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REPORT

Environmental Impact Report for the Kennecott Flambeau Project

Scope I.D.: 87K10

Volume III - Appendix 3.3-A to 3.5-N

Kennecott Minerals Company
Ladysmith, Wisconsin

April 1989

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VOLUME 3
APPENDIX 3.3-A TO 3.5-N
ENVIRONMENTAL IMPACT REPORT
FOR THE
KENNECOTT FLAMBEAU PROJECT

Prepared for:

KENNECOTT MINERALS COMPANY

Prepared by:

FOTH & VAN DYKE and Associates Inc.
and Contributors
2737 S. Ridge Road
P. O. Box 19012
Green Bay, Wisconsin 54307-9012

APRIL 1989

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APPENDIX 3.3-A

Letter from James Morton Smith
State Historic Preservation Officer
dated January 23, 1976

THE STATE HISTORICAL
SOCIETY OF WISCONSIN

816 STATE STREET / MADISON, WISCONSIN 53706 / JAMES MORTON SMITH, DIRECTOR

January 23, 1976

Mr. C. D. Besadny
Department of Natural Resources
Box 450
Madison, Wisconsin 53701

SHSW 0262-75-1
(see also 0213-75)

Dear Mr. Besadny:

This follows up my June 30 and August 22 letters concerning the necessity for an archeological survey of the proposed coppermine south of Ladysmith in Rusk County and the disposition of buildings on the site.

The information on the buildings submitted subsequently by the Flambeau Mining Corporation has been evaluated. It is now evident that there are no buildings which need to be protected because of their historical or architectural value.

However, it is our understanding that arrangements for the required archeological survey are still in progress. Until we have received and evaluated the archeologists report we cannot make the necessary determination of effect on possible archeological assets.

Sincerely,

James Morton Smith
State Historic Preservation Officer

JMS:dd

cc: Mr. Edwarde R. M[illegible]

Sister Alice Henk, President
Rusk County Historical Society

3.3-A-1

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APPENDIX 3.3-B

A Phase I Archaeological Survey of a Proposed Overburden and Waste Rock Stockpile for the Kennecott Copper Company at Ladysmith, Wisconsin

A PHASE I ARCHAEOLOGICAL SURVEY OF A PROPOSED OVERBURDEN AND WASTE ROCK STOCKPILE FOR THE KENNECOTT COPPER COMPANY AT LADYSMITH, WISCONSIN

by

Margie L. Staab, Ph.D. (Principal Investigator)

for

Foth & Van Dyke

2737 S. Ridge Road
P.O. Box 19012
Green Bay, WI 54307-9012

Contact Person: Tim J. Weyenberg, P.E.

Dec. 1, 1988

Abstract:

On September 29 and 30 and October 27, 1988, M. L. Staab, Ph.D. (Principal Investigator), assisted by M. S. Cronin, conducted a Phase I Archaeological Survey of a proposed overburden, saprolite, and type one waste rock stockpile site for the Kennecott Copper Co. at Ladysmith, Wisconsin. Since no evidence of any prehistoric or significant historic occupation was discovered within the Project Area, clearance for the utilization of the aforementioned stockpile site is recommended by the Principal Investigator.

A PHASE I ARCHAEOLOGICAL SURVEY OF A PROPOSED OVERBURDEN AND WASTE ROCK STOCKPILE FOR THE KENNECOTT COPPER COMPANY AT LADYSMITH, WISCONSIN

On September 29 and 30 and October 27, 1988, Margie L. Staab, Ph.D. (Principal Investigator), assisted by Michael S. Cronin, conducted a Phase I Archaeological Survey of a proposed overburden, saprolite, and type one waste rock stockpile site for the Kennecott Copper Company at Ladysmith, Wisconsin. The proposed stock pile is located within the $S\frac{1}{2}$, $NE\frac{1}{4}$, and the N 1/8, $SE\frac{1}{4}$, Sect. 9, T34N, R6W (Grant), Rusk County (Map 1).

Since no evidence of any prehistoric or significant historic occupation was discovered within the Project Area, clearance for the utilization of the proposed Kennecott Copper stockpile site is recommended by the Principal Investigator. However, it must be emphasized that even the most diligent application of currently accepted archaeological survey techniques will not guarantee location of all sites within a given area. This is especially true where the ground surface is obscured by vegetation, where bare ground has not been rain-settled, and where erosion prone soils may have been subject to redeposition. Small sites, deeply buried sites, and/or those with sparse artifactual debris are particularly difficult to detect. If any sites are located during various mining activities, the Historic Preservation Division, State Historical Society of Wisconsin, Madison, should be immediately notified.

Natural Environment and Archaeological Potential

Two previous archaeological surveys have been conducted for the Kennecott copper mine project; Report of the Archaeological Site Survey Conducted at the Bear Creek Mining Flambeau Project Site Rusk County, Wisconsin, 1973, by William McHugh and Michael L. Gregg, and Archaeological Survey of the Flambeau Mining Corporation's Proposed Copper Mining Project Rusk County, Wisconsin, 1976, by Joseph Tiffany. The Project Areas for these surveys, bound the present Project Area on the east, west, and south sides. The results of these surveys were essentially negative, but they do provide a great deal of background information on natural environment and archaeological sites within the general vicinity. Even so, in order to maintain objectivity, the Principal Investigator repeated the preliminary research. The results of this research are presented below, with comments concerning levels of agreement with the McHugh and Gregg and Tiffany reports.

The Project Area vicinity is typified by glacial topography exhibiting significant relief. Numerous and extensive marshes occupy floodplains and eutrophied glacial lakes and ponds. High ground soils region are well drained sandy silt loams in unplowed and minimally plowed areas and loamy sands where plowing has caused significant erosion. Low ground, poorly drained soils are peaty. In both cases, however, the parent material is glacial outwash sand and gravel. Bedrock is precambriam igneous.

Native vegetation is maple, hemlock and birch forest (Hole 1976:89-97). This essentially agrees with statements in the two previous reports.

