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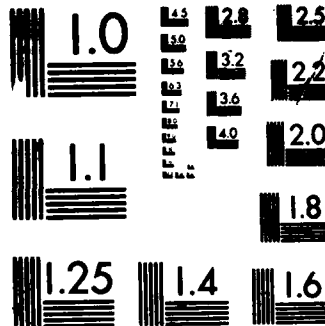
A USER'S GUIDE TO THE N-LINE MODEL: A NUMERICAL MODEL
TO SIMULATE SEDIMENTATION COASTAL ENGINEERING RESEARCH
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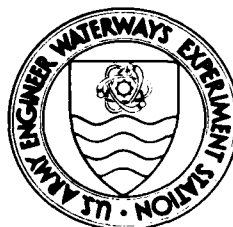
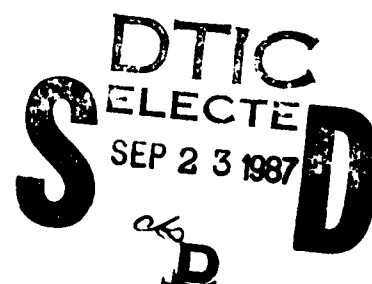
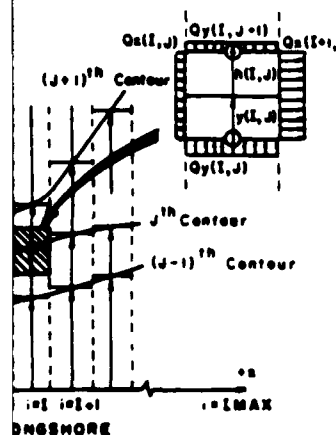
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SECURITY CLASSIFICATION OF THIS PAGE

AD-A185280

REPORT DOCUMENTATION PAGE				Form Approved OMB No 0704 0188 Exp Date Jun 30 1986	
1a REPORT SECURITY CLASSIFICATION Unclassified			1b RESTRICTIVE MARKINGS		
2a SECURITY CLASSIFICATION AUTHORITY			3 DISTRIBUTION/AVAILABILITY OF REPORT Approved for public release; distribution unlimited		
2b DECLASSIFICATION/DOWNGRADING SCHEDULE					
4 PERFORMING ORGANIZATION REPORT NUMBER(S) Instruction Report CERC-87-4			5 MONITORING ORGANIZATION REPORT NUMBER(S)		
6a NAME OF PERFORMING ORGANIZATION USAEWES Coastal Engineering Research Center		6b OFFICE SYMBOL (if applicable) WESCV	7a NAME OF MONITORING ORGANIZATION		
6c ADDRESS (City, State, and ZIP Code) PO Box 631 Vicksburg, MS 39180-0631			7b ADDRESS (City, State, and ZIP Code)		
8a NAME OF FUNDING/SPONSORING ORGANIZATION US Army Corps of Engineers		8b OFFICE SYMBOL (if applicable) DAEN-CWO-R	9 PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER		
8c ADDRESS (City, State, and ZIP Code) Washington, DC 20314-1000			10 SOURCE OF FUNDING NUMBERS		
			PROGRAM ELEMENT NO	PROJECT NO	TASK NO
			WORK UNIT ACCESSION NO		
11 TITLE (Include Security Classification) A User's Guide to the N-Line Model: A Numerical Model to Simulate Sediment Transport In the Vicinity of Coastal Structures					
12 PERSONAL AUTHOR(S) Scheffner, Norman W., Rosati, Julie Dean					
13a TYPE OF REPORT Final report		13b TIME COVERED FROM 1982 TO 1983		14 DATE OF REPORT (year Month Day) August 1987	
15 PAGE COUNT 130					
16 SUPPLEMENTARY NOTATION Available from National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161.					
17 COSAT CODES			18 SUBJECT TERMS (Continue on reverse if necessary and identify by block number)		
FIELD	GROUP	SUB GROUP	Bathymetric response Littoral barriers		
			Detached offshore N-line model		
			breakwaters (Continued)		
19 ABSTRACT (Continue on reverse if necessary and identify by block number)					
A user's manual was developed for the N-line numerical sediment transport model by the Coastal Engineering Research Center (CERC). This report provides the necessary guidance, complete with multiple example applications which include model input and output, for using the N-line numerical model. Capabilities of the model include the simulation of (a) single or multiple shore-perpendicular structures, (b) single or multiple detached offshore breakwaters, and (c) disposal of material or dredging of material in the coastal zone. Model parameters are discussed in order to guide the potential user to a successful application of the model. The N-line model is versatile, easy to use, and capable of producing dependable results when used for appropriate applications. The documentation presented in this manual is intended to cover only the breakwater subroutine. Since conceptual modifications were (Continued)					
20 DISTRIBUTION AVAILABILITY OF ABSTRACT ☒ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT ☐ DOWNGRADING			21 ABSTRACT SECURITY CLASSIFICATION Unclassified		
22a NAME OF RESPONSIBLE INDIVIDUAL			22b TELEPHONE (Include Area Code)		22c OFFICE SYMBOL

DD FORM 1473, 84 MAR

83 APR edition may be used until exhausted
All other editions are obsolete

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18. SUBJECT TERMS (Continued).

Numerical model	User's manual
Sediment transport	Wave refraction/
Shoreline evolution	diffraction

19. ABSTRACT (Continued).

not made to the original model, the original documentation, presented in CERC's report MR 83-10, should be obtained by any potential user of the model.

The N-line model is useful in showing qualitative trends for a complex case such as Lakeview Park, Lorain, Ohio. Some of the drawbacks of the program when modeling Lakeview Park, such as the inability to reach an equilibrium shoreline, and the low sinuosity of the shoreline when influenced by breakwater segments, could possibly be successfully modeled by modifying the different input parameters, such as the ADEAN parameter and/or initial shoreline location and/or the model code. Perhaps then a quantitative verification of the model could be made. However, in this case, the model would have then been tailored to produce a previously known result.

A project cannot be successfully modeled without experimenting with different time-steps, space-steps, contour depths, shoreline locations, and structure configurations. A wave climate representative of the area being modeled is also very important. Finally, the response of the model to a particular setup must be interpreted with engineering judgment.

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PREFACE

This study was authorized as a part of the Civil Works Research and Development Program by the Office, Chief of Engineers (OCE), US Army. The work was jointly performed under Work Unit C31551, Numerical Modeling of Shoreline Response to Coastal Structures, which is part of the Shore Protection and Restoration Program and Work Unit C31232, Evaluation of Navigation and Shore Protection Structures, which is part of the Coastal Structure, Evaluation, and Design Program. Messers. J. H. Lockhart, Jr., and J. Housley were OCE Technical Monitors.

This guide was developed to make the N-line model, developed for the Coastal Engineering Research Center (CERC) by Mr. Marc Perlin and Dr. Robert G. Dean, of the Coastal and Offshore Engineering and Research, Inc., Newark, Delaware, available in an easy-to-use-and-apply format. This has been accomplished by providing detailed examples demonstrating appropriate model applications. Each example includes a listing of the model input parameters and a complete output file for user comparison. The model includes an interactive input data generator for fast and easy application of the model. Program listings are provided in the appendix of this report. Magnetic tape copies of the code can be obtained by contacting the Engineering Computer Programs Library Section of the Technical Information Division, US Army Engineer Waterways Experiment Station (WES), Vicksburg, Mississippi.

This guide was prepared by Dr. Norman W. Scheffner of the Research Division, CERC, and Ms. Julie Dean Rosati of the Engineering Development Division, CERC. The report was prepared under the direction of Dr. James R. Houston, Chief, CERC, and Mr. Charles C. Calhoun, Jr., Assistant Chief, CERC.

COL Allen F. Grum, USA, was the previous Director of WES. COL Dwayne G. Lee, CE, is the present Commander and Director. Dr. Robert W. Whalin is Technical Director.



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CONVERSION FACTORS, NON-SI TO SI (METRIC) UNITS OF MEASUREMENT

Non-SI units of measurement used in this report can be converted to SI (metric) units as follows:

<u>Multiply</u>	<u>By</u>	<u>To Obtain</u>
cubic yards	0.7645549	cubic metres
degrees (angle)	0.01745329	radians
feet	0.3048	metres
inches	2.54	centimetres

A USER'S GUIDE TO THE N-LINE MODEL: A NUMERICAL
MODEL TO SIMULATE SEDIMENT TRANSPORT IN THE
VICINITY OF COASTAL STRUCTURES

PART I: INTRODUCTION

1. The US Army Engineer Waterways Experiment Station, Coastal Engineering Research Center (CERC), presently supports a general use numerical model for simulating sediment transport and bathymetric changes in the coastal zone. The original report, "A Numerical Model to Simulate Sediment Transport in the Vicinity of Coastal Structures" (Perlin and Dean 1983), detailed an N-line model developed to simulate the effects of single or multiple, equal length groins and/or offshore dredged material disposal on the shoreline location and the local bathymetry. These changes are the result of wave action from an offshore wave field of known period, height, and direction. Subsequent enhancements to the model include the effects of single or multiple detached breakwaters; the capability of handling multiple unequal length groins; the capability to specify an initial nonstraight shoreline; and the addition of a separate, user-friendly program to generate input data files for the N-line model.

2. The purpose of this report is to provide a user's guide for applying the model to specific cases of interest. Theory of the model, with the exception of the breakwater subroutine, is not covered in this report. Those details can be found in the program documentation (Perlin and Dean 1983). This report includes (a) a description of the capabilities and limitations of the model, (b) a brief documentation of the breakwater subroutine, and (c) details on how to apply the model to specific cases. Since the intent of this report is to provide a potential user with enough guidance to properly use the model, specific input and output listings for detailed applications of the model. This approach will allow the user to become familiar with generating data and running the model are given. The sample output is provided as a check to verify that the model is producing the correct results for a given input condition. This solution also is valuable for comparison when the model is run on different computer systems. Finally, a listing of the model and the data file generation program is provided. Appendix A provides example input and output, while Appendix B provides the program listing.

PART II: CAPABILITIES AND LIMITATIONS

3. The intent of the N-line model is to provide the user with a tool to adequately predict the effects of modifications to the coastal zone if certain criteria are met. For example, the model was developed for specific application to coastal areas that are predominately influenced by waves and that are not characterized by complex bathymetries such as offshore bars, barrier islands, or deep and/or irregular channels. Areas of this complexity require more sophisticated, expensive, and difficult-to-apply numerical models. Physical models may even be required in some cases. The N-line model may, however, provide adequate results even to relatively complex areas if the user is aware of the limitations of the model and interprets the results with these limitations in mind. Incorrectly used, this model, as with any model, can yield erroneous results that must be recognized as resulting from poor input data or from an application to a situation beyond the capabilities of the model. It is the modeler's responsibility to correctly use and interpret the results of the model.

4. The limitations of the N-line model that restrict its applicability are a result of the basic formulation of the model. Certain physical processes are not accounted for in the governing equations. For example, the model simulates refraction and diffraction, onshore/offshore and alongshore sediment transport, and conservation of mass resulting from a known wave field. The model does not simulate tidally induced velocities and water levels nor does it simulate wave-induced currents and setup/setdown. The assumption that these complex effects are minor in comparison to the wave field allows for a simplified set of governing equations that result in a model which can easily and economically be used as a design tool. Cases in which tidal and/or wave-induced effects are significant require the use of additional governing equations resulting in a highly complex numerical model which is both difficult and expensive to apply. The purpose of the N-line model is to provide the user with a tool for the prediction of changes in the primarily wave-dominated coastal zone.

5. The distinction between an appropriate and inappropriate application of the model is difficult to define since certain idealizations and simplifications can be made that might adequately represent the physical system. This will often result in qualitative results that are useful in determining trends

or rates of change. In order to make a decision as to whether or not the model can be applied to a given situation, the following list of major assumptions and limitations of the model must be consulted:

- a. The model is based on an equilibrium beach-profile concept. This requires that the beach profile be assumed to monotonically increase in depth in the offshore direction. The relationship used in the model is

$$h = Ay^{2/3}$$

where

h = depth

A = Dean's equilibrium profile coefficient

y = distance offshore

The entire modeled area is assumed to have this profile.

- b. The offshore boundary condition for the model is the specification of a single wave climate for the entire offshore boundary. Although this can be changed at each time-step, it must apply to the entire length of coastline being modeled.
- c. Shore-connected structures, such as groins or jetties, must be perpendicular to the specified baseline. This requirement is a consequence of the computational grid employed by the model.
- d. The model is based on mean sea level and has no provisions for deviations from a mean condition.
- e. The addition of offshore dredged material disposal is made by advancing the appropriate depth contours offshore by an amount equivalent to the quantity of material added. Because of the limitations imposed by the monotonically increasing depth assumption, a berm or dredged material island cannot be modeled.
- f. Limitations of the modeling of a breakwater will be covered in the next section.

6. Several of the above limitations could be modified. For example, a separate equilibrium profile could be specified for each location along the modeled area. This could be in the form of a spatially variable coefficient A, which could be determined from a series of shore-perpendicular profiles. Similarly, mean sea level changes could be incorporated in the model formulation. Assumptions such as the equilibrium profile concept with a monotonically increasing depth are, however, basic assumptions of the model and cannot be altered. If a particular application cannot be adequately represented with these assumptions, the N-line model should not be used.

PART III: DETACHED OFFSHORE BREAKWATERS

7. A subroutine was added to the original N-line model described in Perlin and Dean (1983) to extend the applicability of the model to include the effects of detached offshore breakwaters. This subroutine was developed to utilize the computational procedure of the existing model. Certain assumptions and simplifications were made in order to achieve compatibility with the basic model. The major simplification is that only the refractive, diffractive, and transmissive effects of the breakwater on the wave field are considered. The physical existence of the breakwater (e.g., a small island) was not possible due to the N-line model formulation of a monotonically increasing depth offshore. The consequences of this assumption will be discussed in paragraph 12.

8. The procedure used for the breakwater computations was to first calculate the entire wave-field distribution using the N-line model as if no breakwater existed. The effects of the breakwater on the wave field can then be determined by adding the diffracted and refracted wave energy vectors from each breakwater tip to the previously computed vector components at each grid point. If the grid point falls in the shadow zone of the breakwater, the N-line-computed contribution is multiplied by a user-supplied transmission coefficient.

9. A more comprehensive description of the computational procedure can be made by referring to Figure 1 and to the list of variables shown in Table 1. The sequence of events is as follows:

- a. Calculate the breakwater orientation angle (BRKANG).
- b. Calculate the depth (DEEPL, DEEPR), angle (THETAL, THETAR), wave height (HLFT, HRT), celerity (CLFT, CRT), and group velocity (CGLFT, CGRT) for the left and right tips of the breakwater based on a linear interpolation of N-line-computed values.
- c. Calculate the left and right X-coordinate for the shadow zone (XXL, XXR).
- d. Calculate the local contour line orientation (CONANG) and the X- and Y-components of the N-line-computed wave height based on the N-line-computed wave angle (THETA).
- e. Calculate the angle from the tip of the breakwater to the grid point (ANG). A separate computation is made for diffraction from the right and left tips of the breakwater.
- f. Calculate wave height at the local point using the diffraction subroutines included in the N-line model (HTEMPR, HTEMPL).

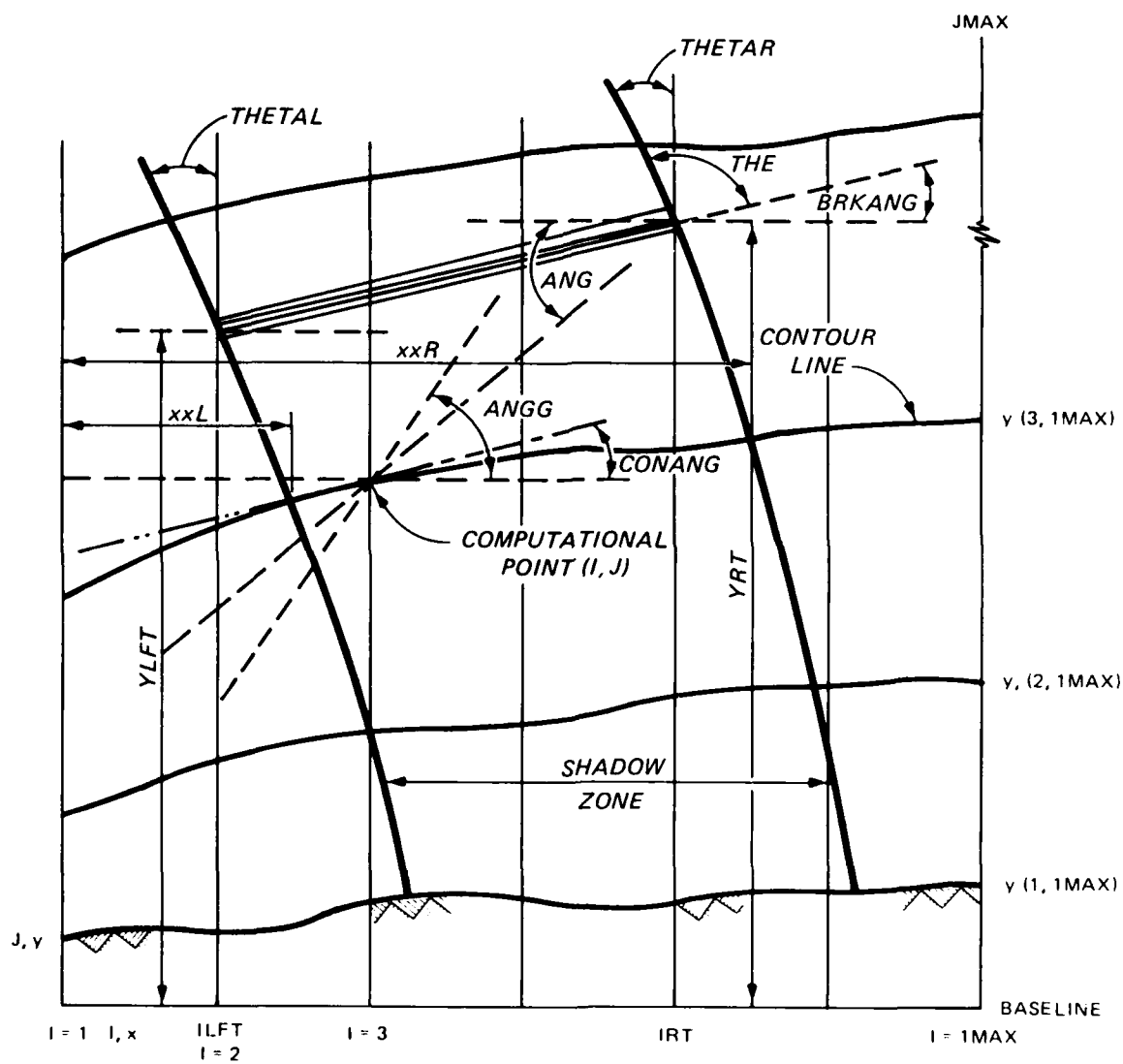


Figure 1. Schematic diagram of breakwater

Table 1
List of Variables

Parameter Name	Used For
ILFT(N)	I-location of left end of breakwater
IRT(N)	I-location of right end of breakwater
YLFT(N)	Distance offshore to left end of breakwater
YRT(N)	Distance offshore to right end of breakwater
NOBKS	Total number of breakwaters
DEEPR(N)	Depth at right end of breakwater
DEEPL(N)	Depth at left end of breakwater
HRT(N)	Wave height at right end of breakwater
HLFT(N)	Wave height at left end of breakwater
THETAL(N)	Wave angle at left end of breakwater
THETLL(N)	Wave angle used at left edge of shadow zone
THETAR(N)	Wave angle at right end of breakwater
THETRR(N)	Wave angle used at right edge of shadow zone
XXL(N)	X-location of left edge of shadow zone
XXR(N)	X-location of right edge of shadow zone
CLFT(N)	Wave celerity at left end of breakwater
CRT(N)	Wave celerity at right end of breakwater
HTEMPR(N)	Wave height contribution of diffraction from right end of breakwater
HTEML(N)	Wave height contribution of diffraction from left end of breakwater
HTXL(N)	X-component of HTEML
HTYL(N)	Y-component of HTEML
HTXR(N)	X-component of HTEMPR
HTYR(N)	Y-component of HTEMPR
YLLFT(N)	Y-location used to calculate left edge of shadow zone
YRRT(N)	Y-location used to calculate right edge of shadow zone
DXL(N)	X-distance used in calculation of left edge of shadow zone
DXR(N)	X-distance used in calculation of right edge of shadow zone
BRKANG(N)	Angle of the breakwater with respect to baseline
CGRT(N)	Group velocity at right end of breakwater
CGLFT(N)	Group velocity at left end of breakwater
XXDIST	X-distance to point (I,J)
HX	X-component of H (I,J)
HY	Y-component of H (I,J)
THETA(I,J)	Wave angle at I-,J-location
Y	Y-distance to I-,J-location
ANG	Diffraction angle from breakwater tip
ANGJET	Angle from breakwater tip to jetty tip
ANGG	Refracted value of ANG at point I,J
THE	Wave angle at breakwater adjusted for BRKANG(N)
AMP	Amplitude factor after diffraction
SHADOW	Zone in lee of breakwater
H(I,J)	Wave height at I-,J-location
HB(I,J)	Breaking wave height at I-,J-location
CONANG	Angle of local contour at I-,J-location

- g. Calculate the refracted angle for the wave at the local point by using Snell's Law. For this computation, a shallow-water wave approximation is used for wave celerity. The computed angle is then adjusted to compensate for the local contour angle.
- h. Compute the X- and Y-components of the diffracted wave from each tip by using the refracted wave angle (HTXR, HTYR, HTXL, HTYL).
- i. Multiply the X- and Y-components of the N-line-computed wave heights by a shadow-zone factor. This coefficient is equal to unity when the point is not in the shadow zone behind the breakwater.
- j. Sum all the contributing waves for each grid point, based on conservation of energy, and calculate an effective wave height and angle (H, THETA). For example:

$$XXX = \sum_{i=1}^{NOBKS} \left(HTXL_i * |HTXL_i| + HTXR_i * |HTXR_i| + HX * |HX| \right)$$

$$YYY = \sum_{i=1}^{NOBKS} \left(HTYL_i * |HTYL_i| + HTYR_i * |HTYR_i| + HY * |HY| \right)$$

$$H = \sqrt{|XXX| + |YYY|}$$

$$THETA = ATAN \left[\left(XXX / \sqrt{|XXX|} \right) / \left(YYY / \sqrt{|YYY|} \right) \right]$$

where NOBKS = the number of breakwaters in the modeled area.

10. The above formulation includes some simplifications that were not felt to be significant. These were considered to be justifiable since a rigorous treatment of the process of refraction and diffraction from a detached breakwater would require a total reformulation of the N-line model. In view of the original purpose of the model, reformulation was not considered appropriate.

11. The breakwater subroutine does not include a second diffraction and refraction of the breakwater-diffracted wave around groins or jetties. The program will compute a shadow zone behind each groin or jetty and will set the breakwater-diffracted wave components to zero for that area. Since it is unlikely that shore-perpendicular structures would be located directly behind a detached breakwater, this simplification appears adequate.

12. The unavoidable simplification of not recognizing the physical

presence of the breakwater in the surf zone was mentioned in paragraph 7. This approach introduces two physical processes which must be considered in the numerical model formulation. First, an actual breakwater causes the incoming waves to break, due in part to the decrease in depth in the vicinity of the structure. The exact location of the breaking point is primarily a function of both wave height and water depth. The model formulation assumes the breakwater can be considered as an abrupt barrier so that the wave height at the breakwater is equal to the wave height at the location computed by the N-line model. This value is used to diffract the wave around the breakwater tip. The breaking wave height and depth used in the N-line model for onshore/offshore sediment transport calculations are replaced by the height and depth at the breakwater location unless the wave would have broken seaward of the breakwater. Values between breakwater tips are calculated by linear interpolation of heights and depths at the ends of the breakwater.

13. The second process associated with a real breakwater is that depth contours do not cross the breakwater but tend to show a depth decrease shoreward of the breakwater and a depth increase offshore. This phenomenon cannot be correctly simulated by the N-line model without making alterations to the basic formulation. The solution adopted was to retain the N-line computations as if no breakwater existed. This will allow the contours to cross the breakwater; however, due to the decrease in wave energy inside the breakwater, the tendency is for the contours to behave in a qualitatively correct manner. This can be seen in the contour plots shown in Part IV.

14. The simplifications employed in the formulation and solution approach of the breakwater subroutine were made in order to achieve total compatibility with the existing N-line model. Consequently, very few changes have been made to the original model. Any questions concerning basic assumptions or numerical methods are referred to the program documentation (Perlin and Dean 1983).

PART IV: APPLICATION OF THE MODEL

15. The primary advantage of the N-line model over more complex numerical models is that, if applicable to the situation, the N-line model can be easily and economically used to simulate the physical problem and to provide a great deal of information on two-dimensional (2-D) changes in the modeled area. This simulation includes the capability to make predictions on the order of several months to several years. Simulations of this order of magnitude are not economically feasible with more complex sediment-transport models.

16. Application of the model to a specific or hypothetical situation is relatively easy. For example, there is no requirement for generating a complex computational grid, boundary conditions other than the offshore wave climate do not need to be specified, and a minimum of input data is required. The following list contains variables that are required. These can be classified as the basic model parameters that define the modeled area, and the time-dependent parameters that must be introduced at each time-step. A more complete description of a majority of the input variables can be found in Perlin and Dean (1983). Required variables include:

a. Basic parameters (see Figure 2 and Table 2):

- (1) IMAX--The total number of alongshore grid cells used to adequately represent the modeled area. The examples in Perlin and Dean (1983) and in this report used 50. The specification of a total number much exceeding this will significantly increase the cost of running the model; therefore, some care should be exercised in selecting this number.
- (2) JMAX--The total number of computational contour lines (Y-direction grid cells) used in the modeled area. Numbers in the vicinity of 8-10 were used in the examples. This number will have to adequately define the bathymetry in the modeled area by defining enough contour lines between the shoreline and the offshore depth defined by the variable WDEPTH. The parameter statements in the code (see Appendix B) must reflect $NI = IMAX + 3$ and $NJ = JMAX + 3$ for correct dimensioning.
- (3) WDEPTH--The depth of water, defined in metres (as in the original publication), corresponding to the location of the input wave conditions. This depth represents the offshore boundary depth contour and is used as a constant computational boundary condition. A value of 10 m was used in all examples.

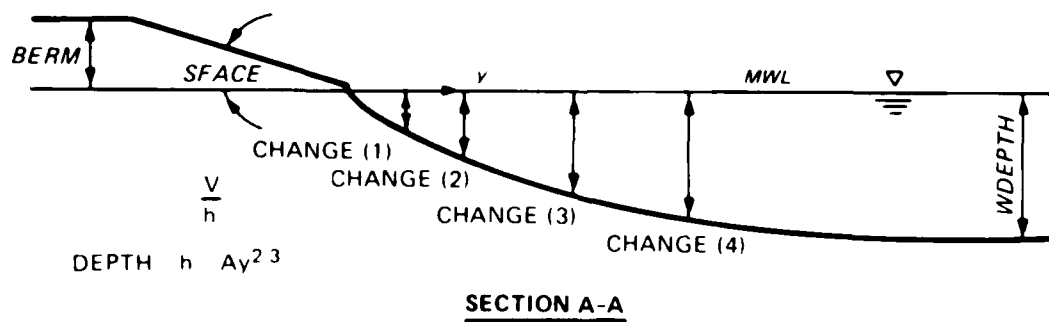
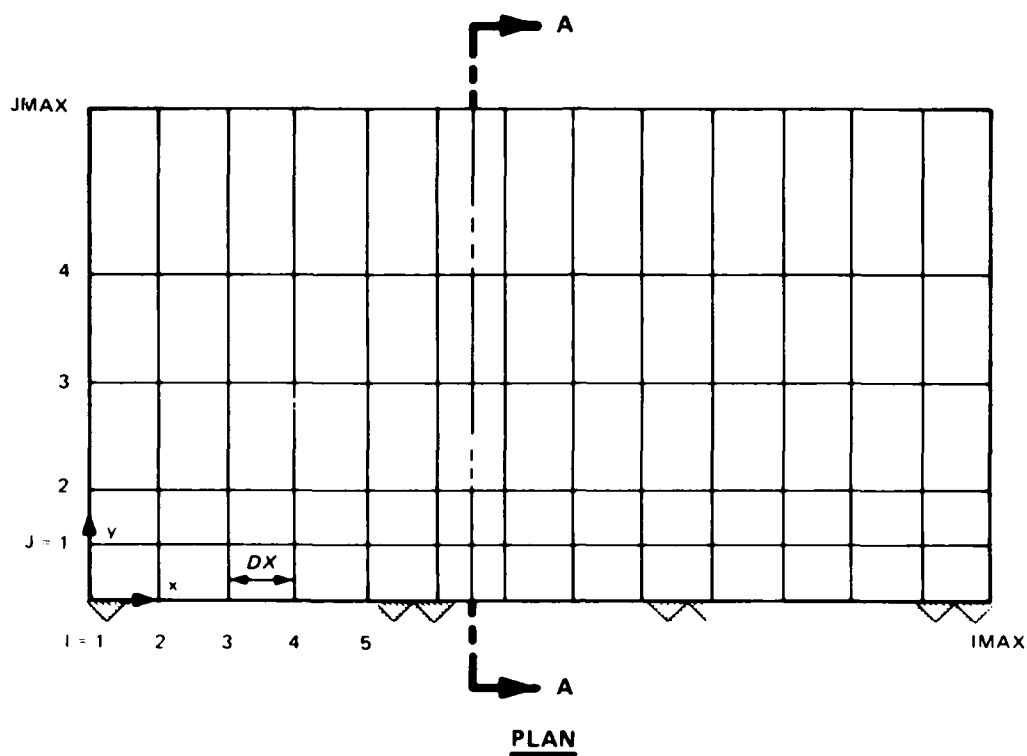


Figure 2. Schematic diagram of modeled area
(mwl = mean water level)

Table 2
Input Parameters

Card	Variables	Format	Comment
1	IMAX, JMAX	2I10	
2	WDEPTH	10X,F10.3	In metres
3	CHANGE(N), N = 1, JMAX + 1	10F8.3	
4	NWRITE	I10	
5	BERM, SFACE, DIAM	10X,F10.3,F10.4, F14.3	
6	MMAX	I3	If none exist, enter 1 and see next card
7	IJET, SJETTY	I3,F10.3	One card per structure. If none exist, enter any location and zero length
8	ADEAN	F10.4	
9	DX, DELT	2F10.3	
10	Y(I,1), I = 1, IMAX	10F8.2	
11	NOBKS	I5	If none, enter zero
12	ILFT, IRT, YLFT, YRT	10X,2I10,2F10.2	One card per structure. If none exist, omit card
13	HS, T, ALPWIS, IDDD	I5,5X,3F6.1, I5	This card is repeated for the desired number of time-steps in the total simulation. The simu- lation is terminated when HS > 50. If dredged material is to be added to any time increment (IDDD = 1), the IDREG, JDREG, and DREDGE cards must be inserted
14	IDREG, JDREG, DREDGE	2I5,F10.2	The dredged material simula- tion is terminated when IDREG = JMAX

- (4) **CHANGE**--A one-dimensional array that specifies the numerical value of each contour line. For example: **CHANGE(1) = 1.0**, **CHANGE(2) = 2.0**, **CHANGE(3) = 3.0**, ...sets the **J = 1,2,3,4**, **JMAX... + 1** contour lines to be the 1-ft,* 2-ft, 3-ft,... contour intervals. Note that **JMAX + 1** values must be specified between a depth of 0 ft (shoreline) and **WDEPTH** (offshore boundary). The **JMAX + 1** contour is merely a boundary condition used in conjunction with **WDEPTH** to define boundary derivatives. The 1 - **JMAX** contour lines represent the computational lines which will define the bathymetry of the modeled area.
- (5) **NWRITE**--The desired frequency of printed output. The model provides a complete solution at each time-step. For a 1-month run at a 6-hr interval, 120 time-steps are computed. If, for example, only the weekly values are desired, enter **NWRITE = 30** to print only every 30th output (i.e., 30, 60, 90, 120).
- (6) **BERM**--A specified height of the berm (see Figure 2).
- (7) **SFACE**--The slope of the beach face from the berm to the mwl (see Figure 2).
- (8) **DIAM**--The mean diameter of the sediment particles in millimetres.
- (9) **ADEAN**--The value of Dean's equilibrium constant. This value determines the distance offshore to a specified depth contour, $y = (h/A)^{1.5}$ ft; therefore, the values of **CHANGE** and **A** must produce the proper degree of resolution in the area of interest if reasonable results are to be expected. For a given **A** value, an improper selection of desired contour intervals (**CHANGE**) may result in contours located offshore of the area of interest. For example, a 3-ft contour with an **A** value of 0.15 will be 89 ft offshore. This contour will not provide much information about shoreline response to a groin that only extends 50 ft offshore.
- (10) **DX**--The X-direction grid spacing in feet (see Figure 2). Examples used for this report have varied from 50 to 100 ft.
- (11) **DELT**--The time-step in hours. The examples used specify a value of 6 hr.
- (12) **Y(I,1)**--Represents the initial shoreline location with respect to some reference line. A straight shoreline would be represented by **Y(I,1) = 0.0** for **IMAX** values of **I**.
- (13) **MMAX**--The number of shore-perpendicular structures (two groins, three groins, etc.).
- (14) **IJET**--The I-grid location associated with each of the **MMAX** shore-perpendicular structures. The computations will consider the structure to be located to the right (increasing **I**) of the specified I-location.

* A table of factors for converting non-SI units of measurement to SI (metric) units is presented on page 3.

- (15) SJETTY--The length of each shore-perpendicular structure measured from the baseline.
- (16) NOBKS--The number of detached breakwaters.
- (17) ILFT,IRT--The I-grid location to be associated with the left and right end of each detached breakwater. Computationally, the I-value is assumed to be the exact location.
- (18) YLFT,YRT--The exact Y-distance, measured from the baseline, offshore to the left and right tips of each detached breakwater.

b. Time-dependent parameters:

- (1) HS--Offshore significant wave height (feet) specified at each time-step.
- (2) T--Period of each wave in seconds.
- (3) ALPWIS--The angle (-90 to +90 deg) of propagation of each wave with respect to the x-axis. Waves propagating onshore from the left of shore-perpendicular are positive (see Figure 2).
- (4) IDREG,JDREG--The addition of dredged material, beach fill, or any other alteration to the existing bathymetry is simulated in the model by advancing a contour by an amount which yields the appropriate volume of material. The IDREG and JDREG parameters indicate the location of the contour line that will be moved.
- (5) DREDGE--Indicates the amount of movement, in feet, the contours are to be moved to simulate dredging, fill, etc.
- (6) IDDD--A dummy variable used to indicate whether or not the dredged material/fill option is used. This is specified at each time increment. When IDDD equals 1, the amount specified by DREDGE is read resulting in a movement of the (I,J) contour by the amount specified. The option is not exercised when 0 is entered.

17. The program can be submitted to the computer by either using cards (batch) or interactively using a remote terminal. If cards are used, the user will have to supply an input card deck. The required and optional cards are shown in Table 2.

18. An alternative to using a card deck is to use the interactive capability of a computer. To simplify the input data requirements, a user-friendly interactive program has been written to generate input data files for the N-line model. Since CERC is presently using CYBERNET services for computer support, the model and input generator are currently operational on the CYBER 176 computer. A detailed description of the steps necessary to generate an input file and execute the model will be presented for terminal entry batch processing for the CYBER 176. A similar procedure is available for any computer system with interactive capabilities.

19. The interactive generation of data and subsequent execution of the N-line model require the following user files:

BLDFIL	Input data file generation program
INPFIL	Input data generated by BLDFIL (excluding dredged material)
SPOOL	Dredged material data (generated by BLDFIL)
RUNLINE	Job control file to submit the N-line model for terminal entry batch processing
TRANSP	The N-line model

Examples will be presented which demonstrate how to create input files for the model using the program BLDFIL. Following the creation of appropriate input files, the N-line model can be submitted and executed in a variety of ways. The following examples use the program RUNLINE to submit the job for terminal entry batch processing:

```
GET,RUNLINE
SUBMIT,RUNLINE,T
```

where the job control file RUNLINE contains the following control entries:

```
/JOB
JOB,T1500,CM200000,P4.
/USER
/CHARGE
GET,TAPE1=INPFIL.
GET,TAPE20=SPOOL.
GET,TRANSP.
FTN5,I=TRANSP,L=OUTPUT,REW=I/L.
BEGIN,IMSL5,IMSLCCL.
$LIBRARY,IMSL5.
LGO.
/EOR
```

Following execution, the job output can be either routed to a remote job entry facility or retrieved at the user's terminal.

20. Before presenting example model applications, an explanation of the model output must be made so that model results can be properly interpreted. This can best be accomplished by reproducing the computational representation of Figure 2 of Perlin and Dean (1985), shown here as Figure 3. As in many numerical models, certain computations are made for midpoints between the I,J modes. For example, Figure 3 shows that the sediment transport values in the

onshore-offshore direction Q_y correspond to the contours specified by the user (CHANGE(1), CHANGE(2), etc.); however, the alongshore values Q_x correspond to a point halfway between the I grid points. Numerical differentiation of the continuity equation then yields a y value corresponding to an I grid location, but a midcontour location:

$$\frac{\partial y}{\partial t} + \frac{\partial Q_x}{\partial x} + \frac{\partial Q_y}{\partial y} = 0$$

For example, if a CHANGE(1) and CHANGE(2) contour was specified as 1.0 and 2.0, the Y(I,2)-distance would correspond to the 1.5-ft depth. In all cases, the Y(I,1)-location corresponds to a zero depth. The understanding of the computational representation of these variables is absolutely necessary if the user intends to compute or tabulate total transport quantities in, for example, cubic yards per year.

21. The results of any numerical model, especially one based on empirical relationships, must be carefully examined to determine whether or not the results are realistic. Empirically based models are generally site specific, requiring the adjustment of various parameters and coefficients to achieve model results that match prototype behavior. The selection of these values can have a substantial effect on the model results. Improper selection can lead to erroneous results or even to numerical instabilities resulting in the model "blowing up." The following list represents some of those parameters and coefficients that can be varied to achieve stability or to obtain better agreement between model and prototype:

- a. DELT--The time increment used in the model has a substantial effect on the stability of the model. All example simulations shown in this report used a value of 6 hr.
- b. DX--The alongshore grid also has a marked effect on the stability of the model. The selection of a reasonable value must be made based on the structures present, the length of coast being modeled, and the stability of the model. For example, a detached breakwater should be at least three grid spacings. The spacings used in the examples varied from 80 to 100 ft.
- c. ADEAN--Dean's equilibrium profile coefficient determines the equilibrium profile for the entire modeled area. This coefficient should be determined by selecting a value that produces a beach profile which most closely matches the specific site being modeled. If no data are available to make this selection, the graph of ADEAN (signified by A in this figure) versus sediment diameter shown in Figure 4 (reproduced from Perlin and Dean 1983) can be used.

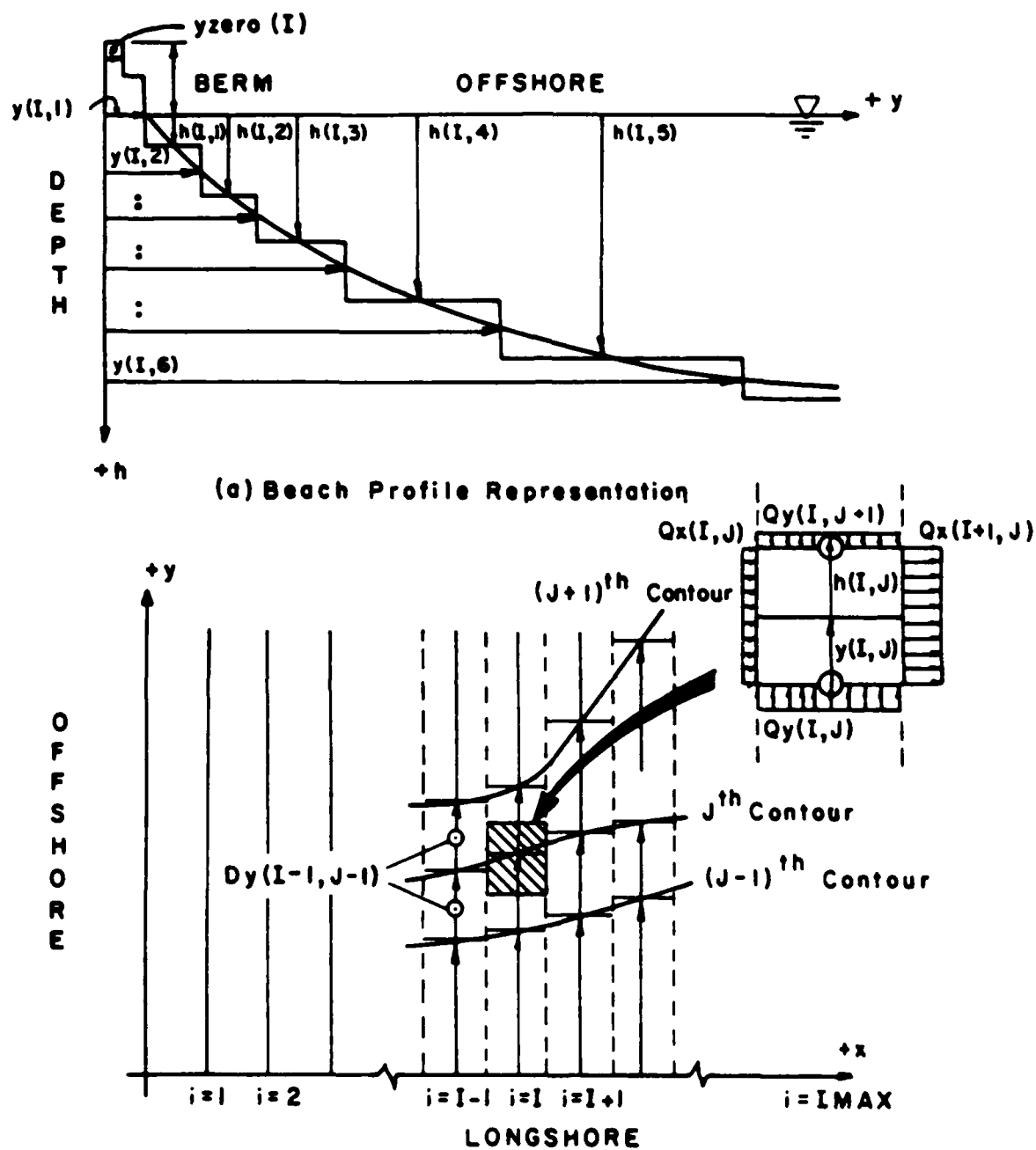


Figure 3. Definition sketch (from Perlin and Dean 1983)

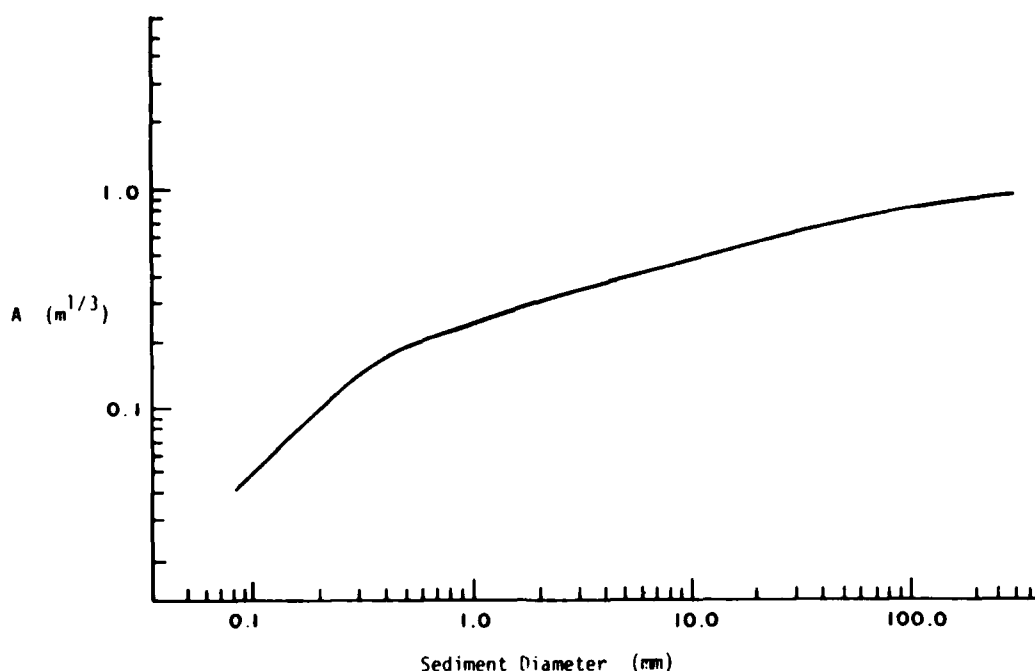


Figure 4. A versus sediment diameter (after Moore 1982)

- d. COFF--The coefficient COFF linearly affects the magnitude of the onshore-offshore sediment transport. For example, doubling the COFF value will double Q_y . The value used in Perlín and Dean (1983) and in all examples of this report is 0.00001. This program coefficient can be changed to achieve proper onshore-offshore sediment transport magnitudes.
- e. CONST and CAPPA--These coefficients determine the value for the constant TKSI which linearly affects the magnitude of the total longshore transport. As in the COFF example, these coefficients can be altered to produce a desired total longshore sediment transport magnitude. The coefficients (lines 284 and 285 of the program) are currently set at 0.77 and 0.78.
- f. An additional factor was introduced in the model to slow the shoreline response under certain design cases. This coefficient, Beach Response Factor, (BRF) is shown on lines 564, 565, and 566 of the program listing (Appendix B). The factor was set at 0.5 for the examples presented. This value can be replaced by 1.0, equivalent to the original listing, if the shoreline responds too slowly.
- g. Additional constants such as density, beach slope, and porosity are defined in Perlín and Dean (1983) and can be located in the program listing.

