Summary Of Measurements

Made At The

WLIS III Disposal Site

Disposal Area Monitoring System Damos

Contribution 27

July 11, 1983

US Army Corps of Engineers

New England Division

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The disposal operations at WLIS III have been conducted successfully with the expected results. Most of the material has been deposited in a small mound with a radius of about 100m, which has remained stable over the period of measurement.

The dredged material deposited at the site does not have significantly higher levels of contaminants than the surrounding sediment, but is coarser with a higher percentage of solids in the center of the mound.

(cont.)

20 (cont.)

Photographs of the sediment water interface indicate a "chaotic" texture and no RPD layer in the vicinity of recent disposal on the mound. Diver observations have indicated an immediate recolonization of the mound by macrobenthic organisms which should cause significant bioturbation which in turn should serve to lower the RPD level and return the mound to ambient oxidazation levels.

SUMMARY OF MEASUREMENTS MADE AT THE WLIS III DISPOSAL SITE JANUARY, 1982 - JANUARY, 1983

CONTRIBUTION #27

July 11, 1983

Contract #DACW33-82-D-0001
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1.0 INTRODUCTION

As a result of urgent requirements for dredging of small harbors in the western portions of Long Island Sound, a dredged material disposal site was designated by the New England Division of the U.S. Army Corps of Engineers at $40^{o}59.34'N$, $73^{o}29.21'W$ (Fig. 1.0-1). This point and the surrounding area, known as the Western Long Island Sound III (WLIS III) disposal site was studied extensively during preparation of an Environmental Impact Statement, including field observations conducted by the DAMOS program during January, 1982 (DAMOS Contribution #19).

The disposal point was marked with a taut-wire moored buoy in March, 1982 and has since been used for disposal of sediment from several projects as shown in Table 1.0-1. Two major periods of disposal have occurred, the first from March through May, 1982, and the second from December, 1982 through the winter of 82-83.

An interim survey was made during April, 1982, to insure that operational procedures were effective in developing a mound at the disposal site. The results of this survey were presented in DAMOS Contribution #18.

A more detailed survey of the area, using precision navigation control was made in August, 1982, which included replication of the baseline hydrographic and sediment chemistry surveys as well as diver observations of the disposed dredged material surface conditions. A similar survey was conducted in January, 1983, however, the diver observations were replaced by a REMOTS camera survey which photographed the sediment-water

Figure 1.0-1. WLIS III Designated Disposal Site.

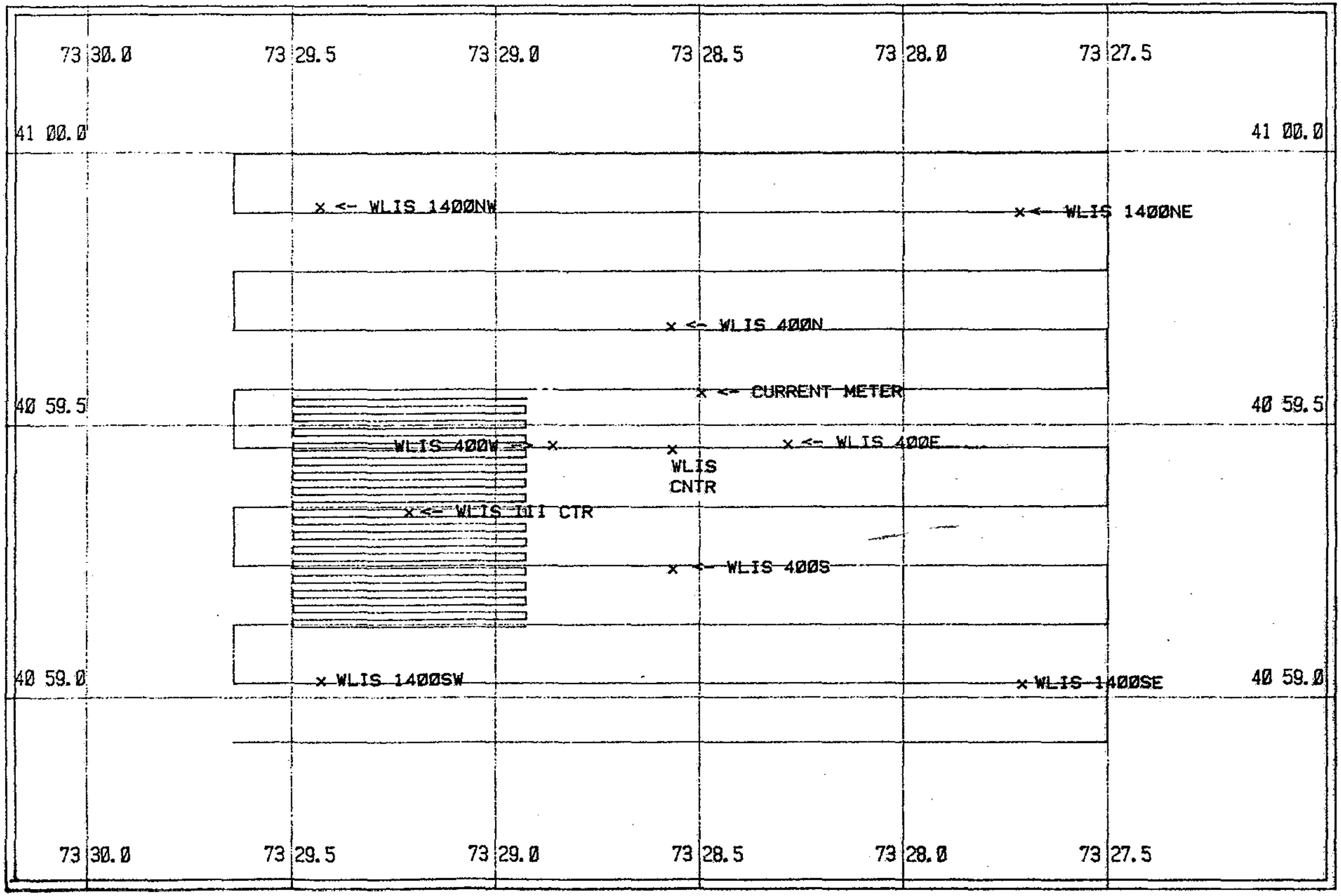


Table 1.0-1
Disposal Operations at the
WLIS III Disposal Site

Source	Dates	Volume (yds^3)	Volume (m^3)
Mamaroneck	March-April, 1982	22,180	16,967
Shore Acres Pt.	March-April, 1982	20,600	15,759
Post Road Boat Yard	April, 1982	1,900	1,453
Crescent	May, 1982	4,350	3,327
Various Permits	April, 1982	4,050	3,098
		53,080	40,606
		August 1982 Survey	
Rex Marina	Dec 1982-Jan 1983	5,850	4,475
F. Ludwig	Dec, 1982	2,695	2,061
Beach Pt. Club	Jan, 1983	6,700	5,126
		15,245	11,662
		January 1983 Survey	
Nichols Yacht Yd.	Jan-Feb, 1983	19,850	15,185
Beach Pt. Club	Feb, 1983	550	421
Rex Marina	Feb, 1983	550	421
Darien Boat Club	Feb-March, 1983	6,500	4,973
Mamaroneck	Feb-April, 1983	9,050	6,923
American YC	Feb-March, 1983	26,800	20,502
Cove Marina	March-April, 1983	10,350	7,918
H. Govziska	March, 1983	4,050	3,098
		77,700	59,441
		Post Survey	

interface.

The purpose of this report is to document the information acquired during the August, 1982 and January, 1983 surveys for comparison with baseline data and evaluation of environmental impacts resulting from the disposal operation.

2.0 SPATIAL DISTRIBUTION OF DREDGED MATERIAL

The distribution of dredged material disposed at the WLIS III site was monitored through replication of precision bathymetric surveys conducted over an $800m^2$ area centered at the disposal point. A survey grid identical to that used to conduct the baseline survey, consisting of 33 east-west lanes spaced 25 meters apart, was used for subsequent surveys in August '82 and January '83.

Navigation control for all surveys and sampling was provided by an SAI Navigation and Data Acquisition System interfaced to a Del Norte Trisponder positioning unit and an Edo-Western 24KHz fathometer. Using this equipment, accurate depth and position measurements can be made and recorded while maintaining the ship's course to within ± 5 meters of the predetermined survey track. This precise navigation allows direct comparison between depth profiles of individual transects from replicate surveys and overall comparison of sediment volume through depth contour difference procedures.

Figure 2.0-1 presents a contour chart of the original baseline survey at the WLIS III site conducted on 26 January, 1982. Based on this chart, the disposal area can be characterized as a relatively flat bottom in an east-west

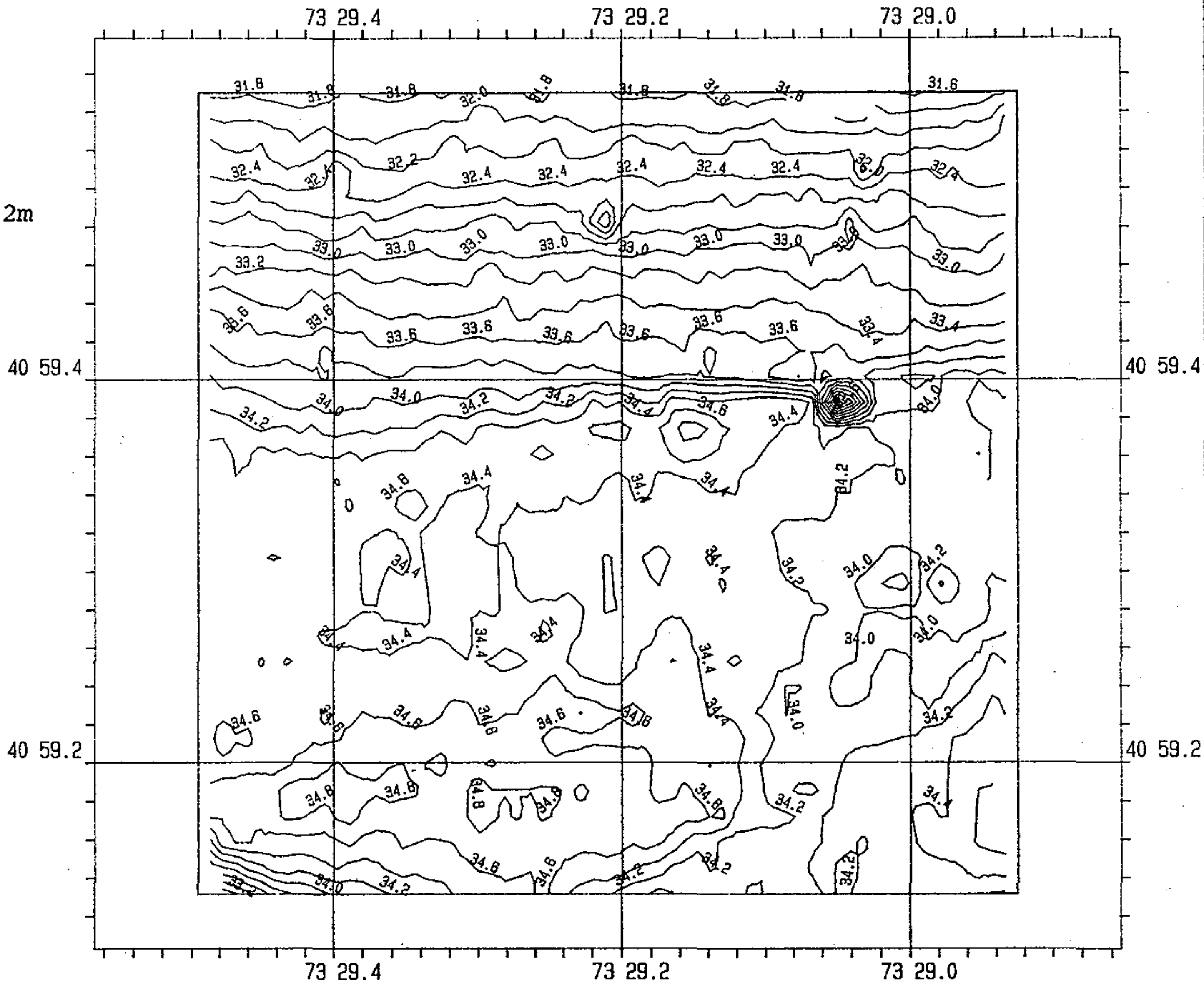
WLIS III

January 1982
Contour Interval .2m
Grid Resolution
12.5 X 25m
Datum MLW

Figure 2.0-1

0 80 160

SCALE (m)



trending trough with an average depth slightly less than 34.5 meters. The small feature in the northeast quadrant of the survey has been identified as a sunken barge and has been edited from volume difference calculations.

Figure 2.0-2 is a contour chart of the 18 August survey conducted after approximately 40,000 m^3 of material had been disposed at the site between March and May, 1982. Based on this chart it is readily apparent that a successful dumping operation has been accomplished which has restricted the majority of dredged material to a small area in a mound with a radius of approximately 80 meters and a maximum thickness of almost 3 meters. Figures 2.0-3 (a&b) provide a comparison of vertical depth profiles from transects crossing the mound area which indicate where dredged material has been deposited.

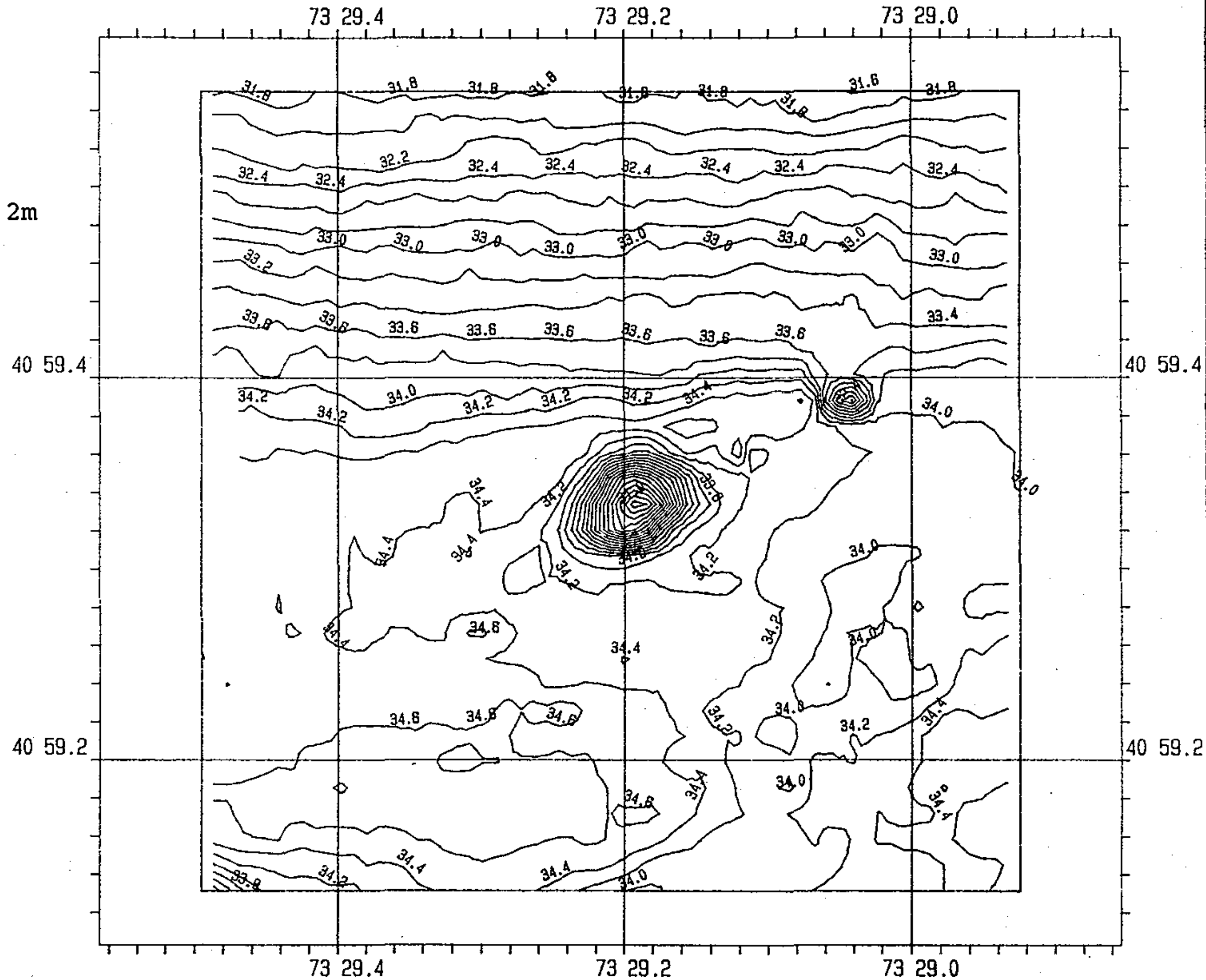
Through point by point comparison of the January and August depth contours, a contour difference chart can be generated (Fig. 2.0-4) which more accurately displays the distribution of dredged material. Using this technique, shoaling due to the presence of dredged material can be observed as far as 100 m from the disposal point as a thin layer of material.

