SCIENCE APPLICATIONS, INC.

POST-DISPOSAL SURVEY OF THE WLIS III DISPOSAL SITE AUGUST - SEPTEMBER, 1983

CONTRIBUTION #35

SAI-84/7505&C35

DACW33-83-D-0004

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1.0 INTRODUCTION

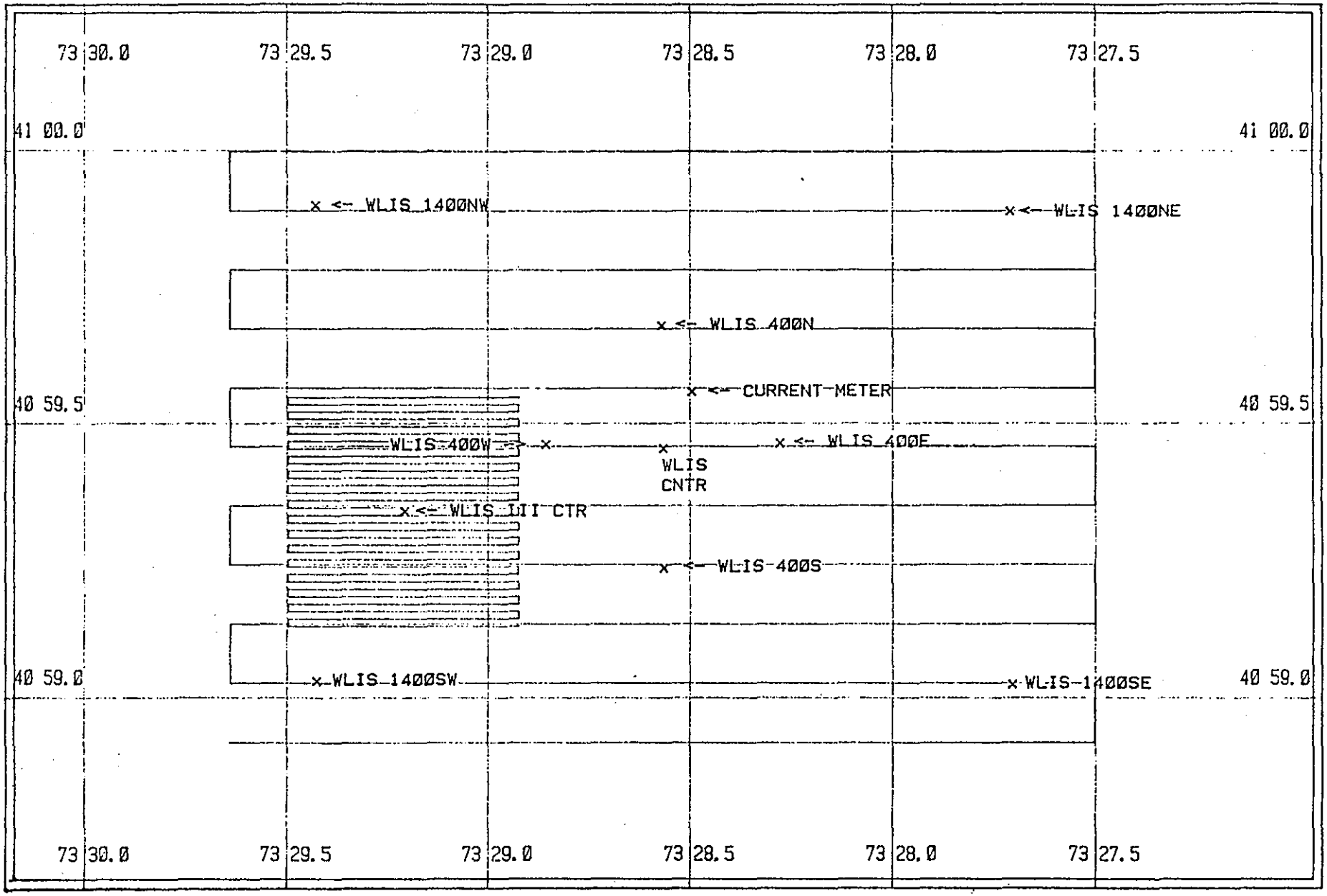
The Western Long Island Sound dredged material disposal site ($40^{o}59.34'N$, $73^{o}29.21'W$), shown in Figure 1.0-1, has been used for dredged materials from small harbors in the western portions of Long Island Sound during two major periods of disposal. From March through May, 1982, 40606m^3 of dredged material were disposed and from December, 1982 through March, 1983, approximately 71,000m^3 were disposed. DAMOS surveys at the disposal site during and between the two disposal operations are described in DAMOS Contribution #27.

In August and September, 1983, a detailed survey of the disposal area was conducted. Using precision navigation control, a bathymetric survey was done, along with a REMOTS survey and diver observations. This report documents the information collected on these surveys and compares the bathymetric and REMOTS survey data to those collected in January 1982.

2.0 BATHYMETRY

Figures 2.0-1 and 2.0-2 represent the depth contour charts generated from the bathymetric surveys of January and August 1983 respectively. It is evident that there has been a substantial deposition of material at this disposal site during the intervening 8 months. The disposal mound is obviously larger in all directions. This is further substantiated in Figures 2.0-3 and 2.0-4, which depict the depth profiles of the eight survey lanes which cover the mound. A volume difference calculation produced the results illustrated in Table 2.0-1 and Figure 2.0-5. These data show a deposition of new material in

Figure 1.0-1. WLIS III Designated Disposal Site.

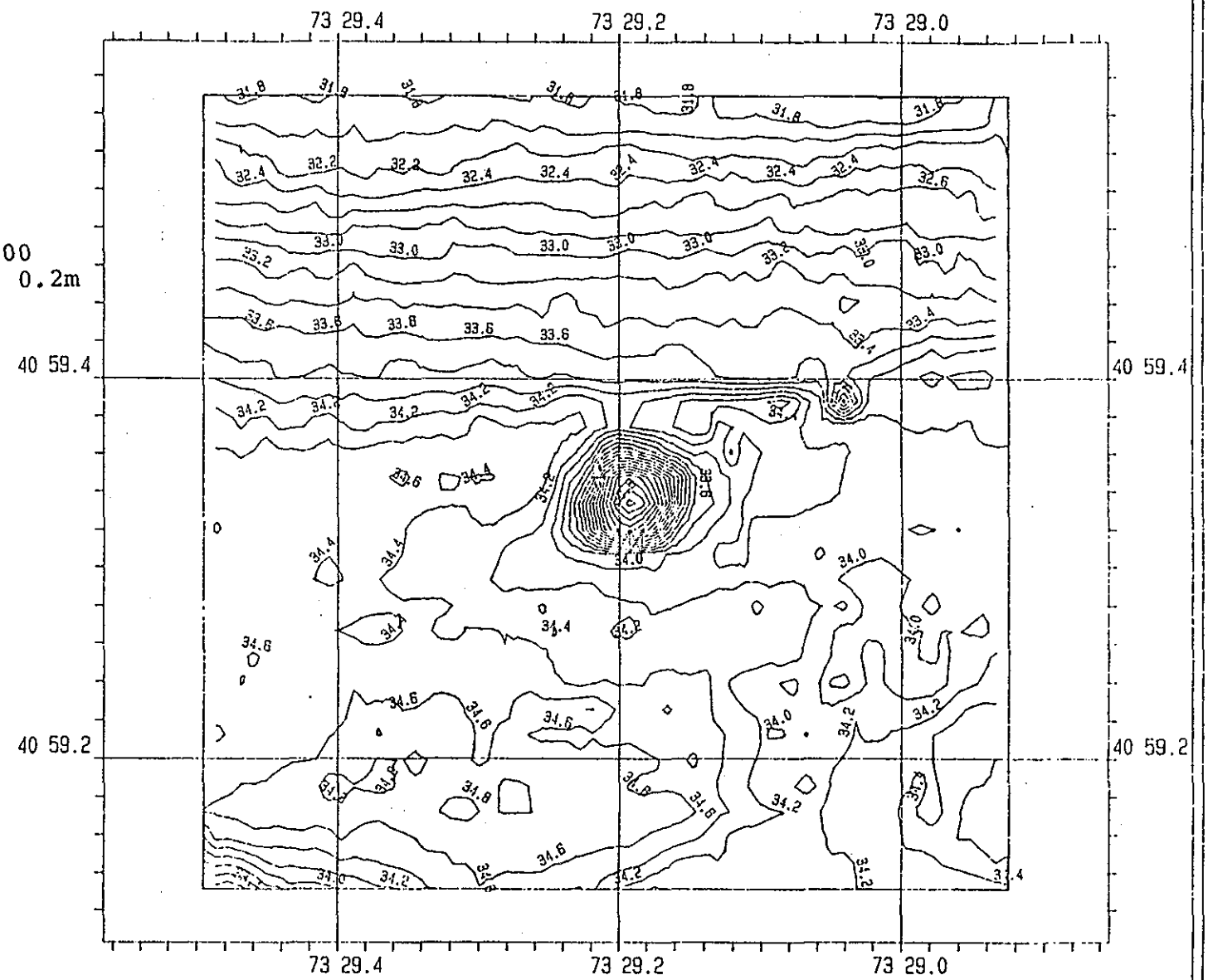


WLIS III

19 January 1983
Chart Scale: 1/4000
Contour Interval: 0.2m
Datum: MLW

Figure 2.0-1.

Preliminary

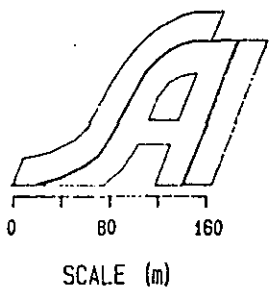


WLIS III

24 August 1983
Chart Scale: 1/4000
Contour Interval: 0.2m
Datum: MLW

Figure 2.0-2.

Preliminary



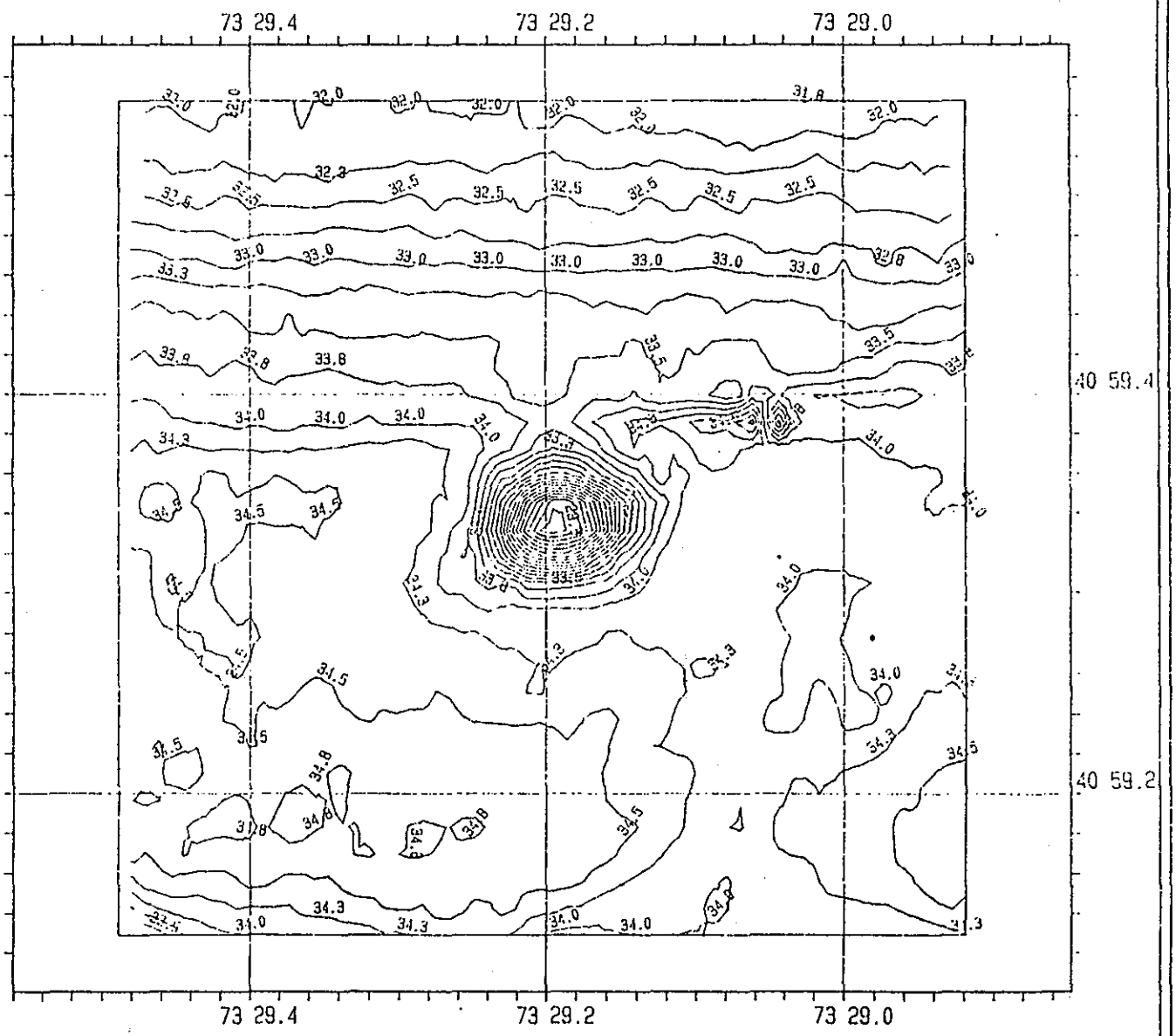


Figure 2.0-3.