22. Several examples are presented in this document to both demonstrate the capability of the model and allow the potential user the ability to verify that the model is operating correctly. Initially, five examples are

presented, three of which are taken from Perlin and Dean (1983). Complete input and output data are provided for each example in Appendix A. These cases are presented so that a user can become familiar with the model by applying known input data to reproduce known output data. This will also allow the user the opportunity of determining the model's response to varying certain of the model coefficients. A final example is presented which demonstrates the use of the interactive input data file generation program for the subsequent analysis of the Lakeview Park project in Lorain, Ohio. This actual example will show the simultaneous application of all of the N-line model capabilities. The five examples are:

- a. Example 1--Single Jetty. The first example is for case 4.2a presented in Perlin and Dean (1983). Figure 5 is a reprint of the equilibrium planform along with input data. Sample input and output data after 30 iterations are shown in Appendix A.
- b. Example 2--Multiple Jetties. Example 2 represents the multiple jetty example presented in Perlin and Dean (1983) as case 4.2c. Figure 6 shows the initial and final contours as presented by Perlin and Dean. Input and output data after 30 iterations are shown in Appendix A.
- c. Example 3--Dredged Material Disposal. This simulation represents the single addition of dredged material disposal at the 7- and 11-ft contours according to the monthly incremental value used for case 2.c1 in Perlin and Dean (1983). Figure 7, reproduced from Perlin and Dean (1983), shows the equilibrium results for this case. Input and output data after 30 iterations are presented in Appendix A.
- d. Example 4--Single Breakwater. This example, shown in Figure 8, shows a hypothetical case of a single detached offshore breakwater. Input variables for this case and a sample output after 30 iterations are shown in Appendix A.
- e. Example 5--Double Breakwaters, Single Jetty. Figure 9 represents the fifth example which begins to demonstrate the use of multiple structures. This hypothetical case incorporates a single jetty, as in Example 1, with two detached breakwaters. Input and output data after 30 iterations are shown in Appendix A.
- f. Example 6--Lakeview Park, Lorain, Ohio. A specific application of the model was made to the Lakeview Park project in Lorain, Ohio. This project incorporates all of the capabilities of the model in a single application. This design case, along with some of the problems associated with its computer simulation, is presented in Part V.

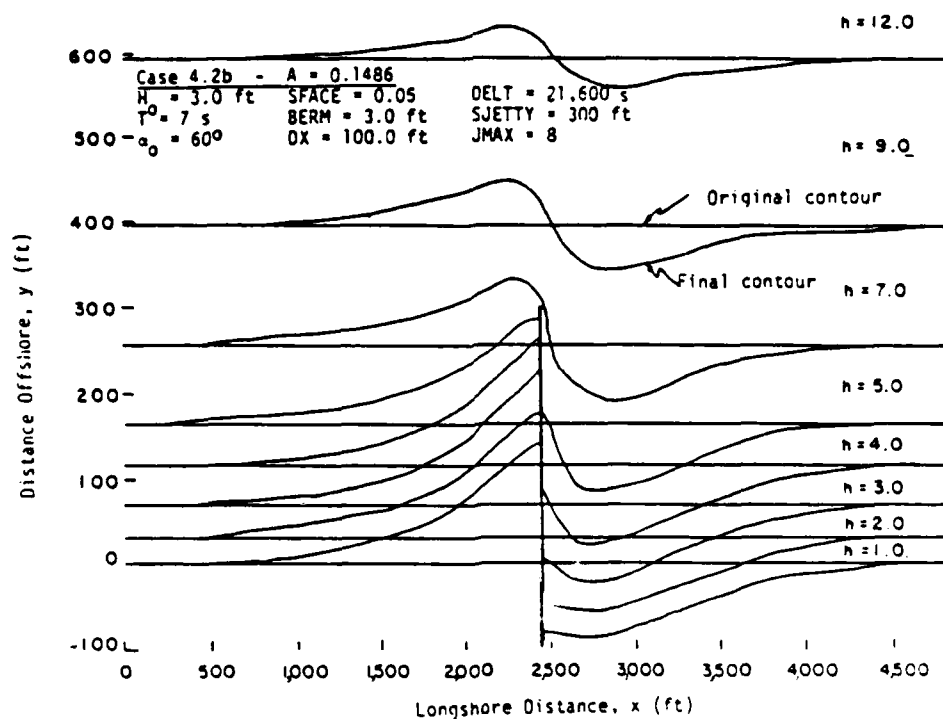


Figure 5. Single jetty (from Perlin and Dean 1983)

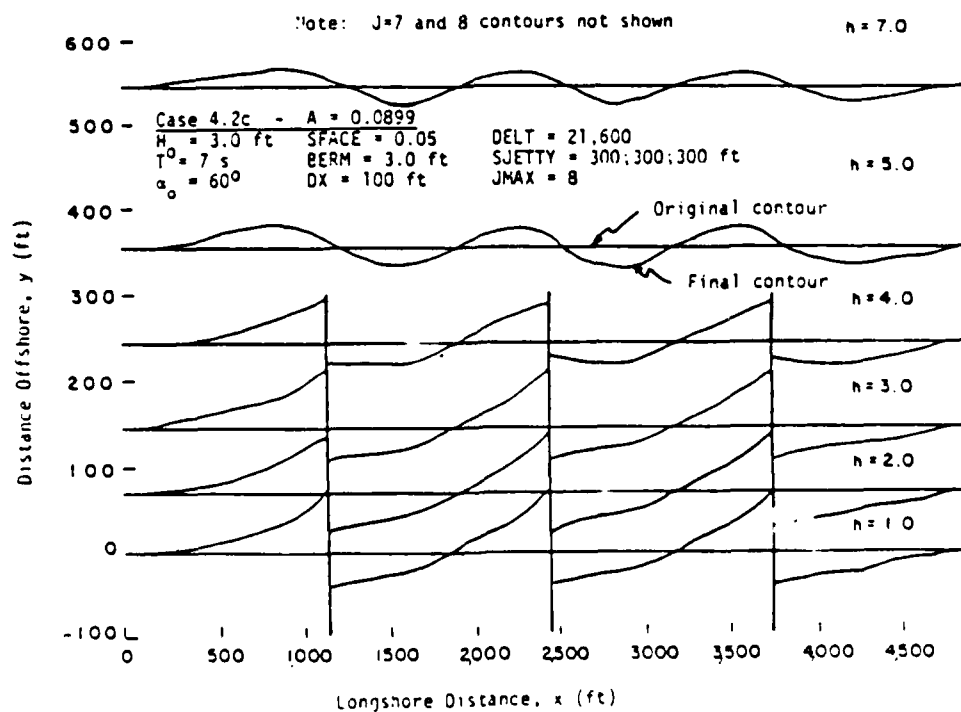


Figure 6. Multiple jetties (from Perlin and Dean 1983)

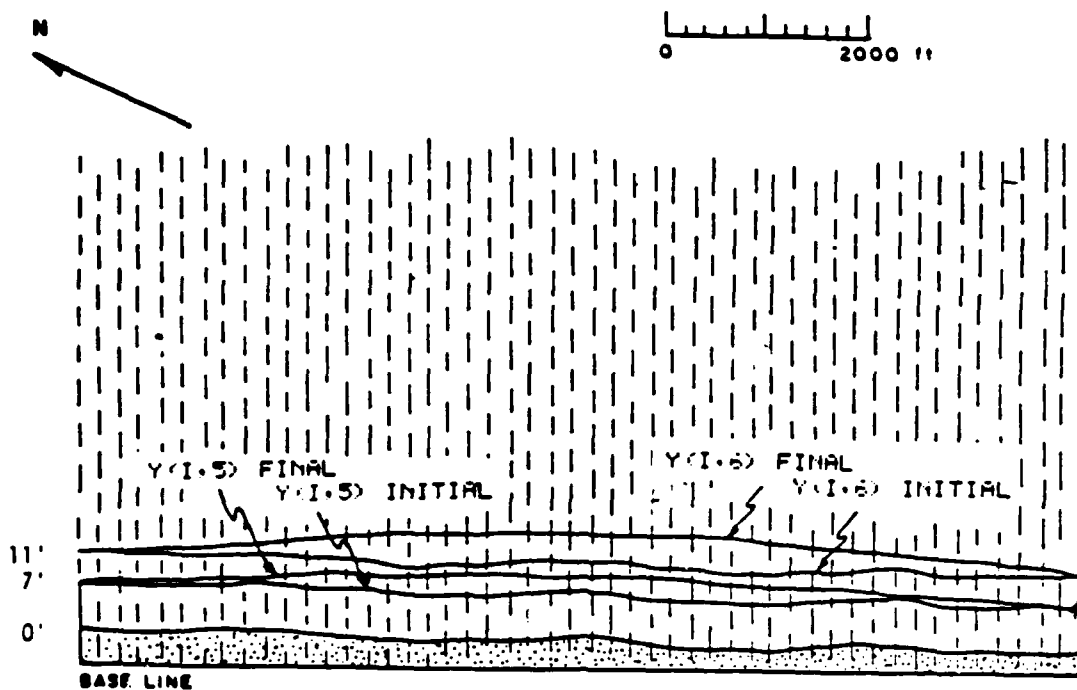


Figure 7. Dredged material disposal (from Perlin and Dean 1983)

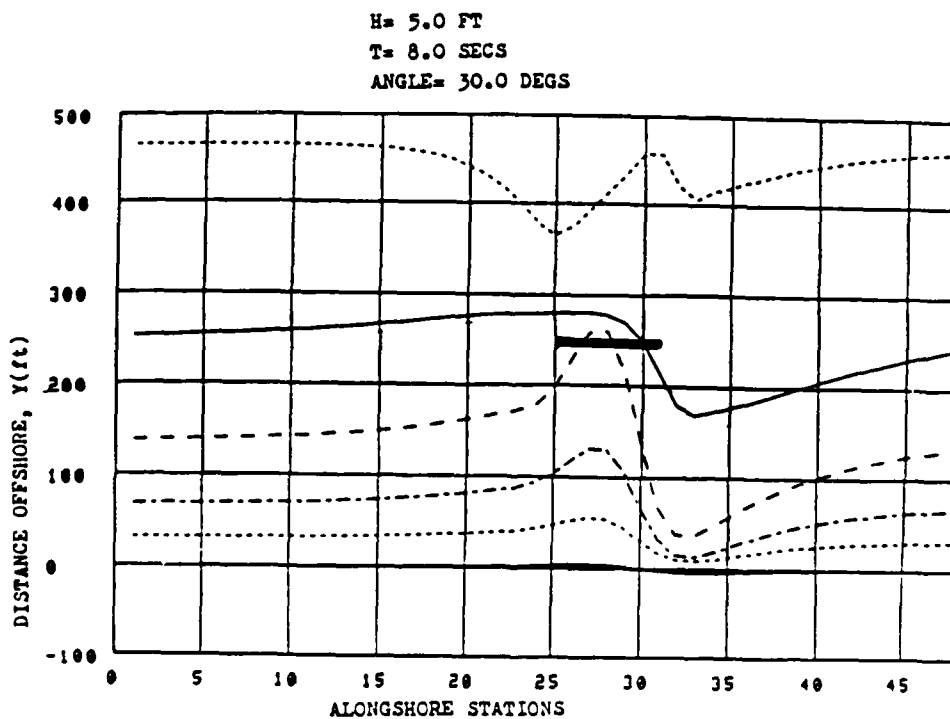


Figure 8. Single breakwater

H= 4.0 FT
T= 6.0 SECS
ANGLE= 25.0 DEGS

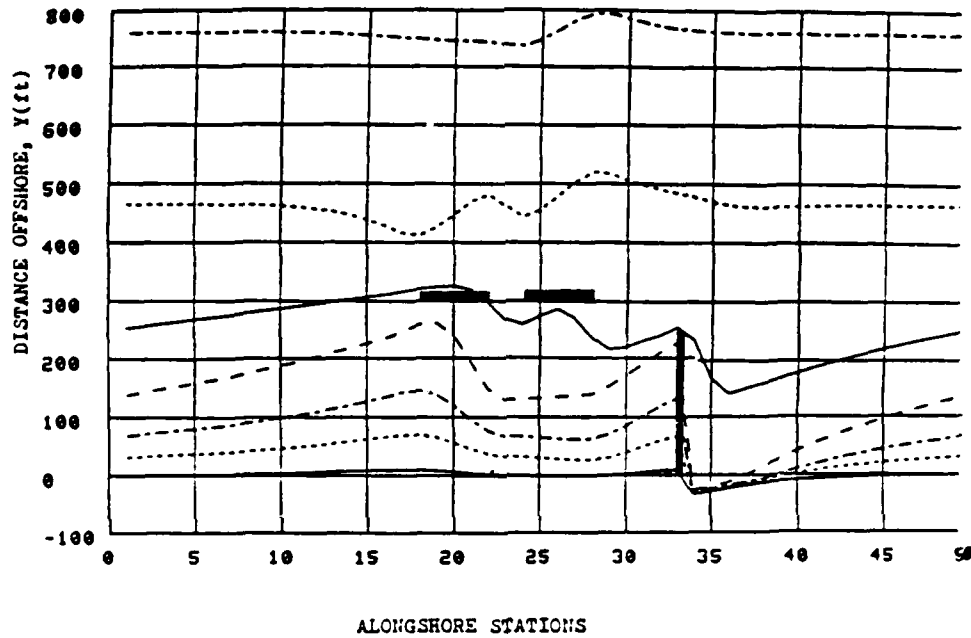


Figure 9. Double breakwaters, single jetty

PART V: MODELING LAKEVIEW PARK WITH THE N-LINE MODEL

23. When modeling an actual process, whether using an equation, a physical model, or a computer program, comparison of the model's output with a real-world result is necessary for verification of the model. This comparison can be in a qualitative and/or quantitative sense; if the modeling process is successful for one real situation, it is reasonable to expect successful results for other similar cases.

24. The N-line model has been verified in a qualitative sense, as presented in Figures 5-9 of this report. Lakeview Park, Lorain, Ohio, was modeled with the N-line program to compare the actual beach response of Lakeview Park with the model. This allows a quantitative evaluation of the model's adaptivity to specific conditions where a known response is expected.

Lakeview Park

25. Lakeview Park in Lorain, Ohio, is a project that has been monitored since its creation in 1977 by the Buffalo District and CERC. Lakeview Park has been a successful project, accreting approximately 3,000 cu yd of material per year (Pope and Rowen 1983). The site has a three-segmented detached breakwater, two groins, and placed fill, and, as such, utilizes most of the capabilities of the modified N-line model (see Figure 10). The beach fill was placed along 1,250 ft of shoreline, the two groins are 166 and 350 ft in length, and the detached breakwater has segments approximately 250 ft in length and 200 to 250 ft from the initial placed fill waterline.

26. The project has a large prototype data base, including bathymetric surveys for 1977-1982, aerial photographs from 1977-1982, hindcast and Littoral Environment Observation (LEO) wave data for the area, and data from a physical model study (Bottin 1982). The prototype aerial photographs of Lakeview Park were digitized, and a set of shorelines were plotted that represent the stabilized project shoreline, creating an envelope of shorelines that was compared with the model's output (see Figure 11). Thus, the prototype data from Lakeview Park were used to conduct verification tests of the N-line model. In this way the N-line model could be used for a situation where the beach response was well known.

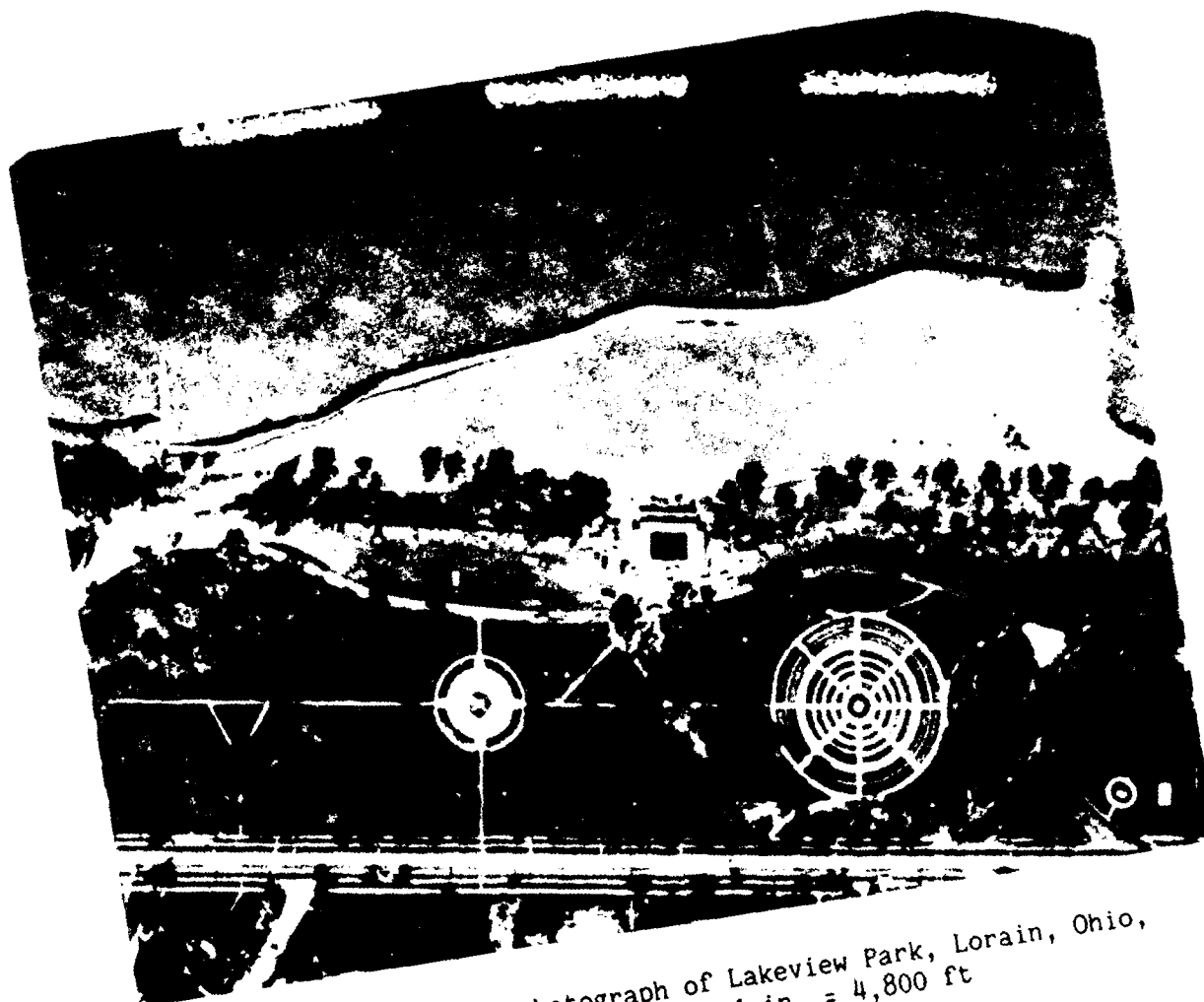


Figure 10. Aerial photograph of Lakeview Park, Lorain, Ohio,
8 Sep 1980. Scale: 1 in. = 4,800 ft

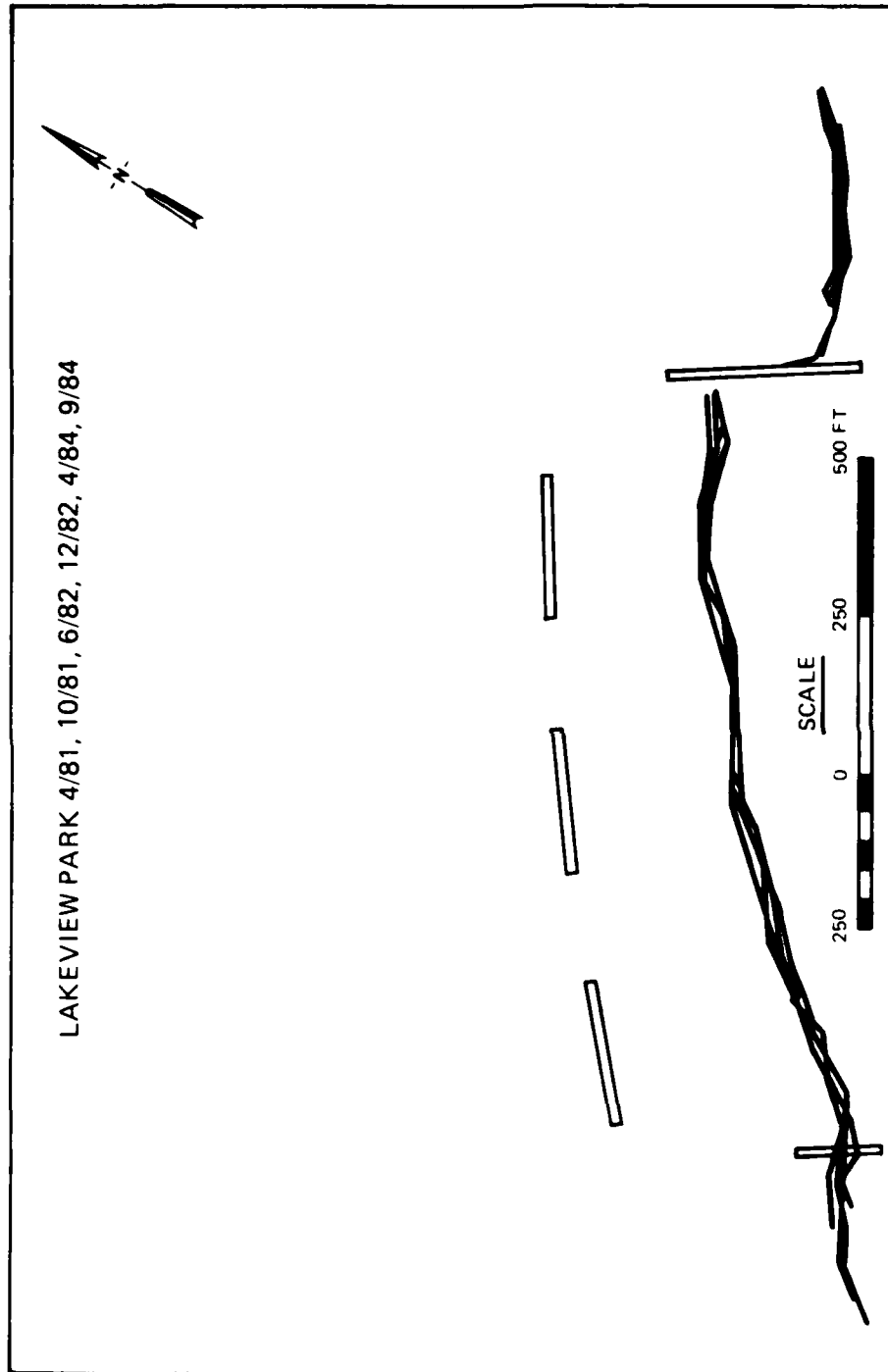


Figure 11. Stabilized project shoreline, 1981-1984 (digitized from aerial photographs)

Model Input Conditions

27. For the Lakeview Park example presented herein, hindcast wave data (Saville 1953) were reduced to obtain representative values of wave height, period, direction, and percentage of time from a particular direction. The 10 wave conditions that resulted agreed reasonably well with the LEO data. These 10 wave conditions were repeated and used in all the Lakeview Park cases presented. A single wave condition from a single direction is not a true prototype occurrence and could generate unrealistic responses in the model, or cause the model to "blow up."

28. The initial project contour locations that were used for each model run are presented in Figure 12. The initial shoreline was calculated by measuring the distance from the baseline to the approximate waterline based on the as-constructed condition. Since the model assumes equilibrium profiles at each I-grid shoreline point, the Lakeview Park fill area (on a linear slope) was simulated using the model's disposal option, creating a file called SPOOL that contains the I,J-location and the amount of fill to be added to the average of each two adjacent contours (see Figure 13). The model uses the average depth between adjacent contours in all calculations.

29. The value of ADEAN can be calculated using the equations presented in Figure 4, which gives ADEAN in metres^{1/3}. ADEAN as used in the model is in units of feet^{1/3}; the value of $D_{50} = 0.22$ mm (the grain size of the placed fill) was used, giving a value of ADEAN = 0.15 ft^{1/3}.

30. The selection of a time-step of 6 hr and a space-step of 50 ft was the result of an interactive analysis. A larger space-step would give ample distance for the contours to return to their boundary conditions (problems arise if the project ends are too close to the boundaries), but would not show much detail in the project area. A small space-step requires a small time-step and a large number of x-grid points, and therefore is costly to run. Several combinations of time-steps and space-steps were attempted, some resulting in unrealistic responses from the model, until the values presented here were selected. The interactive file generator is shown in Figure 14. The input files are presented in Figures 15 and 16.

31. Since the sediment transport from the west into the prototype area is small, the contours west of the smaller groin were modeled to move no sediment in the longshore direction by changing the N-line model code.

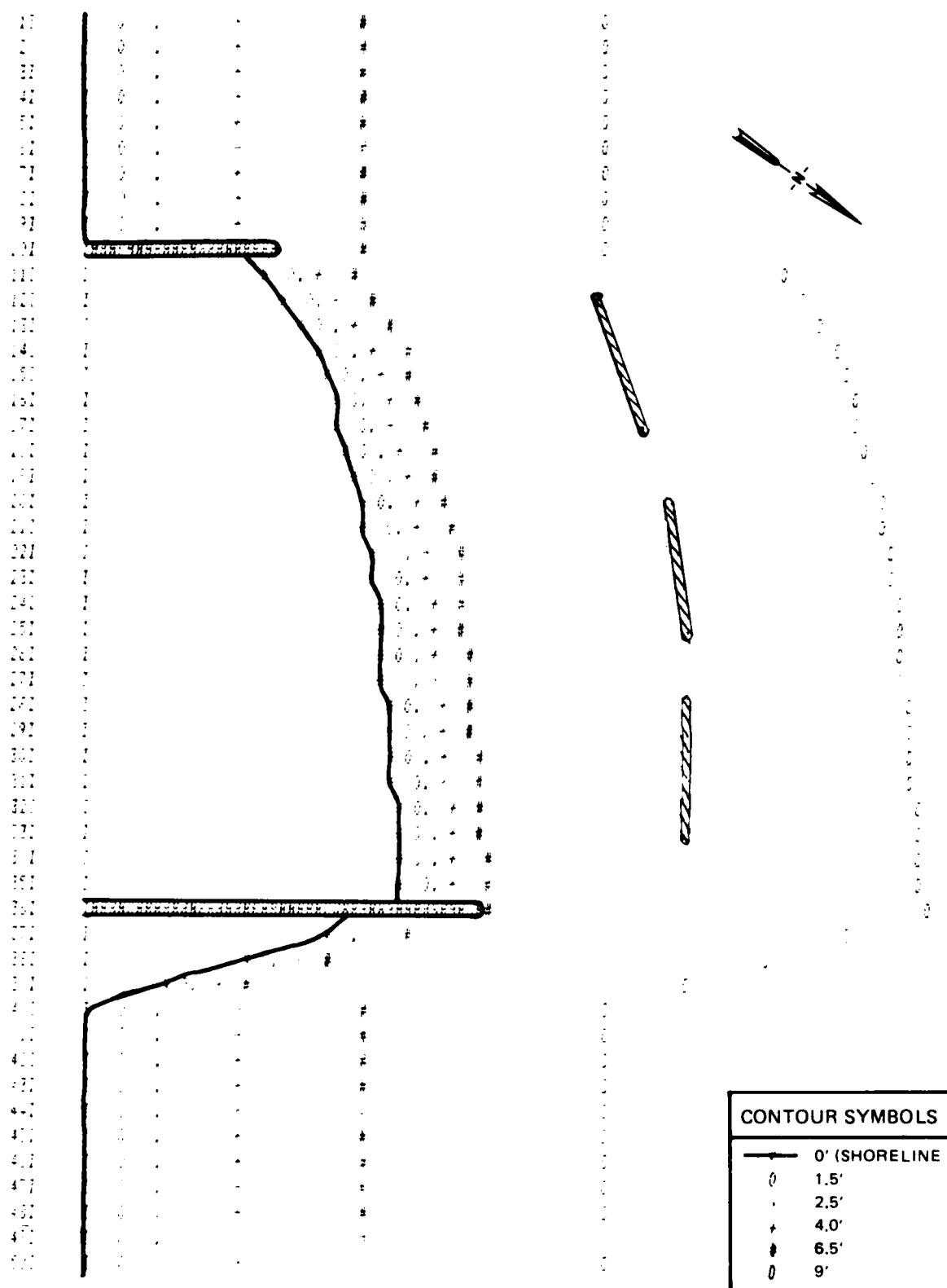


Figure 12. Initial project contour locations used for each model run, $t = 0$ days

GRID 16 - LAKEVIEW PARK

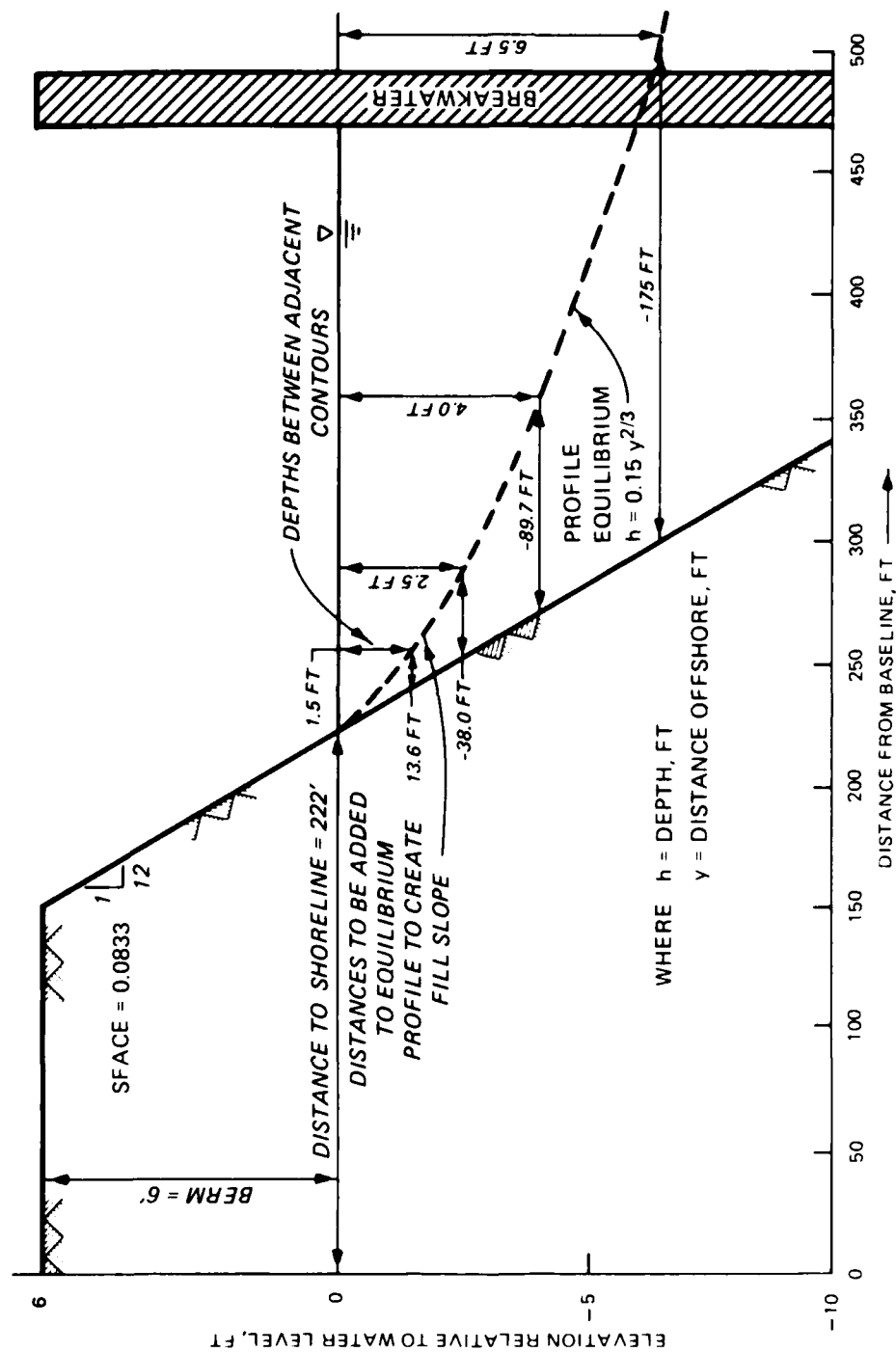


Figure 13. Example grid profile and distance to be added to equilibrium profile to get fill slope (creating file SPOOL)


```

50      3      IMAX, JMAX
        10.000 WDEPTH (meter)
1.000  2.000  3.000  5.000  7.000  11.000  14.000  17.000  25.000  32.868 } Contour Depths (feet)
.000   .000   .000   .000   .000   .000   .000   .000   .000   .000
20 ← Number of Iterations between printouts
    0.000  .0000  .000  Berm height (ft), slope, grain diameter (mm)
2 ← Number of Groins
10 100.000 } I-location, length of groin (ft)
10 350.000
.1500 ADEAN, ft/s
50.000 21600.000 space step (ft), time step (sec)
.00   .00   .00   .00   .00   .00   .00   .00   .00   .00 } Initial shoreline:
165.00 180.00 195.00 210.00 216.00 222.00 228.00 234.00 240.00 246.00 } Distances from baseline (ft)
252.00 258.00 264.00 268.00 272.00 276.00 280.00 284.00 288.00 292.00
276.00 278.00 280.00 282.00 284.00 286.00 288.00 290.00 292.00 294.00
.00   .00   .00   .00   .00   .00   .00   .00   .00   .00
3 ← Number of Breakwaters
    12    17    460.00    500.00 } Breakwaters:
    20    25    520.00    540.00 } Right location, left location, distance offshore right side,
    28    33    540.00    540.00 } distance offshore left side
1      1.5    3.1    35.0    1      ← Code meaning fill added at this time-step
2      2.5    4.2    30.0    0
3      2.5    4.2    30.0    0
4      3.5    5.1    30.0    0
5      4.5    5.7    30.0    0
6      2.5    4.0    15.0    0
7      1.5    2.9    -3.0    0
8      1.5    2.9    15.0    0
9      2.5    4.0    -3.0    0
10     1.5    2.9    -30.0    0
11     2.5    3.1    30.0    0
12     1.5    4.2    30.0    0
13     2.5    4.2    30.0    0
14     2.5    5.1    30.0    0
15     2.5    5.7    30.0    0
16     2.5    4.0    15.0    0
17     1.5    2.9    -3.0    0
18     1.5    2.9    15.0    0
19     1.5    4.0    -3.0    0
20     1.5    2.9    -30.0    0
    .
    .
    .
112    2.5    4.2    30.0    0
113    2.5    4.2    30.0    0
114    2.5    5.1    30.0    0
115    2.5    5.7    30.0    0
116    2.5    4.0    15.0    0
117    1.5    2.9    -3.0    0
118    1.5    2.9    15.0    0
119    1.5    4.0    -3.0    0
120    1.5    2.9    -30.0    0
121    99.0    99.0    99.0    0

```

Wave Conditions:
 wave height (ft), period (sec), angle (deg)

(Ten Wave Conditions Repeated)

Figure 15. INPUT file (this file generated Figure 7)

15	4	-89.76
16	4	-89.76
17	4	-89.76
18	4	-89.76
19	4	-89.76
20	4	-89.76
21	4	-89.76
22	4	-89.76
23	4	-89.76
24	4	-89.76
25	4	-89.76
26	4	-89.76
27	4	-89.76
28	4	-89.76
29	4	-89.76
30	4	-89.76
31	4	-89.76
32	4	-89.76
33	4	-89.76
34	4	-89.76
35	4	-89.76
36	4	-89.76
37	4	-89.76
38	4	-89.76
39	4	-89.76
40	4	-89.76
41	5	-175.00
42	5	-175.00
43	5	-175.00
44	5	-175.00
45	5	-175.00
46	5	-175.00
47	5	-175.00
48	5	-175.00
49	5	-175.00
50	5	-175.00
51	5	-175.00
52	5	-175.00
53	5	-175.00
54	5	-175.00
55	5	-175.00
56	5	-175.00
57	5	-175.00
58	5	-175.00
59	5	-175.00
60	5	-175.00

Contour Level to add fill

$z' =$ average of 2 and 3 contour depths

'5' = " " 4 and 5 " "

etc.

Distance to be added to contour level

34

32. The parameter in the N-line model code that controls the rate of shoreline movement, the BRF, was set at 1.0 (BRF = 1.0).

Model Output

33. The model was run using the input configuration described for a period of 360 days; printouts are included at 30 days (Figure 17), 180 days (Figure 18), and 360 days (Figure 19). Notice that the model never reaches the equilibrium shoreline as shown in Figure 11; the shoreline keeps eroding. The outer contours show a greater sinuosity than the inner contours; this is because of the small slope of the equilibrium profile as distance offshore increases. As in the prototype, the model's shoreline on the west end erodes more quickly than the east end. However, since the sinuosity of the model's shoreline is much less than in the prototype, it is difficult to see the influence of the individual breakwater segments which was obvious in the prototype.

34. After the model was run for the original configuration of structures at Lakeview Park, eight different configurations were run for 30 days. Each of these runs can be compared with Figure 17 to see how different structure configurations influence the project area; except for the change in structures, all model input parameters have been held constant. These runs are presented in Figures 20-27.

Discussion

35. In Figure 22, the run with four short-length breakwater segments and two groins, the model acts unrealistically, eroding the project severely at the east end. Figure 23 shows a run with four longer length breakwater segments which appear to respond more realistically when performing as a long, single breakwater (compare with Figure 24). Therefore, the number of breakwater segments does not cause unrealistic response in the model. In comparing Figure 22 (short-length breakwater segments and two groins) with Figure 20 (two groins, no breakwater), one can see that the addition of the breakwater causes more erosion than the run without the breakwater. Apparently, the reflected waves around each segment in the four short-breakwater segment case interact and create a focusing of wave energy on the shoreline.