Using the baseline survey as a datum, the total volume of material present in the mound can be calculated by summing the depth difference for each grid point in the survey after correction for errors due to tide, sound velocity and ships motion. This procedure, using a least squares analysis to account for measurement errors, has been described in detail by Morton (1983). The results of the volume difference calculation for each lane and the summation over all lanes is presented in

WLIS III

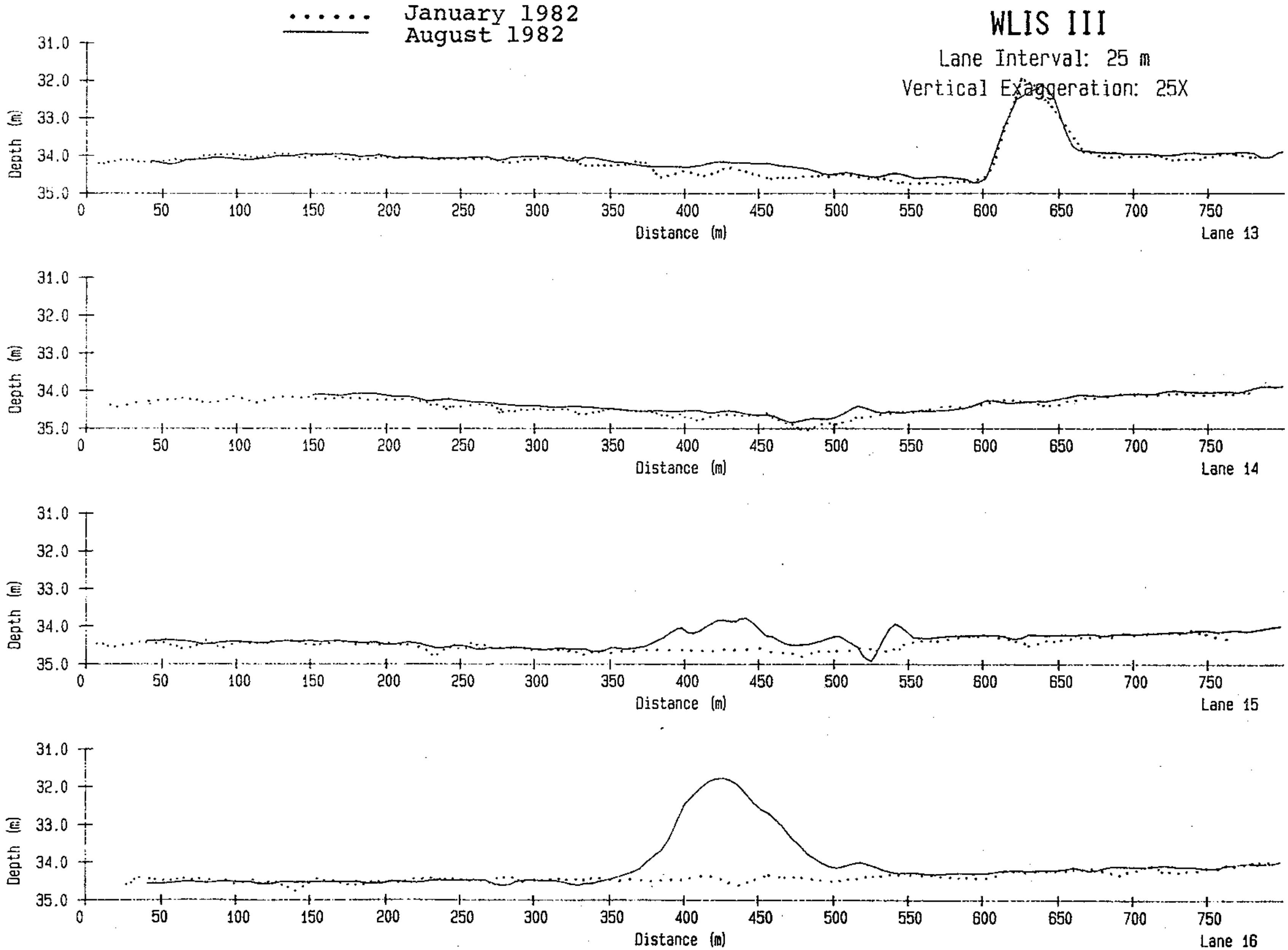
August 1982
Contour Interval .2m
Grid Resolution
12.5 X 25
Datum MLW

Figure 2.0-2



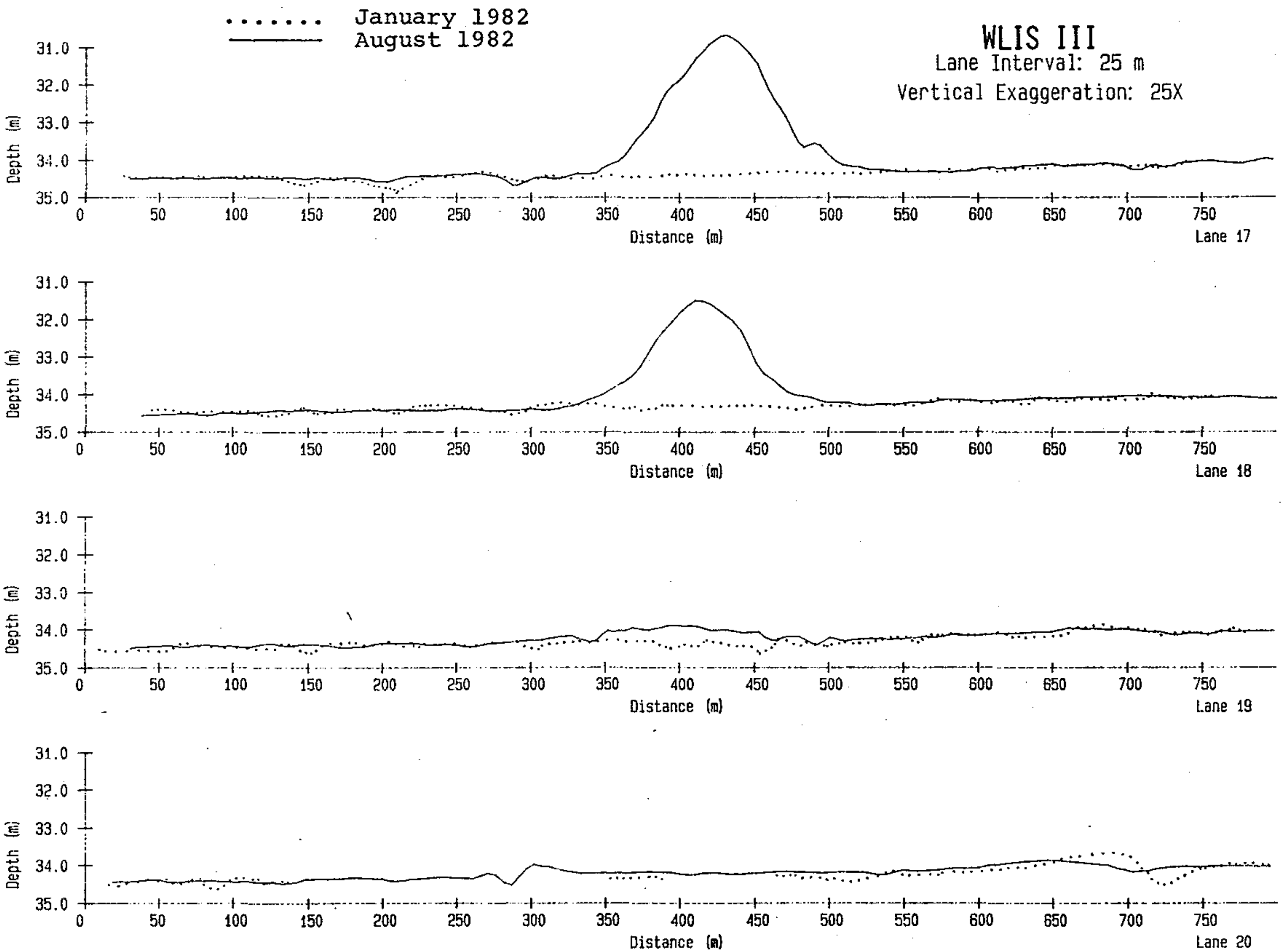
0 80 160
SCALE (m)

Figure 2.0-3a



January 1982
August 1982
WLIS III
Lane Interval: 25 m
Vertical Exaggeration: 25X
Depth (m)
31.0
32.0
33.0
34.0
35.0
0
50
100
150
200
250
300
350
400
450
500
550
600
650
700
750
Distance (m)
Lane 13
Lane 14
Lane 15
Lane 16

Figure 2.0-3b



January 1982
August 1982
WLIS III
Lane Interval: 25 m
Vertical Exaggeration: 25X
Depth (m)
31.0
32.0
33.0
34.0
35.0
0
50
100
150
200
250
300
350
400
450
500
550
600
650
700
750
Distance (m)
Lane 17
Lane 18
Lane 19
Lane 20

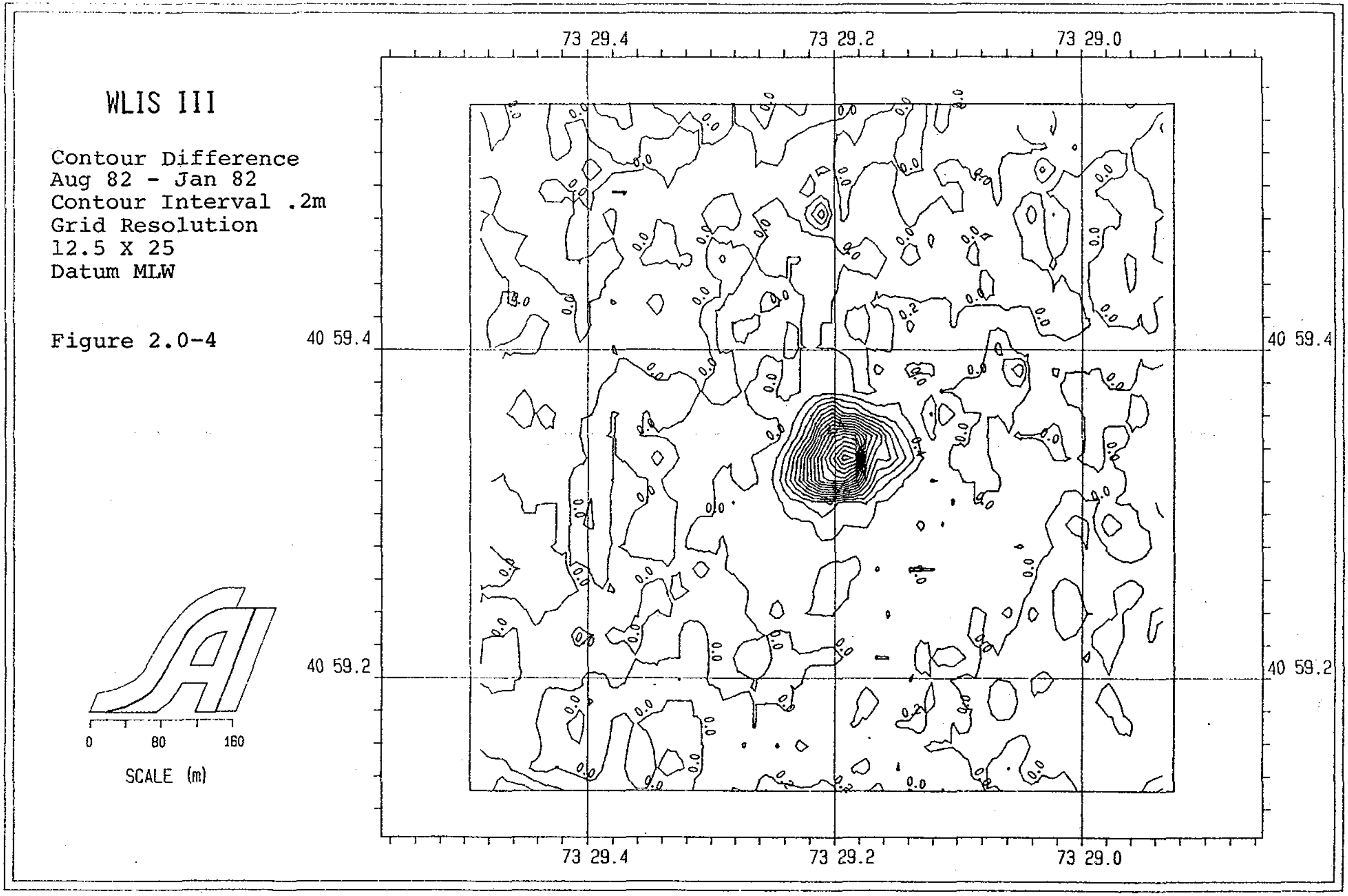

WLIS III
Contour Difference
Aug 82 - Jan 82
Contour Interval .2m
Grid Resolution
12.5 X 25
Datum MLW
73 29.4
73 29.2
73 29.0
40 59.4
40 59.2
0
80
160
SCALE (m)

Figure 2.0-4

Figure 2.0-5. The total volume of 25000 m^3 is significantly less than the estimated volume of 40,606 m^3 removed from the various dredge sites, however, since the survey was not conducted until several months after disposal, consolidating and reworking of the mound should have occurred.

A second survey was conducted on 19 January, 1983 over the same survey grid after approximately 11,662 m^3 of additional material were added to the site during December, '82 and early January, '83. The contour chart of that survey is presented in Figure 2.0-6 and the vertical depth profiles for the same transects over the site are shown in Figure 2.0-7. The additional material deposited at the site between August and January is readily apparent as an increase in the thickness of material on the mound. The contour difference chart (Fig. 2.0-8) indicates only slight changes to the shape of the mound with a general increase in overall thickness, but no significant expansion of the margins as would be expected, since turbidity flows from material dumped at the same point would not extend further than the original disposal operation until substantially more sediment is available. The volume calculation for the difference between the January and August surveys (Fig. 2.0-9) shows an additional 10,000 m^3 of material present at the site which compares more favorably with the 11,662 m^3 estimated from scow loads.

The volume difference between January, '83 and the baseline survey (Fig. 2.0-10 & 11) indicates a total of 35,000 m^3 of dredged material is present at the site in a relatively compact mound formation. These numbers are all consistent and

