THE CRAWFORD POND NICKEL DEPOSIT

FINAL REPORT
TO
THE OFFICE OF MINERALS EXPLORATION
UNITED STATES DEPARTMENT OF INTERIOR

PART II

DRILLING HOLE CROSS-SECTIONS

Docket No.:	OME - 6104
Commodity :	Nickel
Contract No.:	14-23-090-2123
County :	Knox
State :	Maine

June 15, 1962

THE CRAWFORD POND NICKEL DEPOSIT

FINAL REPORT
TO
THE OFFICE OF MINERALS EXPLORATION
UNITED STATES DEPARTMENT OF INTERIOR

June 15, 1962

Docket No.:	OME - 6104
Commodity :	Nickel
Contract No.:	14-23-090-2123
County :	Knox
State :	Maine

TABLE OF CONTENTS

	Page No.
Introduction	1
Drilling Program	2
Table I - Chronology of Drilling	2
Table II - Physical Characteristics of the Drilling Holes	3
Mineralogic and Flotation Studies	3
Table III - Tabulation of Assays	4, 5, 6
Geology	8
Characteristics of Rocks Associated with the Ore Body	8
Sulfides	9
Dikes (Pegmatites and Lamprophyres)	9
Trend	10
Attitude	10
Host Rock	10
Estimate of Tonnage	11
Tonnage Computations	12
Table IV - Estimate of Grade and Tonnage Nickel-Copper Ore	14

Enclosures:

Block Diagram No. 1 - Map of Harriman Prospect

Block Diagram No. 3 - Map of Crawford Pond Prospect

THE CRAWFORD POND NICKEL DEPOSIT

FINAL REPORT TO THE OFFICE OF MINERALS EXPLORATION

INTRODUCTION

On February 16, 1961, Roland F. Beers, Inc. (Operator) entered into an agreement with the Office of Minerals Exploration, United States Department of the Interior. Under this agreement, the Government will provide financial assistance in the search for unexplored nickel deposits in Knox County, Maine. This contract (14-23-090-2123) called for a total allowable cost of $48,186.00, to which the Government would advance fifty percent as a loan. Work authorized under the contract was initiated on May 1, 1961, and was concluded June 15, 1962.

The purpose of the program was to explore the relatively large areas, geologically and geophysically favorable, delineated by previous geophysical exploration and core drilling (see Final Report, Contract Idm-E1224, DMEA). The program was designed to confirm and enlarge prior reserve estimates of approximately four million tons for the entire prospect. Initially, the work proposal called for core drilling in a pattern to intersect the ore body at intervals of not less than 200 feet along the known extent.

Secondary objectives were (a) to test an extensive geophysical anomaly, of favorable characteristics, under Alford Lake, and (b) to determine the relationship of the south end of the Harriman ore body to the north end of the Crawford Pond mineralized zone.

To accomplish these objectives, fourteen holes, aggregating 6,086.0 feet, of diamond drilling, were completed. Of the total drilling footage, 4,361.5 feet, distributed over ten holes, were expended on the Crawford Pond zone; two holes totaling 1,001.0 feet were put down at Alford Lake; two holes involving 723.5 feet tested the south end of the Harriman zone.

In over-all aspect the work program completed under the current contract was successful, although the information relating to the secondary objectives is largely negative.

On the basis of previous drilling and that completed under the current program, the ore reserves of the Crawford Pond East Side zone are revised to approximately two million tons (short) with an average nickel tenor of 0.623%.

DRILLING PROGRAM

Detailed lithologic logs of all drill holes were submitted with monthly progress reports and are not duplicated herein. However, cross-sections of all drill holes are included because they constitute a summary of drilling information and they clearly illustrate the geologic characteristics upon which the reserve estimates are based. The collar locations of all drill holes are shown on an accompanying map.

The chronology of drilling and the physical characteristics of all drill holes are presented below in tabular form.

TABLE I

Drill Hole	Beginning Date	Completion Date
E-60-2	5/1/61	5/13/61
E-52-2	5/14/61	5/31/61
E-55-1	6/1/61	6/10/61
E-64-1	6/10/61	6/30/61
E-62-1	7/1/61	7/18/61
E-64-2	7/19/61	8/9/61
E-48-1	8/10/61	8/26/61
E-55-1	(wedged for ore sample during September, 1961)	
E-55-2	10/1/61	10/15/61
E-55-3	10/15/61	10/31/61
E-50-1	11/1/61	11/30/61

The physical characteristics of the drill holes are presented below in tabular form:

TABLE II

Hole	Location	Inclination	Bearing	Total Depth	Elevation
E-60-2	60.00S+5.52E	-60°	N63°30'W	420'	120' a.s.l.
E-52-2	52.20S+6.20E	-60°	N72°00'W	420'	120' a.s.l.
E-55-1	54.90S+5.30E	-60°	N72°00'W	363'	110' a.s.l.
E-64-1	63.87S+4.30E	-42°	N72°00'W	550'	120' a.s.l.
E-62-1	61.75S+4.70E	-41°	N72°00'W	364'	110' a.s.l.
E-64-2	63.87S+4.30E	-60°	N72°00'W	399'6"	120' a.s.l.
E-48-1	48.00S+4.60E	-90°	None	399'	110' a.s.l.
E-55-2	54.90S+5.60E	-45°	N72°00'W	420'	120' a.s.l.
E-55-3	54.90S+5.60E	-77°	N72°00'W	461'	120' a.s.l.
E-50-1	49.90S+6.88E	-41°	N72°00'W	565'	120' a.s.l.

The cross-sections, drill logs, and assays of the above listed drill holes accompany this report.

Eighty-four (84) assays were made on mineralized areas of interest, including sulfide-bearing wall rocks, pegmatites and basic intrusives, as well as massive sulfides. Copies of assay certificates have been previously submitted to the Government and are, therefore, not included in this report. For ready reference in ore reserve calculations, all assay data are summarized in Table III.

MINERALOGIC AND FLOTATION STUDIES

The studies described in this section of the Final Report were not supported by Government funds; however, the data are pertinent to the general problem and the Operator wishes to make this information available.

More than two hundred polished sections were prepared from both core and surface samples. These sections were studied to determine mineralogy, textural relations, grain size,

TABULATION OF ASSAYS

Hole No.	Assay No.	Interval	Cu %	S %	Fe %	Ni %	Co %
E-60-2	1	369' 9" - 374' 9"	0.497	18.17	32.8	0.951	0.095
	2	374' 9" - 379' 9"	0.371	16.66	29.8	0.886	0.103
	3	379' 9" - 384' 9"	0.648	18.90	35.6	1.008	0.103
	4	384' 9" - 389' 9"	0.422	21.19	38.4	1.097	0.110
	5	389' 9" - 394' 4"	0.522	20.64	37.2	1.097	0.103
E-52-2	1	350' 3" - 355' 0"	0.063	2.82	8.4	0.227	0.029
	2	355' 0" - 360' 0"	0.189	7.23	14.2	0.422	0.036
	3	360' 0" - 365' 0"	0.144	6.62	13.4	0.443	0.051
	4	365' 0" - 370' 0"	0.434	4.01	10.4	0.256	0.029
	5	370' 0" - 375' 0"	0.623	4.88	10.6	0.307	0.029
	6	375' 0" - 380' 0"	0.359	8.08	17.8	0.530	0.014
	7	380' 0" - 385' 0"	0.201	1.46	6.2	0.122	0.036
	8	385' 0" - 390' 0"	0.207	3.65	9.4	0.274	0.022
	9	390' 0" - 395' 0"	0.126	1.51	6.0	0.140	0.014
	10	395' 0" - 400' 0"	0.195	0.87	6.2	0.079	0.014
E-55-1	1	297' 8" - 303' 0"	0.346	13.79	28.4	0.843	0.102
	2	303' 0" - 308' 0"	0.680	13.96	31.6	0.983	0.095
	3	308' 0" - 313' 0"	0.510	15.68	31.8	0.780	0.088
	4	313' 0" - 318' 0"	0.283	17.37	34.6	1.079	0.088
	5	318' 0" - 325' 0"	0.176	1.92	8.6	0.156	0.014
	6	325' 0" - 330' 0"	0.415	24.29	46.8	1.593	0.073
	7	330' 0" - 335' 0"	0.617	31.98	54.2	1.914	0.095
	8	335' 0" - 340' 0"	1.012	30.97	53.0	1.719	0.110
	9	340' 0" - 344' 2"	1.315	29.24	47.4	1.662	0.117
E-55-2	1	321' 1" - 325' 0"	0.107	5.09		0.337	
	2	325' 0" - 330' 0"	0.207	7.50	16.6	0.430	0.088
	3	330' 0" - 336' 6"	0.170	8.47	18.8	0.548	0.058
	4	336' 6" - 340' 4"	0.119	3.71		0.244	
	5	340' 4" - 344' 6"	0.270	9.26		0.532	
	6	344' 6" - 349' 0"	0.107	5.89	14.0	0.333	0.073
	7	349' 0" - 354' 0"	0.156	11.64	24.0	0.727	0.058
	8	354' 0" - 358' 8"	0.387	7.11	15.8	0.394	0.066
	9	365'11" - 370' 5"	0.170	7.16		0.402	
	10	370' 5" - 372' 9"	0.321	9.40		0.394	
	11	372' 9" - 378'10"	0.504	2.47		0.138	
	12	378'10" - 385' 7"	0.308	11.88	23.8	0.707	0.058

TABULATION OF ASSAYS

Hole No.	Assay No.	Interval	Cu %	S %	Fe %	Ni %	Co %
E-55-3	1	365' 2" - 370' 0"	0.113	5.03	11.4	0.316	0.022
	2	370' 0" - 375' 0"	0.220	6.06	13.4	0.375	0.014
	3	375' 0" - 380' 0"	0.441	10.36	19.8	0.613	0.036
	4	380' 0" - 385' 0"	0.522	7.89	14.6	0.447	0.029
	5	385' 0" - 391' 3"	0.233	14.29	26.4	0.845	0.058
E-62-1	1	295' 3" - 302' 0"	0.189	7.10	14.8	0.398	0.044
	2	302' 0" - 305' 6"	0.138	5.09	11.4	0.284	0.029
	3	305' 6" - 320' 0"	0.088			0.073	
	4	320' 0" - 325' 0"	0.201	14.06	28.6	0.744	0.073
	5	325' 0" - 330' 0"	0.252	16.04	31.4	0.845	0.088
	6	330' 0" - 335' 0"	0.088			0.170	
	7	335' 0" - 339' 2"	0.302	12.40	24.2	0.638	0.059
E-64-1	1	341' 4" - 345' 3"	0.441	23.14	38.4	1.213	0.088
	2	351' 5" - 353' 2"	0.567	29.95	47.8	1.715	0.110
	3	356' 2" - 357'10"	0.340	27.26	44.6	1.528	0.102
E-64-2	1	322' 0" - 328' 0"	0.655	28.88	47.6	1.503	0.117

TABULATION OF ASSAYS

Hole No.	Assay No.	Interval	Cu %	S %	Fe %	Ni %	Co %
E-50-1	1	378' 0" - 383' 0"	0.315			0.162	
	2	383' 0" - 388' 0"	0.081			0.174	
	3	388' 0" - 394' 0"	0.107			0.406	
	4	394' 0" - 404' 0"	0.050	0.91	6.2	0.097	0.014
	5	404' 0" - 413' 0"	0.081			0.138	
	6a	413' 0" - 415' 3"					
	b	416' 8" - 418'11"	0.113			0.109	
	c	420' 8" - 423' 2"					
	7a	415' 3" - 416' 8"					
	b	418'11" - 420' 8"	0.081			0.203	
	c	426' 4" - 428' 0"					
	8a	423' 2" - 426' 4"					
	b	428' 0" - 429' 6"				0.020	
	c	429' 6" - 430' 4"					
	d	430' 4" - 432' 4"					
	9a	432' 4" - 433' 1"					
	b	434' 8" - 435' 5"	0.113			0.211	
	c	435' 5" - 437' 3"					
	10a	433' 1" - 434' 8"	0.056			0.060	
	b	442'10" - 445' 6"					
	11	437' 3" - 442'10"	0.107	4.99	12.0	0.312	0.022
	12	445' 6" - 450' 0"	0.056			0.115	
	13	450' 0" - 455' 0"	0.144			0.251	
	14	455' 0" - 463' 0"	0.163	2.42	11.4	0.308	0.014
	15	463' 0" - 471' 2"	0.056			0.069	
	16	471' 2" - 477' 0"	0.094			0.125	
	17	477' 0" - 482' 7"	0.113			0.154	
	18	482' 7" - 483' 3"	0.031	0.03		0.130	
	19	493' 0" - 499' 4"	0.037			0.028	
	20	499' 4" - 504' 4"	0.434	9.04	18.8	0.694	0.051
	21	504' 4" - 511' 4"	0.056	1.13	8.2	0.134	0.014
	22	518' 4" - 526' 2"	0.220			0.079	

nickel distribution, and mineralogic affinities. The results of the study are based on observations derived from standard mineragraphic procedures and use of the Gaudin chromic acid staining technique. Sulfide minerals identified in the explored area (4N - 100S) are:

pyrrhotite	pyrite	sphalerite
pentlandite	niccolite	galena
chalcopyrite	gersdorffite (?)	

In addition to the foregoing sulfides, another mineral, suspected of being a nickel or nickel-cobalt sulfide, is rather widely distributed, though never in significant amounts, in the East Side ore zone.

Magnetite is ubiquitous in basic rock and sulfide zones and is found in a number of relationships with both sulfides and silicates. It may be significant to point out that frequently pentlandite grains are diluted by magnetite in complex vein intergrowths.

Although it was evident from the outset of exploration that pentlandite was the predominant nickel ore mineral, the role of "nickeliferous pyrrhotite" had not been evaluated. Optical examination of polished sections revealed lamellar structures in certain pyrrhotite grains which closely resemble the alpha and beta pyrrhotite of Scholtz. Dennen noted similar structures in sulfide-bearing norite from Dracut, Massachusetts. Although the lamellae, in simple-to-complex development, may be detected on carefully polished sections under high magnification, they become strikingly outlined when stained with the Gaudin chromic acid solution. Because of the differential staining and the association with normal nickel minerals, it was assumed that the stained lamellae were nickel-rich and the unstained host nickel-poor. This particular problem has not been clearly resolved; however, optical, chemical and X-ray studies of the final Ni-Cu-Co concentrate indicate that if nickel is held in the pyrrhotite it is, indeed, in small quantities.

Inasmuch as no cobalt minerals were identified, it is assumed that the cobalt reported on assay certificates is present in pentlandite, proxying for nickel (as is the case with Sudbury ore). All of the copper occurs in the mineral chalcopyrite.

Metallurgical investigations of sulfide ore from the East Union prospect continued through 1961. The flotation process developed by the U. S. Bureau of Mines (Shelton, 1961) has been improved in further developments by R. W. Flagg of Denver Equipment Company. These studies have demonstrated that a competitive nickel-copper-cobalt concentrate can be prepared through selective flotation of Crawford Pond sulfide ore.

GEOLOGY

This portion of the report is concerned with the general characteristics of the basic body and the host rock. Conclusions are drawn from the information provided by drill holes within the limits of traverses 42 South and 64 South. It should be noted that drill holes E-1 and E-4 (traverses 42 South and 60 South respectively) were not a part of the drilling program under Contract No. 14-23-090-2123, but were included in a previous contract with the Defense Minerals Exploration Administration, No. Idm-E-1224, Docket No. DMEA-4947.

CHARACTERISTICS OF ROCKS ASSOCIATED WITH THE ORE BODY

The ultra-basics appear to represent a true intrusive although the information accumulated to date has not conclusively established this as a fact. The original intrusive probably contained pyroxene, olivine, brown mica, and feldspar. Alteration as a result of metamorphism probably produced the variations now noted as anthophyllite, serpentine, talc, biotite, chlorite, and hornblende. The abundance of gabbro and norite cut by drill hole E-55-3 on traverse 55 South is exceptional. Elsewhere in the lake area these types of basic rocks characteristically occur as then lenses above, near the top, or immediately below the peridotite body. In general, the basic body is represented by a chloritic peridotite and the variations are local. One exception that should be noted is the section of chlorite-free pyroxene cut in drill hole E-55-1 where the pyroxene is mostly augite and is comparable to the basics of the original outcrop near the coordinates 0.0 + 0.0 on the land grid.

SULFIDES

Sulfides that occur in the peridotite body are pyrrhotite, chalcopyrite, pentlandite, niccolite, sphalerite and galena. They are listed here in order of decreasing abundance. Sphalerite and galena are present only in trace quantities but are recognizable by hand lens. The most abundant sulfide, pyrrhotite, is disseminated and rather evenly distributed locally. When the amount approaches 50% of the total volume, the pyrrhotite crystals are interconnected. Chalcopyrite content is not evenly distributed but is concentrated in zones which are often adjacent to dikes. Niccolite is sometimes observed by hand lens as thin veinlets in dike material. The most obvious quantitative variation of pyrrhotite is from top to bottom in the peridotite body. Five to fifteen percent pyrrhotite by volume is common for the upper one quarter section and a gradual increase in noticeable toward the lower portion. Sulfide content varies from 30% to massive near the lower part of the body with the massive and semi-massive zones almost invariably lying on the bottom. Impregnation of wall rock beneath the basic rock characteristically involves only three to five feet and can usually be described as semi-massive. The thicker sections of sulfides in the lake area lie between the traverses 52 South and 60 South. To the north of this area there are probably more total sulfides but the quantity is disseminated through a much thicker basic section. To the south the basic rocks lens out at least along the established trend and at traverse 64 South no basic rocks are associated with the vein of massive sulfides. The high nickel values in the lake area were from cores between traverses 55 South and 64 South. These values are generally associated with the massive and semi-massive pyrrhotite zones in the lower part of the basic body. Noticeable in the massive zones are minor amounts of biotite, quartz, garnet, and possibly feldspar.

DIKES (PEGMATITES AND LAMPROPHYRES)

Numerous pegmatite dikes penetrate the ultra-basic body in the lake area. Between traverses 42 South and 50 South the dilution of the lake body by these dikes is comparable to the Harriman body. At traverse 50 South the dilution is greater. From traverse 52 South to traverse 62 South the pegmatite dikes

occur less frequently than was expected. Dark colored, fine-grained dikes identified as lamprophyres sometimes cut both the peridotite and the pegmatites. These thin "exotic" dikes are often porphyritic and contain very little sulfides. When sulfides are present in these dikes it is usually chalcopyrite.

TREND

The original EM Vertical Coil Survey on Crawford Pond between the traverses 42 South and 64 South suggested that the trend of a basic body beneath the pond would be north-south and generally parallel to the base line (N 18° E) with only slight variations. The preliminary drilling, drill holes E-1, E-3 and E-4 supported this assumption. Subsequent drill holes have further proven this is the case. The eastward and westward variation of the EM axis is now attributed to the concentration of sulfides, their proximity to the surface and, possibly, the amount of graphite in the wall rock.

ATTITUDE

Since the bottom of the basic body is invariably more uniform than the top, the bottom of the basic sections on traverses including more than one drill hole was used to determine the attitude of the body. As a result of these calculations the basics are estimated to plunge eastward at 20° in the area of traverse 62 South and 46° at traverse 52 South. If this change of dip continued northward at this rate the plunge would be nearly vertical by traverse 34 South. However, it is assumed that the plunge does not exceed 60° by traverse 42 South and no assumption is made north of this traverse because of insufficient data. Drill hole E-48-1 may have missed the basic body because the basics were in a more nearly vertical position.

HOST ROCK

So far as is known, the basic mass is intrusive into and lies concordant with metasediments which may be generally classified as schists. The minerals sillimanite, quartz,

chlorite, garnet, hornblende, biotite, and muscovite are variable. Dolomite and some marble occur within the schist generally in lenticular forms. Attempts to correlate the dolomites and marbles, even between closely spaced drill holes, have been unsuccessful. Graphite and serpentine occur in the host rock adjacent to the basic body and probably represent alteration haloes. Graphite occurrences often assume 5 to 15% of the wall rock but only in very narrow bands, the usual occurrence being 1% or less of the total volume. So far, no massive graphite beds have been encountered. With respect to the lake area, there is more graphite in the wall rock north of traverse 50 South than elsewhere. Associated pyrite is found in minor quantities wherever the graphite is present. The occurrence of white mica in zones ranging from 2 feet to 6 feet in thickness probably account for the "cavities" logged by the drillers. Here the mica is cemented by calcite and minor silica and very little core is retrieved. No more than one of these soft zones is cut in any single drill hole. They usually occur a considerable distance above the basic body. All attempts to log and make use of the schistosity and foliation of the wall rock for correlation have been unsuccessful. The cores immediately above and below the basic body are particularly distorted.

ESTIMATE OF TONNAGE

The total mass of the ore body, including veins of massive pyrrhotite is estimated to be about two million tons. Actually, insufficient data were obtained by the single drill hole on traverse 42 South and on the structure between traverse 50 South and traverse 32 South. That something unusual has occurred in this area is evidenced by the facts that drill hole E-48-1 missed the basic rock; that drill holes E-1 and H-32-S (located on traverses 42 South and 32 South respectively) cut only narrow sections of basic rock; that drill hole E-50-1 cut a section of basic rock twice the normal thickness; and that ultra-basics containing significant nickel values outcrop on the surface on traverse 34 South at 1.5 East, at an elevation approximately 250 feet higher than those on traverses 42 South and 32 South.

Considering only the assayed sections through the lake area, the total ore tonnage is computed to be approximately two million tons. Considering the abnormal thickness of the E-50-1 traverse, this estimate is probably conservative, since it is assumed that this segment contributes only 63,000 tons. However, this procedure is consistent with that used on all other sections and its effect on the total is minimal.

The marginal limits of the basic body are not known and can only be assumed. The western margin lies approximately below the 2 East coordinate and the eastern margin ranges from 2.5 East on traverse 62 South to 5 East on traverse 50 South. On the basis of total basics, the thick section of norite and gabbro cut by drill hole E-55-3 above the peridotite on traverse 55 South suggests that the eastern limit here extends to at least 6 East but this limit has not been clearly defined. The perodite body varies in thickness from 160 feet at traverse 50 South to 40 feet on traverse 62 South in what is considered to be its central portion. It is assumed to lens out on the margins.

TONNAGE COMPUTATIONS

This method is based on the assumption that we do not know enough about the mineralized zone to assign it a specific shape, especially up-dip and down-dip from the last hole in each section (as on traverse 55 South). Therefore, each hole is assigned a "zone of influence", the specific size of which varies with wide limits.

On those lines with only one drill hole, the width of the zone was a function of the thickness of the assayed section; the width was never less than twice the thickness. In all cases, the length of the rectangular "zone" was one-half the distance to adjacent sections.

On the sections with more than one drill hole, the zone assigned to each hole was one-half the distance to the adjacent hole on the same section. The same half-distance was used to define the outer limits (up-dip and down-dip) of the mineralized area.

Thus, the East Side body was treated as being composed of a number of unit rectangles, the nickel contribution of each being decided by the assays of the core in the center of the rectangle. The tonnage of each block was determined by dividing the volume (cubic feet) by 9.45 (number of cubic feet per ton of "average" ore). The nickel content was then ascertained by multiplying the tonnage of each block by the weighted average assay of the controlling drill hole. The ore reserve estimated is the sum of all unit blocks. The tenor is the ore reserve divided by the nickel content of the entire body. The gross figures given in Table IV include a factor of 10% for dilution.

TABLE IV

ESTIMATE OF GRADE AND TONNAGE NICKEL-COPPER ORE CRAWFORD POND, KNOX COUNTY, MAINE

	Tons	Tons
E-64-1 Block:	28,800	
	0.624% Ni	180
	0.199% Cu	57
E-64-2 Block:	7,830	
	1.503% Ni	118
	0.655% Cu	51
E-62-1 Block:	145,800	
	0.368% Ni	536
	0.159% Cu	232
E-60-2 Block:	189,200	
	1.008% Ni	1907
	0.492% Cu	931
E-4 Block:	659,000	
	0.608% Ni	4007
	0.325% Cu	2142
E-55-1 Block:	196,600	
	1.129% Ni	2220
	0.564% Cu	1109
E-55-2 Block:	280,000	
	0.396% Ni	1109
	0.215% Cu	602
E-55-3 Block:	149,100	
	0.536% Ni	799
	0.304% Cu	453
E-3 Block:	63,700	
	0.677% Ni	431
	0.498% Cu	317
E-52-2 Block:	109,800	
	0.280% Ni	307
	0.254% Cu	279
E-50-1 Block:	63,000	
	0.368% Ni	232
	0.217% Cu	137
E-1 Block:	23,830	
	0.301% Ni	72
	0.126% Cu	30
Total Tonnage:	1,916,660	
Average Grade:	0.623% Ni	11,918 Ni
	0.331% Cu	6,340 Cu
10% Dilution:	191,666	
Gross Tonnage:	2,108,326	
Average Grade:	0.566% Ni	
	0.333% Cu	

THE CRAWFORD POND NICKEL DEPOSIT

FINAL REPORT
TO
THE OFFICE OF MINERALS EXPLORATION
UNITED STATES DEPARTMENT OF INTERIOR

June 15, 1962

Docket No.:	OME - 6104
Commodity :	Nickel
Contract No.:	14-23-090-2123
County :	Knox
State :	Maine

TABLE OF CONTENTS

	Page No.
Introduction	1
Drilling Program	2
Table I - Chronology of Drilling	2
Table II - Physical Characteristics of the Drilling Holes	3
Mineralogic and Flotation Studies	3
Table III - Tabulation of Assays	4, 5, 6
Geology	8
Characteristics of Rocks Associated with the Ore Body	8
Sulfides	9
Dikes (Pegmatites and Lamprophyres)	9
Trend	10
Attitude	10
Host Rock	10
Estimate of Tonnage	11
Tonnage Computations	12
Table IV - Estimate of Grade and Tonnage Nickel-Copper Ore	14

Enclosures:

Block Diagram No. 1 - Map of Harriman Prospect

Block Diagram No. 3 - Map of Crawford Pond Prospect

THE CRAWFORD POND NICKEL DEPOSIT

FINAL REPORT TO THE OFFICE OF MINERALS EXPLORATION

INTRODUCTION

On February 16, 1961, Roland F. Beers, Inc. (Operator) entered into an agreement with the Office of Minerals Exploration, United States Department of the Interior. Under this agreement, the Government will provide financial assistance in the search for unexplored nickel deposits in Knox County, Maine. This contract (14-23-090-2123) called for a total allowable cost of $48,186.00, to which the Government would advance fifty percent as a loan. Work authorized under the contract was initiated on May 1, 1961, and was concluded June 15, 1962.

The purpose of the program was to explore the relatively large areas, geologically and geophysically favorable, delineated by previous geophysical exploration and core drilling (see Final Report, Contract Idm-E1224, DMEA). The program was designed to confirm and enlarge prior reserve estimates of approximately four million tons for the entire prospect. Initially, the work proposal called for core drilling in a pattern to intersect the ore body at intervals of not less than 200 feet along the known extent.

Secondary objectives were (a) to test an extensive geophysical anomaly, of favorable characteristics, under Alford Lake, and (b) to determine the relationship of the south end of the Harriman ore body to the north end of the Crawford Pond mineralized zone.

To accomplish these objectives, fourteen holes, aggregating 6,086.0 feet, of diamond drilling, were completed. Of the total drilling footage, 4,361.5 feet, distributed over ten holes, were expended on the Crawford Pond zone; two holes totaling 1,001.0 feet were put down at Alford Lake; two holes involving 723.5 feet tested the south end of the Harriman zone.

In over-all aspect the work program completed under the current contract was successful, although the information relating to the secondary objectives is largely negative.

On the basis of previous drilling and that completed under the current program, the ore reserves of the Crawford Pond East Side zone are revised to approximately two million tons (short) with an average nickel tenor of 0.623%.

DRILLING PROGRAM

Detailed lithologic logs of all drill holes were submitted with monthly progress reports and are not duplicated herein. However, cross-sections of all drill holes are included because they constitute a summary of drilling information and they clearly illustrate the geologic characteristics upon which the reserve estimates are based. The collar locations of all drill holes are shown on an accompanying map.

The chronology of drilling and the physical characteristics of all drill holes are presented below in tabular form.

TABLE I

Drill Hole	Beginning Date	Completion Date
E-60-2	5/1/61	5/13/61
E-52-2	5/14/61	5/31/61
E-55-1	6/1/61	6/10/61
E-64-1	6/10/61	6/30/61
E-62-1	7/1/61	7/18/61
E-64-2	7/19/61	8/9/61
E-48-1	8/10/61	8/26/61
E-55-1 (wedged for ore sample during September, 1961)		
E-55-2	10/1/61	10/15/61
E-55-3	10/15/61	10/31/61
E-50-1	11/1/61	11/30/61

The physical characteristics of the drill holes are presented below in tabular form:

TABLE II

Hole	Location	Inclination	Bearing	Total Depth	Elevation
E-60-2	60.00S+5.52E	-60°	N63°30'W	420'	120' a.s.l.
E-52-2	52.20S+6.20E	-60°	N72°00'W	420'	120' a.s.l.
E-55-1	54.90S+5.30E	-60°	N72°00'W	363'	110' a.s.l.
E-64-1	63.87S+4.30E	-42°	N72°00'W	550'	120' a.s.l.
E-62-1	61.75S+4.70E	-41°	N72°00'W	364'	110' a.s.l.
E-64-2	63.87S+4.30E	-60°	N72°00'W	399'6"	120' a.s.l.
E-48-1	48.00S+4.60E	-90°	None	399'	110' a.s.l.
E-55-2	54.90S+5.60E	-45°	N72°00'W	420'	120' a.s.l.
E-55-3	54.90S+5.60E	-77°	N72°00'W	461'	120' a.s.l.
E-50-1	49.90S+6.88E	-41°	N72°00'W	565'	120' a.s.l.

The cross-sections, drill logs, and assays of the above listed drill holes accompany this report.

Eighty-four (84) assays were made on mineralized areas of interest, including sulfide-bearing wall rocks, pegmatites and basic intrusives, as well as massive sulfides. Copies of assay certificates have been previously submitted to the Government and are, therefore, not included in this report. For ready reference in ore reserve calculations, all assay data are summarized in Table III.

MINERALOGIC AND FLOTATION STUDIES

The studies described in this section of the Final Report were not supported by Government funds; however, the data are pertinent to the general problem and the Operator wishes to make this information available.

More than two hundred polished sections were prepared from both core and surface samples. These sections were studied to determine mineralogy, textural relations, grain size,

TABLE III

TABULATION OF ASSAYS

Hole No.	Assay No.	Interval	Cu %	S %	Fe %	Ni %	Co %
E-60-2	1	369' 9" - 374' 9"	0.497	18.17	32.8	0.951	0.095
	2	374' 9" - 379' 9"	0.371	16.66	29.8	0.886	0.103
	3	379' 9" - 384' 9"	0.648	18.90	35.6	1.008	0.103
	4	384' 9" - 389' 9"	0.422	21.19	38.4	1.097	0.110
	5	389' 9" - 394' 4"	0.522	20.64	37.2	1.097	0.103
E-52-2	1	350' 3" - 355' 0"	0.063	2.82	8.4	0.227	0.029
	2	355' 0" - 360' 0"	0.189	7.23	14.2	0.422	0.036
	3	360' 0" - 365' 0"	0.144	6.62	13.4	0.443	0.051
	4	365' 0" - 370' 0"	0.434	4.01	10.4	0.256	0.029
	5	370' 0" - 375' 0"	0.623	4.88	10.6	0.307	0.029
	6	375' 0" - 380' 0"	0.359	8.08	17.8	0.530	0.014
	7	380' 0" - 385' 0"	0.201	1.46	6.2	0.122	0.036
	8	385' 0" - 390' 0"	0.207	3.65	9.4	0.274	0.022
	9	390' 0" - 395' 0"	0.126	1.51	6.0	0.140	0.014
	10	395' 0" - 400' 0"	0.195	0.87	6.2	0.079	0.014
E-55-1	1	297' 8" - 303' 0"	0.346	13.79	28.4	0.843	0.102
	2	303' 0" - 308' 0"	0.680	13.96	31.6	0.983	0.095
	3	308' 0" - 313' 0"	0.510	15.68	31.8	0.780	0.088
	4	313' 0" - 318' 0"	0.283	17.37	34.6	1.079	0.088
	5	318' 0" - 325' 0"	0.176	1.92	8.6	0.156	0.014
	6	325' 0" - 330' 0"	0.415	24.29	46.8	1.593	0.073
	7	330' 0" - 335' 0"	0.617	31.98	54.2	1.914	0.095
	8	335' 0" - 340' 0"	1.012	30.97	53.0	1.719	0.110
	9	340' 0" - 344' 2"	1.315	29.24	47.4	1.662	0.117
E-55-2	1	321' 1" - 325' 0"	0.107	5.09		0.337	
	2	325' 0" - 330' 0"	0.207	7.50	16.6	0.430	0.088
	3	330' 0" - 336' 6"	0.170	8.47	18.8	0.548	0.058
	4	336' 6" - 340' 4"	0.119	3.71		0.244	
	5	340' 4" - 344' 6"	0.270	9.26		0.532	
	6	344' 6" - 349' 0"	0.107	5.89	14.0	0.333	0.073
	7	349' 0" - 354' 0"	0.156	11.64	24.0	0.727	0.058
	8	354' 0" - 358' 8"	0.387	7.11	15.8	0.394	0.066
	9	365'11" - 370' 5"	0.170	7.16		0.402	
	10	370' 5" - 372' 9"	0.321	9.40		0.394	
	11	372' 9" - 378'10"	0.504	2.47		0.138	
	12	378'10" - 385' 7"	0.308	11.88	23.8	0.707	0.058

TABULATION OF ASSAYS

Hole No.	Assay No.	Interval	Cu %	S %	Fe %	Ni %	Co %
E-55-3	1	365' 2" - 370' 0"	0.113	5.03	11.4	0.316	0.022
	2	370' 0" - 375' 0"	0.220	6.06	13.4	0.375	0.014
	3	375' 0" - 380' 0"	0.441	10.36	19.8	0.613	0.036
	4	380' 0" - 385' 0"	0.522	7.89	14.6	0.447	0.029
	5	385' 0" - 391' 3"	0.233	14.29	26.4	0.845	0.058
E-62-1	1	295' 3" - 302' 0"	0.189	7.10	14.8	0.398	0.044
	2	302' 0" - 305' 6"	0.138	5.09	11.4	0.284	0.029
	3	305' 6" - 320' 0"	0.088			0.073	
	4	320' 0" - 325' 0"	0.201	14.06	28.6	0.744	0.073
	5	325' 0" - 330' 0"	0.252	16.04	31.4	0.845	0.088
	6	330' 0" - 335' 0"	0.088			0.170	
	7	335' 0" - 339' 2"	0.302	12.40	24.2	0.638	0.059
E-64-1	1	341' 4" - 345' 3"	0.441	23.14	38.4	1.213	0.088
	2	351' 5" - 353' 2"	0.567	29.95	47.8	1.715	0.110
	3	356' 2" - 357'10"	0.340	27.26	44.6	1.528	0.102
E-64-2	1	322' 0" - 328' 0"	0.655	28.88	47.6	1.503	0.117

TABULATION OF ASSAYS

Hole No.	Assay No.	Interval	Cu %	S %	Fe %	Ni %	Co %
E-50-1	1	378' 0" - 383' 0"	0.315			0.162	
	2	383' 0" - 388' 0"	0.081			0.174	
	3	388' 0" - 394' 0"	0.107			0.406	
	4	394' 0" - 404' 0"	0.050	0.91	6.2	0.097	0.014
	5	404' 0" - 413' 0"	0.081			0.138	
	6a	413' 0" - 415' 3"					
	b	416' 8" - 418'11"	0.113			0.109	
	c	420' 8" - 423' 2"					
	7a	415' 3" - 416' 8"					
	b	418'11" - 420' 8"	0.081			0.203	
	c	426' 4" - 428' 0"					
	8a	423' 2" - 426' 4"					
	b	428' 0" - 429' 6"				0.020	
	c	429' 6" - 430' 4"					
	d	430' 4" - 432' 4"					
	9a	432' 4" - 433' 1"					
	b	434' 8" - 435' 5"	0.113			0.211	
	c	435' 5" - 437' 3"					
	10a	433' 1" - 434' 8"	0.056			0.060	
	b	442'10" - 445' 6"					
	11	437' 3" - 442'10"	0.107	4.99	12.0	0.312	0.022
	12	445' 6" - 450' 0"	0.056			0.115	
	13	450' 0" - 455' 0"	0.144			0.251	
	14	455' 0" - 463' 0"	0.163	2.42	11.4	0.308	0.014
	15	463' 0" - 471' 2"	0.056			0.069	
	16	471' 2" - 477' 0"	0.094			0.125	
	17	477' 0" - 482' 7"	0.113			0.154	
	18	482' 7" - 483' 3"	0.031	0.03		0.130	
	19	493' 0" - 499' 4"	0.037			0.028	
	20	499' 4" - 504' 4"	0.434	9.04	18.8	0.694	0.051
	21	504' 4" - 511' 4"	0.056	1.13	8.2	0.134	0.014
	22	518' 4" - 526' 2"	0.220			0.079	

nickel distribution, and mineralogic affinities. The results of the study are based on observations derived from standard mineragraphic procedures and use of the Gaudin chromic acid staining technique. Sulfide minerals identified in the explored area (4N - 100S) are:

pyrrhotite	pyrite	sphalerite
pentlandite	niccolite	galena
chalcopyrite	gersdorffite (?)	

In addition to the foregoing sulfides, another mineral, suspected of being a nickel or nickel-cobalt sulfide, is rather widely distributed, though never in significant amounts, in the East Side ore zone.

Magnetite is ubiquitous in basic rock and sulfide zones and is found in a number of relationships with both sulfides and silicates. It may be significant to point out that frequently pentlandite grains are diluted by magnetite in complex vein intergrowths.

Although it was evident from the outset of exploration that pentlandite was the predominant nickel ore mineral, the role of "nickeliferous pyrrhotite" had not been evaluated. Optical examination of polished sections revealed lamellar structures in certain pyrrhotite grains which closely resemble the alpha and beta pyrrhotite of Scholtz. Dennen noted similar structures in sulfide-bearing norite from Dracut, Massachusetts. Although the lamellae, in simple-to-complex development, may be detected on carefully polished sections under high magnification, they become strikingly outlined when stained with the Gaudin chromic acid solution. Because of the differential staining and the association with normal nickel minerals, it was assumed that the stained lamellae were nickel-rich and the unstained host nickel-poor. This particular problem has not been clearly resolved; however, optical, chemical and X-ray studies of the final Ni-Cu-Co concentrate indicate that if nickel is held in the pyrrhotite it is, indeed, in small quantities.

Inasmuch as no cobalt minerals were identified, it is assumed that the cobalt reported on assay certificates is present in pentlandite, proxying for nickel (as is the case with Sudbury ore). All of the copper occurs in the mineral chalcopyrite.

Metallurgical investigations of sulfide ore from the East Union prospect continued through 1961. The flotation process developed by the U. S. Bureau of Mines (Shelton, 1961) has been improved in further developments by R. W. Flagg of Denver Equipment Company. These studies have demonstrated that a competitive nickel-copper-cobalt concentrate can be prepared through selective flotation of Crawford Pond sulfide ore.

GEOLOGY

This portion of the report is concerned with the general characteristics of the basic body and the host rock. Conclusions are drawn from the information provided by drill holes within the limits of traverses 42 South and 64 South. It should be noted that drill holes E-1 and E-4 (traverses 42 South and 60 South respectively) were not a part of the drilling program under Contract No. 14-23-090-2123, but were included in a previous contract with the Defense Minerals Exploration Administration, No. Idm-E-1224, Docket No. DMEA-4947.

CHARACTERISTICS OF ROCKS ASSOCIATED WITH THE ORE BODY

The ultra-basics appear to represent a true intrusive although the information accumulated to date has not conclusively established this as a fact. The original intrusive probably contained pyroxene, olivine, brown mica, and feldspar. Alteration as a result of metamorphism probably produced the variations now noted as anthophyllite, serpentine, talc, biotite, chlorite, and hornblende. The abundance of gabbro and norite cut by drill hole E-55-3 on traverse 55 South is exceptional. Elsewhere in the lake area these types of basic rocks characteristically occur as then lenses above, near the top, or immediately below the peridotite body. In general, the basic body is represented by a chloritic peridotite and the variations are local. One exception that should be noted is the section of chlorite-free pyroxene cut in drill hole E-55-1 where the pyroxene is mostly augite and is comparable to the basics of the original outcrop near the coordinates 0.0 + 0.0 on the land grid.

SULFIDES

Sulfides that occur in the peridotite body are pyrrhotite, chalcopyrite, pentlandite, niccolite, sphalerite and galena. They are listed here in order of decreasing abundance. Sphalerite and galena are present only in trace quantities but are recognizable by hand lens. The most abundant sulfide, pyrrhotite, is disseminated and rather evenly distributed locally. When the amount approaches 50% of the total volume, the pyrrhotite crystals are interconnected. Chalcopyrite content is not evenly distributed but is concentrated in zones which are often adjacent to dikes. Niccolite is sometimes observed by hand lens as thin veinlets in dike material. The most obvious quantitative variation of pyrrhotite is from top to bottom in the peridotite body. Five to fifteen percent pyrrhotite by volume is common for the upper one quarter section and a gradual increase in noticeable toward the lower portion. Sulfide content varies from 30% to massive near the lower part of the body with the massive and semi-massive zones almost invariably lying on the bottom. Impregnation of wall rock beneath the basic rock characteristically involves only three to five feet and can usually be described as semi-massive. The thicker sections of sulfides in the lake area lie between the traverses 52 South and 60 South. To the north of this area there are probably more total sulfides but the quantity is disseminated through a much thicker basic section. To the south the basic rocks lens out at least along the established trend and at traverse 64 South no basic rocks are associated with the vein of massive sulfides. The high nickel values in the lake area were from cores between traverses 55 South and 64 South. These values are generally associated with the massive and semi-massive pyrrhotite zones in the lower part of the basic body. Noticeable in the massive zones are minor amounts of biotite, quartz, garnet, and possibly feldspar.

DIKES (PEGMATITES AND LAMPROPHYRES)

Numerous pegmatite dikes penetrate the ultra-basic body in the lake area. Between traverses 42 South and 50 South the dilution of the lake body by these dikes is comparable to the Harriman body. At traverse 50 South the dilution is greater. From traverse 52 South to traverse 62 South the pegmatite dikes

occur less frequently than was expected. Dark colored, fine-grained dikes identified as lamprophyres sometimes cut both the peridotite and the pegmatites. These thin "exotic" dikes are often porphyritic and contain very little sulfides. When sulfides are present in these dikes it is usually chalcopyrite.

TREND

The original EM Vertical Coil Survey on Crawford Pond between the traverses 42 South and 64 South suggested that the trend of a basic body beneath the pond would be north-south and generally parallel to the base line (N 18° E) with only slight variations. The preliminary drilling, drill holes E-1, E-3 and E-4 supported this assumption. Subsequent drill holes have further proven this is the case. The eastward and westward variation of the EM axis is now attributed to the concentration of sulfides, their proximity to the surface and, possibly, the amount of graphite in the wall rock.

