# PRECISION BATHYMETRY, DIVING OBSERVATION AND SEDIMENT DESCRIPTION

NORWALK
DISPOSAL OPERATION
MONITORING SURVEY REPORT

POST DISPOSAL SURVEYS
APRIL 1981

DAMOS CONTRIBUTION #15

July 8, 1981

Submitted to:

New England Division
US Army Corps of Engineers
424 Trapelo Rd.
Waltham, MA 02154

Submitted by:

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## 1.0 INTRODUCTION

The dredging of Norwalk Harbor required the removal and disposal of approximately 16,000 $m^3$ of Class III material in conjunction with the dredging of 78,432 $yds^3$ of Class I and II material. In order to reduce the potential for adverse environmental impact resulting from the disposal of those sediments enriched with contaminants, a capping procedure similar to that used for the Stamford-New Haven disposal operation was proposed.

To accomplish this capping, a taut wire moored buoy was installed for control of the disposal operation. Since a significant amount of Class I and II material had to be dredged prior to the Class III portion, this material was dumped south of the buoy during the Spring of 1980 and the Fall and Winter of 1980-81. The distribution of that Class I and II material as of January 1981 is presented in Figure 1. At that time the material was located slightly southeast of the disposal buoy and was distributed in a small mound approximately 150 meters in diameter and 1.5 meters thick with a minimum depth of 18 meters slightly southeast of the disposal buoy position.

Between January and April 1981, additional material was dumped south of the buoy and Class III material was dumped north of the buoy. On April 27, 28 and 29 Science Applications, Inc. (SAI) personnel conducted specific measurements at the Norwalk disposal site to evaluate the conditions of the site following disposal of all Class III material and to provide baseline information. The studies conducted during this cruise

included:

- a precision bathymetric survey
- surface sediment samples to obtain chemical and spoil thickness data
- diving observations to define the limits of spoil distribution, to characterize the surface features of the spoil mound and to observe the distribution of macrobenthic and epibenthic organisms in the vicinity of the disposal site.

The results of these studies were presented to the New England division in rough form on May 12, 1981. This document, therefore, represents a confirmation, expansion and permanent record of the data discussed during that meeting.

## 2.0 PRECISION BATHYMETRIC SURVEY

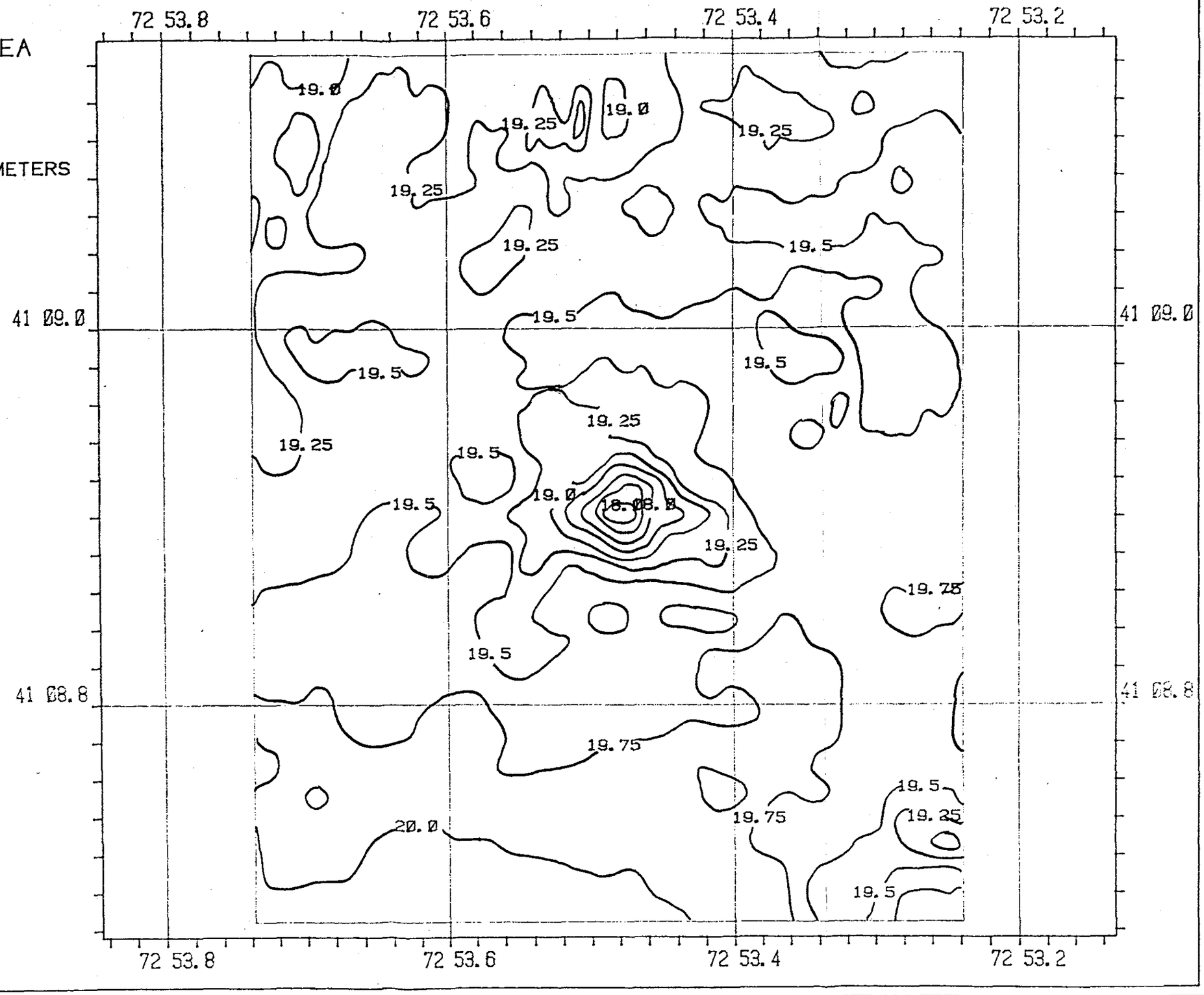
The overall distribution of dredged material disposed at the Norwalk site is most clearly defined by the results of the precision bathymetric survey conducted on 28 April 1981. As in previous DAMOS studies, this survey was run over identical lanes established in April 1980 and repeated in June 1980, September 1980 and January 1981. These lanes are 750 meters long, 25 meters apart and oriented in an east-west direction. Using the SAI Navigation and Data Acquisition System, with a Del Norte 540 Trisponder and an EDO Western Fathometer system operating at 24 Khz, replication of the survey procedure can be accomplished with a high degree of precision and differences from earlier surveys can be accurately measured.

The results of the April survey are presented as a contour chart in Figure 2.1 and as individual profiles across the disposal area in Figures 2.2(a-i). From these data, it is readily

NORWALK SURVEY AREA

25 JANUARY 1981

CONTOUR INTERVAL: .25 METERS
CHART SCALE: 1/4000
DATUM: MLW
SOUNDINGS IN METERS



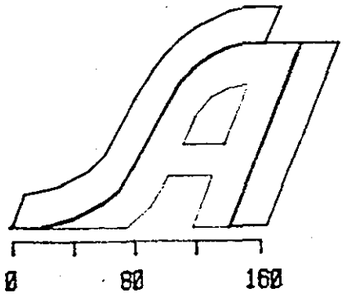




FIGURE 1-1

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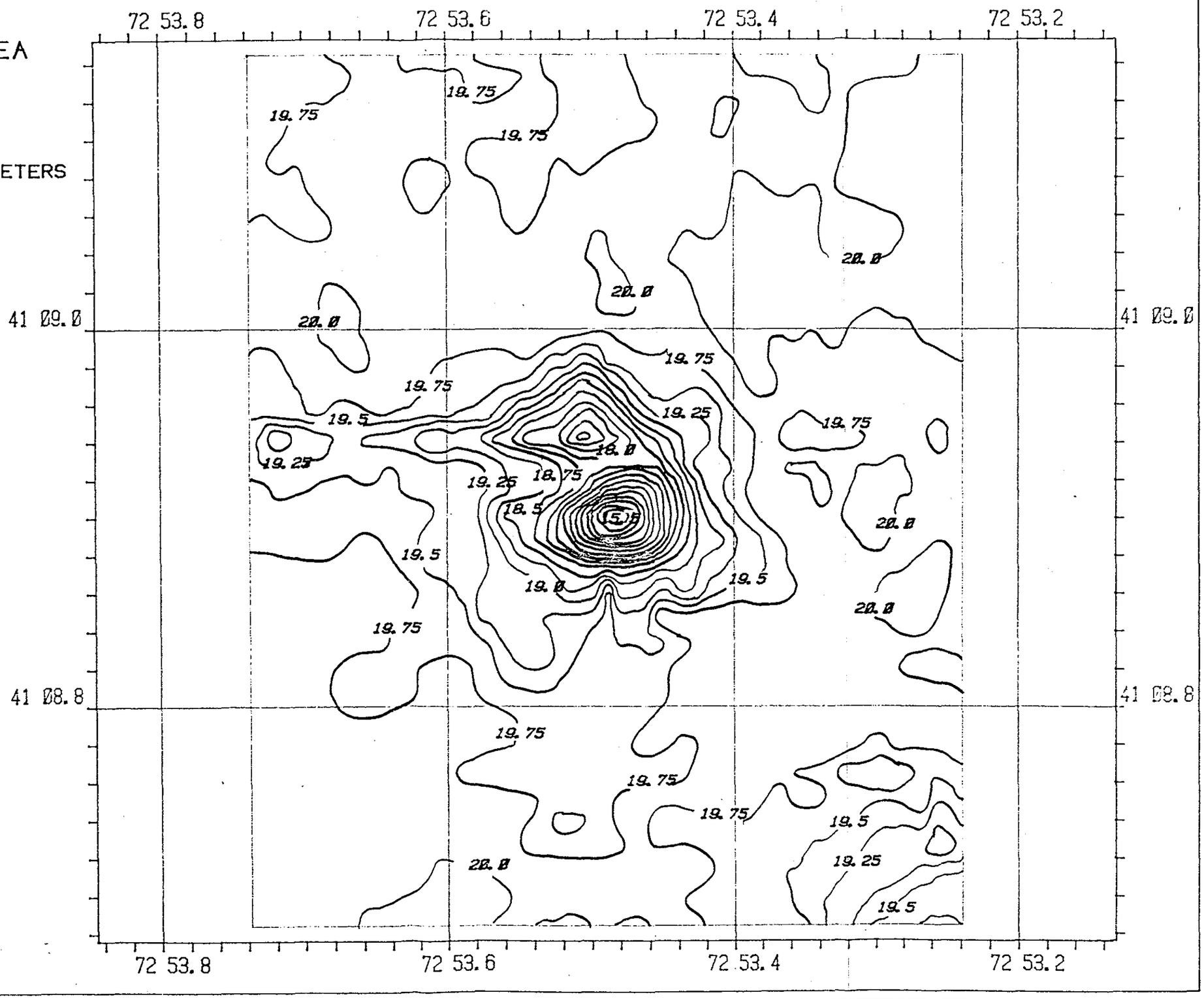
NORWALK SURVEY AREA