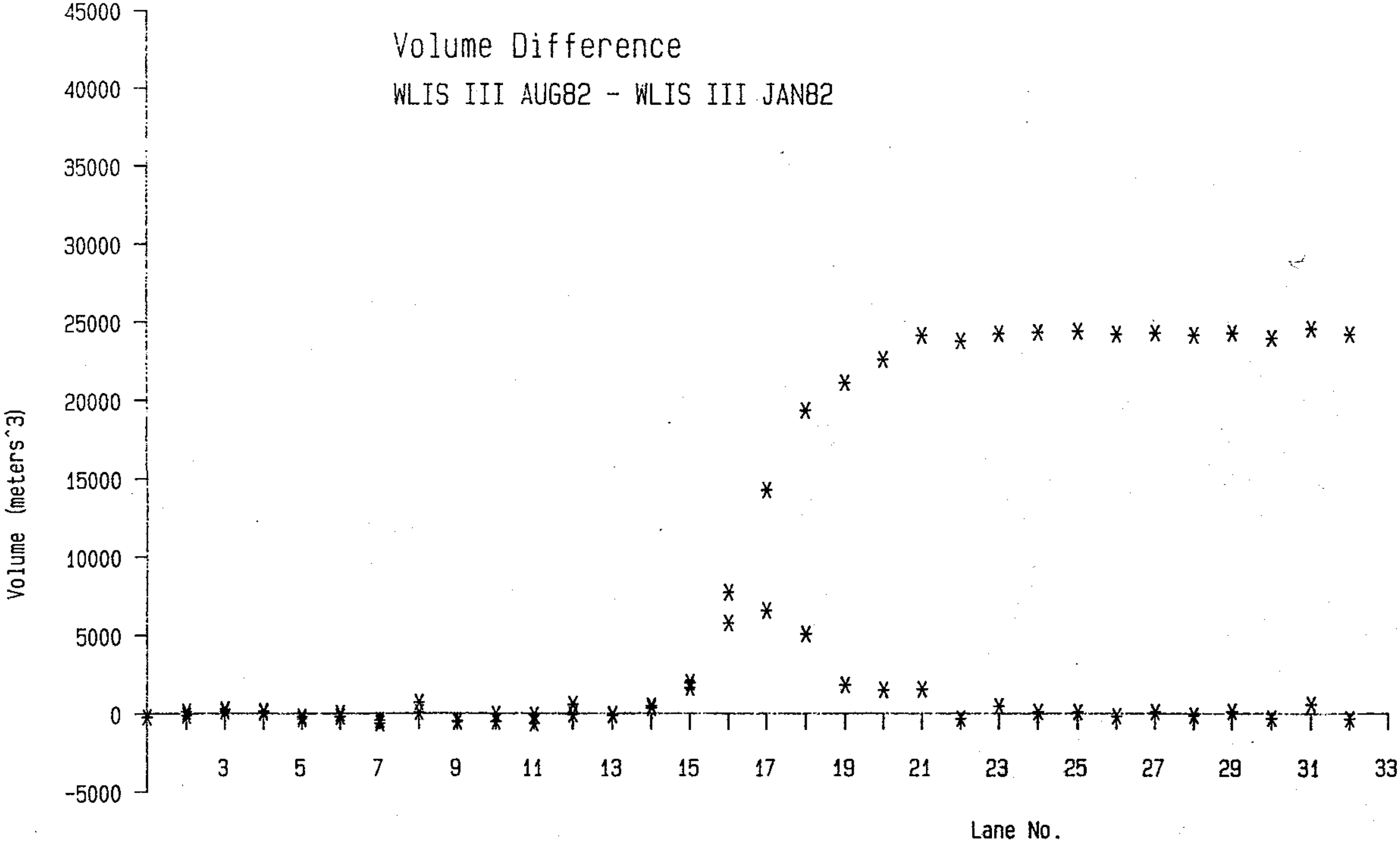
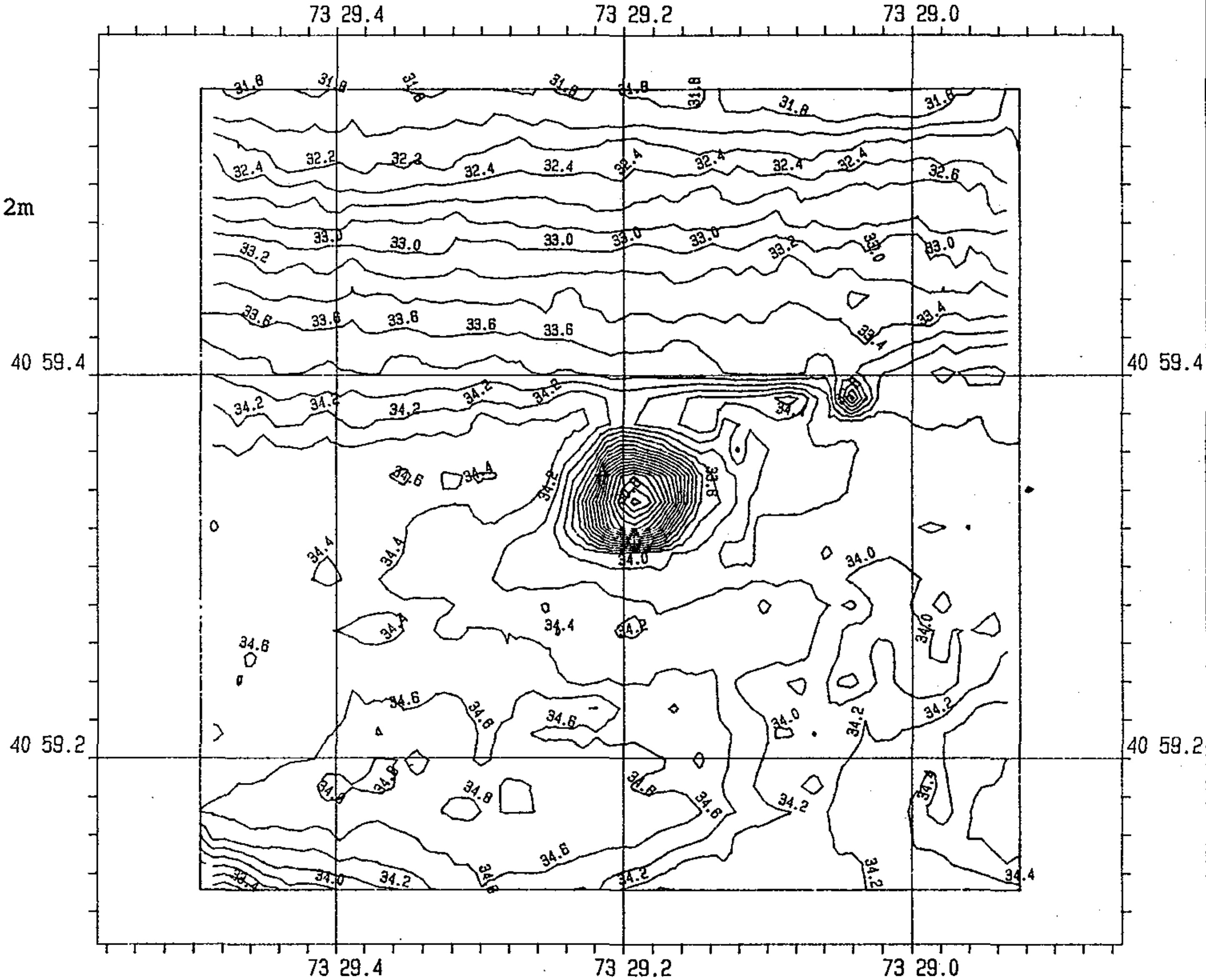

Volume Difference
WLIS III AUG82 - WLIS III JAN82
Volume (meters^3)
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
-5000
3
5
7
9
11
13
15
17
19
21
23
25
27
29
31
33
Lane No.

Figure 2.0-5

WLIS III

January 1983
Contour Interval .2m
Grid Resolution
12.5 X 25
Datum MLW

Figure 2.0-6



0 80 160
SCALE (m)

Figure 2.0-7a

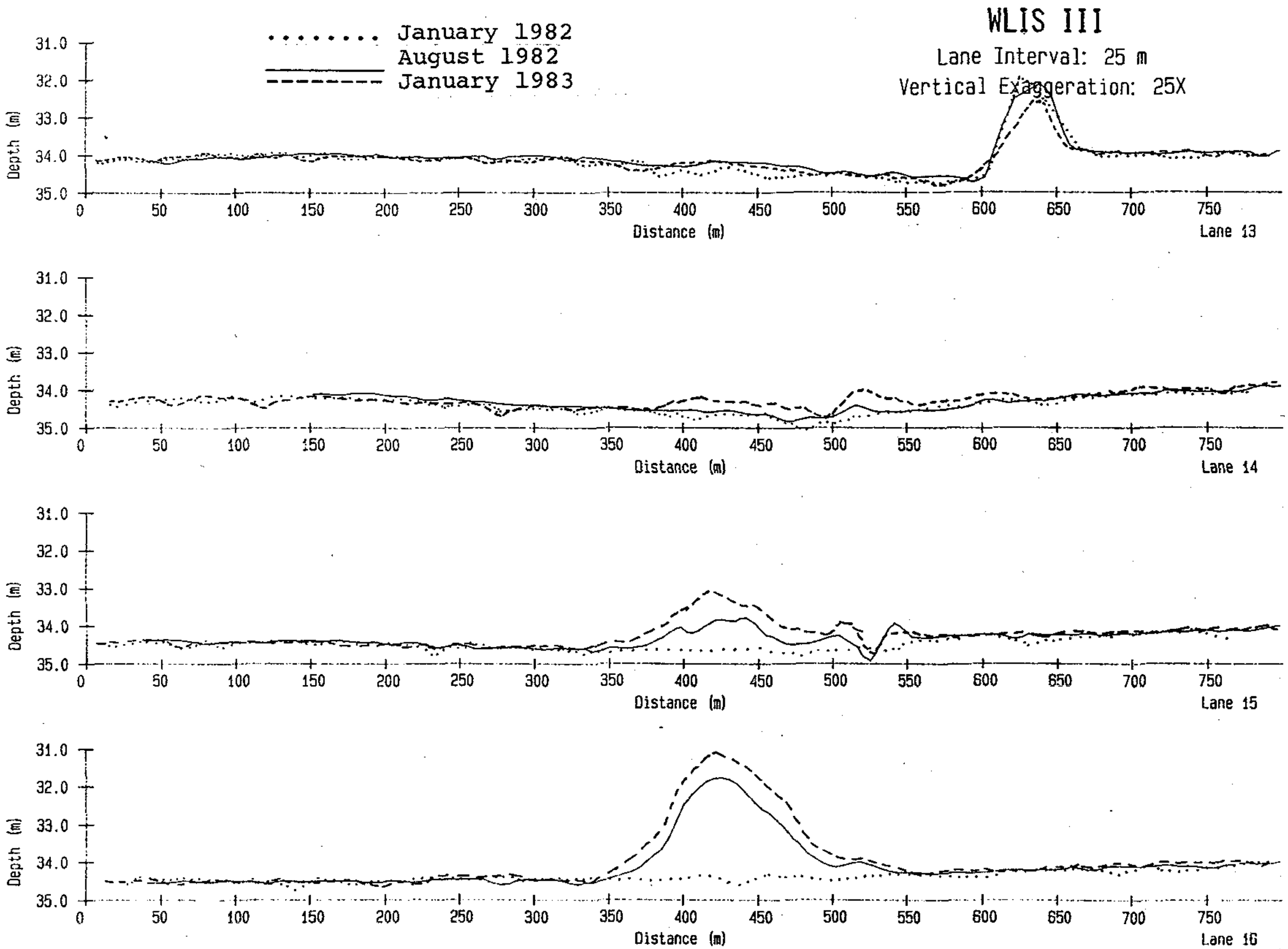
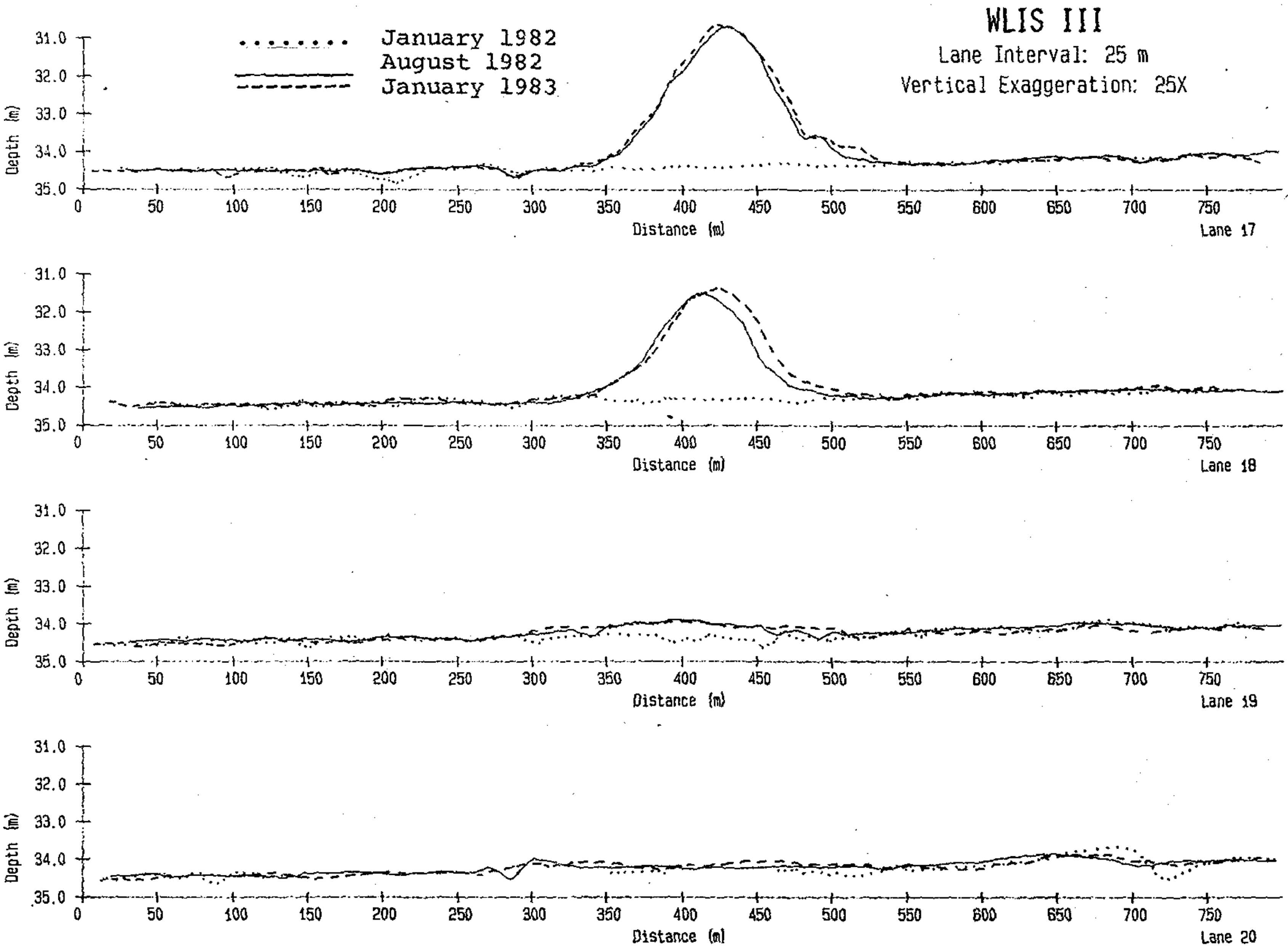

January 1982
August 1982
January 1983
WLIS III
Lane Interval: 25 m
Vertical Exaggeration: 25X
Depth (m)
31.0
32.0
33.0
34.0
35.0
0
50
100
150
200
250
300
350
400
450
500
550
600
650
700
750
Distance (m)
Lane 13
Lane 14
Lane 15
Lane 16

Figure 2.0-7b

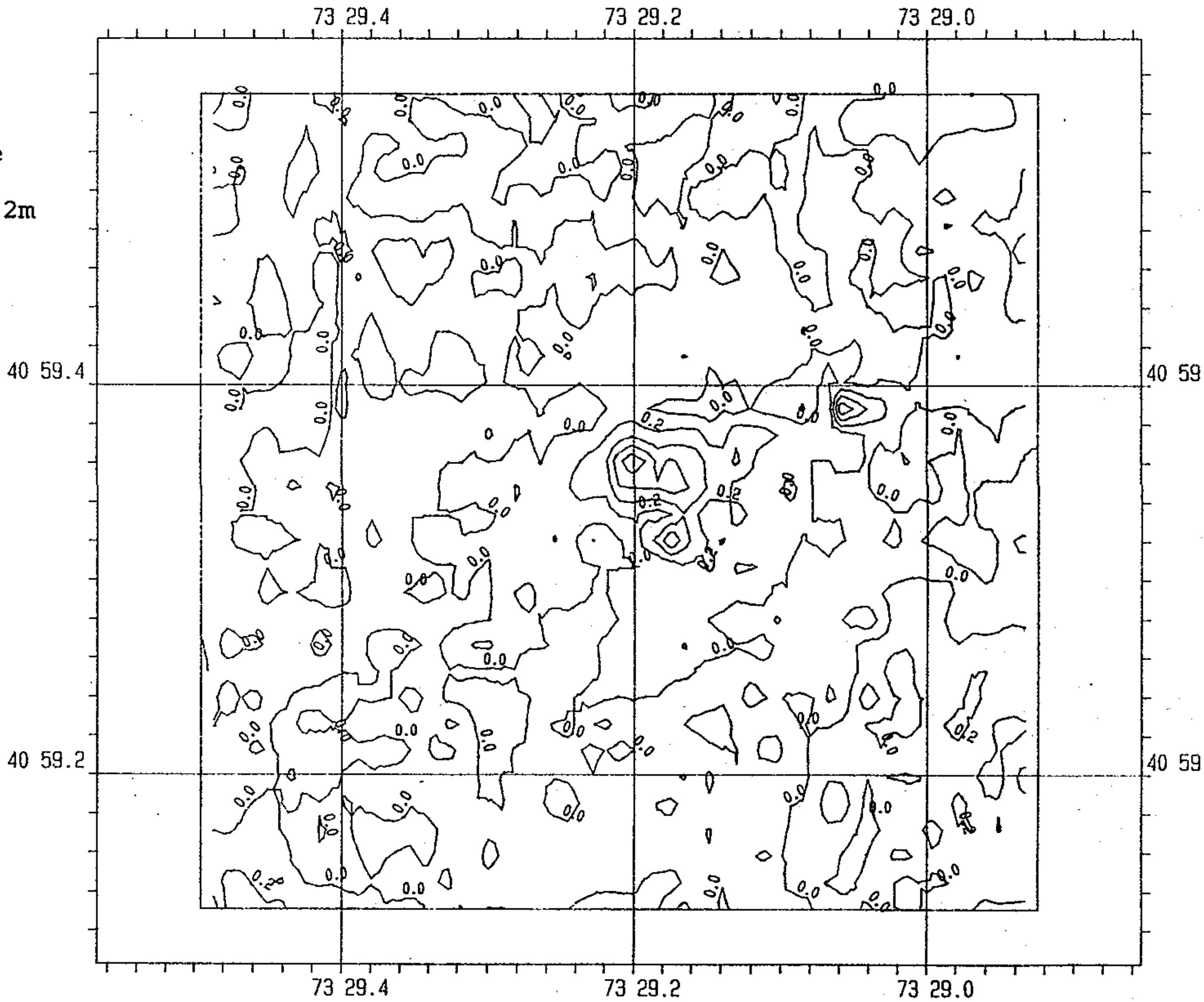


January 1982
August 1982
January 1983
WLIS III
Lane Interval: 25 m
Vertical Exaggeration: 25X
Depth (m)
31.0
32.0
33.0
34.0
35.0
0
50
100
150
200
250
300
350
400
450
500
550
600
650
700
750
Distance (m)
Lane 17
Lane 18
Lane 19
Lane 20

