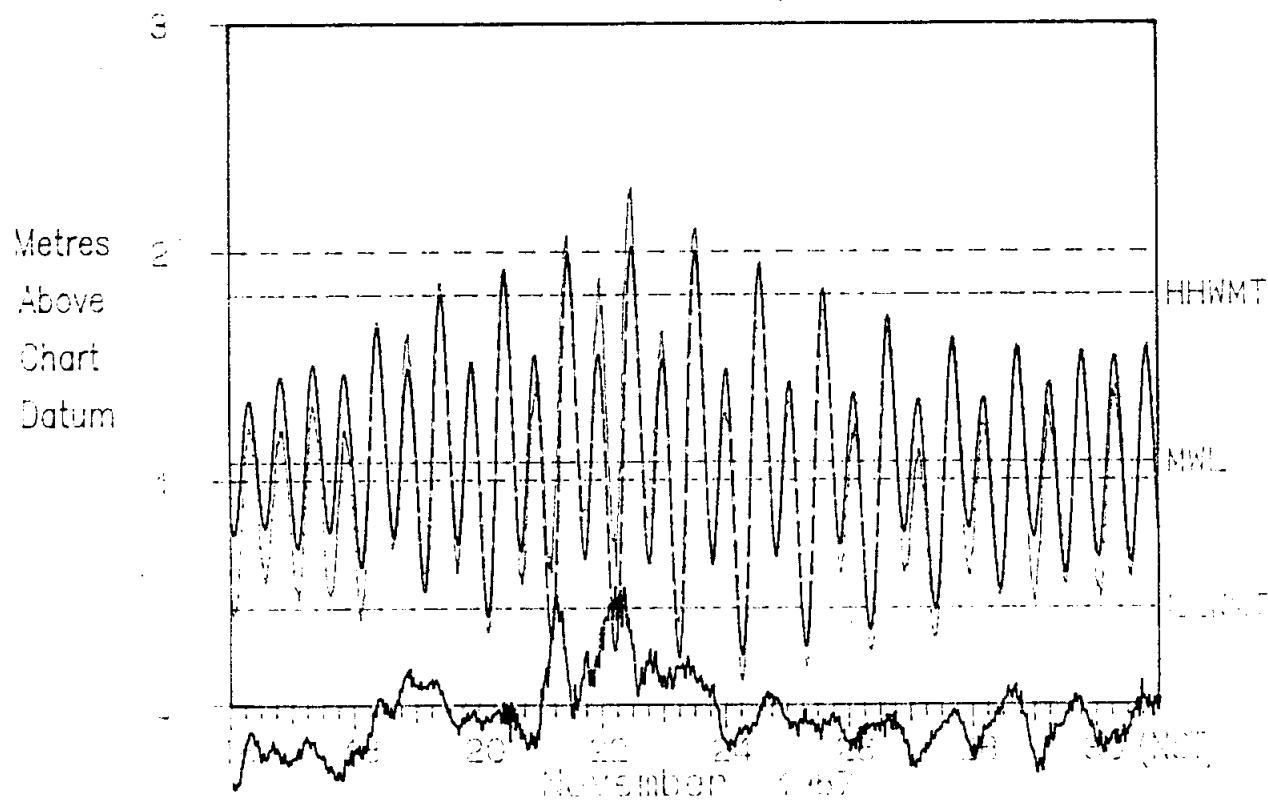
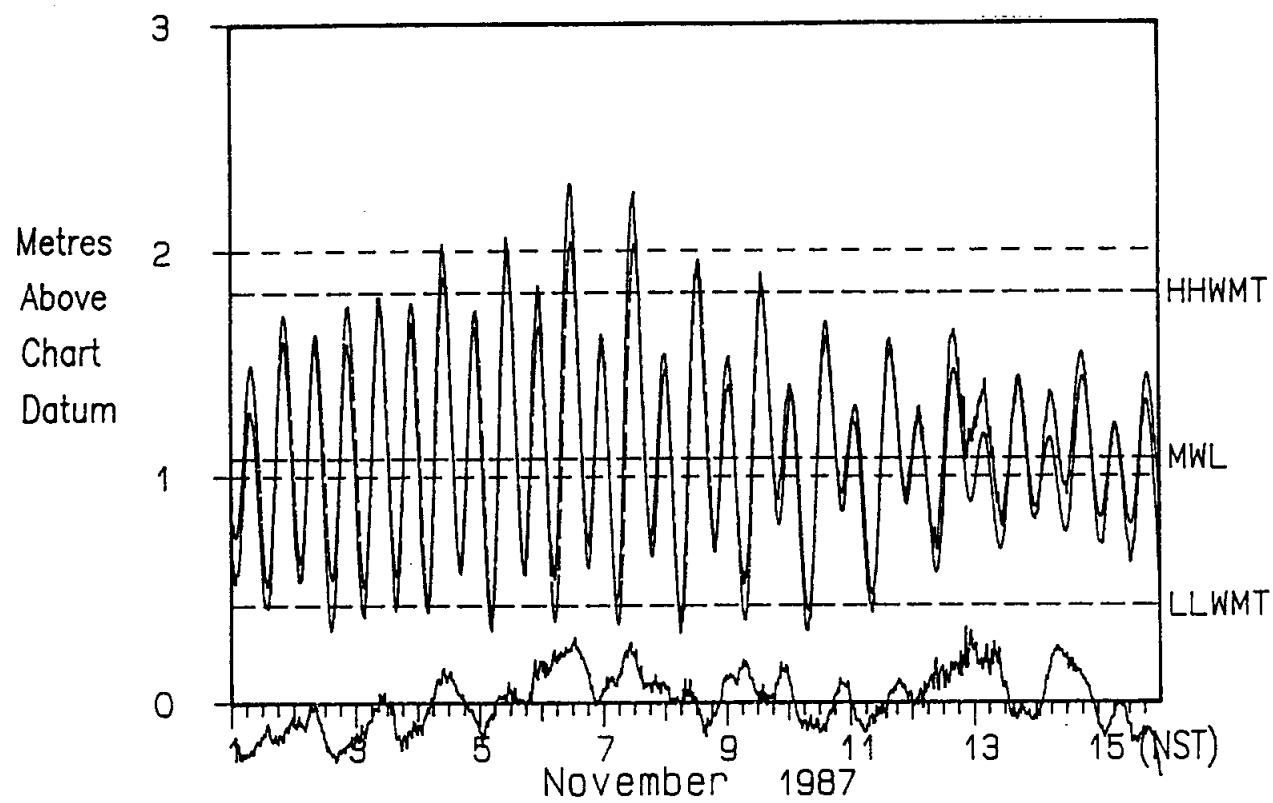
TABLE 8.1.2  
TIDAL CONSTITUENTS DERIVED FROM PARSON'S POND DATA

<u>Constituent</u>	<u>Frequency</u> (hr <sup>-1</sup> )	<u>Amplitude</u> (m)	<u>Greenwich Phase</u> (degrees)
Mean water level, Z0	0.0000	1.0355	0.00
Lunar semidiurnal, M <sub>2</sub>	0.0805	0.3912	327.33
Solar semidiurnal, S <sub>2</sub>	0.0833	0.1017	326.37
Lunar elliptic semidiurnal, N <sub>2</sub>	0.0790	0.0626	317.45
Lunisolar diurnal, K <sub>1</sub>	0.0418	0.1081	207.57
Lunar diurnal, O <sub>1</sub>	0.0387	0.0987	198.17
Shallow water, M <sub>4</sub>	0.1610	0.0108	150.73
MM	0.00151215	1.0637	89.49
MSF	0.00282193	0.0930	20.05
ALP1	0.03439657	0.0149	347.37
2Q1	0.03570635	0.0062	185.15
Q1	0.03721850	0.0131	173.46
N01	0.04026860	0.0125	269.28
J1	0.04329290	0.0042	265.88
001	0.04483084	0.0065	231.41
UPS1	0.04634299	0.0016	353.68
EPS2	0.07617731	0.0022	215.46
MU2	0.07768947	0.0152	147.52
L2	0.08202355	0.0019	300.20
ETA2	0.08507364	0.0022	204.96
M03	0.11924210	0.0025	161.20
M3	0.12076710	0.0044	356.04
MK3	0.12229210	0.0026	269.21
SK3	0.12511410	0.0059	0.51
MN4	0.15951060	0.0012	156.92
SN4	0.16233260	0.0013	305.53
MS4	0.16384470	0.0040	193.82
S4	0.16666670	0.0023	54.36
2MK5	0.20280360	0.0038	276.27
2SK5	0.20844740	0.0006	134.90
2MN6	0.24002200	0.0021	66.51
M6	0.24153420	0.0017	38.76
2MS6	0.24435610	0.0037	71.14
2SM6	0.24717810	0.0007	38.00
3MK7	0.28331490	0.0005	88.13
M8	0.32204560	0.0010	290.75



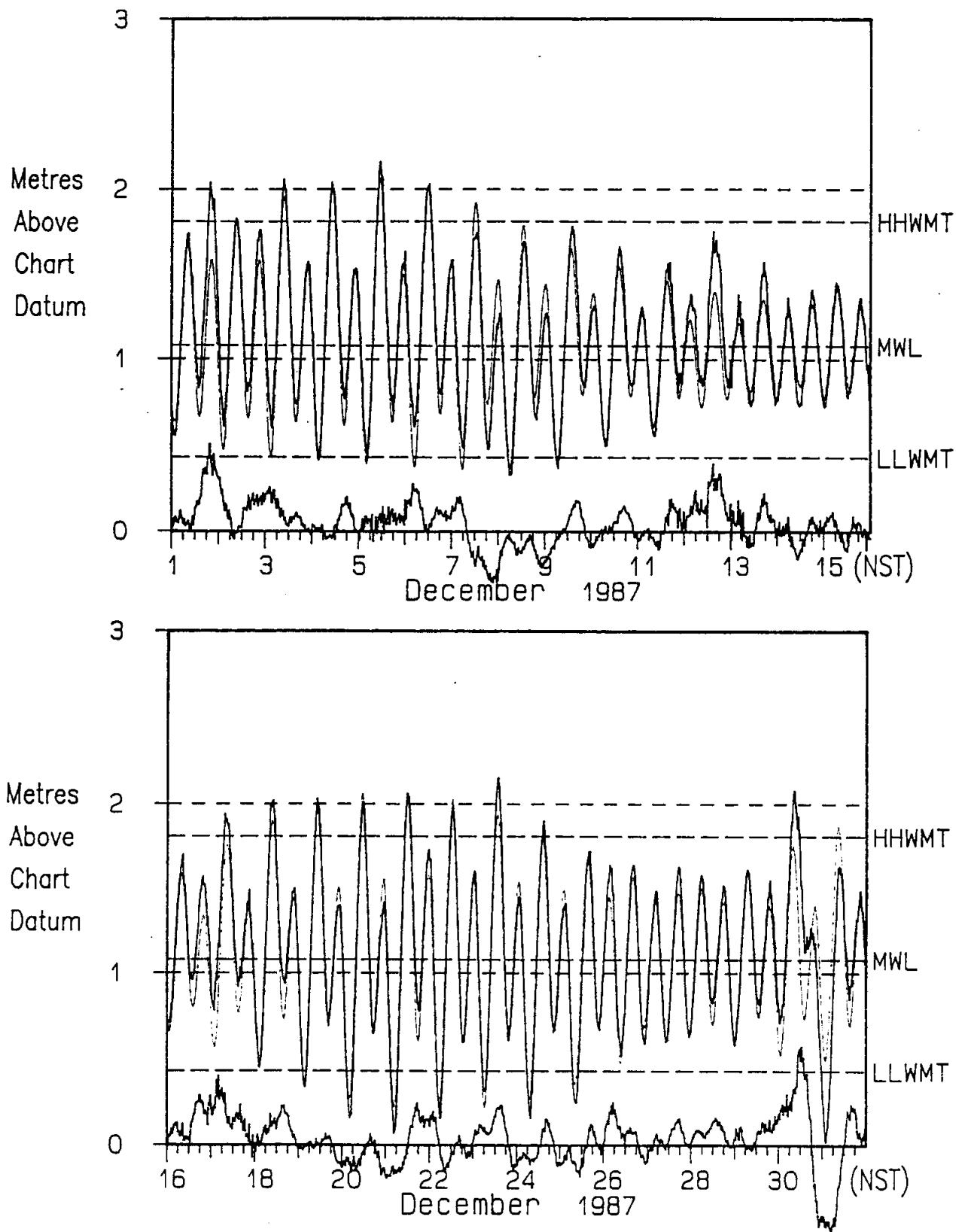
**FIGURE 8.1. 1**

**SURGE AT LARK HARBOUR - OCT**



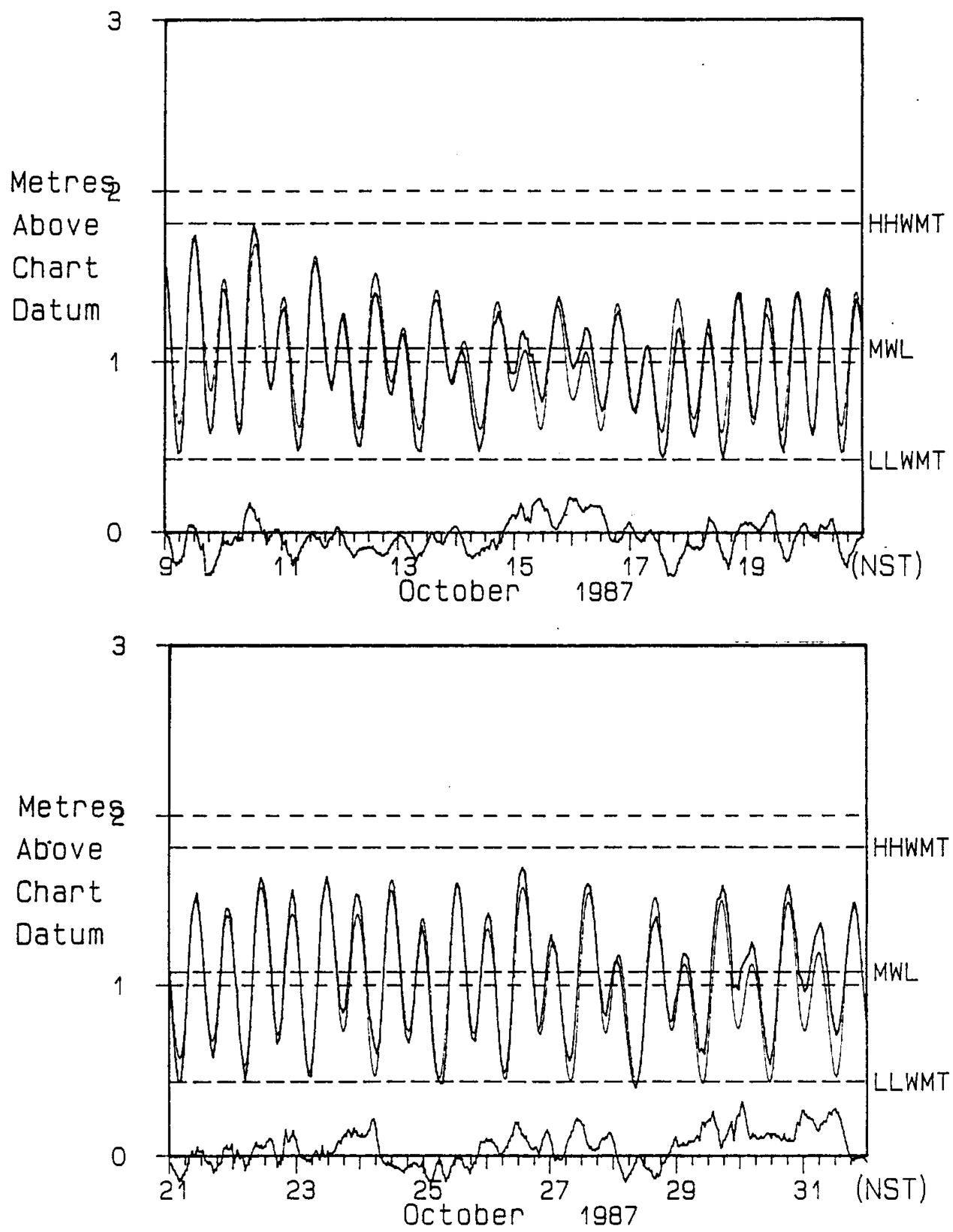
**FIGURE 8.1.2**

**SURGE AT LARK HARBOUR - NOV**



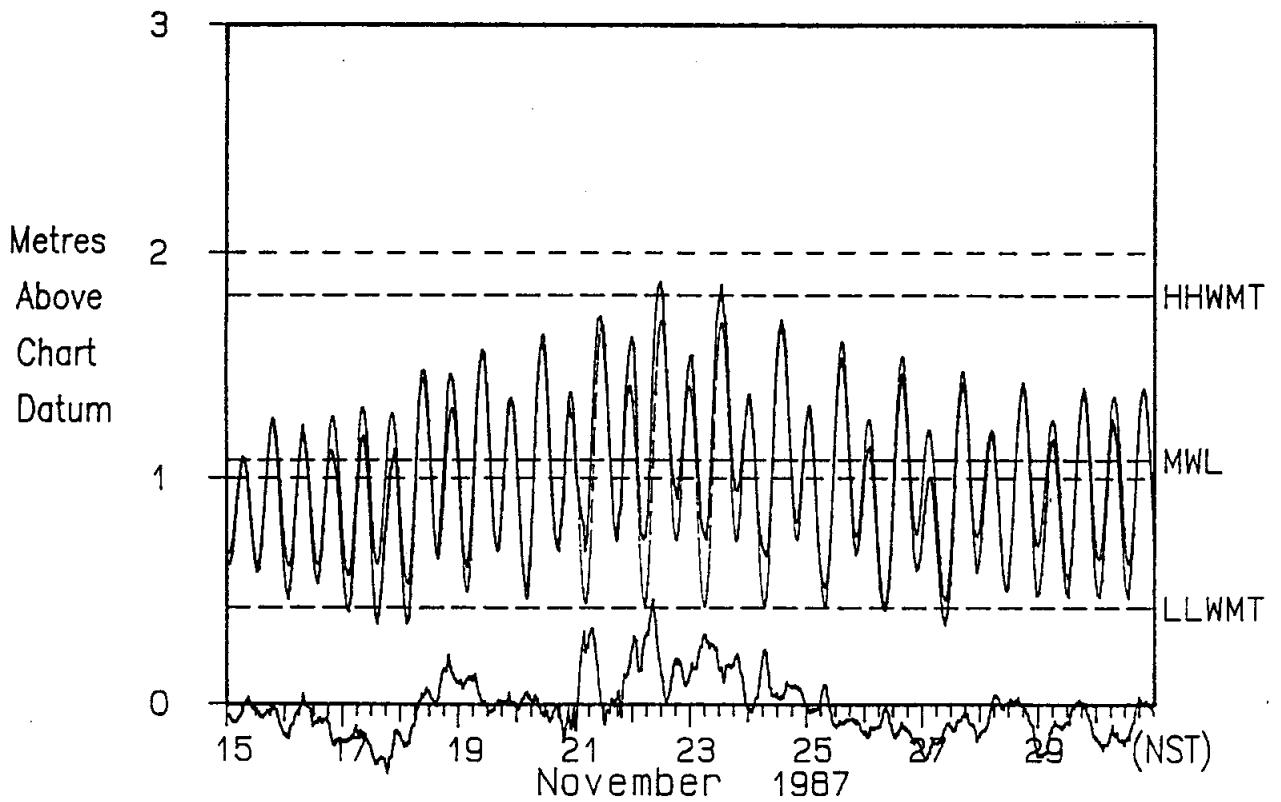
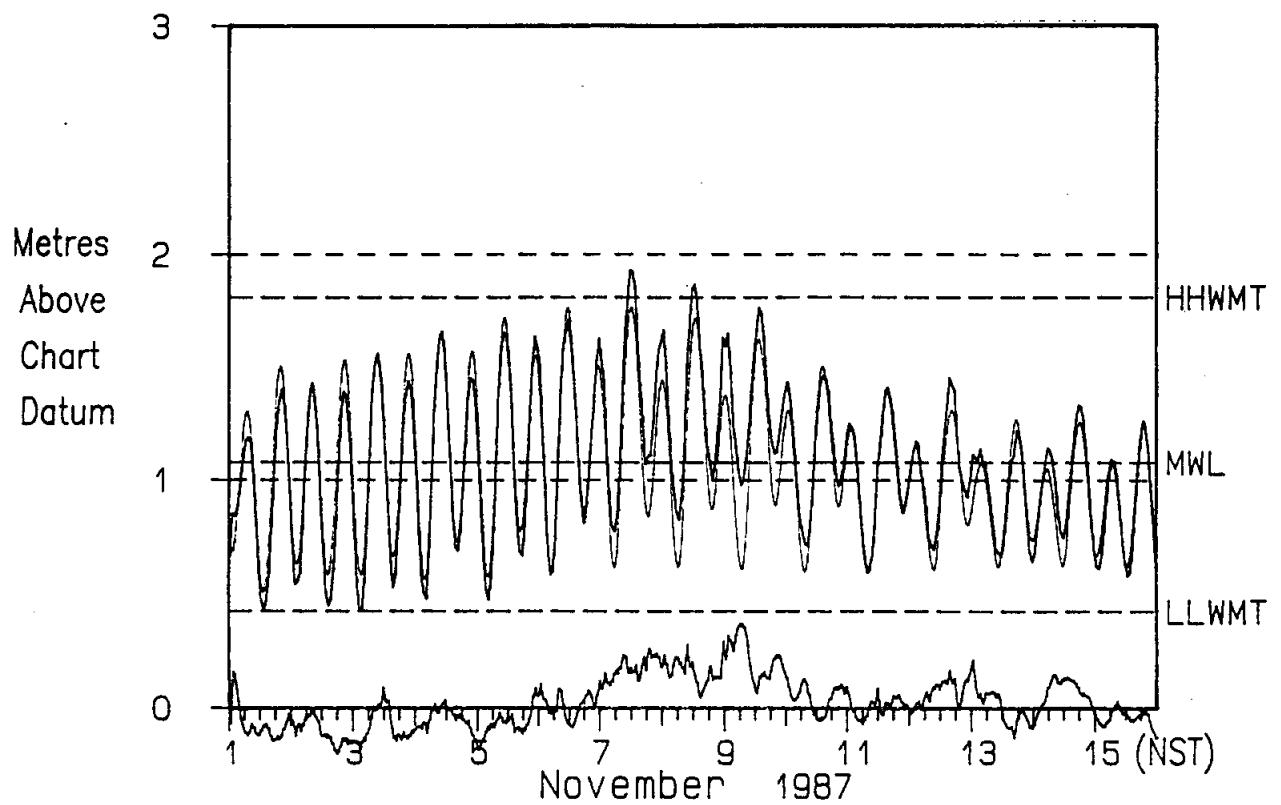
**FIGURE 8.1. 3**

**SURGE AT LARK HARBOUR - DEC**



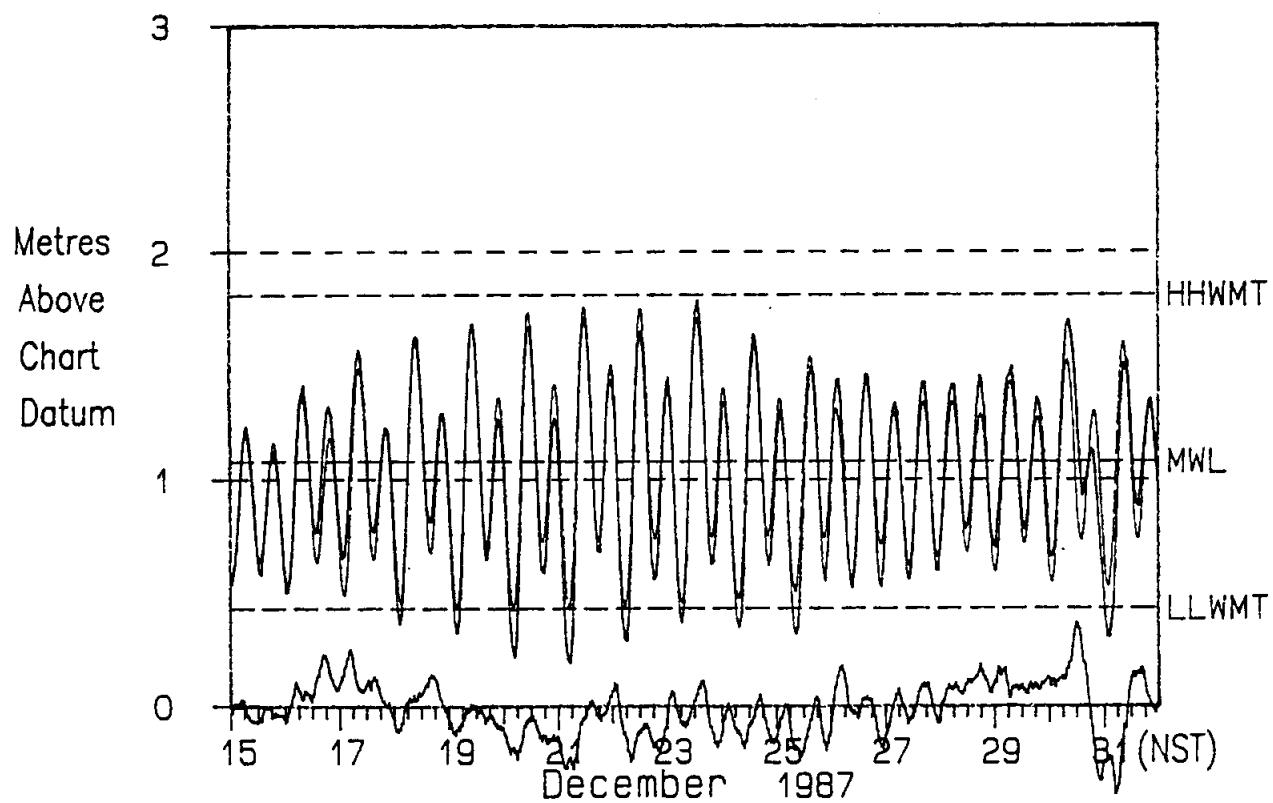
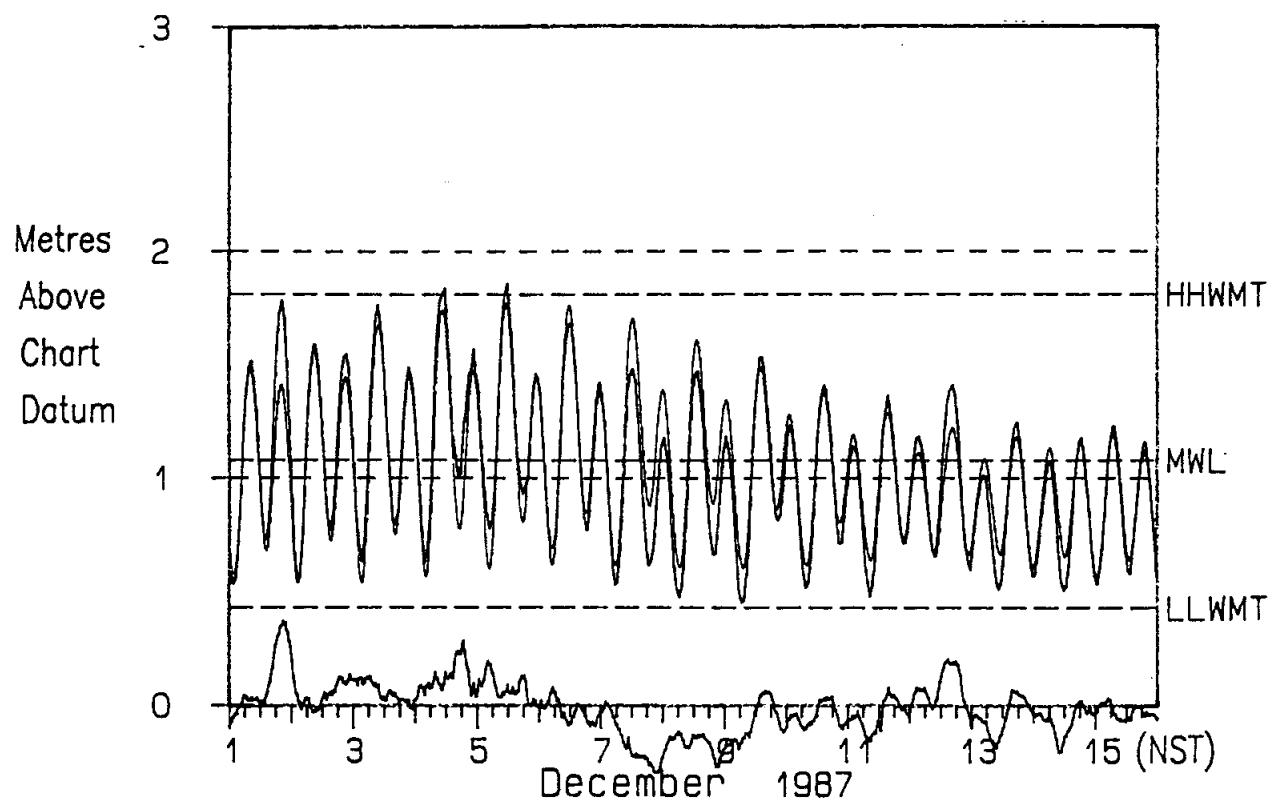
**FIGURE 8.1.4**

**SURGE AT PARSON'S POND - OCT**



**FIGURE 8.1. 5**

**SURGE AT PARSON'S POND - NOV**



**FIGURE 8.1. 6**

**SURGE AT PARSON'S POND - DEC**

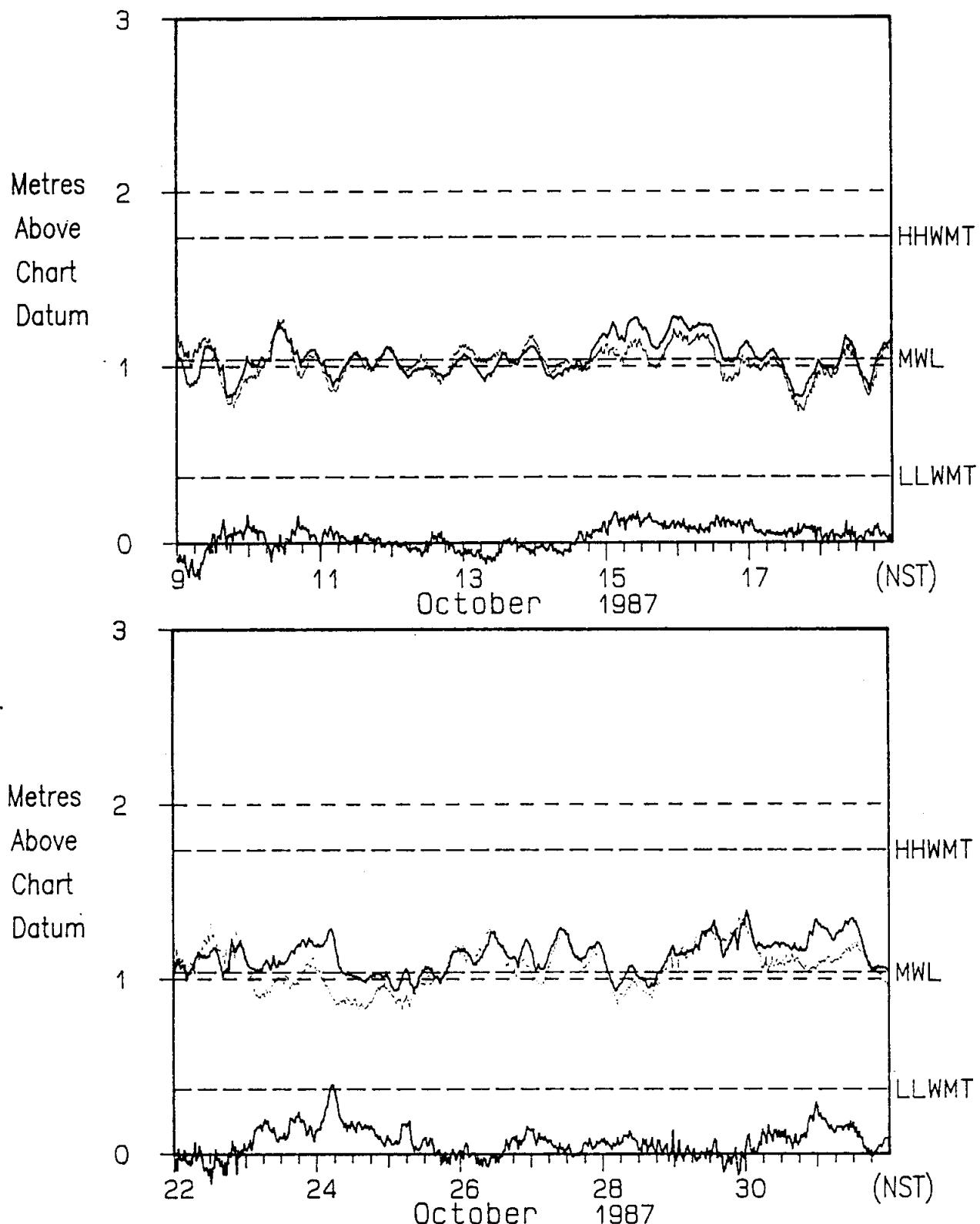
## 8.2 Correlation Analysis

The storm surge (i.e non-tidal fluctuations) at Parson's Pond (determined as described in Section 8.1) was compared to the corresponding Lark Harbour storm surge record.