The most obvious attraction to both historic and prehistoric occupation in the Project Area vicinity, is the Flambeau River. Numerous high, well drained locations are available along its course. One site near the river was reported by local informants. It is located in Section 17 about two miles southwest of the Project Area. This site is represented by the Raasch Collection described in McHugh and Gregg, and is probably Middle Woodland. A second river side site, represented by the Cadotte collection (Map 1) and again described by McHugh and Gregg, was not reported to the Principal Investigator. Two Hixton salicified sandstone artifacts, according to McHugh and Gregg, of probable Late Archaic origin, comprise the collection.

Local informants were aware of one other prehistoric site, which is represented by the Drum collection (Map 1) and described by McHugh and Gregg. The reported location of this site is about one half mile east of the eastern boundary of the Present Project Area. Artifacts range from Late Archaic through Late Woodland. The material was collected from high ground bordering an extensive marsh which may be the remains of an extinct glacial lake. This site location is most relevant to the present survey because the east end (Map 1) of the Project Area also encompasses high, well drained ground overlooking the same marsh. Although

no artifacts were recovered, there appears to be greater archaeological potential here than in those areas to the west (Map 2) which are somewhat distant from the marsh and separated from it by erosion channels. Unfortunately, Project Area survey conditions near the old marsh are far from ideal, since level, well drained ground is generally confined to abandoned, overgrown fields. These fields were, of course, thoroughly shovel tested, but this survey technique is definitely less effective than bare ground inspection

The potential for location of historic sites appears more limited than that for prehistoric sites. This may be in part due to a lack of available early plats and other historic documents. However, the survey revealed only a recent appliance dump and the remains of a dirt, automobile race track, which local informants date somewhere in the 1940's or 1950's. No evidence of any structures was encountered within the Project Area, but it should be emphasized that even quite obvious historic foundations may be difficult to detect in areas overgrown with brush and undergrowth.

Survey Techniques and Results

Because most of the ground within the Project Area was obscured by vegetation, shovel testing was the primary survey technique utilized (Map 2). Intervals ranged from 50 to 100 feet depending on the degree of slope, disturbance and vegetation cover. All soil removed from the shovel tests was either screened or carefully troweled and worked by hand. Of course, all available bare ground was closely inspected.

The arrows on Map 2 indicate the descending direction of moderately steep to very steep slopes. In those areas without arrows, shovel tests were at 50 foot intervals. The interval was increased with the degree of slope, until such point that no shovel tests were considered necessary.

Based on survey conditions and topographic characteristics, the Project Area is divided into a number of subareas detailed in the Map 2 Legend. Extreme changes in environment and topography have occurred in the region since the last glacial retreat. Most recently, clear cutting of the forest near Ladysmith, in the latter part of the nineteenth century (W.P.A. 1941:468), and subsequent agricultural activities have resulted in severe erosion. In addition, nearby sites indicate occupation ranging from the Archaic through Late Woodland, and Paleo-Indian and Historic sites are certainly also possible (Mason 1986:181-206). Thus, none of these subareas are considered as having any greater or lesser archaeological potential, excluding, of course, the exceptions noted above and on the Map 2 Legend. In any event, no evidence of any prehistoric or significant historic occupation was encountered.

As reported above, early maps and documents indicating the location of structures were not available and it does seem most likely, that main logging camps and the majority of settlers homes would have been found closer to the Flambeau than the boundaries of the Project Area. However, one of the earliest

settlers in what is now Ladysmith (originally Flambeau Falls) was one Bruno Vinette, who arrived in 1856 (Terrill 1985:7). This is a relatively early date for the beginnings of a northern Wisconsin settlement. Furthermore, there is a reference to the falls of the Flambeau River as a fur trade rendezvous site (W.P.A. 1941:468) which might indicate a much earlier date for white occupation, as well as fairly early Historic American Indian occupation; after ca. 1700 by the Chippewa (Smith 1973:15). Therefore, although most of the Project Area would not appear to have been an especially attractive location for occupation during the historic period, the possibility of early isolated settlers' cabins, temporary logging and trapping camps, etc., was given special attention.

An important technique for the detection of historic sites involves the identification of surface indications of structural remains; that is the testing and examination of "unnatural" appearing depressions, mounds, rock concentrations, domestic plant growth, such as lilacs, apple trees, etc., and roughly geometric patterns indicative of variations in soil nutrients. Testing of such locations is, of course, independent of any particular test interval. Results of all such tests (11 locations - 27 shovel tests) were negative; all locations appear to have been natural depressions, hillocks or variations in native vegetation (no domestic flora - difficult to detect in fall, or unusual rock concentrations were observed).

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Smith, Alice E.
1973 The History of Wisconsin (Vol. I), State Hist. Soc. of Wisc., Madison.

Terrill, John
1985 Ladysmith Lore. Ladysmith Centenial Steering Comm.

Tiffany, Joseph
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Work Projects Administration Writer's Program
1941 Wisconsin. Duell, Sloan and Pearce, New York.

CURATION STATEMENT

Notes and artifacts to be housed at the Dept. of Anthropology, Lawrence University, Appleton, WI.

