

Reports

1972

**Study of channel sediments, Baltimore Harbor, Norfolk Harbor,
York entrance channel**

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STUDY
OF
CHANNEL SEDIMENTS
BALTIMORE HARBOR
NORFOLK HARBOR
YORK ENTRANCE CHANNEL

DECEMBER 1972

Project Report under Contract No. DACW 65-72-C-0047 submitted to
the United States Army Corps of Engineers by the Virginia Institute
of Marine Science.

Table of Contents

	Page
Areas of Study	1
Analytical Methods	1
Sample Designation Key	3
Surface Samples: Raw Data	4
Surface Samples: Figures	10
Long Core Subsamples: Raw Data	22
Key to Interpreting Figures	29
Long Core Subsamples: Figures	30
Discussion of Results	93
Samples having one or more parameter exceeding EPA guidelines	95
Comparison of mean surface concentrations with EPA guidelines	96
Comparison of mean long core concentrations with EPA guidelines	97
Appendix I Sample Location Keys:	
Channel to Newport News	98
Norfolk Harbor Channel	99
Thimble Shoal Channel	100
York Entrance Channel	101
Baltimore Harbor and Channels:	102
Cape Henry Channel	
York Spit Channel	
Rappahannock Shoal Channel	

STUDY OF CHANNEL SEDIMENTS
CORPS OF ENGINEERS: SUMMER 1972

Bottom sediment samples were collected from seven channel locations in the Chesapeake Bay and communicating river systems. The sampling format involved long cores (designated "L") taken at two nautical mile intervals and surface samples (designated "S") taken at one-half mile intervals. Exact sampling sites were specified by the Corps of Engineers. Long cores were collected using a hydraulic vibrating corer leased from Ocean Science and Engineering Corp., Rockville, Md. Collection of surface samples utilized a Ponar grab or a three-foot gravity corer. Surface samples were iced in the field, returned to the laboratory where they were sieved through a 2 mm screen, homogenized, and refrigerated. Long cores were returned to the laboratory and stored in a "cold room." Four inch subsamples were cut from the cores, sieved through a 2 mm screen, homogenized and refrigerated.

The following areas were included in the study:

Thimble Shoals Channel
Newport News Channel
Norfolk Harbor Channel
Rappahannock Shoals Channel
Cape Henry Channel
York Spit Channel
York Entrance Channel

Parameters Studied and Methods Used:

	Symbol
Total Solids ¹	TS
Volatile Solids ¹	VS
Chemical Oxygen Demand ¹	COD
Total Kjeldahl Nitrogen ¹	TKN
Total Phosphorus ²	TP
Zinc ³	Zn

Copper³

Cu

Lead³

Pb

Mercury⁴

Hg

1. Determinations of % Total Solids, % Volatile Solids, % Chemical Oxygen Demand, and Total Kjeldahl Nitrogen were made as prescribed in "Chemistry Laboratory Manual, Bottom Sediments," compiled by The Great Lakes Regional Committee on Analytical Methods, EPA (1969).

2. Total Phosphorus determinations were made using a VIMS modification of the procedure described in "Standard Methods for the Examination of Water and Wastewater," 13 ed. (1971). One-half gram samples were fumed with sulfuric and nitric acids. Digested sediments were removed by filtration and diluted filtrates were analyzed colorimetrically. Duplicate analysis showed that this method compared favorably with the EPA technique for sediment analysis, but consumed much less time per sample.

3. Zinc, Copper and Lead were determined by digesting one-half gram sediment samples in concentrated nitric acid for 24 hours and were analyzed by atomic absorption spectrophotometry (Varian Techtron, Md1 AA-5).

4. Mercury determinations were made by wet digestion and flameless atomic absorption spectrophotometry. One-half gram samples were digested in 10.0 ml concentrated sulfuric acid for 24 hours followed by oxidation with 20.0 ml 5.0% KMnO_4 , reduction with hydroxylamine and stannous sulfate, and analyzed using a Coleman Mercury Analyzer, MAS 50.

All weights reported in techniques of analysis are wet weights. Final results have been corrected for % Total Solids and represent dry-weight concentrations.

Sample Designation Key

<u>Sample Designation</u>		
Area	Surface Core/Grab	Long Core
Thimble Shoals Channel	TSS	TSL
Newport News Channel	NNS	NNL
Norfolk Harbor Channel	(1)	E40L, E45L
Rappahannock Shoals Channel	RSS	RSL
Cape Henry Channel	CHS	CHL
York Spit Channel	YSS	YSL
York Entrance Channel	YES	YEL

(1) No surface samples collected from Norfolk Harbor. Data for this area is reported in Corps of Engineers Contract No. DACW-65-71-C-0047.

All surface samples are numbered consecutively in a given area and correspond to identification on the enclosed charts.

Long cores are numbered consecutively in a given area. In addition, long core subsamples are identified according to the core they came from and the distance (in feet) of that sample below mean low water (MLW).

THIMBLE SHOALS - SURFACE

Series	TS %	VS %	COD %	TP ppm	TSS ppm	Zn ppm	Cu ppm	Pb ppm	Hg ppm
TSS-1	81.7	.52	0	62	60	3.92	T	21.37	.11
TSS-2	81.0	1.27	.40	311	157	7.55	T	T	.22
TSS-3	75.1	1.56	.52	439	266	17.60	9.15	24.63	.13
TSS-4	74.8	1.34	.46	379	186	14.71	8.35	26.07	.14
TSS-5	77.5	1.15	.20	299	123	8.45	5.63	13.61	.12
TSS-6	69.7	2.55	1.38	441	534	28.59	7.62	20.97	.11
TSS-7	82.1	1.25	.14	60	59	2.70	4.80	17.38	.12
TSS-8	59.2	5.99	1.49	444	819	14.91	4.74	23.73	.25
TSS-9	74.2	1.03	.21	258	150	3.50	T	T	.20
TSS-10	51.2	4.42	2.96	500	1275	42.38	8.65	19.89	.27
TSS-11	72.3	1.14	.40	397	245	12.36	6.41	15.11	.11
TSS-12	69.7	1.86	1.15	371	509	21.08	3.40	26.52	.31
TSS-13	54.7	4.27	2.63	460	1036	41.13	10.97	26.51	.26
TSS-14	63.0	2.21	1.71	431	710	14.05	6.32	10.73	.15
TSS-15	71.3	1.27	.72	387	491	9.41	4.92	11.39	.17
Mean	70.5	2.12	.96	349	441	16.16	5.50	17.26	.18
Std.Dev.	9.6	1.56	.91	134	375	12.48	3.25	8.62	.07

T = trace

NEWPORT NEWS - SURFACE

Series	TS %	VS %	COD %	TP ppm	TKN ppm	Zn ppm	Cu ppm	Pb ppm	Hg ppm
NNS-1	63.7	3.79	3.15	547	844	50.9	12.1	31.5	.11
NNS-2	45.5	5.76	4.28	497	410	119.3	17.5	47.9	.22
NNS-3	70.4	2.79	2.72	328	585	47.2	7.6	28.2	.12
NNS-4	70.4	1.45	2.04	360	424	30.5	3.5	18.3	.14
NNS-5	61.8	3.48	4.43	532	1004	45.1	13.5	30.1	.19
NNS-6	70.6	2.02	1.40	552	334	24.1	15.4	43.4	.45
Mean	63.7	3.21	3.00	469	600	52.85	11.60	33.23	.21
Std.Dev.	9.7	1.52	1.20	99	269	34.17	5.19	10.77	.13

RAPPAHANNOCK SHOALS - SURFACE

Series	TS %	VS %	COD %	TP ppm	TKN ppm	Zn ppm	Cu ppm	Pb ppm	Hg ppm
RRS-1	50.5	6.05	5.87	675	1140	40.49	8.44	14.27	.22
RRS-2	48.9	5.21	5.31	697	1671	43.91	11.71	41.00	.28
RRS-3	48.5	5.21	4.98	744	1473	31.17	10.99	18.60	.28
RRS-4	54.8	3.67	3.37	571	1048	31.77	3.34	13.38	.35
RRS-5	54.7	5.22	3.89	553	1016	53.28	14.27	43.76	.30
RRS-6	55.4	4.98	4.08	470	1233	45.67	11.71	28.10	.12
RRS-7	57.9	4.69	3.61	535	839	42.34	8.64	33.70	-
RRS-8	56.7	4.13	3.26	562	981	43.40	10.85	31.83	.12
RRS-9	55.6	4.25	3.34	534	970	30.34	T	34.52	.09
RRS-10	50.3	4.95	3.97	499	1239	33.57	4.63	10.02	.54
RRS-11	50.9	5.22	4.72	548	1328	47.25	12.60	32.55	.16
RRS-12	58.9	4.37	3.68	573	1176	20.75	7.91	T	.18
Mean	53.6	4.83	4.17	580	1176	38.66	8.80	25.19	.24
Std.Dev.	3.6	.64	.85	82	234	9.16	4.13	13.49	.13

T = trace

CAPE HENRY - SURFACE

Series	TS %	VS %	COD %	TP ppm	TKN ppm	Zn ppm	Cu ppm	Pb ppm	Hg ppm
CHS-1	65.9	2.65	1.47	462	643	27.31	10.62	29.58	.20
CHS-2	73.5	1.34	1.41	420	179	11.33	4.12	17.00	.12
Mean	69.7	1.99	1.44	441	411	19.32	7.37	23.29	.16
Std.Dev.	5.4	.93	.04	30	328	11.30	4.60	8.90	.056

YORK SPIT - SURFACE

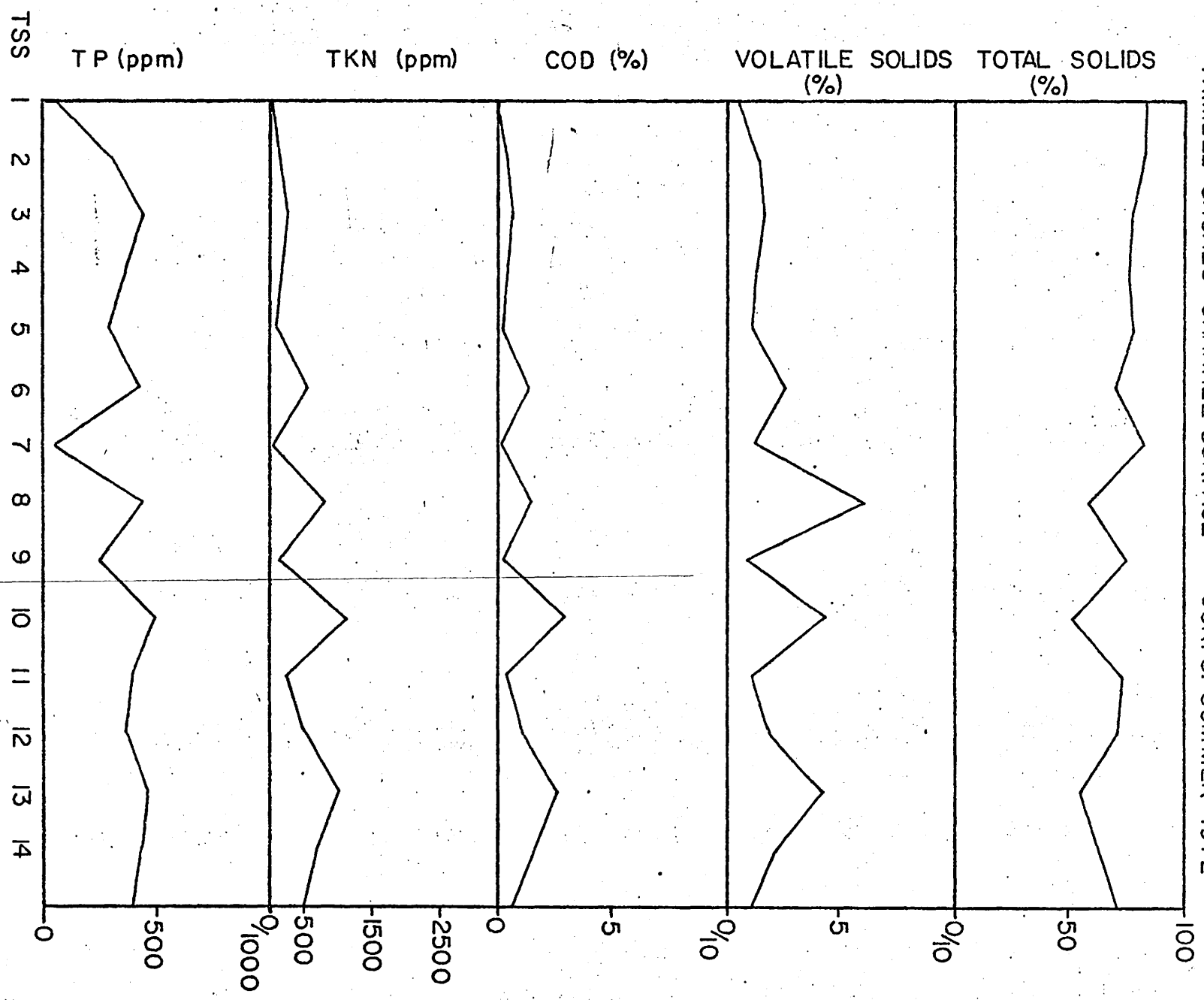
Series	TS %	VS %	COD %	TP ppm	TKN ppm	Zn ppm	Cu ppm	Pb ppm	Hg ppm
YSS-1	66.9	2.52	2.05	437	747	22.4	9.7	13.5	.43
YSS-2	67.2	2.46	1.74	528	533	33.8	8.1	8.1	.21
YSS-3	70.1	2.25	1.70	546	616	27.8	5.0	17.1	.12
YSS-4	57.3	3.42	1.38	616	1059	41.9	9.4	34.6	.17
YSS-5	63.3	2.69	2.54	620	710	37.3	8.0	15.4	.16
YSS-6	65.2	2.11	2.02	478	578	26.6	4.7	21.8	.19
YSS-7	71.4	1.43	.44	425	132	18.3	5.8	20.8	.15
YSS-8	73.5	1.80	2.34	404	443	26.1	5.1	13.0	.15
YSS-9	67.0	2.06	1.41	455	515	20.6	4.3	6.2	.14
YSS-10	69.1	2.00	1.53	399	565	26.0	5.4	26.8	.26
YSS-11	71.5	1.08	.50	446	184	10.8	1.4	11.4	.20
YSS-12	72.9	1.38	.45	425	250	21.8	5.9	7.9	.17
YSS-13	72.9	1.11	.53	334	227	21.5	1.4	7.9	.15
YSS-14	70.4	1.81	1.36	421	388	22.1	4.9	19.0	.14
YSS-15	76.8	0.60	.26	213	143	27.0	6.7	26.2	.18
YSS-16	69.2	1.58	1.04	868	549	30.0	6.9	16.1	.18
YSS-17	70.0	1.85	1.20	398	502	50.7	T	36.2	.11
YSS-18	79.4	0.56	.24	362	226	12.6	T	12.6	.20
YSS-19	66.0	1.99	1.42	522	623	24.4	T	31.5	.65
YSS-20	80.7	0.50	.22	136	73	T	T	T	-
YSS-21	75.1	0.80	.14	139	123	25.1	T	19.3	.12
YSS-22	77.0	0.54	.24	154	163	14.6	T	19.6	.18
YSS-23	77.0	0.58	.15	116	155	20.6	5.3	29.7	.07
YSS-24	78.2	0.96	.28	276	263	19.9	1.8	10.9	.21
Mean	71.2	1.59	1.05	405	407	24.27	4.28	17.75	.20
Std.Dev.	5.6	.79	.77	176	252	10.25	3.05	9.38	.12

T = trace

YORK ENTRANCE - SURFACE

Series	TS %	VS %	COD %	TP ppm	TKN ppm	Zn ppm	Cu ppm	Pb ppm	Hg ppm
YES-1	40.6	6.24	8.67	679	1711	66.2	15.1	33.7	.27
YES-2	40.0	6.66	6.80	766	2361	97.7	15.6	45.6	.18
YES-3	42.5	6.40	6.02	766	2189	82.9	15.6	42.0	.19
YES-4	32.1	7.41	10.33	887	3254	56.7	10.1	60.5	.36
YES-5	39.2	6.10	6.41	749	2205	54.7	10.4	27.3	.33
YES-6	32.1	7.52	7.90	881	2737	83.9	45.6	44.5	.23
YES-7	38.8	7.69	6.94	563	2433	52.9	15.5	42.3	-
YES-8	41.6	6.42	6.83	898	2414	92.1	16.0	46.7	.13
YES-9	43.1	5.84	5.90	696	1992	87.0	17.2	47.3	.32
YES-10	46.5	5.54	5.25	623	1267	63.5	13.3	40.7	.06
YES-11	51.1	4.68	4.79	661	1789	41.8	14.6	22.8	-
YES-12	-	-	-	-	-	-	-	-	-
YES-13	61.3	3.39	3.32	388	1037	50.1	9.3	24.6	.13
YES-14	47.3	4.82	7.09	630	1815	63.4	13.7	37.0	.19
YES-15	56.9	3.95	3.89	467	1352	59.5	10.3	27.6	.12
YES-16	66.1	2.97	2.98	483	876	45.8	6.5	18.9	-
YES-17	63.9	2.69	2.02	663	731	34.5	6.9	19.8	-
YES-18	64.8	2.82	2.42	562	868	33.7	6.1	16.8	.10
YES-19	71.8	2.16	1.55	489	582	23.1	4.4	3.0	-
YES-20	68.3	1.83	2.76	551	476	31.0	6.4	14.3	.12
YES-21	66.2	1.61	1.14	549	573	31.5	4.9	16.8	.36
Mean	50.7	4.84	4.91	648	1633	57.6	12.9	31.6	.21
Std.Dev.	12.9	2.01	2.25	146	813	22.1	8.9	14.7	.10

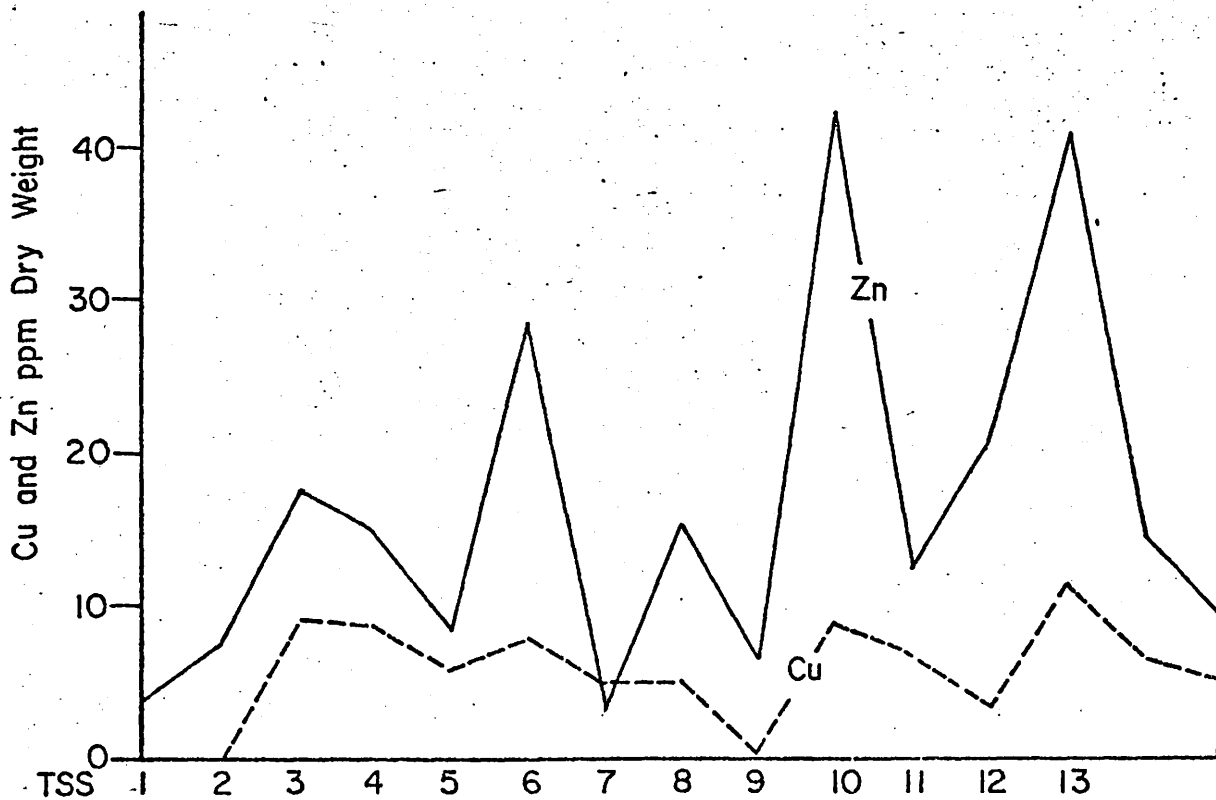
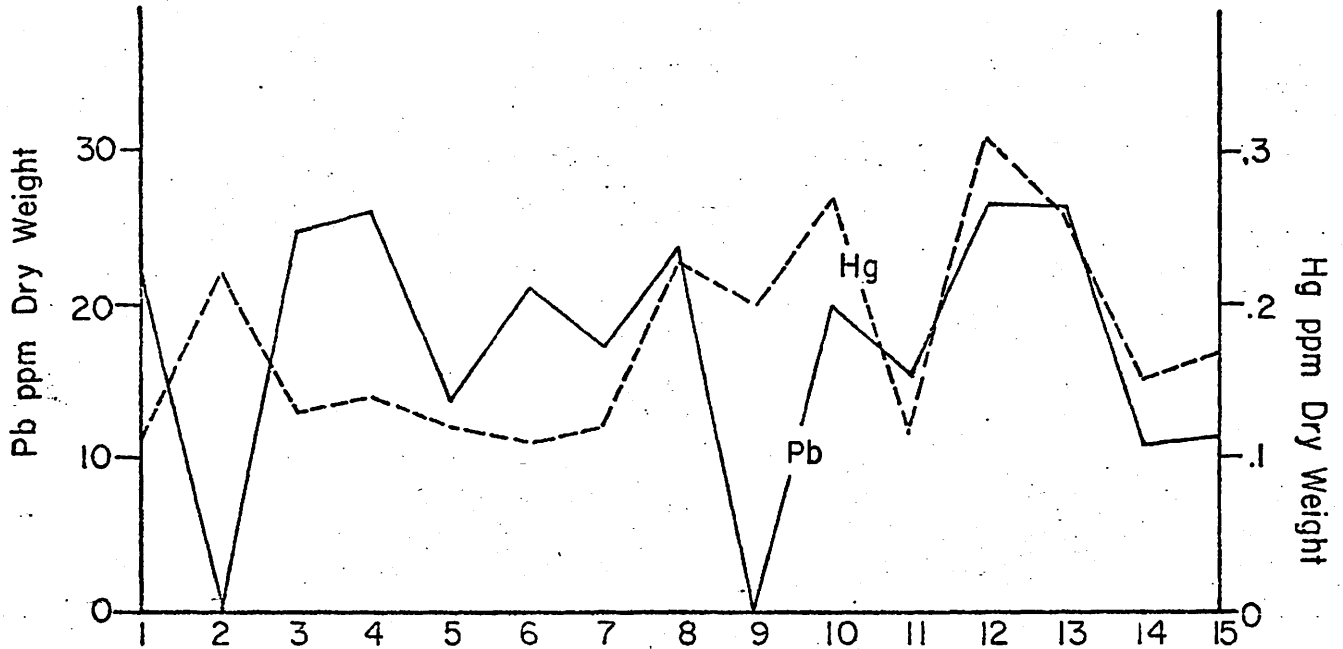
THIMBLE SHOALS CHANNEL-SURFACE CORPS: SUMMER 1972



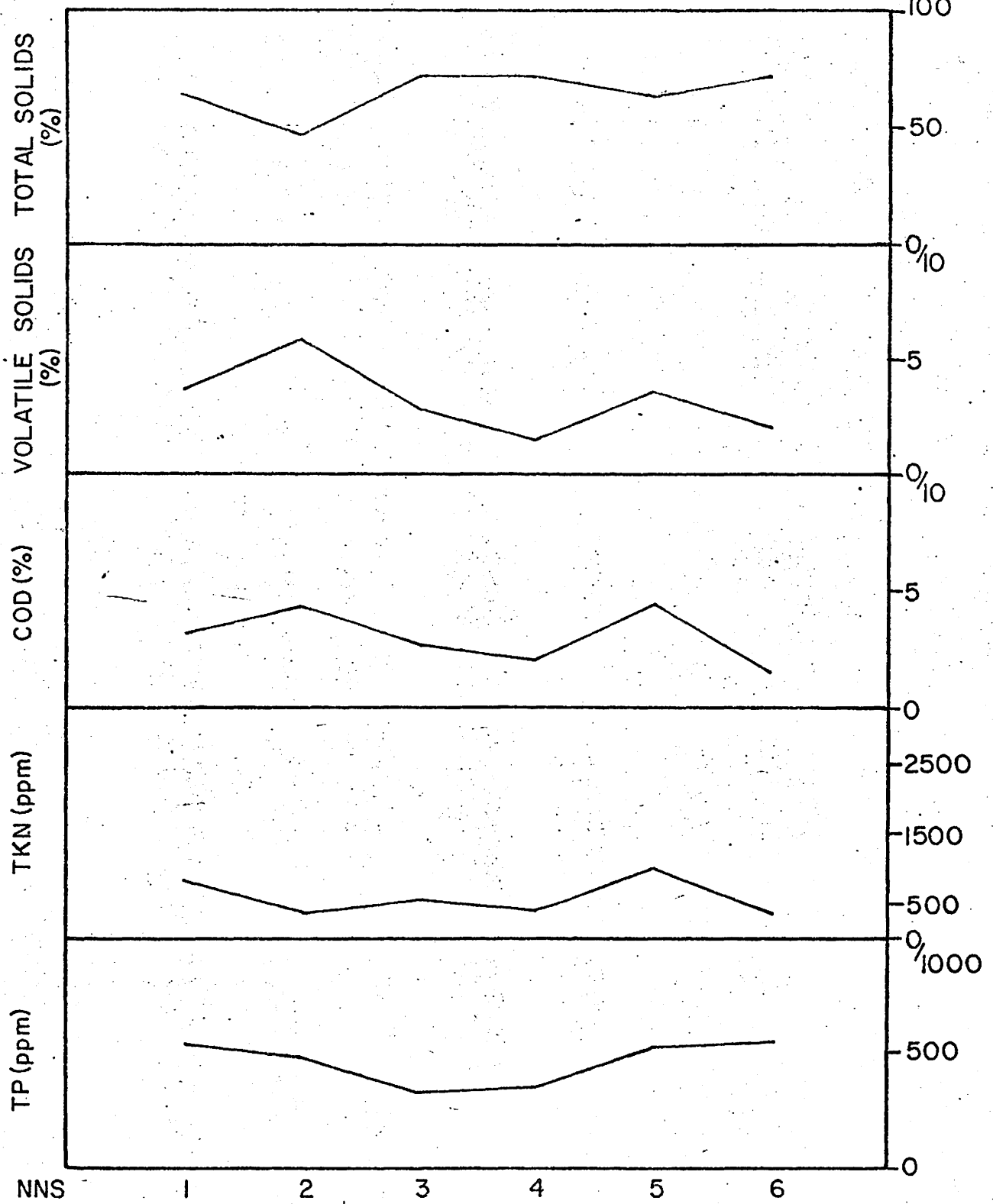
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METALS: THIMBLE SHOALS CHANNEL-SURFACE

CORPS: SUMMER 1972

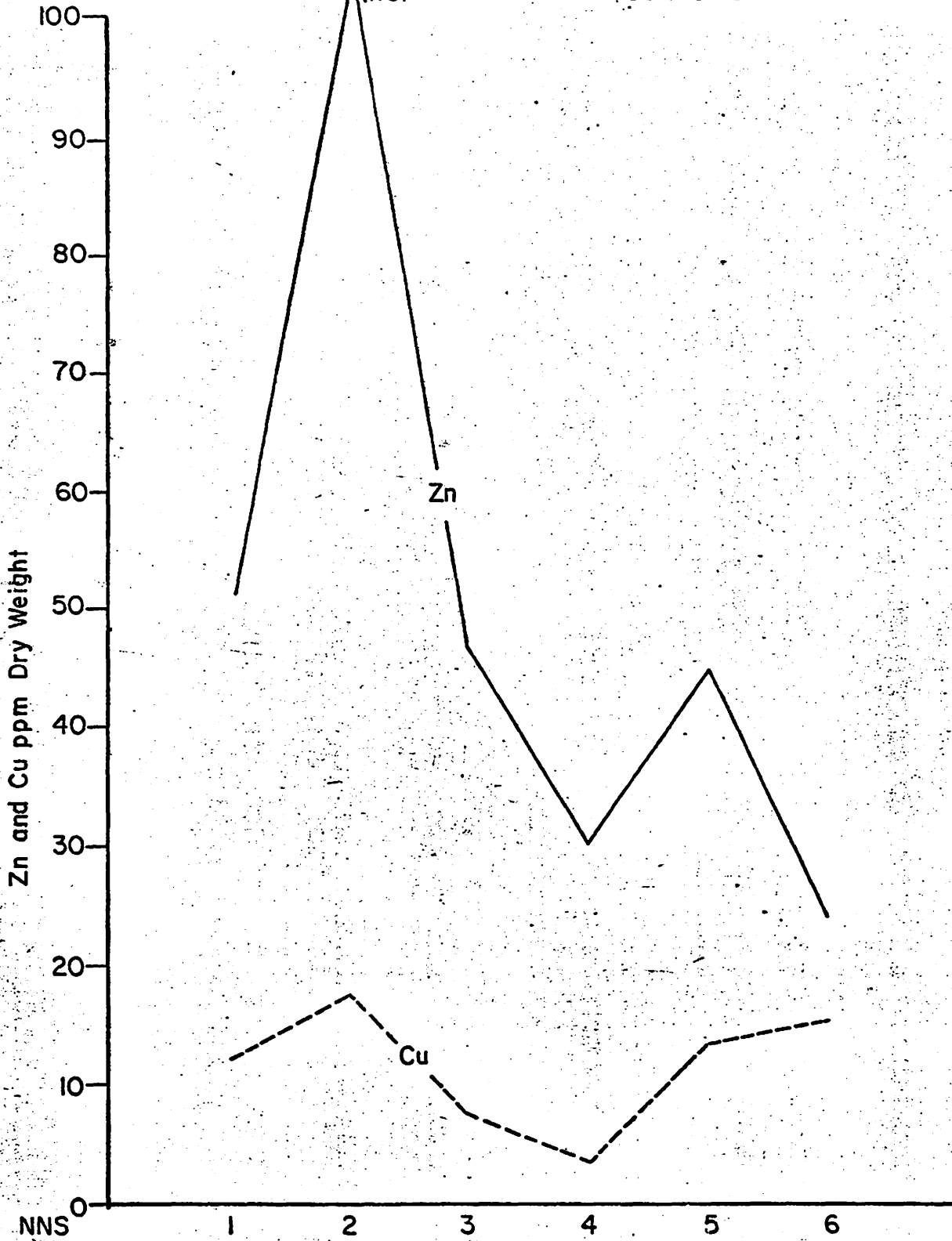


NEWPORT NEWS CHANNEL-SURFACE CORPS: SUMMER 1972



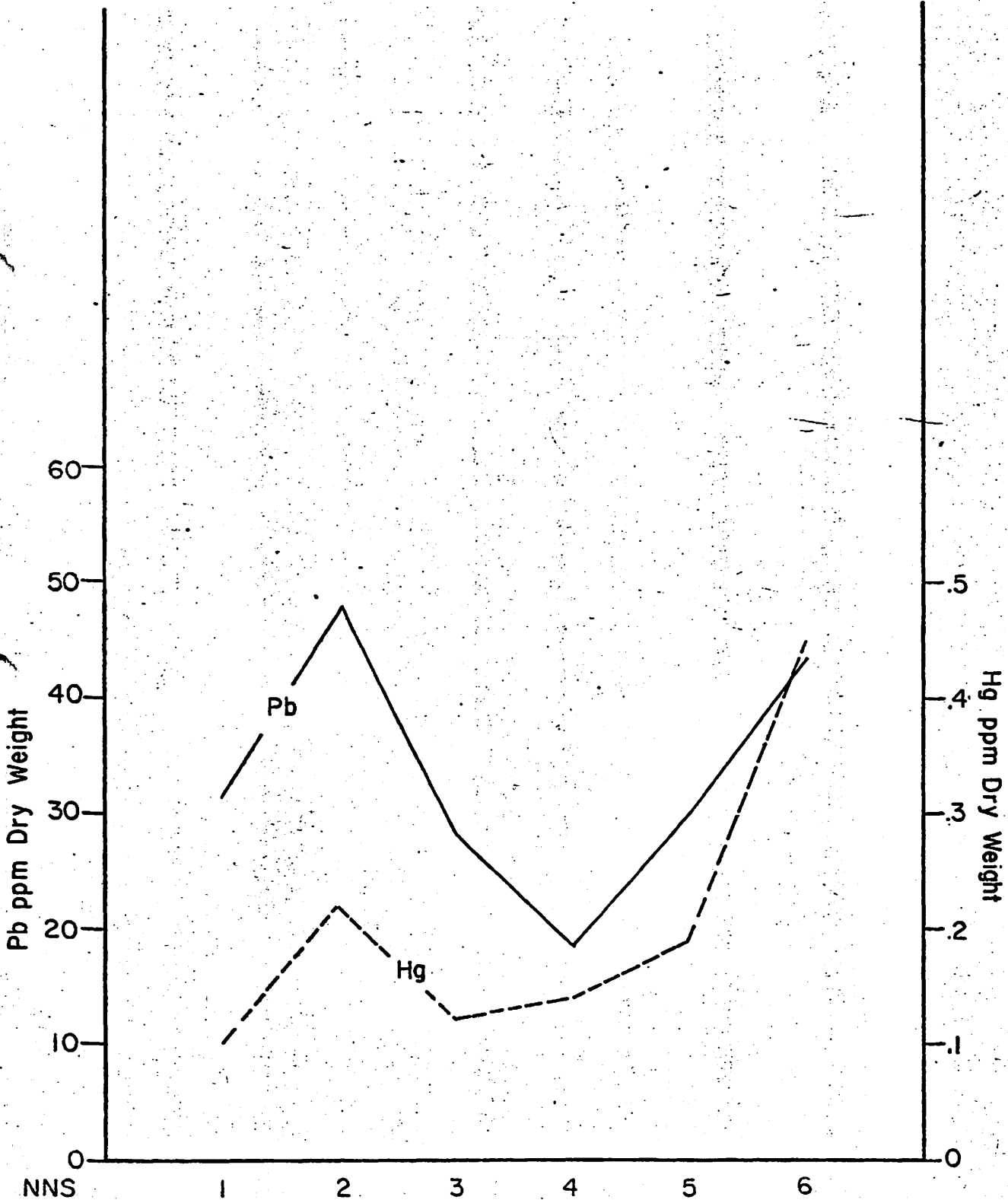
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CORPS: SUMMER 1972

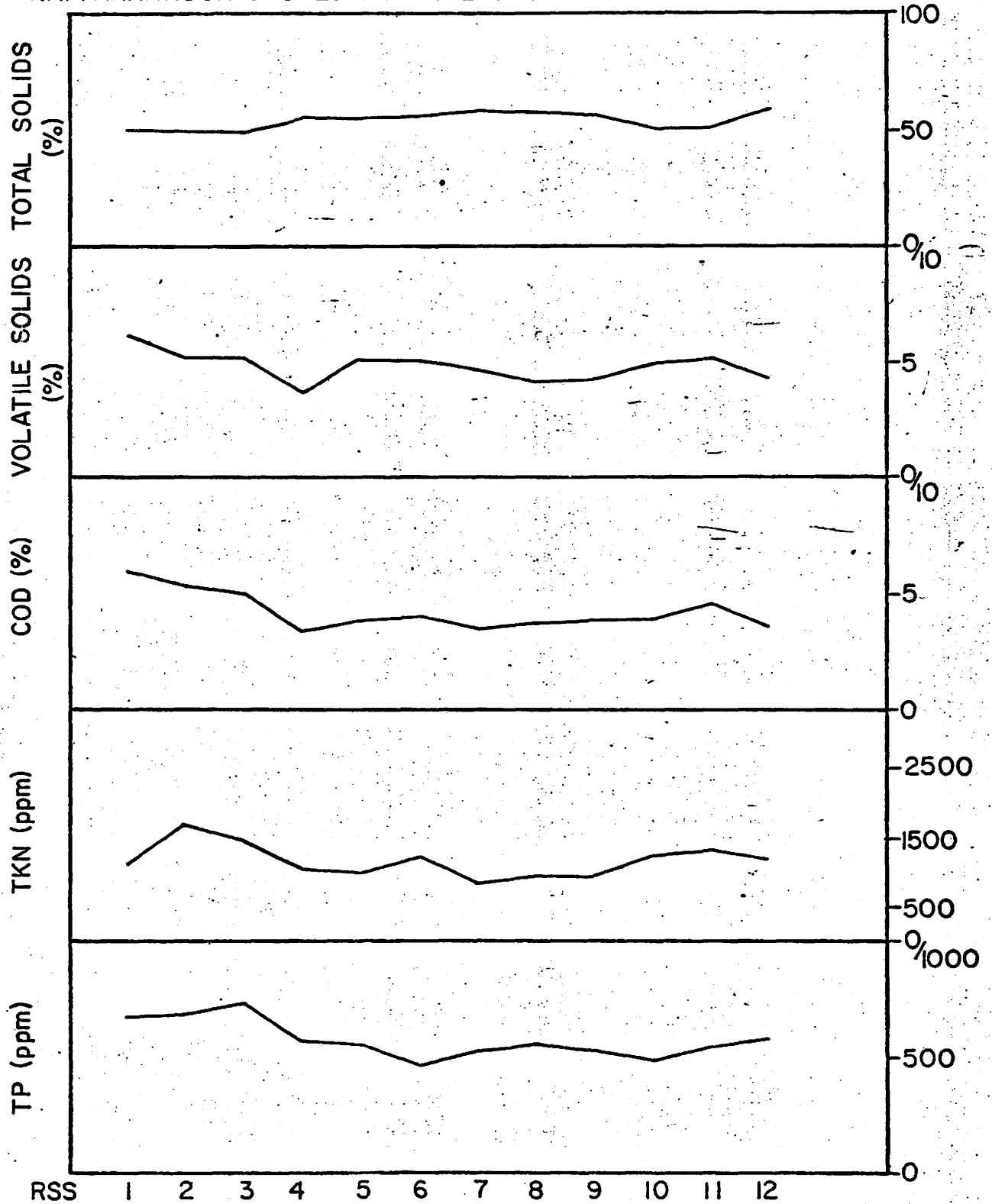


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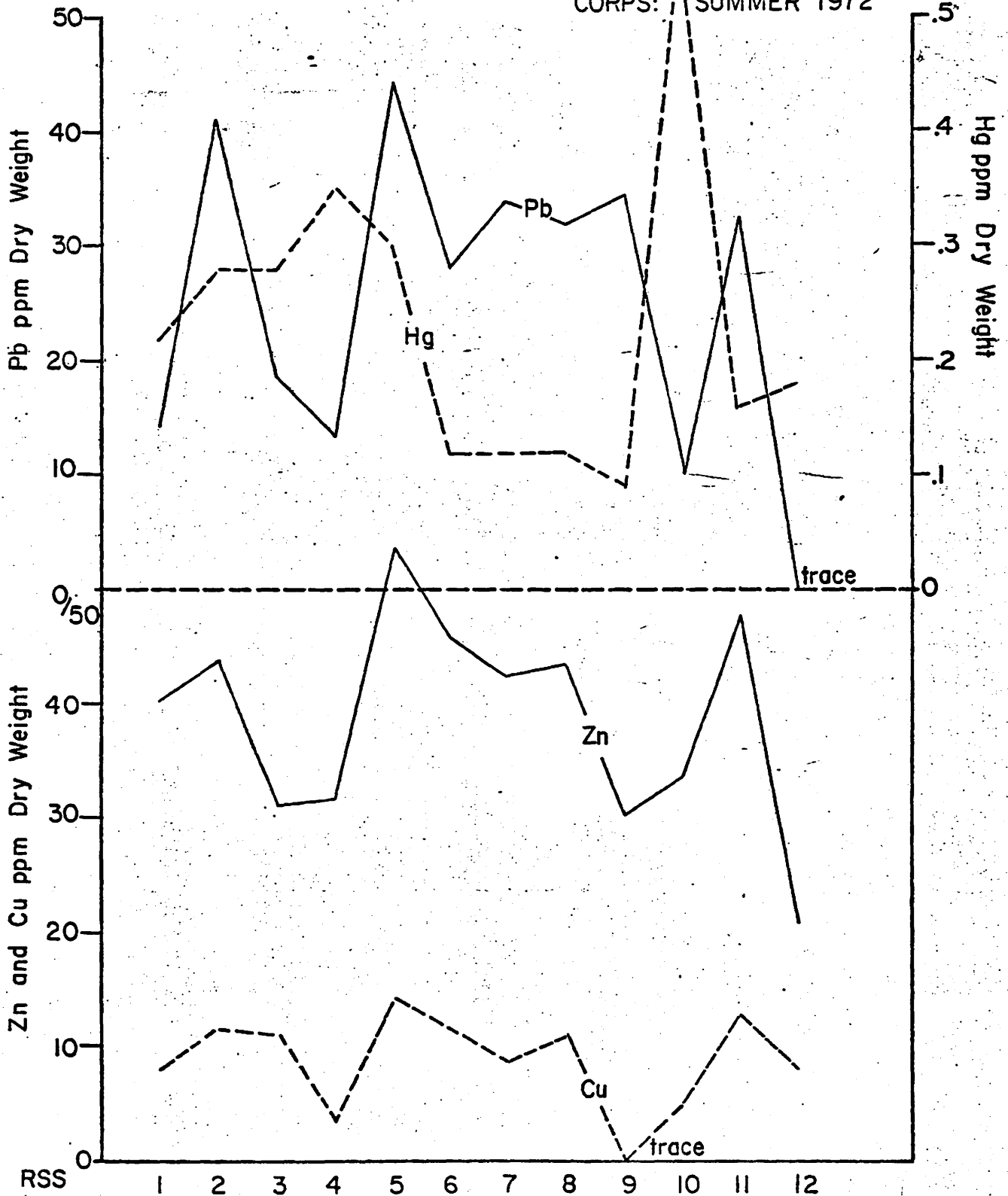
CORPS: SUMMER 1972