Figures 8.2.1 to 8.2.3 show the storm surge records at Parson's Pond and Lark Harbour varying about the mean water line. The plot of the differences in these two storm surge records is positioned along the bottom axis of the figures. The plot of the surge record at Lark Harbour and Parson's Pond show that the surge records closely resemble each other throughout the entire recording period. It should be noted that, in the difference record between Lark Harbour and Parson's Pond plotted along the bottom axis of Figures 8.2.1 to 8.2.3, a long term departure from the axis occurs over intervals of two or three days at a time. This is typical of meteorological influences where the wind forcing results in wave setup.

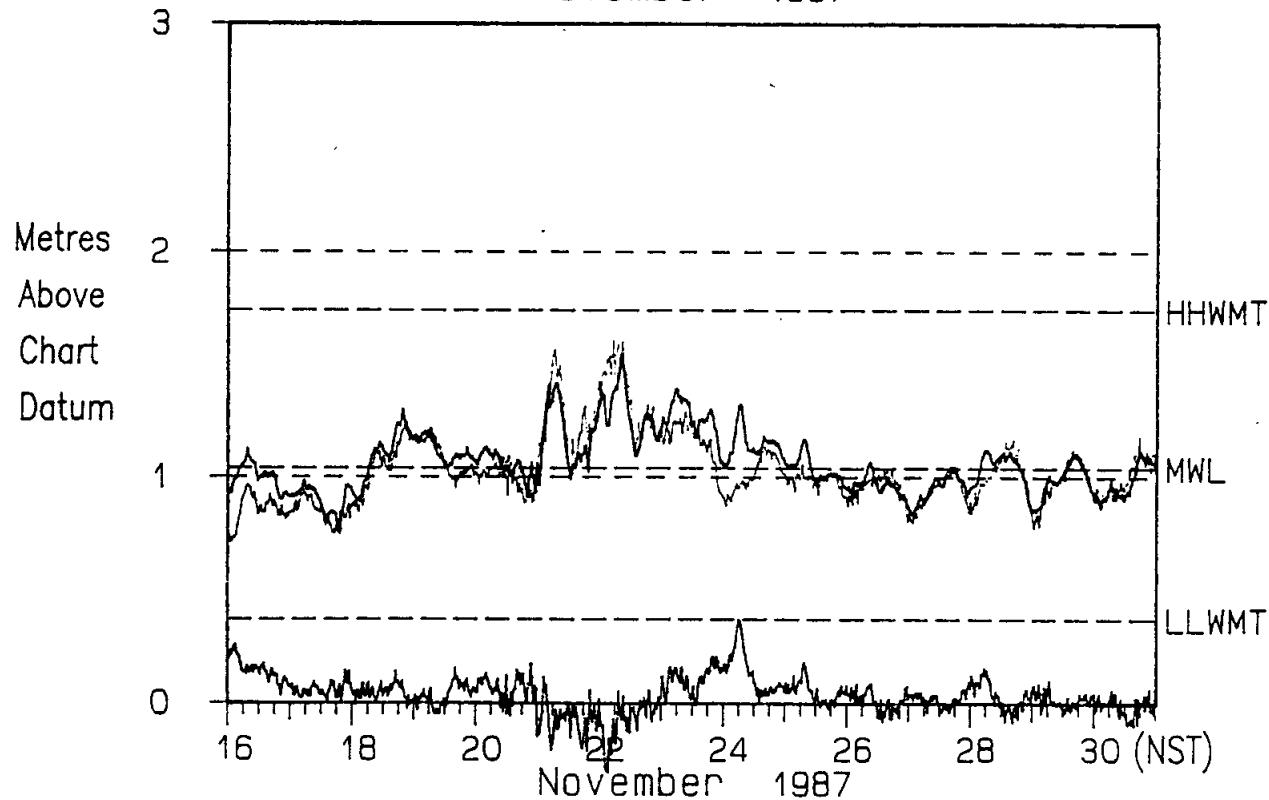
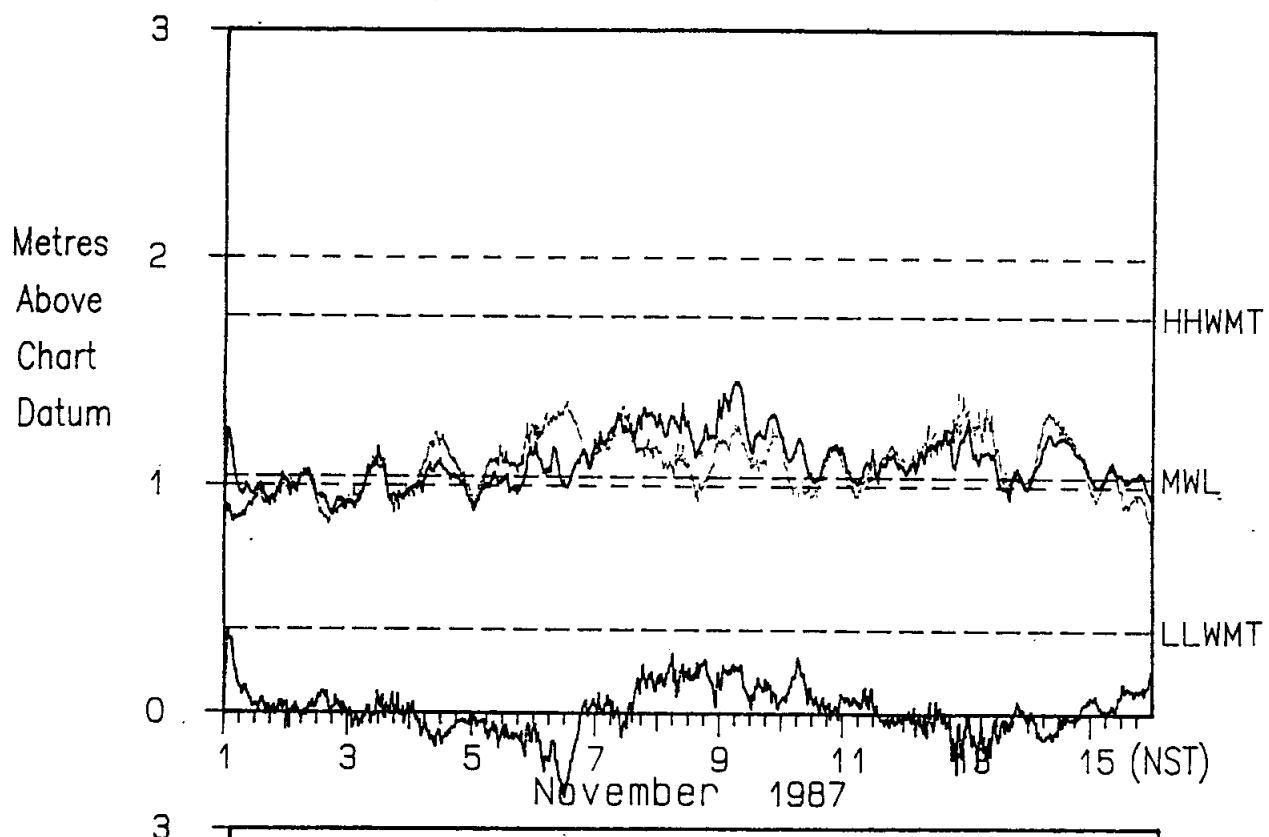
Since we are interested in using the long term historical water level data at Lark Harbour to predict surge effects at Parson's Pond, we need to know quantitatively how much of the variation in surge at Parson's Pond can be explained by the variation in surge at Lark Harbour. The cross correlation function between the surge at Lark Harbour and that at Parson's Pond was calculated.

The cross-correlation function identifies the statistical similarity between two time series at several different time lags. The time series of storm surge at Lark Harbour,  $LH(t)$ , and at Parson's Pond,  $PP(t)$ , are used to estimate the cross-covariance function  $\sigma(k)$  which is required to determine the cross-correlation function.



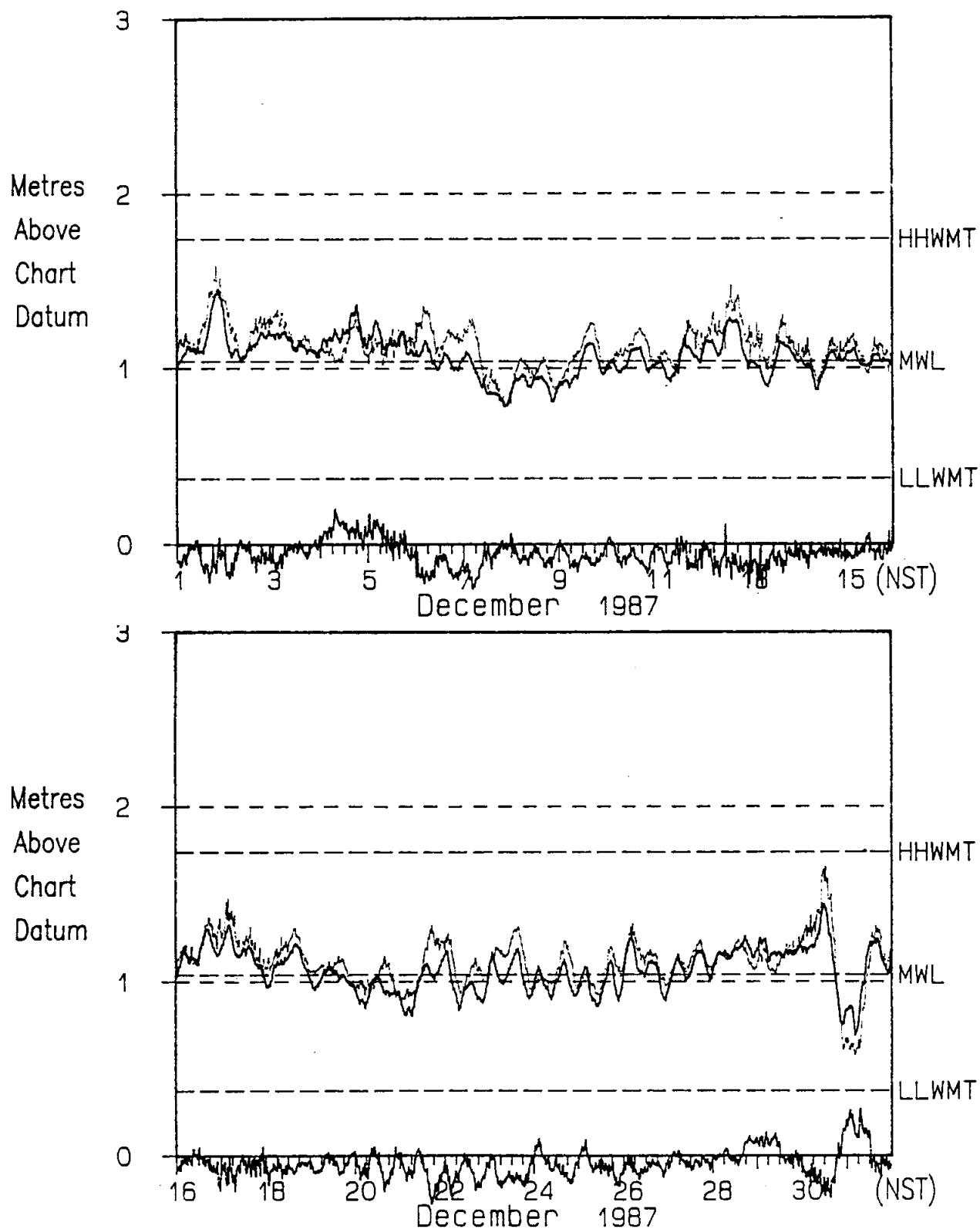
**FIGURE 8.2.1**

**DIFFERENCE IN SURGE AT PARSON'S POND  
AND LARK HARBOUR - OCT**



**FIGURE 8.2.2**

**DIFFERENCE IN SURGE AT PARSON'S POND  
AND LARK HARBOUR - NOV**



**FIGURE 8.2.3**

**DIFFERENCE IN SURGE AT PARSON'S POND  
AND LARK HARBOUR - DEC**

$$\sigma(k) = \frac{1}{n} \sum_{t=1}^{n-k} [LH(t) - \bar{LH}][PP(t) - \bar{PP}], \quad k = 0, 1, 2, \dots, k$$

$$\frac{1}{n} \sum_{t=1-k}^n [LH(t) - \bar{LH}][PP(t) - \bar{PP}], \quad k = -1, -2, \dots, -k$$

where  $\bar{LH}$  is the mean of  $LH(t)$

$\bar{PP}$  is the mean of  $PP(t)$

$n$  is the number of observations

$k$  is the time lag

The cross correlation function,  $p(k)$ , can then be calculated as

$$p(k) = \frac{\sigma(k)}{[\text{VAR}(LH) * \text{VAR}(PP)]^{\frac{1}{2}}}$$

where  $\text{VAR}(LH)$  and  $\text{VAR}(PP)$  represent the variance of the Lark Harbour and Parson's Pond time series respectively.

To assist in quantifying the time lag and the correlation coefficient between the two surge records, a Lagrange four point differentiation estimator and a three point interpolation formula (Abramowitz and Stegun, 1968) was used to define the location and amplitude of peaks in the data curves more accurately. The results of the correlation analysis of these records is shown in Figure 8.2.4 as a plot of the cross correlation coefficient versus time lag.

The correlation analysis showed that:

- a) The greatest correlation occurs when the Lark Harbour record is advanced by 10 minutes relative to the Parson's Pond record.

CROSS CORRELATION BETWEEN LARK HARBOUR AND PARSON'S POND SURGE

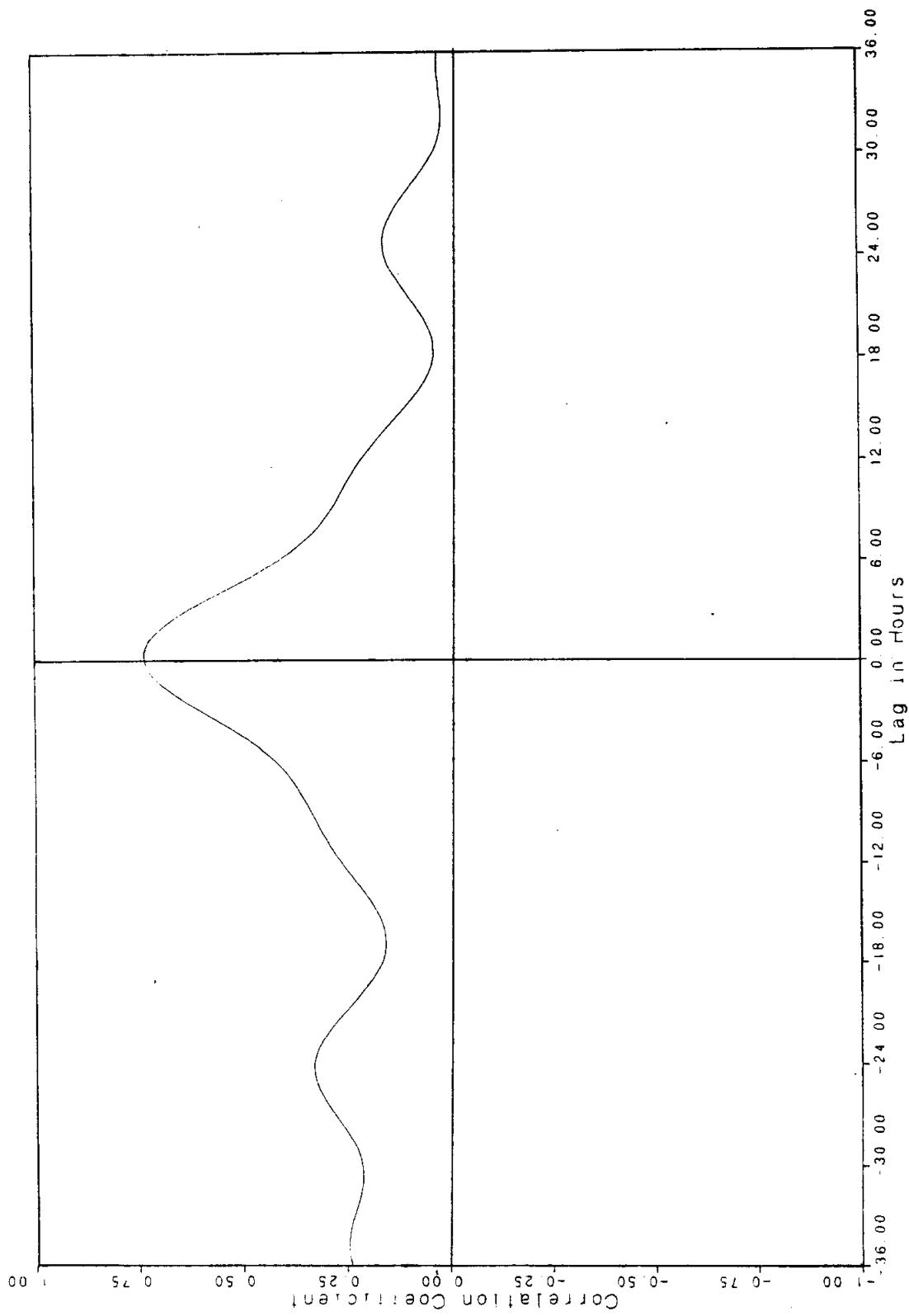


FIGURE 8.2.4

- b) At this optimum time shift, the correlation coefficient between the two surge records is  $r=0.74$  which indicates that approximately 55 percent ( $0.74^2$ ) of the variance in the Parson's Pond record can be explained by the Lark Harbour record. Thus it can be seen that although there is evidence of some local effects at Parson's Pond and Lark Harbour that are independent of each other, there is sufficient agreement between the two sites to transfer the long term record at Lark Harbour into a long term record at Parson's Pond, suitable for extremal analysis.
- c) Assuming a linear relationship between the storm surges at Lark Harbour and Parson's Pond the regression coefficient can be calculated as:

$$\text{regression coefficient} = \frac{\text{correlation coefficient at optimum lag}}{\sqrt{\frac{\text{standard deviation at Parson's Pond}}{\text{standard deviation at Lark Harbour}}}}$$

$$= 0.74 \times \frac{0.121}{0.142}$$

$$= 0.63$$

- d) The unexplained component of the relationship between the storm surge at Lark Harbour and Parson's Pond, is termed the residual error. The standard deviation of this residual can be calculated as:

$$\begin{aligned} \text{std. dev. residual error} &= \text{std. dev. at Parson's Pond} * \sqrt{1-r^2} \\ &= .1212 * \sqrt{1-.55} \\ &= 9.13 \text{ cm} \end{aligned}$$

At the 90% confidence limit this residual error is increased to 13.4 cm.

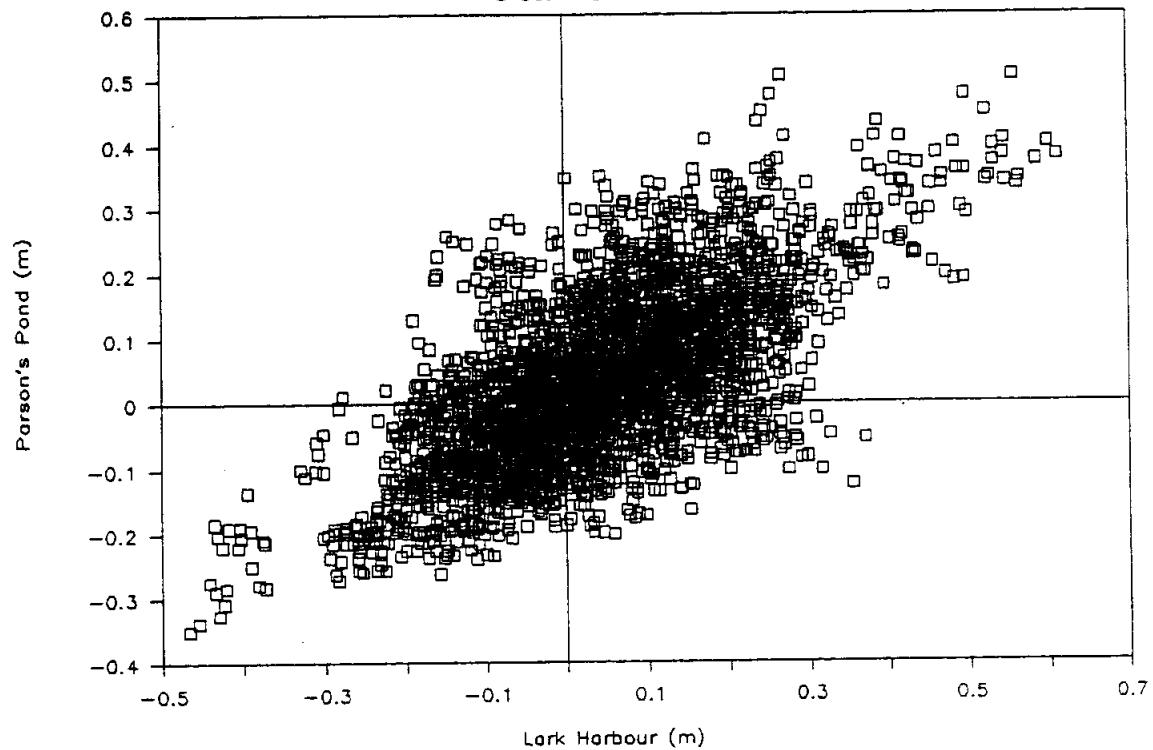
- e) It can be seen in the plot of correlation coefficient versus time lag of Figure 8.2.4 that, in addition to the major peak with near zero lag, a smaller peak in the correlation occurs with lags of approximately 2 days. These fluctuations, apparent in the difference plots of Figures 8.2.1 to 8.2.3 (as mentioned above) are considered to be of secondary importance.
- f) The regression equation relating storm surge at Parson's Pond to the surge at Lark Harbour is  $PP = (LH*0.63+.13)$ .

Further analysis was undertaken to explain the differences between the surge regimes at Lark Harbour and Parson's Pond. Figure 8.2.5 is a scatter plot of the surge data with Parson's Pond data along the Y axis and Lark Harbour data along the X axis. The scatter, which reflects the effects of natural forcing on the water level at one area not being felt at the other, is primarily due to the location of the data collection sites. Lark Harbour is particularly sensitive to winds from the northeast causing water to pile up in the harbour; these winds have an insignificant effect at locations on the exposed west coast, such as Parson's Pond. Similarly westerly winds, causing a wave setup along the west coast, will have a greater influence on the Parson's Pond storm surge regime than that of Lark Harbour.

A two parameter model, using water level and wave data, was considered to reduce the amount of unexplained variance between the storm surges at Parson's Pond and Lark Harbour. However, because a directly measured wave climate for the region does not exist, and the confidence limits induced by hindcasting waves numerically from the available wind data are large, it was concluded that the incorporation of another parameter would not contribute to a more accurate model relating the two water level regimes. In other words there is insufficient data (both wind and wave) to parameterize the physical process to the extent required to significantly reduce the unexplained variance.

## SCATTER PLOT OF SURGE DATA

8 Oct - 31 Dec 1987



**FIGURE 8.2.5**

**LARK HARBOUR VERSUS PARSON'S POND SURGE**

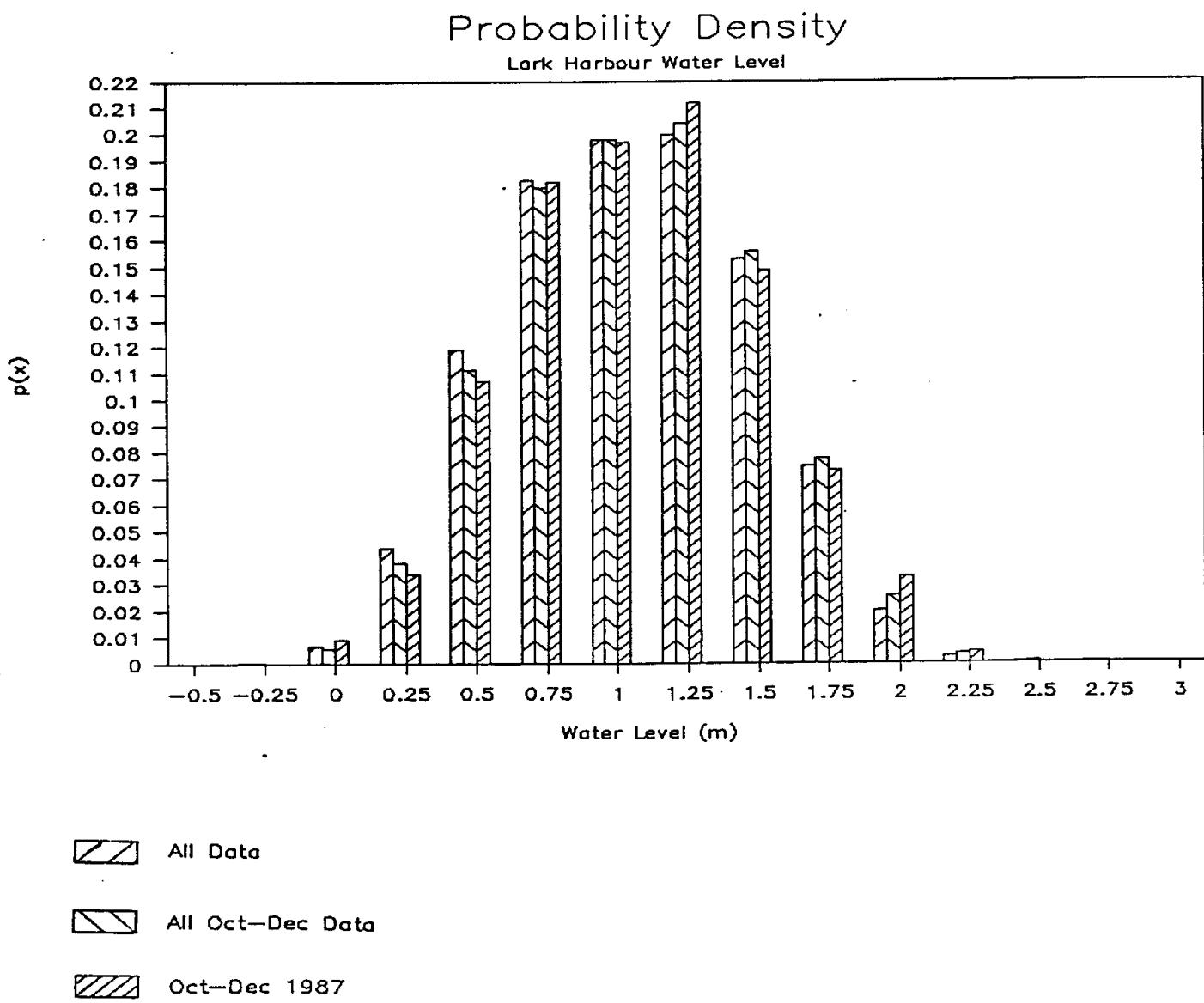
As a result, the linear model, with its simplicity, and attendant unexplained variance is regarded as the best choice. Therefore the long term Lark Harbour data can be suitably adjusted to represent the long term water level regime at Parson's Pond. An extremal analysis can then be undertaken to calculate extreme events.

### 8.3 Extremal Analysis

Prior to undertaking the extremal analysis, the representativeness of conditions from October to December 1987 was examined. This was carried out by using the Lark Harbour data to assess whether or not the sample data distribution was typical of the long term water level distribution. Figure 8.3.1 shows the distribution of three data sets of water level collected at Lark Harbour; all of the data (from 1963 to 1986), all of the October to December data; and the October to December 1987 data. It can be seen that, as expected, the winter data is somewhat weighted at the higher water levels but there is very little variability in the distribution of the three data sets. As a result, conditions observed during the field program can be considered representative of the water level regime.

The maximum sea levels for several return periods were determined by:

- a) Examining 21 years of sea surface elevation data collected at Lark Harbour;
- b) Transforming the data to represent the Parson's Pond water level regime;
- c) Assessing the validity of the statistical assumptions used in extrapolating the data to long return periods;



**FIGURE 8.3.1**

**DISTRIBUTION OF WATER LEVELS AT LARK HARBOUR**

- d) Fitting the water level data to several extremal frequency distributions, and
- e) Identifying the statistical distribution that the data best fit.

The monthly instantaneous maximum values of water levels collected by the Canadian Hydrographic Service at Lark Harbour were used as a database for the extremal analysis. These data, gathered from 1966 to 1986 are related to Chart Datum which refers to the plane of lowest normal tides.

A reduced data set consisting of the 18 annual maximum water levels was then determined. A complete set of 21 annual maxima could not be resolved due to the data gaps in the Lark Harbour record. The data return from the Lark Harbour gauge was determined to be on average 78 percent. There were sufficient water level data available to provide a statistically sound data base for the extremal analysis. Because the extremal analysis procedure uses a time scale of years to express the maximum values (e.g. 1 in 20 year, 1 in 100 year, etc.) it is important to define an appropriate surge year for the sea level. To accommodate the seasonal variation due to river runoff and storm activity within one twelve month period, a surge year from July to June was selected.

The transfer function, i.e. the regression equation calculated in Section 8.2, established between Lark Harbour and Parson's Pond is based on the storm surge component of the water level. The tidal component of the annual maximum values, determined using the tidal analysis techniques described in Section 8.1, was subtracted from the observed value to give a set of 18 surge levels. These were transformed to Parson's Pond values by multiplying the regression coefficient and adding the 90% confidence limit due to the unexplained variance. This resulted in a set of 18 surge values for Parson's Pond. To recover a total (i.e. tidal plus

surge) water level, the 90% confidence limit of the tide at the principal tidal station in the region, Harrington Harbour (see Figure 2.2), was added. The transformation can be written as;

$$\begin{aligned}\text{Parson's Pond water level} &= \text{Lark Harbour water level} \\ &\quad * 0.6325 \text{ (regression coefficient)} \\ &\quad + 0.1345 \text{ (residual error)} \\ &\quad + 2.266 \text{ (tide)}\end{aligned}$$

Martec's suite of extreme value analysis computer programs includes two originally developed by the Inland Waters Directorate of Environment Canada; programme NONPARA which tests the validity of the assumptions made of the input data, and program FDRPFFA which fits the data to several frequency distributions.

A 90% confidence interval provides a reasonable level of certainty in the result while avoiding a large range between the upper and lower confidence limits.

Since a statistical frequency analysis assumes that the sample to be analyzed is a reliable set of measurements of independent random events from a homogeneous population, the validity of this assumption was tested using the following nonparametric tests:

- The Spearman rank order correlation coefficient for independence and trend;
- The Mann-Whitney U statistics for homogeneity of split sample means;
- The Wald-Wolfowitz R statistic for any difference in homogeneity of split samples, and

- The number of runs above and below the median for general randomness.

The monthly water level maxima data were ranked and sorted as required for the various tests. The relevant test statistics and their significance levels were calculated and tabulated for each characteristic of the data set under consideration. The results of the statistical significance tests were used to determine whether more than one population is present in the data due to the evolution in time of the physical processes that cause the variation in the water level.

The nonparametric tests revealed that the set of water level values that comprised the annual maxima were statistically independent and homogeneous at a one percent significance level. In addition, the data set was random and exhibited no trend at the one percent significance level. These tests for independence, trend, homogeneity and randomness indicated that the data set was suitable for the calculation of extreme values. The results of the tests are included in Table 8.3.1.

As part of the extremal analysis, the magnitudes of the measured parameters were fitted to frequency distributions and then extrapolated from the recorded events to extreme return periods. Since it is possible to fit several distributions to the sample data, and obtain several different estimates for a given extreme event, a variety of frequency distributions were tested. The distribution that was best fit by the data was used to provide the extreme values.

The following distributions were fitted:

- Gumbel I;
- Lognormal;
- Three-Parameter Lognormal, and
- Log-Pearson type III.

TABLE 8.3.1  
 TESTS FOR INDEPENDENCE, TREND, HOMOGENEITY AND RANDOMNESS  
 PARSON'S POND, NEWFOUNDLAND, .... WATER LEVEL DATA 1966-1986 3 MISSING YEARS

Spearman Rank Order Serial Correlation Coefficient for Independence = .2283 From Table Critical T Value at 1 Percent Significance Level TCR.01	D.F. = 15 TCR.01 = 2.602	Students T = -.908 = 2.602
Spearman Rank Order Serial Correlation Coefficient for Trend = .0108 From Table Critical T Value at 1 Percent Significance Level TCR.01	D.F. = 16 TCR.01 = 2.921	Students T = .043 = 2.921
Mann-Whitney Split Sample Test for Homogeneity From Table Critical U Value at 1 Percent Significance Level UCR.01	Level UCR.01 = 14.0	Mann-Whitney U = 32.5 = 14.0
Wald-Wolfowitz Split Sample Test for Homogeneity. Ties in Different Subsamples, Test Invalid.		Not Significant
Runs Above and Below the Median Test for General Randomness N1=9 N2=9 Acceptable Range at 5% Significance Level is 6. to 14. Inclusive.		RUNAB = .11 Not Significant

The means by which the sample data are fitted to the frequency distribution was achieved by using the method of maximum likelihood. The parameters of the distribution were estimated to maximize the probability that the sample was obtained from the particular distribution being considered. In situations where a maximum likelihood fit of a selected distribution to the water level data was not possible, the method of moments was used.

The standard deviation, coefficient of skew and coefficient of kurtosis of the input data were calculated for each distribution. These sample statistics were then compared with the theoretical characteristics of the selected distributions to determine which distribution the data most closely follows. The extremes and their asymptotic errors of estimate were then computed for selected return periods for each distribution.