28 APRIL 1981

CONTOUR INTERVAL: .25 METERS
CHART SCALE: 1/4000
DATUM: MLW
SOUNDINGS IN METERS



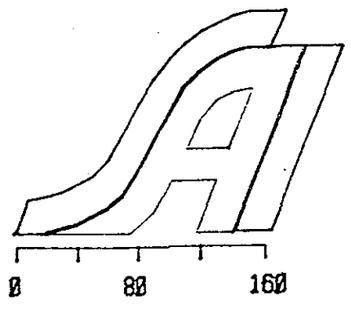




FIGURE 2.1

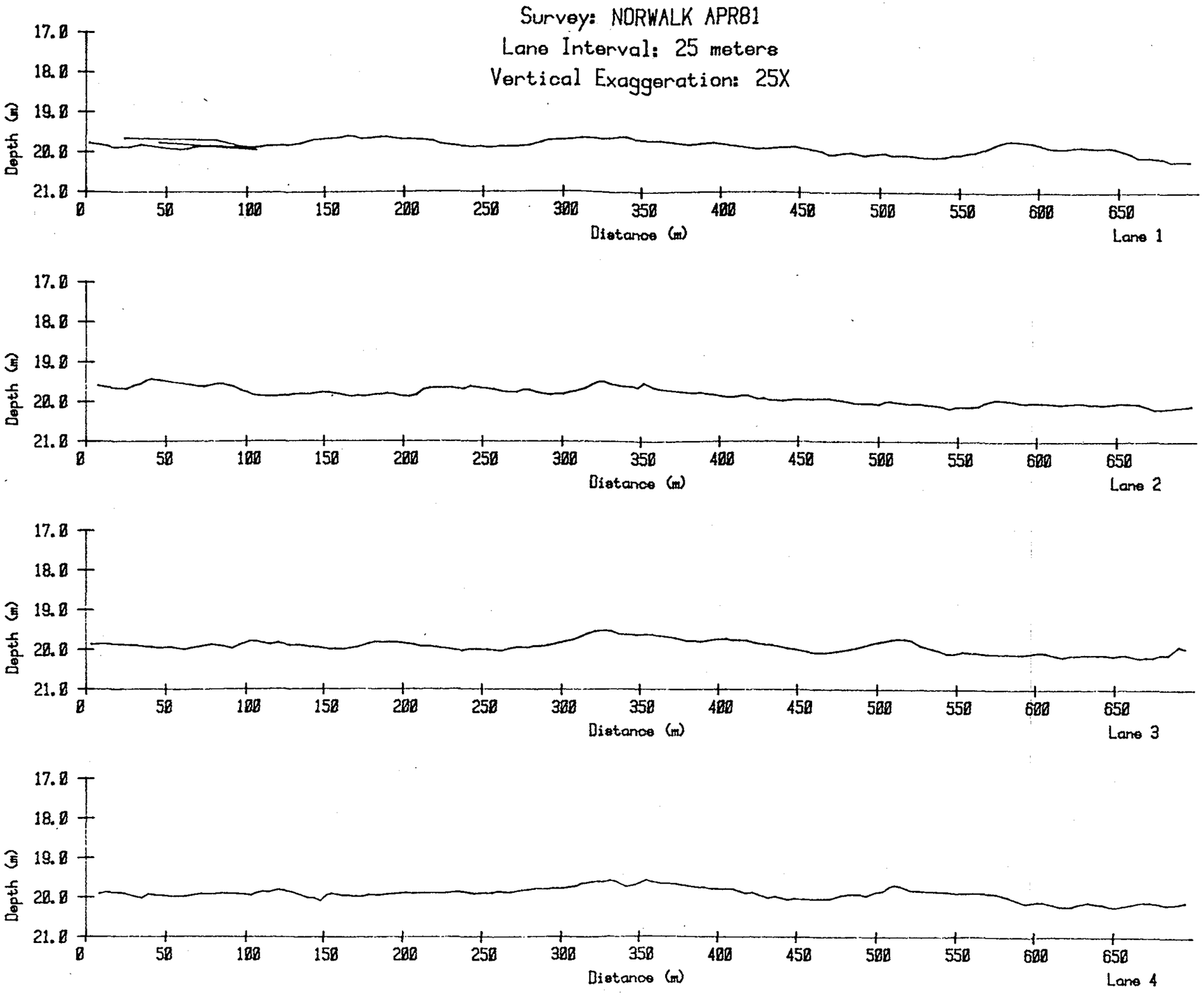

Survey: NORWALK APR81
Lane Interval: 25 meters
Vertical Exaggeration: 25X
Depth (m)
17.0
18.0
19.0
20.0
21.0
0
50
100
150
200
250
300
350
400
450
500
550
600
650
Distance (m)
Lane 1
Lane 2
Lane 3
Lane 4

FIGURE 2.2a

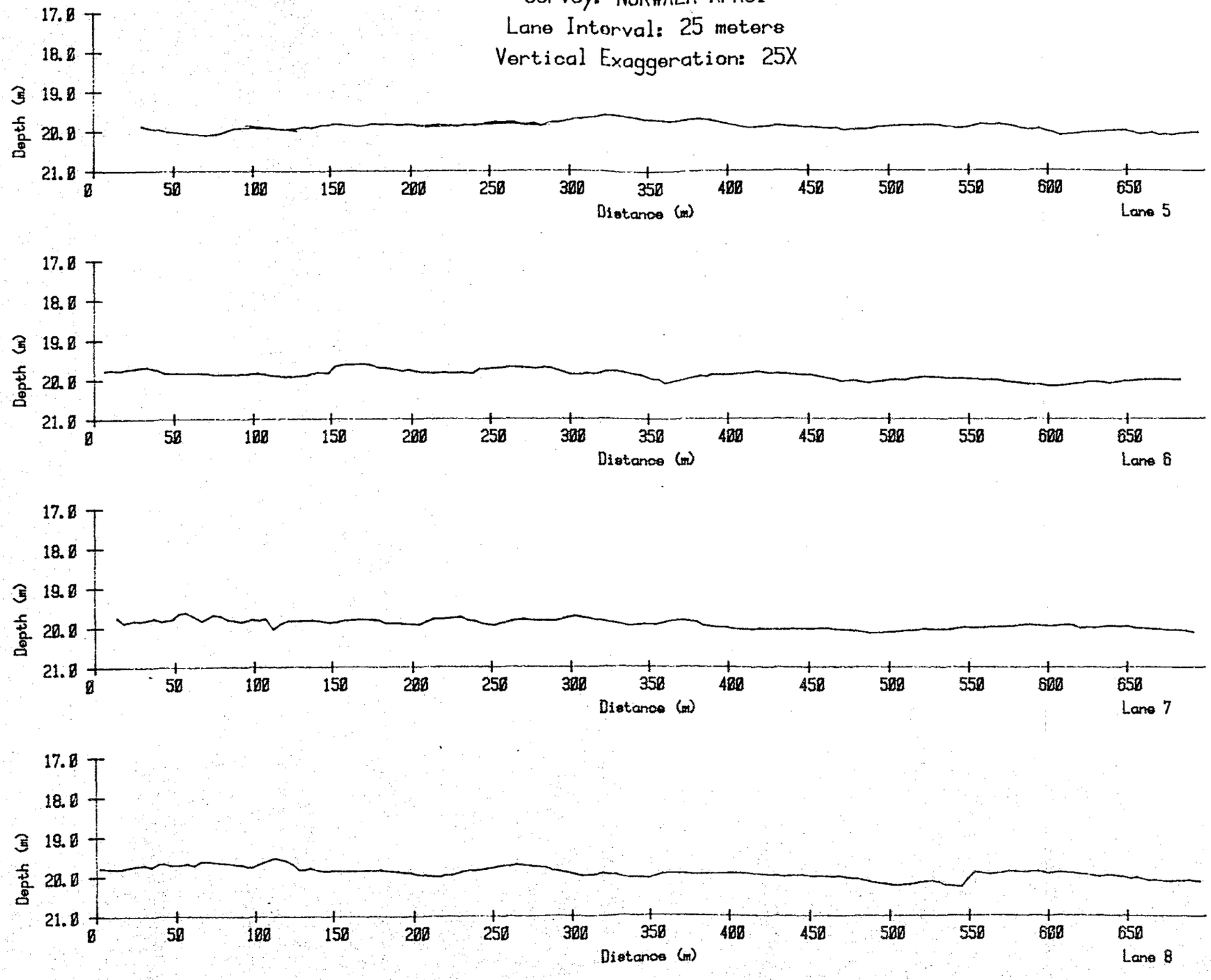

Survey: NORWALK APR81
Lane Interval: 25 meters
Vertical Exaggeration: 25X
Depth (m)
17.0
18.0
19.0
20.0
21.0
0
50
100
150
200
250
300
350
400
450
500
550
600
650
Distance (m)
Lane 5
Lane 6
Lane 7
Lane 8