ATTITUDE

Since the bottom of the basic body is invariably more uniform than the top, the bottom of the basic sections on traverses including more than one drill hole was used to determine the attitude of the body. As a result of these calculations the basics are estimated to plunge eastward at 20° in the area of traverse 62 South and 46° at traverse 52 South. If this change of dip continued northward at this rate the plunge would be nearly vertical by traverse 34 South. However, it is assumed that the plunge does not exceed 60° by traverse 42 South and no assumption is made north of this traverse because of insufficient data. Drill hole E-48-1 may have missed the basic body because the basics were in a more nearly vertical position.

HOST ROCK

So far as is known, the basic mass is intrusive into and lies concordant with metasediments which may be generally classified as schists. The minerals sillimanite, quartz,

chlorite, garnet, hornblende, biotite, and muscovite are variable. Dolomite and some marble occur within the schist generally in lenticular forms. Attempts to correlate the dolomites and marbles, even between closely spaced drill holes, have been unsuccessful. Graphite and serpentine occur in the host rock adjacent to the basic body and probably represent alteration haloes. Graphite occurrences often assume 5 to 15% of the wall rock but only in very narrow bands, the usual occurrence being 1% or less of the total volume. So far, no massive graphite beds have been encountered. With respect to the lake area, there is more graphite in the wall rock north of traverse 50 South than elsewhere. Associated pyrite is found in minor quantities wherever the graphite is present. The occurrence of white mica in zones ranging from 2 feet to 6 feet in thickness probably account for the "cavities" logged by the drillers. Here the mica is cemented by calcite and minor silica and very little core is retrieved. No more than one of these soft zones is cut in any single drill hole. They usually occur a considerable distance above the basic body. All attempts to log and make use of the schistosity and foliation of the wall rock for correlation have been unsuccessful. The cores immediately above and below the basic body are particularly distorted.

ESTIMATE OF TONNAGE

The total mass of the ore body, including veins of massive pyrrhotite is estimated to be about two million tons. Actually, insufficient data were obtained by the single drill hole on traverse 42 South and on the structure between traverse 50 South and traverse 32 South. That something unusual has occurred in this area is evidenced by the facts that drill hole E-48-1 missed the basic rock; that drill holes E-1 and H-32-S (located on traverses 42 South and 32 South respectively) cut only narrow sections of basic rock; that drill hole E-50-1 cut a section of basic rock twice the normal thickness; and that ultra-basics containing significant nickel values outcrop on the surface on traverse 34 South at 1.5 East, at an elevation approximately 250 feet higher than those on traverses 42 South and 32 South.

Considering only the assayed sections through the lake area, the total ore tonnage is computed to be approximately two million tons. Considering the abnormal thickness of the E-50-1 traverse, this estimate is probably conservative, since it is assumed that this segment contributes only 63,000 tons. However, this procedure is consistent with that used on all other sections and its effect on the total is minimal.

The marginal limits of the basic body are not known and can only be assumed. The western margin lies approximately below the 2 East coordinate and the eastern margin ranges from 2.5 East on traverse 62 South to 5 East on traverse 50 South. On the basis of total basics, the thick section of norite and gabbro cut by drill hole E-55-3 above the peridotite on traverse 55 South suggests that the eastern limit here extends to at least 6 East but this limit has not been clearly defined. The perodite body varies in thickness from 160 feet at traverse 50 South to 40 feet on traverse 62 South in what is considered to be its central portion. It is assumed to lens out on the margins.

TONNAGE COMPUTATIONS

This method is based on the assumption that we do not know enough about the mineralized zone to assign it a specific shape, especially up-dip and down-dip from the last hole in each section (as on traverse 55 South). Therefore, each hole is assigned a "zone of influence", the specific size of which varies with wide limits.

On those lines with only one drill hole, the width of the zone was a function of the thickness of the assayed section; the width was never less than twice the thickness. In all cases, the length of the rectangular "zone" was one-half the distance to adjacent sections.

On the sections with more than one drill hole, the zone assigned to each hole was one-half the distance to the adjacent hole on the same section. The same half-distance was used to define the outer limits (up-dip and down-dip) of the mineralized area.

Thus, the East Side body was treated as being composed of a number of unit rectangles, the nickel contribution of each being decided by the assays of the core in the center of the rectangle. The tonnage of each block was determined by dividing the volume (cubic feet) by 9.45 (number of cubic feet per ton of "average" ore). The nickel content was then ascertained by multiplying the tonnage of each block by the weighted average assay of the controlling drill hole. The ore reserve estimated is the sum of all unit blocks. The tenor is the ore reserve divided by the nickel content of the entire body. The gross figures given in Table IV include a factor of 10% for dilution.

TABLE IV

ESTIMATE OF GRADE AND TONNAGE NICKEL-COPPER ORE CRAWFORD POND, KNOX COUNTY, MAINE

	Tons	Tons
E-64-1 Block:	28,800	
	0.624% Ni	180
	0.199% Cu	57
E-64-2 Block:	7,830	
	1.503% Ni	118
	0.655% Cu	51
E-62-1 Block:	145,800	
	0.368% Ni	536
	0.159% Cu	232
E-60-2 Block:	189,200	
	1.008% Ni	1907
	0.492% Cu	931
E-4 Block:	659,000	
	0.608% Ni	4007
	0.325% Cu	2142
E-55-1 Block:	196,600	
	1.129% Ni	2220
	0.564% Cu	1109
E-55-2 Block:	280,000	
	0.396% Ni	1109
	0.215% Cu	602
E-55-3 Block:	149,100	
	0.536% Ni	799
	0.304% Cu	453
E-3 Block:	63,700	
	0.677% Ni	431
	0.498% Cu	317
E-52-2 Block:	109,800	
	0.280% Ni	307
	0.254% Cu	279
E-50-1 Block:	63,000	
	0.368% Ni	232
	0.217% Cu	137
E-1 Block:	23,830	
	0.301% Ni	72
	0.126% Cu	30
Total Tonnage:	1,916,660	
Average Grade:	0.623% Ni	11,918 Ni
	0.331% Cu	6,340 Cu
10% Dilution:	191,666	
Gross Tonnage:	2,108,326	
Average Grade:	0.566% Ni	
	0.333% Cu	

THE CRAWFORD POND NICKEL DEPOSIT

FINAL REPORT

TO

THE OFFICE OF MINERALS EXPLORATION

UNITED STATES DEPARTMENT OF INTERIOR

Docket No.: OME - 6104
Commodity : Nickel
Contract No.: 14-23-090-2123
County : Knox
State : Maine

EXTRA COPY
O. M. E
RECEIVED JUL 30 1962
DATE

ROLAND F. BEERS, INC. 813 NORTH ROYAL STREET ALEXANDRIA, VIRGINIA

June 15, 1962

TABLE OF CONTENTS

	Page No.
Introduction	1
Drilling Program	2
Table I - Chronology of Drilling	2
Table II - Physical Characteristics of the Drilling Holes	3
Mineralogic and Flotation Studies	3
Table III - Tabulation of Assays	4, 5, 6
Geology	8
Characteristics of Rocks Associated with the Ore Body	8
Sulfides	9
Dikes (Pegmatites and Lamprophyres)	9
Trend	10
Attitude	10
Host Rock	10
Estimate of Tonnage	11
Tonnage Computations	12
Table IV - Estimate of Grade and Tonnage Nickel-Copper Ore	14

Enclosures:

Block Diagram No. 1 - Map of Harriman Prospect

Block Diagram No. 3 - Map of Crawford Pond Prospect

THE CRAWFORD POND NICKEL DEPOSIT

FINAL REPORT TO THE OFFICE OF MINERALS EXPLORATION

INTRODUCTION

On February 16, 1961, Roland F. Beers, Inc. (Operator) entered into an agreement with the Office of Minerals Exploration, United States Department of the Interior. Under this agreement, the Government will provide financial assistance in the search for unexplored nickel deposits in Knox County, Maine. This contract (14-23-090-2123) called for a total allowable cost of $48,186.00, to which the Government would advance fifty percent as a loan. Work authorized under the contract was initiated on May 1, 1961, and was concluded June 15, 1962.

The purpose of the program was to explore the relatively large areas, geologically and geophysically favorable, delineated by previous geophysical exploration and core drilling (see Final Report, Contract Idm-E1224, DMEA). The program was designed to confirm and enlarge prior reserve estimates of approximately four million tons for the entire prospect. Initially, the work proposal called for core drilling in a pattern to intersect the ore body at intervals of not less than 200 feet along the known extent.

Secondary objectives were (a) to test an extensive geophysical anomaly, of favorable characteristics, under Alford Lake, and (b) to determine the relationship of the south end of the Harriman ore body to the north end of the Crawford Pond mineralized zone.

To accomplish these objectives, fourteen holes, aggregating 6,086.0 feet, of diamond drilling, were completed. Of the total drilling footage, 4,361.5 feet, distributed over ten holes, were expended on the Crawford Pond zone; two holes totaling 1,001.0 feet were put down at Alford Lake; two holes involving 723.5 feet tested the south end of the Harriman zone.

In over-all aspect the work program completed under the current contract was successful, although the information relating to the secondary objectives is largely negative.

On the basis of previous drilling and that completed under the current program, the ore reserves of the Crawford Pond East Side zone are revised to approximately two million tons (short) with an average nickel tenor of 0.623%.

DRILLING PROGRAM

Detailed lithologic logs of all drill holes were submitted with monthly progress reports and are not duplicated herein. However, cross-sections of all drill holes are included because they constitute a summary of drilling information and they clearly illustrate the geologic characteristics upon which the reserve estimates are based. The collar locations of all drill holes are shown on an accompanying map.

The chronology of drilling and the physical characteristics of all drill holes are presented below in tabular form.

TABLE I

Drill Hole	Beginning Date	Completion Date
E-60-2	5/1/61	5/13/61
E-52-2	5/14/61	5/31/61
E-55-1	6/1/61	6/10/61
E-64-1	6/10/61	6/30/61
E-62-1	7/1/61	7/18/61
E-64-2	7/19/61	8/9/61
E-48-1	8/10/61	8/26/61
E-55-1 (wedged for ore sample during September, 1961)		
E-55-2	10/1/61	10/15/61
E-55-3	10/15/61	10/31/61
E-50-1	11/1/61	11/30/61

10

The physical characteristics of the drill holes are presented below in tabular form:

TABLE II

Hole	Location	Inclination	Bearing	Total Depth	Elevation
E-60-2	60.00S+5.52E	-60°	N63°30'W	420'	120' a.s.l.
E-52-2	52.20S+6.20E	-60°	N72°00'W	420'	120' a.s.l.
E-55-1	54.90S+5.30E	-60°	N72°00'W	363'	110' a.s.l.
E-64-1	63.87S+4.30E	-42°	N72°00'W	550'	120' a.s.l.
E-62-1	61.75S+4.70E	-41°	N72°00'W	364'	110' a.s.l.
E-64-2	63.87S+4.30E	-60°	N72°00'W	399'6"	120' a.s.l.
E-48-1	48.00S+4.60E	-90°	None	399'	110' a.s.l.
E-55-2	54.90S+5.60E	-45°	N72°00'W	420'	120' a.s.l.
E-55-3	54.90S+5.60E	-77°	N72°00'W	461'	120' a.s.l.
E-50-1	49.90S+6.88E	-41°	N72°00'W	565'	120' a.s.l.

10

The cross-sections, drill logs, and assays of the above listed drill holes accompany this report.

Eighty-four (84) assays were made on mineralized areas of interest, including sulfide-bearing wall rocks, pegmatites and basic intrusives, as well as massive sulfides. Copies of assay certificates have been previously submitted to the Government and are, therefore, not included in this report. For ready reference in ore reserve calculations, all assay data are summarized in Table III.

MINERALOGIC AND FLOTATION STUDIES

The studies described in this section of the Final Report were not supported by Government funds; however, the data are pertinent to the general problem and the Operator wishes to make this information available.

More than two hundred polished sections were prepared from both core and surface samples. These sections were studied to determine mineralogy, textural relations, grain size,

TABLE III

TABULATION OF ASSAYS

Hole No.	Assay No.	Interval	Cu %	S %	Fe %	Ni %	Co %
E-60-2 ✓	1	369' 9" - 374' 9"	0.497	18.17	32.8	0.951	0.095
	2	374' 9" - 379' 9"	0.371	16.66	29.8	0.886	0.103
	3	379' 9" - 384' 9"	0.648	18.90	35.6	1.008	0.103
	4	384' 9" - 389' 9"	0.422	21.19	38.4	1.097	0.110
	5	389' 9" - 394' 4"	0.522	20.64	37.2	1.097	0.103
E-52-2 ✓	1	350' 3" - 355' 0"	0.063	2.82	8.4	0.227	0.029
	2	355' 0" - 360' 0"	0.189	7.23	14.2	0.422	0.036
	3	360' 0" - 365' 0"	0.144	6.62	13.4	0.443	0.051
	4	365' 0" - 370' 0"	0.434	4.01	10.4	0.256	0.029
	5	370' 0" - 375' 0"	0.623	4.88	10.6	0.307	0.029
	6	375' 0" - 380' 0"	0.359	8.08	17.8	0.530	0.014
	7	380' 0" - 385' 0"	0.201	1.46	6.2	0.122	0.036
	8	385' 0" - 390' 0"	0.207	3.65	9.4	0.274	0.022
	9	390' 0" - 395' 0"	0.126	1.51	6.0	0.140	0.014
	10	395' 0" - 400' 0"	0.195	0.87	6.2	0.079	0.014
E-55-1 ✓	1	297' 8" - 303' 0"	0.346	13.79	28.4	0.843	0.102
	2	303' 0" - 308' 0"	0.680	13.96	31.6	0.983	0.095
	3	308' 0" - 313' 0"	0.510	15.68	31.8	0.780	0.088
	4	313' 0" - 318' 0"	0.283	17.37	34.6	1.079	0.088
	5	318' 0" - 325' 0"	0.176	1.92	8.6	0.156	0.014
	6	325' 0" - 330' 0"	0.415	24.29	46.8	1.593	0.073
	7	330' 0" - 335' 0"	0.617	31.98	54.2	1.914	0.095
	8	335' 0" - 340' 0"	1.012	30.97	53.0	1.719	0.110
	9	340' 0" - 344' 2"	1.315	29.24	47.4	1.662	0.117
E-55-2 ✓	1	321' 1" - 325' 0"	0.107	5.09		0.337	
	2	325' 0" - 330' 0"	0.207	7.50	16.6	0.430	0.088
	3	330' 0" - 336' 6"	0.170	8.47	18.8	0.548	0.058
	4	336' 6" - 340' 4"	0.119	3.71		0.244	
	5	340' 4" - 344' 6"	0.270	9.26		0.532	
	6	344' 6" - 349' 0"	0.107	5.89	14.0	0.333	0.073
	7	349' 0" - 354' 0"	0.156	11.64	24.0	0.727	0.058
	8	354' 0" - 358' 8"	0.387	7.11	15.8	0.394	0.066
	9	365'11" - 370' 5"	0.170	7.16		0.402	
	10	370' 5" - 372' 9"	0.321	9.40		0.394	
	11	372' 9" - 378'10"	0.504	2.47		0.138	
	12	378'10" - 385' 7"	0.308	11.88	23.8	0.707	0.058

TABULATION OF ASSAYS

Hole No.	Assay No.	Interval	Cu %	S %	Fe %	Ni %	Co %
E-55-3 ✓	1	365' 2" - 370' 0"	0.113	5.03	11.4	0.316	0.022
	2	370' 0" - 375' 0"	0.220	6.06	13.4	0.375	0.014
	3	375' 0" - 380' 0"	0.441	10.36	19.8	0.613	0.036
	4	380' 0" - 385' 0"	0.522	7.89	14.6	0.447	0.029
	5	385' 0" - 391' 3"	0.233	14.29	26.4	0.845	0.058
E-62-1 ✓	1	295' 3" - 302' 0"	0.189	7.10	14.8	0.398	0.044
	2	302' 0" - 305' 6"	0.138	5.09	11.4	0.284	0.029
	3	305' 6" - 320' 0"	0.088			0.073	
	4	320' 0" - 325' 0"	0.201	14.06	28.6	0.744	0.073
	5	325' 0" - 330' 0"	0.252	16.04	31.4	0.845	0.088
	6	330' 0" - 335' 0"	0.088			0.170	
	7	335' 0" - 339' 2"	0.302	12.40	24.2	0.638	0.059
E-64-1 ✓	1	341' 4" - 345' 3"	0.441	23.14	38.4	1.213	0.088
	2	351' 5" - 353' 2"	0.567	29.95	47.8	1.715	0.110
	3	356' 2" - 357'10"	0.340	27.26	44.6	1.528	0.102
E-64-2 ✓	1	322' 0" - 328' 0"	0.655	28.88	47.6	1.503	0.117

TABULATION OF ASSAYS

Hole No.	Assay No.	Interval	Cu %	S %	Fe %	Ni %	Co %
E-50-1	1	378' 0" - 383' 0"	0.315			0.162	
	2	383' 0" - 388' 0"	0.081			0.174	
	3	388' 0" - 394' 0"	0.107			0.406	
	4	394' 0" - 404' 0"	0.050	0.91	6.2	0.097	0.014
	5	404' 0" - 413' 0"	0.081			0.138	
	6a	413' 0" - 415' 3"					
	b	416' 8" - 418'11"	0.113			0.109	
	c	420' 8" - 423' 2"					
	7a	415' 3" - 416' 8"					
	b	418'11" - 420' 8"	0.081			0.203	
	c	426' 4" - 428' 0"					
	8a	423' 2" - 426' 4"					
	b	428' 0" - 429' 6"				0.020	
	c	429' 6" - 430' 4"					
	d	430' 4" - 432' 4"					
	9a	432' 4" - 433' 1"					
	b	434' 8" - 435' 5"	0.113			0.211	
	c	435' 5" - 437' 3"					
	10a	433' 1" - 434' 8"	0.056			0.060	
	b	442'10" - 445' 6"					
	11	437' 3" - 442'10"	0.107	4.99	12.0	0.312	0.022
	12	445' 6" - 450' 0"	0.056			0.115	
	13	450' 0" - 455' 0"	0.144			0.251	
	14	455' 0" - 463' 0"	0.163	2.42	11.4	0.308	0.014
	15	463' 0" - 471' 2"	0.056			0.069	
	16	471' 2" - 477' 0"	0.094			0.125	
	17	477' 0" - 482' 7"	0.113			0.154	
	18	482' 7" - 483' 3"	0.031	0.03		0.130	
	19	493' 0" - 499' 4"	0.037			0.028	
	20	499' 4" - 504' 4"	0.434	9.04	18.8	0.694	0.051
	21	504' 4" - 511' 4"	0.056	1.13	8.2	0.134	0.014
	22	518' 4" - 526' 2"	0.220			0.079	

nickel distribution, and mineralogic affinities. The results of the study are based on observations derived from standard mineragraphic procedures and use of the Gaudin chromic acid staining technique. Sulfide minerals identified in the explored area (4N - 100S) are:

pyrrhotite	pyrite	sphalerite
pentlandite	niccolite	galena
chalcopyrite	gersdorffite (?)	

In addition to the foregoing sulfides, another mineral, suspected of being a nickel or nickel-cobalt sulfide, is rather widely distributed, though never in significant amounts, in the East Side ore zone.

Magnetite is ubiquitous in basic rock and sulfide zones and is found in a number of relationships with both sulfides and silicates. It may be significant to point out that frequently pentlandite grains are diluted by magnetite in complex vein intergrowths.

Although it was evident from the outset of exploration that pentlandite was the predominant nickel ore mineral, the role of "nickeliferous pyrrhotite" had not been evaluated. Optical examination of polished sections revealed lamellar structures in certain pyrrhotite grains which closely resemble the alpha and beta pyrrhotite of Scholtz. Dennen noted similar structures in sulfide-bearing norite from Dracut, Massachusetts. Although the lamellae, in simple-to-complex development, may be detected on carefully polished sections under high magnification, they become strikingly outlined when stained with the Gaudin chromic acid solution. Because of the differential staining and the association with normal nickel minerals, it was assumed that the stained lamellae were nickel-rich and the unstained host nickel-poor. This particular problem has not been clearly resolved; however, optical, chemical and X-ray studies of the final Ni-Cu-Co concentrate indicate that if nickel is held in the pyrrhotite it is, indeed, in small quantities.

Inasmuch as no cobalt minerals were identified, it is assumed that the cobalt reported on assay certificates is present in pentlandite, proxying for nickel (as is the case with Sudbury ore). All of the copper occurs in the mineral chalcopyrite.

Metallurgical investigations of sulfide ore from the East Union prospect continued through 1961. The flotation process developed by the U. S. Bureau of Mines (Shelton, 1961) has been improved in further developments by R. W. Flagg of Denver Equipment Company. These studies have demonstrated that a competitive nickel-copper-cobalt concentrate can be prepared through selective flotation of Crawford Pond sulfide ore.

GEOLOGY

This portion of the report is concerned with the general characteristics of the basic body and the host rock. Conclusions are drawn from the information provided by drill holes within the limits of traverses 42 South and 64 South. It should be noted that drill holes E-1 and E-4 (traverses 42 South and 60 South respectively) were not a part of the drilling program under Contract No. 14-23-090-2123, but were included in a previous contract with the Defense Minerals Exploration Administration, No. Idm-E-1224, Docket No. DMEA-4947.

CHARACTERISTICS OF ROCKS ASSOCIATED WITH THE ORE BODY

The ultra-basics appear to represent a true intrusive although the information accumulated to date has not conclusively established this as a fact. The original intrusive probably contained pyroxene, olivine, brown mica, and feldspar. Alteration as a result of metamorphism probably produced the variations now noted as anthophyllite, serpentine, talc, biotite, chlorite, and hornblende. The abundance of gabbro and norite cut by drill hole E-55-3 on traverse 55 South is exceptional. Elsewhere in the lake area these types of basic rocks characteristically occur as then lenses above, near the top, or immediately below the peridotite body. In general, the basic body is represented by a chloritic peridotite and the variations are local. One exception that should be noted is the section of chlorite-free pyroxene cut in drill hole E-55-1 where the pyroxene is mostly augite and is comparable to the basics of the original outcrop near the coordinates 0.0 + 0.0 on the land grid.

SULFIDES

Sulfides that occur in the peridotite body are pyrrhotite, chalcopyrite, pentlandite, niccolite, sphalerite and galena. They are listed here in order of decreasing abundance. Sphalerite and galena are present only in trace quantities but are recognizable by hand lens. The most abundant sulfide, pyrrhotite, is disseminated and rather evenly distributed locally. When the amount approaches 50% of the total volume, the pyrrhotite crystals are interconnected. Chalcopyrite content is not evenly distributed but is concentrated in zones which are often adjacent to dikes. Niccolite is sometimes observed by hand lens as thin veinlets in dike material. The most obvious quantitative variation of pyrrhotite is from top to bottom in the peridotite body. Five to fifteen percent pyrrhotite by volume is common for the upper one quarter section and a gradual increase in noticeable toward the lower portion. Sulfide content varies from 30% to massive near the lower part of the body with the massive and semi-massive zones almost invariably lying on the bottom. Impregnation of wall rock beneath the basic rock characteristically involves only three to five feet and can usually be described as semi-massive. The thicker sections of sulfides in the lake area lie between the traverses 52 South and 60 South. To the north of this area there are probably more total sulfides but the quantity is disseminated through a much thicker basic section. To the south the basic rocks lens out at least along the established trend and at traverse 64 South no basic rocks are associated with the vein of massive sulfides. The high nickel values in the lake area were from cores between traverses 55 South and 64 South. These values are generally associated with the massive and semi-massive pyrrhotite zones in the lower part of the basic body. Noticeable in the massive zones are minor amounts of biotite, quartz, garnet, and possibly feldspar.

DIKES (PEGMATITES AND LAMPROPHYRES)

Numerous pegmatite dikes penetrate the ultra-basic body in the lake area. Between traverses 42 South and 50 South the dilution of the lake body by these dikes is comparable to the Harriman body. At traverse 50 South the dilution is greater. From traverse 52 South to traverse 62 South the pegmatite dikes

occur less frequently than was expected. Dark colored, fine-grained dikes identified as lamprophyres sometimes cut both the peridotite and the pegmatites. These thin "exotic" dikes are often porphyritic and contain very little sulfides. When sulfides are present in these dikes it is usually chalcopyrite.

TREND

The original EM Vertical Coil Survey on Crawford Pond between the traverses 42 South and 64 South suggested that the trend of a basic body beneath the pond would be north-south and generally parallel to the base line (N 18° E) with only slight variations. The preliminary drilling, drill holes E-1, E-3 and E-4 supported this assumption. Subsequent drill holes have further proven this is the case. The eastward and westward variation of the EM axis is now attributed to the concentration of sulfides, their proximity to the surface and, possibly, the amount of graphite in the wall rock.

ATTITUDE

Since the bottom of the basic body is invariably more uniform than the top, the bottom of the basic sections on traverses including more than one drill hole was used to determine the attitude of the body. As a result of these calculations the basics are estimated to plunge eastward at 20° in the area of traverse 62 South and 46° at traverse 52 South. If this change of dip continued northward at this rate the plunge would be nearly vertical by traverse 34 South. However, it is assumed that the plunge does not exceed 60° by traverse 42 South and no assumption is made north of this traverse because of insufficient data. Drill hole E-48-1 may have missed the basic body because the basics were in a more nearly vertical position.

HOST ROCK

So far as is known, the basic mass is intrusive into and lies concordant with metasediments which may be generally classified as schists. The minerals sillimanite, quartz,

chlorite, garnet, hornblende, biotite, and muscovite are variable. Dolomite and some marble occur within the schist generally in lenticular forms. Attempts to correlate the dolomites and marbles, even between closely spaced drill holes, have been unsuccessful. Graphite and serpentine occur in the host rock adjacent to the basic body and probably represent alteration haloes. Graphite occurrences often assume 5 to 15% of the wall rock but only in very narrow bands, the usual occurrence being 1% or less of the total volume. So far, no massive graphite beds have been encountered. With respect to the lake area, there is more graphite in the wall rock north of traverse 50 South than elsewhere. Associated pyrite is found in minor quantities wherever the graphite is present. The occurrence of white mica in zones ranging from 2 feet to 6 feet in thickness probably account for the "cavities" logged by the drillers. Here the mica is cemented by calcite and minor silica and very little core is retrieved. No more than one of these soft zones is cut in any single drill hole. They usually occur a considerable distance above the basic body. All attempts to log and make use of the schistosity and foliation of the wall rock for correlation have been unsuccessful. The cores immediately above and below the basic body are particularly distorted.

ESTIMATE OF TONNAGE

The total mass of the ore body, including veins of massive pyrrhotite is estimated to be about two million tons. Actually, insufficient data were obtained by the single drill hole on traverse 42 South and on the structure between traverse 50 South and traverse 32 South. That something unusual has occurred in this area is evidenced by the facts that drill hole E-48-1 missed the basic rock; that drill holes E-1 and H-32-S (located on traverses 42 South and 32 South respectively) cut only narrow sections of basic rock; that drill hole E-50-1 cut a section of basic rock twice the normal thickness; and that ultra-basics containing significant nickel values outcrop on the surface on traverse 34 South at 1.5 East, at an elevation approximately 250 feet higher than those on traverses 42 South and 32 South.

Considering only the assayed sections through the lake area, the total ore tonnage is computed to be approximately two million tons. Considering the abnormal thickness of the E-50-1 traverse, this estimate is probably conservative, since it is assumed that this segment contributes only 63,000 tons. However, this procedure is consistent with that used on all other sections and its effect on the total is minimal.

The marginal limits of the basic body are not known and can only be assumed. The western margin lies approximately below the 2 East coordinate and the eastern margin ranges from 2.5 East on traverse 62 South to 5 East on traverse 50 South. On the basis of total basics, the thick section of norite and gabbro cut by drill hole E-55-3 above the peridotite on traverse 55 South suggests that the eastern limit here extends to at least 6 East but this limit has not been clearly defined. The perodite body varies in thickness from 160 feet at traverse 50 South to 40 feet on traverse 62 South in what is considered to be its central portion. It is assumed to lens out on the margins.

TONNAGE COMPUTATIONS

This method is based on the assumption that we do not know enough about the mineralized zone to assign it a specific shape, especially up-dip and down-dip from the last hole in each section (as on traverse 55 South). Therefore, each hole is assigned a "zone of influence", the specific size of which varies with wide limits.

On those lines with only one drill hole, the width of the zone was a function of the thickness of the assayed section; the width was never less than twice the thickness. In all cases, the length of the rectangular "zone" was one-half the distance to adjacent sections.

On the sections with more than one drill hole, the zone assigned to each hole was one-half the distance to the adjacent hole on the same section. The same half-distance was used to define the outer limits (up-dip and down-dip) of the mineralized area.

Thus, the East Side body was treated as being composed of a number of unit rectangles, the nickel contribution of each being decided by the assays of the core in the center of the rectangle. The tonnage of each block was determined by dividing the volume (cubic feet) by 9.45 (number of cubic feet per ton of "average" ore). The nickel content was then ascertained by multiplying the tonnage of each block by the weighted average assay of the controlling drill hole. The ore reserve estimated is the sum of all unit blocks. The tenor is the ore reserve divided by the nickel content of the entire body. The gross figures given in Table IV include a factor of 10% for dilution.

TABLE IV

ESTIMATE OF GRADE AND TONNAGE NICKEL-COPPER ORE CRAWFORD POND, KNOX COUNTY, MAINE

	Tons	Tons
E-64-1 Block:	28,800	
	0.624% Ni	180
	0.199% Cu	57
E-64-2 Block:	7,830	
	1.503% Ni	118
	0.655% Cu	51
E-62-1 Block:	145,800	
	0.368% Ni	536
	0.159% Cu	232
E-60-2 Block:	189,200	
	1.008% Ni	1907
	0.492% Cu	931
E-4 Block:	659,000	
	0.608% Ni	4007
	0.325% Cu	2142
E-55-1 Block:	196,600	
	1.129% Ni	2220
	0.564% Cu	1109
E-55-2 Block:	280,000	
	0.396% Ni	1109
	0.215% Cu	602
E-55-3 Block:	149,100	
	0.536% Ni	799
	0.304% Cu	453
E-3 Block:	63,700	
	0.677% Ni	431
	0.498% Cu	317
E-52-2 Block:	109,800	
	0.280% Ni	307
	0.254% Cu	279
E-50-1 Block:	63,000	
	0.368% Ni	232
	0.217% Cu	137
E-1 Block:	23,830	
	0.301% Ni	72
	0.126% Cu	30
Total Tonnage:	1,916,660	
Average Grade:	0.623% Ni	11,918 Ni
	0.331% Cu	6,340 Cu
10% Dilution:	191,666	
Gross Tonnage:	2,108,326	
Average Grade:	0.566% Ni	
	0.333% Cu	

THE CRAWFORD POND NICKEL DEPOSIT

FINAL REPORT

TO

THE OFFICE OF MINERALS EXPLORATION

UNITED STATES DEPARTMENT OF INTERIOR

PART II

DRILLING HOLE CROSS-SECTIONS

Docket No.: OME - 6104
Commodity : Nickel
Contract No.: 14-23-090-2123
County : Knox
State : Maine

OFFICIAL FILE COPY
O. M. E
RECEIVED JUL 31 1962

DATE	INITIALS	CODE

ROLAND F. BEERS, INC. 813 NORTH ROYAL STREET ALEXANDRIA, VIRGINIA

June 15, 1962

THE CRAWFORD POND NICKEL DEPOSIT

FINAL REPORT

TO

THE OFFICE OF MINERALS EXPLORATION

UNITED STATES DEPARTMENT OF INTERIOR

EXTRA COPY
O. M. E.
RECEIVED JUL
DATE

PART II

DRILLING HOLE CROSS-SECTIONS

Docket No.: OME - 6104
Commodity : Nickel
Contract No.: 14-23-090-2123
County : Knox
State : Maine

ROLAND F. BEERS, INC. 813 NORTH ROYAL STREET ALEXANDRIA, VIRGINIA

June 15, 1962

THE CRAWFORD POND NICKEL DEPOSIT

FINAL REPORT

TO

THE OFFICE OF MINERALS EXPLORATION

UNITED STATES DEPARTMENT OF INTERIOR

Docket No.: OME - 6104
Commodity : Nickel
Contract No.: 14-23-090-2123
County : Knox
State : Maine

EXTRA COPY
O. M. E
RECEIVED JUL 30 '62

ROLAND F. BEERS, INC. 813 NORTH ROYAL STREET ALEXANDRIA, VIRGINIA

June 15, 1962

TABLE OF CONTENTS

	Page No.
Introduction	1
Drilling Program	2
Table I - Chronology of Drilling	2
Table II - Physical Characteristics of the Drilling Holes	3
Mineralogic and Flotation Studies	3
Table III - Tabulation of Assays	4, 5, 6
Geology	8
Characteristics of Rocks Associated with the Ore Body	8
Sulfides	9
Dikes (Pegmatites and Lamprophyres)	9
Trend	10
Attitude	10
Host Rock	10
Estimate of Tonnage	11
Tonnage Computations	12
Table IV - Estimate of Grade and Tonnage Nickel-Copper Ore	14

Enclosures:

Block Diagram No. 1 - Map of Harriman Prospect

Block Diagram No. 3 - Map of Crawford Pond Prospect

THE CRAWFORD POND NICKEL DEPOSIT

FINAL REPORT TO THE OFFICE OF MINERALS EXPLORATION

INTRODUCTION

On February 16, 1961, Roland F. Beers, Inc. (Operator) entered into an agreement with the Office of Minerals Exploration, United States Department of the Interior. Under this agreement, the Government will provide financial assistance in the search for unexplored nickel deposits in Knox County, Maine. This contract (14-23-090-2123) called for a total allowable cost of $48,186.00, to which the Government would advance fifty percent as a loan. Work authorized under the contract was initiated on May 1, 1961, and was concluded June 15, 1962.

The purpose of the program was to explore the relatively large areas, geologically and geophysically favorable, delineated by previous geophysical exploration and core drilling (see Final Report, Contract Idm-E1224, DMEA). The program was designed to confirm and enlarge prior reserve estimates of approximately four million tons for the entire prospect. Initially, the work proposal called for core drilling in a pattern to intersect the ore body at intervals of not less than 200 feet along the known extent.

Secondary objectives were (a) to test an extensive geophysical anomaly, of favorable characteristics, under Alford Lake, and (b) to determine the relationship of the south end of the Harriman ore body to the north end of the Crawford Pond mineralized zone.

To accomplish these objectives, fourteen holes, aggregating 6,086.0 feet, of diamond drilling, were completed. Of the total drilling footage, 4,361.5 feet, distributed over ten holes, were expended on the Crawford Pond zone; two holes totaling 1,001.0 feet were put down at Alford Lake; two holes involving 723.5 feet tested the south end of the Harriman zone.

In over-all aspect the work program completed under the current contract was successful, although the information relating to the secondary objectives is largely negative.

On the basis of previous drilling and that completed under the current program, the ore reserves of the Crawford Pond East Side zone are revised to approximately two million tons (short) with an average nickel tenor of 0.623%.

DRILLING PROGRAM

Detailed lithologic logs of all drill holes were submitted with monthly progress reports and are not duplicated herein. However, cross-sections of all drill holes are included because they constitute a summary of drilling information and they clearly illustrate the geologic characteristics upon which the reserve estimates are based. The collar locations of all drill holes are shown on an accompanying map.

The chronology of drilling and the physical characteristics of all drill holes are presented below in tabular form.

TABLE I

Drill Hole	Beginning Date	Completion Date
E-60-2	5/1/61	5/13/61
E-52-2	5/14/61	5/31/61
E-55-1	6/1/61	6/10/61
E-64-1	6/10/61	6/30/61
E-62-1	7/1/61	7/18/61
E-64-2	7/19/61	8/9/61
E-48-1	8/10/61	8/26/61
E-55-1	(wedged for ore sample during September, 1961)	
E-55-2	10/1/61	10/15/61
E-55-3	10/15/61	10/31/61
E-50-1	11/1/61	11/30/61

The physical characteristics of the drill holes are presented below in tabular form:

TABLE II

Hole	Location	Inclination	Bearing	Total Depth	Elevation
E-60-2	60.00S+5.52E	-60°	N63°30'W	420'	120' a.s.l.
E-52-2	52.20S+6.20E	-60°	N72°00'W	420'	120' a.s.l.
E-55-1	54.90S+5.30E	-60°	N72°00'W	363'	110' a.s.l.
E-64-1	63.87S+4.30E	-42°	N72°00'W	550'	120' a.s.l.
E-62-1	61.75S+4.70E	-41°	N72°00'W	364'	110' a.s.l.
E-64-2	63.87S+4.30E	-60°	N72°00'W	399'6"	120' a.s.l.
E-48-1	48.00S+4.60E	-90°	None	399'	110' a.s.l.
E-55-2	54.90S+5.60E	-45°	N72°00'W	420'	120' a.s.l.
E-55-3	54.90S+5.60E	-77°	N72°00'W	461'	120' a.s.l.
E-50-1	49.90S+6.88E	-41°	N72°00'W	565'	120' a.s.l.

The cross-sections, drill logs, and assays of the above listed drill holes accompany this report.

Eighty-four (84) assays were made on mineralized areas of interest, including sulfide-bearing wall rocks, pegmatites and basic intrusives, as well as massive sulfides. Copies of assay certificates have been previously submitted to the Government and are, therefore, not included in this report. For ready reference in ore reserve calculations, all assay data are summarized in Table III.

MINERALOGIC AND FLOTATION STUDIES

The studies described in this section of the Final Report were not supported by Government funds; however, the data are pertinent to the general problem and the Operator wishes to make this information available.

More than two hundred polished sections were prepared from both core and surface samples. These sections were studied to determine mineralogy, textural relations, grain size,

TABLE III

TABULATION OF ASSAYS

Hole No.	Assay No.	Interval	Cu %	S %	Fe %	Ni %	Co %
E-60-2	1	369' 9" - 374' 9"	0.497	18.17	32.8	0.951	0.095
	2	374' 9" - 379' 9"	0.371	16.66	29.8	0.886	0.103
	3	379' 9" - 384' 9"	0.648	18.90	35.6	1.008	0.103
	4	384' 9" - 389' 9"	0.422	21.19	38.4	1.097	0.110
	5	389' 9" - 394' 4"	0.522	20.64	37.2	1.097	0.103
E-52-2	1	350' 3" - 355' 0"	0.063	2.82	8.4	0.227	0.029
	2	355' 0" - 360' 0"	0.189	7.23	14.2	0.422	0.036
	3	360' 0" - 365' 0"	0.144	6.62	13.4	0.443	0.051
	4	365' 0" - 370' 0"	0.434	4.01	10.4	0.256	0.029
	5	370' 0" - 375' 0"	0.623	4.88	10.6	0.307	0.029
	6	375' 0" - 380' 0"	0.359	8.08	17.8	0.530	0.014
	7	380' 0" - 385' 0"	0.201	1.46	6.2	0.122	0.036
	8	385' 0" - 390' 0"	0.207	3.65	9.4	0.274	0.022
	9	390' 0" - 395' 0"	0.126	1.51	6.0	0.140	0.014
	10	395' 0" - 400' 0"	0.195	0.87	6.2	0.079	0.014
E-55-1	1	297' 8" - 303' 0"	0.346	13.79	28.4	0.843	0.102
	2	303' 0" - 308' 0"	0.680	13.96	31.6	0.983	0.095
	3	308' 0" - 313' 0"	0.510	15.68	31.8	0.780	0.088
	4	313' 0" - 318' 0"	0.283	17.37	34.6	1.079	0.088
	5	318' 0" - 325' 0"	0.176	1.92	8.6	0.156	0.014
	6	325' 0" - 330' 0"	0.415	24.29	46.8	1.593	0.073
	7	330' 0" - 335' 0"	0.617	31.98	54.2	1.914	0.095
	8	335' 0" - 340' 0"	1.012	30.97	53.0	1.719	0.110
	9	340' 0" - 344' 2"	1.315	29.24	47.4	1.662	0.117
E-55-2	1	321' 1" - 325' 0"	0.107	5.09		0.337	
	2	325' 0" - 330' 0"	0.207	7.50	16.6	0.430	0.088
	3	330' 0" - 336' 6"	0.170	8.47	18.8	0.548	0.058
	4	336' 6" - 340' 4"	0.119	3.71		0.244	
	5	340' 4" - 344' 6"	0.270	9.26		0.532	
	6	344' 6" - 349' 0"	0.107	5.89	14.0	0.333	0.073
	7	349' 0" - 354' 0"	0.156	11.64	24.0	0.727	0.058
	8	354' 0" - 358' 8"	0.387	7.11	15.8	0.394	0.066
	9	365'11" - 370' 5"	0.170	7.16		0.402	
	10	370' 5" - 372' 9"	0.321	9.40		0.394	
	11	372' 9" - 378'10"	0.504	2.47		0.138	
	12	378'10" - 385' 7"	0.308	11.88	23.8	0.707	0.058

TABULATION OF ASSAYS

Hole No.	Assay No.	Interval	Cu %	S %	Fe %	Ni %	Co %
E-55-3	1	365' 2" - 370' 0"	0.113	5.03	11.4	0.316	0.022
	2	370' 0" - 375' 0"	0.220	6.06	13.4	0.375	0.014
	3	375' 0" - 380' 0"	0.441	10.36	19.8	0.613	0.036
	4	380' 0" - 385' 0"	0.522	7.89	14.6	0.447	0.029
	5	385' 0" - 391' 3"	0.233	14.29	26.4	0.845	0.058
E-62-1	1	295' 3" - 302' 0"	0.189	7.10	14.8	0.398	0.044
	2	302' 0" - 305' 6"	0.138	5.09	11.4	0.284	0.029
	3	305' 6" - 320' 0"	0.088			0.073	
	4	320' 0" - 325' 0"	0.201	14.06	28.6	0.744	0.073
	5	325' 0" - 330' 0"	0.252	16.04	31.4	0.845	0.088
	6	330' 0" - 335' 0"	0.088			0.170	
	7	335' 0" - 339' 2"	0.302	12.40	24.2	0.638	0.059
E-64-1	1	341' 4" - 345' 3"	0.441	23.14	38.4	1.213	0.088
	2	351' 5" - 353' 2"	0.567	29.95	47.8	1.715	0.110
	3	356' 2" - 357'10"	0.340	27.26	44.6	1.528	0.102
E-64-2	1	322' 0" - 328' 0"	0.655	28.88	47.6	1.503	0.117

TABULATION OF ASSAYS

Hole No.	Assay No.	Interval	Cu %	S %	Fe %	Ni %	Co %
E-50-1	1	378' 0" - 383' 0"	0.315			0.162	
	2	383' 0" - 388' 0"	0.081			0.174	
	3	388' 0" - 394' 0"	0.107			0.406	
	4	394' 0" - 404' 0"	0.050	0.91	6.2	0.097	0.014
	5	404' 0" - 413' 0"	0.081			0.138	
	6a	413' 0" - 415' 3"					
	b	416' 8" - 418'11"	0.113			0.109	
	c	420' 8" - 423' 2"					
	7a	415' 3" - 416' 8"					
	b	418'11" - 420' 8"	0.081			0.203	
	c	426' 4" - 428' 0"					
	8a	423' 2" - 426' 4"					
	b	428' 0" - 429' 6"				0.020	
	c	429' 6" - 430' 4"					
	d	430' 4" - 432' 4"					
	9a	432' 4" - 433' 1"					
	b	434' 8" - 435' 5"	0.113			0.211	
	c	435' 5" - 437' 3"					
	10a	433' 1" - 434' 8"	0.056			0.060	
	b	442'10" - 445' 6"					
	11	437' 3" - 442'10"	0.107	4.99	12.0	0.312	0.022
	12	445' 6" - 450' 0"	0.056			0.115	
	13	450' 0" - 455' 0"	0.144			0.251	
	14	455' 0" - 463' 0"	0.163	2.42	11.4	0.308	0.014
	15	463' 0" - 471' 2"	0.056			0.069	
	16	471' 2" - 477' 0"	0.094			0.125	
	17	477' 0" - 482' 7"	0.113			0.154	
	18	482' 7" - 483' 3"	0.031	0.03		0.130	
	19	493' 0" - 499' 4"	0.037			0.028	
	20	499' 4" - 504' 4"	0.434	9.04	18.8	0.694	0.051
	21	504' 4" - 511' 4"	0.056	1.13	8.2	0.134	0.014
	22	518' 4" - 526' 2"	0.220			0.079	

nickel distribution, and mineralogic affinities. The results of the study are based on observations derived from standard mineragraphic procedures and use of the Gaudin chromic acid staining technique. Sulfide minerals identified in the explored area (4N - 100S) are:

pyrrhotite	pyrite	sphalerite
pentlandite	niccolite	galena
chalcopyrite	gersdorffite (?)	