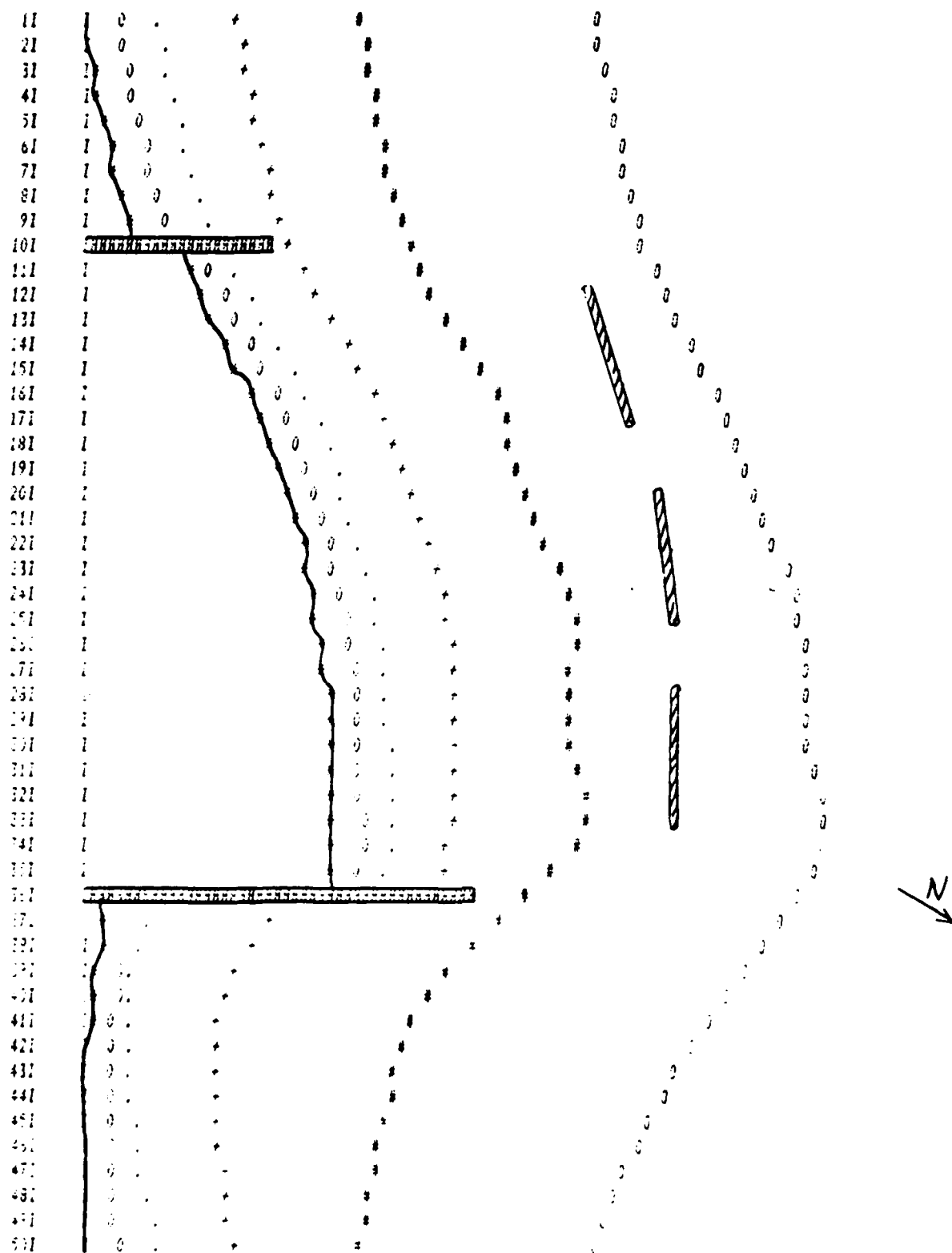


Figure 17. Prototype configuration at $t = 30$ days

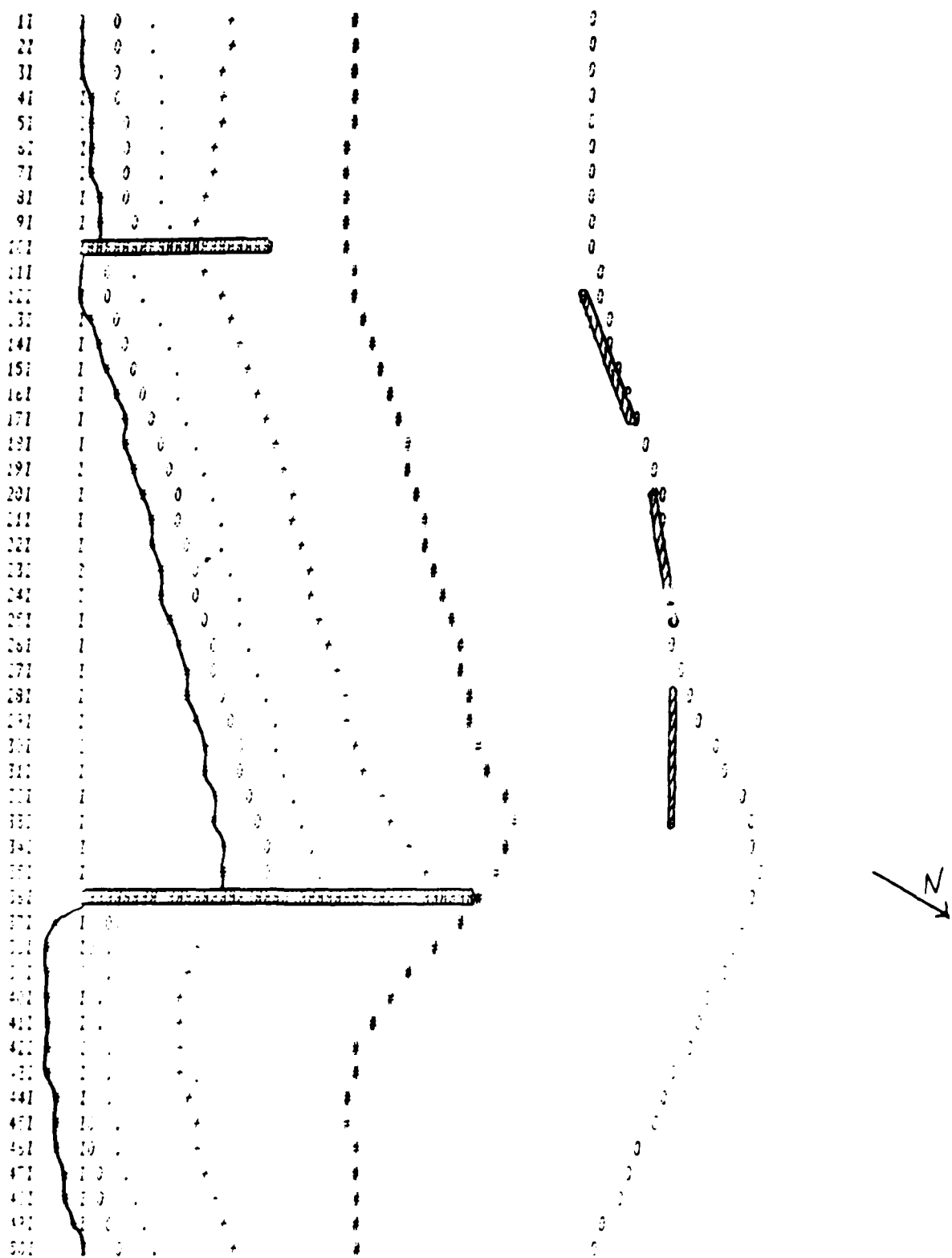


Figure 18. Prototype configuration at $t = 180$ days

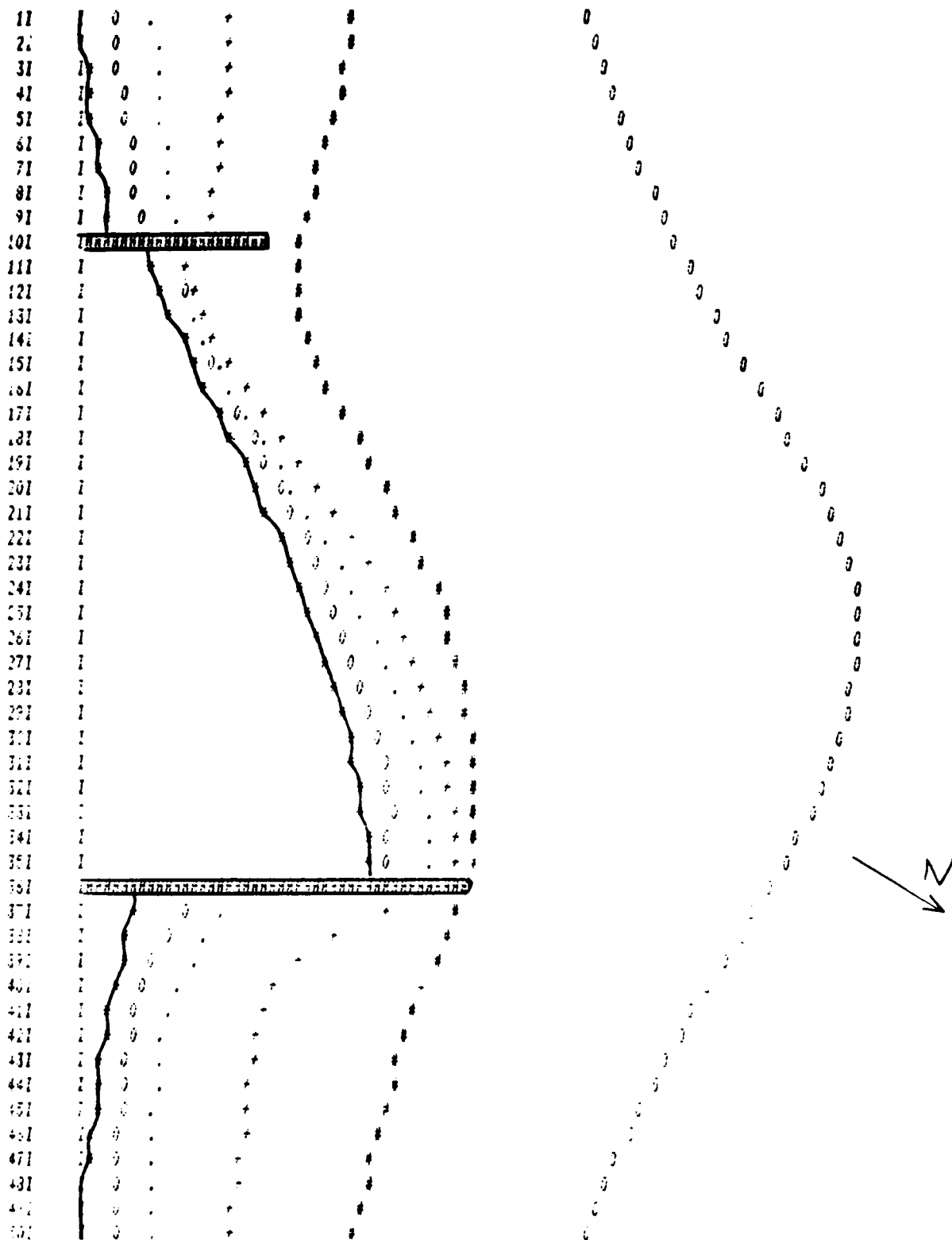


Figure 20. Two groins, no breakwater, $t = 30$ days

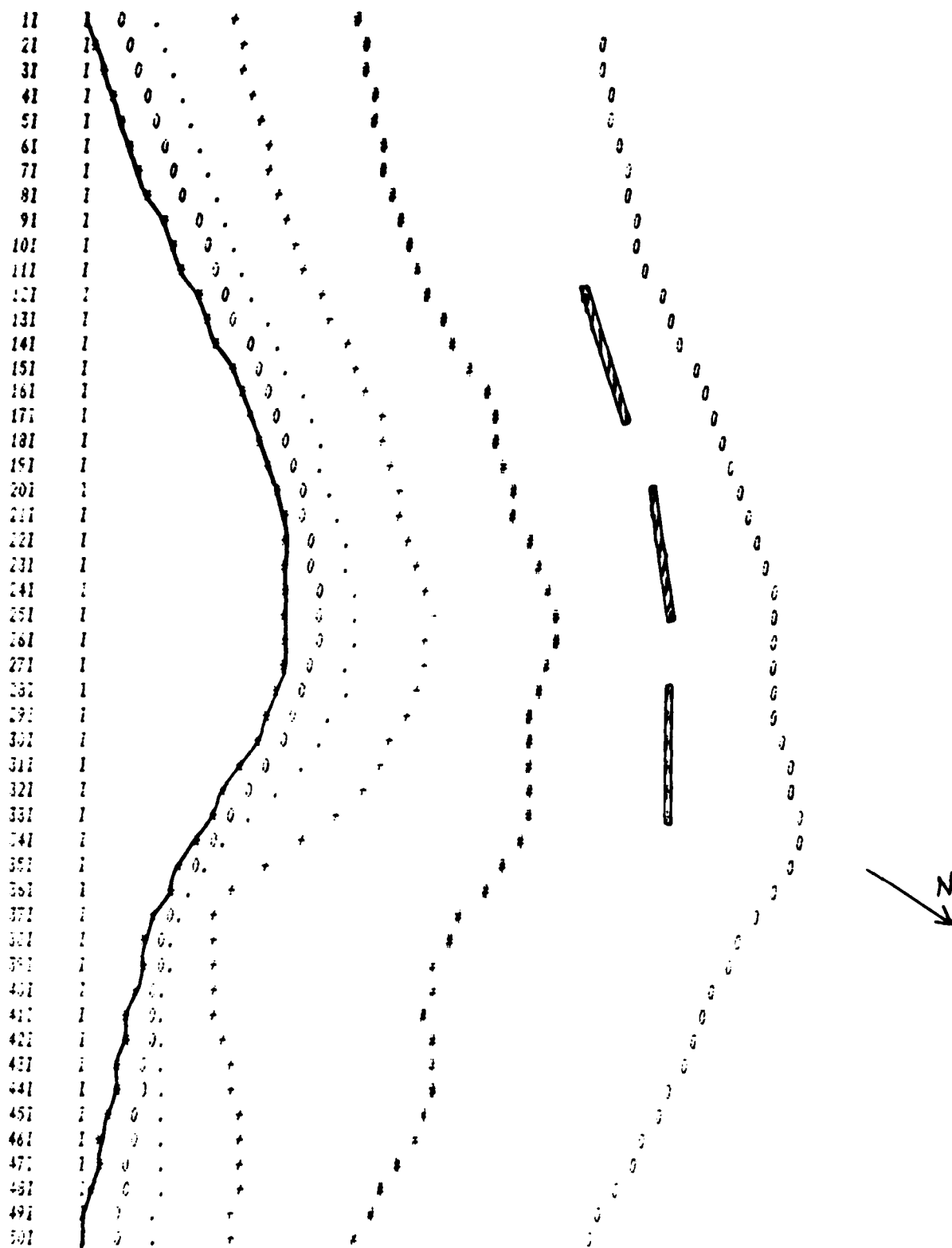


Figure 21. Three segment breakwater, no groins, $t = 30$ days

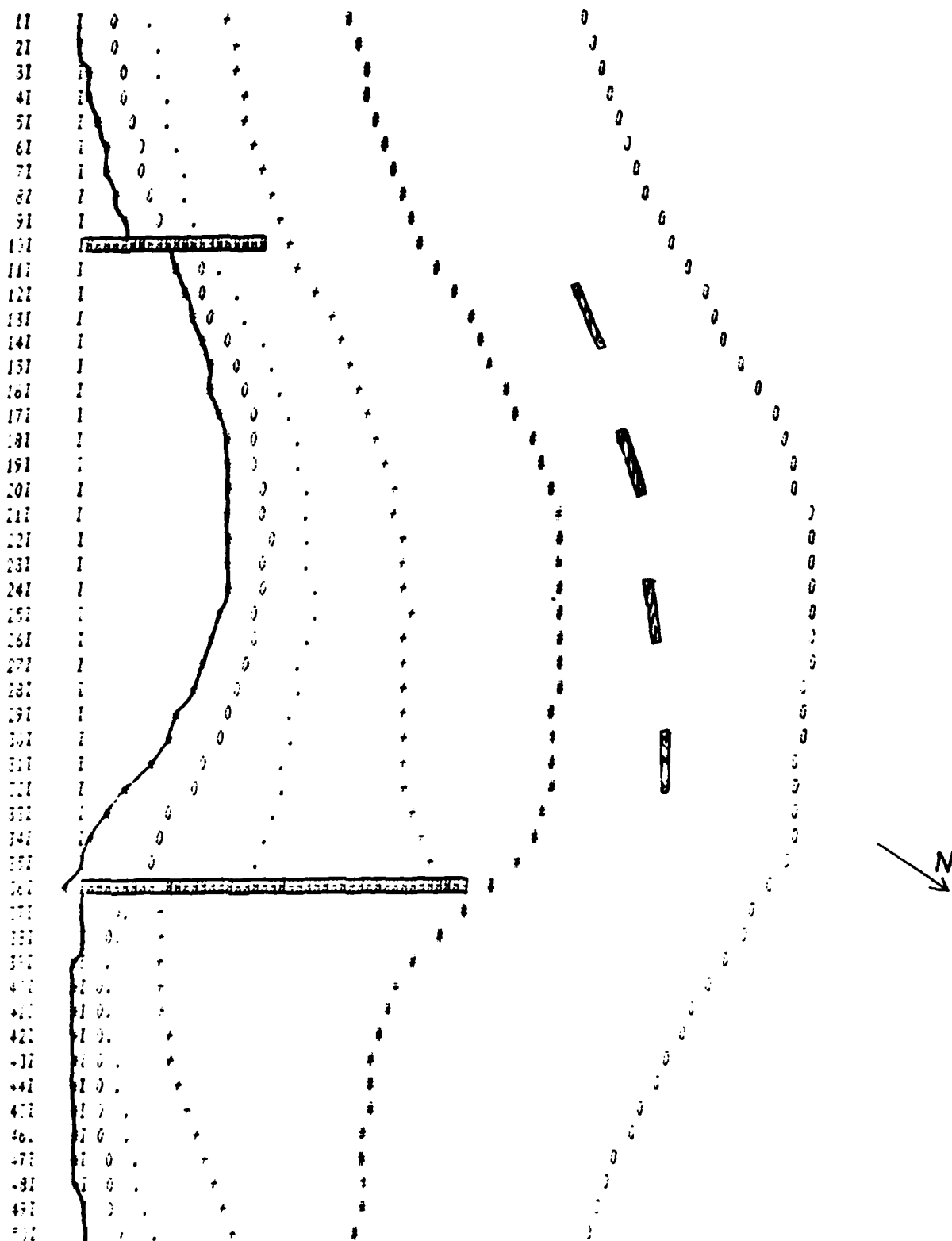


Figure 22. Four short-length breakwater segments, two groins,
 $t = 30$ days

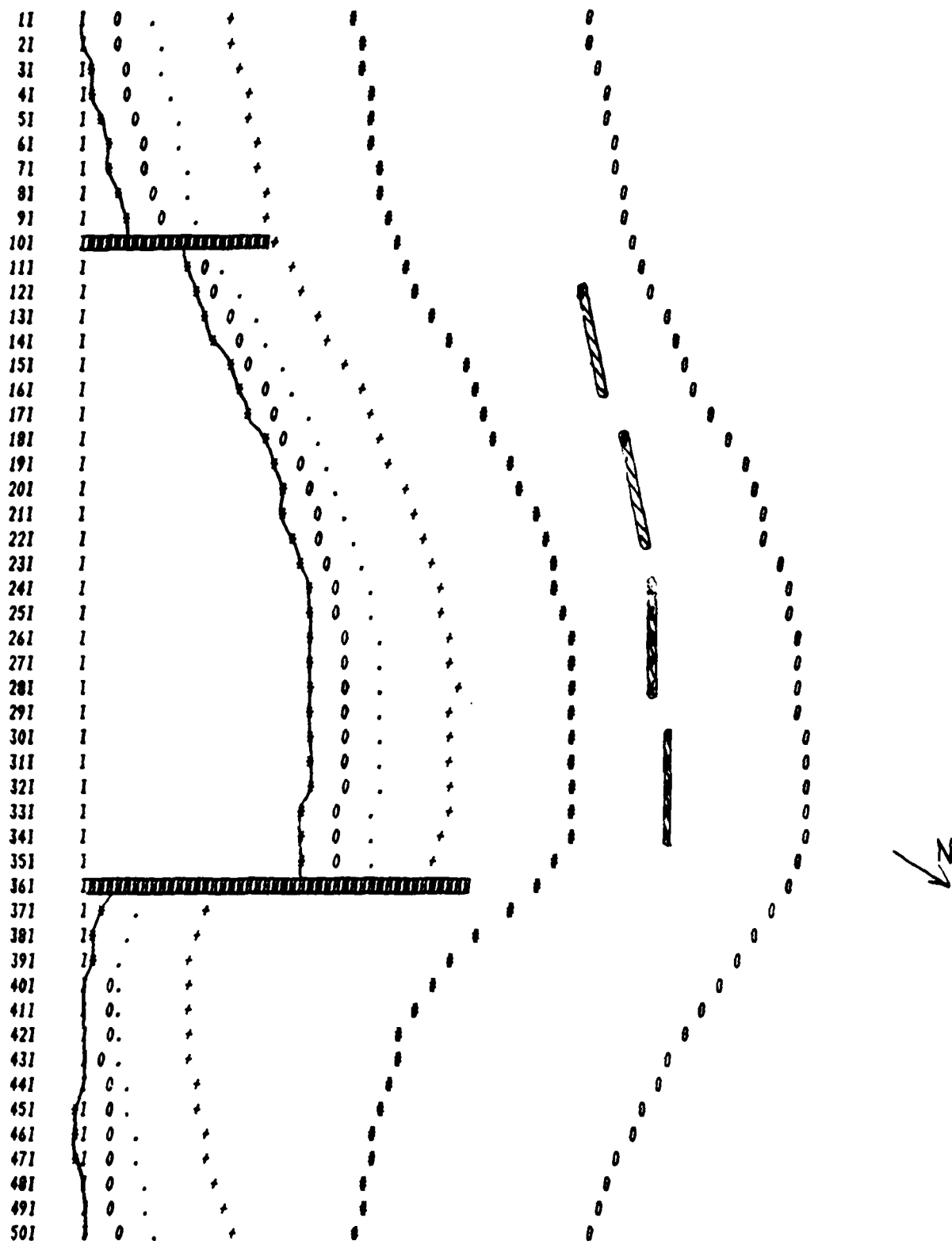


Figure 23. Four longer length breakwater segments, two groins,
 $t = 30$ days

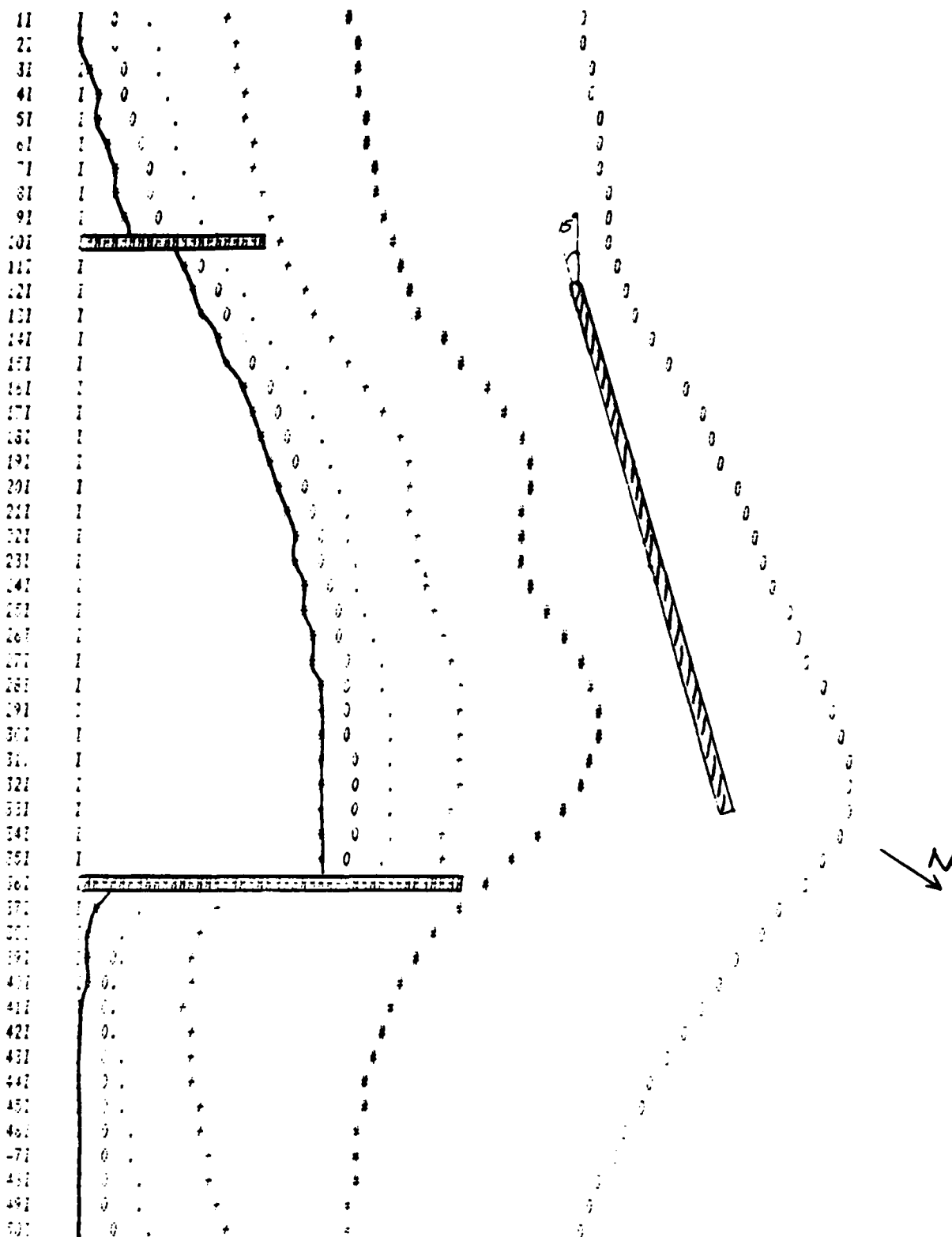


Figure 24. One breakwater, 15 deg offshore from baseline, two groins, $t = 30$ days

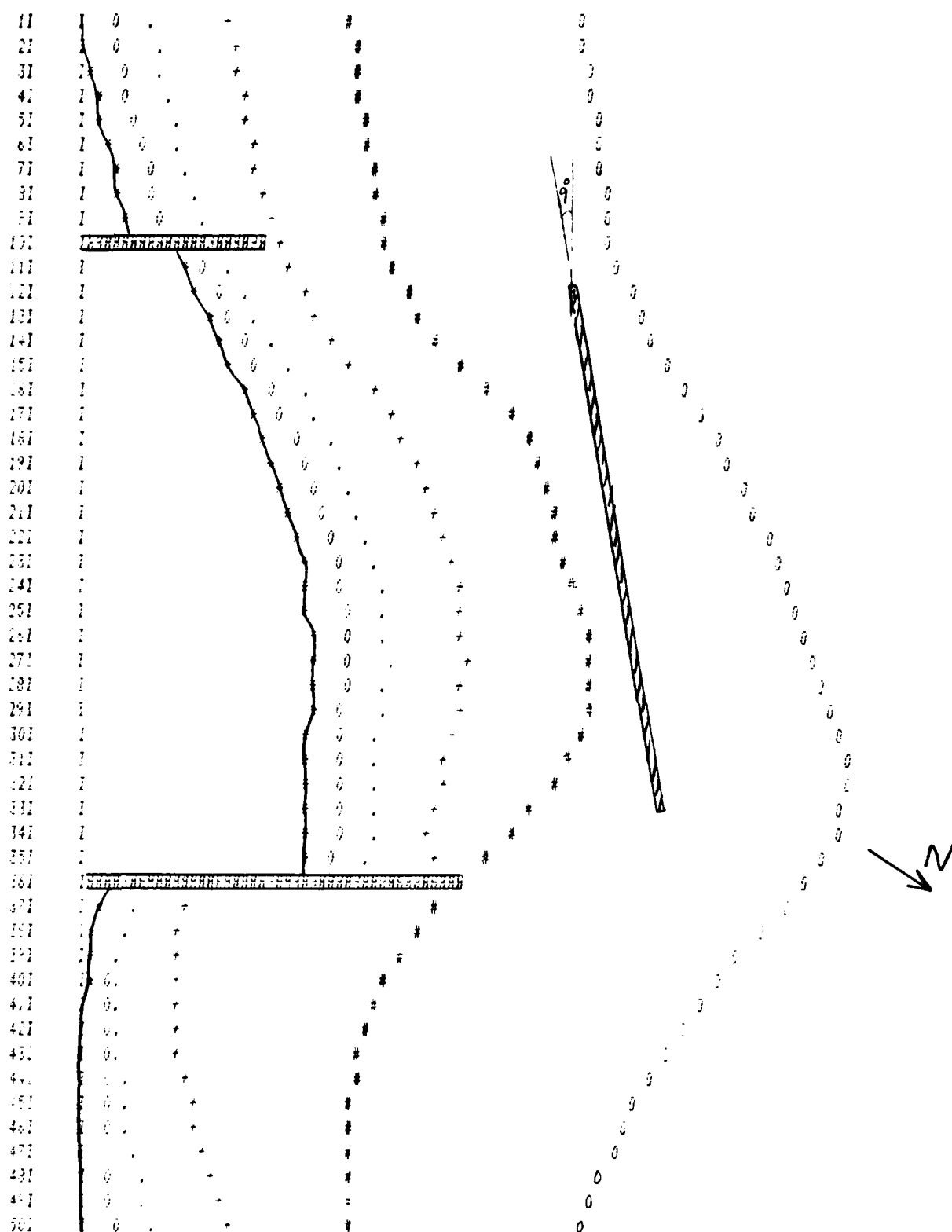


Figure 25. One breakwater, 9 deg offshore from baseline, two groins, $t = 30$ days

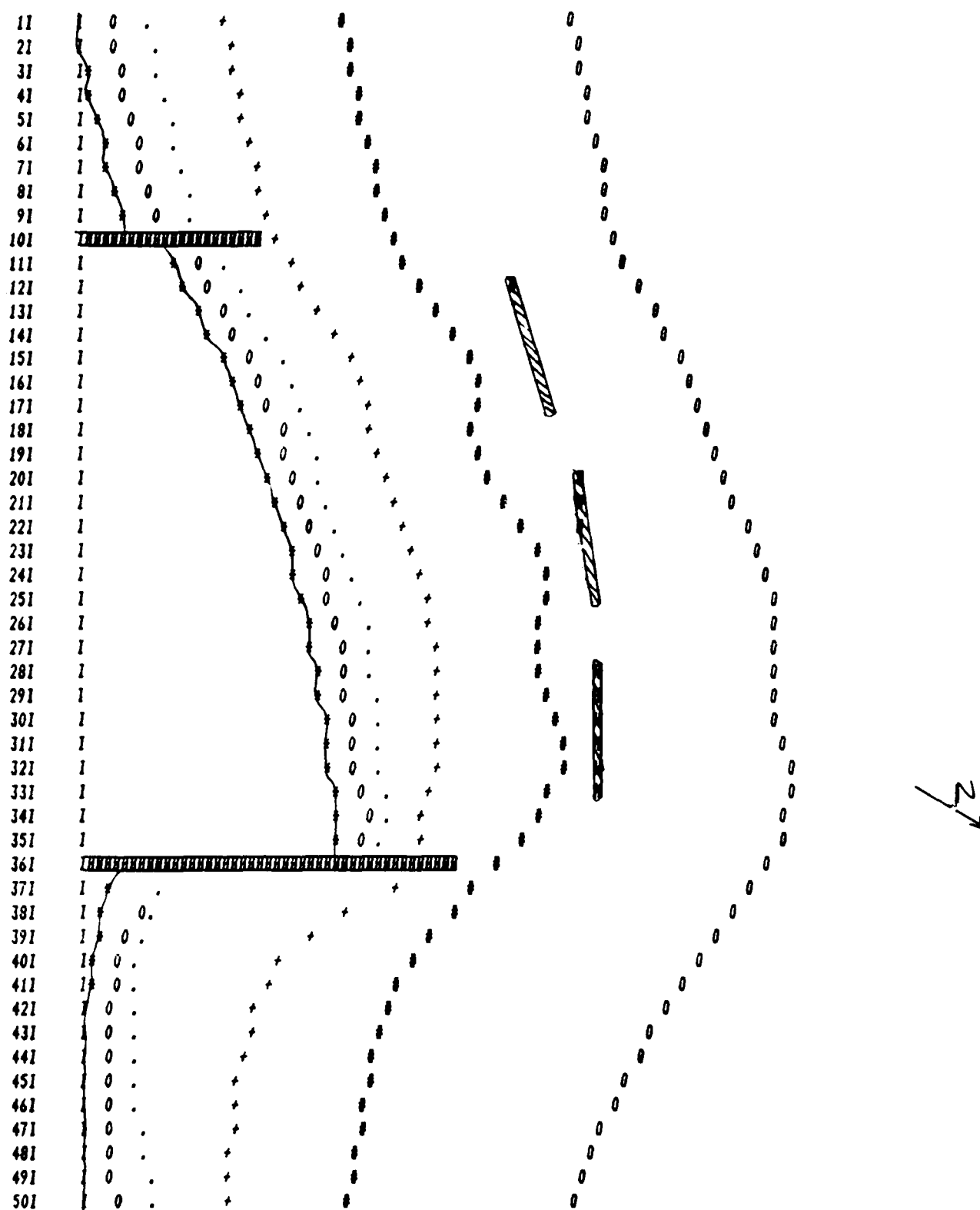


Figure 26. Three breakwater segments, 50 ft closer to shoreline, two groins, $t = 30$ days

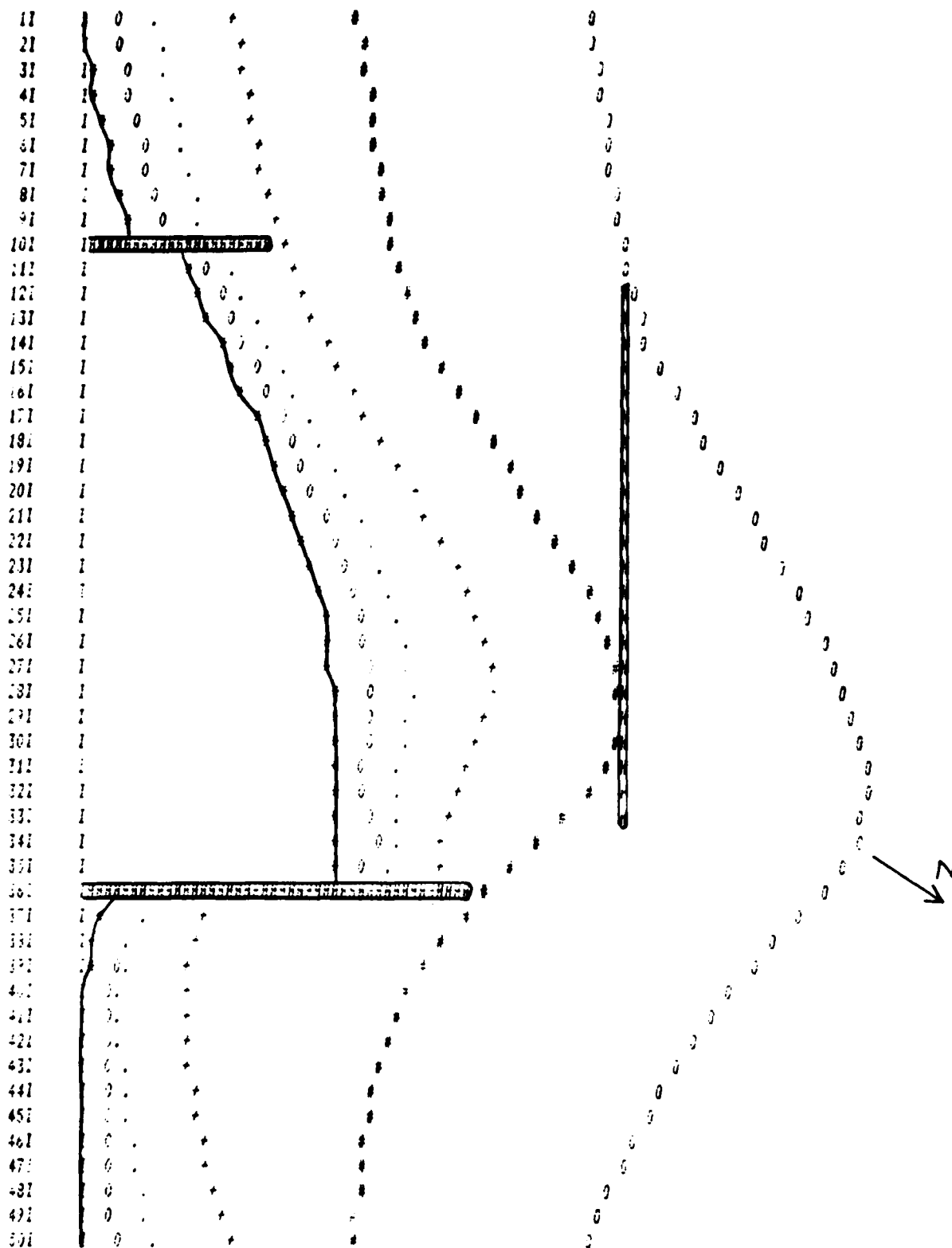


Figure 27. One breakwater parallel to baseline, two groins, $t = 30$ days

36. In Figure 26, the breakwater segments were moved 50 ft closer to shore. In comparing Figures 26 and 17, it is apparent that the contours did not change at all when the breakwater segments were moved closer to shore.

37. The two model responses described above are not logical and indicate that the program can only realistically model certain simple configurations. The user should be wary of accepting the model's output at face value, and should experiment with different configurations as was done here to determine the model's sensitivity to the user's particular setup. The breakwater addition to the model was written for use with structures that are located shore-parallel or near-parallel. Angled structures alone or connected to shore-parallel structures are not intended for use with the N-line model.

38. The choice of the initial shoreline position may appear arbitrary to the model user; however, the initial beach conditions greatly influence the model's output. A run was made using an initial shoreline on the baseline ($(I,J) = 0.0$). Fill was then added to create the same initial configuration as presented in Figure 12. However, after 30 days the model gave an entirely different result than when using an initial shoreline defined at the waterline (compare Figures 26 and 28). This discrepancy results because the model's rate of erosion is calculated from the difference between the waterline location after the fill has been added, and the initial shoreline location before the fill is added; the larger this distance, the faster the erosion rate.

39. In experimenting further with the model, two conditions used in simulating Lakeview Park, the BRF and the restriction of longshore transport across the west groin, were adjusted in the model code. Both of these conditions were observed as greatly influencing the model's output.

40. Figure 28 was a run made for 360 days with the BRF changed to 0.5 while continuing to restrict transport across the west groin. The amount of beach at 360 days is much greater with $BRF = 0.5$ than when $BRF = 1.0$ (compare Figures 29 and 19). This factor controls the rate of transport.

41. Figure 30 was a run for 360 days with the BRF kept at 0.5, but longshore transport was allowed across the west groin. Note that this run did reach an equilibrium point (compare with Figure 31, the same run at 300 days). However, the beach planform is not sinuous at all, and the cutback at the west groin is not apparent as it is in the prototype.

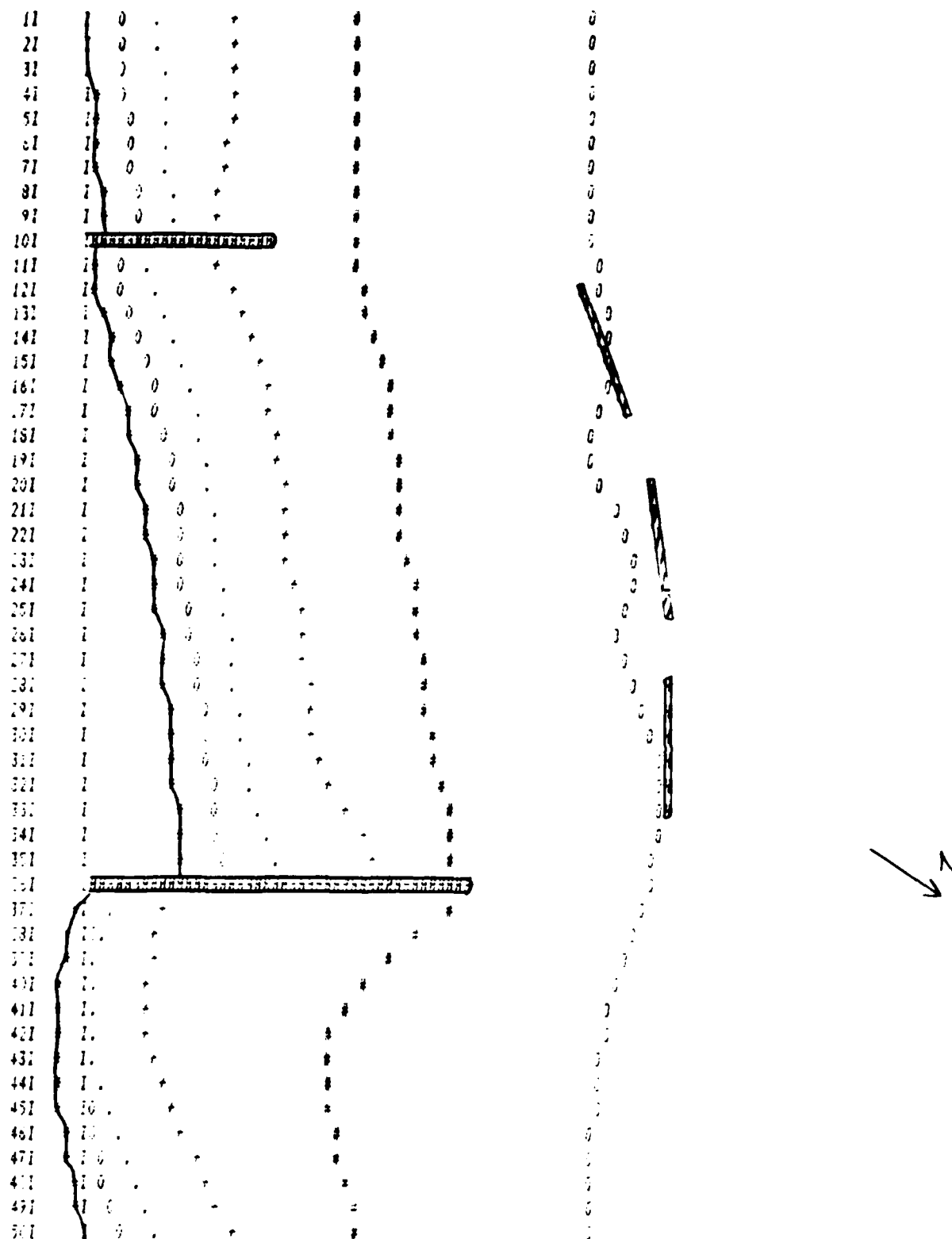


Figure 28. Model at $t = 30$ days; initial shoreline = 0.0; fill added to create initial contour locations as in Figure 1

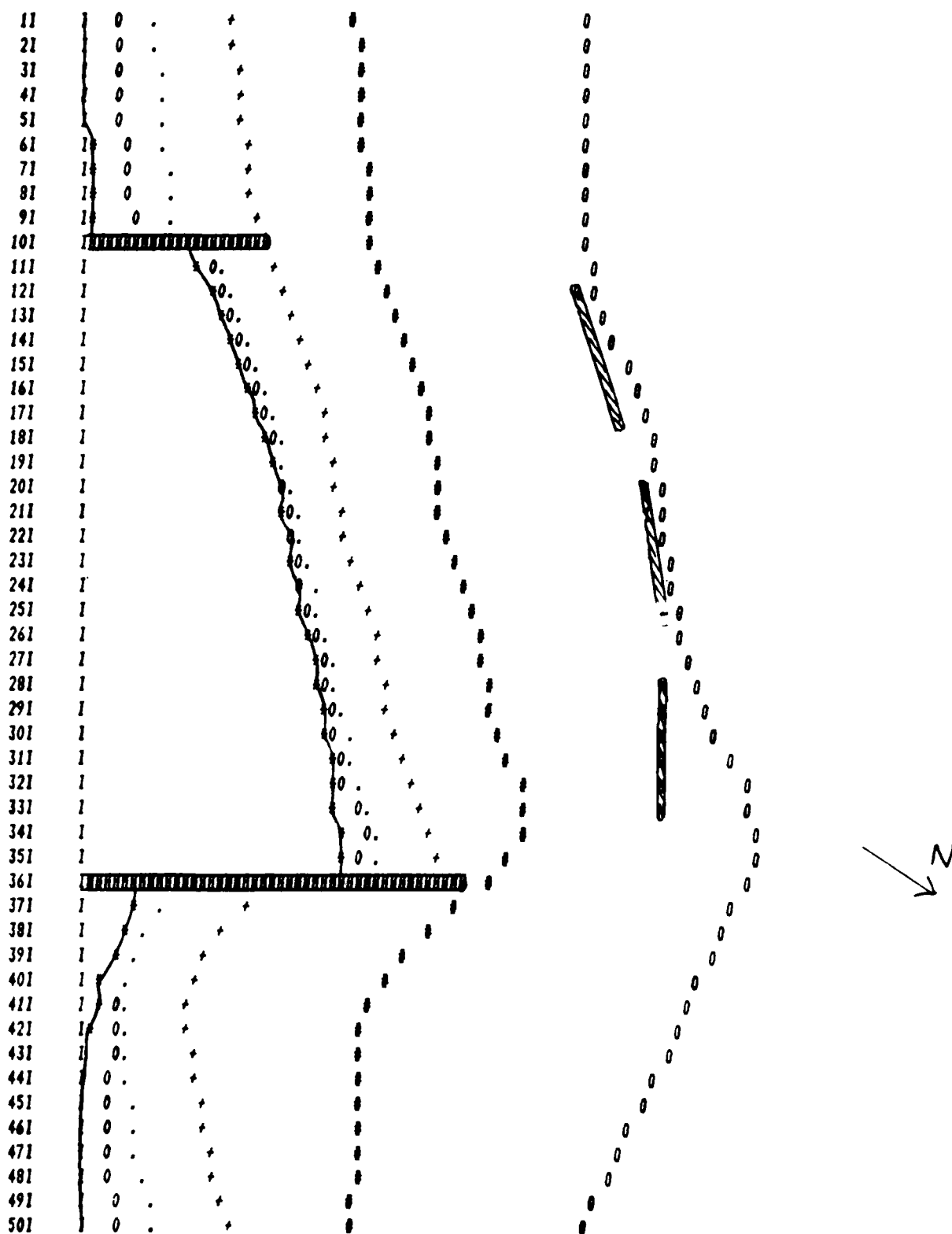


Figure 29. Three breakwater segments, two groins,
BRF = 0.5, $t = 360$ days

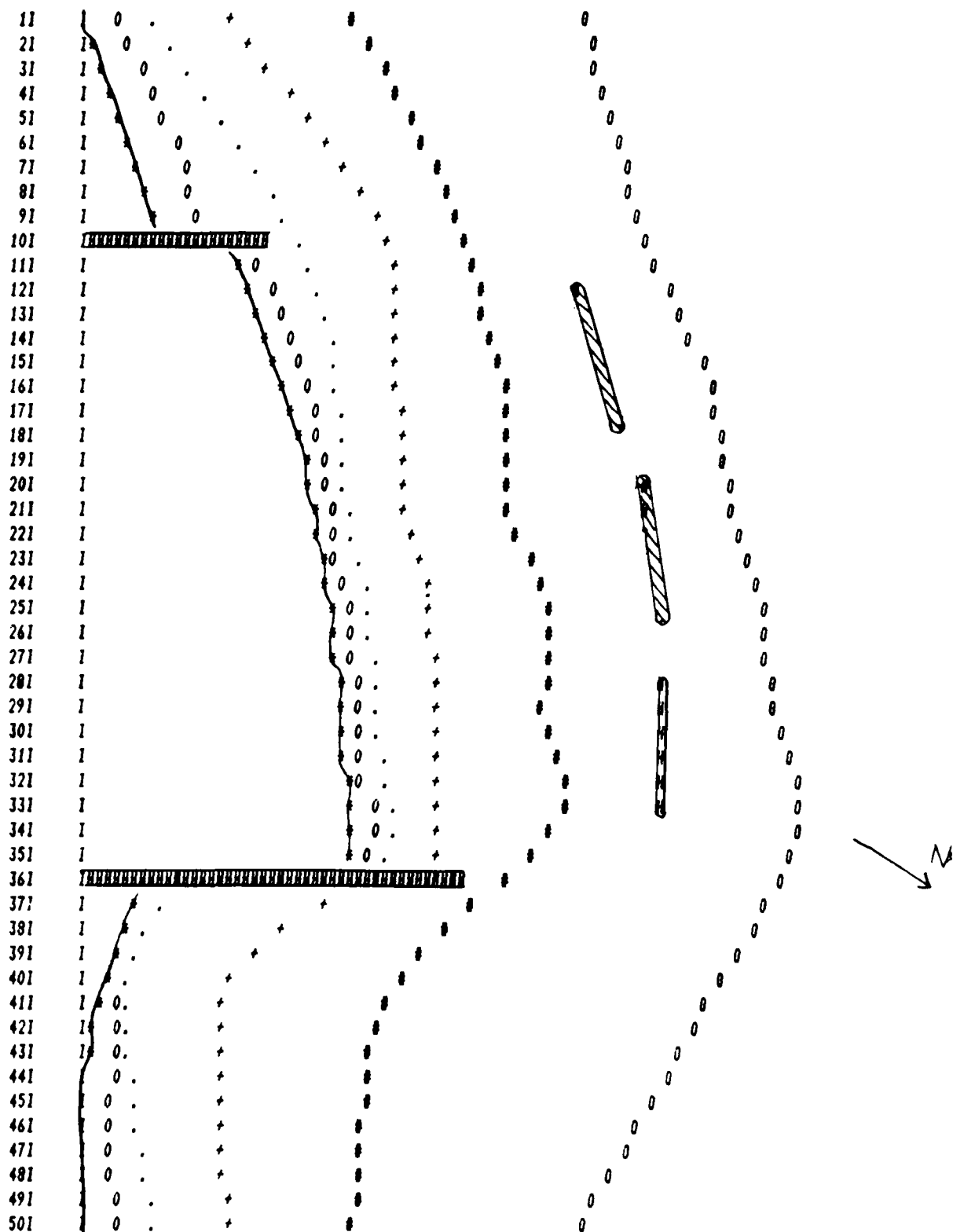


Figure 30. Three breakwater segments, two groins, $BRF = 0.5$,
transport allowed across west groin, $t = 360$ days

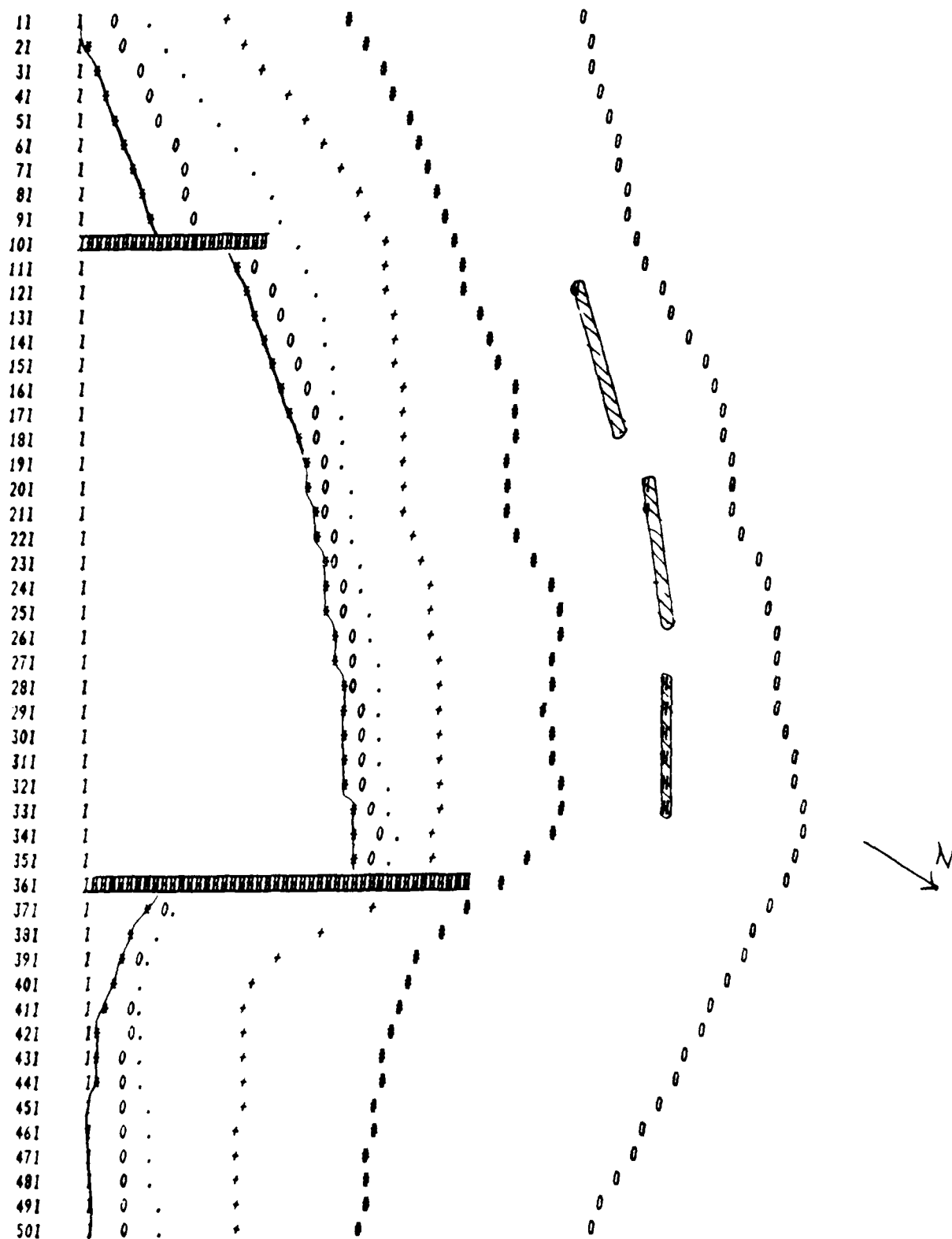


Figure 31. Three breakwater segments, two groins, $BRF = 0.5$, transport allowed across west groin, $t = 300$ days

PART VI: CONCLUSIONS

42. The N-line model presented in this report is versatile, easy to use, and capable of producing dependable results when used for appropriate applications. The documentation presented in this report is intended to cover only the breakwater subroutine. Since conceptual modifications were not made to the original model, the original documentation presented in Perlin and Dean (1983) should be obtained by any potential user of the model.

43. The N-line model is useful in showing qualitative trends for a complex case such as Lakeview Park. Some of the drawbacks of the program when modeling Lakeview Park, such as the inability to reach an equilibrium shoreline and the low sinuosity of the shoreline when influenced by breakwater segments, could possibly be successfully modeled by modifying the different input parameters (such as the ADEAN parameter, the initial shoreline location, and/or the model code). Perhaps then a quantitative verification of the model could be made. However, in this case, the model would have then been tailored to produce a previously known result.

44. A project cannot be successfully modeled without experimenting with different time-steps, space-steps, contour depths, shoreline locations, and structure configurations. A wave climate representative of the area being modeled is also very important. Finally, the response of the model to a particular setup must be interpreted with engineering judgment.