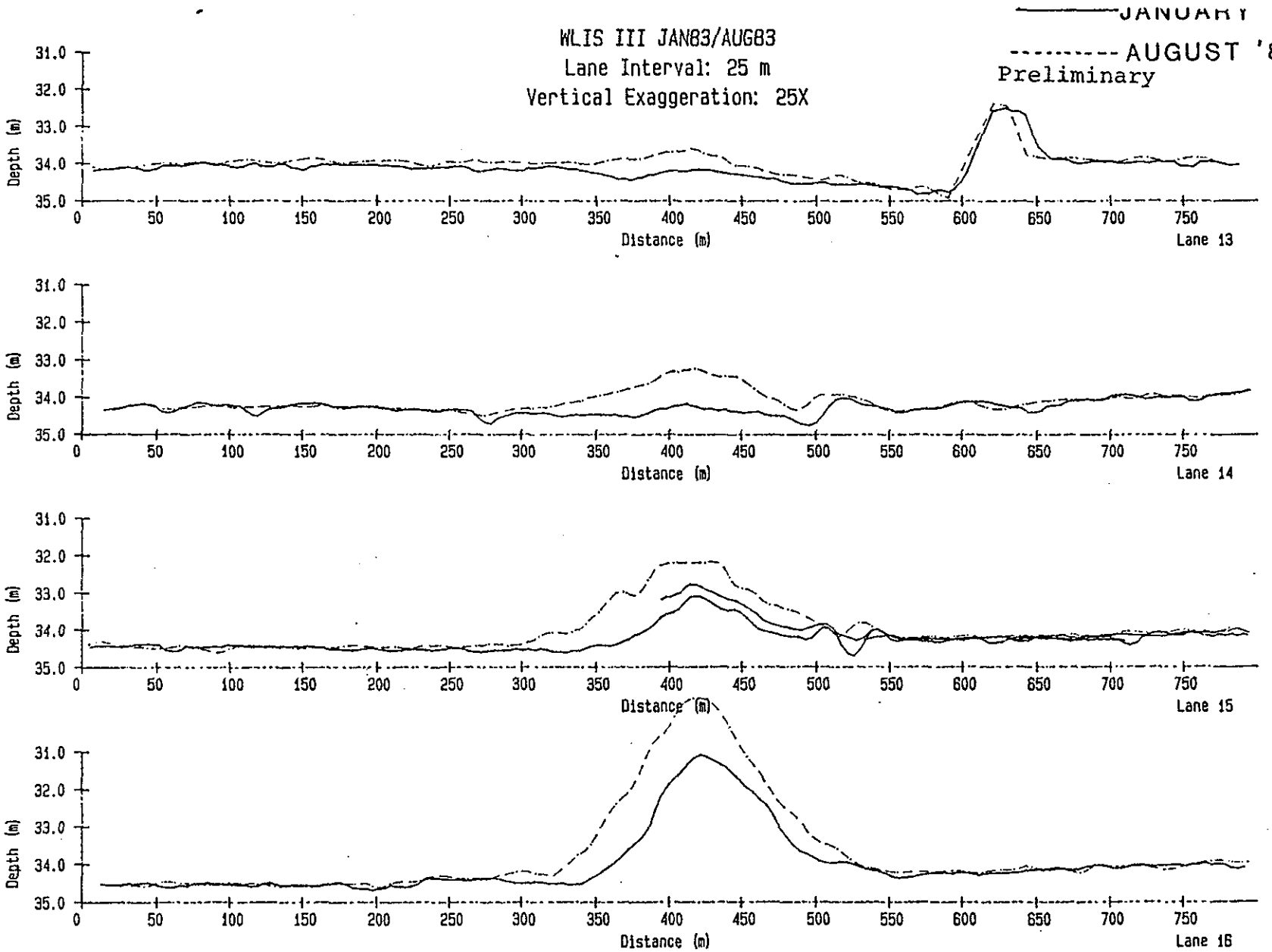

JANUARY '83
AUGUST '83
Preliminary
WLIS III JAN83/AUG83
Lane Interval: 25 m
Vertical Exaggeration: 25X
Depth (m)
31.0
32.0
33.0
34.0
35.0
0
50
100
150
200
250
300
350
400
450
500
550
600
650
700
750
Distance (m)
Lane 13
Lane 14
Lane 15
Lane 16

Figure 2.0-4.

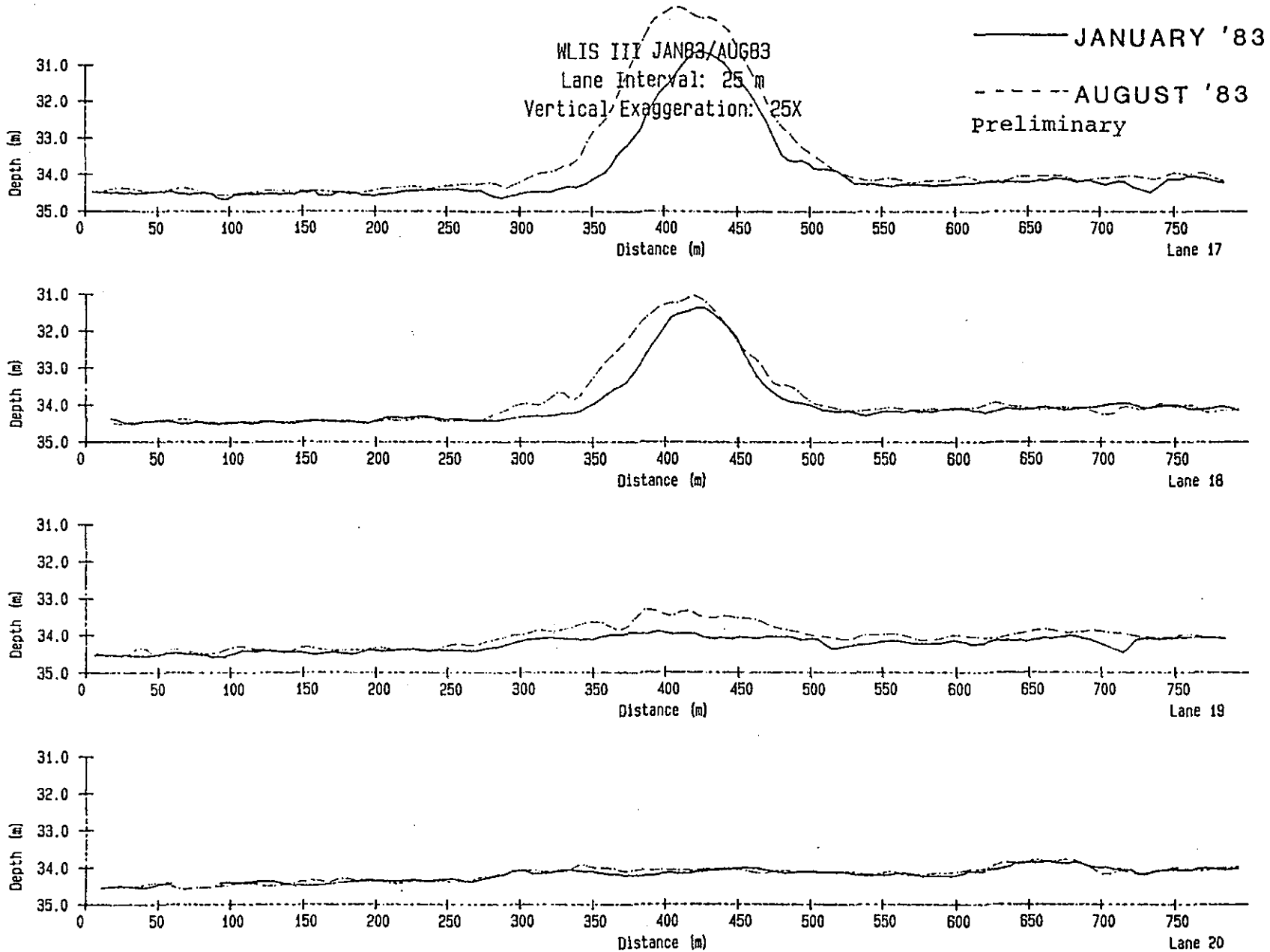
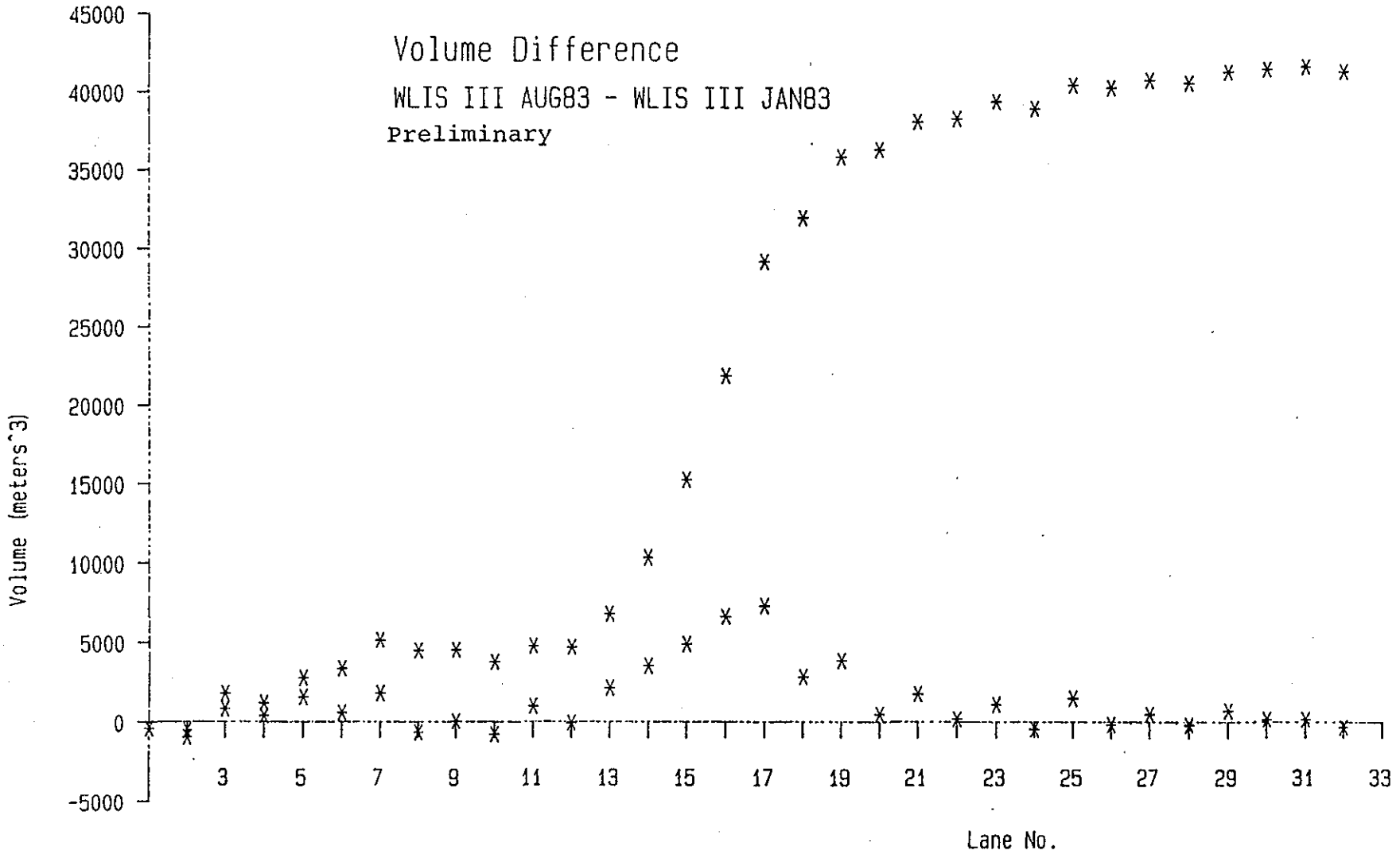

WLIS III JAN83/AUG83
Lane Interval: 25 m
Vertical Exaggeration: 25X
JANUARY '83
AUGUST '83
Preliminary
Depth (m)
31.0
32.0
33.0
34.0
35.0
0
50
100
150
200
250
300
350
400
450
500
550
600
650
700
750
Distance (m)
Lane 17
Lane 18
Lane 19
Lane 20

Figure 2.0-5.