In addition to the foregoing sulfides, another mineral, suspected of being a nickel or nickel-cobalt sulfide, is rather widely distributed, though never in significant amounts, in the East Side ore zone.

Magnetite is ubiquitous in basic rock and sulfide zones and is found in a number of relationships with both sulfides and silicates. It may be significant to point out that frequently pentlandite grains are diluted by magnetite in complex vein intergrowths.

Although it was evident from the outset of exploration that pentlandite was the predominant nickel ore mineral, the role of "nickeliferous pyrrhotite" had not been evaluated. Optical examination of polished sections revealed lamellar structures in certain pyrrhotite grains which closely resemble the alpha and beta pyrrhotite of Scholtz. Dennen noted similar structures in sulfide-bearing norite from Dracut, Massachusetts. Although the lamellae, in simple-to-complex development, may be detected on carefully polished sections under high magnification, they become strikingly outlined when stained with the Gaudin chromic acid solution. Because of the differential staining and the association with normal nickel minerals, it was assumed that the stained lamellae were nickel-rich and the unstained host nickel-poor. This particular problem has not been clearly resolved; however, optical, chemical and X-ray studies of the final Ni-Cu-Co concentrate indicate that if nickel is held in the pyrrhotite it is, indeed, in small quantities.

Inasmuch as no cobalt minerals were identified, it is assumed that the cobalt reported on assay certificates is present in pentlandite, proxying for nickel (as is the case with Sudbury ore). All of the copper occurs in the mineral chalcopyrite.

Metallurgical investigations of sulfide ore from the East Union prospect continued through 1961. The flotation process developed by the U. S. Bureau of Mines (Shelton, 1961) has been improved in further developments by R. W. Flagg of Denver Equipment Company. These studies have demonstrated that a competitive nickel-copper-cobalt concentrate can be prepared through selective flotation of Crawford Pond sulfide ore.

GEOLOGY

This portion of the report is concerned with the general characteristics of the basic body and the host rock. Conclusions are drawn from the information provided by drill holes within the limits of traverses 42 South and 64 South. It should be noted that drill holes E-1 and E-4 (traverses 42 South and 60 South respectively) were not a part of the drilling program under Contract No. 14-23-090-2123, but were included in a previous contract with the Defense Minerals Exploration Administration, No. Idm-E-1224, Docket No. DMEA-4947.

CHARACTERISTICS OF ROCKS ASSOCIATED WITH THE ORE BODY

The ultra-basics appear to represent a true intrusive although the information accumulated to date has not conclusively established this as a fact. The original intrusive probably contained pyroxene, olivine, brown mica, and feldspar. Alteration as a result of metamorphism probably produced the variations now noted as anthophyllite, serpentine, talc, biotite, chlorite, and hornblende. The abundance of gabbro and norite cut by drill hole E-55-3 on traverse 55 South is exceptional. Elsewhere in the lake area these types of basic rocks characteristically occur as then lenses above, near the top, or immediately below the peridotite body. In general, the basic body is represented by a chloritic peridotite and the variations are local. One exception that should be noted is the section of chlorite-free pyroxene cut in drill hole E-55-1 where the pyroxene is mostly augite and is comparable to the basics of the original outcrop near the coordinates 0.0 + 0.0 on the land grid.

SULFIDES

Sulfides that occur in the peridotite body are pyrrhotite, chalcopyrite, pentlandite, niccolite, sphalerite and galena. They are listed here in order of decreasing abundance. Sphalerite and galena are present only in trace quantities but are recognizable by hand lens. The most abundant sulfide, pyrrhotite, is disseminated and rather evenly distributed locally. When the amount approaches 50% of the total volume, the pyrrhotite crystals are interconnected. Chalcopyrite content is not evenly distributed but is concentrated in zones which are often adjacent to dikes. Niccolite is sometimes observed by hand lens as thin veinlets in dike material. The most obvious quantitative variation of pyrrhotite is from top to bottom in the peridotite body. Five to fifteen percent pyrrhotite by volume is common for the upper one quarter section and a gradual increase in noticeable toward the lower portion. Sulfide content varies from 30% to massive near the lower part of the body with the massive and semi-massive zones almost invariably lying on the bottom. Impregnation of wall rock beneath the basic rock characteristically involves only three to five feet and can usually be described as semi-massive. The thicker sections of sulfides in the lake area lie between the traverses 52 South and 60 South. To the north of this area there are probably more total sulfides but the quantity is disseminated through a much thicker basic section. To the south the basic rocks lens out at least along the established trend and at traverse 64 South no basic rocks are associated with the vein of massive sulfides. The high nickel values in the lake area were from cores between traverses 55 South and 64 South. These values are generally associated with the massive and semi-massive pyrrhotite zones in the lower part of the basic body. Noticeable in the massive zones are minor amounts of biotite, quartz, garnet, and possibly feldspar.

DIKES (PEGMATITES AND LAMPROPHYRES)

Numerous pegmatite dikes penetrate the ultra-basic body in the lake area. Between traverses 42 South and 50 South the dilution of the lake body by these dikes is comparable to the Harriman body. At traverse 50 South the dilution is greater. From traverse 52 South to traverse 62 South the pegmatite dikes

occur less frequently than was expected. Dark colored, fine-grained dikes identified as lamprophyres sometimes cut both the peridotite and the pegmatites. These thin "exotic" dikes are often porphyritic and contain very little sulfides. When sulfides are present in these dikes it is usually chalcopyrite.

TREND

The original EM Vertical Coil Survey on Crawford Pond between the traverses 42 South and 64 South suggested that the trend of a basic body beneath the pond would be north-south and generally parallel to the base line (N 18° E) with only slight variations. The preliminary drilling, drill holes E-1, E-3 and E-4 supported this assumption. Subsequent drill holes have further proven this is the case. The eastward and westward variation of the EM axis is now attributed to the concentration of sulfides, their proximity to the surface and, possibly, the amount of graphite in the wall rock.

ATTITUDE

Since the bottom of the basic body is invariably more uniform than the top, the bottom of the basic sections on traverses including more than one drill hole was used to determine the attitude of the body. As a result of these calculations the basics are estimated to plunge eastward at 20° in the area of traverse 62 South and 46° at traverse 52 South. If this change of dip continued northward at this rate the plunge would be nearly vertical by traverse 34 South. However, it is assumed that the plunge does not exceed 60° by traverse 42 South and no assumption is made north of this traverse because of insufficient data. Drill hole E-48-1 may have missed the basic body because the basics were in a more nearly vertical position.

HOST ROCK

So far as is known, the basic mass is intrusive into and lies concordant with metasediments which may be generally classified as schists. The minerals sillimanite, quartz,

chlorite, garnet, hornblende, biotite, and muscovite are variable. Dolomite and some marble occur within the schist generally in lenticular forms. Attempts to correlate the dolomites and marbles, even between closely spaced drill holes, have been unsuccessful. Graphite and serpentine occur in the host rock adjacent to the basic body and probably represent alteration haloes. Graphite occurrences often assume 5 to 15% of the wall rock but only in very narrow bands, the usual occurrence being 1% or less of the total volume. So far, no massive graphite beds have been encountered. With respect to the lake area, there is more graphite in the wall rock north of traverse 50 South than elsewhere. Associated pyrite is found in minor quantities wherever the graphite is present. The occurrence of white mica in zones ranging from 2 feet to 6 feet in thickness probably account for the "cavities" logged by the drillers. Here the mica is cemented by calcite and minor silica and very little core is retrieved. No more than one of these soft zones is cut in any single drill hole. They usually occur a considerable distance above the basic body. All attempts to log and make use of the schistosity and foliation of the wall rock for correlation have been unsuccessful. The cores immediately above and below the basic body are particularly distorted.

ESTIMATE OF TONNAGE

The total mass of the ore body, including veins of massive pyrrhotite is estimated to be about two million tons. Actually, insufficient data were obtained by the single drill hole on traverse 42 South and on the structure between traverse 50 South and traverse 32 South. That something unusual has occurred in this area is evidenced by the facts that drill hole E-48-1 missed the basic rock; that drill holes E-1 and H-32-S (located on traverses 42 South and 32 South respectively) cut only narrow sections of basic rock; that drill hole E-50-1 cut a section of basic rock twice the normal thickness; and that ultra-basics containing significant nickel values outcrop on the surface on traverse 34 South at 1.5 East, at an elevation approximately 250 feet higher than those on traverses 42 South and 32 South.

Considering only the assayed sections through the lake area, the total ore tonnage is computed to be approximately two million tons. Considering the abnormal thickness of the E-50-1 traverse, this estimate is probably conservative, since it is assumed that this segment contributes only 63,000 tons. However, this procedure is consistent with that used on all other sections and its effect on the total is minimal.

The marginal limits of the basic body are not known and can only be assumed. The western margin lies approximately below the 2 East coordinate and the eastern margin ranges from 2.5 East on traverse 62 South to 5 East on traverse 50 South. On the basis of total basics, the thick section of norite and gabbro cut by drill hole E-55-3 above the peridotite on traverse 55 South suggests that the eastern limit here extends to at least 6 East but this limit has not been clearly defined. The perodite body varies in thickness from 160 feet at traverse 50 South to 40 feet on traverse 62 South in what is considered to be its central portion. It is assumed to lens out on the margins.

TONNAGE COMPUTATIONS

This method is based on the assumption that we do not know enough about the mineralized zone to assign it a specific shape, especially up-dip and down-dip from the last hole in each section (as on traverse 55 South). Therefore, each hole is assigned a "zone of influence", the specific size of which varies with wide limits.

On those lines with only one drill hole, the width of the zone was a function of the thickness of the assayed section; the width was never less than twice the thickness. In all cases, the length of the rectangular "zone" was one-half the distance to adjacent sections.

On the sections with more than one drill hole, the zone assigned to each hole was one-half the distance to the adjacent hole on the same section. The same half-distance was used to define the outer limits (up-dip and down-dip) of the mineralized area.

Thus, the East Side body was treated as being composed of a number of unit rectangles, the nickel contribution of each being decided by the assays of the core in the center of the rectangle. The tonnage of each block was determined by dividing the volume (cubic feet) by 9.45 (number of cubic feet per ton of "average" ore). The nickel content was then ascertained by multiplying the tonnage of each block by the weighted average assay of the controlling drill hole. The ore reserve estimated is the sum of all unit blocks. The tenor is the ore reserve divided by the nickel content of the entire body. The gross figures given in Table IV include a factor of 10% for dilution.

TABLE IV

ESTIMATE OF GRADE AND TONNAGE NICKEL-COPPER ORE CRAWFORD POND, KNOX COUNTY, MAINE

	Tons	Tons
E-64-1 Block:	28,800	
	0.624% Ni	180
	0.199% Cu	57
E-64-2 Block:	7,830	
	1.503% Ni	118
	0.655% Cu	51
E-62-1 Block:	145,800	
	0.368% Ni	536
	0.159% Cu	232
E-60-2 Block:	189,200	
	1.008% Ni	1907
	0.492% Cu	931
E-4 Block:	659,000	
	0.608% Ni	4007
	0.325% Cu	2142
E-55-1 Block:	196,600	
	1.129% Ni	2220
	0.564% Cu	1109
E-55-2 Block:	280,000	
	0.396% Ni	1109
	0.215% Cu	602
E-55-3 Block:	149,100	
	0.536% Ni	799
	0.304% Cu	453
E-3 Block:	63,700	
	0.677% Ni	431
	0.498% Cu	317
E-52-2 Block:	109,800	
	0.280% Ni	307
	0.254% Cu	279
E-50-1 Block:	63,000	
	0.368% Ni	232
	0.217% Cu	137
E-1 Block:	23,830	
	0.301% Ni	72
	0.126% Cu	30
Total Tonnage:	1,916,660	
Average Grade:	0.623% Ni	11,918 Ni
	0.331% Cu	6,340 Cu
10% Dilution:	191,666	
Gross Tonnage:	2,108,326	
Average Grade:	0.566% Ni	
	0.333% Cu	

EXTRA COPY
O. M. E
RECEIVED
DATE JUL 31

THE CRAWFORD POND NICKEL DEPOSIT

FINAL REPORT

TO

THE OFFICE OF MINERALS EXPLORATION

UNITED STATES DEPARTMENT OF INTERIOR

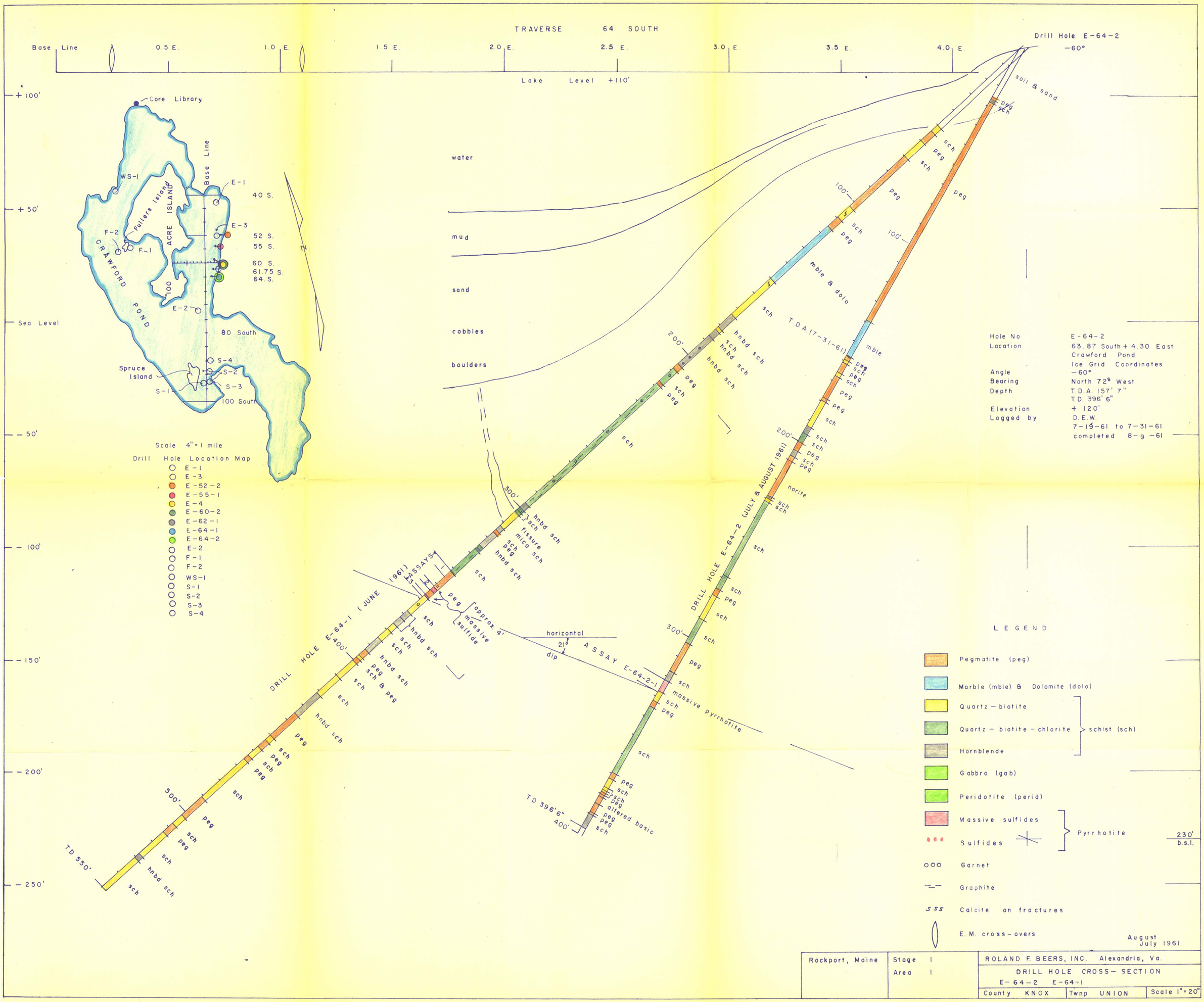
PART II

DRILLING HOLE CROSS-SECTIONS

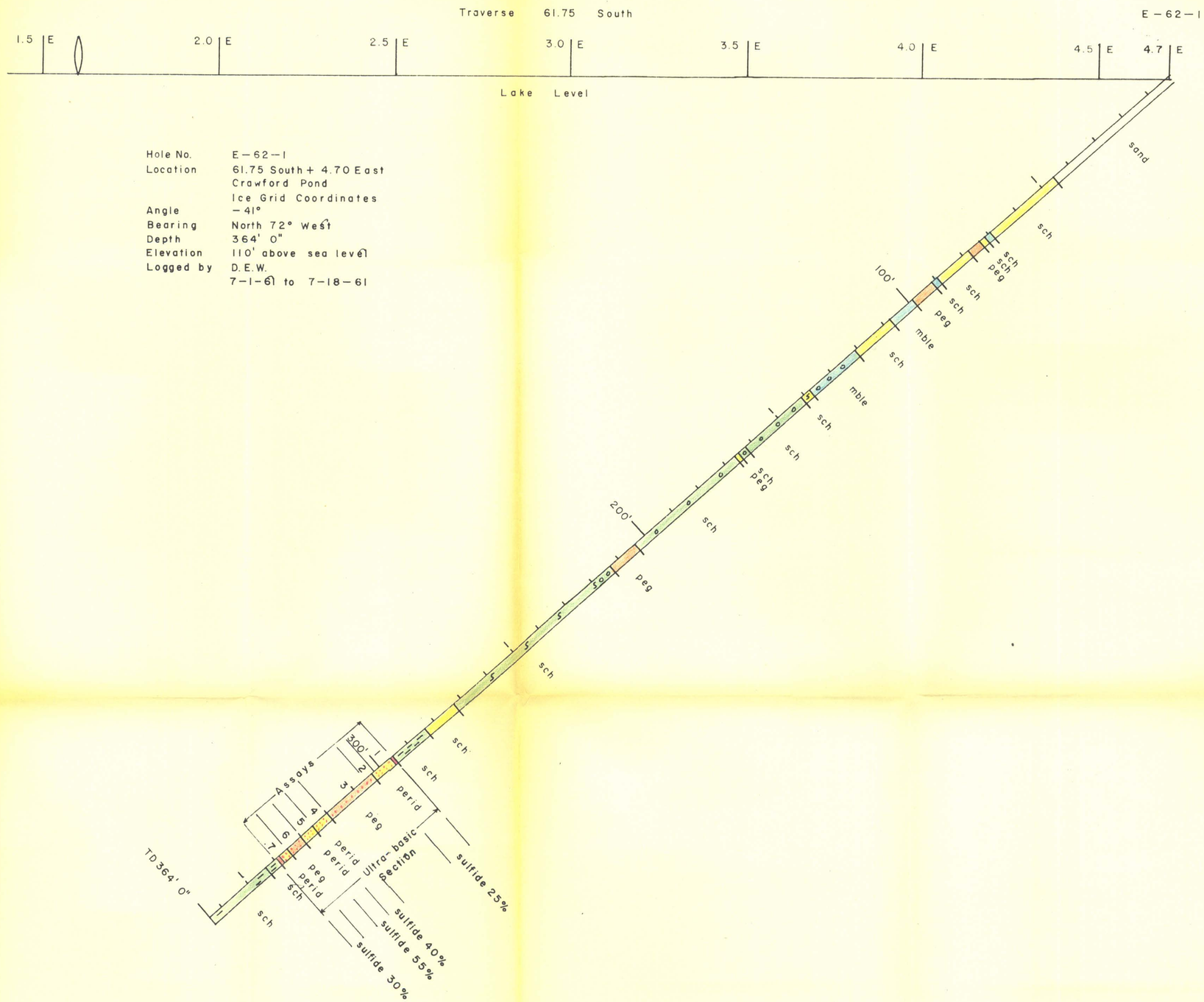
Docket No.: OME - 6104
Commodity : Nickel
Contract No.: 14-23-090-2123
County : Knox
State : Maine

ROLAND F. BEERS, INC. 813 NORTH ROYAL STREET ALEXANDRIA, VIRGINIA

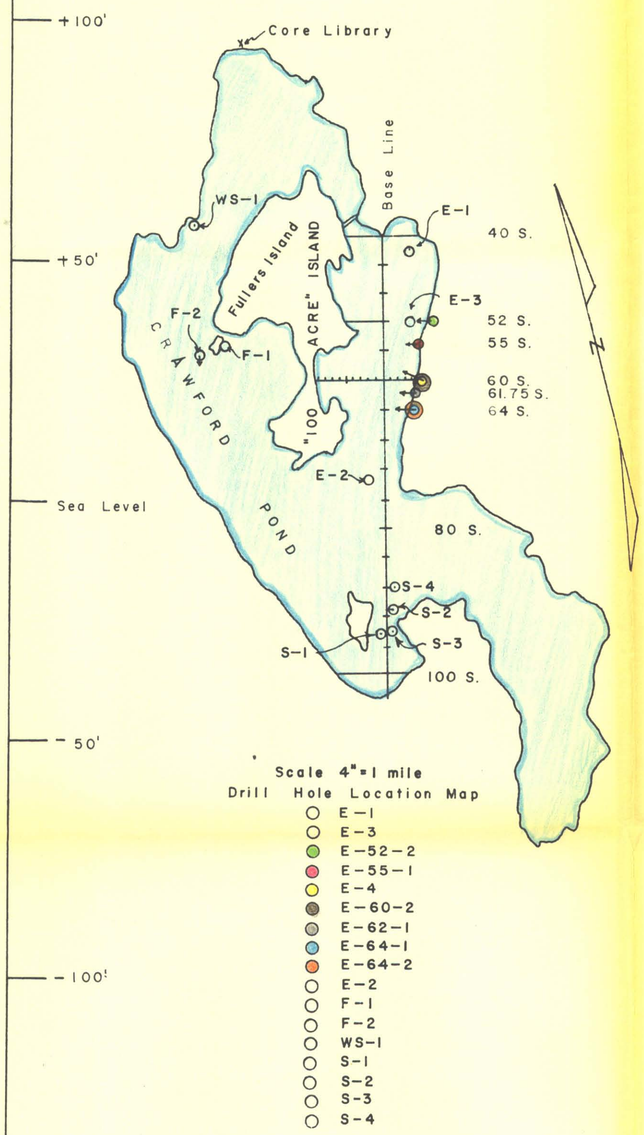
June 15, 1962


TRAVERSE 64 SOUTH
Base Line
0.5 E.
1.0 E.
1.5 E.
2.0 E.
2.5 E.
3.0 E.
3.5 E.
4.0 E.
Lake Level +110'
Drill Hole E-64-2
-60°
+100'
+50'
Sea Level
-50'
-100'
-150'
-200'
-250'
Core Library
Base Line
WS-1
E-1
40 S.
E-3
52 S.
55 S.
60 S.
61.75 S.
64 S.
Fullers Island
ACRE ISLAND
F-2
F-1
CRAWFORD POND
100
E-2
80 South
S-4
S-2
S-3
S-1
Spruce Island
100 South
Scale 4" = 1 mile
Drill Hole Location Map
E-1
E-3
E-52-2
E-55-1
E-4
E-60-2
E-62-1
E-64-1
E-64-2
E-2
F-1
F-2
WS-1
S-1
S-2
S-3
S-4
water
mud
sand
cobbles
boulders
soil & sand
peg
sch
mble & dolo
mble
T.D.A. (7-31-61)
hnbd sch
norite
DRILL HOLE E-64-2 (JULY & AUGUST 1961)
DRILL HOLE E-64-1 (JUNE 1961)
ASSAYS
fissure
mica sch
approx 4' massive sulfide
horizontal
21°
dip
ASSAY E-64-2-1
massive pyrrhotite
altered basic
TD 396'6"
TD 550'
100'
200'
300'
400'
500'
Hole No. E-64-2
Location 63.87 South + 4.30 East
Crawford Pond
Ice Grid Coordinates
Angle -60°
Bearing North 72° West
Depth T.D.A. 157' 7"
T.D. 396' 6"
Elevation + 120'
Logged by D.E.W.
7-19-61 to 7-31-61
completed 8-9-61
LEGEND
Pegmatite (peg)
Marble (mble) & Dolomite (dolo)
Quartz - biotite
Quartz - biotite - chlorite
Hornblende
schist (sch)
Gabbro (gab)
Peridotite (perid)
Massive sulfides
Sulfides
Pyrrhotite
230' b.s.l.
Garnet
Graphite
Calcite on fractures
E.M. cross-overs
August
July 1961
Rockport, Maine
Stage 1
Area 1
ROLAND F. BEERS, INC. Alexandria, Va.
DRILL HOLE CROSS-SECTION
E-64-2 E-64-1
County KNOX
Twnp UNION
Scale 1" = 20'

Drill Hole
E – 62 – 1



Hole No.	E – 62 – 1
Location	61.75 South + 4.70 East Crawford Pond Ice Grid Coordinates
Angle	– 41°
Bearing	North 72° West
Depth	364' 0"
Elevation	110' above sea level
Logged by	D. E. W. 7 – 1 – 61 to 7 – 18 – 61



Scale 4" = 1 mile
Drill Hole Location Map

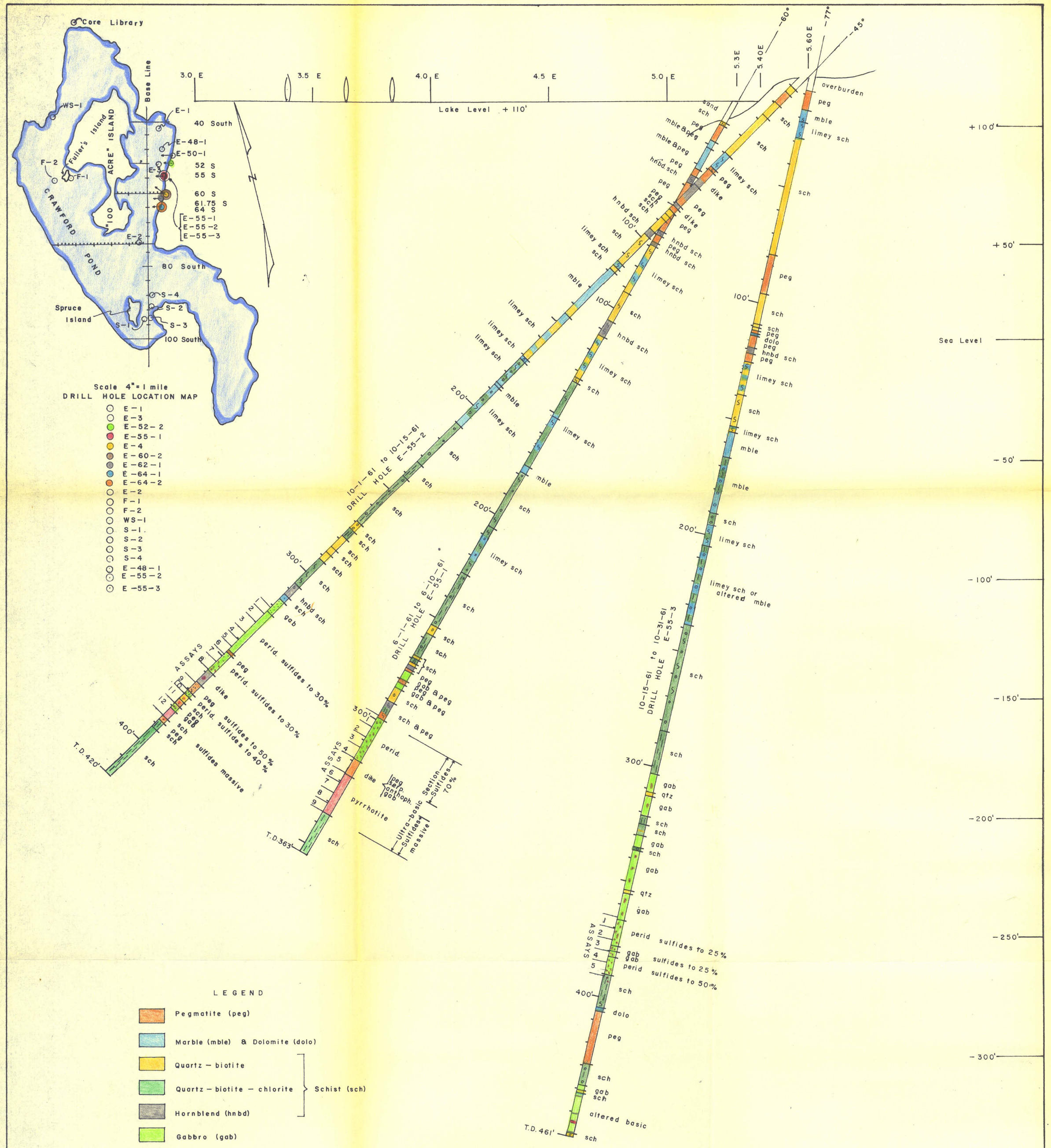
- E – 1
- E – 3
- E – 52 – 2
- E – 55 – 1
- E – 4
- E – 60 – 2
- E – 62 – 1
- E – 64 – 1
- E – 64 – 2
- E – 2
- F – 1
- F – 2
- WS – 1
- S – 1
- S – 2
- S – 3
- S – 4

LEGEND

- Pegmatite (peg)
- Marble (mble) & Dolomite (dolo)
- Quartz – biotite schist (sch)
- Quartz – biotite – chlorite schist (sch)
- Hornblend schist (hnbd sch)
- Gabbro (gab)
- Peridotite (perid)
- Massive sulfides } Pyrrhotite
- Sulfides } Pyrrhotite
- Garnet (gar)
- Graphite
- Calcite on fractures
- E. M. Cross – over

JULY 1961

Rockport, Maine	Stage 1 Area 1	ROLAND F. BEERS, INC. Alexandria, Va. DRILL HOLE CROSS SECTION E – 62 – 1 County KNOX · Twnp. UNION · Scale 1" = 20'



LEGEND

- Pegmatite (peg)
- Marble (mble) & Dolomite (dolo)
- Quartz – biotite
- Quartz – biotite – chlorite } Schist (sch)
- Hornblend (hnbd)
- Gabbro (gab)
- Peridotite (perid)
- Massive sulfides } Pyrrhotite
- Sulfides
- Garnet
- Graphite
- Calcite on fractures
- E. M. Cross – overs

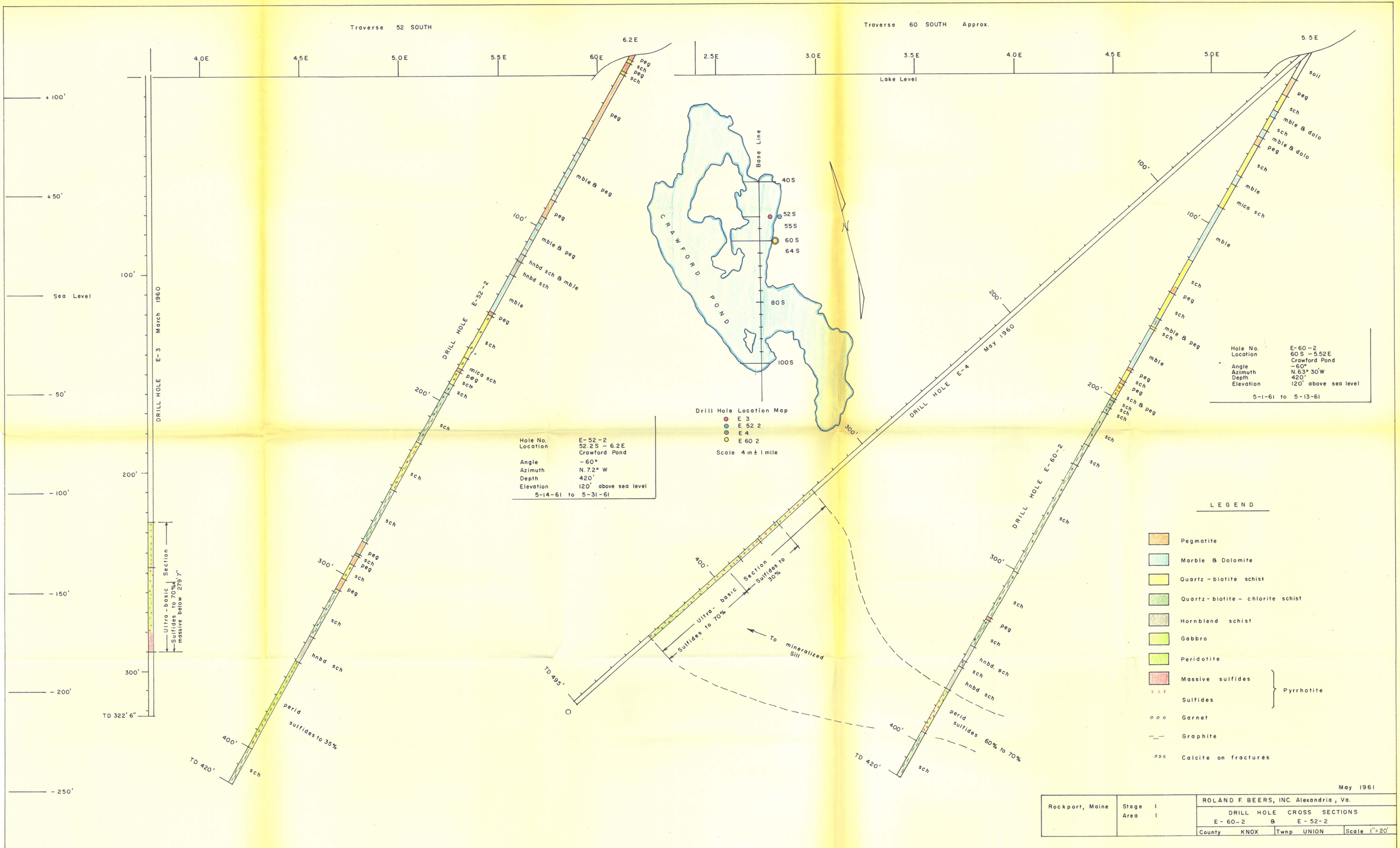
October 1961

DRILL HOLE DATA

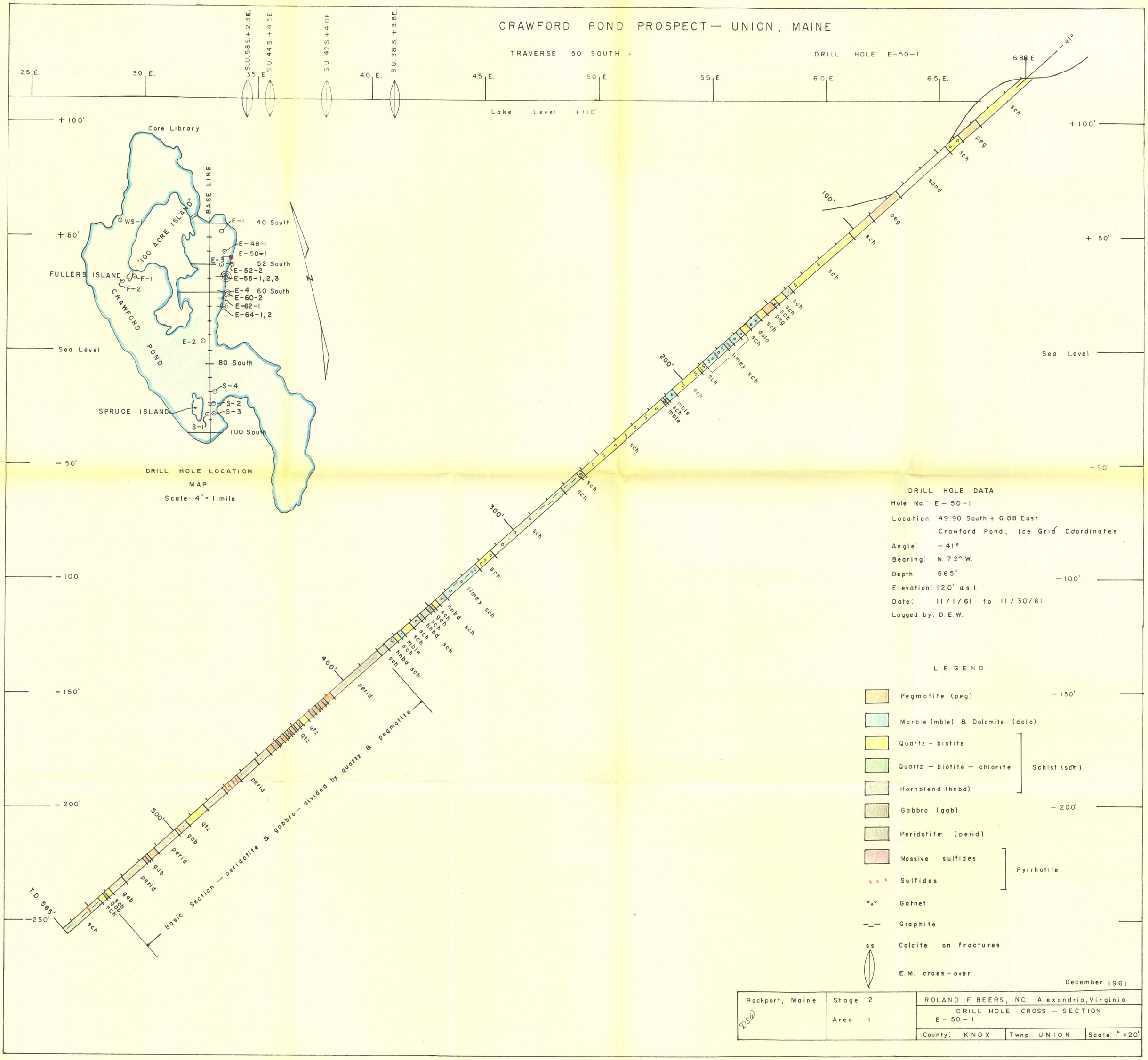
Hole No.	Location	Angle	Depth	Elevation	Bearing	Date
E-55-1	54.9 S. + 5.30 E.	-60°	363'	+110'	N. 72° W.	6-1-61 to 6-10-61
E-55-2	54.9 S. + 5.60 E.	-45°	420'	+120'	N. 72° W.	10-1-61 to 10-15-61
E-55-3	54.9 S. 5.60 E.	-77°	461'	+120'	N. 72° W.	10-15-61 to 10-31-61

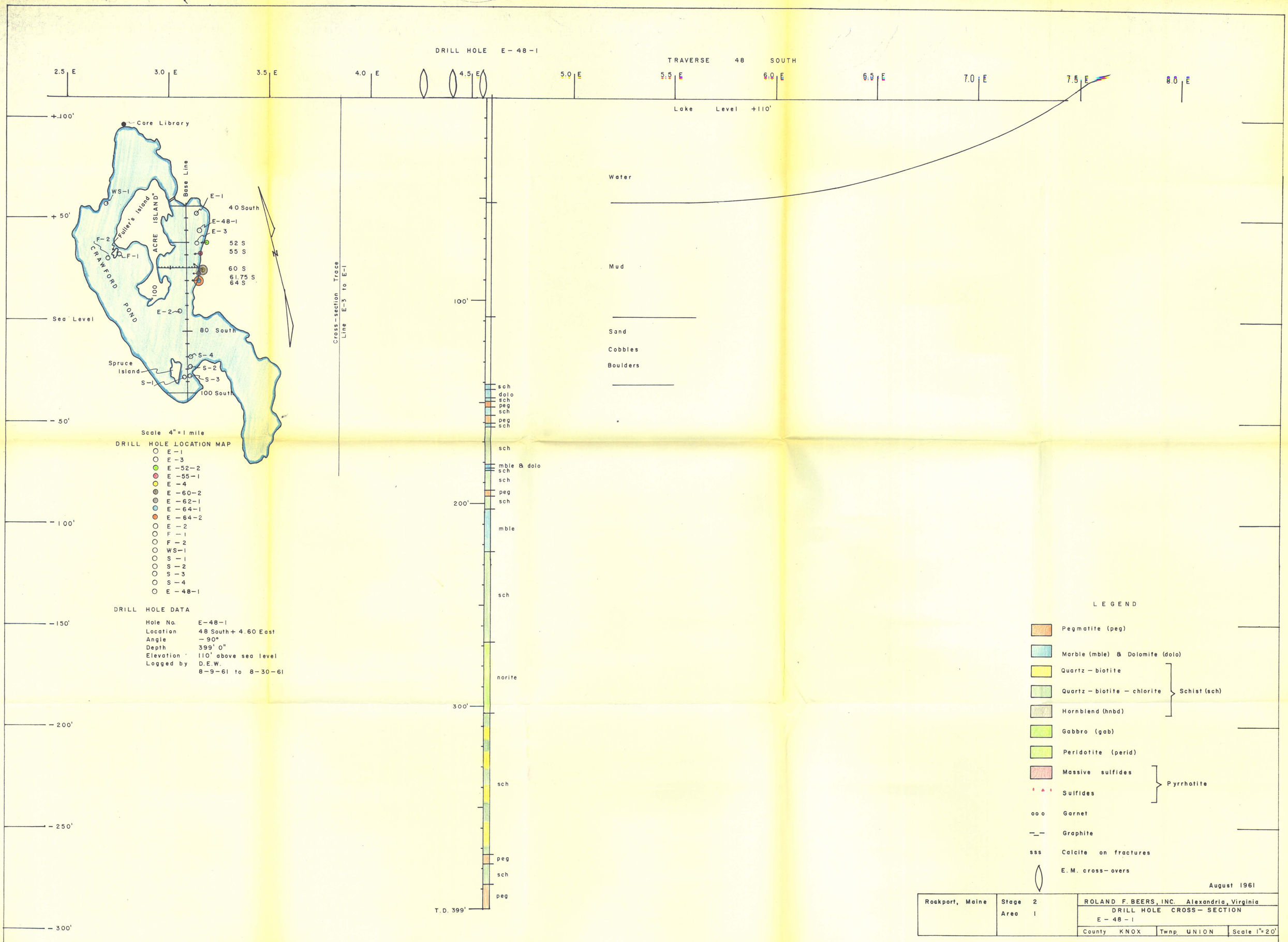
Rockport, Maine	Stage I, Area I	ROLAND F. BEERS, INC. Alexandria, Virginia		
		DRILL HOLE CROSS-SECTIONS E-55-1 E-55-2 E-55-3		
		County: KNOX	Twnp: UNION	Scale: 1" = 20'