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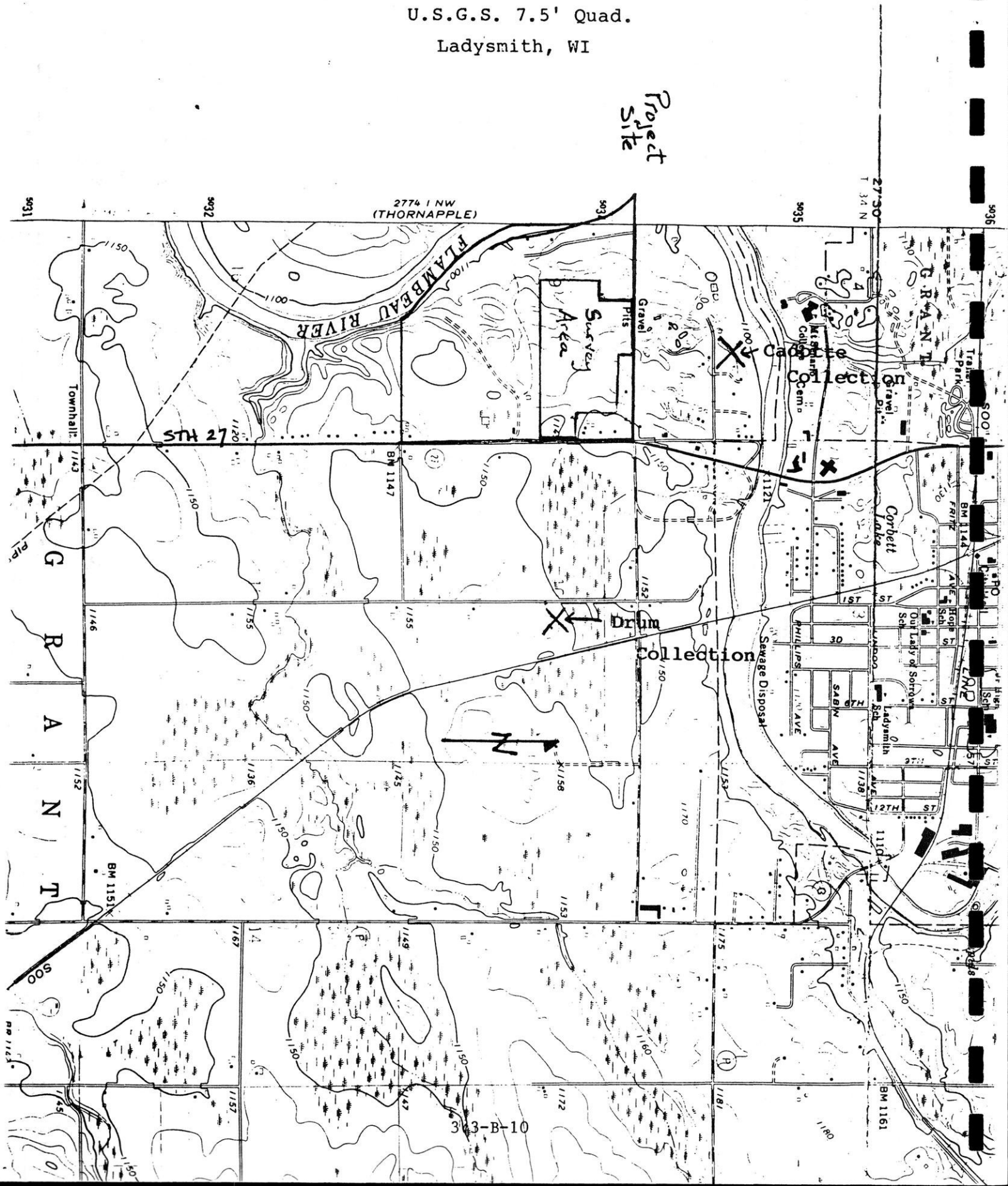
MAP 1

U.S.G.S. 7.5' Quad.

Ladysmith, WI



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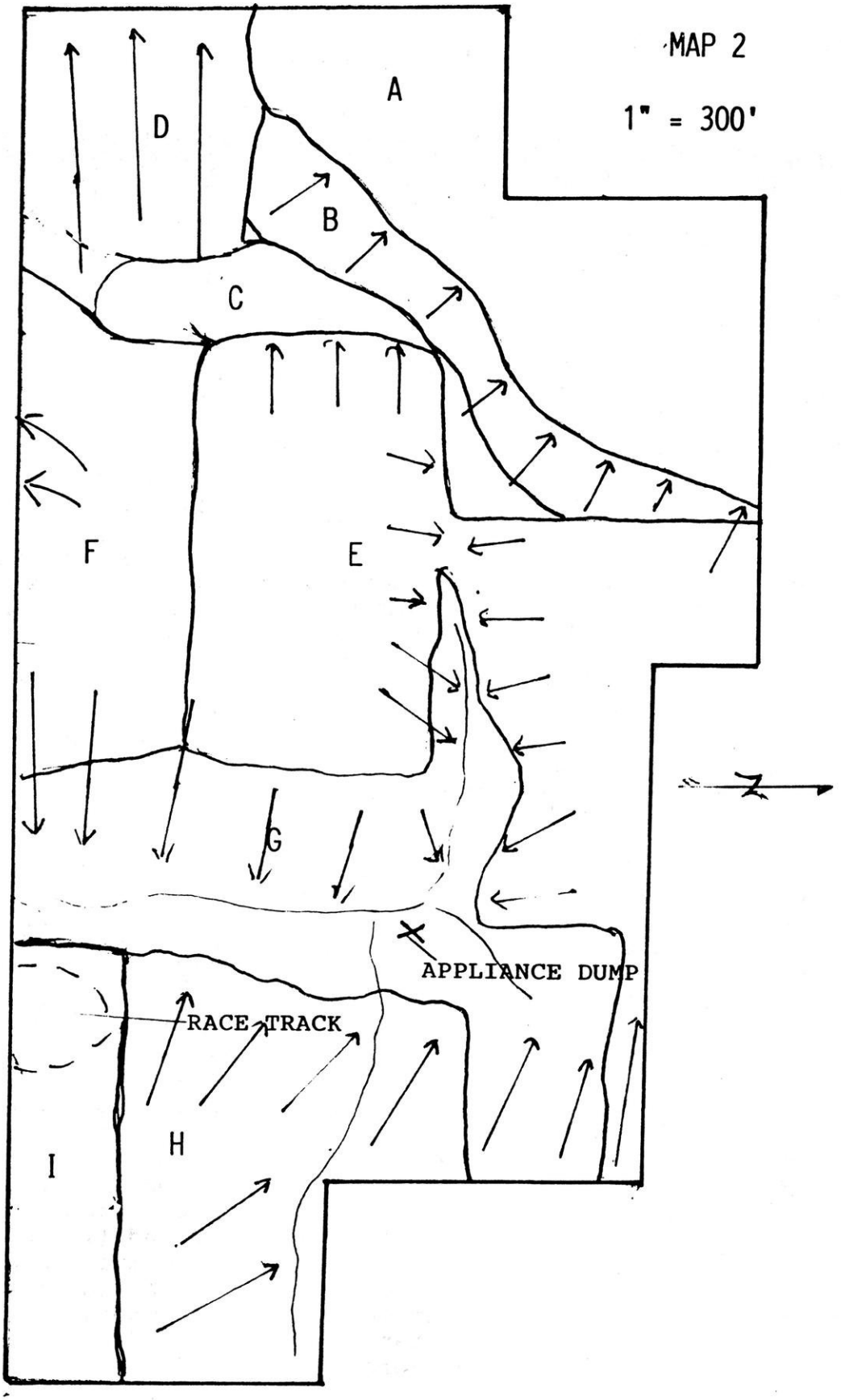

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MAP 2 LEGEND

Area A - Quarry floor.