Volume Difference
WLIS III AUG83 - WLIS III JAN83
Preliminary
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.

WLIS III AUG83.MTX - WLIS III JAN83.MTX

Table 2.0-1.

Least Squares Coefficients:
A0 = -3.38120871
A1 = -8.16536088
A2 = 2.390643
A3 = 21.7938101

Standard Deviation = 5.42381959

Lane #	Lane Volume (meters^3)	Cumulative Volume (meters^3)	Lane Correction (centimeters)
1	-410	-410	-15
2	-561	-970	-11
3	1777	806	-9
4	383	1190	-7
5	1559	2749	-5
6	603	3352	-4
7	1807	5159	-2
8	-664	4494	-2
9	45	4540	-1
10	-769	3771	-1
11	990	4761	-1
12	-75	4685	-1
13	2125	6811	-2
14	3315	10126	-2
15	4902	15227	-3
16	6646	21873	-3
17	7306	29180	-4
18	2819	31999	-4
19	3852	35851	-5
20	487	36337	-5
21	1762	38099	-5
22	190	38289	-5
23	1103	39392	-5
24	-455	38937	-4
25	1495	40433	-4
26	-167	40265	-2
27	497	40762	-1
28	-179	40583	1
29	717	41301	3
30	154	41455	6
31	158	41613	9
32	-376	41237	13

excess of 41,000 cubic meters between January and August 1983. Figure 2.0-6 represents a contour difference plot of the volume difference data. This shows a deposition of an additional 2 meters of new material since January of 1983.

3.0 SEDIMENT SAMPLES

In January and August 1983, sediment samples were taken with a Smith McIntyre grab sampler at the locations described in Table 3.0-1. Visual observations were made on every grab from each station and sediment samples were collected in triplicate for subsequent analysis by NED.

The results of the chemcial analyses for January and August, 1983 are shown in Tables 3.0-2 to 3.0-5. The concentrations of zinc, chromium and copper were higher in all surface sediment samples taken in January. These samples were taken during the disposal operation after the deposition of approximately 11,000m^3 of dredged material. The median grain size of the sediments was smaller, which would also account for the higher metal concentrations. There were no apparent station differences in January, except that the center samples were generally lower in metal content. By August, this station difference is much more dramatic, principally because the center station had coarser sediment. The 200N, 100N and 100W stations also consisted of coarser sediments with lower metal levels.

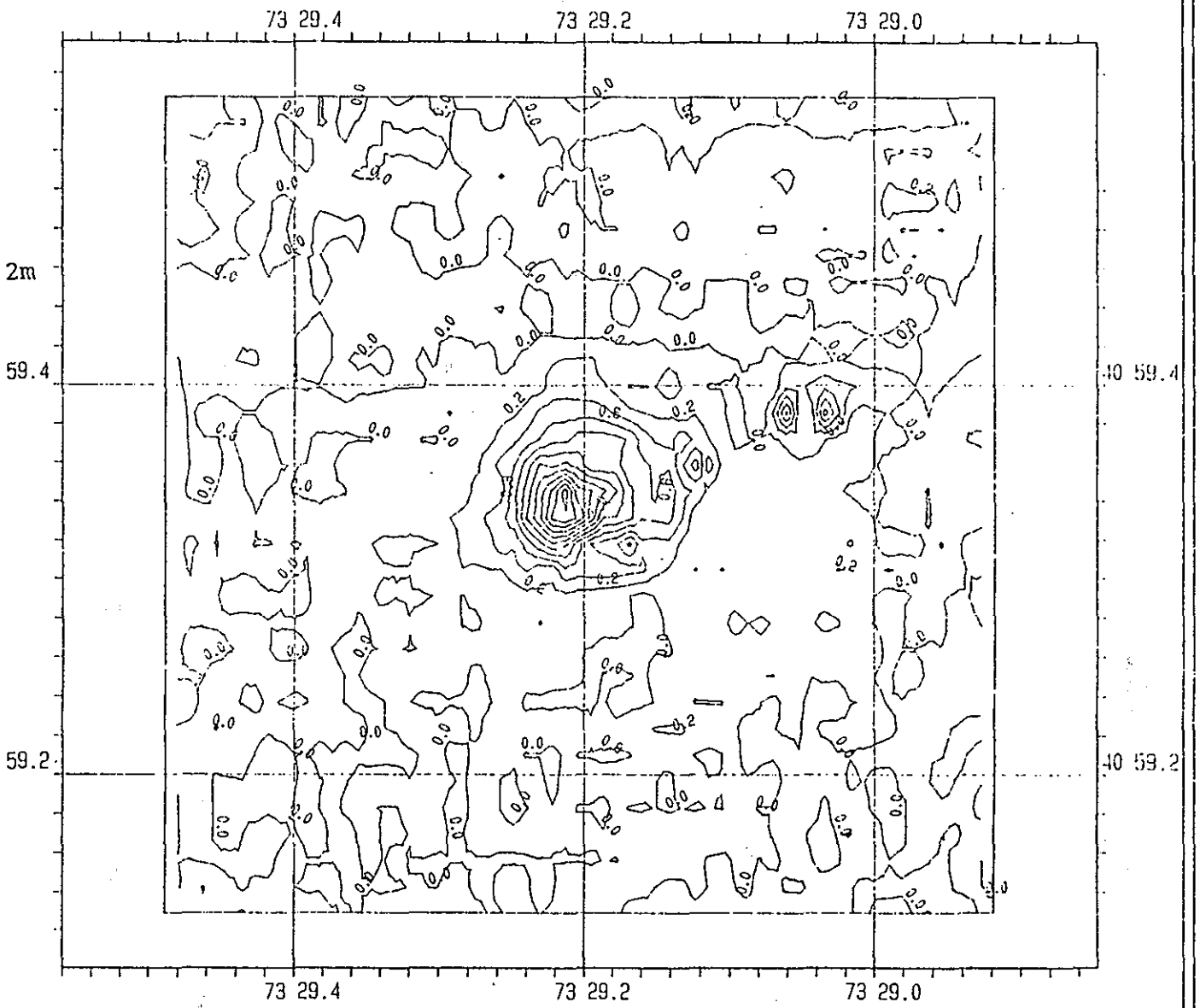
The sediment characteristics of the WLIS III site are compared to previous sediment data in Table 3.0-6. The January 1983 concentrations for most constituents are higher than those taken during the 1982 disposal operations (SAI Contribution #27);

WLIS III

Contour Difference
Aug 83 - Jan 83
Chart Scale: 1/4000
Contour Interval: 0.2m
Datum: MLW

Figure 2.0-6.

Preliminary



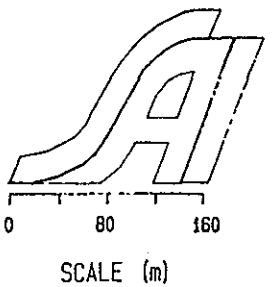


Table 3.0-1. Locations of Sediment Samples

WLIS III AUGUST 1983

SAMPLE#	DISPOSAL SITE	LOCATION	TYPE
3323	WLIS-III	WLIS-III-200W-A	GS
3324	WLIS-III	WLIS-III-200W-A	HM
3325	WLIS-III	WLIS-III-200W-B	HM
3326	WLIS-III	WLIS-III-200W-C	HM
3327	WLIS-III	WLIS-III-100W-A	GS
3328	WLIS-III	WLIS-III-100W-A	HM
3329	WLIS-III	WLIS-III-100W-B	HM
3330	WLIS-III	WLIS-III-100W-C	HM
3331	WLIS-III	WLIS-III-CTR-A	GS
3332	WLIS-III	WLIS-III-CTR-A	HM
3333	WLIS-III	WLIS-III-CTR-B	HM
3334	WLIS-III	WLIS-III-CTR-C	HM
3335	WLIS-III	WLIS-III-100E-A	GS
3336	WLIS-III	WLIS-III-100E-A	HM
3337	WLIS-III	WLIS-III-100E-B	HM
3338	WLIS-III	WLIS-III-100E-C	HM
3339	WLIS-III	WLIS-III-200E-A	GS
3340	WLIS-III	WLIS-III-200E-A	HM
3341	WLIS-III	WLIS-III-200E-B	HM
3342	WLIS-III	WLIS-III-200E-C	HM
3343	WLIS-III	WLIS-III-200N-A	GS
3344	WLIS-III	WLIS-III-200N-A	HM
3345	WLIS-III	WLIS-III-200N-B	HM
3346	WLIS-III	WLIS-III-200N-C	HM
3347	WLIS-III	WLIS-III-100N-A	GS
3348	WLIS-III	WLIS-III-100N-A	HM
3349	WLIS-III	WLIS-III-100N-B	HM
3350	WLIS-III	WLIS-III-100N-C	HM
3351	WLIS-III	WLIS-III-100S-A	GS
3352	WLIS-III	WLIS-III-100S-A	HM
3353	WLIS-III	WLIS-III-100S-B	HM
3354	WLIS-III	WLIS-III-100S-C	HM
3355	WLIS-III	WLIS-III-200S-A	GS
3356	WLIS-III	WLIS-III-200S-A	HM
3357	WLIS-III	WLIS-III-200S-B	HM
3358	WLIS-III	WLIS-III-200S-C	HM
3359	WLIS-REFERENCE	WLIS-REF-A	GS
3360	WLIS-REFERENCE	WLIS-REF-A	HM
3361	WLIS-REFERENCE	WLIS-REF-B	HM
3362	WLIS-REFERENCE	WLIS-REF-C	HM

GS = Grain Size Analysis HM = Heavy Metal Analysis

TABLE 3.0-2
CHEMICAL ANALYSIS
WLIS - III
WEST-EAST TRANSECT
JANUARY 1983

Location	Median Grain Size (mm)	% Volatiles NED	COD ppmx10^{-5}	Fe ppmx10^{-4}	Zn ppm	Cr ppm	Cu ppm	C:N
200W-A	.011	4.60	0.83	2.86	275	126	122	10.5
B		3.79	1.06	2.86	315	114	129	13.5
C		3.64	1.03	2.88	293	136	126	11.1
100W-A	.011	3.41	1.17	2.51	275	104	101	9.6
B		6.86	0.86	2.89	183	98	104	12.7
C		2.57	1.30	2.56	299	97	94	10.2
CTR-A	.010	6.09	0.54	1.96	218	83	110	14.1
B		6.86	0.86	2.89	183	98	95	12.7
C		5.32	0.76	2.97	214	86	92	11.5
100E-A	.013	5.47	1.51	2.79	116	50	24	10.9
B		6.54	1.40	1.96	184	67	69	9.9
C		7.05	0.78	2.61	300	86	82	8.7
200E-A	.006	6.62	0.94	2.66	410	99	98	10.0
B		7.48	0.88	2.66	210	111	94	10.2
C		3.36	0.86	2.68	267	115	102	10.5
REF-A	.006	6.58	0.74	2.83	168	58	37	11.4
B		6.13	0.71	2.69	367	24	27	13.4
C		4.50	0.91	0.84	146	45	19	11.3