RAPPAHANNOCK SHOALS CHANNEL-SURFACE CORPS: SUMMER 1972

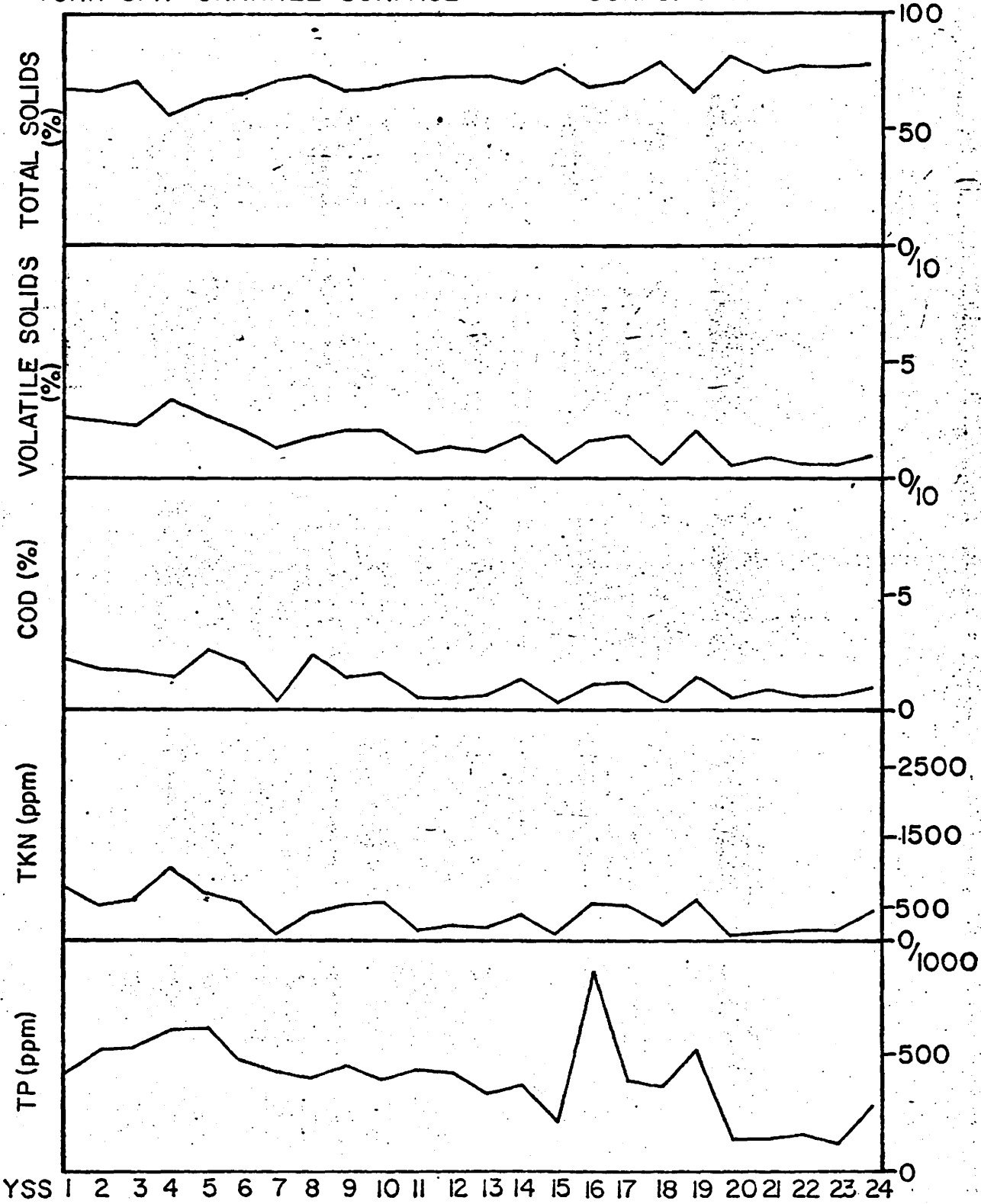


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 CORPS: SUMMER 1972

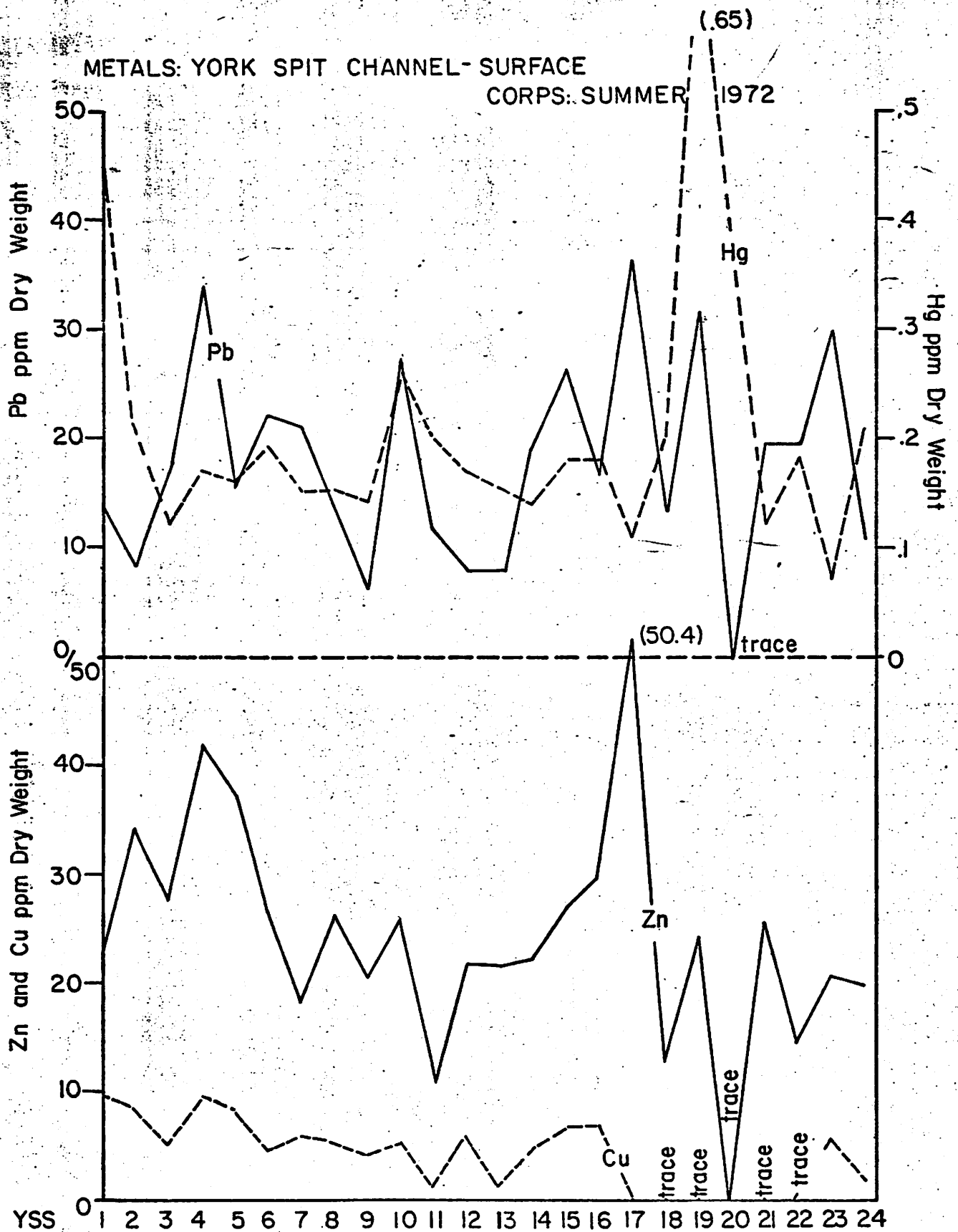


YORK SPIT CHANNEL-SURFACE

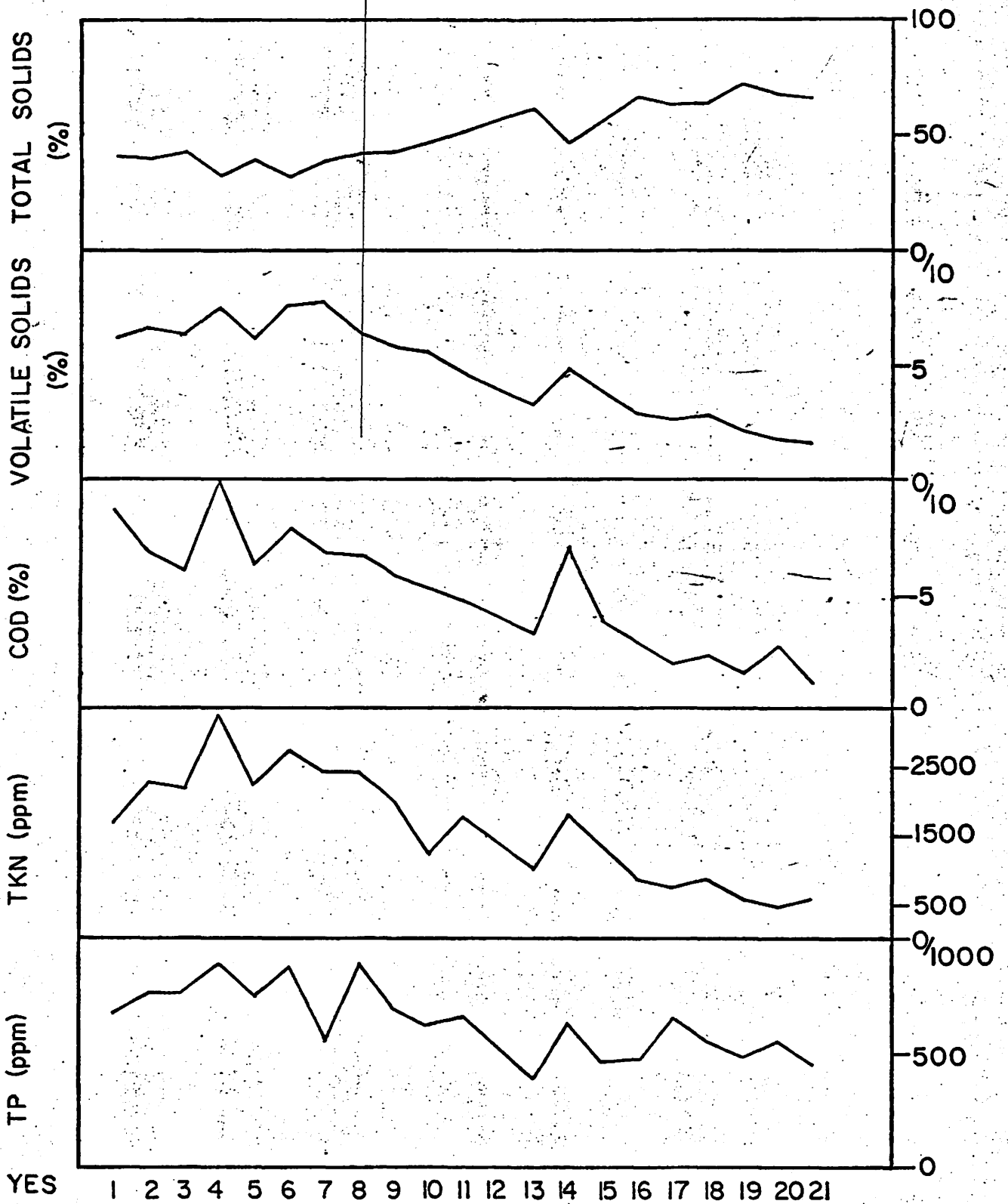
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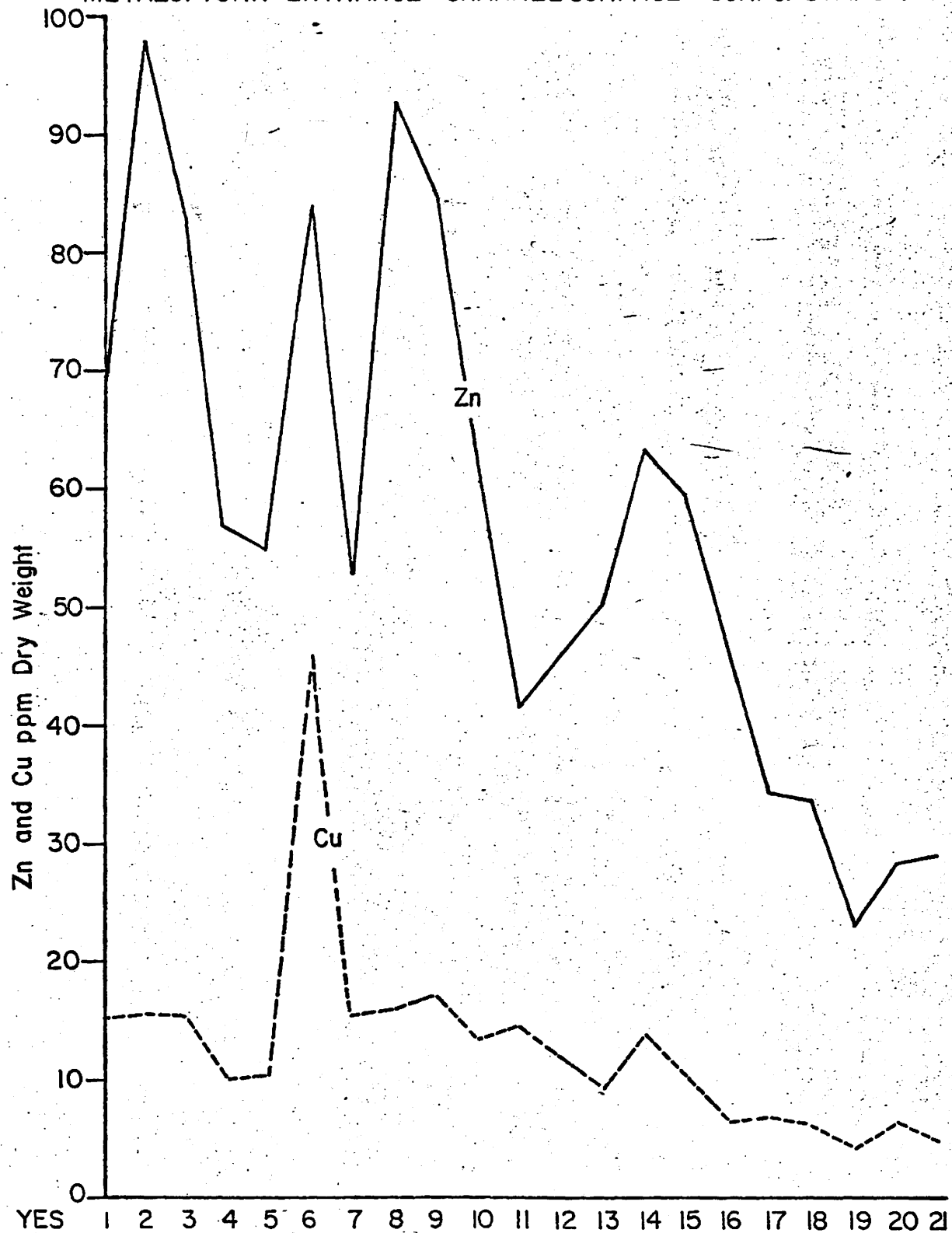
METALS: YORK SPIT CHANNEL - SURFACE
CORPS: SUMMER 1972



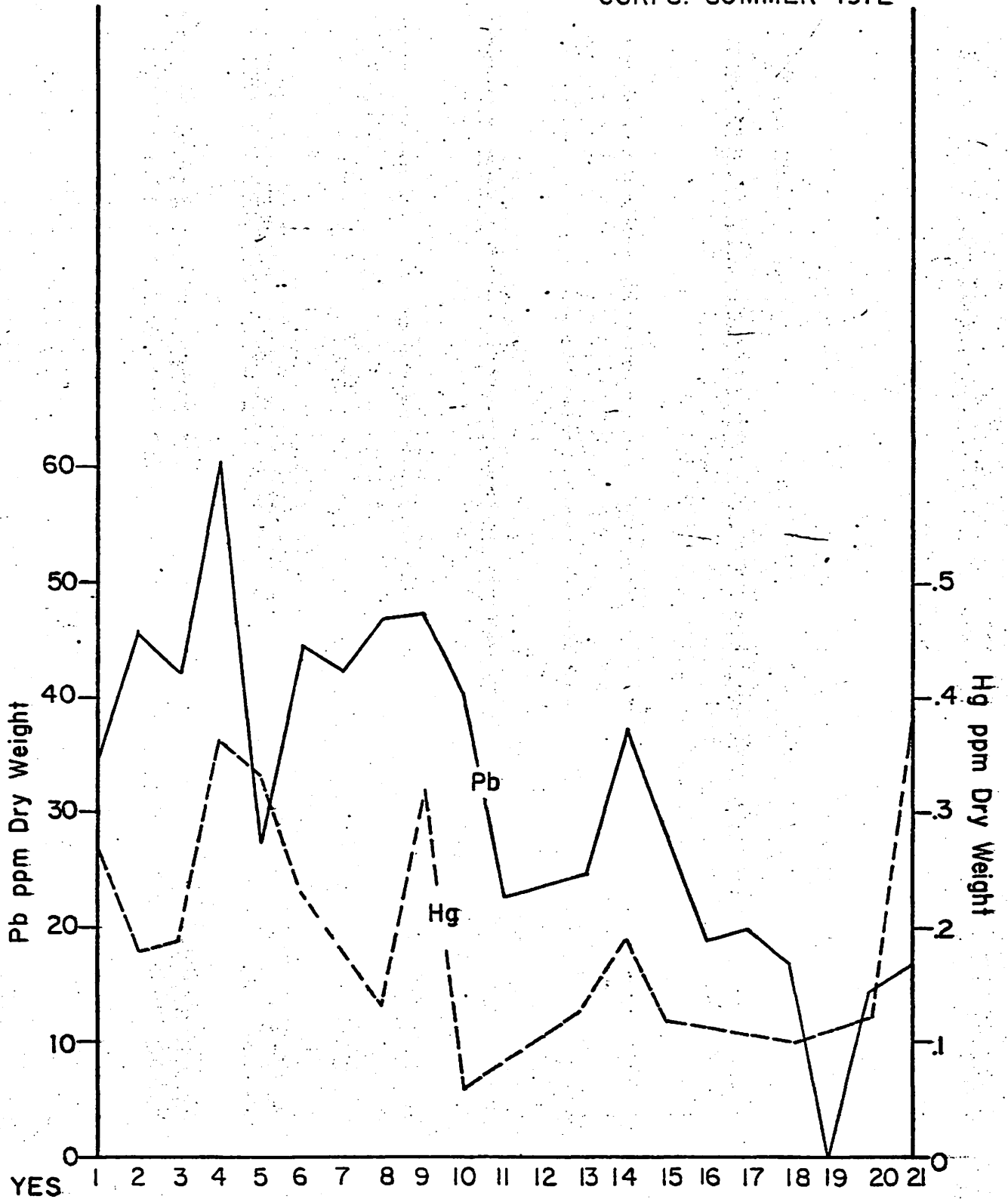
YORK ENTRANCE CHANNEL-SURFACE CORPS: SUMMER 1972



METALS: YORK ENTRANCE CHANNEL-SURFACE CORPS: SUMMER 1972



METALS: YORK ENTRANCE CHANNEL-SURFACE
CORPS: SUMMER 1972



THIMBLE SHOALS - LONG CORES

Series	TS %	VS %	COD %	TP ppm	TKN ppm	Zn ppm	Cu ppm	Pb ppm	Hg ppm
TSL #1-75	74.0	2.85	2.54	381	405	27.9	7.2	13.1	.07
TSL #2-50	67.7	3.09	2.29	445	572	33.2	9.0	16.9	.10
TSL 55	63.0	3.50	2.83	489	717	38.1	8.7	20.6	.13
TSL #3-50	82.1	.48	.019	89	30	7.4	2.8	6.7	.06
TSL 55	81.3	.45	.040	98	57	7.3	2.4	8.8	.09
TSL #4-50	78.9	.96	.23	298	145	13.9	5.3	11.9	.08
TSL 55	82.1	.57	.19	213	75	15.8	6.4	5.3	.10
TSL #5-50	78.0	1.31	-	329	351	17.1	8.3	7.9	.10
TSL 55	65.5	2.20	1.89	237	327	19.4	7.9	8.6	.11
TSL #6-49	77.7	1.88	1.29	414	335	26.0	7.4	11.8	.13
TSL 50	74.5	2.11	1.49	373	397	24.2	9.1	10.9	.12
TSL 55	71.8	2.63	1.81	410	441	30.0	11.1	15.4	.17
TSL #7-51	65.0	3.41	2.39	404	675	41.0	23.0	20.8	.10
TSL 55	63.8	3.63	2.90	494	805	38.8	8.8	20.4	.25
Mean	73.2	2.08	1.68	334	381	24.29	8.38	12.79	.12
Std.Dev.	7.1	1.16	.90	131	249	11.22	4.85	5.28	.05

NEWPORT NEWS - LONG CORES

Series	TS %	VS %	COD %	TP ppm	TKN ppm	Zn ppm	Cu ppm	Pb ppm	Hg ppm
NNL #1-52	63.6	3.53	3.29	482	-	51.9	8.6	20.4	.13
NNL 55	57.2	4.30	3.88	543	1011	46.5	10.6	24.7	.24
NNL #2-40	76.6	1.09	.67	234	206	24.1	4.2	9.0	.08
NNL 50	73.2	2.44	1.44	374	231	21.1	7.0	18.2	.10
NNL 55	72.9	2.63	1.61	494	224	26.2	9.4	17.0	.17
NNL #3-55	57.0	4.32	3.79	551	1043	48.7	17.1	23.8	.08
Mean	66.8	3.05	2.45	446	543	36.42	9.48	18.85	.13
Std.Dev.	8.6	1.25	1.37	122	442	14.02	4.33	5.69	.06

NORFOLK HARBOR - LONG CORES

Series	TS %	VS %	COD %	TP ppm	TKN ppm	Zn ppm	Cu ppm	Pb ppm	Hg ppm
E4OL #1-44	58.0	9.80	5.63	574	1573	394.4	66.8	145.8	.65
E4OL 50	46.4	7.87	8.82	787	2202	79.2	20.1	40.2	.34
E4OL 55	51.4	13.52	18.00	462	3155	73.0	34.6	29.9	.11
E4OL #2-43	51.9	6.49	10.53	480	1737	72.2	15.4	36.1	.14
E4OL 50	49.7	10.08	16.73	551	2610	81.7	18.8	39.8	.14
E4OL 55	55.4	7.00	7.67	367	1580	66.1	18.4	30.6	.25
E45L #1-54	58.0	4.25	3.84	431	804	41.6	17.2	31.2	.24
E45L 55	54.1	5.82	-	798	1109	97.5	23.6	56.9	.74
E45L #2-50	52.6	4.40	4.60	566	1267	57.4	11.2	22.8	.09
E45L 55	56.1	4.68	5.79	554	1438	53.2	23.6	30.1	.22
E45L #4-50	62.1	4.79	3.04	542	1346	68.0	20.4	21.6	.14
E45L 55	57.6	5.87	5.57	545	1400	56.4	16.3	27.2	.16
Mean	54.4	7.05	8.20	596	1685	95.06	23.87	42.68	.27
Std.Dev.	4.3	2.83	5.03	141	664	95.41	14.69	33.81	.21

RAPPAHANNOCK SHOALS - LONG CORES

Series	TS %	VS %	COD %	TP ppm	TKN ppm	Zn ppm	Cu ppm	Pb ppm	Hg ppm
RSL #1-45.5	61.3	3.83	3.32	568	890	36.9	6.4	20.7	.11
RSL 50	76.3	1.56	1.35	361	302	16.1	3.8	12.0	.06
RSL 55	78.5	1.32	.94	209	211	15.0	4.7	11.9	.08
RSL #2-47	64.6	3.37	2.87	508	708	39.5	8.1	18.9	.14
RSL 50	61.1	3.74	3.39	539	969	44.5	11.7	21.1	.11
RSL 55	63.9	3.57	3.27	497	838	32.7	6.8	19.7	.09
RSL #3-48	47.1	5.63	5.48	741	1727	58.2	14.1	32.0	.14
RSL 50	56.9	3.73	3.48	553	894	37.1	6.9	22.3	.11
RSL 55	66.9	3.07	2.29	434	641	35.3	8.3	20.7	.07
RSL #4-46	65.9	3.09	4.55	456	1031	47.7	7.7	21.0	.10
RSL 50	71.6	2.27	1.52	391	354	28.2	10.1	18.3	.79
RSL 55	78.0	1.45	.28	361	197	27.2	28.3	15.8	.07
RSL #5-45	60.0	3.42	3.32	508	784	33.2	7.6	18.5	.07
RSL 50	77.7	1.76	1.58	303	291	22.3	7.4	10.0	.07
RSL 55	78.9	1.29	.55	216	99	21.4	5.8	14.1	.07
Mean	67.2	2.87	2.61	443	662	33.02	9.18	18.47	.14
Std.Dev.	9.4	1.24	1.50	141	432	11.89	5.89	5.38	.18

CAPE HENRY - LONG CORES

Series	TS %	VS %	COD %	TP ppm	TKN ppm	Zn ppm	Cu ppm	Pb ppm	Hg ppm
CHL #1-50	82.3	.99	.24	257	964	13.2	3.1	8.4	.06
CHL 55	82.6	.65	.045	169	62	12.8	8.8	7.2	.10
CHL #2-40	77.7	1.09	.36	329	162	13.8	8.7	7.7	.08
50	78.1	1.09	.45	379	169	12.2	5.6	9.1	.16
55	78.5	.94	.42	348	127	10.4	5.2	5.2	-
CHL #3-55	78.7	.90	.49	269	100	10.4	5.2	11.3	.09
Mean	79.6	.94	.33	292	264	12.13	6.10	8.15	.10
Std.Dev.	2.2	.16	.17	76	346	1.44	2.23	2.03	.04

YORK SPIT - LONG CORES

Series	TS %	VS %	COD %	TP ppm	TKN ppm	Zn ppm	Cu ppm	Pb ppm	Hg ppm
YSL #1-61	69.2	2.27	1.94	432	485	24.7	7.6	18.2	.14
YSL #2-57	68.7	2.52	1.99	501	585	34.3	8.7	20.0	.09
YSL #3-46.5	71.9	2.46	2.12	480	530	30.3	11.6	33.3	
YSL 50	73.2	2.36	2.00	401	497				.11
YSL 55	70.3	2.54	2.22	462	542	26.0	6.8	16.3	.15
YSL #4-47	74.7	1.26	.55	439	229	17.7	5.1	11.2	.21
YSL 50	75.6	4.52	3.14	357	345	25.1	11.9	18.2	.07
YSL 55	72.1	2.28	1.65	1164	467	25.5	8.1	18.1	.12
YSL #5-47	74.8	1.20	1.01	389	186	23.2	6.9	16.5	.09
YSL 50	71.2	2.75	2.12	427	531	30.7	7.7	20.6	.10
YSL 55	76.9	2.00	1.86	370	397	21.6	7.0	13.0	.10
YSL #6-49	77.3	1.29	.48	343	170	17.8	4.9	12.2	
YSL 50	71.0	2.41	2.12	416	451	27.3	7.9	20.2	.14
YSL #7-48	74.5	1.80	1.64	132	276	21.8	6.6	30.4	.07
YSL 50	67.2	2.55	1.85	369	296	40.3	11.2	25.3	.12
YSL 55	70.9	3.85	3.07	358	399	28.3	11.7	22.8	.20
YSL #8-49	79.3	.76	3.39	238	88	14.1	5.9	20.6	.06
YSL 50	82.6	.40	.09	24	16	7.3	8.1	18.6	.07
YSL 55	69.1	1.91	3.46	298	668	30.6	11.9	19.5	.11
YSL #9-51	76.7	.51	.32	95	612	14.9	8.3	17.3	.11
YSL 55	81.4	.67	.23	105	102	26.0	5.4	26.8	.05
Mean	73.9	2.01	1.77	371	375	24.37	8.16	19.95	.11
Std.Dev.	4.4	1.04	1.02	227	188	7.56	2.32	5.62	.04

YORK ENTRANCE - LONG CORES

Series	TS %	VS %	COD %	TP ppm	TKN ppm	Zn ppm	Cu ppm	Pb ppm	Hg ppm
YEL #1-42	41.5	6.16	7.02	643	1567	60.6	21.2	47.0	.33
YEL 50	50.9	5.02	4.59	686	1075	52.4	14.1	33.2	.10
YEL 55	55.3	4.35	4.62	509	920	45.7	16.3	48.8	.10
YEL #2-42	42.3	5.98	8.61	569	1533	64.6	18.1	30.6	.18
YEL 50	62.6	3.69	4.14	470	804	34.1	10.8	24.2	.58
YEL 55	57.8	4.13	3.66	564	116	42.4	8.1	27.9	.32
YEL #3-41	50.1	4.94	4.86	520	1205	57.7	23.3	43.0	.10
YEL 50	58.7	3.96	.37	415	309	44.6	11.1	34.5	.28
YEL #4-40	55.6	4.02	4.06	88	1028	45.8	12.3	39.6	.09
YEL 50	60.1	4.41	3.79	570	1016	37.6	10.9	30.4	.08
YEL 55	61.2	3.85	3.76	585	1042	35.1	11.9	23.8	.03
YEL #5-40	73.4	1.79	1.41	294	360	12.9	3.4	10.8	.05
YEL 50	74.8	1.25	0.14	182	154	10.1	4.0	12.8	.09
YEL #6-32	76.1	2.05	.73	475	405	38.9	18.8	14.9	.39
YEL 38.6	79.2	4.39	1.23	356	174	17.7	12.2	39.1	.12
YEL #7-42	71.7	2.32	1.90	437	362	26.4	8.6	19.0	.17
YEL 50	76.9	1.83	2.70	139	103	14.2	8.6	17.9	.05
YEL 55	79.1	1.39	1.96	63	177	8.4	10.5	17.4	.07
YEL #8-47	79.8	1.30	.83	304	196	14.6	4.0	16.7	.08
YEL 50	81.9	.87	.60	90	92	7.3	4.7	19.2	.08
YEL 55	69.3	2.80	2.44	367	427	31.9	6.8	19.7	.09
Mean	64.7	3.36	3.02	382	622	33.48	11.41	27.17	.16
Std.Dev.	12.7	1.60	2.23	201	490	18.05	5.65	11.49	.14

Key to Interpreting Figures

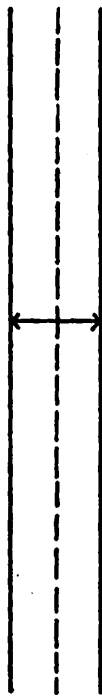
The following figures illustrate the spatial distribution of parameters examined in this study.

Figures are labeled to indicate the parameter and the area. Horizontal numbers identify individual long cores from a given area; vertical numbers indicate the water depth below mean low water. The actual concentration of the parameters on display is a function of the horizontal distance to either side of each core axis. Use of connecting lines drawn at a 45° angle from the horizontal distance to the core axis adds a mass dimension to the segments and aids visual interpretation of the figures.

Comparison of this data with EPA guidelines for open water disposal is achieved by using the enclosed transparency. With the transparency overlaid on the figure, any chosen segment may be bracketed within the appropriate reference bands. The broken lines on the transparency coincide with the long core axis. If a chosen segment extends past the bands, the concentration represented by that segment exceeds EPA guidelines; if within the bands, the concentration falls within allowable limits.

CONCENTRATION REFERENCE BANDS FOR EPA GUIDELINES TO OPEN WATER DISPOSAL

%VS
EPA = 6%



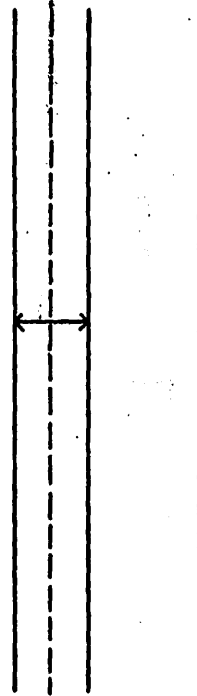
| BOX = .5%

%COD
EPA = 5%



| BOX = .5%

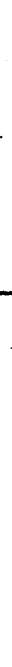
TKN (ppm)
EPA = 1000ppm



| BOX = 100ppm

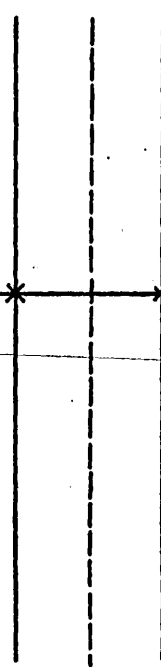
CAPE HENRY CORES (CHL) ONLY

%COD
EPA = 5%



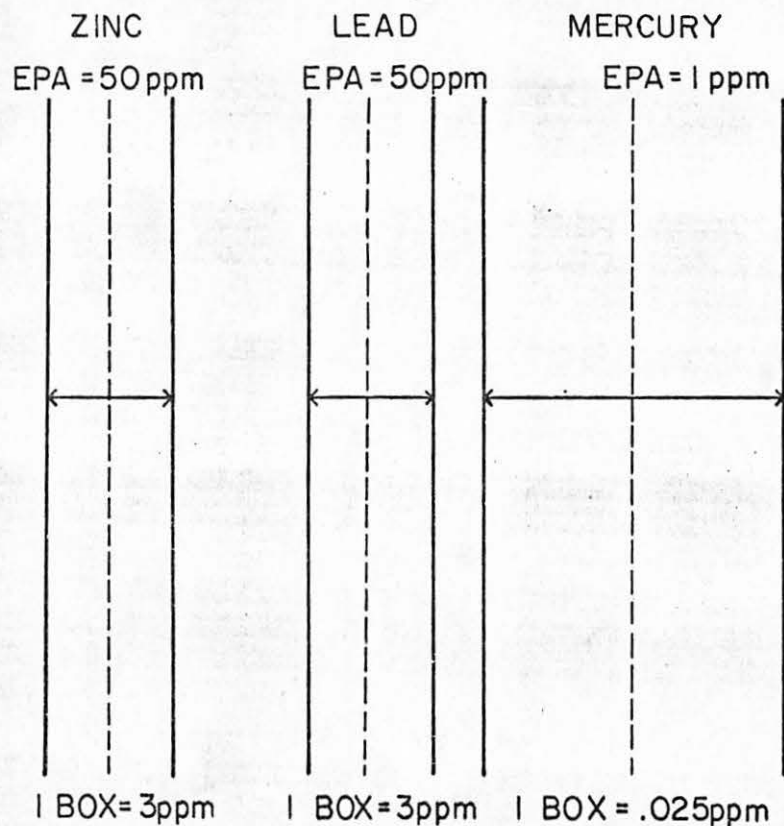
| BOX = .1%

TKN (ppm)
EPA = 1000ppm

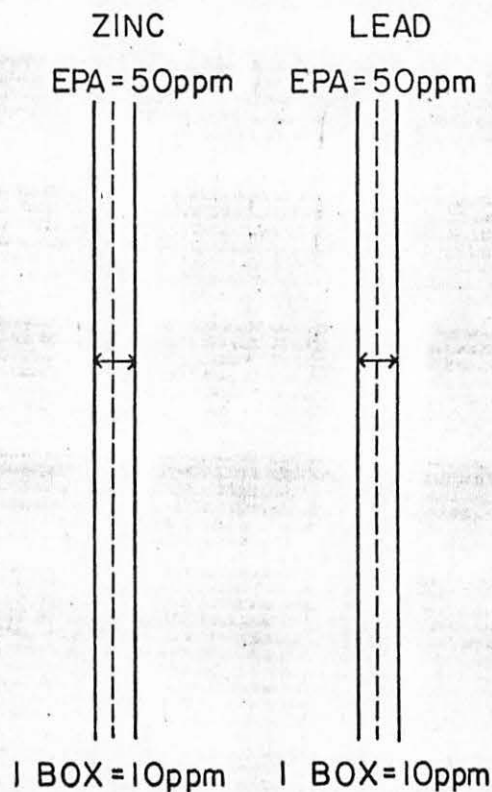


| BOX = 50ppm

CONCENTRATION REFERENCE BANDS FOR EPA GUIDELINES TO OPEN WATER DISPOSAL



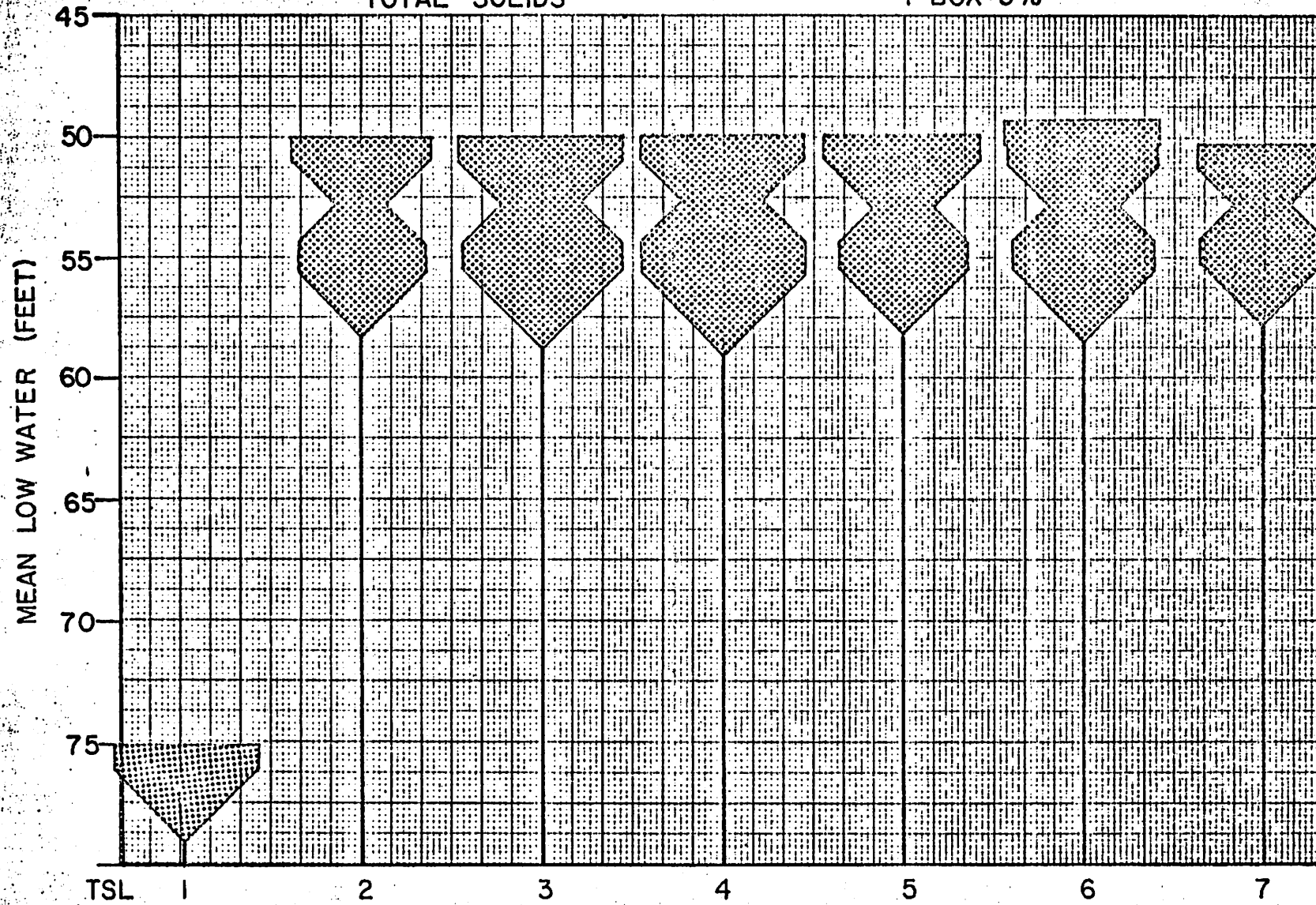
NORFOLK HARBOR CORES ONLY
(E 40- E 45 L)