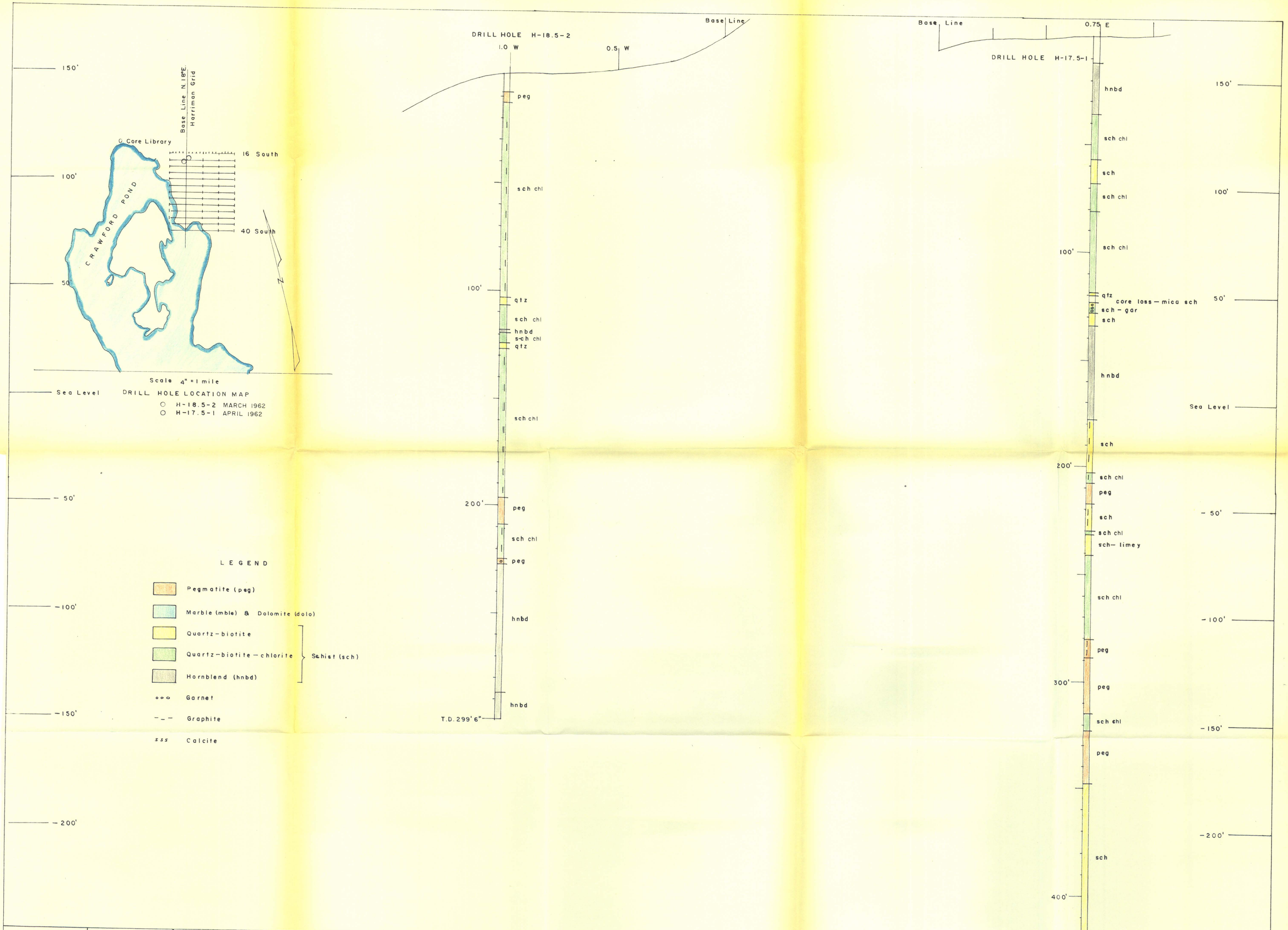
DRILL HOLE CROSS-SECTIONS E-55-1 E-55-2 E-55-3


Traverse 52 SOUTH
4.0E
4.5E
5.0E
5.5E
6.2E
+100'
+50'
Sea Level
-50'
-100'
-150'
-200'
-250'
100'
200'
300'
400'
DRILL HOLE E-3 March 1960
Ultra-basic Section
Sulfides to 70%
massive below 279'7"
TD 322' 6"
DRILL HOLE E-52-2
peg
sch
mble & peg
hnbd sch & mble
hnbd sch
mble
mica sch
perid
sulfides to 35%
TD 420'
Hole No. E-52-2
Location 52.2S - 6.2E
Crawford Pond
Angle -60°
Azimuth N.72° W
Depth 420'
Elevation 120' above sea level
5-14-61 to 5-31-61
Traverse 60 SOUTH Approx.
2.5E
3.0E
3.5E
4.0E
4.5E
5.0E
5.5E
Lake Level
Base Line
40S
52S
55S
60S
64S
80S
100S
CRAWFORD POND
Drill Hole Location Map
E 3
E 52 2
E 4
E 60 2
Scale 4 in ± 1 mile
DRILL HOLE E-4 May 1960
Ultra-basic Section
Sulfides to 70%
Sulfides to 30%
To mineralized Sill
TD 495'
DRILL HOLE E-60-2
soil
mble & dolo
mica sch
perid
sulfides 60% to 70%
TD 420'
Hole No. E-60-2
Location 60 S - 5.52E
Crawford Pond
Angle -60°
Azimuth N.63° 30'W
Depth 420'
Elevation 120' above sea level
5-1-61 to 5-13-61
LEGEND
Pegmatite
Marble & Dolomite
Quartz-biotite schist
Quartz-biotite-chlorite schist
Hornblend schist
Gabbro
Peridotite
Massive sulfides
Sulfides
Pyrrhotite
Garnet
Graphite
Calcite on fractures
May 1961
Rockport, Maine
Stage 1
Area 1
ROLAND F. BEERS, INC. Alexandria, Va.
DRILL HOLE CROSS SECTIONS
E-60-2 & E-52-2
County KNOX
Twnp UNION
Scale 1"=20'

CRAWFORD POND PROSPECT — UNION, MAINE



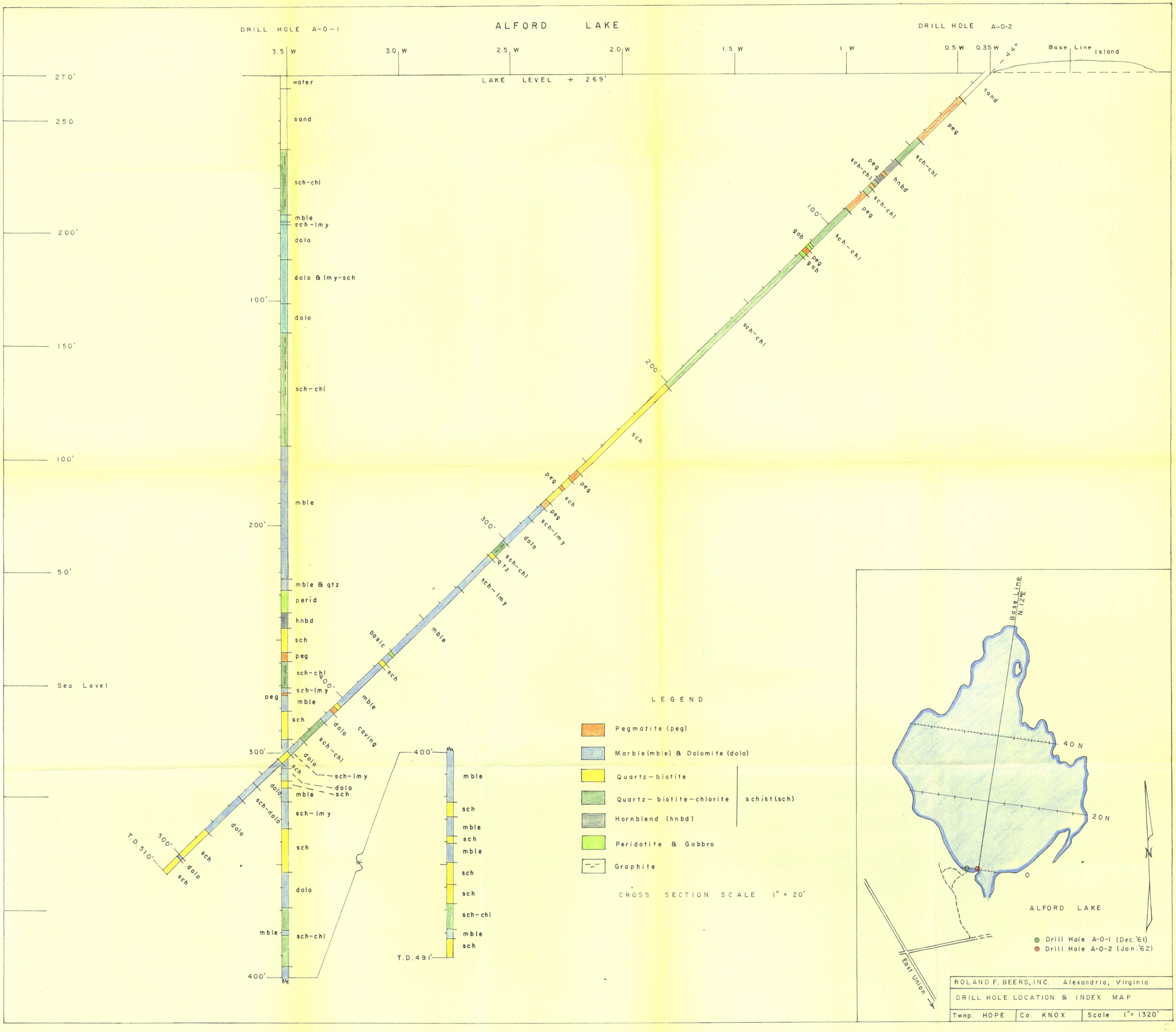

DRILL HOLE E-48-1
TRAVERSE 48 SOUTH
2.5 E
3.0 E
3.5 E
4.0 E
4.5 E
5.0 E
5.5 E
6.0 E
6.5 E
7.0 E
7.5 E
8.0 E
Lake Level +110'
+100'
+50'
Sea Level
-50'
-100'
-150'
-200'
-250'
-300'
Core Library
Base Line
WS-1
Fuller's Island
"100 ACRE ISLAND"
CRAWFORD POND
F-2
F-1
E-1
40 South
E-48-1
E-3
52 S
55 S
60 S
61.75 S
64 S
E-2
80 South
S-4
S-2
S-3
Spruce Island
S-1
100 South
N
Scale 4" = 1 mile
DRILL HOLE LOCATION MAP
E-1
E-3
E-52-2
E-55-1
E-4
E-60-2
E-62-1
E-64-1
E-64-2
E-2
F-1
F-2
WS-1
S-1
S-2
S-3
S-4
E-48-1
DRILL HOLE DATA
Hole No. E-48-1
Location 48 South + 4.60 East
Angle -90°
Depth 399' 0"
Elevation 110' above sea level
Logged by D.E.W.
8-9-61 to 8-30-61
Cross-section Trace
Line E-3 to E-1
Water
Mud
Sand
Cobbles
Boulders
100'
200'
300'
T.D. 399'
sch
dolo
sch
peg
sch
peg
sch
sch
mble & dolo
sch
sch
peg
sch
mble
sch
norite
sch
peg
sch
peg
LEGEND
Pegmatite (peg)
Marble (mble) & Dolomite (dolo)
Quartz - biotite
Quartz - biotite - chlorite
Hornblend (hnbd)
Schist (sch)
Gabbro (gab)
Peridotite (perid)
Massive sulfides
Sulfides
Pyrrhotite
ooo Garnet
Graphite
sss Calcite on fractures
E. M. cross-overs
August 1961
Rockport, Maine
Stage 2
Area 1
ROLAND F. BEERS, INC. Alexandria, Virginia
DRILL HOLE CROSS-SECTION
E-48-1
County KNOX
Twnp. UNION
Scale 1" = 20'

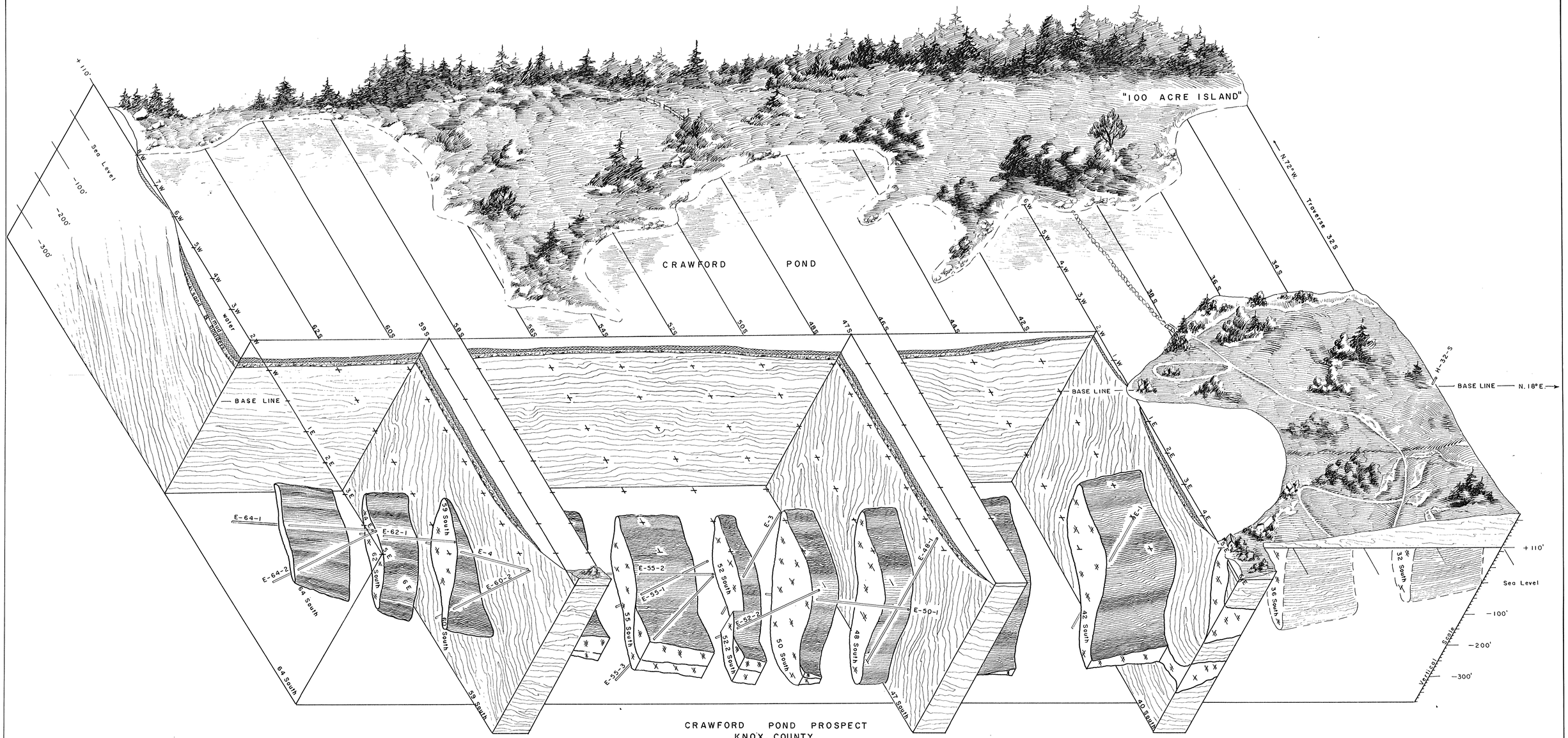


Rockport, Maine	Area 1	ROLAND F. BEERS, INC. Alexandria, Virginia DRILL HOLE CROSS-SECTIONS H-18.5-2 & H-17.5-1 County KNOX · Twnp UNION · Scale 1"=20'

DRILL HOLE	LOCATION	ANGLE	TOTAL DEPTH	ELEV.
H-18.5-2	18.5 South + 1.0 West	-90°	299' 6"	151.3'
H-17.5-1	17.5 South + 0.75 East	-90°	424' 0"	161.8'

DRILL HOLE
CROSS-SECTIONS
H-18.5-2 MARCH 1962
H-17.5-1 APRIL 1962


ALFORD LAKE
DRILL HOLE A-0-1
DRILL HOLE A-0-2
3.5 W
3.0 W
2.5 W
2.0 W
1.5 W
1 W
0.5 W
0.35 W
44°
Base Line
Island
LAKE LEVEL + 269'
270'
250
200'
150'
100'
50'
Sea Level
water
sand
sch-chl
mble
sch-lmy
dolo
dolo & lmy-sch
dolo
sch-chl
mble
mble & qtz
perid
hnbd
sch
peg
sch-chl
sch-lmy
mble
sch
dolo
sch-chl
sch-lmy
dolo
mble
sch
sch-lmy
sch
dolo
mble
sch-chl
T.D. 510'
T.D. 491'
caving
basic
LEGEND
Pegmatite (peg)
Marble (mble) & Dolomite (dolo)
Quartz-biotite
Quartz-biotite-chlorite
Hornblend (hnbd)
schist (sch)
Peridotite & Gabbro
Graphite
CROSS SECTION SCALE 1" = 20'
Base Line N.12°E.
40 N
20 N
0
ALFORD LAKE
Drill Hole A-0-1 (Dec.'61)
Drill Hole A-0-2 (Jan.'62)
East Union
ROLAND F. BEERS, INC. Alexandria, Virginia
DRILL HOLE LOCATION & INDEX MAP
Twnp. HOPE
Co. KNOX
Scale 1" = 1320'



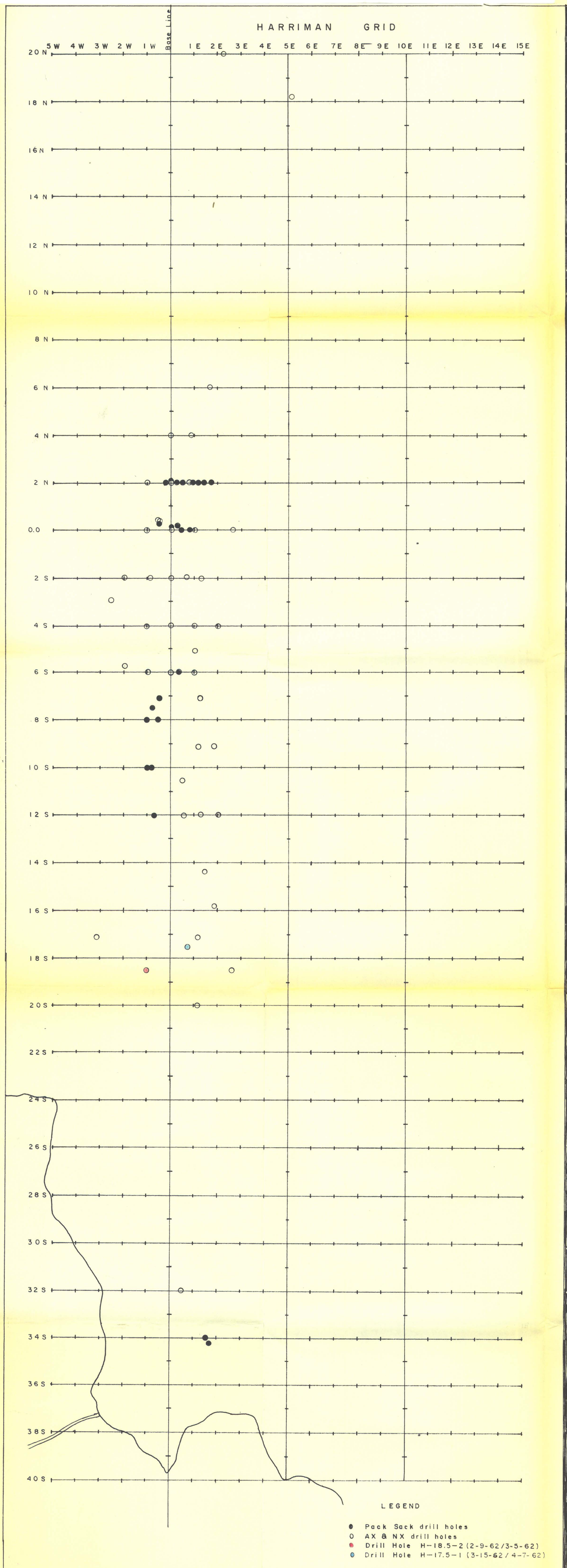
CRAWFORD POND PROSPECT
KNOX, COUNTY
UNION, MAINE

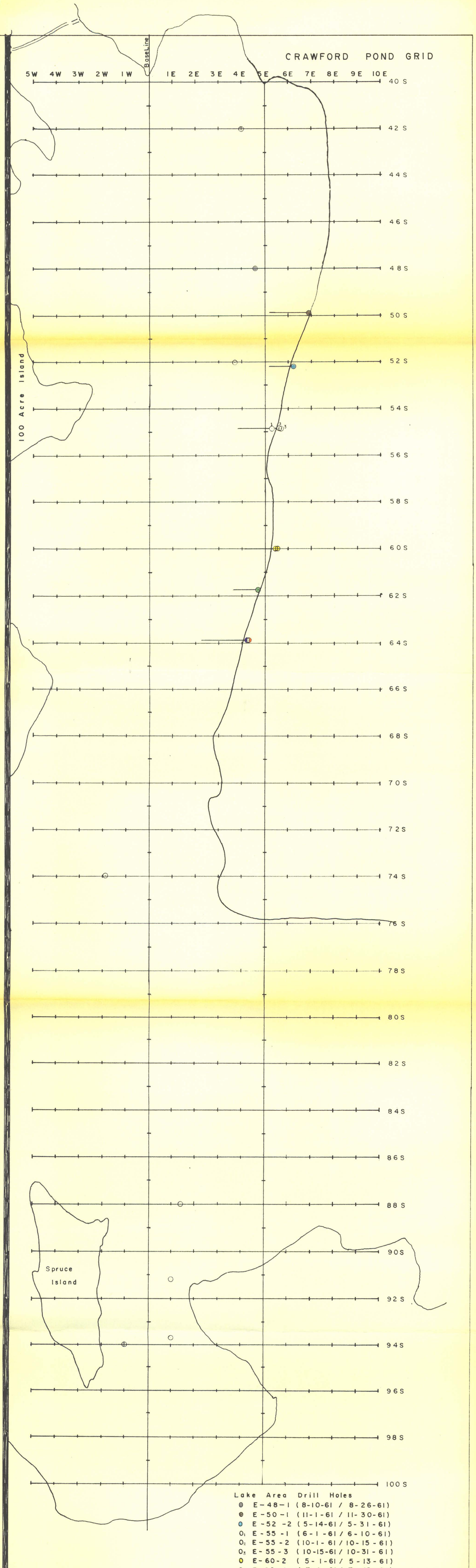
ROLAND F. BEERS, INC. ALEXANDRIA, VIRGINIA

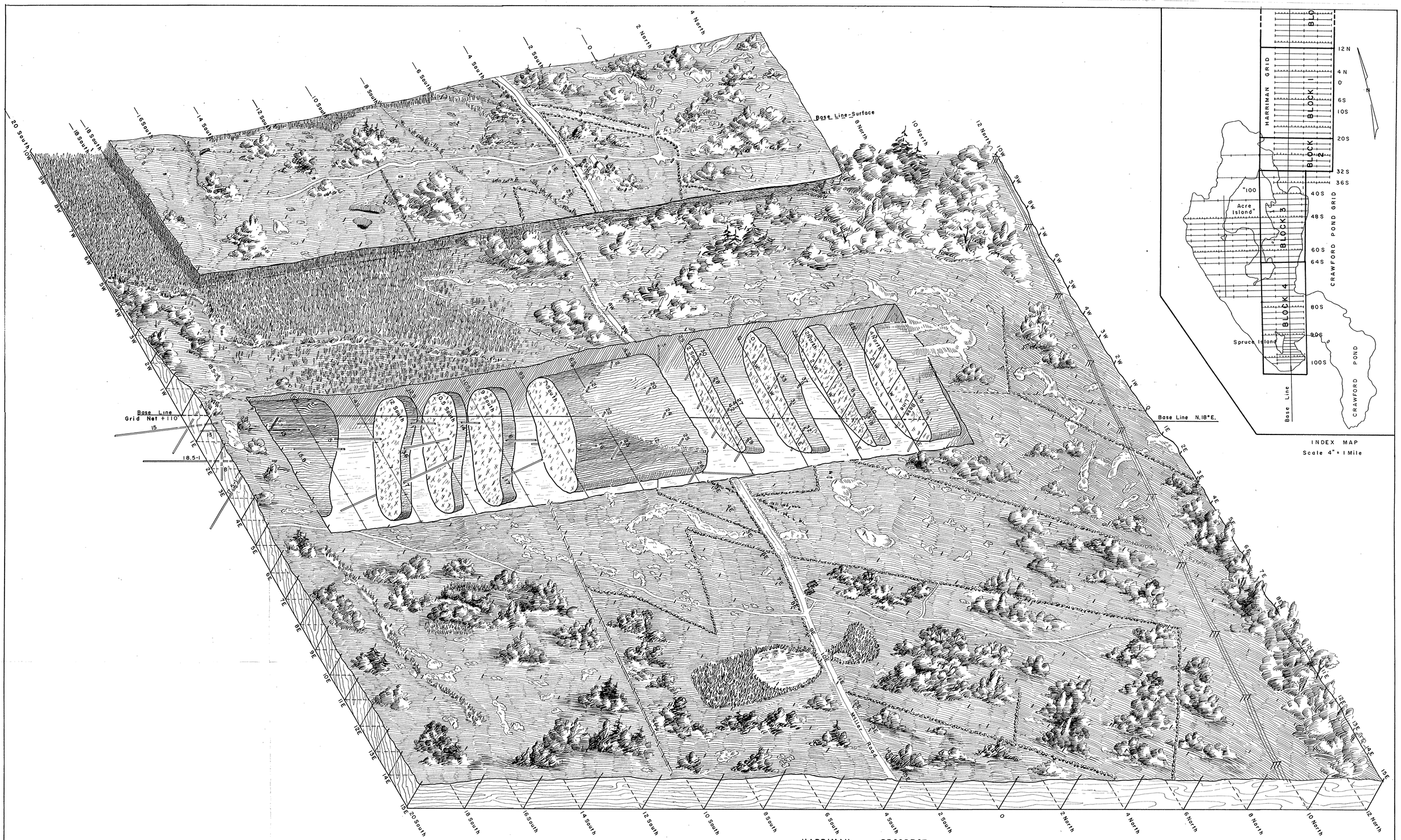
Drawn By D. E. Wyke

BLOCK DIAGRAM NO. 3

NO. 3


HARRIMAN GRID
Base Line
5W 4W 3W 2W 1W 1E 2E 3E 4E 5E 6E 7E 8E 9E 10E 11E 12E 13E 14E 15E
20 N
18 N
16 N
14 N
12 N
10 N
8 N
6 N
4 N
2 N
0.0
2 S
4 S
6 S
8 S
10 S
12 S
14 S
16 S
18 S
20 S
22 S
24 S
26 S
28 S
30 S
32 S
34 S
36 S
38 S
40 S
LEGEND
Pack Sack drill holes
AX & NX drill holes
Drill Hole H-18.5-2 (2-9-62/3-5-62)
Drill Hole H-17.5-1 (3-15-62/4-7-62)


CRAWFORD POND GRID
Base Line
5W 4W 3W 2W 1W 1E 2E 3E 4E 5E 6E 7E 8E 9E 10E
40 S
42 S
44 S
46 S
48 S
50 S
52 S
54 S
56 S
58 S
60 S
62 S
64 S
66 S
68 S
70 S
72 S
74 S
76 S
78 S
80 S
82 S
84 S
86 S
88 S
90 S
92 S
94 S
96 S
98 S
100 S
100 Acre Island
Spruce Island
Lake Area Drill Holes
E-48-1 (8-10-61 / 8-26-61)
E-50-1 (11-1-61 / 11-30-61)
E-52-2 (5-14-61 / 5-31-61)
O1 E-55-1 (6-1-61 / 6-10-61)
O2 E-55-2 (10-1-61 / 10-15-61)
O3 E-55-3 (10-15-61 / 10-31-61)
E-60-2 (5-1-61 / 5-13-61)
E-62-1 (7-1-61 / 7-18-61)
E-64-1 (6-10-61 / 6-30-61)
E-64-2 (7-19-61 / 8-9-61)