WLIS III

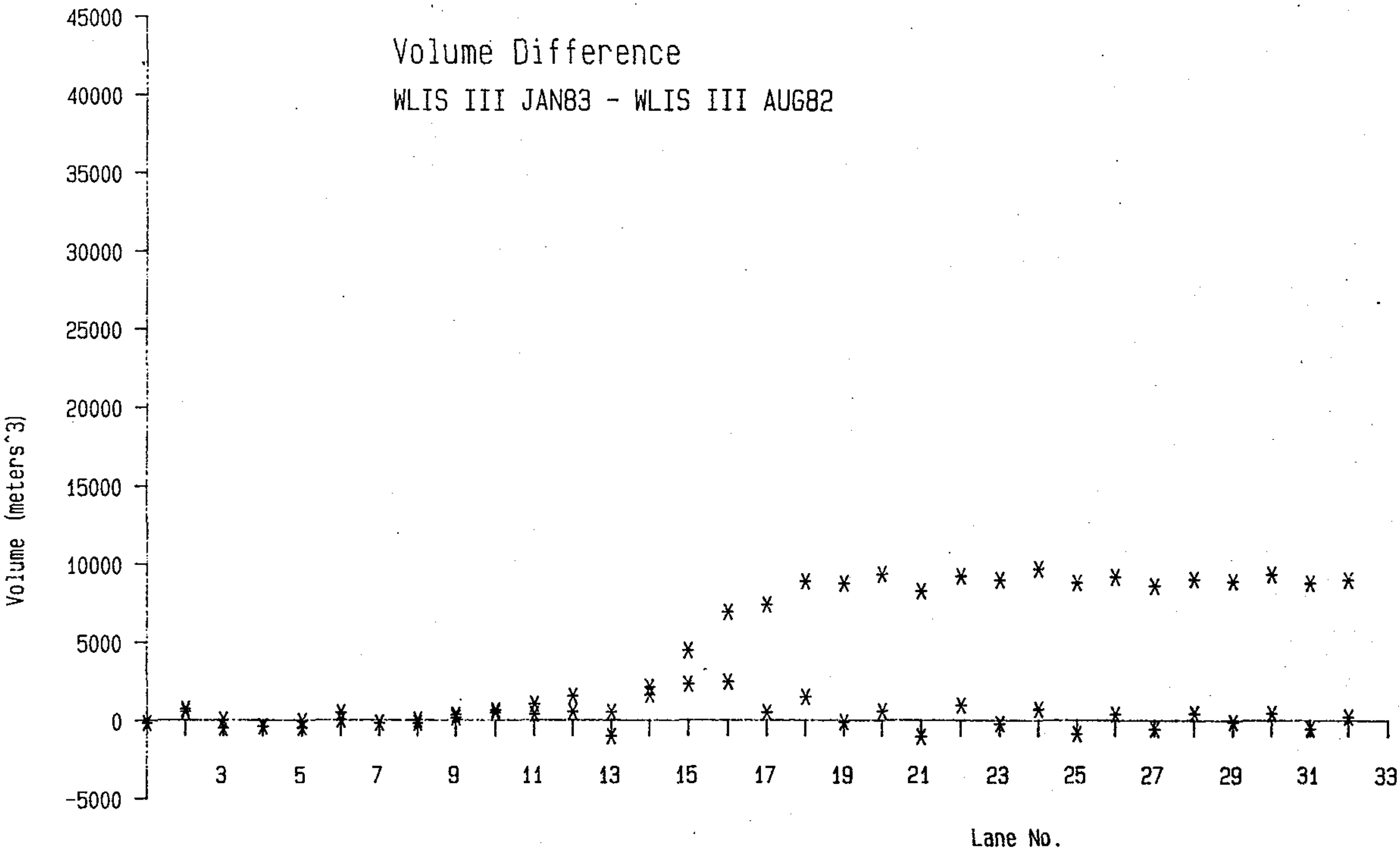
Contour Difference
Jan 83 - Aug 82
Contour Interval .2m
Grid Resolution
12.5 X 25
Datum MLW

Figure 2.0-8



0 80 160

SCALE (m)



Volume Difference
WLIS III JAN83 - WLIS III AUG82
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
-5000
Volume (meters^3)
3
5
7
9
11
13
15
17
19
21
23
25
27
29
31
33
Lane No.

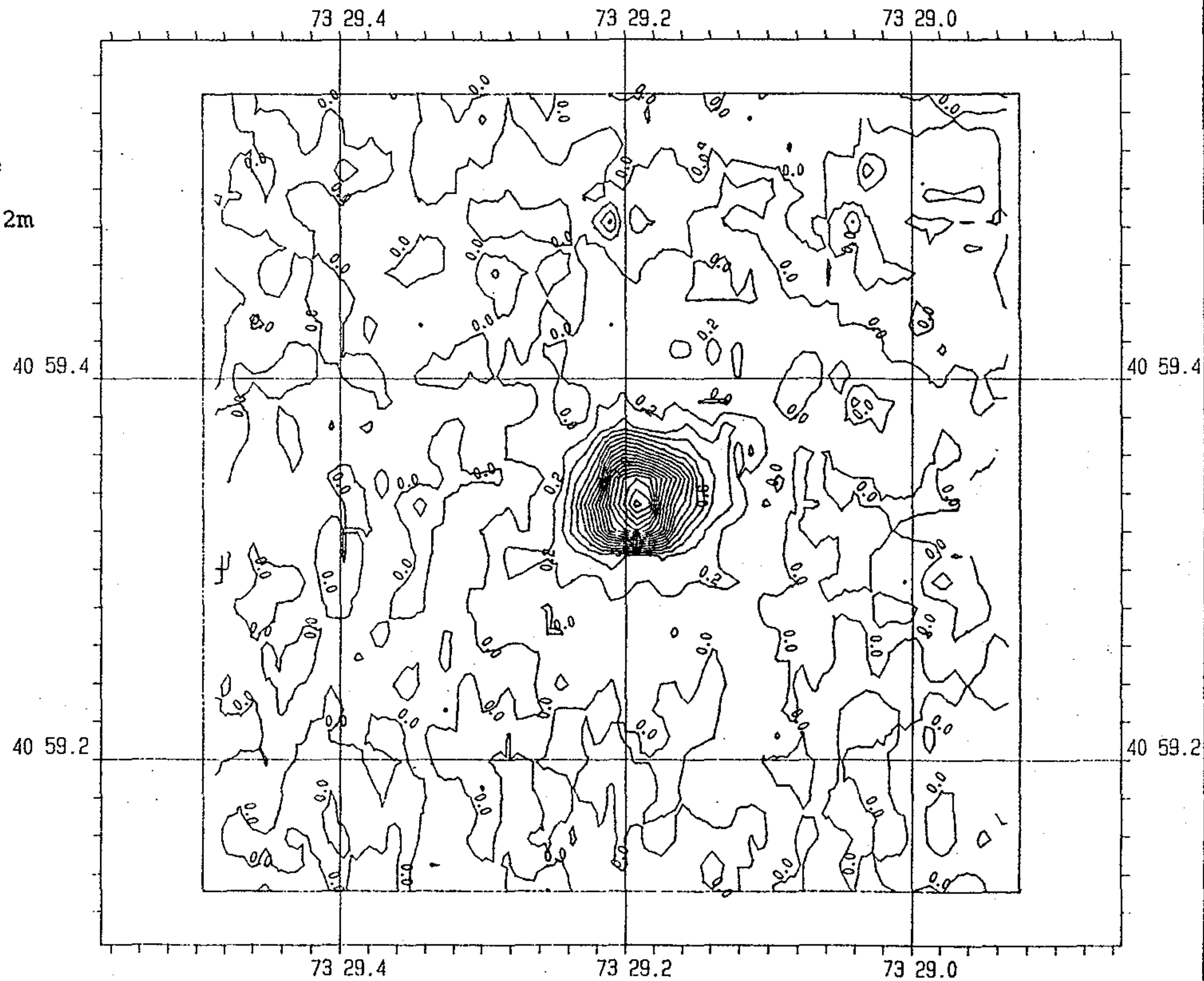
Figure 2.0-9

WLIS III

Contour Difference
Jan 83 - Jan 82
Contour Interval .2m
Grid Resolution
12.5·X 25
Datum MLW

Figure 2.0-10

0 80 160
SCALE (m)



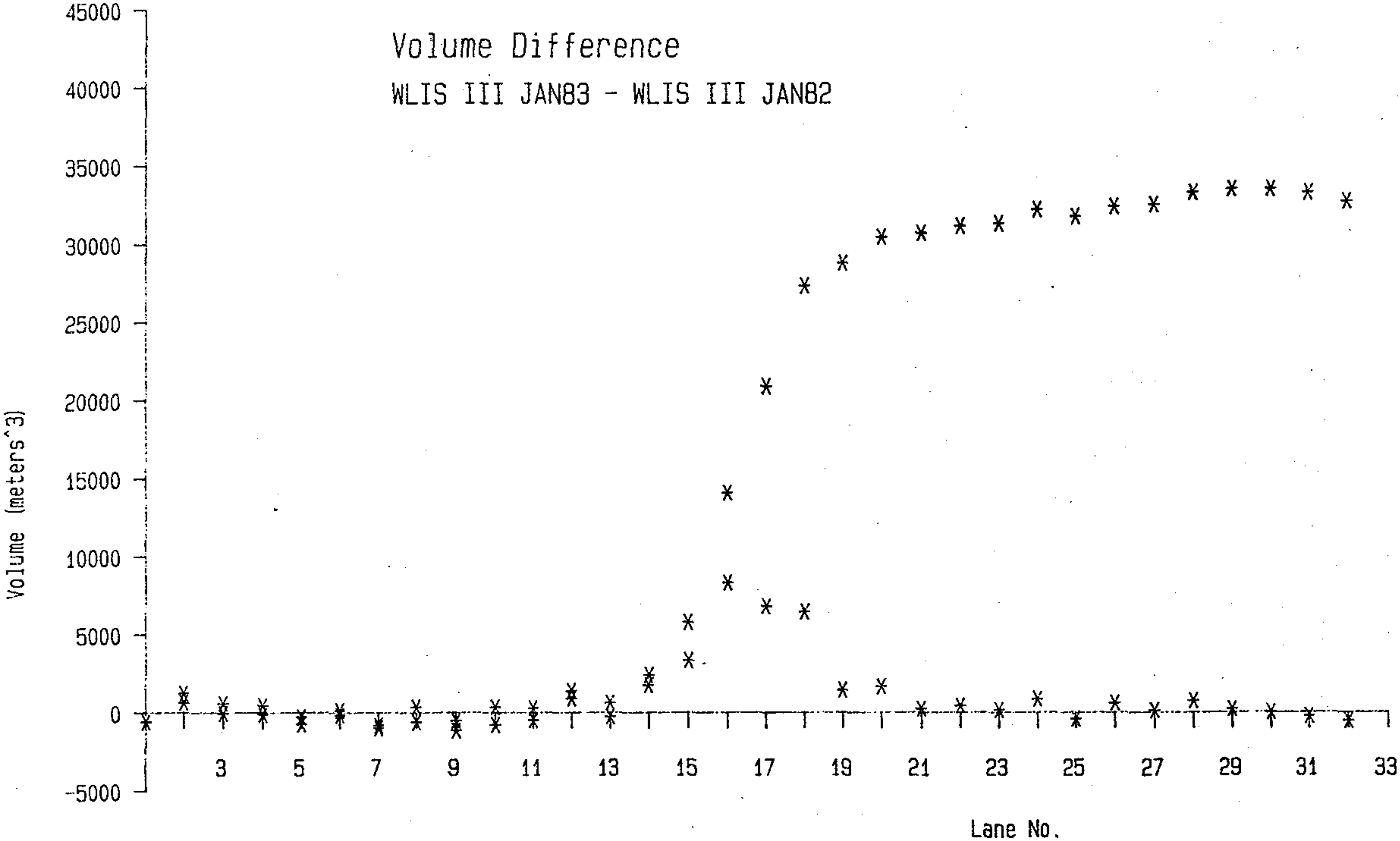

Volume Difference
WLIS III JAN83 - WLIS III JAN82
Volume (meters^3)
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
-5000
3
5
7
9
11
13
15
17
19
21
23
25
27
29
31
33
Lane No.

Figure 2.0-11

indicate that no detectable amount of material was lost from the disposal mound between August and December, 1982 when the new disposal operations began.

It is not possible to assess how much of the difference between dredged volume estimates and the August survey volume can be accounted for by compaction of the mound during the 2 1/2 months between disposal and measurement. However, experience at the CLIS disposal site has shown that most of the changes due to compaction occur immediately after disposal. The good agreement between the August-January survey volume and the disposed volume estimates indicate that some of this difference must be due to compaction and that the mound was not susceptible to significant erosion during the summer and fall months.

To date, there is no indication of spreading of material from the mound and as expected the disposed dredged material appears stable at the WLIS III disposal site.

3.0 SEDIMENT CHARACTERISTICS

Although the bathymetric data provide information on the overall distribution of dredged material at the site, samples of the sediment on the mound and over the surrounding area are required to assess the character of the dredged material and natural sediments within the disposal site. Samples at the WLIS III site were obtained with a Smith-MacIntyre grab sampler at specific locations on North, South, East and West transects under control of the SAI Navigation and Data Acquisition System (Figs. 3.0-1 & 2).

Figure 3.0-1. Sediment Sample Locations.
August 1982.