The fundamental tenet of selecting the flood frequency distribution is to choose the one that the data best fit, therefore, the Three-Parameter Lognormal is the most appropriate representation of the water level regime at Parson's Pond. Table 8.3.2 gives the relevant parameters of the distribution, Table 8.3.3 provides the extreme values at specific return periods, and Figure 8.3.2 shows the data, the fitted distribution and the 90% confidence limits.

The plot of extreme event data of Figure 8.3.2 shows that the long term water level distribution curve has a small slope and thus there are not large changes in water level values over various return periods. It can be seen from the extremal analysis that the 1:5, 1:20 and 1:100 year return periods are 2.831, 2.915 and 2.990 m, a change of 0.159 m.

TABLE 8.3.2  
EXTREMAL ANALYSIS OF PARSON'S POND  
WATER LEVEL DATA

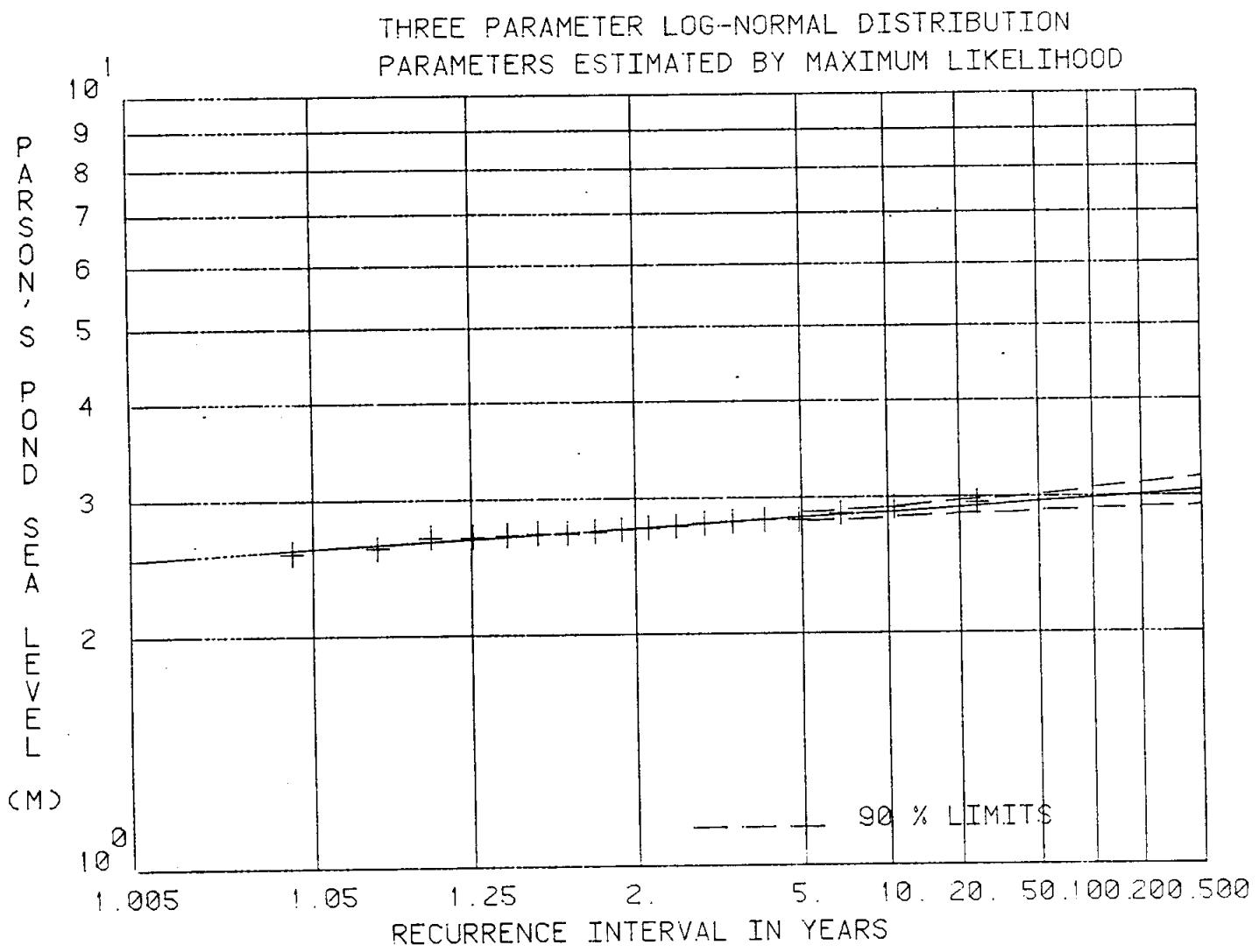
<u>Ordered Input Data</u> (m above)		<u>Surge Year</u>	<u>Probability</u>	<u>Return Period</u>
Chart Datum	Geodetic Datum			
2.95	1.06	1985	.041	24.342
2.91	1.02	1970	.095	10.511
2.86	.97	1983	.149	6.703
2.81	.92	1966	.203	4.920
2.81	.92	1968	.257	3.887
2.80	.91	1971	.311	3.212
2.78	.89	1973	.365	2.737
2.76	.87	1977	.419	2.384
2.75	.86	1969	.474	2.112
2.74	.85	1982	.528	1.895
2.72	.83	1974	.582	1.719
2.71	.82	1981	.636	1.573
2.71	.82	1972	.690	1.450
2.70	.81	1965	.744	1.344
2.69	.80	1986	.798	1.253
2.69	.80	1979	.852	1.174
2.60	.71	1978	.906	1.104
2.57	.68	1967	.960	1.042

	<u>Input Data</u>	<u>Three-Parameter Lognormal Transformation</u>
mean	2.7512	0.2908
standard deviation	0.1000	0.0714
coefficient of skew	0.2170	-0.0016
coefficient of kurtosis	3.9594	3.9506

TABLE 8.3.3  
WATER LEVEL AT PARSON'S POND FOR SELECTED RETURN PERIODS

Three-Parameter Lognormal Distribution fitted by Maximum Likelihood

<u>Return Period</u> (year)	<u>Estimate</u> (m above)		<u>90% Confidence Limits</u> (m above)	
	<u>Chart</u> <u>Datum</u>	<u>Geodetic</u> <u>Datum</u>	<u>Chart</u> <u>Datum</u>	<u>Geodetic</u> <u>Datum</u>
5	2.83	0.94	2.79 - 2.88	.90 - .99
10	2.88	0.99	2.82 - 2.93	.93 - 1.04
20	2.92	1.03	2.84 - 2.99	.95 - 1.10
50	2.96	1.07	2.87 - 3.05	.98 - 1.16
100	2.99	1.1	2.88 - 3.10	.99 - 1.21
200	3.02	1.13	2.88 - 3.15	.99 - 1.26



**FIGURE 8.3.2**

**EXTREME EVENTS AT PARSON'S POND**

#### 8.4 Fresh Water Influence

Based upon existing information concerning the tidal range inside and outside of Parson's Pond, and the area of Parson's Pond, a head-discharge relationship has been established (see Appendix C). This relationship shows that even if the storage capacity of the pond (which is considerable) is ignored, the 1:100 year annual instantaneous fresh water flood peak (see Appendix D) could be continuously sustained with only 0.48 m surcharge of the pond elevation. The fresh water surcharge is +0.4 m when the storage of the pond is taken into account. These values of surcharge (0.48 and 0.4 m) produce pond levels of -0.37 and -0.49 m relative to geodetic datum.

When the 1:1 year fresh water inflow of 109.2  $\text{m}^3/\text{s}$  (extrapolated from values in Appendix D) is coupled with the 1:20 and 1:100 year surge events (applied for 13 hours) the resulting pond water levels are +0.27 m and +0.44 m, respectively, above geodetic datum. The 13 hour continuous surge duration was selected as a conservative estimate of the surge event time series. The water levels above are conservative estimates because the probability of the 1:1 year fresh water inflow occurring in conjunction with the storm surge events is less than 1. However, even if a continuous but low fresh water input is considered (say 9  $\text{m}^3/\text{s}$ ), the resulting extreme water levels are reduced by less than 0.2 m. This serves to demonstrate that the extreme water levels in the pond are controlled primarily by the outside sea levels with a reduction in amplitude caused by the constriction to flow under the highway bridge coupled with the large storage capacity of the pond both of which act as filters to the fluctuations in the open coast sea level. The estimate of the head-discharge relationship is based on available information on how the pond responds to normal tidal fluctuations (see Appendix C). To allow for any errors introduced by this factor, and in consideration of the accuracy of plotting on the flood plain map, the levels plotted are 0.3 m for the 1:20 year event and 0.5 m for the 1:100 year event. In the

south west corner of Parson's Pond there is a boggy area where, due to the low dense vegetation, the plotting of contour lines would be fairly inaccurate. Since this area is normally marshy, the 1:20 and 1:100 year flood plain lines have been plotted as the bottom edge of the embankment which borders this area.

### 8.5 Wave Runup and Overtopping

The maximum height of a wave travelling in deep water is limited by a maximum wave steepness for which the wave form can remain stable. This limiting steepness is approximately  $H_o/L_o = 0.142$  (Shore Protection Manual (SPM), 1977) where  $H_o$  is the deep water wave height and  $L_o$  is the wave length in deep water. When the waves move into shallow water, this limiting steepness decreases being a function of both the relative depth  $d/L$  (where  $d$ =water depth and  $L$ =wavelength) and the slope of the bottom. As a wave moves into shallow water, it will steepen up to a point where wave breaking will commence and a rough estimate of the breaking wave height,  $H_b$ , to the depth at the point of breaking,  $d_b$ , is given as  $H_b/d_b = 1.28$  (SPM, 1977). The actual ratio depends upon the beach slope ( $m$ ), as noted above and the full analysis has been used in determining the breaker wave height.

The determination of the wave run-up on the beach involves the establishment of the largest wave that can impact on the beach berm.

The wave run-up is defined as the vertical distance above the existing water level that the wave propagating to shore will reach. Based upon field observations and hydrographic charts, an average representative cross-sectional profile was determined.

Based upon methodology outlined in the U.S. Army Corps of Engineers Shore Protection Manual (SPM) (1977), wave runup and overtopping have been calculated for various sea levels and beach berm crest heights at Parson's Pond.

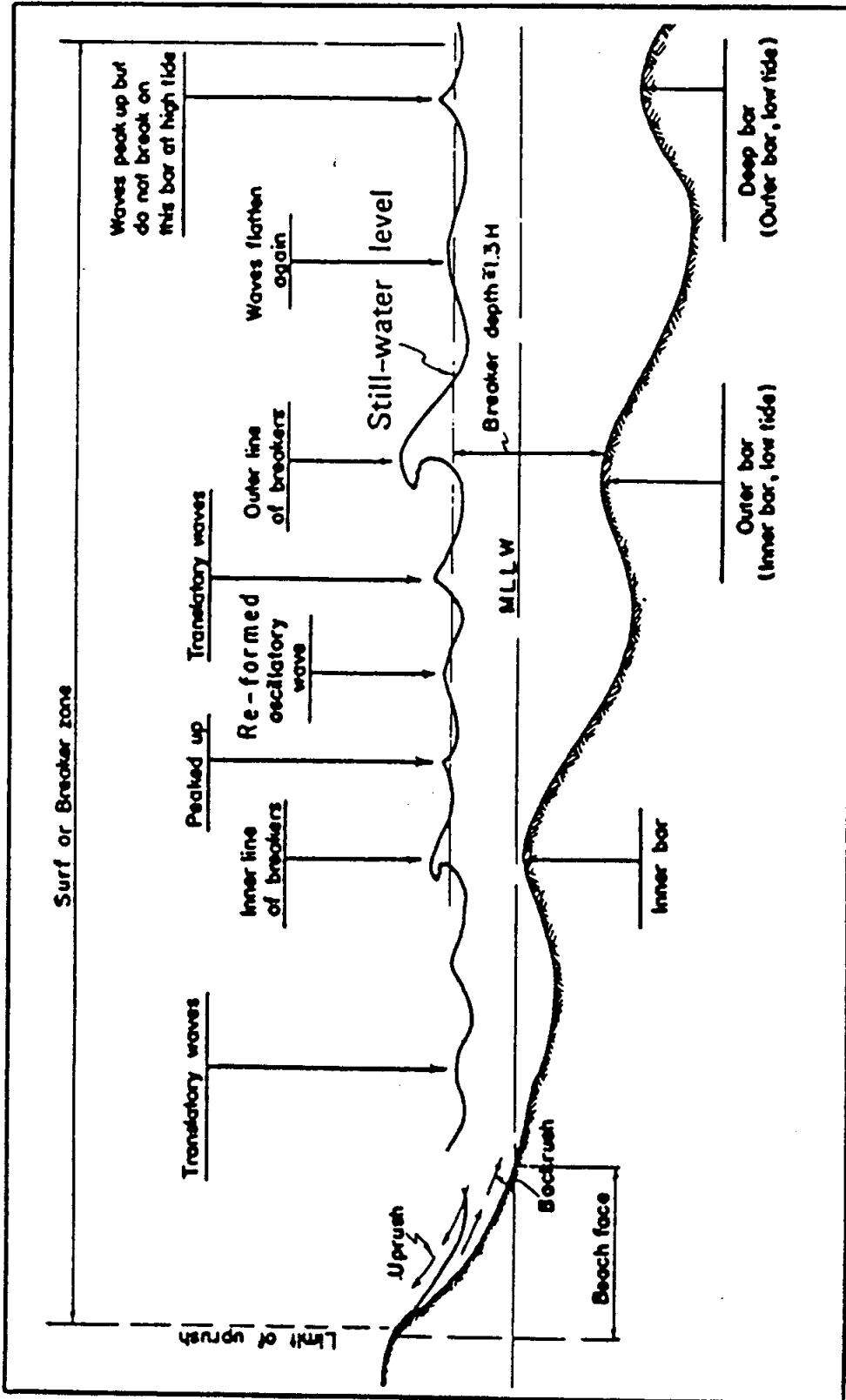
The slope of the berm face has been taken as 1 vertical to 5 horizontal (1:5) (based on 1:2500 scale map). The toe of the berm is shown from contours on the map to be at an elevation of +0.5 m (all elevations are with respect to local geodetic datum) and is fronted by a beach with an average slope of 1:10 (based on field observations) to an elevation of -1.9 m where it changes to a nearshore slope of 1:100 out to the 60 m depth contour (from the hydrographic chart).

The worst case for run-up and overtopping occurs when waves break at the toe of the berm. With any reasonable storm, the majority of waves are so large that they break seaward of the berm but they contain sufficient energy that they can reform and propagate inshore as smaller waves. Also, some of the smaller waves in the wave train may be of small enough amplitude that they can reach the berm. Figure 8.5.1 shows an example of this breaking process. The vertical scale is exaggerated in this figure and the process will be similar to that shown with or without the presence of sand bars. For the reasons outlined above, a conservative (i.e. high) estimate of runup and overtopping can be obtained by assuming a continuous train of waves breaking at the toe of the beach berm. The fetch and storm limited sea state for this coast has a significant wave period of 11 to 12 seconds using Figure 8.5.2 with representative fetch length of 150 to 200 nautical miles and wind speed of 50 to 60 knots. It is not unreasonable to assume that the upper limit (i.e. worst case) for an average wave period for waves reaching the berm would be in the order of 10 seconds.

Using Figure 8.5.3 for various wave and near-shore conditions, the breaking wave heights were established as 1.25 and 1.54 m respectively for sea levels of 1.1 and 1.21 m, the 1:20 and 1:100 year events (see Table 8.3.3). The upper 90% confidence limits were used for the open coast water levels to allow for uncertainties associated with relating Lark Harbour storm surge to Parson's Pond surge levels. Using Figure 8.5.4, it was determined that the breaking wave heights would correspond to unrefracted deep water wave heights ( $H_o'$ ) of 0.53 and 0.72 m respect-

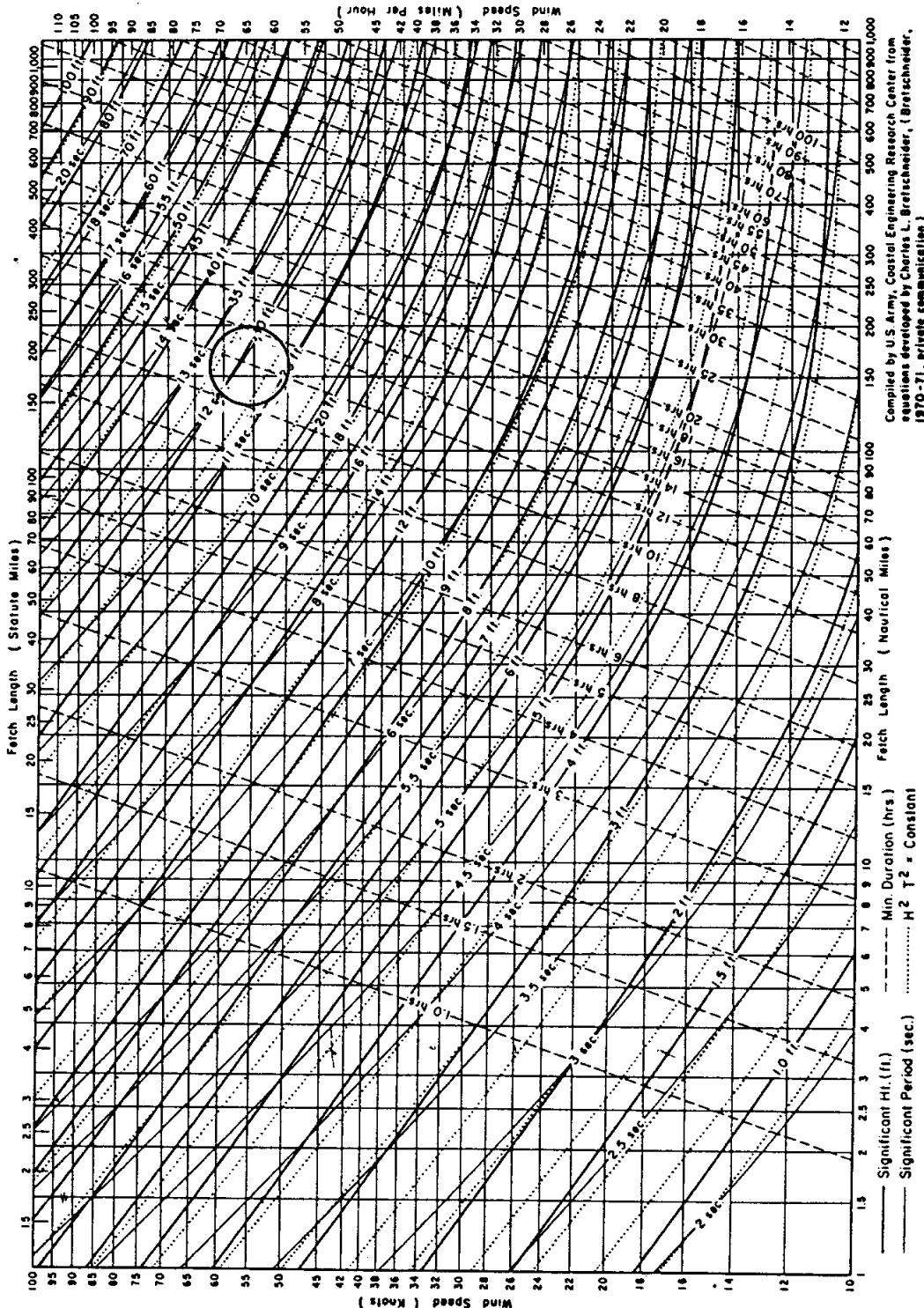
**FIGURE 8.5.1**

SCHEMATIC DIAGRAM OF WAVES IN THE BREAKER ZONE  
(FROM FIGURE A-2 OF SPM, 1977)



**FIGURE 8.5.2**

DEEPWATER WAVE FORECASTING CURVES AS A FUNCTION OF  
WIND SPEED, FETCH LENGTH, AND WIND DURATION  
(FOR FETCHES 1 TO 1,000 MILES)  
(FROM FIGURE 3-15 OF SPM, 1977)



DIMENSIONLESS DESIGN BREAKER HEIGHT VERSUS  
RELATIVE DEPTH AT STRUCTURE (FROM FIGURE 7-4 OF SPM, 1977)

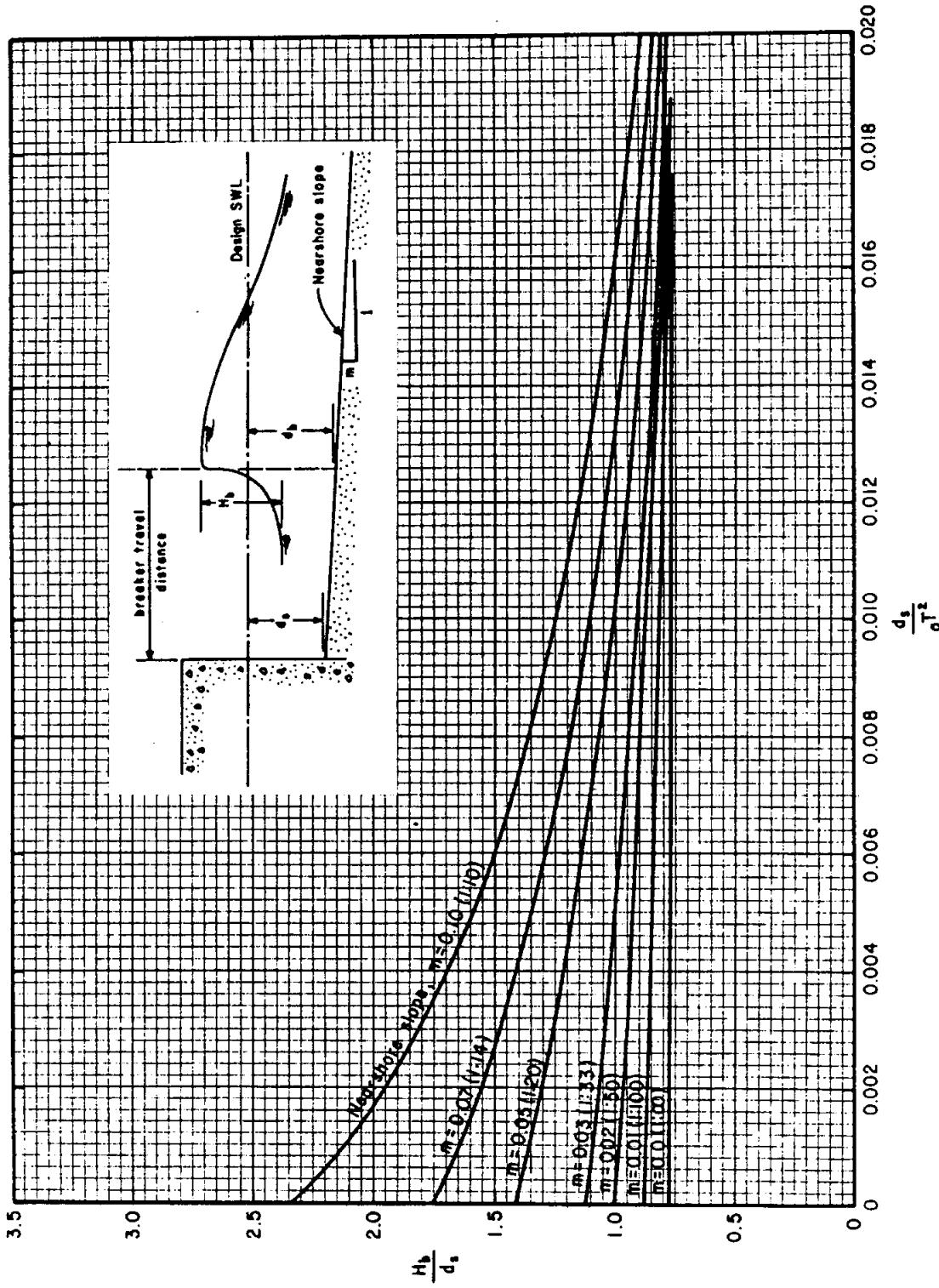
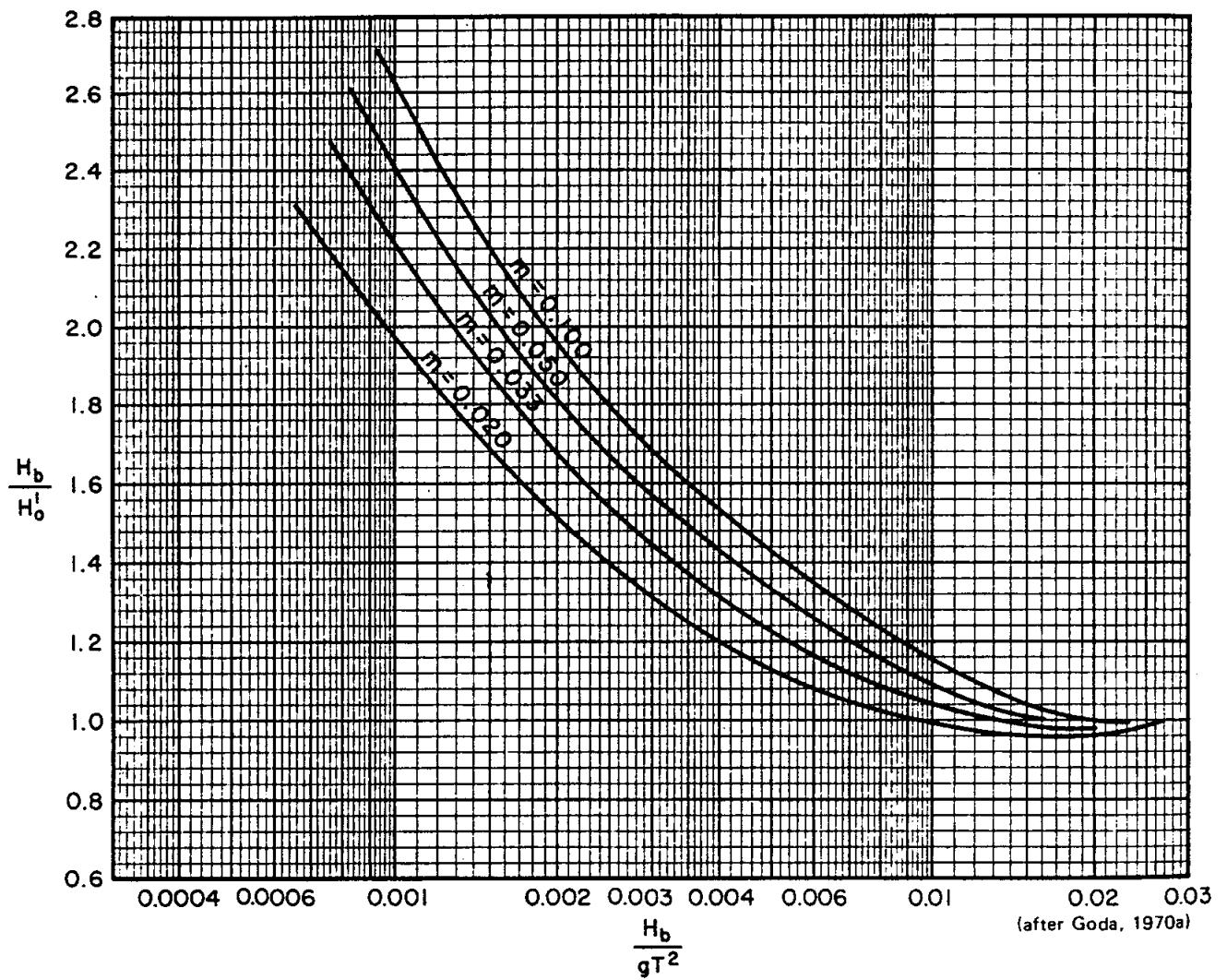


FIGURE 8.5.3



**FIGURE 8.5.4**

BREAKER HEIGHT INDEX  $H_b/H_o'$  VERSUS  $H_b/gT^2$   
(FROM FIGURE 7-5 OF SPM, 1977)

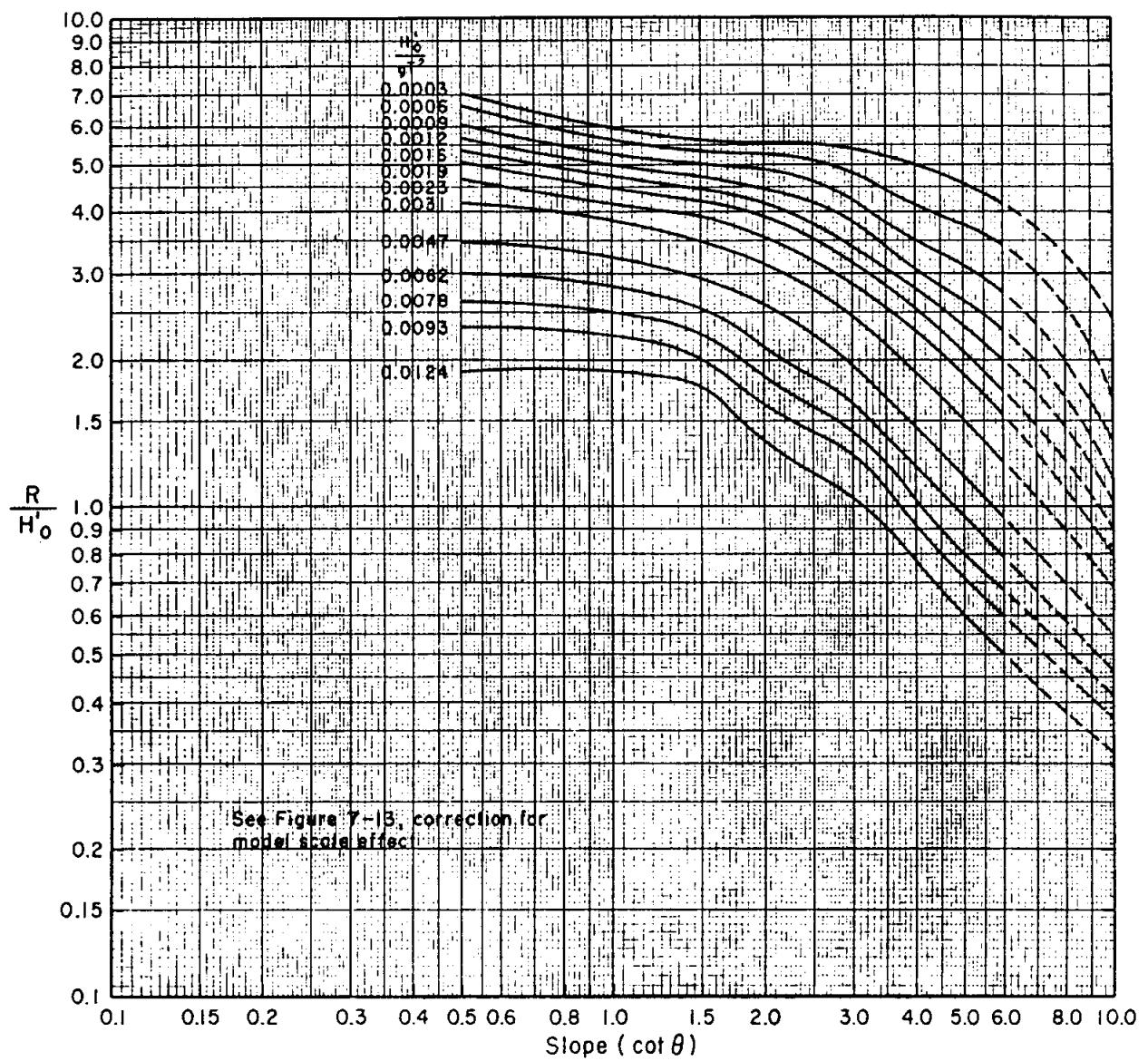
ively and so it can be seen that there would be only a relatively small offshore sea state required to provide such waves. The large amplification effect is due to the shoaling effect as the waves travel from deep water into shallow water.

By taking the elevation of the toe of the beach berm to be +0.5 m (as discussed above), the depth of water at the toe of the berm ( $d_s$ ) is 0.6 m and 0.71 m for the 1:20 and 1:100 year events. From these, by interpolating between the predictions of Figures 8.5.5 and 8.5.6, the uncorrected runup predictions were obtained. According to the SPM (1977) procedure, these were corrected for scale effects using Figure 8.5.7. The H=4' to 12' curve was used since  $H_{1:20}=1.25\text{ m} = 4.1\text{ ft}$  and  $H_{1:100}=1.54\text{ m} = 5.1\text{ ft}$ . The resulting predicted runup on smooth impermeable slopes was corrected for the roughness and permeability of a sandy slope according to SPM (1977) procedures. For this case, it was assumed that a sand and grass berm would be roughly equivalent to either fitted concrete blocks or a grass slope and thererby a representative correction factor of 0.9 was obtained from Table 7-2 of SPM (1977).

As discussed above, following the SMP (1977) procedures, correcting for scale effects and berm roughness, the runup elevations would be 3.04 and 3.54 m for water elevations of 1.1 and 1.21 m, respectively. If the berm slope is 1:10 (as it is at various locations of the beach) these runup elevations would be 2.03 and 2.19 m, respectively for the 1.1 and 1.21 m sea levels.