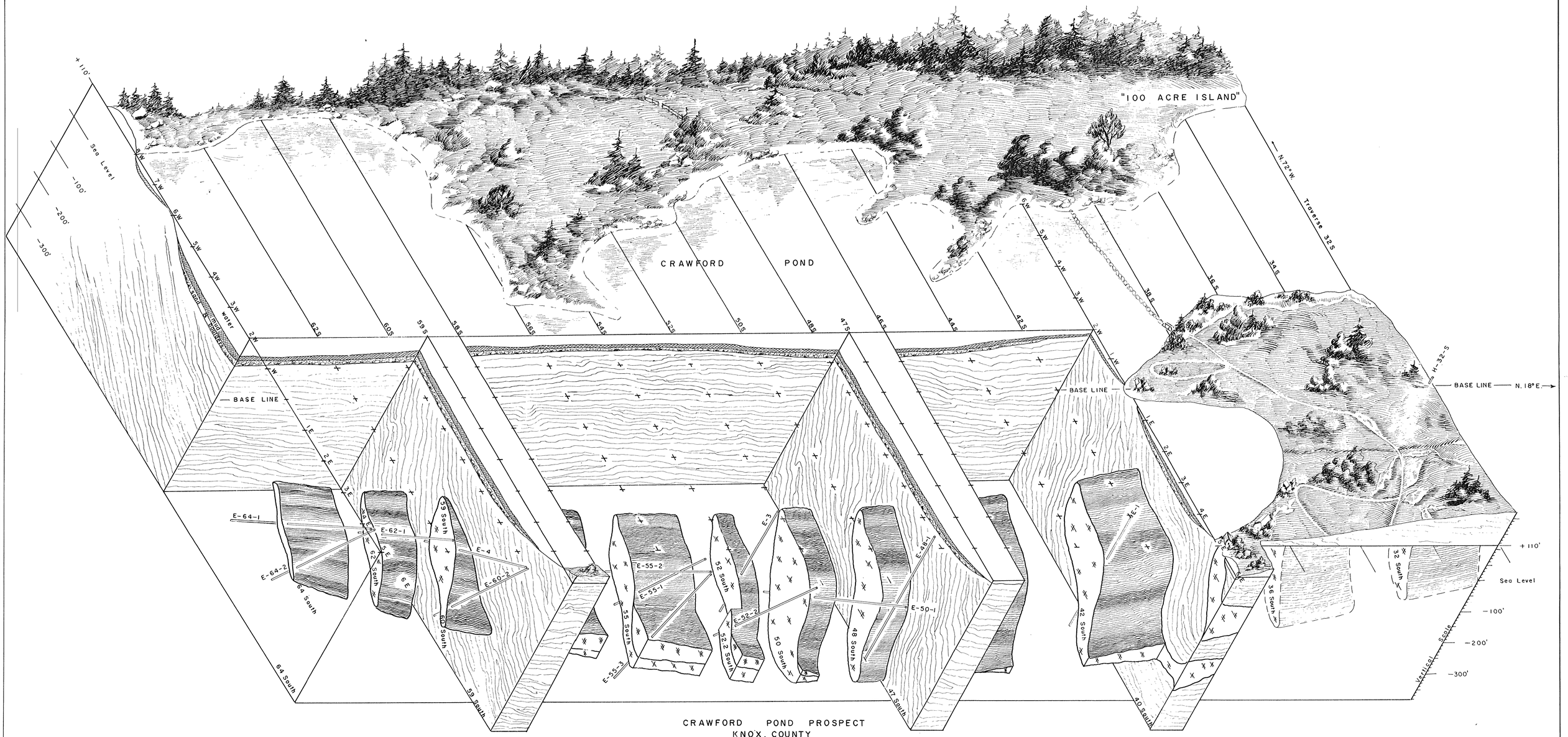
HARRIMAN PROSPECT
KNOX, COUNTY
UNION, MAINE

ROLAND F. BEERS, INC. ALEXANDRIA, VIRGINIA

Drawn By D.E. Wyke

BLOCK DIAGRAM NO. 1

NO. 1



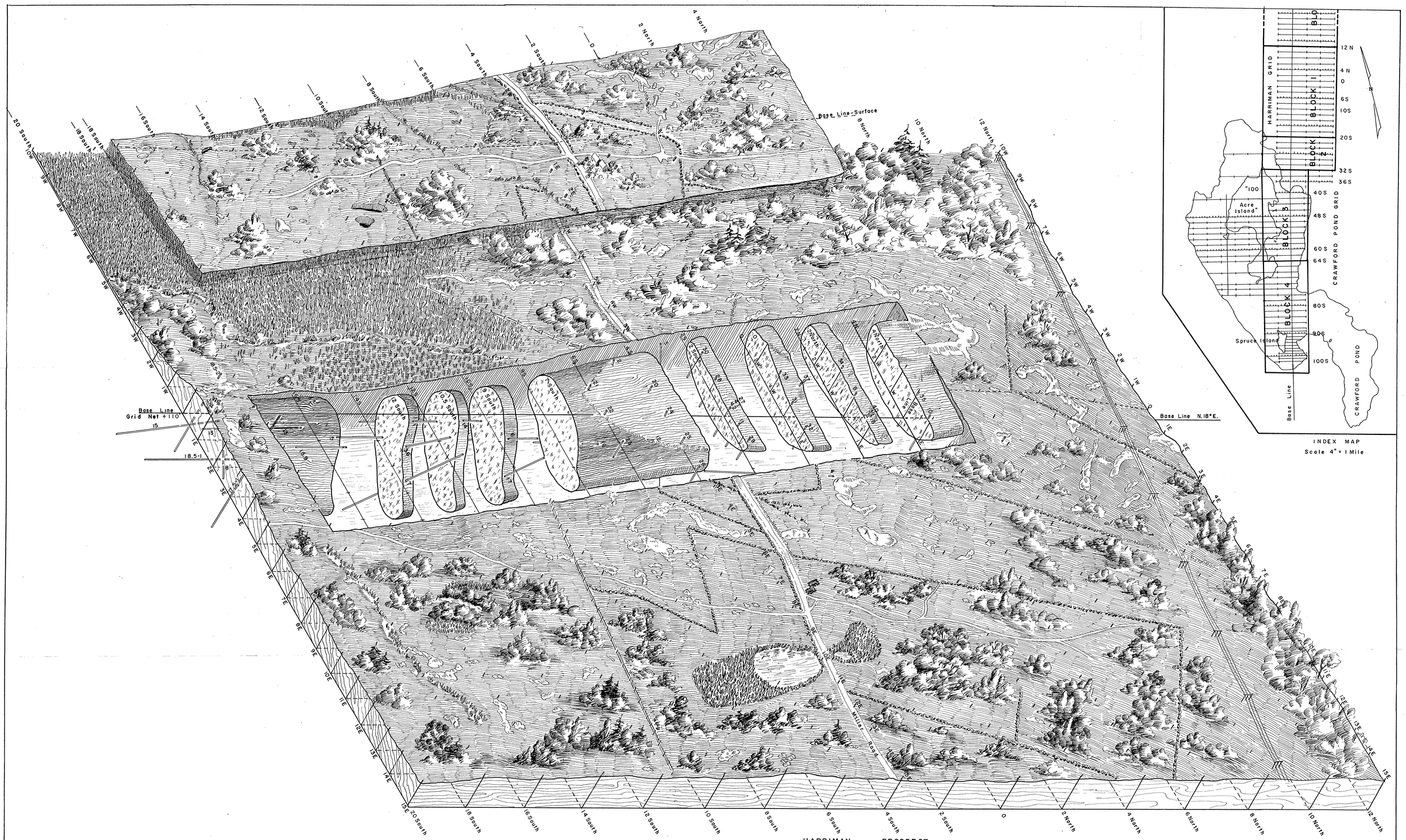
CRAWFORD POND PROSPECT
KNOX, COUNTY
UNION, MAINE

ROLAND F. BEERS, INC. ALEXANDRIA, VIRGINIA

Drawn By D. E. Wyke

BLOCK DIAGRAM NO. 3

NO. 3



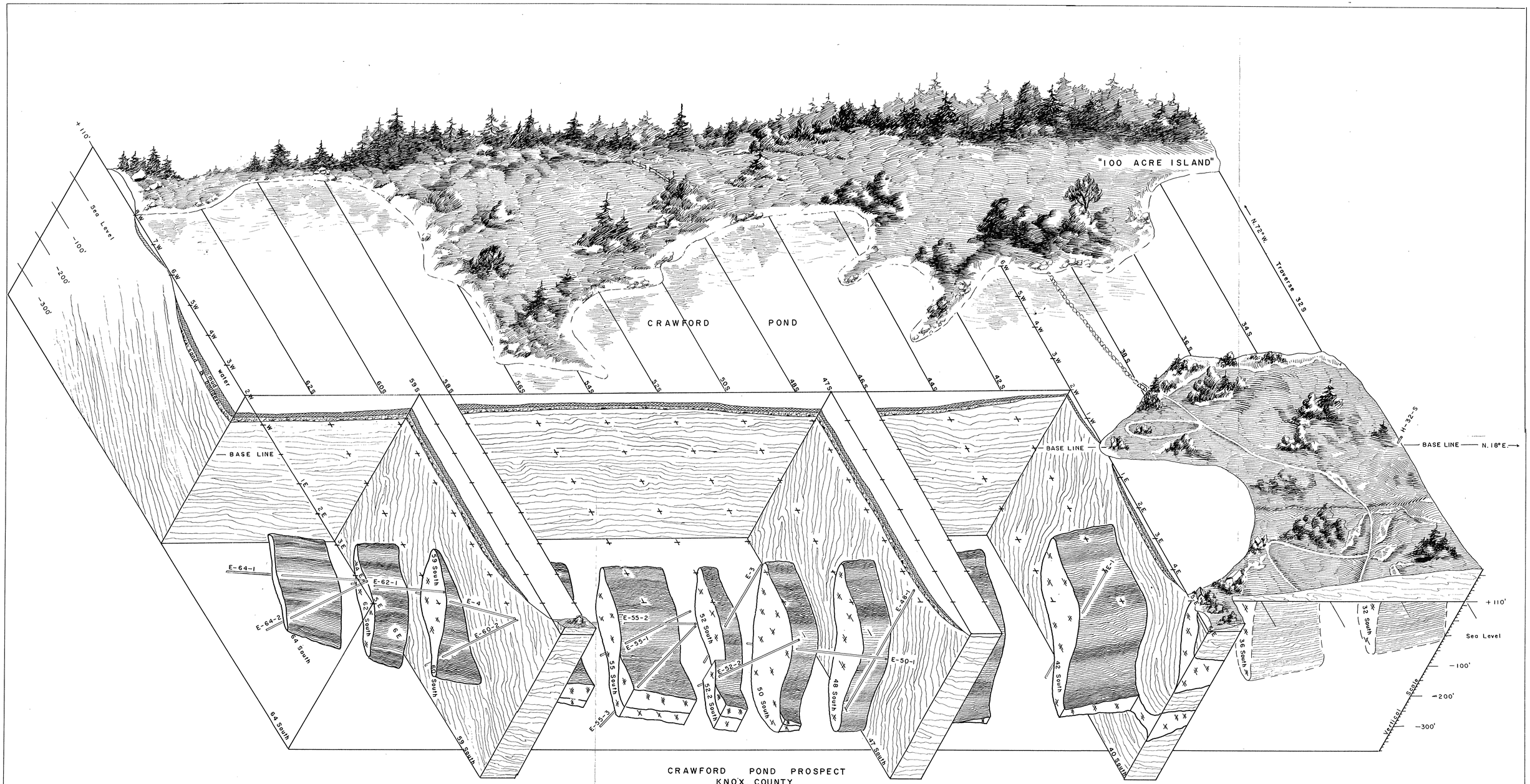
HARRIMAN PROSPECT
KNOX, COUNTY
UNION, MAINE

ROLAND F. BEERS, INC. ALEXANDRIA, VIRGINIA

Drawn By D.E. Wyke

BLOCK DIAGRAM NO. 1

NO. 1



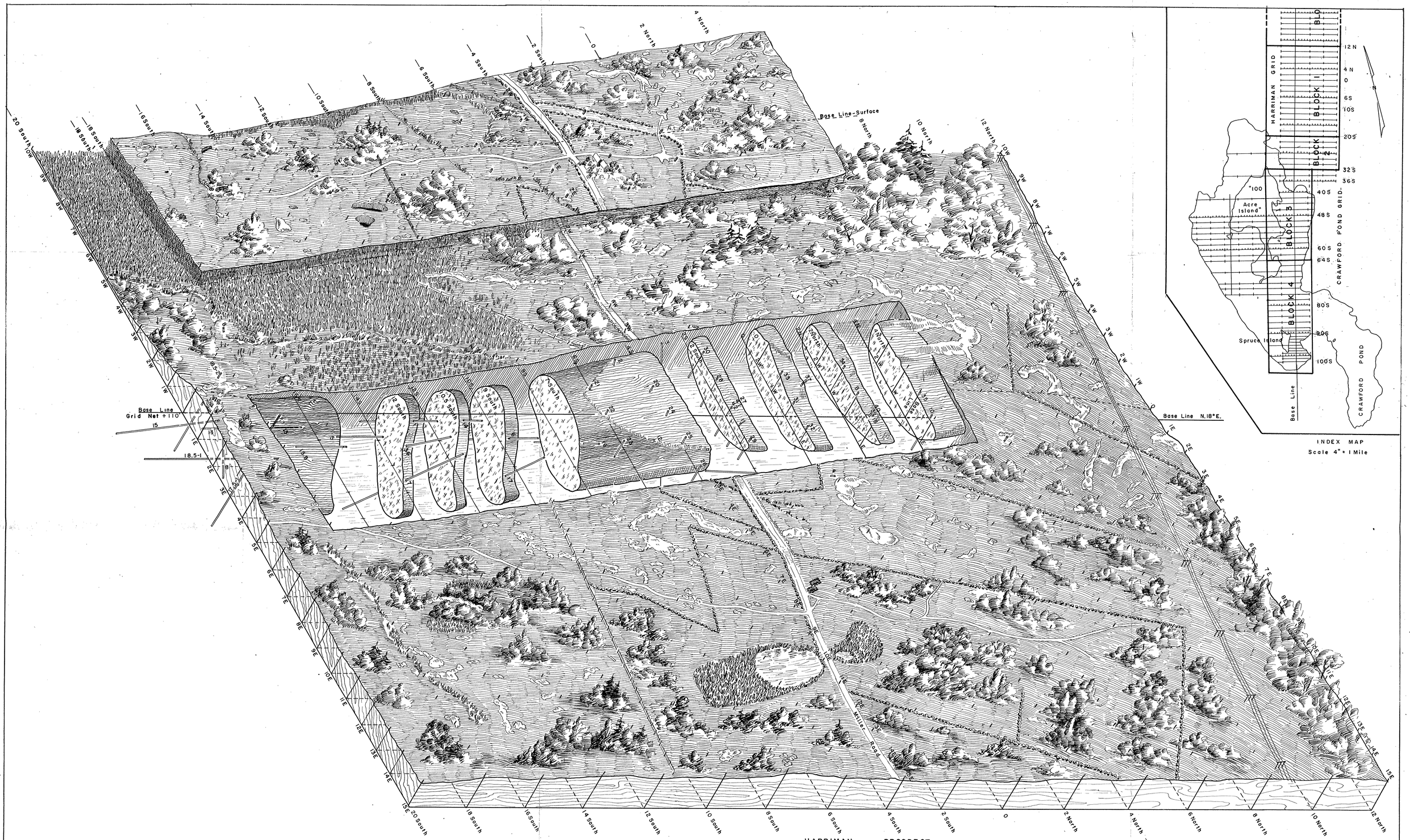
CRAWFORD POND PROSPECT
KNOX, COUNTY
UNION, MAINE

ROLAND F. BEERS, INC. ALEXANDRIA, VIRGINIA

Drawn By D. E. Wyke

BLOCK DIAGRAM NO. 3

NO. 3



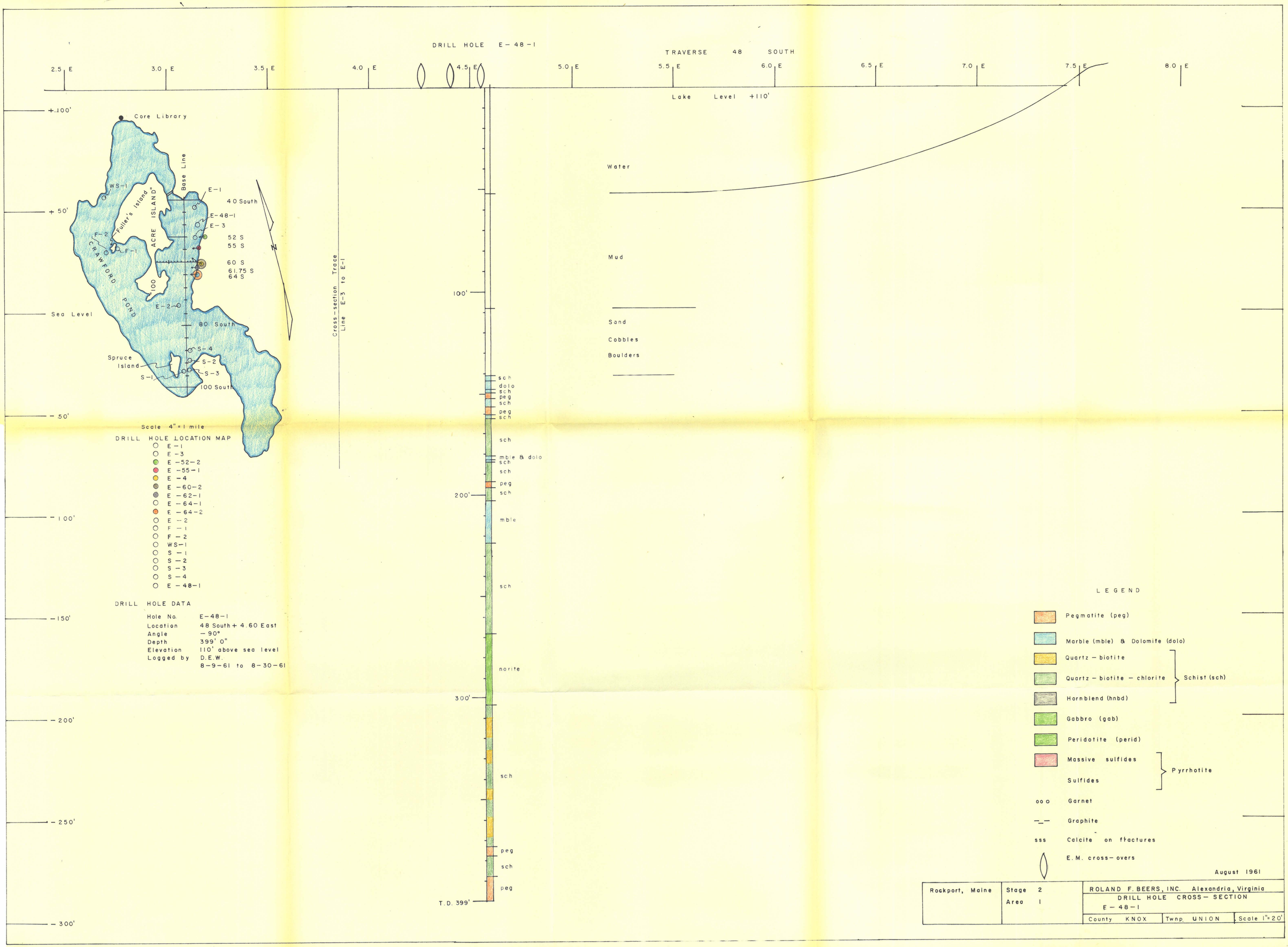
HARRIMAN PROSPECT
KNOX, COUNTY
UNION, MAINE

ROLAND F. BEERS, INC. ALEXANDRIA, VIRGINIA

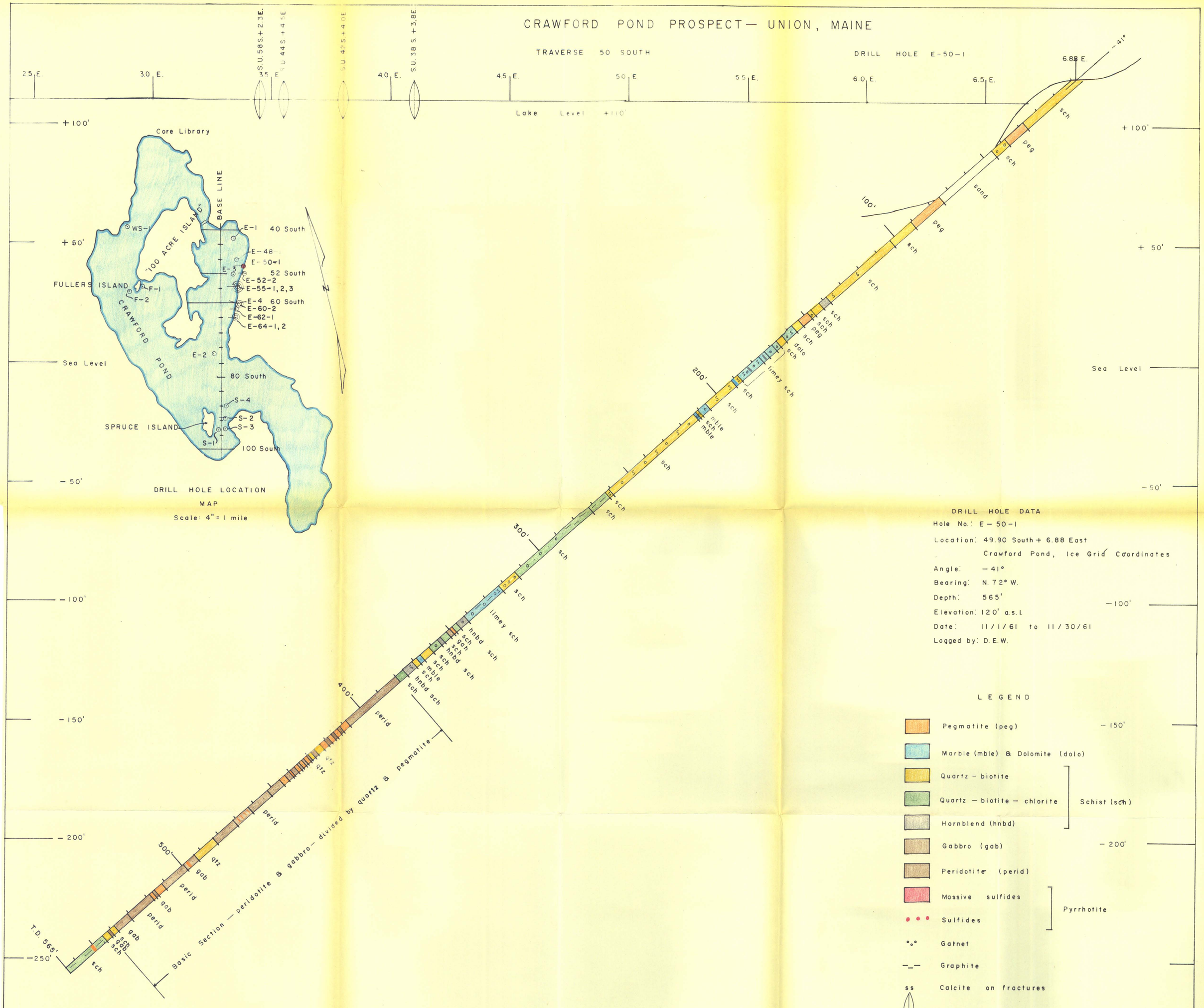
Drawn By D. E. Wyke

BLOCK DIAGRAM NO. 1

NO. 1


DRILL HOLE E-48-1
TRAVERSE 48 SOUTH
2.5 E
3.0 E
3.5 E
4.0 E
4.5 E
5.0 E
5.5 E
6.0 E
6.5 E
7.5 E
8.0 E
Lake Level +110'
+100'
+50'
Sea Level
-50'
-100'
-150'
-200'
-250'
-300'
Core Library
Base Line
WS-1
Fuller's Island
"ACRE ISLAND"
E-1
40 South
E-48-1
E-3
52 S
55 S
60 S
61.75 S
64 S
F-2
F-1
CRAWFORD POND
100
E-2
80 South
S-4
S-2
S-3
Spruce Island
S-1
100 South
N
Scale 4" = 1 mile
DRILL HOLE LOCATION MAP
E-1
E-3
E-52-2
E-55-1
E-4
E-60-2
E-62-1
E-64-1
E-64-2
E-2
F-1
F-2
WS-1
S-1
S-2
S-3
S-4
E-48-1
DRILL HOLE DATA
Hole No. E-48-1
Location 48 South + 4.60 East
Angle -90°
Depth 399' 0"
Elevation 110' above sea level
Logged by D.E.W.
8-9-61 to 8-30-61
Cross-section Trace
Line E-3 to E-1
100'
200'
300'
T.D. 399'
sch
dolo
sch
peg
sch
peg
sch
sch
mble & dolo
sch
sch
peg
sch
mble
sch
norite
sch
peg
sch
peg
Water
Mud
Sand
Cobbles
Boulders
LEGEND
Pegmatite (peg)
Marble (mble) & Dolomite (dolo)
Quartz - biotite
Quartz - biotite - chlorite
Hornblend (hnbd)
Schist (sch)
Gabbro (gab)
Peridotite (perid)
Massive sulfides
Sulfides
Pyrrhotite
ooo Garnet
Graphite
sss Calcite on fractures
E.M. cross-overs
August 1961
Rockport, Maine
Stage 2
Area 1
ROLAND F. BEERS, INC. Alexandria, Virginia
DRILL HOLE CROSS-SECTION
E-48-1
County KNOX
Twnp. UNION
Scale 1" = 20'

CRAWFORD POND PROSPECT — UNION, MAINE



DRILL HOLE DATA

Hole No.: E – 50 – 1

Location: 49.90 South + 6.88 East
Crawford Pond, Ice Grid Coordinates

Angle: – 41°

Bearing: N. 72° W.

Depth: 565'

Elevation: 120' a.s.l.

Date: 11/1/61 to 11/30/61

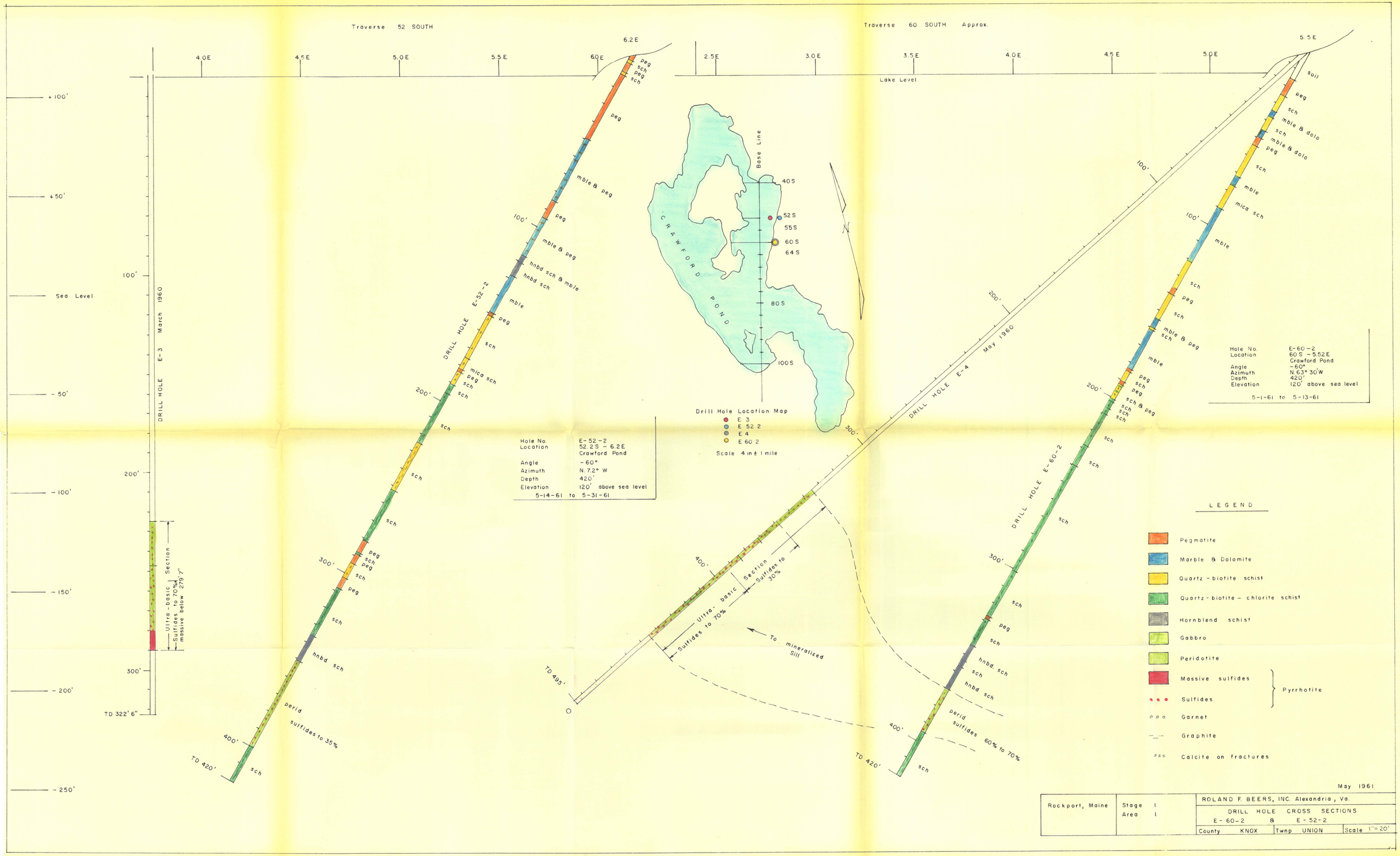
Logged by: D.E.W.

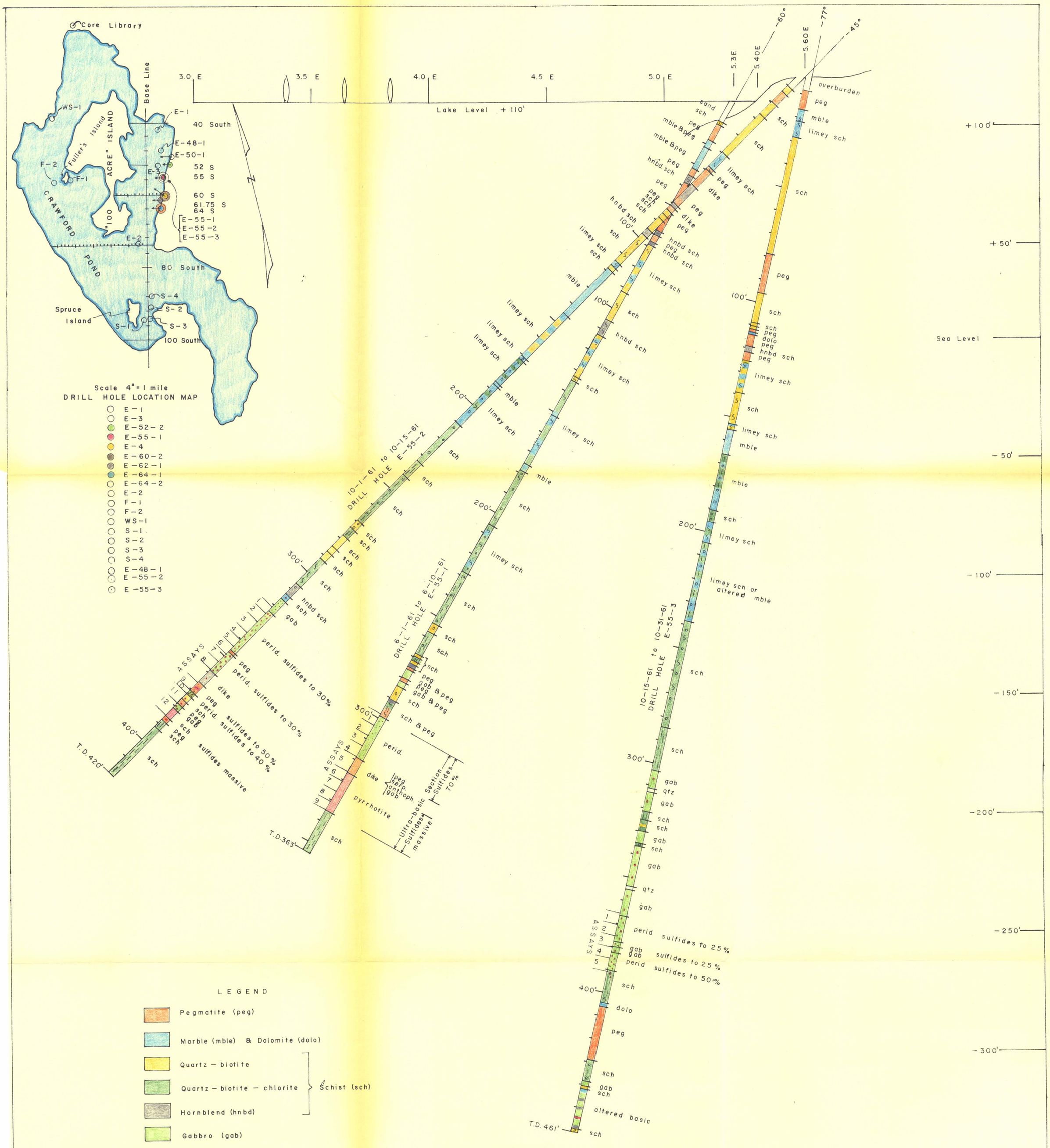
LEGEND

- Pegmatite (peg)
- Marble (mble) & Dolomite (dolo)
- Quartz – biotite
- Quartz – biotite – chlorite
- Hornblend (hnbd)
- Schist (sch)
- Gabbro (gab)
- Peridotite (perid)
- Massive sulfides
- Sulfides
- Pyrrhotite
- Garnet
- Graphite
- ss Calcite on fractures
- E.M. cross-over

December 1961

Rockport, Maine	Stage 2	ROLAND F. BEERS, INC. Alexandria, Virginia
DEW	Area 1	DRILL HOLE CROSS – SECTION E – 50 – 1
		County: KNOX · Twnp: UNION · Scale: 1" = 20'


Traverse 52 SOUTH
4.0E
4.5E
5.0E
5.5E
6.0E
6.2E
+100'
+50'
Sea Level
-50'
-100'
-150'
-200'
-250'
100'
200'
300'
DRILL HOLE E-3 March 1960
Ultra-basic Section
Sulfides to 70%
massive below 279'7"
TD 322'6"
DRILL HOLE E-52-2
peg
sch
mble & peg
hnbd sch & mble
hnbd sch
mble
mica sch
hnbd sch
perid
sulfides to 35%
400'
TD 420'
Hole No. E-52-2
Location 52.2S - 6.2E
Crawford Pond
Angle -60°
Azimuth N.7.2° W
Depth 420'
Elevation 120' above sea level
5-14-61 to 5-31-61
Base Line
40S
52S
55S
60S
64S
80S
100S
CRAWFORD POND
N
Drill Hole Location Map
E 3
E 52 2
E 4
E 60 2
Scale 4 in ± 1 mile
Traverse 60 SOUTH Approx.
2.5E
3.0E
3.5E
4.0E
4.5E
5.0E
5.5E
Lake Level
DRILL HOLE E-4 May 1960
Ultra-basic Section
Sulfides to 70%
Sulfides to 30%
To mineralized Sill
TD 435'
DRILL HOLE E-60-2
soil
peg
sch
mble & dolo
mble
mica sch
mble & peg
sch & peg
hnbd. sch
perid
sulfides 60% to 70%
TD 420'
Hole No. E-60-2
Location 60S - 5.52E
Crawford Pond
Angle -60°
Azimuth N.63° 30'W
Depth 420'
Elevation 120' above sea level
5-1-61 to 5-13-61
LEGEND
Pegmatite
Marble & Dolomite
Quartz-biotite schist
Quartz-biotite-chlorite schist
Hornblend schist
Gabbro
Peridotite
Massive sulfides
Sulfides
Pyrrhotite
Garnet
Graphite
Calcite on fractures
May 1961
Rockport, Maine
Stage I
Area I
ROLAND F. BEERS, INC. Alexandria, Va.
DRILL HOLE CROSS SECTIONS
E-60-2 & E-52-2
County KNOX
Twnp UNION
Scale 1"=20'



DRILL HOLE DATA

Hole No.	Location	Angle	Depth	Elevation	Bearing	Date
E-55-1	54.9 S. + 5.30 E.	-60°	363'	+110'	N. 72° W.	6-1-61 to 6-10-61
E-55-2	54.9 S. + 5.60 E.	-45°	420'	+120'	N. 72° W.	10-1-61 to 10-15-61
E-55-3	54.9 S. 5.60 E.	-77°	461'	+120'	N. 72° W.	10-15-61 to 10-31-61

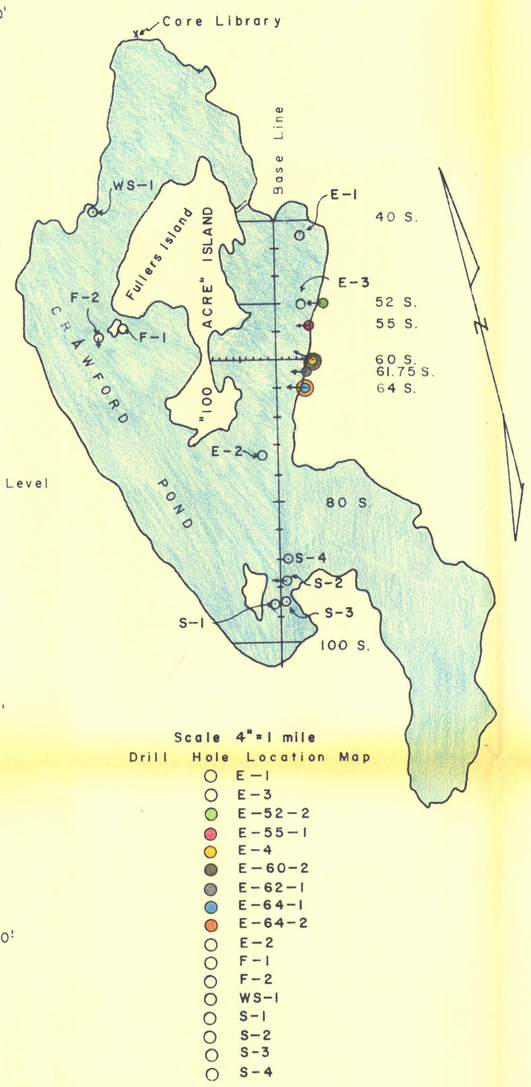
Drill Hole
E – 62 – 1

Traverse 61.75 South

1.5 E | 2.0 E | 2.5 E | 3.0 E | 3.5 E | 4.0 E | 4.5 E | 4.7 E

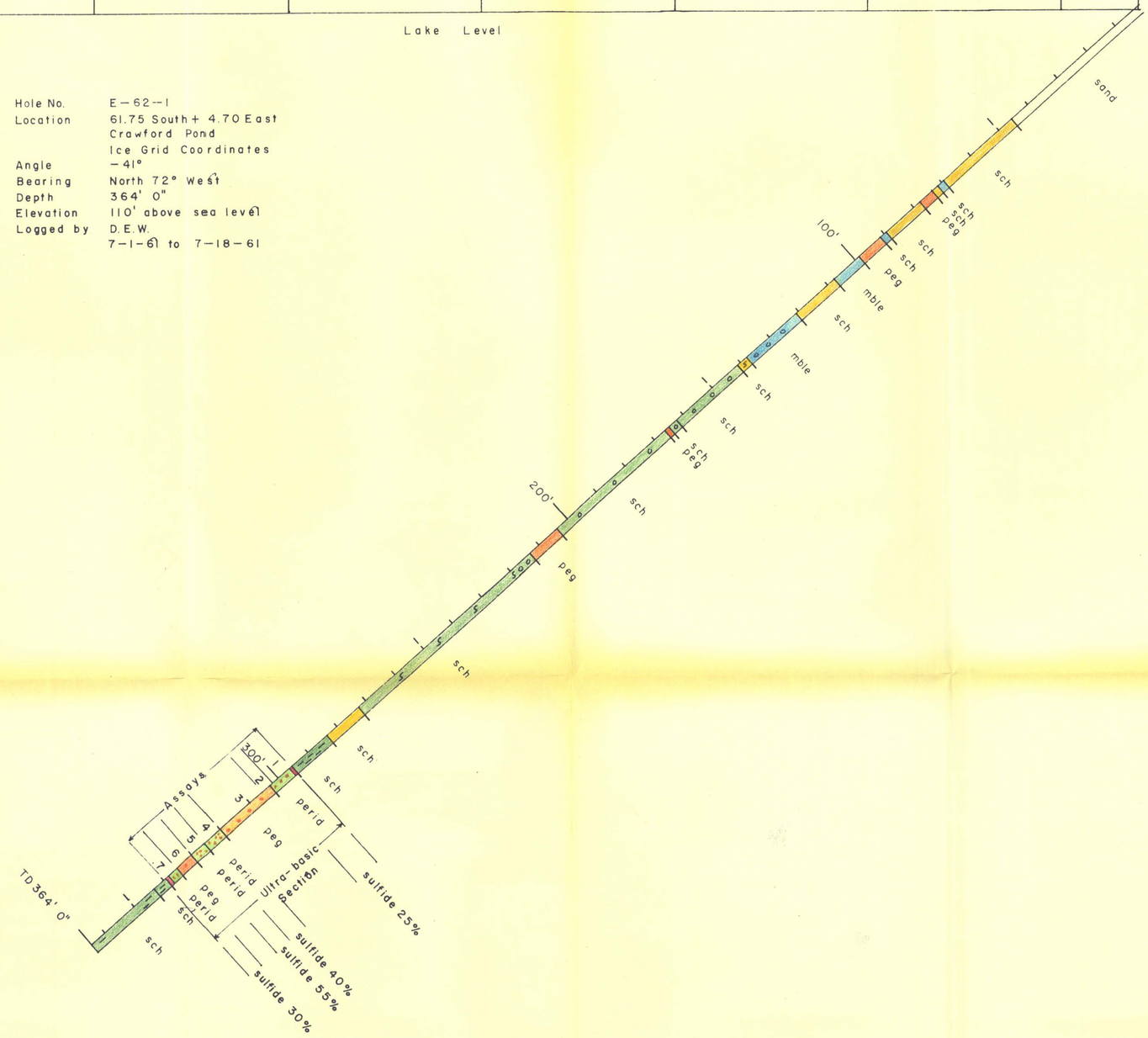
Lake Level

Hole No.	E – 62 – 1
Location	61.75 South + 4.70 East Crawford Pond Ice Grid Coordinates
Angle	– 41°
Bearing	North 72° West
Depth	364' 0"
Elevation	110' above sea level
Logged by	D.E.W. 7-1-61 to 7-18-61



Scale 4" = 1 mile
Drill Hole Location Map

- E – 1
- E – 3
- E – 52 – 2
- E – 55 – 1
- E – 4
- E – 60 – 2
- E – 62 – 1
- E – 64 – 1
- E – 64 – 2
- E – 2
- F – 1
- F – 2
- WS – 1
- S – 1
- S – 2
- S – 3
- S – 4

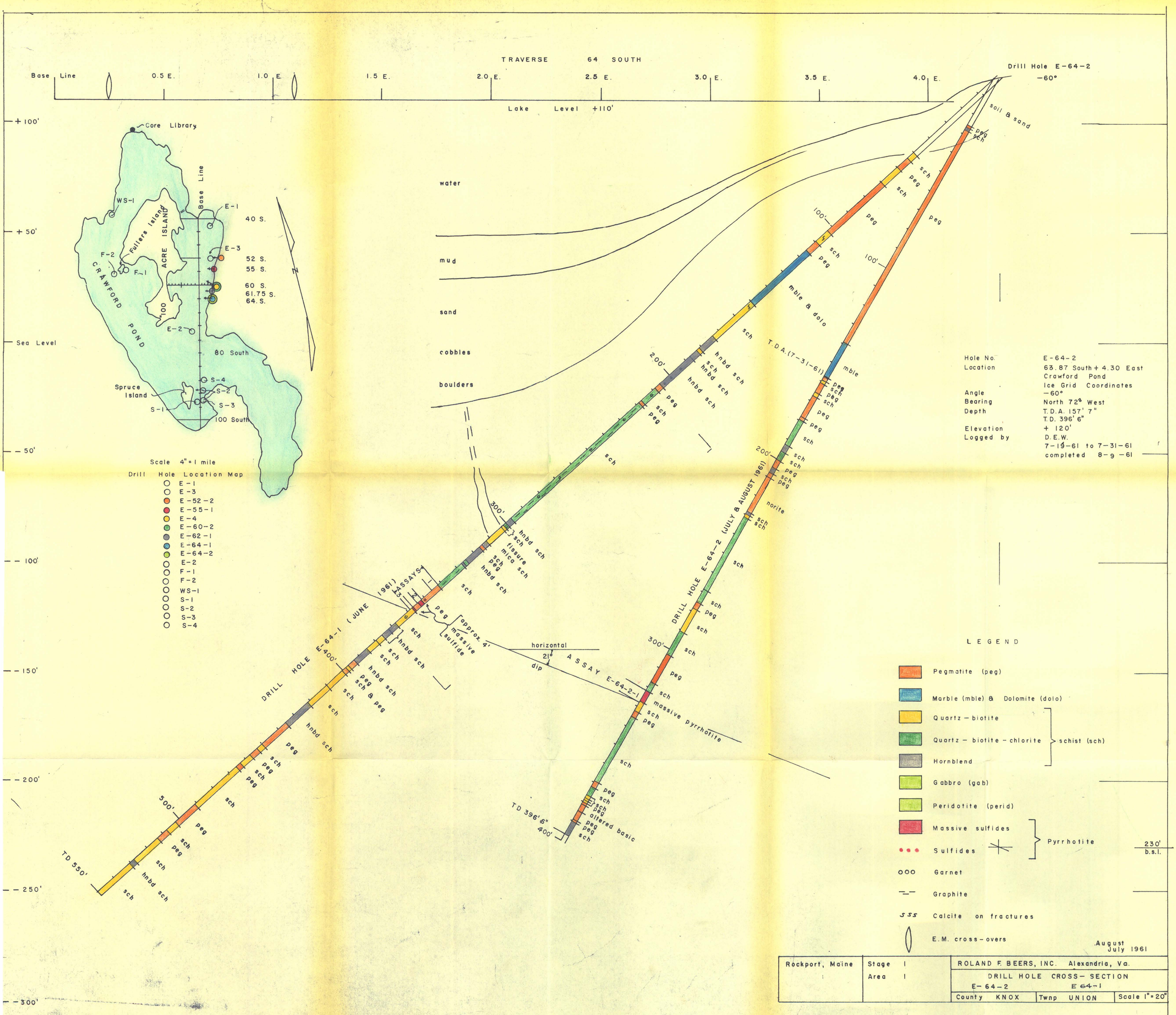


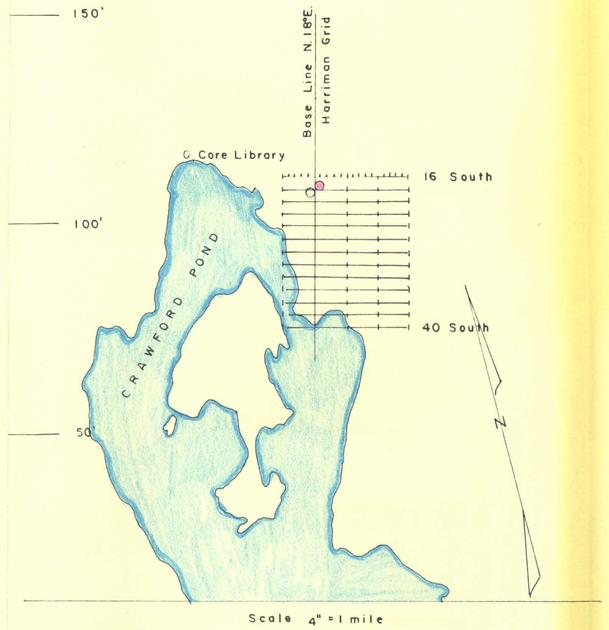
LEGEND

- Pegmatite (peg)
- Marble (mble) & Dolomite (dolo)
- Quartz – biotite schist (sch)
- Quartz – biotite – chlorite schist (sch)
- Hornblend schist (hnbd sch)
- Gabbro (gab)
- Peridotite (perid)
- Massive sulfides } Pyrrhotite
- Sulfides } Pyrrhotite
- Garnet (gar)
- Graphite
- Calcite on fractures
- E. M. Cross – over

JULY 1961

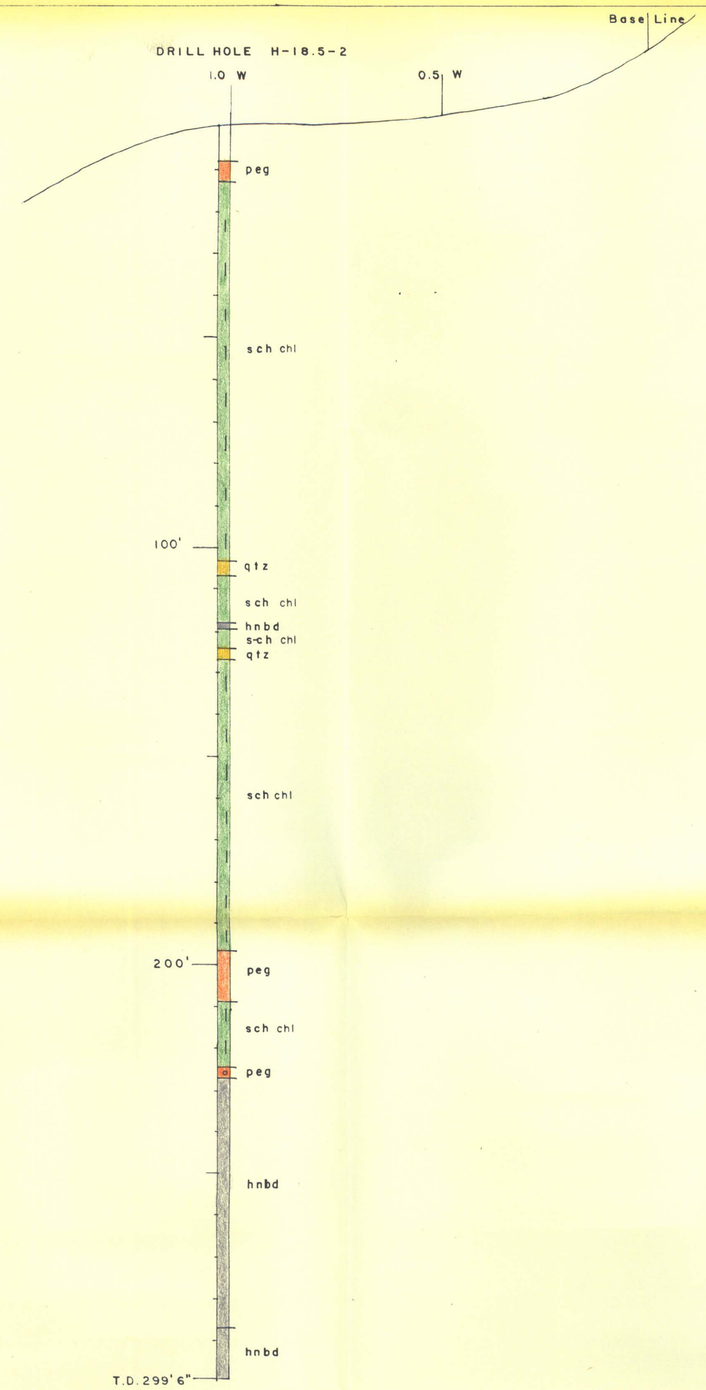
Rockport, Maine	Stage I Area I	ROLAND F. BEERS, INC. Alexandria, Va. DRILL HOLE CROSS SECTION E – 62 – 1 County KNOX · Twnp. UNION · Scale 1" = 20'

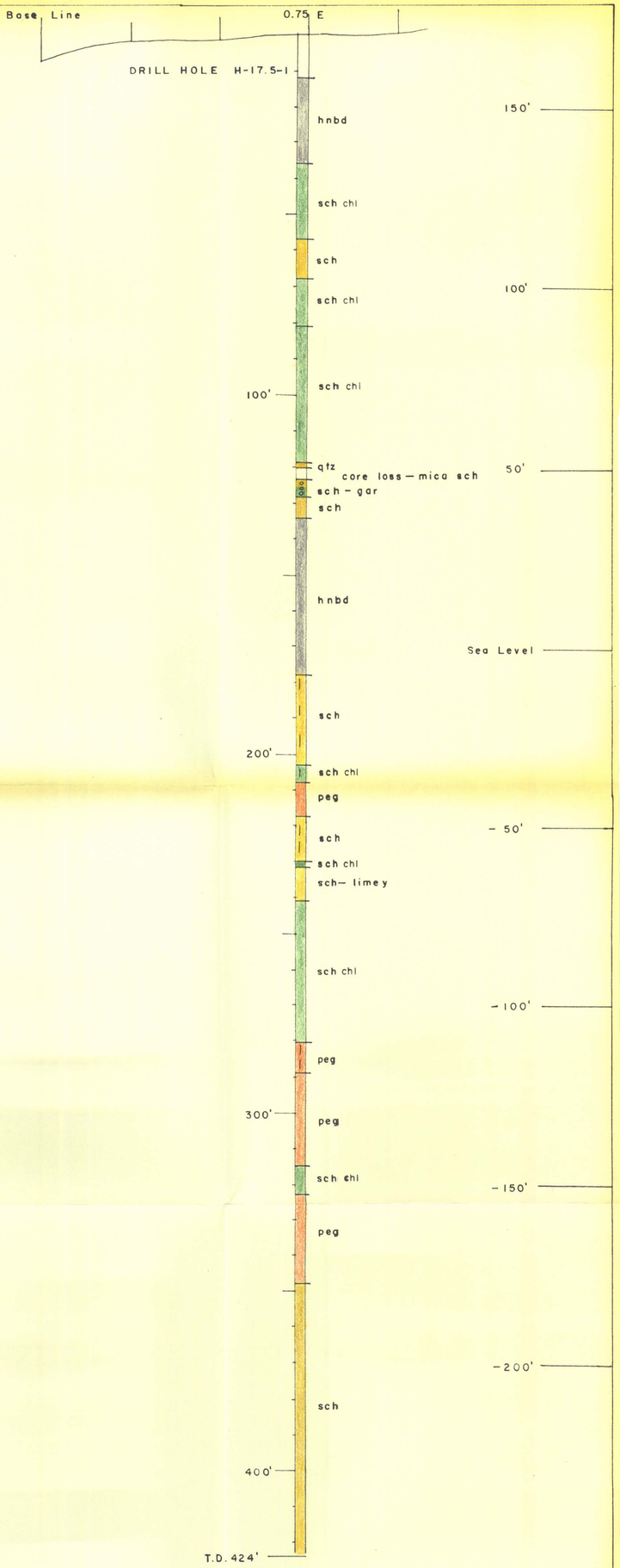

TRAVERSE 64 SOUTH
Base Line
0.5 E.
1.0 E.
1.5 E.
2.0 E.
2.5 E.
3.0 E.
3.5 E.
4.0 E.
Lake Level +110'
Drill Hole E-64-2
-60°
+100'
+50'
Sea Level
-50'
-100'
-150'
-200'
-250'
-300'
Core Library
WS-1
Fullers Island
ACRE ISLAND
Base Line
E-1
40 S.
E-3
52 S.
55 S.
60 S.
61.75 S.
64.S.
F-2
F-1
CRAWFORD POND
100
E-2
80 South
S-4
Spruce Island
S-2
S-3
S-1
100 South
Scale 4" = 1 mile
Drill Hole Location Map
E-1
E-3
E-52-2
E-55-1
E-4
E-60-2
E-62-1
E-64-1
E-64-2
E-2
F-1
F-2
WS-1
S-1
S-2
S-3
S-4
water
mud
sand
cobbles
boulders
soil & sand
peg
sch
mble & dolo
T.D.A. (7-31-61)
mble
hnbd sch
tissure
mica sch
norite
altered basic
DRILL HOLE E-64-2 (JULY & AUGUST 1961)
DRILL HOLE E-64-1 (JUNE 1961)
ASSAYS
43
approx. 4' massive sulfide
horizontal
21°
dip
ASSAY E-64-2-1
massive pyrrhotite
sch & peg
TD 550'
TD 396' 6"
100'
200'
300'
400'
500'
Hole No. E-64-2
Location 63.87 South + 4.30 East
Crawford Pond
Ice Grid Coordinates
Angle -60°
Bearing North 72° West
Depth T.D.A. 157' 7"
T.D. 396' 6"
Elevation + 120'
Logged by D.E.W.
7-19-61 to 7-31-61
completed 8-9-61
LEGEND
Pegmatite (peg)
Marble (mble) & Dolomite (dolo)
Quartz - biotite
Quartz - biotite - chlorite
Hornblend
schist (sch)
Gabbro (gab)
Peridotite (perid)
Massive sulfides
Sulfides
Pyrrhotite
Garnet
Graphite
Calcite on fractures
E.M. cross-overs
230' b.s.l.
August
July 1961
Rockport, Maine
Stage 1
Area 1
ROLAND F. BEERS, INC. Alexandria, Va.
DRILL HOLE CROSS-SECTION
E-64-2
E 64-1
County KNOX
Twnp UNION
Scale 1" = 20'