Area B - Steeply sloping, totally disturbed and extremely eroded quarry walls.

Area C - Quarry overburden and spoil stockpile. Area spot checked with eight shovel tests. No artifacts recovered.

Area D - Steeply sloping and dissected wooded area. Twelve shovel tests at ca. 100' intervals. A thin organic soil horizon (1" to 6") generally rests directly on sand and cobble alluvium or glacial drift. The high concentration of cobbles just under the thin top soil indicates fairly severe erosion of the sand, parent material component. No artifacts recovered.

Area E - Adjoining hay fields currently under cultivation. Treated liquid waste from the Ladysmith municipal sewage disposal plant is spread on the north field twice a year. Shovel tests at 50' intervals in level and moderately sloping areas and at 100' intervals in steeply sloping areas (total - 131 shovel tests). Plowzone depth ranges from 6 to 14 inches, depending on slope and is generally alluvial or glacial drift sand mixed with a few water worn pebbles and small amount of organic material. Where the slope is moderate to steep water worn pebbles and cobbles are much more common. No artifacts were recovered.

Area F - Abandoned agricultural field; small trees and stands of brush present. Due to agriculturally induced erosion and depletion of organic nutrients, vegetation cover is patchy, with exposed bare ground up to 50% in some locations. Soils here are the same as those in Area E, but because of fairly long abandonment, somewhat more compact. Shovel tested at a 50 to 100 foot interval, depending on degree of vegetation cover and slope (32 shovel tests). No artifacts recovered.

Area G - Wooded area adjacent to ephemeral stream, steeply to moderately sloping. Shovel tested at 50 to 100 foot intervals, depending on degree of slope (23 shovel tests). The soil is sandy loam and does not appear to have ever been plowed. The organic soil stratum is variable, quite deep in depressions (up to 12 inches) and shallow on sloping ground (1 inch). The The sandy loam parent material is crisp and compact and is strongly mottled, indicating poor drainage. A dump site for large household appliances is located in the woods. However, all the appliances and associated debris are of recent vintage. No other artifacts were recovered.

MAP 2 LEGEND - page 2

Area H - Hay field recently under cultivation. Most of this field slopes steeply toward the Area G ephemeral stream, and is itself dissected by an ephemeral drainage channel. Seven shovel tests were excavated along the south margin of the field; the only fairly level and well drained ground. Soils are the same as those in Area E hay fields. No artifacts were recovered.

Area I - Abandoned agricultural fields. Shovel tested at 50 to 100 foot intervals, depending on degree of slope, disturbance and vegetation cover (37 shovel tests). Soils the same as Area F. No artifacts recovered. However, informants indicate that an abandoned, dirt, automobile racetrack is located within Area I. An extensive area of disturbance coincides with the reported location of the track. Piles of bulldozed soil can still be discerned, and in many location subsoil is exposed and vegetation sparse.

APPENDIX 3.5-A

Geologic Logs of Diamond Drill Holes Used to Construct Geologic Sections H-H', I-I', and J-J'