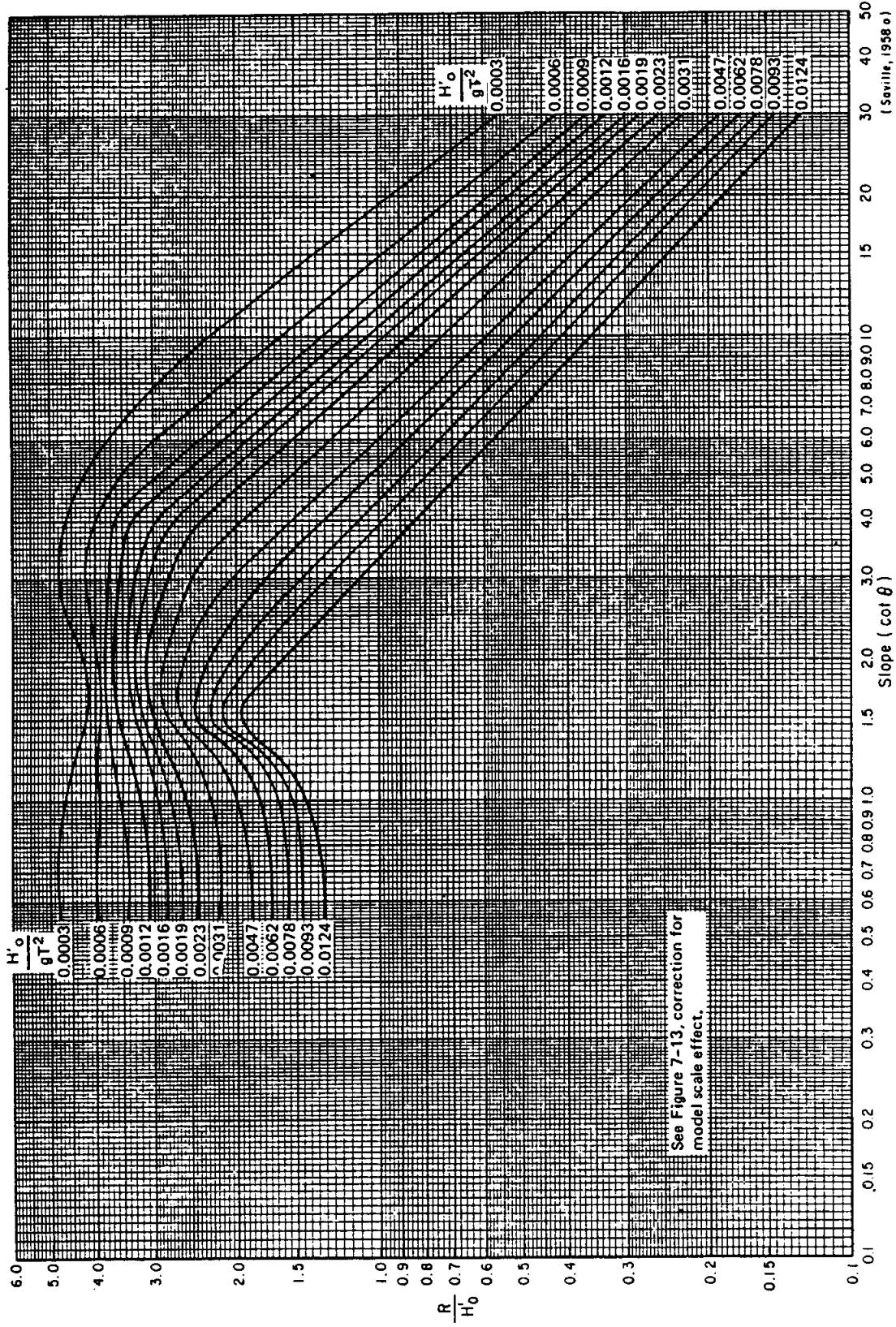
Based on the (limited) overtopping calibration coefficients in SPM (1977) (see Figure 8.5.8 as an example) the rates of overtopping for various berm crest elevations have been estimated using equation 7-10 of SPM (1977) and are included in Table 8.5.1.

These overtopping rates may be increased by as much as 55% (SPM, 1977) if there is a strong onshore wind assisting the overtopping process. It is most likely that there will be strong onshore winds when



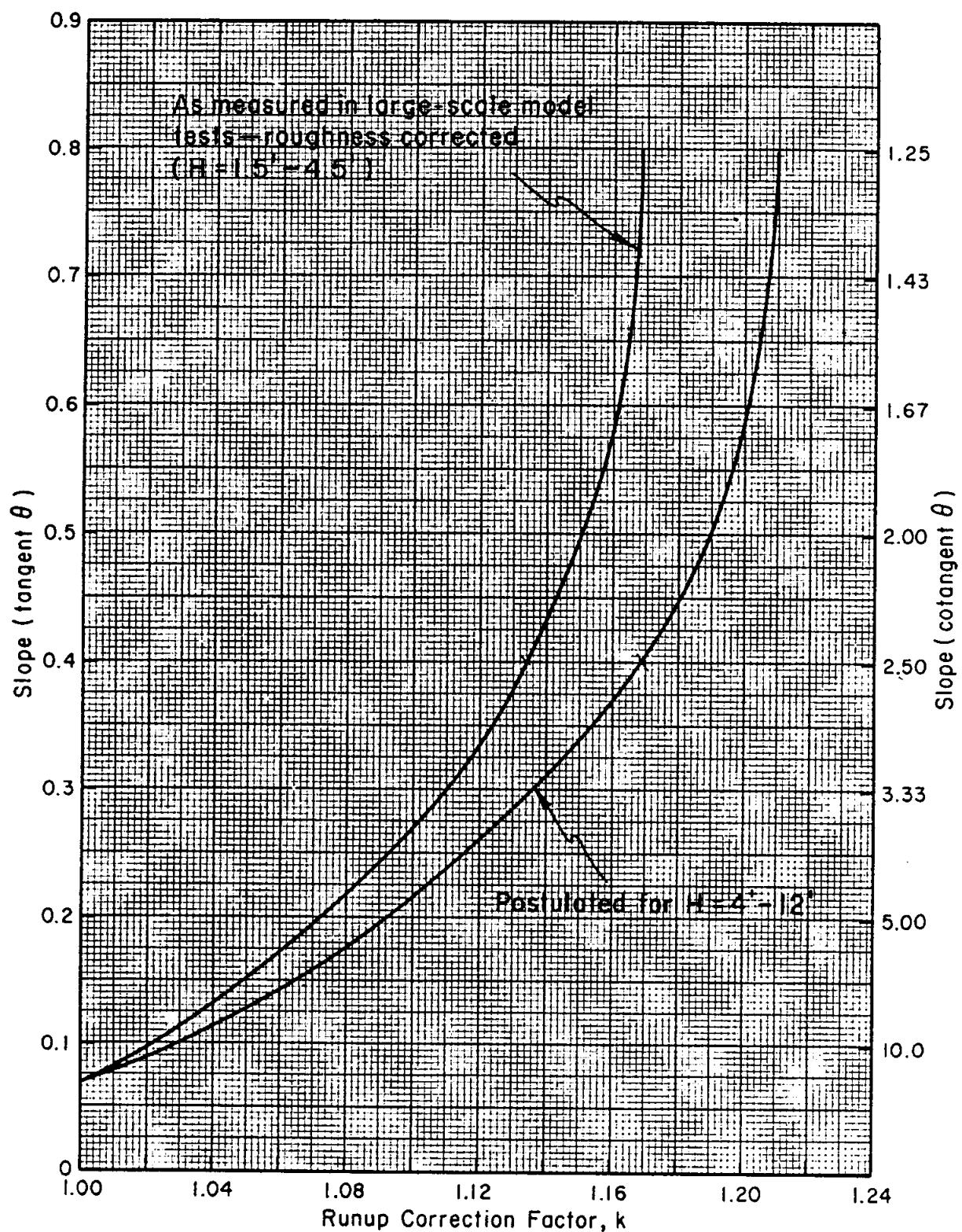
**FIGURE 8.5.5**

WAVE RUNUP ON SMOOTH, IMPERMEABLE SLOPES  
WHEN  $d_s/H_0 \approx 0.80$  (FROM FIGURE 7-10 OF SPM, 1977)



**FIGURE 8.5.6**

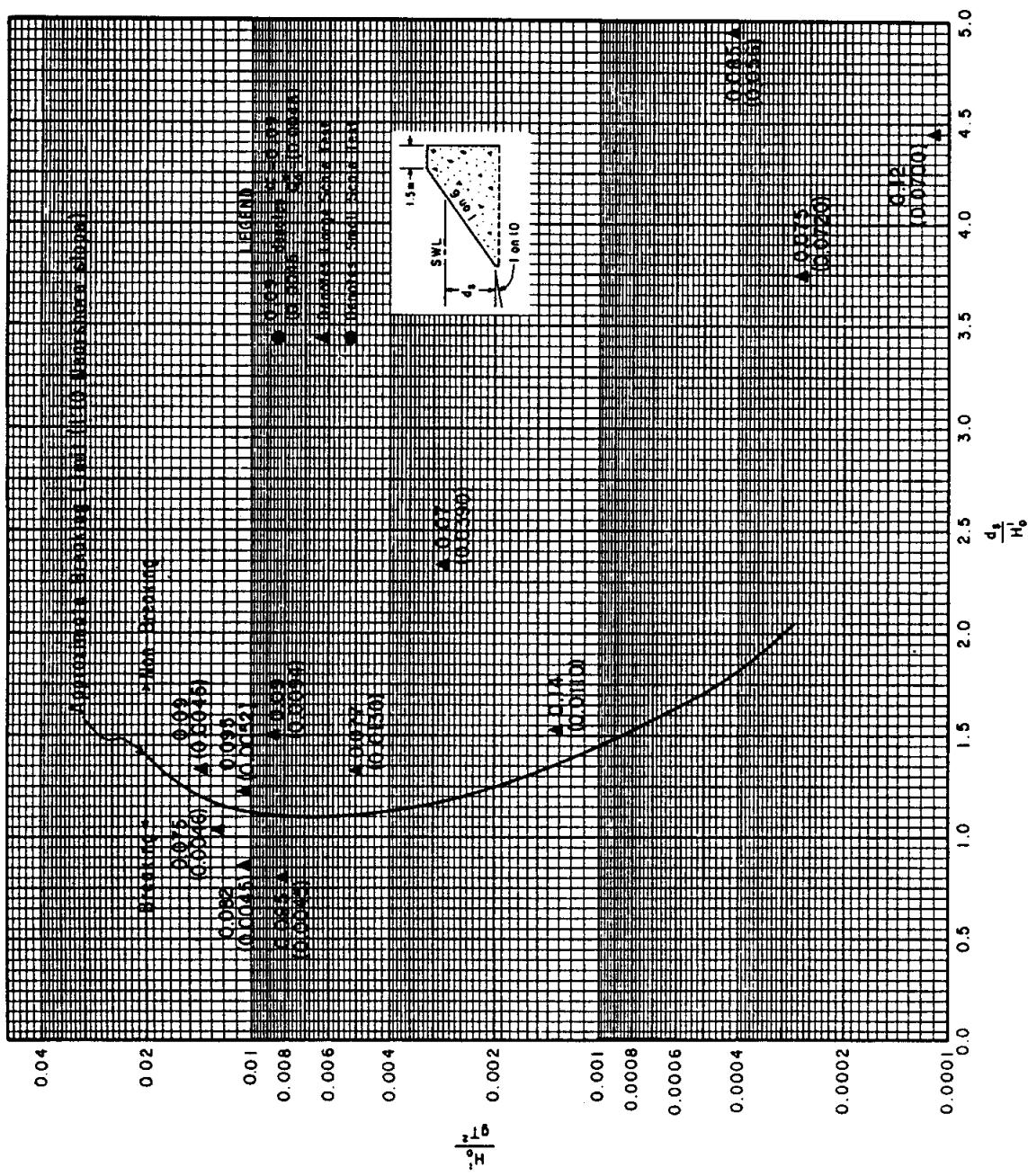
WAVE RUNUP ON SMOOTH, IMPERMEABLE SLOPES  
WHEN  $d_s/H_o \approx 2.0$  (FROM FIGURE 7-11 OF SPM, 1977)



**FIGURE 8.5.7**

RUNUP CORRECTION FOR SCALE EFFECTS  
(FROM FIGURE 7-13 OF SPM, 1977)

**FIGURE 8.5.8**



OVERTOPPING PARAMETERS  $\alpha$  and  $Q^*$   
(FROM FIGURE 7-27 OF SPM, 1977)

TABLE 8.5.1  
OVERTOPPING RATES  
 ( $\text{m}^3/\text{s}$  per metre of shoreline)

Sea Level*	1.1 m	1.21 m
Berm Crest Elevation*		
(a) (berm slope = 1:5)		
1.5	0.116	0.20
2.0	0.063	0.12
2.5	0.027	0.071
3.0	0.001	0.031
3.5	---	0.002
4.0	---	---
(b) (berm slope = 1:10)		
1.5	0.07	0.14
2.0	0.002	0.025
2.5	---	---
(c) (average for between 1:5 and 1:10 berm slopes)		
1.5	0.09	0.17
2.0	0.03	0.073
2.5	0.015	0.03
3.0	---	---

\*Elevations with respect to local geodetic datum.

there is a positive coastal storm surge and so this factor (1.55) is used (as shown below) in the final prediction of overtopping rates.

It is important to note that erosion of the beach during a storm will likely cause an effective increase in the water depth at the toe of the beach berm and thereby result in areas where the berm slope of 1:10 becomes 1:5 during storm. With this in mind the overtopping rates obtained with a sea level of 1.1 m (1:20 year event) or 1.2 m (1:100 year event) can be conservatively estimated as those rates listed in Table 8.5.1.

In 1986, when the aerial photographs were obtained from which the flood risk map was produced, the majority of the beach berm where overtopping could occur was at an elevation of from 3.0 to 3.5 m. The total length of beach berm is 975 m of which 160 m has an elevation of from 2.5 to 3.0 m. Since the top of the berm is generally sandy (field observations), it is reasonable to assume that the top of the berm will quickly be eroded once overtopping commences. It is therefore reasonable to assume an effective berm crest elevation of 2.5 m. Also, erosion of the berm will cause the seaward face of the beach to steepen therefore it is reasonable to use a berm slope of 1:5. From Table 8.5.1 (see underlined values) multiplying by 1.55 to take onshore winds into account (as described above), the respective upper limits of the 1:20 and 1:100 year overtopping rates have been estimated at 0.042 and 0.11 m<sup>3</sup>/s per metre of shoreline for berm slope of 1:5 m.

By multiplying these unit length overtopping rates by the length of the berm, the resulting rates of inflow would be 41 m<sup>3</sup>/s and 107 m<sup>3</sup>/s during the 1:20 and 1:100 year floods. At these flows the area up to the 1.3 m level (the level of the south end road) would be flooded in one to two hours during the 1:20 year event and from half an hour to an hour for the 1:100 year event. These times were estimated by determining the total volume of the space between ground level and the +1.3 m elevation

(by planimeter on the 1:2500 scale map) and dividing this volume by the inflow rates). As can be seen from these relatively short infill times, the low lying area behind the beach berm would flood to the point where the south road was overrun before the high tide subsided.

Treating the south end access road as if it were a broad crested weir 160 m long, the depth of water above the weir (upstream of the weir) can be estimated as:

$$H \approx \left( \frac{Q}{1.7 \times 160} \right)^{3/2} \quad (\text{Streeter, 1975})$$

Which yields 0.06 m and 0.25 m above the weir (i.e. road) crest for the 1:20 and 1:100 year overtopping flows, respectively.

Based on the above, the 1:20 and 1:100 year flood levels north of the south end access road are estimated at  $1.3 + 0.06 = 1.36$  m and  $1.3 + 0.25 = 1.55$  m (above local geodetic datum), respectively.

## 9.0 FLOOD LEVEL CONTOURS

The respective 1:20 and 1:100 year flood levels for the area of Parson's Pond north of the south end access road have been calculated (Section 8.5) to be 1.36 and 1.55 m above local geodetic datum.

In the area south of the south end access road but west of the highway bridge, the 1:20 and 1:100 year sea levels are 1.1 and 1.21 m (upper 90% confidence limits as discussed in Section 8.5), respectively above local geodetic datum.

For the area east of the highway bridge (Parson's Pond itself) the flood levels have been estimated at +0.3 m and +0.5 m for the 1:20 and 1:100 year events (see Section 8.4). As discussed in Section 8.4, the south west corner of Parson's Pond is a boggy area where, due to the low dense vegetation, the plotting of contour lines would be fairly inaccurate. Since this area is normally marshy, the 1:20 and 1:100 year flood plain lines have been plotted as the bottom edge of the embankment which borders this small area of Parson's Pond shoreline.

All of the areas affected by the above flood levels are shown in Appendix E.

## 10.0 REMEDIAL MEASURES

In order to reduce the extent of flooding at Parson's Pond, there are two courses of action which could be undertaken. The first is to increase the beach berm crest height to reduce and/or eliminate overtopping for all but very extreme sea levels. The second is to excavate drainage channels and place culverts under access roads so that overtopping water can drain away rather than back up and cause flooding as experienced in 1976 and 1977.

Some remedial work was undertaken after the 1976 and 1977 floods to increase the beach berm height in the area west and north of the cemetery, and so it is conceivable that the 1976 and 1977 floods resulted from sea levels lower than the 1:20 or 1:100 year events. This would be particularly true for the 1977 flood if the overtopping waves of the 1976 flood eroded the crest of the beach berm leaving the berm all the more susceptible to overtopping.

There are two options for increasing the berm height. One is to design a properly armoured (i.e. with rip-rap) berm slope (in effect, a seawall) so that no erosion of the berm is anticipated during some prescribed design life. The other option is a sacrificial berm which would have to be repaired periodically after severe storms. The advantage to the second option is much lower capital cost and since the majority of the increase in sea level is extreme astronomical tides it need be designed only to withstand a few hours (2 or 3 hours) of severe wave attack during a single event. A disadvantage is that repair may have to be relatively prompt after such an event in order to ensure continued protection against flooding during the next extreme high tide.

The second approach, drainage channels and culverts, could be undertaken in conjunction with increasing the berm height. The channels and culverts would have to be sized to accommodate the anticipated flows

associated with overtopping. Some precautions would have to be taken to keep channels and culverts free of debris and vegetation which could accumulate during "dormant" periods. The culvert(s) under the south end access road would have to have check valves (like Acadian abideaux gates) to prevent salt water flowing into the area north of the road. There are a number of possible routes that drainage channels could be laid out along. A more detailed site investigation (i.e. evaluation of the capacity of existing brooks, surficial geology; land use, etc.) would have to be conducted to select the optimum layout for a drainage system. The principal disadvantage to the drainage system is that, without pumping, the flood level cannot be reduced below sea level. Thus, the 1:20 and 1:100 year events could have the flood levels reduced from 1.38 and 1.52 m to just above 1.1 and 1.2 m, respectively. While this is not a large reduction, it may be associated with a substantial reduction in potential property damage and thereby be economically attractive.

With either (or both) of the two above flood reductions systems, the smaller flood areas, which are directly adjacent to Parson's Pond River west of the highway, will be unaffected.

Should the construction of remedial measures be proposed, it is advisable to investigate the response of Parson's Pond to high sea levels in more detail in order to define more exactly the extent of flooding east of the main highway. Also, the beach dynamics, geometries and near-shore bathymetries should be further studied to obtain a more precise determination of the beach berm crest elevation that is required to eliminate wave overtopping in the 1:20 and 1:100 year storms. A similar type of investigation should be carried out if a drainage system is proposed for the flooded areas.

As an alternative to remedial measures intended to reduce flooding, measures can be adopted which accept the existing flood levels but reduce the damages suffered during flooding. Such measures include zoning regu-

tations concerning land use in the flood plain, flood proofing exposed existing properties, and/or purchases of properties subjected to flooding by one or more levels of government.

Zoning regulations can be used to prevent or restrict new development in areas subject to flooding unless they meet strict "flood proofing" specifications. Public lands can be zoned for recreational use or leased agriculture to prevent new construction in areas at risk of flooding.

Some examples of flood proofing include raising buildings (new and/or existing) on piles, building dykes around the exposed property, and sealing the structure up to the predicted flood elevation.

Government acquisition of certain properties may be a potential means of reducing the damage to private property caused by flooding but will probably be cost prohibitive in most cases. Individual properties would have to be considered separately to evaluate the cost:benefit ratio of land purchase versus one of the other methods of reducing flood damage.

## 11.0 CONCLUSIONS AND RECOMMENDATIONS

The areas in and adjacent to the community of Parson's Pond are subject to periodic flooding which is primarily the result of storm surge causing increases in the sea levels along the open coast. This effect is reduced east of the highway bridge (see Appendix E) by the "throttling" effect of the bridge but still represents the "worst case" cause of flooding in this area compared to fresh water flooding events. West of the bridge in the area of the river/estuary channel, the flooding is also controlled by open coast sea levels but experiences virtually no damping because of the relatively high hydraulic conductivity through the coastal channel (normally dredged to keep open). North of this channel and west of the highway the flooding is caused by waves overtopping the crest of the coastal beach when high sea levels elevate the attack of waves and also allow larger than normal waves to get in close to shore before they break.

The extreme sea levels (1:20 and 1:100 year) were obtained by correlating the short record of water level (3 months) obtained at Parson's Pond as part of this study, with water levels at Lark Harbour recorded during the same period. The Lark Harbour location has 21 years of water elevation data which were then used in an extremal analysis (Section 8.3) and spatially extrapolated (by using the short term correlation) to provide extreme event predictions for Parson's Pond. The upper 90% confidence limits were used to allow for errors introduced during the spatial extrapolation. These water levels were used in conjunction with knowledge of the normal channel hydraulics of the estuary (inferred from local estuarine tidal ranges) to predict the associated flood levels in the land areas adjacent to the estuary (Section 8.4). The procedures of SPM (1977) were used to predict the quantity of wave overtopping along the open coast which was in turn used to arrive at predicted flood levels in the area behind the coastal beach (Section 8.5). All of the affected areas are shown on the map of Appendix E.

As mentioned above, the coastal flooding at Parson's Pond is dominated by two related processes. These are high coastal sea levels and by waves overtopping the beach berm north of the river during these periods of high sea level. Presently the water which overtops the berm in this region is held behind the south-end access road and results in higher water levels to the area north of this road than exist in the Parson's Pond channel during high sea levels. If a drainage system was constructed for this area which suffers from the worst flooding, the total area affected by the 1:20 and 1:100 year floods could be reduced. In order to affect a larger reduction in the area of flooding, the crest of the beach berm would have to be elevated in order to prevent wave overtopping. There are no practical means of reducing the flooding in other areas which have open connections to the sea, but the level of damage can be reduced by taking measures as discussed in Section 10.0.

## REFERENCES

- Abramowitz, M. and I.A. Stegun, 1964. Handbook of Mathematical Functions, National Bureau of Standards, Washington, D.C., 1046 pp.
- Atmospheric Environment Service, 1982. Canadian Climate Normals, Volume 5 - Wind, Canadian Climate Program, Downsview, 281 pp.
- Canadian Hydrographic Service, 1986. Sailing Directions Newfoundland, Eighth Edition, Department of Fisheries and Oceans, Ottawa.
- Lewis, P.J. and M.D. Moran, 1984. Severe Storms off Canada's East Coast: A Catalogue Summary for the Period 1957 to 1983. Canadian Climate Program Report 84-13, Downsview, 322 pp.
- "Regional Flood Frequency Analysis for the Island of Newfoundland", 1984, report prepared for the Canada-Newfoundland Flood Damage Reduction Program, Nfld., Dept. of Environment and Environmental Canada.
- Streeter, V.L. and Wylie, E.B., 1975, "Fluid Mechanics" McGraw-Hill, Inc.
- U.S. Army Corps of Engineers "Shore Protection Manual", 1977, U.S. Army Engineering Waterways Experiment Station Coastal Engineering Research Center, P.O. Box 631, Vicksburg, Miss. 39180.

**APPENDIX A**  
**WATER LEVEL DATA AT PARSON'S POND AND LARK HARBOUR**

.1 6.35 0. 0. .35 -105 ' WATER LEVEL AT PARSON'S POND, NFLD.  
011087 311087

2685	12.5000	91087	1.738	1.680	1.622	1.514	1.406	1.322	1.237	1.040	0.5000
2685	16.5000	91087	0.843	0.756	0.670	0.627	0.583	0.600	0.616	0.696	0.5000
2685	20.5000	91087	0.775	0.887	0.998	1.107	1.216	1.318	1.420	1.419	0.5000
2685	0.5000	101087	1.418	1.394	1.371	1.283	1.195	1.093	0.991	0.907	0.5000
2685	4.5000	101087	0.823	0.732	0.642	0.612	0.583	0.607	0.632	0.774	0.5000
2685	8.5000	101087	0.915	1.065	1.214	1.370	1.525	1.613	1.702	1.752	0.5000
2685	12.5000	101087	1.802	1.778	1.754	1.721	1.688	1.569	1.451	1.367	0.5000
2685	16.5000	101087	1.284	1.146	1.008	0.944	0.881	0.860	0.839	0.865	0.5000
2685	20.5000	101087	0.892	0.955	1.017	1.096	1.174	1.219	1.264	1.281	0.5000
2685	0.5000	111087	1.298	1.307	1.316	1.230	1.144	1.061	0.979	0.852	0.5000
2685	4.5000	111087	0.725	0.659	0.593	0.538	0.483	0.497	0.512	0.563	0.5000
2685	8.5000	111087	0.615	0.718	0.822	0.958	1.094	1.222	1.349	1.438	0.5000
2685	12.5000	111087	1.526	1.555	1.584	1.577	1.570	1.534	1.498	1.407	0.5000
2685	16.5000	111087	1.317	1.223	1.129	1.050	0.971	0.927	0.884	0.859	0.5000
2685	20.5000	111087	0.834	0.871	0.908	0.981	1.053	1.108	1.162	1.202	0.5000
2685	0.5000	121087	1.241	1.246	1.252	1.209	1.167	1.107	1.047	0.956	0.5000
2685	4.5000	121087	0.865	0.772	0.679	0.621	0.564	0.538	0.511	0.512	0.5000
2685	8.5000	121087	0.513	0.562	0.611	0.699	0.786	0.901	1.016	1.113	0.5000
2685	12.5000	121087	1.209	1.281	1.352	1.375	1.399	1.391	1.384	1.347	0.5000
2685	16.5000	121087	1.311	1.243	1.176	1.107	1.038	0.966	0.893	0.857	0.5000
2685	20.5000	121087	0.820	0.815	0.809	0.845	0.880	0.930	0.980	1.039	0.5000
2685	0.5000	131087	1.098	1.125	1.152	1.156	1.160	1.118	1.077	1.017	0.5000
2685	4.5000	131087	0.956	0.875	0.793	0.716	0.638	0.574	0.510	0.497	0.5000
2685	8.5000	131087	0.484	0.481	0.478	0.536	0.593	0.690	0.786	0.895	0.5000
2685	12.5000	131087	1.003	1.108	1.213	1.271	1.328	1.342	1.356	1.356	0.5000
2685	16.5000	131087	1.355	1.327	1.299	1.236	1.174	1.126	1.078	1.023	0.5000
2685	20.5000	131087	0.968	0.928	0.889	0.891	0.892	0.916	0.940	0.970	0.5000
2685	0.5000	141087	1.001	1.022	1.043	1.055	1.067	1.046	1.025	0.985	0.5000
2685	4.5000	141087	0.945	0.902	0.859	0.794	0.728	0.683	0.638	0.597	0.5000
2685	8.5000	141087	0.555	0.518	0.480	0.500	0.520	0.552	0.583	0.665	0.5000
2685	12.5000	141087	0.747	0.821	0.895	0.994	1.092	1.154	1.216	1.225	0.5000
2685	16.5000	141087	1.233	1.261	1.288	1.262	1.235	1.219	1.203	1.152	0.5000
2685	20.5000	141087	1.101	1.048	0.995	0.966	0.937	0.935	0.934	0.938	0.5000
2685	0.5000	151087	0.942	0.986	1.029	1.092	1.154	1.166	1.178	1.157	0.5000
2685	4.5000	151087	1.137	1.136	1.136	1.086	1.037	1.040	1.044	1.004	0.5000
2685	8.5000	151087	0.965	0.922	0.880	0.848	0.817	0.793	0.770	0.788	0.5000
2685	12.5000	151087	0.807	0.874	0.941	0.995	1.049	1.095	1.142	1.199	0.5000
2685	16.5000	151087	1.257	1.295	1.333	1.355	1.377	1.358	1.340	1.306	0.5000
2685	20.5000	151087	1.272	1.219	1.167	1.129	1.092	1.049	1.005	0.984	0.5000
2685	0.5000	161087	0.963	0.978	0.993	1.004	1.014	1.041	1.068	1.095	0.5000
2685	4.5000	161087	1.121	1.159	1.197	1.194	1.192	1.174	1.156	1.108	0.5000
2685	8.5000	161087	1.061	1.010	0.958	0.903	0.847	0.808	0.770	0.742	0.5000
2685	12.5000	161087	0.714	0.728	0.743	0.780	0.817	0.866	0.915	0.988	0.5000
2685	16.5000	161087	1.060	1.137	1.214	1.242	1.271	1.281	1.292	1.262	0.5000
2685	20.5000	161087	1.232	1.199	1.167	1.099	1.031	0.972	0.913	0.849	0.5000
2685	0.5000	171087	0.785	0.757	0.728	0.716	0.704	0.734	0.764	0.809	0.5000
2685	4.5000	171087	0.855	0.919	0.984	1.028	1.073	1.083	1.093	1.068	0.5000
2685	8.5000	171087	1.044	0.983	0.922	0.848	0.773	0.706	0.638	0.559	0.5000
2685	12.5000	171087	0.481	0.462	0.444	0.458	0.472	0.514	0.556	0.649	0.5000
2685	16.5000	171087	0.742	0.823	0.905	0.980	1.056	1.117	1.178	1.186	0.5000
2685	20.5000	171087	1.194	1.161	1.128	1.071	1.015	0.960	0.904	0.811	0.5000
2685	0.5000	181087	0.718	0.661	0.604	0.585	0.567	0.593	0.619	0.666	0.5000
2685	4.5000	181087	0.713	0.791	0.870	0.953	1.037	1.102	1.167	1.206	0.5000
2685	8.5000	181087	1.245	1.200	1.155	1.092	1.028	0.939	0.850	0.742	0.5000
2685	12.5000	181087	0.634	0.564	0.494	0.468	0.441	0.485	0.529	0.584	0.5000
2685	16.5000	181087	0.638	0.766	0.894	1.025	1.156	1.243	1.331	1.365	0.5000