REFERENCES

- Bottin, R. R. 1982. "Lakeview Park Beach Erosion Study, Ohio," unpublished Letter Report, 30 September, US Army Engineer Waterways Experiment Station, Vicksburg, Miss.
- Moore, B. 1982. "Beach Profile Evolution in Response to Changes in Water Level and Wave Height," M.S. Thesis, University of Delaware, Newark, Del.
- Perlin, M., and Dean, R. G. 1983 (May). "A Numerical Model to Simulate Sediment Transport in the Vicinity of Coastal Structures," MR 83-10, Coastal Engineering Research Center, US Army Engineer Waterways Experiment Station, Vicksburg, Miss.
- Pope, J., and Rowen, D. D. 1983. "Breakwaters for Beach Protection at Lorain, OH," Coastal Structures '83, American Society of Civil Engineers, New York.
- Saville, T., Jr. 1953. "Wave and Lake Level Statistics for Lake Erie," Technical Memorandum No. 37, Beach Erosion Board.

APPENDIX A: EXAMPLES OF INPUT AND OUTPUT DATA

EXAMPLE 1 - INPUT

50	8									
	10.000									
1.000	2.000	3.000	4.000	5.000	7.000	9.000	12.000	18.000	32.808	
.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	
30										
	3.000	.0500	.220							
1										
25	300.000									
	.1486									
100.000	21600.000									
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
0										
1	3.0	7.0	60.0	0						
2	3.0	7.0	60.0	0						
3	3.0	7.0	60.0	0						
4	3.0	7.0	60.0	0						
5	3.0	7.0	60.0	0						
6	3.0	7.0	60.0	0						
7	3.0	7.0	60.0	0						
8	3.0	7.0	60.0	0						
9	3.0	7.0	60.0	0						
10	3.0	7.0	60.0	0						
11	3.0	7.0	60.0	0						
12	3.0	7.0	60.0	0						
13	3.0	7.0	60.0	0						
14	3.0	7.0	60.0	0						
15	3.0	7.0	60.0	0						
16	3.0	7.0	60.0	0						
17	3.0	7.0	60.0	0						
18	3.0	7.0	60.0	0						
19	3.0	7.0	60.0	0						
20	3.0	7.0	60.0	0						
21	3.0	7.0	60.0	0						
22	3.0	7.0	60.0	0						
23	3.0	7.0	60.0	0						
24	3.0	7.0	60.0	0						
25	3.0	7.0	60.0	0						
26	3.0	7.0	60.0	0						
27	3.0	7.0	60.0	0						
28	3.0	7.0	60.0	0						
29	3.0	7.0	60.0	0						
30	3.0	7.0	60.0	0						
31	39.0	39.0	39.0	0						

EXAMPLE 1 - SPOOL: NONE

EXAMPLE 1 - OUTPUT

```

*****
THE DEPTH (IN FT) WAVES TRANSFORMED TO, WDEPTH=      32.808
*****
THE HEIGHT OF THE BERM, BERM=      3.000
THE SLOPE OF THE BEACH FACE, SFACE=      .0500
THE SEDIMENT DIAMETER, DIAM=      .220
*****
THE LENGTH OF THE STRUCTURE, SJETTY=      300.000
THE NUMBER      1 GROIN IS LOCATED AT GRID      25
*****
THE VALUE OF ADEAN=      .1486 IN THE EQ. H=AY**2/3
*****
THE VALUE OF THE LONGSHORE SPACE-STEP, DX=      100.000
THE TIME-STEP IN SECONDS, DELT=      21600.000
*****

```

THE INITIAL SHORELINE COORDINATES :

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

THE BOUNDARY C-VALUES, I=1,IMAX ARE AS FOLLOWS

.00	32.07	69.01	114.31	166.64	256.57	395.01	593.96	1014.17	2235.24
.00	32.07	69.01	114.31	166.64	256.57	395.01	593.96	1014.17	2235.24

THE DEPTHS BETWEEN CONTOURS ARE AS FOLLOWS

1.00	2.00	3.00	4.00	5.00	7.00	9.00	12.00	18.00	32.81
------	------	------	------	------	------	------	-------	-------	-------

1	3.0	7.0	60.0	0
2	3.0	7.0	60.0	0
3	3.0	7.0	60.0	0
4	3.0	7.0	60.0	0
5	3.0	7.0	60.0	0
6	3.0	7.0	60.0	0
7	3.0	7.0	60.0	0
8	3.0	7.0	60.0	0
9	3.0	7.0	60.0	0
10	3.0	7.0	60.0	0
11	3.0	7.0	60.0	0
12	3.0	7.0	60.0	0
13	3.0	7.0	60.0	0
14	3.0	7.0	60.0	0
15	3.0	7.0	60.0	0
16	3.0	7.0	60.0	0
17	3.0	7.0	60.0	0
18	3.0	7.0	60.0	0
19	3.0	7.0	60.0	0
20	3.0	7.0	60.0	0
21	3.0	7.0	60.0	0
22	3.0	7.0	60.0	0
23	3.0	7.0	60.0	0
24	3.0	7.0	60.0	0
25	3.0	7.0	60.0	0

26	3.0	7.0	60.0	0
27	3.0	7.0	60.0	0
28	3.0	7.0	60.0	0
29	3.0	7.0	60.0	0
30	3.0	7.0	60.0	0

THE TOTAL ELAPSED NUMBER OF TIME-STEPS, NUNIV= 30

LONGSHORE STATION 1									
Y	.000	32.071	69.005	114.307	166.644	256.566	395.009	593.958	1014.165
OX	.005	.113	.527	.725	.232	.008	.000	.000	.000
OY	.000	.000	.000	.000	.000	.000	.000	.000	.000
LONGSHORE STATION 2									
Y	.003	32.129	69.330	115.697	166.584	256.565	395.009	593.958	1014.165
OX	.005	.113	.527	.725	.232	.008	.000	.000	.000
OY	.000	.000	.000	.000	.000	.000	.000	.000	.000
LONGSHORE STATION 3									
Y	.010	32.200	69.552	116.999	166.494	256.562	395.009	593.958	1014.165
OX	.005	.114	.525	.722	.232	.008	.000	.000	.000
OY	.000	.000	.000	.000	.000	.000	.000	.000	.000
LONGSHORE STATION 4									
Y	.021	32.280	69.746	118.314	166.354	256.554	395.009	593.958	1014.165
OX	.005	.113	.524	.721	.232	.008	.000	.000	.000
OY	.000	.000	-.001	.000	.000	.000	.000	.000	.000
LONGSHORE STATION 5									
Y	.038	32.380	70.013	119.772	166.188	256.543	395.009	593.958	1014.165
OX	.005	.113	.523	.718	.232	.008	.000	.000	.000
OY	.000	.000	-.001	.000	.000	.000	.000	.000	.000
LONGSHORE STATION 6									
Y	.068	32.529	70.405	121.447	166.025	256.532	395.009	593.958	1014.165
OX	.005	.113	.522	.715	.232	.008	.000	.000	.000
OY	.000	.000	-.001	.000	.000	.00	.000	.000	.000
LONGSHORE STATION 7									
Y	.116	32.757	70.966	123.394	165.872	256.519	395.009	593.958	1014.165
OX	.005	.113	.520	.710	.232	.008	.000	.000	.000
OY	.000	-.001	-.001	.000	.000	.000	.000	.000	.000
LONGSHORE STATION 8									
Y	.195	33.092	71.748	125.671	165.767	256.501	395.009	593.958	1014.165
OX	.005	.113	.517	.705	.232	.008	.000	.000	.000
OY	.000	-.001	-.002	.000	.000	.000	.000	.000	.000
LONGSHORE STATION 9									
Y	.315	33.573	72.818	128.340	165.731	256.481	395.009	593.958	1014.165
OX	.005	.113	.514	.699	.234	.008	.000	.000	.000
OY	.000	-.001	-.002	-.001	.000	.000	.000	.000	.000
LONGSHORE STATION 10									
Y	.497	34.250	74.261	131.464	165.828	256.454	395.009	593.958	1014.165
OX	.005	.113	.510	.692	.234	.008	.000	.000	.000
OY	-.001	-.002	-.003	-.001	.000	.000	.000	.000	.000
LONGSHORE STATION 11									
Y	.765	35.188	76.180	135.113	166.141	256.411	395.009	593.958	1014.165
OX	.005	.113	.505	.685	.234	.008	.000	.000	.000
OY	-.001	-.002	-.004	-.001	.000	.000	.000	.000	.000
LONGSHORE STATION 12									
Y	1.155	36.470	78.705	139.363	166.797	256.369	395.009	593.958	1014.165
OX	.005	.112	.498	.676	.234	.008	.000	.000	.000
OY	-.001	-.003	-.005	-.001	.000	.000	.000	.000	.000

LONGSHORE STATION 13									
Y	1.715	38.201	81.992	144.295	167.951	256.305	395.008	593.958	1014.165
OX	.005	.112	.489	.666	.234	.003	.000	.000	.000
OY	-.001	-.004	-.007	-.001	.001	.000	.000	.000	.000
LONGSHORE STATION 14									
Y	2.507	40.508	86.225	149.993	169.796	256.223	395.008	593.958	1014.165
OX	.005	.111	.478	.656	.233	.009	.000	.000	.000
OY	-.002	-.006	-.009	-.001	.001	.000	.000	.000	.000
LONGSHORE STATION 15									
Y	3.614	43.545	91.616	156.543	172.556	256.125	395.008	593.958	1014.165
OX	.005	.109	.465	.644	.232	.009	.000	.000	.000
OY	-.002	-.008	-.011	-.001	.001	.000	.000	.000	.000
LONGSHORE STATION 16									
Y	5.137	47.488	98.409	164.032	176.469	256.030	395.008	593.958	1014.165
OX	.006	.108	.448	.632	.229	.010	.000	.000	.000
OY	-.003	-.010	-.014	-.001	.001	.000	.000	.000	.000
LONGSHORE STATION 17									
Y	7.193	52.541	106.880	172.562	181.785	255.932	395.008	593.958	1014.165
OX	.006	.106	.428	.619	.226	.010	.000	.000	.000
OY	-.004	-.013	-.017	-.001	.001	.000	.000	.000	.000
LONGSHORE STATION 18									
Y	9.909	58.950	117.433	182.161	188.556	256.119	395.008	593.958	1014.165
OX	.006	.103	.404	.607	.223	.011	.000	.000	.000
OY	-.005	-.017	-.021	-.001	.001	.000	.000	.000	.000
LONGSHORE STATION 19									
Y	13.397	66.888	130.254	193.314	197.600	256.787	395.011	593.958	1014.165
OX	.006	.101	.380	.587	.213	.011	.000	.000	.000
OY	-.006	-.021	-.026	-.018	.001	.000	.000	.000	.000
LONGSHORE STATION 20									
Y	17.727	76.474	145.228	206.779	209.943	256.513	395.015	593.958	1014.165
OX	.006	.097	.358	.569	.221	.015	.000	.000	.000
OY	-.007	-.026	-.032	-.016	.001	.000	.000	.000	.000
LONGSHORE STATION 21									
Y	22.898	87.925	162.495	222.303	224.925	261.508	395.022	593.958	1014.165
OX	.006	.094	.334	.539	.211	.015	.000	.000	.000
OY	-.008	-.033	-.038	-.015	.001	.001	.000	.000	.000
LONGSHORE STATION 22									
Y	28.753	101.343	182.290	239.479	241.472	266.163	395.031	593.958	1014.165
OX	.006	.090	.302	.511	.205	.016	.000	.000	.000
OY	-.009	-.040	-.044	-.012	.001	.001	.000	.000	.000
LONGSHORE STATION 23									
Y	34.905	116.411	204.252	257.607	259.404	271.874	395.041	593.958	1014.165
OX	.006	.084	.268	.504	.203	.017	.000	.000	.000
OY	-.009	-.049	-.051	-.006	.001	.001	.000	.000	.000
LONGSHORE STATION 24									
Y	40.605	133.477	229.672	277.517	279.316	281.551	395.047	593.958	1014.165
OX	.006	.070	.202	.487	.191	.014	.000	.000	.000
OY	-.010	-.061	-.059	-.005	.002	.002	.000	.000	.000
LONGSHORE STATION 25									
Y	44.258	147.313	251.641	266.314	268.733	284.163	395.044	593.958	1014.165
OX	.007	.080	.239	.340	.185	.012	.000	.000	.000
OY	-.010	-.071	-.067	.001	.022	.001	.000	.000	.000
LONGSHORE STATION 26									
Y	-49.295	-46.263	-44.450	177.726	181.930	257.021	395.013	593.958	1014.165
OX	.000	.000	.000	.000	.000	.003	.000	.000	.000

QY	.010	.014	.001	.000	.000	.000	.000	.000	.000
LONGSHORE STATION	27								
Y	-51.222	-48.249	-46.430	48.840	116.942	256.328	395.021	593.958	1014.165
QX	.017	.028	.000	.000	.000	.000	.000	.000	.000
QY	.003	.053	.019	.000	.000	.000	.000	.000	.000
LONGSHORE STATION	28								
Y	-51.352	-48.415	-46.536	-35.806	75.695	254.699	395.013	593.958	1014.165
QX	.009	.114	.030	.000	.000	.000	.000	.000	.000
QY	.010	.056	.076	.001	-.001	-.001	.000	.000	.000
LONGSHORE STATION	29								
Y	-47.975	-44.934	-43.251	-41.432	68.367	253.722	395.008	593.958	1014.165
QX	.003	.070	.269	.699	.180	.004	.000	.000	.000
QY	.010	.064	.089	.033	-.001	-.001	.000	.000	.000
LONGSHORE STATION	30								
Y	-37.328	-34.371	-32.552	-27.936	79.830	253.510	395.005	593.958	1014.165
QX	.002	.064	.307	.383	.164	.008	.000	.000	.000
QY	.010	.037	.044	.002	-.001	-.001	.000	.000	.000
LONGSHORE STATION	31								
Y	-27.621	-24.580	-20.612	-9.508	93.796	254.012	395.005	593.958	1014.165
QX	.003	.077	.375	.426	.178	.010	.000	.000	.000
QY	.009	.029	.033	.034	-.001	-.001	.000	.000	.000
LONGSHORE STATION	32								
Y	-20.452	-14.400	-6.957	8.750	109.649	255.101	395.007	593.958	1014.165
QX	.004	.086	.388	.480	.204	.016	.000	.000	.000
QY	.008	.026	.029	.030	-.001	-.001	.000	.000	.000
LONGSHORE STATION	33								
Y	-15.024	-4.827	6.165	25.718	125.137	256.289	395.008	593.958	1014.165
QX	.004	.097	.403	.513	.210	.016	.000	.000	.000
QY	.007	.022	.026	.028	-.001	.000	.000	.000	.000
LONGSHORE STATION	34								
Y	-10.889	3.541	13.248	40.763	138.389	157.322	395.010	593.958	1014.165
QX	.005	.103	.415	.556	.220	.16	.000	.000	.000
QY	.006	.017	.023	.021	-.001	.000	.000	.000	.000
LONGSHORE STATION	35								
Y	-7.703	13.472	23.080	53.400	150.141	257.713	395.011	593.958	1014.165
QX	.006	.105	.424	.585	.213	.013	.000	.000	.000
QY	.004	.014	.016	.021	-.001	.000	.000	.000	.000
LONGSHORE STATION	36								
Y	-5.309	18.114	28.503	61.430	153.337	257.702	395.011	593.958	1014.165
QX	.016	.113	.416	.614	.214	.011	.000	.000	.000
QY	.013	.010	.014	.011	-.001	.000	.000	.000	.000
LONGSHORE STATION	37								
Y	-3.680	22.644	38.930	77.434	157.336	257.701	395.011	593.958	1014.165
QX	.016	.113	.416	.614	.214	.011	.000	.000	.000
QY	.013	.010	.014	.011	-.001	.000	.000	.000	.000
LONGSHORE STATION	38								
Y	-2.490	27.174	49.217	97.538	157.334	257.701	395.011	593.958	1014.165
QX	.016	.113	.416	.614	.214	.011	.000	.	

QX	.005	.113	.492	.668	.238	.009	.000	.000	.000
QY	.001	.003	.005	.001	-.001	.000	.000	.000	.000
LONGSHORE STATION 41									
Y	-.674	29.164	62.125	94.265	168.750	256.801	395.009	593.958	1014.165
QX	.005	.113	.500	.677	.238	.009	.000	.000	.000
QY	.001	.002	.004	.001	.000	.000	.000	.000	.000
LONGSHORE STATION 42									
Y	-.423	30.062	63.998	97.904	168.711	256.728	395.009	593.958	1014.165
QX	.005	.113	.506	.686	.237	.009	.000	.000	.000
QY	.001	.002	.003	.001	.000	.000	.000	.000	.000
LONGSHORE STATION 43									
Y	-.259	30.696	65.384	101.000	168.487	256.678	395.009	593.958	1014.165
QX	.005	.113	.511	.693	.236	.009	.000	.000	.000
QY	.000	.001	.002	.000	.000	.000	.000	.000	.000
LONGSHORE STATION 44									
Y	-.155	31.140	66.402	103.645	168.188	256.645	395.009	593.958	1014.165
QX	.005	.113	.515	.700	.235	.008	.000	.000	.000
QY	.000	.001	.002	.000	.000	.000	.000	.000	.000
LONGSHORE STATION 45									
Y	-.089	31.446	67.142	105.921	167.878	256.621	395.009	593.958	1014.165
QX	.005	.114	.513	.705	.234	.008	.000	.000	.000
QY	.000	.000	.001	.000	.000	.000	.000	.000	.000
LONGSHORE STATION 46									
Y	-.050	31.653	67.673	107.896	167.589	256.605	395.009	593.958	1014.165
QX	.005	.114	.520	.710	.234	.008	.000	.000	.000
QY	.000	.000	.001	.000	.000	.000	.000	.000	.000
LONGSHORE STATION 47									
Y	-.027	31.783	68.046	109.634	167.330	256.593	395.009	593.958	1014.165
QX	.005	.114	.523	.714	.233	.008	.000	.000	.000
QY	.000	.000	.001	.000	.000	.000	.000	.000	.000
LONGSHORE STATION 48									
Y	-.012	31.899	68.310	111.134	167.093	256.583	395.009	593.958	1014.165
QX	.005	.114	.523	.717	.233	.008	.000	.000	.000
QY	.000	.000	.000	.000	.000	.000	.000	.000	.000
LONGSHORE STATION 49									
Y	-.004	31.992	68.539	112.708	166.861	256.573	395.009	593.958	1014.165
QX	.005	.114	.524	.718	.232	.008	.000	.000	.000
QY	.000	.000	.000	.000	.000	.000	.000	.000	.000
LONGSHORE STATION 50									
Y	.000	32.071	68.695	114.307	166.644	256.563	395.009	593.958	1014.165
QX	.005	.113	.526	.721	.232	.008	.000	.000	.000
QY	.000	.000	.000	.000	.000	.000	.000	.000	.000

A8

EXAMPLE 2 - INPUT

	50		8							
		10.000								
	1.000	2.000	3.000	4.000	5.000	7.000	10.000	15.000	25.000	32.803
	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
	30									
		3.000	.0500	.220						
3										
12	300.000									
25	300.000									
38	300.000									
	.0399									
	100.000	21600.000								
	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
0										
1	3.0	7.0	60.0	0						
2	3.0	7.0	60.0	0						
3	3.0	7.0	60.0	0						
4	3.0	7.0	60.0	0						
5	3.0	7.0	60.0	0						
6	3.0	7.0	60.0	0						
7	3.0	7.0	60.0	0						
8	3.0	7.0	60.0	0						
9	3.0	7.0	60.0	0						
10	3.0	7.0	60.0	0						
11	3.0	7.0	60.0	0						
12	3.0	7.0	60.0	0						
13	3.0	7.0	60.0	0						
14	3.0	7.0	60.0	0						
15	3.0	7.0	60.0	0						
16	3.0	7.0	60.0	0						
17	3.0	7.0	60.0	0						
18	3.0	7.0	60.0	0						
19	3.0	7.0	60.0	0						
20	3.0	7.0	60.0	0						
21	3.0	7.0	60.0	0						
22	3.0	7.0	60.0	0						
23	3.0	7.0	60.0	0						
24	3.0	7.0	60.0	0						
25	3.0	7.0	60.0	0						
26	3.0	7.0	60.0	0						
27	3.0	7.0	60.0	0						
28	3.0	7.0	60.0	0						
29	3.0	7.0	60.0	0						
30	3.0	7.0	60.0	0						
31	39.0	39.0	39.0	0						

EXAMPLE 2 - SPOOL: NONE

EXAMPLE 2 - OUTPUT

THE DEPTH (IN FT) WAVES TRANSFORMED TO, WDEPTH= 32.808

THE HEIGHT OF THE BERM, BERM= 3.000

THE SLOPE OF THE BEACH FACE, SFACE= .0500

THE SEDIMENT DIAMETER, DIAM= .220

THE LENGTH OF THE STRUCTURE, SJETTY= 300.000

THE LENGTH OF THE STRUCTURE, SJETTY= 300.000

THE LENGTH OF THE STRUCTURE, SJETTY= 300.000

THE NUMBER 1 GROIN IS LOCATED AT GRID 12

THE NUMBER 2 GROIN IS LOCATED AT GRID 25

THE NUMBER 3 GROIN IS LOCATED AT GRID 38

THE VALUE OF ADEAN= .0899 IN THE EQ. $H=AY^{2/3}$

THE VALUE OF THE LONGSHORE SPACE-STEP, DX= 100.000

THE TIME-STEP IN SECONDS, DELT= 21600.000

THE INITIAL SHORELINE COORDINATES :

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

THE BOUNDARY Y-VALUES, I=1,IMAX ARE AS FOLLOWS

.00	68.15	146.65	242.92	354.14	545.24	819.37	1639.55	3318.22	5764.97
.00	68.15	146.65	242.92	354.14	545.24	819.37	1639.55	3318.22	5764.97

THE DEPTHS BETWEEN CONTOURS ARE AS FOLLOWS

	1.00	2.00	3.00	4.00	5.00	7.00	10.00	15.00	25.00	32.81
--	------	------	------	------	------	------	-------	-------	-------	-------

1	3.0	7.0	60.0	0
2	3.0	7.0	60.0	0
3	3.0	7.0	60.0	0
4	3.0	7.0	60.0	0
5	3.0	7.0	60.0	0
6	3.0	7.0	60.0	0
7	3.0	7.0	60.0	0
8	3.0	7.0	60.0	0
9	3.0	7.0	60.0	0
10	3.0	7.0	60.0	0
11	3.0	7.0	60.0	0
12	3.0	7.0	60.0	0
13	3.0	7.0	60.0	0
14	3.0	7.0	60.0	0
15	3.0	7.0	60.0	0
16	3.0	7.0	60.0	0
17	3.0	7.0	60.0	0
18	3.0	7.0	60.0	0
19	3.0	7.0	60.0	0
20	3.0	7.0	60.0	0
21	3.0	7.0	60.0	0

22	3.0	7.0	60.0	0
23	3.0	7.0	60.0	0
24	3.0	7.0	60.0	0
25	3.0	7.0	60.0	0
26	3.0	7.0	60.0	0
27	3.0	7.0	60.0	0
28	3.0	7.0	60.0	0
29	3.0	7.0	60.0	0
30	3.0	7.0	60.0	0

THE TOTAL ELAPSED NUMBER OF TIME-STEPS, NUNIV= 30

LONGSHORE STATION 1

Y	.000	68.155	146.646	242.920	354.143	545.240	919.3671639	.5533318	.222
QX	.004	.106	.472	.659	.262	.012	.000	.000	.000
QY	.000	.000	.000	.000	.000	.000	.000	.000	.000

LONGSHORE STATION 2

Y	1.656	72.780	155.034	252.783	357.283	545.350	919.3671639	.5533318	.222
QX	.004	.106	.472	.659	.262	.012	.000	.000	.000
QY	-.001	-.003	-.004	-.001	.000	.000	.000	.000	.000

LONGSHORE STATION 3

Y	3.376	77.162	162.277	261.592	360.279	545.417	919.3671639	.5533318	.222
QX	.005	.104	.455	.644	.260	.012	.000	.000	.000
QY	-.001	-.006	-.007	.000	.001	.000	.000	.000	.000

LONGSHORE STATION 4

Y	5.254	81.491	169.080	269.782	363.081	545.410	919.3671639	.5533318	.222
QX	.005	.102	.448	.640	.255	.011	.000	.000	.000
QY	-.002	-.008	-.009	.000	.001	.000	.000	.000	.000

LONGSHORE STATION 5

Y	7.434	86.192	176.448	278.114	366.225	545.374	919.3671639	.5533318	.222
QX	.005	.100	.438	.635	.251	.011	.000	.000	.000
QY	-.003	-.011	-.012	-.001	.001	.000	.000	.000	.000

LONGSHORE STATION 6

Y	10.097	91.704	184.892	286.967	370.225	545.344	919.3671639	.5533318	.222
QX	.005	.098	.423	.627	.249	.011	.000	.000	.000
QY	-.004	-.013	-.015	-.001	.001	.000	.000	.000	.000

LONGSHORE STATION 7

Y	13.427	96.553	195.077	297.063	374.787	545.255	919.3671639	.5533318	.222
QX	.005	.096	.406	.616	.243	.011	.000	.000	.000
QY	-.005	-.017	-.018	-.001	.001	.000	.000	.000	.000

LONGSHORE STATION 8

Y	17.568	107.361	207.982	309.919	379.891	545.096	919.3671639	.5533318	.222
QX	.005	.095	.388	.610	.232	.010	.000	.000	.000
QY	-.005	-.022	-.022	-.001	.002	.001	.000	.000	.000

LONGSHORE STATION 9

Y	22.529	118.749	224.597	326.420	386.258	544.895	919.3671639	.5533318	.222
QX	.005	.093	.368	.616	.229	.011	.000	.000	.000
QY	-.006	-.028	-.027	-.001	.002	.001	.000	.000	.000

LONGSHORE STATION 10

Y	28.049	132.903	244.774	347.258	395.998	545.513	919.3721639	.5533318	.222
QX	.005	.091	.349	.593	.219	.012	.000	.000	.000
QY	-.007	-.037	-.033	-.006	.003	.001	.000	.000	.000

LONGSHORE STATION 11

Y	33.438	150.595	269.203	369.740	410.457	547.117	919.3721639	.5533318	.222
QX	.005	.091	.301	.632	.241	.021	.000	.000	.000
QY	-.007	-.049	-.040	-.004	.003	.001	.000	.000	.000

LONGSHORE STATION 12									
Y	37.105	166.364	291.059	388.628	427.770	548.818	919.3731639	.5533318	.222
Dr	.006	.091	.353	.524	.221	.022	.000	.000	.000
Qr	-.008	-.061	-.046	-.001	.003	.001	.000	.000	.000
LONGSHORE STATION 13									
Y	-24.708	15.548	86.456	349.719	423.819	548.919	919.3731639	.5533318	.222
Dr	.000	.000	.162	1.076	.286	.012	.000	.000	.000
Qr	.004	.028	.000	-.006	.001	.001	.000	.000	.000
LONGSHORE STATION 14									
Y	-23.891	15.392	72.875	246.700	380.615	547.224	919.3701639	.5533318	.222
Dr	.002	.031	.057	.003	.000	.000	.000	.000	.000
Qr	.004	.029	.022	-.004	-.001	.000	.000	.000	.000
LONGSHORE STATION 15									
Y	-22.565	15.505	66.466	184.606	331.924	544.968	919.3661639	.5533318	.222
Dr	.001	.028	.213	.598	.041	.000	.000	.000	.000
Qr	.004	.030	.028	-.001	-.001	.000	.000	.000	.000
LONGSHORE STATION 16									
Y	-21.043	18.437	70.503	177.230	302.357	542.853	919.3611639	.5533318	.222
Dr	.002	.043	.209	.467	.102	.001	.000	.000	.000
Qr	.004	.030	.027	-.001	.000	-.001	.000	.000	.000
LONGSHORE STATION 17									
Y	-16.048	26.500	91.464	173.219	285.548	540.833	919.3581639	.5533318	.222
Dr	.003	.063	.236	.435	.104	.001	.000	.000	.000
Qr	.003	.026	.024	.000	.000	-.001	.000	.000	.000
LONGSHORE STATION 18									
Y	-10.675	39.438	100.262	192.637	286.281	540.175	919.3571639	.5533318	.222
Dr	.005	.024	.234	.484	.153	.003	.000	.000	.000
Qr	.002	.018	.018	.004	.001	-.001	.000	.001	.000
LONGSHORE STATION 19									
Y	-4.340	55.032	124.130	215.565	305.461	541.537	919.3531639	.5533318	.222
Dr	.005	.091	.324	.548	.264	.024	.000	.000	.000
Qr	.001	.006	.009	.005	.001	-.001	.000	.000	.000
LONGSHORE STATION 20									
Y	2.519	71.143	148.696	240.136	329.987	543.600	919.3631639	.5533318	.222
Dr	.005	.093	.319	.511	.233	.022	.000	.000	.000
Qr	.000	-.001	.001	.005	.001	.000	.000	.000	.000
LONGSHORE STATION 21									
Y	8.814	87.018	172.311	263.303	352.828	545.152	919.3671639	.5533318	.222
Dr	.015	.133	.308	.512	.247	.022	.000	.000	.000
Qr	-.003	-.003	-.007	.005	.001	.000	.000	.000	.000
LONGSHORE STATION 22									
Y	16.904	103.172	196.441	286.699	373.603	546.119	919.3701639	.5533318	.222
Dr	.015	.137	.297	.511	.242	.021	.000	.000	.000
Qr	-.003	-.003	-.015	.006	.001	.000	.000	.000	.000
LONGSHORE STATION 23									
Y	21.839	121.345	221.471	313.078	392.329	547.278	919.3731639	.5533318	.222
Dr	.015	.135	.287	.510	.238	.021	.000	.000	.000
Qr	-.004	-.028	-.023	.000	.001	.001	.000	.000	.000
LONGSHORE STATION 24									
Y	31.344	141.057	252.313	341.194	411.131	548.712	919.3751639	.5533318	.222
Dr	.016	.079	.245	.577	.235	.025	.000	.000	.000
Qr	-.005	-.043	.033	.003	.001	.001	.000	.000	.000
LONGSHORE STATION 25									
Y	44.575	159.146	279.713	364.415	429.119	549.861	919.3781639	.5533318	.222
Dr	.016	.037	.211	.497	.224	.024	.000	.000	.000

QY	- .006	- .056	- .042	.012	.002	.001	.000	.000	.000
LONGSHORE STATION 26									
Y	-25.539	11.801	67.545	330.446	424.795	543.448	313.3741639	.5533318	.222
QX	.000	.000	.088	1.046	.288	.012	.000	.000	.000
QY	.005	.031	.001	- .006	.001	.001	.000	.000	.000
LONGSHORE STATION 27									
Y	-24.763	12.010	59.613	234.257	380.862	547.419	313.3711639	.5533318	.222
QX	.003	.037	.030	.002	.000	.000	.000	.000	.000
QY	.005	.032	.031	- .004	- .001	.000	.000	.000	.000
LONGSHORE STATION 28									
Y	-23.172	12.716	57.587	177.587	332.281	545.033	313.3661639	.5533318	.222
QX	.001	.031	.154	.607	.045	.000	.000	.000	.000
QY	.005	.032	.034	- .002	- .001	.000	.000	.000	.000
LONGSHORE STATION 29									
Y	-20.480	16.268	63.861	172.436	303.300	542.891	313.3611639	.5533318	.222
QX	.002	.044	.170	.446	.107	.001	.000	.000	.000
QY	.004	.031	.031	- .001	- .001	- .001	.000	.000	.000
LONGSHORE STATION 30									
Y	-16.333	24.877	76.556	175.336	286.555	540.932	313.3581639	.5533318	.222
QX	.004	.063	.211	.424	.105	.001	.000	.000	.000
QY	.004	.027	.027	.000	.000	- .001	.000	.000	.000
LONGSHORE STATION 31									
Y	-10.842	38.297	96.727	189.353	286.948	540.218	313.3571639	.5533318	.222
QX	.005	.084	.276	.473	.154	.003	.000	.000	.000
QY	.003	.019	.020	.004	.001	- .001	.000	.000	.000
LONGSHORE STATION 32									
Y	-4.423	54.294	121.729	212.637	305.806	541.581	313.3591639	.5533318	.222
QX	.005	.091	.311	.539	.266	.024	.000	.000	.000
QY	.001	.009	.011	.005	.001	.001	.000	.000	.000
LONGSHORE STATION 33									
Y	2.488	70.697	147.074	237.407	329.913	541.614	313.3631639	.5533318	.221
QX	.005	.093	.308	.505	.234	.022	.000	.000	.000
QY	.000	.000	.002	.006	.001	.000	.000	.000	.000
LONGSHORE STATION 34									
Y	9.610	86.777	171.300	260.626	352.297	545.166	313.3671639	.5533318	.222
QX	.005	.089	.298	.508	.248	.022	.000	.000	.000
QY	- .001	- .003	- .006	.007	.001	.001	.000	.000	.000
LONGSHORE STATION 35									
Y	16.910	103.198	195.997	293.927	372.961	546.018	313.3701639	.5533318	.221
QX	.005	.087	.287	.511	.243	.021	.000	.000	.000
QY	- .003	- .013	- .014	.008	.001	.001	.000	.000	.000
LONGSHORE STATION 36									
Y	23.906	120.930	222.648	310.243	391.982	547.015	313.3711639	.5533318	.221
QX	.005	.085	.276	.519	.238	.021	.000	.000	.000
QY	- .004	- .023	- .023	.009	.001	.001	.000	.000	.000
LONGSHORE STATION 37									
Y	30.349	141.588	253.952	317.641	410.204	548.027	313.3751639	.5533318	.221
QX	.006	.078	.230	.563	.315	.021	.000	.000	.000
QY	- .005	- .043	- .034	.013	.002	.001	.000	.000	.000
LONGSHORE STATION 38									
Y	34.573	153.473	281.630	360.057	428.410	549.900	313.3761639	.5533318	.221
QX	.006	.092	.295	.497	.222	.024	.000	.000	.000
QY	- .006	- .057	- .044	.018	.002	.001	.000	.000	.000
LONGSHORE STATION 39									
Y	-27.671	3.956	47.585	223.412	425.059	549.501	313.3751639	.5533318	.210

QX	.000	.000	.056	1.066	.283	.012	.000	.000	.000
QY	.006	.037	.001	-.006	.000	.001	.000	.000	.000
LONGSHORE STATION 40									
Y	-26.828	5.847	43.269	221.134	382.807	547.727	919.3721639	919.5513318	919.220
QX	.003	.066	.035	.001	.000	.000	.000	.000	.000
QY	.006	.036	.041	-.004	-.001	.000	.000	.000	.000
LONGSHORE STATION 41									
Y	-25.508	6.692	42.831	157.931	335.079	545.761	919.3681639	919.5513318	919.222
QX	.002	.030	.123	.571	.035	.000	.000	.000	.000
QY	.006	.036	.043	-.001	-.002	.000	.000	.000	.000
LONGSHORE STATION 42									
Y	-23.608	8.959	48.609	149.889	308.920	544.299	919.3651639	919.5513318	919.222
QX	.002	.051	.186	.467	.087	.000	.000	.000	.000
QY	.006	.036	.039	.000	-.002	-.001	.000	.000	.000
LONGSHORE STATION 43									
Y	-20.978	14.498	58.170	150.824	298.616	543.352	919.3621639	919.5513318	919.222
QX	.003	.066	.237	.465	.117	.001	.000	.000	.000
QY	.006	.033	.035	.000	-.001	-.001	.000	.000	.000
LONGSHORE STATION 44									
Y	-17.827	21.892	69.821	157.075	297.735	542.894	919.3611639	919.5513318	919.222
QX	.004	.076	.283	.486	.141	.003	.000	.000	.000
QY	.006	.028	.031	.001	-.001	-.001	.000	.000	.000
LONGSHORE STATION 45									
Y	-14.473	30.015	82.445	167.071	302.534	542.863	919.3611639	919.5513318	919.222
QX	.004	.085	.324	.498	.159	.004	.000	.000	.000
QY	.005	.024	.026	.001	-.001	-.001	.000	.000	.000
LONGSHORE STATION 46									
Y	-11.178	38.179	95.317	179.720	311.133	541.199	919.3621639	919.5513318	919.222
QX	.005	.093	.358	.513	.179	.006	.000	.000	.000
QY	.004	.019	.021	.001	-.001	-.001	.000	.000	.000
LONGSHORE STATION 47									
Y	-8.094	45.946	107.906	194.321	322.548	541.343	919.3641639	919.5513318	919.221
QX	.005	.098	.388	.529	.199	.008	.000	.000	.000
QY	.004	.014	.016	.001	-.001	-.001	.000	.000	.000
LONGSHORE STATION 48									
Y	-5.249	53.266	119.949	209.648	334.622	544.542	919.3651639	919.5513318	919.221
QX	.005	.101	.409	.544	.220	.011	.000	.000	.000
QY	.002	.010	.012	.007	-.001	.000	.000	.000	.000
LONGSHORE STATION 49									
Y	-2.578	60.564	132.496	225.519	345.066	544.691	919.3661639	919.5513318	919.221
QX	.005	.105	.417	.542	.229	.010	.000	.000	.000
QY	.001	.005	.006	.000	.000	.000	.000	.000	.000
LONGSHORE STATION 50									
Y	.000	68.155	146.646	242.920	354.143	545.240	919.3671639	919.5513318	919.221
QX	.005	.108	.446	.574	.235	.011	.000	.000	.000
QY	.000	.000	.000	.000	.000	.000	.000	.000	.000

A 15

EXAMPLE 3 - INPUT

50	8								
	10.000								
1.000	2.000	3.000	5.000	7.000	11.000	14.000	17.000	25.000	32.808
.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
30									
	5.000	.0500	.220						
1									
3	.000								
	.1500								
200.000	21600.000								
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
0									
1	3.0	7.0	.0	0					
2	3.0	7.0	.0	0					
3	3.0	7.0	.0	0					
4	3.0	7.0	.0	0					
5	3.0	7.0	.0	1					
6	3.0	7.0	.0	0					
7	3.0	7.0	.0	0					
8	3.0	7.0	.0	0					
9	3.0	7.0	.0	0					
10	3.0	7.0	.0	0					
11	3.0	7.0	.0	0					
12	3.0	7.0	.0	0					
13	3.0	7.0	.0	0					
14	3.0	7.0	.0	0					
15	3.0	7.0	.0	0					
16	3.0	7.0	.0	0					
17	3.0	7.0	.0	0					
18	3.0	7.0	.0	0					
19	3.0	7.0	.0	0					
20	3.0	7.0	.0	0					
21	3.0	7.0	.0	0					
22	3.0	7.0	.0	0					
23	3.0	7.0	.0	0					
24	3.0	7.0	.0	0					
25	3.0	7.0	.0	0					
26	3.0	7.0	.0	0					
27	3.0	7.0	.0	0					
28	3.0	7.0	.0	0					
29	3.0	7.0	.0	0					
30	3.0	7.0	.0	0					
31	33.0	33.0	33.0	0					

EXAMPLE 3 - SPOOL

13	5	10.40
14	5	20.80
15	5	31.20
16	5	41.70
17	5	52.10
18	5	62.50
19	5	72.90
20	5	83.30
21	5	93.70
22	5	104.10
23	5	114.60
24	5	125.00
25	5	135.40
26	5	145.80
27	5	156.20
28	5	166.60
29	5	177.00
30	5	187.40
31	5	197.80
32	5	208.20
33	5	218.60
34	5	229.00
35	5	239.40
36	5	249.80
37	5	260.20
38	5	270.60
39	5	281.00
40	5	291.40
41	5	301.80
42	5	312.20
43	5	322.60
44	5	333.00
45	5	343.40
46	5	353.80
47	5	364.20
48	5	374.60
49	5	385.00
50	5	395.40
51	5	405.80
52	5	416.20
53	5	426.60
54	5	437.00
55	5	447.40
56	5	457.80
57	5	468.20
58	5	478.60
59	5	489.00
60	5	499.40
61	5	509.80
62	5	520.20
63	5	530.60
64	5	541.00
65	5	551.40
66	5	561.80
67	5	572.20
68	5	582.60
69	5	593.00
70	5	603.40
71	5	613.80
72	5	624.20
73	5	634.60
74	5	645.00
75	5	655.40
76	5	665.80
77	5	676.20
78	5	686.60
79	5	697.00
80	5	707.40
81	5	717.80
82	5	728.20
83	5	738.60
84	5	749.00
85	5	759.40
86	5	769.80
87	5	780.20
88	5	790.60
89	5	801.00
90	5	811.40
91	5	821.80
92	5	832.20
93	5	842.60
94	5	853.00
95	5	863.40
96	5	873.80
97	5	884.20
98	5	894.60
99	5	905.00
100	5	915.40
101	5	925.80
102	5	936.20
103	5	946.60
104	5	957.00
105	5	967.40
106	5	977.80
107	5	988.20
108	5	998.60
109	5	1009.00
110	5	1019.40
111	5	1029.80
112	5	1040.20
113	5	1050.60
114	5	1061.00
115	5	1071.40
116	5	1081.80
117	5	1092.20
118	5	1102.60
119	5	1113.00
120	5	1123.40
121	5	1133.80
122	5	1144.20
123	5	1154.60
124	5	1165.00
125	5	1175.40
126	5	1185.80
127	5	1196.20
128	5	1206.60
129	5	1217.00
130	5	1227.40
131	5	1237.80
132	5	1248.20
133	5	1258.60
134	5	1269.00
135	5	1279.40
136	5	1289.80
137	5	1300.20
138	5	1310.60
139	5	1321.00
140	5	1331.40
141	5	1341.80
142	5	1352.20
143	5	1362.60
144	5	1373.00
145	5	1383.40
146	5	1393.80
147	5	1404.20
148	5	1414.60
149	5	1425.00
150	5	1435.40
151	5	1445.80
152	5	1456.20
153	5	1466.60
154	5	1477.00
155	5	1487.40
156	5	1497.80
157	5	1508.20
158	5	1518.60
159	5	1529.00
160	5	1539.40
161	5	1549.80
162	5	1560.20
163	5	1570.60
164	5	1581.00
165	5	1591.40
166	5	1601.80
167	5	1612.20
168	5	1622.60
169	5	1633.00
170	5	1643.40
171	5	1653.80
172	5	1664.20
173	5	1674.60
174	5	1685.00
175	5	1695.40
176	5	1705.80
177	5	1716.20
178	5	1726.60
179	5	1737.00
180	5	1747.40
181	5	1757.80
182	5	1768.20
183	5	1778.60
184	5	1789.00
185	5	1799.40
186	5	1809.80
187	5	1820.20
188	5	1830.60
189	5	1841.00
190	5	1851.40
191	5	1861.80
192	5	1872.20
193	5	1882.60
194	5	1893.00
195	5	1903.40
196	5	1913.80
197	5	1924.20
198	5	1934.60
199	5	1945.00
200	5	1955.40
201	5	1965.80
202	5	1976.20
203	5	1986.60
204	5	1997.00
205	5	2007.40
206	5	2017.80
207	5	2028.20
208	5	2038.60
209	5	2049.00
210	5	2059.40
211	5	2069.80
212	5	2080.20
213	5	2090.60
214	5	2101.00
215	5	2111.40
216	5	2121.80
217	5	2132.20
218	5	2142.60
219	5	2153.00
220	5	2163.40
221	5	2173.80
222	5	2184.20
223	5	2194.60
224	5	2205.00
225	5	2215.40
226	5	2225.80
227	5	2236.20
228	5	2246.60
229	5	2257.00
230	5	2267.40
231	5	2277.80
232	5	2288.20
233	5	2298.60
234	5	2309.00
235	5	2319.40
236	5	2329.80
237	5	2340.20
238	5	2350.60
239	5	2361.00
240	5	2371.40
241	5	2381.80
242	5	2392.20
243	5	2402.60
244	5	2413.00
245	5	2423.40
246	5	2433.80
247	5	2444.20
248	5	2454.60
249	5	2465.00
250	5	2475.40
251	5	2485.80
252	5	2496.20
253	5	2506.60
254	5	2517.00
255	5	2527.40
256	5	2537.80
257	5	2548.20
258	5	2558.60
259	5	2569.00
260	5	2579.40
261	5	2589.80
262	5	2600.20
263	5	2610.60
264	5	2621.00
265	5	2631.40
266	5	2641.80
267	5	2652.20
268	5	2662.60
269	5	2673.00
270	5	2683.40
271	5	2693.80
272	5	2704.20
273	5	2714.60
274	5	2725.00
275	5	2735.40
276	5	2745.80
277	5	2756.20
278	5	2766.60
279	5	2777.00
280	5	2787.40
281	5	2797.80
282	5	2808.20
283	5	2818.60
284	5	2829.00
285	5	2839.40
286	5	2849.80
287	5	2860.20
288	5	2870.60
289	5	2881.00
290	5	2891.40
291	5	2901.80
292	5	2912.20
293	5	2922.60
294	5	2933.00
295	5	2943.40
296	5	2953.80
297	5	2964.20
298	5	2974.60
299	5	2985.00
300	5	2995.40
301	5	3005.80
302	5	3016.20
303	5	3026.60
304	5	3037.00
305	5	3047.40
306	5	3057.80
307	5	3068.20
308	5	3078.60
309	5	3089.00
310	5	3099.40
311	5	3109.80
312	5	3120.20
313	5	3130.60
314	5	3141.00
315	5	3151.40
316	5	3161.80
317	5	3172.20
318	5	3182.60
319	5	3193.00
320	5	3203.40
321	5	3213.80
322	5	3224.20
323	5	3234.60
324	5	3245.00
325	5	3255.40
326	5	3265.80
327	5	3276.20
328	5	3286.60
329	5	3297.00
330	5	3307.40
331	5	3317.80
332	5	3328.20
333	5	3338.60
334	5	3349.00
335	5	3359.40
336	5	3369.80
337	5	3380.20
338	5	3390.60
339	5	3401.00
340	5	3411.40
341	5	3421.80
342	5	3432.20
343	5	3442.60
344	5	3453.00
345	5	3463.40
346	5	3473.80
347	5	3484.20
348	5	3494.60
349	5	3505.00
350	5	3515.40
351	5	3525.80
352	5	3536.20
353	5	3546.60
354	5	3557.00
355	5	3567.40
356	5	3577.80
357	5	3588.20
358	5	3598.60
359	5	3609.00
360	5	3619.40
361	5	3629.80
362	5	3640.20
363	5	3650.60
364	5	3661.00
365	5	3671.40
366	5	3681.80
367	5	3692.20
368	5	3702.60
369	5	3713.00
370	5	3723.40
371	5	3733.80
372	5	3744.20
373	5	3754.60
374	5	3765.00
375	5	3775.40
376	5	3785.80
377	5	3796.20
378	5	3806.60
379	5	3817.00
380	5	3827.40
381	5	3837.80
382	5	3848.20
383	5	3858.60
384	5	3869.00
385	5	3879.40
386	5	3889.80
387	5	3900.20
388	5	3910.60
389	5	3921.00
390	5	3931.40
391	5	3941.80
392	5	3952.20
393	5	3962.60
394	5	3973.00
395	5	3983.40
396	5	3993.80
397	5	4004.20
398	5	4014.60
399	5	4025.00
400	5	4035.40
401	5	4045.80
402	5	4056.20
403	5	4066.60
404	5	4077.00
405	5	4087.40
406	5	4097.80
407	5	4108.20
408	5	4118.60
409	5	4129.00
410	5	4139.40
411	5	4149.80
412	5	4160.20
413	5	4170.60
414	5	4181.00
415	5	4191.40