FIGURE 2.2b

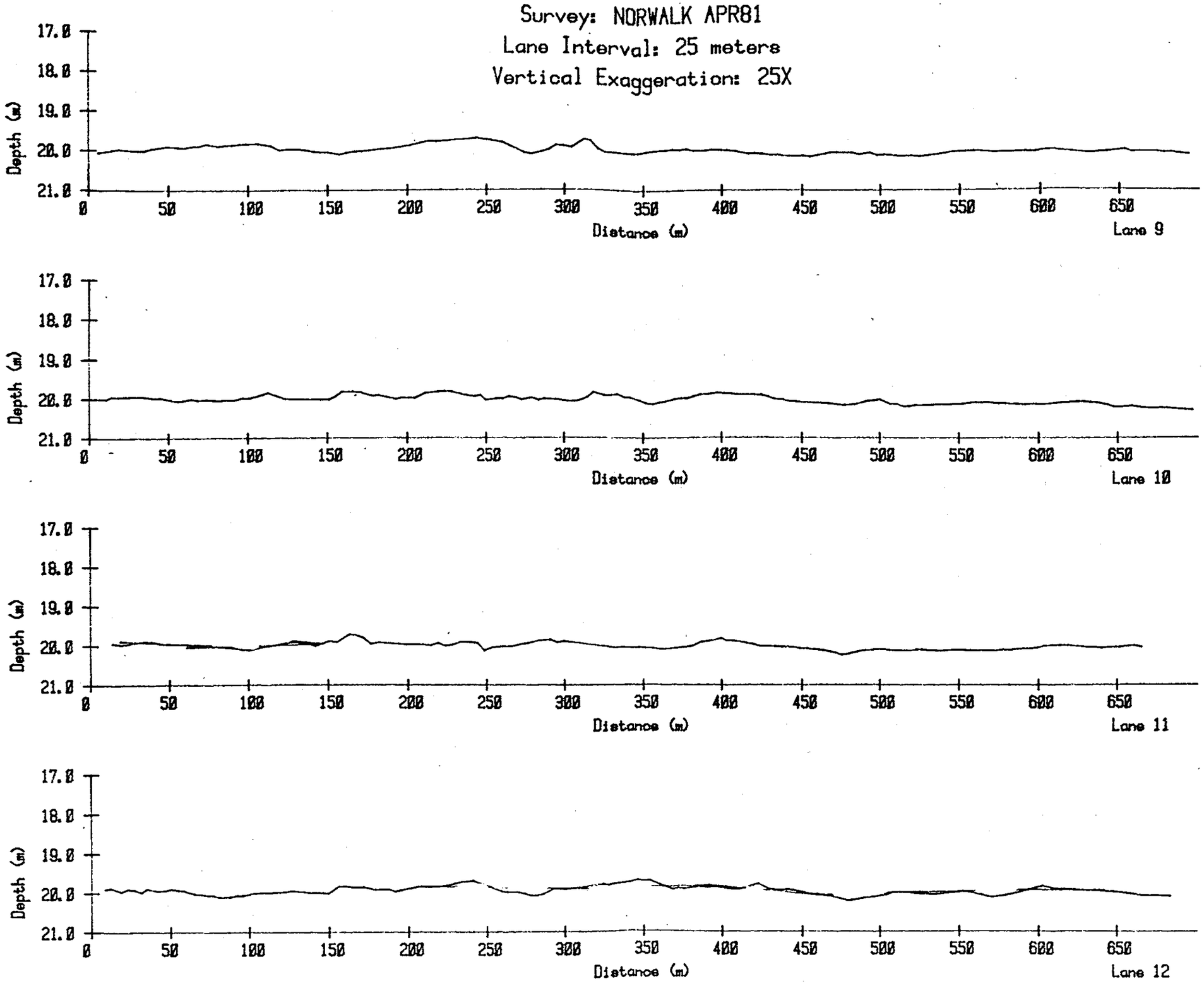

Survey: NORWALK APR81
Lane Interval: 25 meters
Vertical Exaggeration: 25X
Depth (m)
17.0
18.0
19.0
20.0
21.0
0
50
100
150
200
250
300
350
400
450
500
550
600
650
Distance (m)
Lane 9
Lane 10
Lane 11
Lane 12

FIGURE 2.2o

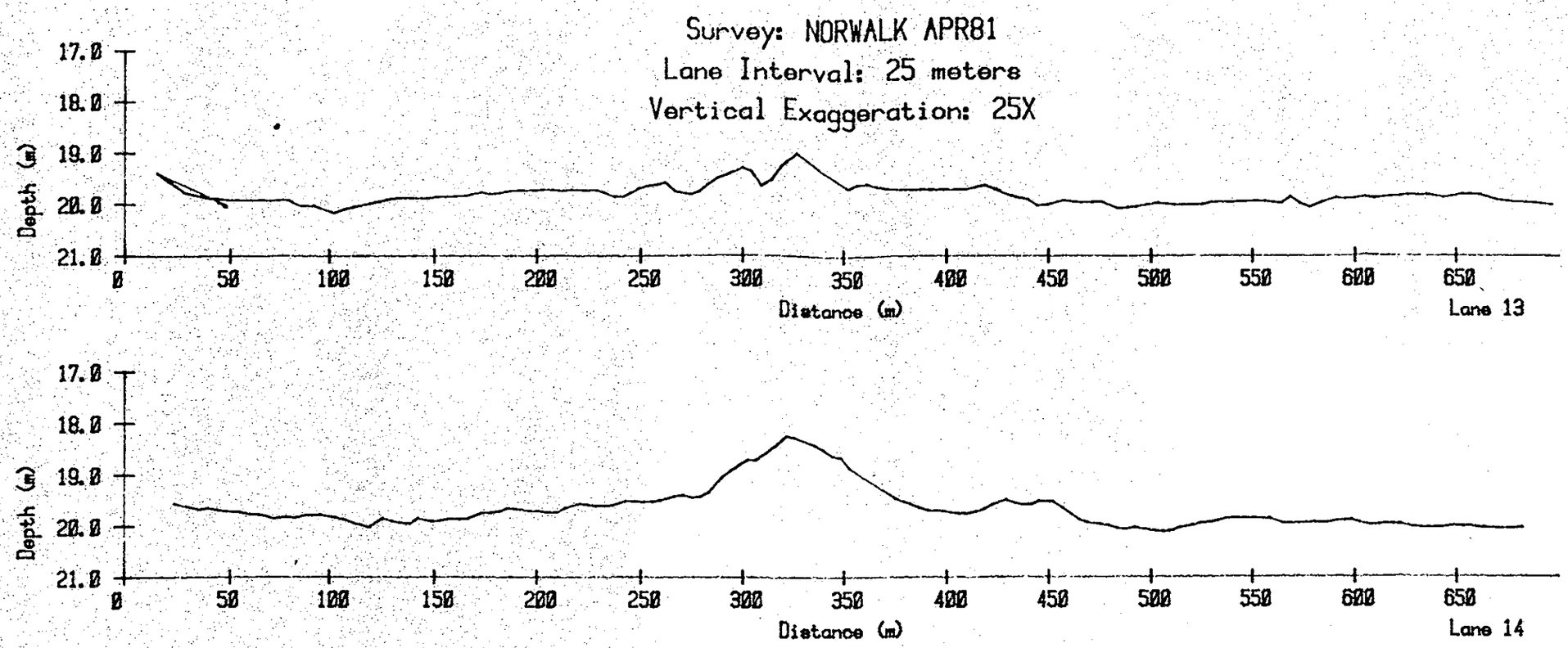

Survey: NORWALK APR81
Lane Interval: 25 meters
Vertical Exaggeration: 25X
Depth (m)
17.0
18.0
19.0
20.0
21.0
0
50
100
150
200
250
300
350
400
450
500
550
600
650
Distance (m)
Lane 13
Lane 14
Lane 15
Lane 16

FIGURE 2.2d

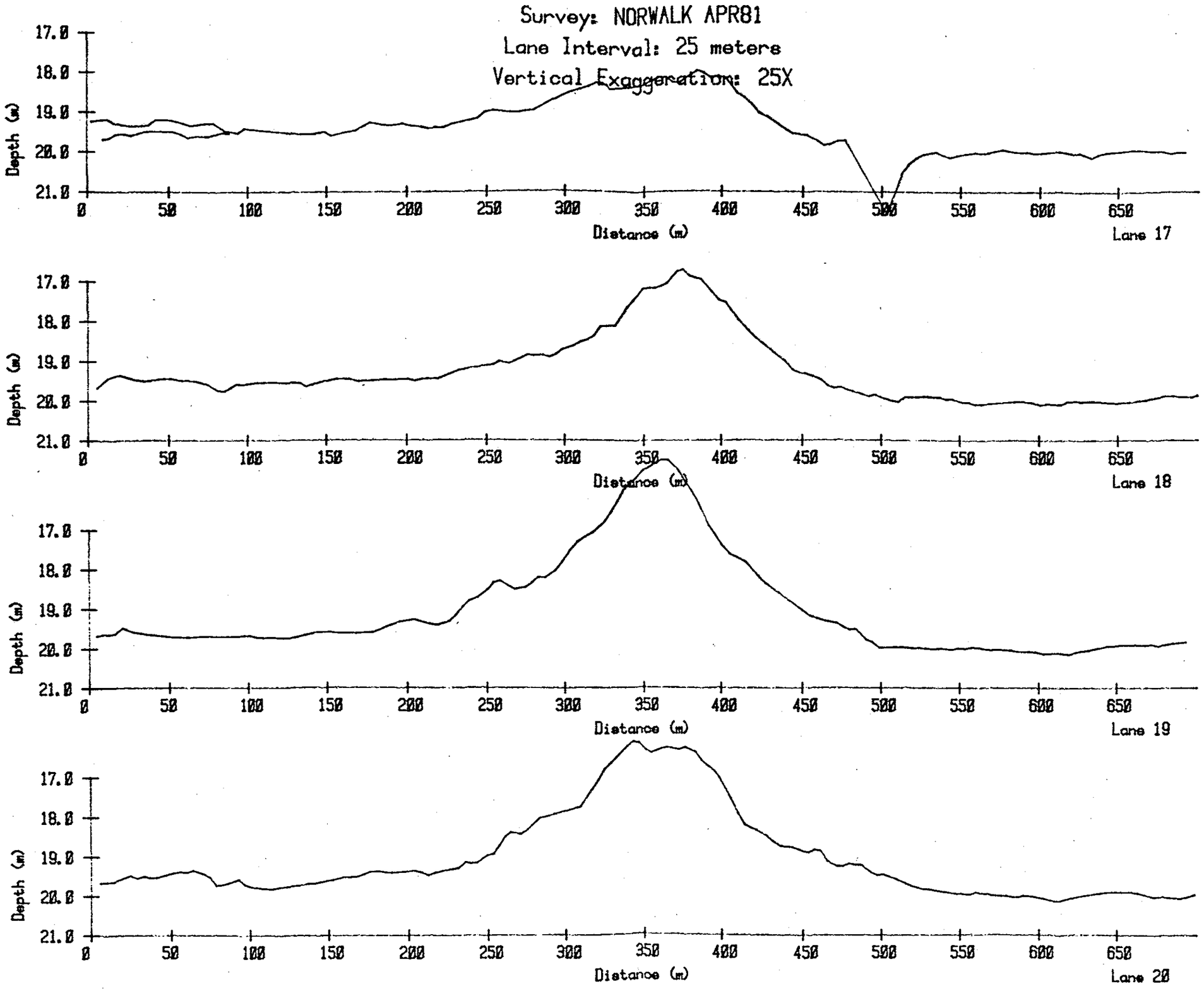

Survey: NORWALK APR81
Lane Interval: 25 meters
Vertical Exaggeration: 25X
Depth (m)
17.0
18.0
19.0
20.0
21.0
0
50
100
150
200
250
300
350
400
450
500
550
600
650
Distance (m)
Lane 17
Lane 18
Lane 19
Lane 20