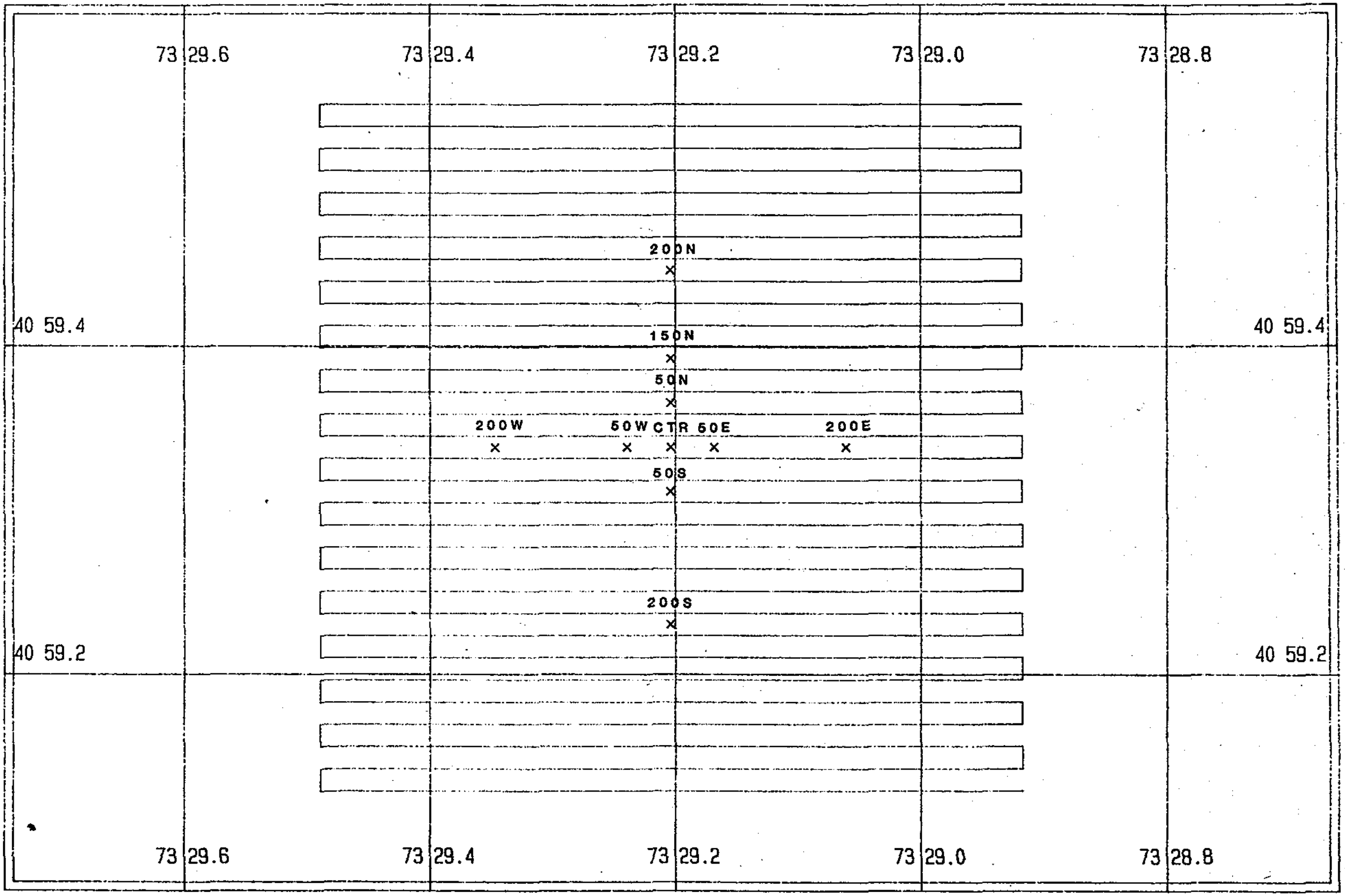
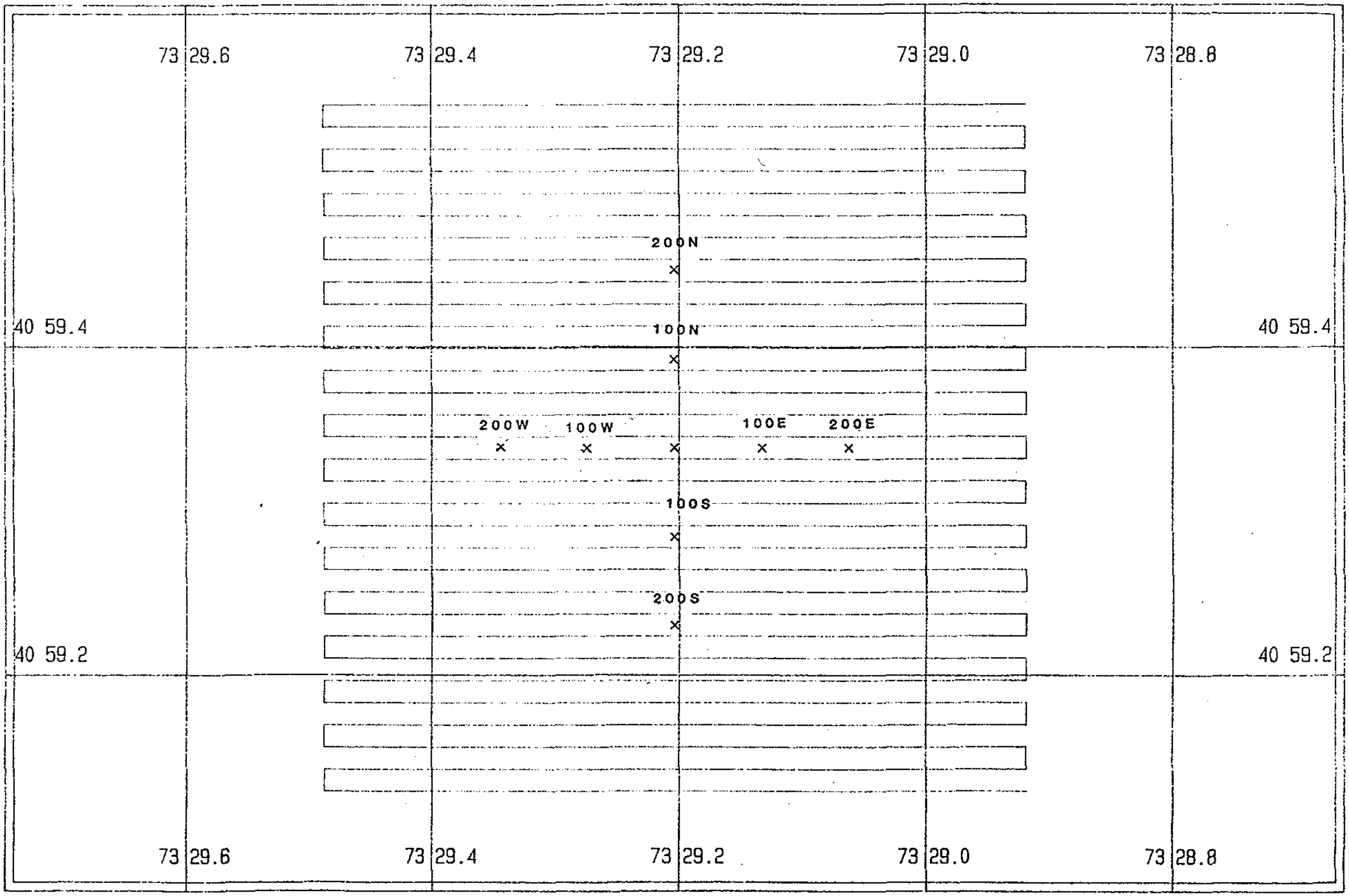


Figure 3.0-2. Sediment Sample Locations.
WLIS January 1983.



3.1 Description of Sediment Samples

Descriptions of the samples taken during the August, '82 and January, '83 cruises are presented in Table 3.1-1 and 3.1-2.

In general, it is difficult to distinguish dredged material from the black organic silt which is common to the natural bottom of the trough within the WLIS III site. The most common features identifying dredged material are the presence of leaves and branches, more coarse material and the presence of shell hash from near shore deposits. However, once beyond the flanks of the mound, the fine grained organic silts deposited on the margins are nearly identical to the natural sediments and thickness of dredged material cannot be measured.

3.2 Sediment Chemistry

Each of the samples described above was sent to the New England Division of the Corps of Engineers for Bulk Sediment Analysis. The results of the August sampling are presented in Table 3.2-1 (a&b), however, the January, '83 data are not yet available and will presented in a later report. Table 3.2-1 has been divided into two sections based on distance from the disposal point. Section "a" consists of data close to the center of the mound and certainly represents dredged material, while Section "b" contains samples 200 meters from the center and at the reference site, which should be representative of background levels at the site.

A comparison of mean values from pre-disposal, interim and post-disposal samples collected from the center of the disposal site is presented in Table 3.2-2. Data for pre-disposal

Table 3.1-1

Sediment Sample Descriptions
August, 1982

CTR	A	black silty dredged material over gray cohesive clay; some odor
	B	similar to A, shell hash on surface, less gray clay; definite odor
	C	same as A & B, more clay; strong odor
50E-A		oxidized layer with fine shell hash over black organic silt
	B	same as A, very soft, same odor at bottom of grab
	C	more like dredged material, has terrestrial material - plastic and cloth; same odor, less cohesive
200E-A		oxidized layer with small clams (<u>Nucula proxima</u>) over black organic silt; slight odor
	B	same as A
	C	same as A & B
50N		coarse shell hash over gray modular clay (no chemistry)
100N-A		lot of leaf material, black organic silt over gray clay; strong odor
	B	same as A
	C	fewer leaves, oxidized layer present over black organic silt
200N-A		similar to 200E, <u>Nucula proxima</u> on oxidized layer over black organic silt
	B	same as A
	C	same as A & B
50W-A		shell hash, over dark organic silt, over gray cohesive clay

B	same as A
C	same as A & B, rock present, more coarse material
200W-A	oxidized layer over fine black organic silt, similar to 200 E&N
B	same as A
C	same as A & B
50S-A	oxidized layer over black organic silt, concentration of leaves in bottom of grab
B	same as A
C	same as A & B
200S-A	oxidized layer over black organic silt
B	same as A
C	same as A & B
REF-A	same as 200m stations, oxidized layer with some shell hash over dark organic silt
B	same as A
C	same as A & B

Table 3.1-2

Sediment Sample Descriptions
January, 1983

CTR A		thin oxidized layer, black organic silt with clay balls, branches and leaves present; strong odor, not cohesive
	B	same as A
	C	same as A & B
100E-A		thin oxidized layer over black organic silt, strong odor, non-cohesive
	B	same as A
	C	same as A & B
200E-A		slight odor, thin oxidized layer over black silt
	B	same as A
	C	same as A & B
100N-A		very thin patchy oxidized layer, clay balls, cohesive sand with shell hash
	B	leaf debris present
	C	same as A
200N-A		no oxidized layer, strong odor, black silt with shell hash
	B	same as A
	C	same as A & B
100W-A		thin oxidized layer over black silt, gravel & shell hash present; strong odor
	B	same as A
	C	same as A & B

200W-A	thin oxidized layer over black silt, clay 8cm below surface
B	same as A, but shell hash and strong odor
C	same as A
100S-A	thin oxidized layer over black silt, cohesive; strong odor
B	same as A with wood debris
C	same as A
200S-A	thin oxidized layer over black silt with shell hash; strong odor
B	same as A
C	same as A & B
REF-A	1.5cm oxidized layer over black silt over gray clay; thick shell hash
B	same as A
C	same as A & B

Table 3.2-1a

WESTERN LONG ISLAND SOUND III
SEDIMENT CHEMISTRY DATA - AUGUST, 1982
VALUES IN PARTS PER MILLION

	COD	% SOLIDS	Hg	Pb	Zn	As	Fe	Cd	Cr	Cu	Mg	Ni	Ca	% TOTAL CARB	OIL & GREASE
CTR-A	53,200	53.5	.05	57	125	1.6	24,300		30	50	8150	83	10,100	2.28	313
B	88,000	41.5	1.35	101	196	2.0	27,600		47	100	8310	--	1,240	3.01	---
C	90,300	43.0	.29	70	164	15.3	26,000	4	40	77	9020	--	6,580	2.17	---
50E-A	93,000	43.1	.46	233	285	6.4	30,100	--	49	130	9030	74	1,240	3.14	899
B	89,500	44.3	.32	162	238	5.4	26,700	4	46	124	8180	--	772	3.11	---
C	123,000	45.5	.31	254	264	5.5	30,700	6.8	51	138	8020	53	5,280	4.55	---
100N-A	120,000	43.4	.15	199	232	3.0	25,100	--	47	119	7700	--	1,820	4.63	1250
B	167,000	45.6	---	214	239	1.9	22,900	--	51	124	7470	--	3,500	4.85	---
C	81,000	50.3	.31	193	230	2.9	25,300	--	48	109	7400	--	1,000	4.00	---
50W-A	85,300	46.2	.40	59	99	3.1	13,500	--	25	41	4000	--	740	2.94	246
B	93,600	43.5	.22	72	152	3.8	30,600	--	48	66	9410	--	1,150	2.88	---
C	89,200	48.2	.41	70	171	1.7	30,200	--	51	98	8250	66	1,480	2.41	---
50S-A	105,000	41.2	---	143	207	1.3	24,500	--	51	121	8530	--	1,880	3.63	1090
B	85,800	43.7	.27	141	229	3.8	23,600	--	50	102	7800	--	1,000	3.78	---
C	102,000	46.4	.20	207	225	.7	22,500	--	46	103	7620	--	2,030	3.85	---

Table 3.2-1b

WESTERN LONG ISLAND SOUND III
SEDIMENT CHEMISTRY DATA - AUGUST 1982
VALUES IN PARTS PER MILLION

	COD	% SOLIDS	Hg	Pb	Zn	As	Fe	Cd	Cr	Cu	Mg	Ni	Ca	% TOTAL CARB	OIL & GREASE
200E-A	93,400	40.0	.19	120	232	4.2	29,100	--	77	104	10,400	--	1,850	2.86	310
B	94,100	38.0	.23	130	222	3.7	29,400	--	78	106	10,600	--	1,500	3.24	---
C	95,300	36.9	.13	104	205	1.3	28,200	--	73	100	10,400	--	1,560	3.07	---
200N-A	92,500	33.4	.25	150	230	4.3	30,600	--	75	123	10,400	52	507	3.43	547
B	95,400	39.2	.27	150	252	4.4	30,600	--	71	115	9,810	--	503	3.41	---
C	110,000	35.6	.33	126	248	3.1	30,600	--	70	114	9,770	--	622	3.43	---
200W-A	109,000	30.6	---	124	225	3.7	29,200	--	89	124	10,900	80	1,620	3.11	261
B	110,000	30.7	---	111	246	1.8	29,600	--	95	134	10,900	59	3,090	3.12	---
C	96,800	32.2	.15	77	234	1.0	29,600	--	87	116	11,800	50	2,760	3.28	---
200S-A	89,300	34.0	.05	104	240	0.4	29,900	--	77	113	11,300	83	650	3.12	---
B	86,400	35.8	.05	114	253	1.7	30,300	--	81	111	11,400	78	1,980	3.14	---
C	77,100	33.0	---	106	234	4.0	28,300	--	76	109	11,700	55	3,980	3.22	---
REF-A	89,900	35.4	.18	107	233	5.9	27,100	--	78	107	10,300	--	3,140	3.16	354
B	83,900	31.9	.22	128	248	3.0	28,800	--	96	135	10,900	55	1,610	3.05	---
C	76,100	40.2	.39	131	220	3.0	26,400	--	82	125	9,900	--	2,640	2.90	---

Table 3.2-2

Mean Concentration of Chemicals and Materials in Sediments Collected at the Center of the Western Long Island Sound III Disposal Site Before, During and After Disposal. Values in Parts Per Million.

	COD	% Solids	HG	Pb	Zn	As	Cd	Cr	Cu	Mg	Ni	Ca	% Total Carbon	Oil & Grease
Pre-Disposal	105,000	33.76	.02	70	230	11	6	79	125	--	57	--	--	330
Interim	81,000	44.30	.16	101	150	4	3	48	80	--	43	--	--	118
Post-Disposal	77,200	46.00	.56	76	162	6.3	4	39	76	8490	83	5,970	2.49	313

and interim surveys were presented in previous reports (DAMOS Contribution 's 18 & 19). An analysis of variance (ANOVA) was used to test whether the concentrations had changed at this location as a result of disposal. Table 3.2-3 summarizes the results of the tests and indicates that at this site, % solids, oil and grease, and nickel were the only parameters with significant concentration changes through time. The % solids were lower before and increased to a fairly constant level during and after disposal. In contrast, oil and grease and nickel concentrations were higher in the pre-disposal sediments and decreased during disposal. No other parameters had significant differences. The higher amounts of solids, probably due to the coarser nature of the sediment in the dredged material, are consistent with the lower values observed for associated contaminants.

It is also important to test for differences in sediment chemistry on and off of the disposal mound to assess the potential impact of spreading material over the ambient bottom. The August 1982 samples (Table 3.2-1) were collected from several locations both on (a) and off (b) the mound and were analyzed by ANOVA to make this test. The results, summarized in Table 3.2-4, indicate that the disposal mound differed from the natural bottom in levels of % solids, iron, chromium and magnesium. Higher levels of solids were measured in samples from the disposal mound, which is consistent with the result (Table 3.2-3) that solids increased after disposal began. Concentrations of iron, chromium and magnesium were lower in the disposal mound samples than in samples taken off the mound indicating that the dredged

Table 3.2-3

Summary of Statistical Tests Comparing Pre-Disposal, Interim and Post-Disposal Concentration of Chemicals at the Center of the Disposal Site.

Chemical	Significance of ANOVA	Times Which Differ in Concentration
COD	NS	
% SOLIDS	**	Pre-Disp. < Interim & Post
Hg	NS	
Pb	NS	
Zn	NS	
As	NS	
Fe	Not Tested	
Cd	NS	
Cr	NS	
Cu	NS	
Mg	Not Tested	
Ni	*	Pre-Disp. > Interim
Ca	Not Tested	
% Total Carbon	Not Tested	
Oil & Grease	*	Pre-Disp. > Interim

NS = not significant
* = signicant difference ($\geq$ .05)
** = highly significant difference ($\geq$ .010)
Not Tested = lack of replication precluded testing

Table 3.2-4

Summary of Statistical Tests Comparing Samples From On or Off the Disposal Mound in August, 1982

Chemical	Significance of ANOVA	Places (On or Off Mound) Which Differ in Concentration
COD	NS	
% SOLIDS	**	On > Off
Hg	NS	
Pb	NS	
Zn	NS	
As	NS	
Fe	*	Off > On
Cd	Not Tested	
Cr	**	Off > On
Cu	NS	
Mg	**	Off > On
Ni	NS	
Ca	NS	
% Total Carbon	NS	
Oil & Grease	NS	

NS = no significant difference
* = signicant difference (≥ .05)
** = highly significant difference (≥ .010)
Not Tested = lack of replication precluded testing

material dumped at the site is similar to but generally less contaminated than sediments currently existing in the area.