EXAMPLE 3 - OUTPUT

THE DEPTH (IN FT) WAVES TRANSFORMED TO, WDEPTH= 32.808

THE HEIGHT OF THE BERM, BERM= 5.000

THE SLOPE OF THE BEACH FACE, SFACE= .0500

THE SEDIMENT DIAMETER, DIAM= .220

THE LENGTH OF THE STRUCTURE, SJETTY= .000

THE NUMBER 1 GROIN IS LOCATED AT GRID 3

THE VALUE OF ADEAN= .1500 IN THE EQ. $H=AY^{2/3}$

THE VALUE OF THE LONGSHORE SPACE-STEP, DX= 200.000

THE TIME-STEP IN SECONDS, DELT= 21600.000

THE INITIAL SHORELINE COORDINATES :

.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

THE BOUNDARY Y-VALUES, I=1,IMAX ARE AS FOLLOWS

.00	31.62	68.04	137.71	252.98	464.76	760.73	1050.41	1656.50	2674.85
.00	31.62	68.04	137.71	252.98	464.76	760.73	1050.41	1656.50	2674.85

THE DEPTHS BETWEEN CONTOURS ARE AS FOLLOWS

1.00	2.00	3.00	5.00	7.00	11.00	14.00	17.00	25.00	32.81
------	------	------	------	------	-------	-------	-------	-------	-------

1	3.0	7.0	.0	0
2	3.0	7.0	.0	0
3	3.0	7.0	.0	0
4	3.0	7.0	.0	0
5	3.0	7.0	.0	1

DREDGED MATERIAL ADDED AT TIME 5

CONTOURS AFTER MATERIAL ADDITION AT TIME

SAFE:

1	.000	31.623	68.041	137.706	252.982	464.753	760.728	1050.414
2	.000	31.623	68.041	137.706	252.982	464.753	760.728	1050.414
3	.000	31.623	68.041	137.706	252.982	464.753	760.728	1050.414
4	.000	31.623	68.041	137.706	252.982	464.753	760.728	1050.414
5	.000	31.623	68.041	137.706	252.982	464.753	760.728	1050.414
6	.000	31.623	68.041	137.706	252.982	464.753	760.728	1050.414
7	.000	31.623	68.041	137.706	252.982	464.753	760.728	1050.414
8	.000	31.623	68.041	137.706	252.982	464.753	760.728	1050.414
9	.000	31.623	68.041	137.706	252.982	464.753	760.728	1050.414
10	.000	31.623	68.041	137.706	252.982	464.753	760.728	1050.414
11	.000	31.623	68.041	137.706	252.982	464.753	760.728	1050.414
12	.000	31.623	68.041	137.706	252.982	464.753	760.728	1050.414
13	.000	31.623	68.041	137.706	252.982	464.753	760.728	1050.414
14	.000	31.623	68.041	137.706	252.982	464.753	760.728	1050.414
15	.000	31.623	68.041	137.706	252.982	464.753	760.728	1050.414
16	.000	31.623	68.041	137.706	252.982	464.753	760.728	1050.414
17	.000	31.623	68.041	137.706	252.982	464.753	760.728	1050.414
18	.000	31.623	68.041	137.706	252.982	464.753	760.728	1050.414

19	.000	31.623	68.041	137.706	325.882	561.958	760.726	1050.414
20	.000	31.623	68.041	137.706	336.282	575.858	760.726	1050.414
21	.000	31.623	68.041	137.706	346.682	589.758	760.726	1050.414
22	.000	31.623	68.041	137.706	357.082	603.658	760.726	1050.414
23	.000	31.623	68.041	137.706	367.582	617.458	760.726	1050.414
24	.000	31.623	68.041	137.706	377.982	631.358	760.726	1050.414
25	.000	31.623	68.041	137.706	388.382	645.258	760.726	1050.414
26	.000	31.623	68.041	137.706	398.782	659.158	760.726	1050.414
27	.000	31.623	68.041	137.706	388.382	645.258	760.726	1050.414
28	.000	31.623	68.041	137.706	377.982	631.358	760.726	1050.414
29	.000	31.623	68.041	137.706	367.582	617.458	760.726	1050.414
30	.000	31.623	68.041	137.706	357.082	603.658	760.726	1050.414
31	.000	31.623	68.041	137.706	346.682	589.758	760.726	1050.414
32	.000	31.623	68.041	137.706	336.282	575.858	760.726	1050.414
33	.000	31.623	68.041	137.706	325.882	561.958	760.726	1050.414
34	.000	31.623	68.041	137.706	315.482	548.058	760.726	1050.414
35	.000	31.623	68.041	137.706	305.082	534.158	760.726	1050.414
36	.000	31.623	68.041	137.706	294.682	520.258	760.726	1050.414
37	.000	31.623	68.041	137.706	284.182	506.458	760.726	1050.414
38	.000	31.623	68.041	137.706	273.782	492.558	760.726	1050.414
39	.000	31.623	68.041	137.706	263.382	478.658	760.726	1050.414
40	.000	31.623	68.041	137.706	252.982	464.758	760.726	1050.414
41	.000	31.623	68.041	137.706	252.982	464.758	760.726	1050.414
42	.000	31.623	68.041	137.706	252.982	464.758	760.726	1050.414
43	.000	31.623	68.041	137.706	252.982	464.758	760.726	1050.414
44	.000	31.623	68.041	137.706	252.982	464.758	760.726	1050.414
45	.000	31.623	68.041	137.706	252.982	464.758	760.726	1050.414
46	.000	31.623	68.041	137.706	252.982	464.758	760.726	1050.414
47	.000	31.623	68.041	137.706	252.982	464.758	760.726	1050.414
48	.000	31.623	68.041	137.706	252.982	464.758	760.726	1050.414
49	.000	31.623	68.041	137.706	252.982	464.758	760.726	1050.414
50	.000	31.623	68.041	137.706	252.982	464.758	760.726	1050.414
6	3.0	7.0	.0	.0				
7	3.0	7.0	.0	.0				
8	3.0	7.0	.0	.0				
9	3.0	7.0	.0	.0				
10	3.0	7.0	.0	.0				
11	3.0	7.0	.0	.0				
12	3.0	7.0	.0	.0				
13	3.0	7.0	.0	.0				
14	3.0	7.0	.0	.0				
15	3.0	7.0	.0	.0				
16	3.0	7.0	.0	.0				
17	3.0	7.0	.0	.0				
18	3.0	7.0	.0	.0				
19	3.0	7.0	.0	.0				
20	3.0	7.0	.0	.0				
21	3.0	7.0	.0	.0				
22	3.0	7.0	.0	.0				
23	3.0	7.0	.0	.0				
24	3.0	7.0	.0	.0				
25	3.0	7.0	.0	.0				
26	3.0	7.0	.0	.0				
27	3.0	7.0	.0	.0				
28	3.0	7.0	.0	.0				

29 3.0 7.0 .0 0
 30 3.0 7.0 .0 0
 THE TOTAL ELAPSED NUMBER OF TIME-STEPS, NUNIU= 30

LONGSHORE STATION 1									
Y	.000	31.623	68.041	137.706	252.982	464.758	760.7261050	.4141656	.502
QX	.000	.000	.000	.012	-.001	.000	.000	.000	.000
OY	.000	.000	.000	.000	.000	.000	.000	.000	.000
LONGSHORE STATION 2									
Y	-.021	31.523	67.799	137.283	253.156	464.789	760.7261050	.4141656	.502
QX	.000	.000	.000	.012	-.001	.000	.000	.000	.000
OY	.000	.000	.000	.000	.000	.000	.000	.000	.000
LONGSHORE STATION 3									
Y	-.044	31.417	67.559	136.861	253.377	464.847	760.7261050	.4141656	.502
QX	.000	.000	.001	.014	-.002	.000	.000	.000	.000
OY	.000	.000	.001	.001	.000	.000	.000	.000	.000
LONGSHORE STATION 4									
Y	-.071	31.302	67.308	136.428	253.703	464.970	760.7261050	.4141656	.502
QX	.000	.000	.001	.015	-.002	.000	.000	.000	.000
OY	.000	.000	.001	.001	.000	.000	.000	.000	.000
LONGSHORE STATION 5									
Y	-.102	31.175	67.036	135.975	254.202	465.225	760.7271050	.4141656	.502
QX	.000	.000	.001	.018	-.003	.000	.000	.000	.000
OY	.000	.001	.001	.001	.000	.000	.000	.000	.000
LONGSHORE STATION 6									
Y	-.138	31.036	66.749	135.512	254.959	465.715	760.7271050	.4141656	.502
QX	.000	.000	.002	.021	-.005	.000	.000	.000	.000
OY	.000	.001	.001	.002	.000	.000	.000	.000	.000
LONGSHORE STATION 7									
Y	-.177	30.891	66.458	135.060	256.075	466.584	760.7291050	.4141656	.502
QX	.000	.000	.002	.025	-.007	.000	.000	.000	.000
OY	.000	.001	.002	.002	.000	.000	.000	.000	.000
LONGSHORE STATION 8									
Y	-.216	30.750	66.185	134.651	257.666	468.063	760.7311050	.4141656	.502
QX	.000	.000	.003	.030	-.010	.000	.000	.000	.000
OY	.000	.001	.002	.002	.000	.000	.000	.000	.000
LONGSHORE STATION 9									
Y	-.252	30.629	65.958	134.327	259.855	470.165	760.7351050	.4141656	.502
QX	.000	.000	.003	.035	-.013	.000	.000	.000	.000
OY	.000	.001	.002	.003	.000	.000	.000	.000	.000
LONGSHORE STATION 10									
Y	-.278	30.542	65.806	134.132	262.759	473.751	760.7411050	.4141656	.502
QX	.000	.000	.004	.040	-.017	.000	.000	.000	.000
OY	.000	.002	.002	.003	-.001	.000	.000	.000	.000
LONGSHORE STATION 11									
Y	-.292	30.505	65.758	134.109	266.475	478.447	760.7481050	.4141656	.502
QX	.000	.000	.005	.046	-.021	.000	.000	.000	.000
OY	.000	.002	.002	.003	-.001	.000	.000	.000	.000
LONGSHORE STATION 12									
Y	-.290	30.531	65.837	134.292	271.065	484.609	760.7561050	.4141656	.502
QX	.000	.000	.005	.051	-.026	.000	.000	.000	.000
OY	.000	.002	.002	.002	-.001	.000	.000	.000	.000
LONGSHORE STATION 13									
Y	-.269	30.623	66.057	134.702	276.542	492.292	760.7721050	.4141656	.502
QX	.000	.001	.006	.056	-.030	.000	.000	.000	.000

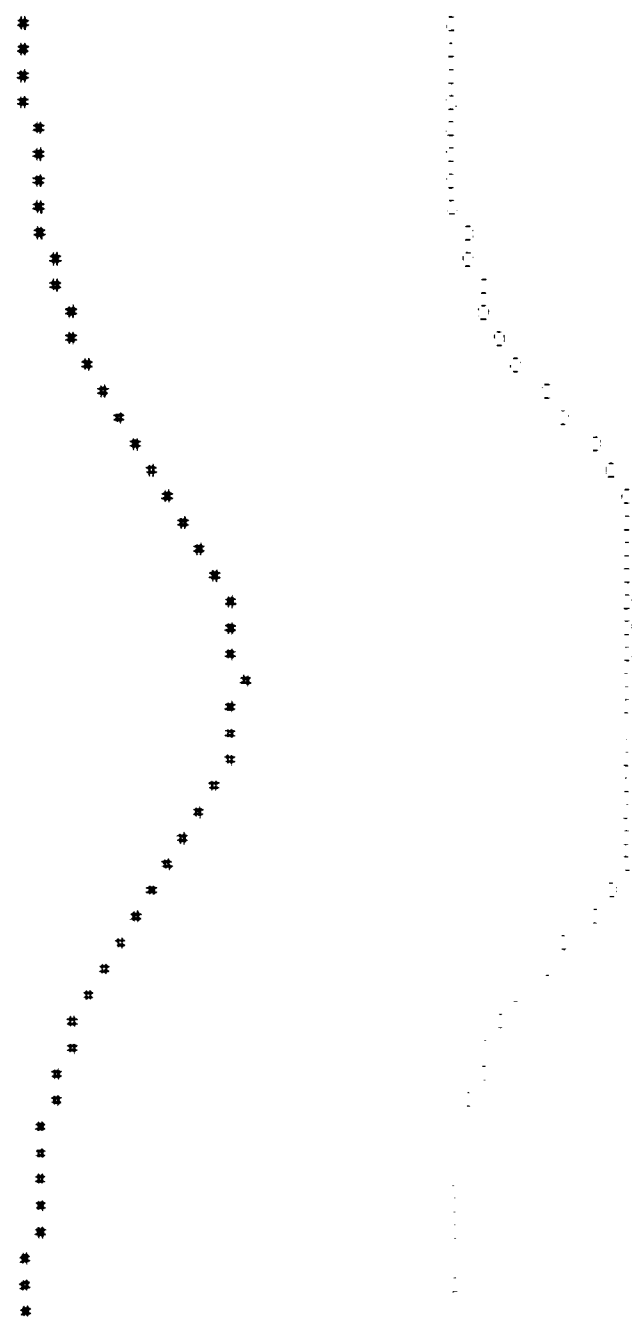
N-1

QY	.000	.001	.002	.002	-.001	.000	.000	.000	.000
LONGSHORE STATION 14									
Y	-.229	30.791	66.421	135.343	282.868	501.438	760.787	1050.414	1656.502
QX	.000	.001	.007	.060	-.034	.000	.000	.000	.000
QY	.000	.001	.002	.002	-.002	.000	.000	.000	.000
LONGSHORE STATION 15									
Y	-.171	31.024	66.924	136.206	289.952	511.883	760.805	1050.414	1656.502
QX	.000	.001	.007	.064	-.038	.000	.000	.000	.000
QY	.000	.001	.001	.001	-.002	.000	.000	.000	.000
LONGSHORE STATION 16									
Y	-.098	31.317	67.551	137.267	297.654	523.385	760.824	1050.414	1656.502
QX	.000	.001	.008	.066	-.041	.000	.000	.000	.000
QY	.000	.000	.000	.000	-.002	.000	.000	.000	.000
LONGSHORE STATION 17									
Y	-.013	31.663	68.286	138.496	305.796	535.654	760.845	1050.414	1656.502
QX	.000	.001	.008	.067	-.044	.000	.000	.000	.000
QY	.000	.000	.000	-.001	-.003	.000	.000	.000	.000
LONGSHORE STATION 18									
Y	.084	32.050	69.104	139.855	314.168	548.378	760.866	1050.414	1656.502
QX	.000	.001	.008	.067	-.045	.000	.000	.000	.000
QY	.000	-.001	-.001	-.002	-.003	.000	.000	.000	.000
LONGSHORE STATION 19									
Y	.189	32.467	69.981	141.298	322.534	561.226	760.888	1050.414	1656.502
QX	.000	.001	.008	.064	-.045	.000	.000	.000	.000
QY	.000	-.001	-.002	-.003	-.003	.000	.000	.000	.000
LONGSHORE STATION 20									
Y	.299	32.901	70.884	142.774	330.833	573.839	760.909	1050.414	1656.502
QX	.000	.001	.007	.060	-.043	.000	.000	.000	.000
QY	-.001	-.002	-.003	-.004	-.004	-.001	.000	.000	.000
LONGSHORE STATION 21									
Y	.411	33.334	71.776	144.220	339.188	585.807	760.928	1050.414	1656.502
QX	.000	.001	.007	.055	-.040	.000	.000	.000	.000
QY	-.001	-.003	-.004	-.006	-.004	-.001	.000	.000	.000
LONGSHORE STATION 22									
Y	.519	33.742	72.611	145.561	344.910	596.661	760.948	1050.414	1656.502
QX	.000	.001	.006	.047	-.035	.000	.000	.000	.000
QY	-.001	-.003	-.005	-.007	-.004	-.001	.000	.000	.000
LONGSHORE STATION 23									
Y	.619	34.100	73.336	146.718	350.513	605.882	760.968	1050.414	1656.502
QX	.000	.001	.005	.038	-.028	.000	.000	.000	.000
QY	-.001	-.004	-.006	-.007	-.004	-.001	.000	.000	.000
LONGSHORE STATION 24									
Y	.691	34.381	73.899	147.611	354.731	612.843	760.979	1050.414	1656.502
QX	.000	.001	.004	.028	-.022	.000	.000	.000	.000
QY	-.001	-.004	-.006	-.008	-.005	-.001	.000	.000	.000
LONGSHORE STATION 25									
Y	.740	34.559	74.294	148.171	357.355	617.401	760.989	1050.414	1656.502
QX	.000	.000	.002	.017	-.014	.000	.000	.000	.000
QY	-.001	-.004	-.007	-.009	-.005	-.001	.000	.000	.000
LONGSHORE STATION 26									
Y	.756	34.618	74.371	148.294	358.244	618.323	760.995	1050.414	1656.502
QX	.000	.000	.001	.005	-.005	.000	.000	.000	.000
QY	-.001	-.004	-.007	-.008	-.005	-.001	.000	.000	.000
LONGSHORE STATION 27									
Y	.738	34.552	74.213	148.143	357.143	617.401	760.989	1050.414	1656.502

OX	.000	.000	-.001	-.007	.004	.000	.000	.000	.000
OY	-.001	-.004	-.007	-.008	-.005	-.001	.001	.000	.000
LONGSHORE STATION 28									
Y	.688	34.368	73.868	147.556	354.720	612.349	760.375	1050.414	1656.502
OX	.000	.000	-.002	-.018	.013	.000	.000	.000	.000
OY	-.001	-.004	-.006	-.008	-.005	-.001	.001	.000	.000
LONGSHORE STATION 29									
Y	.610	34.082	73.293	146.642	350.497	605.882	760.362	1050.414	1656.502
OX	.000	.000	-.004	-.029	.022	.000	.000	.000	.000
OY	-.001	-.004	-.006	-.007	-.004	-.001	.001	.000	.000
LONGSHORE STATION 30									
Y	.514	33.720	72.559	145.470	344.893	596.661	760.348	1050.414	1656.502
OX	.000	-.001	-.005	-.039	.029	.000	.000	.000	.000
OY	-.001	-.003	-.005	-.006	-.004	-.001	.000	.000	.000
LONGSHORE STATION 31									
Y	.406	33.309	71.719	144.120	338.170	585.807	760.329	1050.414	1656.502
OX	.000	-.001	-.006	-.048	.035	.000	.000	.000	.000
OY	-.001	-.003	-.004	-.005	-.004	-.001	.000	.000	.000
LONGSHORE STATION 32									
Y	.284	32.875	70.824	142.671	330.814	573.339	760.309	1050.414	1656.502
OX	.000	-.001	-.007	-.055	.040	.000	.000	.000	.000
OY	-.001	-.002	-.003	-.004	-.004	-.001	.000	.000	.000
LONGSHORE STATION 33									
Y	.183	32.442	69.921	141.196	322.514	561.228	760.286	1050.414	1656.502
OX	.000	-.001	-.007	-.061	.043	.000	.000	.000	.000
OY	.000	-.001	-.002	-.003	-.003	.000	.000	.000	.000
LONGSHORE STATION 34									
Y	.078	32.025	69.047	139.757	314.149	549.173	760.260	1050.414	1656.502
OX	.000	-.001	-.008	-.065	.044	.000	.000	.000	.000
OY	.000	-.001	-.001	-.002	-.003	.000	.000	.000	.000
LONGSHORE STATION 35									
Y	-.012	31.640	68.232	138.406	305.777	535.453	760.248	1050.414	1656.502
OX	.000	-.001	-.008	-.067	.045	.000	.000	.000	.000
OY	.000	.000	.000	-.001	-.003	.000	.000	.000	.000
LONGSHORE STATION 36									
Y	-.103	31.296	67.504	137.133	297.636	521.034	760.224	1050.414	1656.502
OX	.000	-.001	-.008	-.067	.044	.000	.000	.000	.000
OY	.000	.000	.000	.000	.000	.000	.000	.000	.000
LONGSHORE STATION 37									
Y	-.175	31.006	66.883	136.141	289.035	511.111	760.205	1050.414	1656.502
OX	.000	-.001	-.008	-.068	.041	.000	.000	.000	.000
OY	.000	.001	.001	.001	-.002	.000	.000	.000	.000
LONGSHORE STATION 38									
Y	-.232	30.777	66.000	135.109	280.354	501.463	760.201	1050.414	1656.502
OX	.000	-.001	-.007	-.064	.036	.000	.000	.000	.000
OY	.000	.001	.000	.000	.000	.000	.000	.000	.000
LONGSHORE STATION 39									
Y	-.271	30.616	65.137	134.075	276.511	492.102	760.273	1050.414	1656.502
OX	.000	-.001	-.007	-.060	.034	.000	.000	.000	.000
OY	.000	.001	.002	.002	-.001	.000	.000	.000	.000
LONGSHORE STATION 40									
Y	-.291	30.527	65.327	134.077	271.157	484.617	760.253	1050.414	1656.502
OX	.000	-.001	-.006	-.058	.037	.000	.000	.000	.000
OY	.000	.002	.002	.002	-.004	.000	.000	.000	.000
LONGSHORE STATION 41									

Y	-.292	30.506	65.763	134.127	266.472	479.447	760.743	1050.414	1356.502
QX	.000	-.001	-.005	-.051	.026	.000	.000	.000	.000
QY	.000	.002	.002	.003	-.001	.000	.000	.000	.000
LONGSHORE STATION 42									
Y	-.277	30.548	65.824	134.173	262.760	473.751	760.741	1050.414	1356.502
QX	.000	.000	-.005	-.045	.021	.000	.000	.000	.000
QY	.000	.002	.002	.003	-.001	.000	.000	.000	.000
LONGSHORE STATION 43									
Y	-.243	30.640	65.989	134.393	259.858	470.365	760.735	1050.414	1356.502
QX	.000	.000	-.004	-.040	.017	.000	.000	.000	.000
QY	.000	.001	.002	.003	.000	.000	.000	.000	.000
LONGSHORE STATION 44									
Y	-.213	30.767	66.230	134.744	257.670	468.063	760.731	1050.414	1356.502
QX	.000	.000	-.003	-.035	.013	.000	.000	.000	.000
QY	.000	.001	.002	.002	.000	.000	.000	.000	.000
LONGSHORE STATION 45									
Y	-.173	30.914	66.519	135.183	256.076	466.594	760.729	1050.414	1356.502
QX	.000	.000	-.003	-.030	.010	.000	.000	.000	.000
QY	.000	.001	.002	.002	.000	.000	.000	.000	.000
LONGSHORE STATION 46									
Y	-.132	31.066	66.830	135.673	254.952	465.715	760.727	1050.414	1356.502
QX	.000	.000	-.002	-.026	.007	.000	.000	.000	.000
QY	.000	.001	.001	.002	.000	.000	.000	.000	.000
LONGSHORE STATION 47									
Y	-.094	31.216	67.144	136.183	254.180	465.324	760.727	1050.414	1356.502
QX	.000	.000	-.002	-.022	.005	.000	.000	.000	.000
QY	.000	.001	.001	.001	.000	.000	.000	.000	.000
LONGSHORE STATION 48									
Y	-.060	31.359	67.452	136.695	253.654	464.966	760.728	1050.414	1356.502
QX	.000	.000	-.001	-.020	.004	.000	.000	.000	.000
QY	.000	.000	.001	.001	.000	.000	.000	.000	.000
LONGSHORE STATION 49									
Y	-.029	31.493	67.750	137.202	253.281	464.635	760.719	1050.414	1356.502
QX	.000	.000	-.001	-.018	.003	.000	.000	.000	.000
QY	.000	.000	.000	.000	.000	.000	.000	.000	.000
LONGSHORE STATION 50									
Y	.000	31.613	68.041	137.706	252.932	464.753	760.718	1050.414	1356.502
QX	.000	.000	-.001	-.017	.002	.000	.000	.000	.000
QY	.000	.000	.000	.000	.000	.000	.000	.000	.000

11	1	0	.	+
21	1	0	.	+
31	1	0	.	+
41	1	0	.	+
51	1	0	.	+
61	1	0	.	+
71	1	0	.	+
81	1	0	.	+
91	1	0	.	+
101	1	0	.	+
111	1	0	.	+
121	1	0	.	+
131	1	0	.	+
141	1	0	.	+
151	1	0	.	+
161	1	0	.	+
171	1	0	.	+
181	1	0	.	+
191	1	0	.	+
201	1	0	.	+
211	1	0	.	+
221	1	0	.	+
231	1	0	.	+
241	1	0	.	+
251	1	0	.	+
261	1	0	.	+
271	1	0	.	+
281	1	0	.	+
291	1	0	.	+
301	1	0	.	+
311	1	0	.	+
321	1	0	.	+
331	1	0	.	+
341	1	0	.	+
351	1	0	.	+
361	1	0	.	+
371	1	0	.	+
381	1	0	.	+
391	1	0	.	+
401	1	0	.	+
411	1	0	.	+
421	1	0	.	+
431	1	0	.	+
441	1	0	.	+
451	1	0	.	+
461	1	0	.	+
471	1	0	.	+
481	1	0	.	+
491	1	0	.	+
501	1	0	.	+
511	1	0	.	+
521	1	0	.	+
531	1	0	.	+
541	1	0	.	+
551	1	0	.	+
561	1	0	.	+
571	1	0	.	+
581	1	0	.	+
591	1	0	.	+
601	1	0	.	+
611	1	0	.	+
621	1	0	.	+
631	1	0	.	+
641	1	0	.	+
651	1	0	.	+
661	1	0	.	+
671	1	0	.	+
681	1	0	.	+
691	1	0	.	+
701	1	0	.	+
711	1	0	.	+
721	1	0	.	+
731	1	0	.	+
741	1	0	.	+
751	1	0	.	+
761	1	0	.	+
771	1	0	.	+
781	1	0	.	+
791	1	0	.	+
801	1	0	.	+
811	1	0	.	+
821	1	0	.	+
831	1	0	.	+
841	1	0	.	+
851	1	0	.	+
861	1	0	.	+
871	1	0	.	+
881	1	0	.	+
891	1	0	.	+
901	1	0	.	+
911	1	0	.	+
921	1	0	.	+
931	1	0	.	+
941	1	0	.	+
951	1	0	.	+
961	1	0	.	+
971	1	0	.	+
981	1	0	.	+
991	1	0	.	+
1001	1	0	.	+



EXAMPLE 4 - INPUT

	50	5	10,000							
1.000	2.000	3.000	5.000	7.000	11.000	14.000	17.000	25.000	32.808	
.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	
30										
	5.000	.0500	.220							
1										
3	.000									
	.1500									
100.000	21600.000									
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1										
		25	31	250.00	250.00					
1	5.0	8.0	30.0	0						
2	5.0	8.0	30.0	0						
3	5.0	8.0	30.0	0						
4	5.0	8.0	30.0	0						
5	5.0	8.0	30.0	0						
6	5.0	8.0	30.0	0						
7	5.0	8.0	30.0	0						
8	5.0	8.0	30.0	0						
9	5.0	8.0	30.0	0						
10	5.0	8.0	30.0	0						
11	5.0	8.0	30.0	0						
12	5.0	8.0	30.0	0						
13	5.0	8.0	30.0	0						
14	5.0	8.0	30.0	0						
15	5.0	8.0	30.0	0						
16	5.0	8.0	30.0	0						
17	5.0	8.0	30.0	0						
18	5.0	8.0	30.0	0						
19	5.0	8.0	30.0	0						
20	5.0	8.0	30.0	0						
21	5.0	8.0	30.0	0						
22	5.0	8.0	30.0	0						
23	5.0	8.0	30.0	0						
24	5.0	8.0	30.0	0						
25	5.0	8.0	30.0	0						
26	5.0	8.0	30.0	0						
27	5.0	8.0	30.0	0						
28	5.0	8.0	30.0	0						
29	5.0	8.0	30.0	0						
30	5.0	8.0	30.0	0						
31	33.0	33.0	33.0	0						

EXAMPLE 4 - SPOOL: NONE

EXAMPLE 4 - OUTPUT

```

*****
THE DEPTH (IN FT) WAVES TRANSFORMED TO, WDEPTH=      32.809
*****
THE HEIGHT OF THE BERM, BERM=      5.000
THE SLOPE OF THE BEACH FACE, SFACE=      .0500
THE SEDIMENT DIAMETER, DIAM=      .220
*****
THE LENGTH OF THE STRUCTURE, SJETT (=      .000
THE NUMBER      1 GROIN IS LOCATED AT GRID      3
*****
THE VALUE OF ADEAN=      .1500 IN THE EQ. H=AY**2/3
*****
THE VALUE OF THE LONGSHORE SPACE-STEP, DX=      100.000
THE TIME-STEP IN SECONDS, DELT=      21600.000
*****
THE INITIAL SHORELINE COORDINATES :
      .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
      .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
      .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
      .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
      .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
*****
THE BOUNDARY X-VALUES, I=1,IMAX ARE AS FOLLOWS
      .00      31.62      68.04      137.71      252.98      464.76      760.73      1050.41      1656.50      2674.85
      .00      31.62      68.04      137.71      252.98      464.76      760.73      1050.41      1656.50      2674.85
*****
THE DEPTHS BETWEEN CONTOURS ARE AS FOLLOWS
      1.00      2.00      3.00      5.00      7.00      11.00      14.00      17.00      25.00      33.81
*****
BREAKWATER LEFT LOC RIGHT LOC LEFT X-VALUE RIGHT X-VALUE
      1          25          31          250.00          250.00
*****
      1          5.0      3.0      30.0      0
      2          5.0      3.0      30.0      0
      3          5.0      3.0      30.0      0
      4          5.0      3.0      30.0      0
      5          5.0      3.0      30.0      0
      6          5.0      3.0      30.0      0
      7          5.0      3.0      30.0      0
      8          5.0      3.0      30.0      0
      9          5.0      3.0      30.0      0
     10          5.0      3.0      30.0      0
     11          5.0      3.0      30.0      0
     12          5.0      3.0      30.0      0
     13          5.0      3.0      30.0      0
     14          5.0      3.0      30.0      0
     15          5.0      3.0      30.0      0
     16          5.0      3.0      30.0      0
     17          5.0      3.0      30.0      0
     18          5.0      3.0      30.0      0
     19          5.0      3.0      30.0      0
     20          5.0      3.0      30.0      0
     21          5.0      3.0      30.0      0

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22	5.0	8.0	30.0	0
23	5.0	8.0	30.0	0
24	5.0	8.0	30.0	0
25	5.0	8.0	30.0	0
26	5.0	8.0	30.0	0
27	5.0	8.0	30.0	0
28	5.0	8.0	30.0	0
29	5.0	8.0	30.0	0
30	5.0	8.0	30.0	0

THE TOTAL ELAPSED NUMBER OF TIME-STEPS, NUNIV= 30

LONGSHORE STATION 1									
Y	.000	31.623	68.041	137.706	252.982	464.758	760.7261050	.4141656	.502
Qx	.001	.025	.146	1.443	2.257	.518	.000	.000	.000
Qy	.000	.000	.000	.000	.000	.000	.000	.000	.000
LONGSHORE STATION 2									
Y	.106	32.027	68.786	138.894	254.313	464.803	760.7261050	.4141656	.502
Qx	.001	.025	.146	1.443	2.257	.518	.000	.000	.000
Qy	.000	.000	.000	.000	.000	.000	.000	.000	.000
LONGSHORE STATION 3									
Y	.181	32.279	69.317	139.853	255.564	464.826	760.7261050	.4141656	.502
Qx	.001	.024	.144	1.432	2.251	.517	.000	.000	.000
Qy	.000	.000	-.001	-.001	.000	.000	.000	.000	.000
LONGSHORE STATION 4									
Y	.230	32.431	69.714	140.692	256.792	464.833	760.7261050	.4141656	.502
Qx	.001	.024	.144	1.431	2.250	.517	.000	.000	.000
Qy	.000	-.001	-.001	-.001	.000	.000	.000	.000	.000
LONGSHORE STATION 5									
Y	.268	32.576	70.112	141.561	258.028	464.829	760.7261050	.4141656	.502
Qx	.001	.024	.144	1.427	2.247	.517	.000	.000	.000
Qy	.000	-.001	-.001	-.002	.000	.000	.000	.000	.000
LONGSHORE STATION 6									
Y	.306	32.742	70.555	142.511	259.323	464.805	760.7261050	.4141656	.502
Qx	.001	.024	.143	1.422	2.243	.517	.000	.000	.000
Qy	.000	-.001	-.001	-.002	.000	.000	.000	.000	.000
LONGSHORE STATION 7									
Y	.349	32.941	71.067	143.569	260.680	464.751	760.7261050	.4141656	.502
Qx	.001	.024	.142	1.415	2.237	.518	.000	.000	.000
Qy	.000	-.001	-.002	-.003	.000	.000	.000	.000	.000
LONGSHORE STATION 8									
Y	.402	33.181	71.665	144.759	262.111	464.647	760.7261050	.4141656	.502
Qx	.001	.023	.142	1.408	2.231	.518	.000	.000	.000
Qy	.000	-.001	-.002	-.003	.000	.000	.000	.000	.000
LONGSHORE STATION 9									
Y	.468	33.471	72.364	146.106	263.625	464.489	760.7261050	.4141656	.502
Qx	.001	.023	.141	1.396	2.224	.519	.000	.000	.000
Qy	.000	-.001	-.002	-.004	.000	.000	.000	.000	.000
LONGSHORE STATION 10									
Y	.550	33.820	73.181	147.629	265.239	464.185	760.7261050	.4141656	.502
Qx	.001	.023	.140	1.384	2.215	.521	.000	.000	.000
Qy	-.001	-.002	-.003	-.005	.000	.000	.000	.000	.000
LONGSHORE STATION 11									
Y	.652	34.238	74.134	149.348	266.925	463.687	760.7261050	.4141656	.502
Qx	.000	.023	.139	1.370	2.206	.523	.000	.000	.000
Qy	-.001	-.002	-.003	-.005	.000	.001	.000	.000	.000

LONGSHORE STATION 12									
Y	.777	34.735	75.240	151.279	268.717	462.951	760.716	1050.414	1656.502
OX	.000	.023	.138	1.355	2.136	.526	.000	.000	.000
OY	-.001	-.002	-.004	-.006	.000	.001	.000	.000	.000
LONGSHORE STATION 13									
Y	.828	35.321	76.513	153.435	270.600	461.850	760.703	1050.414	1656.502
OX	.000	.023	.136	1.338	2.184	.531	.000	.000	.000
OY	-.001	-.003	-.005	-.007	.000	.001	.000	.000	.000
LONGSHORE STATION 14									
Y	1.107	36.007	77.968	155.819	272.564	460.244	760.677	1050.414	1656.502
OX	.000	.022	.135	1.319	2.172	.537	.000	.000	.000
OY	-.001	-.003	-.005	-.008	.000	.001	.000	.000	.000
LONGSHORE STATION 15									
Y	1.314	36.800	79.614	158.431	274.529	457.956	760.626	1050.414	1656.502
OX	.000	.022	.133	1.298	2.159	.546	.000	.000	.000
OY	-.001	-.004	-.006	-.009	.000	.001	.000	.000	.000
LONGSHORE STATION 16									
Y	1.552	37.710	81.458	161.259	276.641	454.765	760.527	1050.414	1656.502
OX	.000	.022	.130	1.276	2.146	.557	.000	.000	.000
OY	-.001	-.004	-.007	-.010	.000	.001	.000	.000	.000
LONGSHORE STATION 17									
Y	1.826	38.739	83.497	164.281	278.669	450.407	760.347	1050.413	1656.502
OX	.000	.021	.128	1.252	2.132	.572	.000	.000	.000
OY	-.002	-.005	-.008	-.011	.000	.001	.000	.000	.000
LONGSHORE STATION 18									
Y	2.144	39.889	85.722	167.463	280.598	444.563	760.038	1050.412	1656.502
OX	-.001	.021	.124	1.226	2.113	.590	.000	.000	.000
OY	-.002	-.006	-.009	-.012	.000	.002	.000	.000	.000
LONGSHORE STATION 19									
Y	2.508	41.151	88.107	170.756	282.325	437.459	759.537	1050.410	1656.502
OX	-.001	.020	.120	1.198	2.106	.612	.000	.000	.000
OY	-.002	-.007	-.010	-.013	.000	.002	.000	.000	.000
LONGSHORE STATION 20									
Y	2.926	42.512	90.620	174.093	283.737	429.374	758.774	1050.408	1656.502
OX	-.001	.019	.116	1.168	2.100	.639	.000	.000	.000
OY	-.003	-.008	-.012	-.014	.000	.002	.000	.000	.000
LONGSHORE STATION 21									
Y	3.416	43.974	93.260	177.367	284.748	414.217	757.682	1050.414	1656.502
OX	-.001	.018	.111	1.136	2.093	.667	.000	.000	.000
OY	-.003	-.009	-.013	-.014	.000	.003	.000	.000	.000
LONGSHORE STATION 22									
Y	4.015	45.517	96.037	180.581	285.315	398.113	756.111	1050.410	1656.502
OX	-.001	.017	.104	1.094	2.101	.696	.000	.000	.000
OY	-.003	-.010	-.014	-.015	.001	.004	-.001	.000	.000
LONGSHORE STATION 23									
Y	4.733	47.342	98.465	183.602	285.625	380.517	754.368	1050.391	1656.502
OX	-.001	.016	.098	1.077	2.101	.720	.000	.000	.000
OY	-.004	-.011	-.015	-.014	.001	.004	-.001	.000	.000
LONGSHORE STATION 24									
Y	5.691	51.416	105.304	189.464	286.199	359.390	751.145	1050.290	1656.502
OX	-.001	.016	.095	.898	2.091	.749	.000	.000	.000
OY	-.004	-.014	-.017	-.014	.001	.005	-.001	.000	.000
LONGSHORE STATION 25									
Y	6.893	56.566	116.475	207.211	288.663	345.091	741.612	1050.179	1656.502
OX	-.001	.020	.099	1.026	2.058	.667	.000	.000	.000

QY	-0.004	-0.018	-0.023	-0.021	.035	.005	-0.001	.000	.000
LONGSHORE STATION	26								
Y	7.413	61.916	132.515	239.425	295.163	353.884	747.046	1050.371	1656.502
OX	.000	.016	.098	1.039	2.071	1.636	.002	.000	.000
OY	-0.004	-0.023	-0.034	-0.038	.064	.005	-0.001	.000	.000
LONGSHORE STATION	27								
Y	7.339	64.567	144.727	268.898	307.970	371.959	745.337	1050.362	1656.502
OX	.001	.017	.104	1.058	1.930	1.286	.010	.000	.000
OY	-0.004	-0.025	-0.044	-0.055	.039	.005	-0.001	.000	.000
LONGSHORE STATION	28								
Y	5.944	60.276	137.822	267.488	321.795	390.866	746.433	1050.353	1656.502
OX	.001	.012	.048	.680	1.900	1.464	.029	.000	.000
OY	-0.003	-0.023	-0.041	-0.060	.084	.005	-0.001	.000	.000
LONGSHORE STATION	29								
Y	3.142	47.249	106.166	217.554	309.133	410.420	752.741	1050.358	1656.502
OX	.001	.002	-0.016	.289	1.264	1.642	.064	.000	.000
OY	-0.001	-0.012	-0.022	-0.042	.043	.090	.000	.000	.000
LONGSHORE STATION	30								
Y	-0.513	29.080	61.607	131.945	245.105	434.627	766.212	1050.406	1656.502
OX	.000	-0.002	-0.026	-0.103	-0.589	1.281	.106	.000	.000
OY	.000	.002	.004	-0.301	.000	.024	.000	.000	.000
LONGSHORE STATION	31								
Y	-4.065	12.297	23.150	56.465	164.924	435.037	779.138	1050.477	1656.502
OX	.000	.001	-0.001	-0.001	-0.817	4.485	.202	.001	.000
OY	.002	.015	.025	.036	-0.015	-0.037	.000	.000	.000
LONGSHORE STATION	32								
Y	-6.652	1.648	3.467	22.570	129.338	401.543	790.608	1050.502	1656.502
OX	.001	.013	.053	.467	.963	.474	.000	.000	.000
OY	.003	.023	.037	.050	-0.011	-0.001	-0.001	.000	.000
LONGSHORE STATION	33								
Y	-7.340	-1.650	.169	20.441	134.104	389.172	775.221	1050.484	1656.502
OX	.002	.024	.039	.767	2.519	1.375	.001	.000	.000
OY	.004	.025	.038	.049	-0.010	-0.001	-0.001	.000	.000
LONGSHORE STATION	34								
Y	-8.135	.364	3.653	29.657	147.888	398.633	779.472	1050.461	1656.502
OX	.002	.025	.106	.741	2.138	1.669	.001	.000	.000
OY	.005	.023	.033	.044	-0.008	-0.001	-0.001	.000	.000
LONGSHORE STATION	35								
Y	-7.634	3.338	9.982	40.649	157.946	404.680	766.899	1050.444	1656.502
OX	.002	.025	.106	.770	2.386	1.964	.001	.000	.000
OY	.005	.020	.030	.039	-0.004	-0.001	-0.001	.000	.000
LONGSHORE STATION	36								
Y	-6.772	6.760	16.755	51.416	165.354	411.117	784.199	1050.462	1656.502
OX	.002	.026	.108	.835	2.393	1.911	.001	.000	.000
OY	.005	.018	.026	.035	.000	-0.001	.000	.000	.000
LONGSHORE STATION	37								
Y	-5.775	10.186	23.347	61.550	173.130	417.185	782.747	1050.424	1656.502
OX	.002	.025	.110	.883	2.444	2.042	.001	.000	.000
OY	.005	.015	.023	.032	.004	-0.001	.000	.000	.000
LONGSHORE STATION	38								
Y	-4.788	13.398	23.458	70.887	190.111	423.103	781.742	1050.420	1656.502
OX	.002	.025	.112	.928	2.466	2.033	.001	.000	.000
OY	.004	.013	.020	.029	.007	-0.001	.000	.000	.000
LONGSHORE STATION	39								
Y	-3.886	16.303	35.005	79.450	166.249	423.813	781.172	1050.417	1656.502

QX	.002	.025	.114	.969	2.475	2.123	.001	.000	.000
QY	.004	.011	.018	.025	.009	-.001	.000	.000	.000
LONGSHORE STATION 40									
Y	-3.103	18.873	39.981	87.238	193.457	433.634	760.8771050	.4161656	.502
QX	.002	.025	.116	1.007	2.482	2.161	.001	.000	.000
QY	.003	.009	.015	.022	.010	-.001	.000	.000	.000
LONGSHORE STATION 41									
Y	-2.443	21.115	44.412	94.443	199.963	438.240	760.7401050	.4151656	.502
QX	.002	.025	.117	1.041	2.493	2.198	.001	.000	.000
QY	.003	.008	.013	.019	.010	-.001	.000	.000	.000
LONGSHORE STATION 42									
Y	-1.898	23.055	48.343	100.957	206.366	442.428	760.6861050	.4151656	.502
QX	.002	.025	.119	1.071	2.508	2.231	.001	.000	.000
QY	.002	.007	.011	.017	.010	-.001	.000	.000	.000
LONGSHORE STATION 43									
Y	-1.454	24.728	51.828	106.886	212.644	446.208	760.6731050	.4141656	.502
QX	.002	.025	.120	1.095	2.528	2.261	.001	.000	.000
QY	.002	.005	.009	.014	.010	-.001	.000	.000	.000
LONGSHORE STATION 44									
Y	-1.092	26.171	54.925	112.297	218.771	449.608	760.6761050	.4141656	.502
QX	.002	.024	.120	1.116	2.549	2.297	.001	.000	.000
QY	.002	.004	.008	.012	.009	-.001	.000	.000	.000
LONGSHORE STATION 45									
Y	-.739	27.419	57.690	117.265	224.735	452.665	760.6841050	.4141656	.502
QX	.002	.024	.121	1.133	2.569	2.308	.001	.000	.000
QY	.001	.003	.006	.010	.008	-.001	.000	.000	.000
LONGSHORE STATION 46									
Y	-.562	28.509	60.182	121.862	230.537	455.428	760.6931050	.4141656	.502
QX	.002	.024	.121	1.146	2.589	2.326	.001	.000	.000
QY	.001	.002	.005	.008	.007	.000	.000	.000	.000
LONGSHORE STATION 47									
Y	-.370	29.472	62.456	126.165	236.194	457.946	760.7021050	.4141656	.502
QX	.002	.024	.121	1.156	2.605	2.341	.001	.000	.000
QY	.001	.002	.003	.006	.005	.000	.000	.000	.000
LONGSHORE STATION 48									
Y	-.217	30.329	64.555	130.241	241.740	460.272	760.7091050	.4141656	.502
QX	.002	.024	.122	1.163	2.618	2.352	.001	.000	.000
QY	.000	.001	.002	.004	.004	.000	.000	.000	.000
LONGSHORE STATION 49									
Y	-.098	31.049	66.426	134.087	247.300	462.595	760.7171050	.4141656	.502
QX	.002	.024	.122	1.169	2.624	2.357	.001	.000	.000
QY	.000	.000	.001	.002	.002	.000	.000	.000	.000
LONGSHORE STATION 50									
Y	.000	31.623	68.041	137.706	252.982	464.759	760.7261050	.4141656	.502
QX	.002	.023	.120	1.166	2.639	2.365	.001	.000	.000
QY	.000	.000	.000	.000	.000	.000	.000	.000	.000

11	1	0	.	+	*		
21	1	0	.	+	*		
31	1	0	.	+	*		
41	1	0	.	+	*		
51	1	0	.	+	*		
61	1	0	.	+	*		
71	1	0	.	+	*		
81	1	0	.	+	*		
91	1	0	.	+	*		
101	1	0	.	+	*		
111	1	0	.	+	*		
121	1	0	.	+	*		
131	1	0	.	+	*		
141	1	0	.	+	*		
151	1	0	.	+	*		
161	1	0	.	+	*		
171	1	0	.	+	*		
181	1	0	.	+	*		
191	1	0	.	+	*		
201	1	0	.	+	*		
211	1	0	.	+	*		
221	1	0	.	+	*		
231	1	0	.	+	*		
241	1	0	.	+	*		
251	1*	0	.	+	+	H	
261	1*	0	.	.	+	H	
271	1*	0	.	.	+	H	
281	1	0	.	.	+	H	
291	1	0	.	.	+	H	
301	1	0	.	+	+	H	
311	*10	.	+	*			
321	*1	+	.	*			
331	*1	+	.	*			
341	*1	+	.	*			
351	*1	.	+	*			
361	*10	.	+	*			
371	*10	.	+	*			
381	*10	.	+	*			
391	*1	0	.	+	*		
401	*1	0	.	+	*		
411	*1	0	.	+	*		
421	1	0	.	+	*		
431	1	0	.	+	*		
441	1	0	.	+	*		
451	1	0	.	+	*		
461	1	0	.	+	*		
471	1	0	.	+	*		
481	1	0	.	+	*		
491	1	0	.	+	*		
501	1	0	.	+	*		
31		99.0	99.0	99.0	0		

EXAMPLE 5 - INPUT

50	8								
	10.000								
1.000	2.000	3.000	5.000	7.000	11.000	14.000	17.000	25.000	32.806
.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
30									
	5.000	.0500	.220						
1									
33	250.000								
	.1500								
100.000	21600.000								
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
2									
		18	22	300.00	300.00				
		24	28	300.00	300.00				
1	4.0	6.0	25.0	0					
2	4.0	6.0	25.0	0					
3	4.0	6.0	25.0	0					
4	4.0	6.0	25.0	0					
5	4.0	6.0	25.0	0					
6	4.0	6.0	25.0	0					
7	4.0	6.0	25.0	0					
8	4.0	6.0	25.0	0					
9	4.0	6.0	25.0	0					
10	4.0	6.0	25.0	0					
11	4.0	6.0	25.0	0					
12	4.0	6.0	25.0	0					
13	4.0	6.0	25.0	0					
14	4.0	6.0	25.0	0					
15	4.0	6.0	25.0	0					
16	4.0	6.0	25.0	0					
17	4.0	6.0	25.0	0					
18	4.0	6.0	25.0	0					
19	4.0	6.0	25.0	0					
20	4.0	6.0	25.0	0					
21	4.0	6.0	25.0	0					
22	4.0	6.0	25.0	0					
23	4.0	6.0	25.0	0					
24	4.0	6.0	25.0	0					
25	4.0	6.0	25.0	0					
26	4.0	6.0	25.0	0					
27	4.0	6.0	25.0	0					
28	4.0	6.0	25.0	0					
29	4.0	6.0	25.0	0					
30	4.0	6.0	25.0	0					
31	99.0	99.0	99.0	0					

EXAMPLE 5 - SPOOL: NONE

EXAMPLE 5 - OUTPUT

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*****
THE DEPTH (IN FT) WAVES TRANSFORMED TO, WDEPTH=      32.808
*****
THE HEIGHT OF THE BERM, BERM=      5.000
THE SLOPE OF THE BEACH FACE, SFACE=      .0500
THE SEDIMENT DIAMETER, DIAM=      .220
*****
THE LENGTH OF THE STRUCTURE, SJETTY=      250.000
THE NUMBER      1 GROIN IS LOCATED AT GRID      33
*****
THE VALUE OF ADEAN=      .1500  IN THE EQ.  $H=AY^{2/3}$ 
*****
THE VALUE OF THE LONGSHORE SPACE-STEP, DX=      100.000
THE TIME-STEP IN SECONDS, DELT=      21600.000
*****
THE INITIAL SHORELINE COORDINATES :
      .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
      .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
      .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
      .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
      .00      .00      .00      .00      .00      .00      .00      .00      .00      .00
*****
THE BOUNDARY Y-VALUES, I=1,IMAX ARE AS FOLLOWS
      .00      31.62      68.04      137.71      252.98      464.76      760.73      1050.41      1656.50      2674.85
      .00      31.62      68.04      137.71      252.98      464.76      760.73      1050.41      1656.50      2674.85
*****
THE DEPTHS BETWEEN CONTOURS ARE AS FOLLOWS
      1.00      2.00      3.00      5.00      7.00      11.00      14.00      17.00      25.00      32.81
*****
*****
BREAKWATER  LEFT LOC  RIGHT LOC  LEFT Y VALUE  RIGHT Y VALUE
      1          18          22          300.00          300.00
      2          24          28          300.00          300.00
*****
*****
      1          4.0      6.0      25.0      0
      2          4.0      6.0      25.0      0
      3          4.0      6.0      25.0      0
      4          4.0      6.0      25.0      0
      5          4.0      6.0      25.0      0
      6          4.0      6.0      25.0      0
      7          4.0      6.0      25.0      0
      8          4.0      6.0      25.0      0
      9          4.0      6.0      25.0      0
     10          4.0      6.0      25.0      0
     11          4.0      6.0      25.0      0
     12          4.0      6.0      25.0      0
     13          4.0      6.0      25.0      0
     14          4.0      6.0      25.0      0
     15          4.0      6.0      25.0      0
     16          4.0      6.0      25.0      0
     17          4.0      6.0      25.0      0
     18          4.0      6.0      25.0      0
     19          4.0      6.0      25.0      0
     20          4.0      6.0      25.0      0