FIGURE 2.2e

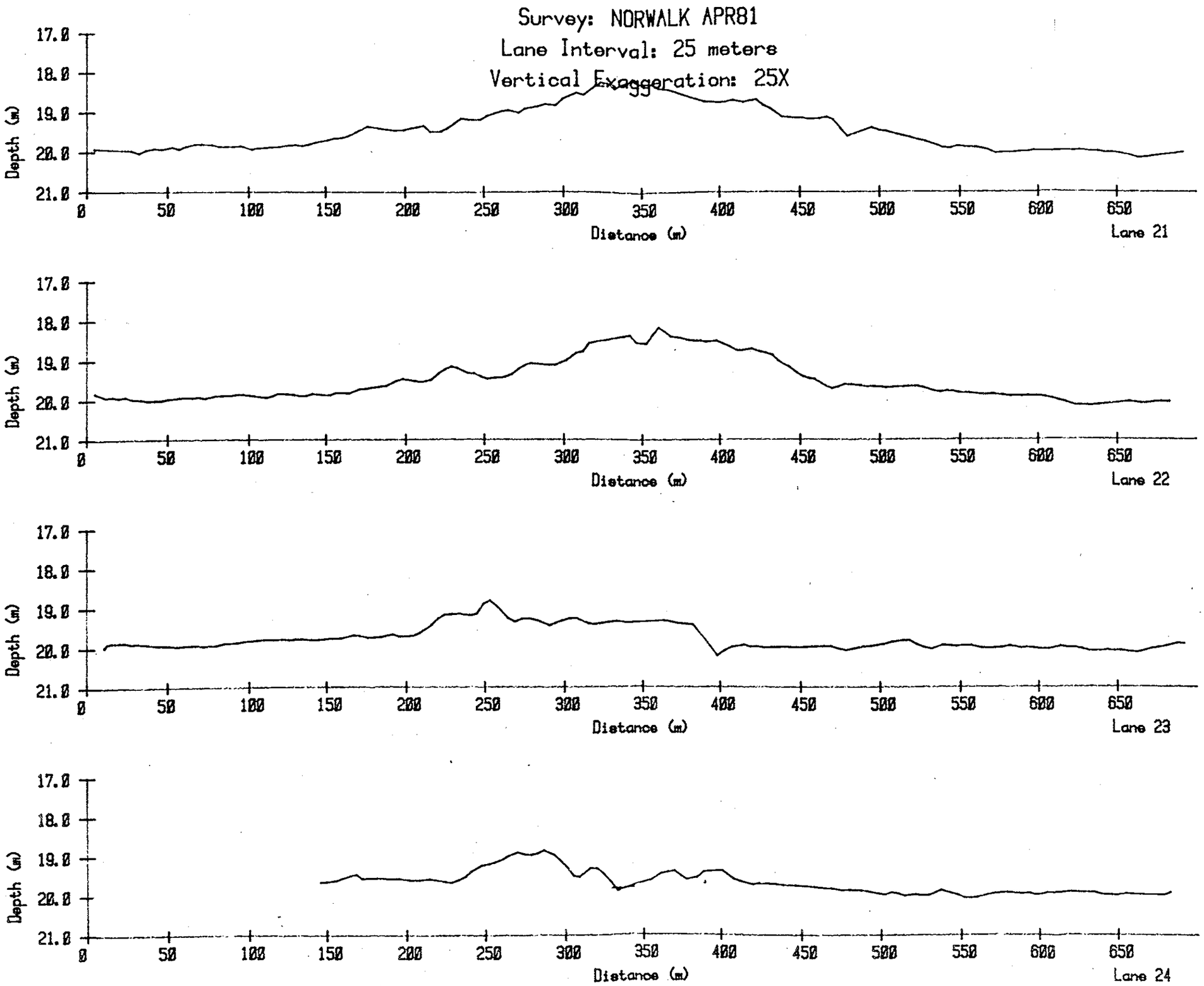

Survey: NORWALK APR81
Lane Interval: 25 meters
Vertical Exaggeration: 25X
Depth (m)
17.0
18.0
19.0
20.0
21.0
0
50
100
150
200
250
300
350
400
450
500
550
600
650
Distance (m)
Lane 21
Lane 22
Lane 23
Lane 24

FIGURE 2.2f

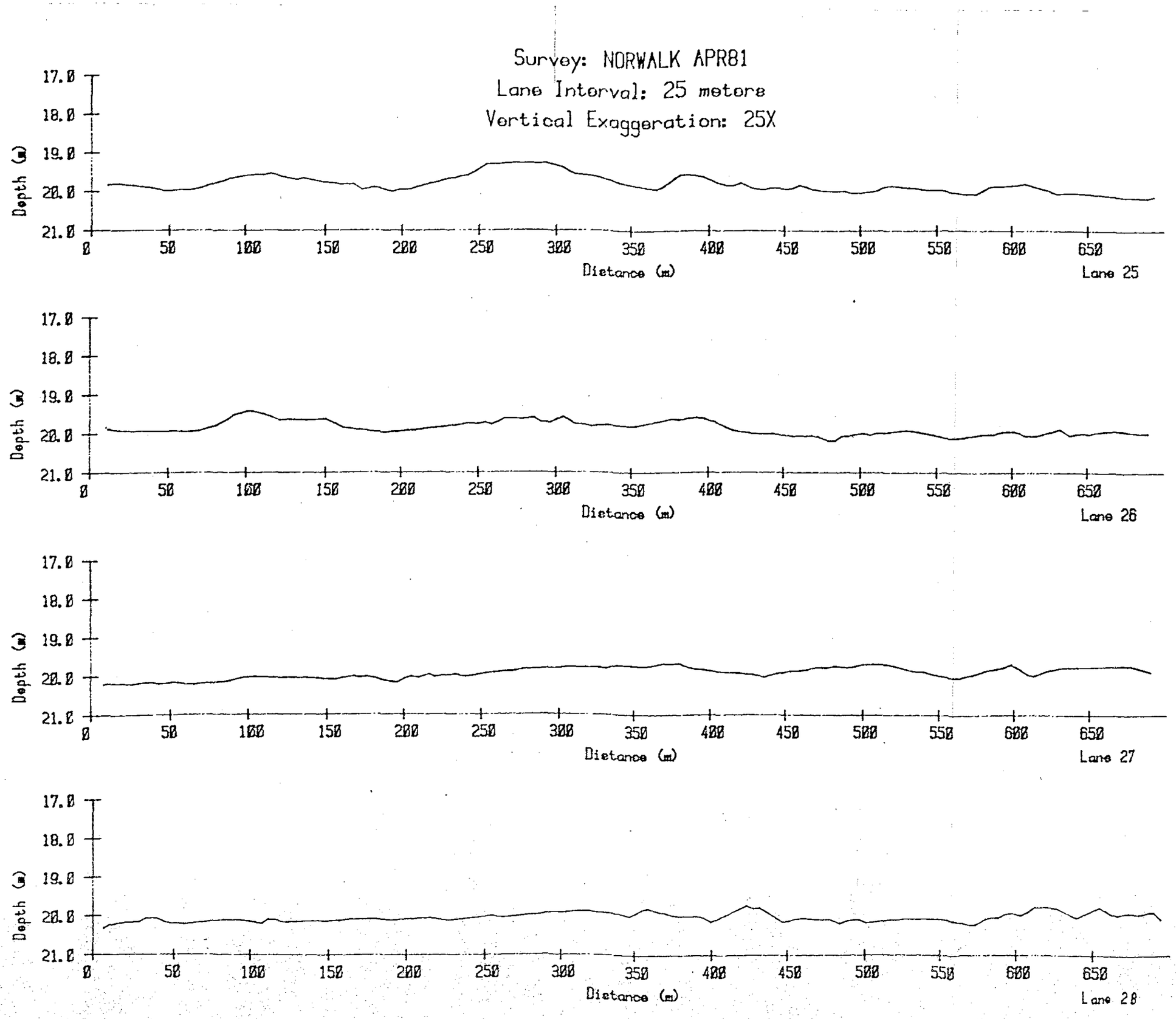
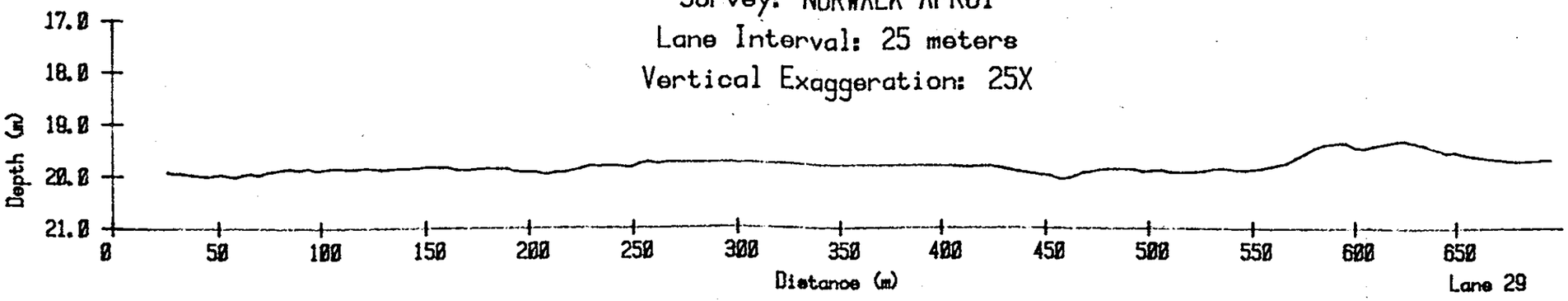
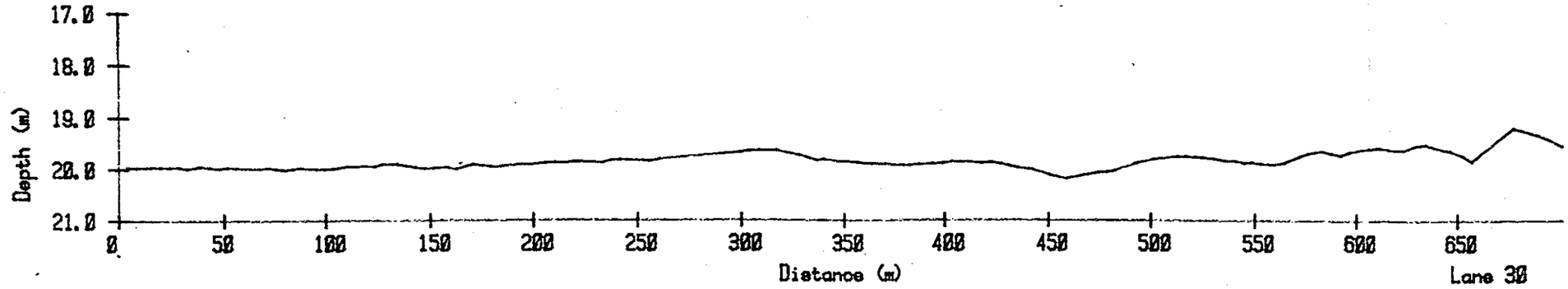
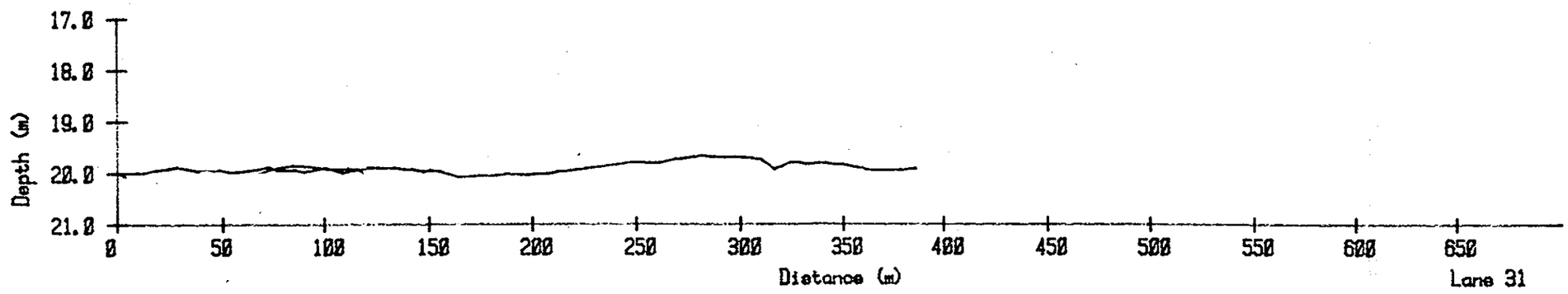