4.0 REMOTS CAMERA ANALYSIS

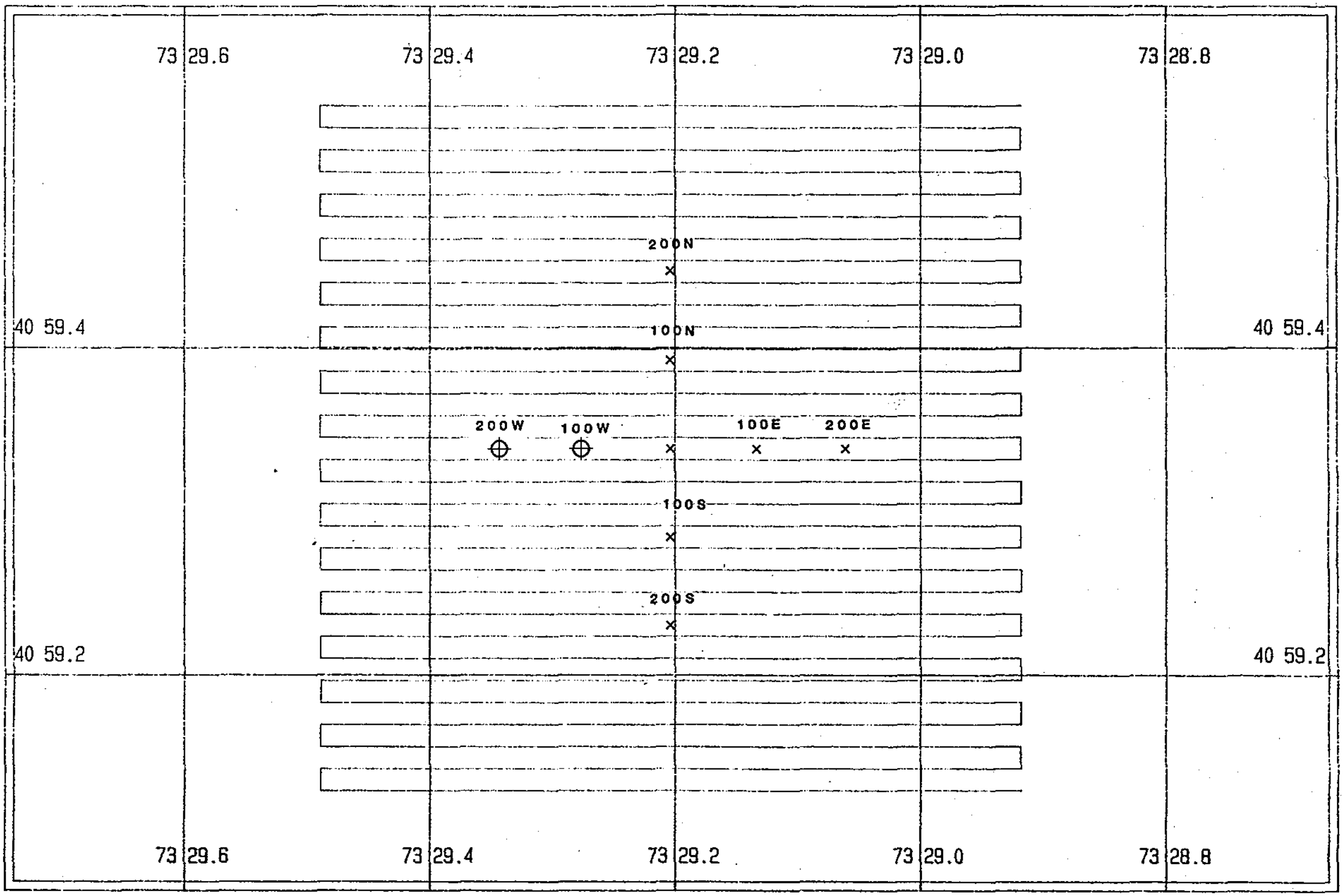
A REMOTS benthic camera survey was made of the WLIS III disposal site on January 19 and 20, 1983. The survey provided photographic information on the sediment particle size, the depth of the oxygenated zone (Redox Potential Discontinuity or RPD), and the presence and depth of infaunal organisms. The RPD depth is given special attention in the REMOTS analysis because it is a sensitive indicator of infaunal succession, within station patchiness, and bioturbation. The camera was deployed at seven stations (Fig. 4.0-1) located along north (N) - south (S) and east (E) - west (W) transects oriented about the center (CTR) of the disposal mound. The stations were located at 100m intervals and were designated 200S, 100S, CTR, 100N, 200N, 100E and 200E. No samples were obtained on the western transect because the camera flooded.

Sediment texture ranged from silt-clay to very fine sand at these stations. The disposal mound had very shallow RPD depths which ranged from 0 to 2.37 cm (Fig. 4.0-2). Stations 100N and 100E, which had no apparent RPD, exhibited a "chaotic" mixture of oxidized and reduced mud clasts, silt-clay and sand, and shell fragments. This chaotic structure and absence of an RPD, is interpreted as representing newly deposited dredged material (see Figure 4.0-3 through 5).

The absence of the RPD is diagnostic of recent dredged material disposal and the absence of invertebrate infauna. Some

Figure 4.0-1. REMOTS Photograph Locations
WLIS January 1983.

⊕ No photos taken at these sites.



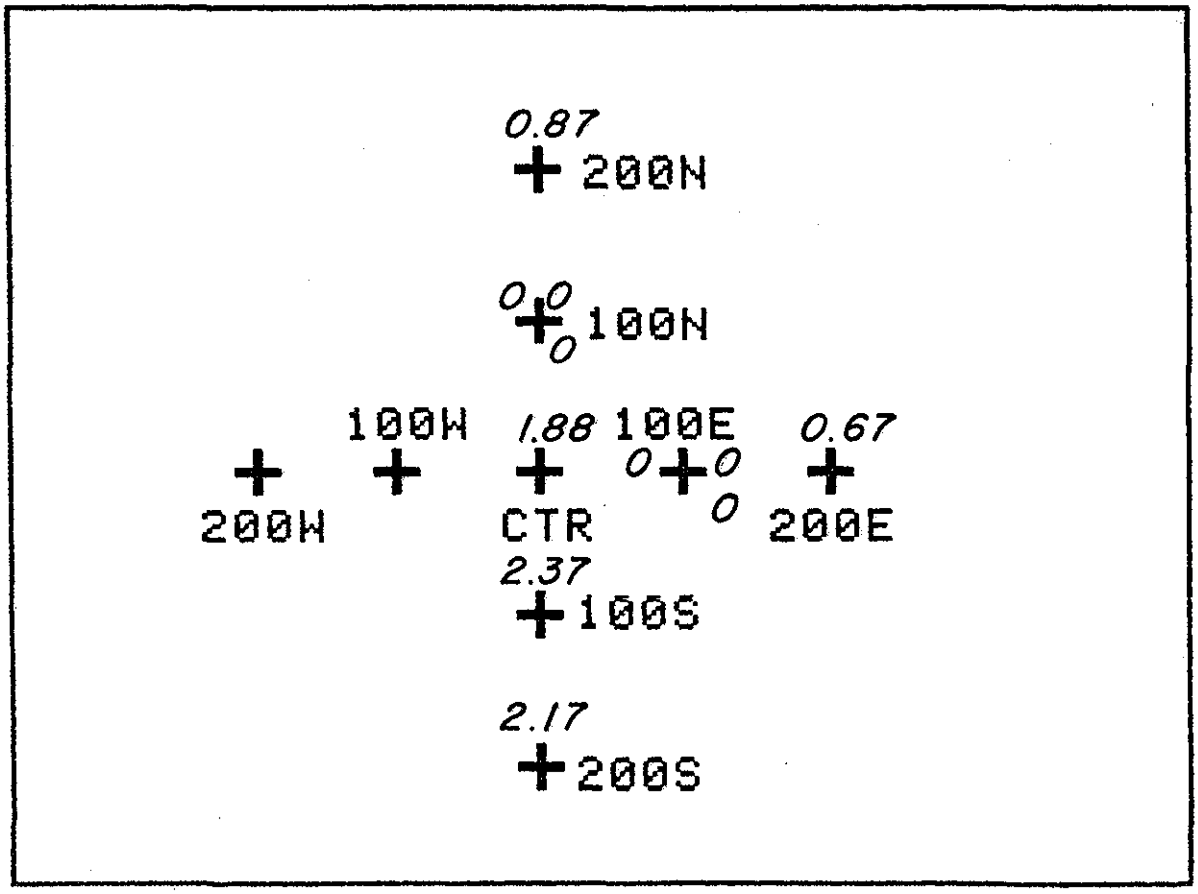


Figure 4.0-2. Mean depth of the oxygen penetration zone (or RPD).

of the stations (see Figure 4.0-2), including CTR and 100S, had an RPD present and apparently had been colonized by shallow-burrowing infauna. Figure 4.0-6, taken at 200E, demonstrates that the RPD was much deeper in the past, indicating that a more established biological community was present prior to disposal. Future application of the REMOTS camera should document the spread of material and recolonization of the area following completion of disposal operations.

5.0 POST-DISPOSAL DIVER OBSERVATIONS

A diver survey was conducted on 19 August 1982 to assess post-disposal benthic conditions. The two divers, in 118 feet of water, observed sediment surface conditions and species type and abundance on a transect from the center of the disposal site to the edge of the mound in an E-SE direction. The divers then made additional observations while swimming N for 50 feet. Photographs were taken to document the benthic conditions.

The disposal mound sediment surface was composed of a clay matrix containing shells (fragments and whole valves) which often protruded upward. Small mounds (0.5-1m elevation) characterized the surface in the immediate area of deposition, however, no steep slope contours were observed.

Significant bioturbation was created by the organsisms inhabiting the mounds. Macrobenthic organisms, listed in Table 5.0-1, were concentrated in dense shell hash patches (50% shell cover). Figures 5.0-1 through 6 provide documentation of conditions at the disposal site. Additional notes are included on the DAMOS diver log, Table 5.0-2.

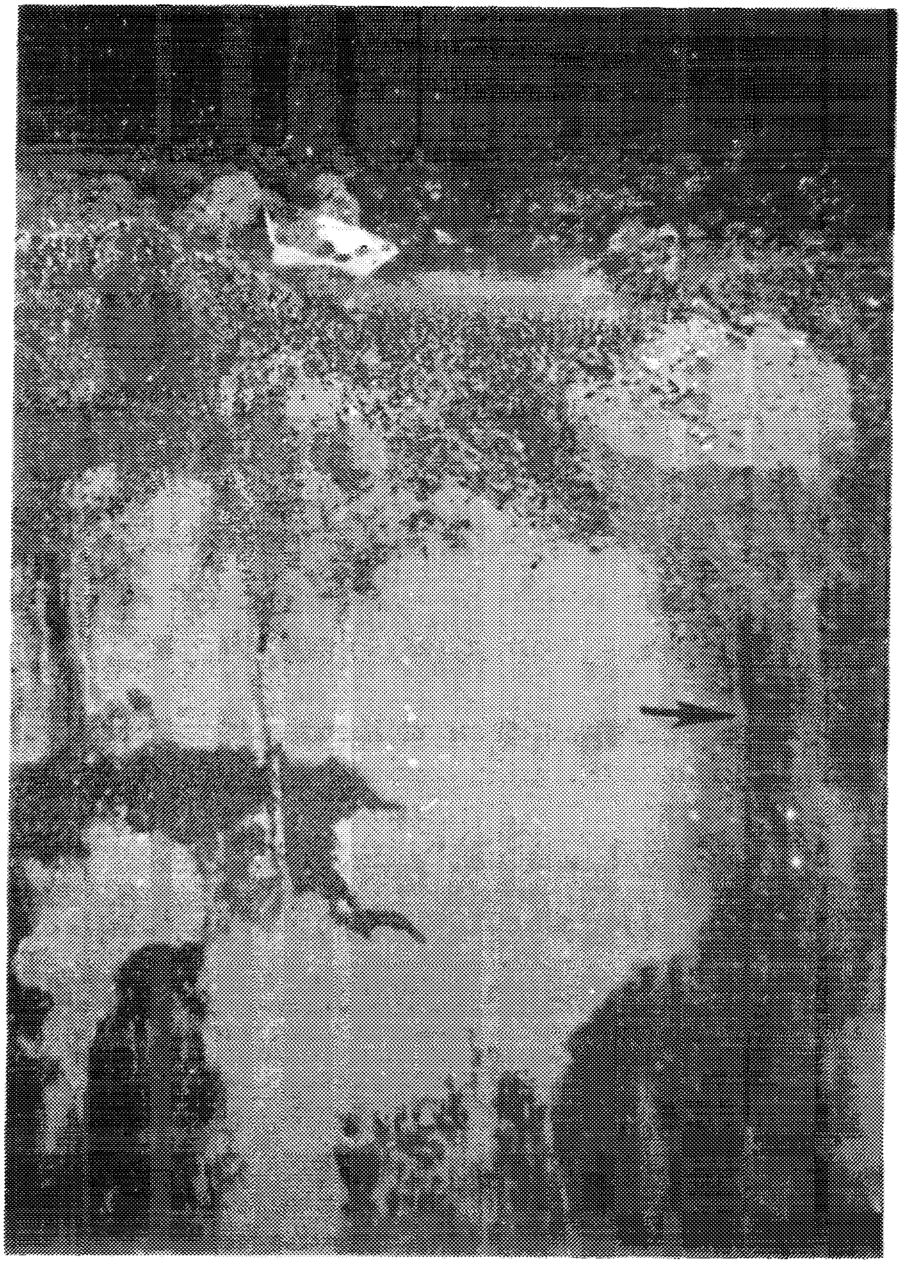


Figure 4.0-3. WLIS III Disposal Site, station 100N. Scale = 1.5x.
This recently deposited material has a "chaotic" fabric related to the rapid deposition of a heterogeneous mixture of oxidized and reduced mud clasts, sand, and shell. A vertical 'conduit' (arrow) probably represents a dewatering structure.

Figure 4.0-4. WLIS III Disposal Site, station 100N. Scale = 1.5x.
Fine sand overlies silt-clay mud clasts in recently deposited dredged material.

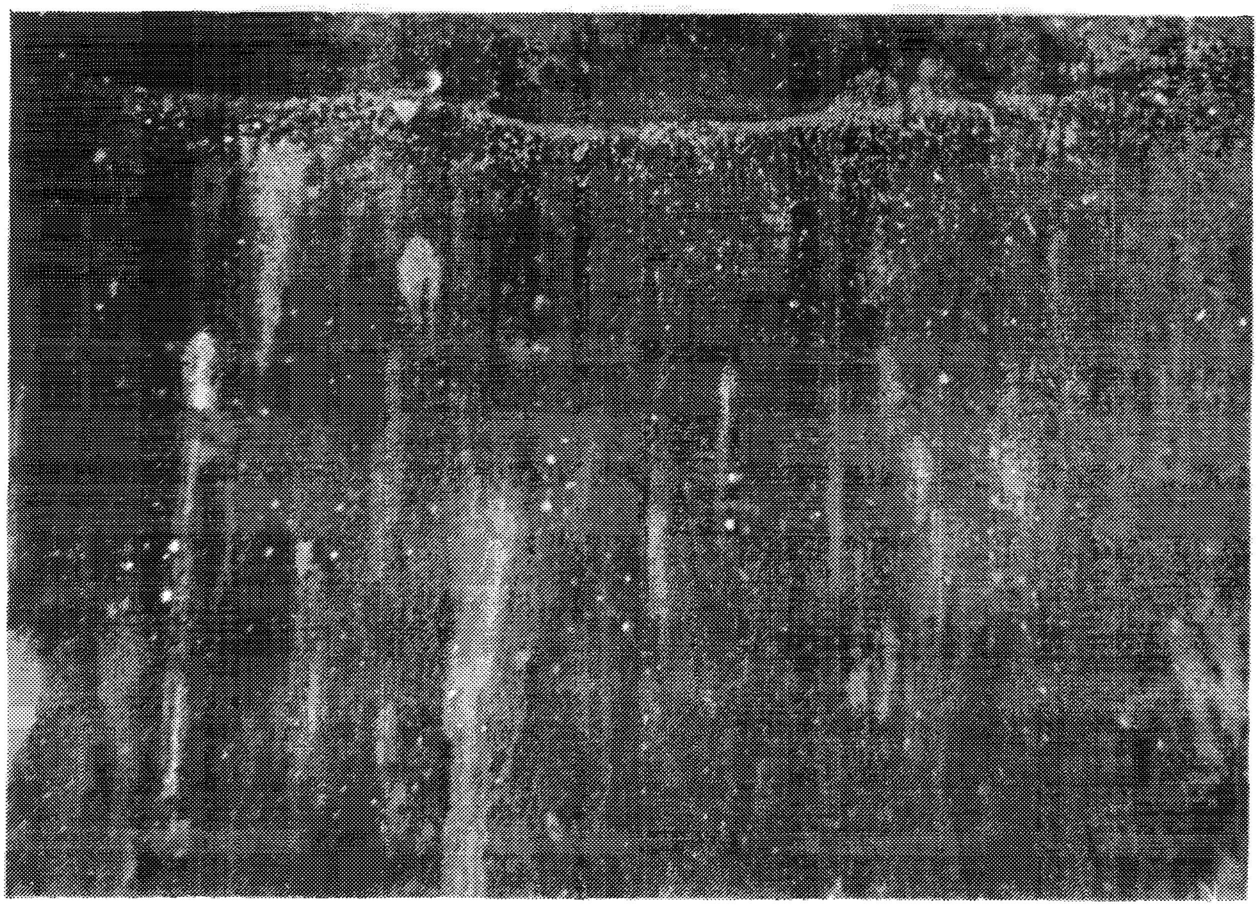


Figure 4.0-5. WLIS III Disposal Site, station 100E. Scale = 1.5x.
The presence of a reduced sedimentary surface and reduced mud clasts at the surface identifies recently deposited dredged material.