GREAT LAKES EXPLORATION

FLAMBEAU 22

HOLE No 22-6

SECTION 410

COORDINATES 40,628.74 N, 39,414.88 E

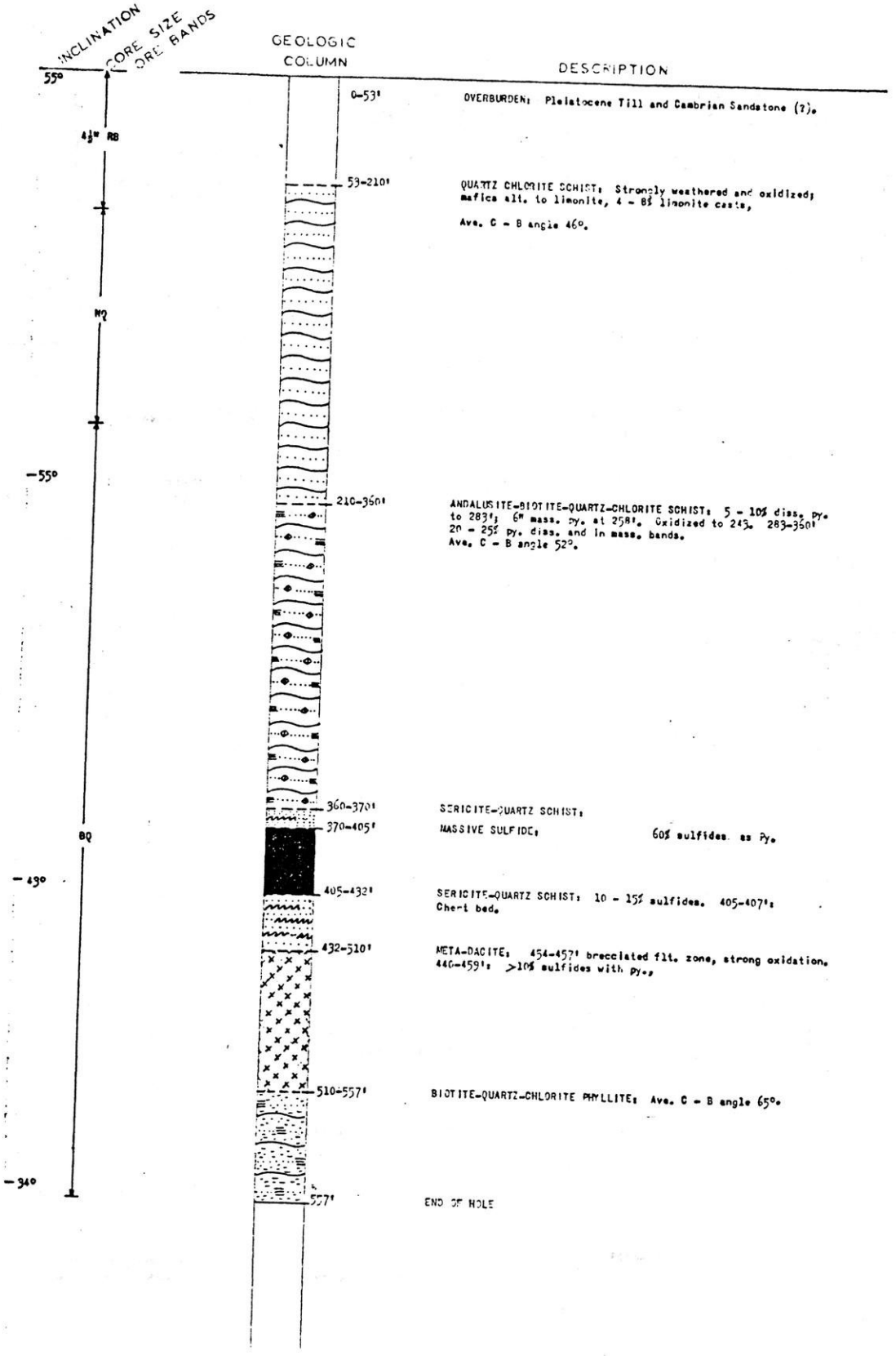
AZIMUTH 135°

ELEVATION 1117.16 ft.

DATE STARTED 4/23/69

COMPLETED 4/30/69

LENGTH OF HOLE 557 ft.



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GREAT LAKES EXPLORATION

PLANREAU 22

HOLE No 22-66

SECTION 422

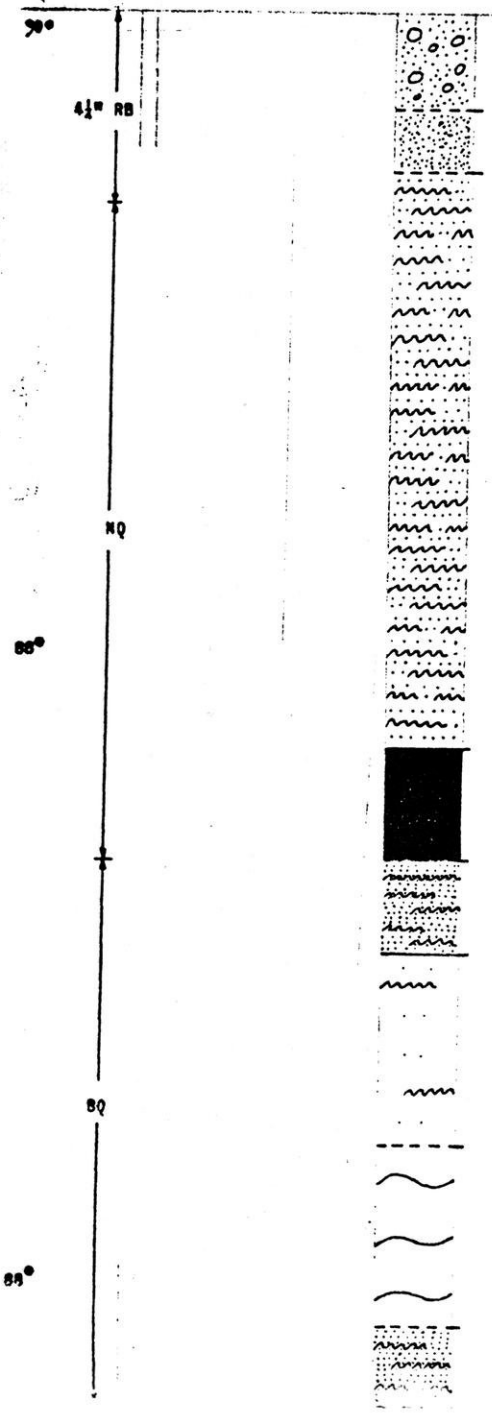
COORDINATES 41,321.53 N, 40,440.45 E

AZIMUTH

ELEVATION 1138.92 ft.

DATE STARTED 3/24/70
DATE COMPLETED 3/30/70

LENGTH OF HOLE 437 ft.



	DESCRIPTION
0–29.5'	PLEISTOCENE TILL
29.5–49'	CAMBRIAN SANDSTONE. Fine to crs.-gr., poorly sorted qtz. arenite. Abundant white qtz. below 47'.
	—ANGULAR UNCONFORMITY—
49–230'	Weathered, bleached QUARTZ-MICA SCHIST, white to v. lt. gray, fine-gr. Minor white kaolinite. A few large irregular kaolinized porphyroblasts
230–265'	MASSIVE SULFIDE. Sharp upper contact.
265–294.5'	SERICITE-QUARTZ SCHIST, lt. gray, fine-gr. Sharp upper contact. Minor white kaolinite.
294.5–[illegible]'	KAOLINITE w/minor ser. and qtz. Sharp upper contact.
355–412'	KAOLINITE-CHLORITE ROCK, lt. grayish-green, fine-gr., w/minor dolomite. A few kaolinite pseudomorphs after amphibole are present.
412–427'	SERICITE-QUARTZ SCHIST.