2685	20.5000	181087	1.400	1.399	1.397	1.339	1.281	1.207	1.132	1.030	0.5000
2685	0.5000	191087	0.928	0.857	0.787	0.737	0.687	0.678	0.670	0.708	0.5000
2685	4.5000	191087	0.745	0.822	0.899	1.005	1.111	1.190	1.268	1.318	0.5000
2685	8.5000	191087	1.367	1.365	1.363	1.322	1.281	1.198	1.115	0.983	0.5000
2685	12.5000	191087	0.852	0.742	0.632	0.574	0.517	0.495	0.473	0.521	0.5000
2685	16.5000	191087	0.569	0.666	0.763	0.887	1.010	1.124	1.239	1.302	0.5000
2685	20.5000	191087	1.366	1.387	1.407	1.381	1.355	1.290	1.225	1.127	0.5000
2685	0.5000	201087	1.028	0.912	0.795	0.717	0.638	0.607	0.576	0.598	0.5000
2685	4.5000	201087	0.619	0.706	0.792	0.932	1.072	1.167	1.263	1.324	0.5000
2685	8.5000	201087	1.385	1.407	1.429	1.423	1.416	1.354	1.292	1.172	0.5000
2685	12.5000	201087	1.052	0.935	0.818	0.697	0.576	0.525	0.475	0.481	0.5000
2685	16.5000	201087	0.487	0.550	0.612	0.748	0.885	0.989	1.094	1.180	0.5000
2685	20.5000	201087	1.266	1.316	1.365	1.351	1.337	1.291	1.245	1.137	0.5000
2685	0.5000	211087	1.028	0.904	0.779	0.677	0.575	0.505	0.435	0.436	0.5000
2685	4.5000	211087	0.437	0.513	0.590	0.712	0.833	1.001	1.169	1.289	0.5000
2685	8.5000	211087	1.408	1.448	1.487	1.515	1.543	1.487	1.432	1.353	0.5000
2685	12.5000	211087	1.273	1.141	1.009	0.902	0.795	0.729	0.662	0.618	0.5000
2685	16.5000	211087	0.573	0.618	0.663	0.764	0.864	0.973	1.082	1.213	0.5000
2685	20.5000	211087	1.343	1.399	1.454	1.449	1.444	1.419	1.394	1.258	0.5000
2685	0.5000	221087	1.121	1.049	0.976	0.845	0.713	0.645	0.576	0.507	0.5000
2685	4.5000	221087	0.438	0.487	0.536	0.642	0.748	0.915	1.082	1.235	0.5000
2685	8.5000	221087	1.388	1.471	1.553	1.593	1.633	1.617	1.600	1.553	0.5000
2685	12.5000	221087	1.507	1.420	1.334	1.218	1.102	0.976	0.850	0.754	0.5000
2685	16.5000	221087	0.657	0.672	0.688	0.744	0.801	0.983	1.165	1.231	0.5000
2685	20.5000	221087	1.297	1.384	1.472	1.517	1.562	1.519	1.477	1.381	0.5000
2685	0.5000	231087	1.286	1.162	1.037	0.915	0.793	0.687	0.581	0.524	0.5000
2685	4.5000	231087	0.468	0.466	0.463	0.547	0.630	0.754	0.878	1.003	0.5000
2685	8.5000	231087	1.129	1.299	1.470	1.515	1.559	1.600	1.640	1.605	0.5000
2685	12.5000	231087	1.571	1.496	1.421	1.325	1.230	1.143	1.056	0.967	0.5000
2685	16.5000	231087	0.879	0.860	0.840	0.855	0.870	0.956	1.042	1.123	0.5000
2685	20.5000	231087	1.203	1.323	1.443	1.490	1.537	1.532	1.528	1.494	0.5000
2685	0.5000	241087	1.460	1.368	1.276	1.167	1.058	0.952	0.847	0.792	0.5000
2685	4.5000	241087	0.738	0.694	0.650	0.623	0.596	0.629	0.662	0.785	0.5000
2685	8.5000	241087	0.907	1.051	1.194	1.317	1.441	1.498	1.555	1.554	0.5000
2685	12.5000	241087	1.553	1.507	1.460	1.369	1.278	1.160	1.041	0.935	0.5000
2685	16.5000	241087	0.828	0.766	0.704	0.681	0.659	0.688	0.717	0.803	0.5000
2685	20.5000	241087	0.890	0.988	1.087	1.165	1.244	1.298	1.351	1.319	0.5000
2685	0.5000	251087	1.287	1.206	1.125	1.019	0.913	0.798	0.683	0.603	0.5000
2685	4.5000	251087	0.524	0.486	0.448	0.433	0.418	0.421	0.423	0.501	0.5000
2685	8.5000	251087	0.579	0.733	0.887	1.063	1.239	1.358	1.477	1.533	0.5000
2685	12.5000	251087	1.589	1.583	1.576	1.518	1.461	1.343	1.225	1.121	0.5000
2685	16.5000	251087	1.017	0.899	0.782	0.735	0.687	0.679	0.670	0.727	0.5000
2685	20.5000	251087	0.783	0.906	1.029	1.123	1.217	1.299	1.382	1.403	0.5000
2685	0.5000	261087	1.425	1.404	1.383	1.305	1.227	1.113	1.000	0.866	0.5000
2685	4.5000	261087	0.733	0.644	0.554	0.519	0.484	0.493	0.501	0.574	0.5000
2685	8.5000	261087	0.647	0.766	0.884	1.064	1.244	1.378	1.512	1.581	0.5000
2685	12.5000	261087	1.651	1.671	1.692	1.679	1.666	1.593	1.520	1.414	0.5000
2685	16.5000	261087	1.307	1.201	1.095	1.005	0.915	0.822	0.728	0.751	0.5000
2685	20.5000	261087	0.773	0.837	0.900	0.996	1.091	1.161	1.230	1.264	0.5000
2685	0.5000	271087	1.297	1.261	1.225	1.209	1.193	1.109	1.024	0.933	0.5000
2685	4.5000	271087	0.841	0.764	0.688	0.645	0.602	0.578	0.554	0.576	0.5000
2685	8.5000	271087	0.599	0.683	0.768	0.876	0.984	1.117	1.249	1.363	0.5000
2685	12.5000	271087	1.477	1.525	1.573	1.585	1.596	1.587	1.578	1.520	0.5000
2685	16.5000	271087	1.463	1.380	1.298	1.200	1.102	1.033	0.963	0.900	0.5000
2685	20.5000	271087	0.838	0.829	0.820	0.871	0.922	0.979	1.036	1.083	0.5000
2685	0.5000	281087	1.130	1.140	1.151	1.132	1.112	1.057	1.002	0.913	0.5000

2685	4.5000	281087	0.824	0.754	0.683	0.609	0.534	0.484	0.434	0.413	0.5000
2685	8.5000	281087	0.392	0.413	0.433	0.482	0.532	0.614	0.697	0.818	0.5000
2685	12.5000	281087	0.938	1.055	1.171	1.246	1.321	1.344	1.368	1.385	0.5000
2685	16.5000	281087	1.402	1.356	1.311	1.265	1.219	1.125	1.031	0.954	0.5000
2685	20.5000	281087	0.876	0.831	0.785	0.789	0.793	0.846	0.900	0.931	0.5000
2685	0.5000	291087	0.962	1.025	1.088	1.135	1.182	1.181	1.181	1.167	0.5000
2685	4.5000	291087	1.154	1.098	1.043	0.969	0.895	0.833	0.771	0.690	0.5000
2685	8.5000	291087	0.608	0.617	0.625	0.609	0.593	0.657	0.721	0.818	0.5000
2685	12.5000	291087	0.915	1.060	1.206	1.286	1.367	1.437	1.506	1.510	0.5000
2685	16.5000	291087	1.514	1.550	1.585	1.562	1.538	1.482	1.425	1.352	0.5000
2685	20.5000	291087	1.279	1.133	0.987	0.993	1.000	0.987	0.974	1.036	0.5000
2685	0.5000	301087	1.097	1.116	1.135	1.150	1.165	1.176	1.188	1.221	0.5000
2685	4.5000	301087	1.254	1.234	1.214	1.161	1.107	1.047	0.987	0.903	0.5000
2685	8.5000	301087	0.820	0.754	0.689	0.636	0.583	0.558	0.533	0.580	0.5000
2685	12.5000	301087	0.628	0.707	0.786	0.900	1.013	1.117	1.221	1.337	0.5000
2685	16.5000	301087	1.453	1.496	1.540	1.564	1.588	1.548	1.508	1.439	0.5000
2685	20.5000	301087	1.370	1.320	1.271	1.170	1.069	1.051	1.033	0.998	0.5000
2685	0.5000	311087	0.963	0.972	0.980	1.028	1.076	1.138	1.201	1.244	0.5000
2685	4.5000	311087	1.287	1.306	1.325	1.345	1.366	1.337	1.309	1.244	0.5000
2685	8.5000	311087	1.179	1.122	1.066	0.970	0.875	0.824	0.773	0.739	0.5000
2685	12.5000	311087	0.705	0.721	0.736	0.788	0.840	0.921	1.001	1.091	0.5000
2685	16.5000	311087	1.181	1.259	1.337	1.386	1.436	1.455	1.475	1.443	0.5000
2685	20.5000	311087	1.412	1.331	1.249	1.147	1.044	0.941	0.837	0.753	0.5000

.1 6.35 0.0. .35 -105 ' WATER LEVEL AT PARSON'S POND, NFLD.  
 011187 301187

STN	1ST HR	DATE	1	2	3	4	5	6	7	8	DT HRS
2685	0.5000	11187	0.667	0.759	0.852	0.848	0.844	0.864	0.885	0.929	0.5000
2685	4.5000	11187	0.972	1.032	1.092	1.132	1.172	1.180	1.188	1.177	0.5000
2685	8.5000	11187	1.167	1.094	1.021	0.915	0.809	0.709	0.610	0.544	0.5000
2685	12.5000	11187	0.478	0.455	0.432	0.453	0.475	0.533	0.591	0.692	0.5000
2685	16.5000	11187	0.792	0.914	1.036	1.141	1.246	1.299	1.352	1.377	0.5000
2685	20.5000	11187	1.401	1.366	1.331	1.266	1.202	1.077	0.952	0.847	0.5000
2685	0.5000	21187	0.742	0.645	0.549	0.555	0.561	0.577	0.594	0.689	0.5000
2685	4.5000	21187	0.784	0.915	1.046	1.145	1.245	1.316	1.387	1.402	0.5000
2685	8.5000	21187	1.417	1.372	1.327	1.247	1.168	1.037	0.905	0.797	0.5000
2685	12.5000	21187	0.689	0.603	0.516	0.486	0.456	0.468	0.480	0.545	0.5000
2685	16.5000	21187	0.609	0.714	0.820	0.951	1.083	1.190	1.298	1.344	0.5000
2685	20.5000	21187	1.390	1.380	1.370	1.305	1.240	1.138	1.037	0.912	0.5000
2685	0.5000	31187	0.786	0.679	0.572	0.501	0.430	0.435	0.440	0.497	0.5000
2685	4.5000	31187	0.553	0.679	0.804	0.956	1.108	1.254	1.400	1.456	0.5000
2685	8.5000	31187	1.513	1.537	1.561	1.525	1.488	1.449	1.409	1.267	0.5000
2685	12.5000	31187	1.125	1.015	0.905	0.778	0.651	0.592	0.534	0.559	0.5000
2685	16.5000	31187	0.585	0.685	0.786	0.888	0.991	1.117	1.244	1.309	0.5000
2685	20.5000	31187	1.373	1.405	1.437	1.422	1.408	1.334	1.260	1.149	0.5000
2685	0.5000	41187	1.037	0.911	0.784	0.682	0.580	0.545	0.510	0.498	0.5000
2685	4.5000	41187	0.485	0.595	0.706	0.859	1.012	1.167	1.322	1.409	0.5000
2685	8.5000	41187	1.496	1.565	1.634	1.646	1.658	1.619	1.579	1.471	0.5000
2685	12.5000	41187	1.362	1.238	1.115	0.995	0.874	0.793	0.712	0.704	0.5000
2685	16.5000	41187	0.695	0.734	0.773	0.863	0.953	1.058	1.162	1.266	0.5000
2685	20.5000	41187	1.370	1.410	1.449	1.445	1.440	1.388	1.337	1.221	0.5000
2685	0.5000	51187	1.105	0.996	0.886	0.772	0.659	0.592	0.525	0.504	0.5000
2685	4.5000	51187	0.482	0.527	0.571	0.677	0.783	0.948	1.113	1.267	0.5000
2685	8.5000	51187	1.422	1.505	1.587	1.619	1.651	1.647	1.643	1.584	0.5000
2685	12.5000	51187	1.524	1.428	1.331	1.170	1.009	0.913	0.817	0.754	0.5000
2685	16.5000	51187	0.692	0.683	0.674	0.734	0.795	0.905	1.015	1.139	0.5000
2685	20.5000	51187	1.263	1.389	1.516	1.576	1.636	1.610	1.584	1.549	0.5000
2685	0.5000	61187	1.513	1.376	1.238	1.109	0.979	0.846	0.714	0.653	0.5000
2685	4.5000	61187	0.592	0.598	0.605	0.674	0.743	0.922	1.100	1.244	0.5000
2685	8.5000	61187	1.387	1.481	1.576	1.616	1.657	1.682	1.707	1.665	0.5000
2685	12.5000	61187	1.623	1.551	1.479	1.386	1.294	1.191	1.087	1.008	0.5000
2685	16.5000	61187	0.928	0.884	0.839	0.868	0.896	0.963	1.031	1.115	0.5000
2685	20.5000	61187	1.200	1.269	1.338	1.430	1.522	1.575	1.627	1.580	0.5000
2685	0.5000	71187	1.533	1.489	1.444	1.313	1.182	1.065	0.948	0.875	0.5000
2685	4.5000	71187	0.801	0.790	0.779	0.808	0.837	0.939	1.041	1.209	0.5000
2685	8.5000	71187	1.377	1.514	1.652	1.723	1.793	1.860	1.927	1.924	0.5000
2685	12.5000	71187	1.922	1.889	1.857	1.735	1.613	1.519	1.426	1.355	0.5000
2685	16.5000	71187	1.285	1.178	1.072	1.088	1.105	1.108	1.111	1.182	0.5000
2685	20.5000	71187	1.253	1.347	1.440	1.507	1.575	1.594	1.613	1.637	0.5000
2685	0.5000	81187	1.662	1.592	1.523	1.405	1.287	1.187	1.088	1.026	0.5000
2685	4.5000	81187	0.964	0.914	0.864	0.847	0.830	0.873	0.916	1.009	0.5000
2685	8.5000	81187	1.103	1.303	1.502	1.580	1.657	1.751	1.844	1.855	0.5000
2685	12.5000	81187	1.865	1.836	1.806	1.720	1.633	1.559	1.486	1.398	0.5000
2685	16.5000	81187	1.310	1.229	1.149	1.118	1.088	1.044	1.001	1.039	0.5000
2685	20.5000	81187	1.076	1.146	1.216	1.290	1.363	1.498	1.632	1.613	0.5000
2685	0.5000	91187	1.593	1.622	1.651	1.572	1.493	1.379	1.264	1.209	0.5000
2685	4.5000	91187	1.153	1.102	1.051	1.016	0.981	0.991	1.002	1.049	0.5000
2685	8.5000	91187	1.095	1.155	1.214	1.305	1.395	1.475	1.556	1.601	0.5000

2685	12.5000	91187	1.646	1.705	1.764	1.751	1.739	1.687	1.636	1.543	0.5000
2685	16.5000	91187	1.450	1.361	1.272	1.224	1.175	1.148	1.121	1.124	0.5000
2685	20.5000	91187	1.128	1.172	1.216	1.261	1.305	1.347	1.389	1.411	0.5000
2685	0.5000	101187	1.433	1.407	1.380	1.321	1.262	1.187	1.111	1.033	0.5000
2685	4.5000	101187	0.955	0.892	0.829	0.800	0.771	0.748	0.724	0.722	0.5000
2685	8.5000	101187	0.719	0.767	0.815	0.890	0.966	1.079	1.193	1.256	0.5000
2685	12.5000	101187	1.319	1.376	1.432	1.448	1.463	1.454	1.444	1.421	0.5000
2685	16.5000	101187	1.397	1.330	1.263	1.210	1.157	1.092	1.027	1.001	0.5000
2685	20.5000	101187	0.975	0.995	1.016	1.039	1.063	1.132	1.201	1.226	0.5000
2685	0.5000	111187	1.251	1.241	1.231	1.216	1.200	1.135	1.070	1.000	0.5000
2685	4.5000	111187	0.929	0.848	0.767	0.716	0.666	0.634	0.601	0.611	0.5000
2685	8.5000	111187	0.620	0.649	0.677	0.733	0.790	0.925	1.059	1.099	0.5000
2685	12.5000	111187	1.139	1.196	1.253	1.322	1.391	1.401	1.411	1.388	0.5000
2685	16.5000	111187	1.364	1.336	1.307	1.239	1.172	1.115	1.057	0.989	0.5000
2685	20.5000	111187	0.922	0.891	0.861	0.882	0.903	0.935	0.966	1.000	0.5000
2685	0.5000	121187	1.034	1.080	1.126	1.149	1.172	1.164	1.156	1.098	0.5000
2685	4.5000	121187	1.040	1.008	0.975	0.931	0.888	0.817	0.746	0.733	0.5000
2685	8.5000	121187	0.719	0.710	0.700	0.733	0.765	0.819	0.872	0.968	0.5000
2685	12.5000	121187	1.063	1.140	1.217	1.268	1.319	1.386	1.452	1.436	0.5000
2685	16.5000	121187	1.421	1.410	1.399	1.296	1.192	1.125	1.058	1.027	0.5000
2685	20.5000	121187	0.996	0.977	0.958	0.943	0.927	0.958	0.990	1.051	0.5000
2685	0.5000	131187	1.113	1.106	1.099	1.094	1.090	1.114	1.138	1.112	0.5000
2685	4.5000	131187	1.085	1.082	1.079	1.031	0.983	0.939	0.895	0.849	0.5000
2685	8.5000	131187	0.803	0.753	0.702	0.694	0.687	0.679	0.671	0.695	0.5000
2685	12.5000	131187	0.720	0.777	0.835	0.900	0.965	1.025	1.085	1.098	0.5000
2685	16.5000	131187	1.111	1.165	1.219	1.207	1.195	1.160	1.125	1.049	0.5000
2685	20.5000	131187	0.974	0.898	0.821	0.756	0.691	0.670	0.649	0.668	0.5000
2685	0.5000	141187	0.686	0.737	0.788	0.841	0.895	0.943	0.991	1.029	0.5000
2685	4.5000	141187	1.067	1.104	1.141	1.134	1.128	1.109	1.090	1.044	0.5000
2685	8.5000	141187	0.998	0.932	0.865	0.820	0.775	0.764	0.752	0.773	0.5000
2685	12.5000	141187	0.794	0.848	0.902	0.964	1.027	1.094	1.161	1.215	0.5000
2685	16.5000	141187	1.269	1.300	1.331	1.327	1.322	1.293	1.264	1.205	0.5000
2685	20.5000	141187	1.147	1.076	1.005	0.918	0.830	0.760	0.690	0.658	0.5000
2685	0.5000	151187	0.626	0.622	0.619	0.645	0.672	0.723	0.774	0.841	0.5000
2685	4.5000	151187	0.907	0.958	1.010	1.048	1.086	1.085	1.083	1.053	0.5000
2685	8.5000	151187	1.022	0.956	0.890	0.818	0.747	0.696	0.644	0.615	0.5000
2685	12.5000	151187	0.586	0.593	0.600	0.649	0.699	0.777	0.855	0.937	0.5000
2685	16.5000	151187	1.019	1.080	1.140	1.189	1.238	1.241	1.243	1.200	0.5000
2685	20.5000	151187	1.157	1.071	0.984	0.894	0.804	0.717	0.630	0.572	0.5000
2685	0.5000	161187	0.513	0.488	0.464	0.504	0.545	0.596	0.648	0.742	0.5000
2685	4.5000	161187	0.837	0.921	1.005	1.069	1.133	1.182	1.232	1.193	0.5000
2685	8.5000	161187	1.155	1.102	1.050	0.982	0.913	0.803	0.693	0.639	0.5000
2685	12.5000	161187	0.585	0.560	0.536	0.565	0.594	0.638	0.682	0.767	0.5000
2685	16.5000	161187	0.852	0.935	1.018	1.067	1.115	1.116	1.116	1.096	0.5000
2685	20.5000	161187	1.075	1.042	1.008	0.941	0.873	0.780	0.687	0.609	0.5000
2685	0.5000	171187	0.532	0.483	0.433	0.422	0.411	0.446	0.481	0.564	0.5000
2685	4.5000	171187	0.647	0.766	0.885	0.956	1.027	1.095	1.163	1.173	0.5000
2685	8.5000	171187	1.183	1.152	1.121	1.049	0.977	0.885	0.794	0.687	0.5000
2685	12.5000	171187	0.581	0.493	0.405	0.382	0.358	0.394	0.430	0.494	0.5000
2685	16.5000	171187	0.558	0.640	0.723	0.774	0.826	0.918	1.010	1.041	0.5000
2685	20.5000	171187	1.072	1.098	1.124	1.066	1.007	0.918	0.828	0.722	0.5000
2685	0.5000	181187	0.617	0.527	0.438	0.399	0.360	0.371	0.383	0.475	0.5000
2685	4.5000	181187	0.567	0.677	0.788	0.942	1.096	1.216	1.336	1.403	0.5000
2685	8.5000	181187	1.471	1.473	1.475	1.450	1.426	1.342	1.259	1.145	0.5000
2685	12.5000	181187	1.030	0.928	0.825	0.749	0.672	0.675	0.678	0.750	0.5000
2685	16.5000	181187	0.822	0.921	1.019	1.104	1.189	1.304	1.419	1.439	0.5000

2685	20.5000	181187	1.458	1.446	1.434	1.384	1.335	1.251	1.166	1.075	0.5000
2685	0.5000	191187	0.984	0.869	0.755	0.699	0.643	0.627	0.611	0.644	0.5000
2685	4.5000	191187	0.677	0.765	0.854	1.003	1.152	1.259	1.365	1.437	0.5000
2685	8.5000	191187	1.510	1.539	1.568	1.558	1.548	1.477	1.406	1.300	0.5000
2685	12.5000	191187	1.193	1.086	0.978	0.883	0.788	0.746	0.705	0.702	0.5000
2685	16.5000	191187	0.699	0.741	0.782	0.874	0.966	1.060	1.155	1.243	0.5000
2685	20.5000	191187	1.331	1.342	1.353	1.337	1.321	1.253	1.186	1.081	0.5000
2685	0.5000	201187	0.975	0.885	0.795	0.707	0.620	0.576	0.533	0.523	0.5000
2685	4.5000	201187	0.512	0.568	0.623	0.736	0.850	1.022	1.194	1.318	0.5000
2685	8.5000	201187	1.442	1.505	1.569	1.583	1.597	1.575	1.554	1.478	0.5000
2685	12.5000	201187	1.403	1.272	1.141	1.035	0.929	0.854	0.778	0.742	0.5000
2685	16.5000	201187	0.707	0.694	0.681	0.735	0.789	0.841	0.893	1.023	0.5000
2685	20.5000	201187	1.152	1.245	1.338	1.303	1.268	1.276	1.285	1.156	0.5000
2685	0.5000	211187	1.028	0.993	0.957	0.917	0.877	0.837	0.817	0.796	0.5000
2685	4.5000	211187	0.681	0.716	0.751	0.874	0.996	1.145	1.295	1.422	0.5000
2685	8.5000	211187	1.549	1.626	1.702	1.708	1.715	1.689	1.663	1.584	0.5000
2685	12.5000	211187	1.504	1.443	1.382	1.258	1.134	1.052	0.971	0.874	0.5000
2685	16.5000	211187	0.776	0.762	0.749	0.795	0.840	0.860	0.880	1.078	0.5000
2685	20.5000	211187	1.277	1.360	1.443	1.505	1.567	1.595	1.623	1.600	0.5000
2685	0.5000	221187	1.577	1.467	1.357	1.167	0.978	0.870	0.761	0.748	0.5000
2685	4.5000	221187	0.735	0.741	0.747	0.796	0.846	0.999	1.152	1.342	0.5000
2685	8.5000	221187	1.533	1.641	1.749	1.798	1.846	1.857	1.867	1.831	0.5000
2685	12.5000	221187	1.796	1.686	1.577	1.478	1.380	1.276	1.173	1.100	0.5000
2685	16.5000	221187	1.027	0.993	0.960	0.936	0.912	0.959	1.007	1.075	0.5000
2685	20.5000	221187	1.143	1.218	1.294	1.374	1.454	1.496	1.538	1.540	0.5000
2685	0.5000	231187	1.542	1.456	1.370	1.260	1.151	1.065	0.980	0.893	0.5000
2685	4.5000	231187	0.805	0.782	0.759	0.747	0.734	0.786	0.837	0.969	0.5000
2685	8.5000	231187	1.101	1.256	1.411	1.550	1.689	1.735	1.780	1.819	0.5000
2685	12.5000	231187	1.857	1.805	1.753	1.721	1.688	1.581	1.474	1.349	0.5000
2685	16.5000	231187	1.223	1.129	1.035	0.995	0.954	0.950	0.947	0.967	0.5000
2685	20.5000	231187	0.988	1.061	1.135	1.183	1.231	1.285	1.340	1.343	0.5000
2685	0.5000	241187	1.347	1.307	1.268	1.206	1.145	1.033	0.921	0.853	0.5000
2685	4.5000	241187	0.786	0.751	0.716	0.700	0.684	0.672	0.659	0.683	0.5000
2685	8.5000	241187	0.706	0.817	0.927	1.081	1.234	1.370	1.505	1.573	0.5000
2685	12.5000	241187	1.641	1.670	1.699	1.679	1.658	1.611	1.564	1.449	0.5000
2685	16.5000	241187	1.334	1.214	1.095	1.004	0.913	0.862	0.811	0.813	0.5000
2685	20.5000	241187	0.815	0.870	0.924	0.997	1.070	1.146	1.222	1.256	0.5000
2685	0.5000	251187	1.291	1.285	1.279	1.231	1.183	1.093	1.004	0.898	0.5000
2685	4.5000	251187	0.793	0.712	0.630	0.592	0.554	0.539	0.525	0.523	0.5000
2685	8.5000	251187	0.520	0.573	0.625	0.727	0.830	0.963	1.097	1.213	0.5000
2685	12.5000	251187	1.330	1.411	1.492	1.510	1.529	1.507	1.484	1.418	0.5000
2685	16.5000	251187	1.352	1.248	1.145	1.040	0.934	0.845	0.755	0.710	0.5000
2685	20.5000	251187	0.664	0.676	0.689	0.728	0.767	0.842	0.917	0.993	0.5000
2685	0.5000	261187	1.069	1.093	1.118	1.127	1.136	1.083	1.031	0.948	0.5000
2685	4.5000	261187	0.866	0.774	0.683	0.600	0.517	0.475	0.433	0.427	0.5000
2685	8.5000	261187	0.420	0.437	0.455	0.507	0.559	0.665	0.772	0.885	0.5000
2685	12.5000	261187	0.998	1.113	1.228	1.301	1.374	1.418	1.462	1.432	0.5000
2685	16.5000	261187	1.403	1.332	1.261	1.162	1.063	0.953	0.844	0.750	0.5000
2685	20.5000	261187	0.656	0.627	0.597	0.604	0.610	0.645	0.679	0.740	0.5000
2685	0.5000	271187	0.802	0.856	0.910	0.952	0.994	0.999	1.004	0.979	0.5000
2685	4.5000	271187	0.953	0.876	0.800	0.721	0.642	0.568	0.494	0.442	0.5000
2685	8.5000	271187	0.389	0.373	0.356	0.382	0.407	0.470	0.532	0.629	0.5000
2685	12.5000	271187	0.727	0.844	0.961	1.084	1.206	1.273	1.340	1.381	0.5000
2685	16.5000	271187	1.421	1.416	1.410	1.346	1.282	1.175	1.068	0.971	0.5000
2685	20.5000	271187	0.873	0.795	0.717	0.652	0.587	0.607	0.626	0.681	0.5000
2685	0.5000	281187	0.736	0.805	0.874	0.942	1.010	1.071	1.132	1.170	0.5000

2685	4.5000	281187	1.209	1.199	1.189	1.135	1.081	1.003	0.924	0.825	0.5000
2685	8.5000	281187	0.726	0.650	0.575	0.545	0.514	0.515	0.517	0.586	0.5000
2685	12.5000	281187	0.655	0.731	0.808	0.923	1.038	1.140	1.241	1.297	0.5000
2685	16.5000	281187	1.353	1.387	1.422	1.397	1.373	1.306	1.240	1.135	0.5000
2685	20.5000	281187	1.031	0.932	0.834	0.719	0.604	0.543	0.483	0.490	0.5000
2685	0.5000	291187	0.496	0.538	0.580	0.657	0.733	0.810	0.887	0.982	0.5000
2685	4.5000	291187	1.076	1.116	1.156	1.162	1.169	1.116	1.064	0.996	0.5000
2685	8.5000	291187	0.927	0.836	0.745	0.672	0.598	0.551	0.504	0.492	0.5000
2685	12.5000	291187	0.479	0.553	0.626	0.706	0.787	0.900	1.012	1.110	0.5000
2685	16.5000	291187	1.208	1.273	1.338	1.367	1.397	1.369	1.342	1.271	0.5000
2685	20.5000	291187	1.199	1.099	0.998	0.872	0.745	0.660	0.576	0.532	0.5000
2685	0.5000	301187	0.487	0.482	0.478	0.515	0.551	0.645	0.738	0.833	0.5000
2685	4.5000	301187	0.927	1.026	1.125	1.192	1.258	1.241	1.224	1.194	0.5000
2685	8.5000	301187	1.164	1.078	0.993	0.905	0.818	0.714	0.609	0.559	0.5000
2685	12.5000	301187	0.509	0.491	0.472	0.529	0.586	0.671	0.756	0.885	0.5000
2685	16.5000	301187	1.014	1.127	1.240	1.299	1.359	1.378	1.397	1.381	0.5000
2685	20.5000	301187	1.365	1.294	1.224	1.120	1.017	0.907	0.797	0.691	0.5000

.1 6.35 0. 0. .35 -105  
011287 311287

WATER LEVEL AT PARSON'S POND, NFLD.

STN	1ST HR	DATE	1	2	3	4	5	6	7	8	DT HRS
2685	0.5000	11287	0.585	0.560	0.534	0.546	0.559	0.635	0.711	0.822	0.5000
2685	4.5000	11287	0.934	1.072	1.209	1.301	1.392	1.439	1.486	1.501	0.5000
2685	8.5000	11287	1.516	1.477	1.438	1.369	1.300	1.186	1.072	0.974	0.5000
2685	12.5000	11287	0.876	0.802	0.729	0.732	0.736	0.788	0.841	0.945	0.5000
2685	16.5000	11287	1.048	1.193	1.337	1.448	1.560	1.643	1.726	1.754	0.5000
2685	20.5000	11287	1.782	1.746	1.709	1.613	1.516	1.380	1.244	1.075	0.5000
2685	0.5000	21287	0.906	0.787	0.668	0.612	0.557	0.561	0.566	0.658	0.5000
2685	4.5000	21287	0.749	0.891	1.034	1.165	1.297	1.378	1.458	1.504	0.5000
2685	8.5000	21287	1.550	1.563	1.575	1.533	1.490	1.420	1.350	1.255	0.5000
2685	12.5000	21287	1.160	1.038	0.916	0.861	0.807	0.789	0.771	0.813	0.5000
2685	16.5000	21287	0.856	0.952	1.048	1.165	1.281	1.365	1.449	1.489	0.5000
2685	20.5000	21287	1.529	1.537	1.544	1.516	1.487	1.387	1.287	1.175	0.5000
2685	0.5000	31287	1.064	0.941	0.817	0.760	0.703	0.667	0.632	0.679	0.5000
2685	4.5000	31287	0.726	0.843	0.960	1.109	1.258	1.377	1.496	1.589	0.5000
2685	8.5000	31287	1.682	1.722	1.763	1.727	1.692	1.638	1.583	1.473	0.5000
2685	12.5000	31287	1.363	1.262	1.160	1.050	0.940	0.877	0.815	0.806	0.5000
2685	16.5000	31287	0.797	0.827	0.857	0.958	1.058	1.158	1.257	1.335	0.5000
2685	20.5000	31287	1.413	1.450	1.487	1.458	1.429	1.392	1.355	1.261	0.5000
2685	0.5000	41287	1.166	1.074	0.981	0.878	0.775	0.701	0.627	0.650	0.5000
2685	4.5000	41287	0.673	0.737	0.801	0.933	1.065	1.247	1.430	1.541	0.5000
2685	8.5000	41287	1.652	1.715	1.778	1.796	1.814	1.825	1.836	1.746	0.5000
2685	12.5000	41287	1.656	1.553	1.450	1.316	1.182	1.140	1.099	1.053	0.5000
2685	16.5000	41287	1.007	1.016	1.024	1.113	1.203	1.251	1.299	1.375	0.5000
2685	20.5000	41287	1.451	1.462	1.473	1.520	1.568	1.511	1.455	1.419	0.5000
2685	0.5000	51287	1.384	1.263	1.142	1.045	0.947	0.896	0.844	0.812	0.5000
2685	4.5000	51287	0.779	0.794	0.808	0.880	0.951	1.068	1.186	1.322	0.5000
2685	8.5000	51287	1.459	1.577	1.695	1.754	1.813	1.835	1.856	1.792	0.5000
2685	12.5000	51287	1.727	1.649	1.571	1.437	1.303	1.194	1.085	1.031	0.5000
2685	16.5000	51287	0.976	0.953	0.931	0.948	0.964	0.984	1.004	1.097	0.5000
2685	20.5000	51287	1.190	1.285	1.379	1.419	1.460	1.447	1.435	1.402	0.5000
2685	0.5000	61287	1.369	1.264	1.159	1.056	0.953	0.865	0.777	0.738	0.5000
2685	4.5000	61287	0.699	0.697	0.694	0.727	0.760	0.875	0.989	1.095	0.5000
2685	8.5000	61287	1.201	1.340	1.479	1.546	1.612	1.644	1.676	1.680	0.5000
2685	12.5000	61287	1.685	1.632	1.579	1.502	1.424	1.305	1.186	1.077	0.5000
2685	16.5000	61287	0.967	0.896	0.824	0.797	0.770	0.804	0.838	0.925	0.5000
2685	20.5000	61287	1.013	1.089	1.165	1.249	1.333	1.367	1.402	1.380	0.5000
2685	0.5000	71287	1.358	1.307	1.256	1.153	1.050	0.939	0.828	0.732	0.5000
2685	4.5000	71287	0.636	0.584	0.532	0.540	0.547	0.612	0.677	0.784	0.5000
2685	8.5000	71287	0.891	1.009	1.127	1.259	1.391	1.423	1.455	1.469	0.5000
2685	12.5000	71287	1.482	1.459	1.435	1.362	1.288	1.192	1.097	0.992	0.5000
2685	16.5000	71287	0.887	0.806	0.724	0.671	0.617	0.626	0.635	0.671	0.5000
2685	20.5000	71287	0.708	0.786	0.865	0.940	1.015	1.080	1.144	1.162	0.5000
2685	0.5000	81287	1.180	1.149	1.118	1.049	0.980	0.877	0.774	0.691	0.5000
2685	4.5000	81287	0.607	0.559	0.510	0.495	0.479	0.502	0.524	0.595	0.5000
2685	8.5000	81287	0.665	0.785	0.905	1.027	1.150	1.260	1.369	1.411	0.5000
2685	12.5000	81287	1.452	1.462	1.472	1.433	1.394	1.327	1.259	1.160	0.5000
2685	16.5000	81287	1.061	0.970	0.880	0.810	0.740	0.703	0.665	0.667	0.5000
2685	20.5000	81287	0.668	0.728	0.788	0.881	0.974	1.042	1.111	1.147	0.5000
2685	0.5000	91287	1.184	1.157	1.130	1.077	1.025	0.942	0.860	0.769	0.5000
2685	4.5000	91287	0.679	0.592	0.506	0.479	0.453	0.460	0.466	0.520	0.5000
2685	8.5000	91287	0.573	0.656	0.739	0.874	1.010	1.138	1.266	1.343	0.5000