THIMBLE SHOALS LONG CORES
CORPS: SUMMER 1972

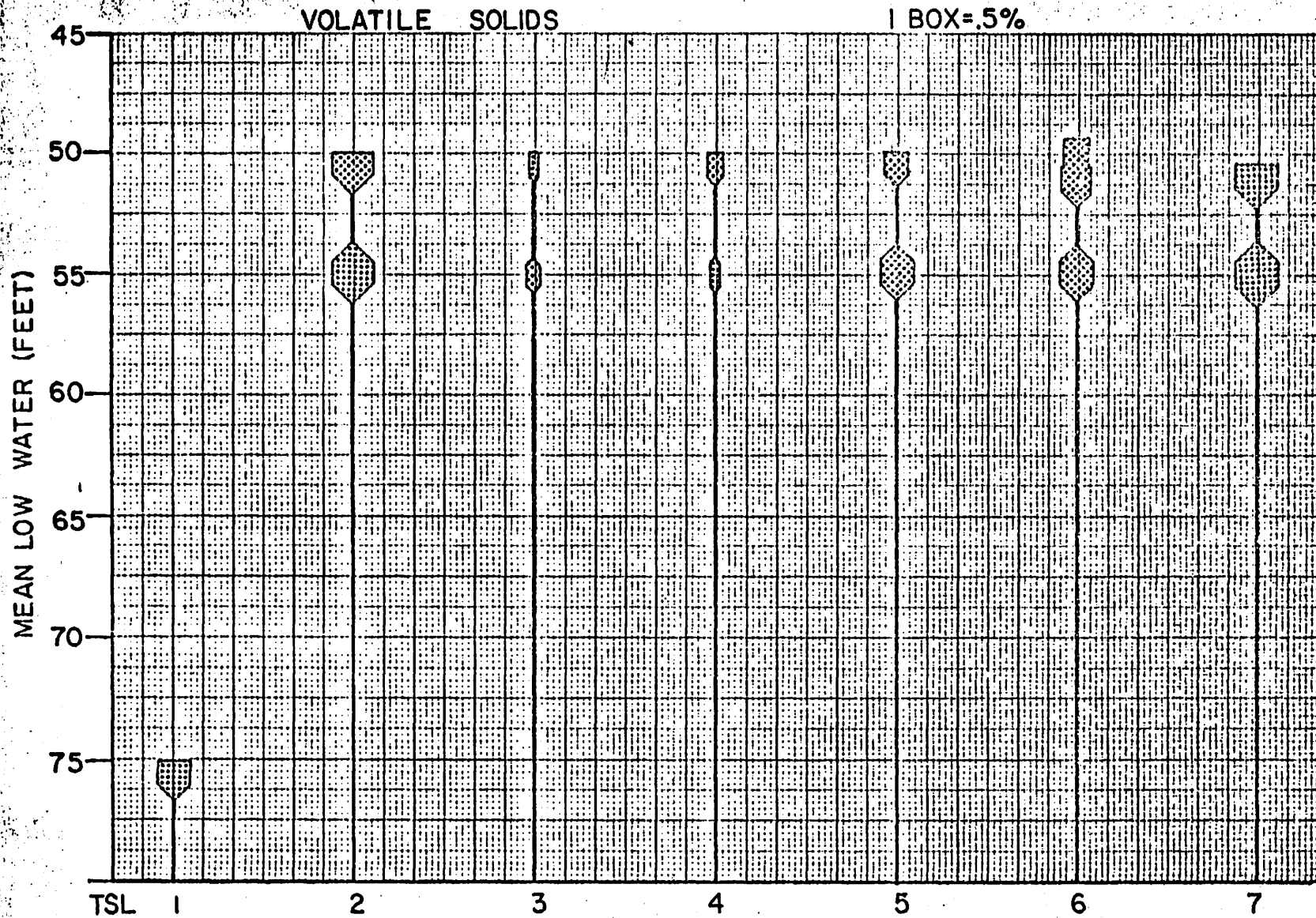
TOTAL SOLIDS

1 BOX=3%

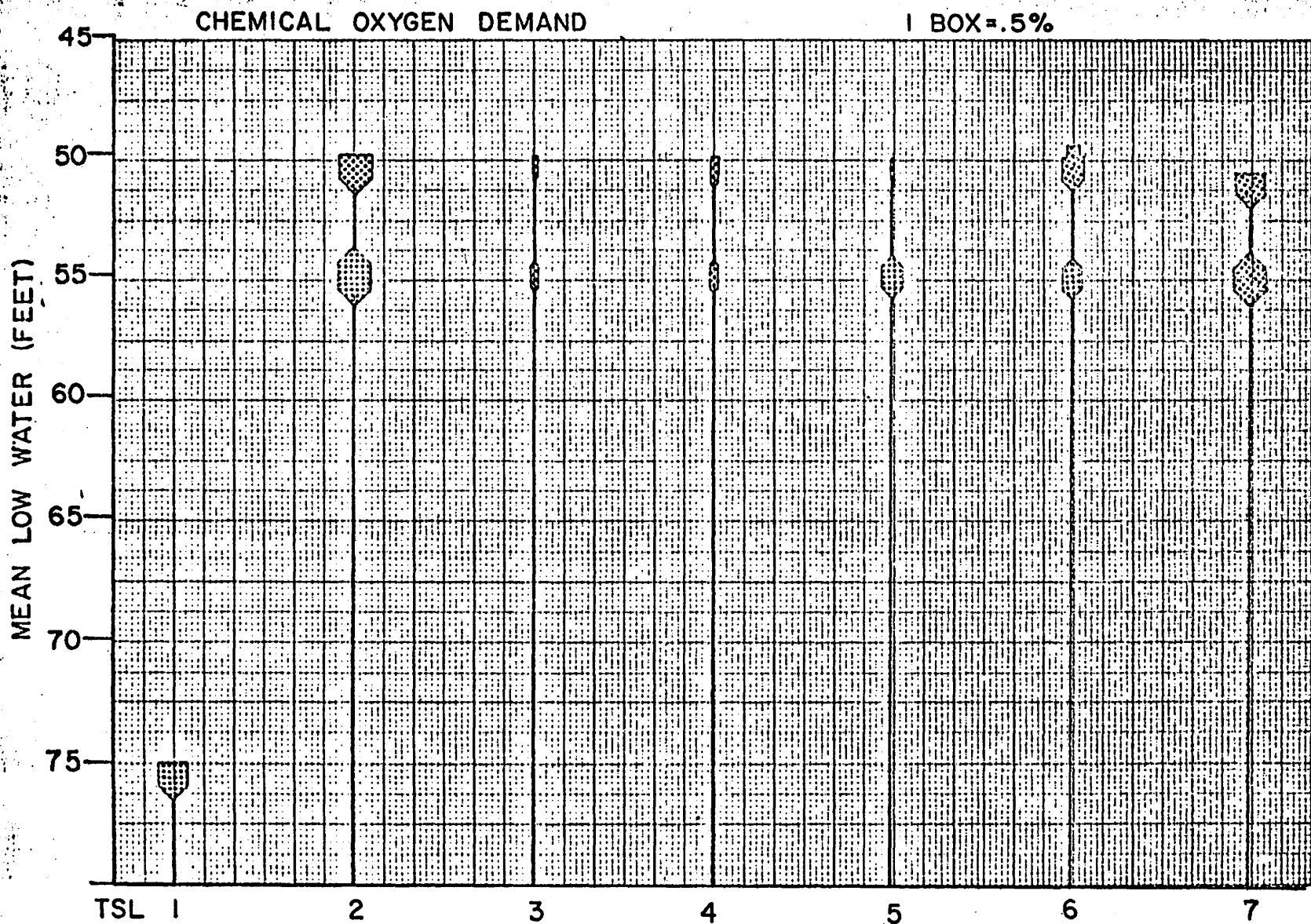


30

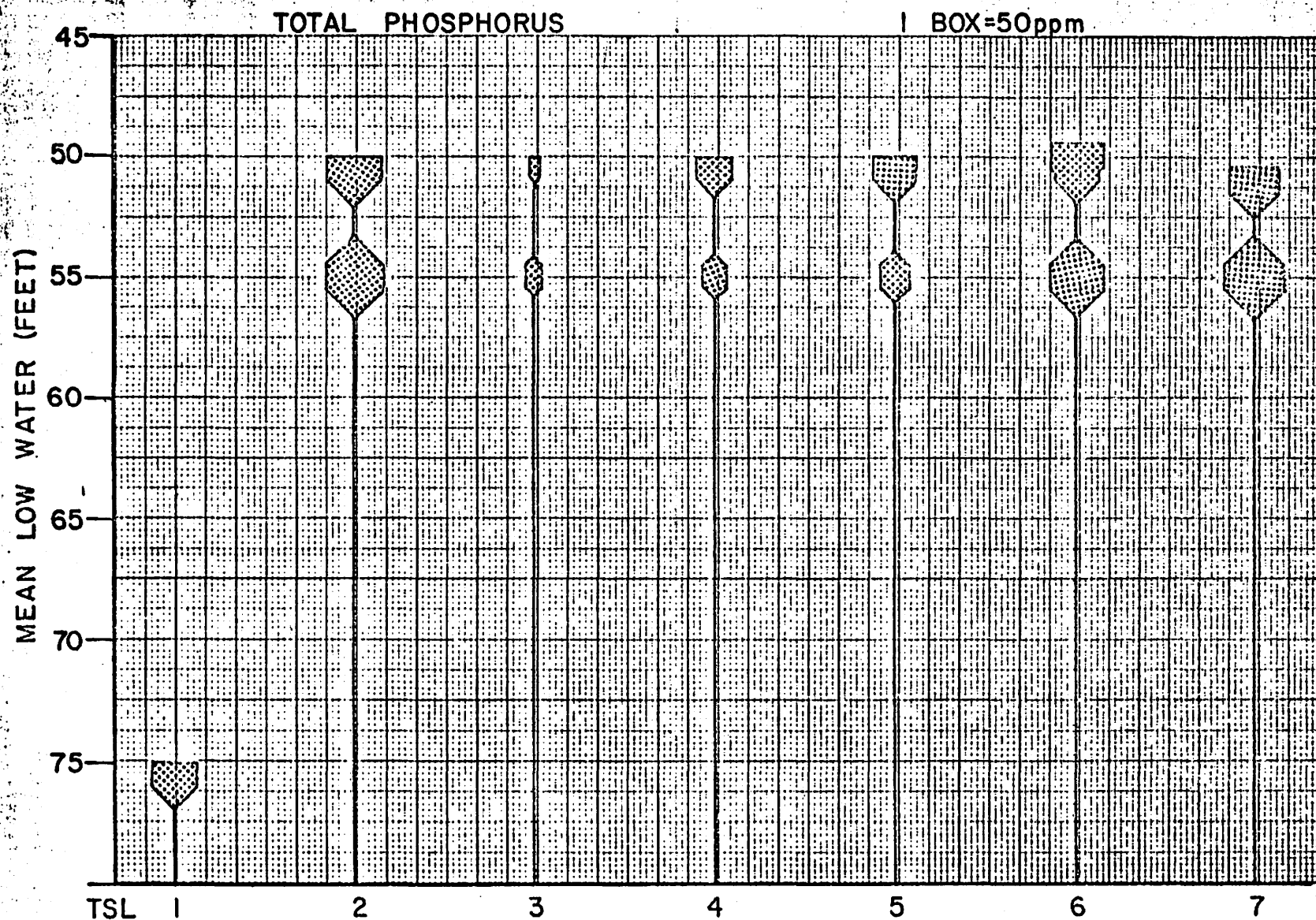
THIMBLE SHOALS LONG CORES
CORPS: SUMMER 1972



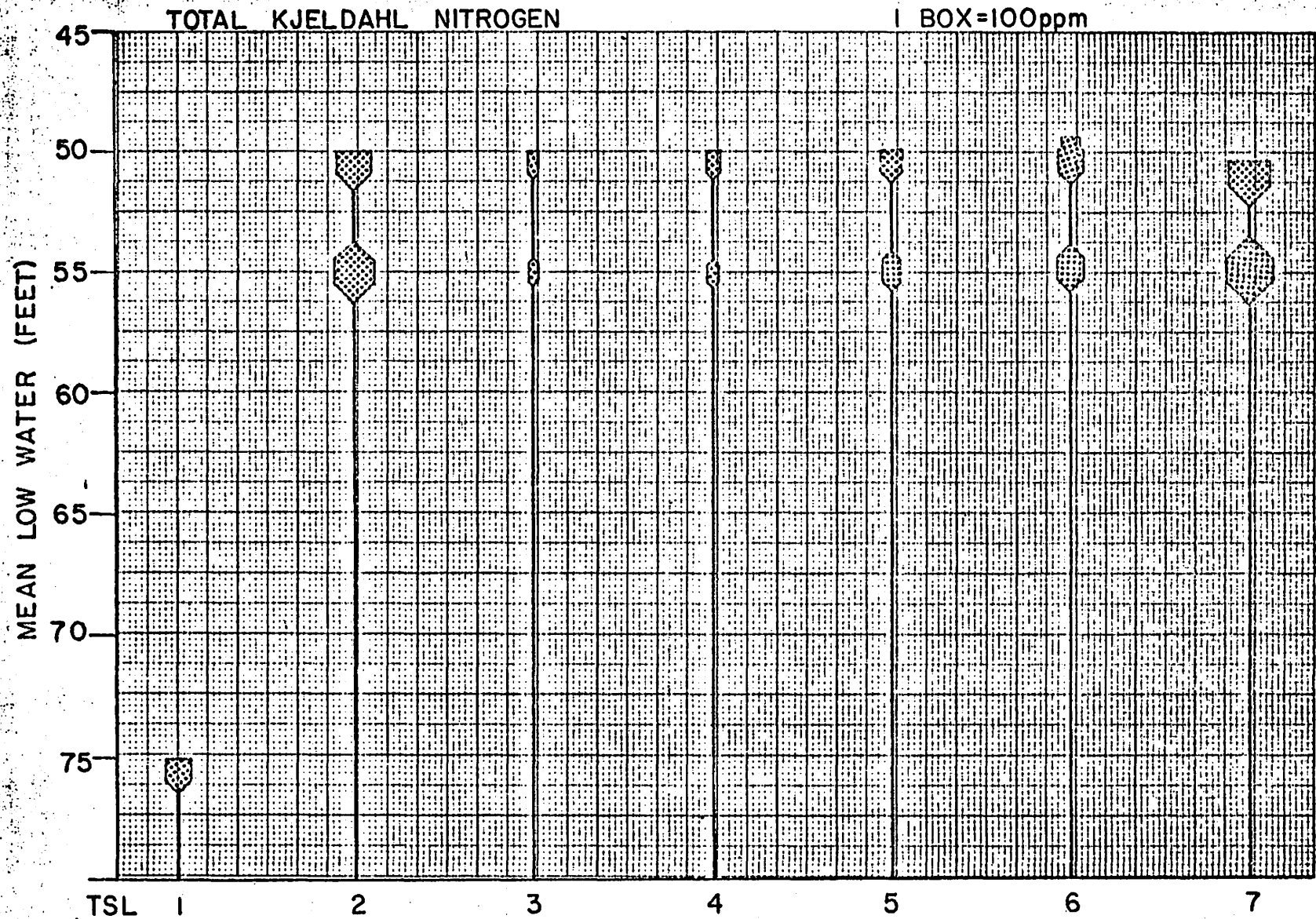
THIMBLE SHOALS LONG CORES
CORPS: SUMMER 1972



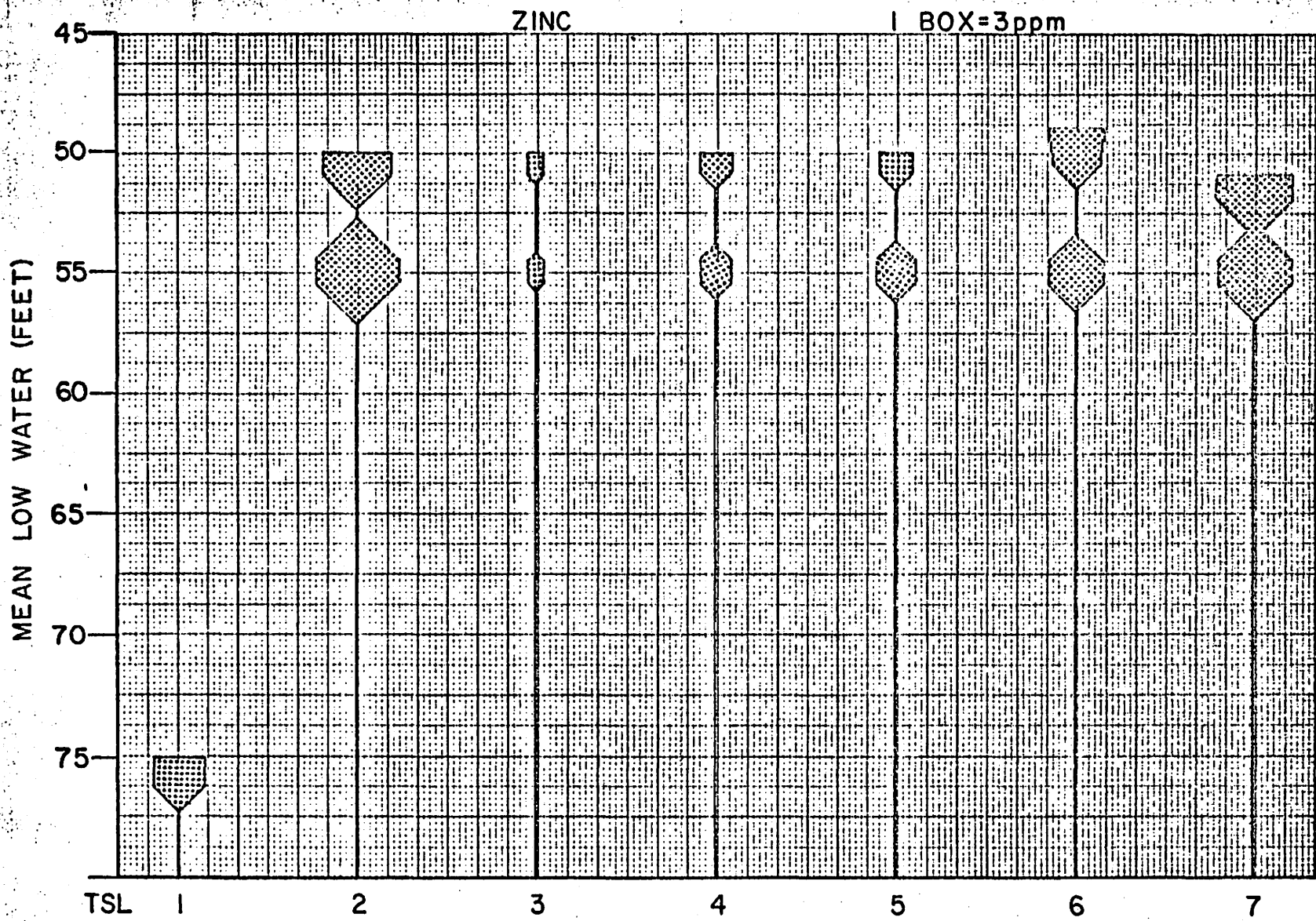
THIMBLE SHOALS LONG CORES
CORPS: SUMMER 1972



THIMBLE SHOALS LONG CORES
CORPS: SUMMER 1972



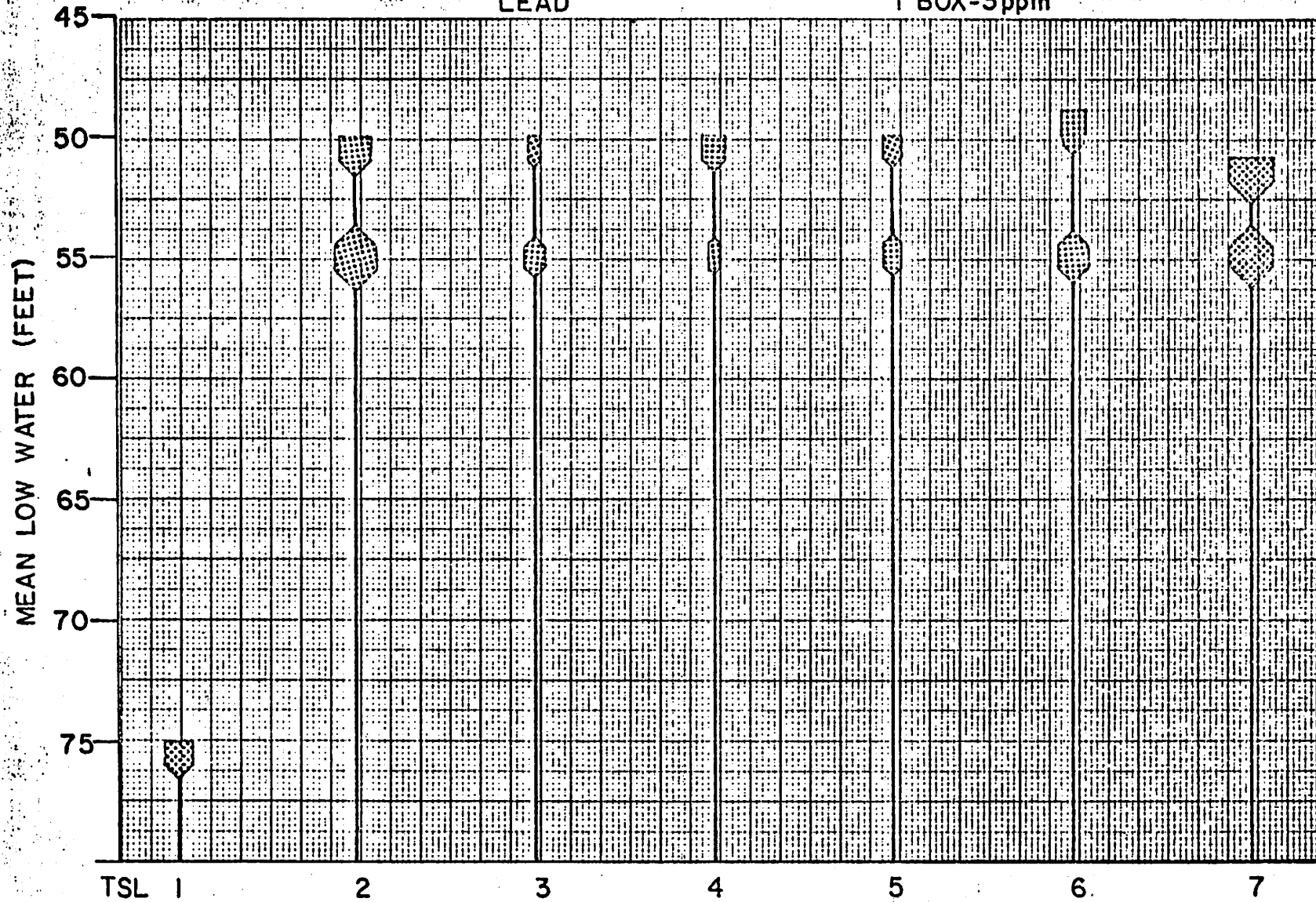
THIMBLE SHOALS LONG CORES
CORPS: SUMMER 1972



THIMBLE SHOALS LONG CORES
CORPS: SUMMER 1972

LEAD

1 BOX=3ppm

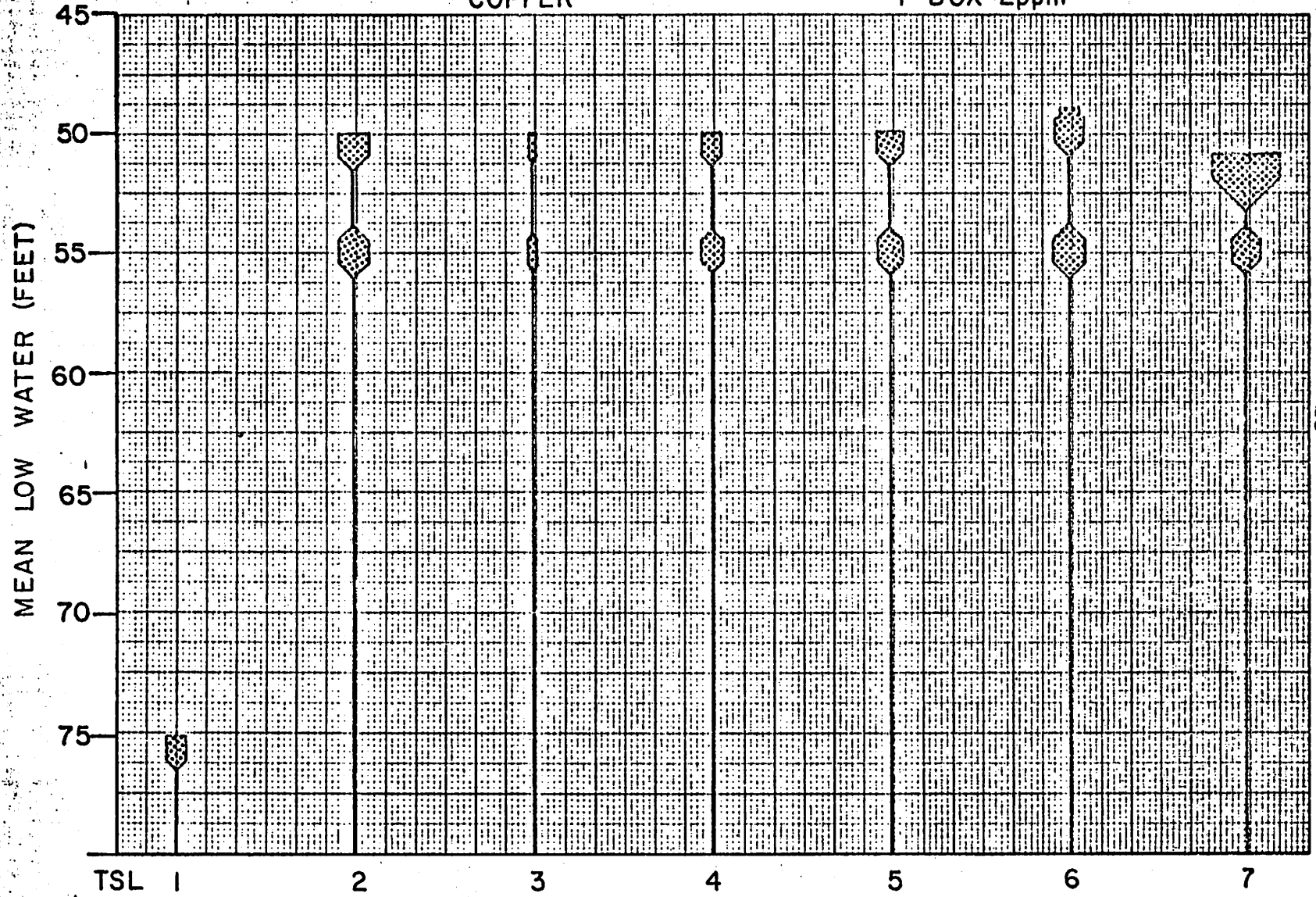


36

THIMBLE SHOALS LONG CORES
CORPS: SUMMER 1972

COPPER

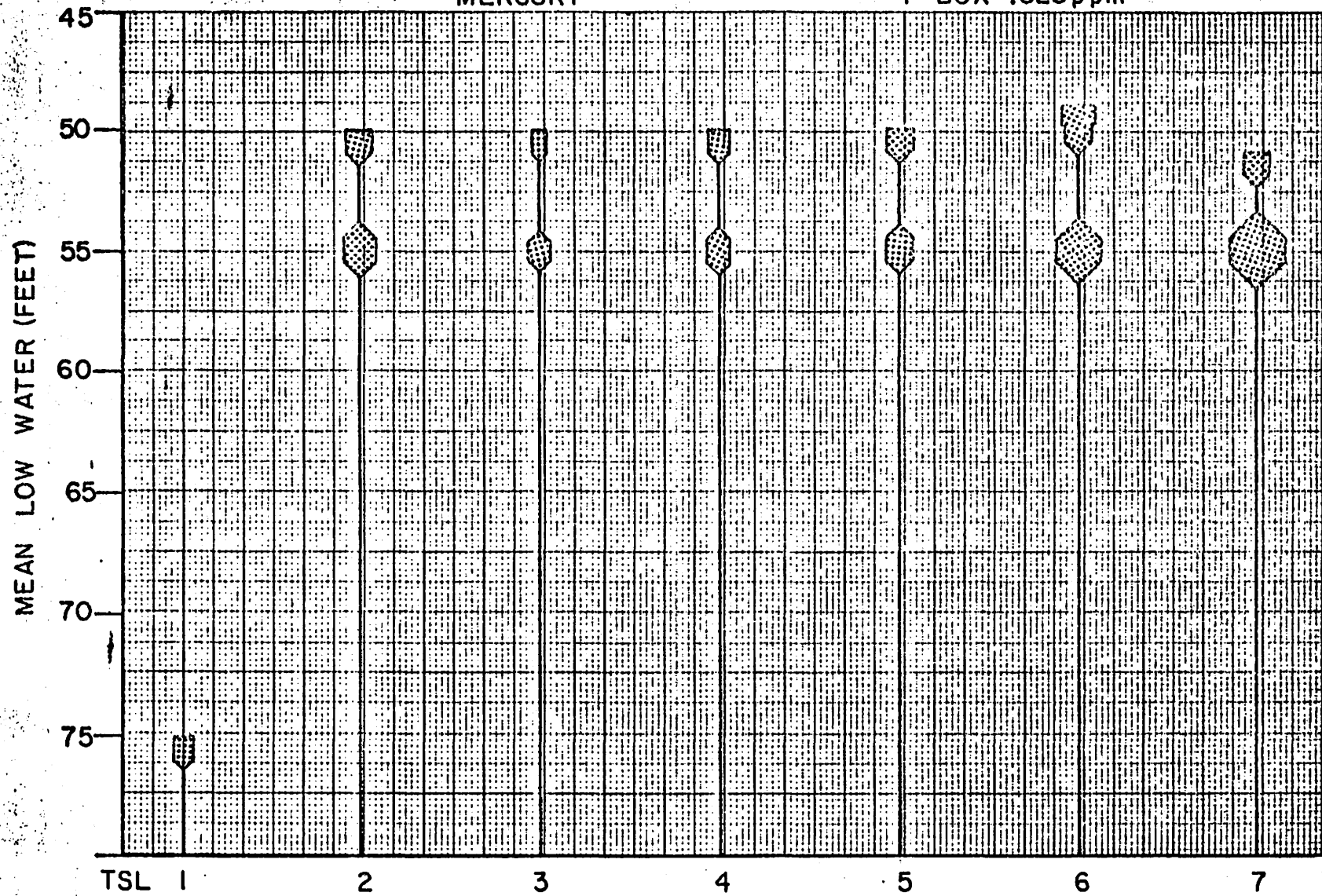
1 BOX=2ppm



THIMBLE SHOALS LONG CORES
CORPS: SUMMER 1972

MERCURY

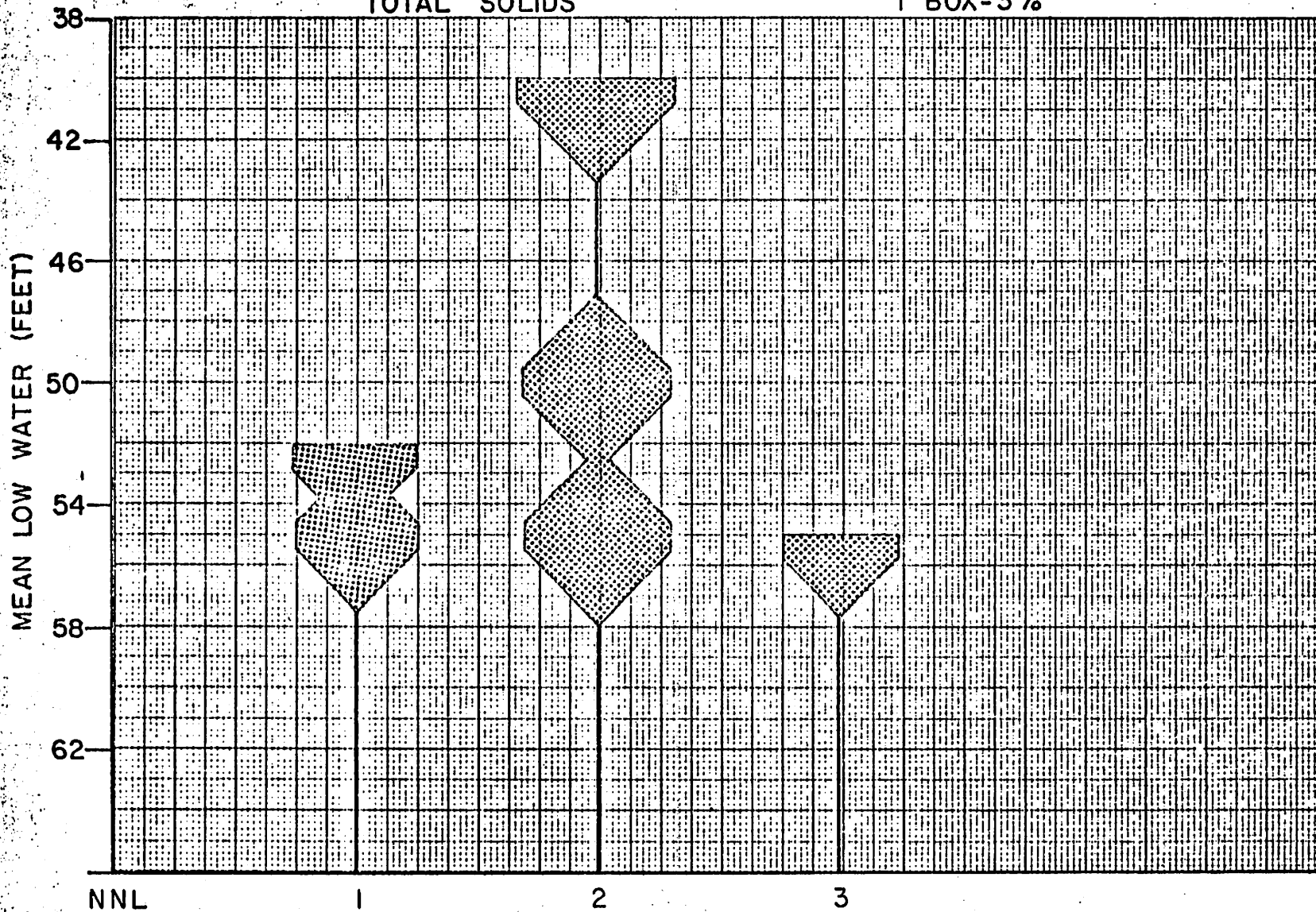
1 BOX = .025 ppm



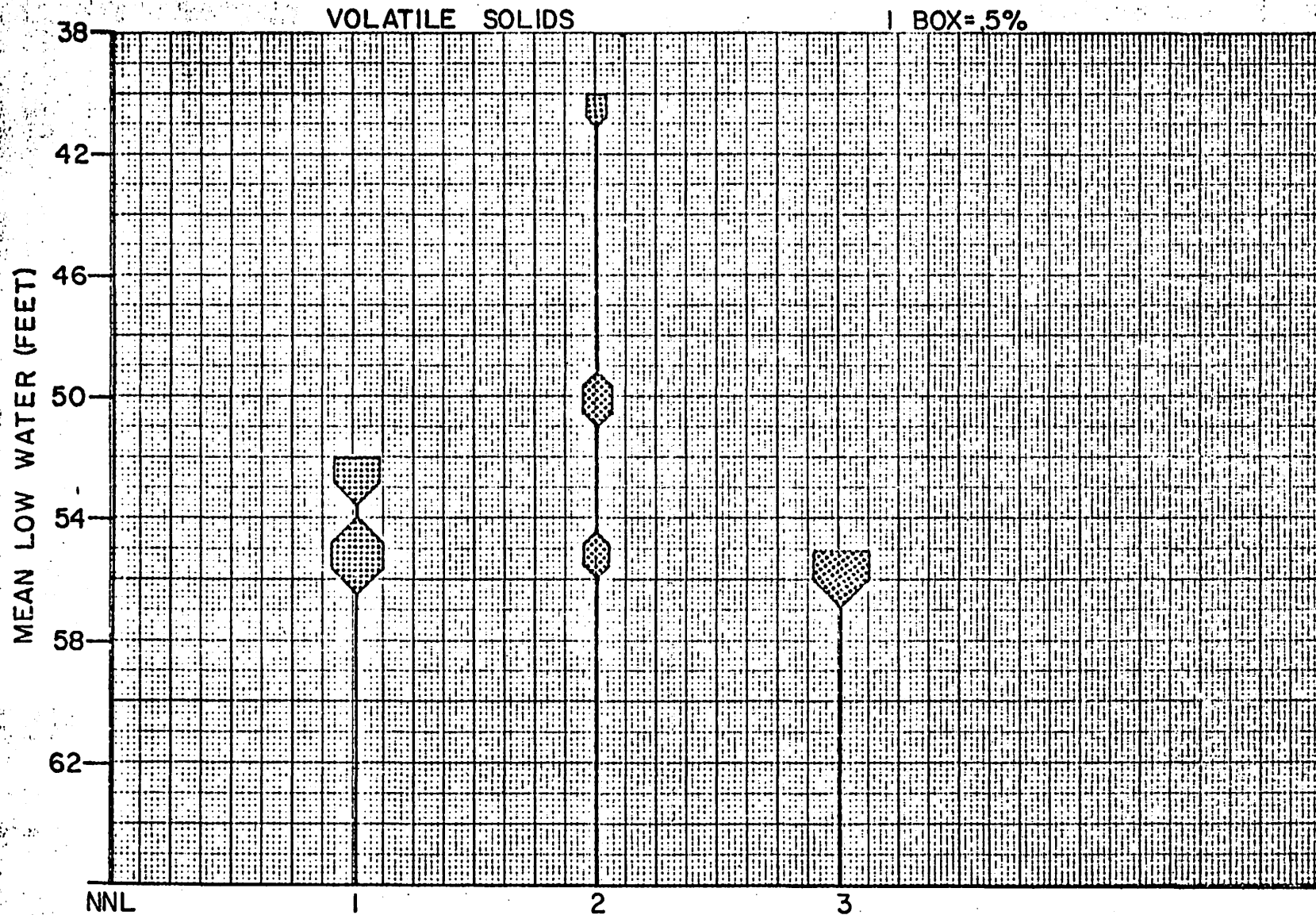
NEWPORT NEWS LONG CORES
CORPS: SUMMER 1972

TOTAL SOLIDS

1 BOX=3%

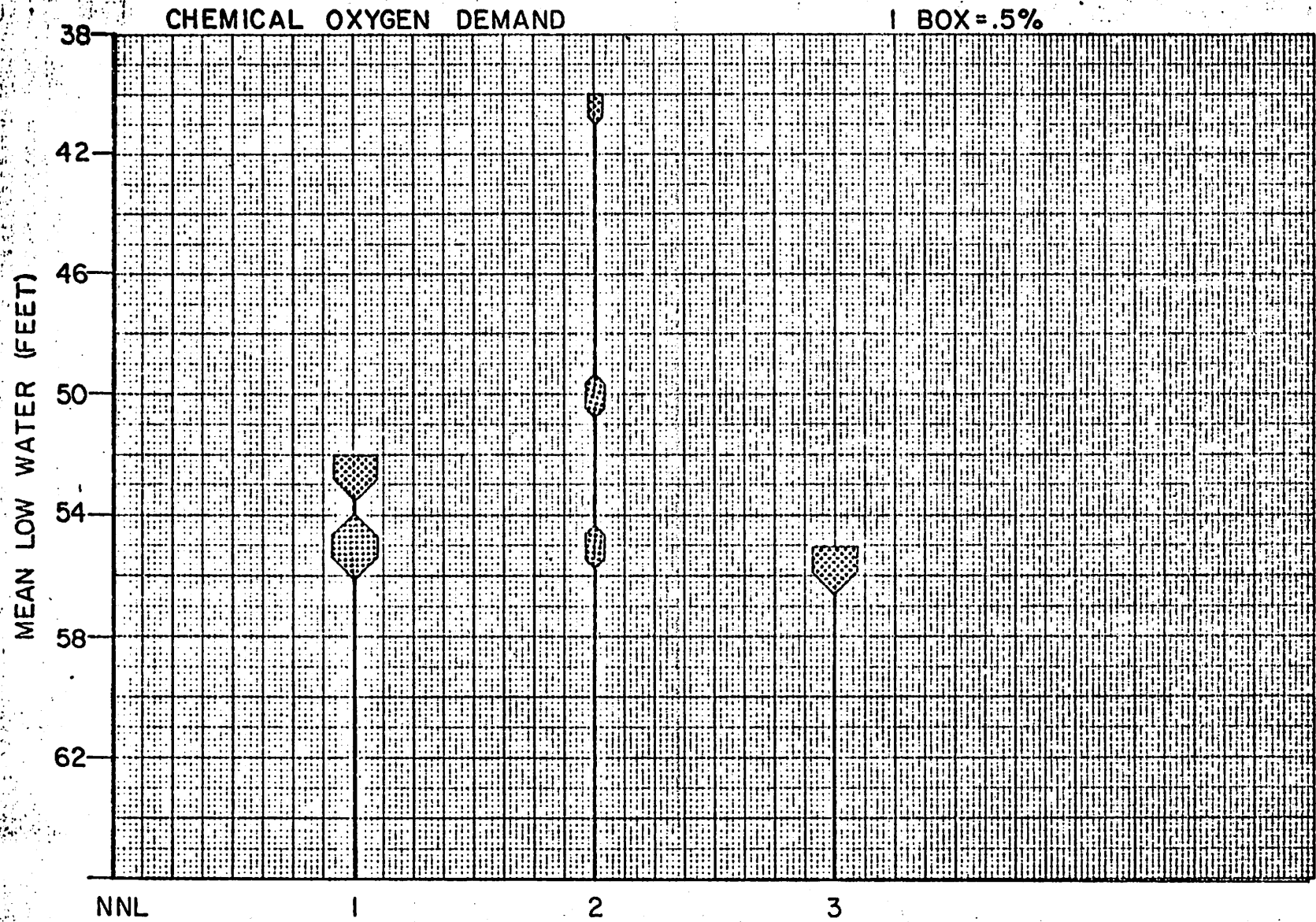


NEWPORT NEWS LONG CORES
CORPS: SUMMER 1972



40

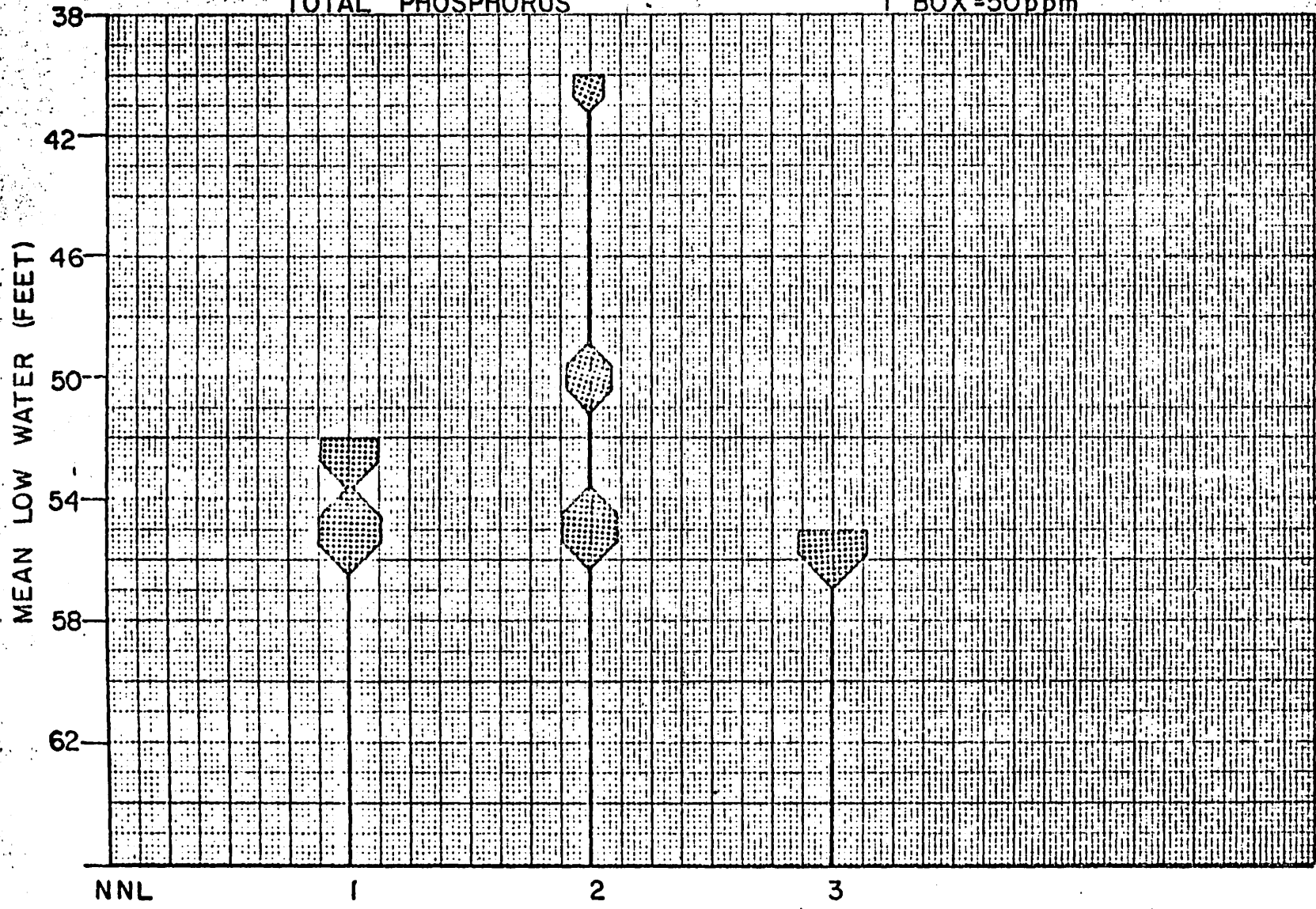
NEWPORT NEWS LONG CORES
CORPS: SUMMER 1972