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DRILL No. 22-68

Section 422

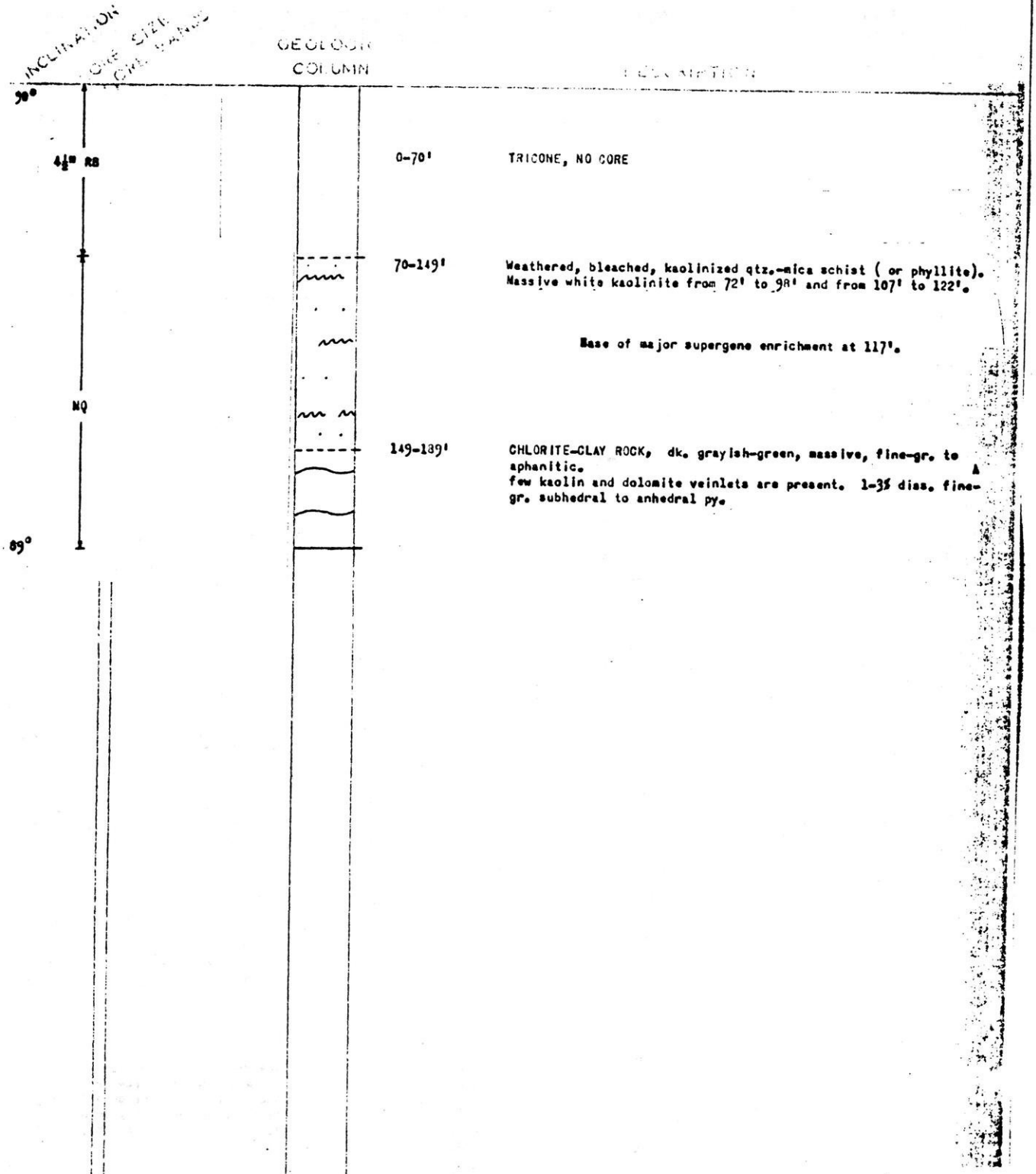
COORDINATES 41,256.99 N, 40,518.36 E

AZIMUTH

ELEVATION 1136.99 ft.

DATE 3/31/70 - 4/2/70

189 ft.



0-70' TRICONE, NO CORE

70-149' Weathered, bleached, kaolinized qtz.-mica schist (or phyllite). Massive white kaolinite from 72' to 98' and from 107' to 122'.

Base of major supergene enrichment at 117'.

149-189' CHLORITE-CLAY ROCK, dk. grayish-green, massive, fine-gr. to aphanitic.
few kaolin and dolomite veinlets are present. 1-3% diss. fine-gr. subhedral to anhedral py.

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HOLE No. 22-71

SECTION 422

COORDINATES 41,642.63 N, 40,126.50 E

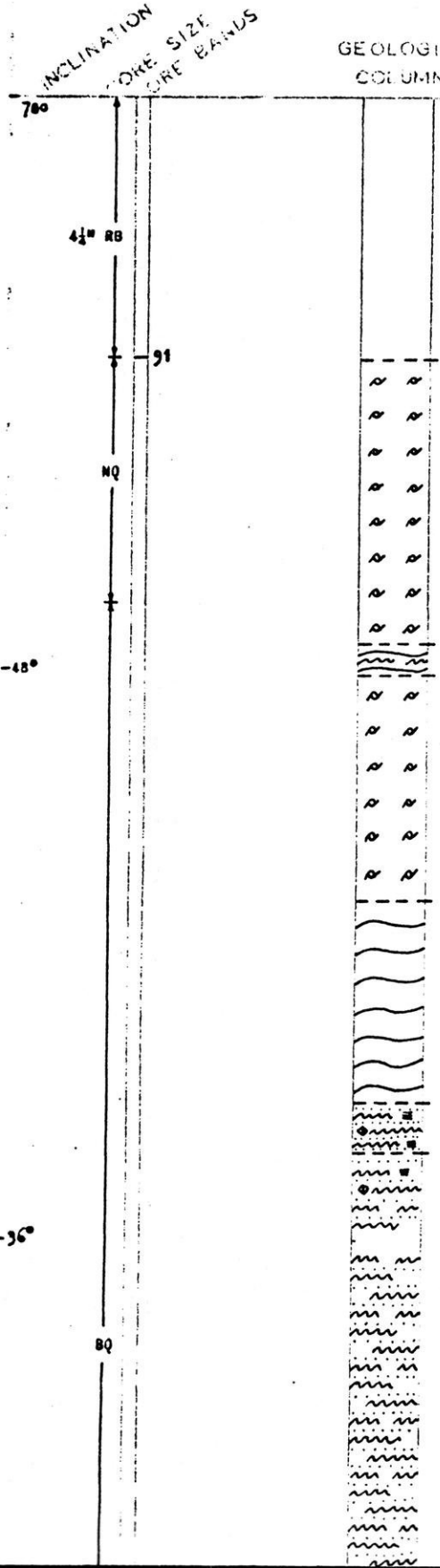
AZIMUTH 135°

ELEVATION 1143.32 ft.

DATE STARTED 4/4/70

DATE FINISHED 4/14/70

LENGTH OF HOLE 697 ft.