```

21	4.0	6.0	25.0	0
22	4.0	6.0	25.0	0
23	4.0	6.0	25.0	0
24	4.0	6.0	25.0	0
25	4.0	6.0	25.0	0
26	4.0	6.0	25.0	0
27	4.0	6.0	25.0	0
28	4.0	6.0	25.0	0
29	4.0	6.0	25.0	0
30	4.0	6.0	25.0	0

THE TOTAL ELAPSED NUMBER OF TIME-STEPS, NUNIV= 30

LONGSHORE STATION 1									
Y	.000	31.623	68.041	137.706	252.982	464.758	760.7261050	.4141656	.502
OX	.001	.029	.154	1.173	1.178	.089	.000	.000	.000
OY	.000	.000	.000	.000	.000	.000	.000	.000	.000
LONGSHORE STATION 2									
Y	.365	33.172	71.497	143.456	257.058	464.852	760.7251050	.4141656	.502
OX	.001	.029	.154	1.173	1.178	.089	.000	.000	.000
OY	.000	-.001	-.002	-.002	.000	.000	.000	.000	.000
LONGSHORE STATION 3									
Y	.704	34.570	74.537	148.621	260.890	464.894	760.7241050	.4141656	.502
OX	.001	.028	.150	1.144	1.170	.088	.000	.000	.000
OY	-.001	-.002	-.003	-.004	.000	.000	.000	.000	.000
LONGSHORE STATION 4									
Y	1.027	35.871	77.355	153.501	264.551	464.853	760.7221050	.4141656	.502
OX	.001	.027	.148	1.140	1.166	.087	.000	.000	.000
OY	-.001	-.003	-.005	-.006	.000	.000	.000	.000	.000
LONGSHORE STATION 5									
Y	1.361	37.203	80.256	158.493	268.204	464.740	760.7141050	.4141656	.502
OX	.001	.027	.146	1.127	1.162	.087	.000	.000	.000
OY	-.001	-.004	-.007	-.009	.000	.000	.000	.000	.000
LONGSHORE STATION 6									
Y	1.730	38.654	83.365	163.713	271.920	464.553	760.6961050	.4141656	.502
OX	.001	.027	.144	1.108	1.155	.087	.000	.000	.000
OY	-.002	-.005	-.008	-.011	.000	.000	.000	.000	.000
LONGSHORE STATION 7									
Y	2.158	40.280	86.749	169.224	275.722	464.250	760.6541050	.4141656	.502
OX	.001	.026	.141	1.086	1.147	.086	.000	.000	.000
OY	-.002	-.006	-.010	-.013	.000	.000	.000	.000	.000
LONGSHORE STATION 8									
Y	2.664	42.119	90.455	175.068	279.613	463.751	760.5991050	.4141656	.502
OX	.001	.026	.138	1.060	1.139	.086	.000	.000	.000
OY	-.003	-.008	-.012	-.015	.000	.000	.000	.000	.000
LONGSHORE STATION 9									
Y	3.266	44.136	94.512	181.269	283.570	462.938	760.4831050	.4141656	.502
OX	.001	.025	.135	1.030	1.129	.086	.000	.000	.000
OY	-.003	-.009	-.014	-.017	.001	.000	.000	.000	.000
LONGSHORE STATION 10									
Y	3.976	46.528	98.934	187.828	287.549	461.644	760.1111050	.4071656	.502
OX	.001	.025	.130	.997	1.118	.081	.000	.000	.000
OY	-.004	-.011	-.016	-.019	.001	.000	.000	.000	.000
LONGSHORE STATION 11									
Y	4.801	49.118	103.725	194.728	291.478	459.644	759.6331050	.4021656	.502
OX	.001	.024	.126	.960	1.106	.083	.000	.000	.000

OY	-.004	-.012	-.018	-.021	.001	.001	.000	.000	.000
LONGSHORE STATION	12								
Y	5.735	51.962	108.889	201.942	295.305	456.657	758.904	1050.394	1656.502
QX	.000	.023	.120	.921	1.092	.096	.000	.000	.000
OY	-.005	-.014	-.020	-.023	.001	.001	.000	.000	.000
LONGSHORE STATION	13								
Y	6.753	55.044	114.432	209.441	299.136	452.370	757.863	1050.382	1656.502
QX	.000	.023	.114	.878	1.077	.099	.000	.000	.000
OY	-.005	-.016	-.023	-.025	.001	.001	.000	.000	.000
LONGSHORE STATION	14								
Y	7.798	58.341	120.377	217.175	303.170	446.464	756.494	1050.364	1656.502
QX	.000	.022	.108	.835	1.069	.103	.000	.000	.000
OY	-.005	-.019	-.025	-.027	.001	.001	.000	.000	.000
LONGSHORE STATION	15								
Y	8.779	61.831	126.808	225.173	307.402	438.645	754.784	1050.338	1656.502
QX	.000	.021	.100	.784	1.060	.107	.000	.000	.000
OY	-.006	-.021	-.028	-.029	.001	.001	.000	.000	.000
LONGSHORE STATION	16								
Y	9.545	65.417	133.962	233.187	311.671	428.661	752.782	1050.299	1656.502
QX	-.001	.020	.091	.755	1.044	.110	.000	.000	.000
OY	-.006	-.024	-.032	-.030	.001	.001	.000	.000	.000
LONGSHORE STATION	17								
Y	9.861	68.520	141.773	244.203	316.401	416.289	750.574	1050.238	1656.502
QX	-.001	.019	.083	.561	1.018	.112	.000	.000	.000
OY	-.006	-.027	-.037	-.033	.002	.001	.000	.000	.000
LONGSHORE STATION	18								
Y	9.469	68.799	145.363	257.194	321.232	412.130	748.458	1050.146	1656.502
QX	-.001	.017	.087	.955	1.063	.094	.000	.000	.000
OY	-.006	-.027	-.040	-.042	.051	.002	.000	.000	.000
LONGSHORE STATION	19								
Y	8.248	64.018	137.809	259.368	324.837	426.288	746.846	1050.015	1656.502
QX	.000	.002	.011	.502	1.028	.749	.006	.000	.000
OY	-.005	-.024	-.037	-.052	.049	.002	.000	.000	.000
LONGSHORE STATION	20								
Y	6.343	55.264	119.345	237.038	325.574	447.954	745.892	1049.841	1656.502
QX	.000	.000	-.007	.307	1.121	.449	.012	.000	.000
OY	-.004	-.017	-.027	-.048	.026	.001	.000	.000	.000
LONGSHORE STATION	21								
Y	4.152	45.145	95.621	191.412	319.149	470.835	745.663	1049.636	1656.502
QX	.000	-.001	-.013	-.075	1.067	.430	.023	.000	.000
OY	-.003	-.009	-.014	-.026	-.013	.001	.000	.000	.000
LONGSHORE STATION	22								
Y	2.165	36.568	75.054	146.890	297.041	482.043	744.106	1049.430	1656.502
QX	.000	.001	-.003	-.071	1.024	1.138	.042	.000	.000
OY	-.002	-.003	-.002	-.002	-.035	.026	.000	.000	.000
LONGSHORE STATION	23								
Y	.727	32.439	66.252	128.144	268.771	462.810	738.545	1049.270	1656.502
QX	.001	.009	.022	.126	.546	.024	.000	.000	.000
OY	-.001	.000	.003	.008	-.001	.000	.000	.000	.000
LONGSHORE STATION	24								
Y	-.220	31.361	65.974	129.304	260.637	444.072	737.305	1049.355	1656.502
QX	.001	.018	.078	.567	1.022	.048	.000	.000	.000
OY	-.001	.000	.002	.006	-.015	.027	.000	.000	.000
LONGSHORE STATION	25								
Y	-.936	29.681	64.483	131.703	275.104	455.825	748.894	1049.948	1656.502

QX	.000	.002	.013	.180	.882	1.219	.228	.004	.000
OY	.000	.001	.002	.003	-.026	.029	.000	.000	.000
LONGSHORE STATION 26									
Y	-1.442	27.681	62.014	133.384	287.194	479.465	766.102	1050.543	1656.502
QX	.000	.003	.018	.256	.864	.516	.171	.004	.000
OY	.000	.003	.002	-.001	-.038	.018	.000	.000	.000
LONGSHORE STATION 27									
Y	-1.570	26.533	60.798	135.107	272.003	503.462	783.409	1051.205	1656.502
QX	.000	.003	.021	.272	.380	.560	.170	.004	.000
OY	-.001	.004	.002	-.004	-.023	-.019	.000	.000	.000
LONGSHORE STATION 28									
Y	-1.095	26.643	61.803	138.627	238.260	520.237	795.104	1051.623	1656.502
QX	.000	.003	.019	.228	.234	1.027	.226	.004	.000
OY	-.001	.004	.001	-.007	.014	-.069	.000	.000	.000
LONGSHORE STATION 29									
Y	.267	30.422	69.785	151.360	219.091	517.534	793.539	1051.635	1656.502
QX	.001	.009	.043	.323	.518	.092	.000	.000	.000
OY	-.002	.002	-.003	-.012	.002	-.001	.000	.000	.000
LONGSHORE STATION 30									
Y	2.542	38.747	84.591	170.321	223.152	506.532	785.385	1051.411	1656.502
QX	.003	.030	.080	.311	1.088	.136	.000	.000	.000
OY	-.002	-.004	-.009	-.016	.003	-.001	.000	.000	.000
LONGSHORE STATION 31									
Y	5.269	48.821	101.128	189.398	234.207	497.825	778.201	1051.158	1656.502
QX	.003	.028	.061	.206	.698	.121	.000	.000	.000
OY	-.003	-.012	-.016	-.018	.003	-.001	.000	.000	.000
LONGSHORE STATION 32									
Y	7.806	58.975	118.130	209.319	243.452	491.357	772.392	1050.919	1656.502
QX	.003	.027	.056	.145	.793	.107	.000	.000	.000
OY	-.003	-.019	-.023	-.021	.003	.000	.000	.000	.000
LONGSHORE STATION 33									
Y	9.423	66.781	131.815	225.751	258.820	484.381	768.053	1050.730	1656.502
QX	.003	.030	.084	.387	.574	.096	.000	.000	.000
OY	-.003	-.026	-.028	-.024	.003	.000	.000	.000	.000
LONGSHORE STATION 34									
Y	-13.165	-29.559	-27.740	-25.209	234.217	477.793	765.051	1050.508	1656.502
QX	.000	.000	.000	.000	2.109	.096	.000	.000	.000
OY	.017	.064	.074	.029	-.006	.000	.000	.000	.000
LONGSHORE STATION 35									
Y	-28.683	-25.071	-23.252	-20.718	169.807	469.139	761.120	1050.511	1656.502
QX	.001	.025	.114	.119	.001	.000	.000	.000	.000
OY	.018	.051	.062	.082	-.003	-.011	.000	.000	.000
LONGSHORE STATION 36									
Y	-22.896	-19.181	-17.362	-12.182	144.147	464.135	761.368	1050.461	1656.502
QX	.000	.011	.072	.318	2.005	.158	.000	.000	.000
OY	.017	.041	.050	.063	-.002	-.011	.000	.000	.000
LONGSHORE STATION 37									
Y	-17.720	-13.891	-12.072	.343	154.329	461.974	761.313	1050.407	1656.502
QX	.001	.018	.104	.366	.606	.065	.000	.000	.000
OY	.016	.037	.045	.056	-.002	-.001	.000	.000	.000
LONGSHORE STATION 38									
Y	-13.146	-7.977	-6.364	13.997	162.035	461.533	760.398	1050.424	1656.502
QX	.001	.023	.121	.486	.275	.079	.000	.000	.000
OY	.012	.026	.035	.049	-.001	-.001	.000	.000	.000
LONGSHORE STATION 39									

r	-10.234	-2.362	1.200	27.324	171.244	462.052	760.840	1050.418	1656.502
QX	.001	.026	.119	.558	.859	.086	.000	.000	.000
QY	.009	.024	.032	.044	-.001	-.001	.000	.000	.000
LONGSHORE STATION 40									
Y	-8.165	2.765	10.135	41.304	180.374	462.858	760.770	1050.416	1656.502
QX	.002	.028	.123	.628	.890	.089	.000	.000	.000
QY	.007	.020	.029	.038	-.001	-.001	.000	.000	.000
LONGSHORE STATION 41									
Y	-6.549	7.345	18.054	53.869	189.244	463.606	760.741	1050.415	1656.502
QX	.002	.029	.126	.633	.912	.091	.000	.000	.000
QY	.006	.017	.026	.034	-.001	-.001	.000	.000	.000
LONGSHORE STATION 42									
Y	-5.231	11.400	25.430	65.555	197.752	464.183	760.731	1050.415	1656.502
QX	.002	.030	.129	.752	.934	.091	.000	.000	.000
QY	.005	.015	.022	.029	-.001	-.001	.000	.000	.000
LONGSHORE STATION 43									
Y	-4.145	14.963	32.205	76.388	205.916	464.575	760.727	1050.414	1656.502
QX	.002	.030	.133	.805	.959	.091	.000	.000	.000
QY	.004	.012	.019	.025	-.001	-.001	.000	.000	.000
LONGSHORE STATION 44									
Y	-3.249	18.088	38.384	86.432	213.676	464.815	760.726	1050.414	1656.502
QX	.002	.030	.137	.852	.984	.091	.000	.000	.000
QY	.003	.010	.016	.022	.000	-.001	.000	.000	.000
LONGSHORE STATION 45									
Y	-2.505	20.836	44.011	95.770	220.947	464.944	760.726	1050.414	1656.502
QX	.002	.031	.140	.892	1.004	.091	.000	.000	.000
QY	.003	.008	.013	.018	.000	.000	.000	.000	.000
LONGSHORE STATION 46									
Y	-1.880	23.272	49.153	104.509	227.767	465.004	760.726	1050.414	1656.502
QX	.002	.031	.143	.927	1.021	.091	.000	.000	.000
QY	.002	.006	.010	.014	.000	.000	.000	.000	.000
LONGSHORE STATION 47									
Y	-1.343	25.476	53.891	112.751	234.257	465.046	760.726	1050.414	1656.502
QX	.002	.031	.145	.955	1.036	.090	.000	.000	.000
QY	.002	.005	.008	.011	.000	.000	.000	.000	.000
LONGSHORE STATION 48									
Y	-.863	27.562	58.374	120.624	240.465	465.040	760.726	1050.414	1656.502
QX	.002	.031	.147	.975	1.049	.090	.000	.000	.000
QY	.001	.003	.006	.007	.000	.000	.000	.000	.000
LONGSHORE STATION 49									
Y	-.420	29.609	62.996	128.749	246.587	464.922	760.726	1050.414	1656.502
QX	.002	.031	.148	.977	1.046	.087	.000	.000	.000
QY	.001	.002	.003	.004	.000	.000	.000	.000	.000
LONGSHORE STATION 50									
Y	.000	31.622	68.041	137.706	252.982	464.759	760.726	1050.414	1656.502
QX	.002	.030	.153	1.024	1.066	.087	.000	.000	.000
QY	.000	.000	.000	.000	.000	.000	.000	.000	.000

APPENDIX B: PROGRAM LISTING

AD-A185 200

A USER'S GUIDE TO THE N-LINE MODEL: A NUMERICAL MODEL
TO SIMULATE SEDIMENT. (U) COASTAL ENGINEERING RESEARCH
CENTER VICKSBURG MS N W SCHEFFNER ET AL. AUG 87

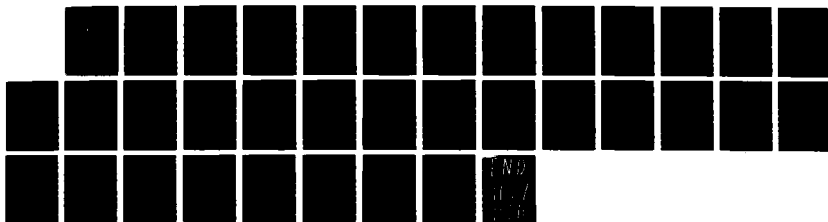
2/2

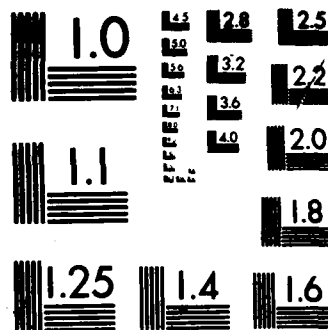
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CERC-87-4

F/G 8/8

NL





MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

APPENDIX B: PROGRAM LISTING

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00056      WRITE(2,738)   DIAM
00057  738  FORMAT(2X,"THE SEDIMENT DIAMETER, DIAM= ",F10.3)
00058      WRITE(2,732)
00059  780  FORMAT(2X,"SUPPLY MMAX( THE NO. OF GROINS) AND THEIR I-LOC",/)
00060      UCRIT=16.3*SQR(DIAM*0.00328)
00061  C*THE NO. OF MULTIPLE GROINS,MMAX MUST BE GIVEN THEIR X LOCATIONS.
00062      READ(1,779)   MMAX
00063  779  FORMAT(I3)
00064      DO 760 M=1,MMAX
00065  C*IJET REPS LESSER I-VALUE ADJACENT TO STRUCTURE.
00066      READ(1,778)   IJET(M),SJETTY(M)
00067  760  WRITE(2,761) SJETTY(M)
00068  778  FORMAT(I3,F10.3)
00069      WRITE(2,759)   (M,IJET(M),M=1,MMAX)
00070  759  FORMAT(2X,"THE NUMBER",I5," GROIN IS LOCATED AT GRID",I5)
00071      WRITE(2,732)
00072  C*CONVERT TO RADIANS.
00073  C*FIRST MUST GIVE Y COORS POSITIONS AND DEPTHS.
00074  C*FIRST, MUST SET UP ALL OF THE DEEP-VALUES.
00075  C****READ THE VALUE OF ADEAN
00076      READ(1,774)ADEAN
00077  774  FORMAT(F10.4)
00078      WRITE(2,749)   ADEAN
00079  749  FORMAT(2X,"THE VALUE OF ADEAN= ",F10.4," IN THE EQ. H=AY**2/3")
00080      WRITE(2,732)
00081      READ(1,775)   DX,DELT
00082  775  FORMAT(2(F10.3))
00083      WRITE(2,737)   DX
00084  737  FORMAT(2X,"THE VALUE OF THE LONGSHORE SPACE-STEP, DX= ",F10.3)
00085      WRITE(2,736)   DELT
00086  736  FORMAT(2X,"THE TIME-STEP IN SECONDS, DELT= ",F10.3)
00087      DO 220 J=1,JMAX+3
00088      DO 220 I=1,IMAX+1
00089  220  DEEP(I,J)=CHANGE(J)
00090      DATA(HC(I),I=1,8)/1.87,0.5,0.35,.25,.21,.20,.19,.19/
00091      DATA(TC(I),I=1,8)/2.,3.,4.,6.,8.,10.,12.,14./
00092  C*****DEFINE INITIAL COASTLINE*****
00093      READ(1,63) (Y(I,1),I=1,IMAX)
00094  63  FORMAT(10F8.2)
00095  C*****
00096      DO 200 J=1,JMAX+2
00097      DO 200 I=1,IMAX
00098  200  Y(I,J+1)=(0.5*(DEEP(I,J+1)+DEEP(I,J))/ADEAN)**1.5+Y(I,1)
00099      WRITE(2,732)
00100      WRITE(2,772)
00101  772  FORMAT(3X,35HTHE INITIAL SHORELINE COORDINATES : )
00102      WRITE(2,9993) (Y(I,1),I=1,IMAX)
00103  9993  FORMAT(10F8.2)
00104      WRITE(2,732)
00105  C*****
00106  C*WE WILL ALWAYS REQUIRE Y(I,JM) TO COMPUTE DY AND YBAR.
00107  C*WE WILL ALWAYS REQUIRE DEEP(I,JM) TO COMP SEDIMENT TRANSPORT.
00108  C*****
00109      WRITE(2,734)
00110  734  FORMAT(2X,"THE BOUNDARY Y-VALUES, I=1,IMAX ARE AS FOLLOWS",)

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00111      WRITE(2,801)      (Y(1,J),J=1,JMAX+2)
00112      WRITE(2,801)      (Y(IMAX,J),J=1,JMAX+2)
00113      WRITE(2,732)
00114      WRITE(2,735)
00115      735 FORMAT(2X,"THE DEPTHS BETWEEN CONTOURS ARE AS FOLLOWS",)
00116      WRITE(2,801)      (DEEP(1,J),J=1,JMAX+2)
00117      WRITE(2,732)
00118      801 FORMAT(10F8.2)
00119      DO 2 I=1,IMAX
00120      2   YZERO(I)=Y(I,1)-(BERM/SFACE)
00121      C*WILL COMPUTE THE EQUIL WIDTH BETWEEN CONTOURS, HERE.
00122      DO 1 I=1,IMAX
00123      WEQ(I,1)=Y(I,1)-YZERO(I)
00124      DO 1 J=1,JMAX
00125      IF(J.NE.1) GO TO 32
00126      YTEMP1=0.0
00127      GO TO 33
00128      32 YTEMP1=((0.5*(DEEP(I,J-1)+DEEP(I,J)))/ADEAN)**1.5
00129      33 YTEMP2=((0.5*(DEEP(I,J)+DEEP(I,J+1)))/ADEAN)**1.5
00130      WEQ(I,J+1)=YTEMP2-YTEMP1
00131      1   CONTINUE
00132      C*LET'S STORE THE ORIG VALUES TO COMPUTE VOL CHANGES OVER CONTOURS,LATER
00133      DO 796 I=1,IMAX+1
00134      YZERO0(I)=YZERO(I)
00135      DO 796 J=1,JMAX+2
00136      796 YORIG(I,J)=Y(I,J)
00137      C*****
00138      C READ IN THE BREAKWATER INFORMATION
00139      C*****
00140      READ(1,800) NOBKS
00141      800 FORMAT(I5)
00142      IF(NOBKS.EQ.0) GO TO 899
00143      DO 805 N=1,NOBKS
00144      805 READ(1,807) ILFT(N),IRT(N),YLFT(N),YRT(N)
00145      807 FORMAT(10X,2I10,2F10.2)
00146      WRITE(2,732)
00147      WRITE(2,810)
00148      810 FORMAT(1X,45HBREAKWATER LEFT LOC RIGHT LOC LEFT Y VALUE,2X,
00149      113HRIGHT Y VALUE)
00150      DO 820 N=1,NOBKS
00151      820 WRITE(2,830) N,ILFT(N),IRT(N),YLFT(N),YRT(N)
00152      830 FORMAT(4X,I3,8X,I3,7X,I3,7X,F9.2,5X,F9.2)
00153      WRITE(2,732)
00154      899 CONTINUE
00155      C*****
00156      C*READ THE DISK FILE AND TRANSFORM PARAMETERS INTO MY UNITS.
00157      C*****
00158      C*ALL ADJUSTMENTS TO WAVE ANGLE,HEIGHT,CELERITY,GROUP VEL. WILL BE MADE
00159      C**HERE, AND THRUOUT THE REST OF THE PROG, THEY WILL BE AS IF OCCURRED
00160      C***AT WDEPTH?
00161      C***SELECT DREDGED DISPOSAL OPTION
00162      798 READ(1,799) IJKLMN,HS,T,ALPWIS,IDDD
00163      WRITE(2,799) IJKLMN,HS,T,ALPWIS,IDDD
00164      C   IF(EOF(5) .EQ. 1) GO TO 1000
00165      IF(HS.GT.50.) GO TO 1000

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00166 C*****
00167 799 FORMAT(15,5X,3F6.1,15)
00168 NTIMES=1
00169 NCHECK=NUNIV+NTIMES
00170 HGEN=0.707107*HS
00171 SIGMA=2*WOPI/T
00172 G=32.17
00173 CO=G*T/TWOPI
00174 ELO=CO*T
00175 IF(T.LE.2.0) GO TO 797
00176 HCC=0.23
00177 DO 444 I=2,7
00178 T2=TC(I)
00179 IF(T.GT.T2) GO TO 444
00180 T1=TC(I-1)
00181 DELTAT=T2-T1
00182 DT=(T-T1)/DELTAT
00183 DTT=(T2-T)/DELTAT
00184 HCC=HC(I)*DT+HC(I-1)*DTT
00185 GO TO 446
00186 444 CONTINUE
00187 446 CONTINUE
00188 IF(HGEN.LT.HCC) GO TO 797
00189 ANGGEN=ALPWIS*2*WOPI/360.
00190 C*****
00191 CALL WUNUM(WDEPTH,T,DUMKK)
00192 C*ANGGEN,HGEN,CGEN,CGEN REPRESENT THE WAVE ANGLE,HEIGHT,CELERITY AND
00193 C*GROUP VEL(RESPECT.) OF THE SPECIFIED WAVE INPUT AT A DEPTH, WDEPTH
00194 CALL WUNUM(11.0,T,DUMKKK)
00195 C11=2*WOPI/(T*DUMKKK)
00196 CG11=0.5*C11*(1.+(2.*DUMKKK*11.0/SINH(2.*DUMKKK*11.0)))
00197 CGEN=2*WOPI/(T*DUMKK)
00198 CGEN=0.5*CGEN*(1.+(2.*DUMKK*WDEPTH/SINH(2.*DUMKK*WDEPTH)))
00199 IF(IDDD.EQ.0) GO TO 8002
00200 WRITE(2,67) NCHECK
00201 67 FORMAT(1X,31HDREDGED MATERIAL ADDED AT TIME ,15)
00202 WRITE(2,294) NCHECK
00203 294 FORMAT(1X,40HCONTOURS AFTER MATERIAL ADDITION AT TIME,15,4HARE:)
00204 66 READ(20,65) IDREG,JDREG,DREDGE
00205 65 FORMAT(215,F10.2)
00206 IF(IDREG.EQ.IMAX.AND.JDREG.EQ.JMAX) GO TO 795
00207 Y(IDREG,JDREG)=Y(IDREG,JDREG)+DREDGE
00208 GO TO 66
00209 795 CONTINUE
00210 DO 8001 I=1,IMAX
00211 8001 WRITE(2,8000) I,(Y(I,J),J=1,JMAX)
00212 8000 FORMAT(15,8F9.3)
00213 8002 CONTINUE
00214 IF(NUNIV.EQ.0) CALL PLOTNS(IMAX,JMAX,Y,YLEFT,YRT,ILFT
00215 1,IRT,SJETTY,IJET,NOBKS,MMAX)
00216 REWIND 20
00217 CALL TRANS
00218 797 IF(NCHECK.NE.NUNIV) NUNIV=NCHECK
00219 709 GO TO 798
00220 1000 CONTINUE

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00221      STOP
00222      END
00223      SUBROUTINE TRANS
00224      PARAMETER (NI=53,NJ=11)
00225 C*****
00226 C*THIS SUBROUTINE WILL COMPUTE SEDIMENT TRANSPORT
00227      COMMON/A/ C(NI,NJ),RK(NI,NJ),Y(NI,NJ),DEEP(NI,NJ),ALPHAS(NI,NJ)
00228      COMMON/AA/YZERO(NI),WDEPTH
00229      COMMON/BB/WEQ(NI,NJ)
00230      COMMON/B/ THETA(NI,NJ),QXTOT(NI), OLDANG(NI,NJ), DY(NI,NJ)
00231      COMMON/C/ H(NI,NJ),CG(NI,NJ),HOLD(NI,NJ),HB(NI,NJ),YB(NI)
00232      COMMON/N USED/JUSE,T,CO,CGEN,CGGEN,ANGGEN,DX,BERM,THETA0(10),MMAX
00233      COMMON/D/SIGMA,G,ELO,JMAX,IMAX,PI,TWOPI,PI02,HGEN,IJET(10)
00234      1,SJETTY(10)
00235      COMMON/E/RHO,RHOS,POROS,CONST,TKSI
00236      COMMON/F/ADEAN,REPOSE,DIAM
00237      COMMON/G/IBREAK(NI),HNONBR(NJ)
00238      COMMON/P/HBQ(NI),DEEPB(NI)
00239      COMMON/ZZZ/NTIME
00240      COMMON/AAA/DELT,NTIMES
00241      COMMON/COUNT/NUNIV,NWRITE
00242      COMMON/NWS/ILFT(5),IRT(5),YLFT(5),YRT(5),NOBKS
00243      1,DEEPR(5),DEEPL(5),HRT(5),HLFT(5)
00244      DIMENSION YOLD(NI,NJ),R(NI,NJ),S(NI,NJ),HC(NI,NJ),QY(NI,NJ),YDISS(
00245      * 60,20)
00246      DIMENSION RHS1(NI,NJ),S3(NI,NJ),THETAB(NI,NJ),ANGLOC(NI,NJ)
00247      DIMENSION DISTR(NI,NJ),AWARE(NI,NJ),
00248      *BMATRX((NJ-3)*(NI-5)),ABAND((NJ-3)*(NI-5),2*(NJ-3)+1),QX(NI,NJ),
00249      1XL((NJ-3)*(NI-5),NJ-2),CONST6(NI,NJ)
00250 C*****
00251 C*****
00252 C***** NOTE 00000SIZE OF ABAND AND XL HAVE TO BE CHANGED
00253 C***** ACCORDING TO JMAX+1+JMAX AND JMAX+1,RESPECT.
00254 C***** CHANGE REQ'D AT 7040 AND 18650
00255 C*****
00256      COMMON/MP/ RKB(NI),HBI(NI),DEEPBI(NI)
00257      COMMON/EXPL/QYEXP(NI,NJ),YIMP(NI,NJ)
00258      DIMENSION SANGLE(NJ)
00259      DO 199 J=1,JMAX+3
00260      SANGLE(J)=0.
00261      DO 199 I=1,IMAX+3
00262      YOLD(I,J)=0.
00263      R(I,J)=0.
00264      QY(I,J)=0.
00265      YDISS(I,J)=0.
00266      RHS1(I,J)=0.
00267      S3(I,J)=0.
00268      THETAB(I,J)=0.
00269      ANGLOC(I,J)=0.
00270      DISTR(I,J)=0.
00271      AWARE(I,J)=0.
00272      QX(I,J)=0.
00273      CONST6(I,J)=0.
00274      QYEXP(I,J)=0.
00275      199 CONTINUE

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00276      DO 200 I=1,IMAX+3
00277      DEEPB(I)=0.
00278      HBQ(I)=0.
00279      DEEBI(I)=0.
00280 200   HBI(I)=0.
00281      RHO=1.99
00282      RHOS=5.14
00283      POROS=0.40
00284      CONST=0.77
00285      CAPPA=0.78
00286      TAU=0.25
00287      TKS1=(CONST*RHO*SQRT(G))/((RHOS-RHO)*(1.0-POROS)*16.0*SQRT(CAPPA))
00288 C* QX(I,J) IS THE TRANSPORT BETWEEN THE (I,J+1) AND (I,J) CONTOURS.
00289 C*THE \DO 1 LOOP\ SIMULATES TIME---TIME=DELT*NTIMES.
00290      COFF=0.00001
00291      GAMMA=RHO*G
00292      DO 1 NTIME=1,NTIMES
00293      NUNIV=NUNIV+1
00294 C*THE MATRICES ABAND AND BMATRX MUST BE \ZEROED OUT\
00295      K=0
00296      DO 26 I=2,IMAX-1
00297      DO 26 J=1,JMAX
00298      K=K+1
00299      BMATRX(K)=0.0
00300      DO 26 L=1,JMAX+1+JMAX
00301 26   ABAND(K,L)=0.0
00302      XNTIME=1.0*(NTIME)
00303      CALL PREDIF
00304      IF(NOBS.EQ.0) GO TO 10
00305      CALL BRKH20(IMAX,JMAX,MMAX,Y,THETA,H,C,IJET,SJETTY,T,DX
00306      1,DEEP,HB,CG)
00307 10   CONTINUE
00308 C*SMOOTHING OF THE WAVE ANGLE,THETA, IS RECD TO ACCT FOR DIFF EFFECTS.
00309      CALL SMOOTH(THETA,IMAX,JMAX,IJET,SJETTY,MMAX,Y)
00310      CALL QTRAN
00311      IF(NOBS.EQ.0) GO TO 9990
00312      DO 9999 N=1,NOBS
00313      XDD=ILFT(N)-IRT(N)
00314      DO 9998 NN=ILFT(N),IRT(N)-1
00315      XLT=ILFT(N)-NN+.5
00316      DEEPM=DEEPL(N)-(DEEPL(N)-DEEPR(N))*XLT/XDD
00317      IF(DEEPB(NN+1).GE.DEEPM) GO TO 9998
00318      DEEPB(NN+1)=DEEPM
00319      HBQ(NN+1)=HLFT(N)-(HLFT(N)-HRT(N))*XLT/XDD
00320 9998 CONTINUE
00321      DEEPB(ILFT(N))=.5*(DEEPB(ILFT(N))+DEEPB(ILFT(N)-1))
00322      HBQ(ILFT(N))=.5*(HBQ(ILFT(N))+HBQ(ILFT(N)-1))
00323      DEEPB(IRT(N)+1)=.5*(DEEPB(IRT(N))+DEEPB(IRT(N)+1))
00324      HBQ(IRT(N)+1)=.5*(HBQ(IRT(N))+HBQ(IRT(N)+1))
00325 9999 CONTINUE
00326 9990 CONTINUE
00327 C*FIRST THE LONGSHORE SEDIMENT TRANSPORT WILL BE DISTRIBUTED
00328 C***ACROSS THE SURF ZONE....
00329      CC=1.25
00330 C***QX(I,J) WILL BE DETERMINED BY SUBTRACTING FROM THE INTEGRAL

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00331 C**OF QX FROM DEEP(I,J-1) TO INFINITY, THE INTEGRAL OF QX FROM DEEP(I,J)
00332 C***TO INFINITY. IN THIS WAY THE SEDIMENT TRANS FROM JMAX OUT GETS
00333 C***INCLUDED IN QX(I,JMAX). TO INCLUDE THE SWASH TRANS, WHEN J=1
00334 C*WE WILL SUBTRACT FROM 2 TO INFINITY FROM 1.0
00335 C*LOOP FOR VALUES WHICH ARE HELD CONST AND STORED.
00336     THETAB(1,1)=0.5*(THETA(1,1)+0.0)
00337     R(1,1)=0.5/(DX*(DEEP(1,1)+BERM/2.))
00338     DO 290 I=2,IMAX
00339     R(I,1)=0.5/(DX*(DEEP(I,1)+BERM/2.))
00340 C*   THETAB(I,1)=0.25*(THETA(I,1)+THETA(I-1,1)+0.+0.)
00341     THETAB(I,1)=0.5*(THETA(I,1)+THETA(I-1,1))
00342 C*NO NEED TO COMPUTE PROP ANGLE AT STRUCTS BECAUSE QX =0.0 AT IJET(M)+1
00343     ANGLOC(I,1)=ATAN((Y(I,1)-Y(I-1,1))/DX)
00344 C*HBQ(IJET(M)+1) IS PROPERLY SET IN THE SUBROUTINE QTRAN.
00345     ARG0=((DEEP(I,1)**1.5+HBQ(I)*ADEAN**1.5)/(CC*DEEPB(I)**1.5
00346     1)**3
00347     IF(ARG0.GT.50.) ARG0=50.
00348     DISTR(I,1)=1.0-EXP(-ARG0)
00349     DISTR(I,1)=DISTR(I,1)*TKSI*HBQ(I)**2.5
00350     DO 290 J=2,JMAX
00351     R(I,J)=0.5/(DX*(DEEP(I,J)-DEEP(I,J-1)))
00352     THETAB(I,J)=0.5*(THETA(I,J)+THETA(I-1,J))
00353     ANGLOC(I,J)=ATAN((Y(I,J)-Y(I-1,J))/DX)
00354     ARG1=((DEEP(I,J-1)**1.5+HBQ(I)*ADEAN**1.5)/(CC*DEEPB(I)**1.5
00355     1)**3
00356     ARG2=((DEEP(I,J)**1.5+HBQ(I)*ADEAN**1.5)/(CC*DEEPB(I)**1.5
00357     1)**3
00358     IF(ARG1.GT.50.) ARG1=50.
00359     IF(ARG2.GT.50.) ARG2=50.
00360     DISTR(I,J)=EXP(-ARG1)-EXP(-ARG2)
00361     DISTR(I,J)=DISTR(I,J)*TKSI*HBQ(I)**2.5
00362 290 CONTINUE
00363     DO 301 J=1,JMAX
00364     DO 301 I=2,IMAX
00365     AWARE(I,J)=DELT*R(I,J)*(QX(I,J)-QX(I+1,J)+OY(I,J)-OY(I,J+1))+Y(I,J
00366     * )
00367     S1=2.*SIN(THETAB(I,J))*COS(THETAB(I,J))*(-1.+2.*(COS(
00368     *   ANGLOC(I,J)))**2)
00369     S2=COS(2.*THETAB(I,J))*COS(ANGLOC(I,J))/(SORT(DX**2+
00370     *   (Y(I,J)-Y(I-1,J))**2))
00371     S3(I,J)=S2*DISTR(I,J)
00372     DO 325 M=1,MMAX
00373     IF(SJETTY(M).EQ.0.0) GO TO 302
00374     IF(I.NE.IJET(M)+1) GO TO 325
00375     IF(THETA0(M).GE.0.0) ISIDE=IJET(M)
00376     IF(THETA0(M).LT.0.0) ISIDE=IJET(M)+1
00377     YSEA=0.5*(Y(ISIDE,J)+Y(ISIDE,J+1))
00378     IF(J.EQ.1) DUMMY=YZERO(ISIDE)
00379     IF(J.GT.1) DUMMY=Y(ISIDE,J-1)
00380     YSHORE=0.5*(Y(ISIDE,J)+DUMMY)
00381     IF(YSEA.GT.SJETTY(M).AND.YSHORE.GT.SJETTY(M)) GO TO 302
00382     IF(YSEA.GT.SJETTY(M).AND.YSHORE.LE.SJETTY(M)) GO TO 298
00383 C*BECAUSE A NO FLOW B.C. IS USED ALONG THE STRUCT, NO ATTN WAS PAID
00384 C**TO GETTING PROPER VALUES OF ANGLOC, THETAB,DISTR,ETC.
00385     S3(I,J)=0.0