Survey: NORWALK APR81
Lane Interval: 25 meters
Vertical Exaggeration: 25X
Depth (m)
17.0
18.0
19.0
20.0
21.0
0
50
100
150
200
250
300
350
400
450
500
550
600
650
Distance (m)
Lane 25
Lane 26
Lane 27
Lane 28

FIGURE 2.2g


Survey: NORWALK APR81
Lane Interval: 25 meters
Vertical Exaggeration: 25X
Depth (m)
17.0
18.0
19.0
20.0
21.0
0
50
100
150
200
250
300
350
400
450
500
550
600
650
Distance (m)
Lane 29


Depth (m)
17.0
18.0
19.0
20.0
21.0
0
50
100
150
200
250
300
350
400
450
500
550
600
650
Distance (m)
Lane 30


Depth (m)
17.0
18.0
19.0
20.0
21.0
0
50
100
150
200
250
300
350
400
450
500
550
600
650
Distance (m)
Lane 31

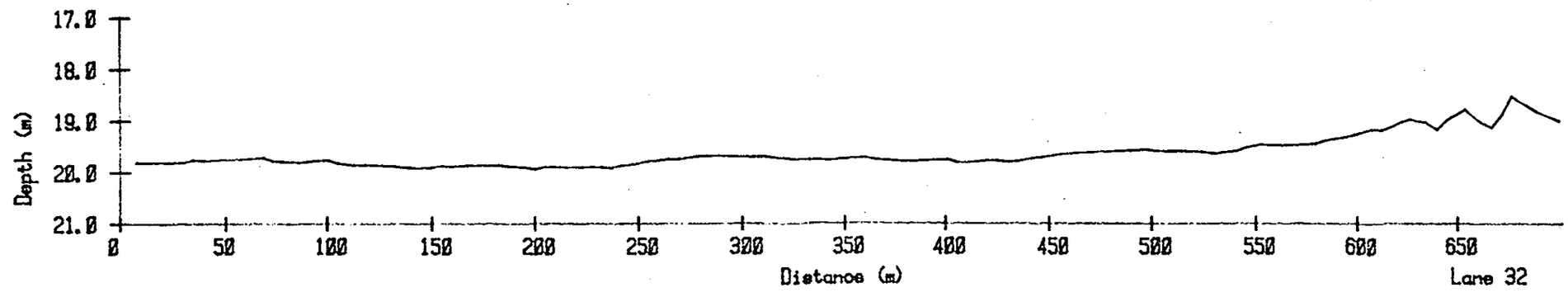

Depth (m)
17.0
18.0
19.0
20.0
21.0
0
50
100
150
200
250
300
350
400
450
500
550
600
650
Distance (m)
Lane 32

FIGURE 2.2h

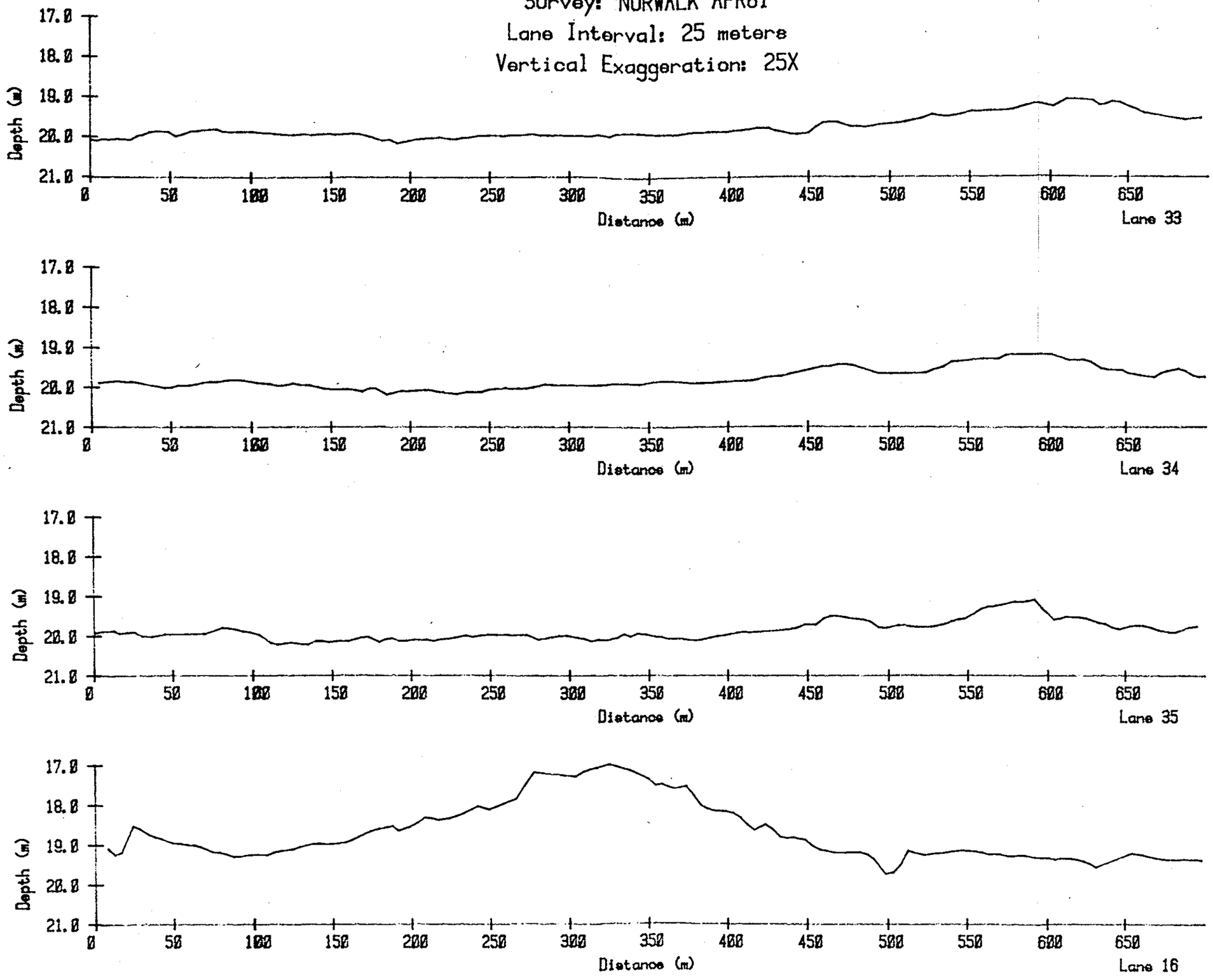

Survey: NORWALK APR81
Lane Interval: 25 meters
Vertical Exaggeration: 25X
Depth (m)
17.0
18.0
19.0
20.0
21.0
0
50
100
150
200
250
300
350
400
450
500
550
600
650
Distance (m)
Lane 33
Lane 34
Lane 35
Lane 16

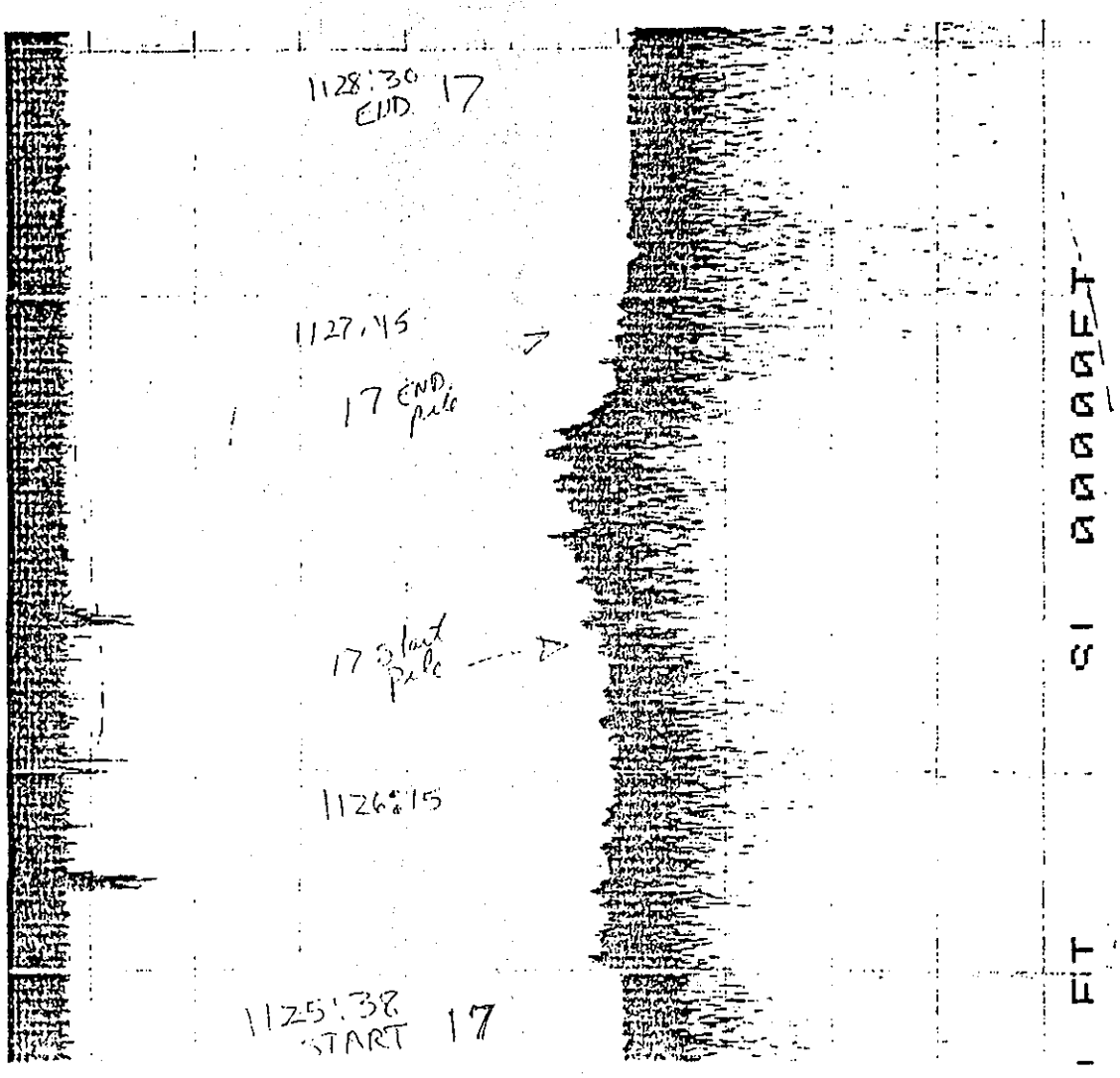
FIGURE 2.2i

apparent that a significant amount of disposal took place between January and April 1981, mostly on the north side of the buoy. It is important to note that the minimum depth of the mound south of the buoy is now less than 16 meters indicating additional material was dumped south of the buoy.