2685	12.5000	91287	1.420	1.475	1.530	1.530	1.530	1.491	1.452	1.381	0.5000
2685	16.5000	91287	1.310	1.231	1.151	1.065	0.979	0.911	0.844	0.829	0.5000
2685	20.5000	91287	0.814	0.826	0.838	0.892	0.947	1.016	1.085	1.143	0.5000
2685	0.5000	101287	1.201	1.217	1.232	1.203	1.173	1.114	1.054	0.962	0.5000
2685	4.5000	101287	0.870	0.783	0.697	0.637	0.576	0.547	0.518	0.531	0.5000
2685	8.5000	101287	0.545	0.595	0.646	0.741	0.835	0.949	1.063	1.166	0.5000
2685	12.5000	101287	1.269	1.317	1.365	1.387	1.409	1.397	1.385	1.336	0.5000
2685	16.5000	101287	1.286	1.224	1.162	1.065	0.968	0.897	0.826	0.770	0.5000
2685	20.5000	101287	0.714	0.716	0.717	0.769	0.820	0.888	0.956	1.009	0.5000
2685	0.5000	111287	1.062	1.101	1.140	1.136	1.133	1.118	1.104	1.030	0.5000
2685	4.5000	111287	0.957	0.881	0.806	0.726	0.645	0.596	0.548	0.515	0.5000
2685	8.5000	111287	0.482	0.507	0.531	0.582	0.632	0.740	0.847	0.904	0.5000
2685	12.5000	111287	0.960	1.088	1.215	1.257	1.300	1.332	1.365	1.326	0.5000
2685	16.5000	111287	1.287	1.240	1.194	1.120	1.046	0.969	0.891	0.826	0.5000
2685	20.5000	111287	0.762	0.738	0.714	0.717	0.720	0.752	0.783	0.863	0.5000
2685	0.5000	121287	0.944	1.017	1.091	1.133	1.175	1.179	1.184	1.164	0.5000
2685	4.5000	121287	1.145	1.109	1.072	1.007	0.942	0.876	0.810	0.755	0.5000
2685	8.5000	121287	0.700	0.679	0.658	0.682	0.705	0.788	0.871	0.964	0.5000
2685	12.5000	121287	1.058	1.144	1.230	1.287	1.344	1.367	1.389	1.401	0.5000
2685	16.5000	121287	1.412	1.391	1.370	1.310	1.251	1.163	1.075	0.959	0.5000
2685	20.5000	121287	0.843	0.774	0.704	0.669	0.634	0.617	0.599	0.654	0.5000
2685	0.5000	131287	0.710	0.768	0.826	0.871	0.915	0.950	0.985	0.997	0.5000
2685	4.5000	131287	1.010	1.007	1.003	0.946	0.888	0.827	0.766	0.706	0.5000
2685	8.5000	131287	0.646	0.595	0.543	0.528	0.513	0.532	0.551	0.610	0.5000
2685	12.5000	131287	0.669	0.754	0.839	0.925	1.011	1.089	1.168	1.197	0.5000
2685	16.5000	131287	1.227	1.236	1.246	1.211	1.176	1.121	1.066	0.994	0.5000
2685	20.5000	131287	0.921	0.842	0.764	0.703	0.641	0.605	0.569	0.574	0.5000
2685	0.5000	141287	0.580	0.622	0.664	0.725	0.786	0.835	0.884	0.936	0.5000
2685	4.5000	141287	0.987	1.027	1.067	1.068	1.068	1.025	0.982	0.908	0.5000
2685	8.5000	141287	0.833	0.743	0.654	0.597	0.540	0.524	0.508	0.518	0.5000
2685	12.5000	141287	0.528	0.575	0.621	0.689	0.757	0.846	0.934	1.004	0.5000
2685	16.5000	141287	1.074	1.118	1.163	1.171	1.179	1.137	1.095	1.025	0.5000
2685	20.5000	141287	0.955	0.901	0.847	0.762	0.677	0.622	0.568	0.552	0.5000
2685	0.5000	151287	0.536	0.566	0.596	0.640	0.685	0.761	0.837	0.929	0.5000
2685	4.5000	151287	1.022	1.090	1.158	1.180	1.203	1.194	1.186	1.143	0.5000
2685	8.5000	151287	1.100	1.040	0.981	0.907	0.833	0.757	0.682	0.639	0.5000
2685	12.5000	151287	0.595	0.587	0.580	0.637	0.694	0.752	0.811	0.879	0.5000
2685	16.5000	151287	0.947	1.005	1.064	1.083	1.102	1.115	1.128	1.090	0.5000
2685	20.5000	151287	1.052	0.992	0.932	0.855	0.779	0.695	0.612	0.557	0.5000
2685	0.5000	161287	0.503	0.505	0.506	0.541	0.576	0.660	0.744	0.869	0.5000
2685	4.5000	161287	0.995	1.088	1.181	1.255	1.330	1.355	1.380	1.398	0.5000
2685	8.5000	161287	1.415	1.368	1.321	1.244	1.167	1.061	0.956	0.890	0.5000
2685	12.5000	161287	0.824	0.797	0.771	0.772	0.773	0.830	0.887	0.970	0.5000
2685	16.5000	161287	1.053	1.124	1.196	1.246	1.296	1.309	1.321	1.303	0.5000
2685	20.5000	161287	1.285	1.230	1.175	1.095	1.016	0.939	0.863	0.800	0.5000
2685	0.5000	171287	0.737	0.695	0.654	0.662	0.670	0.726	0.781	0.889	0.5000
2685	4.5000	171287	0.998	1.106	1.213	1.303	1.392	1.449	1.506	1.538	0.5000
2685	8.5000	171287	1.570	1.553	1.536	1.481	1.426	1.345	1.263	1.168	0.5000
2685	12.5000	171287	1.073	0.960	0.847	0.817	0.787	0.780	0.773	0.803	0.5000
2685	16.5000	171287	0.832	0.889	0.945	1.010	1.074	1.134	1.194	1.211	0.5000
2685	20.5000	171287	1.227	1.218	1.208	1.130	1.053	0.954	0.856	0.734	0.5000
2685	0.5000	181287	0.612	0.530	0.447	0.405	0.363	0.382	0.402	0.499	0.5000
2685	4.5000	181287	0.596	0.721	0.845	1.006	1.168	1.288	1.408	1.502	0.5000
2685	8.5000	181287	1.595	1.611	1.627	1.621	1.615	1.537	1.459	1.359	0.5000
2685	12.5000	181287	1.258	1.154	1.050	0.958	0.866	0.840	0.814	0.818	0.5000
2685	16.5000	181287	0.823	0.874	0.926	1.004	1.083	1.147	1.211	1.249	0.5000

2685	20.5000	181287	1.288	1.288	1.288	1.248	1.208	1.115	1.023	0.909	0.5000
2685	0.5000	191287	0.795	0.669	0.543	0.457	0.371	0.347	0.324	0.349	0.5000
2685	4.5000	191287	0.375	0.476	0.577	0.738	0.899	1.078	1.257	1.377	0.5000
2685	8.5000	191287	1.498	1.577	1.657	1.670	1.683	1.642	1.600	1.494	0.5000
2685	12.5000	191287	1.388	1.275	1.161	1.035	0.908	0.803	0.698	0.672	0.5000
2685	16.5000	191287	0.647	0.673	0.699	0.774	0.850	0.936	1.023	1.104	0.5000
2685	20.5000	191287	1.186	1.224	1.263	1.258	1.253	1.197	1.141	1.028	0.5000
2685	0.5000	201287	0.915	0.779	0.644	0.516	0.389	0.328	0.268	0.243	0.5000
2685	4.5000	201287	0.219	0.253	0.288	0.420	0.553	0.732	0.911	1.107	0.5000
2685	8.5000	201287	1.304	1.425	1.545	1.605	1.665	1.668	1.670	1.612	0.5000
2685	12.5000	201287	1.554	1.437	1.319	1.172	1.025	0.892	0.760	0.682	0.5000
2685	16.5000	201287	0.605	0.598	0.590	0.618	0.646	0.742	0.838	0.947	0.5000
2685	20.5000	201287	1.057	1.144	1.230	1.249	1.268	1.251	1.234	1.139	0.5000
2685	0.5000	211287	1.044	0.906	0.769	0.624	0.479	0.376	0.273	0.238	0.5000
2685	4.5000	211287	0.203	0.197	0.191	0.250	0.309	0.468	0.626	0.835	0.5000
2685	8.5000	211287	1.045	1.229	1.413	1.517	1.622	1.666	1.710	1.705	0.5000
2685	12.5000	211287	1.700	1.639	1.578	1.463	1.347	1.207	1.068	0.942	0.5000
2685	16.5000	211287	0.816	0.753	0.691	0.686	0.682	0.755	0.828	0.934	0.5000
2685	20.5000	211287	1.041	1.167	1.293	1.376	1.459	1.481	1.503	1.478	0.5000
2685	0.5000	221287	1.453	1.360	1.266	1.104	0.942	0.780	0.619	0.503	0.5000
2685	4.5000	221287	0.387	0.343	0.299	0.294	0.289	0.352	0.415	0.568	0.5000
2685	8.5000	221287	0.720	0.918	1.115	1.271	1.426	1.511	1.595	1.622	0.5000
2685	12.5000	221287	1.650	1.624	1.598	1.509	1.420	1.288	1.156	1.009	0.5000
2685	16.5000	221287	0.862	0.750	0.639	0.599	0.560	0.568	0.577	0.646	0.5000
2685	20.5000	221287	0.716	0.839	0.962	1.091	1.219	1.293	1.366	1.408	0.5000
2685	0.5000	231287	1.449	1.407	1.364	1.259	1.153	1.003	0.853	0.722	0.5000
2685	4.5000	231287	0.592	0.507	0.422	0.394	0.367	0.400	0.432	0.537	0.5000
2685	8.5000	231287	0.641	0.804	0.966	1.144	1.321	1.450	1.579	1.656	0.5000
2685	12.5000	231287	1.733	1.759	1.786	1.753	1.721	1.629	1.537	1.395	0.5000
2685	16.5000	231287	1.253	1.089	0.924	0.815	0.705	0.666	0.628	0.635	0.5000
2685	20.5000	231287	0.641	0.712	0.783	0.895	1.008	1.103	1.199	1.267	0.5000
2685	0.5000	241287	1.335	1.336	1.337	1.287	1.236	1.124	1.012	0.881	0.5000
2685	4.5000	241287	0.750	0.637	0.524	0.453	0.383	0.366	0.349	0.371	0.5000
2685	8.5000	241287	0.394	0.485	0.576	0.731	0.885	1.058	1.232	1.341	0.5000
2685	12.5000	241287	1.451	1.508	1.565	1.589	1.613	1.582	1.552	1.473	0.5000
2685	16.5000	241287	1.395	1.262	1.130	0.996	0.862	0.773	0.683	0.652	0.5000
2685	20.5000	241287	0.620	0.642	0.664	0.742	0.820	0.921	1.022	1.113	0.5000
2685	0.5000	251287	1.204	1.252	1.301	1.285	1.269	1.224	1.180	1.088	0.5000
2685	4.5000	251287	0.997	0.866	0.735	0.612	0.489	0.416	0.342	0.331	0.5000
2685	8.5000	251287	0.320	0.342	0.364	0.459	0.554	0.689	0.825	0.971	0.5000
2685	12.5000	251287	1.117	1.224	1.330	1.396	1.462	1.478	1.494	1.476	0.5000
2685	16.5000	251287	1.459	1.380	1.301	1.187	1.073	0.927	0.781	0.694	0.5000
2685	20.5000	251287	0.607	0.580	0.553	0.608	0.663	0.760	0.857	0.993	0.5000
2685	0.5000	261287	1.130	1.237	1.344	1.389	1.434	1.436	1.437	1.392	0.5000
2685	4.5000	261287	1.346	1.258	1.170	1.060	0.951	0.828	0.706	0.639	0.5000
2685	8.5000	261287	0.573	0.547	0.522	0.555	0.588	0.658	0.727	0.851	0.5000
2685	12.5000	261287	0.976	1.099	1.222	1.298	1.374	1.418	1.463	1.457	0.5000
2685	16.5000	261287	1.450	1.404	1.358	1.259	1.161	1.037	0.912	0.797	0.5000
2685	20.5000	261287	0.682	0.616	0.549	0.537	0.526	0.586	0.646	0.732	0.5000
2685	0.5000	271287	0.819	0.920	1.022	1.112	1.201	1.252	1.303	1.319	0.5000
2685	4.5000	271287	1.335	1.315	1.296	1.218	1.141	1.054	0.966	0.878	0.5000
2685	8.5000	271287	0.790	0.695	0.600	0.580	0.560	0.583	0.606	0.680	0.5000
2685	12.5000	271287	0.754	0.860	0.966	1.075	1.185	1.264	1.343	1.385	0.5000
2685	16.5000	271287	1.428	1.426	1.425	1.384	1.343	1.250	1.156	1.044	0.5000
2685	20.5000	271287	0.932	0.835	0.738	0.669	0.600	0.600	0.600	0.668	0.5000
2685	0.5000	281287	0.737	0.813	0.890	0.999	1.109	1.195	1.282	1.330	0.5000

2685	4.5000	281287	1.379	1.399	1.419	1.416	1.413	1.359	1.304	1.223	0.5000
2685	8.5000	281287	1.142	1.056	0.969	0.901	0.833	0.809	0.784	0.794	0.5000
2685	12.5000	281287	0.804	0.843	0.883	0.959	1.034	1.116	1.198	1.273	0.5000
2685	16.5000	281287	1.348	1.403	1.459	1.443	1.428	1.374	1.319	1.239	0.5000
2685	20.5000	281287	1.159	1.050	0.940	0.859	0.778	0.746	0.714	0.708	0.5000
2685	0.5000	291287	0.701	0.768	0.835	0.892	0.948	1.056	1.165	1.267	0.5000
2685	4.5000	291287	1.369	1.407	1.445	1.453	1.461	1.480	1.499	1.461	0.5000
2685	8.5000	291287	1.422	1.351	1.280	1.176	1.072	0.998	0.925	0.865	0.5000
2685	12.5000	291287	0.806	0.793	0.781	0.813	0.845	0.931	1.017	1.078	0.5000
2685	16.5000	291287	1.139	1.216	1.293	1.327	1.360	1.348	1.336	1.306	0.5000
2685	20.5000	291287	1.277	1.205	1.133	1.050	0.967	0.885	0.804	0.732	0.5000
2685	0.5000	301287	0.659	0.663	0.667	0.687	0.708	0.807	0.905	1.029	0.5000
2685	4.5000	301287	1.152	1.272	1.392	1.470	1.549	1.614	1.679	1.689	0.5000
2685	8.5000	301287	1.700	1.670	1.640	1.603	1.566	1.489	1.411	1.309	0.5000
2685	12.5000	301287	1.207	1.134	1.060	0.994	0.928	0.953	0.978	0.992	0.5000
2685	16.5000	301287	1.006	1.046	1.086	1.110	1.133	1.126	1.119	1.060	0.5000
2685	20.5000	301287	1.001	0.933	0.865	0.786	0.706	0.644	0.582	0.495	0.5000
2685	0.5000	311287	0.408	0.358	0.307	0.306	0.306	0.341	0.377	0.416	0.5000
2685	4.5000	311287	0.455	0.599	0.744	0.891	1.037	1.193	1.349	1.431	0.5000
2685	8.5000	311287	1.512	1.498	1.484	1.503	1.521	1.448	1.374	1.283	0.5000
2685	12.5000	311287	1.192	1.088	0.984	0.940	0.897	0.890	0.882	0.935	0.5000
2685	16.5000	311287	0.987	1.042	1.096	1.153	1.210	1.267	1.323	1.340	0.5000
2685	20.5000	311287	1.356	1.328	1.299	1.239	1.178	1.119	1.059	0.946	0.5000

.2 6.35 0. 0. .35 -105 · WATER LEVEL AT LARK HARBOUR, NFLD.  
011087 311087

011087	1.010	1.030	1.080	1.120	1.190	1.260	1.290	1.300
	1.350	1.350	1.350	1.320	1.260	1.240	1.140	1.100
	0.990	0.920	0.880	0.800	0.770	0.760	0.790	0.770
	0.810	0.880	0.960	1.050	1.170	1.260	1.390	1.450
	1.560	1.640	1.720	1.750	1.750	1.750	1.720	1.650
	1.590	1.500	1.420	1.350	1.270	1.200	1.100	1.060
021087	1.060	1.160	1.240	1.180	1.250	1.270	1.340	1.400
	1.470	1.520	1.690	1.720	1.750	1.730	1.650	1.640
	1.700	1.530	1.360	1.290	1.300	1.100	0.960	0.860
	0.830	0.750	0.680	0.610	0.700	0.790	0.790	0.800
	0.910	1.130	1.280	1.340	1.360	1.500	1.570	1.600
	1.540	1.490	1.390	1.340	1.260	1.090	0.920	0.870
031087	0.770	0.650	0.600	0.680	0.690	0.690	0.760	0.910
	0.990	1.090	1.180	1.270	1.360	1.420	1.450	1.400
	1.360	1.320	1.280	1.180	1.040	0.950	0.840	0.720
	0.570	0.500	0.460	0.440	0.360	0.450	0.520	0.600
	0.690	0.860	0.990	1.150	1.280	1.440	1.490	1.580
	1.600	1.620	1.550	1.510	1.400	1.250	1.150	1.030
041087	0.840	0.720	0.640	0.550	0.500	0.510	0.540	0.550
	0.630	0.810	0.900	1.040	1.160	1.310	1.340	1.490
	1.470	1.460	1.450	1.400	1.290	1.160	1.020	0.930
	0.750	0.640	0.480	0.440	0.400	0.390	0.400	0.530
	0.540	0.780	0.960	1.080	1.310	1.480	1.670	1.820
	1.860	1.930	1.960	1.940	1.890	1.800	1.730	1.570
051087	1.370	1.190	1.030	0.920	0.830	0.720	0.680	0.750
	0.700	0.800	0.920	1.030	1.200	1.360	1.490	1.670
	1.720	1.830	1.780	1.800	1.710	1.650	1.390	1.310
	1.140	0.940	0.750	0.600	0.500	0.400	0.350	0.320
	0.400	0.510	0.650	0.780	0.970	1.170	1.360	1.500
	1.630	1.780	1.880	1.940	1.910	1.860	1.760	1.620
061087	1.480	1.260	1.080	0.920	0.760	0.610	0.470	0.440
	0.390	0.480	0.550	0.700	0.840	1.050	1.230	1.410
	1.550	1.710	1.800	1.870	1.880	1.850	1.730	1.600
	1.430	1.250	1.060	0.890	0.700	0.540	0.440	0.350
	0.290	0.290	0.360	0.440	0.580	0.750	0.930	1.100
	1.270	1.410	1.550	1.610	1.700	1.690	1.640	1.570
071087	1.430	1.270	1.090	0.910	0.730	0.550	0.410	0.290
	0.240	0.230	0.260	0.340	0.480	0.630	0.820	1.030
	1.200	1.360	1.520	1.640	1.700	1.770	1.710	1.670
	1.540	1.380	1.190	1.020	0.830	0.590	0.450	0.320
	0.250	0.190	0.160	0.220	0.320	0.470	0.610	0.840
	1.010	1.210	1.350	1.490	1.600	1.730	1.700	1.700
081087	1.570	1.460	1.260	1.120	0.930	0.740	0.600	0.450
	0.310	0.250	0.270	0.320	0.380	0.550	0.750	0.970
	1.110	1.320	1.500	1.660	1.810	1.850	1.940	1.920
	1.930	1.760	1.730	1.510	1.310	1.110	0.940	0.750
	0.660	0.480	0.480	0.460	0.520	0.560	0.660	0.820
	1.020	1.180	1.370	1.480	1.680	1.700	1.770	1.760
091087	1.760	1.620	1.540	1.370	1.150	1.000	0.810	0.690
	0.480	0.360	0.360	0.370	0.380	0.450	0.620	0.750
	0.970	1.170	1.360	1.510	1.660	1.820	1.890	1.890
	1.930	1.970	1.810	1.660	1.520	1.320	1.140	0.950
	0.810	0.600	0.480	0.390	0.360	0.300	0.360	0.450

		0.560	0.690	0.840	1.010	1.100	1.210	1.270	1.360
101087		1.380	1.380	1.310	1.230	1.090	1.000	0.810	0.690
		0.570	0.450	0.370	0.350	0.320	0.370	0.480	0.600
		0.760	0.960	1.170	1.390	1.500	1.690	1.830	1.960
		1.970	1.980	1.980	1.950	1.820	1.680	1.530	1.360
		1.170	1.050	0.880	0.760	0.680	0.630	0.610	0.630
		0.720	0.780	0.860	0.960	1.070	1.160	1.230	1.280
111087		1.290	1.270	1.260	1.190	1.100	0.950	0.820	0.690
		0.570	0.440	0.330	0.260	0.230	0.210	0.230	0.310
		0.400	0.560	0.700	0.900	1.060	1.230	1.360	1.530
		1.610	1.710	1.760	1.790	1.750	1.690	1.640	1.510
		1.410	1.270	1.160	1.030	0.950	0.850	0.780	0.750
		0.760	0.780	0.840	0.910	0.990	1.050	1.130	1.190
121087		1.230	1.240	1.250	1.240	1.190	1.130	1.040	0.930
		0.800	0.710	0.600	0.520	0.430	0.380	0.350	0.350
		0.390	0.450	0.540	0.690	0.790	0.930	1.020	1.190
		1.280	1.400	1.430	1.520	1.550	1.580	1.530	1.500
		1.410	1.370	1.260	1.190	1.080	1.030	0.920	0.860
		0.830	0.850	0.840	0.860	0.900	0.980	1.030	1.100
131087		1.140	1.200	1.210	1.240	1.230	1.220	1.180	1.110
		1.010	0.910	0.850	0.730	0.650	0.560	0.510	0.450
		0.460	0.460	0.500	0.560	0.650	0.730	0.860	0.960
		1.110	1.200	1.300	1.390	1.460	1.490	1.510	1.550
		1.540	1.490	1.430	1.390	1.320	1.250	1.170	1.120
		1.050	1.020	0.980	0.970	0.990	0.990	1.030	1.040
141087		1.070	1.100	1.120	1.130	1.130	1.130	1.120	1.090
		1.040	0.970	0.900	0.850	0.780	0.710	0.670	0.600
		0.560	0.530	0.520	0.520	0.560	0.600	0.650	0.700
		0.800	0.890	0.990	1.080	1.190	1.230	1.310	1.350
		1.400	1.430	1.410	1.400	1.360	1.350	1.280	1.230
		1.160	1.100	1.050	1.000	0.980	0.920	0.910	0.960
151087		0.980	0.950	1.010	1.050	1.090	1.080	1.100	1.120
		1.130	1.090	1.100	1.030	1.040	0.980	0.960	0.890
		0.860	0.780	0.760	0.740	0.680	0.700	0.730	0.730
		0.750	0.810	0.890	0.950	1.000	1.080	1.160	1.230
		1.300	1.350	1.410	1.440	1.460	1.470	1.410	1.410
		1.360	1.310	1.240	1.180	1.130	1.120	1.050	1.000
161087		0.980	1.010	1.010	0.990	1.050	1.070	1.120	1.110
		1.150	1.190	1.220	1.230	1.240	1.230	1.160	1.130
		1.080	1.030	0.950	0.890	0.860	0.780	0.740	0.720
		0.710	0.670	0.700	0.770	0.840	0.860	0.910	1.040
		1.090	1.170	1.270	1.330	1.350	1.380	1.400	1.380
		1.320	1.280	1.280	1.240	1.110	1.040	0.980	0.920
171087		0.810	0.780	0.770	0.780	0.770	0.810	0.830	0.870
		0.930	1.000	1.070	1.090	1.150	1.150	1.180	1.150
		1.130	1.070	0.990	0.920	0.830	0.770	0.690	0.600
		0.560	0.520	0.480	0.510	0.510	0.610	0.630	0.740
		0.780	0.920	1.000	1.070	1.140	1.230	1.300	1.310
		1.330	1.280	1.280	1.190	1.200	1.070	1.010	0.900
181087		0.880	0.780	0.700	0.670	0.700	0.680	0.690	0.730
		0.830	0.880	0.880	0.960	1.050	1.150	1.220	1.330
		1.290	1.320	1.250	1.230	1.090	1.040	0.920	0.880
		0.730	0.650	0.580	0.570	0.550	0.550	0.590	0.640
		0.730	0.850	1.000	1.090	1.240	1.320	1.460	1.530
		1.560	1.550	1.560	1.510	1.460	1.350	1.300	1.180
191087		1.100	0.980	0.900	0.830	0.770	0.740	0.760	0.780

	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
201087	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
211087	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
221087	1.270	1.230	1.000	0.890	0.730	0.630	0.490	0.470			
	0.420	0.470	0.560	0.650	0.770	0.890	1.180	1.340			
	1.460	1.600	1.760	1.890	1.940	1.930	1.950	1.850			
	1.860	1.650	1.520	1.270	1.180	1.020	0.910	0.770			
	0.740	0.680	0.770	0.760	0.790	1.020	1.140	1.280			
	1.350	1.610	1.590	1.690	1.720	1.710	1.610	1.530			
231087	1.410	1.230	1.030	0.920	0.720	0.510	0.360	0.260			
	0.190	0.170	0.210	0.280	0.370	0.550	0.700	0.900			
	1.070	1.280	1.460	1.580	1.690	1.770	1.800	1.770			
	1.720	1.590	1.510	1.360	1.200	0.990	0.870	0.760			
	0.650	0.580	0.550	0.540	0.620	0.720	0.840	0.970			
	1.130	1.260	1.360	1.440	1.560	1.610	1.570	1.530			
241087	1.480	1.360	1.190	1.030	0.850	0.660	0.510	0.360			
	0.230	0.140	0.090	0.100	0.130	0.240	0.380	0.570			
	0.750	0.960	1.120	1.320	1.450	1.560	1.620	1.670			
	1.700	1.660	1.540	1.400	1.280	1.140	0.970	0.810			
	0.680	0.570	0.500	0.440	0.430	0.470	0.550	0.660			
	0.790	0.900	1.040	1.150	1.260	1.310	1.360	1.370			
251087	1.360	1.290	1.190	1.040	0.880	0.740	0.580	0.430			
	0.240	0.170	0.100	0.080	0.050	0.060	0.190	0.360			
	0.520	0.700	0.910	1.130	1.330	1.470	1.600	1.690			
	1.780	1.840	1.830	1.720	1.630	1.510	1.400	1.240			
	1.080	0.920	0.850	0.720	0.680	0.610	0.660	0.700			
	0.810	0.890	1.010	1.140	1.280	1.360	1.430	1.460			
261087	1.510	1.550	1.460	1.350	1.260	1.170	1.010	0.830			
	0.660	0.540	0.470	0.380	0.360	0.330	0.390	0.450			
	0.580	0.780	0.950	1.150	1.330	1.510	1.660	1.790			
	1.890	1.980	2.000	2.000	1.950	1.850	1.680	1.560			
	1.440	1.260	1.100	0.970	0.870	0.730	0.690	0.660			
	0.710	0.760	0.830	0.910	0.970	1.060	1.140	1.180			
271087	1.220	1.250	1.270	1.240	1.180	1.110	0.990	0.880			
	0.740	0.650	0.560	0.470	0.400	0.380	0.360	0.380			
	0.440	0.580	0.660	0.840	0.980	1.170	1.310	1.450			
	1.570	1.680	1.800	1.850	1.870	1.870	1.840	1.770			
	1.660	1.540	1.390	1.260	1.150	1.070	0.940	0.890			
	0.850	0.830	0.820	0.850	0.920	0.980	1.020	1.080			
281087	1.110	1.160	1.160	1.170	1.170	1.140	1.050	0.960			
	0.840	0.710	0.650	0.540	0.430	0.320	0.250	0.220			
	0.210	0.210	0.270	0.370	0.450	0.570	0.680	0.870			

	1.000	1.150	1.220	1.350	1.430	1.540	1.550	1.570
	1.530	1.520	1.470	1.410	1.280	1.180	1.120	1.060
	0.940	0.870	0.810	0.910	0.870	0.920	0.860	1.050
291087	1.090	1.130	1.100	1.230	1.290	1.330	1.310	1.270
	1.240	1.210	1.150	1.060	0.930	0.900	0.830	0.720
	0.620	0.590	0.610	0.600	0.630	0.650	0.760	0.850
	0.990	1.090	1.210	1.310	1.500	1.560	1.670	1.700
	1.800	1.820	1.810	1.760	1.710	1.680	1.580	1.490
	1.370	1.310	1.220	1.200	1.090	1.100	1.100	1.090
301087	1.100	1.110	1.210	1.240	1.230	1.270	1.300	1.320
	1.330	1.340	1.240	1.200	1.150	1.110	0.930	0.870
	0.790	0.740	0.610	0.550	0.530	0.470	0.480	0.500
	0.580	0.630	0.790	0.870	0.990	1.120	1.280	1.380
	1.470	1.580	1.650	1.660	1.650	1.610	1.540	1.490
	1.380	1.270	1.190	1.090	1.000	0.910	0.840	0.820
311087	0.830	0.830	0.870	0.920	0.970	1.050	1.130	1.200
	1.240	1.300	1.360	1.390	1.390	1.360	1.320	1.240
	1.180	1.090	1.010	0.900	0.820	0.710	0.680	0.610
	0.620	0.610	0.680	0.710	0.800	0.890	1.030	1.120
	1.260	1.330	1.470	1.520	1.620	1.630	1.640	1.590
	1.530	1.440	1.360	1.230	1.090	0.970	0.850	0.740

.1 6.35 0. 0. .35 -105 ' WATER LEVEL AT LARK HARBOUR, NFLD.  
011187 301187

011187	0.630	0.580	0.530	0.570	0.570	0.600	0.670	0.780
	0.860	0.960	1.070	1.150	1.220	1.280	1.280	1.250
	1.230	1.170	1.090	0.980	0.860	0.770	0.650	0.560
	0.470	0.440	0.430	0.420	0.430	0.490	0.580	0.700
	0.850	0.960	1.090	1.260	1.380	1.470	1.520	1.590
	1.590	1.550	1.460	1.400	1.300	1.190	1.020	0.890
021187	0.750	0.660	0.620	0.540	0.540	0.550	0.600	0.670
	0.800	0.940	1.100	1.240	1.360	1.450	1.540	1.600
	1.600	1.540	1.470	1.380	1.250	1.120	0.960	0.810
	0.640	0.540	0.430	0.360	0.320	0.340	0.380	0.440
	0.560	0.720	0.870	1.000	1.160	1.300	1.400	1.510
	1.560	1.580	1.540	1.510	1.370	1.260	1.140	1.020
031187	0.850	0.680	0.560	0.520	0.420	0.390	0.380	0.470
	0.580	0.700	0.840	0.990	1.170	1.340	1.480	1.590
	1.670	1.790	1.790	1.730	1.680	1.600	1.430	1.280
	1.140	1.000	0.810	0.740	0.600	0.460	0.410	0.440
	0.510	0.580	0.670	0.860	1.020	1.160	1.260	1.450
	1.550	1.610	1.620	1.670	1.610	1.490	1.350	1.240
041187	1.080	0.890	0.710	0.620	0.510	0.440	0.420	0.400
	0.470	0.590	0.710	0.870	1.060	1.270	1.460	1.620
	1.740	1.860	1.990	2.030	1.990	1.910	1.840	1.720
	1.590	1.400	1.230	1.060	0.910	0.770	0.670	0.620
	0.600	0.650	0.710	0.810	0.930	1.070	1.200	1.340
	1.470	1.560	1.620	1.650	1.650	1.590	1.480	1.360
051187	1.160	1.030	0.870	0.750	0.580	0.480	0.390	0.350
	0.320	0.390	0.510	0.640	0.820	1.010	1.190	1.380
	1.550	1.720	1.830	1.920	2.060	2.030	2.000	1.880
	1.760	1.660	1.460	1.280	1.100	0.960	0.820	0.700
	0.630	0.580	0.570	0.660	0.750	0.910	1.010	1.220
	1.400	1.580	1.620	1.690	1.790	1.840	1.810	1.700
061187	1.630	1.430	1.320	1.110	0.970	0.810	0.710	0.650
	0.610	0.550	0.570	0.680	0.790	0.980	1.160	1.350
	1.550	1.760	1.910	2.050	2.170	2.240	2.300	2.290
	2.240	2.090	1.950	1.780	1.600	1.410	1.250	1.090
	0.940	0.830	0.750	0.730	0.700	0.780	0.850	0.950
	1.050	1.180	1.300	1.390	1.500	1.570	1.620	1.600
071187	1.550	1.500	1.330	1.210	1.050	0.910	0.760	0.610
	0.520	0.450	0.470	0.490	0.590	0.690	0.910	1.110
	1.320	1.490	1.700	1.890	2.040	2.110	2.200	2.230
	2.260	2.130	2.040	1.880	1.780	1.560	1.370	1.230
	1.070	0.950	0.840	0.770	0.700	0.750	0.790	0.910
	0.970	1.070	1.200	1.260	1.390	1.470	1.520	1.530
081187	1.530	1.480	1.350	1.210	1.090	0.950	0.780	0.660
	0.560	0.450	0.380	0.310	0.420	0.430	0.620	0.690
	0.880	1.040	1.290	1.380	1.570	1.670	1.810	1.890
	1.890	1.930	1.880	1.790	1.640	1.540	1.360	1.290
	1.130	0.980	0.870	0.790	0.720	0.670	0.670	0.730
	0.800	0.900	1.000	1.160	1.280	1.350	1.440	1.480
091187	1.510	1.520	1.470	1.400	1.290	1.150	1.010	0.900
	0.820	0.710	0.620	0.590	0.530	0.550	0.580	0.640
	0.710	0.850	1.010	1.150	1.290	1.420	1.560	1.630
	1.770	1.800	1.900	1.840	1.820	1.700	1.640	1.520
	1.400	1.290	1.160	1.040	1.010	0.930	0.910	0.900