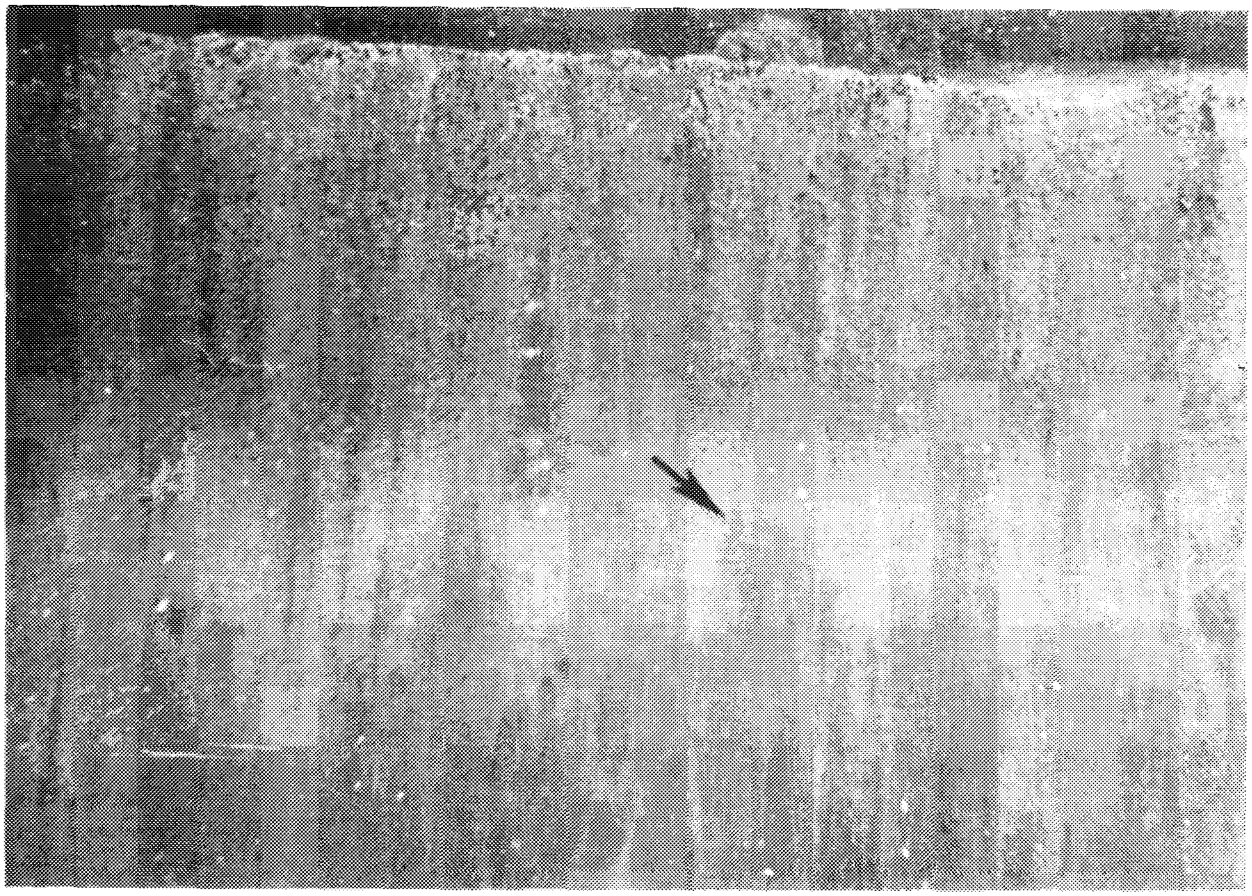


Figure 4.0-6. WLIS III Disposal Site, station 200E. Scale = 1.5x.
A rebounded RPD is characteristic of a retrograde faunal succession. The former depth of the RPD is marked by arrow. The present RPD is located at a mean depth of 0.6cm.

Table 5.0-1

Macrobenthic Organisms
Observed on the WLIS III Disposal Site
August, 1982

Species	Relative Abundance
Crustacea	
Homarus americanus (juv.)	2
Crangon septemspinosa	20+
Paqurus longicarpus	10
Cancer irroratus (1-2 cm)	25+
Cancer irroratus (10)	5
Gastropoda	
Nassarius trivittatus	15+
Pisces	
Pseudopleuronectes americanus	4
Sygnathus fuscus	1
Raja	1

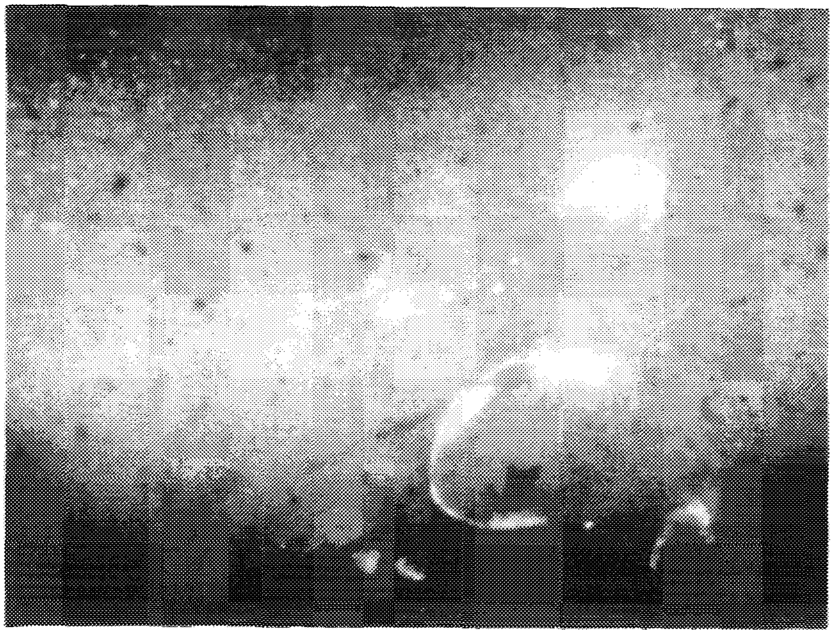


Figure 5.0-1. Bivalve (Mercenaria) shell fragments on surface of disposed dredged material. Disposed sediment appeared more compacted then surrounding natural bottom sediment.

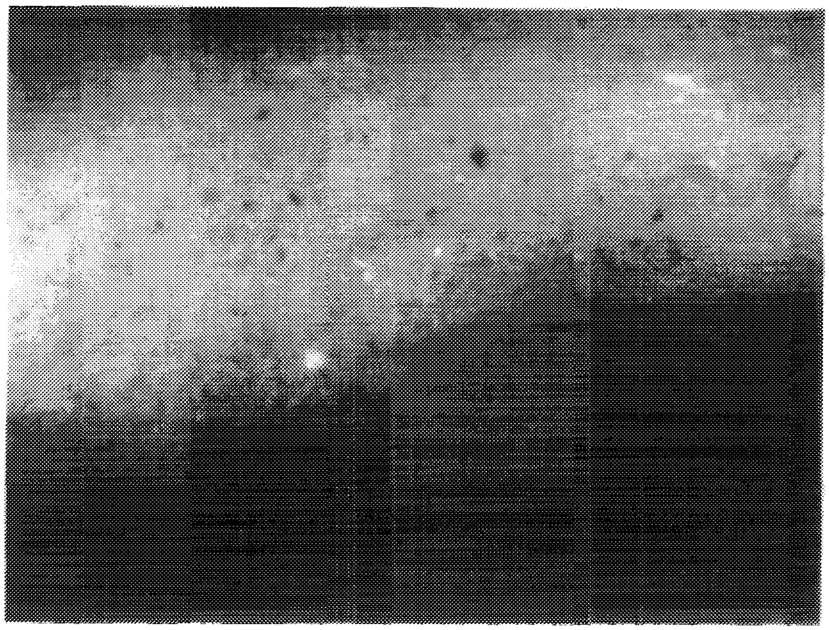


Figure 5.0-2. Semi-consolidated dredged material with no apparent macroorganisms. Sediment surface veneer often obscures siphons, tubes and mucal tracks.

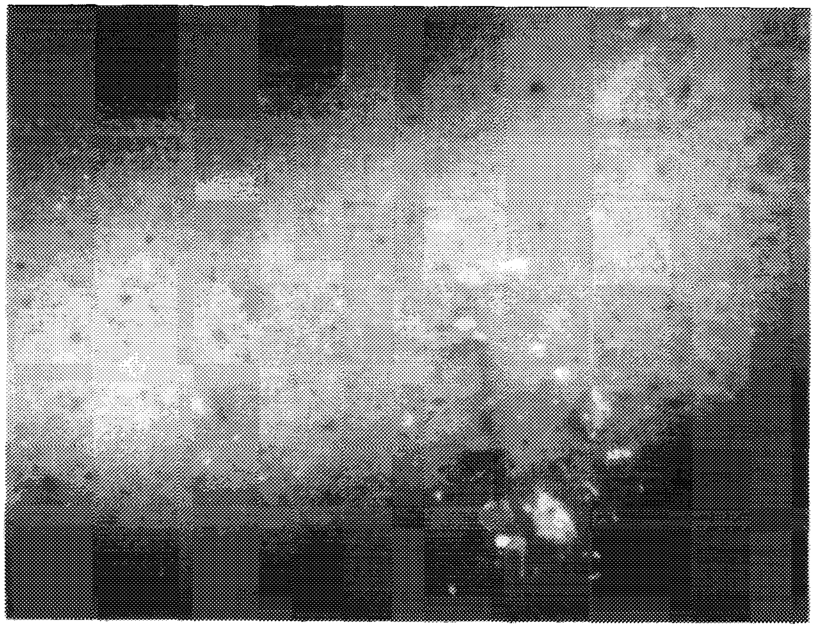


Figure 5.0-3. Shell frgament patches attracted mobile benthic species on the mound. The recolonization process has formed a patchy or "mosaic" distribution pattern.

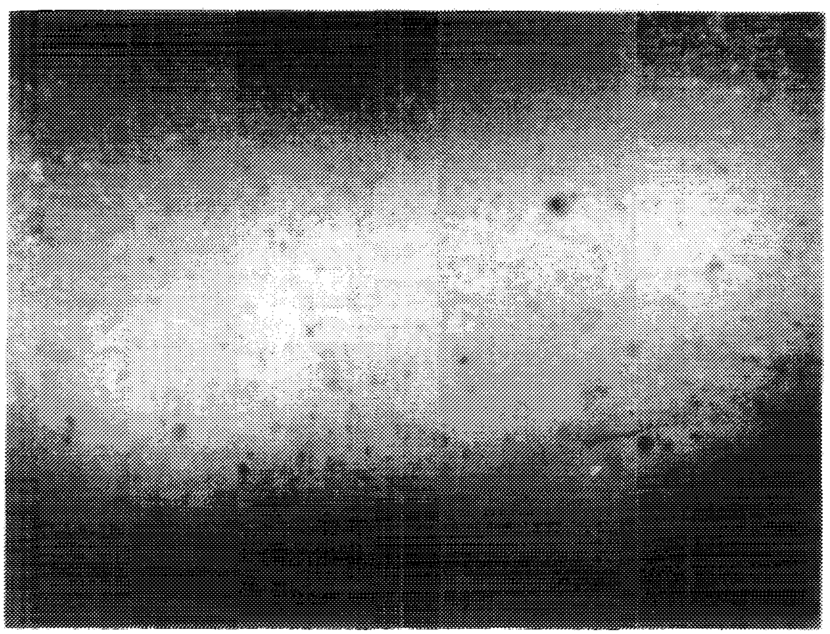


Figure 5.0-4. The winter flounder, *Pseudopleuronectes americanus*, creates bioturbation in active feeding and cryptic burial behavior.

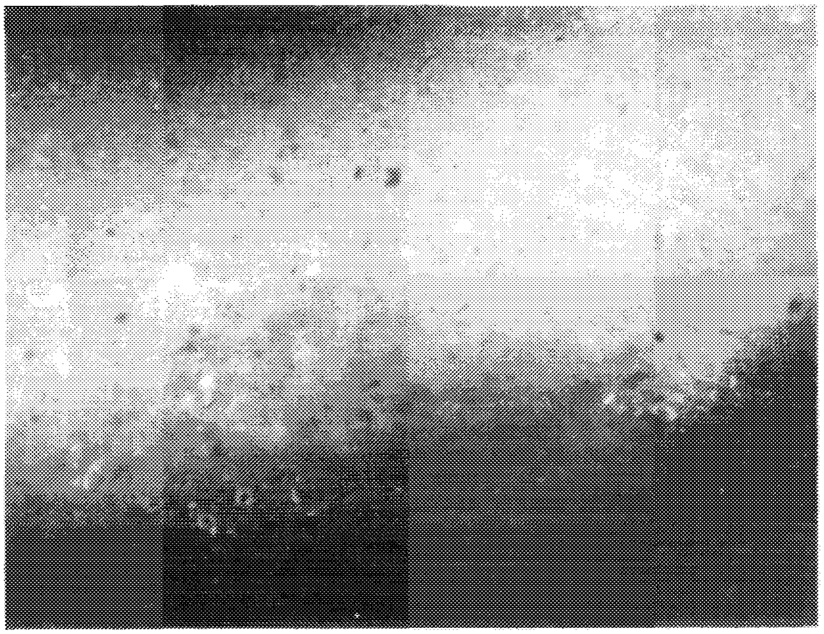


Figure 5.0-5. Pseudopleuronectes americanus partially buried in the sediment. Note shell fragments exposed around fin ray margin.

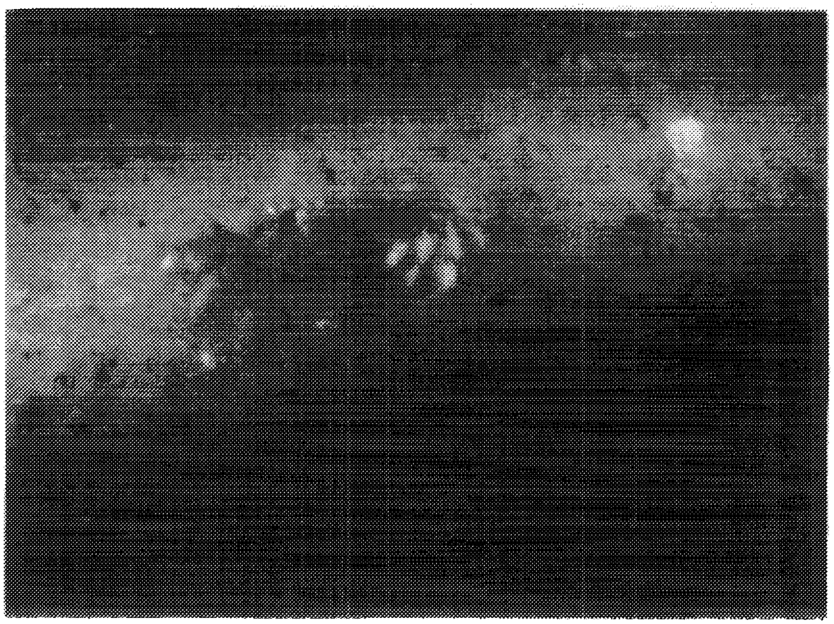


Figure 5.0-6. *Cancer irroratus* and *Pagurus longicarpus* manipulate the surface sediment layer in seeking food and shelter. In general, the more variable terrain was inhabited by 2-3 times more mobile macrofaunal organisms than the adjacent natural bottom.

Table 5.0-2

D.A.M.O.S. DIVER MONITORING LOG

DATE: 19 Aug '82 **LOCATION:** Western Long Island Sound III site - central

DIVERS: Stewart Buchholz **TIME:** 1152-1206 **DEPTH:** 118' **T°C:** 62°F **VISIBILITY:** 1.5'

DIVE (in/out Loran C): 43975.1/26830.6 **DISPOSAL or REFERENCE BUOY (L/C:**
Descend to disposal buoy base and followed ESE course to "natural" bottom, then tracked perimeter of pile 50' to north.