TABLE 3.0-3
CHEMICAL ANALYSIS
WLIS - III
NORTH-SOUTH TRANSECT
JANUARY 1983

Location	Median Grain Size (mm)	% Volatiles NED	COD ppmx10^{-5}	Fe ppmx10^{-4}	Zn ppm	Cr ppm	Cu ppm	C:N
200N-A	.015	3.75	1.28	2.66	469	116	111	12.0
B		4.41	1.05	2.78	261	112	112	10.3
C		6.63	0.80	2.75	463	120	105	8.6
100N-A	.027	4.50	0.89	2.43	206	70	74	12.4
B		5.58	0.85	2.52	201	96	110	11.5
C		4.61	0.75	2.28	256	58	53	14.6
CTR-A	.010	6.09	0.54	1.96	218	83	110	14.1
B		6.86	0.86	2.89	183	98	95	12.7
C		5.32	0.76	2.97	218	86	92	11.5
100S-A	.010	5.50	0.90	2.57	445	96	106	12.7
B		2.97	0.77	2.70	269	102	102	11.0
C		4.11	1.06	2.34	462	89	91	10.2
200S-A	.011	5.46	0.92	2.93	289	142	129	9.4
B		5.35	0.94	2.78	272	127	116	9.6
C		4.67	0.94	2.88	323	132	121	9.4
REF-A	.008	6.58	0.74	2.83	168	58	37	11.4
B		6.13	0.71	2.69	367	24	27	13.4
C		4.50	0.91	0.84	146	45	19	11.3

TABLE 3.0-4
CHEMICAL ANALYSIS
WLIS - III
NORTH-SOUTH TRANSECT
AUGUST 1983

Location	Median Grain Size (mm)	% Vol. NED	COD ppmx10^{-5}	Fe ppmx10^{-4}	Zn ppm	Cr ppm	Cu ppm	Oil and Grease ppm	C:N
200N-A	.130	3.32	0.39	1.68	133	49	40	124	9.3
B		3.40	0.46	2.09	167	59	52	119	10.3
C		2.37	0.29	1.73	99	46	24	60	--
100N-A	.120	2.40	0.27	1.57	100	38	25	23	--
B		2.46	0.22	1.35	84	**	22	24	10.7
C		1.83	0.24	1.11	88	**	27	81	11.6
CTR-A	.095	2.12	0.34	1.39	72	37	23	35	9.2
B		1.51	0.27	1.19	69	29	24	48	--
C		1.56	0.17	1.27	73	34	24	65	13.1
100S-A	.025	4.28	0.41	1.92	171	56	115	280	11.2
B		3.83	0.49	2.12	166	65	57	190	11.3
C		4.66	0.45	2.09	175	69	57	299	11.4
200S-A	.009	7.02	0.81	2.18	216	88	89	518	9.1
B		7.28	0.70	2.04	216	86	89	310	9.1
C		6.87	0.75	2.53	249	95	102	306	9.2
REF-A	.006	4.27	0.54	2.50	107	46	29	73	8.8
B		3.89	0.56	2.74	136	46	33	72	11.5
C		3.19	0.51	2.61	95	**	21	60	12.2

TABLE 3.0-5
CHEMICAL ANALYSIS
WLIS - III
WEST-EAST TRANSECT
AUGUST 1983

Location	Median Grain Size (mm)	% Vol. NED	COD ppmx10^{-5}	Fe ppmx10^{-4}	Zn ppm	Cr ppm	Cu ppm	Oil and Grease ppm	C:N
200W-A	.030	3.87	0.54	1.81	142	55	54	255	11.3
B		3.52	0.46	1.93	166	61	65	289	10.5
C		3.20	0.43	1.96	169	62	66	149	11.6
100W-A	.170	2.51	0.35	1.77	134	46	35	38	--
B		1.61	0.27	1.24	82	30	20	52	--
C		1.60	0.35	1.33	82	31	30	1	--
CTR-A	.095	2.12	0.34	1.39	72	37	23	35	9.2
B		1.51	0.27	1.19	69	20	24	48	--
C		1.56	0.17	1.27	73	34	24	65	13.1
100E-A	.090	3.04	0.41	1.83	115	52	43	123	11.6
B		4.39	0.56	2.12	174	68	69	182	12.7
C		3.64	0.58	2.31	196	74	97	144	10.5
200E-A	.060	4.08	0.58	2.23	170	68	65	217	10.1
B		3.94	0.51	2.11	179	67	61	175	13.5
C		3.76	0.38	2.00	146	63	55	261	11.7
REF-A	.006	4.27	0.54	2.50	107	46	29	73	8.8
B		3.89	0.56	2.74	136	46	33	72	11.5
C		3.19	0.51	2.61	95	**	21	60	12.2

TABLE 3.0-6

Mean Concentration of Chemicals and Materials in Sediments Collected at the Center of the Western Long Island Sound III Disposal Site from January 1982 to August 1983. Values in Parts Per Million.

	COD	% Solids	HG	Pb	Zn	As	Cd	Cr	Cu	Mg	Ni	Ca	% Total Carbon	Oil & Grease
Pre-Disposal January 1982	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 August 1982	77,200	46.00	.56	76	162	6.3	4	39	76	8490	83	5970	2.49	313
January 1983	72,000	39.70	.45	59	205	5.4	*	89	99	7553	*	2773	2.66	790
August 1983	26,200	69.40	.13	17	71	4.8	*	33	23	--	*	--	1.36	49

however, the metal concentrations are still lower than those measured under baseline conditions. These results indicate no significant contamination as a result of the dredged material disposal. The lowest values measured to date were in the August 1983 survey, reflecting the presence of coarser, and probably cleaner, dredged sediments.

Sediment samples at this site were characterized by the presence of a coarse sand mixed with gray, possibly oxidized silt on the surface of each grab extending to a depth of 2-3cm. The sediment under this layer was dark gray to black and exhibited a strong sulphide odor. All samples showed signs of colonization with large numbers of juvenile Cancer, Pagurus and amphipod tubes. Also present in most samples were large amounts of broken shell material. These characterisitcs gradually thinned out until the sediment appeared essentially natural at a distance of 200 meters from the center in any direction.

4.0 DIVER OBSERVATIONS

Diver surveys were conducted in late August and September 1983 to assess conditions at the WLIS III disposal site. On 31 August, two dives were performed to observe sediment surface conditions and to survey and sample species types and abundances on a 50m easterly transect from the center of the disposal site and near the border of the dredge material. A southeasterly transect for 70m from a beginning position of 50m E of the center of the site was performed on 7 September.

The sediment condition at the center of the disposal site on 31 August was 1cm of flocculent natural silt over hard

gravel. At slack tide, there was no neffloid layer but the top layer of silt was easily disturbed by the diver's manual agitation. The gravel below the silt was highly compacted and not easily moved by hand. The only anthropogenic input observed was a 6-foot long iron pole protruding out of the sediment surface. The general sediment topography was flat and featureless, except for patchy areas where large Mercenaria mercenaria and Crassostrea virginica shells littered the surface. Because these shells are not native to this environment, it is thus assumed that they were transported along with the dredge material. Primary bioturbation activity appeared to be from decapods, noteably juvenile Cancer irroratus. At the center of the site, a diver operator epi-benthic sample was taken and Table 4.0-1 presents the species collected, showing a moderate mix of motile and sedentary epifauna.

Sediment conditions outside of the border of dredge material were equally flat and featureless unconsolidated silt, except that no hard gravel layer was detected below. Here too, bioturbation was evident as pock marks and tracks from ubiquitous community of decapods. Additionally, mud shrimp and lobsters were noted at this location.

At both sites, the comb jelly Mmemiopis leidyi, was observed throughout the entire water column. Table 4.0-2 summarizes all the visual biological observation made by the four divers, and additional notes on these two dives are shown in Tables 4.0-3 and 4.0-4. Photographic documentation of the conditions described above is provided in Figures 4.0-1 through 4.0-10.

Table 4.0-1. Summary of Diver Operated Epibenthic Sample Over Dredge Material at Center WLIS III, 31 August, 1983.

Species	Quantitative Abundance
Cnidaria	
hydroid sp.	1
Bivalvia	
Mulinia lateralis	13
Nucula proxima	1
Yoldia limatula	51
Gastropoda	
Nassarius trivittatus	850
Polychaeta	
polychaete sp.	2
Crustacea	
Cancer irroratus	7
Crangon septemspinosa (incl. 23 berried females)	290
Neomysis americana	9
Pagurus longicarpus	14
amphipod sp.	1

Table 4.0-2. Summary of Diver Visual Species Observations at Center and Edge of Dredge Material WLIS III, 31 August, 1983.

Species	Relative Abundance
Ctenophora	
Mnemiopsis leidyi	16/m^3 at bottom
Bivalvia	
Mercenaria mercenaria	1
Cephalopoda	
Loligo pealei	3
Crustacea	
Cancer irroratus (juv. 2 cm carapaces)	8/m^2
Crangon septemspinosa	ubiq.
Homarus americanus	2
Libinia emarginata	11
Pagurus longicarpus	12/m^2
Pisces	
Scopthalmus aquosus	4
Tautogolabrus adspersus	1

Table 4.0-3.

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

DATE: 31 Aug 83 LOCATION: WLIS III tCenter 50 m E

DIVERS: Buchholz/ Moffat TIME: 1219 1213.5 12.5 min. DEPTH: 112' $T^{o}C$: VISIBILITY: 5.6'

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

26830.7
43995.1 30 m E

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.

1/4 kt W, 5-6' visibility. 1 cm flocculent silt over hard gravel-type sand that was not easily dug by hand. No neffloid layer but silt was easily suspended. 1-2% shell hash incl. adult Mercenaria and Crussostrea shells on surface (dead). No change slope. Only anthropogenic input observed was a 6' long iron pole sticking out of the sediment at a 75° angle - 3 cm in diameter and encrusted w/hydroids. Bioturbation - juv. decapod tracks.

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.).

Mercenaria mercenaria - evidence of transport
Crangon - ubiq.
Windowpane flounder - (4) all 4-9" length
Libinia emarginata - (1) - 30 cm tip to tip legs
Cancer irroratus - juv. 2/1/4m^2 - 3 cm carapace
Pagurus longicarpus - 3/1/4m^2
Mnemiopsis leidyi - comb jelly - 2/0.25m^3 at bottom
(1) cunner - Tautogolabrus adspersus
(3) squid - Loligo pealei - 6-8 cm long

II. DISCRETE SAMPLES OR METHODS:

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

__X__ B. .25 m^2 quadrant count/photography. Nikonos 21 - 36

____ 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.)

Table 4.0-4.

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

DATE: 31 Aug 83 LOCATION: WLIS III Platform site

DIVERS: Miller, DeGoursey TIME: 1301 - 1311 DEPTH: 112' T°C: 21.7° VISIBILITY: 2 m

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

43976.1
26832.1

26830.7
43975.1

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.

Flat, featureless, soft unconsolidated sediment. No spoil material evident. Visibility 2 meters. Few particulates. Nmemiopsis abundant through entire water column. Pole marks and tracings. Ubiquitous due to Cancer irroratus and Pagurus longicarpus. Burrows of mud shrimp ~1/5m². No clay clumps, no evidence of spoil.

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.).

Juvenile Cancer irroratus < 3 cm carapace length were ubiquitous, estimate 1/m². Both Cancer and P. longicarpus responsible for high level of mechanical disturbance of upper sediment layers. Adult C. irroratus >10 cm c L (~15 individuals). Libinia emarginata (adults) ~10 and Homarus am. were observed on and under experimental platform.