DRILL HOLE LOCATION MAP

○ H-18.5-2 MARCH 1962
● H-17.5-1 APRIL 1962





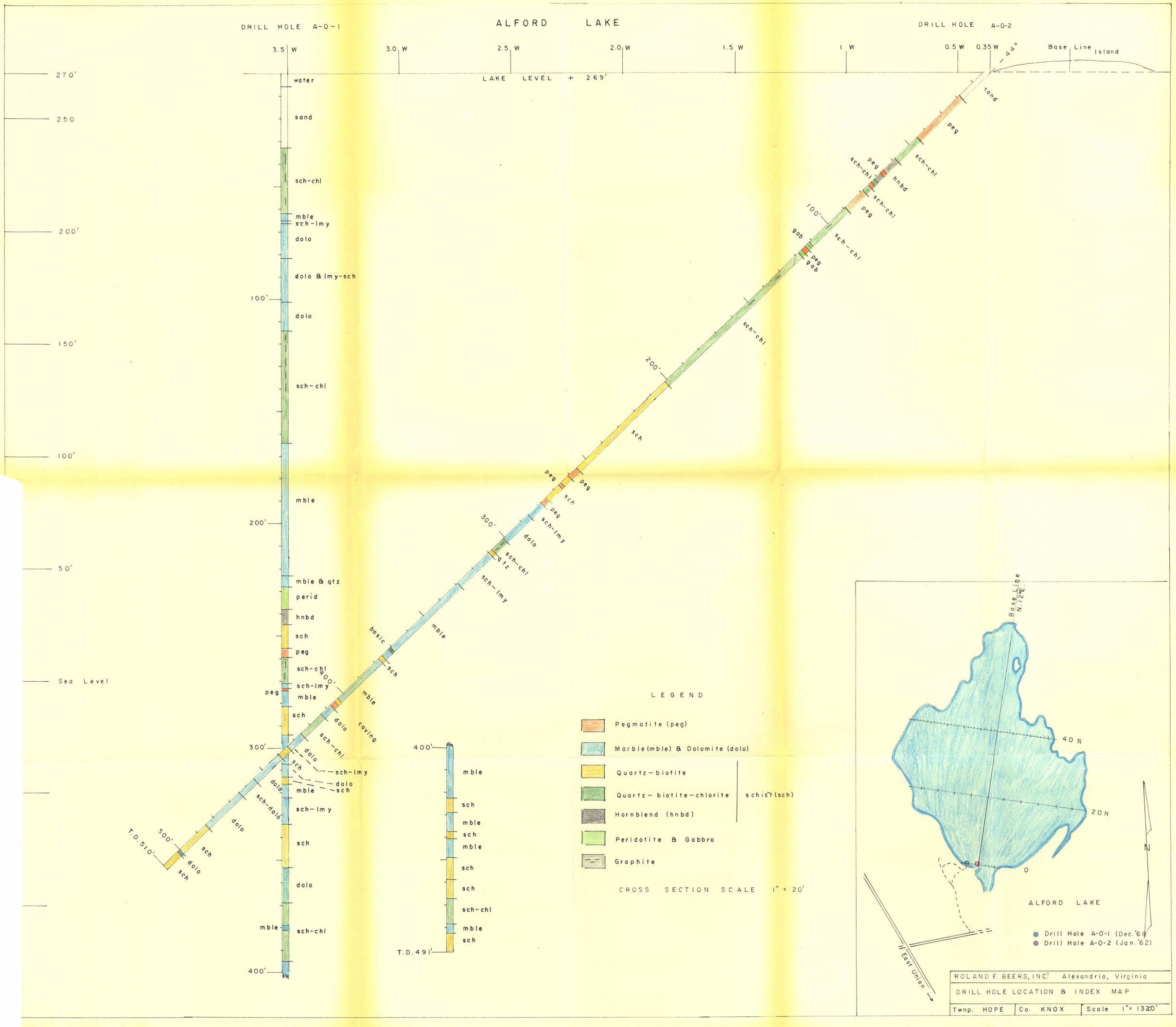
LEGEND

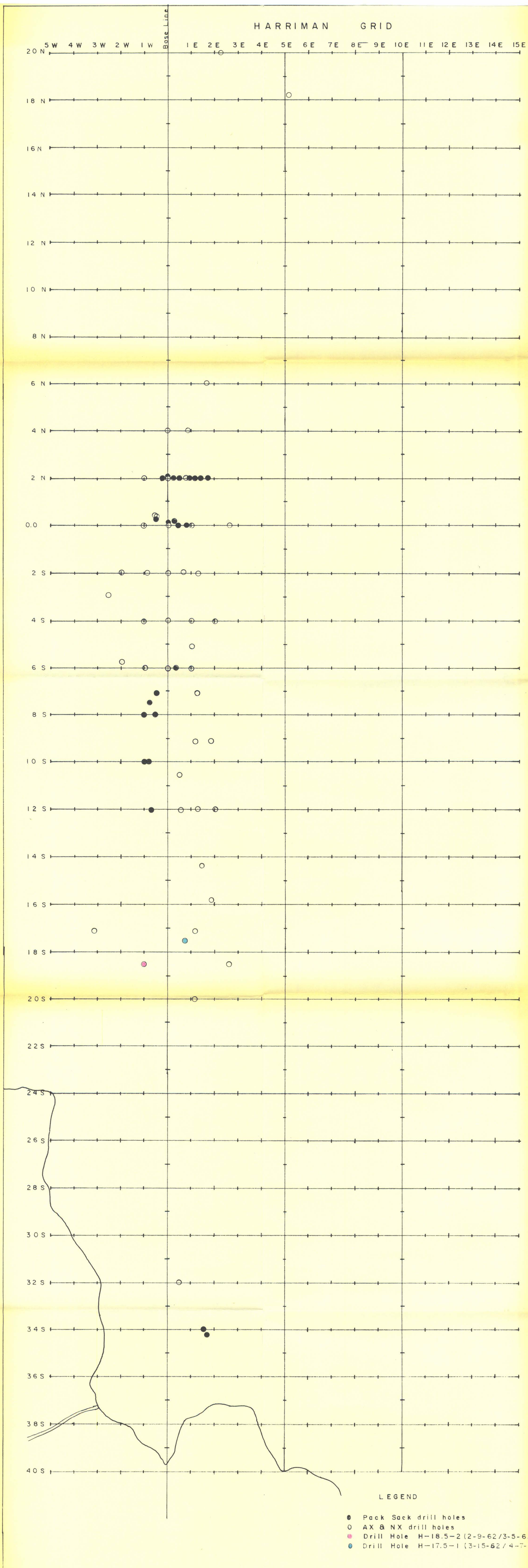
- Pegmatite (peg)
- Marble (mble) & Dolomite (dolo)
- Quartz-biotite
- Quartz-biotite-chlorite } Schist (sch)
- Hornblend (hnbd)
- ooo Garnet
- — — Graphite
- sss Calcite

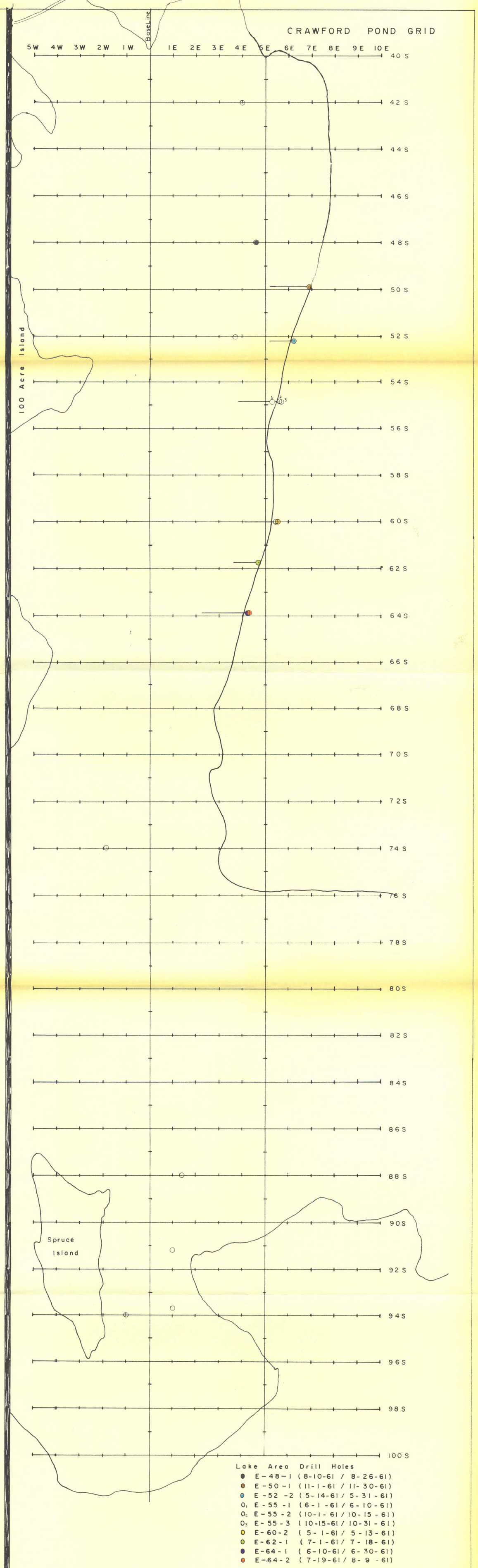
Rockport, Maine	Area 1	ROLAND F. BEERS, INC. Alexandria, Virginia DRILL HOLE CROSS-SECTIONS H-18.5-2 & H-17.5-1 County KNOX · Twnp UNION · Scale 1" = 20'

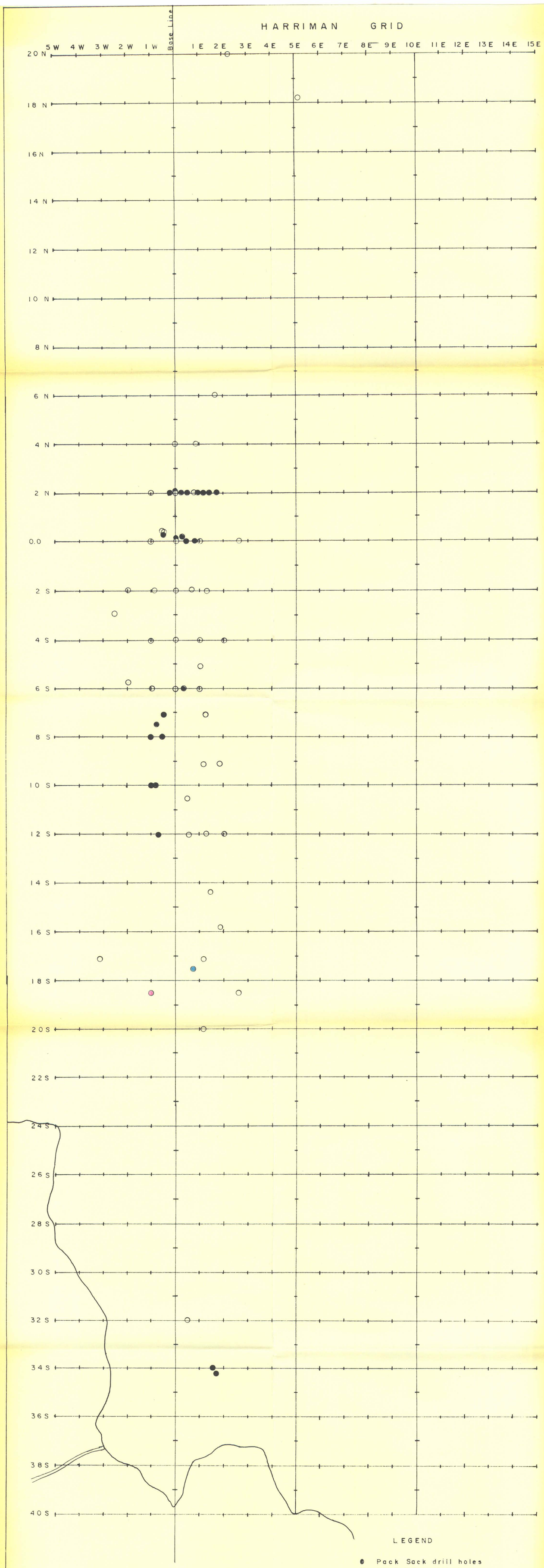
DRILL HOLE	LOCATION	ANGLE	TOTAL DEPTH	ELEV.
H-18.5-2	18.5 South + 1.0 West	-90°	299' 6"	151.3'
H-17.5-1	17.5 South + 0.75 East	-90°	424' 0"	161.8'

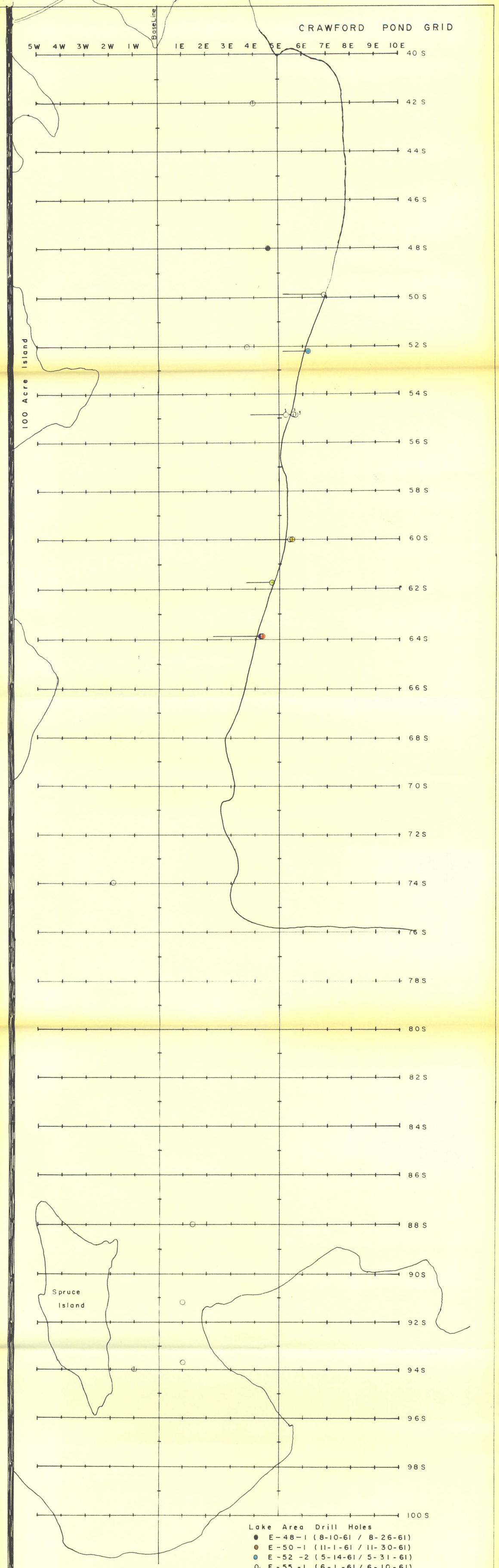
H-18.5-2 MARCH 1962
H-17.5-1 APRIL 1962

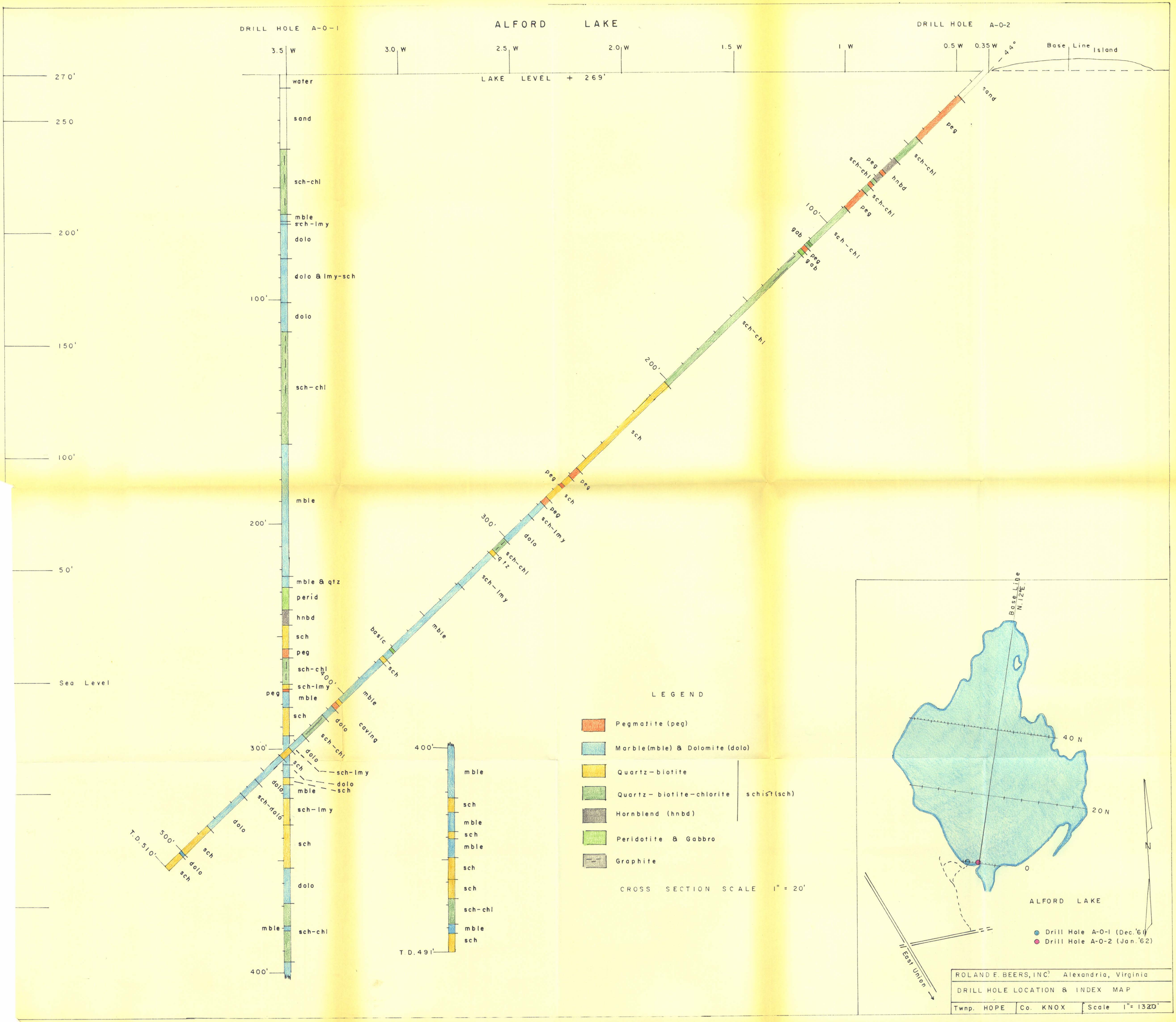

ALFORD LAKE
DRILL HOLE A-0-1
DRILL HOLE A-0-2
3.5 W
3.0 W
2.5 W
2.0 W
1.5 W
1 W
0.5 W
0.35 W
44°
Base Line
Island
LAKE LEVEL + 269'
270'
250
200'
150'
100'
50'
Sea Level
300'
400'
500'
T.D. 510'
T.D. 491'
water
sand
sch-chl
mble
sch-lmy
dolo
dolo & lmy-sch
mble & qtz
perid
hnbd
sch
peg
sch-dolo
basic
caving
qtz
gab
LEGEND
Pegmatite (peg)
Marble (mble) & Dolomite (dolo)
Quartz-biotite
Quartz-biotite-chlorite
Hornblend (hnbd)
schist (sch)
Peridotite & Gabbro
Graphite
CROSS SECTION SCALE 1" = 20'
Base Line N. 12° E.
40 N
20 N
0
N
ALFORD LAKE
Drill Hole A-0-1 (Dec. '61)
Drill Hole A-0-2 (Jan. '62)
East Union
ROLAND E. BEERS, INC. Alexandria, Virginia
DRILL HOLE LOCATION & INDEX MAP
Twnp. HOPE
Co. KNOX
Scale 1" = 1320'

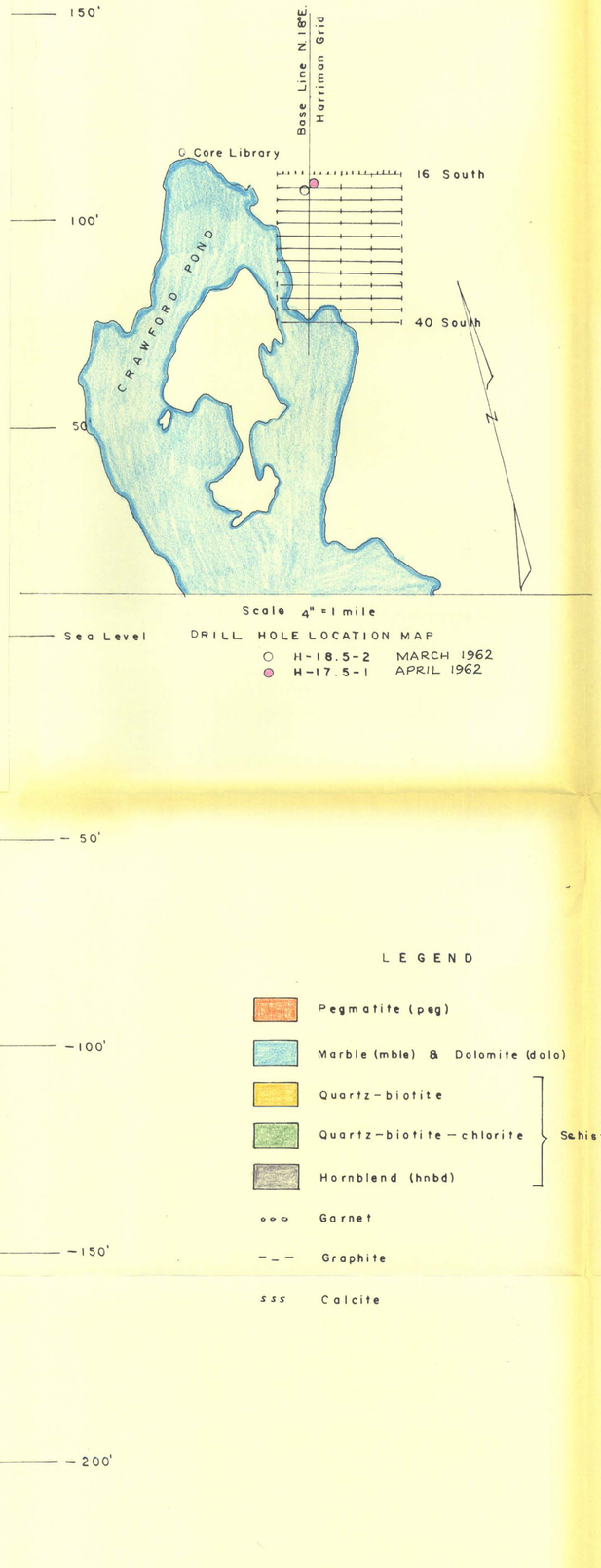

HARRIMAN GRID
Base Line
5W 4W 3W 2W 1W 1E 2E 3E 4E 5E 6E 7E 8E 9E 10E 11E 12E 13E 14E 15E
20 N
18 N
16 N
14 N
12 N
10 N
8 N
6 N
4 N
2 N
0.0
2 S
4 S
6 S
8 S
10 S
12 S
14 S
16 S
18 S
20 S
22 S
24 S
26 S
28 S
30 S
32 S
34 S
36 S
38 S
40 S
LEGEND
Pack Sack drill holes
AX & NX drill holes
Drill Hole H-18.5-2 (2-9-62/3-5-62)
Drill Hole H-17.5-1 (3-15-62/4-7-62)

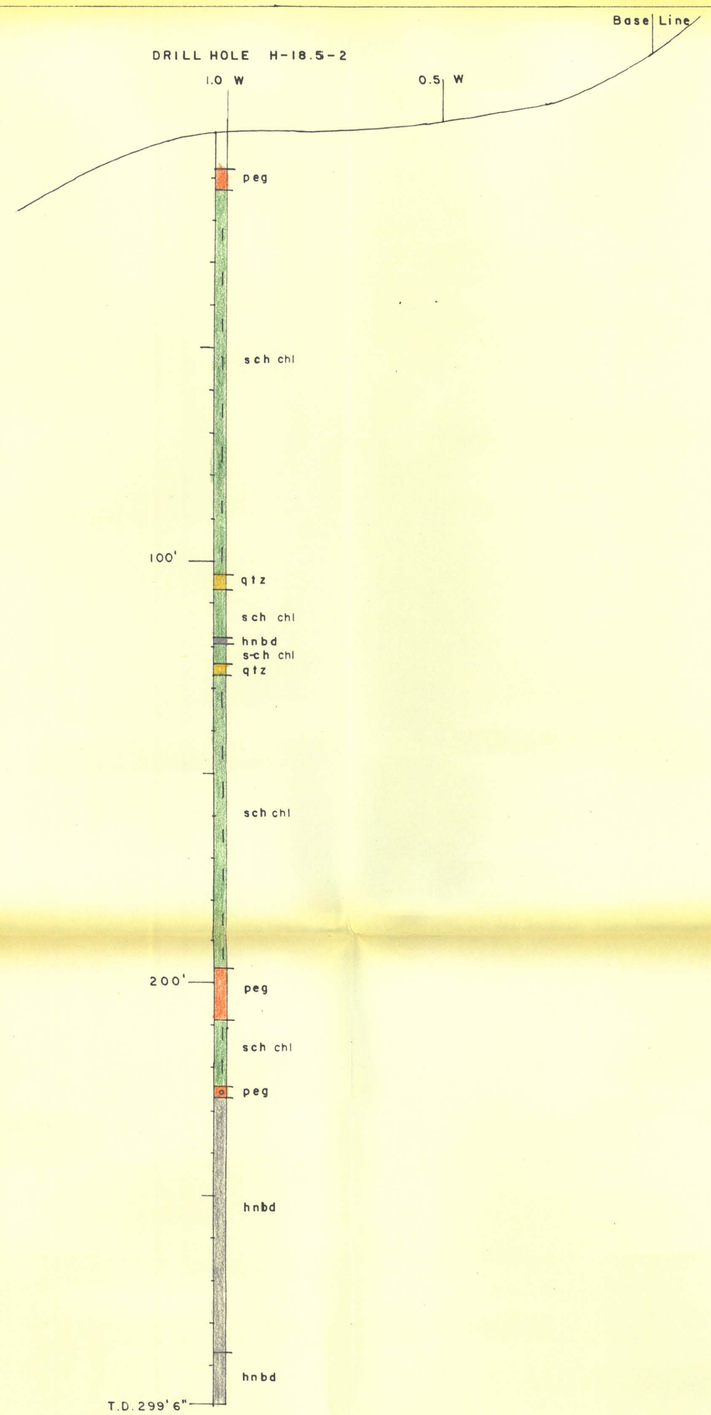

CRAWFORD POND GRID
Base Line
5W 4W 3W 2W 1W 1E 2E 3E 4E 5E 6E 7E 8E 9E 10E
40 S
42 S
44 S
46 S
48 S
50 S
52 S
54 S
56 S
58 S
60 S
62 S
64 S
66 S
68 S
70 S
72 S
74 S
76 S
78 S
80 S
82 S
84 S
86 S
88 S
90 S
92 S
94 S
96 S
98 S
100 S
100 Acre Island
Spruce Island
Lake Area Drill Holes
E-48-1 (8-10-61 / 8-26-61)
E-50-1 (11-1-61 / 11-30-61)
E-52-2 (5-14-61 / 5-31-61)
O1 E-55-1 (6-1-61 / 6-10-61)
O2 E-55-2 (10-1-61 / 10-15-61)
O3 E-55-3 (10-15-61 / 10-31-61)
E-60-2 (5-1-61 / 5-13-61)
E-62-1 (7-1-61 / 7-18-61)
E-64-1 (6-10-61 / 6-30-61)
E-64-2 (7-19-61 / 8-9-61)

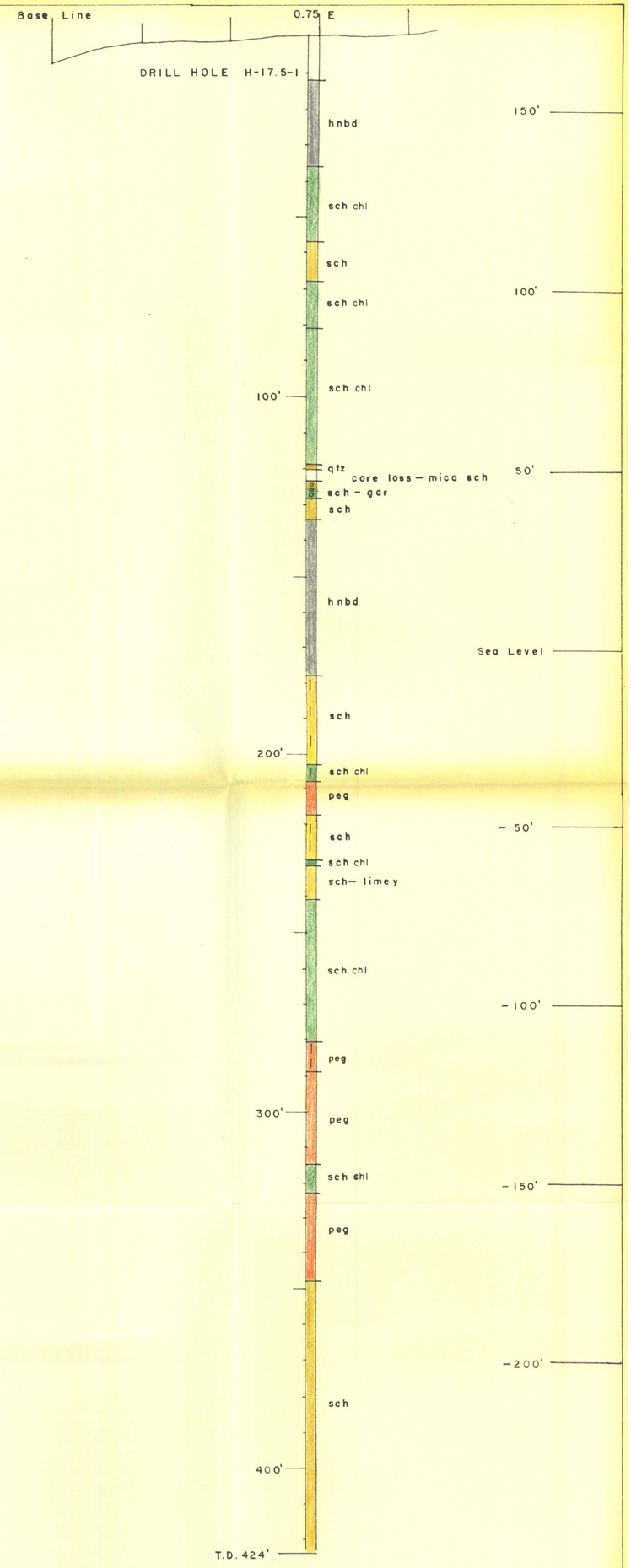

HARRIMAN GRID
Base Line
5W 4W 3W 2W 1W 1E 2E 3E 4E 5E 6E 7E 8E 9E 10E 11E 12E 13E 14E 15E
20 N
18 N
16 N
14 N
12 N
10 N
8 N
6 N
4 N
2 N
0.0
2 S
4 S
6 S
8 S
10 S
12 S
14 S
16 S
18 S
20 S
22 S
24 S
26 S
28 S
30 S
32 S
34 S
36 S
38 S
40 S
LEGEND
Pack Sack drill holes
AX & NX drill holes
Drill Hole H-18.5-2 (2-9-62/3-5-62)
Drill Hole H-17.5-1 (3-15-62/4-7-62)


CRAWFORD POND GRID
Base Line
5W 4W 3W 2W 1W 1E 2E 3E 4E 5E 6E 7E 8E 9E 10E
40 S
42 S
44 S
46 S
48 S
50 S
52 S
54 S
56 S
58 S
60 S
62 S
64 S
66 S
68 S
70 S
72 S
74 S
76 S
78 S
80 S
82 S
84 S
86 S
88 S
90 S
92 S
94 S
96 S
98 S
100 S
100 Acre Island
Spruce Island
Lake Area Drill Holes
E-48-1 (8-10-61 / 8-26-61)
E-50-1 (11-1-61 / 11-30-61)
E-52-2 (5-14-61 / 5-31-61)
O1 E-55-1 (6-1-61 / 6-10-61)
O2 E-55-2 (10-1-61 / 10-15-61)
O3 E-55-3 (10-15-61 / 10-31-61)
E-60-2 (5-1-61 / 5-13-61)
E-62-1 (7-1-61 / 7-18-61)
E-64-1 (6-10-61 / 6-30-61)
E-64-2 (7-19-61 / 8-9-61)


ALFORD LAKE
DRILL HOLE A-0-1
DRILL HOLE A-0-2
3.5 W
3.0 W
2.5 W
2.0 W
1.5 W
1 W
0.5 W
0.35 W
44°
Base Line
Island
LAKE LEVEL + 269'
270'
250
200'
150'
100'
50'
Sea Level
water
sand
sch-chl
mble
sch-lmy
dolo
dolo & lmy-sch
mble & qtz
perid
hnbd
sch
peg
T.D. 510'
T.D. 491'
caving
basic
sch-dolo
qtz
sand
hnbd
gab
LEGEND
Pegmatite (peg)
Marble (mble) & Dolomite (dolo)
Quartz-biotite
Quartz-biotite-chlorite
Hornblend (hnbd)
schist (sch)
Peridotite & Gabbro
Graphite
CROSS SECTION SCALE 1" = 20'
Base Line N.12°E.
40 N
20 N
0
N
East Union
ALFORD LAKE
Drill Hole A-0-1 (Dec.'61)
Drill Hole A-0-2 (Jan.'62)
ROLAND E. BEERS, INC. Alexandria, Virginia
DRILL HOLE LOCATION & INDEX MAP
Twnp. HOPE
Co. KNOX
Scale 1" = 1320'



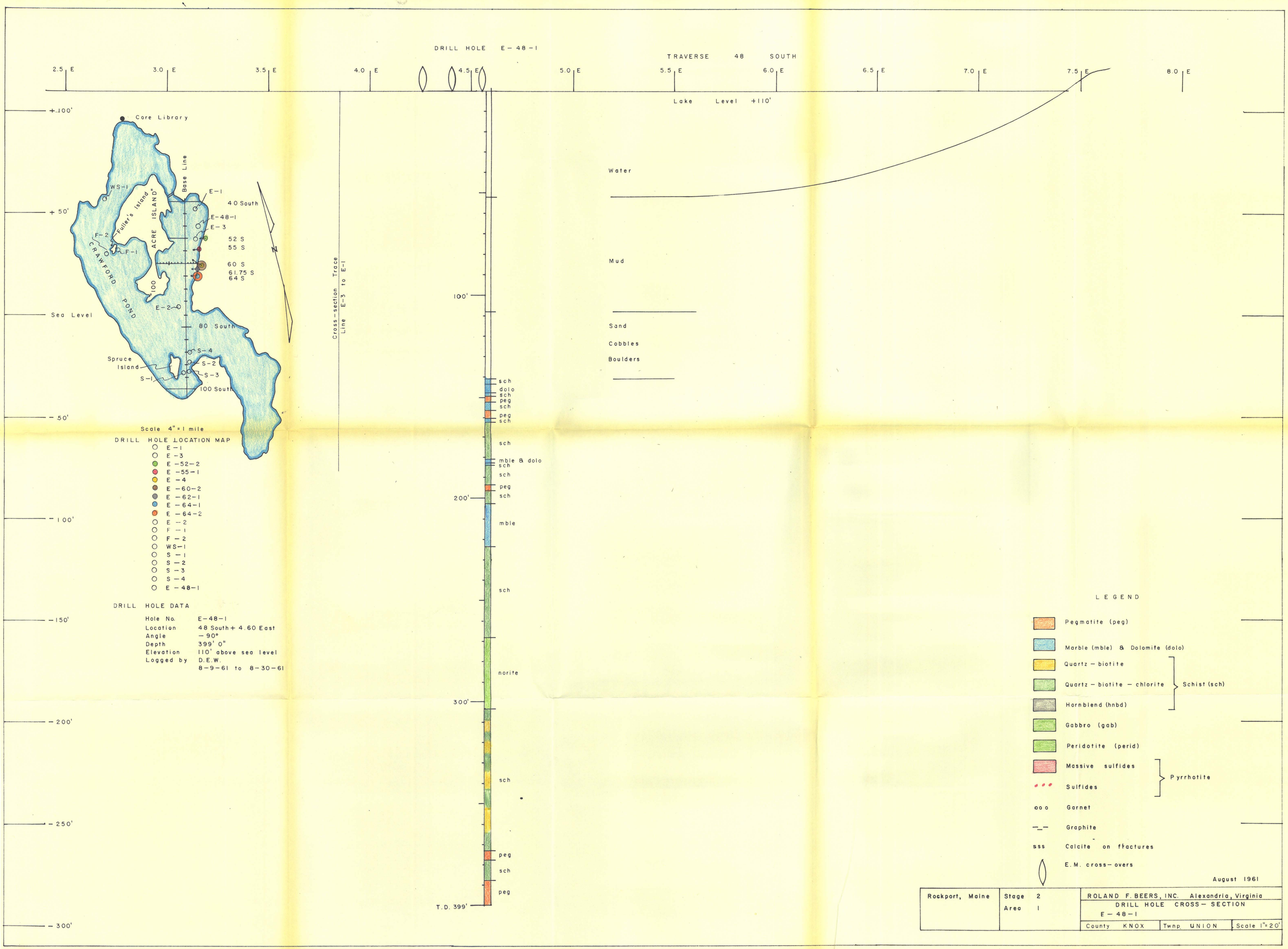




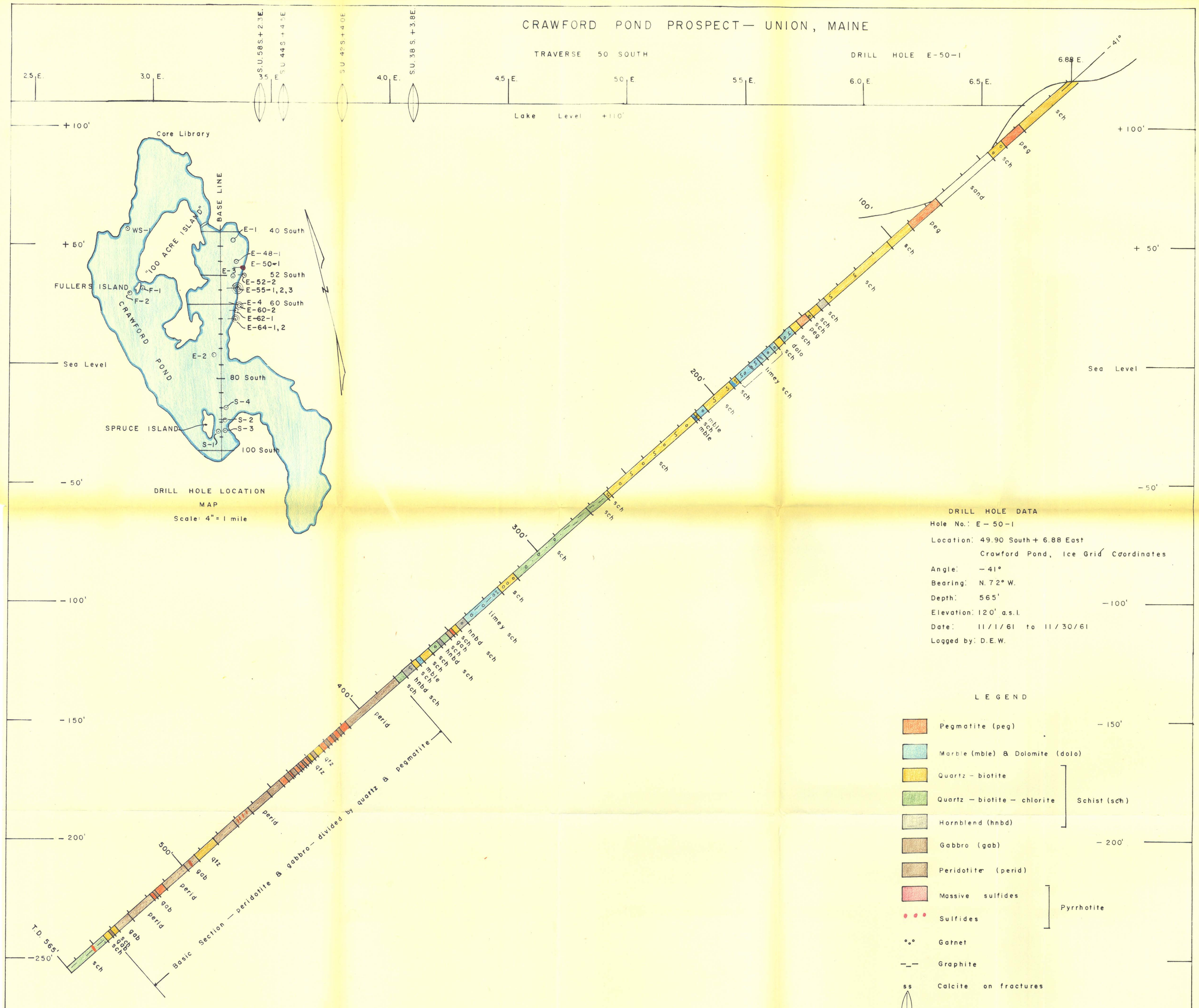
Rockport, Maine	Area 1	ROLAND F. BEERS, INC. Alexandria, Virginia DRILL HOLE CROSS-SECTIONS H-18.5-2 & H-17.5-1 County KNOX · Twnp UNION · Scale 1" = 20'

DRILL HOLE	LOCATION	ANGLE	TOTAL DEPTH	ELEV.
H-18.5-2	18.5 South + 1.0 West	-90°	299' 6"	151.3'
H-17.5-1	17.5 South + 0.75 East	-90°	424' 0"	161.8'

H-18.5-2 MARCH 1962
H-17.5-1 APRIL 1962


DRILL HOLE E-48-1
TRAVERSE 48 SOUTH
2.5 E
3.0 E
3.5 E
4.0 E
4.5 E
5.0 E
5.5 E
6.0 E
6.5 E
7.5 E
8.0 E
Lake Level +110'
+100'
+50'
Sea Level
-50'
-100'
-150'
-200'
-250'
-300'
Core Library
Base Line
WS-1
Fuller's Island
"ACRE ISLAND"
E-1
40 South
E-48-1
E-3
52 S
55 S
60 S
61.75 S
64 S
F-2
F-1
CRAWFORD POND
100
E-2
80 South
S-4
Spruce Island
S-2
S-3
S-1
100 South
N
Scale 4" = 1 mile
DRILL HOLE LOCATION MAP
E-1
E-3
E-52-2
E-55-1
E-4
E-60-2
E-62-1
E-64-1
E-64-2
E-2
F-1
F-2
WS-1
S-1
S-2
S-3
S-4
E-48-1
DRILL HOLE DATA
Hole No. E-48-1
Location 48 South + 4.60 East
Angle -90°
Depth 399' 0"
Elevation 110' above sea level
Logged by D.E.W.
8-9-61 to 8-30-61
Cross-section Trace
Line E-3 to E-1
100'
200'
300'
T.D. 399'
sch
dolo
sch
peg
sch
peg
sch
sch
mble & dolo
sch
sch
peg
sch
mble
sch
norite
sch
peg
sch
peg
Water
Mud
Sand
Cobbles
Boulders
LEGEND
Pegmatite (peg)
Marble (mble) & Dolomite (dolo)
Quartz - biotite
Quartz - biotite - chlorite
Hornblend (hnbd)
Schist (sch)
Gabbro (gab)
Peridotite (perid)
Massive sulfides
Sulfides
Pyrrhotite
Garnet
Graphite
Calcite on fractures
E.M. cross-overs
August 1961
Rockport, Maine
Stage 2
Area 1
ROLAND F. BEERS, INC. Alexandria, Virginia
DRILL HOLE CROSS-SECTION
E-48-1
County KNOX
Twnp. UNION
Scale 1"=20'

CRAWFORD POND PROSPECT — UNION, MAINE



DRILL HOLE DATA

Hole No.: E – 50 – 1

Location: 49.90 South + 6.88 East
Crawford Pond, Ice Grid Coordinates

Angle: – 41°

Bearing: N. 72° W.