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00386      DISTR(I,J)=0.0
00387      GO TO 302
00388      325 CONTINUE
00389      GO TO 302
00390 C***ABOVE, ALL PARAMETERS(I.E.,S1,S2,S3,THETAB,DISTR,ANGLOC)
00391 C***ARE COMPUTED AS IF THE STRUCT IS NOT THERE. THE B.C. AT THE
00392 C***STRUCT TIP ASSUMES QX COMPUTED AS IF NO STRUCT PRESENT AND THEN
00393 C***BYPASSES ACCORDING TO \RATIO\.
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00394      298 RATIO=(YSEA-SJETTY(M))/(YSEA-YSHORE)
00395      S3(I,J)=S3(I,J)*RATIO
00396      DISTR(I,J)=DISTR(I,J)*RATIO
00397      302 RHS1(I,J)=DISTR(I,J)*S1-S3(I,J)*(Y(I,J)-Y(I-1,J))
00398      301 CONTINUE
00399      CALL BREAK(IMAX,JMAX)
00400      IF(NOBKS.EQ.0) GO TO 9991
00401      DO 9996 N=1,NOBKS
00402      XDD=ILFT(N)-IRT(N)
00403      DO 9996 NN=ILFT(N),IRT(N)
00404      XLT=ILFT(N)-NN
00405      DEEPM=DEEPL(N)-(DEEPL(N)-DEEPR(N))*XLT/XDD
00406      IF(DEEPM(N).GE.DEEPM) GO TO 9996
00407      DEEPM(N)=DEEPM
00408      HBI(NN)=HLFT(N)-(HLFT(N)-HRT(N))*XLT/XDD
00409      9996 CONTINUE
00410      9991 CONTINUE
00411 C*TO DETERMINE DECAY OF CONST6(I,J),NEED WAVE NO. AT BREAKING.
00412      DO 754 I=1,IMAX+1
00413      754 CALL WNUM(DEEPM(I),T,RKB(I))
00414 C*USING SHIELD\ S DIAG,Y AXIS=0.05 + (TAUD=RHO*C*U**2),GET UCRIT(FT/SEC)
00415      UCRIT=16.3*SQRT(DIAM*.00328)
00416      DO 748 J=1,JMAX+2
00417      748 H(IMAX+1,J)=H(IMAX,J)
00418      DO 750 I=1,IMAX+1
00419      CONST6(I,1)=COFF*DX
00420      DO 750 J=2,JMAX+2
00421 C*CONST6(I,J) GOES W/ QY(I,J) WHICH IS ASSOC W/ DEEP(I,J-1)
00422      IF(DEEP(I,J-1).LE.DEEPM(I)) GO TO 751
00423 C*HERE, MUST CAUSE COFF TO DECAY (WE'RE BEYOND SURF ZONE)
00424      UMAXB=HBI(I)*G*T*RKB(I)/(2.*TWOPI*COSH(RKB(I)*DEEPM(I)))
00425      UMAX=H(I,J-1)*G*T*RKB(I)/(2.*TWOPI*COSH(RKB(I)*DEEP(I,J-1)))
00426      IF(UCRIT.LT.UMAX.AND.UCRIT.LT.UMAXB) GO TO 749
00427      CONST6(I,J)=0.0
00428      GO TO 750
00429      749 TOP=0.01*H(I,J-1)**3*SIGMA**3/(SINH(RKB(I)*DEEP(I,J-1))**3)
00430      BOT=DEEP(I,J-1)*(0.625*TWOPI*G**1.5*0.78**2*ADEAN**1.5+
00431      *(0.01*HBI(I)**3*SIGMA**3/(DEEPM(I)*(SINH(RKB(I)*DEEPM(I))**3)))
00432      CONST6(I,J)=DX*COFF*TOP/BOT
00433      GO TO 750
00434      751 CONST6(I,J)=COFF*DX
00435      750 CONTINUE
00436      K=0
00437 C**PUT INTO BANDED FORM USING THE ALGORITHM A(M,N)-;B(M,NN) WHERE
00438 C***NN=KB+1-M+N(KB IS THE NUMBER OF LOWER CODIAGONALS(=JMAX,HERE)).
00439      DO 304 I=2,IMAX-1
00440      DO 304 J=1,JMAX
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00441      K=K+1
00442      AWARE(I,J)=AWARE(I,J)+DELT*RHS1(I,J)*R(I,J)-DELT*R(I,J)*RHS1(I+1,J
00443      * )+DELT*R(I,J)*CONST6(I,J)*WEQ(I,J)-DELT*R(I,J)*CONST6(I,J+1)*
00444      * WEQ(I,J-1)
00445      YDUM=YZERO(I)
00446      IF(J.NE.1) YDUM=Y(I,J-1)
00447      AWARE(I,J)=AWARE(I,J)+DELT*R(I,J)*CONST6(I,J)*0.5*(YDUM-Y(I,J))
00448      * -DELT*R(I,J)*CONST6(I,J+1)*0.5*(Y(I,J)-Y(I,J+1))
00449      U=DELT*R(I,J)*S3(I,J)
00450      V=DELT*R(I,J)*S3(I+1,J)
00451      Z1=DELT*R(I,J)*CONST6(I,J)*0.5
00452      Z2=DELT*R(I,J)*CONST6(I,J+1)*0.5
00453 C*NOW WILL SET UP THE MATRICES ABAND AND BMATRIX.
00454      ABAND(K,JMAX+1)=1.0+U+V+Z1+Z2
00455      IF(I.NE.2) GO TO 305
00456      AWARE(I,J)=AWARE(I,J)+U*Y(I-1,J)
00457      GO TO 310
00458 305 ABAND(K,1)=-U
00459 310 IF(I.NE.IMAX-1) GO TO 306
00460      AWARE(I,J)=AWARE(I,J)+V*Y(IMAX,J)
00461      GO TO 311
00462 306 ABAND(K,JMAX+1+JMAX)=-V
00463 311 IF(J.NE.1) GO TO 307
00464      ABAND(K,JMAX+1)=ABAND(K,JMAX+1)-Z1
00465      AWARE(I,1)=AWARE(I,1)+Z1*(YZERO(I)-Y(I,1))
00466      GO TO 312
00467 307 ABAND(K,JMAX)=-Z1
00468 312 IF(J.NE.JMAX) GO TO 308
00469      AWARE(I,J)=AWARE(I,J)+Z2*Y(I,JMAX+1)
00470      GO TO 309
00471 308 ABAND(K,JMAX+2)=-Z2
00472 309 BMATRIX(K)=AWARE(I,J)
00473 304 CONTINUE
00474      KMAX=K
00475 C**CALL IMSL ROUTINE LEQT1B TO SOLVE THE BANDED MATRIX.
00476      ISIZE=(NJ-3)*(NI-5)
00477      CALL LEQT1B(ABAND,KMAX,JMAX,JMAX,ISIZE,BMATRIX,1,ISIZE,0,XL,IER)
00478 C*NOW, GIVE Y'S THEIR NEW VALUES STORING OLD VALUES IN YOLD.
00479      K=0
00480      DO 315 I=2,IMAX-1
00481      YOLD(I,JMAX+1)=Y(I,JMAX+1)
00482      DO 315 J= 1,JMAX
00483      K=K+1
00484      YOLD(I,J)=Y(I,J)
00485      Y(I,J)=BMATRIX(K)
00486 315 CONTINUE
00487      DO 320 J=1,JMAX+3
00488      YOLD(1,J)=Y(1,J)
00489 320 YOLD(IMAX,J)=Y(IMAX,J)
00490 C*WILL USE ABBOTT'S DISSIPATIVE INTERFACE TO RID HIGH FREQ OSCILLATIONS
00491      DO 650 J=1,JMAX
00492      DO 650 I=2,IMAX-1
00493      YDISS(I,J)=TAU*Y(I-1,J)+(1.-2.*TAU)*Y(I,J)+TAU*Y(I+1,J)
00494      DO 649 M=1,MMAX
00495      IF(SJETTY(M).EQ.0.) GO TO 650

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00496     IF(I.NE.IJET(M).AND.I.NE.IJET(M)+1) GO TO 649
00497     IF(Y(IJET(M),J).GT.SJETTY(M).OR.Y(IJET(M)+1,J).GT.SJETTY(M))GO
00498     1 TO 649
00499     IF(I.EQ.IJET(M))YDISS(I,J)=TAU*Y(I-1,J)+(1.-TAU)*Y(I,J)
00500     IF(I.EQ.(IJET(M)+1))YDISS(I,J)=TAU*Y(I+1,J)+(1.-TAU)*Y(I,J)
00501
00502
00503     649 CONTINUE
00504     650 CONTINUE
00505     DO 651 J=1,JMAX
00506     DO 651 I=2,IMAX-1
00507     651 Y(I,J)=YDISS(I,J)
00508     C*THIS LOOP WILL STORE THE IMPLICIT Y VALUES REQ'D TO COMP QY+QX
00509     DO 40 I=1,IMAX+1
00510     DO 40 J=1,JMAX+3
00511     40 YIMP(I,J)=Y(I,J)
00512     C*THIS LOOP WILL EXPLICITLY MOVE CONTOURS SEAWARD IF REPOSE EXCEEDED.
00513     KOUNT=0
00514     SLOPEM=TAN(0.9*REPOSE)
00515     DO 48 I=1,IMAX
00516     43 KOUNT=KOUNT+1
00517     IF(KOUNT.GT.50000) GO TO 41
00518     C*LET US COMPUTE ALL THE SLOPES(PSLOP) FOR EACH CHANGE IN DEPTH.
00519     DO 47 J=1,JMAX+1
00520     DUM=-BERM/2.0
00521     IF(J.NE.1) DUM=DEEP(I,J-1)
00522     DELH=0.5*(DEEP(I,J+1)+DEEP(I,J))-0.5*(DEEP(I,J)+DUM)
00523     PSLOP=DELH/(Y(I,J+1)-Y(I,J))
00524     47 SANGLE(J)=ATAN(PSLOP)
00525     C*FIND THE MIN NEG SLOPE ANGLE OR THEN THE POS SLOPE;REPOSE OR FORGET IT
00526     ASLOPM=-1.0E50
00527     ASLOPP=0.0
00528     DO 46 J=1,JMAX+1
00529     IF(SANGLE(J).GT.0.0) GO TO 45
00530     IF(SANGLE(J).GT.ASLOPM)ASLOPM=SANGLE(J)
00531     IF(ASLOPM.EQ.SANGLE(J)) JM=J
00532     GO TO 46
00533     45 IF(SANGLE(J).GT.REPOSE.AND.SANGLE(J).GT.ASLOPP)ASLOPP=SANGLE(J)
00534     IF(ASLOPP.EQ.SANGLE(J)) JP=J
00535     46 CONTINUE
00536     IF(ASLOPM.EQ.-1.0E50.AND.ASLOPP.EQ.0.0) GO TO 42
00537     IF(ASLOPM.EQ.-1.0E50) GO TO 44
00538     DUM=-BERM/2.
00539     IF(JM.NE.1) DUM=DEEP(I,JM-1)
00540     ALTER=((0.5/SLOPEM*(DEEP(I,JM+1)-DUM))-(Y(I,JM+1)-Y(I,JM)))/
00541     * (1.0+((DEEP(I,JM+1)-DEEP(I,JM))/(DEEP(I,JM)-DUM)))
00542     Y(I,JM+1)=Y(I,JM+1)+ALTER
00543     Y(I,JM)=Y(I,JM)-(ALTER*(DEEP(I,JM+1)-DEEP(I,JM))/(DEEP(I,JM)-DUM))
00544     OYEXP(I,JM+1)=OYEXP(I,JM+1)+DX/DELT*ALTER*(DEEP(I,JM+1)-DEEP(I,JM)
00545     * )
00546     GO TO 43
00547     44 CONTINUE
00548     DUM=-BERM/2.
00549     IF(JP.NE.1) DUM=DEEP(I,JP-1)
00550     ALTER=((0.5/SLOPEM*(DEEP(I,JP+1)-DUM))-(Y(I,JP+1)-Y(I,JP)))/

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00551      * (1.0+((DEEP(I,JP+1)-DEEP(I,JP))/(DEEP(I,JP)-DUM)))
00552      Y(I,JP+1)=Y(I,JP+1)+ALTER
00553      Y(I,JP)=Y(I,JP)-(ALTER*(DEEP(I,JP+1)-DEEP(I,JP))/(DEEP(I,JP)-DUM))
00554      QYEXP(I,JP+1)=QYEXP(I,JP+1)+DX/DELT*ALTER*(DEEP(I,JP+1)-DEEP(I,JP)
00555      * )
00556      GO TO 43
00557      42 WEQ(I,JMAX+1)=Y(I,JMAX+1)-Y(I,JMAX)
00558      48 CONTINUE
00559 C*IF WE GET SENT HERE, LOOP 444 WILL CATCH THE CROSSED CONTOURS.
00560      41 CONTINUE
00561 C*NOW WE CAN COMPUTE QX\S AND QY\S?
00562      DO 318 I=2,IMAX
00563 C*ALL IMPLIC AND EXPLIC MOVEMENT OF YZERO WILL BE TAKEN CARE OF HERE
00564      BRF=.5
00565      QY(I,1)=-BRF*BERM*DX*(Y(I,1)-YOLD(I,1))/DELT
00566      YZERO(I)=YZERO(I)+BRF*(Y(I,1)-YOLD(I,1))
00567      319 DO 318 J=1,JMAX
00568      QX(I,J)=RHS1(I,J)-S3(I,J)*YIMP(I,J)+S3(I,J)*YIMP(I-1,J)
00569      318 QY(I,J+1)=CONST6(I,J+1)*(0.5*(YIMP(I,J)+YOLD(I,J)-YIMP(I,J+1)
00570      * -YOLD(I,J+1))+WEQ(I,J+1))
00571      DO 323 J=1,JMAX
00572      QX(1,J)=QX(2,J)
00573      323 QX(IMAX+1,J)=QX(IMAX,J)
00574 C*TOTAL QYS WILL BE COMP FROM IMPLIC AND EXPLIC VALUES.THEN ZERO QYEXP
00575      DO 39 I=1,IMAX+1
00576      DO 39 J=1,JMAX+3
00577      QY(I,J)=QY(I,J)+QYEXP(I,J)
00578      39 QYEXP(I,J)=0.0
00579 C*THIS CHECK WILL BOMB THINGS OUT IF CONTOURS HAVE CROSSED.
00580      DO 444 I=1,IMAX
00581      DO 444 J=1,JMAX
00582 C*IF CONTOURS CROSS AT ANY TIME WANT PROGRAM TO STOP?
00583      IF(Y(I,J).LT.Y(I,J+1)) GO TO 444
00584      WRITE(2,103)
00585      9265 FORMAT(" */ REPLACEMENT ",I5)
00586      WRITE(2,9265) NUNIV
00587 COMMENT WRITE(2,*/ ) NUNIV
00588      103 FORMAT(2X,"THE CONTOURS HAVE CROSSED AND SOMETHING IS WRONG",/)
00589 COMMENT I AND J HAVE BEEN CHANGED TO II AND JJ HERE
00590      DO 150 JJ=1,JMAX
00591      150 WRITE(2,100) (QX(II,JJ),II=1,IMAX)
00592      DO 151 JJ=1,JMAX
00593      151 WRITE(2,101) (QY(II,JJ),II=1,IMAX)
00594      DO 152 JJ=1,JMAX
00595      152 WRITE(2,100) (Y(II,JJ),II=1,IMAX)
00596      DO 19 JJ=1,JMAX
00597      19 WRITE(2,100) (YOLD(II,JJ),II=1,IMAX)
00598 COMMENT I AND J WERE CHANGED DOWN TO HERE
00599      GO TO 445
00600      444 CONTINUE
00601 C WRITE(2,9265) NUNIV
00602 COMMENT WRITE(2,9265) NUNIV
00603 C*THE FOLLOWING STATEMENT DETERMINES AT WHAT FREQ EVERYTHING IS WRITTEN?
00604      IF(MOD(NUNIV,NWRITE).NE.0) GO TO 1
00605 C*LET\S WRITE ALL OF IT OUT.

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00606      WRITE(2,926)  NUNIV
00607  926  FORMAT(2X,"THE TOTAL ELAPSED NUMBER OF TIME-STEPS. NUNIV= ",15,/)
00608  800  FORMAT(2X,14(F8.4))
00609  C*    DO 900 I=1,IMAX
00610  C*900  WRITE(2,800)  (THETA(I,J),J=1,JMAX)
00611  C*    DO 903 J=1,JMAX+1
00612  C*903  WRITE(2,801)  DEEP(1,J)
00613  C*    DO 906 I=1,IMAX
00614  C*906  WRITE(2,800)  (H(I,J),J=1,JMAX)
00615  C*    DO 755 J=1,JMAX
00616  C*755  WRITE(2,800)  (CONST6(I,J),I=1,IMAX)
00617  801  FORMAT(2X,14(F8.2))
00618  C      WRITE(2,107)
00619  C 107  FORMAT(/,2X,"THE LONGSHORE TRANSPORTS, QX, FOLLOW")
00620  C      DO 15 J=1,JMAX
00621  C 15    WRITE(2,100)  (QX(I,J),I=1,IMAX)
00622  C      WRITE(2,108)
00623  C 108  FORMAT(/,2X,"THE ON-OFFSHORE TRANSPORTS, QY, FOLLOW")
00624  C      DO 17 J=1,JMAX
00625  C 17    WRITE(2,101)  (QY(I,J),I=1,IMAX)
00626  C      WRITE(2,109)
00627  C 109  FORMAT(/,2X,"THE NEW CONTOUR VALUES, Y, FOLLOW")
00628  C      DO 18 J=1,JMAX
00629  C 18    WRITE(2,100)  (Y(I,J),I=1,IMAX)
00630  C      DO 15 I=1,IMAX
00631  C          WRITE(2,17) I
00632  C          WRITE(2,1801) (H(I,J),J=1,JMAX+1)
00633  1801  FORMAT(1X,5HH      ,9F8.3)
00634  C          WRITE(2,1802) (THETA(I,J),J=1,JMAX+1)
00635  1802  FORMAT(1X,5HTHETA,9F8.3)
00636  C          WRITE(2,1803) (Y(I,J),J=1,JMAX+1)
00637  1803  FORMAT(1X,5HY      ,9F8.2)
00638  C          WRITE(2,1804) (QX(I,J),J=1,JMAX+1)
00639  1804  FORMAT(1X,5HQX      ,9F8.3)
00640  15    WRITE(2,1805) (QY(I,J),J=1,JMAX+1)
00641  1805  FORMAT(1X,5HOY      ,9F8.3)
00642  17    FORMAT(1X,17HLONGSHORE STATION,15)
00643  100   FORMAT(2X,13(F9.3))
00644  101   FORMAT(2X,13(F9.4))
00645  CALL PLOTNS(IMAX,JMAX,Y,YLEFT,YRT,ILFT,IRT,SJETTY,IJET,NOSKS,MMAX)
00646  1      CONTINUE
00647  RETURN
00648  445  STOP
00649  446  CONTINUE
00650  END
00651  SUBROUTINE QTRAN
00652  PARAMETER (NI=53,NJ=11)
00653  C*THIS SUBROUTINE CALCS THE BREAKER HEIGHT FOR EACH
00654  C*****
00655  C*OF THE I GRID LINES. METHOD--FINDS Y-LOCATIONS BEFORE AND AFTER
00656  C*BREAKING HAS OCCURRED BY \REFRAC\, THEN USES SHOALING TO GET THE
00657  C*HBO.SNELL'S LAW IS USED FOR REFRACTION OVER THE SHORT DIST TO BREAKING
00658  C* QX(I,J) IS THE TRANS BETWEEN(I-1,J) AND (I,J) AT THE BLOCKCENT
00659  COMMON/A/ C(NI,NJ),RK(NI,NJ),Y(NI,NJ),DEEP(NI,NJ),ALPHAS(NI,NJ)
00660  COMMON/AA/YZERO(NI),WDEPTH

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00661      COMMON/B/ THETA(NI,NJ),QXTOT(NI), OLDANG(NI,NJ), DY(NI,NJ)
00662      COMMON/C/ H(NI,NJ),CG(NI,NJ),HOLD(NI,NJ),HB(NI,NJ),YB(NI)
00663      COMMON/N USED/JUSE,T,CO,CGEN,CGGEN,ANGGEN,DX,BERM,THETA0(10),MMAX
00664      COMMON/D/SIGMA,G,ELO,JMAX,IMAX,PI,TWOPI,PI02,HGEN,IJET(10)
00665      1,SJETTY(10)
00666      COMMON/G/IBREAK(NI),HNONBR(NJ)
00667      COMMON/E/RHO,RHOS,POROS,CONST,TKSI
00668      COMMON/P/HBQ(NI),DEEPB(NI)
00669      CAPPA=0.78
00670      DO 1 I=2,IMAX
00671      DO 2 JJ=1,JMAX
00672      J=JMAX-JJ+1
00673      HDUM=(H(I,J)+H(I-1,J))*0.5
00674      HBDUM=(HB(I,J)+HB(I-1,J))*0.5
00675 C*CAN ONLY USE COND ON ONE SIDE OF STRUCT. CAN'T AVG HERE?
00676      DO 4 M=1,MMAX
00677      IF(SJETTY(M).EQ.0.) GO TO 74
00678      IF(I.NE.IJET(M)+1) GO TO 4
00679      IF(THETA0(M).GE.0.0) ISIDE=IJET(M)
00680      IF(THETA0(M).LT.0.0) ISIDE=IJET(M)+1
00681      YSEA=.5*(Y(ISIDE,J)+Y(ISIDE,J+1))
00682      IF(YSEA.GT.SJETTY(M)) GO TO 3
00683      HDUM=H(ISIDE,J)
00684      HBDUM=HB(ISIDE,J)
00685      GO TO 3
00686      4 CONTINUE
00687      74 CONTINUE
00688      3 IF(HDUM.LT.HBDUM) GO TO 2
00689      DEEPB(I)=((0.5*(H(I,J+1)+H(I-1,J+1)))+(0.5*(DEEP(I,J+1)
00690      * +DEEP(I-1,J+1)))*0.25)/CAPPA)**0.8
00691      HBQ(I)=CAPPA*DEEPB(I)
00692 C*HBQ(I) AND DEEPB(I) WILL BE COMPUTED ACCORDING TO THE WAVE DIR.
00693 C** AT THE STRUCTURE TIP,THETA0.
00694      DO 6 M=1,MMAX
00695      IF(SJETTY(M).EQ.0.) GO TO 1
00696      IF(I.NE.IJET(M)+1) GO TO 6
00697 C**THE TRANSPORTING WAVES WILL BE COMPUTED USING THE WAVE TO PROP SIDE.
00698      IF(THETA0(M).GE.0.0) GO TO 11
00699      DEEPB(I)=(H(IJET(M)+1,J+1)*DEEP(IJET(M)+1,J+1)**0.25/CAPPA)**0.8
00700      IBREAK(I)=IBREAK(IJET(M)+1)
00701      GO TO 12
00702      11 DEEPB(I)=(H(IJET(M),J+1)*DEEP(IJET(M),J+1)**0.25/CAPPA)**0.8
00703      IBREAK(I)=IBREAK(IJET(M))
00704      12 HBQ(I)=DEEPB(I)*CAPPA
00705      GO TO 1
00706      6 CONTINUE
00707      GO TO 1
00708      2 CONTINUE
00709      1 CONTINUE
00710 C*IF THE OFFSHORE WAVE HT IS ZERO, NEVER GET TO HERE.
00711 C*HOWEVER IF THE H IS SUCH THAT IT WOULD BREAK INSHORE OF Y(I,2)
00712      DO 20 I=2,IMAX
00713      IF(DEEPB(I).GT.0.0) GO TO 20
00714      DEEPB(I)=(H(I,1)*DEEP(I,1)**0.25/CAPPA)**0.8
00715      HBQ(I)=CAPPA*DEEPB(I)

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00716 20 CONTINUE
00717 HBQ(1)=HBQ(2)
00718 HBQ(IMAX+1)=HBQ(IMAX)
00719 DEEPB(1)=DEEPB(2)
00720 DEEPB(IMAX+1)=DEEPB(IMAX)
00721 RETURN
00722 END
00723 SUBROUTINE BREAK(IMAX,JMAX)
00724 PARAMETER(NI=53,NJ=11)
00725 C*****
00726 C*ROUTINE WILL DETERMINE HB AND DEEPB ON THE GRID LINES RATHER
00727 C* THAN BETWEEN THEM. REQ'D FOR COFF BEYOND SURF ZONE.
00728 COMMON/A/ C(NI,NJ),RK(NI,NJ),Y(NI,NJ),DEEP(NI,NJ),ALPHAS(NI,NJ)
00729 COMMON/C/ H(NI,NJ),CG(NI,NJ),HOLD(NI,NJ),HB(NI,NJ),YB(NI)
00730 COMMON/MP/ RKB(NI),HBI(NI),DEEPBI(NI)
00731 CAPPA=0.78
00732 DO 1 I=2,IMAX
00733 DO 2 JJ=1,JMAX
00734 J=JMAX-JJ+1
00735 IF(H(I,J).LT.HB(I,J)) GO TO 2
00736 DEEPBI(I)=((H(I,J+1)*DEEP(I,J+1)**0.25)/CAPPA)**0.8
00737 HBI(I)=CAPPA*DEEPBI(I)
00738 C***ONCE THE HEIGHT + DEPTH AT BREAKING ARE FOUND, GO TO NEXT GRID-LINE.
00739 GO TO 1
00740 2 CONTINUE
00741 1 CONTINUE
00742 DO 20 I=2,IMAX
00743 IF(DEEPBI(I).GT.0.0) GO TO 20
00744 DEEPBI(I)=(H(I,1)*DEEP(I,1)**0.25/CAPPA)**0.8
00745 HBI(I)=CAPPA*DEEPBI(I)
00746 20 CONTINUE
00747 DEEPBI(1)=DEEPBI(2)
00748 DEEPBI(IMAX+1)=DEEPBI(IMAX)
00749 HBI(1)=HBI(2)
00750 HBI(IMAX+1)=HBI(IMAX)
00751 RETURN
00752 END
00753 SUBROUTINE REFRAC(JBEGIN,JEND,NPTS,IBEGIN,IEND,ISTART,M)
00754 PARAMETER(NI=53,NJ=11)
00755 COMMON/A/ C(NI,NJ),RK(NI,NJ),Y(NI,NJ),DEEP(NI,NJ),ALPHAS(NI,NJ)
00756 COMMON/AA/YZERO(NI),WDEPTH
00757 COMMON/B/ THETA(NI,NJ),QXTOT(NI),OLDANG(NI,NJ),DY(NI,NJ)
00758 COMMON/C/ H(NI,NJ),CG(NI,NJ),HOLD(NI,NJ),HB(NI,NJ),YB(NI)
00759 COMMON/N USED/JUSE,T,CO,CGEN,CGGEN,ANGGEN,DX,BERM,THETA0(10),MMAX
00760 COMMON/D/SIGMA,G,ELO,JMAX,IMAX,PI,TWOFI,PI02,HGEN,IJET(10)
00761 1,SJETTY(10)
00762 COMMON/G/IBREAK(NI),HNONBR(NJ)
00763 COMMON/ZZZ/NTIME
00764 DIMENSION JBEGIN(NI),JEND(NI)
00765 C***** THIS SUBROUTINE WILL DETERMINE H AND
00766 C***** THETA AT THE MID PT OF Y VALUES.
00767 C***TAU IS THE FACTOR WHICH RECOUPLES THE REFRACTION EQS.SEE ABBOTT
00768 TAU=0.25
00769 C*MUST PRESCRIBE THE WAVE ANGLE AT THE OUTERMOST CONTOUR BOX
00770 C*SNELL'S LAW WILL BE USED TO START THINGS OFF.

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00771 C*THETA(I,J) WILL BE AT AREA'S CENTER AND WILL USE Y(I,J) IN NEG Y-DIR
00772 C*WILL INITIALIZE ALL THETA'S USING SNELL'S LAW.
00773     DO 206 I=IBEGIN,IEND
00774 C*INITIALIZE TWO J-VALUES BEYOND JMAX,IF IN REGION 1.
00775     IF(JEND(I).EQ.JMAX) JINIT=2
00776     IF(JEND(I).NE.JMAX) JINIT=0
00777     DO 206 J=JBEGIN(I),JEND(I)+JINIT
00778 C*MUST CORRECT FOR THE CONTOUR ORIENTATION, ALPHAS.
00779     IF(I.NE.IBEGIN) GO TO 960
00780     ALPHAS(I,J)=ATAN((0.5*(Y(I+1,J)+Y(I+1,J+1))-0.5*(Y(I,J)
00781 * +Y(I,J+1)))/DX)
00782     GO TO 962
00783 960 IF(I.NE.IEND) GO TO 961
00784     ALPHAS(I,J)=ATAN((0.5*(Y(I,J)+Y(I,J+1))-0.5*(Y(I-1,J)
00785 * +Y(I-1,J+1)))/DX)
00786     GO TO 962
00787 961 ALPHAS(I,J)=ATAN((0.5*(Y(I+1,J)+Y(I+1,J+1))-0.5*
00788 * (Y(I-1,J)+Y(I-1,J+1)))/(2.*DX))
00789 962 DALPHA=ANGGEN-ALPHAS(I,J)
00790     ARG=(C(I,J)/CGEN)*SIN(DALPHA)
00791     IF(ARG.GT.1.) ARG=1.
00792     THETA(I,J)=ASIN(ARG)
00793 C*MUST GET THETA WRT THE X-AXIS.
00794     THETA(I,J)=THETA(I,J)+ALPHAS(I,J)
00795 206 CONTINUE
00796 C*NOW, WE MUST COMP THE BOUN WAVE HTS SO THE HTS CAN BE COMPUTED.
00797 C*WILL USE THE EQ. ***** DEL DOT (E*CG)=0.0
00798 C*NOW WE WILL CORRECT THE HT FOR SHOALING AND REFRACTION TO THE B.C.
00799 C*WILL ALSO INITIALIZE H'S WITH THESE EQUATIONS FOR ENTIRE ARRAY.
00800     DO 500 I=IBEGIN,IEND
00801 C*INITIALIZE TWO J-VALUES BEYOND JMAX IF IN REGION 1.
00802     IF(JEND(I).EQ.JMAX) JINIT=2
00803     IF(JEND(I).NE.JMAX) JINIT=0
00804     DO 500 J=JBEGIN(I),JEND(I)+JINIT
00805     H(I,J)=HGEN*SQRT(CGGEN/CG(I,J))*SQRT(COS(ANGGEN)/COS(THETA(I,
00806 * J)))
00807     IF(HB(I,J).LT.H(I,J)) H(I,J)=HB(I,J)
00808 500 CONTINUE
00809 C*-----
00810 C*****
00811 C*LET'S FILL THE DY ARRAY.
00812 C*DY WILL BE INDEXED AS THE THETA TO WHICH WE ARE GOING.
00813     DO 209 I=IBEGIN,IEND
00814     DO 209 J=JBEGIN(I)+1,JEND(I)
00815     DY(I,J-1)=0.5*(Y(I,J-1)+Y(I,J))-0.5*(Y(I,J)+Y(I,J+1))
00816 209 CONTINUE
00817     NITERS=100
00818     DO 100 NITER=1,NITERS
00819     SUMANG=0.0
00820 C*DO \60 LOOP\ GOES FROM 2 TO IMAX IF ISTART =IBEGIN
00821 C*DO \60 LOOP\ GOES FROM IMAX-1 TO 1 IF ISTART=IEND
00822     DO 60 II=IBEGIN,IEND
00823 C*MUST HAVE IT SET UP SO THAT THE KNOWN BOUNDARIES
00824     IF(ISTART .EQ. IBEGIN) I=II
00825 COMMENT LINE WITH UNKNOWN CHARACTERS REMOVED HERE.

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00826      IF(ISTART.EQ.IBEGIN .AND. I.EQ.IBEGIN) GO TO 60
00827      IF(ISTART.EQ.IEND) I=IEND-II+IBEGIN
00828      IF(ISTART.EQ.IEND .AND. I.EQ.IEND) GO TO 60
00829 C*ADX EQUALS ACTUAL DELTA X ACROSS SPACE STEP.
00830 C*ONLY ON BOUNDARIES WHERE FORWARD OR BACKWARD DIFFERENCING.
00831      IF(I.NE.IBEGIN) GO TO 6
00832      ADX=DX
00833      IP=I+1
00834      IM=I
00835      GO TO 12
00836 6      IF(I.NE.IEND) GO TO 10
00837      ADX=DX
00838      IP=I
00839      IM=I-1
00840      GO TO 12
00841 10     ADX=2.0*DX
00842      IP=I+1
00843      IM=I-1
00844 12     CONTINUE
00845      DO 40 J=JBEGIN(I),JEND(I)-1
00846 C*WILL GO FROM (JMAX-1) TO 1 BECAUSE THAT'S THE DIR WAVE COMES IN FROM.
00847      JJ=JEND(I)-1-J+JBEGIN(I)
00848      OLDANG(I,JJ)=THETA(I,JJ)
00849 C*LOCATE MIDPOINT BETWEEN TWO ADJACENT BLOCK CENTERS
00850 C*BECAUSE THETA'S JJ-VALUE IS THE SAME AS THE FIRST SHOREWARD Y VALUE
00851 C*MUST USE JJ, JJ+1, AND JJ+2 TO COMPUTE YBAR.
00852      YBAR=0.25*(Y(I,JJ)+2.0*Y(I,JJ+1)+Y(I,JJ+2))
00853 C*LOCATE APPROPRIATE INDICES ON IP AND IM GRID LINES.
00854      IMINUS=-1
00855      IPLUS=+1
00856      CALL LOC(IM,JJ,JOIM,JSIM,YBAR,IMINUS)
00857      CALL LOC(IP,JJ,JOIP,JSIP,YBAR,IPLUS)
00858 C*NOW USE THE CONSERVATION OF WAVES EQUATION.....
00859      PART1C=RK(I,JJ+1)*SIN(THETA(I,JJ+1))
00860      PART2=-DY(I,JJ)/ADX
00861 C*WILL LINEARLY INTERPOLATE TO DETERMINE RK*COS(THETA) AT I+1 AND I-1.
00862 C*IF NO ADJ SHOREWARD PT EXISTS, PUT IN ZERO FOR TERMS IN GOV. EQ.
00863      IF(JSIM.NE.0) GO TO 301
00864      PART3B=0.0
00865      GO TO 302
00866 301     TOPIM=RK(IM,JOIM-1)*COS(THETA(IM,JOIM-1))
00867      BOTIM=RK(IM,JSIM)*COS(THETA(IM,JSIM))
00868      TOTALB=0.5*(Y(IM,JOIM)+Y(IM,JOIM-1))-0.5*(Y(IM,JSIM+1)+Y(IM,JSIM))
00869      DUMB=0.5*(Y(IM,JOIM)+Y(IM,JOIM-1))-YBAR
00870      PART3B=((TOTALB-DUMB)*(TOPIM-BOTIM)/TOTALB)+BOTIM
00871 302     IF(JSIP.NE.0) GO TO 303
00872      PART3A=0.0
00873      GO TO 304
00874 303     TOPIP=RK(IP,JOIP-1)*COS(THETA(IP,JOIP-1))
00875      BOTIP=RK(IP,JSIP)*COS(THETA(IP,JSIP))
00876      TOTALA=0.5*(Y(IP,JOIP)+Y(IP,JOIP-1))-0.5*(Y(IP,JSIP+1)+Y(IP,JSIP))
00877      DUMA=0.5*(Y(IP,JOIP)+Y(IP,JOIP-1))-YBAR
00878      PART3A=((TOTALA-DUMA)*(TOPIP-BOTIP)/TOTALA)+BOTIP
00879 304     PART3=PART3A-PART3B
00880 C*NOW MUST FIND RK*SIN(THETA) FOR I+1 AND I-1 AT J+1

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00881      YBARP=0.25*(Y(I,JJ+1)+2.*Y(I,JJ+2)+Y(I,JJ+3))
00882      CALL LOC(IM,JJ+1,JPOIM,JPSIM,YBARP,IMINUS)
00883      CALL LOC(IP,JJ+1,JPOIP,JPSIP,YBARP,IPLUS)
00884      IF(JPSIM.NE.0) GO TO 305
00885      PART1B=0.0
00886      GO TO 306
00887 305 TOPM=RK(IM,JPOIM-1)*SIN(THETA(IM,JPOIM-1))
00888      BOTM=RK(IM,JPSIM)*SIN(THETA(IM,JPSIM))
00889      TOTB=0.5*(Y(IM,JPOIM)+Y(IM,JPOIM-1))-0.5*(Y(IM,JPSIM+1)+
00890      * Y(IM,JPSIM))
00891      DUMPB=0.5*(Y(IM,JPOIM)+Y(IM,JPOIM-1))-YBARP
00892      PART1B=((TOTB-DUMPB)*(TOPM-BOTM)/TOTB)+BOTM
00893 306 IF(JPSIP.NE.0) GO TO 307
00894      PART1A=0.0
00895      GO TO 308
00896 307 TOPP=RK(IP,JPOIP-1)*SIN(THETA(IP,JPOIP-1))
00897      BOTP=RK(IP,JPSIP)*SIN(THETA(IP,JPSIP))
00898      TOTA=0.5*(Y(IP,JPOIP)+Y(IP,JPOIP-1))-0.5*(Y(IP,JPSIP+1)+Y(IP,JPSIP
00899      * ))
00900      DUMPA=0.5*(Y(IP,JPOIP)+Y(IP,JPOIP-1))-YBARP
00901      PART1A=((TOTA-DUMPA)*(TOPP-BOTP)/TOTA)+BOTP
00902 308 PART1=TAU*PART1B+(1.-2.*TAU)*PART1C+TAU*PART1A
00903      IF(JPSIM.EQ.0)PART1=(1.-TAU)*PART1C+TAU*PART1A
00904      IF(JPSIP.EQ.0)PART1=TAU*PART1B+(1.-TAU)*PART1C
00905      ARG=((PART1+PART2*PART3)/RK(I,JJ))
00906 C*IF THE ROUTINE IS TO BLOWUP,USE SNELLS LAW.
00907      IF(ABS(ARG).LE.1.0) GO TO 41
00908      ARG=(C(I,JJ)/C(I,JJ+1))*SIN(THETA(I,JJ+1))
00909      IF(ARG.GT.1.0) ARG=1.0
00910      THETA(I,JJ)=ASIN(ARG)
00911      GO TO 42
00912 41 THETA(I,JJ)=ASIN(ARG)
00913 42 THETA(I,JJ)=0.5*(THETA(I,JJ)+OLDANG(I,JJ))
00914      SUMANG=SUMANG+(ABS(THETA(I,JJ)-OLDANG(I,JJ)))
00915 40 CONTINUE
00916 60 CONTINUE
00917 C*MUST EJECT IF WE HAVE REACHED AN ACCEPTABLE ITERATION ERROR
00918 C*IF THE SUM OF THE ABSOLUTE VALUE OF ANGLE CHANGES DURING AN ITERATION
00919 C* AVERAGES LESS THAN 0.02 DEGREES PER GRID ITS CLOSE ENOUGH.
00920      IF(SUMANG.LT.(NPTS*0.0035)) GO TO 215
00921      IF(NITER.GE.50) GO TO 215
00922 100 CONTINUE
00923      WRITE(2,803)
00924 215 CONTINUE
00925 C*ITERATION LOOP FOR THE WAVE HEIGHT.
00926      DO 501 NITER=1,NITERS
00927      SUMH=0.0
00928      DO 510 II=IBEGIN,IEND
00929 C*MUST HAVE IT SET UP SO THAT THE KNOWN BOUNDARIES HTS. AREN'T RECOMP
00930      IF(ISTART.EQ.IBEGIN) I=II
00931      IF(ISTART.EQ.IBEGIN .AND. I.EQ.IBEGIN) GO TO 510
00932      IF(ISTART.EQ.IEND) I=IEND-II+IBEGIN
00933      IF(ISTART.EQ.IEND .AND. I.EQ.IEND) GO TO 510
00934 C*ADX EQUALS ACTUAL DELTA X ACROSS SPACE STEP.
00935 C*ONLY ON BOUNDARIES WHERE FORWARD OR BACKWARD DIFFERENCING.

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00936      IF(I.NE.IBEGIN)   GO TO 503
00937      ADX=DX
00938      IP=I+1
00939      IM=I
00940      GO TO 505
00941 503      IF(I.NE.IEND)   GO TO 504
00942      ADX=DX
00943      IP=I
00944      IM=I-1
00945      GO TO 505
00946 504      ADX=2.0*DX
00947      IP=I+1
00948      IM=I-1
00949 505      CONTINUE
00950      HNONBR(JMAX)=H(I,JMAX)
00951      DO 502 J=JBEGIN(I),JEND(I)-1
00952      JJ=JEND(I)-1-J+JBEGIN(I)
00953      HOLD(I,JJ)=H(I,JJ)
00954      YBAR=0.25*(Y(I,JJ)+2.0*Y(I,JJ+1)+Y(I,JJ+2))
00955      CALL LOC(IM,JJ,JOIM,JSIM,YBAR,IMINUS)
00956      CALL LOC(IP,JJ,JOIP,JSIP,YBAR,IPLUS)
00957      PART13=(H(I,JJ+1)**2.)*CG(I,JJ+1)*COS(THETA(I,JJ+1))
00958      PART2=DY(I,JJ)/ADX
00959      IF(JSIM.NE.0)   GO TO 311
00960      PART4B=0.0
00961      GO TO 312
00962 311 TOPIMH=(H(IM,JOIM-1)**2.)*CG(IM,JOIM-1)*(SIN(THETA(IM,JOIM-1)))
00963      BOTIMH=(H(IM,JSIM)**2.)*CG(IM,JSIM)*SIN(THETA(IM,JSIM))
00964      TOTALB=0.5*(Y(IM,JOIM)+Y(IM,JOIM-1))-0.5*(Y(IM,JSIM+1)+Y(IM,JSIM))
00965      DUMB=0.5*(Y(IM,JOIM)+Y(IM,JOIM-1))-YBAR
00966      PART4B=((TOTALB-DUMB)*(TOPIMH-BOTIMH)/TOTALB)+BOTIMH
00967 312 IF(JSIP.NE.0)   GO TO 313
00968      PART4A=0.0
00969      GO TO 314
00970 313 TOPIPH=(H(IP,JOIP-1)**2.)*CG(IP,JOIP-1)*SIN(THETA(IP,JOIP-1))
00971      BOTIPH=(H(IP,JSIP)**2.)*CG(IP,JSIP)*SIN(THETA(IP,JSIP))
00972      TOTALA=0.5*(Y(IP,JOIP)+Y(IP,JOIP-1))-0.5*(Y(IP,JSIP+1)+Y(IP,JSIP))
00973      DUMA=0.5*(Y(IP,JOIP)+Y(IP,JOIP-1))-YBAR
00974      PART4A=((TOTALA-DUMA)*(TOPIPH-BOTIPH)/TOTALA)+BOTIPH
00975 314 PART4=PART4A-PART4B
00976      YBARP=0.25*(Y(I,JJ+1)+2.*Y(I,JJ+2)+Y(I,JJ+3))
00977      CALL LOC(IM,JJ+1,JPOIM,JPSIM,YBARP,IMINUS)
00978      CALL LOC(IP,JJ+1,JPOIP,JPSIP,YBARP,IPLUS)
00979      IF(JPSIM.NE.0)   GO TO 315
00980      PART12=0.0
00981      GO TO 316
00982 315 TOPMH=(H(IM,JPOIM-1)**2)*CG(IM,JPOIM-1)*COS(THETA(IM,JPOIM-1))
00983      BOTMH=(H(IM,JPSIM)**2)*CG(IM,JPSIM)*COS(THETA(IM,JPSIM))
00984      TOTB=.5*(Y(IM,JPOIM)+Y(IM,JPOIM-1))-0.5*(Y(IM,JPSIM+1)+Y(IM,JPSIM))
00985      DUMPB=0.5*(Y(IM,JPOIM)+Y(IM,JPOIM-1))-YBARP
00986      PART12=((TOTB-DUMPB)*(TOPMH-BOTMH)/TOTB)+BOTMH
00987 316 IF(JPSIP.NE.0)   GO TO 317
00988      PART11=0.0
00989      GO TO 318
00990 317 TOPPH=(H(IP,JPOIP-1)**2)*CG(IP,JPOIP-1)*COS(THETA(IP,JPOIP-1))

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00991      BOTPH=(H(IP,JPSIP)**2)*CG(IP,JPSIP)*COS(THETA(IP,JPSIP))
00992      TOTA=.5*(Y(IP,JPOIP)+Y(IP,JPOIP-1))-.5*(Y(IP,JPSIP+1)+Y(IP,JPSIP))
00993      DUMPA=0.5*(Y(IP,JPOIP)+Y(IP,JPOIP-1))-YBARF
00994      PART11=((TOTA-DUMPA)*(TOPPH-BOTPH)/TOTA)+BOTPH
00995      318 PART1H=TAU*PART12+(1.-2.*TAU)*PART13+TAU*PART11
00996      IF(JPSIM.EQ.0)PART1H=(1.-TAU)*PART13+TAU*PART11
00997      IF(JPSIP.EQ.0)PART1H=TAU*PART12+(1.-TAU)*PART13
00998      ARG=((PART1H+PART2*PART4)/(CG(I,JJ)*COS(THETA(I,JJ))))
00999      *IF THERE IS TO BE AN INVALID SORT,USE LINEAR SHOALING.
01000      IF(ARG.GE.0.) GO TO 44
01001      ARG=(CG(I,JJ+1)*COS(THETA(I,JJ+1)))/(CG(I,JJ)*COS(THETA(I,JJ)))
01002      IF(ARG.LT.0.0) ARG=0.0
01003      H(I,JJ)=H(I,JJ+1)*SQRT(ARG)
01004      GO TO 45
01005      44 H(I,JJ)=SQRT(ARG)
01006      45 H(I,JJ)=0.5*(H(I,JJ)+HOLD(I,JJ))
01007      HNONBR(JJ)=H(I,JJ)
01008      *IBREAK(I)=JJ, THEREFORE JJ WILL BE LEEWARD SIDE OF GRID AT INIT BREAK
01009      IF(HB(I,JJ).LT.H(I,JJ).AND.HB(I,JJ+1).GE.HNONBR(JJ+1))
01010      * IBREAK(I)=JJ
01011      IF(HB(I,JJ).LT.H(I,JJ)) H(I,JJ)=HB(I,JJ)
01012      SUMH=SUMH+ABS(H(I,JJ)-HOLD(I,JJ))
01013      502 CONTINUE
01014      510 CONTINUE
01015      IBREAK(IEND)=IBREAK(IEND-1)
01016      IBREAK(IBEGIN)=IBREAK(IBEGIN+1)
01017      IF(SUMH.LT.(NPTS*0.01)) GO TO 507
01018      IF(NITER.GE.50) GO TO 507
01019      501 CONTINUE
01020      WRITE(2,803)
01021      507 CONTINUE
01022      802 FORMAT(2X,4(F15.5),/ )
01023      803 FORMAT(2X,"AFTER NITERS ITERATIONS, CONVERGENCE WAS NOT REACHED")
01024      804 FORMAT(2X,"THE WAVE HT. ROUTINE CONVERGED IN, NITER= ",I5,/)
01025      805 FORMAT(2X,"THIS IS MY CHECKING WRITE STATEMENT")
01026      806 FORMAT(2X,"THE WAVE ANGLE ROUTINE CONVERGED IN, NITER= ",I5,/)
01027      RETURN
01028      END
01029      SUBROUTINE DIFF(RHOND,THETA0,ANGLE,AMP)
01030      C*****DIFFRACTION ABOUT SEMI INFINITE BREAKWATER - PENE - PRICE.
01031      PI=3.14159265
01032      ABSS=SIN(0.5*(ANGLE-THETA0))
01033      ABSP=SIN(0.5*(ANGLE+THETA0))
01034      ABC=COS(ANGLE-THETA0)
01035      ABC1=COS(ANGLE+THETA0)
01036      XX=RHOND*ABC
01037      XXC=COS(XX)
01038      XXS=SIN(XX)
01039      XX1=RHOND*ABC1
01040      XXC1=COS(XX1)
01041      XXS1=SIN(XX1)
01042      AL=SQRT(RHOND/PI)
01043      SIG=2.0*AL*ABSS
01044      SIGP=-2.0*AL*ABSP
01045      CALL FRES(SIG,C,S,FR,FI)

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01046      CALL FRES(SIGP,CP,SP,FRP,FIP)
01047      SUM1=XXC*FR+XXS*FI+XXC1*FRP+XXS1*FIP
01048      SUM2=XXC*FI-XXS*FR+XXC1*FIP-XXS1*FRP
01049      AMP=SQRT(SUM1**2+SUM2**2)
01050      RETURN
01051      END
01052      SUBROUTINE FRES(A,C,S,FR,FI)
01053 C*FRESNEL INTEGRAL SUBROUTINE*****AFTER ABROMOWITZ AND STEGUN.
01054      Z=ABS(A)
01055      P02=1.5707963
01056      FZ=(1.0+0.926*Z)/(2.0+1.792*Z+3.104*Z*Z)
01057      GZ=1.0/(2.0+4.142*Z+3.492*Z*Z+6.670*Z*Z*Z)
01058      XX=P02*Z*Z
01059      CZ=COS(XX)
01060      SZ=SIN(XX)
01061      C=0.5-GZ*CZ+FZ*SZ
01062      S=0.5-FZ*CZ-GZ*SZ
01063      IF(A.GT.0.0) GO TO 50
01064      C=-C
01065      S=-S
01066 50      FR=0.5*(1.0+C+S)
01067      FI=-0.5*(S-C)
01068      RETURN
01069      END
01070      SUBROUTINE PREDIF
01071      PARAMETER(NI=53,NJ=11)
01072 C*****
01073      COMMON/AX/ C(NI,NJ),RK(NI,NJ),((NI,NJ),DEEP(NI,NJ),ALPHAS(NI,NJ)
01074      COMMON/AA/YZERO(NI),WDEPTH
01075      COMMON/B/ THETA(NI,NJ),OXTOT(NI), OLDA(SINI,NJ), D(NI,NJ)
01076      COMMON/C/ H(NI,NJ),CG(NI,NJ),HOLD(NI,NJ),HB(NI,NJ),YB(NI)
01077      COMMON/N USED/JUSE,T,CO,CGEN,CGEN,ANGUEN,D, BERM,THETA0(10),IMAX
01078      COMMON/D/SIGMA,G,ELO,JMAX,IMAX,P1,TWOPI,P102,HGEN,IJET(10)
01079      1,SJETTY(10)
01080      COMMON/G/IBREAK(NI),HNONBR(NJ)
01081      DIMENSION J1(NI),J2(NI),J1REF(NI),J3REF(NI)
01082      DO 99 J=1,IMAX+3
01083      J1(J)=0
01084      J2(J)=0
01085      J1REF(J)=0
01086 99      CONTINUE
01087 C*THIS SUB CALCS WHERE DIFFRACTION GOVERNS AND WHERE REFRACT GOVERNS.
01088 C*IT WILL CALL REFRAC FOR OFFSHORE AREA(OFF TIP OF STRUCTURE).
01089 C*THEN IT WILL DO THE SHADOW ZONE USING DIFF IF THETA .NE.0.0)
01090 C* IT WILL THEN FINISH THE OTHERS USING REFRAC AGAIN.
01091 C*NOW, LETS FIND C,CG,RK,HB, AND WUNUM.
01092      DO 202 I=1,IMAX+1
01093      DO 202 J=1,JMAX+2
01094      DEPTH=DEEP(I,J)
01095      CALL WUNUM(DEPTH,T,DUMK)
01096      RK(I,J)=DUMK
01097      C(I,J)=CO*TANH(RK(I,J)*DEEP(I,J))
01098      EN=0.5*(1.0+(1.2*RK(I,J)*DEEP(I,J))