II. DISCRETE SAMPLES OR METHODS:

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

X B. .25 m² quadrant count/photography. 1 - 7

____ 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.)

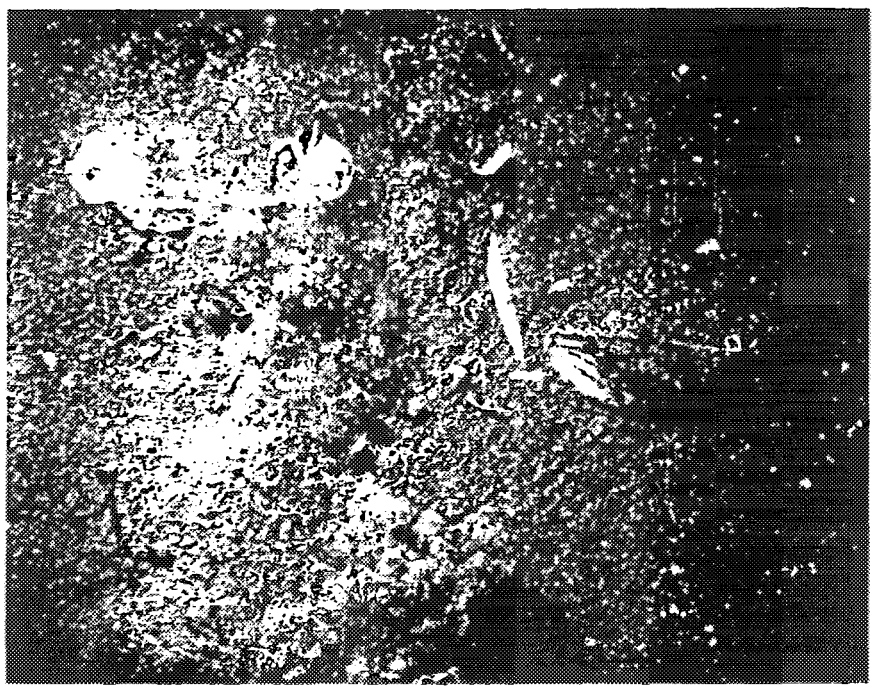


Figure 4.0-1. WLIS III, 31 August 1983 - Post disposal 3 cm Cancer irroratus tracking over dredge material containing large Mercenaria mercenaria.

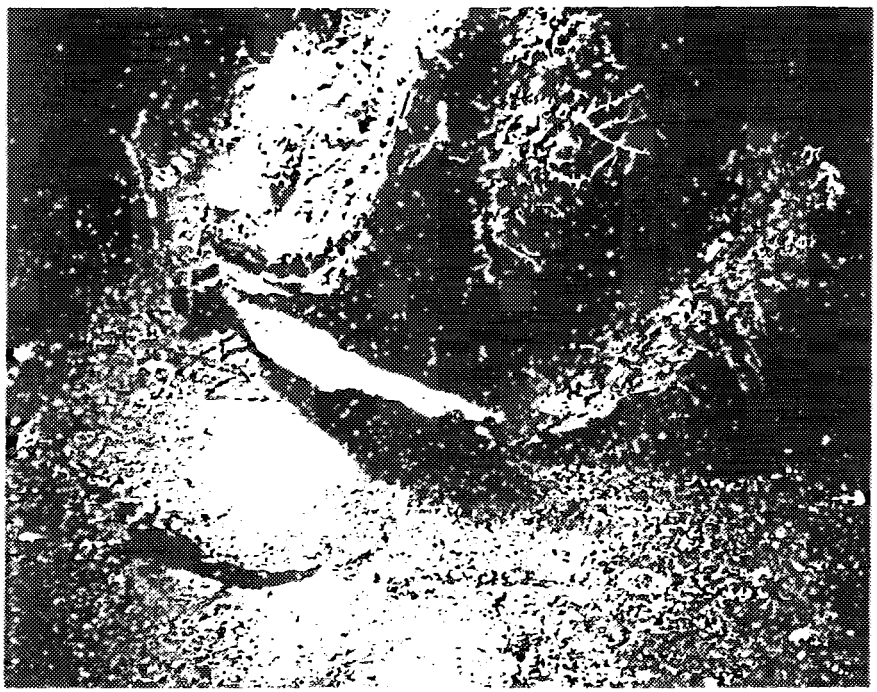


Figure 4.0-2. WLIS III, 31 August 1983 - Post disposal Sedimentation and epiphytic fouling by a bryozoan colony on oyster shells that had been transported with the dredge material.

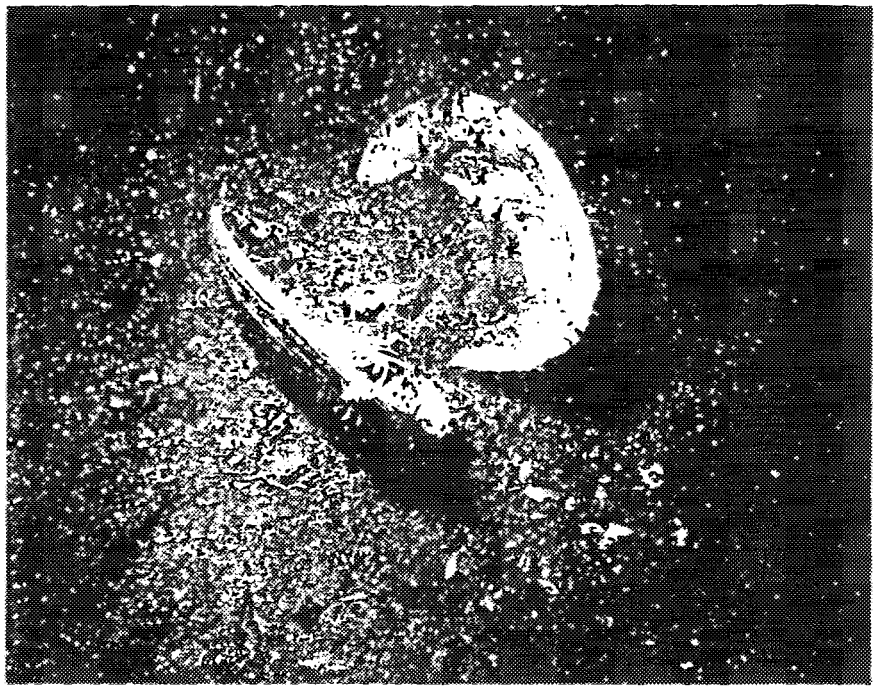


Figure 4.0-3. WLIS III, 31 August 1983 - Post disposal Mercenaria mercenaria shells on the sediment surface near the middle of the site - evidence of transport with dredge material.

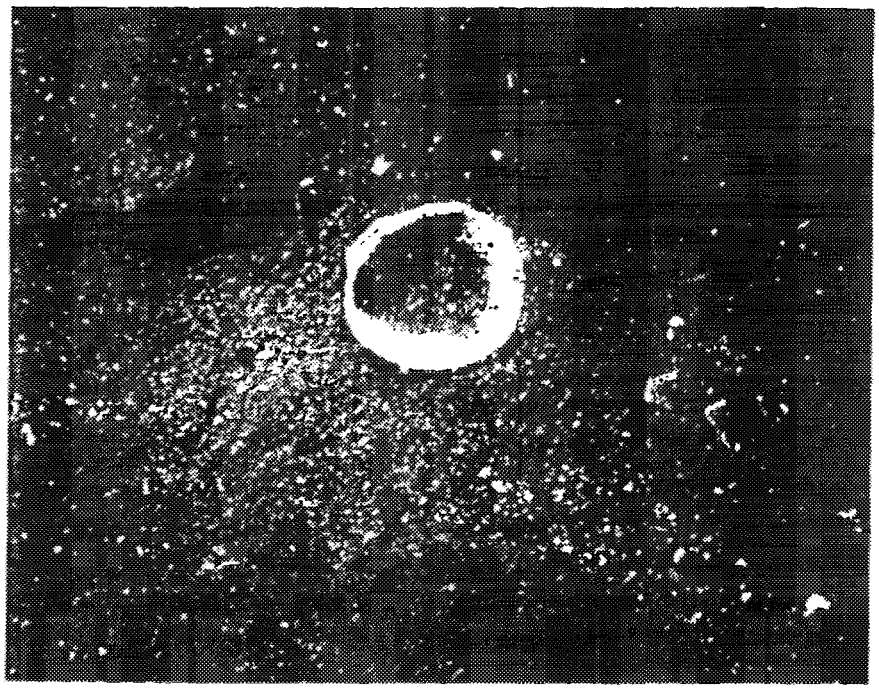


Figure 4.0-4. WLIS III, 31 August 1983 - Post disposal
A cockle shell on the sediment surface.

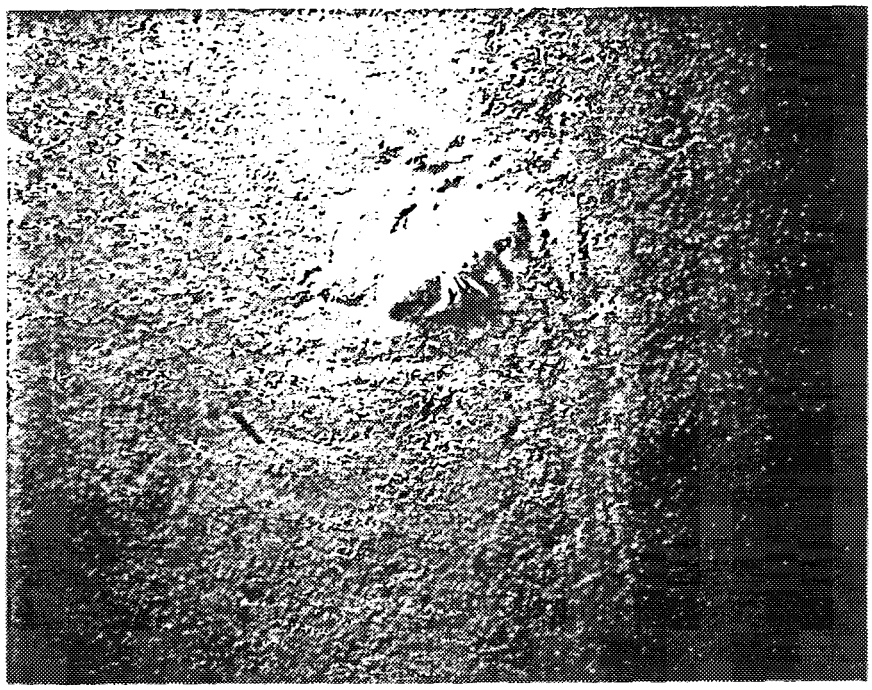


Figure 4.0-5. WLIS III, 31 August 1983 - Post disposal
Two Pagurus longicarpus hermit crabs interacting - possibly displaying reproductive or territorial behavior.

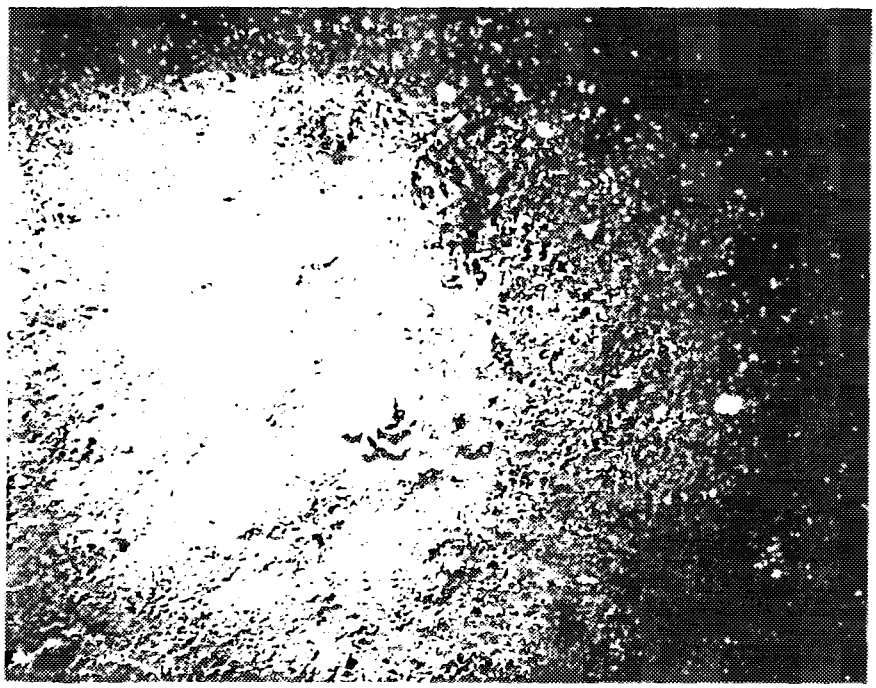


Figure 4.0-6. WLIS III, 31 August 1983 - Post disposal Pagurus longicarpus, hermit crabs tracking over oxidized dredge material.