0-91'	ROTARY TRICONE (NO CORE OR SAMPLES)
91-191'	QUARTZ AUGEN SCHIST, wh to lt. green., 10% lenticular qtz. "eyes" gen 3x5 mm. in fine grain qtz-ser. matrix, very well developed foliation, oxidized wh. goeth. stain down to 120', qtz veins up to 5" th. @ 98, 105, 142', 146', 151', one with coarse books of muscovite (pegmatite?), tr. diss. py. casts.,
191-202'	SERICITE-CHLORITE SCHIST, dk. green, fine gr. ser-chl. layers with minor thin qtz layers, limon. on fracs., no diss. sulf.
202-281'	QUARTZ AUGEN SCHIST, wh., qtz augen 2x5 mm., alternate qtz rich-ser. rich layers; wh. qtz vein @ 249'. 2% diss. py, partial oxidation mod. limon. stain
281-352'	CHLORITE SCHIST, dk. green, fine grained, layers of chl and ser gen. <2 mm. th. few qtz rich layers some up to 5 mm.; several qtz veins, 1% py, esp. in qtz rich layers. Loc. wk. limon. stain.
352-369'	ANDALUSITE-BIOTITE-QUARTZ-SERICITE SCHIST, greenish grey; bio. porphyroblasts 10-15%, occur as flat books up to 5 mm. across and less than 2 mm. th. gen. cut foliation, bio. Also included in clay alt. andalusite xls., sulf. diss. and in distinct bands
369-559'	QUARTZ-SERICITE SCHIST; lt.greenish grey.; distinct fol., qtz rich layers 3-5 mm. th. alternate with mica rich layers mainly ser. with poes. some chl., few andalusite xls, loc. bio. rich layers; contact with unit above gradational, distinct andalusite-biotite sch. layers up to 3" th. occur in upper 10' of unit. Mass. vein qtz. intercept 2' th. @ 488', several deformed qtz. veins less than 1" th.

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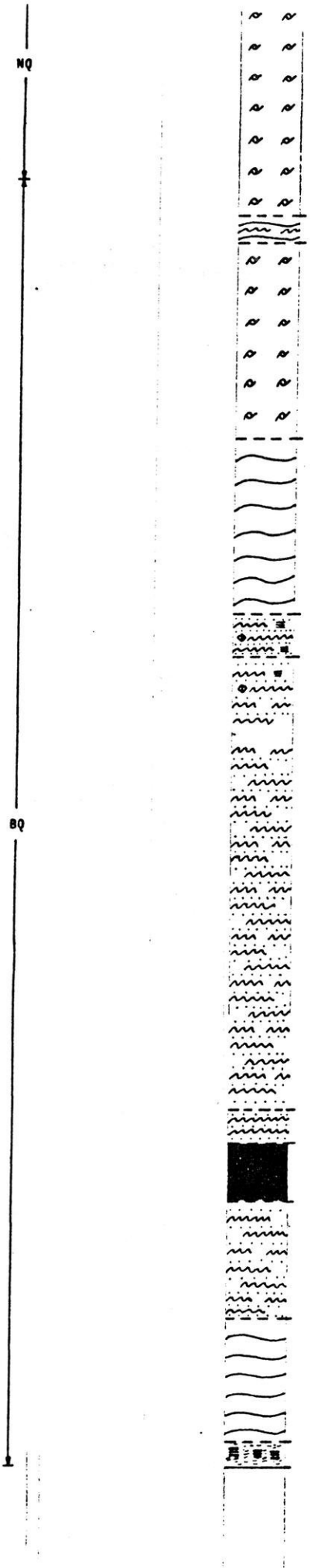

91-191'	
191-202'	
202-281'	
281-352'	
352-369'	
369-553'	
553-566'	QUARTZ-SERICITE SCHIST, wh., alternate qtz rich and mica-qtz layers.
566-590'	MASSIVE SULFIDE.
590-637'	QUARTZ-SERICITE SCHIST, wh., finely laminated, tr. of bio.
637-687'	CHLORITE SCHIST, grey to dk green., numerous thin plates of randomly oriented biotite up to 2 mm. Across and few needles of actinolite in fine grained matrix of chlorite and sericite, 3% diss. py irregular veinlets of carbonate; foliation is poorly developed.
687-697'	BIOTITE QUARTZ PHYLLITE, blk., very fine grain, very poorly developed foliation; diss. sulf. 2-3%, irreg. carbonate veins. Transition with unit above is gradational.
697'	END OF HOLE

DRILL HOLE NO. 22 - 81

SECTION 410

COORDINATES 40,349.45 N, 39,722.44 E

AZIMUTH

ELEVATION 1122.50 ft.

DATE COMPLETED 4/20/70
4/23/70

LENGTH OF HOLE 265 ft.

INCLINATION FROM SURFACE (ONE SHOT)	GEOLOGIC COLUMN	FOOTAGE	DESCRIPTION
90°			
4½" RB	?	0-48'	Overburden; till and cambrian s.s., contact between these units cannot be distinguished.
		48-80'	Precambrian; rotary tricone no core; top of pc based on bright red mud color
		80-142'	CHLORITE SCHIST, greyish-green, lam. less than 1 mm. th. soft strong supergene bleaching in bottom 20' of interval, 1' th. meta chert unit @ 140', thoroughly oxidized, strong hem. stain; deep maroon hem. on frac.; 6" th. qtz vein.
NQ		142-174'	ANDALUSITE-BIOTITE-QUARTZ-CHLORITE SCHIST Andalusite xls up to 2 cm. long which range in outline from round to sharply rectangular, micaceous matrix is pervasively hem. stained, 5' th. metachert unit @ 153; less than 1% diss. py. casts.
86°		174-265'	PORPHYRITIC META-DACITE; grey green; 20% fldspr. phen. less than 2 mm across., lam 1-3 mm th., ser and chl. with some bio. rich layers 3% very finely diss. py.; qtz veins up to 1" th. showing boudinage.
		265	T.D.