North of the buoy a second mound has developed from disposal of class III material which reaches a minimum depth of slightly greater than 17 meters. A significant feature of this mound is the elongation of the deposit to the west indicative of substantial dumping away from the disposal point. A close examination of the fathometer trace from survey lane 17 Figure 2.3a) shows a continual rough topography indicative of individual dumping operations extending westward to the margin. By comparison lanes 15 and 19 (Figures 2.3b,c) have a relatively smooth bottom with only occasional topographic features caused by disposal.

The data described above certainly indicate that disposal of dredged material has occurred at some distance from the designated point. Furthermore, the elongation to the west indicates that the source of the material must be from the Norwalk area. However, at this time it is impossible to determine whether or not the material is Class III or not. The major contractor for the government portion of the work has demonstrated an ability to point dump both on the Stamford/New Haven project and on earlier portions of this project where a mound was formed south of the buoy. It is possible that the mound located north of the buoy consists of Class III material dumped by this contractor while the elongation to the west was created by disposal of material dredged

FIGURE 2.3a


1128:30
END 17
1127:45
17 END pulse
17 last pulse
1126:15
1125:38
START 17
SI AAAAAFT
FIT

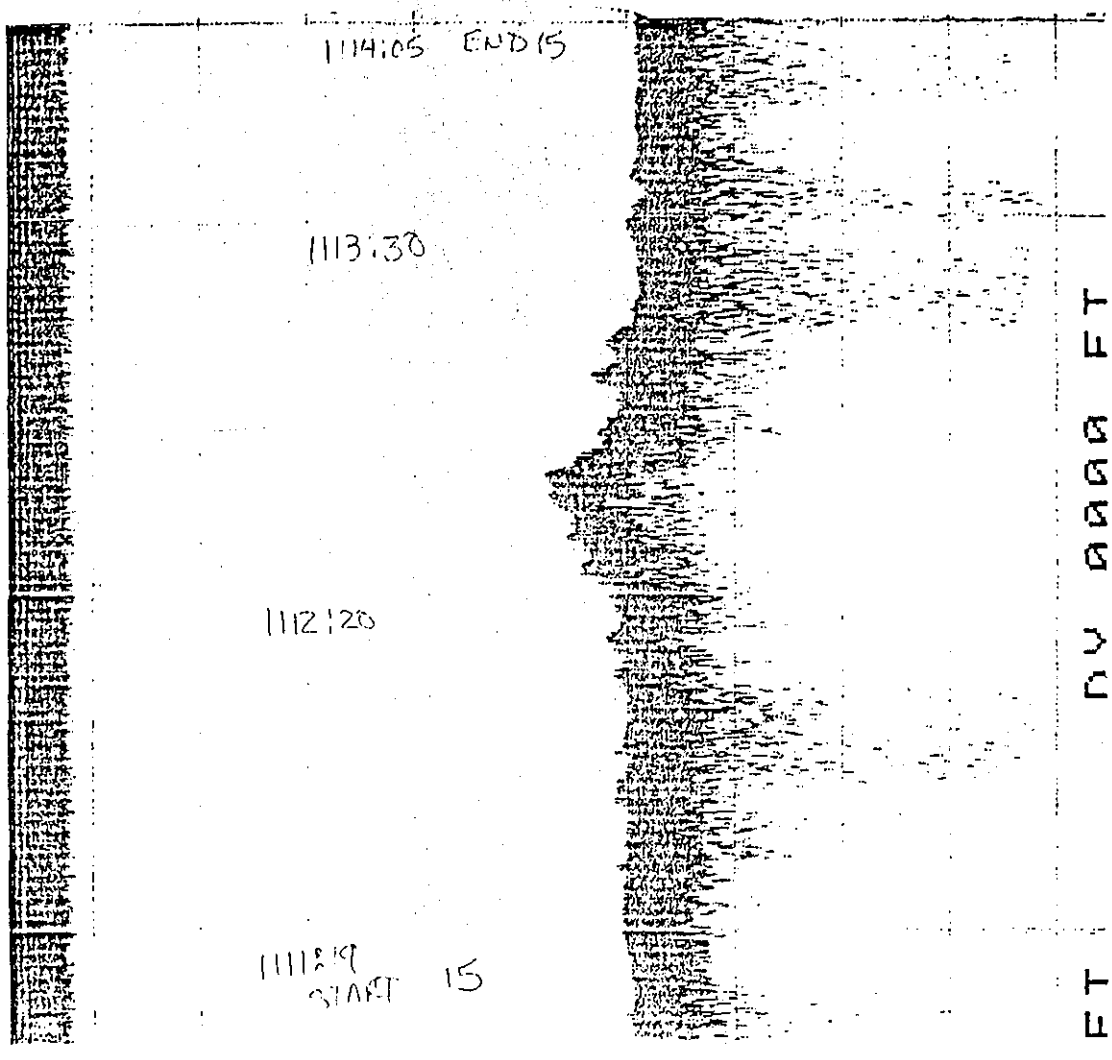



FIGURE 2.3b

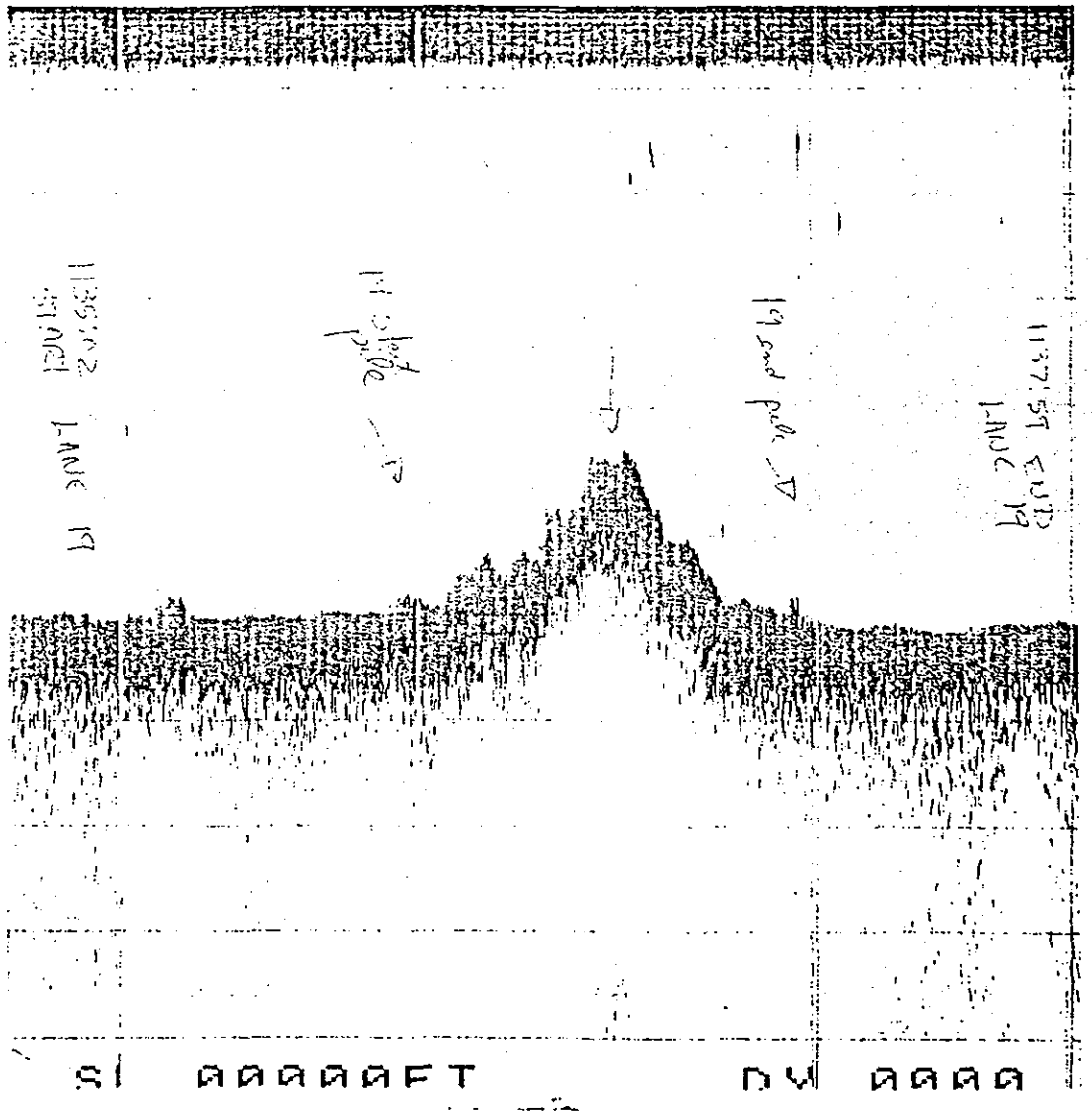


FIGURE 2.3c

under specific permits some of which was Class III material. The composition of the material will be determined through analysis of sediment samples taken after completion of the survey as described in Section 4.0 of this report.

Figure 2.4 presents a contour difference chart indicating changes in the topography of the disposal site that have occurred between January and April 1981 as a result of the disposal operation. Obviously, the contours of this chart are similar in shape to those of the actual depth chart presented in Figure 2.1 since most changes are a result of the disposal operation. In general, both mounds north and south of the buoy have increased in thickness by 2 to 2.5 meters, while the elongation to the west decreases from approximately 1 to .5 meter, although the topography is variable.