Depth: 565'

Elevation: 120' a.s.l.

Date: 11/1/61 to 11/30/61

Logged by: D.E.W.

LEGEND

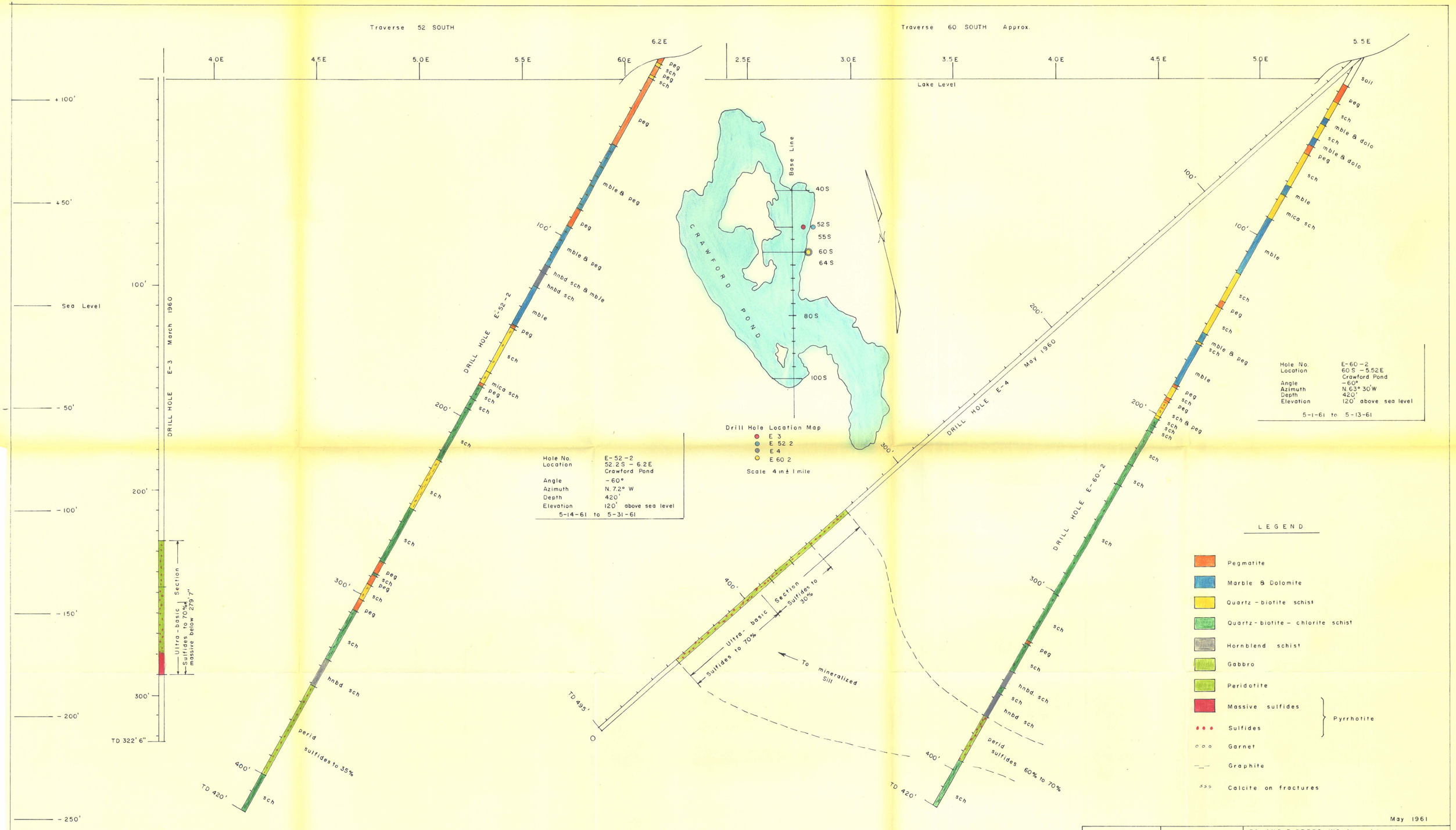
- Pegmatite (peg)
- Marble (mble) & Dolomite (dolo)
- Quartz – biotite
- Quartz – biotite – chlorite
- Hornblend (hnbd)
- Gabbro (gab)
- Peridotite (perid)
- Massive sulfides
- Sulfides
- Garnet
- Graphite
- ss Calcite on fractures
- E.M. cross-over

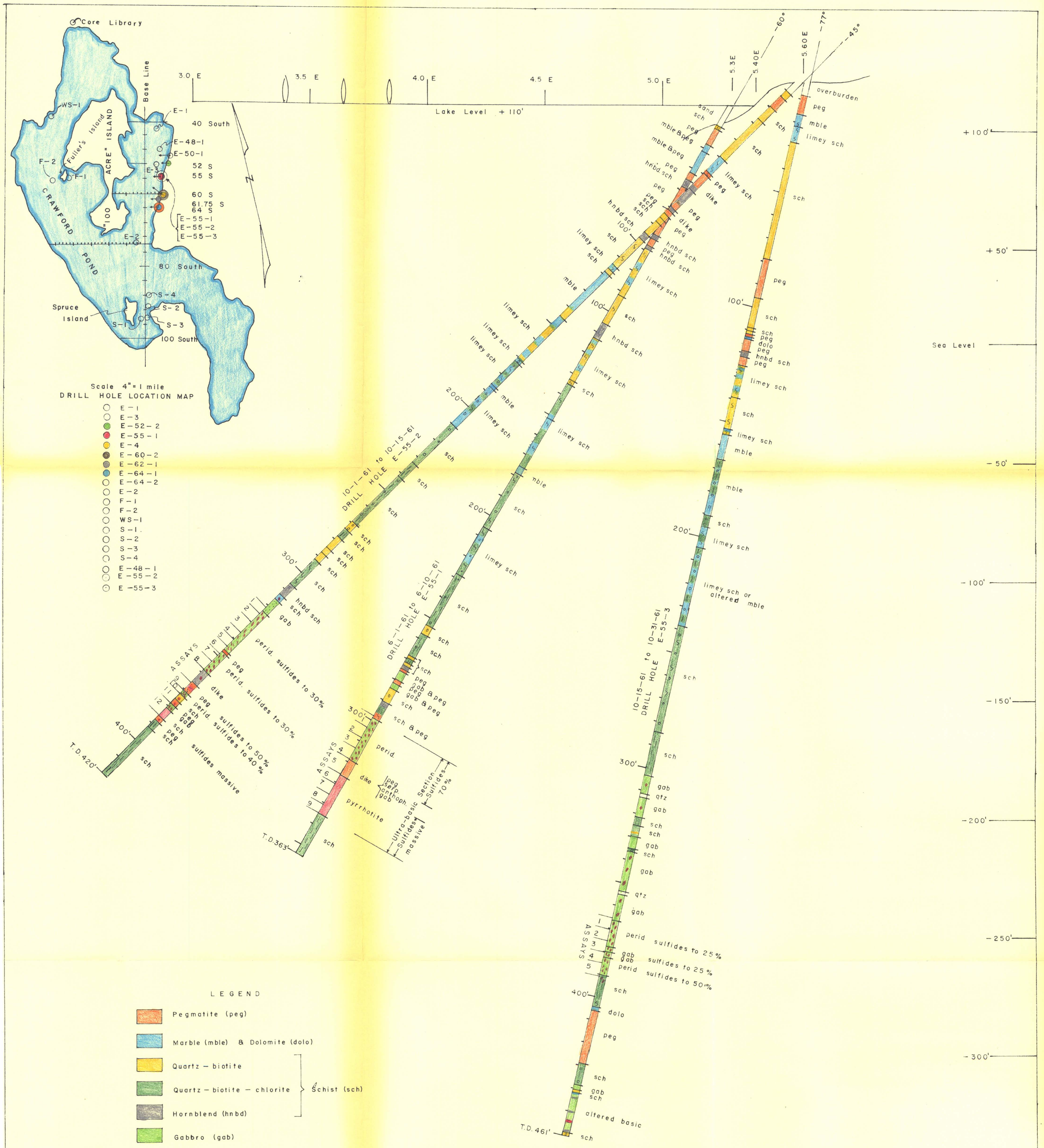
Schist (sch)

Pyrrhotite

December 1961

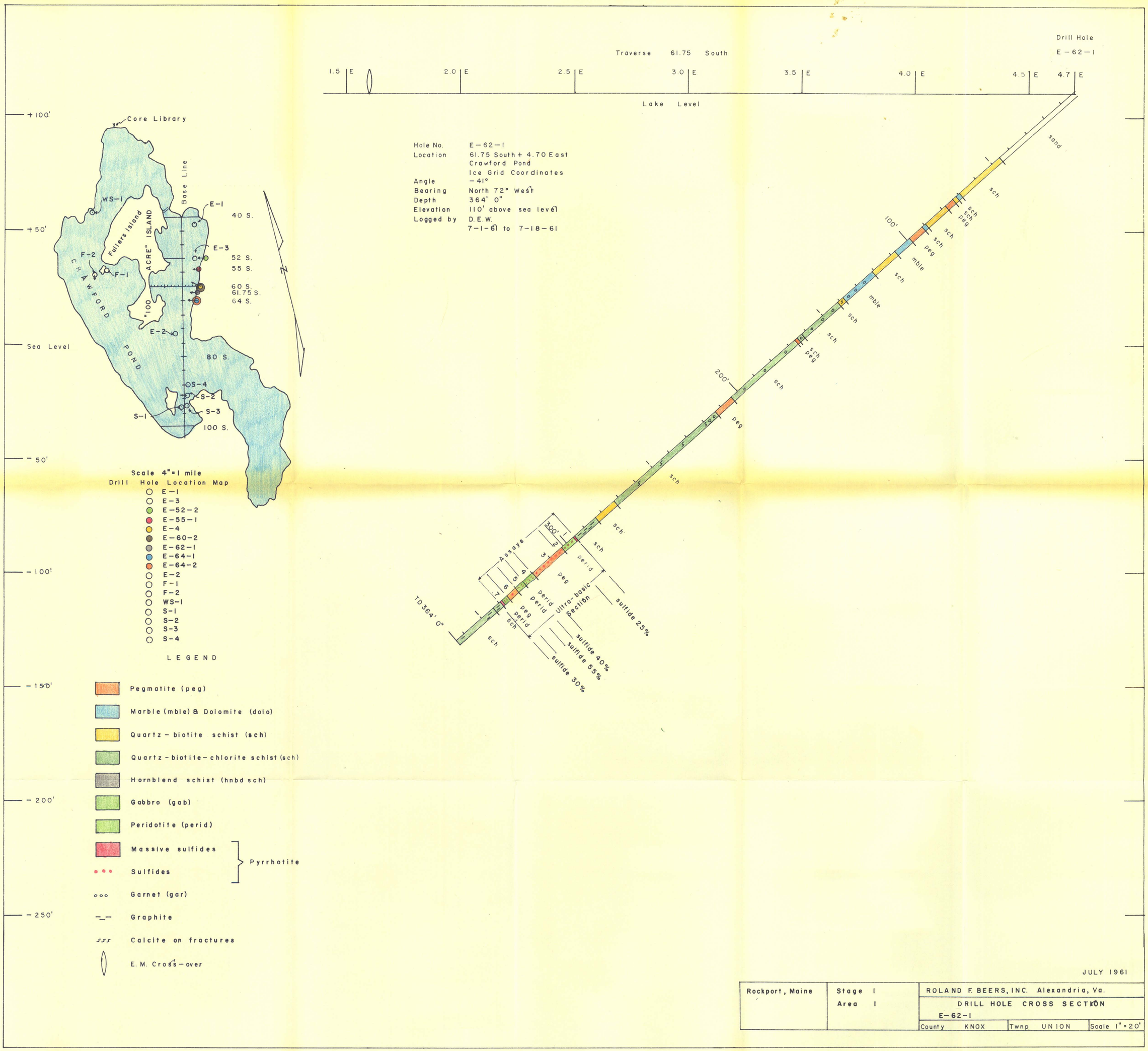
Rockport, Maine	Stage 2	ROLAND F. BEERS, INC. Alexandria, Virginia
DEW	Area 1	DRILL HOLE CROSS – SECTION E – 50 – 1
		County: KNOX · Twnp: UNION · Scale: 1" = 20'

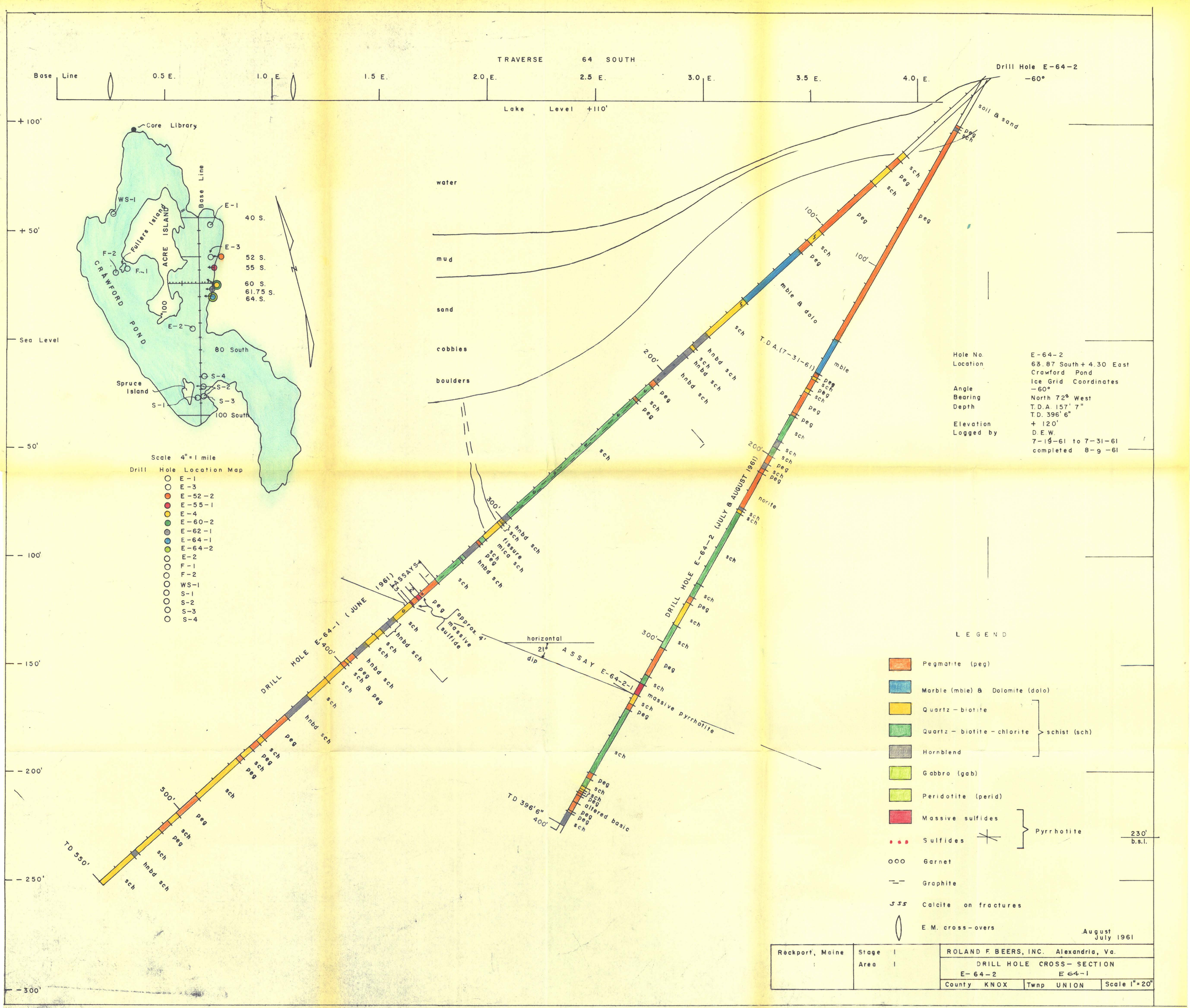

Traverse 52 SOUTH
4.0E
4.5E
5.0E
5.5E
6.2E
+100'
+50'
Sea Level
-50'
-100'
-150'
-200'
-250'
100'
200'
300'
400'
DRILL HOLE E-3 March 1960
Ultra-basic Section
Sulfides to 70% massive below 279'7"
TD 322'6"
DRILL HOLE E-52-2
peg
sch
mble & peg
hnbd sch & mble
hnbd sch
mble
mica sch
perid
sulfides to 35%
TD 420'
Hole No. E-52-2
Location 52.2S - 6.2E Crawford Pond
Angle -60°
Azimuth N. 7.2° W
Depth 420'
Elevation 120' above sea level
5-14-61 to 5-31-61
Base Line
40S
52S
55S
60S
64S
80S
100S
CRAWFORD POND
N
Drill Hole Location Map
E 3
E 52 2
E 4
E 60 2
Scale 4 in ± 1 mile
Traverse 60 SOUTH Approx.
2.5E
3.0E
3.5E
4.0E
4.5E
5.0E
5.5E
Lake Level
DRILL HOLE E-4 May 1960
Ultra-basic Section
Sulfides to 70%
Sulfides to 30%
To mineralized Sill
TD 495'
DRILL HOLE E-60-2
soil
mble & dolo
mica sch
sch & peg
hnbd sch
perid
sulfides 60% to 70%
TD 420'
Hole No. E-60-2
Location 60S - 5.52E Crawford Pond
Angle -60°
Azimuth N. 63° 30'W
Depth 420'
Elevation 120' above sea level
5-1-61 to 5-13-61
LEGEND
Pegmatite
Marble & Dolomite
Quartz - biotite schist
Quartz - biotite - chlorite schist
Hornblend schist
Gabbro
Peridotite
Massive sulfides
Sulfides
Pyrrhotite
Garnet
Graphite
Calcite on fractures
May 1961
Rockport, Maine
Stage I
Area I
ROLAND F. BEERS, INC. Alexandria, Va.
DRILL HOLE CROSS SECTIONS
E-60-2 & E-52-2
County KNOX
Twnp UNION
Scale 1"=20'

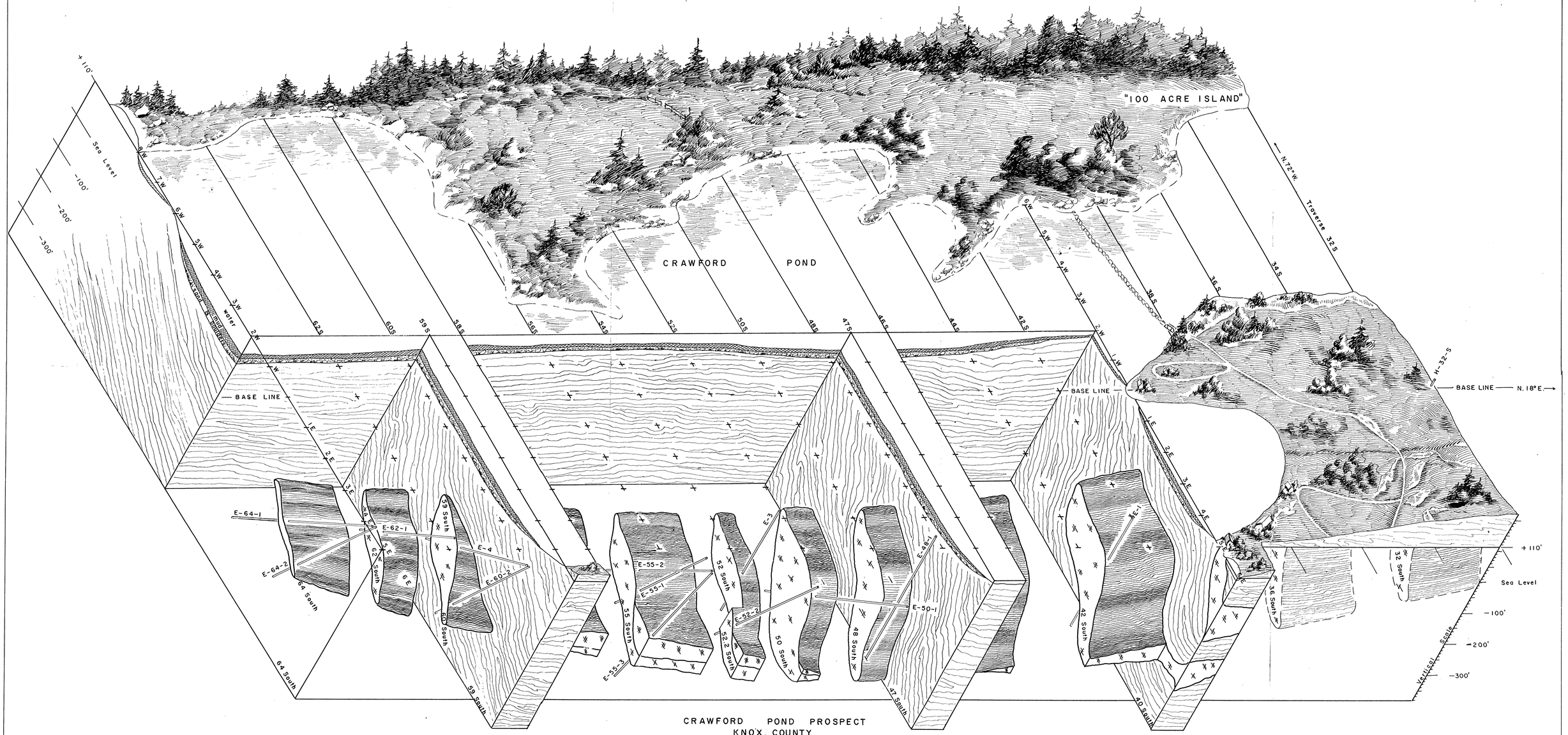


DRILL HOLE DATA

Hole No.	Location	Angle	Depth	Elevation	Bearing	Date
E-55-1	54.9 S. + 5.30 E.	-60°	363'	+110'	N. 72° W.	6-1-61 to 6-10-61
E-55-2	54.9 S. + 5.60 E.	-45°	420'	+120'	N. 72° W.	10-1-61 to 10-15-61
E-55-3	54.9 S. 5.60 E.	-77°	461'	+120'	N. 72° W.	10-15-61 to 10-31-61


Drill Hole
E-62-1
Traverse 61.75 South
1.5 E
2.0 E
2.5 E
3.0 E
3.5 E
4.0 E
4.5 E
4.7 E
Lake Level
+100'
+50'
Sea Level
-50'
-100'
-150'
-200'
-250'
Core Library
Base Line
WS-1
Fullers Island
"ACRE" ISLAND
E-1
40 S.
E-3
52 S.
55 S.
F-2
F-1
CRAWFORD POND
"100"
60 S.
61.75 S.
64 S.
E-2
80 S.
S-4
S-2
S-3
S-1
100 S.
N
Hole No. E-62-1
Location 61.75 South + 4.70 East
Crawford Pond
Ice Grid Coordinates
Angle -41°
Bearing North 72° West
Depth 364' 0"
Elevation 110' above sea level
Logged by D.E.W.
7-1-61 to 7-18-61
sand
sch
peg
mble
100'
200'
300'
Assays
TD 364' 0"
perid
Ultra-basic section
sulfide 25%
sulfide 40%
sulfide 55%
sulfide 30%
Scale 4" = 1 mile
Drill Hole Location Map
E-1
E-3
E-52-2
E-55-1
E-4
E-60-2
E-62-1
E-64-1
E-64-2
E-2
F-1
F-2
WS-1
S-1
S-2
S-3
S-4
LEGEND
Pegmatite (peg)
Marble (mble) & Dolomite (dolo)
Quartz - biotite schist (sch)
Quartz - biotite - chlorite schist (sch)
Hornblend schist (hnbd sch)
Gabbro (gab)
Peridotite (perid)
Massive sulfides
Sulfides
Pyrrhotite
Garnet (gar)
Graphite
Calcite on fractures
E. M. Cross-over
JULY 1961
Rockport, Maine
Stage I
Area I
ROLAND F. BEERS, INC. Alexandria, Va.
DRILL HOLE CROSS SECTION
E-62-1
County KNOX
Twnp. UNION
Scale 1" = 20'


TRAVERSE 64 SOUTH
Base Line
0.5 E.
1.0 E.
1.5 E.
2.0 E.
2.5 E.
3.0 E.
3.5 E.
4.0 E.
Drill Hole E-64-2
-60°
Lake Level +110'
+100'
+50'
Sea Level
-50'
-100'
-150'
-200'
-250'
-300'
Core Library
Base Line
WS-1
Fullers Island
ACRE ISLAND
CRAWFORD POND
F-2
F-1
E-1
40 S.
E-3
52 S.
55 S.
60 S.
61.75 S.
64 S.
100
E-2
80 South
S-4
Spruce Island
S-2
S-3
S-1
100 South
Scale 4" = 1 mile
Drill Hole Location Map
E-1
E-3
E-52-2
E-55-1
E-4
E-60-2
E-62-1
E-64-1
E-64-2
E-2
F-1
F-2
WS-1
S-1
S-2
S-3
S-4
water
mud
sand
cobbles
boulders
soil & sand
peg
sch
mble & dolo
T.D.A. (7-31-61)
mble
norite
DRILL HOLE E-64-2 (JULY & AUGUST 1961)
hnbd sch
tissure
mica sch
ASSAYS (1961)
43
approx. 4' massive sulfide
horizontal
21°
dip
ASSAY E-64-2-1
massive pyrrhotite
altered basic
TD 396'6"
DRILL HOLE E-64-1 (JUNE
sch & peg
TD 550'
100'
200'
300'
400'
500'
Hole No. E-64-2
Location 63.87 South + 4.30 East
Crawford Pond
Ice Grid Coordinates
Angle -60°
Bearing North 72° West
Depth T.D.A. 157' 7"
T.D. 396' 6"
Elevation + 120'
Logged by D.E.W.
7-19-61 to 7-31-61
completed 8-9-61
LEGEND
Pegmatite (peg)
Marble (mble) & Dolomite (dolo)
Quartz - biotite
Quartz - biotite - chlorite
Hornblend
schist (sch)
Gabbro (gab)
Peridotite (perid)
Massive sulfides
Sulfides
Pyrrhotite
Garnet
Graphite
Calcite on fractures
E. M. cross-overs
230' b.s.l.
August
July 1961
Rockport, Maine
Stage 1
Area 1
ROLAND F. BEERS, INC. Alexandria, Va.
DRILL HOLE CROSS-SECTION
E-64-2
E 64-1
County KNOX
Twnp UNION
Scale 1" = 20'



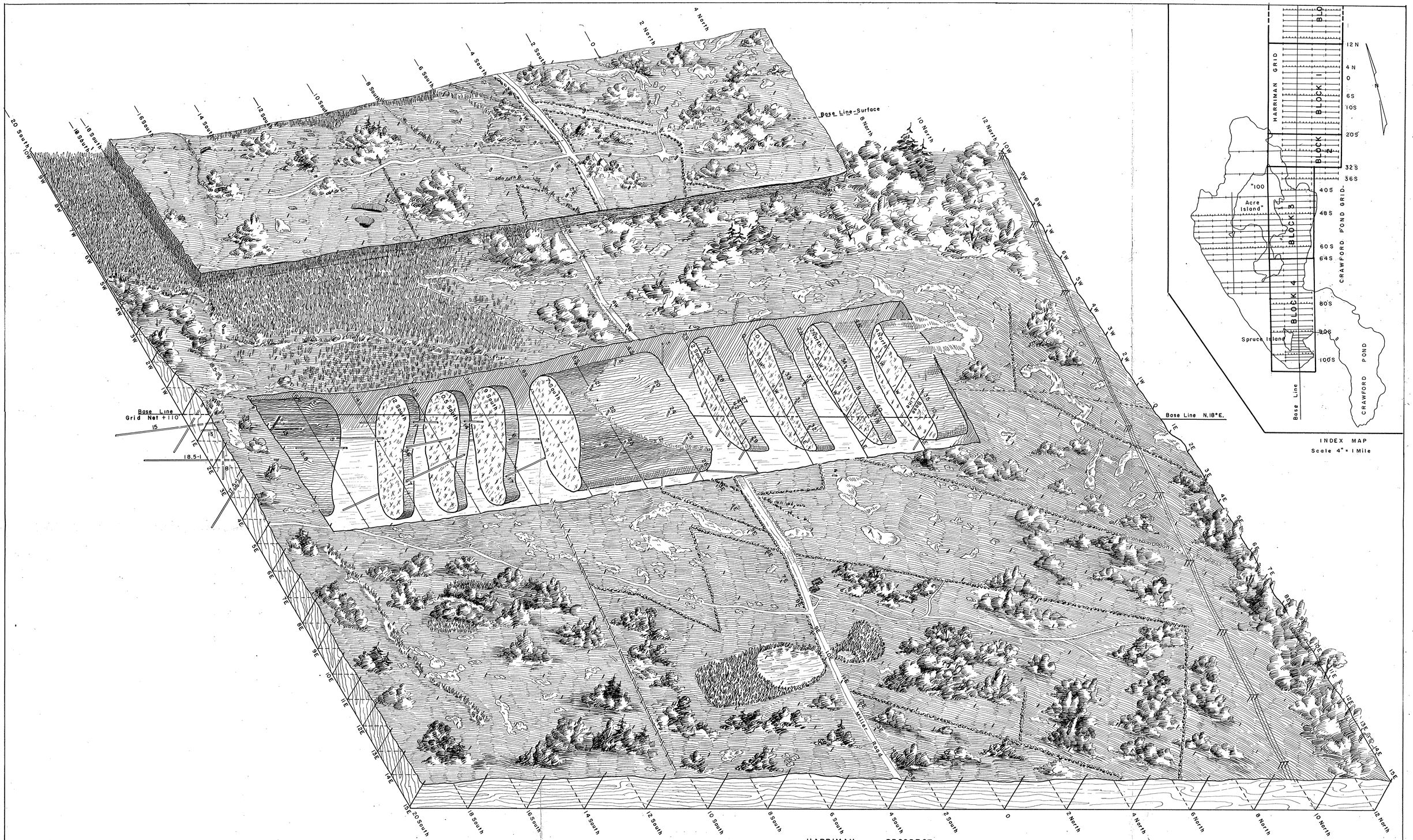
CRAWFORD POND PROSPECT
KNOX, COUNTY
UNION, MAINE

ROLAND F. BEERS, INC. ALEXANDRIA, VIRGINIA

Drawn By D. E. Wyke

BLOCK DIAGRAM NO. 3

NO. 3



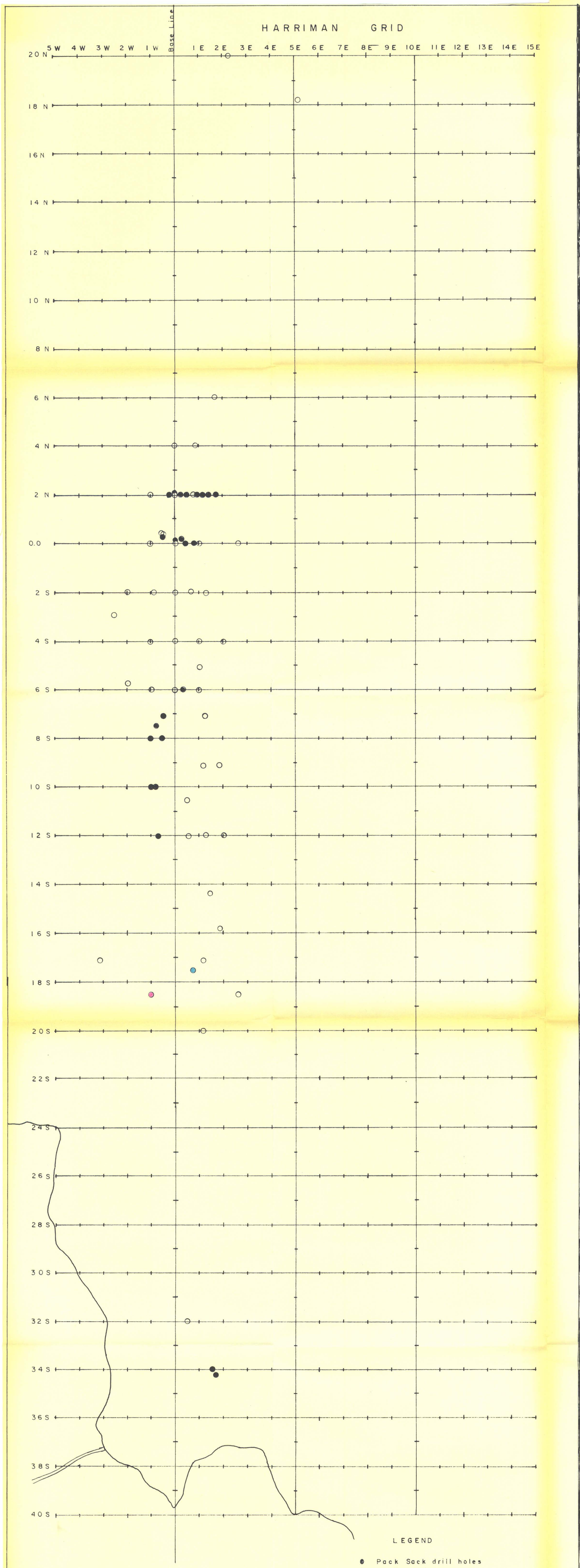
HARRIMAN PROSPECT
KNOX, COUNTY
UNION, MAINE

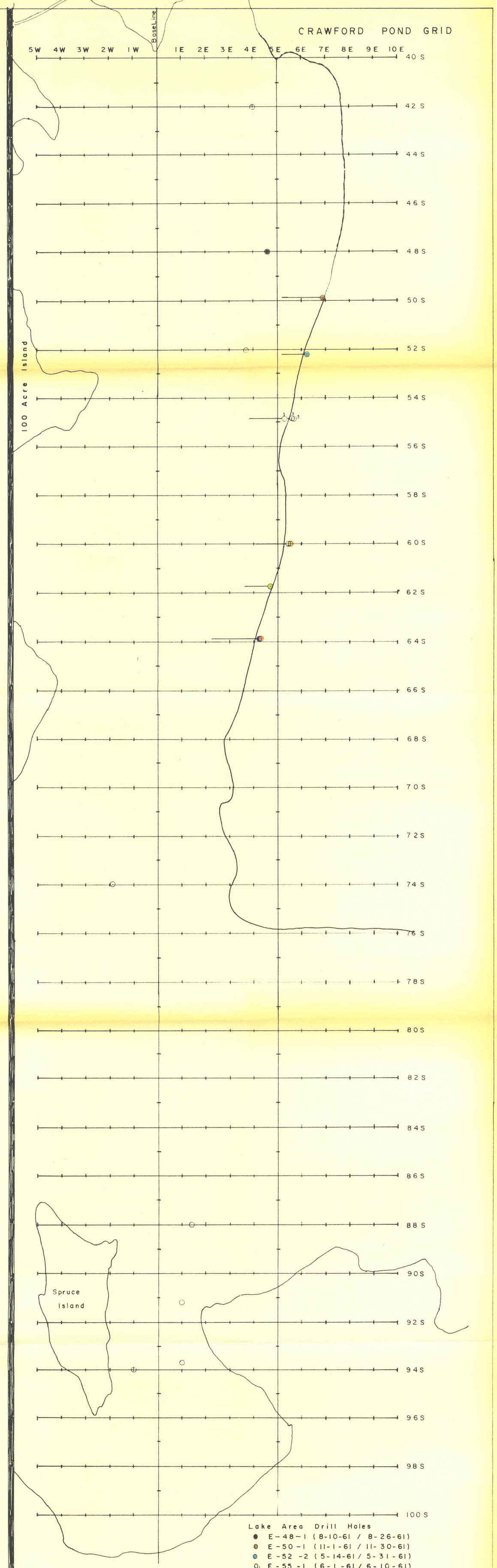
ROLAND F. BEERS, INC. ALEXANDRIA, VIRGINIA

Drawn By D.E. Wyke

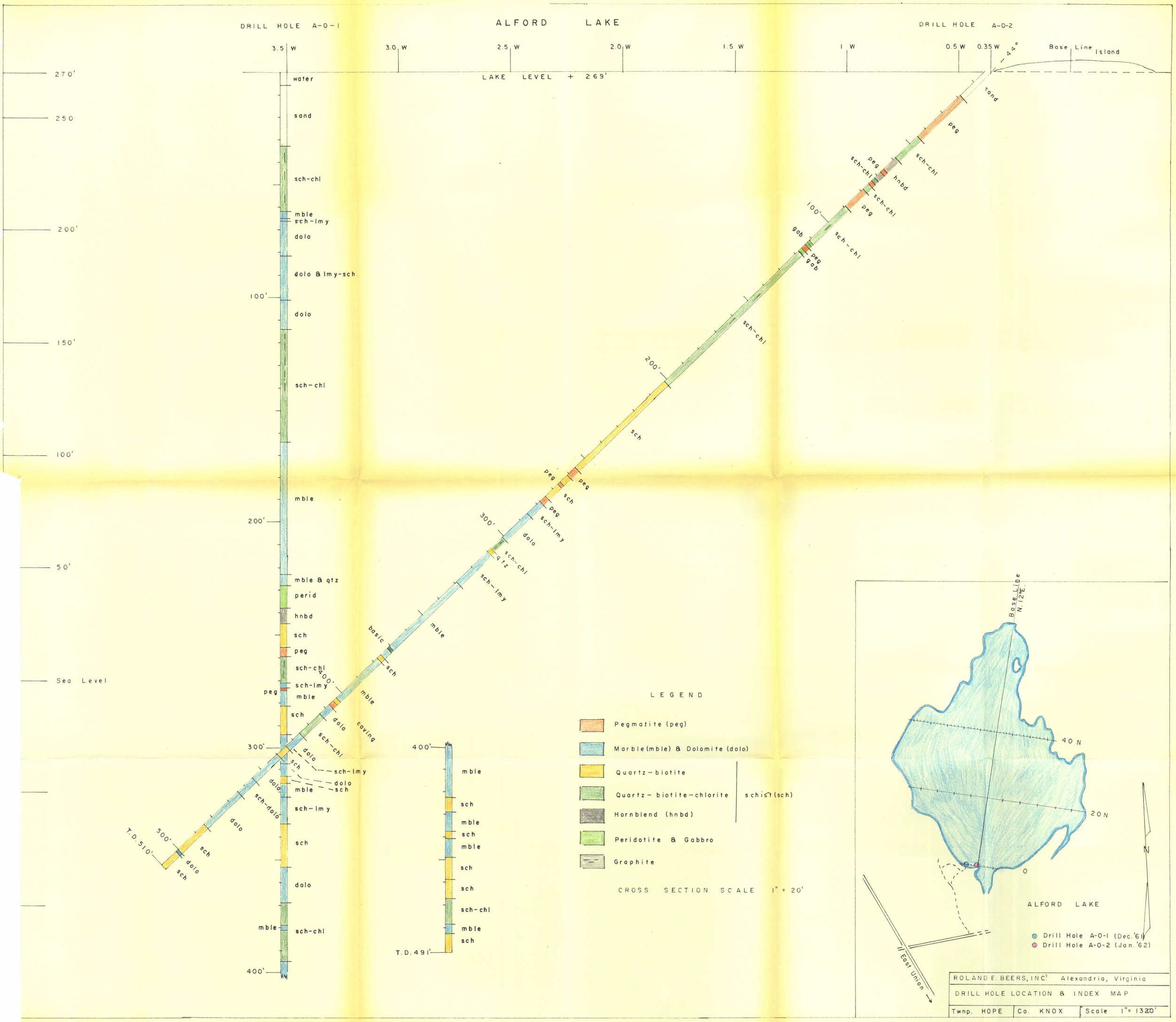
BLOCK DIAGRAM NO. 1

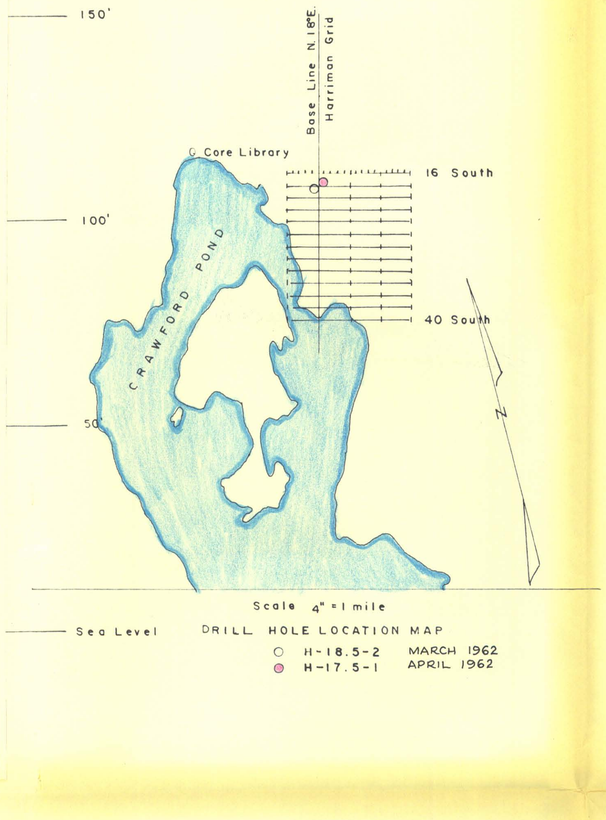
NO. 1


HARRIMAN GRID
Base Line
5W 4W 3W 2W 1W 1E 2E 3E 4E 5E 6E 7E 8E 9E 10E 11E 12E 13E 14E 15E
20 N
18 N
16 N
14 N
12 N
10 N
8 N
6 N
4 N
2 N
0.0
2 S
4 S
6 S
8 S
10 S
12 S
14 S
16 S
18 S
20 S
22 S
24 S
26 S
28 S
30 S
32 S
34 S
36 S
38 S
40 S
LEGEND
Pack Sack drill holes
AX & NX drill holes
Drill Hole H-18.5-2 (2-9-62/3-5-62)
Drill Hole H-17.5-1 (3-15-62/4-7-62)