NEWPORT NEWS LONG CORES
CORPS: SUMMER 1972

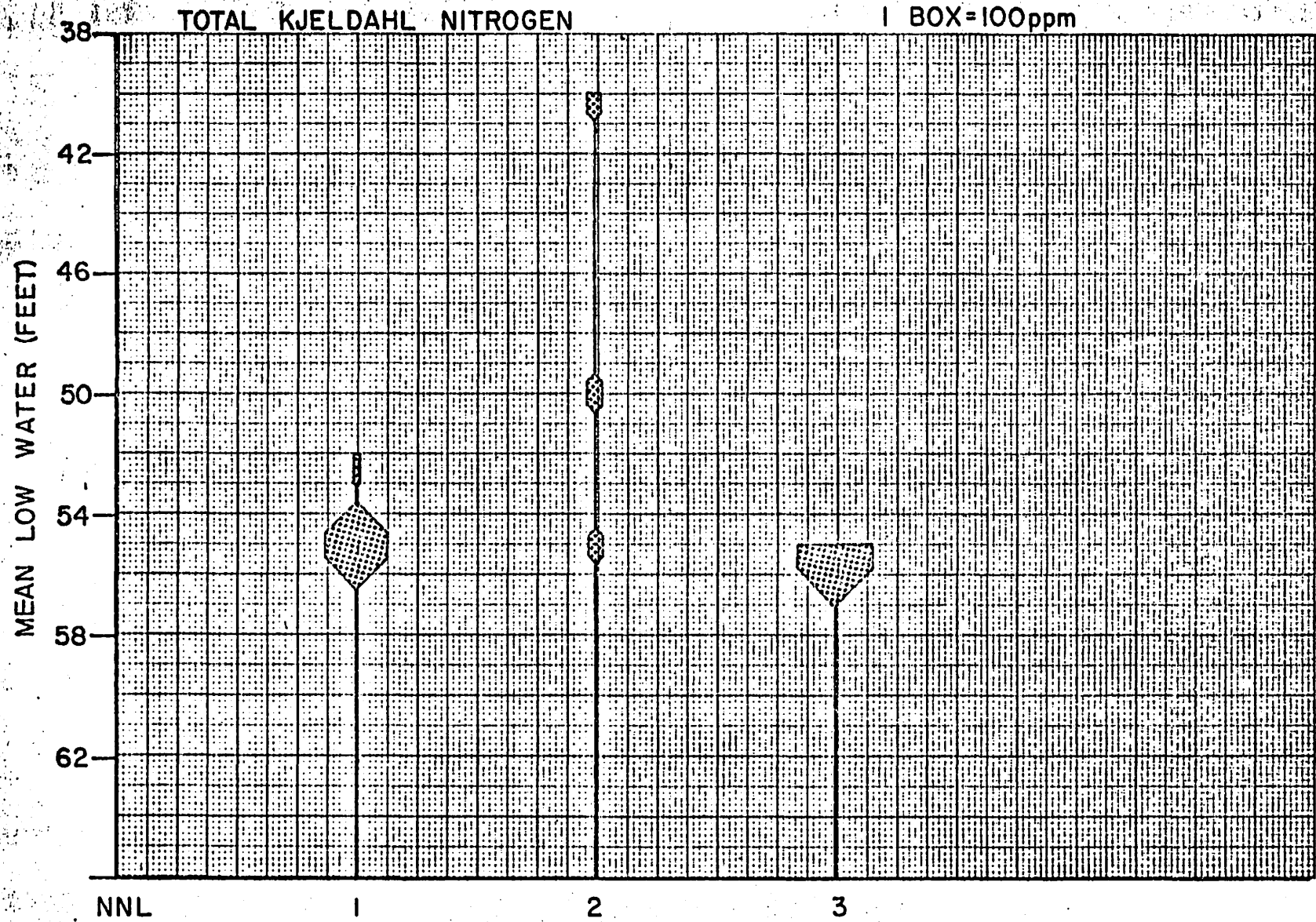
TOTAL PHOSPHORUS

1 BOX = 50 ppm

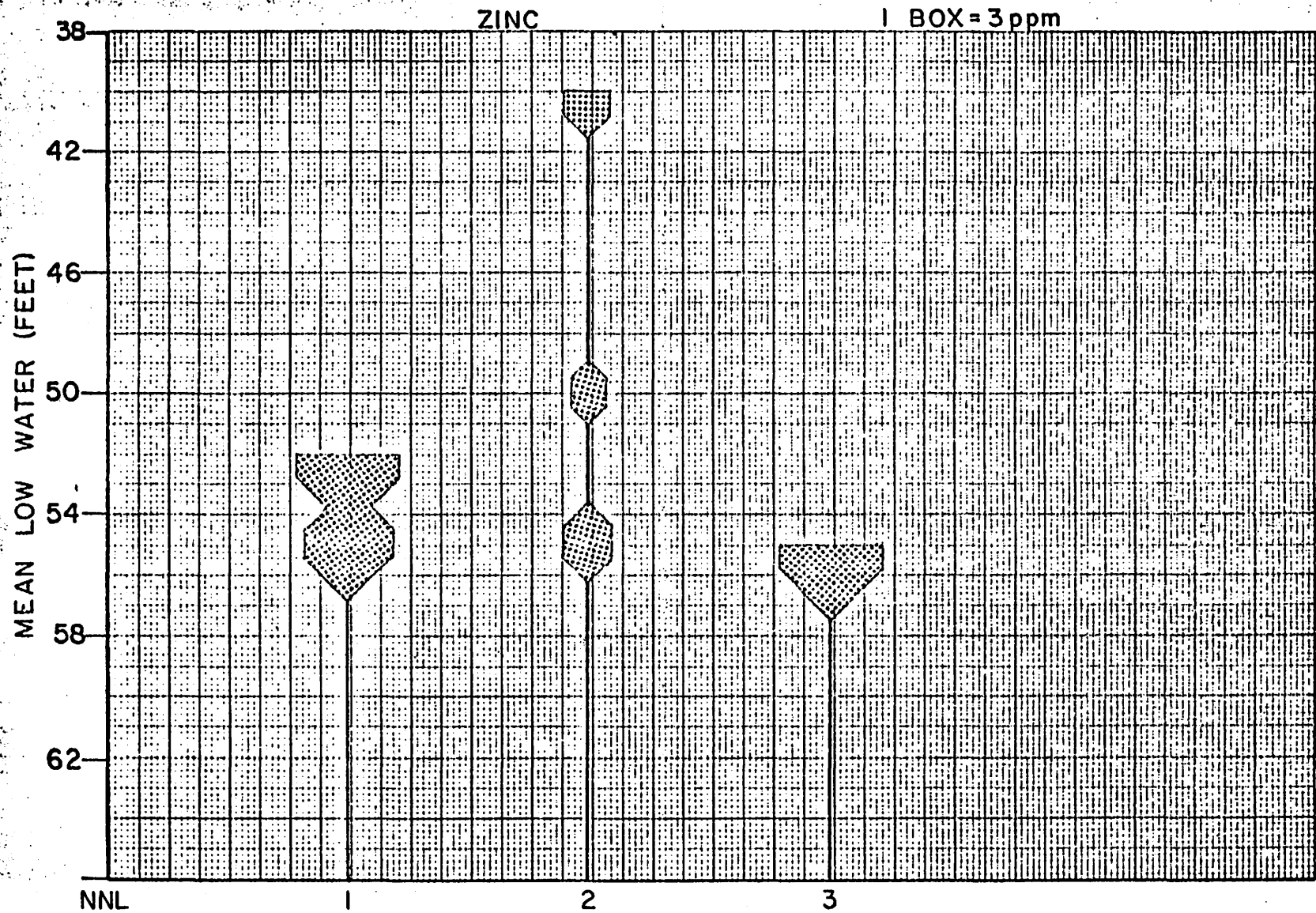


42

NEWPORT NEWS LONG CORES
CORPS: SUMMER 1972



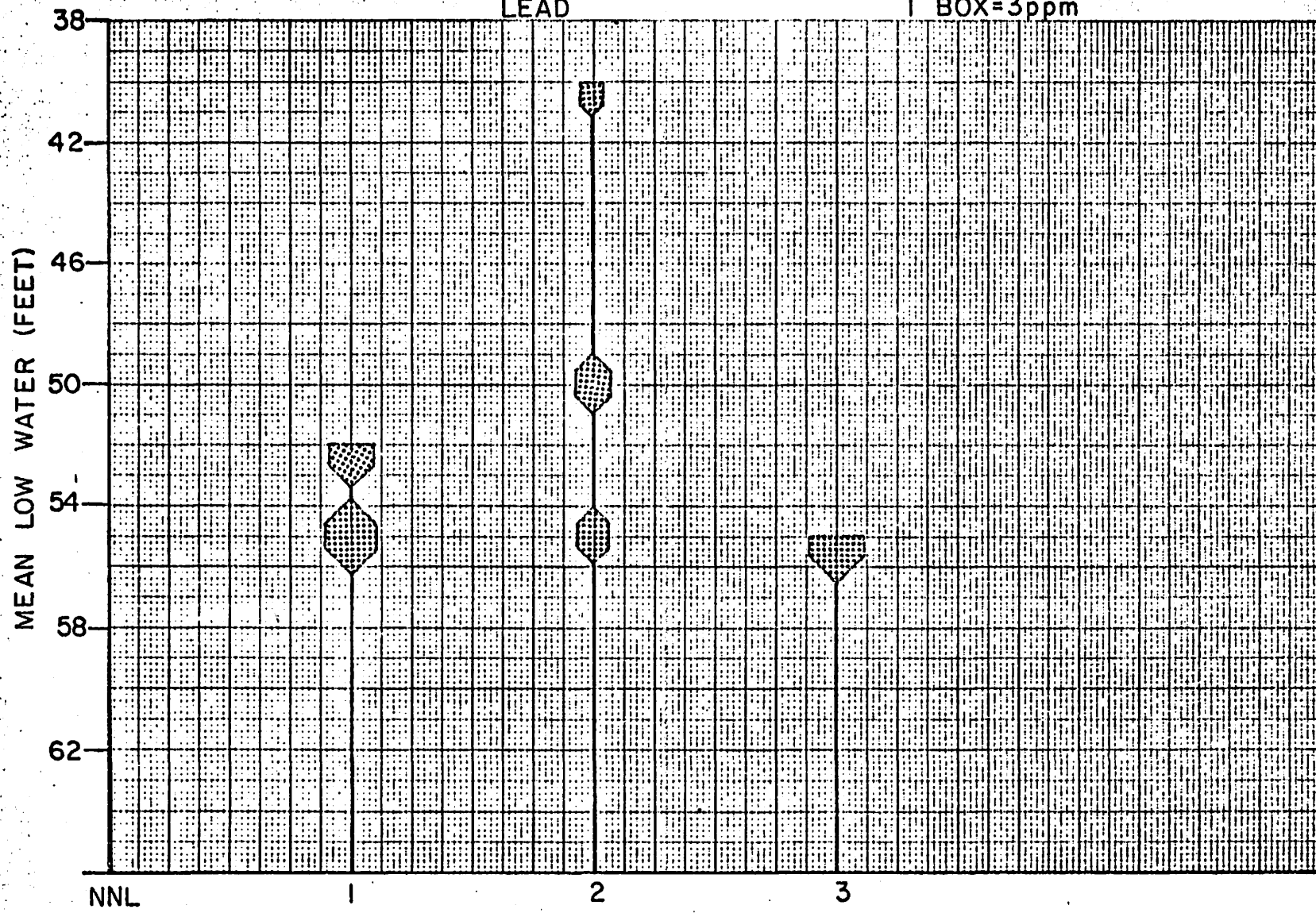
NEWPORT NEWS LONG CORES
CORPS: SUMMER 1972



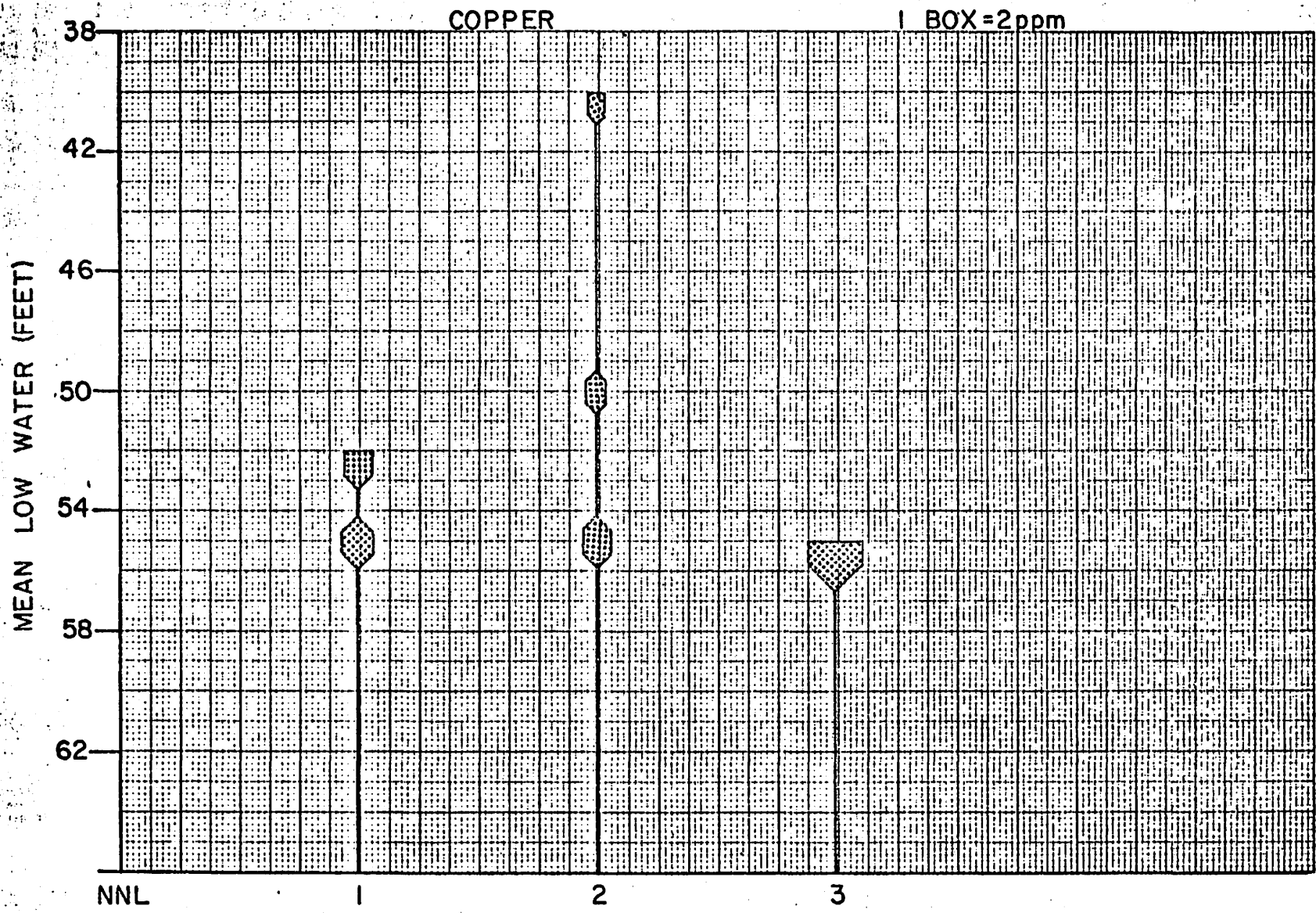
NEWPORT NEWS LONG CORES
CORPS: SUMMER 1972