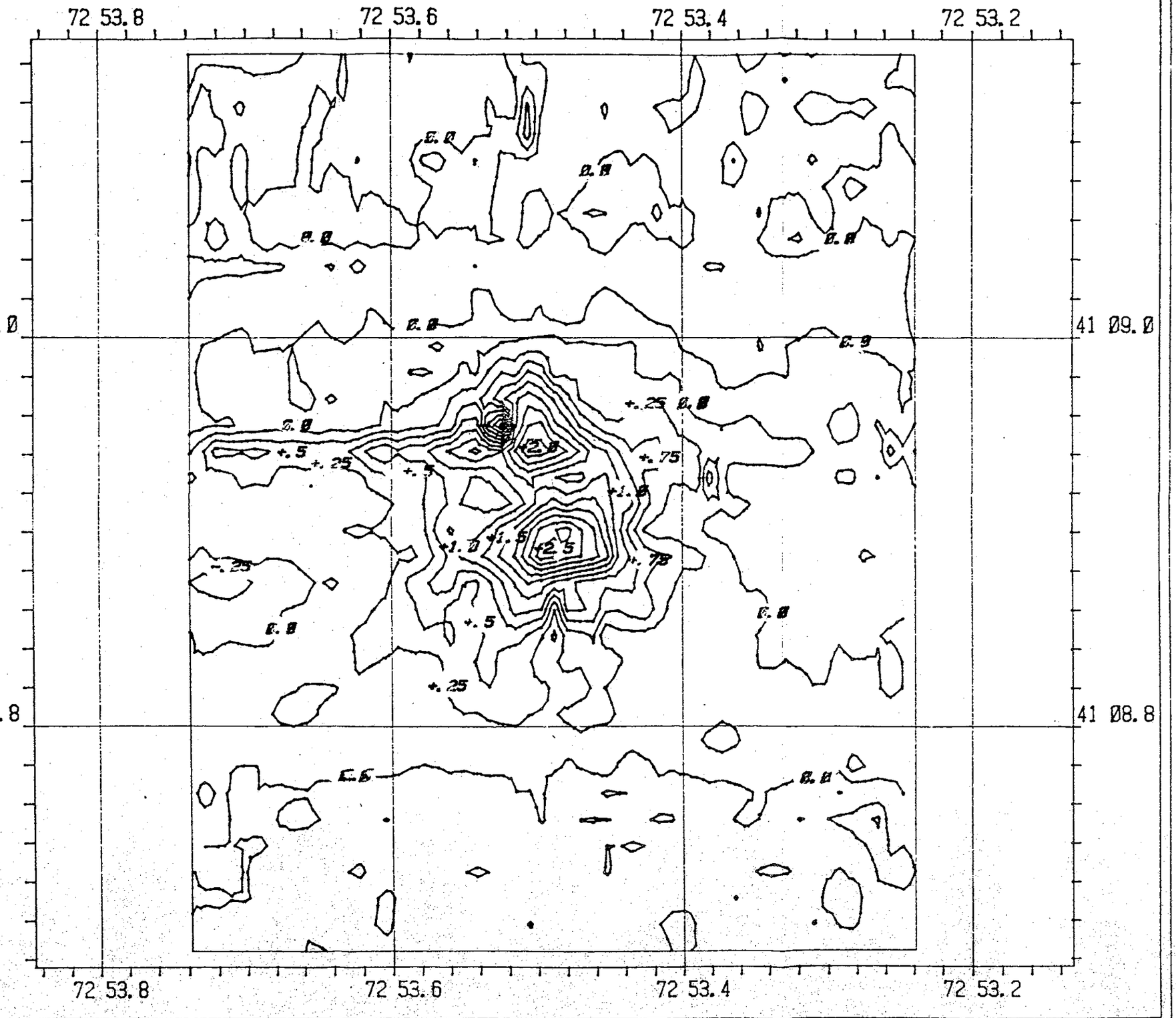
Reports of permit disposal west of the "SP" buoy in the southeast corner of the chart are not reflected as changes to topography in that area. Therefore, it is possible that some of the westward elongation at the Norwalk site may be caused by disposal of this material in the correct orientation, but at the wrong buoy.

Calculation of the volume of material added to the site during the January to April period is presented in Figure 2.5 through summation of volume differences on a lane by lane basis. The largest volume change occurs on lane 16 just north of the disposal buoy as expected. The total volume added to the site through disposal was approximately 60 000 $m^3$.

NORWALK SURVEY AREA
VOLUME DIFFERENCE

APRIL–JANUARY 1981

CONTOUR INTERVAL: .25 METERS
CHART SCALE: 1/4000



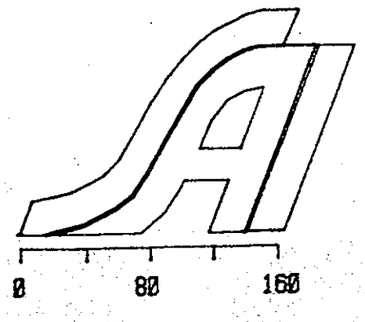




FIGURE 2.4

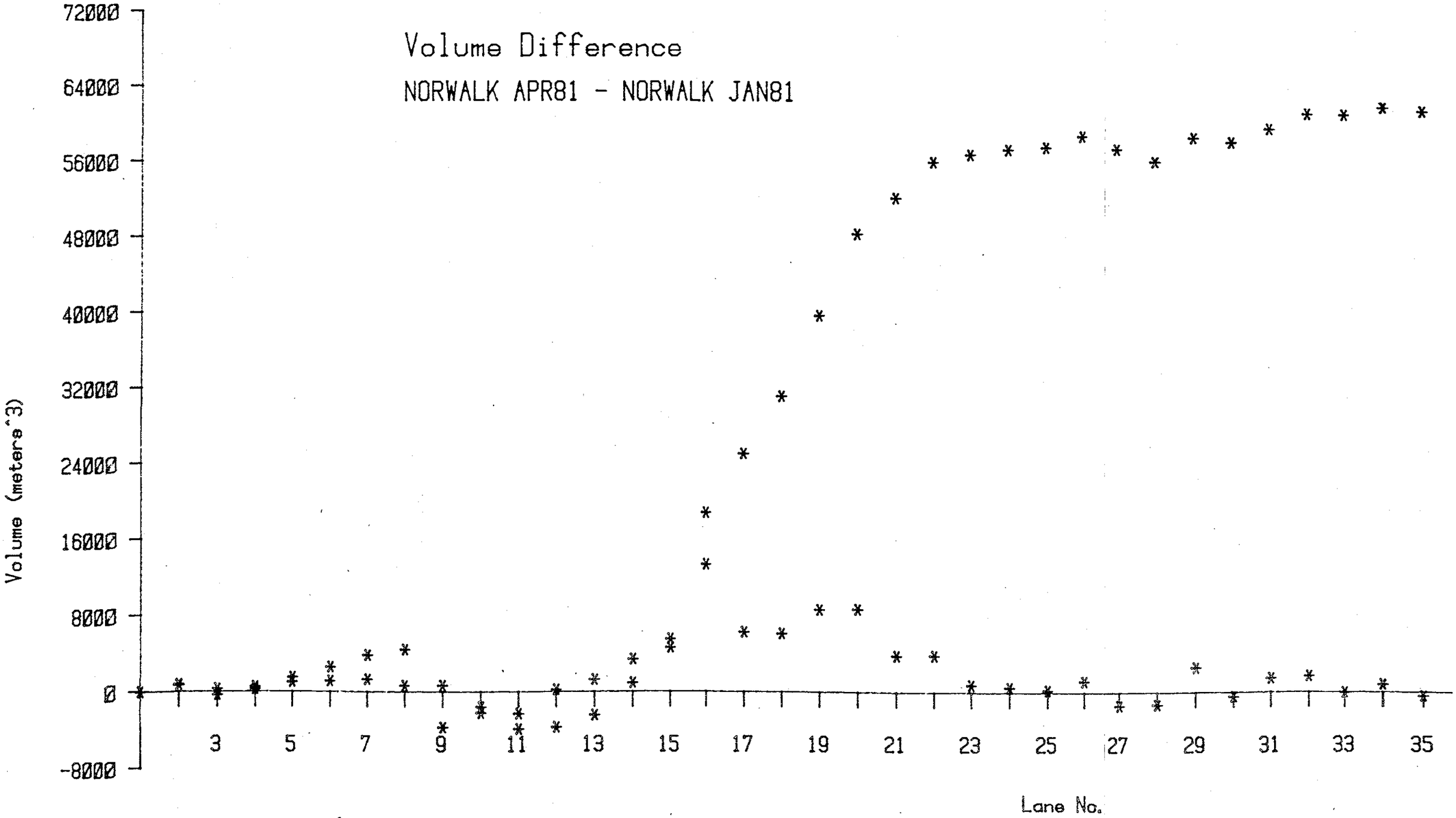

Volume Difference
NORWALK APR81 - NORWALK JAN81
Volume (meters^3)
72000
64000
56000
48000
40000
32000
24000
16000
8000
0
-8000
3
5
7
9
11
13
15
17
19
21
23
25
27
29
31
33
35
Lane No.

FIGURE 2.5

## 3.0 DIVER OBSERVATION

Although acoustic measurement of spoil distribution plays a significant role in evaluating the effect of a disposal operation, final definition of the distribution and fate of the disposed material can best be accomplished though diver observations. For this reason and to observe the distribution of macrobenthic and epibenthic organisms a series of five dives were made in the vicinity of the Norwalk disposal site on April 28 and 29, 1981.

The following excerpts from diver logs provide information on observations of small scale bottom topography, macrobenthos, epibenthic sampling and general distribution of dredged material. The locations of each dive and the perimeters of the Norwalk material are shown on the calibrated Loran-C grid of the Central Long Island Sound Disposal Site (Figure 3.1). Although a dive was made to the west of the disposal buoy, the actual descending point was southwest and the diver was unable to observe the material forming the westward elongation north of the buoy.

1. NORWALK SITE - North sector of pile
   1741-1804 (Lance Stewart, Peter Auster)
   Periphery on north side of spoil pile located and marked with buoy
   Loran C 26550.3/44000.1
   Visibility 3 feet - Current E - W 1/4 kt. 7°C 23 minutes.
   Surface topography at periphery smooth:brown sediment veneer (.1 to 1.0 cm) over black spoil material with clay clumps present.
   Faunal activity at sediment/water interface mobilizing sediment material.
   Benthos observed:
   Asterias -50 - abundant - all size classes to approximately 18 cm dia.
   Mysids-approximately 20-50/.25$m^2$ - dense - with Grangon septemspinosa - repeatedly burrowing and reentering water column.
   Sygnathus fuscus - 2 (1 adult)
   Nassarius trivittatus - 300
   Libinia emarginata - 5 - 2 on surface - 3 burrowed

Scophthalmus aquosus - 2
Psuedopleuronectes americanus - 5
Pagurus longicarpus - 200
Crangon septemspinosa - 100
Homarus/Limulus tracks
tube venting observed from polycheaete tubes
Upogebia - 1 -1 tubes 15 one observed venting - 1 animal collected
Yoldia limatula - one on surface - venting.

collection: Mud shrimp, Upogebia, first live specimen collected.

2.0 NORWALK SITE - East sector of spoil pile.
1815:1823 (R. DeGoursey, D. Hedden)

Periphery located on east side L/C 26548.5/43998.7.
Bottom part spoil perimeter was flat, featureless, topography
with brown silt veneer 1-2 cm deep.
Edge of spoil deineated by presence of clay clumps and irregulartopography.,
Bottom offspoil dominated by Mysids and Pagurus longicarpus.
There was a definite increase in number of organisms on spoilmaterial, apparently attracted by rough topography.
Additional chemo-olfactorary attraction may also contribute to concentrations of organisms on spoil material.
Benthos observed:
Organisms off spoil:
Mysid sp.
Crangon
Pagurus longicarpus - abundant
Libinia emarginata - 5
Cancer irroratus - 1
Sygnathus fuscus
Scophthalmus aquosus - 2
Phuedopleuronectes americanus - 7

Epibenthic:
30 sec at spoil perimeter

Penetrometer: at East perimeter 10 lb pressure. 4.5, 5.0, 3.0, 4.5 cm.

3. NE of NORWALK SITE - Natural Bottom
1903-1930 (L. Stewart, P. Auster).

Topography flat with occasional small clay clumps, and gravel/boulder rises were encountered to north end of transect.

Corymorpha pendula - patchy distribution - densities through one patch/.25 $m^2$: 1, 1, 1, 0, 0, 3, 7, 10, 5, 8, 12, 16, 15, 7, 7, 7, 2,

1.
Individual polyp dimensions were obtained for 12 Corymorpha within a quadrant square.
Libinia - 1 - burrowed
Scophthalmus - 3
Pagurus longicarpus - 5
Sygnathus - 1 juvenile
Mud shrimp burrow - 5
Crangon
Tube venting observed - polycheate and mud shrimp.
Mysids - dense - 60 sec. epibenthic over surface.