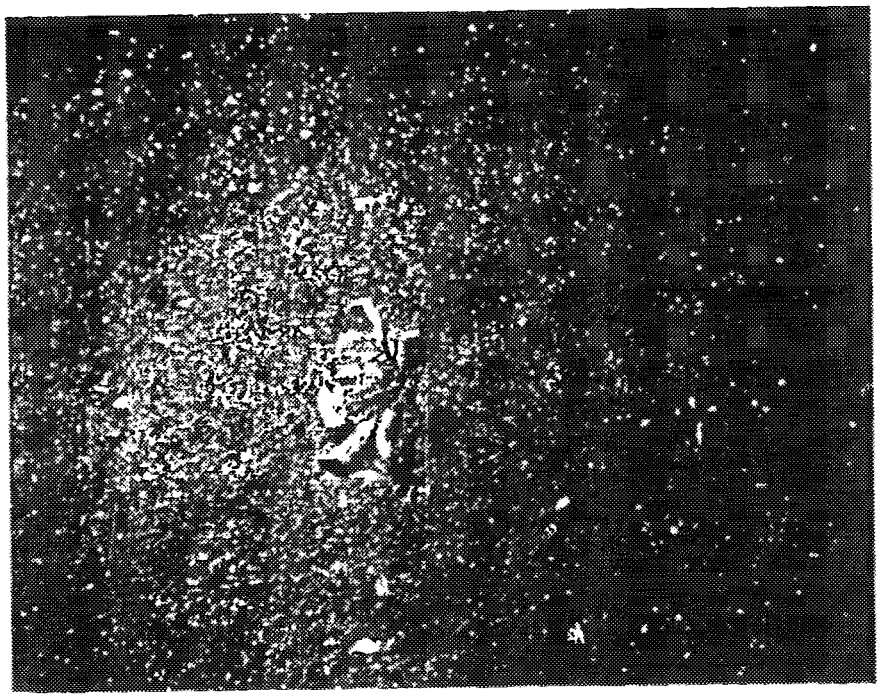


Figure 4.0-7. WLIS III, 31 August 1983 - Post disposal
A small, 3 cm, Cancer irroratus tracking across the sediment surface near the middle of the disposal site.

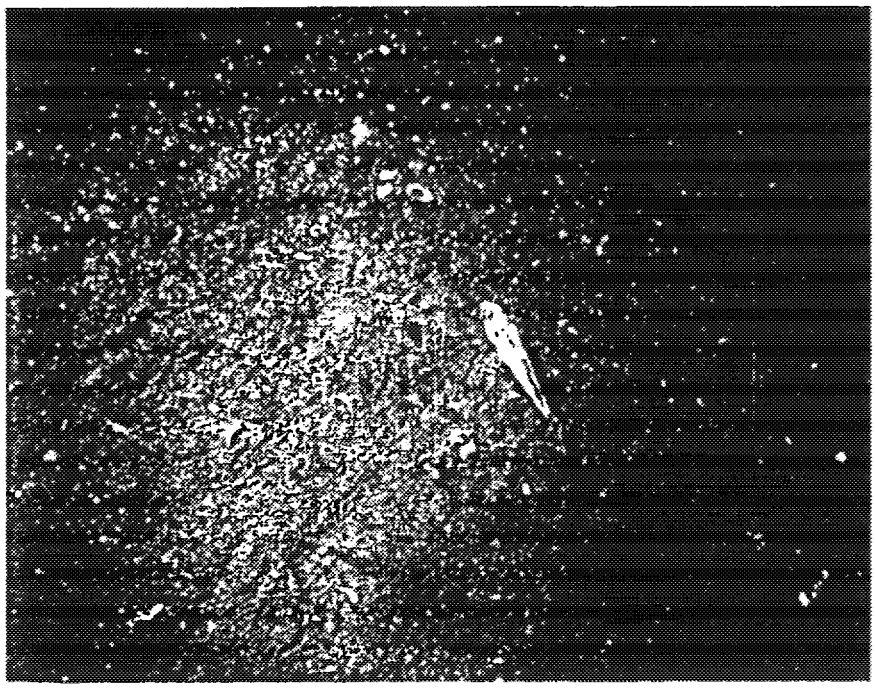


Figure 4.0-8. WLIS III, 31 August 1983 - Post disposal Tautogolabrus adspersus resting on the sediment surface.

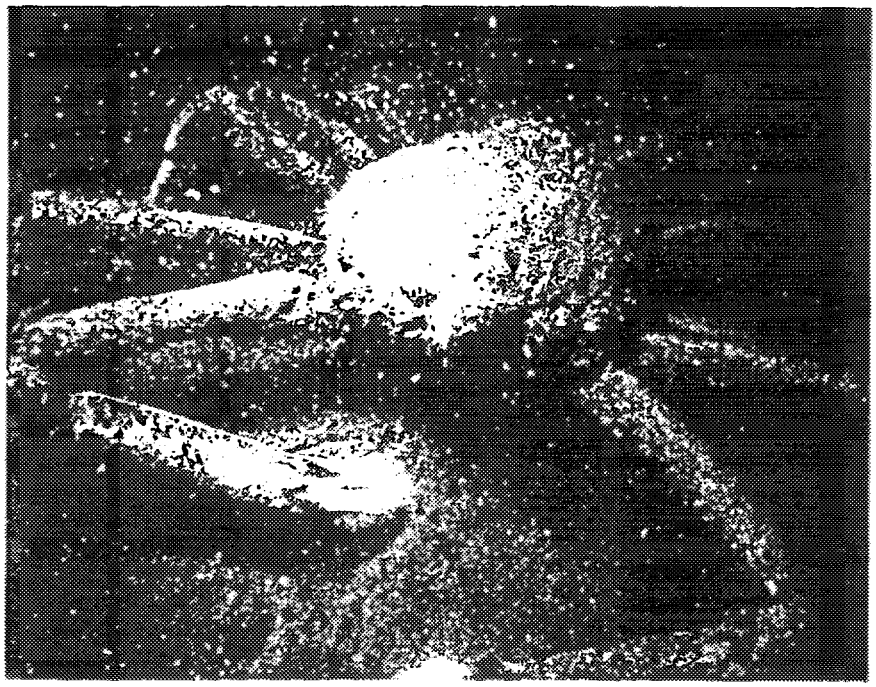


Figure 4.0-9. WLIS III, 31 August 1983 - Post disposal
A large, 30 cm tip to tip, Libinia emarginata spider crab foraging at the center of the disposal site.

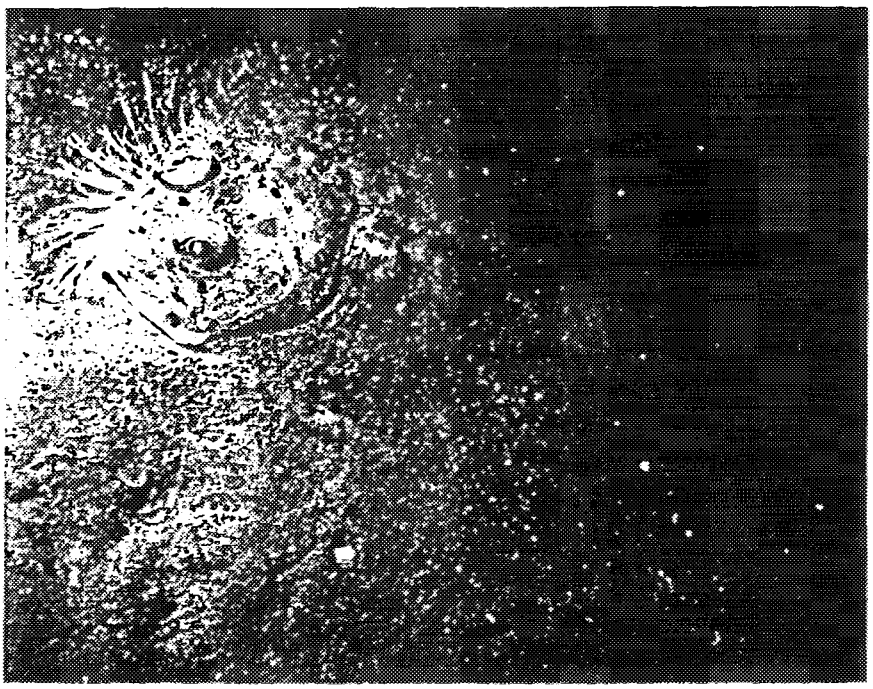


Figure 4.0-10. WLIS III, 31 August 1983 - Post disposal *Scopthalmus aquosus* on the sediment surface.

On 7 September, the general sediment condition at the 50m east site was hard packed sand with a 0.2 - 1cm flocculant overlay. Ten percent of the total substrate was covered with dense shell fragments, being primarily from Mercenaria mercenaria, Crassostrea virginica and Mytilus edulis. Anthropogenic debris near the 50m E of center site included scraps of metal and wood, rubber band type packing material, tin cans and broken glass. The topography was a gentle slope downward from the 105' depth at the beginning of the dive to 120' at the perimeter of the dredge material. At the border of the pile, several large planks and pilings were found and numerous lobster burrows were observed alongside. Outside of the dredge material border, there was a 5cm layer of soft surface sediment where small bivalve venting was observed.

Bioturbation was only observed outside of the dredge material in the form of burrows and bivalve venting. Both on and off the mound, there were numerous species of motile epifauna. Additional notes are provided in Table 4.0-5.

A hand held diver epibenthic sample was taken halfway through the transect and a summary of the species obtained are presented in Table 4.0-6, and the visual observations are summarized in Table 4.0-7.

Table 4.0-5.

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

DATE: 7 Sep 83 LOCATION: WLIS III 50 m East of Center - transect SE

DIVERS: Stewart/ Buchholz TIME: 1207-1223 DEPTH: 105-120 T°C: VISIBILITY: 1.5'

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

In: 26832.3/43972.4 Buoy deployed at Loran C coordinates for diver decent

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.

See attached page

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.).

See attached page

II. DISCRETE SAMPLES OR METHODS:

X A. Epibenthic net (30 sec. traverse): at border of on or off spoil, target species.

X B. .25 m^2 quadrant count/photography. 2 frames, strobe malfunctioning

____ 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.

X G. Video tape (location, time min. run, tape index).. - see attached page

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

Table 4.0-5. (cont.)

Addendum - D.A.M.O.S. Diver Monitoring Log for WLIS III Dredge Disposal Site, 7 September 1983

I. OBSERVATIONS:

A. BENTHIC CONDITIONS (PHYSICAL)

0 velocity current, slack high tide. On spoil 50 m E of center at 105' depth. Sediment was hard packed sand with silt veneer, numerous bivalve shells (clams, oysters, etc.) and crab carapace comprised surface substrate - up to 100% cover in some areas. Anthropogenic material sighted: bottles, cans, scraps of metal, wood and rubber band packing material. Same 70 m SE from drop point and encountered spoil border at 120'. The natural sediment was very soft at upper 5 cm. On return to the south edge of the spoil border, several planks and pilings were observed w/burrow excavations.

During the epibenthic sampling, encountered a 15' wide area of 3 - 10 cm cobble, planks of wood and large oysters - this must have markedly reduced trawl efficiency.

At the spoil border and upon the apron over natural sediment a distinct decrease ($\sim$ 50%) in epibenthic fauna occurred. Crab tracks were observed across the SE border region. On soft natural sediment, infaunal venting was evident (apparently Yoldia siphon discharge) on diver passage.