LEAD

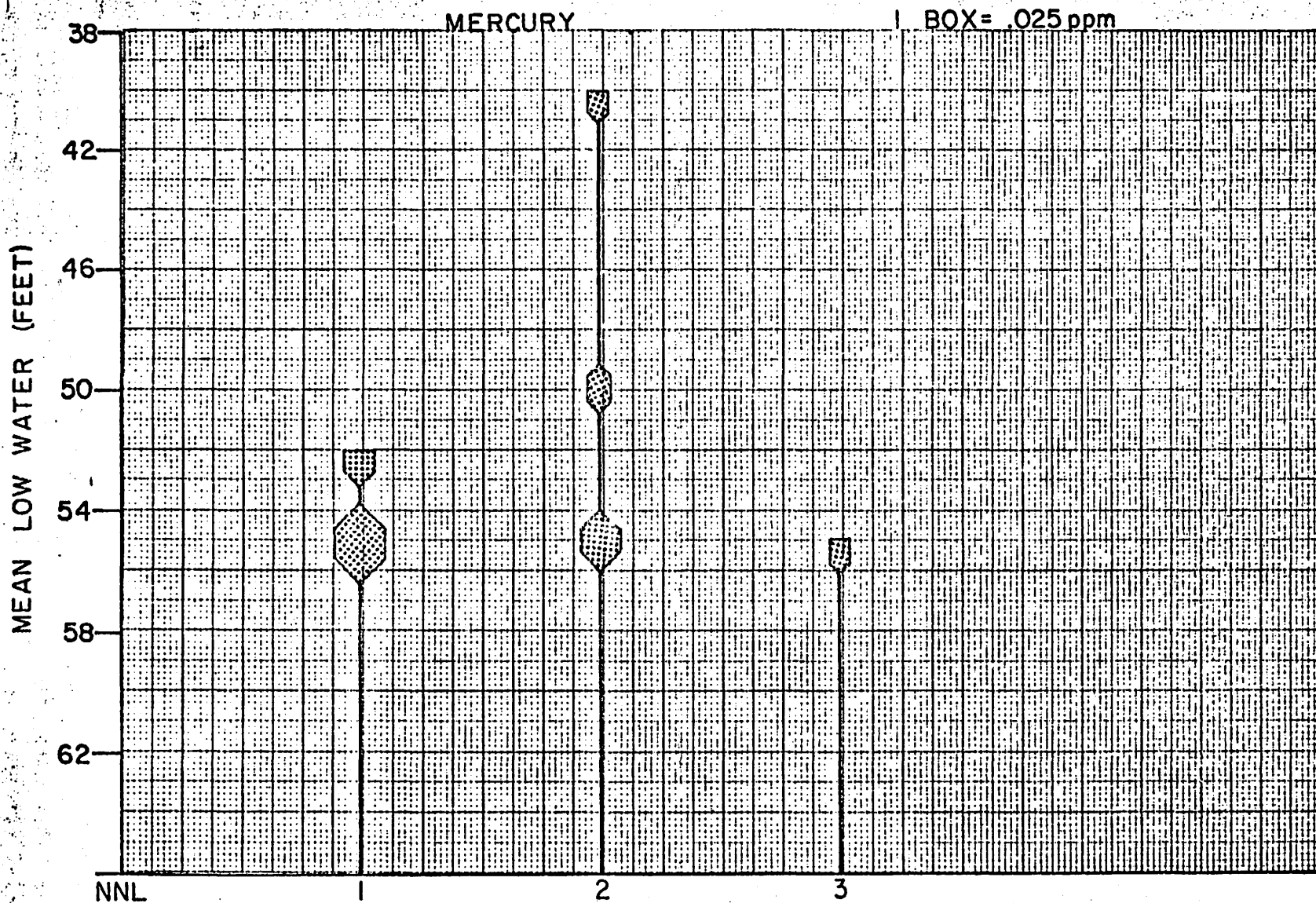
1 BOX=3ppm



NEWPORT NEWS LONG CORES
CORPS: SUMMER 1972



NEWPORT NEWS LONG CORES
CORPS: SUMMER 1972

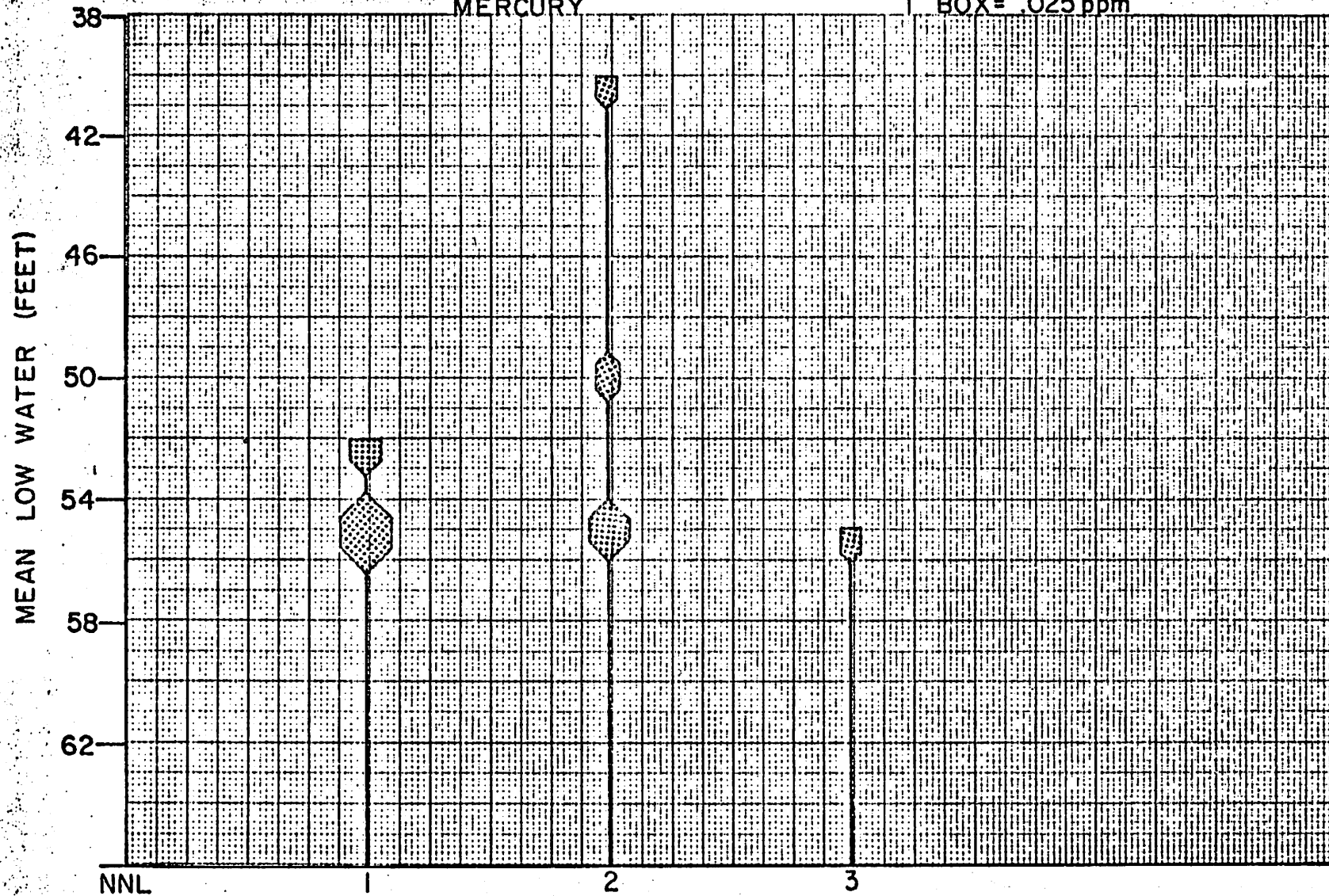


14

NEWPORT NEWS LONG CORES
CORPS: SUMMER 1972

MERCURY

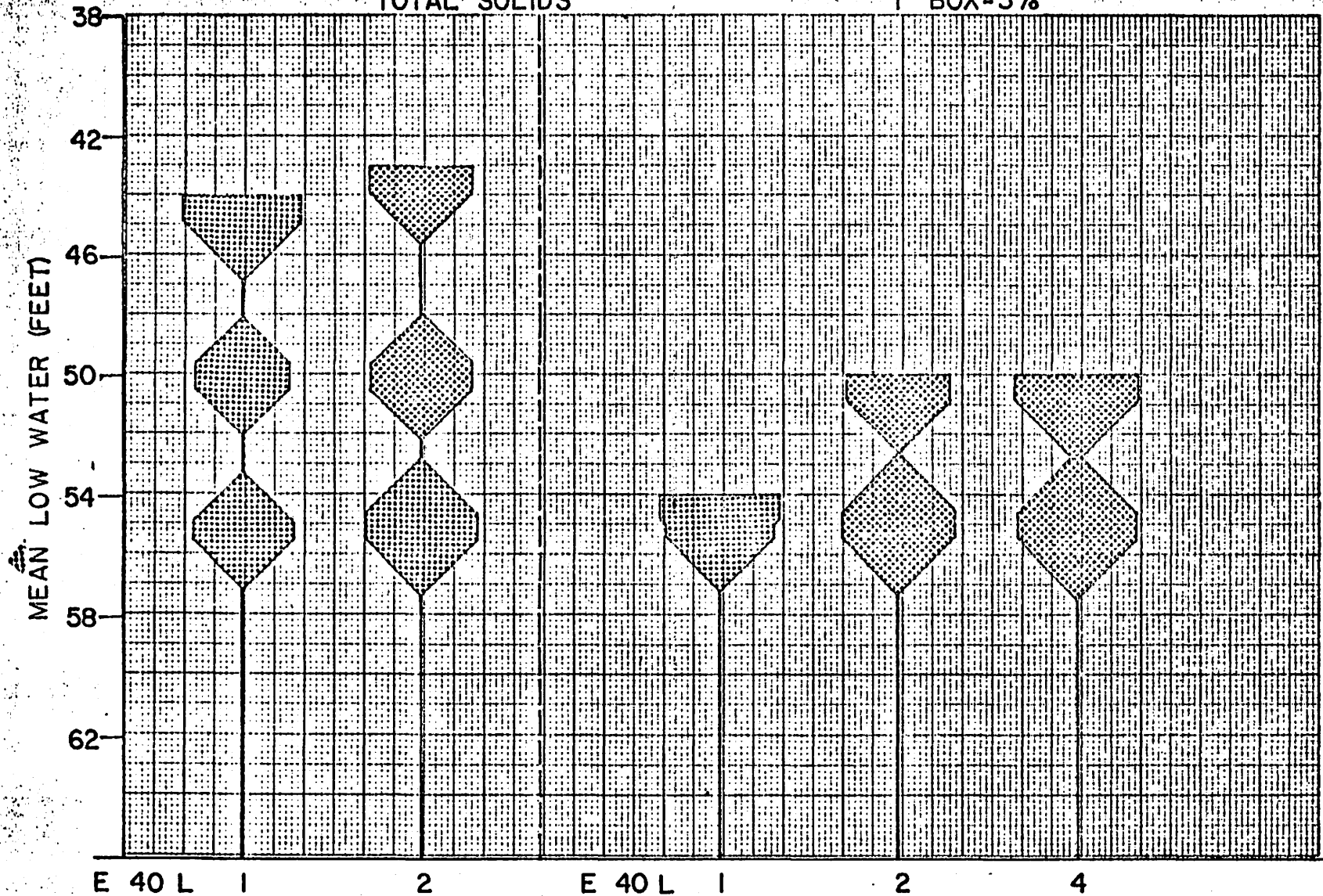
1 BOX = .025 ppm



NORFOLK HARBOR LONG CORES
CORPS: SUMMER 1972

TOTAL SOLIDS

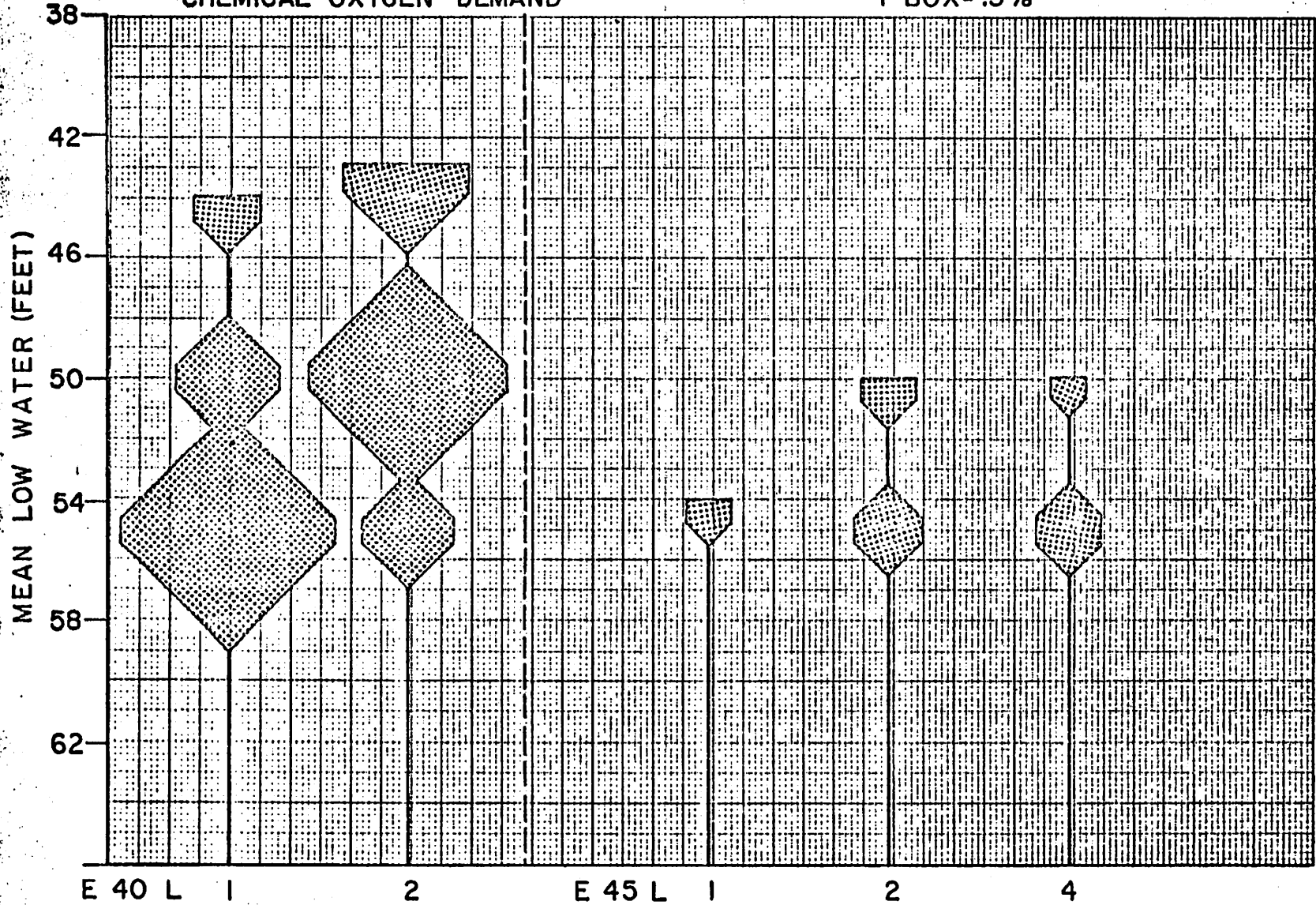
1 BOX=3%



NORFOLK HARBOR LONG CORES
CORPS: SUMMER 1972

CHEMICAL OXYGEN DEMAND

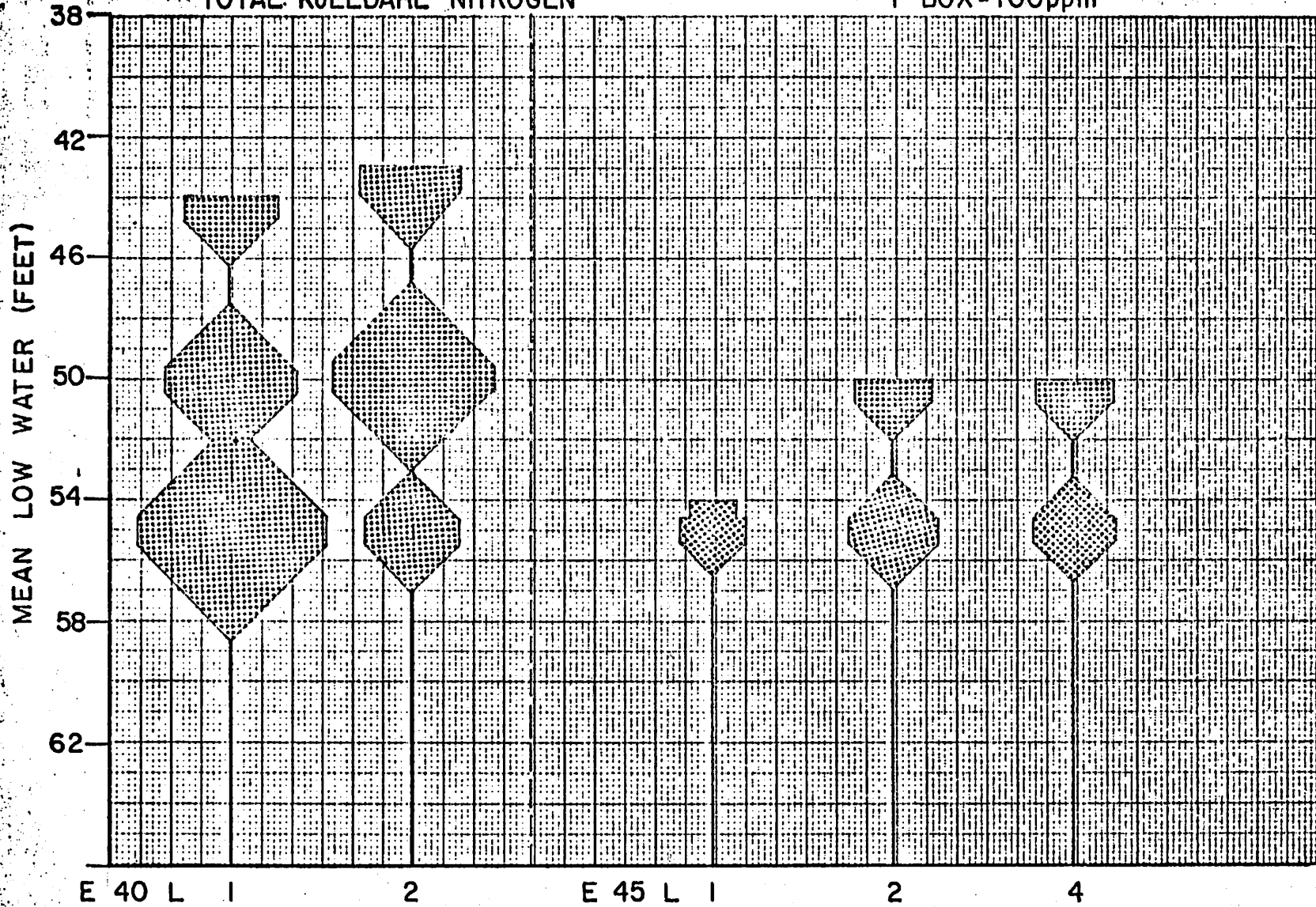
1 BOX = .5%



NORFOLK HARBOR LONG CORES
CORPS: SUMMER 1972

TOTAL KJELDAHL NITROGEN

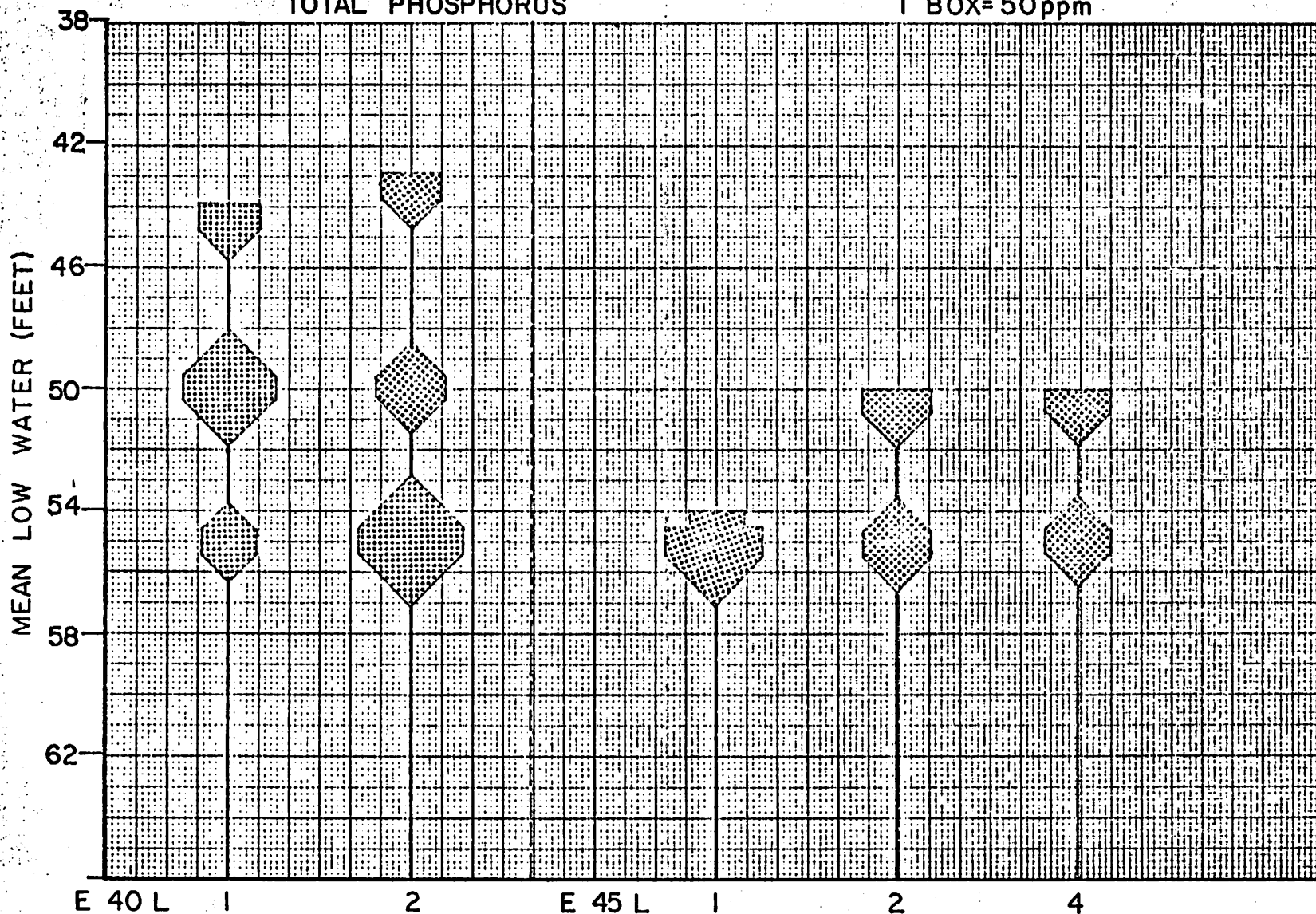
1 BOX=100ppm



NORFOLK HARBOR LONG CORES
CORPS: SUMMER 1972

TOTAL PHOSPHORUS

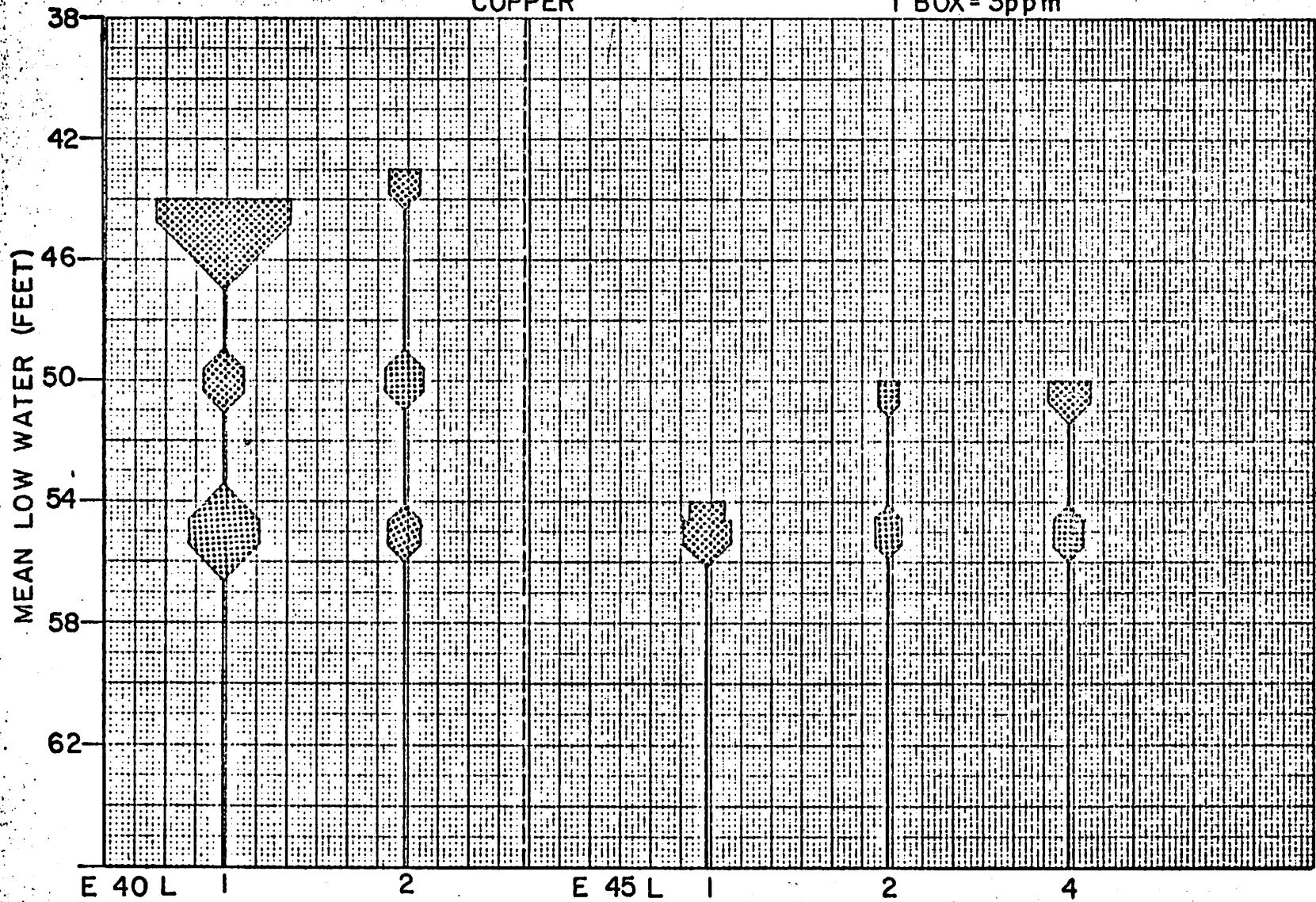
1 BOX=50ppm



NORFOLK HARBOR LONG CORES
CORPS: SUMMER 1972

COPPER

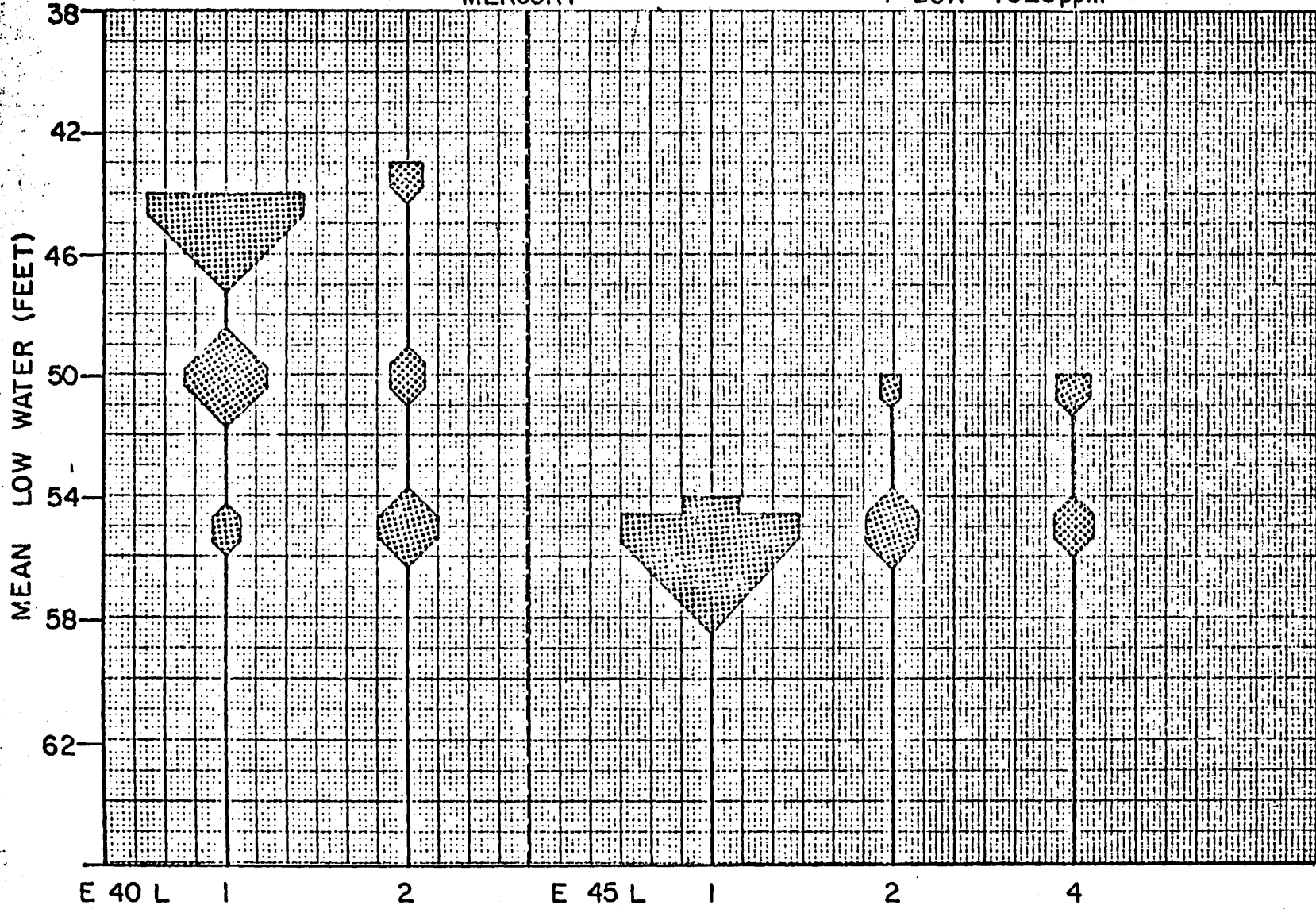
1 BOX = 3ppm



NORFOLK HARBOR LONG CORES
CORPS: SUMMER 1972

MERCURY

1 BOX = .025ppm

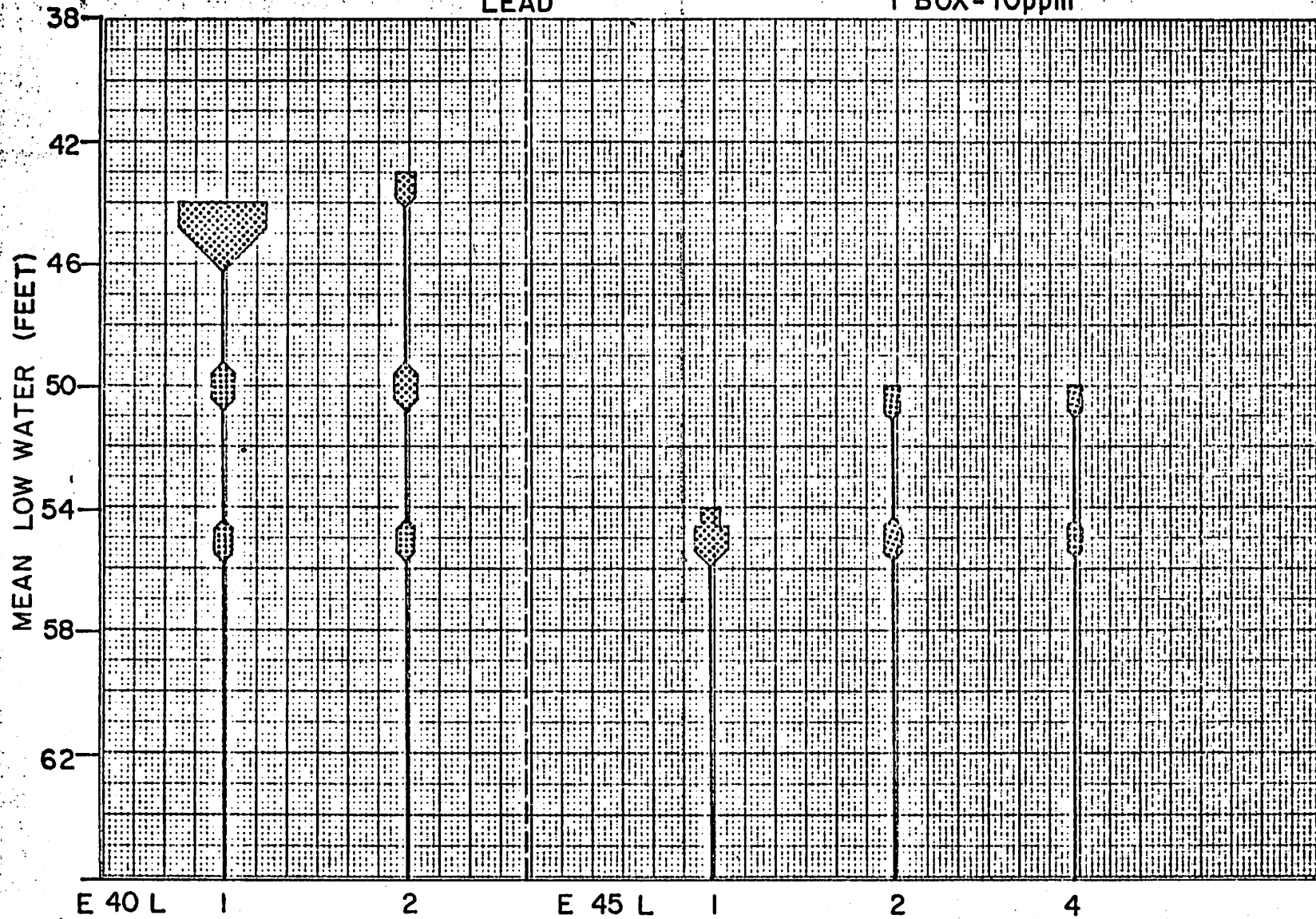


NORFOLK HARBOR LONG CORES

CORPS: SUMMER 1972

LEAD

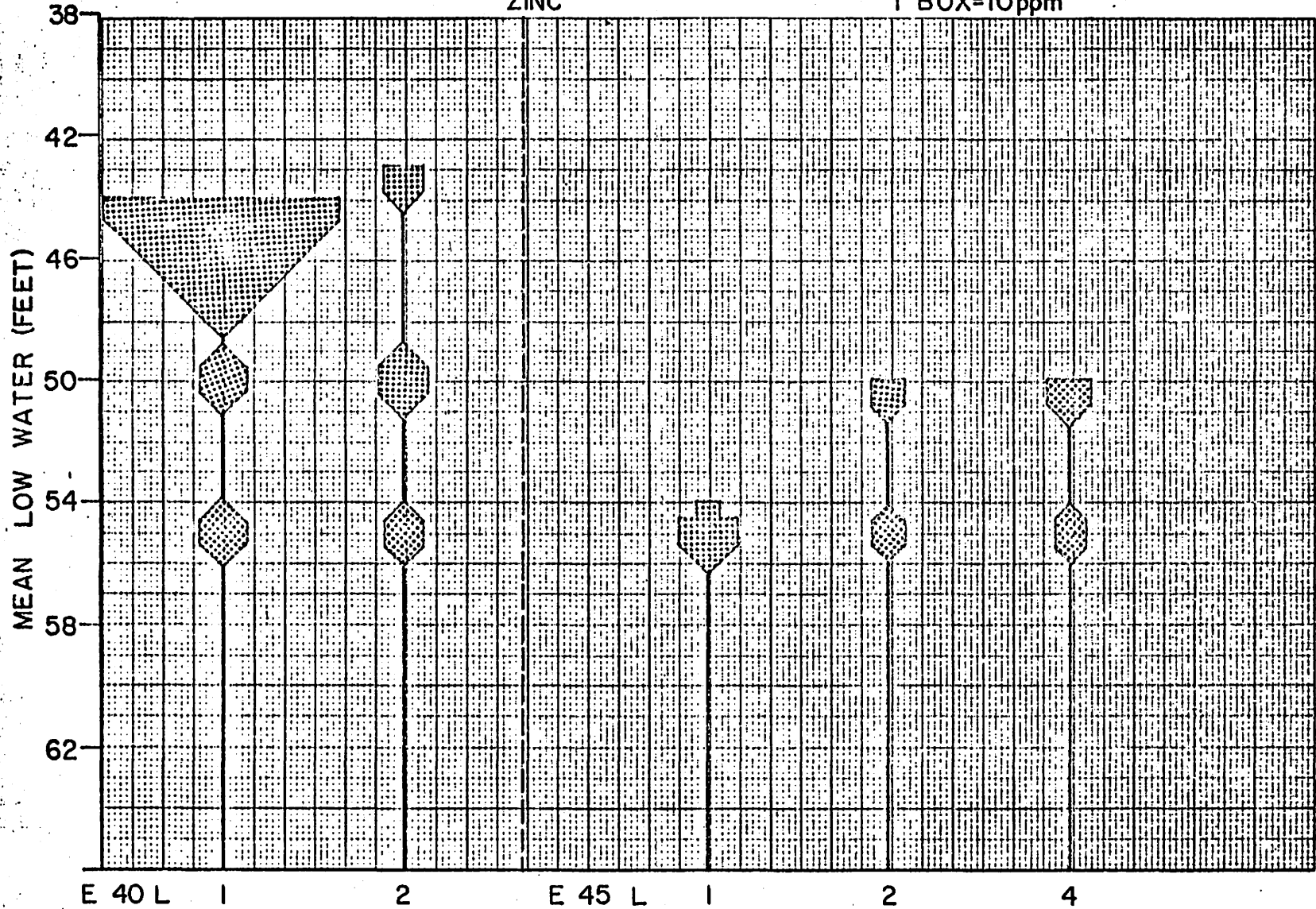
1 BOX = 10ppm



NORFOLK HARBOR LONG CORES
CORPS: SUMMER 1972

ZINC

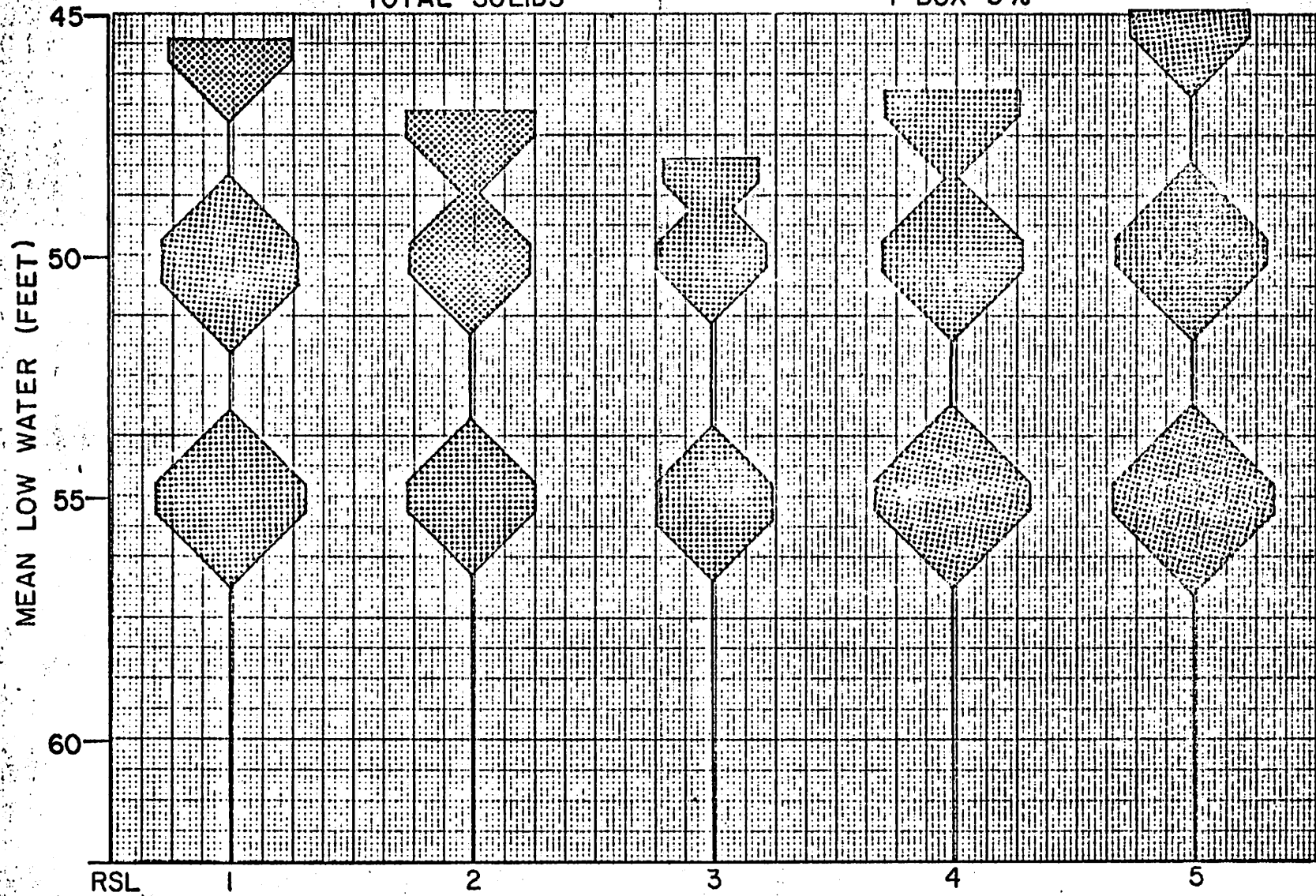
1 BOX=10ppm



RAPPAHANNOCK SHOALS LONG CORES
CORPS: SUMMER 1972

TOTAL SOLIDS

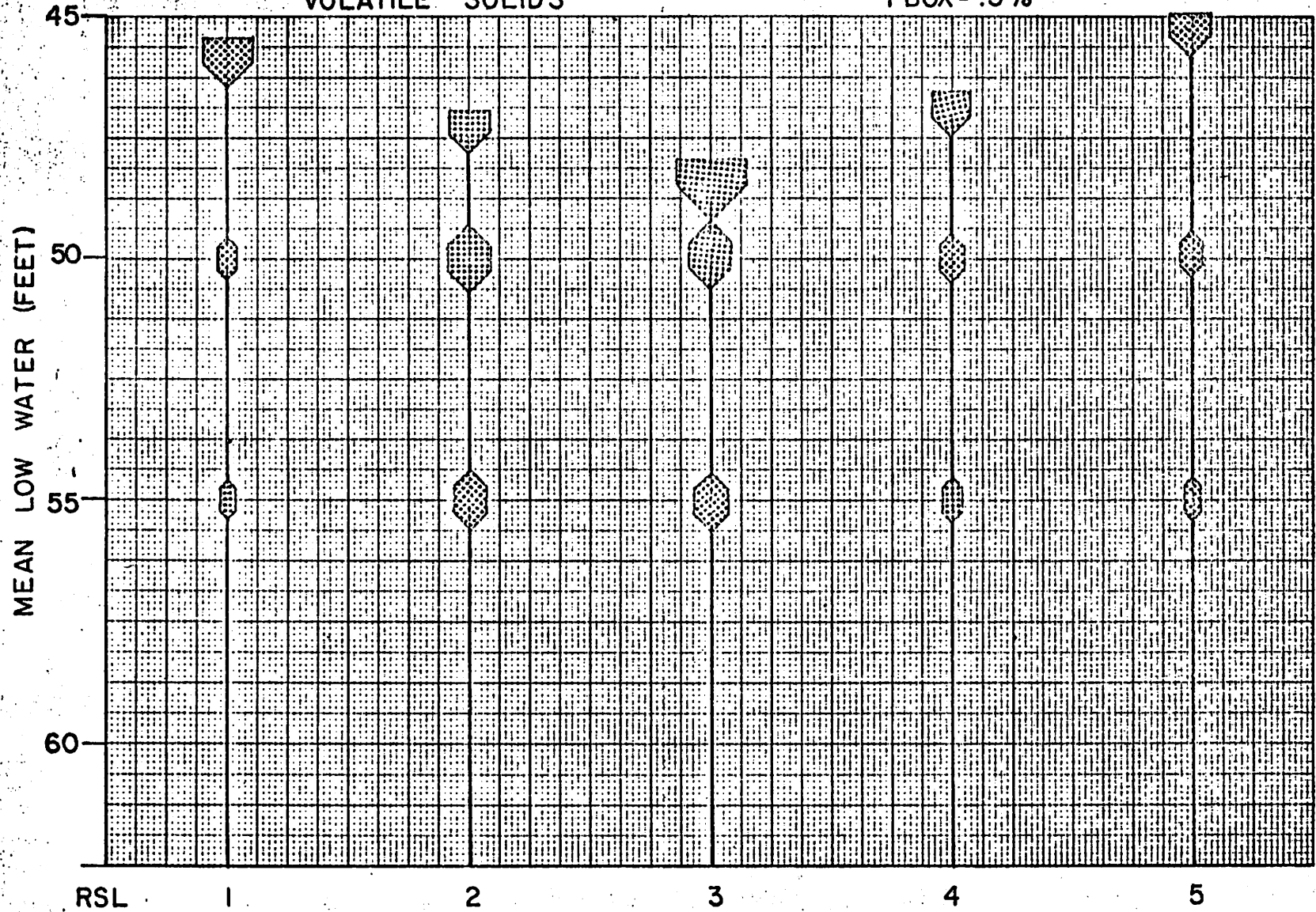
1 BOX=3%



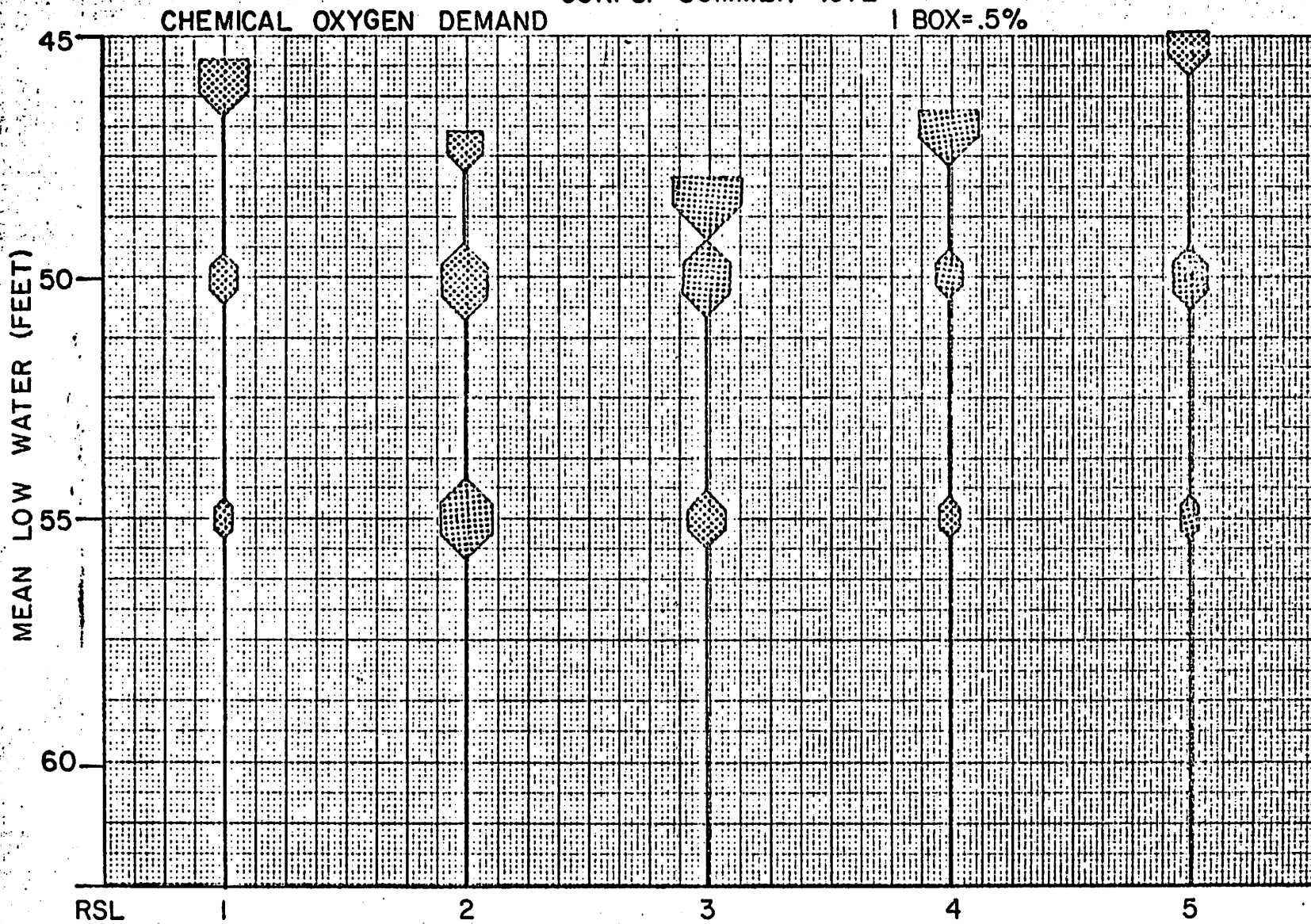
RAPPAHANNOCK SHOALS LONG CORES
CORPS: SUMMER 1972

VOLATILE SOLIDS

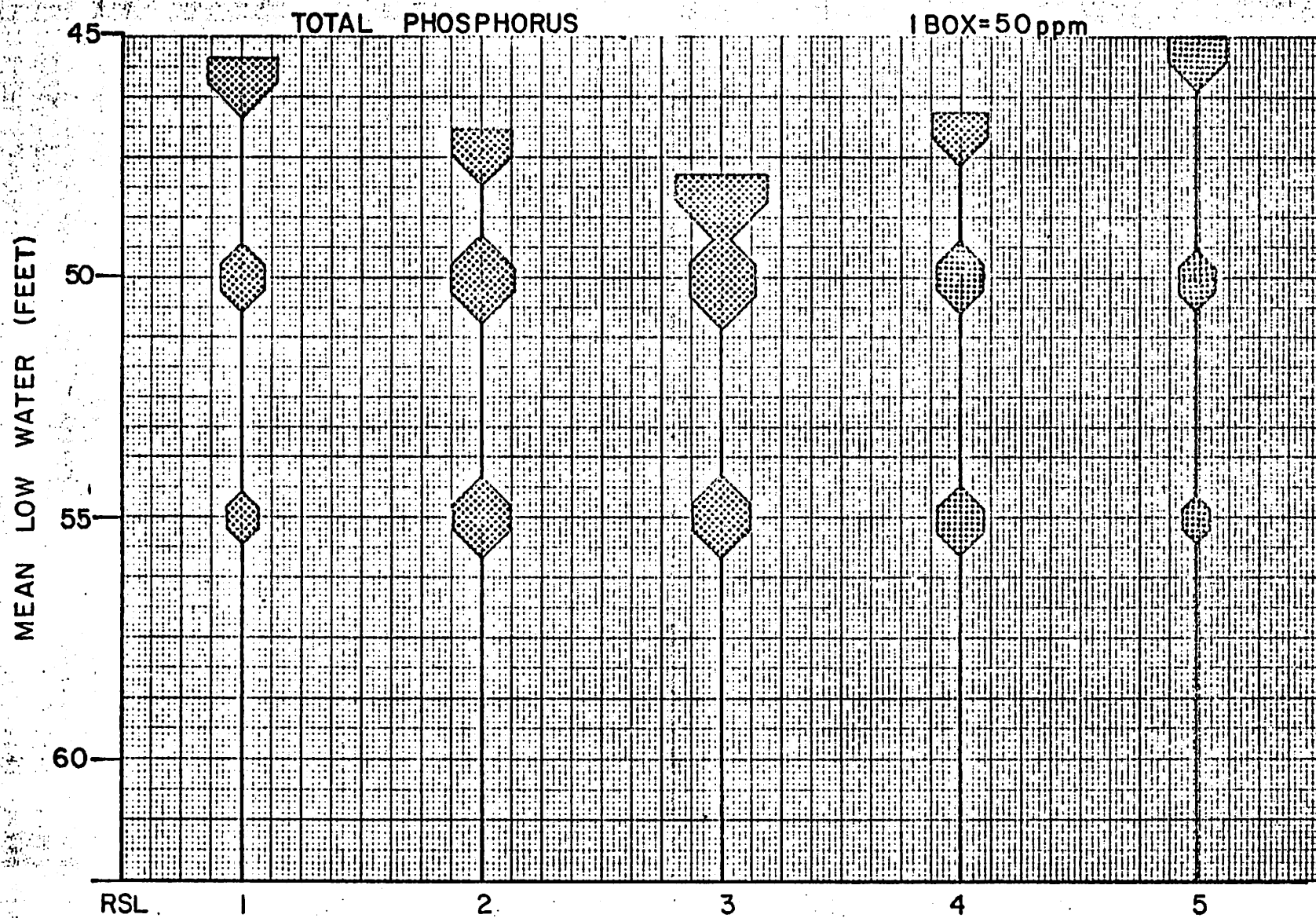
1 BOX = .5%



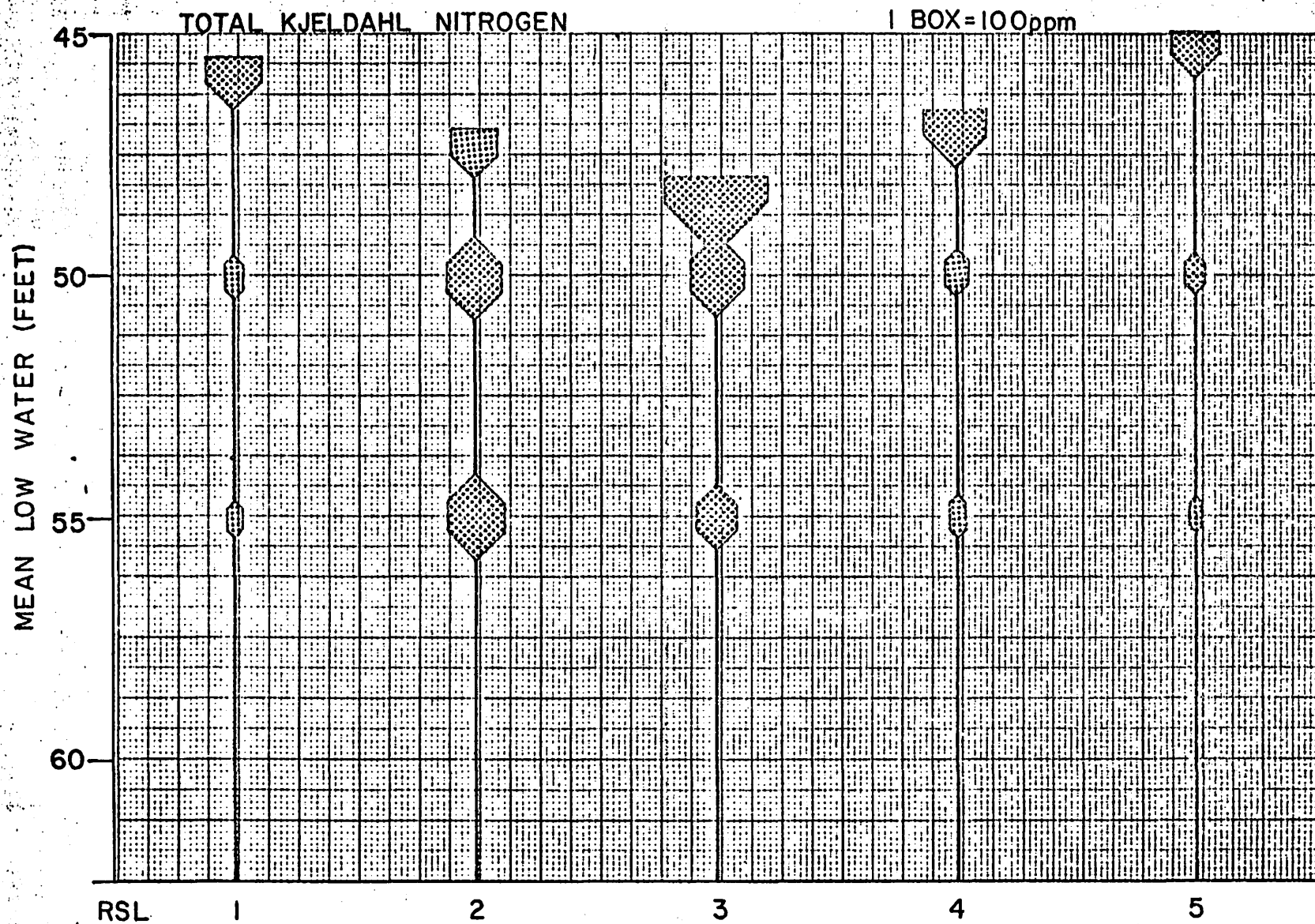
RAPPAHANNOCK SHOALS LONG CORES
CORPS: SUMMER 1972