	0.980	0.990	1.060	1.130	1.240	1.310	1.340	1.370
101187	1.400	1.380	1.360	1.320	1.220	1.120	0.990	0.880
	0.730	0.640	0.540	0.450	0.340	0.320	0.320	0.370
	0.380	0.460	0.580	0.710	0.880	1.000	1.100	1.230
	1.340	1.450	1.520	1.540	1.600	1.610	1.580	1.500
	1.430	1.380	1.300	1.200	1.130	1.030	1.020	0.950
	0.930	0.930	0.950	1.000	1.080	1.100	1.140	1.190
111187	1.230	1.250	1.230	1.230	1.210	1.170	1.080	1.000
	0.880	0.780	0.680	0.610	0.520	0.490	0.440	0.430
	0.400	0.440	0.560	0.600	0.730	0.820	0.960	1.090
	1.180	1.280	1.330	1.460	1.550	1.590	1.600	1.570
	1.550	1.480	1.430	1.360	1.290	1.200	1.110	1.030
	0.990	0.950	0.920	0.910	0.960	1.010	1.050	1.060
121187	1.120	1.180	1.230	1.230	1.290	1.300	1.260	1.160
	1.210	1.100	1.050	0.960	0.910	0.850	0.780	0.680
	0.750	0.770	0.680	0.680	0.810	0.890	0.980	1.040
	1.080	1.250	1.310	1.370	1.470	1.580	1.610	1.610
	1.640	1.610	1.570	1.480	1.510	1.340	1.350	1.240
	1.340	1.110	1.080	1.150	1.200	1.170	1.150	1.200
131187	1.250	1.210	1.250	1.300	1.340	1.320	1.370	1.360
	1.420	1.330	1.250	1.170	1.210	1.090	1.120	1.020
	0.950	0.880	0.920	0.850	0.800	0.780	0.840	0.890
	0.940	0.980	1.010	1.070	1.140	1.260	1.280	1.310
	1.350	1.400	1.400	1.410	1.350	1.300	1.220	1.150
	1.080	1.030	0.930	0.870	0.830	0.820	0.810	0.830
141187	0.840	0.850	0.930	0.980	1.060	1.110	1.210	1.230
	1.290	1.320	1.370	1.360	1.350	1.310	1.280	1.230
	1.160	1.110	1.060	1.000	0.970	0.960	0.970	0.920
	0.990	1.010	1.100	1.120	1.220	1.270	1.350	1.410
	1.470	1.500	1.530	1.540	1.530	1.490	1.450	1.390
	1.300	1.210	1.130	1.040	0.950	0.860	0.800	0.740
151187	0.710	0.710	0.700	0.710	0.760	0.820	0.890	0.950
	1.030	1.080	1.130	1.180	1.220	1.210	1.200	1.170
	1.120	1.060	1.010	0.940	0.850	0.770	0.730	0.700
	0.620	0.630	0.670	0.710	0.750	0.830	0.920	1.000
	1.080	1.170	1.230	1.260	1.320	1.330	1.320	1.280
	1.220	1.170	1.060	0.960	0.860	0.740	0.610	0.540
161187	0.470	0.410	0.400	0.420	0.440	0.490	0.580	0.680
	0.780	0.890	1.000	1.080	1.150	1.210	1.230	1.220
	1.190	1.120	1.060	1.020	0.920	0.810	0.710	0.660
	0.630	0.570	0.550	0.560	0.620	0.660	0.730	0.830
	0.890	0.940	1.040	1.110	1.160	1.170	1.220	1.200
	1.220	1.150	1.090	1.010	0.950	0.850	0.770	0.680
171187	0.600	0.530	0.520	0.510	0.470	0.510	0.580	0.680
	0.760	0.880	0.970	1.060	1.130	1.230	1.290	1.330
	1.310	1.280	1.230	1.180	1.100	1.010	0.930	0.820
	0.690	0.610	0.530	0.510	0.500	0.490	0.510	0.530
	0.610	0.680	0.800	0.890	0.950	1.020	1.100	1.210
	1.220	1.190	1.160	1.140	1.090	0.940	0.890	0.790
181187	0.690	0.570	0.520	0.420	0.380	0.430	0.450	0.490
	0.590	0.760	0.880	1.000	1.150	1.350	1.470	1.530
	1.630	1.690	1.690	1.650	1.600	1.490	1.360	1.290
	1.150	1.010	0.890	0.840	0.740	0.700	0.720	0.770
	0.830	0.880	1.030	1.120	1.240	1.370	1.470	1.550
	1.610	1.610	1.640	1.530	1.510	1.400	1.290	1.180
191187	1.040	0.910	0.820	0.690	0.630	0.590	0.590	0.610

	0.690	0.800	0.920	1.080	1.200	1.380	1.540	1.660
	1.760	1.800	1.860	1.860	1.810	1.730	1.610	1.500
	1.380	1.210	1.050	0.920	0.800	0.710	0.650	0.590
	0.630	0.670	0.770	0.840	0.970	1.070	1.210	1.280
	1.370	1.430	1.480	1.490	1.450	1.350	1.270	1.150
201187	1.010	0.830	0.720	0.580	0.490	0.400	0.340	0.320
	0.350	0.440	0.550	0.690	0.860	1.050	1.240	1.400
	1.510	1.660	1.830	1.810	1.920	1.820	1.840	1.600
	1.650	1.430	1.330	1.090	1.010	0.830	0.730	0.590
	0.580	0.540	0.580	0.610	0.680	0.800	0.940	1.100
	1.160	1.280	1.300	1.350	1.430	1.370	1.380	1.430
211187	1.260	1.180	1.050	0.930	0.700	0.660	0.610	0.660
	0.590	0.730	0.840	0.970	1.080	1.180	1.390	1.620
	1.770	1.820	1.970	2.010	2.040	2.070	1.970	1.890
	1.800	1.820	1.620	1.410	1.290	1.130	1.050	0.950
	0.860	0.870	0.870	0.900	0.850	0.900	1.080	1.160
	1.260	1.470	1.600	1.640	1.690	1.860	1.880	1.730
221187	1.760	1.650	1.500	1.320	1.220	1.050	0.930	0.740
	0.730	0.760	0.620	0.750	0.880	1.040	1.060	1.370
	1.640	1.810	1.860	2.060	2.140	2.250	2.240	2.280
	2.150	2.010	1.850	1.740	1.600	1.500	1.280	1.110
	1.030	0.950	0.850	0.830	0.870	0.850	0.890	1.040
	1.210	1.270	1.360	1.430	1.540	1.560	1.640	1.650
231187	1.560	1.490	1.420	1.300	1.100	0.880	0.730	0.620
	0.540	0.450	0.380	0.370	0.400	0.500	0.610	0.730
	0.970	1.220	1.410	1.540	1.740	1.900	2.000	2.060
	2.090	2.100	2.060	1.980	1.830	1.640	1.480	1.340
	1.170	1.010	0.850	0.770	0.730	0.710	0.660	0.690
	0.780	0.880	0.930	1.010	1.100	1.190	1.250	1.290
241187	1.290	1.260	1.250	1.140	1.000	0.840	0.710	0.570
	0.440	0.330	0.200	0.130	0.110	0.130	0.170	0.280
	0.390	0.580	0.760	0.990	1.170	1.340	1.500	1.660
	1.780	1.890	1.910	1.950	1.850	1.790	1.680	1.540
	1.360	1.230	1.080	0.940	0.800	0.740	0.690	0.680
	0.700	0.760	0.830	0.910	1.010	1.100	1.190	1.260
251187	1.280	1.340	1.320	1.310	1.240	1.120	0.950	0.870
	0.740	0.590	0.450	0.370	0.310	0.200	0.170	0.200
	0.250	0.370	0.500	0.640	0.780	0.970	1.150	1.280
	1.380	1.540	1.680	1.740	1.740	1.720	1.670	1.560
	1.490	1.370	1.230	1.070	0.960	0.830	0.750	0.650
	0.590	0.590	0.640	0.660	0.740	0.830	0.920	0.970
261187	1.090	1.130	1.200	1.180	1.240	1.170	1.160	0.980
	0.950	0.800	0.710	0.550	0.480	0.360	0.290	0.250
	0.240	0.260	0.290	0.400	0.520	0.650	0.770	0.970
	1.090	1.240	1.300	1.500	1.560	1.640	1.660	1.590
	1.530	1.520	1.430	1.250	1.160	1.030	0.920	0.790
	0.730	0.620	0.590	0.610	0.620	0.620	0.660	0.780
271187	0.830	0.890	0.950	1.030	1.070	1.090	1.130	1.110
	1.060	0.970	0.910	0.780	0.680	0.580	0.530	0.410
	0.340	0.300	0.300	0.310	0.350	0.420	0.520	0.650
	0.780	0.910	1.030	1.150	1.290	1.400	1.480	1.560
	1.590	1.570	1.520	1.470	1.360	1.250	1.140	1.040
	0.910	0.790	0.700	0.640	0.600	0.580	0.580	0.670
281187	0.680	0.770	0.860	0.980	1.000	1.080	1.160	1.240
	1.240	1.240	1.200	1.160	1.070	1.000	0.900	0.800
	0.740	0.650	0.600	0.510	0.490	0.490	0.540	0.590

	0.670	0.770	0.920	1.010	1.120	1.210	1.350	1.450
	1.560	1.550	1.590	1.570	1.580	1.430	1.350	1.250
	1.160	0.990	0.860	0.730	0.640	0.570	0.510	0.470
291187	0.460	0.530	0.610	0.680	0.710	0.830	1.000	1.090
	1.120	1.190	1.320	1.280	1.240	1.210	1.200	1.110
	1.020	0.930	0.830	0.740	0.650	0.590	0.560	0.540
	0.540	0.610	0.680	0.720	0.860	0.990	1.100	1.180
	1.300	1.410	1.490	1.520	1.530	1.520	1.480	1.400
	1.300	1.180	1.100	0.970	0.840	0.690	0.590	0.520
301187	0.540	0.520	0.480	0.500	0.570	0.710	0.790	0.880
	1.000	1.110	1.240	1.320	1.390	1.360	1.410	1.320
	1.280	1.220	1.140	1.070	0.890	0.830	0.710	0.650
	0.580	0.600	0.570	0.630	0.680	0.800	0.900	0.920
	1.060	1.300	1.330	1.450	1.520	1.560	1.550	1.590
	1.500	1.440	1.300	1.270	1.150	1.030	0.850	0.790

.1 6.35 0. 0. .35 -105 WATER LEVEL AT LARK HARBOUR, NFLD.  
011287 311287

011287	0.690	0.640	0.640	0.640	0.640	0.700	0.780	0.920
	1.080	1.180	1.300	1.400	1.550	1.610	1.690	1.730
	1.740	1.650	1.620	1.500	1.480	1.310	1.220	1.150
	1.040	0.970	0.890	0.830	0.850	0.890	1.010	1.170
	1.240	1.380	1.480	1.580	1.790	1.890	2.040	2.000
	1.960	1.880	1.940	1.810	1.660	1.520	1.360	1.210
021287	1.080	0.920	0.780	0.740	0.650	0.610	0.700	0.780
	0.840	0.960	1.160	1.280	1.410	1.500	1.600	1.690
	1.800	1.820	1.810	1.770	1.720	1.610	1.480	1.340
	1.240	1.160	1.030	0.920	0.830	0.810	0.860	0.840
	0.870	1.010	1.130	1.270	1.330	1.470	1.580	1.700
	1.700	1.760	1.760	1.730	1.610	1.570	1.400	1.270
031287	1.150	1.010	0.890	0.770	0.730	0.660	0.600	0.650
	0.800	0.920	1.000	1.140	1.370	1.530	1.650	1.760
	1.930	1.990	2.060	2.020	2.000	1.890	1.780	1.640
	1.510	1.380	1.190	1.070	0.930	0.820	0.760	0.740
	0.740	0.760	0.840	0.940	1.050	1.130	1.260	1.350
	1.460	1.510	1.550	1.570	1.550	1.470	1.360	1.240
041287	1.150	0.990	0.840	0.690	0.570	0.490	0.440	0.430
	0.440	0.540	0.680	0.800	0.980	1.150	1.310	1.490
	1.660	1.800	1.920	1.980	2.000	2.000	1.980	1.890
	1.760	1.580	1.470	1.300	1.160	1.020	0.950	0.840
	0.790	0.770	0.830	0.900	0.950	1.040	1.190	1.260
	1.350	1.460	1.520	1.520	1.530	1.520	1.460	1.380
051287	1.210	1.130	0.990	0.890	0.690	0.590	0.560	0.500
	0.440	0.490	0.550	0.670	0.760	1.030	1.070	1.320
	1.500	1.750	1.800	1.960	2.100	2.160	2.110	2.070
	2.060	1.780	1.740	1.540	1.350	1.230	1.130	0.900
	0.830	0.790	0.760	0.700	0.760	0.880	0.920	1.070
	1.190	1.320	1.370	1.490	1.550	1.560	1.530	1.630
061287	1.440	1.430	1.280	1.150	0.990	0.830	0.780	0.740
	0.650	0.610	0.630	0.690	0.770	0.920	1.040	1.190
	1.370	1.560	1.660	1.740	1.890	1.990	2.000	2.010
	2.030	1.960	1.830	1.740	1.590	1.440	1.300	1.180
	1.060	0.930	0.830	0.810	0.800	0.830	0.890	0.980
	1.100	1.230	1.280	1.400	1.470	1.520	1.550	1.580
071287	1.580	1.480	1.380	1.240	1.130	1.020	0.870	0.730
	0.670	0.580	0.520	0.490	0.500	0.580	0.680	0.780
	0.930	1.070	1.240	1.350	1.460	1.600	1.710	1.710
	1.720	1.740	1.720	1.670	1.490	1.350	1.200	1.080
	0.890	0.800	0.650	0.590	0.510	0.480	0.490	0.590
	0.630	0.750	0.830	0.960	1.040	1.110	1.210	1.180
081287	1.240	1.270	1.240	1.110	1.030	0.900	0.780	0.660
	0.560	0.470	0.380	0.330	0.330	0.340	0.400	0.500
	0.640	0.760	0.890	1.050	1.240	1.350	1.460	1.550
	1.630	1.690	1.680	1.660	1.610	1.520	1.420	1.290
	1.200	1.060	0.960	0.830	0.750	0.680	0.670	0.650
	0.720	0.750	0.840	0.920	1.030	1.100	1.170	1.240
091287	1.260	1.270	1.250	1.210	1.120	1.020	0.920	0.800
	0.680	0.550	0.500	0.430	0.390	0.370	0.420	0.450
	0.560	0.660	0.820	0.950	1.100	1.240	1.380	1.500
	1.610	1.700	1.740	1.780	1.760	1.730	1.640	1.580
	1.470	1.370	1.260	1.160	1.040	0.930	0.880	0.860

	0.850	0.840	0.880	0.960	1.030	1.080	1.150	1.220
101287	1.280	1.290	1.310	1.300	1.290	1.200	1.130	1.030
	0.950	0.830	0.750	0.630	0.570	0.540	0.530	0.500
	0.530	0.600	0.720	0.810	0.920	1.040	1.190	1.310
	1.400	1.480	1.540	1.610	1.660	1.640	1.610	1.550
	1.490	1.410	1.310	1.200	1.100	1.020	0.950	0.880
	0.860	0.850	0.860	0.860	0.900	0.990	1.050	1.100
111287	1.170	1.210	1.250	1.290	1.280	1.260	1.240	1.170
	1.090	1.020	0.940	0.840	0.760	0.660	0.610	0.580
	0.560	0.560	0.590	0.670	0.750	0.790	0.900	1.060
	1.190	1.270	1.330	1.410	1.520	1.520	1.560	1.470
	1.570	1.450	1.440	1.320	1.250	1.140	1.070	0.980
	0.930	0.810	0.890	0.920	0.870	0.860	0.940	1.090
121287	1.100	1.110	1.240	1.280	1.310	1.330	1.380	1.350
	1.290	1.300	1.290	1.250	1.070	1.050	0.940	0.880
	0.870	0.910	0.850	0.860	0.890	0.970	1.040	0.990
	1.330	1.390	1.470	1.560	1.640	1.750	1.630	1.650
	1.700	1.610	1.620	1.580	1.530	1.440	1.260	1.190
	1.090	1.020	0.910	0.890	0.840	0.850	0.890	1.000
131287	0.840	1.060	1.110	1.110	1.140	1.180	1.230	1.380
	1.260	1.340	1.160	1.240	1.230	1.050	0.990	0.940
	0.830	0.840	0.750	0.800	0.730	0.750	0.760	0.810
	0.930	1.000	1.110	1.220	1.240	1.310	1.420	1.500
	1.490	1.570	1.510	1.490	1.450	1.320	1.260	1.160
	1.130	1.020	0.970	0.910	0.860	0.740	0.780	0.760
141287	0.770	0.870	0.840	0.890	0.990	1.070	1.080	1.150
	1.250	1.250	1.360	1.300	1.270	1.170	1.190	1.100
	1.030	0.970	0.890	0.810	0.760	0.740	0.730	0.740
	0.740	0.830	0.860	0.880	1.000	1.050	1.120	1.200
	1.300	1.320	1.390	1.410	1.370	1.350	1.280	1.220
	1.190	1.080	0.990	1.010	0.890	0.830	0.800	0.750
151287	0.780	0.770	0.840	0.860	0.910	1.000	1.090	1.170
	1.270	1.310	1.340	1.430	1.450	1.430	1.430	1.360
	1.340	1.250	1.230	1.120	1.010	0.920	0.860	0.790
	0.780	0.820	0.810	0.860	0.900	1.010	1.020	1.060
	1.140	1.150	1.270	1.320	1.350	1.360	1.310	1.260
	1.240	1.210	1.140	0.950	0.970	0.890	0.780	0.710
161287	0.700	0.720	0.710	0.740	0.810	0.840	0.950	1.070
	1.170	1.290	1.400	1.450	1.540	1.580	1.630	1.660
	1.700	1.570	1.520	1.470	1.390	1.280	1.190	1.090
	0.980	1.000	0.970	0.960	0.980	1.000	1.090	1.140
	1.210	1.280	1.390	1.460	1.490	1.550	1.570	1.520
	1.520	1.480	1.410	1.280	1.330	1.220	1.180	1.010
171287	0.880	0.830	0.810	0.780	0.890	0.990	0.960	1.170
	1.150	1.330	1.440	1.620	1.690	1.790	1.940	1.900
	1.910	1.880	1.880	1.840	1.710	1.610	1.490	1.430
	1.300	1.170	1.110	1.040	0.960	0.920	0.950	1.030
	0.970	1.070	1.070	1.200	1.310	1.290	1.370	1.420
	1.400	1.490	1.350	1.300	1.140	1.170	0.990	0.900
181287	0.730	0.660	0.620	0.530	0.450	0.470	0.510	0.590
	0.720	0.890	1.020	1.220	1.340	1.530	1.660	1.800
	1.990	1.980	2.010	2.020	1.960	1.910	1.780	1.620
	1.520	1.400	1.270	1.150	1.060	1.020	0.970	0.960
	0.940	0.980	1.050	1.140	1.230	1.280	1.360	1.420
	1.480	1.480	1.500	1.460	1.390	1.270	1.160	1.020
191287	0.890	0.740	0.610	0.490	0.390	0.350	0.340	0.370

	0.430	0.550	0.690	0.870	1.050	1.250	1.410	1.580
	1.720	1.860	1.940	2.030	2.000	1.970	1.880	1.770
	1.620	1.510	1.340	1.190	1.050	0.950	0.820	0.760
	0.730	0.750	0.790	0.850	0.930	1.030	1.140	1.220
	1.290	1.350	1.390	1.400	1.390	1.340	1.240	1.110
201287	0.990	0.850	0.680	0.510	0.420	0.290	0.230	0.160
	0.180	0.180	0.320	0.450	0.680	0.850	1.020	1.220
	1.430	1.630	1.780	1.850	1.960	2.010	1.990	1.910
	1.790	1.690	1.550	1.390	1.200	1.070	0.960	0.820
	0.700	0.660	0.660	0.710	0.730	0.820	0.920	1.080
	1.170	1.230	1.270	1.350	1.410	1.420	1.370	1.260
211287	1.130	1.000	0.830	0.660	0.490	0.360	0.260	0.170
	0.070	0.080	0.110	0.180	0.320	0.500	0.710	0.900
	1.130	1.330	1.550	1.690	1.860	1.940	2.060	2.040
	2.040	1.970	1.870	1.710	1.530	1.420	1.250	1.140
	0.990	0.930	0.830	0.800	0.780	0.830	0.970	1.070
	1.230	1.300	1.440	1.570	1.650	1.700	1.730	1.670
221287	1.670	1.540	1.430	1.280	1.050	0.900	0.740	0.530
	0.380	0.280	0.210	0.160	0.190	0.310	0.430	0.590
	0.780	1.000	1.220	1.420	1.560	1.730	1.850	1.950
	1.980	1.950	1.860	1.780	1.650	1.490	1.310	1.160
	1.030	0.860	0.700	0.620	0.600	0.600	0.640	0.700
	0.790	0.930	1.090	1.200	1.300	1.420	1.530	1.580
231287	1.600	1.590	1.530	1.380	1.240	1.070	0.950	0.780
	0.640	0.500	0.400	0.320	0.320	0.330	0.390	0.520
	0.670	0.860	1.060	1.260	1.450	1.650	1.810	1.960
	2.050	2.140	2.150	2.100	2.000	1.890	1.750	1.590
	1.390	1.220	1.040	0.880	0.770	0.690	0.610	0.640
	0.690	0.750	0.810	0.940	1.040	1.180	1.260	1.350
241287	1.400	1.450	1.440	1.400	1.290	1.170	1.030	0.900
	0.740	0.590	0.440	0.340	0.250	0.200	0.160	0.220
	0.310	0.430	0.570	0.750	0.930	1.100	1.270	1.450
	1.600	1.710	1.780	1.870	1.900	1.840	1.740	1.690
	1.560	1.410	1.240	1.120	0.950	0.840	0.750	0.690
	0.680	0.670	0.730	0.770	0.860	0.990	1.100	1.180
251287	1.270	1.330	1.380	1.400	1.410	1.350	1.240	1.170
	1.070	0.920	0.770	0.620	0.470	0.360	0.300	0.260
	0.250	0.250	0.320	0.430	0.550	0.670	0.870	1.070
	1.160	1.310	1.490	1.600	1.650	1.690	1.720	1.720
	1.620	1.550	1.430	1.300	1.130	1.030	0.890	0.770
	0.710	0.680	0.670	0.740	0.750	0.870	0.980	1.100
261287	1.210	1.370	1.460	1.540	1.560	1.640	1.620	1.620
	1.500	1.470	1.300	1.200	1.050	0.920	0.770	0.680
	0.630	0.590	0.520	0.570	0.630	0.700	0.760	0.930
	1.070	1.200	1.300	1.410	1.530	1.590	1.620	1.640
	1.630	1.580	1.510	1.400	1.260	1.130	1.000	0.870
	0.750	0.680	0.640	0.610	0.590	0.620	0.690	0.770
271287	0.880	1.010	1.100	1.200	1.260	1.330	1.410	1.470
	1.490	1.480	1.420	1.320	1.230	1.120	1.040	0.930
	0.840	0.730	0.660	0.600	0.610	0.610	0.660	0.740
	0.850	0.950	1.080	1.180	1.280	1.370	1.480	1.550
	1.600	1.630	1.620	1.560	1.460	1.350	1.250	1.140
	1.010	0.880	0.790	0.710	0.670	0.630	0.650	0.660
281287	0.750	0.840	0.940	1.050	1.150	1.260	1.350	1.430
	1.510	1.550	1.580	1.560	1.540	1.460	1.390	1.300
	1.240	1.140	1.060	0.970	0.910	0.850	0.830	0.830

	0.860	0.900	0.980	1.050	1.120	1.180	1.280	1.360
	1.420	1.460	1.520	1.510	1.490	1.410	1.320	1.240
	1.150	1.030	0.910	0.820	0.720	0.660	0.610	0.620
291287	0.620	0.710	0.740	0.810	0.880	1.050	1.170	1.270
	1.330	1.430	1.500	1.560	1.590	1.600	1.590	1.540
	1.470	1.380	1.280	1.190	1.120	1.010	0.920	0.860
	0.850	0.830	0.820	0.850	0.910	1.020	1.090	1.150
	1.200	1.330	1.380	1.440	1.480	1.550	1.470	1.420
	1.350	1.310	1.190	1.160	1.010	0.910	0.830	0.790
301287	0.710	0.730	0.750	0.810	0.820	0.960	1.050	1.180
	1.400	1.420	1.590	1.740	1.870	1.900	2.020	2.080
	2.060	1.990	1.950	1.860	1.930	1.830	1.720	1.530
	1.500	1.330	1.280	1.130	1.130	1.150	1.220	1.150
	1.170	1.190	1.270	1.240	1.240	1.220	1.150	1.180
	1.060	1.010	0.850	0.700	0.610	0.530	0.430	0.290
311287	0.220	0.130	0.040	0.020	0.070	0.110	0.210	0.290
	0.400	0.560	0.740	0.900	1.090	1.180	1.320	1.480
	1.620	1.630	1.620	1.590	1.590	1.510	1.430	1.280
	1.180	1.130	1.090	0.970	0.900	0.850	0.930	0.930
	1.000	1.060	1.160	1.240	1.320	1.320	1.370	1.430
	1.490	1.460	1.390	1.370	1.310	1.190	1.140	0.990

.1 6.35 0. 0. .35 -105  
011087 311087

WATER LEVEL AT COX'S COVE, NFLD.

	0.930	0.730	0.550	0.510	0.440	0.390	0.350	0.480
	0.570	0.680	0.830	1.010	1.110	1.210	1.250	1.350
101087	1.420	1.430	1.410	1.320	1.190	1.060	0.930	0.750
	0.650	0.530	0.430	0.350	0.280	0.350	0.440	0.610
	0.730	0.910	1.120	1.330	1.460	1.630	1.740	1.930
	1.970	1.980	1.970	1.960	1.910	1.260	1.610	1.430
	1.250	1.130	1.010	0.830	0.770	0.720	0.660	0.660
	0.730	0.820	0.880	0.970	1.070	1.170	1.230	1.310
111087	1.330	1.320	1.290	1.270	1.170	1.070	0.930	0.810
	0.650	0.530	0.410	0.330	0.270	0.260	0.250	0.280
	0.410	0.530	0.670	0.830	1.030	1.190	1.330	1.460
	1.610	1.680	1.730	1.790	1.770	1.730	1.680	1.570
	1.490	1.440	1.230	1.090	1.010	0.900	0.830	0.790
	0.780	0.810	0.830	0.910	0.990	1.050	1.100	1.170
121087	1.230	1.330	1.430	1.430	1.230	1.170	1.090	1.010
	0.870	0.770	0.670	0.560	0.530	0.430	0.370	0.360
	0.400	0.430	0.510	0.630	0.760	0.880	0.980	1.110
	1.230	1.330	1.510	1.490	1.530	1.550	1.540	1.510
	1.450	1.390	1.330	1.230	1.130	1.070	0.990	0.910
	0.830	0.850	0.860	0.870	0.890	0.970	1.030	1.080
131087	1.130	1.160	1.210	1.210	1.230	1.220	1.190	1.130
	1.070	0.950	0.880	0.790	0.650	0.630	0.530	0.490
	0.470	0.480	0.500	0.540	0.630	0.730	0.810	0.930
	1.050	1.160	1.250	1.360	1.430	1.480	1.480	1.530
	1.530	1.510	1.450	1.400	1.350	1.290	1.190	1.150
	1.080	1.040	1.000	0.990	0.980	1.010	1.030	1.050
141087	1.100	1.120	1.140	1.160	1.160	1.160	1.160	1.120
	1.120	1.010	0.960	0.920	0.840	0.760	0.750	0.680
	0.610	0.580	0.570	0.560	0.590	0.630	0.680	0.730
	0.800	0.900	1.000	1.090	1.160	1.240	1.320	1.350
	1.400	1.430	1.460	1.420	1.400	1.400	1.340	1.260
	1.220	1.170	1.090	1.060	1.060	0.980	0.950	0.970
151087	1.000	1.010	1.020	1.080	1.110	1.120	1.140	1.140
	1.160	1.160	1.140	1.100	1.110	1.060	1.030	0.990
	0.940	0.840	0.820	0.810	0.770	0.740	0.770	0.810
	0.780	0.840	0.940	1.010	1.050	1.100	1.180	1.260
	1.320	1.380	1.440	1.470	1.500	1.510	1.460	1.440
	1.430	1.360	1.300	1.240	1.180	1.160	1.140	1.070
161087	1.040	1.060	1.080	1.050	1.070	1.120	1.140	1.160
	1.170	1.200	1.230	1.260	1.260	1.220	1.160	
	1.120	1.080	1.020	0.960	0.920	0.860	0.800	0.760
	0.770	0.740	0.720	0.780	0.860	0.900	0.920	1.020
	1.120	1.160	1.250	1.350	1.360	1.370	1.420	1.410
	1.360	1.300	1.410	1.260	1.160	1.090	1.030	0.980
171087	0.890	0.810	0.800	0.820	0.810	0.820	0.860	0.900
	0.910	1.010	1.070	1.100	1.130	1.180	1.190	1.160
	1.160	1.120	1.070	0.990	0.900	0.820	0.760	0.690
	0.600	0.590	0.540	0.520	0.570	0.600	0.660	0.720
	0.800	0.880	1.000	1.060	1.140	1.200	1.300	1.320
	1.340	1.300	1.310	1.240	1.180	1.140	1.060	1.040
181087	0.900	0.860	0.740	0.680	0.730	0.740	0.710	0.730
	0.800	0.900	0.950	1.030	1.130	1.210	1.260	1.310
	1.300	1.310	1.280	1.240	1.160	1.070	0.980	0.940
	0.800	0.700	0.640	0.600	0.580	0.580	0.590	0.640
	0.710	0.820	0.950	1.060	1.160	1.260	1.370	1.480
	1.540	1.530	1.560	1.510	1.460	1.500	1.300	1.220

191087	1.120	1.040	0.930	0.880	0.790	0.780	0.780	0.790
	0.840	0.940	1.000	1.060	1.170	1.360	1.380	1.430
	1.480	1.520	1.550	1.480	1.440	1.340	1.240	1.110
	1.010	0.880	0.770	0.660	0.580	0.560	0.540	0.560
	0.620	0.720	0.780	0.880	1.040	1.160	1.260	1.360
	1.470	1.560	1.580	1.580	1.540	1.520	1.400	1.320
201087	1.200	1.060	0.960	0.830	0.740	0.700	0.660	0.640
	0.690	0.750	0.830	0.940	1.060	1.200	1.310	1.380
	1.500	1.580	1.590	1.600	1.570	1.520	1.430	1.320
	1.140	1.000	0.960	0.800	0.610	0.520	0.510	0.510
	0.500	0.560	0.660	0.760	0.850	0.990	1.100	1.240
	1.320	1.420	1.490	1.490	1.480	1.470	1.360	1.260
210187	1.160	1.060	0.880	0.780	0.660	0.560	0.500	0.460
	0.430	0.500	0.620	0.720	0.840	0.900	1.160	1.290
	1.400	1.560	1.660	1.720	1.760	1.760	1.680	1.580
	1.490	1.360	1.240	1.060	0.910	0.810	0.720	0.630
	0.570	0.640	0.690	0.760	0.850	0.870	0.980	1.230
	1.350	1.480	1.560	1.620	1.640	1.650	1.300	1.260
221087	1.103	0.983	0.823	0.703	0.613	0.493	0.503	0.483
	0.593	0.663	0.753	0.863	1.103	1.283	1.463	1.543
	1.533	1.473	1.453	1.433	1.423	1.403	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
231087	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	1.305	1.115	1.035	0.805
	0.705	0.655	0.605	0.595	0.635	0.725	0.845	0.955
	1.105	1.245	1.365	1.445	1.565	1.635	1.635	1.585
241087	1.545	1.465	1.315	1.135	0.995	0.805	0.625	0.585
	0.345	0.225	0.195	0.195	0.195	0.245	0.385	0.555
	0.745	0.905	1.105	1.265	1.405	1.545	1.635	1.665
	1.715	1.725	1.655	1.515	1.365	1.265	1.105	0.905
	0.765	0.655	0.555	0.515	0.475	0.525	0.605	0.705
	0.825	0.925	1.065	1.155	1.275	1.375	1.385	1.395
251087	1.415	1.345	1.245	1.105	0.965	0.805	0.665	0.505
	0.315	0.195	0.115	0.105	0.095	0.085	0.185	0.385
	0.545	0.715	0.905	1.125	1.305	1.505	1.605	1.705
	1.785	1.865	1.845	1.755	1.645	1.555	1.425	1.285
	1.005	0.985	0.875	0.805	0.725	0.665	0.695	0.765
	0.845	0.925	1.015	1.155	1.265	1.385	1.405	1.485
261087	1.505	1.585	1.505	1.365	1.305	1.205	1.065	0.905
	0.765	0.605	0.545	0.425	0.385	0.385	0.405	0.475
	0.585	0.805	0.985	1.185	1.305	1.525	1.755	1.785
	1.905	2.005	2.025	2.005	1.985	1.885	1.705	1.605
	1.515	1.305	1.155	1.045	0.905	0.805	0.735	0.755
	0.785	0.805	0.905	0.965	1.015	1.105	1.175	1.215
271087	1.255	1.295	1.305	1.285	1.215	1.175	1.065	0.905
	0.805	0.715	0.635	0.525	0.485	0.425	0.405	0.415
	0.485	0.585	0.705	0.835	1.005	1.165	1.305	1.425
	1.545	1.665	1.725	1.805	1.865	1.875	1.865	1.815
	1.765	1.645	1.525	1.385	1.265	1.165	1.055	0.965
	0.905	0.885	0.845	0.865	0.905	0.985	1.015	1.055
281087	1.105	1.145	1.155	1.165	1.185	1.165	1.125	1.065
	0.965	0.825	0.725	0.665	0.545	0.435	0.325	0.235