B. (BIOLOGICAL)

Pagurus longicarpus ($\sim 8/m^2$)
Cancer irroratus (100$^+$ @ $\sim 14/m^2$) 80% juveniles, < 3 cm carapace width
Scopthalmus aquosus (17) < 5 cm to adult 30 cm range
Crangon septemspinosa (10$^+$)
Homarus americanus (2)
Mnemiopsis leidyi (ubiq. in water column)
Cyanea capillata (ubiq. in water column)
Libinia emarginata (4)
Pseudopleuronectes americanus (3)
Yoldia sp. (ubiq. at spoil border)
Pagurus pollicaris 3

II. DISCRETE SAMPLES OR METHODS:

G. Video tape - attempted, but turbidity (1 ft. visibility) precluded good recording. Video sled snagged a "ghost pot" trawl (5$^+$ abandoned/lost lobster traps). Four legal size lobsters were in one pot. R/V UCONN could not haul the combined weight of the tangled trawl and the videa sled, therefore the traps were cut free.

Table 4.0-6. - Summary of Diver Operated Epibenthic Sample over Dredge Material ESE of Center, WLIS III Dredge Disposal Site. 7 September 1983.

Species	Quantitative Abundance
Gastropoda	
Nassarius trivittatus	135
Bivalvia	
Mercenaria mercenaria	1
Modiolus modiolus	1
Yoldia limatula	7
Crustacea	
Cancer irroratus	10
Crangon septemspinosa	203
Pagurus longicarpus	29
Pagurus sp.	1
Neomysis americana	15
amphipoda sp.	5

Table 4.0-7. Summary of Diver Visual Species Observations during SE Transect Across Spoil Material Border. WLIS III Dredge Disposal Site. 7 September 1983

Species	Relative Abundance
Cnidaria	
Cyanea capillata	ubiq. in water column
Ctenophora	
Mnemiopsis leidyi	ubiq. in water column
Bivalvia	
Yoldia sp. (venting of siphons only)	ubiq. at dredge spoil border
Crustacea	
Cancer irroratus (80% juv. 2/ 3 cm carapaces)	100^{+} @ $14/m^{+}$
Crangon septemspinosa	10^{+}
Homarus americanus	2
Libinia emarginata	4
Pagurus longicarpus	$8/m^{2}$
Pagurus pollicaris	3
Pisces	
Pseudopleuronectes americanus	3
Scopthalmus aquosus	17

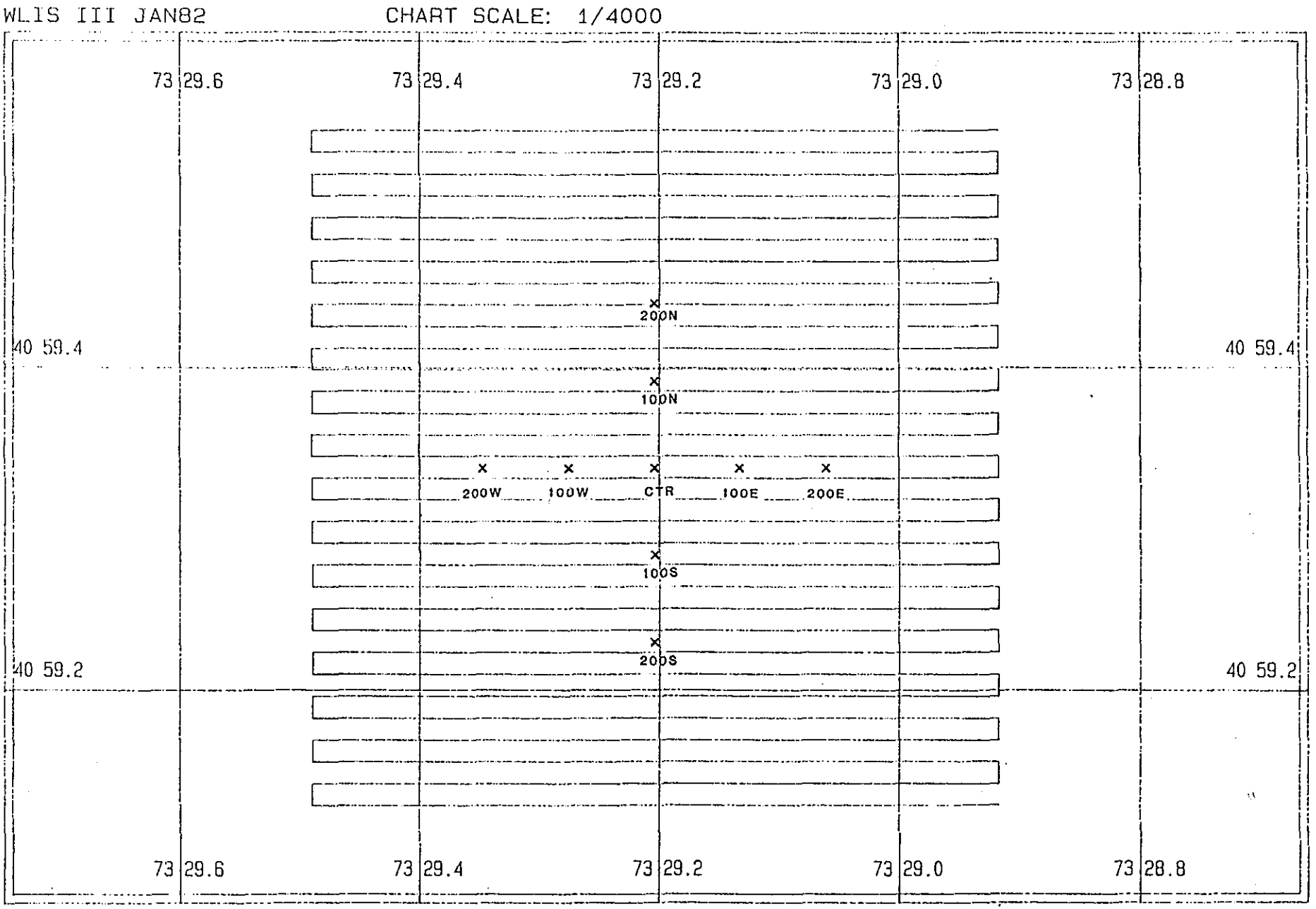
5.0 REMOTS CAMERA ANALYSIS

On January 19 and 20, 1983, a REMOTS benthic survey was made of the Western Long Island Sound (WLIS) disposal site. The results of this winter survey allowed us to characterize the site by a mean habitat index. The purpose of the August REMOTS survey was to determine the successional status and habitat index for the summer period and to compare these results to data from the winter survey.

REMOTS measurements were made using the navigational control system to establish stations on a grid over the disposal site and three replicate observations were made at each of 10 stations (Figure 5.0-1). Measurements of boundary roughness, camera prism penetration depth, and the positive redox area in the sediment, as seen in profile, were taken from the black and white negatives. These measurements were accomplished with the Measuronics LMS ^{tm} Image Analysis System. Negatives were used instead of positive prints in order to avoid changes in image density that can accompany printing a positive image. The image analysis system is capable of detecting 256 grey scale values while density slicing an image. Data on grain-size estimates, evidence of surface erosion, and faunal information were determined from 8 x 10 inch positive prints. At this magnification, the resulting print is 1.5 times real scale.

The range of grain-size (exclusive of shells and shell fragments) is estimated from the photographs by overlaying a grain-size comparator which is of the same scale. The comparator was prepared by photographing a series of Udden-Wentworth size classes through the profile camera (equal to or less than coarse

Figure 5.0-1. REMOTS and Sediment Sample Locations



silt up to granule and larger sizes). Seven grain-size classes are on this comparator. The lower limit of optical resolution of the photographic system is about 62 microns, allowing recognition of grain sizes equal to, or greater than, coarse silt. The accuracy of this method has been documented by comparing our REMOTS estimates with grain-size statistics determined from laboratory sieve analysis.

The boundary roughness values represent the maximum topographic relief measured over the width of the optical window of the profile camera which is fixed at 12.75 cm.

If there is oxygen in the overlying water column, the near surface natural sediment will have a high reflectance value relative to anoxic sediment underlying it. This is because the oxidized surface sediment contains ferric hydroxide (an olive color when associated with organic particles), while the hydrogen sulphide sediments below this oxygenated layer are grey to black. Although the high reflectance value of the surface layer is talked about in this report as the "oxidized layer", some sulphate reduction can take place in micro-anaerobic environments (interiors of fecal pellets or diatom frustules) within this ferric hydroxide zone. The boundary between light colored ferric hydroxide surface sediment and underlying grey to black sediment is called the redox potential discontinuity (RPD). In areas where dredged material is present, this oxidized layer is covered with reduced sediment and the thickness of dredged material can be readily measured.

The areas of positive (aerobic) and negative (anoxic) RPD are determined with the Measuronics LMS System by

density-slicing reflectance values. The area of the oxidized layer can then be divided by 12.75 (the prism window width) to obtain a mean depth for the RPD. In the absence of a bioturbating fauna, the RPD depth is less than 0.5 cm thick in organic-rich muds, while mature bottom sediments have RPD depths greater than 3 cm. A seasonal change in the RPD depth has been observed related to temperature effects on bioturbation rates; however, this is quite small. The RPD depth is given special attention in photograph analysis as it is a sensitive indicator of the presence of dredged material, within station patchiness, bioturbation activity, and deposition/erosion environments.

In order to efficiently characterize conditions at a given station within the disposal site, a multi-parameter habitat index has been constructed to quantify habitat quality. Habitat quality is defined relative to two end-member standards. The lowest value is given to those bottoms which have low, or no dissolved oxygen in the overlying water, no apparent macrofaunal life, and methane gas present within the sediment (Rhoads and Germano, 1982). The habitat index for such a condition is minus 10. At the other end of the scale, an aerobic bottom with a deeply depressed RPD, evidence of a mature macrofaunal assemblage, and no apparent methane gas bubbles at depth will have a habitat index of plus 11. The habitat index is arrived at by summing the subset indices presented in Table 5.0-1.

Sediment texture ranged from silt-clay (21 replicates) to very fine sand (6 replicates) (Fig. 5.0-2). This grain-size distribution is the same as described for the WLIS site in January 1983. The modal boundary roughness value is 1.2cm (Fig.

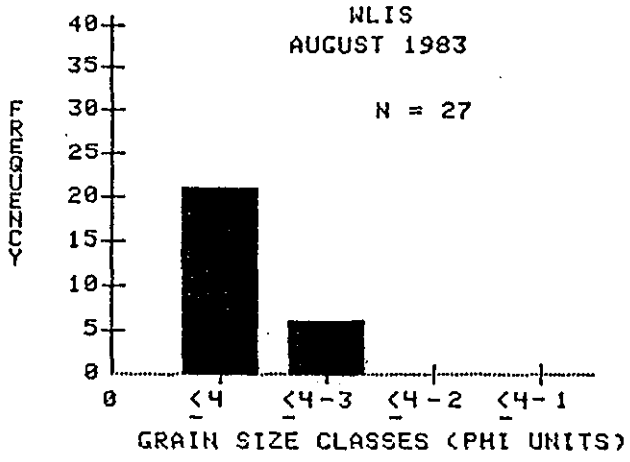


Figure 5.0-2. Frequency distribution of grain size classes at WLIS III. Size class ranges in phi units on x axis; sample size indicated on each histogram.

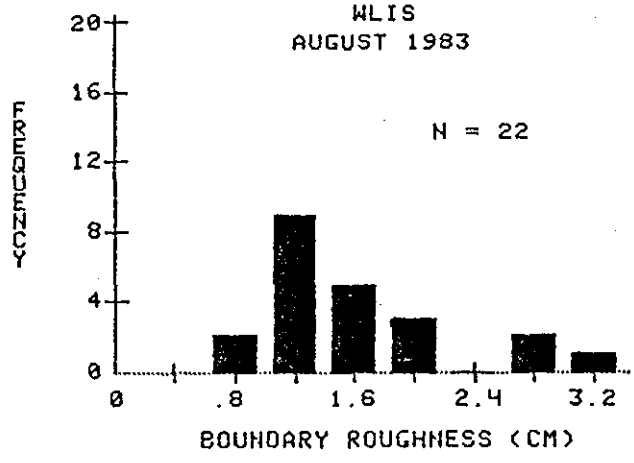


Figure 5.0-3. Frequency distribution of surface boundary roughness values at WLIS III, sample sizes indicated on each histogram.