CRAWFORD POND GRID
Base Line
5W 4W 3W 2W 1W 1E 2E 3E 4E 5E 6E 7E 8E 9E 10E
40 S
42 S
44 S
46 S
48 S
50 S
52 S
54 S
56 S
58 S
60 S
62 S
64 S
66 S
68 S
70 S
72 S
74 S
76 S
78 S
80 S
82 S
84 S
86 S
88 S
90 S
92 S
94 S
96 S
98 S
100 S
100 Acre Island
Spruce Island
Lake Area Drill Holes
E-48-1 (8-10-61 / 8-26-61)
E-50-1 (11-1-61 / 11-30-61)
E-52-2 (5-14-61 / 5-31-61)
O1 E-55-1 (6-1-61 / 6-10-61)
O2 E-55-2 (10-1-61 / 10-15-61)
O3 E-55-3 (10-15-61 / 10-31-61)
E-60-2 (5-1-61 / 5-13-61)
E-62-1 (7-1-61 / 7-18-61)
E-64-1 (6-10-61 / 6-30-61)
E-64-2 (7-19-61 / 8-9-61)

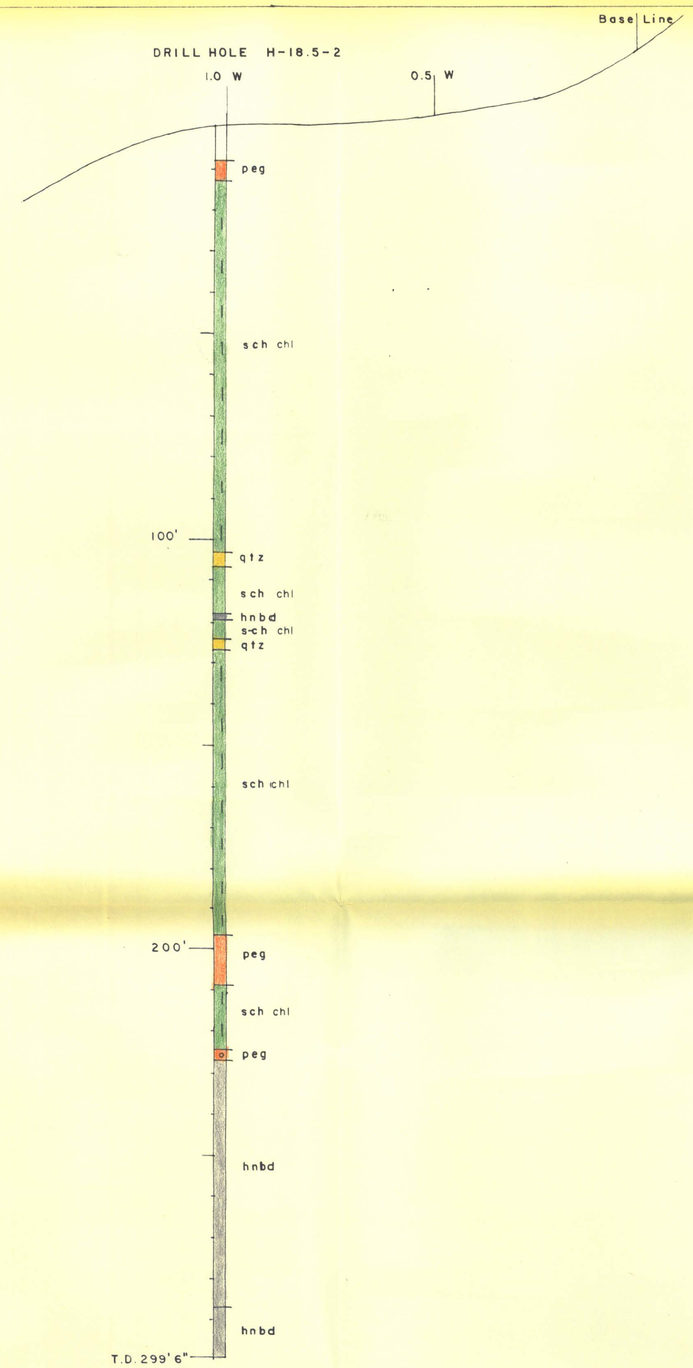
ALFORD LAKE

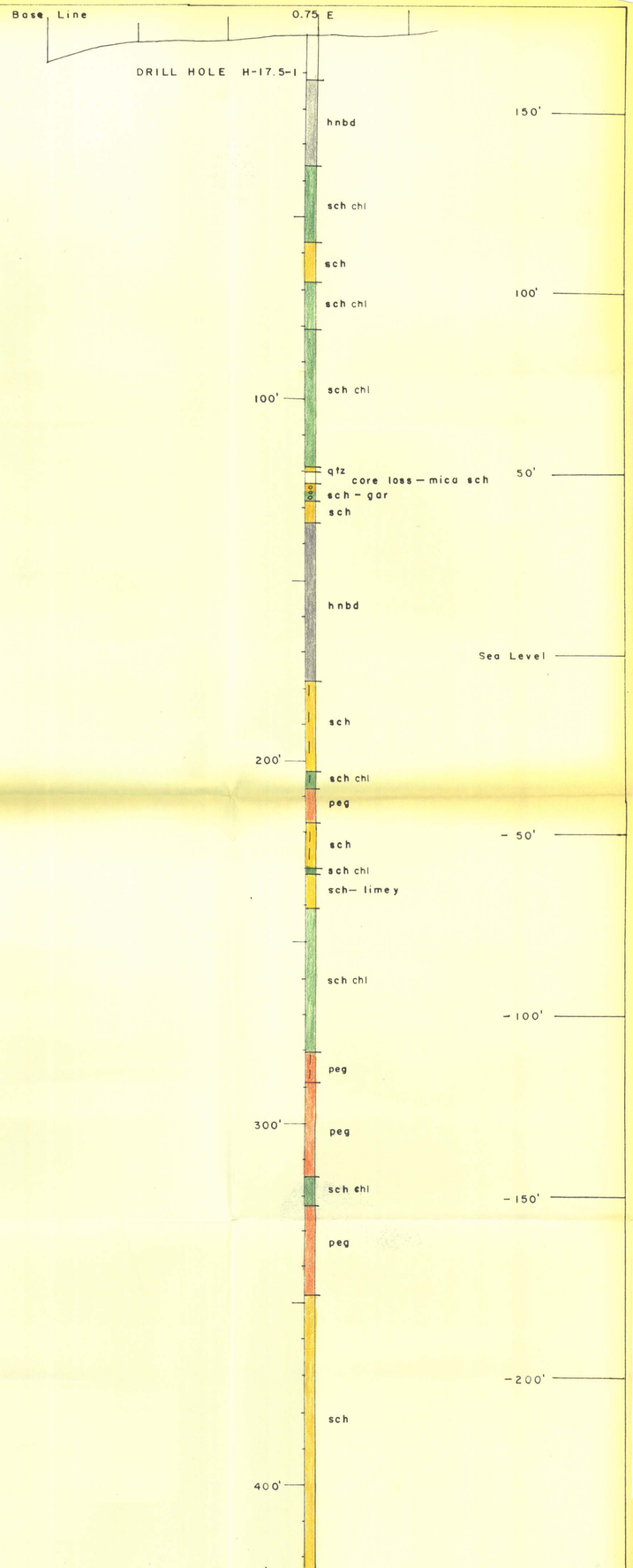

DRILL HOLE A-0-1
DRILL HOLE A-0-2
3.5 W
3.0 W
2.5 W
2.0 W
1.5 W
1 W
0.5 W
0.35 W
44°
Base Line
Island
LAKE LEVEL + 269'
270'
250
200'
150'
100'
50'
Sea Level
water
sand
sch-chl
mble
sch-lmy
dolo
dolo & lmy-sch
mble & qtz
perid
hnbd
sch
peg
gab
basic
caving
T.D. 510'
T.D. 491'
LEGEND
Pegmatite (peg)
Marble (mble) & Dolomite (dolo)
Quartz-biotite
Quartz-biotite-chlorite
Hornblend (hnbd)
schist (sch)
Peridotite & Gabbro
Graphite
CROSS SECTION SCALE 1" = 20'
Base Line N. 12° E.
40 N
20 N
0
N
ALFORD LAKE
Drill Hole A-0-1 (Dec. '61)
Drill Hole A-0-2 (Jan. '62)
East Union
ROLAND E. BEERS, INC. Alexandria, Virginia
DRILL HOLE LOCATION & INDEX MAP
Twnp. HOPE
Co. KNOX
Scale 1" = 1320'



DRILL HOLE LOCATION MAP

○ H-18.5-2 MARCH 1962
● H-17.5-1 APRIL 1962



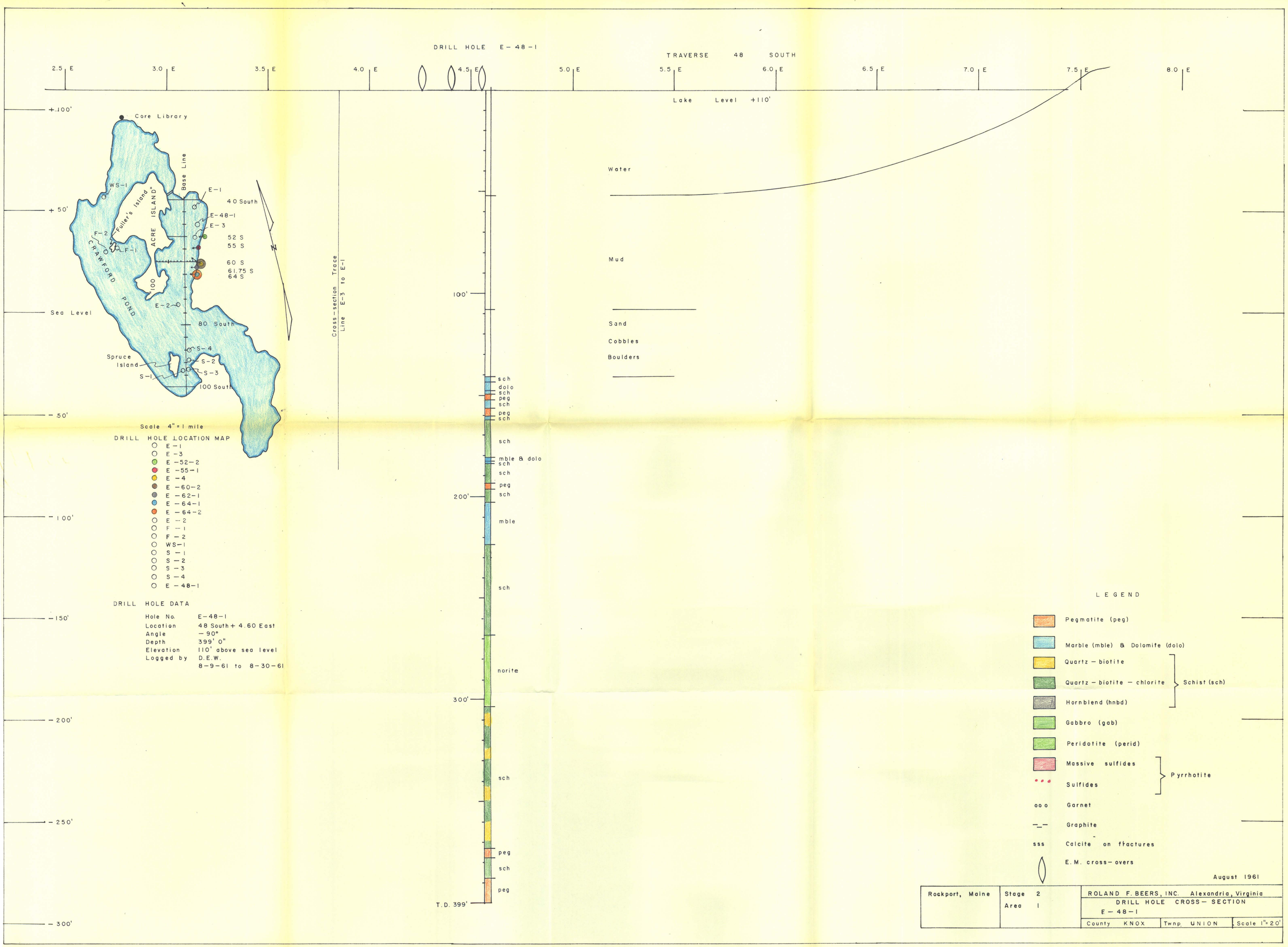


LEGEND

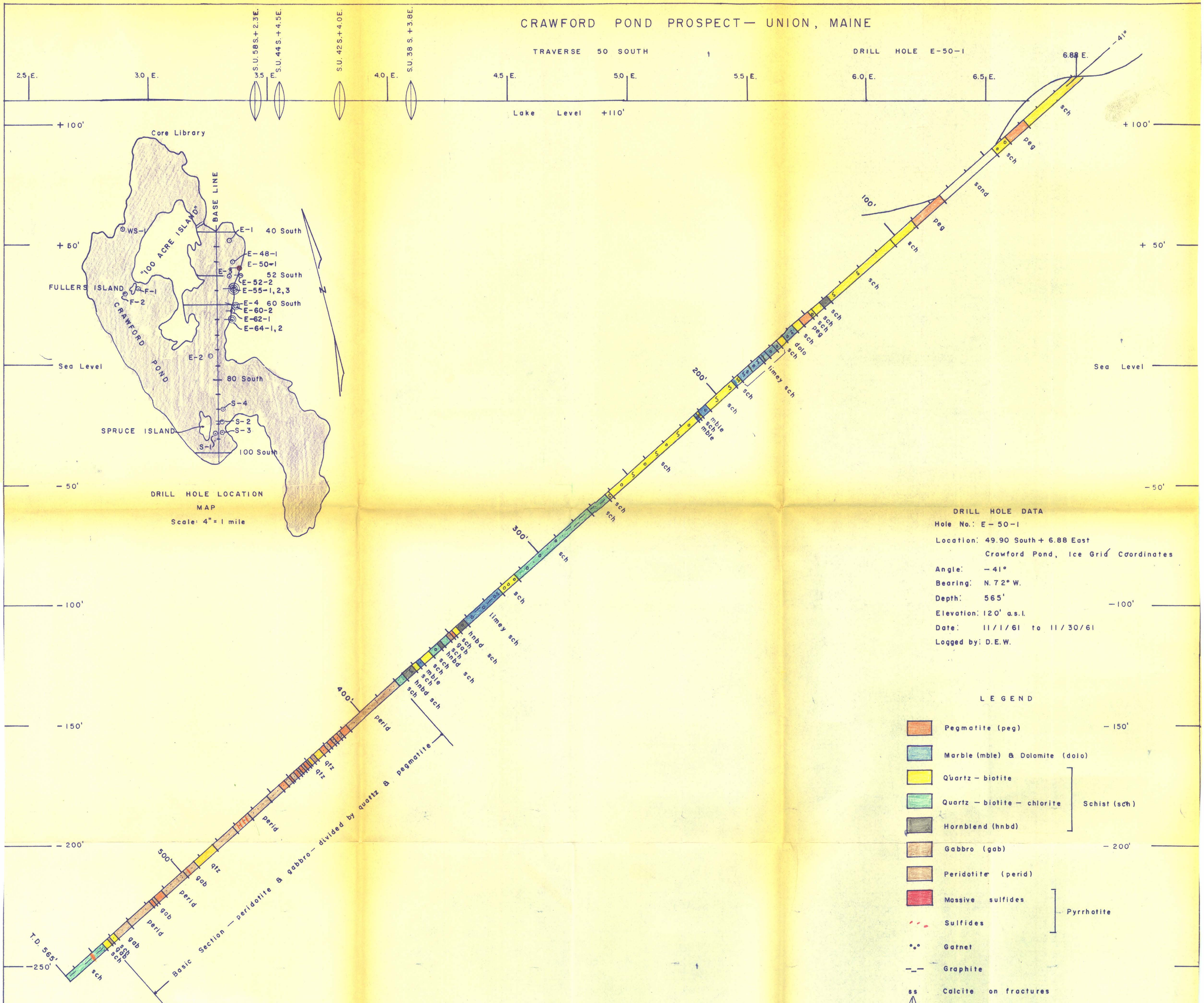
- Pegmatite (peg)
- Marble (mble) & Dolomite (dolo)
- Quartz-biotite
- Quartz-biotite-chlorite } Schist (sch)
- Hornblend (hnbd)
- ooo Garnet
- — — Graphite
- sss Calcite

Rockport, Maine	Area 1	ROLAND F. BEERS, INC. Alexandria, Virginia	DRILL HOLE	LOCATION	ANGLE	TOTAL DEPTH	ELEV.
		DRILL HOLE CROSS-SECTIONS H-18.5-2 & H-17.5-1	H-18.5-2	18.5 South + 1.0 West	-90°	299' 6"	151.3'
		County KNOX Twnp UNION Scale 1" = 20'	H-17.5-1	17.5 South + 0.75 East	-90°	424' 0"	161.8'

H-18.5-2 MARCH 1962
H-17.5-1 APRIL 1962


DRILL HOLE E-48-1
TRAVERSE 48 SOUTH
2.5 E
3.0 E
3.5 E
4.0 E
4.5 E
5.0 E
5.5 E
6.0 E
6.5 E
7.0 E
7.5 E
8.0 E
Lake Level +110'
+100'
+50'
Sea Level
-50'
-100'
-150'
-200'
-250'
-300'
Core Library
Base Line
WS-1
Fuller's Island
"ACRE ISLAND"
E-1
40 South
E-48-1
E-3
52 S
55 S
60 S
61.75 S
64 S
F-2
F-1
CRAWFORD POND
100
E-2
80 South
S-4
S-2
S-3
Spruce Island
S-1
100 South
N
Cross-section Trace
Line E-3 to E-1
Scale 4" = 1 mile
DRILL HOLE LOCATION MAP
E-1
E-3
E-52-2
E-55-1
E-4
E-60-2
E-62-1
E-64-1
E-64-2
E-2
F-1
F-2
WS-1
S-1
S-2
S-3
S-4
E-48-1
DRILL HOLE DATA
Hole No. E-48-1
Location 48 South + 4.60 East
Angle -90°
Depth 399' 0"
Elevation 110' above sea level
Logged by D.E.W.
8-9-61 to 8-30-61
Water
Mud
Sand
Cobbles
Boulders
100'
200'
300'
T.D. 399'
sch
dolo
sch
peg
sch
peg
sch
sch
mble & dolo
sch
sch
peg
sch
mble
sch
norite
sch
peg
sch
peg
LEGEND
Pegmatite (peg)
Marble (mble) & Dolomite (dolo)
Quartz - biotite
Quartz - biotite - chlorite
Hornblend (hnbd)
Schist (sch)
Gabbro (gab)
Peridotite (perid)
Massive sulfides
Sulfides
Pyrrhotite
Garnet
Graphite
Calcite on fractures
E.M. cross-overs
August 1961
Rockport, Maine
Stage 2
Area 1
ROLAND F. BEERS, INC. Alexandria, Virginia
DRILL HOLE CROSS-SECTION
E-48-1
County KNOX
Twnp. UNION
Scale 1" = 20'

CRAWFORD POND PROSPECT — UNION, MAINE



DRILL HOLE DATA

Hole No.: E-50-1

Location: 49.90 South + 6.88 East
Crawford Pond, Ice Grid Coordinates

Angle: -41°

Bearing: N. 72° W.

Depth: 565'

Elevation: 120' a.s.l.

Date: 11/1/61 to 11/30/61

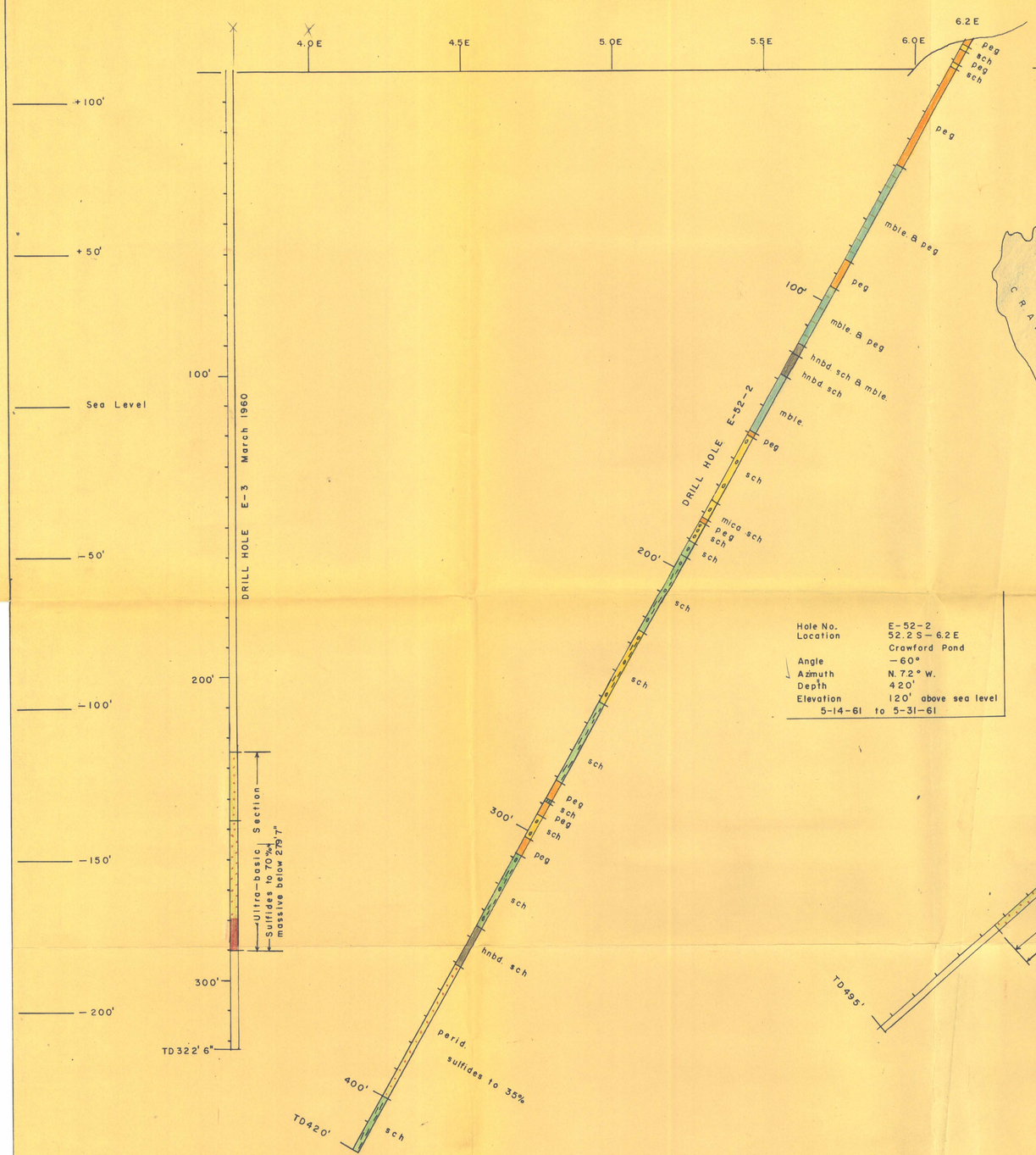
Logged by: D.E.W.

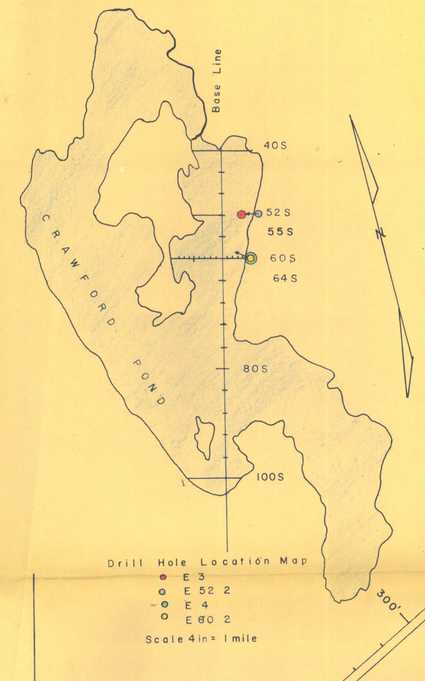
LEGEND

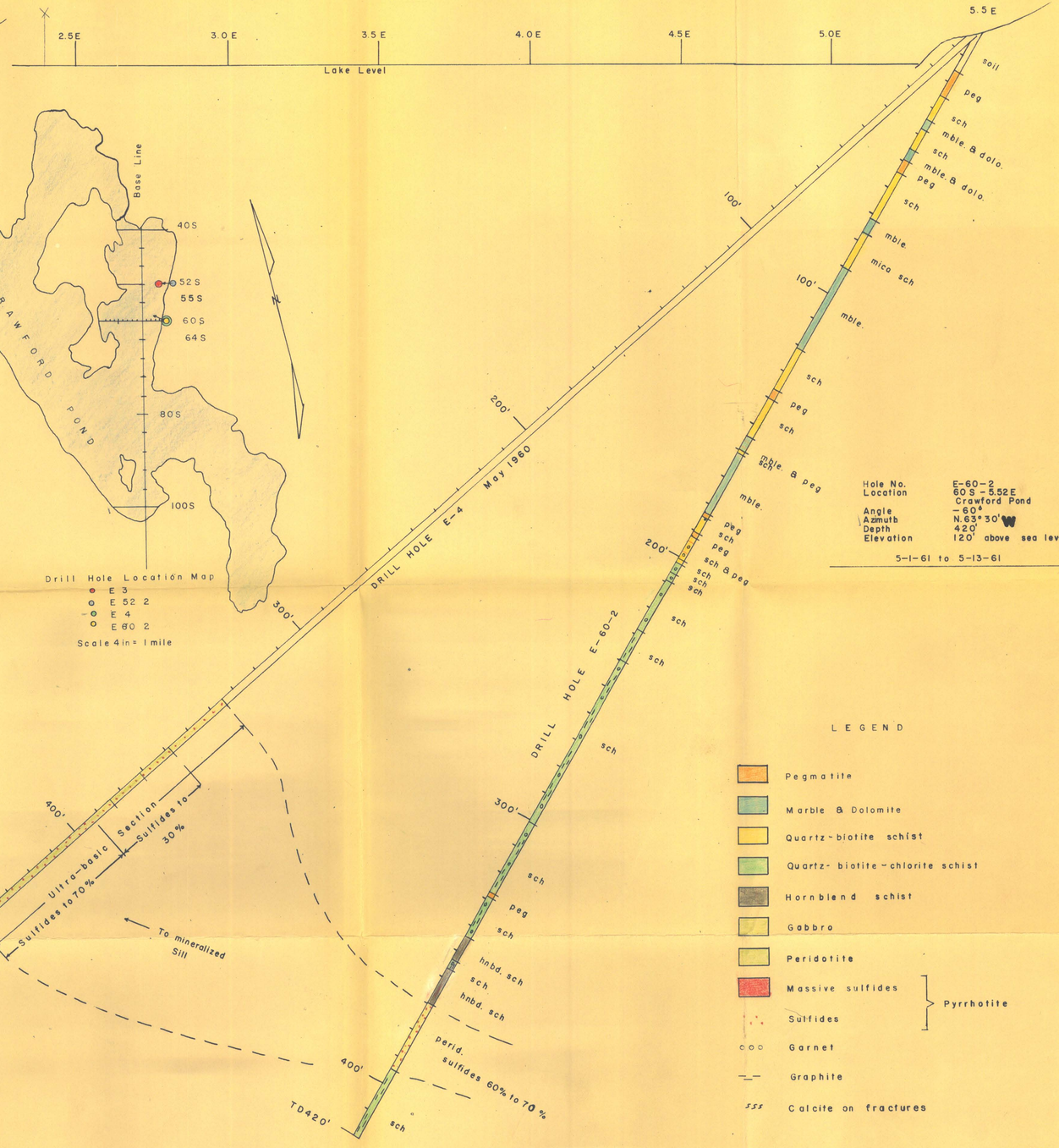
- Pegmatite (peg)
- Marble (mble) & Dolomite (dolo)
- Quartz — biotite
- Quartz — biotite — chlorite
- Hornblend (hnbd)
  - Schist (sch)
- Gabbro (gab)
- Peridotite (perid)
- Massive sulfides
- Sulfides
  - Pyrrhotite
- Garnet
- Graphite
- ss Calcite on fractures
- E.M. cross-over

December 1961

Rockport, Maine	Stage 2	ROLAND F. BEERS, INC. Alexandria, Virginia
DEW	Area 1	DRILL HOLE CROSS — SECTION E-50-1
		County: KNOX · Twnp: UNION · Scale: 1" = 20'







May 1961

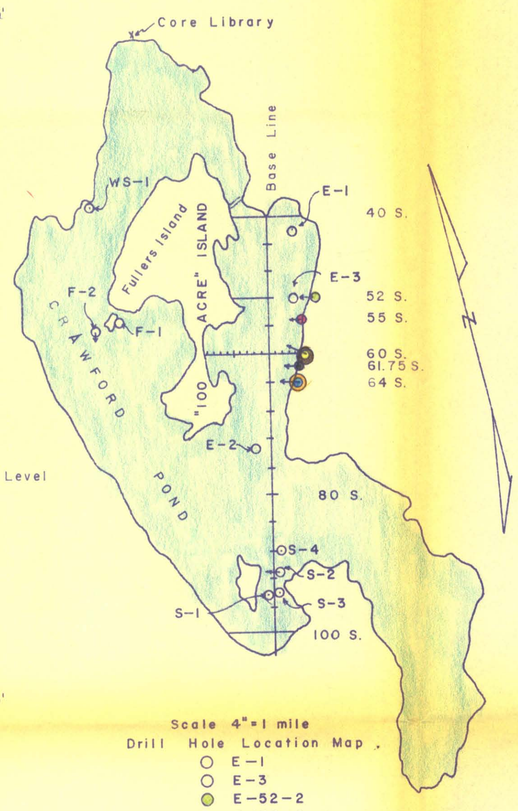
Rockport, Maine	Stage I Area I	ROLAND F BEERS, INC. Alexandria, Va.
		DRILL HOLE CROSS SECTIONS E-60-2 & E-52-2
		County KNOX · Twnp UNION · Scale 1"=20'

October 1961

DRILL HOLE DATA

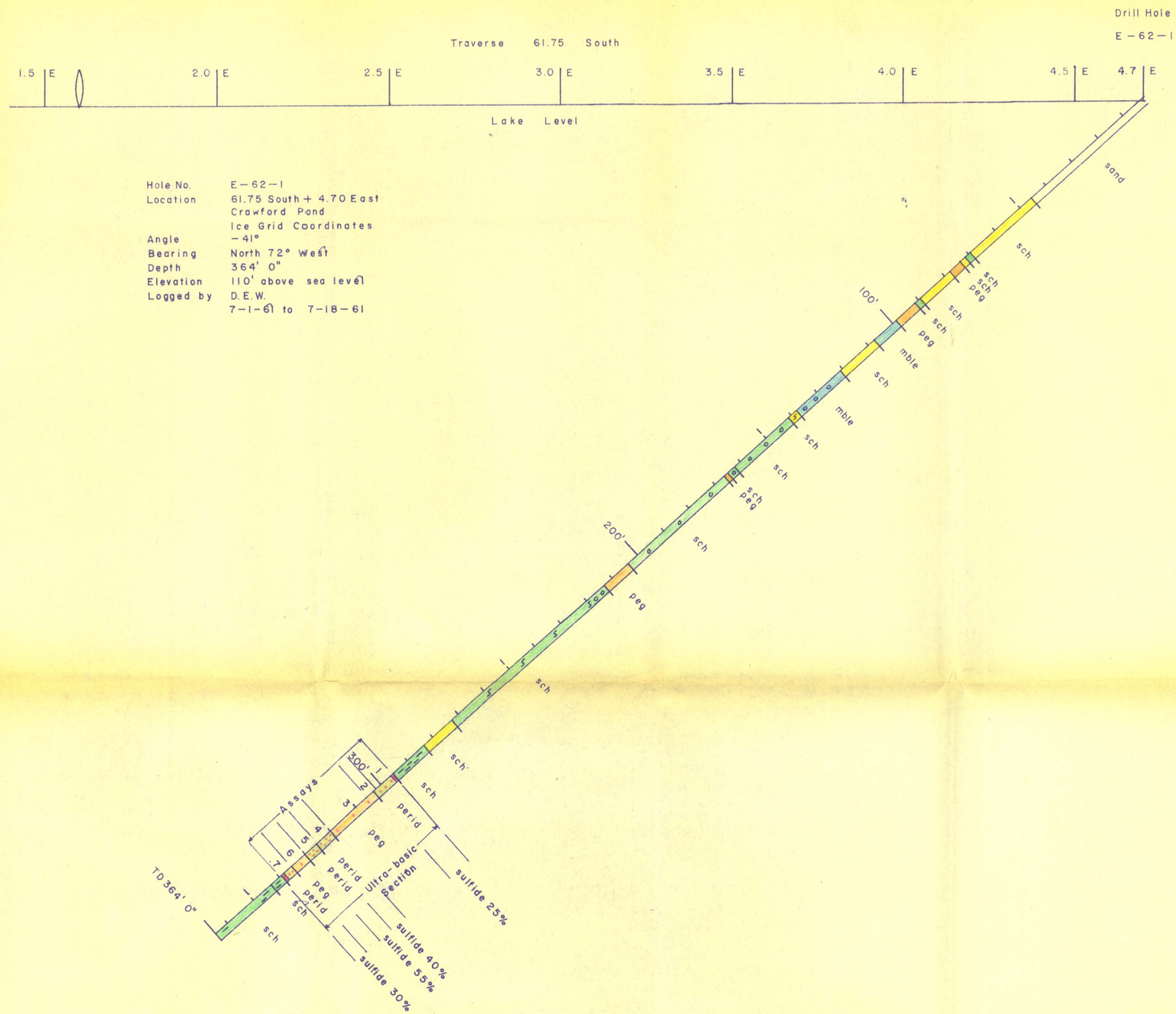
Hole No.	Location	Angle	Depth	Elevation	Bearing	Date
E-55-1	54.9 S. + 5.30 E.	-60°	363'	+110'	N. 72° W.	6-1-61 to 6-10-61
E-55-2	54.9 S. + 5.60 E.	-45°	420'	+120'	N. 72° W.	10-1-61 to 10-15-61
E-55-3	54.9 S. 5.60 E.	-77°	461'	+120'	N. 72° W.	10-15-61 to 10-31-61

Rockport, Maine	Stage I, Area I	ROLAND F. BEERS, INC. Alexandria, Virginia DRILL HOLE CROSS-SECTIONS E-55-1 E-55-2 E-55-3 County: KNOX Twnp: UNION Scale: 1" = 20'



Scale 4" = 1 mile
Drill Hole Location Map

- E-1
- E-3
- E-52-2
- E-55-1
- E-4
- E-60-2
- E-62-1
- E-64-1
- E-64-2
- E-2
- F-1
- F-2
- WS-1
- S-1
- S-2
- S-3
- S-4



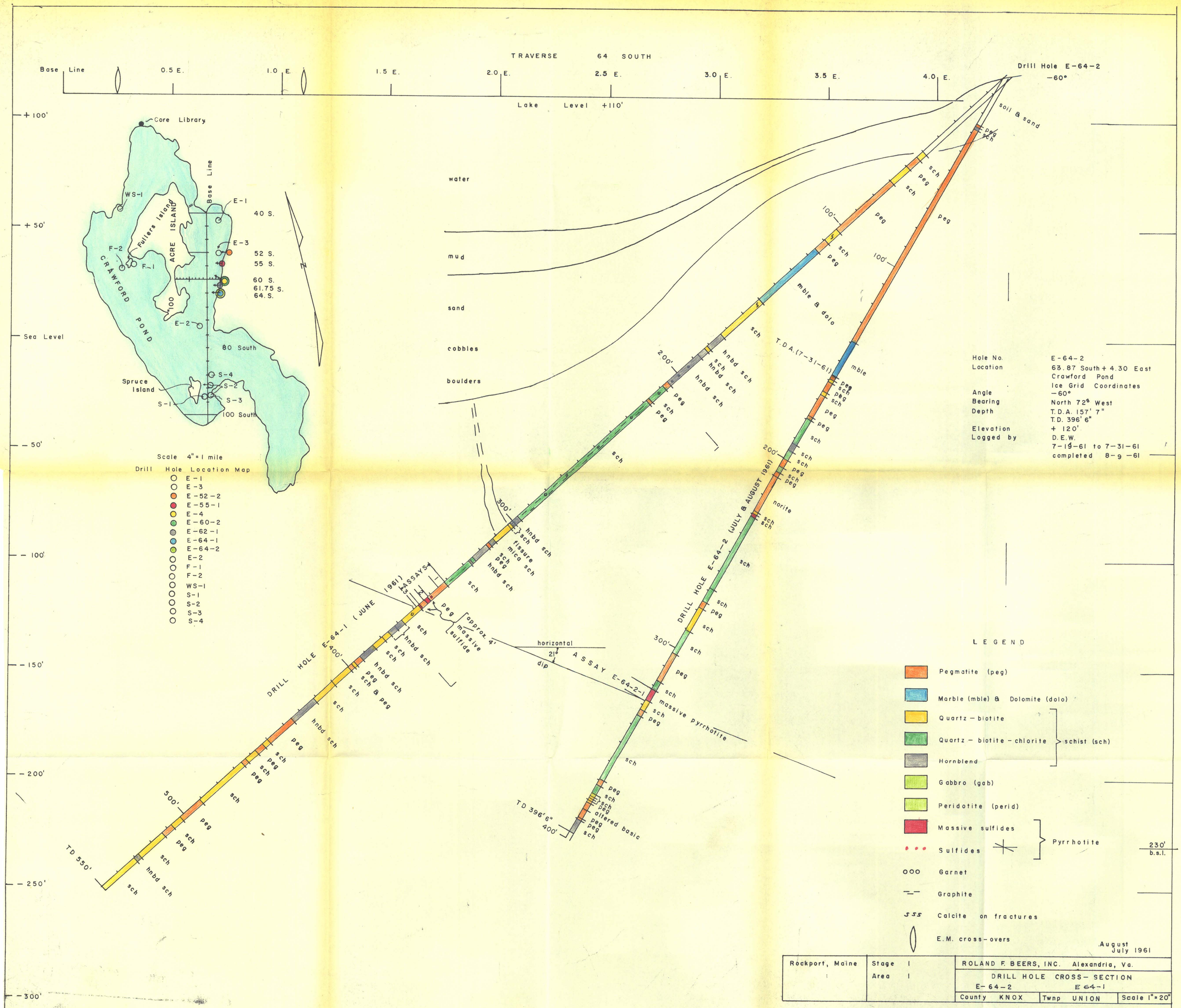
Hole No. E-62-1
Location 61.75 South + 4.70 East
Crawford Pond
Ice Grid Coordinates
Angle -41°
Bearing North 72° West
Depth 364' 0"
Elevation 110' above sea level
Logged by D.E.W.
7-1-61 to 7-18-61

LEGEND

- Pegmatite (peg)
- Marble (mble) & Dolomite (dolo)
- Quartz-biotite schist (sch)
- Quartz-biotite-chlorite schist (sch)
- Hornblend schist (hnbd sch)
- Gabbro (gab)
- Peridotite (perid)
- Massive sulfides } Pyrrhotite
- Sulfides } Pyrrhotite
- Garnet (gar)
- Graphite
- Calcite on fractures
- E. M. Cross-over

JULY 1961

Rockport, Maine	Stage I Area I	ROLAND F. BEERS, INC. Alexandria, Va. DRILL HOLE CROSS SECTION E-62-1 County KNOX · Twnp UNION · Scale 1" = 20'


TRAVERSE 64 SOUTH
Base Line
0.5 E.
1.0 E.
1.5 E.
2.0 E.
2.5 E.
3.0 E.
3.5 E.
4.0 E.
Lake Level +110'
Drill Hole E-64-2
-60°
+100'
+50'
Sea Level
-50'
-100'
-150'
-200'
-250'
-300'
Core Library
WS-1
Fullers Island
ACRE ISLAND
Base Line
E-1
40 S.
E-3
52 S.
55 S.
60 S.
61.75 S.
64. S.
F-2
F-1
CRAWFORD POND
100
E-2
80 South
S-4
S-2
S-3
S-1
Spruce Island
100 South
Scale 4" = 1 mile
Drill Hole Location Map
E-1
E-3
E-52-2
E-55-1
E-4
E-60-2
E-62-1
E-64-1
E-64-2
E-2
F-1
F-2
WS-1
S-1
S-2
S-3
S-4
water
mud
sand
cobbles
boulders
soil & sand
peg
sch
mble & dolo
T.D.A. (7-31-61)
mble
hnbd sch
norite
DRILL HOLE E-64-2 (JULY & AUGUST 1961)
DRILL HOLE E-64-1 (JUNE 1961)
ASSAYS
fissure
mica sch
approx. 4' massive sulfide
horizontal
21° dip
ASSAY E-64-2-1
massive pyrrhotite
altered basic
TD 396'6"
TD 550'
Hole No. E-64-2
Location 63.87 South + 4.30 East
Crawford Pond
Ice Grid Coordinates
Angle -60°
Bearing North 72° West
Depth T.D.A. 157' 7"
T.D. 396' 6"
Elevation + 120'
Logged by D.E.W.
7-19-61 to 7-31-61
completed 8-9-61
LEGEND
Pegmatite (peg)
Marble (mble) & Dolomite (dolo)
Quartz - biotite
Quartz - biotite - chlorite
Hornblend
schist (sch)
Gabbro (gab)
Peridotite (perid)
Massive sulfides
Sulfides
Pyrrhotite
Garnet
Graphite
Calcite on fractures
E.M. cross-overs
230' b.s.l.
August July 1961
Rockport, Maine
Stage I
Area I
ROLAND F. BEERS, INC. Alexandria, Va.
DRILL HOLE CROSS-SECTION
E-64-2 E 64-1
County KNOX
Twnp UNION
Scale 1" = 20'