RAPPAHANNOCK SHOALS LONG CORES
CORPS: SUMMER 1972



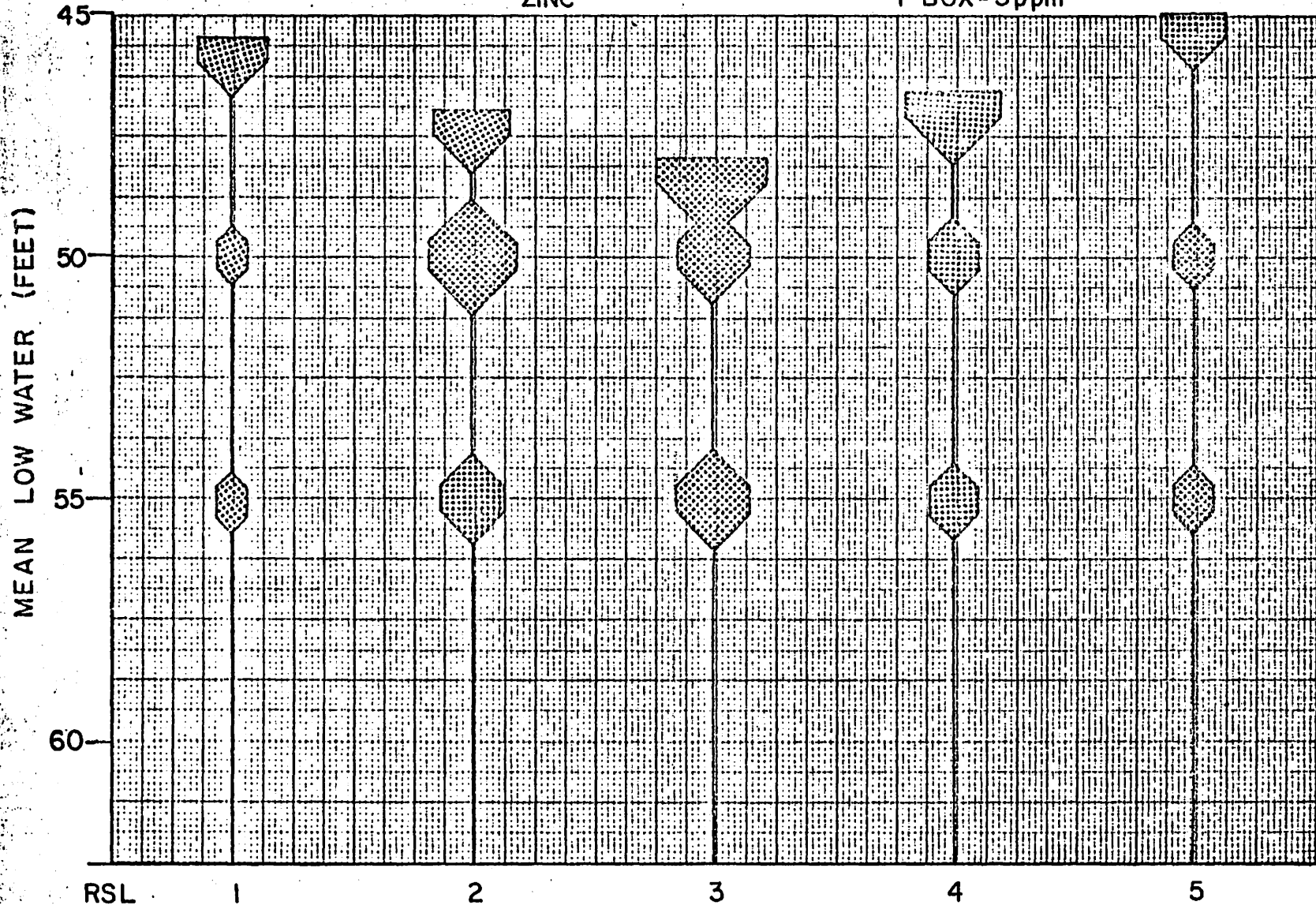
RAPPAHANNOCK SHOALS LONG CORES
CORPS: SUMMER 1972



RAPPAHANNOCK SHOALS LONG CORES
CORPS: SUMMER 1972

ZINC

1 BOX = 3 ppm

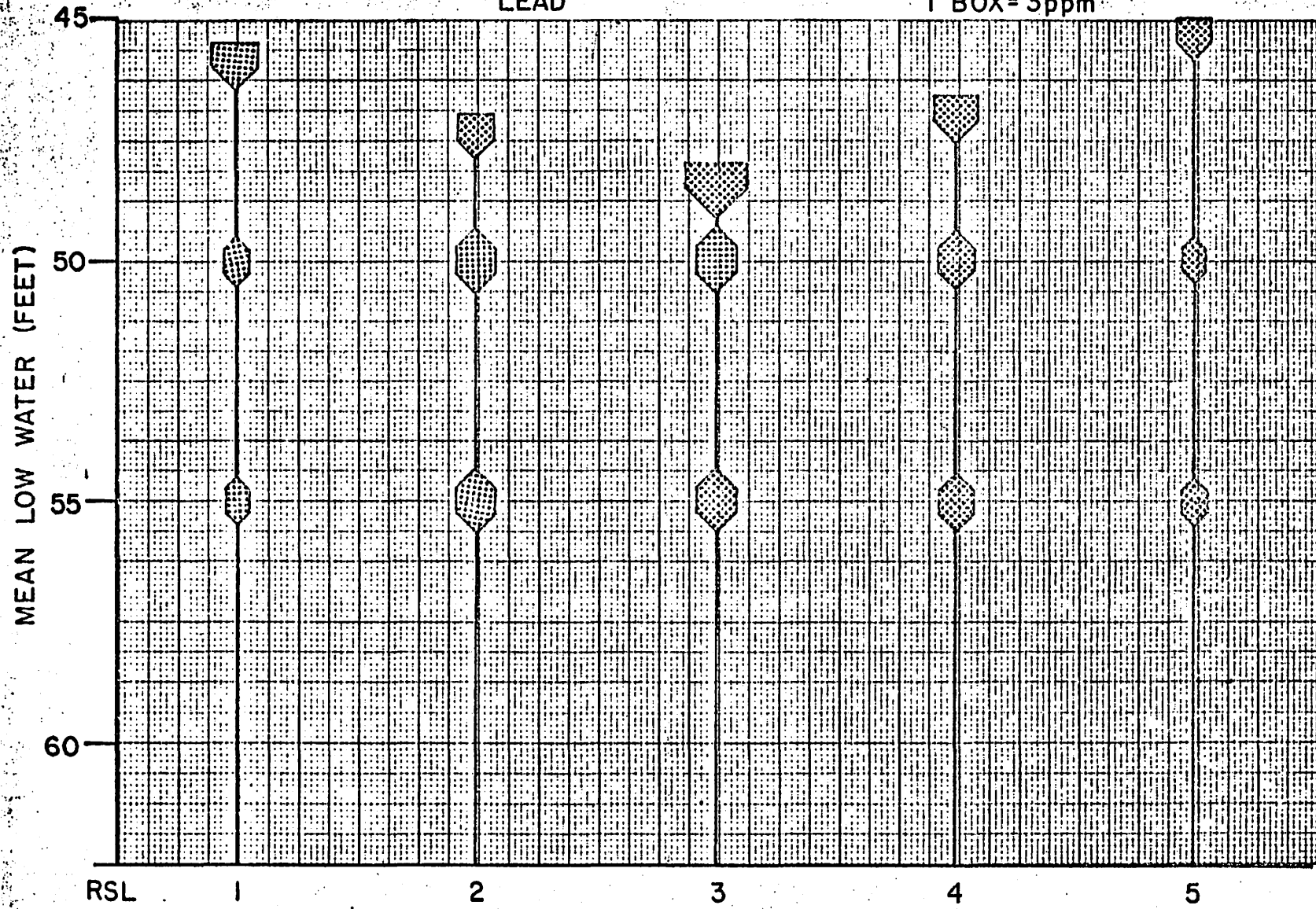


RAPPAHANNOCK SHOALS LONG CORES

CORPS: SUMMER 1972

LEAD

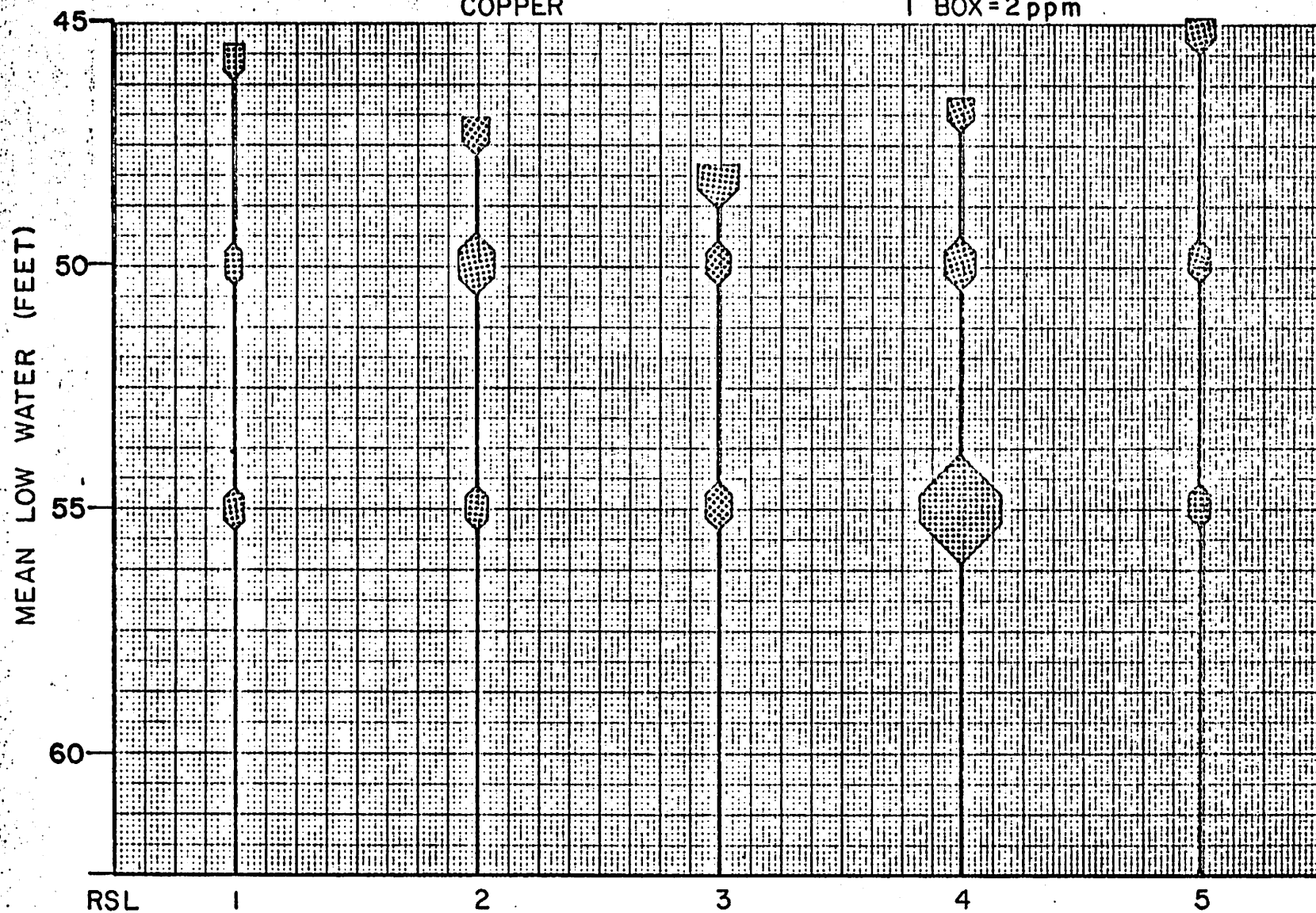
1 BOX = 3ppm



RAPPAHANNOCK SHOALS LONG CORES
CORPS: SUMMER 1972

COPPER

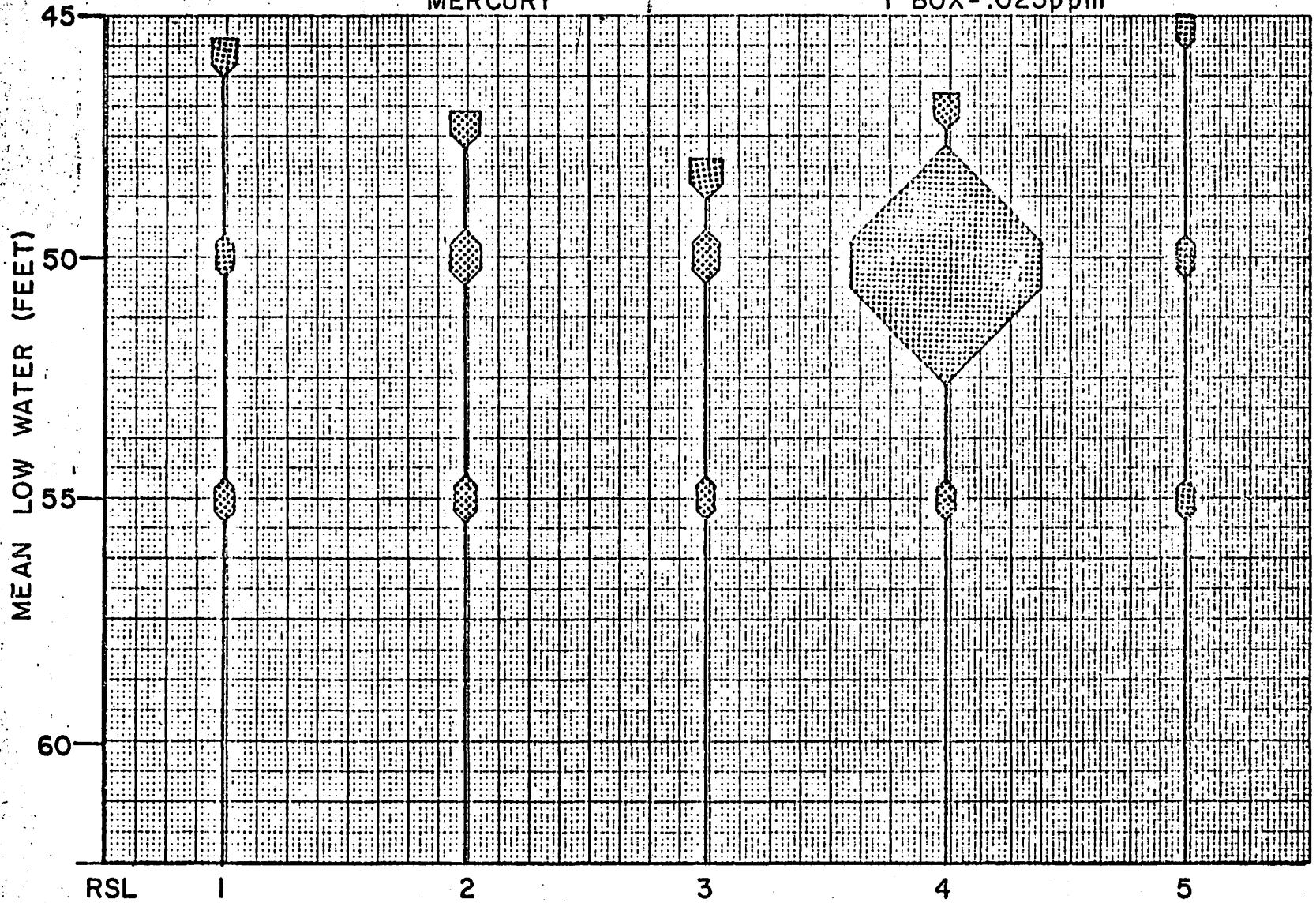
1 BOX = 2 ppm



RAPPAHANNOCK SHOALS LONG CORES
CORPS: SUMMER 1972

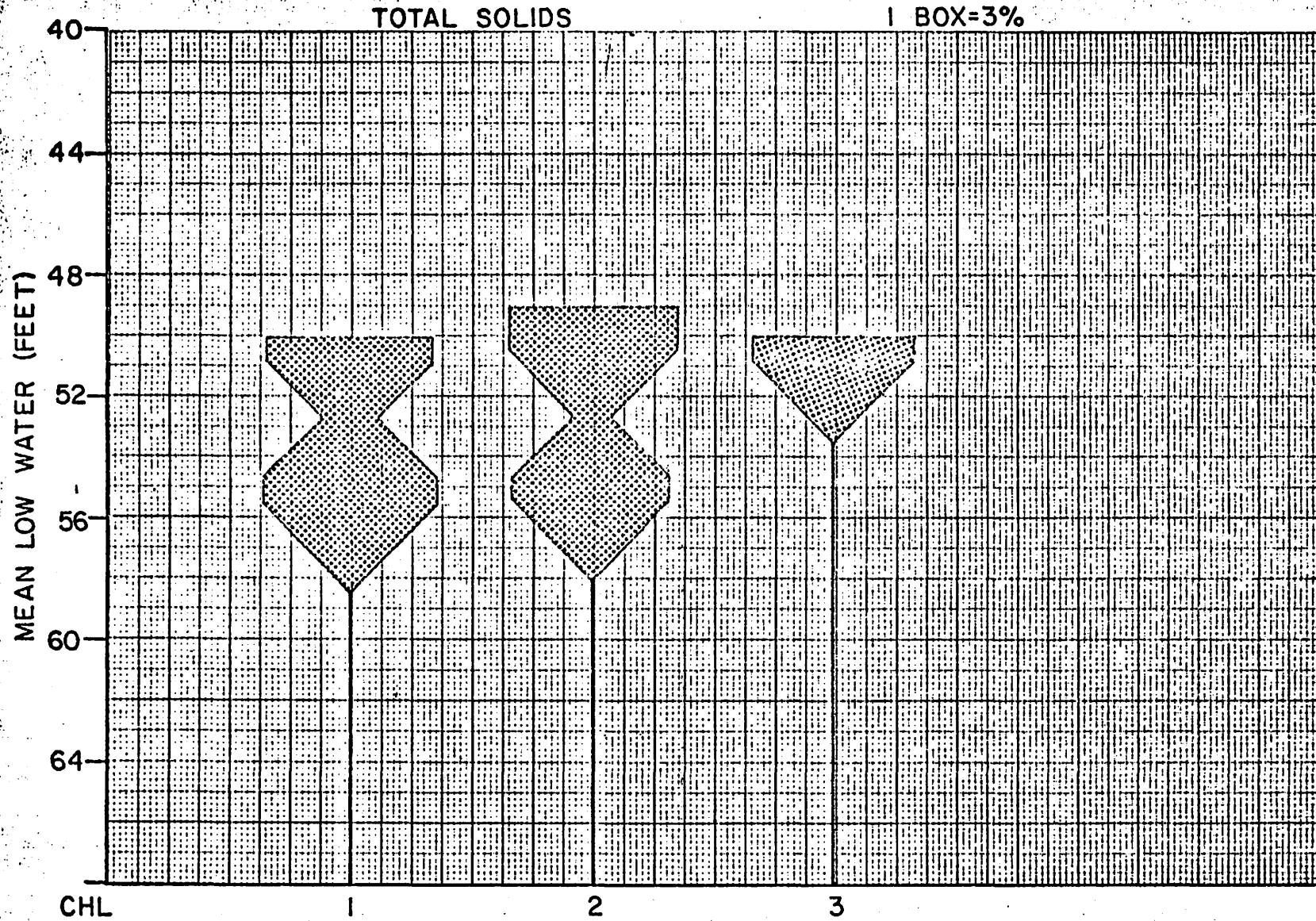
MERCURY

1 BOX = .025ppm



59

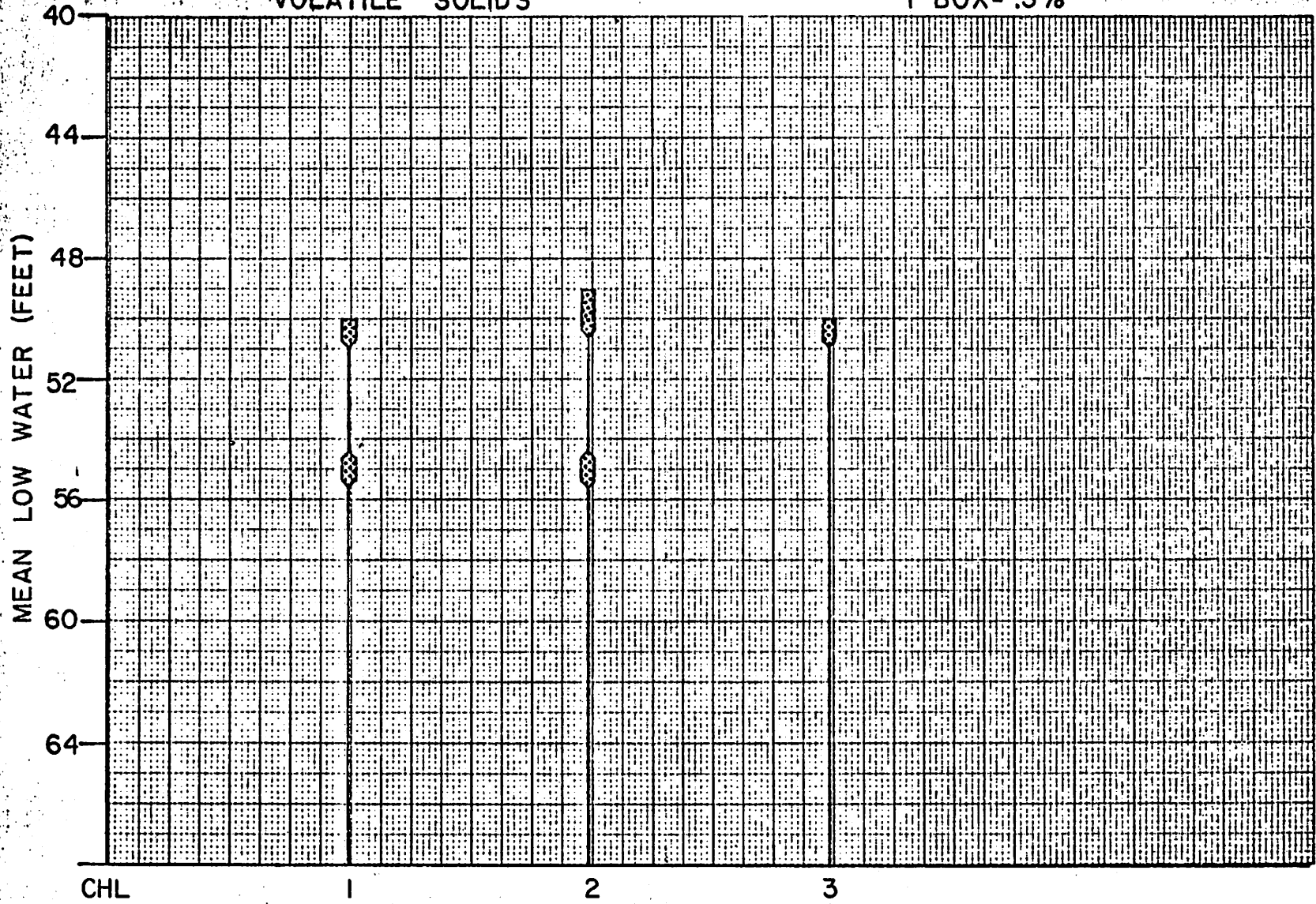
CAPE HENRY LONG CORES
CORPS: SUMMER 1972



CAPE HENRY LONG CORES
CORPS: SUMMER 1972

VOLATILE SOLIDS

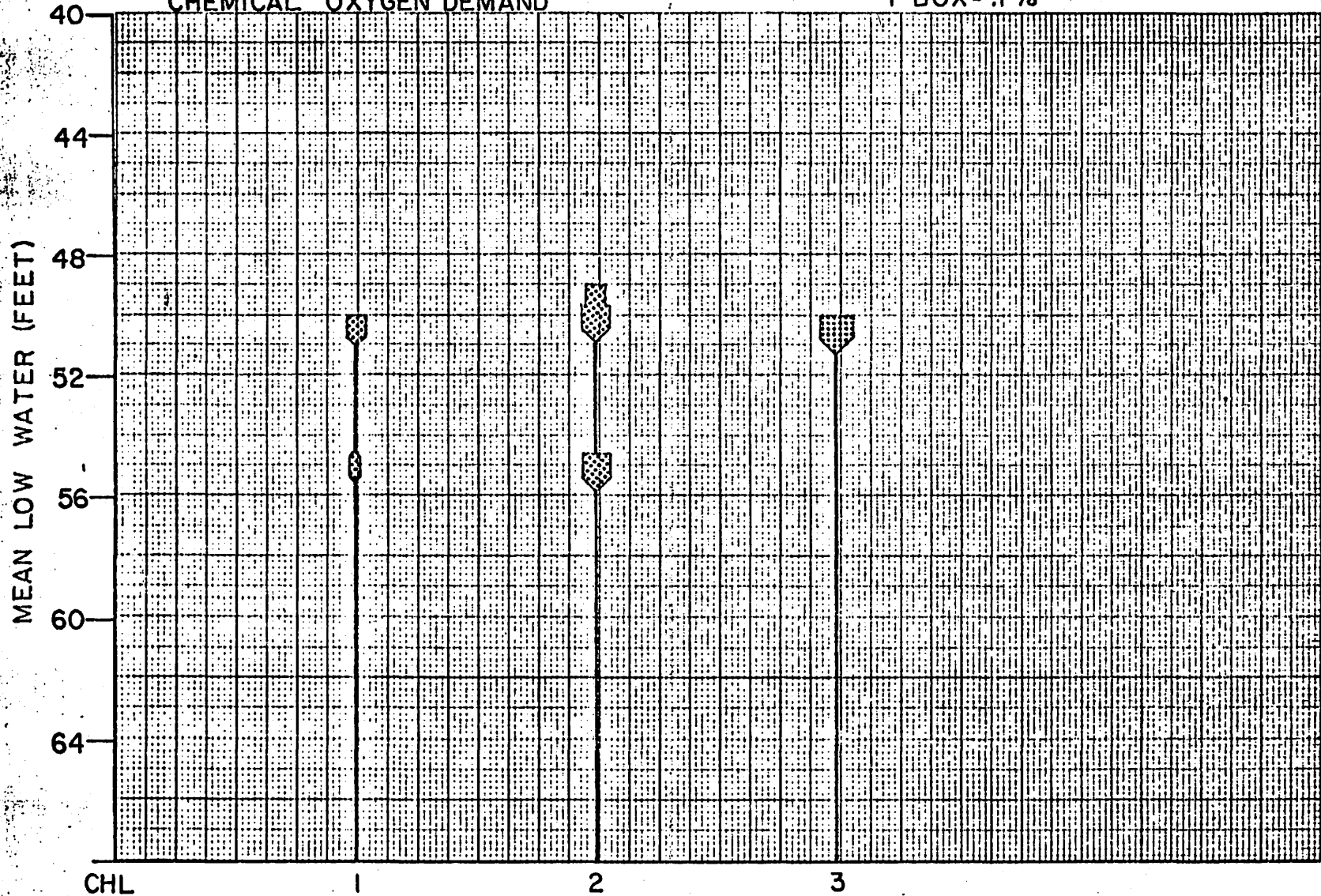
1 BOX = .5%



CAPE HENRY LONG CORES
CORPS: SUMMER 1972

CHEMICAL OXYGEN DEMAND

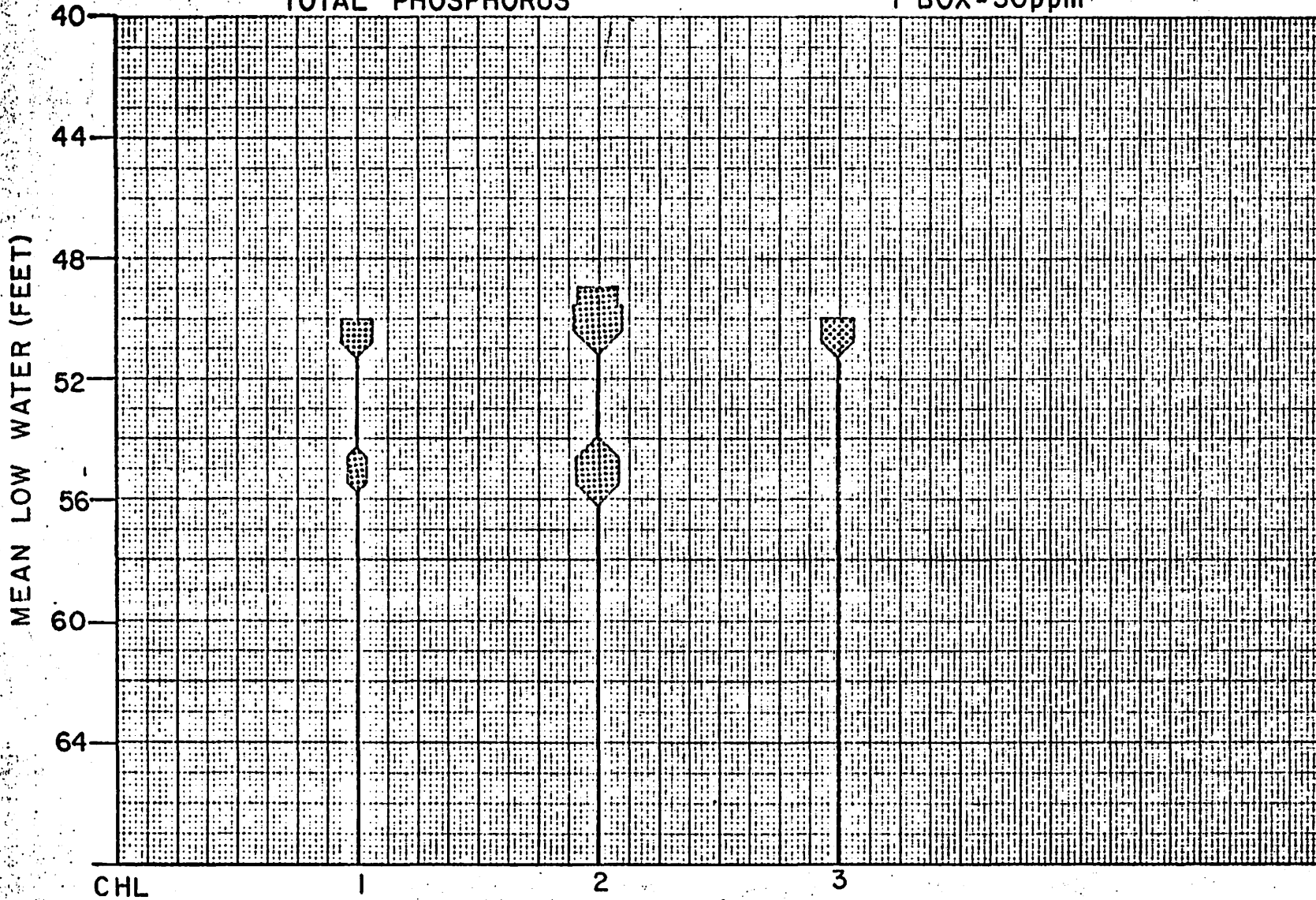
1 BOX = .1%



CAPE HENRY LONG CORES
CORPS: SUMMER 1972

TOTAL PHOSPHORUS

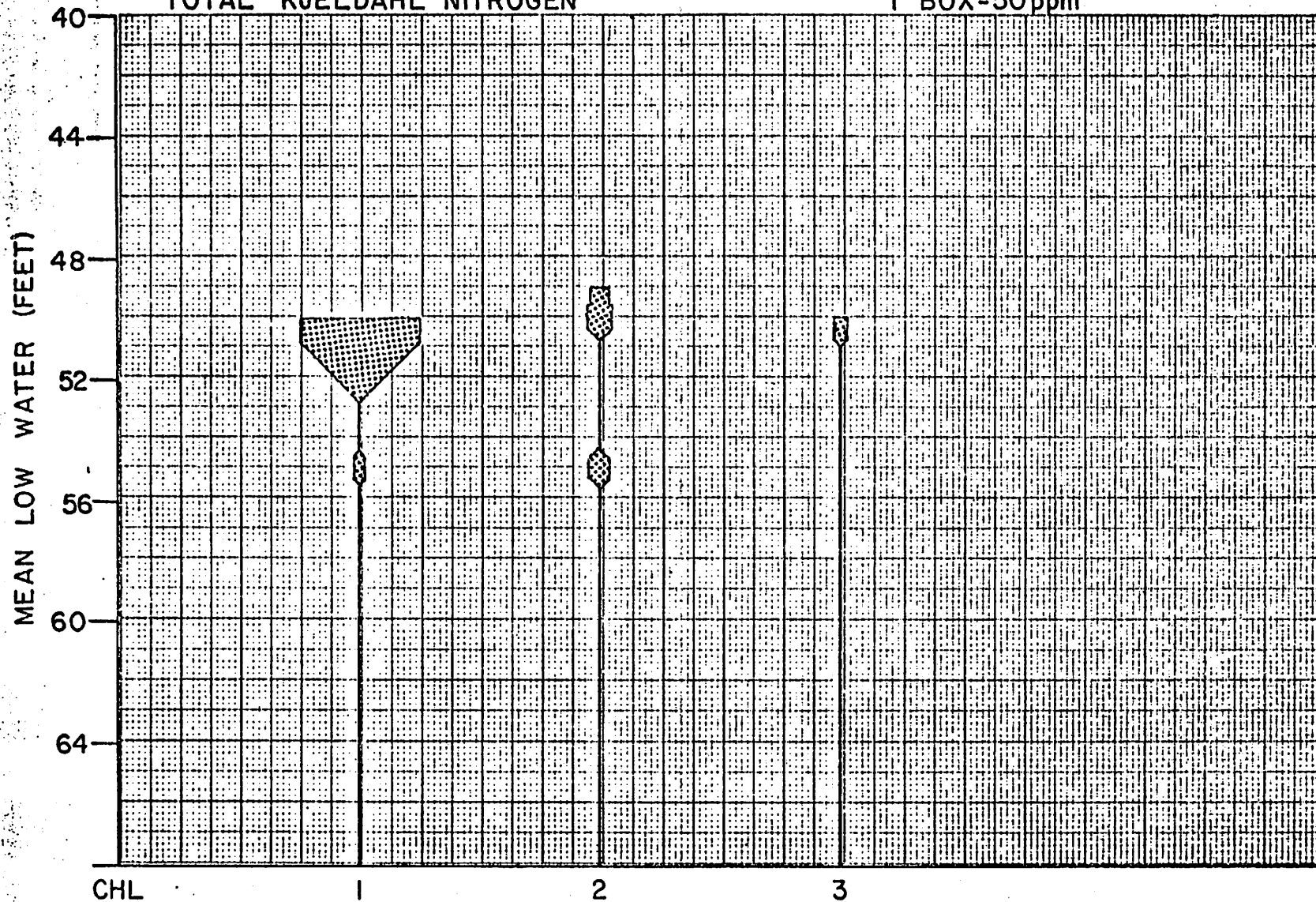
1 BOX = 50ppm



CAPE HENRY LONG CORES
CORPS: SUMMER 1972

TOTAL KJELDAHL NITROGEN

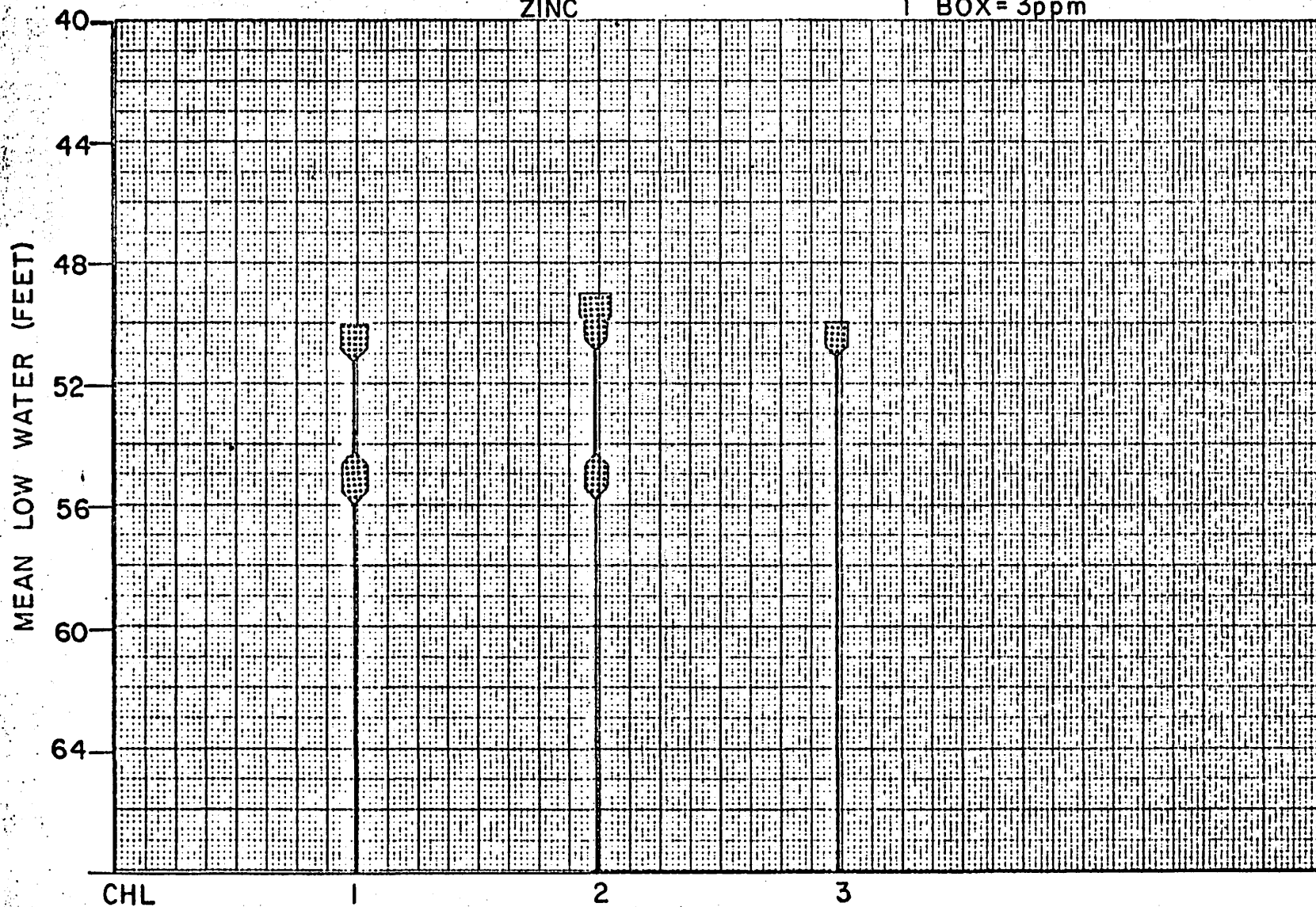
1 BOX=50ppm



CAPE HENRY LONG CORES
CORPS: SUMMER 1972

ZINC

1 BOX = 3ppm

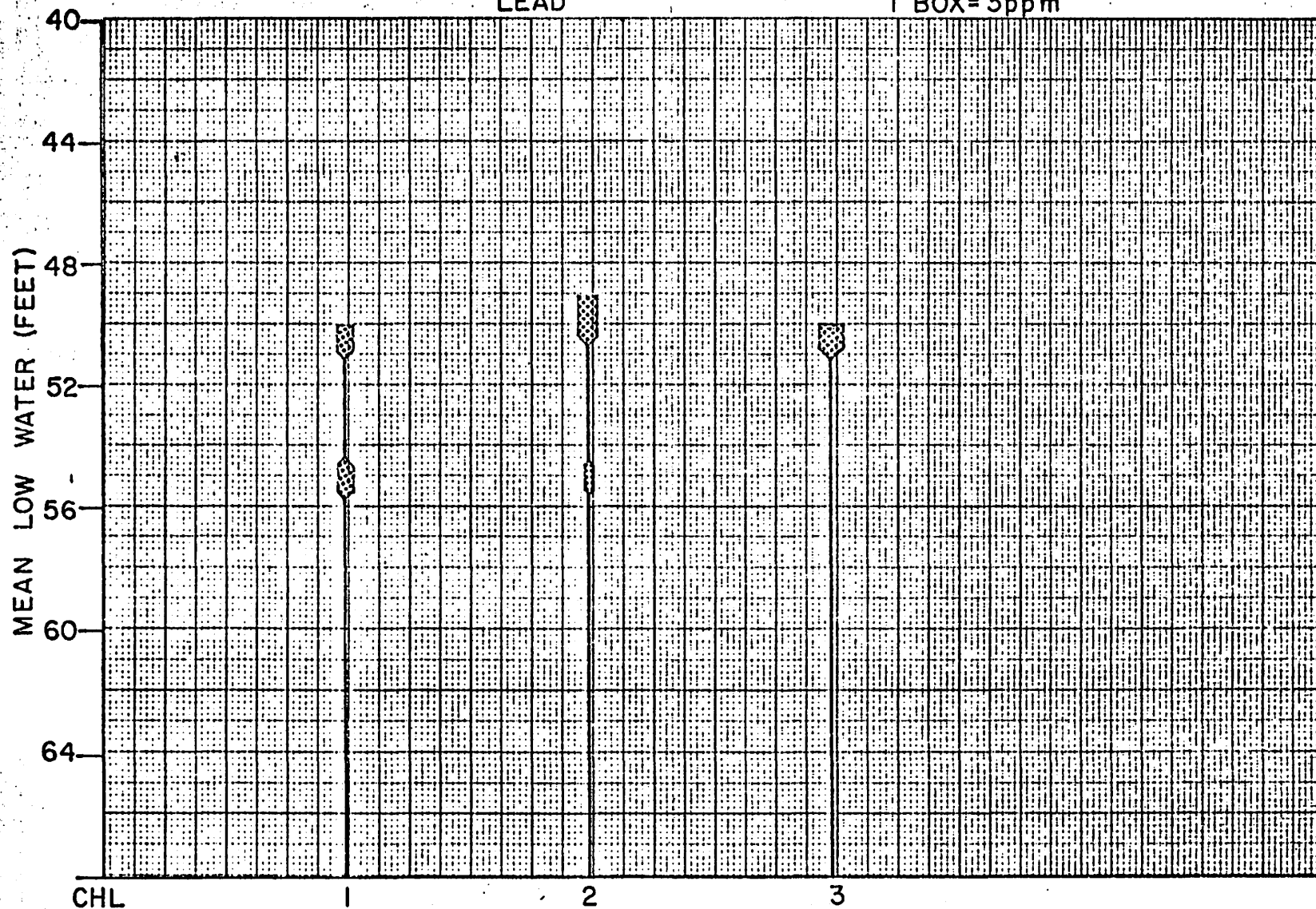


72

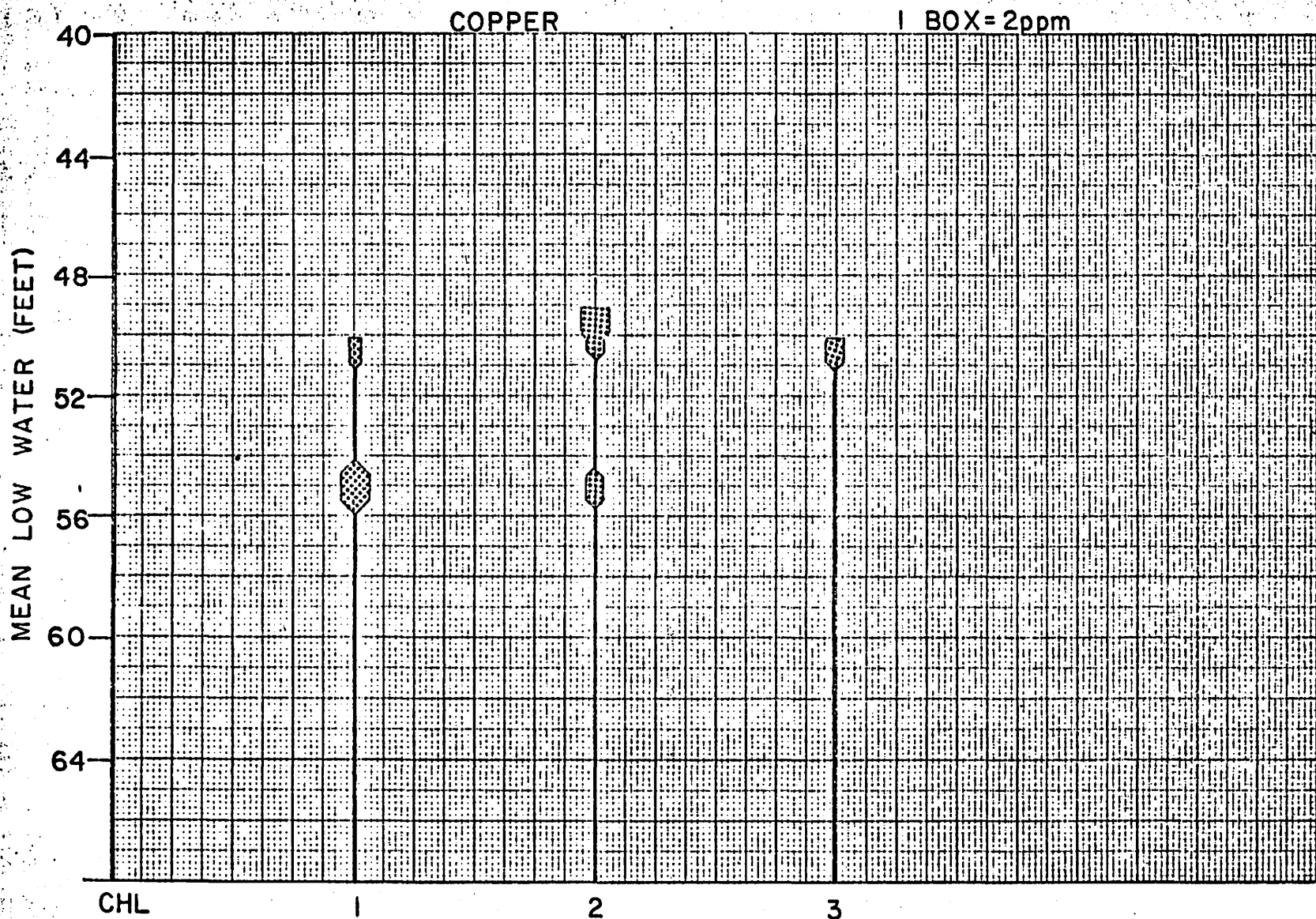
CAPE HENRY LONG CORES
CORPS: SUMMER 1972

LEAD

1 BOX=3ppm



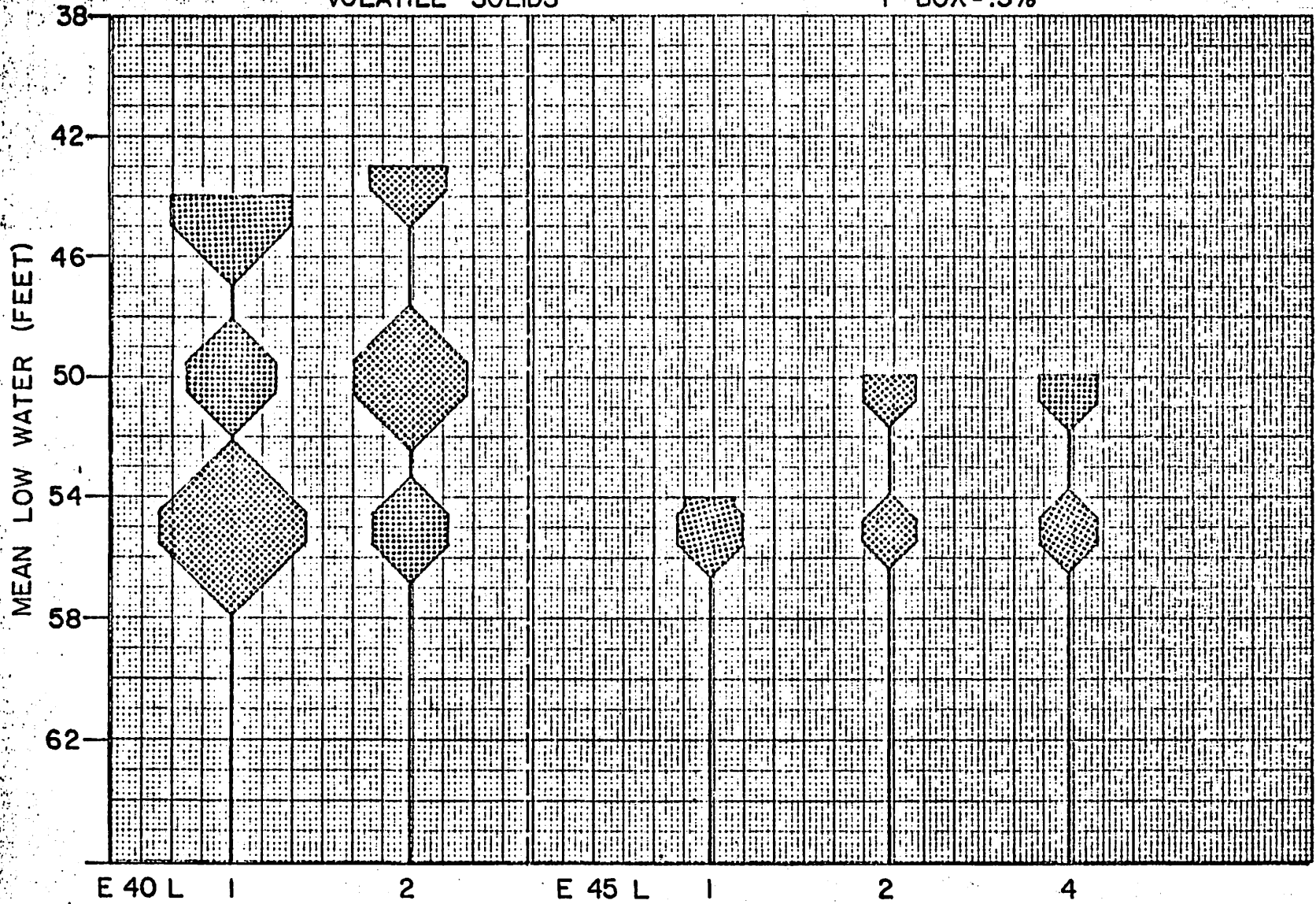
CAPE HENRY LONG CORES
CORPS: SUMMER 1972