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01101      H(I,J)=HB(I,J)
01102 202  CONTINUE
01103 C*WILL ATTRIB AN EQUAL REACH TO EACH SIDE OF EACH M-GROIN.
01104      DO 200 M=1,M*MAX
01105          IDUML=1
01106          IF(M.NE.1) IDUML=(IJET(M)+IJET(M-1))/2
01107          IDUMR=IMAX
01108          IF(M.NE.M*MAX) IDUMR=(IJET(M)+IJET(M+1))/2
01109          NPTS=0
01110          DO 1 I=IDUML,IDUMR
01111              DO 2 J=1,J*MAX
01112                  IF(Y(I,J).LT.SJETTY(M)) GO TO 14
01113                  J1(I)=J
01114                  J2(I)=J*MAX
01115              GO TO 15
01116 14  CONTINUE
01117 2  CONTINUE
01118 15  CONTINUE
01119 C*IF NO STRUCT IS PRESENT(SJETTY=0.0), DO REFRAC THRUOUT GRID SYSTEM
01120      IF(SJETTY(M).EQ.0.0) J1(I)=1
01121 1  CONTINUE
01122      DO 16 I=IDUML,IDUMR
01123 C* \REFRAC\ STARTS ON THE NEXT TO LAST J-CONTOUR,NOT THE LAST?
01124      DO 16 J=J1(I),J2(I)-1
01125 16  NPTS=NPTS+1
01126 C*WILL NOW DO THE REFRAC FOR THE REGION 1 AREA.
01127 C*ISTART REPRESENTS THE DIRECTION THE SWEEPS WILL BEGIN FROM.
01128 C*WILL USE DUMMY IMAX,IJET,IJET+1 IN CALL STTS SO IBEGIN,IEND, AND
01129 C***ISTART WON'T CHANGE THEM,MUST RESET AFTER EACH CALL REFRAC.
01130      IMAX=IDUMR
01131      IJET=IJET(M)
01132      IJETP1=IJET(M)+1
01133      IDUMLL=IDUML
01134      IF(ANGGEN.GE.0.0) CALL REFRAC(J1,J2,NPTS,IDUMLL,IMAX,IDUMLL,M)
01135      IF(ANGGEN.LT.0.0) CALL REFRAC(J1,J2,NPTS,IDUMLL,IMAX,IMAX,M)
01136      IMAX=IDUMR
01137      IJET=IJET(M)
01138      IJETP1=IJET(M)+1
01139      IDUMLL=IDUML
01140      JDUMN=J1(IJET(M))
01141      JDUMS=J1(IJET(M)+1)
01142      XDISTN=(IJET(M)-1.0)*DX+DX/2.
01143      ELTIP=T*0.5*(C(IJET(M),JDUMN)+C(IJET(M)+1,JDUMS))
01144 C*NOW MUST CHECK THE ANGLE AT THE STRUCTURE'S TIP TO SEE WHERE SHAD ZONE
01145 C*IF NO STRUCT PRESENT(SJETTY(M)=0.0), FUTHER REFRAC.DIFF UNNECESSARY.
01146      IF(SJETTY(M).EQ.0.0) GO TO 13
01147      THETA0(M)=0.5*(THETA(IJET(M),JDUMN)+THETA(IJET(M)+1,JDUMS))
01148      HINC=0.5*(H(IJET(M),JDUMN)+H(IJET(M)+1,JDUMS))
01149      IF(THETA0(M))10,11,12
01150 C*THIS SECTION HANDLES REFRAC.DIFF IF THETA0)0.0.
01151 10  CONTINUE
01152 C*FIRST ALL OF REGION 2 WILL GET REFRACTED.
01153      NPTS=0
01154      DO 100 I=IJET(M)+1,IDUMR
01155          J2(I)=J1(I)

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01156 100 J1(I)=1
01157 DO 101 I=IJET(M)+1, IDUMR
01158 DO 101 J=J1(I), J2(I)-1
01159 101 NPTS=NPTS+1
01160 IMAXT=IDUMR
01161 IDUMLL=IDUML
01162 IJETT=IJET(M)
01163 IJETP1=IJET(M)+1
01164 CALL REFRAC(J1, J2, NPTS, IJETP1, IMAXT, IMAXT, M)
01165 IMAXT=IDUMR
01166 IJETT=IJET(M)
01167 IJETP1=IJET(M)+1
01168 IDUMLL=IDUML
01169 C*NOW MUST DO REGION 3 OF NEG THETA0 CASE-SHADOW ZONE.
01170 DO 102 I=IDUML, IJET(M)
01171 J2(I)=J1(I)
01172 102 J1(I)=1
01173 DO 103 I=IDUML, IJET(M)
01174 J1REF(I)=1
01175 DO 104 J=J1(I), J2(I)+1
01176 XCOORD=(I-1.0)*DX
01177 YCOORD=0.5*(Y(I, J)+Y(I, J+1))
01178 ANGLE=ATAN((XDISTN-XCOORD)/(SJETTY(M)-YCOORD))
01179 IF(YCOORD.GT.SJETTY(M)) ANGLE=PI+ANGLE
01180 C*IF MOST SHOREWARD PT OUT OF SHAD ZONE, SO ARE THE OTHERS FOR THAT I.
01181 IF(ABS(ANGLE).GT.ABS(THETA0(M))) GO TO 105
01182 RAD=SQRT((XDISTN-XCOORD)**2+(SJETTY(M)-YCOORD)**2)
01183 RHOND=RAD*TWOPI/ELTIP
01184 C*DIFFRACTION TREATS THE POS THETA0 CASE.
01185 THE=ABS(THETA0(M))
01186 CALL DIFF(RHOND, THE, ANGLE, AMP)
01187 H(I, J)=AMP*HINC
01188 ANGRAD=-ANGLE
01189 C*WILL NOW REFRACT DIFF WAVES IN THE SHAD ZONE USING SNELL'S.
01190 CTIP=ELTIP/T
01191 ALPHAS(I, J)=ATAN((0.5*(Y(I+1, J)+Y(I+1, J+1))-0.5*
01192 * (Y(I-1, J)+Y(I-1, J+1)))/(2.*DX))
01193 IF(I.EQ.IJET(M))ALPHAS(I, J)=ATAN((0.5*(Y(I, J)+Y(I, J+1))-0.5*(Y(I-1
01194 * , J)+Y(I-1, J+1)))/DX)
01195 DALPHA=ANGRAD-ALPHAS(I, J)
01196 ARG=(C(I, J)/CTIP)*SIN(DALPHA)
01197 IF(ARG.GT.1.) ARG=1.
01198 THETA(I, J)=ASIN(ARG)
01199 THETA(I, J)=THETA(I, J)+ALPHAS(I, J)
01200 C*MUST CHECK TO SEE IF WAVE WOULD HAVE BROKEN.
01201 IF(HB(I, J).LE.H(I, J).AND.HB(I, J+1).GT.H(I, J+1))IBREAK(I)=J
01202 IF(HB(I, J).LT.H(I, J)) H(I, J)=HB(I, J)
01203 104 CONTINUE
01204 GO TO 103
01205 105 J1REF(I)=J
01206 103 CONTINUE
01207 C*NOW MUST DO REFRACTION FOR REGION 4.
01208 NPTS=0
01209 DO 106 I=IDUML, IJET(M)
01210 DO 106 J=J1REF(I), J2(I)-1

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01211 106 NPTS=NPTS+1
01212 IDUMLL=IDUML
01213 IMAXT=IDUMR
01214 IJETT=IJET(M)
01215 IJETP1=IJET(M)+1
01216 CALL REFRAC(J1REF,J2,NPTS,IDUMLL,IJETT,IDUMLL,M)
01217 IDUMLL=IDUML
01218 IMAXT=IDUMR
01219 IJETT=IJET(M)
01220 IJETP1=IJET(M)+1
01221 GO TO 13
01222 C*THIS HANDLES REFRAC/DIFF IF THETA0 IS 0.0.
01223 C*FOR THIS CASE, ONLY THREE REGIONS EXIST.
01224 11 CONTINUE
01225 NPTS=0
01226 DO 120 I=IDUML,IJET(M)
01227 J2(I)=J1(I)
01228 120 J1(I)=1
01229 DO 121 I=IDUML,IJET(M)
01230 DO 121 J=J1(I),J2(I)-1
01231 121 NPTS=NPTS+1
01232 IMAXT=IDUMR
01233 IDUMLL=IDUML
01234 IJETT=IJET(M)
01235 IJETP1=IJET(M)+1
01236 CALL REFRAC(J1,J2,NPTS,IDUMLL,IJETT,IDUMLL,M)
01237 IMAXT=IDUMR
01238 IJETT=IJET(M)
01239 IJETP1=IJET(M)+1
01240 IDUMLL=IDUML
01241 DO 122 I=IJET(M)+1,IDUMR
01242 J2(I)=J1(I)
01243 122 J1(I)=1
01244 NPTS=0
01245 DO 123 I=IJET(M)+1,IDUMR
01246 DO 123 J=J1(I),J2(I)-1
01247 123 NPTS=NPTS+1
01248 IMAXT=IDUMR
01249 IDUMLL=IDUML
01250 IJETT=IJET(M)
01251 IJETP1=IJET(M)+1
01252 CALL REFRAC(J1,J2,NPTS,IJETP1,IMAXT,IMAXT,M)
01253 IMAXT=IDUMR
01254 IJETT=IJET(M)
01255 IJETP1=IJET(M)+1
01256 IDUMLL=IDUML
01257 GO TO 13
01258 C*THIS SECTION HANDLES REFRAC/DIFF IF THETA0;0.0
01259 12 CONTINUE
01260 C*FIRST, REGION 2- ALL REFRACTION.
01261 NPTS=0
01262 DO 110 I=IDUML,IJET(M)
01263 J2(I)=J1(I)
01264 110 J1(I)=1
01265 DO 111 I=IDUML,IJET(M)

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01266      DO 111 J= J1(I),J2(I)-1
01267 111 NPTS=NPTS+1
01268      IMAXT=IDUMR
01269      IDUMLL=IDUML
01270      IJETT=IJET(M)
01271      IJETP1=IJET(M)+1
01272      CALL REFRAC(J1,J2,NPTS,IDUMLL,IJETT,IDUMLL,M)
01273      IMAXT=IDUMR
01274      IJETT=IJET(M)
01275      IJETP1=IJET(M)+1
01276      IDUMLL=IDUML
01277 C*NOW WILL DO REGION 3 OF THE POS THETA0 CASE.
01278      DO 112 I=IJET(M)+1,IDUMR
01279      J2(I)=J1(I)
01280 112 J1(I)=1
01281      DO 113 I=IJET(M)+1,IDUMR
01282      J1REF(I)=1
01283 C*WILL GO ONE PT. BEYOND J2(I) TO MAKE SURE OUTOF DIFF ZONE.
01284      DO 114 J=J1(I),J2(I)+1
01285      XCOORD=(I-1.0)*DX
01286      YCOORD=0.5*(Y(I,J)+Y(I,J+1))
01287      ANGLE=ATAN((XCOORD-XDISTN)/(SJETTY(M)-YCOORD))
01288      IF(YCOORD.GT.SJETTY(M)) ANGLE=PI+ANGLE
01289 C*IF LEAST J-VALUE IS OUT OF SHAD ZONE,SO ARE OTHER J'S.(FOR EACH I)
01290      IF(ANGLE.GT.ABS(THETA0(M))) GO TO 115
01291      RAD=SQRT((XCOORD-XDISTN)**2+(SJETTY(M)-YCOORD)**2)
01292      RHOND=RAD*TWOPI/ELTIP
01293      THE=THETA0(M)
01294      CALL DIFF(RHOND,THE,ANGLE,AMP)
01295      ANGRAD=ANGLE
01296 C*WILL NOW REFRACT DIFFRACTED WAVES IN SHAD ZONE USING SNELLS.
01297      CTIP=ELTIP/T
01298      ALPHAS(I,J)=ATAN((0.5*(Y(I+1,J)+(I+1,J+1))-0.5*
01299 * (Y(I-1,J)+Y(I-1,J+1)))/(2.*DX))
01300      IF(I.EQ.IJET(M)+1)ALPHAS(I,J)=ATAN((0.5*(Y(I+1,J)+Y(I+1,J+1))-0.5*
01301 * ((I,J)+Y(I,J+1)))/DX)
01302      DALPHA=ANGRAD-ALPHAS(I,J)
01303      ARG=(C(I,J)/CTIP)*SIN(DALPHA)
01304      IF(ARG.GT.1.) ARG=1.
01305      THETA(I,J)=ASIN(ARG)
01306      THETA(I,J)=THETA(I,J)+ALPHAS(I,J)
01307      H(I,J)=HINC*AMP
01308 C*MUST CHECK TO SEE IF WAVE WOULD HAVE BROKEN.
01309      IF(HB(I,J).LE.H(I,J).AND.HB(I,J+1).GT.H(I,J+1))IBREAK(I)=J
01310      IF(HB(I,J).LT.H(I,J)) H(I,J)=HB(I,J)
01311 114 CONTINUE
01312      GO TO 113
01313 115 J1REF(I)=J
01314 113 CONTINUE
01315 C*NOW MUST DO REFRAC FOR REGION 4.
01316      NPTS=0
01317      DO 116 I=IJET(M)+1,IDUMR
01318      DO 116 J=J1REF(I),J2(I)-1
01319 116 NPTS=NPTS+1
01320      IMAXT=IDUMR

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01321      IDUMLL=IDUML
01322      IJETT=IJET(M)
01323      IJETP1=IJET(M)+1
01324      CALL REFRAC(J1REF,J2,NPTS,IJETP1,IMAXT,IMAXT,M)
01325      IMAXT=IDUMR
01326      IJETT=IJET(M)
01327      IJETP1=IJET(M)+1
01328      IDUMLL=IDUML
01329      13 CONTINUE
01330      200 CONTINUE
01331      RETURN
01332      END
01333      SUBROUTINE LOC(IM,JJ,JOIM,JSIM,YBAR,IDUM)
01334      PARAMETER(NI=53,NJ=11)
01335      C*****
01336      COMMON/A/ C(NI,NJ),RK(NI,NJ),Y(NI,NJ),DEEP(NI,NJ),ALPHAS(NI,NJ)
01337      COMMON/AA/YZERO(NI),WDEPTH
01338      COMMON/B/ THETA(NI,NJ),QXTOT(NI),OLDANG(NI,NJ),DY(NI,NJ)
01339      COMMON/C/ H(NI,NJ),CG(NI,NJ),HOLD(NI,NJ),HB(NI,NJ),YB(NI)
01340      COMMON/N USED/JUSE,T,CO,CGEN,CGGEN,ANGGEN,DX,BERM,THETA0(10),MMAX
01341      COMMON/D/SIGMA,G,ELO,JMAX,IMAX,PI,TWOPI,PI02,HGEN,IJET(10)
01342      1,SJETTY(10)
01343      C*SUBROUTINE LOC FINDS J-VALUES WHICH ARE GREATER AND LESS THAN YBAR.
01344      JOIM=2
01345      2 AA=0.5*(Y(IM,JOIM)+Y(IM,JOIM-1))
01346      IF(AA.GT.YBAR) GO TO 4
01347      JOIM=JOIM+1
01348      C*THE FOLLOWING IS REQ'D SO THAT DY/DX<0.5
01349      C*WILL DETERMINE K SIN THETA ON IM-LINE AT A DIST YBAR.
01350      C*WILL CALL THIS POINT JUSE+1.
01351      IF(JOIM.LE.JUSE) GO TO 2
01352      JOIM=JUSE+1
01353      Y(IM,JOIM)=YBAR
01354      C* DEPTH AT THIS POINT WILL BE COMP ASSUMING CONST BEACH SLOPE ON I=IM
01355      DEL=.5*(Y(IM,JOIM-1)+Y(IM,JOIM-2))-.5*(Y(IM,JOIM-2)+Y(IM,JOIM-3))
01356      BSLOPE=(DEEP(IM,JOIM-2)-DEEP(IM,JOIM-3))/DEL
01357      DEEP(IM,JOIM-1)=DEEP(IM,JOIM-2)+BSLOPE*(Y(IM,JOIM)-Y(IM,JOIM-1))
01358      IF(DEEP(IM,JOIM-1).GT.WDEPTH) DEEP(IM,JOIM-1)=WDEPTH
01359      DEPTH=DEEP(IM,JOIM-1)
01360      CALL WUNUM(DEPTH,T,DUMK)
01361      RK(IM,JOIM-1)=DUMK
01362      C(IM,JOIM-1)=CO*TANH(RK(IM,JOIM-1)*DEEP(IM,JOIM-1))
01363      EN=0.5*(1.0+((2.0*RK(IM,JOIM-1)*DEEP(IM,JOIM-1)) *SINH(
01364      * 2.*RK(IM,JOIM-1)*DEEP(IM,JOIM-1))))
01365      CG(IM,JOIM-1)=C(IM,JOIM-1)*EN
01366      C*WILL USE SNELL'S LAW TO DETERMINE THE WAVE ANGLE HERE
01367      C*ANGLE OF CONTOUR WILL BE ASSUME TO BE THE SAME AS THE JMAX+1 CONTOUR
01368      IF(IDUM.EQ.1)ALPH=ATAN((Y(IM,JOIM-1)-Y(IM-1,JOIM-1))/DX)
01369      IF(IDUM.EQ.-1)ALPH=ATAN((Y(IM+1,JOIM-1)-Y(IM,JOIM-1))/DX)
01370      DALPHA=ANGGEN-ALPH
01371      ARG=(C(IM,JOIM-1)/CGEN)*SIN(DALPHA)
01372      IF(ARG.GT.1.) ARG=1.
01373      THETA(IM,JOIM-1)=ASIN(ARG)
01374      THETA(IM,JOIM-1)=THETA(IM,JOIM-1)+ALPH
01375      4 JSIM=JMAX-1

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01376 6 AA=0.5*(Y(IM,JSIM)+(Y(IM,JSIM+1)))
01377 IF(AA.LT.YBAR) GO TO 8
01378 JSIM=JSIM-1
01379 C*IF JSIM=0,THERE IS NO ADJ PT, SUB REFRAC CAN HANDLE IT.
01380 IF(JSIM.EQ.0) GO TO 8
01381 GO TO 6
01382 8 RETURN
01383 END
01384 SUBROUTINE WUNUM(DEPTH,T,RK)
01385 C*****
01386 G=32.17
01387 EPS=0.001
01388 TWOPI=6.283185307
01389 SIGMA=TWOPI/T
01390 RK=TWOPI/(T*SQRT(G*DEPTH))
01391 DO 100 IT=1,20
01392 ARG=RK*DEPTH
01393 EK=(G*RK*TANH(ARG))-(SIGMA**2)
01394 EKPR=G*(ARG*((SECH(ARG)**2)+TANH(ARG)))
01395 RKNEW=RK-EK/EKPR
01396 IF(ABS(RKNEW-RK).LE.ABS(EPS*RKNEW)) GO TO 120
01397 RK=RKNEW
01398 100 CONTINUE
01399 WRITE(2,1000) IT,DEPTH,RK
01400 1000 FORMAT(///,10X,"ITERATION FOR K FAILED TO CONVERGE AFTER"
01401 * ,3X,13,"ITERATION",/,"OUTPUT00000DEPTH, RK",3X,2F13.5)
01402 CALL EXIT
01403 120 RK=RKNEW
01404 IF(RK.GT.0.0) GO TO 140
01405 WRITE(2,1020) DEPTH,RK
01406 1020 FORMAT(///,10X," RK IS NEG",/," OUTPUT DEPTH,RK",3X,2F13.5)
01407 CALL EXIT
01408 140 RETURN
01409 END
01410 SUBROUTINE SMOOTH(THETA,IMAX,JMAX,IJET,SJETTY,MMAX,Y)
01411 PARAMETER(NI=53,NJ=11)
01412 C*****
01413 C*THIS WILL SMOOTH THE WAVE ANGLE FIELD TO ACCT FOR DIFF(ARTIFICIALLY)
01414 DIMENSION TEMP(NI,NJ),Y(NI,NJ),THETA(NI,NJ),IJET(10),SJETTY(10)
01415 C*(MMAX+1) IS REQ'D BECAUSE M-GROINS HAVE M+1 REACHES OF SHORELINE.
01416 SJETTY(MMAX+1)=0.
01417 DO 10 M=1,MMAX+1
01418 IF(M.NE.1) GO TO 3
01419 ILEFT=2
01420 IRIGHT=IJET(1)
01421 GO TO 5
01422 3 IF(M.NE.MMAX+1) GO TO 4
01423 ILEFT=IJET(MMAX+1)
01424 IRIGHT=IMAX-1
01425 GO TO 5
01426 4 ILEFT=IJET(M-1)+1
01427 IRIGHT=IJET(M)
01428 5 CONTINUE
01429 DO 1 J=1,JMAX-1
01430 DO 1 I=ILEFT,IRIGHT

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01431      IF(I.NE.ILEFT.AND.I.NE.IRIGHT) GO TO 15
01432 C*TO GET HERE, MUST BE ON BOUN OR ADJ TO A STRUCTURE.
01433      IF(I.EQ.2.OR.I.EQ.IMAX-1) GO TO 15
01434 C*TO GET HERE,ADJ TO A STRUCT AND CAN BE ILEFT OR IRIGHT.
01435      IF(Y(I,J).GE.SJETTY(M)) GO TO 15
01436 C*IF HERE, WITHIN JETTY AND ADJ TO EITHER SIDE.
01437      IF(I.EQ.ILEFT)TEMP(I,J)=0.5*(THETA(I,J)+THETA(I+1,J))
01438      IF(I.EQ.IRIGHT)TEMP(I,J)=0.5*(THETA(I,J)+THETA(I-1,J))
01439      GO TO 1
01440 15 TEMP(I,J)=0.25*THETA(I-1,J)+0.50*THETA(I,J)+0.25*THETA(I+1,J)
01441 1 CONTINUE
01442 10 CONTINUE
01443 DO 2 J=1,JMAX-1
01444 DO 2 I=2,IMAX-1
01445 2 THETA(I,J)=TEMP(I,J)
01446 RETURN
01447 END
01448 FUNCTION SECH(A)
01449 C*****
01450 SECH=1.0/COSH(A)
01451 RETURN
01452 C****HERE IS WHERE THE IMSL ROUTINES MUST GO
01453 END
01454 SUBROUTINE BRKH20(IMAX,JMAX,MMAX,Y,THETA,H,C
01455 1,IJET,SJETTY,T,DX,DEEP,HB,CG)
01456 PARAMETER(NI=53,NJ=11)
01457 COMMON/NWS/ILFT(5),IRT(5),YLFT(5),YRT(5),NOBKS
01458 1,DEEPR(5),DEEPL(5),HRT(5),HLFT(5)
01459 DIMENSION THETA(5),THETLL(5),THETAR(5),THETRR(5)
01460 1,XXL(5),XXR(5),CLFT(5),CRT(5),HTEMPR(5)
01461 1,HTEML(5),HTXL(5),HTYL(5),HTXR(5),HTYR(5)
01462 1,YLLFT(5),YRRRT(5),DXL(5),DXR(5),BKANG(5)
01463 1,CGRT(5),CGLFT(5)
01464 DIMENSION Y(NI,NJ),THETA(NI,NJ),H(NI,NJ),C(NI,NJ)
01465 1,IJET(10),SJETTY(10),DEEP(NI,NJ),HB(NI,NJ),CG(NI,NJ)
01466 PI=3.14159
01467 TWOPI=2.*PI
01468 DO 500 N=1,NOBKS
01469 XXDIST=DX*(IRT(N)-ILFT(N))
01470 BKANG(N)=ATAN((YRT(N)-YLFT(N))/XXDIST)
01471 DXL(N)=0.0
01472 DXR(N)=0.0
01473 DO 300 J=1,JMAX
01474 JJ=JMAX-J+2
01475 IF(YLFT(N).LT.(Y(ILFT(N),JJ).AND.YLFT(N).GE.(Y(ILFT(N)
01476 1,JJ-1))) GO TO 350
01477 GO TO 300
01478 350 FACT=(Y(ILFT(N),JJ)-YLFT(N))/(Y(ILFT(N),JJ)-Y(ILFT(N),
01479 1,JJ-1))
01480 DEEPL(N)=DEEP(ILFT(N),JJ)-(DEEP(ILFT(N),JJ)-DEEP
01481 1(ILFT(N),JJ-1))*FACT
01482 THETA(N)=THETA(ILFT(N),JJ)-(THETA(ILFT(N),JJ)-THETA
01483 1(ILFT(N),JJ-1))*FACT
01484 HLFT(N)=H(ILFT(N),JJ)-(H(ILFT(N),JJ)-H(ILFT(N),JJ-1)
01485 1*FACT

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01486      CLFT(N)=C(ILFT(N),JJ)-(C(ILFT(N),JJ)-C(ILFT(N),JJ-1))
01487      1*FACT
01488      CGLFT(N)=CG(ILFT(N),JJ)-(CG(ILFT(N),JJ)-CG(ILFT(N),JJ-1))
01489      1*FACT
01490      300 CONTINUE
01491      DO 400 J=1,JMAX
01492      JJ=JMAX-J+2
01493      IF(YRT(N).LT.Y(IRT(N),JJ).AND.YRT(N).GE.Y(IRT(N),JJ-1))
01494      1) GO TO 450
01495      GO TO 400
01496      450 FACT=(Y(IRT(N),JJ)-YRT(N))/(Y(IRT(N),JJ)-Y(IRT(N),JJ-1))
01497      DEEPR(N)=DEEP(IRT(N),JJ)-(DEEP(IRT(N),JJ)-DEEP(IRT(N),
01498      1,JJ-1))*FACT
01499      THETAR(N)=THETA(IRT(N),JJ)-(THETA(IRT(N),JJ)-THETA(IRT(N),
01500      1,JJ-1))*FACT
01501      HRT(N)=H(IRT(N),JJ)-(H(IRT(N),JJ)-H(IRT(N),JJ-1))*FACT
01502      CRT(N)=C(IRT(N),JJ)-(C(IRT(N),JJ)-C(IRT(N),JJ-1))*FACT
01503      CGRT(N)=CG(IRT(N),JJ)-(CG(IRT(N),JJ)-CG(IRT(N),JJ-1))*FACT
01504      400 CONTINUE
01505      YLLFT(N)=YLFT(N)
01506      YRRT(N)=YRT(N)
01507      THETLL(N)=THETAL(N)
01508      THETRR(N)=THETAR(N)
01509 C      WRITE(2,501) N,BKANG(N),DEEPL(N),THETAL(N),HLFT(N),CLFT(N)
01510 C      1,CGLFT(N),DEEPR(N),THETAR(N),HRT(N),CRT(N),CGRT(N),YLLFT(N)
01511 C      1,YRRT(N),THETLL(N),THETRR(N)
01512      501 FORMAT((15,7F10.4)/(8F10.4))
01513      500 CONTINUE
01514      IDIST=DX
01515      DO 1000 J=1,JMAX+1
01516      JJ=JMAX-J+2
01517      DO 1100 N=1,NOBKS
01518      XXL(N)=(YLLFT(N)-Y(ILFT(N),JJ))*TAN(THETLL(N))+DX*(
01519      1ILFT(N)-1)+DXL(N)
01520      XXR(N)=(YRRT(N)-Y(IRT(N),JJ))*TAN(THETRR(N))+DX*(IRT(N)-1
01521      1+DXR(N)
01522      1100 CONTINUE
01523      DO 2000 I=2,IMAX
01524      CONANG=ATAN((Y(I+1,JJ)-Y(I-1,JJ))/(2.*DX))
01525      XDUM=(I-1)*DX
01526      HX=H(I,JJ)*SIN(THETA(I,JJ))
01527      HY=H(I,JJ)*COS(THETA(I,JJ))
01528      OUT=0.0
01529      DO 1800 N=1,NOBKS
01530      HTEMPR(N)=0.
01531      HTEMPL(N)=0.
01532      HTXL(N)=0.
01533      HTYL(N)=0.
01534      HTXR(N)=0.
01535      HTYR(N)=0.
01536 C
01537      IF(Y(I,JJ).GT.YRT(N)) GO TO 1600
01538      IF(XDUM.GT.XXR(N)) GO TO 1600
01539      DELY=YRT(N)-Y(I,JJ)
01540      DELX=(IRT(N)-I)*DX+.0000001

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01541      ANG=ATAN(DELY/DELX)
01542      IF(ANG.LE.BKANG(N)) GO TO 1600
01543      JSHAD=0
01544      DO 1400 JTY=1,MMAX
01545      IF(Y(I,JJ).GT.SJETTY(JTY)) GO TO 1400
01546      IF(I.GE.IJET(JTY).AND.IJET(JTY).LE.IRT(N)) GO TO 1400
01547      IF(I.LE.IJET(JTY).AND.IJET(JTY).GE.IRT(N)) GO TO 1400
01548      ANGJET=ATAN((YRT(N)-SJETTY(JTY))/((IRT(N)-IJET(JTY))*DX))
01549      IF(ABS(ANGJET).LT.ABS(ANG)) JSHAD=1
01550 1400  CONTINUE
01551      IF(JSHAD.EQ.1) GO TO 1600
01552      DUMANG=SQRT(DEEP(I,JJ)/DEEPR(N))*SIN(PI/2.-ANG)
01553      IF(DUMANG.GT.1.0) DUMANG=1.0
01554      ANGG=PI/2.-ASIN(DUMANG)+CONANG
01555      IF(ANG.LT.0.0) ANGG=-ANGG
01556      IF(ANG.LT.0.0) ANG=ANG+PI
01557      IF(ANGG.LT.0.0) ANGG=ANGG+PI
01558      ANG=ANG-BKANG(N)
01559      RHOND=(TWOPI/(T*CRT(N)))*SQRT(DELX*DELX+DELY*DELY)
01560      THE=THETAR(N)+PI/2.-BKANG(N)
01561      CALL DIFF(RHOND,THE,ANG,AMP)
01562      HTEMPR(N)=HRT(N)*AMP
01563      HTXR(N)=-HTEMPR(N)*COS(ANGG)
01564      HTYR(N)=HTEMPR(N)*SIN(ANGG)
01565      OUT=OUT+1.0
01566 1600  CONTINUE
01567 C
01568      IF(Y(I,JJ).GT.YLFT(N)) GO TO 1800
01569      IF(XDUM.LT.XXL(N)) GO TO 1800
01570      DELY=YLFT(N)-Y(I,JJ)
01571      DELX=(I-ILFT(N))*DX+.0000001
01572      ANG=ATAN(DELY/DELX)
01573      IF(ANG.LE.BKANG(N)) GO TO 1800
01574      JSHAD=0
01575      DO 1700 JTY=1,MMAX
01576      IF(Y(I,JJ).GT.SJETTY(JTY)) GO TO 1700
01577      IF(I.LE.IJET(JTY).AND.IJET(JTY).GE.ILEFT(N)) GO TO 1700
01578      IF(I.GE.IJET(JTY).AND.IJET(JTY).LE.ILEFT(N)) GO TO 1700
01579      ANGJET=ATAN((YLFT(N)-SJETTY(JTY))/((IJET(JTY)-ILEFT(N))*DX))
01580      IF(ABS(ANGJET).LT.ABS(ANG)) JSHAD=1
01581 1700  CONTINUE
01582      IF(JSHAD.EQ.1) GO TO 1800
01583      DUMANG=SQRT(DEEP(I,JJ)/DEEPL(N))*SIN(PI/2.-ANG)
01584      IF(DUMANG.GT.1.0) DUMANG=1.0
01585      ANGG=PI/2.-ASIN(DUMANG)-CONANG
01586      IF(ANG.LT.0.0) ANGG=-ANGG
01587      IF(ANG.LT.0.0) ANG=ANG+PI
01588      IF(ANGG.LT.0.0) ANGG=ANGG+PI
01589      ANG=ANG+BKANG(N)
01590      RHOND=(TWOPI/(T*CLFT(N)))*SQRT(DELY*DELY+DELX*DELX)
01591      THE=PI/2.-THETAL(N)+BKANG(N)
01592      CALL DIFF(RHOND,THE,ANG,AMP)
01593      HTEMPL(N)=HLFT(N)*AMP
01594      HTXL(N)=HTEMPL(N)*COS(ANGG)
01595      HTYL(N)=HTEMPL(N)*SIN(ANGG)

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01596      OUT=OUT+1.
01597 1800 CONTINUE
01598      SHADOW=1.0
01599      IF(OUT.LT..5) GO TO 2000
01600      DO 1801 N=1,NOBKS
01601      DD=YLEFT(N)+(XDUM-DX*(ILFT(N)-1))*TAN(BKANG(N))
01602      IF(XDUM.GT.XXL(N).AND.XDUM.LT.XXR(N).AND.Y(I,JJ).LT.DD) SHADOW=0.0
01603      HX=HX*SHADOW
01604      HY=HY*SHADOW
01605 C
01606 C
01607
01608 1801 CONTINUE
01609      HXT=0.0000001
01610      HYT=0.0000001
01611      DO 1900 N=1,NOBKS
01612      HXT=HXT+HTXL(N)*ABS(HTXL(N))+HTXR(N)*ABS(HTXR(N))
01613      HYT=HYT+HTYL(N)*ABS(HTYL(N))+HTYR(N)*ABS(HTYR(N))
01614 1900 CONTINUE
01615      XXX=ABS(HX)*HX+HXT
01616      YYY=ABS(HY)*HY+HYT
01617      H(I,JJ)=SQRT(ABS(XXX)+ABS(YYY))
01618      IF(H(I,JJ).GT.HB(I,JJ)) H(I,JJ)=HB(I,JJ)
01619      THETA(I,JJ)=ATAN((XXX/SQRT(ABS(XXX)))/(YYY/SQRT(ABS(YYY))))
01620 2000 CONTINUE
01621      DO 1950 N=1,NOBKS
01622      IF(Y(ILFT(N),JJ).GT.YLEFT(N)) GO TO 1960
01623      YLLFT(N)=Y(ILFT(N),JJ)
01624      IIXL=XXL(N)
01625      III=IIXL/IDIST+1
01626      THETLL(N)=THETA(III,JJ)
01627      DXL(N)=XXL(N)-DX*(ILFT(N)-1)
01628 1960 CONTINUE
01629      IF(Y(IRT(N),JJ).GT.YRT(N)) GO TO 1970
01630      YRRT(N)=Y(IRT(N),JJ)
01631      IIXR=XXR(N)
01632      III=IIXR/IDIST+2
01633      THETRR(N)=THETA(III,JJ)
01634      DXR(N)=XXR(N)-DX*(IRT(N)-1)
01635 1970 CONTINUE
01636 1950 CONTINUE
01637 1000 CONTINUE
01638      RETURN
01639      END
01640      SUBROUTINE PLOTNS(IMAX,JMAX,Y,YLEFT,YRT,ILFT,IRT,SJETTY,IJET,
01641 1NOBKS,MMAX)
01642      PARAMETER(NI=53,NJ=11)
01643      DIMENSION Y(NI,NJ),YLEFT(5),YRT(5),ILFT(5),IRT(5),SJETTY(5)
01644 1,IJET(5)
01645      DIMENSION ICHAR(200),IY(6),NN(7)
01646      DATA NN/1H*,1H0,1H.,1H+,1H*,1H0,1HH/
01647      DATA NIL/1H /
01648      IWIDTH=127
01649 C      IWIDTH=75
01650      YMIN=-50.

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01651      DO 1 I=1,IMAX
01652      IF(Y(I,1).GT.YMIN) GO TO 1
01653      YMIN=Y(I,1)
01654      1 CONTINUE
01655      YMAX=Y(1,6)
01656      DO 2 I=1,IMAX
01657      IF(Y(I,6).LT.YMAX) GO TO 2
01658      YMAX=Y(I,6)
01659      2 CONTINUE
01660      IF(YMIN.GE.0.) GO TO 3
01661      SCALE=(YMAX-YMIN)/IWIDTH
01662      IZERO=-YMIN/SCALE
01663      GO TO 4
01664      3 SCALE=YMAX/IWIDTH
01665      IZERO=50./SCALE
01666      4 CONTINUE
01667      DO 500 I=1,IMAX
01668      DO 10 N=1,127
01669      10 ICHAR(N)=NIL
01670      ICHAR(IZERO)=1HI
01671      DO 20 J=1,6
01672      IY(J)=Y(I,J)/SCALE+IZERO
01673      IF(IY(J).LT.1) IY(J)=1
01674      IF(IY(J).GT.IWIDTH) IY(J)=IWIDTH
01675      20 ICHAR(IY(J))=NN(J)
01676      DO 200 N=1,MMAX
01677      IF(I.EQ.IJET(N)) GO TO 150
01678      GO TO 200
01679      150 ILNG=SIJET(N)/SCALE+IZERO
01680      IF(ILNG.GT.IWIDTH) ILNG=IWIDTH
01681      DO 175 M=IZERO,ILNG
01682      175 ICHAR(M)=NN(7)
01683      200 CONTINUE
01684      IF(NOBKS.LT.1) GO TO 301
01685      DO 300 N=1,NOBKS
01686      IF(I.GE.ILEFT(N).AND.I.LE.IRT(N)) GO TO 250
01687      GO TO 300
01688      250 ILNG=ILEFT(N)/SCALE+IZERO
01689      IF(ILNG.GT.IWIDTH) ILNG=IWIDTH
01690      ICHAR(ILNG)=NN(7)
01691      300 CONTINUE
01692      301 CONTINUE
01693      WRITE(2,30) I,(ICAR(N),N=1,IWIDTH)
01694      30 FORMAT(1X,I3,1HI,127A1)
01695      C 30 FORMAT(1X,I3,75A1)
01696      500 CONTINUE
01697      RETURN
01698      END

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/LIST
00001      PROGRAM DATA INPUT, OUTPUT, INPUT, SPOOL, TAPE5=1, TAPE10=INPUT
00002      1, TAPE20=INPUT, TAPE20=SPOOL
00003      DIMENSION IJET(20), SJETTY(20), ILEFT(20), IRT(20), ILEFT(20), IRT(20)
00004      1, Y(100,1), CHANGE(20)
00005 C THIS PROGRAM ALLOWS THE USER TO CREATE AN INPUT FILE CONTAINING
00006 C THE PROJECT PARAMETERS AND WAVE CONDITIONS, AND A SPOOL FILE
00007 C TO ADJUST THE CONTOUR LOCATIONS.
00008      DO 1 N=1,20
00009      1 CHANGE(N)=0.0
00010      WRITE(6,10)
00011      10 FORMAT(1X,10HENTER IMAX)
00012      READ(5,*) IMAX
00013      WRITE(6,12)
00014      12 FORMAT(1X,10HENTER JMAX)
00015      READ(5,*) JMAX
00016      WRITE(10,14) IMAX,JMAX
00017      14 FORMAT(2I10)
00018      WRITE(6,2)
00019      2 FORMAT(1X,51HENTER THE OFFSHORE BOUNDARY CONTOUR DEPTH IN METERS,
00020      18H(WDEPTH))
00021      READ(5,*) WDEPTH
00022      WRITE(10,7) WDEPTH
00023      7 FORMAT(10X,F10.3)
00024      WRITE(6,3)
00025      3 FORMAT(1X,40HENTER THE DESIRED CONTOUR DEPTHS IN FEET,
00026      123H(1ST,2ND,3RD,...JMAX+1))
00027      READ(5,*) (CHANGE(J),J=1,JMAX+1)
00028      CHANGE(JMAX+2)=WDEPTH*3.28084
00029      WRITE(10,4) (CHANGE(J),J=1,20)
00030      4 FORMAT(10F8.3)
00031      WRITE(6,5)
00032      5 FORMAT(1X,45HENTER THE DESIRED FREQUENCY OF PRINTED OUTPUT,
00033      124H(SAMPLE-ENERGY IN HOURS))
00034      READ(5,*) NOUTPT
00035      WRITE(10,6) NOUTPT
00036      6 FORMAT(I10)
00037      WRITE(6,17)
00038      17 FORMAT(1X,14HENTER BERM(ST))
00039      READ(5,*) BERM
00040      WRITE(6,18)
00041      18 FORMAT(1X,11HENTER SPACE)
00042      READ(5,*) SPACE
00043      WRITE(6,20)
00044      20 FORMAT(1X,15HENTER DIAM(M))
00045      READ(5,*) DIAM
00046      WRITE(10,22) BERM,SPACE,DIAM
00047      22 FORMAT(10X,F10.3,F10.4,F10.3)
00048      WRITE(6,24)
00049      24 FORMAT(1X,39HENTER NUMBER OF GROINS(NMAX) 10,1,2,ETC.)
00050      READ(5,*) NMAX
00051      IF NMAX.EQ.0 GO TO 30
00052      DO 26 M=1,NMAX
00053      WRITE(6,23) M
00054      23 FORMAT(1X,30HENTER LOCATION, LENGTH OF NO. 12,10- GROIN(FT))
00055      26 READ(5,*) IJET(M), SJETTY(M)

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00056      GO TO 32
00057  30 MMAX=1
00058      IJET(1)=3
00059      SJETTY(1)=0.00
00060  32 WRITE(10,29) MMAX
00061  29 FORMAT(13)
00062      DO 36 M=1,MMAX
00063  36 WRITE(10,34) IJET(M),SJETTY(M)
00064  34 FORMAT(13,F10.3)
00065      WRITE(6,40)
00066  40 FORMAT(1X,21HENTER ADEAN (FT**1/3))
00067      READ(5,*) ADEAN
00068      WRITE(10,42) ADEAN
00069  42 FORMAT(F10.4)
00070      WRITE(5,44)
00071  44 FORMAT(1X,22HENTER DX(FT),DELT(HRS))
00072      READ(5,*) DX,DELT
00073      DELT=DELT*3600.
00074      WRITE(10,46) DX,DELT
00075  46 FORMAT(2F10.3)
00076      DELT=DELT*3600.
00077      DO 61 I=1,IMAX
00078  61 Y(I,1)=0.0
00079      WRITE(6,62)
00080  62 FORMAT(1X,43HSHORELINE IS INITIALLY STRAIGHT(Y(I,1)=0.0).
00081      154HENTER CHANGES BY ENTERING I LOCATION, DISTANCE IN FEET.
00082      158HIF NO CHANGES OR TO TERMINATE CHANGES, ENTER IMAX VALUE,0.)
00083  65 READ(5,*) I,(I,1)
00084      IF I.EQ.IMAX GO TO 62
00085      GO TO 65
00086  68 WRITE(10,69) (Y(I,1),I=1,IMAX)
00087  69 FORMAT(10F8.2)
00088      WRITE(6,48)
00089  48 FORMAT(1X,31HENTER THE NUMBER OF BREAKWATERS
00090      READ(5,*) NOBKS
00091      WRITE(10,50) NOBKS
00092  50 FORMAT(15)
00093      IF(NOBKS.EQ.0) GO TO 60
00094      DO 52 N=1,NOBKS
00095      WRITE(6,54) N
00096  54 FORMAT(1X,9HENTER NO. 12,124 BREAKWATER
00097      125HLEFT,RIGHT I LOCATION, LEFT,RIGHT DISTANCE (FEET)
00098      READ(5,*) ILEFT,N,IRIGHT,N,LEFT(N),YRT(N)
00099  52 WRITE(10,56) ILEFT,N,IRIGHT,N,YLEFT(N),YRT
00100  56 FORMAT(10I,2110,2F10.2)
00101  60 CONTINUE
00102      WRITE(6,100)
00103  100 FORMAT(1X,42HDO YOU WISH TO ADJUST THE LOCATIONS OF
00104      139H CONTOURS? ENTER 0 FOR NO OR 1 FOR YES)
00105      READ(5,*) IDR
00106      IF IDR.EQ.0 GO TO 500
00107      WRITE(6,115)
00108  115 FORMAT(1X,52HAT WHAT TIME INTERVAL WILL THE CONTOURS BE ADJUSTED?)
00109      READ(5,*) IDTIME
00110      WRITE(6,107)

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00111 107 FORMAT(1X,49HENTER 112 VALUE. INCREMENTAL VALUE TO BE ADDED /,
00112 161H TO THE AVERAGE OF EACH ADJACENT CONTOUR(FT). ENTER IMAX, JMAX /
00113 124H VALUES,0. WHEN COMPLETE)
00114 108 READ(5,*) I,J,DREGE
00115 IF(I.EQ.IMAX.AND(J.EQ.JMAX) GO TO 499
00116 WRITE(20,112) I,J,DREGE
00117 112 FORMAT(2I5,F10.2)
00118 GO TO 108
00119 499 WRITE(20,112) I,J,DREGE
00120 500 CONTINUE
00121 ITIME=1
00122 WRITE(6,80)
00123 80 FORMAT(1X,49HENTER WAVE HEIGHT(FT), PERIOD(SECS), ANGLE(DEGS) /,
00124 162HAND NUMBER OF REPETITIONS OF THAT WAVE FIELD. WHEN COMPLETED.
00125 1/,19HENTER 99.,99.,99.,0)
00126 82 CONTINUE
00127 NREP=0
00128 READ(5,*) H,T,A,NREPIT
00129 87 IDO=0
00130 IF(ITIME.EQ.IDTIME IDO=1
00131 WRITE(10,35) ITIME,H,T,A,IDO
00132 85 FORMAT(1I,14,5F8.1,15)
00133 ITIME=ITIME+1
00134 NREP=NREP+1
00135 IF(H.GT.50.) GO TO 80
00136 IF(NREP.LT.NREPIT) GO TO 87
00137 GO TO 82
00138 80 CONTINUE
00139 STOP
00140 END

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END

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