	0.235	0.225	0.245	0.285	0.425	0.535	0.605	0.765
	0.955	1.075	1.165	1.265	1.365	1.445	1.535	1.575
	1.545	1.535	1.515	1.505	1.465	1.265	1.165	1.125
	1.065	0.945	0.855	0.835	0.925	0.905	0.865	0.925
291087	1.005	1.025	1.005	1.035	1.245	1.285	1.305	1.305
	1.265	1.225	1.205	1.145	1.005	0.935	0.905	0.805
	0.705	0.625	0.605	0.605	0.615	0.625	0.665	0.745
	0.885	1.005	1.105	1.205	1.325	1.505	1.555	1.605
	1.705	1.805	1.805	1.795	1.765	1.705	1.665	1.585
	1.505	1.395	1.305	1.245	1.185	1.095	1.085	1.105
301087	1.105	1.125	1.145	1.215	1.265	1.235	1.275	1.325
	1.335	1.365	1.325	1.245	1.185	1.145	1.105	0.955
	0.865	0.845	0.745	0.625	0.585	0.575	0.505	0.515
	0.555	0.625	0.715	0.805	0.925	1.025	1.165	1.305
	1.405	1.505	1.605	1.685	1.695	1.655	1.625	1.585
	1.485	1.385	1.265	1.195	1.105	1.005	0.935	0.885
311087	0.845	0.845	0.885	0.925	0.975	1.005	1.075	1.155
	1.205	1.265	1.325	1.385	1.405	1.385	1.375	1.305
	1.235	1.155	1.075	1.005	0.905	0.805	0.745	0.685
	0.635	0.615	0.655	0.705	0.745	0.815	0.925	1.045
	1.145	1.255	1.365	1.465	1.545	1.615	1.625	1.635
	1.595	1.515	1.435	1.355	1.225	1.085	0.995	0.865

**APPENDIX B**  
**BAROMETRIC PRESSURE DATA AT DANIELS HARBOUR**

BAROMETRIC PRESSURE AT DANIELS HBR, NFLD  
- OCTOBER 1987 -

814014009871001077010039 010032 010025 010022 010015 010008 010002 010029 009995  
009991 009981 009991 -99999M-99999M009988 00  
988 009988 009991 009988 009985 009985 009964 009954 009924  
84014009871002077009897 009866 009853 009846 009839 009829 009809 -99999M009778  
009792 009799 009877 009799 009991 010022 010073 010106 010133 010154 010171 010  
191 010205 010215 -99999  
84014009871003077010232 010235 010242 010245 010242 010238 010242 010242 010242  
010235 010232 010225 010221 010218 010218 010218 010215 010211 010205 010198 010  
194 010191 010188 010174  
84014009871004077010164 010157 010157 -99999M-99999M010127 010123 010117 010110  
010106 010100 010096 010096 010093 010069 010069 010062 010052 010046 010042 010  
032 010022 010012 010008  
84014009871005077009981 009991 009988 009964 009968 009961 009961 009954 009951  
009948 009941 009941 009948 009944 009948 009954 009958 009958 009961 009968 009  
975 009981 009991 009991  
84014009871006077009998 010022 010039 010062 010069 010090 010096 010123 010137  
010147 010157 010161 010161 010161 010164 010167 010171 010171 010181 010184 010  
184 010181 010181 010188  
84014009871007077010181 010177 010174 010174 010177 010177 010177 010177 010177  
010181 010177 010174 010167 010167 010167 010171 010167 010191 010167 010167 -99  
999M010164 010167 -99999  
84014009871008077010167 010167 010164 010157 010154 010154 010150 010144 010144  
010144 010127 010110 010100 010073 010076 010069 010046 010019 010019 010008 009  
998 009991 009988 009981  
84014009871009077009975 009964 009964 009958 009958 009961 009971 009975 009985  
009985 009991 009995 009998 009998 010005 010019 010039 010059 010076 010096 010  
106 010120 010127 010127  
84014009871010077010140 010144 010144 010137 010133 010133 010130 -99999M010123  
010120 010113 010113 010093 010086 010083 010083 010083 010079 010079 010079 010  
083 010083 010090 010093  
84014009871011077010103 010117 010120 010127 010133 010137 010147 010154 010157  
010157 010157 010150 010150 010147 010144 -99999M-99999M010140 010140 010  
140 -99999M010144 010144  
84014009871012077010147 010147 010150 010147 010150 010154 010157 010157 010161  
010164 010167 010164 010161 010157 010157 010154 -99999M010154 010150 010154 010  
150 010150 010150 010150  
84014009871013077010150 010147 010147 010144 010147 010144 -99999M010144 010144  
010144 010147 010140 010137 010137 010137 010133 010137 010137 010137 010144 010  
144 010147 010147 010147  
84014009871014077010147 010157 010157 010157 010164 010171 010177 010164 010177  
010177 010191 010198 010194 010191 010191 010191 010194 009856 010194 010191 010  
181 010174 010174 010161  
84014009871015077010150 010140 010137 010123 010110 010103 010093 -99999M-99999M  
010069 010076 010066 010073 -99999M010073 010076 010076 010076 010076 010083 010  
083 010083 010083  
84014009871016077010083 010090 010100 010106 -99999M-99999M010137 010147 010154  
010161 010167 010171 010174 -99999M010181 010181 010188 010191 010194 010205 010  
205 010211 010211 010215  
84014009871017077010215 010218 010221 010225 010225 010225 010232 010252 010255  
010259 010262 010265 010262 010262 010259 010265 010262 010259 010259 010  
265 010259 010248 010245  
84014009871018077010242 010242 010238 010228 010221 010215 010211 010215 010215

010211 010205 010201 010191 010188 010181 010171 010150 010144 010137 010127 010  
120 010117 010106 010096  
84014009871019077010090 010083 010079 010076 010076 010083 010086 010096 010096  
010100 010106 010103 010106 010106 010110 010113 010117 010123 010127 010133 010  
133 010137 010137 010140  
84014009871020077010144 010144 010147 010147 010147 010150 010154 010157 010157  
-99999M010157 -99999M010161 010164 010161 010167 010167 010171 010171 010177 010  
181 010181 010184 010194  
84014009871021077010188 010188 010188 010181 010177 010174 010167 010161 010144  
010144 010140 010133 -99999M-99999M010113 010106 010090 010079 010062 010062 010  
059 010059 010056 010052  
84014009871022077010052 010052 010049 010039 010032 010019 010019 010015 010008  
010005 009995 009991 009975 009964 009961 009954 009941 009941 009941 009944 009  
951 009941 009961 009978  
184014009871023077009991 010008 010029 -99999M-99999M010069 010079 010090 010103  
010123 010133 -99999M-99999M010167 010174 01  
188 010191 010201 010208 010215 010221 010235 010242 010245  
84014009871024077010248 010235 010259 010259 010259 010265 010269 010276 010279  
010286 010289 010289 010286 010279 010279 010286 010286 010286 010286 010289 010  
289 010292 010289 010286  
84014009871025077010286 010286 010282 010276 010272 010276 -99999M010276 010279  
010272 010276 010265 010259 010248 010245 010238 010225 010221 010215 010201 010  
201 010184 010171 010154  
84014009871026077010144 010123 010103 010100 010090 010076 010069 010052 010052  
010039 010032 010022 010015 010005 010002 009995 009995 009995 009991 009988 010  
029 010019 010029 010039  
84014009871027077010049 010062 010076 010090 010103 010117 010127 010137 010150  
010167 010167 010177 010181 010181 010188 010194 010201 010205 010208 010221 010  
221 010228 010232 010228  
84014009871028077010242 010238 010238 010232 010238 010259 010242 010248 010245  
010248 010242 010248 010235 010242 010238 010242 010242 010235 010238 010232 010  
232 010235 010232 010232  
84014009871029077010232 010218 010215 010205 010188 010181 010171 010167 010150  
010137 010123 010117 010103 010083 010076 010069 010056 010049 010035 010032 010  
019 010015 010005 010002  
84014009871030077010005 009998 009998 010008 010019 010019 010029 010046 010052  
010059 010059 010059 010059 010069 010083 010090 010093 010103 010120 010133 010  
140 010150 010161 010167  
84014009871031077010171 010177 010181 010184 010191 010198 010194 010201 010205  
010205 010205 010198 010188 010181 010177 010174 010177 010177 010174 010171 010  
167 010167 010164 010161

BAROMETRIC PRESSURE AT DANIELS HBR, NFLD.  
- NOVEMBER 1987 -

84014009871101077010157 010150 010147 010147 010147 010147 010147 010147 010147  
010140 010144 010144 010137 010144 010133 010  
133 010133 010127 010137 010127 010127 010123 010127 010123  
84014009871102077010117 010117 010113 010113 010113 010110 010117 010133 010147  
010147 010150 010150 010154 010150 010157 010157 010161 010161 010161 010161 010  
154 010154 010154 010147  
84014009871103077010144 010130 010127 010113 010106 010090 010083 010062 010059  
010056 010025 010012 010005 010120 009985 009975 009975 009981 009985 009985 009  
991 009991 009985 009981  
84014009871104077009985 009985 009981 009985 009991 009995 010002 010008 010019  
010025 010025 010025 010019 010019 010025 010025 010025 010029 010039 010  
039 010035 010035 010032  
84014009871105077010035 010035 010035 010035 010035 010035 010029 010025 010029  
010025 010019 010008 010005 009995 009991 009985 009975 009971 009961 009944 009  
937 -99999M009907 009893  
84014009871106077009883 009873 -99999M009856 009843 009839 009843 009822 009822  
009802 009802 009785 009778 009768 009765 009772 009782 009799 009812 009822 009  
833 009839 009849 009856  
84014009871107077009863 009866 009870 009873 009880 009887 009893 009897 009907  
009914 009920 009924 009917 009924 009924 009927 -99999M009948 009948 -99999M009  
961 -99999M-99999M009971  
84014009871108077009971 -99999M009975 009975 009975 009981 009985 009978 009995  
010008 009995 009995 009991 009985 -99999M-99999M010005 010005 010002 009998 010  
005 010005 010008 010012  
84014009871109077010012 010019 010022 010029 010025 010052 010059 010062 010073  
010073 010073 010076 010073 010073 010069 010069 010073 010073 010073 010073 -99  
999M010073 010076 010079  
84014009871110077010079 010083 010083 010090 010096 010130 010103 010113 010120  
010127 010133 010137 010130 010133 010130 010130 -99999M010127 010130 010133 010  
137 010137 010137  
84014009871111077010140 -99999M010144 -99999M-99999M010147 -99999M-99999M010177  
010181 010184 010177 010177 010174 010171 010171 010161 010161 010157 010157 010  
154 010150 010144 010137  
84014009871112077010130 010117 010113 010106 010093 010090 010083 010083 010069  
010069 010052 010042 010015 010005 009981 009981 009961 009927 009914 009900 009  
866 009829 009812 009812  
84014009871113077009802 009789 009775 009775 009762 009768 009758 009762 009765  
009778 009782 009789 009802 009819 009836 009866 009873 009893 009907 009927 009  
941 009954 009971 009978  
84014009871114077009988 009995 010005 010015 010019 010032 010035 010046 010052  
010059 010062 010062 010062 010066 010069 010069 010069 010076 010079 010069 010  
069 010066 010062 010059  
84014009871115077010052 010049 010039 010039 010039 010046 010049 010059 010073  
010083 010093 010096 010096 010103 010113 010117 010123 010127 010130 010133 010  
137 010137 010144 010147  
84014009871116077010154 010161 010167 010171 010177 010191 010198 010205 010205  
010211 010211 010211 010218 010221 010232 010242 010248 010259 010262 010  
265 010269 010269 010269  
84014009871117077010265 010265 010269 010272 -99999M010272 010269 010265 010279  
010276 010279 010265 010265 010245 010245 010228 010167 010225 010215 010205 010  
198 010184 010171 010164  
84014009871118077010147 010140 010133 -99999M010157 010106 -99999M-99999M010096

010090 010079 010059 009998 010032 010019 009998 009998 009981 009985 009981 009  
975 009981 009981 009981  
8401400987119077009975 009975 009975 009975 009981 009988 009995 010002 010025  
010039 010046 010049 010052 010062 010073 010083 010090 010100 010113 010117 010  
127 010137 010144 010147  
84014009871120077010154 010157 010164 010167 010174 010177 010181 010188 010191  
010191 010188 010181 010177 010181 010177 010167 010174 010161 010154 010144 010  
123 010113 010086 010056  
840140098711212077010052 010015 009981 009954 009941 009937 009934 009941 009954  
009964 009985 009991 009975 009975 009961 009944 009931 009914 009900 009887 009  
883 009880 009877 009877  
84014009871122077009877 009873 009863 009853 009877 009873 009863 009877 009887  
009927 009941 009944 009951 009954 009958 009964 009971 009964 009964 009961 009  
961 009964 009975 009981  
84014009871123077009981 009991 010005 010019 -99999M010029 010042 010039 010046  
010052 010062 010062 010066 010069 010073 010086 010110 010127 010144 010157 010  
177 010191 010198 010208  
84014009871124077010218 010221 010232 010235 010245 010248 010259 010259 010259  
010265 010262 010259 010248 010245 010252 010245 010242 010238 010235 010232 010  
225 010221 010215 010211  
84014009871125077010194 010194 010191 010191 010191 010188 010188 010188 010188  
010201 010205 010211 010211 010208 010215 010221 010235 010242 010252 010248 010  
255 010262 010259 010265  
84014009871126077010265 010265 010262 010262 010265 010269 010276 010276 010289  
010292 010292 010292 010296 010292 010296 010299 010299 010303 010303 010306 010  
306 010309 010299 010296  
84014009871127077010289 010292 010289 010289 010286 010279 010286 010276 010282  
010279 010279 010269 -99999M010255 010248 010248 010242 010235 010232 010225 010  
225 010221 010215 010208  
84014009871128077010201 010201 010194 010181 010171 010164 010161 010164 010167  
010174 010174 010174 010174 010167 010174 010177 010177 010181 010184 010  
188 010194 010201 010205  
84014009871129077010208 010211 010205 010218 010225 010225 010228 010225 010232  
010215 010211 010205 010198 010191 010191 010177 010171 010167 010167 010164 010  
167 010167 010161 010161  
84014009871130077010167 010171 010171 010174 010171 010177 010177 010188 010188  
010184 010181 010177 010167 010161 010150 010150 010144 010140 010144 010144 010  
140 010133 010123 010117

BAROMETRIC PRESSURE AT DANIELS HBR, NFLD.  
- DECEMBER 1987 -

84014009871201077010106 010096 -99999M009985 -99999M-99999M010062 -99999M010052  
010046 010035 010025 010019 010008 009998 009  
985 009964 009941 009924 009893 009843 009819 009829 009833  
84014009871202077009849 009849 009856 009860 009873 009877 009883 009883 009890  
009897 009910 009907 009927 009910 009910 009914 009920 009924 009924 009924 009  
917 009920 009920 009917  
84014009871203077009917 009917 009917 009910 009907 009914 009910 009904  
009887 009907 009904 009900 009893 009893 009897 009897 009904 -99999M-99999M-99  
999M-99999M-99999M-99999  
84014009871204077009910 009917 009917 009920 009927 009927 -99999M009937 009941  
009948 009951 009951 009954 009954 009961 009964 009971 009981 009988 009991 -99  
999M-99999M009998 -99999  
84014009871205077010002 010005 -99999M-99999M-99999M-99999M-99999M-99999M-99999M  
-99999M-99999M-99999M-99999M-99999M-99999M-99999M-99999M-99999M-99999M-99999M-99  
999M009877 009863 009843  
84014009871206077009822 009795 009765 009755 009738 009724 -99999M009728 009724  
009728 009731 009734 009734 009734 009738 009751 009751 009765 009772 009778 009  
782 009792 009795 009799  
84014009871207077009809 009812 009822 009836 009843 009853 009866 009880 009893  
009904 009917 009924 009931 009944 009958 009978 009988 009998 010008 010015 010  
029 010025 010032 010039  
84014009871208077010039 010035 010042 010042 010046 010046 010052 010059 010052  
010046 010042 010049 010039 010035 010035 -99999M010029 010025 010029 010029 010  
029 010025 010025 010022  
84014009871209077010022 -99999M010019 -99999M-99999M010015 -99999M-99999M010012  
010005 010005 010005 010002 010005 010005 010005 010008 010008 010008 010015 010  
015 010022 010019 010025  
84014009871210077010025 -99999M-99999M-99999M-99999M010035 -99999M-99999M010042  
010046 010046 010046 010039 010046 010046 010052 010056 010059 010062 010066 010  
073 010073 010073 010073  
84014009871211077010069 010069 010073 010076 -99999M010079 010086 010090 010096  
010093 010093 010076 010083 010090 010090 010090 010090 010083 010090 010090 010  
083 010079 010073 010062  
84014009871212077010052 010046 010046 010039 010035 010025 010022 010022 010015  
010002 009995 009995 009978 009968 009961 009961 009961 009948 009948 009941 009  
937 009937 009931 009927  
84014009871213077009917 009917 009917 009907 009907 009907 009907 009910 009917  
009924 009924 009920 009917 009920 009920 009931 009937 009941 009944 009948 009  
951 009958 009954 009954  
84014009871214077009961 009971 009975 -99999M009981 009988 009995 010012 010015  
010019 010019 010029 010029 010029 010042 010046 010052 010052 010056 010059 010  
062 010073 010073 010073  
84014009871215077010083 010083 010086 010090 010093 010096 010096 010100 010103  
010103 010106 010106 010096 010096 010100 010106 010106 010110 010113 010117 010  
117 010117 010117 010113  
84014009871216077010113 010093 010103 010106 010100 010100 010103 010100 010113  
010083 010083 010066 010062 010052 010052 010046 010039 010039 010039 010  
035 010029 010019 010008  
84014009871217077009998 009995 009995 -99999M009991 009981 009975 009978 009985  
009975 009975 009961 009958 009954 009954 009951 009954 009958 009961 009964 009  
964 009964 009968 009971  
84014009871218077009971 009971 009975 009978 009981 009985 009995 010019

010005 010025 010022 010019 010025 010025 010032 010052 010042 010049 010056 010  
059 010062 010066 010069  
84014009871219077010073 010073 010076 010083 010083 010086 010093 010096 010103  
010113 010123 010117 010110 010113 010117 010117 010127 010127 010137 010144 010  
150 010161 010161 010167  
84014009871220077010167 010171 010177 010181 010188 010188 010194 010191 010215  
010225 010225 010225 010221 010221 010221 010232 010225 010225 010221 010  
225 010228 010225 010215  
84014009871221077010208 010215 010211 010208 010201 010191 010181 010177 010167  
010174 010167 010157 010150 010140 010123 010103 010113 010083 010073 010062 010  
056 010039 010032 010015  
84014009871222077010008 010005 009998 009995 009981 009971 009981 009961 009961  
009964 009964 009964 009964 009964 009975 009981 009985 009998 010005 010019 010  
019 010025 010029 010035  
84014009871223077010052 010056 010066 010069 010073 010073 010076 010079 010079  
010083 010079 010073 010076 010076 010079 010083 010083 010083 010086 010090 010  
086 010086 010090 010083  
84014009871224077010090 010090 010096 010100 010103 010103 010106 010110 010113  
010117 010117 010117 010113 010113 010110 010106 010117 010120 010117 010120 010  
117 010117 010117 010117  
84014009871225077010113 010117 010120 010127 010127 010133 010137 010137 010140  
010144 010144 010140 010133 010130 010127 010120 010127 010117 -99999M010103 010  
090 010090 010079 010073  
84014009871226077010066 010059 010052 -99999M010049 010042 010039 010052 010046  
010042 010042 010039 010032 010029 010025 010025 010039 010046 010049 010052 010  
052 010059 010059 010062  
84014009871227077010056 010059 010062 010066 010062 010073 010083 010079 010083  
010083 010086 010079 010073 010062 010059 010052 -99999M010049 -99999M010042 010  
039 010035 010032 010029  
84014009871228077010025 010025 010019 010015 010008 010015 009998 009995 009991  
009985 009985 009975 009978 009964 009958 009958 009954 009958 009948 009954 009  
924 009941 009941 009941  
84014009871229077009937 009944 009951 009954 009958 009961 009971 009975 009985  
009995 009998 010005 010005 010008 010012 010022 010029 010015 010046 010029 010  
029 010019 010015 010012  
84014009871230077010005 009985 009954 009954 009941 009914 009900 009893 009819  
-99999M009819 009778 009741 -99999M009687 -99999M009613 009660 009663 009677 009  
687 009724 009748 009758  
84014009871231077009792 009809 009819 009846 009873 009893 009907 009900 009951  
009964 009978 009988 009991 010012 010012 010029 010059 010062 010073 010076 010  
083 010086 010093 010103

**APPENDIX C**  
**PARSON'S POND FRESH WATER INFLOW SURCHARGE PREDICTION**

## APPENDIX C

PARSON'S POND FRESH WATER INFLOW SURCHARGE PREDICTION

The range of tides in Parson's Pond is approximately 27% of that outside in Sandy Bay (pers. comm. Amos Payne, 1988) and so there is a considerable hydraulic connection between Parson's Pond and the open ocean.

In order to establish the relationship between flow through the channel and hydraulic head differences between the pond the the ocean, use has been made of the knowledge of the tidal exchange as follows:

Large tide range outside = 2.2 m; amplitude  $a = 1.1 \text{ m}$

Large tide range inside = 0.6 m; amplitude  $a = 0.3 \text{ m}$   
(pers. comm. Amos Payne, 1988)

then calculating elevation changes  $h$  in the pond and Sandy Bay (assuming time  $t=0$  at high tide in Sandy Bay).

By approximating the semi-diurnal tide with a simple cosine function and tidal period of 12 h 25 m (12.42 hrs), the water levels can be estimated by:

$$h_{\text{pond}}(t) = 0.3 \cos \left[ \frac{2\pi}{12.42} \times (t + \Delta t) \right]$$

$$h_{\text{Sandy Bay}}(t) = 1 \cos \left[ \frac{2\pi}{12.42} \times t \right]$$

where  $\Delta t$  is the time or phase lag (in hours) between the pond and the ocean.

In order to determine  $\Delta t$ , the following can be applied. During a flooding tide, the water level in the pond will rise until the tide outside has risen to a peak of 1 m above MWL and then has subsequently fallen to 0.30 m. At this time, the tidal current in the channel will reverse and the water level in the pond will begin to fall.

Therefore, when  $h_{\text{Sandy Bay}} = 0.3 \text{ m}$ ,  $t + t\Delta = 0$  and  $h_{\text{pond}} = 0.3 \text{ m}$ . When  $h_{\text{Sandy Bay}} = 0.3 \text{ m}$ ,  $t = 2.56 \text{ hours}$ , therefore  $\Delta t = 2.56 \text{ hours}$ . Which is to say that 2.56 hours after high tide in Sandy Bay, the tide in Parson's Pond peaks and the tidal flow reverses.

Based upon the tidal prism (or volume of water the pond exchanges during a tidal cycle) and continuity of mass:

$$Q_{\text{outflow}} = A_{\text{pond}} \times \frac{dh_{\text{pond}}}{dt} (\text{m}^3/\text{hr})$$

$$Q_{\text{outflow}} = 20 \times 10^6 (\text{m}^2) \times \frac{dh_{\text{pond}}}{dt} \text{ and}$$

$$\frac{dh_{\text{pond}}}{dt} = -0.3 \times \frac{2\pi}{12.42} \sin \left[ \frac{2\pi}{12.42} (t+\Delta t) \right] (\text{m/hr}), \text{ therefore}$$

$$Q_{\text{outflow}} = 20 \times 10^6 \times 0.3 \times \frac{2\pi}{12.42} \times \sin \left[ \frac{2\pi}{12.42} \times t \right] (\text{m}^3/\text{hr}) \\ = 843 \sin \left[ \frac{2\pi}{12.42} (t+\Delta t) \right] (\text{m}^3/\text{s})$$

By relating  $Q_{\text{outflow}}$  to  $(h_{\text{Sandy Bay}} - h_{\text{pond}})$  and performing a regression analysis, it was found that over a complete tidal cycle the ratio of discharge to head difference was virtually constant (except for anomalies near zero flow) such that:

$$Q_{\text{outflow}} = 797 (h_{\text{Sandy Bay}} - h_{\text{pond}}) \text{ m}^3/\text{s} \pm 0.1\%$$

By substituting with the 1:100 annual instantaneous flood peak of 380  $\text{m}^3/\text{s}$ ,  $\Delta h$  would be 0.48 m (neglecting the storage of the pond).

To consider either fresh water inflow or storm surge (or any combination of the two), the following relationship was used:

$$\begin{aligned}\frac{dh_{pond}}{dt} \times \text{Area}_{pond} &= Q_{in}(t) - Q_{out}(t) \\ &= Q_{in}(t) - 797 (h_{Sandy Bay}(t) - h_{pond}(t))\end{aligned}$$

where:

$$h_{Sandy Bay} = 1.1 \cos \left( \frac{2\pi}{12.42} t \right) + \text{storm surge } (t)$$

$$h_{pond}(t) = \lim_{\delta t \rightarrow 0} (h_{pond}(t-\delta t) + \frac{dh_{pond}(t)}{dt} \cdot \delta t / 2)$$

By digitally solving this transcendental equation using the digitized hydrograph (Figure D.1) for  $Q_{in}(t)$ , for various scenarios of the fresh water inflow and storm surges, it was determined that the worst case for increased pond water levels occurred as a result of the 1:20 and 1:100 year storm surges plus whatever fresh water inflow event could be deemed reasonable without unduly altering the 1:20 and 1:100 year probabilities. A sustained 1:1 year Winter Daily Flood Peak of 109.2 m<sup>3</sup>/s (by extrapolation of Table D.1) was selected as the maximum reasonable fresh water inflow.

The resulting Parson's Pond water levels for various scenarios are shown in Table C.1.

TABLE C.1  
PARSON'S POND WATER LEVELS  
FROM VARIOUS SCENARIOS

Scenario	Maximum Level (m above MWL)	Surcharge Above Normal High Water Level (m)	Maximum Level (m above local geodetic datum)	Probability of Exceedance
Normal large tide and normal fresh water flow ( $9\text{m}^3/\text{s}$ )	0.33	0	-0.52	1
Normal large tide and 1:20 year annual flood	0.64	0.31	-0.21	<1:20/annum
Normal large tide and 1:100 year annual flood	0.71	0.38	-0.14	<1:100/annum
Normal flow ( $9\text{m}^3/\text{s}$ ) and 1:20 year surge	0.96	0.63	0.11	1:20/annum
Normal flow ( $9\text{m}^3/\text{s}$ ) and 1:100 year surge	1.09	0.76	0.24	1:100/annum
Sustained 1:1 year winter daily flood peak and 1:20 year surge	1.12	0.79	0.27	<1:20/annum
Sustained 1:1 year winter daily peak and 1:100 year surge	1.29	0.96	0.44	<1:100/annum

\*from Q at t=0, Figure B.1

**APPENDIX D**  
**PARSON'S POND HYDROLOGY**

## APPENDIX D

PARSON'S POND HYDROLOGY

The required maximum annual flood flows were computed using the Entire Island Regional Flood Frequency Formulae (Regional Flood Frequency Analysis for the Island of Newfoundland, 1984). The results were factored to obtain maximum instantaneous winter (November through January) peaks and maximum winter daily peaks.

The factors used were determined from comparisons of instantaneous annual, daily annual, and daily winter flows maxima taken from the records of the Water Survey of Canada (Surface Water Data, Atlantic Provinces Inland Waters Directorate (1960-1987), Water Resources Branch, Water Survey of Canada, Ottawa). These factors are:

$$\frac{\text{daily seasonal peak flood}}{\text{daily annual peak flood}} = 0.75$$

$$\frac{\text{daily peak}}{\text{instantaneous peak}} = 0.90$$

and were used in generating the values in Table D.1.

A typical hydrograph for the fresh water inflow to Parson's Pond is shown in Figure D.1.

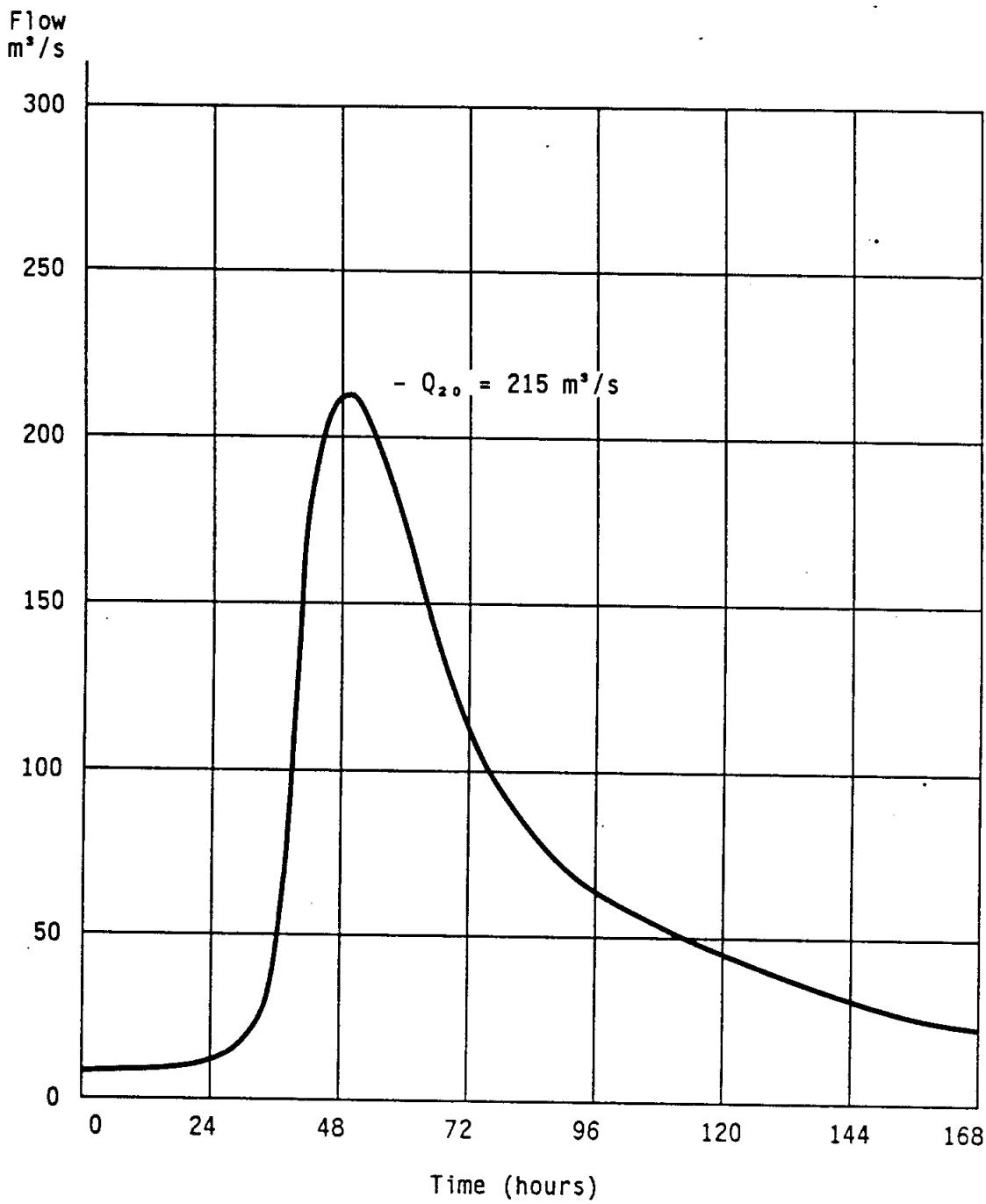
TABLE D.1  
PARSON'S POND FLOOD FREQUENCIES

Probability of Exceedence	Annual Instantaneous Flood Peak m³/s	Winter Instantaneous Flood Peak m³/s	Winter Daily Flood Peak m³/s
50% (1:2 year)	193.7	145.3	130.1
20% (1:5 year)	234.1	175.6	158.0
10% (1:10 year)	285.0	213.8	192.4
5% (1:20 year)	315.1	236.3	212.7
2% (1:50 year)	352.5	264.4	237.9
1% (1:100 year)	379.8	284.9	256.4

Physiographic Data

Drainage Area, DA	= 390 km²
Mean Annual Runoff, MAR	= 1,000 mm
Area Controlled by Lakes and Swamps	= 55%
Shape	= 1.56

Entire Island Formulae applied (Regional Flood Frequency Analysis for the Island of Newfoundland, 1984).



**FIGURE D.1**  
**WINTER FLOOD HYDROGRAPH (1:20 YEAR)**

**APPENDIX E**  
**FLOOD RISK MAP FOR PARSON'S POND**