NORFOLK HARBOR LONG CORES
CORPS: SUMMER 1972

VOLATILE SOLIDS

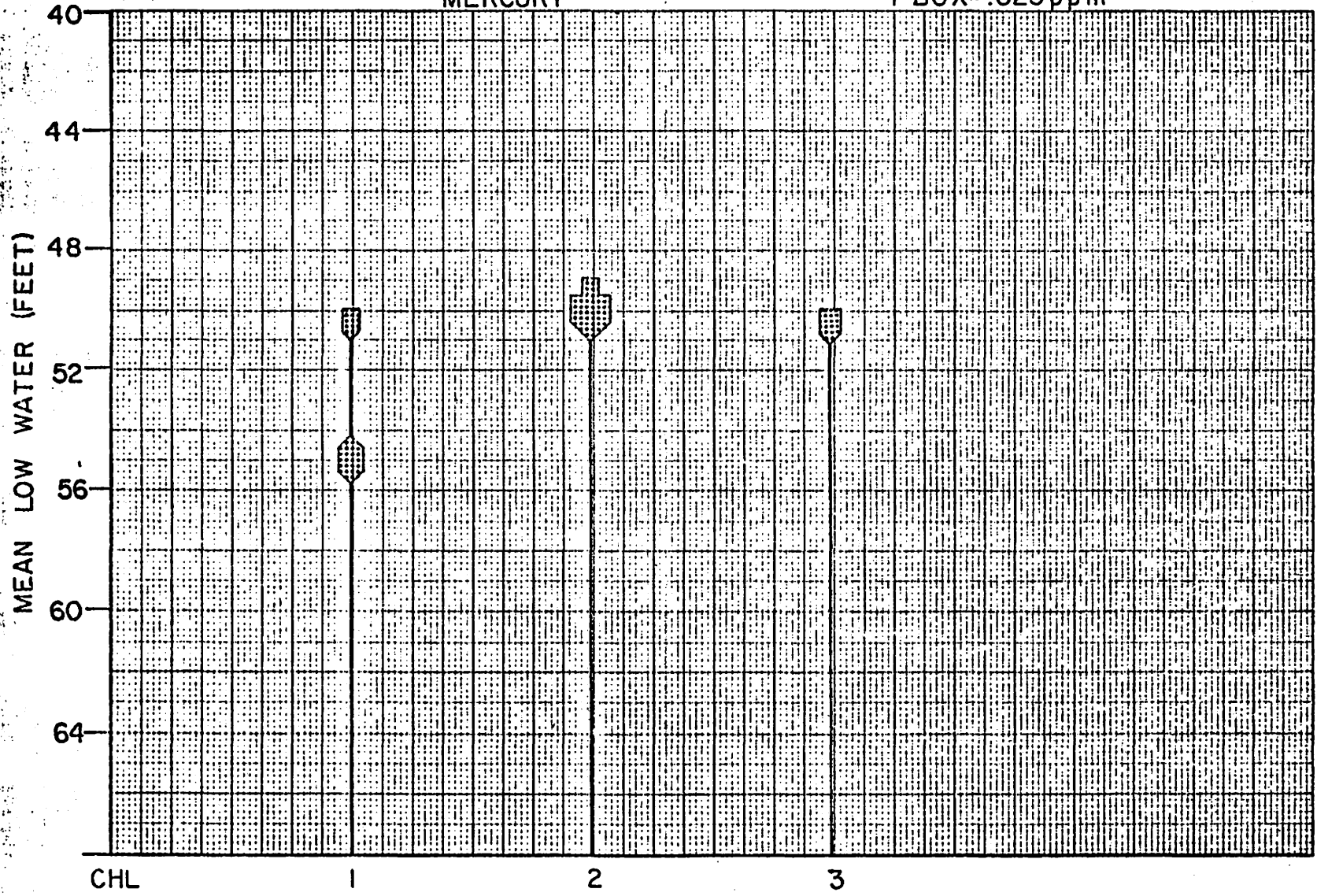
1 BOX = .5%



CAPE HENRY LONG CORES
CORPS: SUMMER 1972

MERCURY

1 BOX = .025 ppm

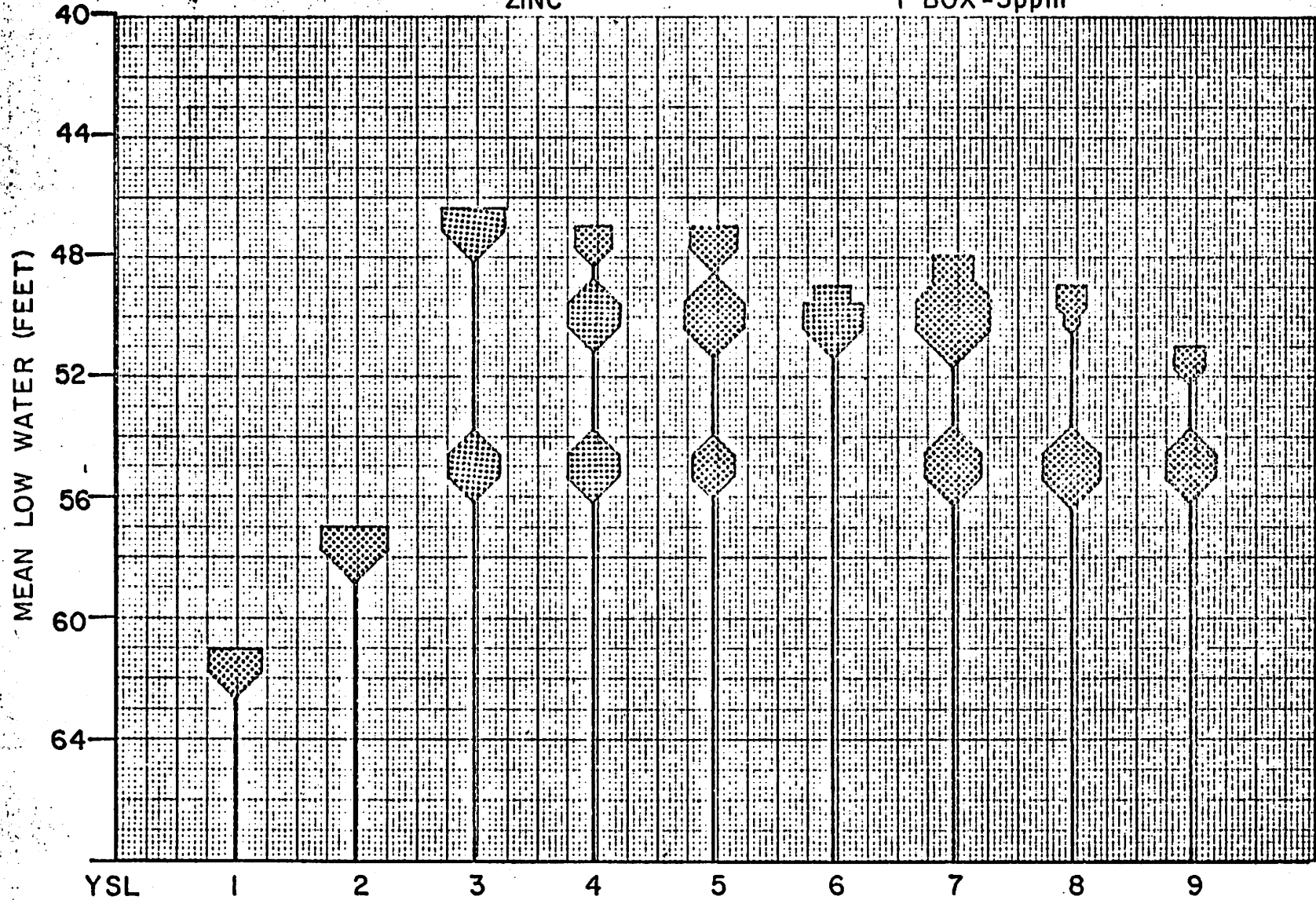


74

YORK SPIT CHANNEL LONG CORES
CORPS: SUMMER 1972

ZINC

1 BOX = 3ppm

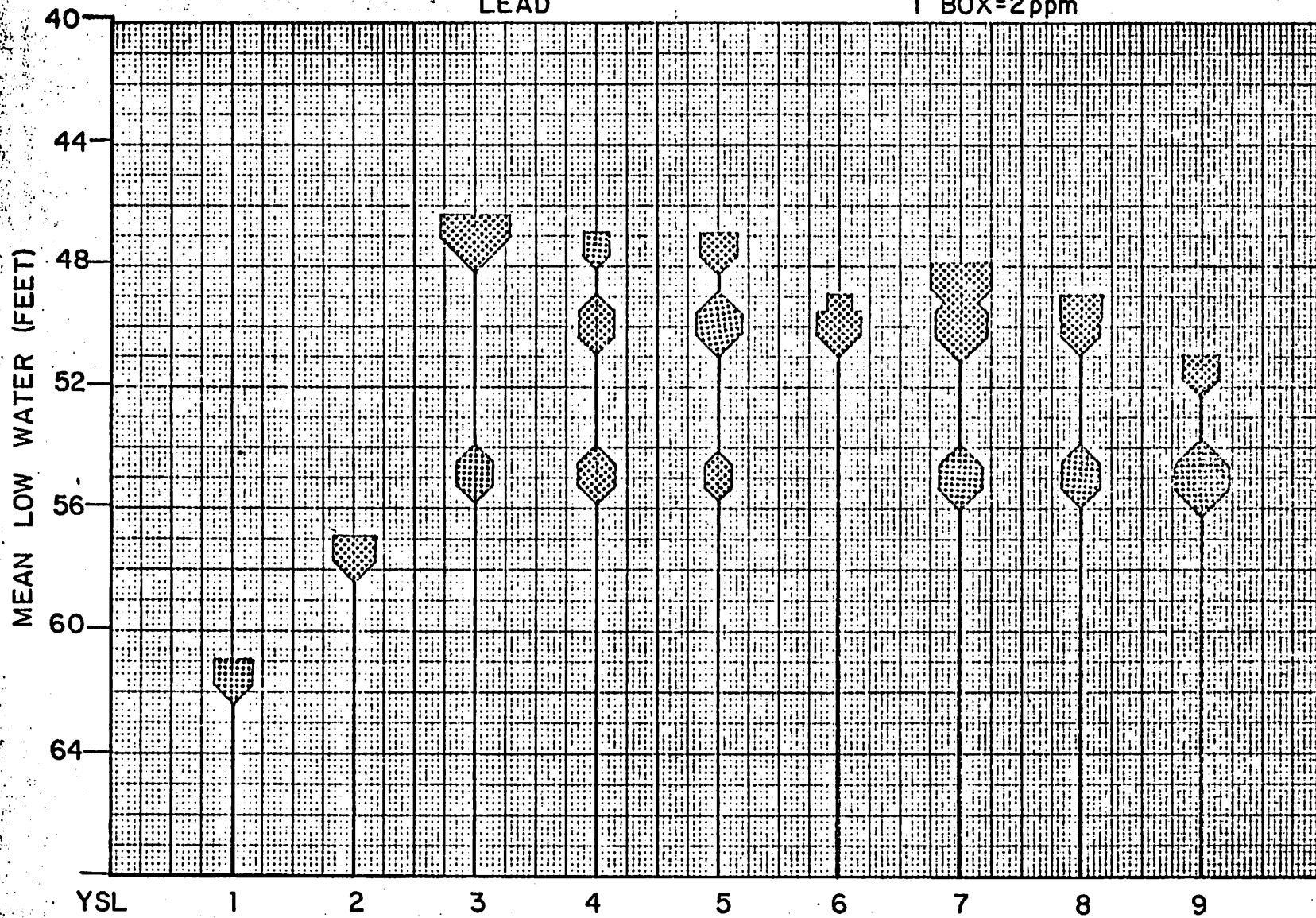


YORK SPIT CHANNEL LONG CORES

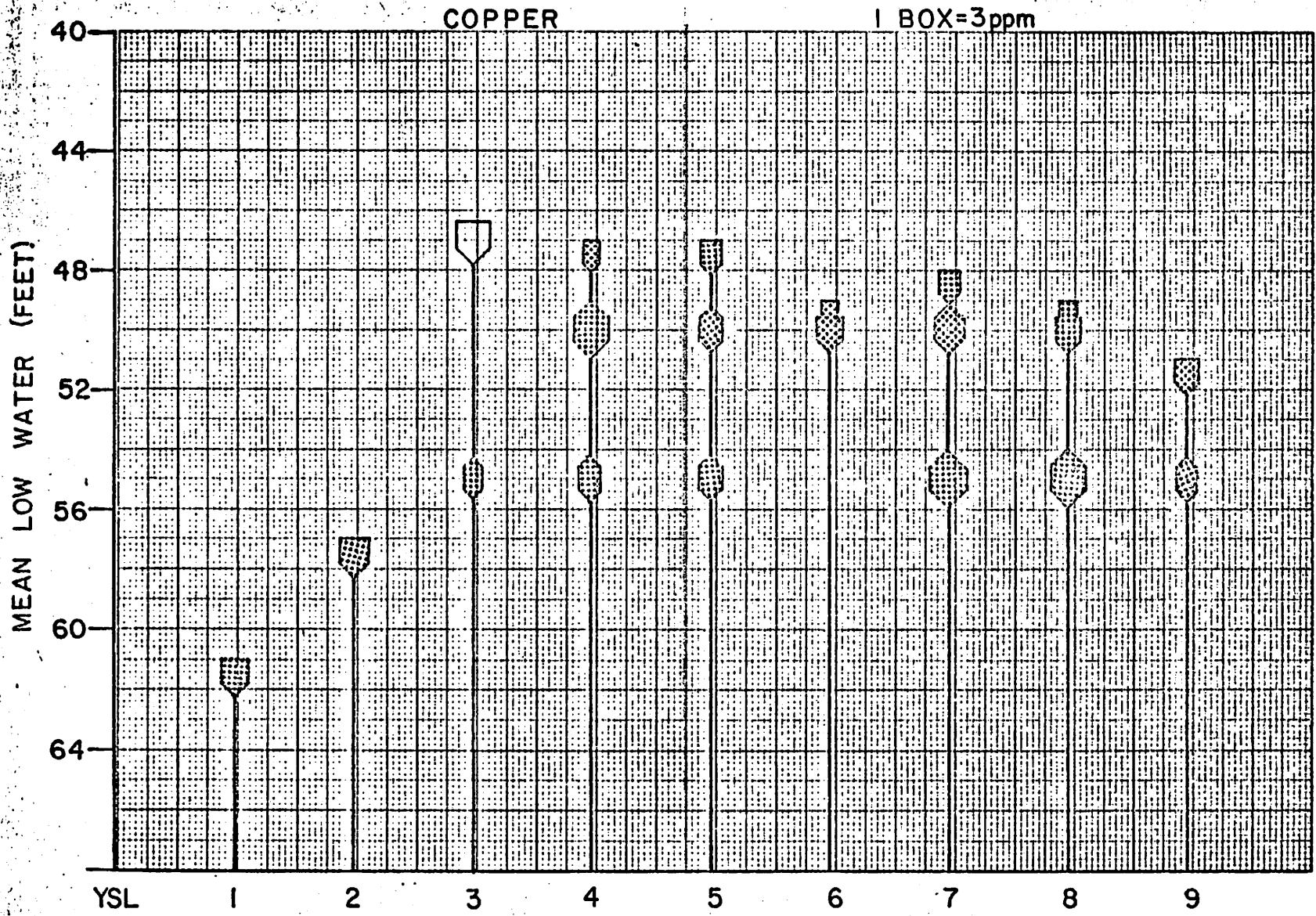
CORPS: SUMMER 1972

LEAD

1 BOX=2 ppm

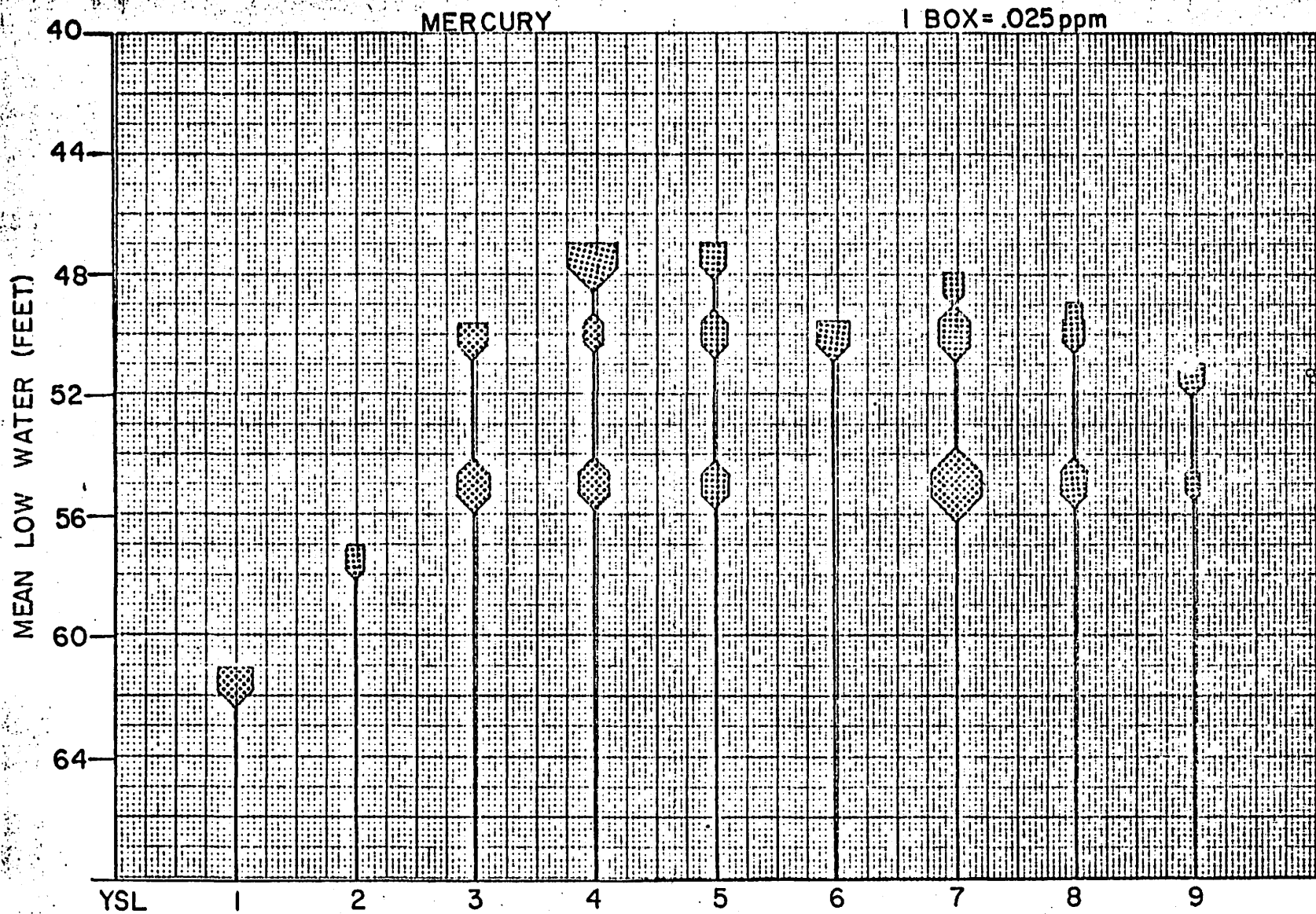


YORK SPIT CHANNEL LONG CORES
CORPS: SUMMER 1972

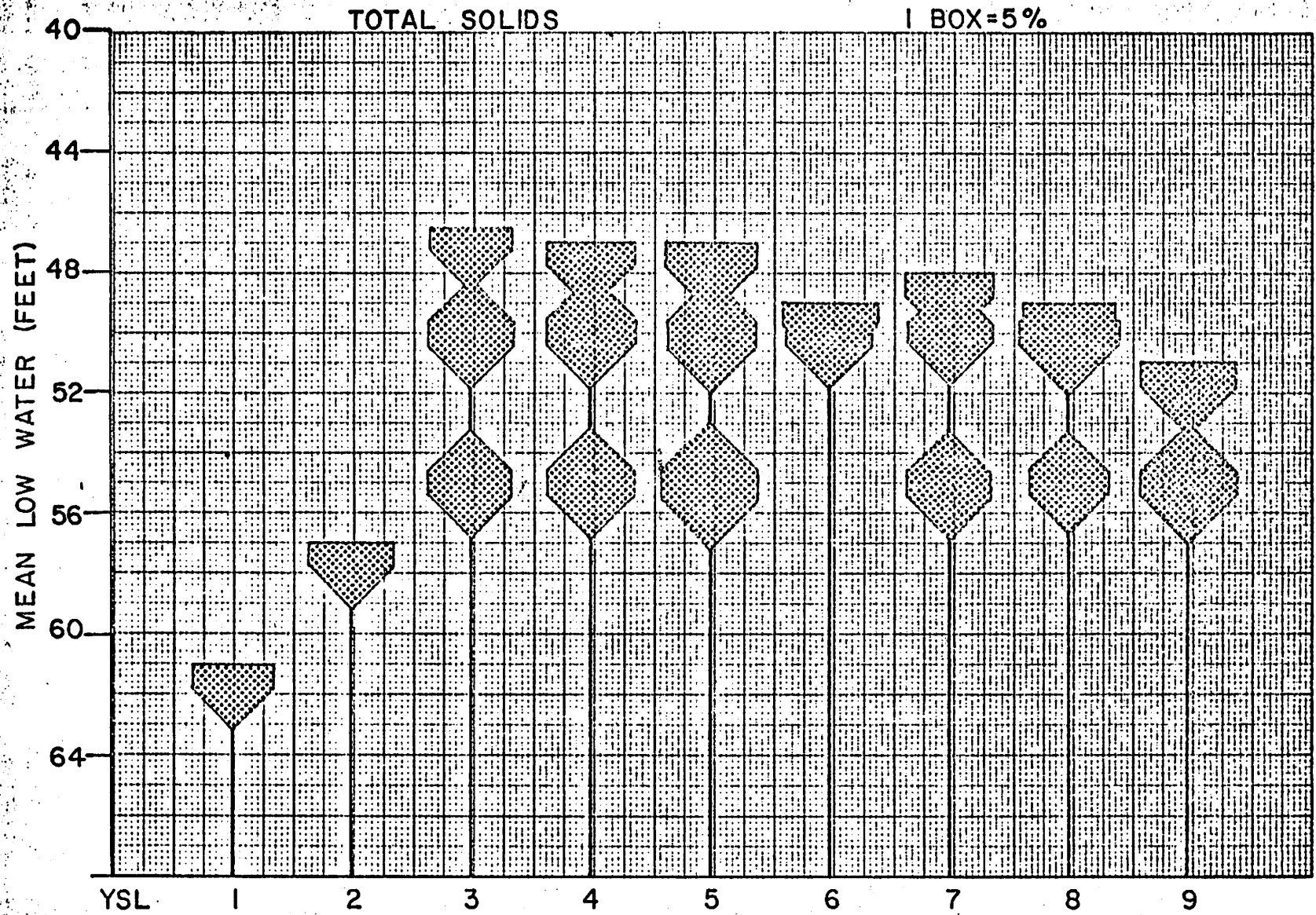


77

YORK SPIT CHANNEL LONG CORES
CORPS: SUMMER 1972



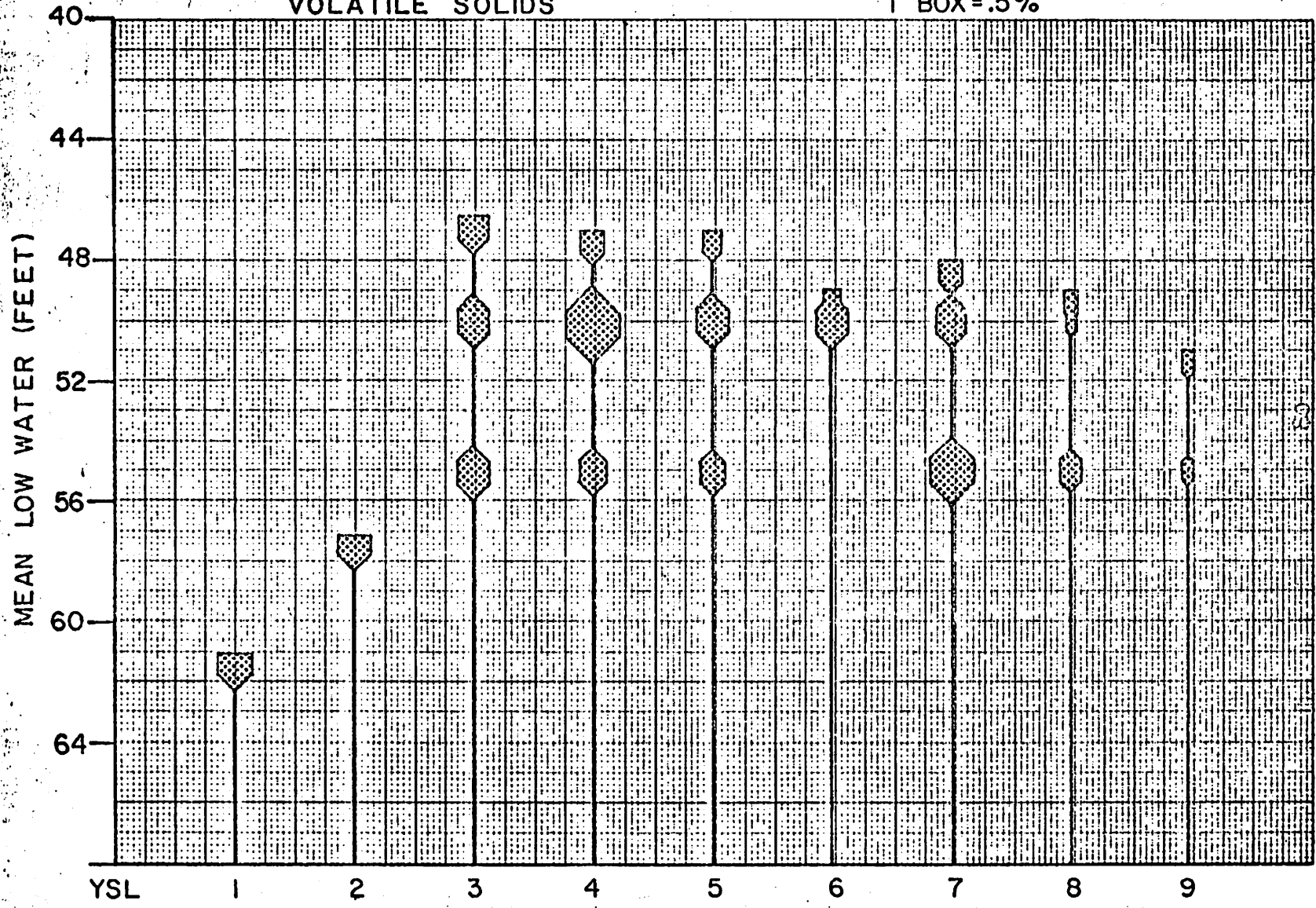
YORK SPIT CHANNEL LONG CORES
CORPS: SUMMER 1972



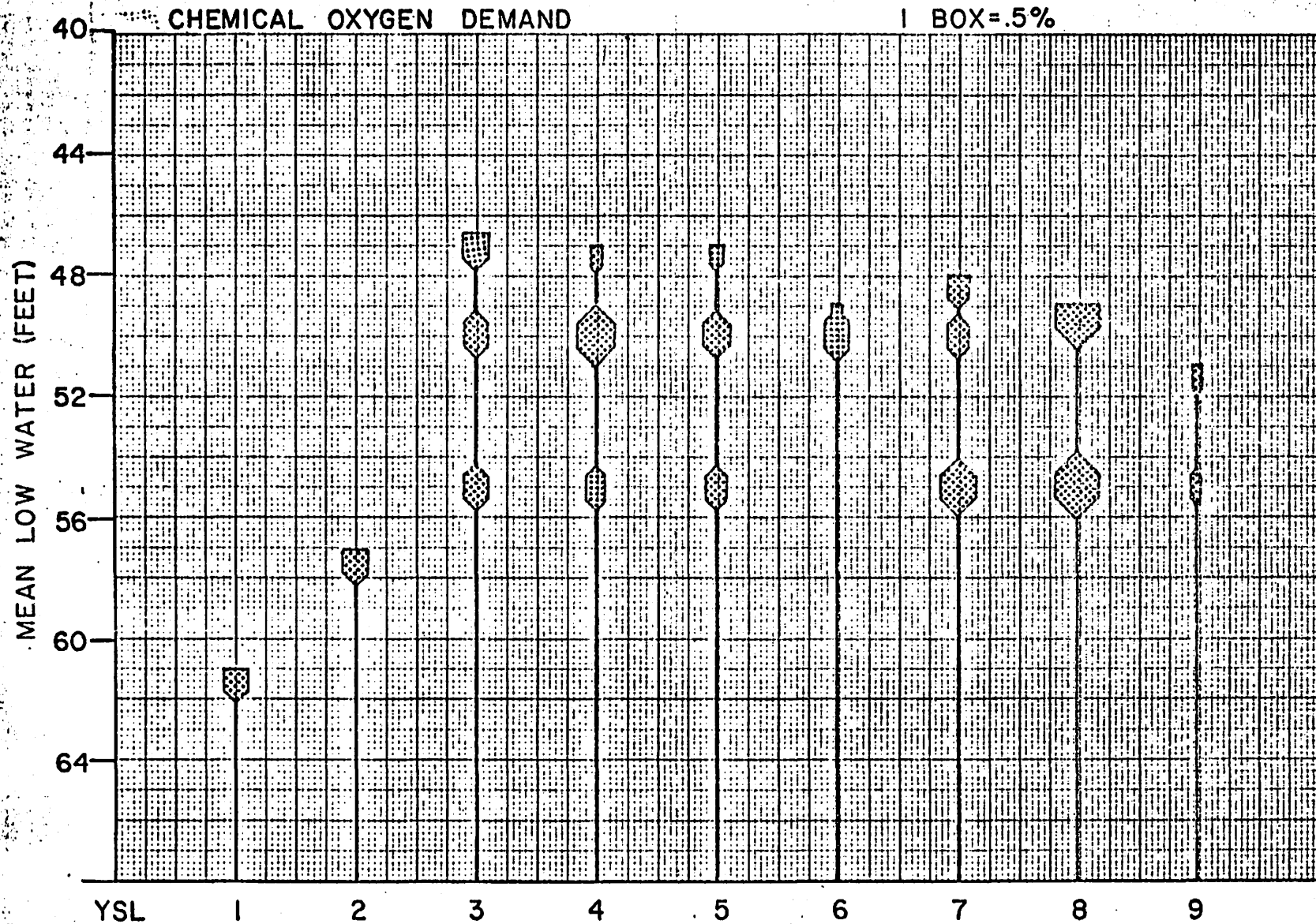
YORK SPIT CHANNEL LONG CORES
CORPS: SUMMER 1972