I. **OBSERVATIONS:**

A. **BENTHIC CONDITIONS (PHYSICAL) - Bottom current vel. and direction, turbidity, sediment grain size, neffloid layer, surface features (composition), shell hash (% cover), topography (slope/contour/ apron), compaction, bioturbation, perimeter Loran C.**

Current negligible, direction indefinite, 1.5 foot visibility, surface of spoil material compact with protruding shell (fragments and whole valves) comprising a shell-sticky clay base matrix. Small mound (.5 - 1 m elevation) topography characterized the spoil surface.Dense (50%) shell hash patches attracted small macro benthos into notable concentration zones. No steep slope contours were observed. Significant bioturbation was occurring due to spoil repopulation by benthic representatives listed below.

B. **(BIOLOGICAL) - Diver species count, densities (est. no.) photo log nos., spoil/ organism dynamics, behavior, transect observations (on/off) difference, biogenic sediment structures (burrows, tubes, tracks, casts, etc.).**

Concentrations of small benthic organisms were noted in shell patch areas:
Crangon (20+), Pagurus (10), Cancer irroratus, (1-2 cm) (25+), Nassarius trivatatus (15+)
Pseudopleuronectes americanus (4) C. irroratus (10 cm) (5)
Sygnathus fuscus (1)
Raja (sp) (1)
Homarus americanus (2) juvenile.

II. **DISCRETE SAMPLES OR METHODS:**

_____ A. **Epibenthic net (30 sec. traverse): on or off spoil, target species.**

__X__ B. **.25 m^2 quadrant count/** photography.

_____ C. **Penotrometer tests, elevation stake readings, sediment trap.**

_____ D. **Mussel deployment - bioaccumulation subsample.**

_____ E. **Sonic beacon placement or electrolyte change.**

_____ F. **Remote bathymetric camera photos.**

_____ G. **Video tape (location, time min. run, tape index).**

_____ H. **Opportunistic collection (i.e. natural mussel bed, Corymorpha Axius.)**

An additional diver survey was conducted on 20 December 1982 to assess conditions at the WLIS III disposal site during disposal operations. Two dives were conducted in 121 feet of water in order to observe sediment surface conditions, survy species types and relative abundances, and provide photo-documentation of conditions.

Sedimentary conditions were typical of an active disposal site. Small scale bottom relief was from 1 to 1.5m. The transect was over a continuous series of small crests and valleys. Large fracturing cohesive clay clumps were common. Shell hash was embedded in the clay clumps and in the spoil material in general. Most of the hash was from Mya and Mercenaria valves and covered 10-15% of the surface.

Tracks of Cancer sp. and Homarus americanus were observed on the spoil surface. Active individuals of both species were also noted along the transect. Mysids were of low density. A single hake, Urophycis tenuis, was observed in a typical shallow depression.

Table 5.0-3 summarizes species observed and their relative abundances along the transect and Figures 5.0-7 through 11 document conditions at the site. The DAMOS diver logs are provided in Tables 5.0-4 and 5.

6.0 SUMMARY

The disposal operations at WLIS III have been conducted successfully with the expected results. Most of the material has been deposited in a small mound with a radius of about 100m which has remained stable over the period of measurement.

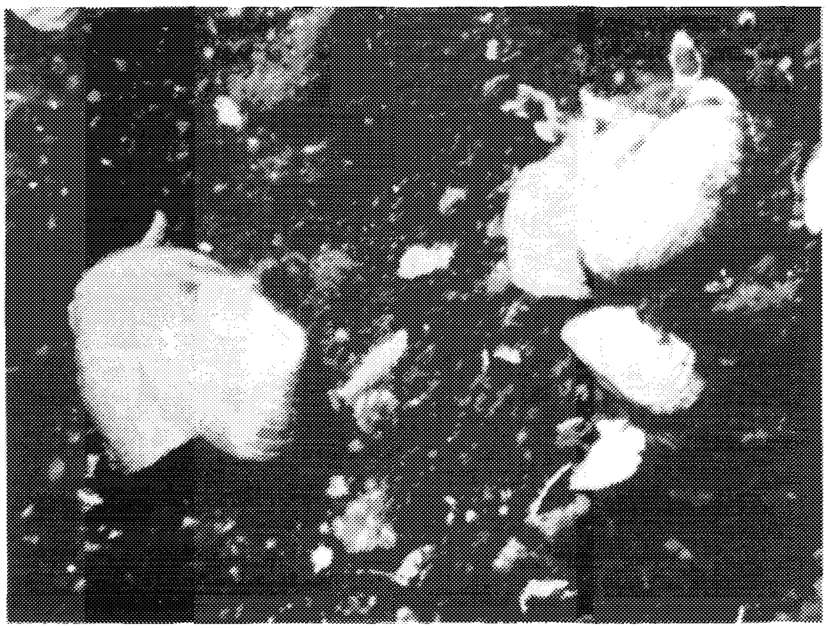


Figure 5.0-7. Embedded shell material from Mya and Mercenaria valves in spoil surface. Notice coarse granular material around shell debris.

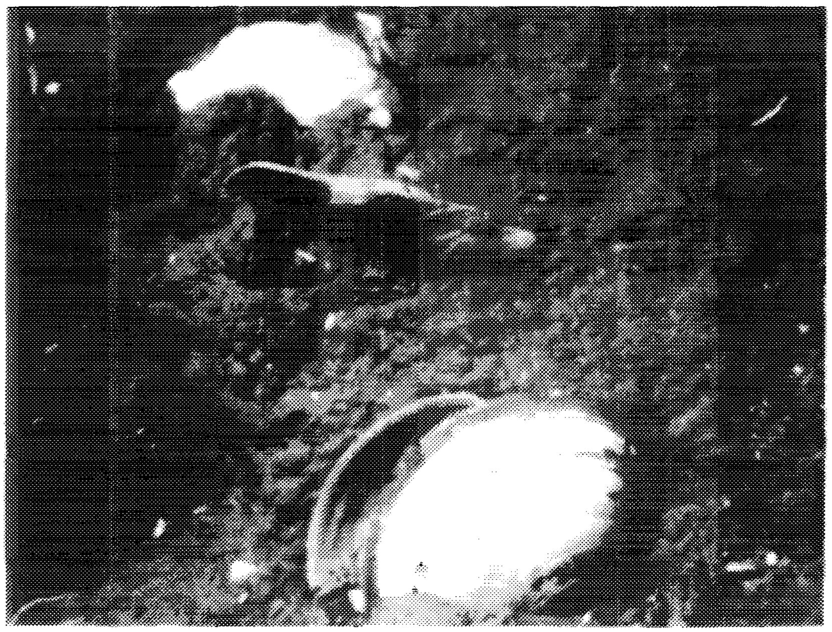


Figure 5.0-8. Shell material embedded in clay clump. Notice more cohesive surface texture than in previous photograph.

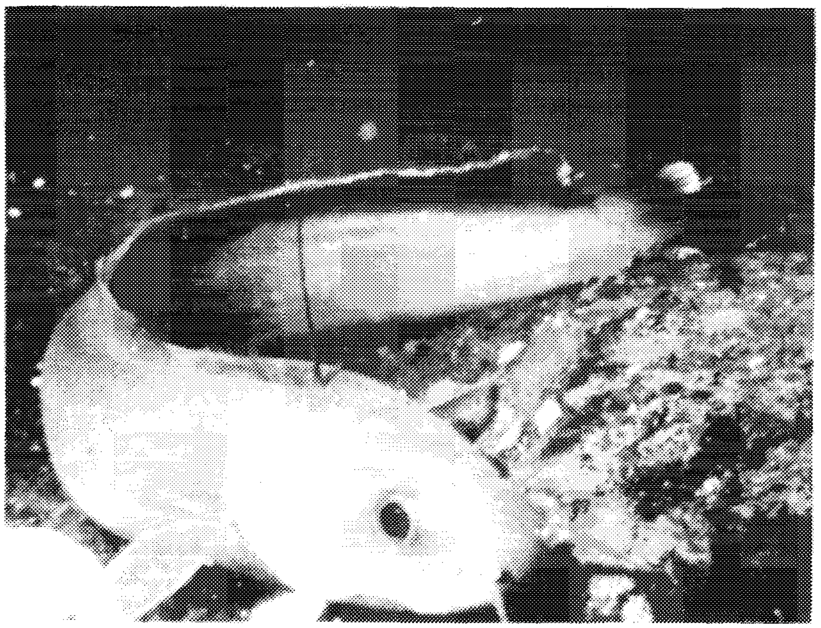


Figure 5.0-9. A red hake, Urophycis tenuis, in a shallow surface depression. The form of the depression indicates it may have formed by tail fanning of the fish.

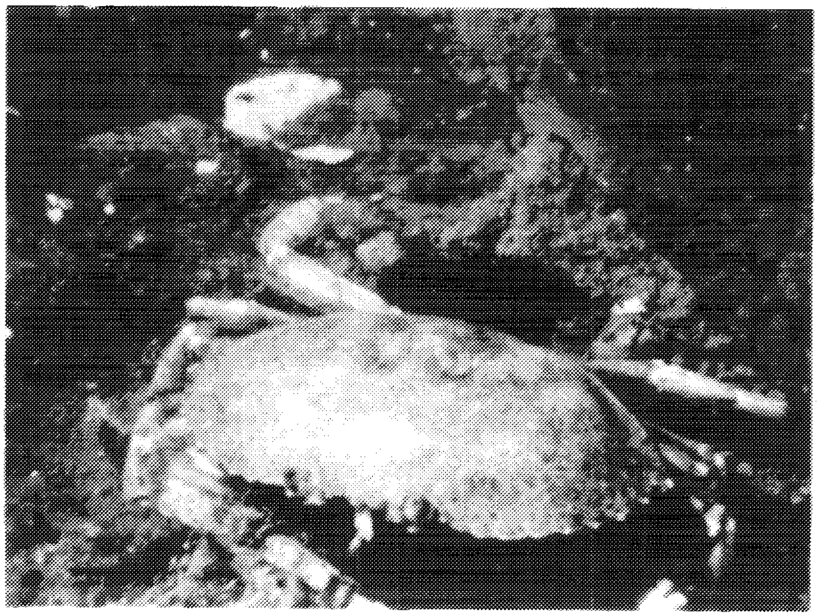


Figure 5.0-10. An active *Cancer irroratus* tracking across the surface of the spoil.

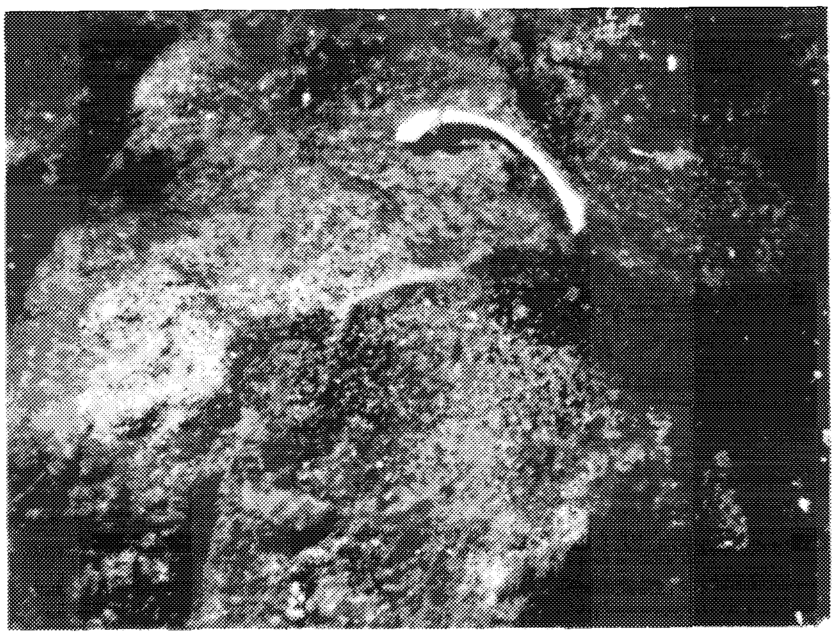


Figure 5.0-11. An eroding clay clump. Note granular remains where lighter material was eroded away.

Table 5.0-3. Macrobenthic Organisms observed on the WLIS III Disposal Site. December, 1982

Species	Relative Abundance
Crustacea	
Mysid Sp.	$1/.25\ m^3$
Cancer irroratus	13
Homarus americanus	1
Pisces	
Prionotus evolans	2
Urophycis tenuis	1

Table 5.0-4.

D.A.M.O.S. DIVER MONITORING LOG

DATE: 20 Dec 1982 LOCATION: WLIS III Site

DIVERS: Auster/ Buchholz TIME: 1229-1239 DEPTH: 121' T°C:~5°C VISIBILITY: 5 ft

DIVE (in/out Loran C): DISPOSAL or REFERENCE BUOY (L/C:

43975.1 - 26830.8
43975.1 - 26831.0

I. OBSERVATIONS:

A. BENTHIC CONDITIONS (PHYSICAL) - Bottom current vel. and direction, turbidity, sediment grain size, neffloid layer, surface features (composition), shell hash (% cover), topography (slope/contour/ apron), compaction, bioturbation, perimeter Loran C.

Bottom current < .25 kt to W. Site typical of active disposal site Large scale local bottom relief from 1 to 1.5 m long, fracturing clay clumps and continuous crests and valleys. Shell hash imbedded in clay clumps and in spoil overall. Mya and Mercenaria debris shell hash cover - 10 - 15%

B. (BIOLOGICAL) - Diver species count, densities (est. no.) photo log nos., spoil/ organism dynamics, behavior, transect observations (on/off) difference, biogenic sediment structures (burrows, tubes, tracks, casts, etc.).

Prionotos evolans - 2 active
Urophycis tenuis - 1 unreactive, in mud depression obviously formed by tail sweeping
Cancer irroratus - 13 - active - tracking over spoil surface and burrowed into surface layer of spoil
Homarus americanus - 1 - active - walking over bottom - not in burrow
Mysids - < 1/.25m^3

II. DISCRETE SAMPLES OR METHODS:

_____ A. Epibenthic net (30 sec. traverse): on or off spoil, target species.

__X__ B. .25 m^2 quadrant count/photography, 6 frames

_____ C. Penetrometer tests, elevation stake readings, sediment trap.

_____ D. Mussel deployment - bioaccumulation subsample.

_____ E. Sonic beacon placement or electrolyte change.

_____ F. Remote bathymetric camera photos.

_____ G. Video tape (location, time min. run, tape index)..

_____ H. Opportunistic collection (i.e. natural mussel bed, Corymorpha Axius.)

Table 5.0-5.

D.A.M.O.S. DIVER MONITORING LOG

DATE: 20 Dec. 82 LOCATION: WLIS dumpsite

DIVERS: Buchholz, Auster TIME: 1229-1239 DEPTH: 120' T°C: 5 VISIBILITY: 6-8'

DIVE (in/out Loran C): DISPOSAL or REFERENCE BUOY (L/C: same

43975.1/26830.8 - 43975.1/26831.0

I. OBSERVATIONS:

A. BENTHIC CONDITIONS (PHYSICAL) - Bottom current vel. and direction, turbidity, sediment grain size, neffloid layer, surface features (composition), shell hash (% cover), topography (slope/contour/apron), compaction, bioturbation, perimeter Loran C.

- No current or turbidity. Visibility 6-8'.
- Fine sediment with large clay clumps of spoil creating 1' riffs and valleys.
- Clay clumps appeared stable, could scrape away by hand.

B. (BIOLOGICAL) - Diver species count, densities (est. no.) photo log nos., spoil/ organism dynamics, behavior, transect observations (on/off) difference, biogenic sediment structures (burrows, tubes, tracks, casts, etc.).

- Auster took approximately 6 photographs.
- No observable small organisms, nor any bioturbation.
- Observed: 1 hake in hollowed-out sediment
  1 legal size lobster
  2 sea robins
  3 *Cancer* crabs

II. DISCRETE SAMPLES OR METHODS: (fouled our bouy line in site bouy chain. (very brief < 10' epibenthic run

_X_ A. Epibenthic net (30-sec. traverse): on or off spoil, target species.

___ B. .25 m^2 quadrant count/photography.

___ C. Penetrometer tests, elevation stake readings, sediment trap. sampling from raft

_X_ D. Mussel ~~deployment~~ - bioaccumulation subsample. - done by divers: DeGoursey/Tettlebach

___ E. Sonic beacon placement or electrolyte change.

___ F. Remote bathymetric camera photos.

___ G. Video tape (location, time min. run, tape index).

___ H. Opportunistic collection (i.e. natural mussel bed, *Corymorpha* *Axius*.)

The dredged material deposited at the site does not have significantly higher levels of contaminants than the surrounding sediment, but is coarser with a higher percentage of solids in the center of the mound.

Photographs of the sediment water interface indicate a "chaotic" texture and no RPD layer in the vicinity of recent disposal on the mound. Diver observations have indicated an immediate recolonization of the mound by macrobenthic organisms which should cause significant bioturbation which in turn should serve to lower the RPD level and return the mound to ambient oxidization levels.

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