Epibenthic:
60 sec net sample to gauge Mysid abundance.

29 April 1981

1. WEST OF NORWALK SITE
1304-1322 (P. Auster)

Periphery delineated 26550.3/43998.8
Boundary at area of clay clumps.
Phragmites debris present
Mystids dense
Crangon : 30
Cancer irroratus - 3 - black eroded carapace : from overwintering.
Same spoil conditions as previously described.

2. NORWALK SITE - South sector
1341-1358 (R. DeGoursey)

Transect due south commenced on new spoil material (many clay clumps). Bottom irregular topography. Spartina roots were abundant atop spoil material (estimate 2-3/10m$^2$). Clay clumps and root clumps were indicative of recently disposed material. Perimeter marked with buoy and survey continued further south to verify marked point was edge of spoil. Bottom outside of recent spoil was relatively flat, featureless and lacked clay clumps.

In contrast to past diver determination of spoil borders, the exact definition of Norwalk (class III) bounds was complicated due to several factors. First, the record of recent disposal on the Norwalk site made visual differentiation of the newer spoil material (class III) from older Norwalk material a virtual impossible in-situ task. The borders located by diver transect represent points at which first evidence of spoil deposit (i.e. mound slope, clay clumps and fragments, lack of epibenthic sediment structures) were observed in north, east,south and

east sectors, therefore, these points represent the outer margin of all Norwalk disposal and not specifically the perimeter of recent class III deposits. Also, due to the winter season and short time separation between successive Norwalk disposal of different class material, biota recolonization and sufficient time for weathering have not occurred. Therefore, indicator species or adequate contrast of spoil surface conditions were not present to provide a distinction between Norwalk spoil type and limits of coverage.

If class III material is to be discharged and the limits determined accuately by in-situ inspection, certain conditions are recommended. The area must not have been used for active disposal in the last six months, or a new natural bottom should be selected for the capping process. Also, coincident disposal must not occur in the immediate (within 200 m0 region (i.e. "SP" buoy disposal) that would confuse border determination due to sediment overlap.

The presence of a full range of benthic species (diver logs) indicates a strong attractive condition existed in the vicinity of the Norwalk site. Concentrations of mysids Neomysis ameracana, mud snails Nassarius trivattatus, and decapod crustacea (Cancer irroratus, Libinia emarginata) were especially predominant. The topographic relief and possible olfactory stimuli offered by recent spoil deposits could cause the unusually high concentration of mobil epibenthic organisms at active disposal sites.

## 4.0 SEDIMENT SAMPLES

The station locations for sediment samples taken from the Norwalk disposal site are presented in Figure 4.1. These stations were selected on the basis of a series of samples taken in each direction to sample the dredge material near the boundary of spoil material and natural bottom just beyond the extent of spoils. Once the stations were selected, three replicates were obtained for chemical analysis and a subsample of the first replicate was taken for grain size analysis (Table 4-1).

A brief description of the physical properties of the sediment from each station is presented below:

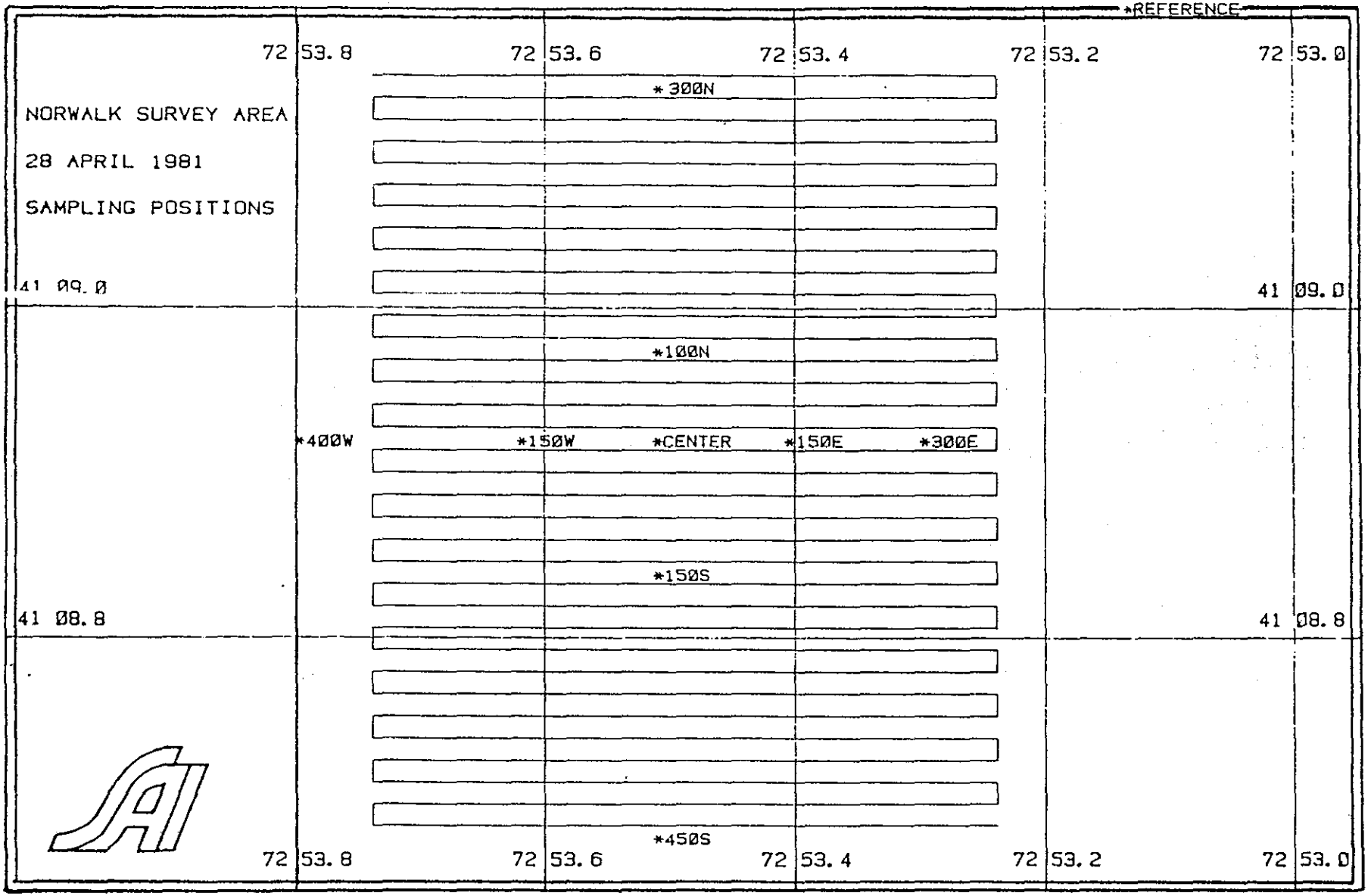

*REFERENCE
72 53.8
72 53.6
72 53.4
72 53.2
72 53.0
*300N
NORWALK SURVEY AREA
28 APRIL 1981
SAMPLING POSITIONS
41 09.0
41 09.0
*100N
*400W
*150W
*CENTER
*150E
*300E
*150S
41 08.8
41 08.8
*450S
72 53.8
72 53.6
72 53.4
72 53.2
72 53.0

FIGURE 4-1

TABLE 4-1

NORWALK 28 APRIL 1981
SEDIMENT SAMPLES

| SAMPLE NUMBER | STATION | ANALYSIS |
|---|---|---|
| 1119 | NOR-CTR-A | GS |
| 1120 | NOR-CTR-A | HM |
| 1121 | NOR-CTR-B | HM |
| 1122 | NOR-CTR-C | HM |
| 1123 | NOR-150W-A | GS |
| 1124 | NOR-150W-A | HM |
| 1125 | NOR-150W-B | HM |
| 1126 | NOR-150W-C | HM |
| 1127 | NOR-400W-A | GS |
| 1128 | NOR-400W-A | HM |
| 1129 | NOR-400W-B | HM |
| 1130 | NOR-400W-C | HM |
| 1131 | NOR-100N-A | GS |
| 1132 | NOR-100N-A | HM |
| 1133 | NOR-100N-B | HM |
| 1134 | NOR-100N-C | HM |
| 1135 | NOR-300N-A | GS |
| 1136 | NOR-300N-A | HM |
| 1137 | NOR-300N-B | HM |
| 1138 | NOR-300N-C | HM |
| 1139 | NOR-150E-A | GS |
| 1140 | NOR-150E-A | HM |
| 1141 | NOR-150E-B | HM |
| 1142 | NOR-150E-C | HM |

TABLE 4-1 (Con't)

| SAMPLE NUMBER | STATION | ANALYSIS |
|---|---|---|
| 1143 | NOR-300E-A | GS |
| 1144 | NOR-300E-A | HM |
| 1145 | NOR-300E-B | HM |
| 1146 | NOR-300E-C | HM |
| 1147 | NOR-150S-A | GS |
| 1148 | NOR-150S-A | HM |
| 1149 | NOR-150S-B | HM |
| 1150 | NOR-150S-C | HM |
| 1151 | NOR-450S-A | GS |
| 1152 | NOR-450S-A | HM |
| 1153 | NOR-450S-B | HM |
| 1154 | NOR-450S-C | HM |
| 1155 | NOR-REF-A | GS |
| 1156 | NOR-REF-A | HM |
| 1157 | NOR-REF-B | HM |
| 1158 | NOR-REF-C | HM |

- NOR - CENTER - black, oily spoil w/gray clumps
- NOR - 150W - dark gray clay mixed with black matrix
- NOR - 400W - mostly natural bottom with slight mixture of black clay, sand & shells
- NOR - 100N - black oily spoil with twigs leaves etc. strong odor
- NOR - 300N - thin veneer of black spoil over oxidized layer of natural bottom
- NOR - 150E - black spoil with gray clay clumps & nodules
- NOR - 300E - less than 1 cm of spoil over oxidized natural bottom
- NOR - 150S - black spoil with gray clumps and sand mixture
- NOR - 450S - approximately 1-2 cm black spoil over oxidized natural bottom

Bulk chemical analysis will be performed on all of these samples to detemine characteristic of in-situ class III material for future use in evaluating the effectiveness of capping.

## 5.0 Summary & Discussion

The results of the April monitoring cruise to the Norwalk Disposal site have indicated that placement of Class III material prior to capping may not have been accomplished as effectively as in previous programs. The elongation of the mound north of the buoy toward the western margin of the disposal site is indicative of a problem controlling disposal. If this deposit consists of permit material composed of Class I and II sediment then the problem is not severe, however, if Class III material from

the major dredging project is involved then steps should be taken to correct the situation. Because of this problem, analysis of sediment samples, particularly NOR - 150W and NOR-400W, should be given a high priority. Should the material to the west be Class III then plans should be made to cap this sediment through controlled dumping west of the buoy.

The high abundance of basic food chain and commercially important food species observed by divers at the disposal site emphasizes the need for rapid and complete coverage of class III material. Since most of this capping will be done between April and June, it is important that additional monitoring be conducted as soon after disposal ceases as possible to evaluate the effectiveness of the capping procedure.