VOLATILE SOLIDS

1 BOX = .5%



YORK SPIT CHANNEL LONG CORES
CORPS: SUMMER 1972

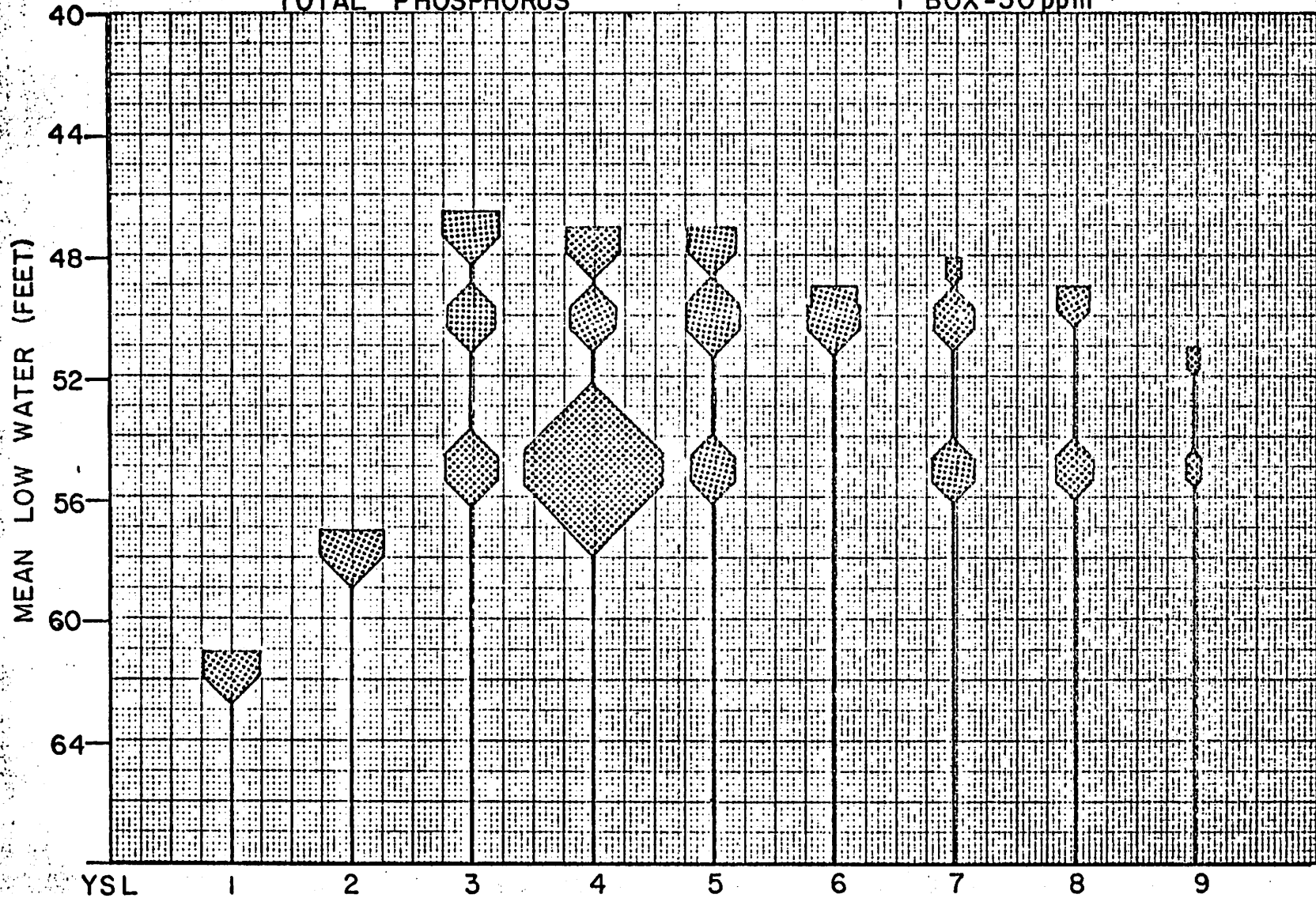


YORK SPIT CHANNEL LONG CORES

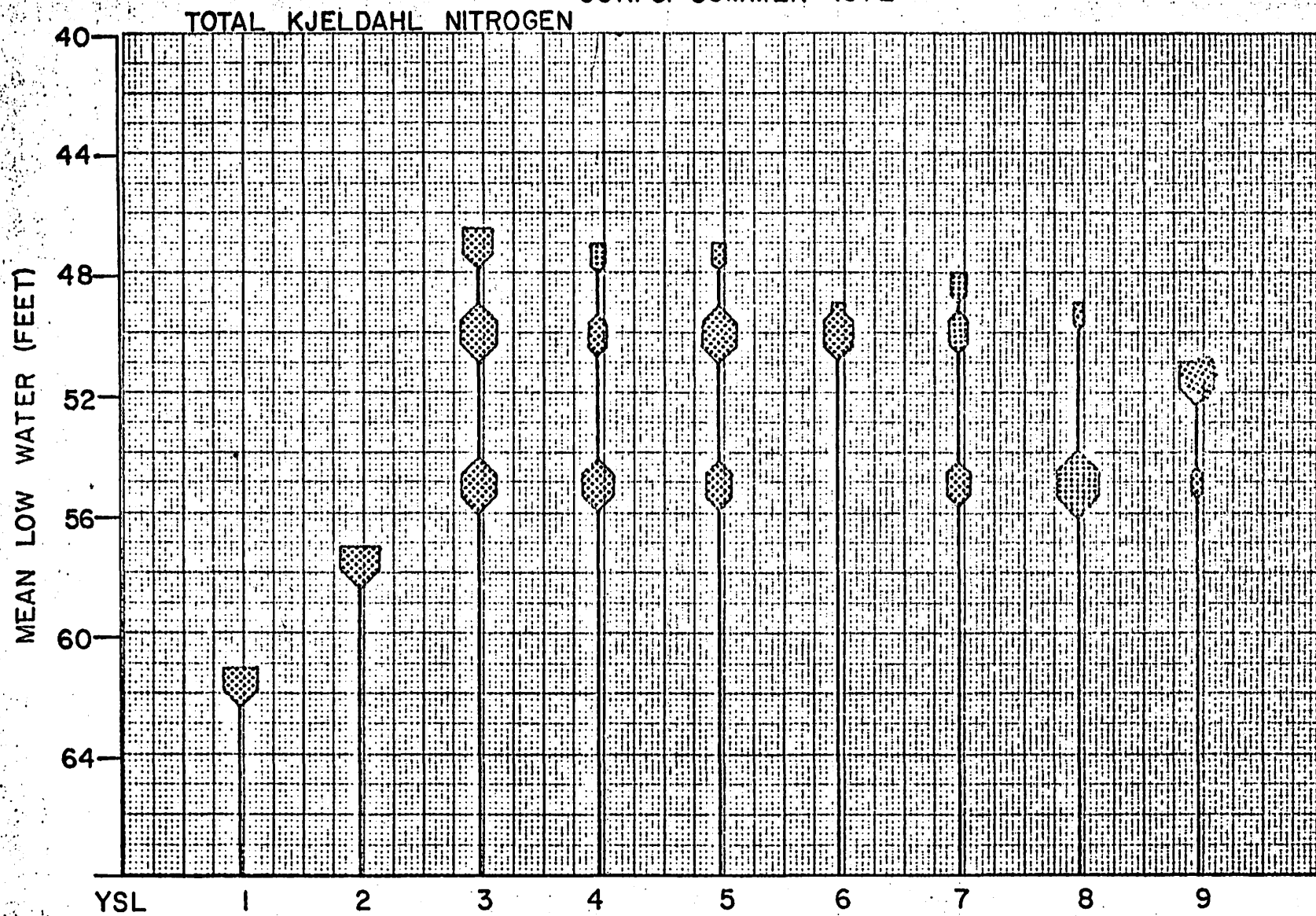
CORPS: SUMMER 1972

TOTAL PHOSPHORUS

1 BOX=50 ppm



YORK SPIT CHANNEL LONG CORES
CORPS: SUMMER 1972

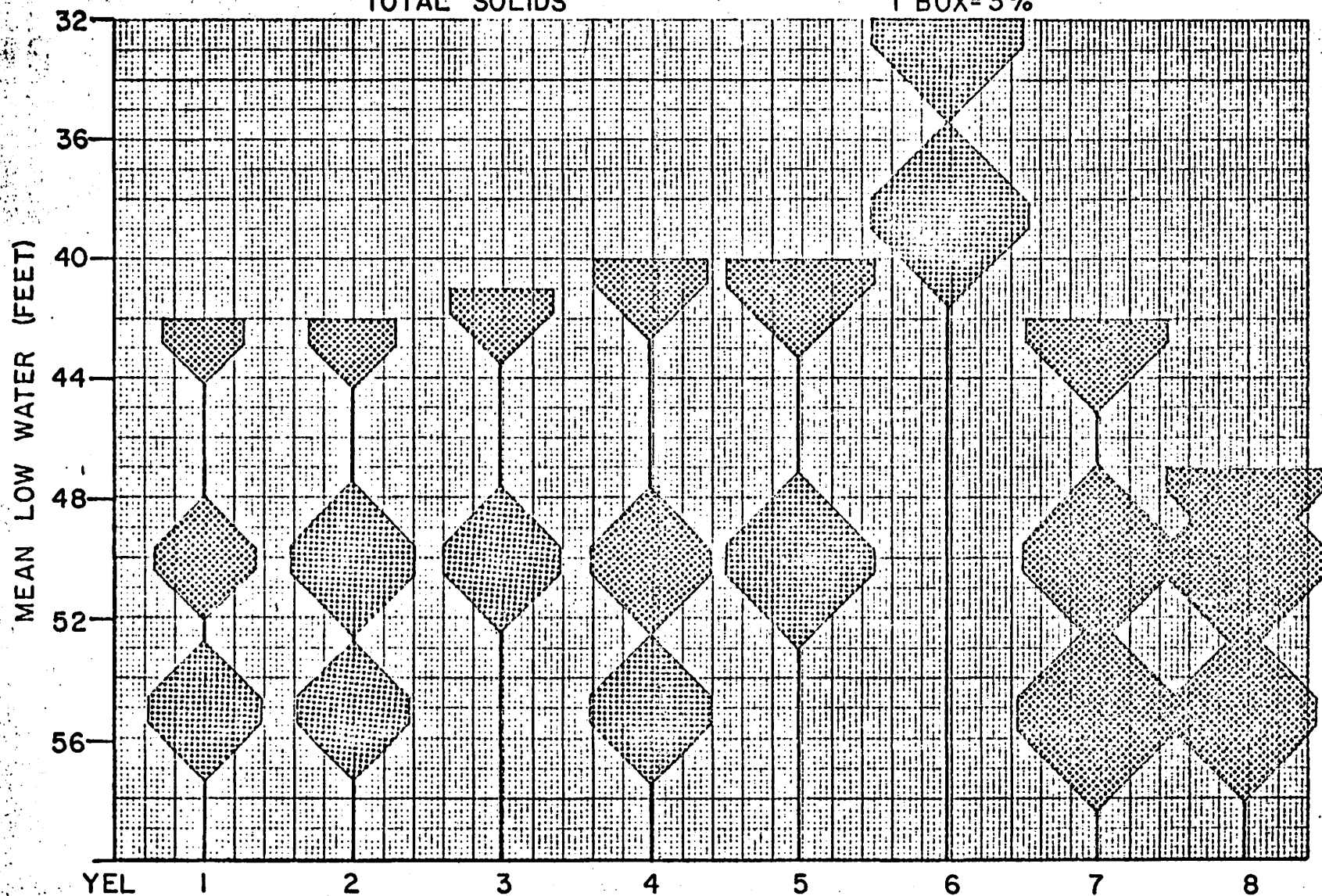


YORK RIVER ENTRANCE LONG CORES

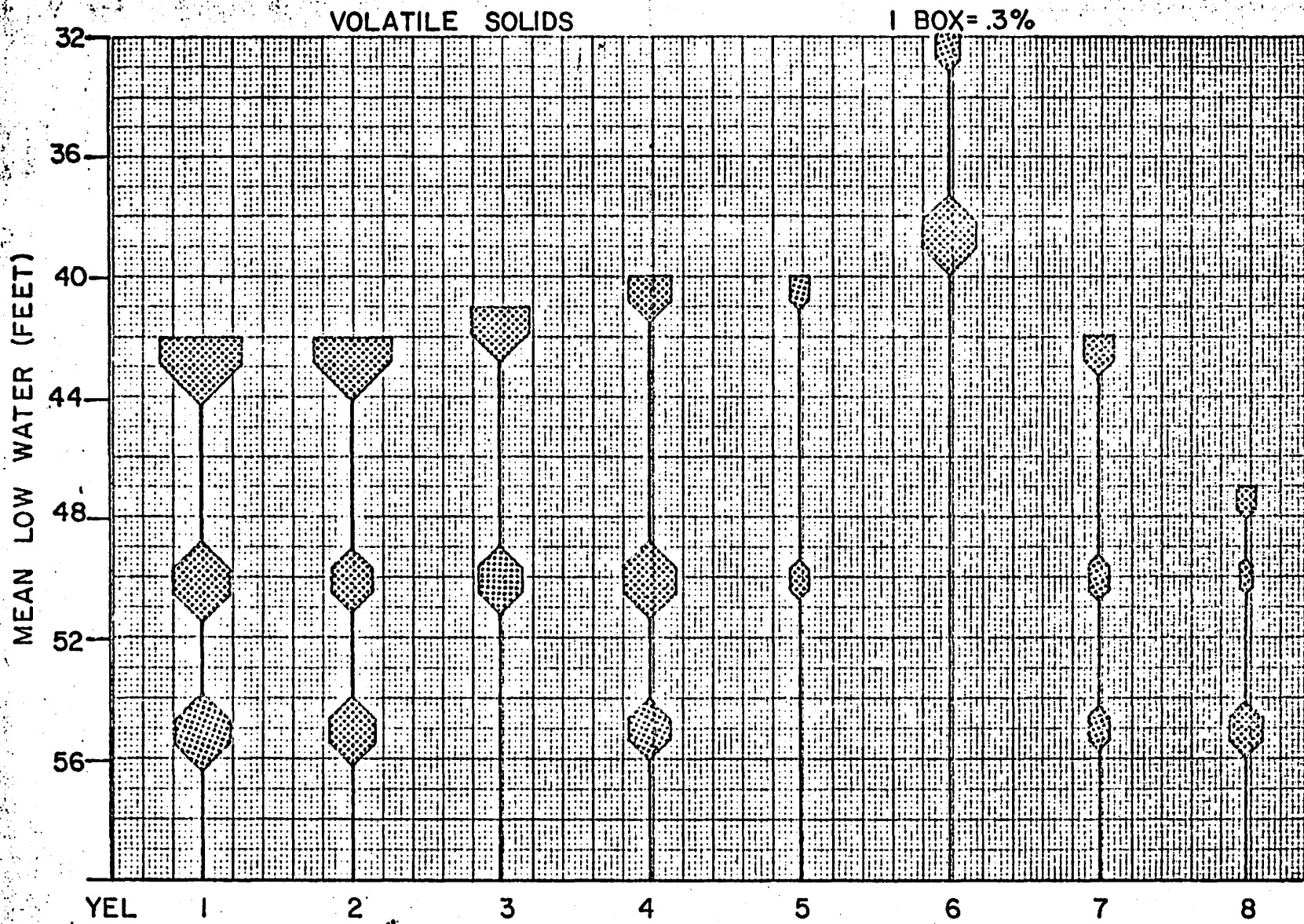
CORPS: SUMMER 1972

TOTAL SOLIDS

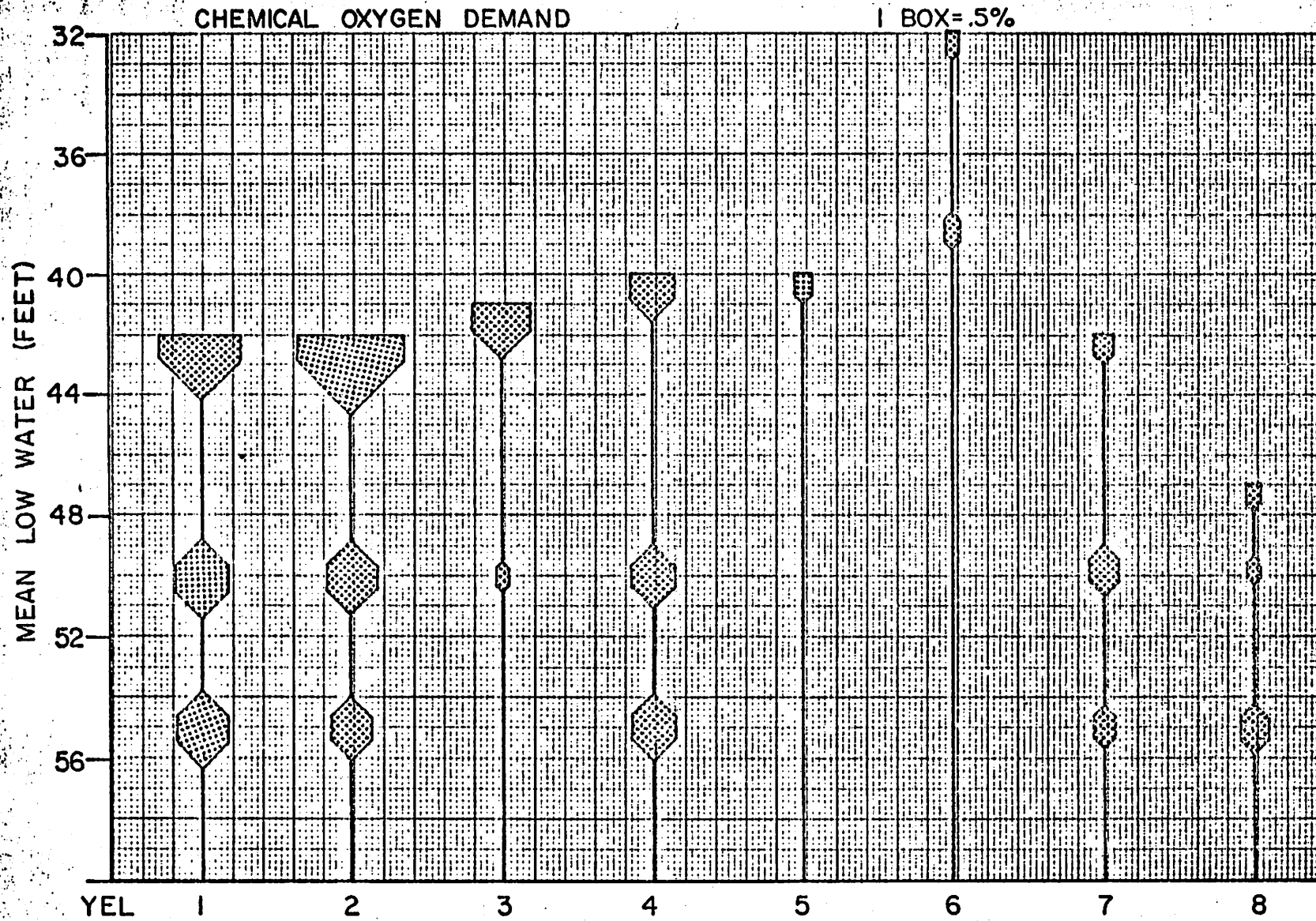
1 BOX=3%



YORK RIVER ENTRANCE LONG CORES
CORPS: SUMMER 1972



YORK RIVER ENTRANCE LONG CORES
CORPS: SUMMER 1972

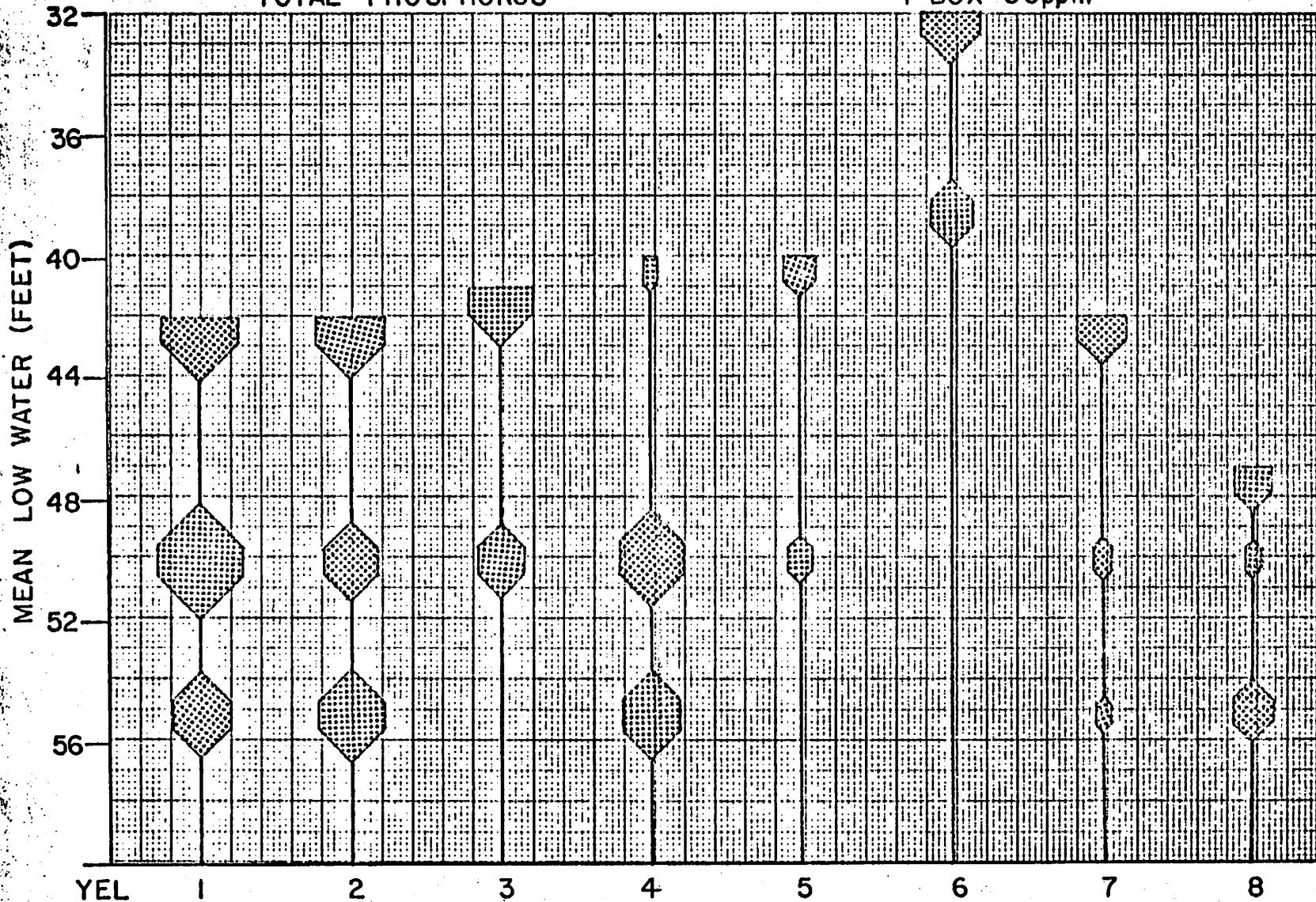


YORK RIVER ENTRANCE LONG CORES

CORPS: SUMMER 1972

TOTAL PHOSPHORUS

1 BOX = 50ppm

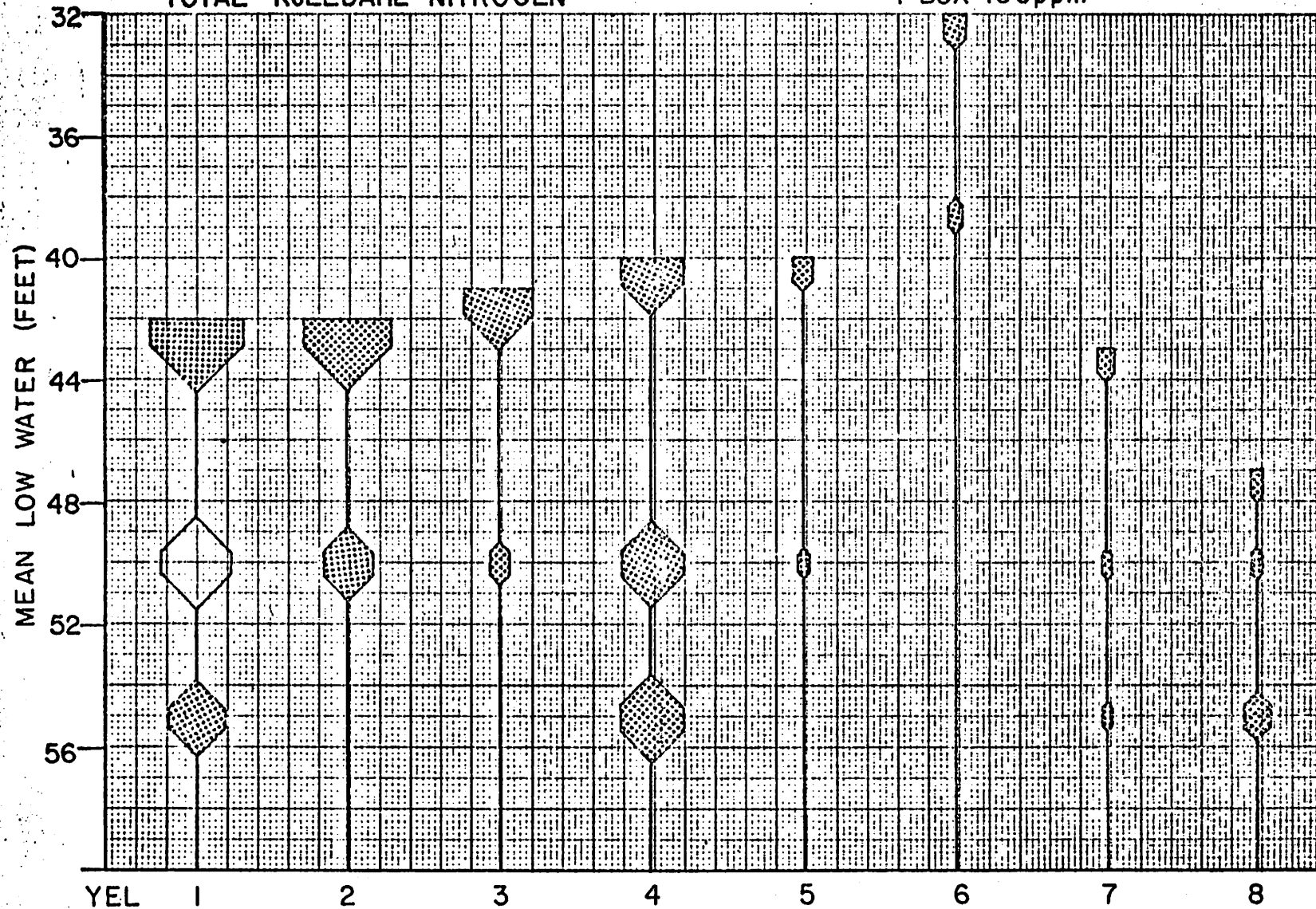


YORK RIVER ENTRANCE LONG CORES

CORPS: SUMMER 1972

TOTAL KJELDAHL NITROGEN

1 BOX=100ppm

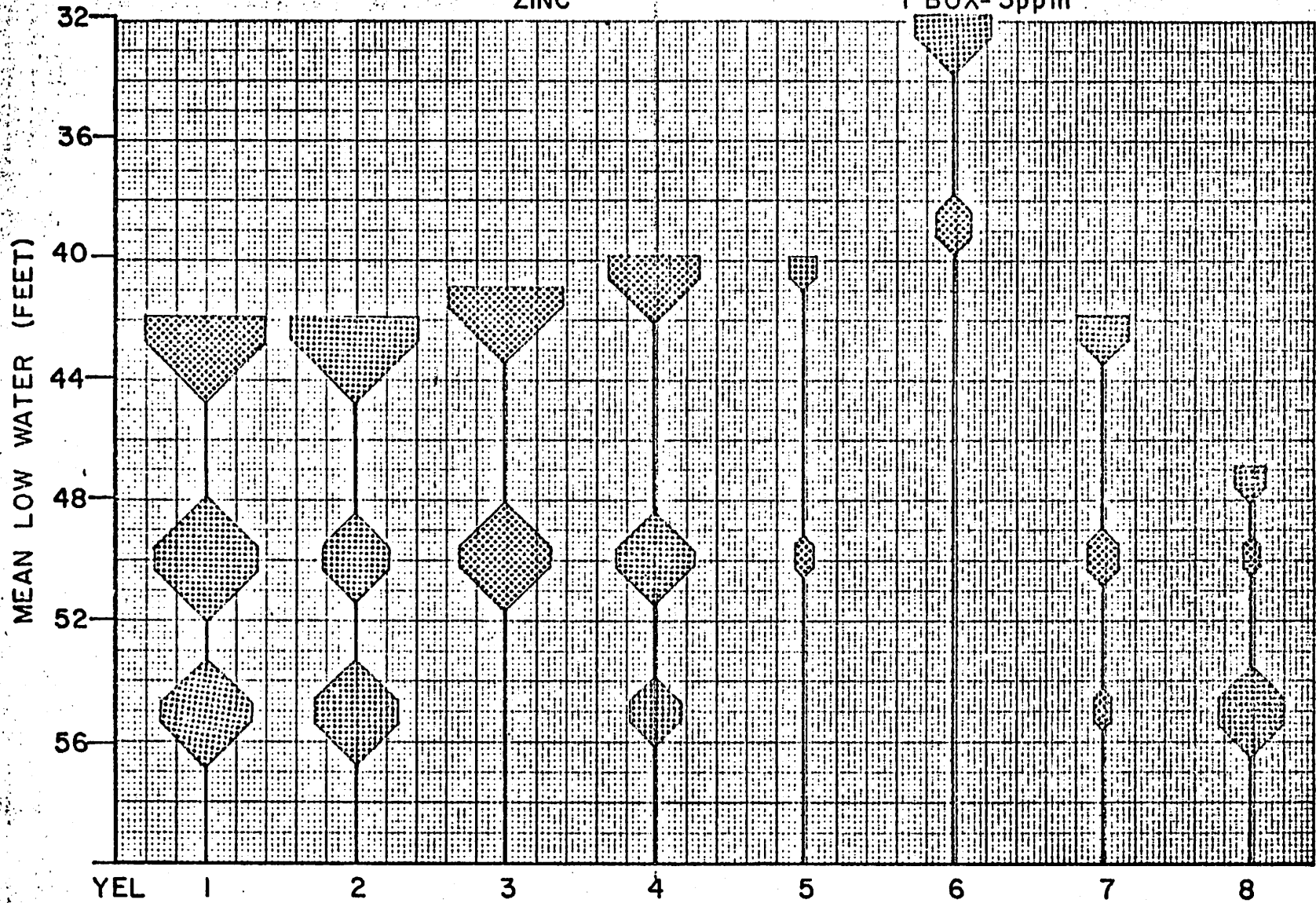


YORK RIVER ENTRANCE LONG CORES

CORPS: SUMMER 1972

ZINC

1 BOX= 3ppm

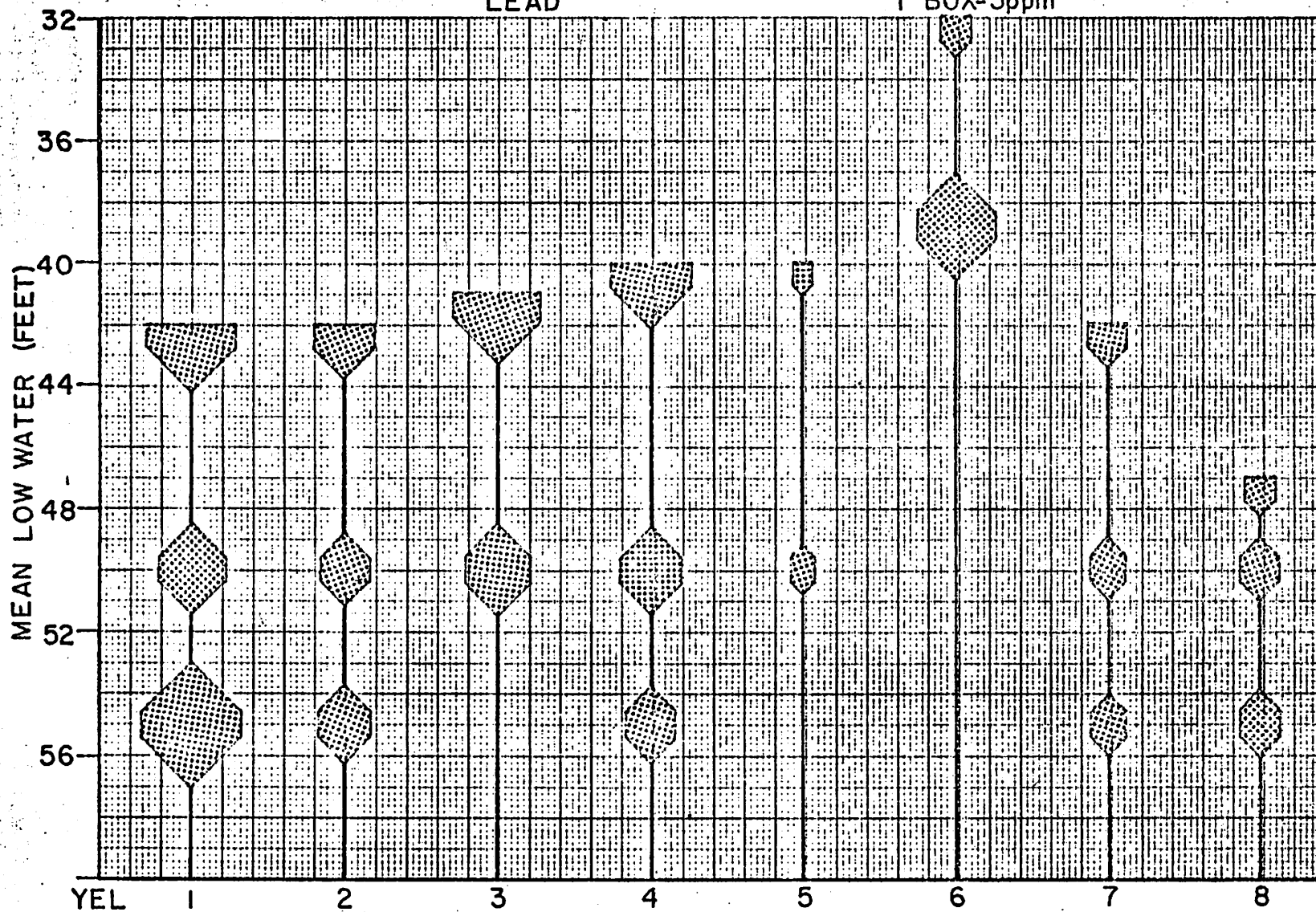


YORK RIVER ENTRANCE LONG CORES

CORPS: SUMMER 1972

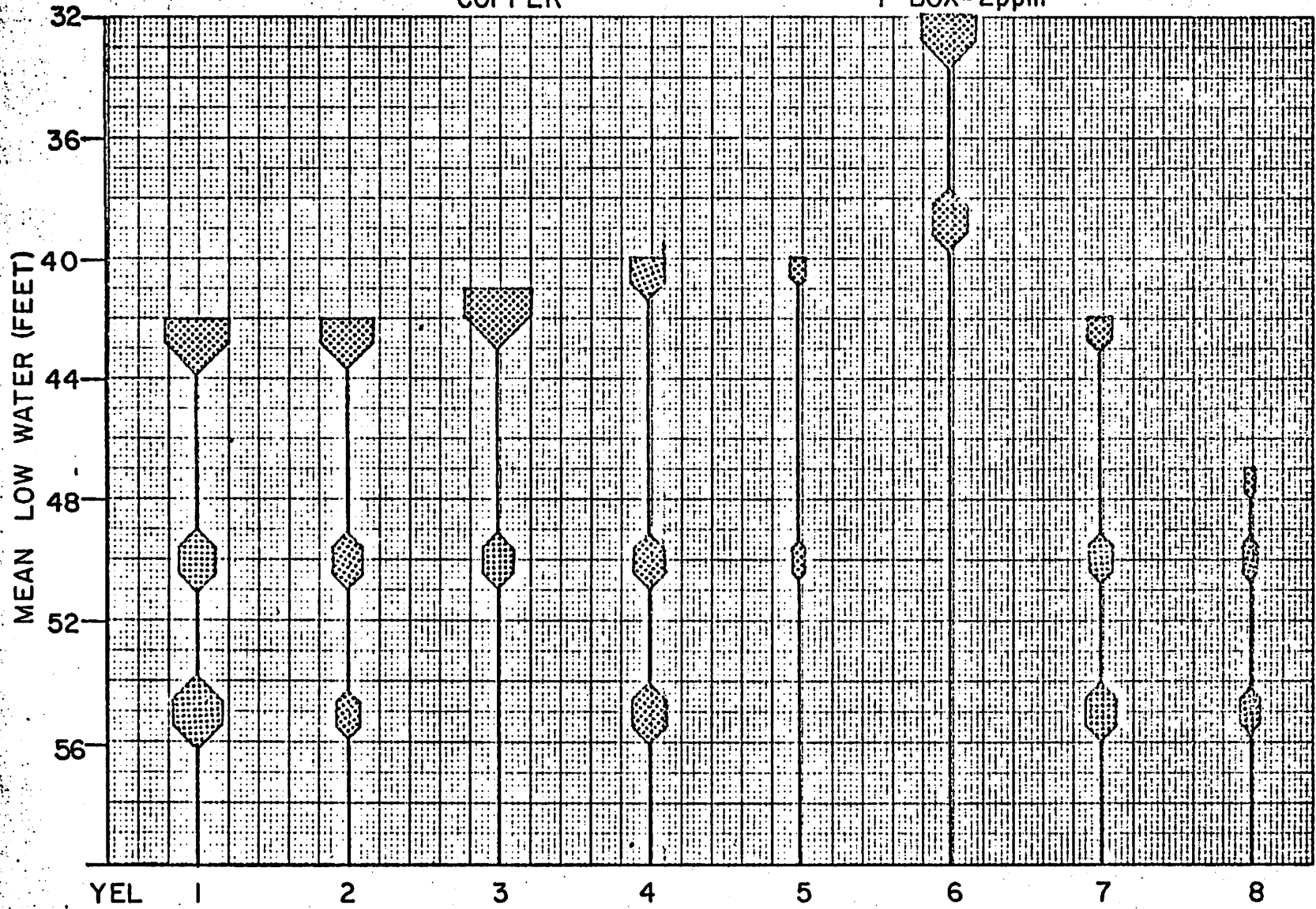
LEAD

1 BOX=3ppm



YORK RIVER ENTRANCE LONG CORES
CORPS: SUMMER 1972
COPPER

1 BOX= 2ppm

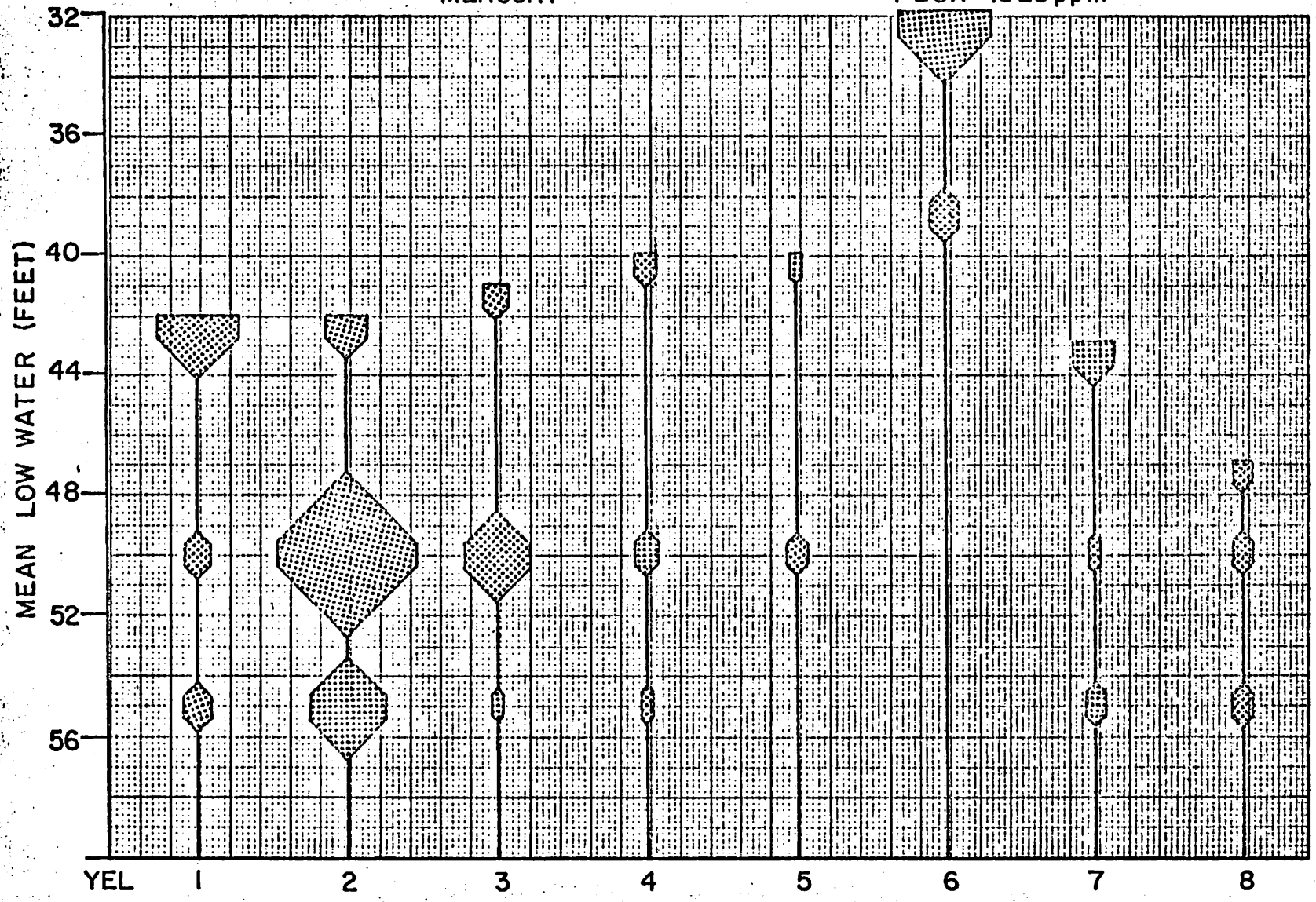


YORK RIVER ENTRANCE LONG CORES

CORPS: SUMMER 1972

MERCURY

1 BOX = .025 ppm



An overview of the results shows that the greatest concentrations of nutrients and metals occur in the surface sediments. There is evidence of a correlation between these high concentrations and the fact that in the surface sediments particle sizes are generally smaller and concentrations of organic materials higher than subsurface samples.

Information as to the magnitude and spatial distribution of specific parameter concentrations are best obtained by reference to the tables and figures within this report. When attention is focused upon each area separately with all parameters discussed as a common unit, the following are observed:

- Rappahannock Shoals Channel - 75% of all surface samples and 13% of the long core subsamples exceeded guidelines for at least one parameter.
- Thimble Shoals Channel - 13% of all surface samples exceeded guidelines; long core subsamples were all within limits.
- Newport News Channel - 50% of surface samples as well as 50% of long core subsamples exceeded guidelines. Coincidentally, the long core subsamples involved were either surface samples or as in one instance, 3 feet below the surface.
- Norfolk Harbor Channel - More than 90% of long core subsamples exceeded guideline limits. No surface sediments were analyzed from Norfolk Harbor during this study.
- Cape Henry Channel - All sediments analyzed from within this area were within guideline limits.
- York Entrance Channel - 67% of surface sediments and 33% of sediments tested from long cores exceeded EPA guidelines.

- York Spit Channel - Only 8% of the surface sediments from this area exceeded guidelines. All long core samples were within allowable limits.

Surface Sediment Samples Having One or More
Parameter Concentrations Exceeding
EPA Guidelines:

RSS	TSS	NNS	YES	YSS
#1	#10	#1	#1	#4
2	13	2	2	17
3		5	3	
4			4	
5			5	
6			6	
10			7	
11			8	
12			9	
			10	
			11	
			13	
			14	
			15	

Long Core Subsamples Having One or More Parameter
Concentrations Exceeding EPA Guidelines:

RSL	E-40L	NNL	YEL
#3-48'	#1-44'	#1-52'	#1-42'
	1-50'	1-55'	1-50'
4-46'	1-55'	3-55'	2-42'
	2-43'		
	2-50'		3-41'
	2-55'		
			4-40'
	E-45L		50'
	#1-55'		55'
	2-50'		
	55'		
	4-50'		
	55'		

Comparison of Mean Surface Concentrations with EPA Guidelines
for Open Water Disposal

		TS	VS %	COD	TP	TKN	Zn	Cu	Pb	Hg
					ppm					
EPA Guidelines		NA	6.0	5.0	NA	1000	50	NA	50	1.0
\bar{X}	RSS	53.6	4.83	4.17	580	1176	38.66	8.80	25.19	0.24
%			8.33%	8.33%		75.00%	8.33%		0	0
\bar{X}	TSS	70.5	2.12	0.96	349	441	16.16	5.50	17.26	0.18
%			0	0		6.67%	0		0	0
\bar{X}	NNS	63.7	3.21	3.00	469	600	52.85	11.60	33.23	0.21
%			0	0		16.67%	33.33%		0	0
\bar{X}	CHS	69.7	1.99	1.44	441	411	19.32	7.37	23.29	0.16
%			0	0		0	0		0	0
\bar{X}	YES	50.7	4.84	4.91	648	1633	57.6	12.90	31.6	0.21
%			38.10%	52.38%		66.68%	61.90%		4.76%	0
\bar{X}	YSS	71.2	1.59	1.05	405	407	24.27	4.28	17.75	0.20
%			0	0		4.17%	4.17%		0	0

\bar{X} = Statistical mean.

Boxes identify areas whose mean concentrations exceed EPA guidelines for open water disposal.

Percentages reflect the proportion of samples collected from a specific area which have concentrations exceeding EPA guidelines.

Comparison of Mean Long Core Concentrations with EPA Guidelines
for Open Water Disposal.

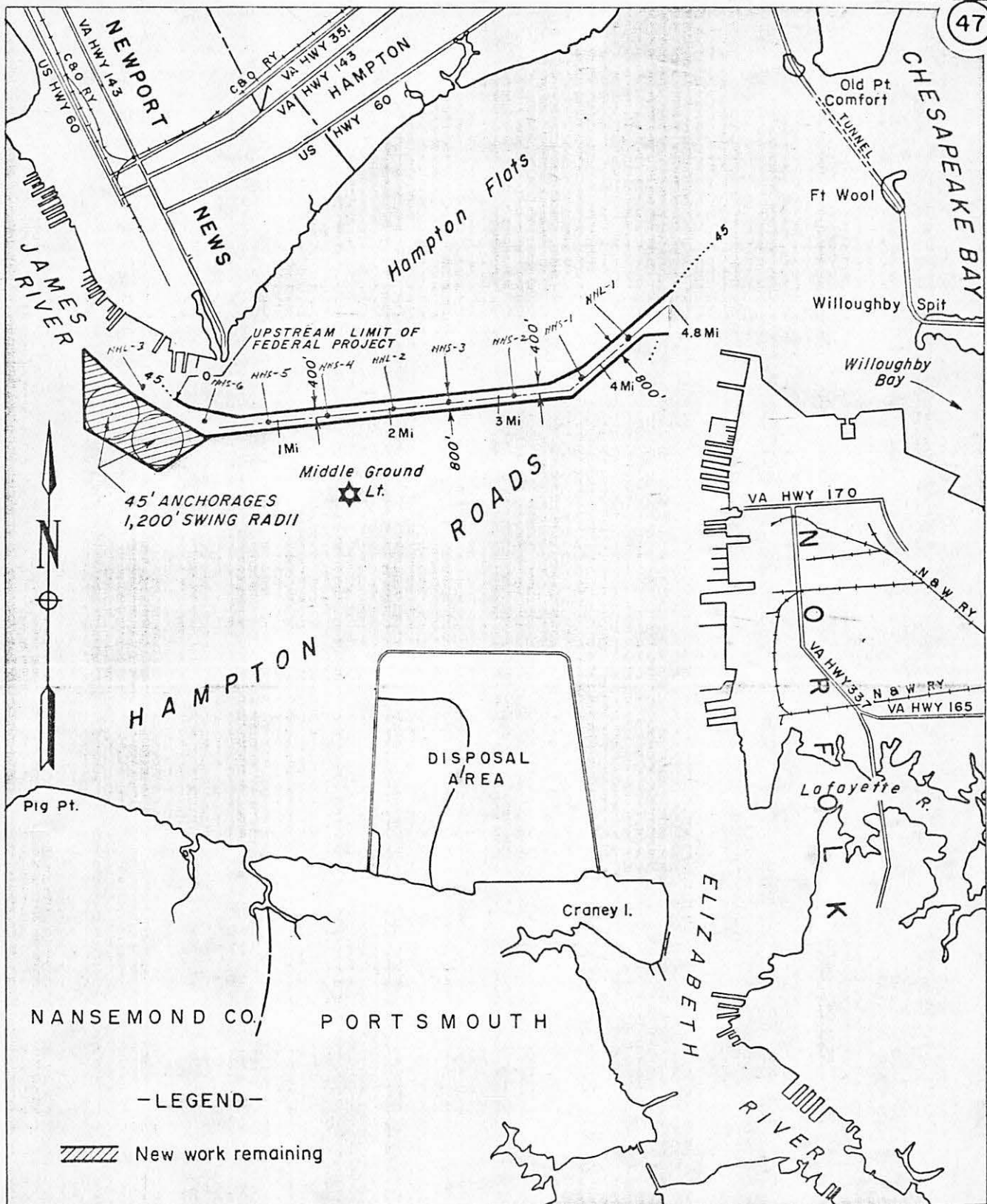
	TS	VS %	COD	TP	TKN	Zn	Cu DOM	Pb	Hg
EPA Guidelines	NA	6.0	5.0	NA	1000	50	NA	50	1.0
\bar{X} RSL %	67.2	2.87 0	2.61 6.67%	443	662 13.33%	33.02 6.67%	9.18	18.47 0	0.14 0
\bar{X} TSL %	73.2	2.08 0	1.68 0	334	381 0	24.29 0	8.38	12.79 0	0.12 0
\bar{X} E ₄₀ L-E ₄₅ L %	54.4	7.05 50.00%	8.20 66.67%	59	1685 91.67%	95.06 91.67%	23.87	42.68 16.67%	0.27 0
\bar{X} >NNL %	66.8	3.05 0	2.45 0	446	543 33.33%	36.42 16.67%	9.48	18.85 0	0.13 0
\bar{X} CHL %	79.6	0.94 0	0.33 0	292	264 0	12.13 0	6.10	8.15 0	0.10 0
\bar{X} YEL %	64.7	3.36 0	3.02 9.52%	382	622 33.33%	33.43 19.05%	11.41	27.17 0	0.16 0
\bar{X} YSL %	73.9	2.01 0	1.77 0	371	375 0	24.37 0	8.16	19.95 0	0.11 0

\bar{X} = Statistical mean.

Boxes identify areas whose mean (\bar{X}) concentrations exceed EPA guidelines for open water disposal.

Percentages reflect the proportion of samples collected from a specific area which have concentrations exceeding EPA guidelines.

CHANNEL TO NEWPORT NEWS

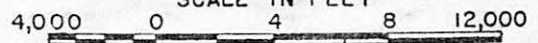


Project Depth: -45'

CHANNEL TO NEWPORT NEWS VIRGINIA

MAP REVISED JUNE 1970

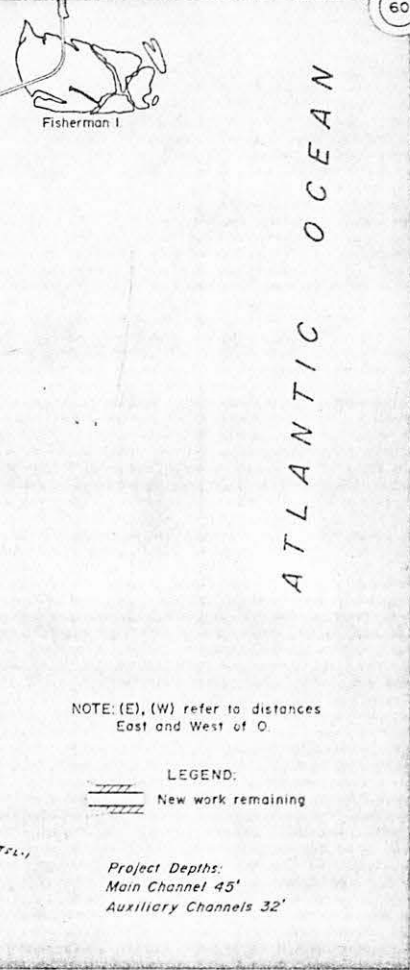
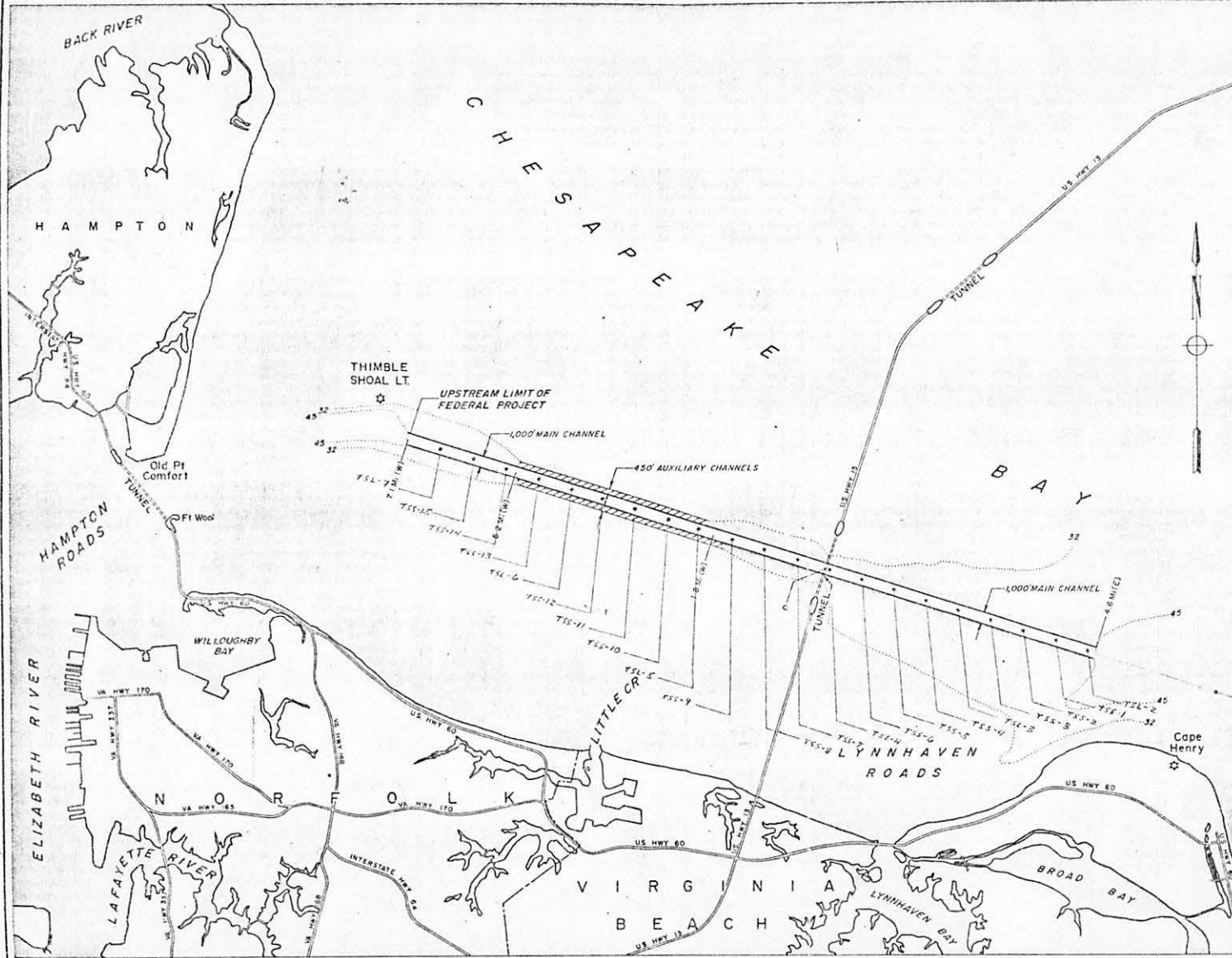
SCALE IN FEET



NORFOLK DISTRICT

NORFOLK HARBOR CHANNEL

THIMBLE SHOAL CHANNEL



NOTE: (E), (W) refer to distances East and West of O.

LEGEND:
 [Hatched pattern] New work remaining

Project Depths:
 Main Channel 45'
 Auxiliary Channels 32'

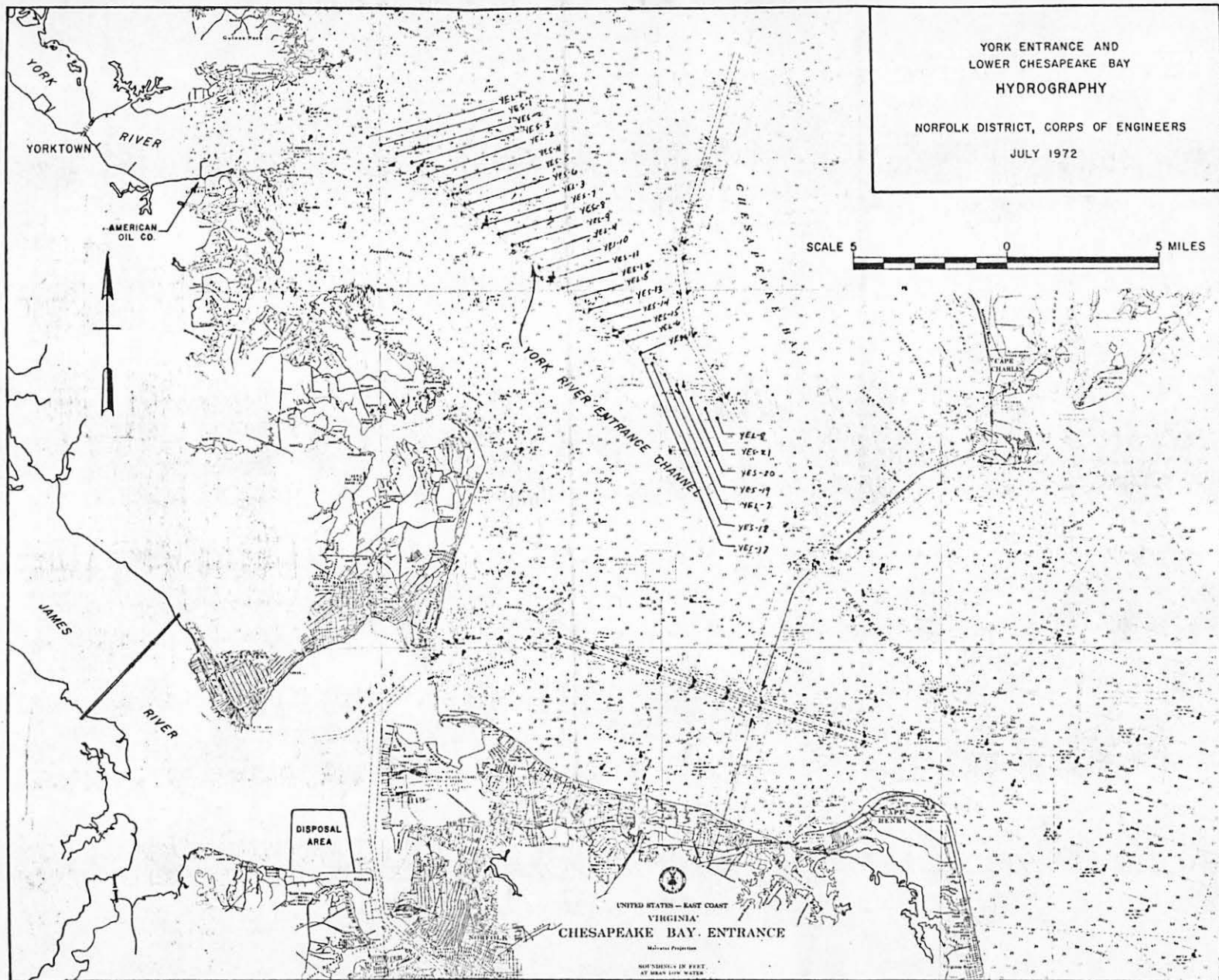
THIMBLE SHOAL CHANNEL VIRGINIA

MAP REVISED JUNE 1970
 SCALE IN FEET



NORFOLK DISTRICT

YORK ENTRANCE CHANNEL



YORK ENTRANCE AND
LOWER CHESAPEAKE BAY
HYDROGRAPHY

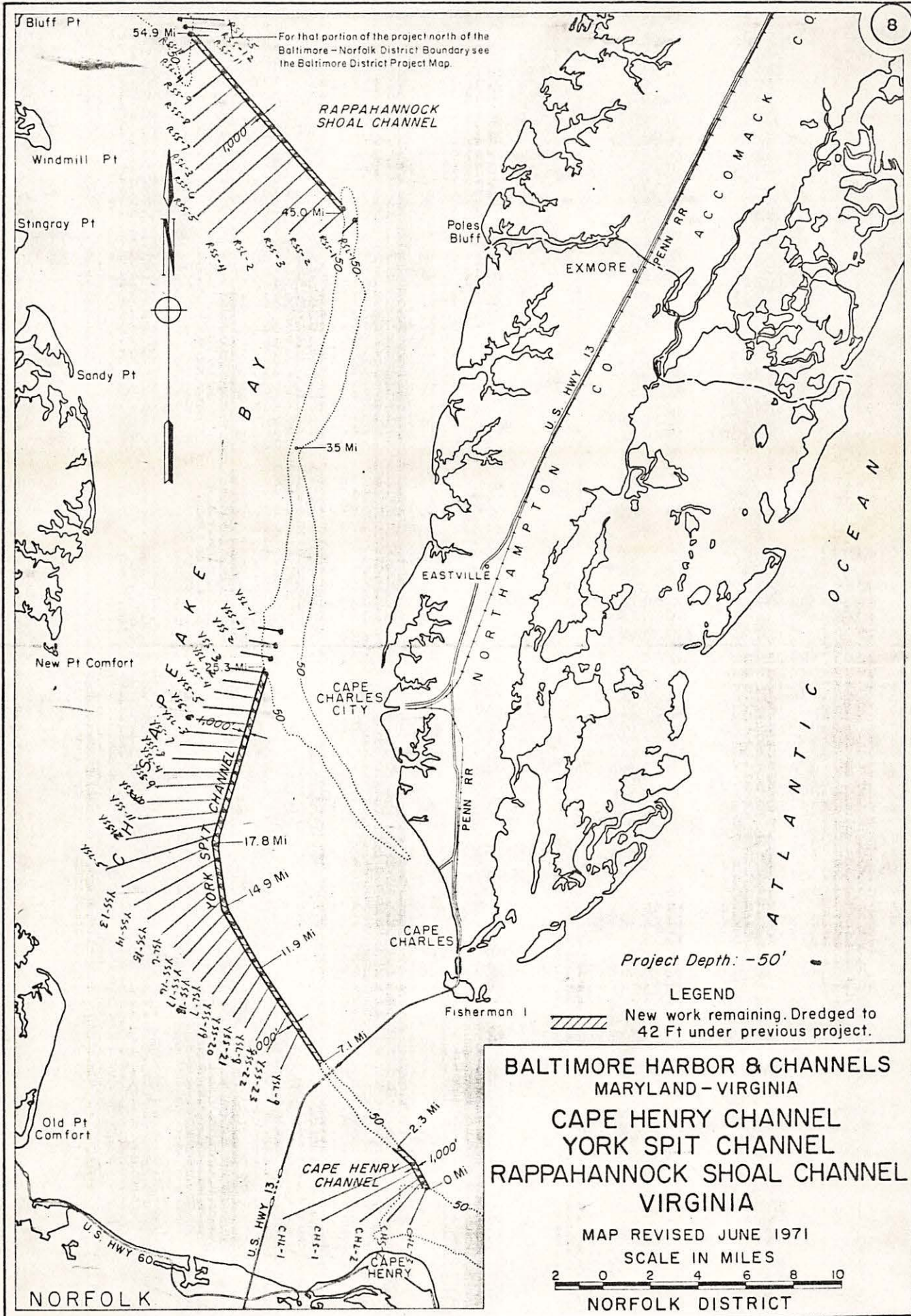
NORFOLK DISTRICT, CORPS OF ENGINEERS
JULY 1972

SCALE 5 0 5 MILES

UNITED STATES — EAST COAST
VIRGINIA
CHESAPEAKE BAY ENTRANCE

NOT SHOWN IN FEET
BY GRAY LINES WATER


BALTIMORE HARBOR AND CHANNELS



For that portion of the project north of the Baltimore - Norfolk District Boundary see the Baltimore District Project Map

Project Depth: -50'

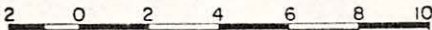
LEGEND

 New work remaining. Dredged to 42 Ft under previous project.

BALTIMORE HARBOR & CHANNELS
MARYLAND - VIRGINIA
CAPE HENRY CHANNEL
YORK SPIT CHANNEL
RAPPAHANNOCK SHOAL CHANNEL
VIRGINIA

MAP REVISED JUNE 1971

SCALE IN MILES



NORFOLK DISTRICT