5.0-3). this represents an increase in the modal roughness of 4mm since the January survey. Most of the small scale roughness, 1cm, appears to be related to either surface erosion or the presence of mud clasts at the sediment-water interface.

The major modal redox depth for this site falls within the 2.1-3.0 cm class (Fig. 5.0-4). This represents a significant improvement over the modal value recorded for this site in January 1983 (0 to 1cm). The mean RPD depth for the CLIS-REF station in August 1983 was 4cm, while the mean RPD depth for the WLIS-Ref site was 2.2cm.

Successional stages are mapped in Figure 5.0-7 as well as habitat indices for each station replicate (n=3). Figure 5.0-6 gives the habitat-index frequency distribution for the WLIS site. Within station variation is high suggesting local patchiness in faunal colonization on a very small scale. Stations 200N, 100N, 200W, 100E, 100S, and 200S all have values equal to, or greater than, the WLIS-REF station (i.e. successional stage=III or I-III; habitat indices=10,6,6,7 with a mean of 7.25). Only six station replicates have values below the reference station (Fig. 5.0-6). The January 1983 WLIS habitat indices ranged from -3 to +5 with a mean of 0.60 (n=15). The August values represent a marked improvement. This rate of change is unprecedented in our experience with patterns of faunal recovery in Long Island Sound. For example, the FVP site experienced a change in habitat indices from +3 to +5 over a period of three months. The change in habitat values at the WLIS site over a period of 8 months ranged from no change to +14 habitat index units. The very large rate of change of habitat

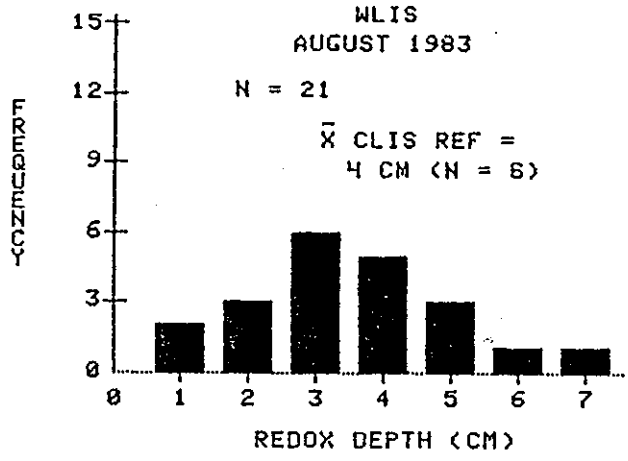


Figure 5.0-4. Frequency distribution of mean redox depth at the WLIS III; sample sizes indicated on each histogram, also shown is the mean value for the CLIS REF station.

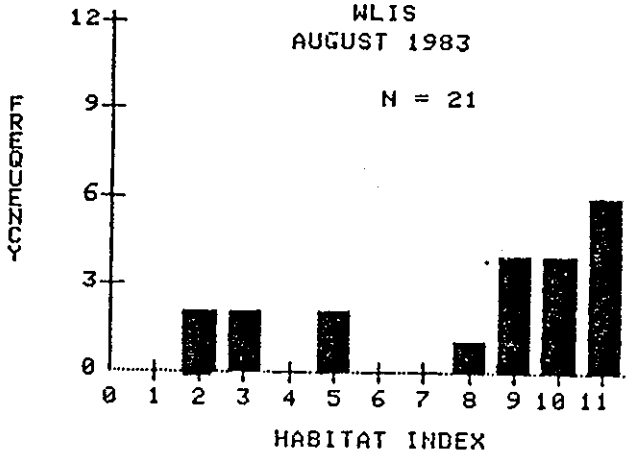


Figure 5.0-5. Frequency distributions for habitat index values at WLIS III; sample sizes indicated on each histogram.

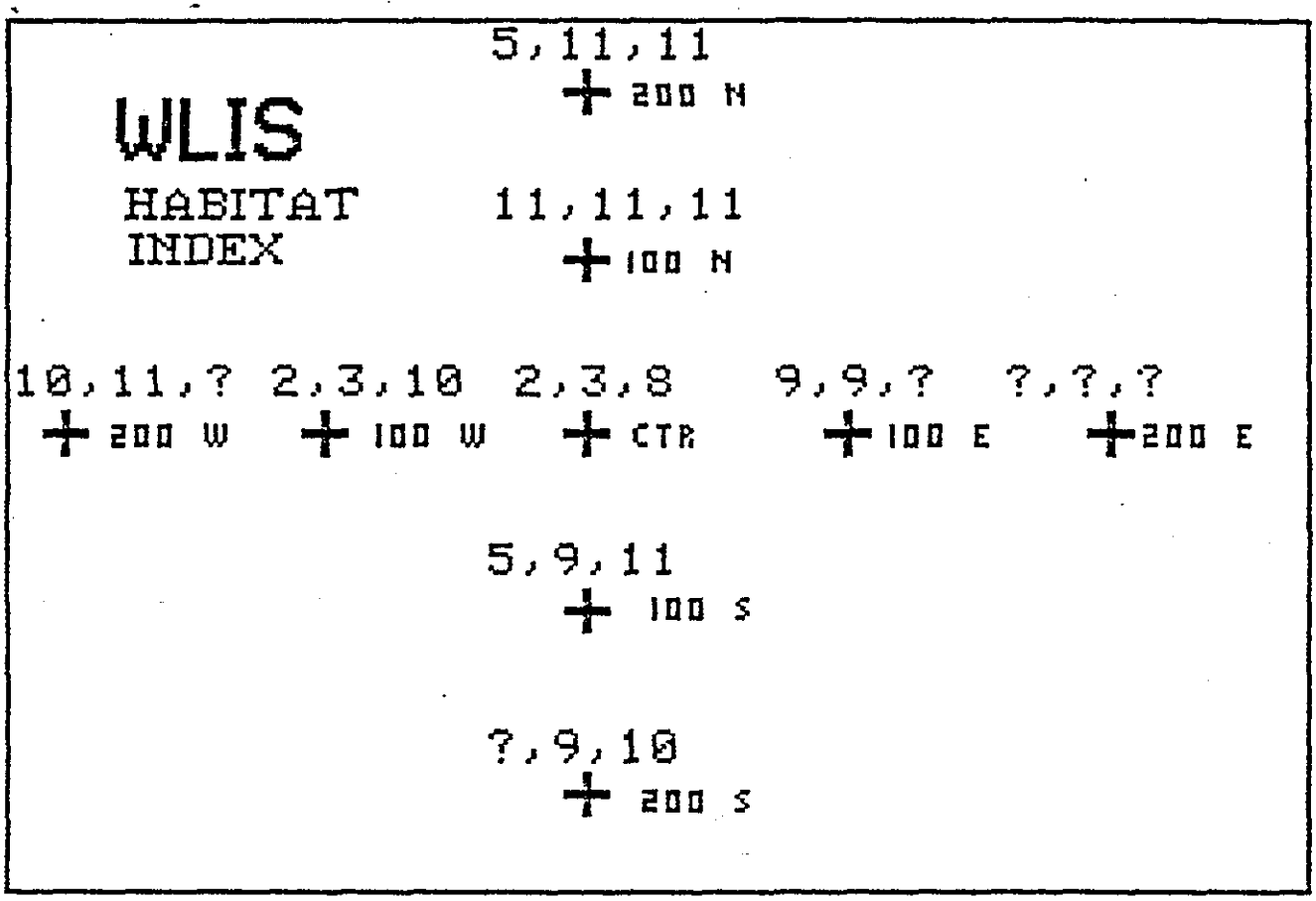
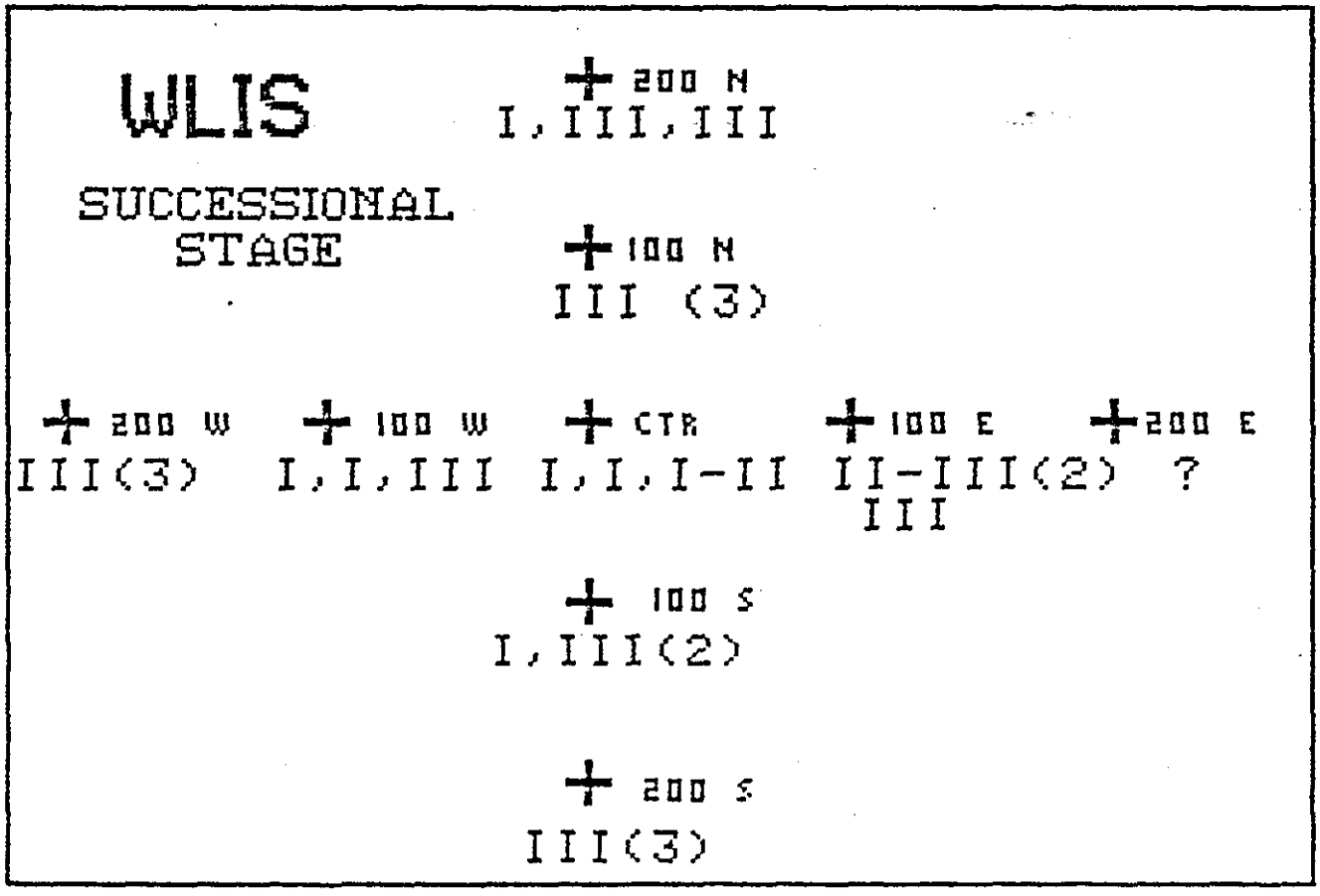


Figure 5.0-6. Habitat index and successional stage values for each replicate at the WLIS site; numbers in parentheses indicate number of replicates with the same value.



indices from -3 to +11 (eg. sta 100N) over the 8 month period has never been observed before.

6.0 SUMMARY

The post-disposal bathymetric survey in August 1983, shows that the December 1982 through March 1983 disposal operation successfully deposited approximately 41,000 cubic meters of dredged material at the Western Long Island Sound III disposal site. The degree of possible contamination from the disposal operations appears non-existent. Visual observations of the sediment surface and in-situ diver observations indicate that the surface layers of the disposal mound have become oxidized and are being colonized by some infauna and juvenile crabs. REMOTS data show that the grain size distribution has not changed since the January survey which occurred just after the beginning of the disposal operation. The mean redox depth has rebounded from 0-1cm in January to between 3-4cm in August. The mean habitat index shows a marked improvement over the January values. Faunal colonization at the site appears to be quite good.