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HOLE NO 22-82

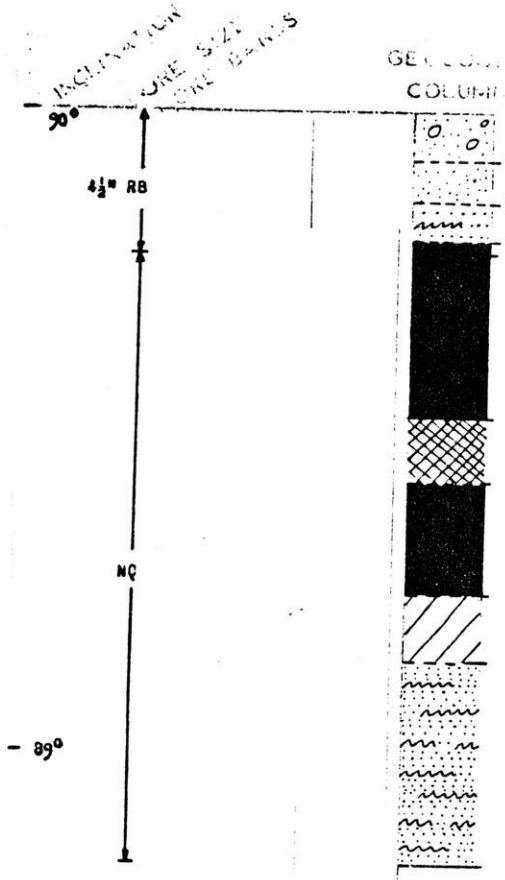
410

40,420.13 N, 39,651.69 E

DATE STARTED 4/23/70
DATE COMPLETED 4/27/70

ELEVATION 1121.12 ft.

LENGTH OF HOLE 235 ft.



0-44' TRICONE-ROCK CUTTINGS: 0-15; Pleistocene till, 15-28'; Cambrian sandstone, 28-44; Precambrian, 28-40; Much limonitic chips, minor Py, 40-44; Massive sulfide cuttings.

44-95' MASSIVE SULFIDES: Largely qtz gangue where not sulfides.

95-115' META-CHERT: Sharp sulfide contact. Because of it's sugary texture meta-chert could be sericite-qtz schist with sericite replaced by qtz.

115-150' MASSIVE SULFIDES: Sharp contact.

150-171' SEMI-MASSIVE SULFIDES: Bedded meta-chert grading to sericite-qtz schist.

171-235' SERICITE-QUARTZ SCHIST: Grad. upper contact. Fine grained schist. Light gray.

235' END OF HOLE

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HOLE NO 22-85

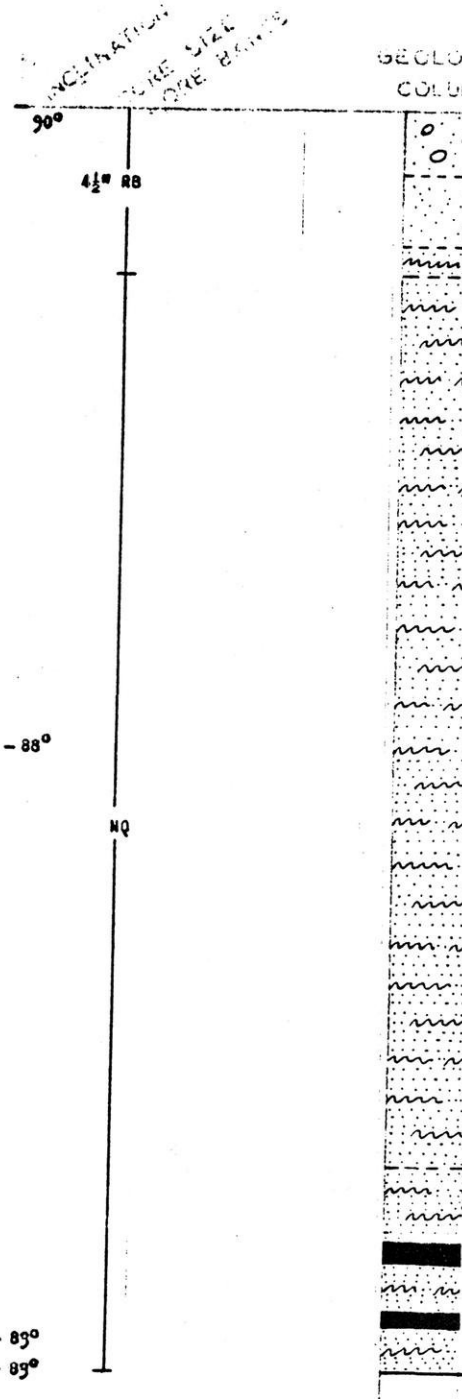
410

COORDINATES 40,490.59 N, 39,579.63 E

ELEVATION 1124.82 ft.

DATE 4/27/70 - 4/30/70

395 ft.



0-51' TRICONE-NO CORE TILL- Sandstone contact at 20'. Sandstone-precambrian contact at 42'. 42-46': Sericite fragments.

51-330' SERICITE-QUARTZ SCHIST. Fine grained, light gray. Kaolinized in varying degrees down to 330'. 51-54': Light limonitic stain, moderately kaolinized, less than 1% py casts 54-60': hematite stained.

330-395' INTERBEDDED MASSIVE AND SEMIMASSIVE SULFIDES IN SERICITE-QUARTZ SCHIST.
Fine grained, light gray schist with majority of sulfides concen. in bands with bedding. Gradational contact.

END OF HOLE.

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GREAT LAKES EXPLORATION
CARIBEAN
HOLE NO 22-98

SECTION 422
COORDINATES 41,284.10 N, 40,487.50 E
AZIMUTH
ELEVATION 1137.50 ft.

DATE STARTED 6/5/70
DATE COMPLETED 6/10/70
LENGTH OF HOLE 320 ft.

VERTICAL HOLE

INCLINATION	ORE SIZE / ORE BANDS	GEOLOGIC COLUMN		DESCRIPTION
90°			0-26'	PLEISTOCENE TILL:
	4½" RB		26-45'	CAMBRIAN SANDSTONE:
			45-80'	QUARTZ-SERICITE SCHIST: White to light pink or tan, fine grained schist. Altered to quartz-kaolin schist with patchy limonitic staining throughout.
			80-143'	MASSIVE SULFIDE: Sharp contact.
			143-175'	KAOLINIZED SERICITE-QUARTZ-SCHIST: Sharp contact. Very fine grained light gray. 143-147; Very dense looking gray matrix with kaolinized xls (1 x 2 mm).
38°	NQ		175-194'	MASSIVE SULFIDE: Sharp upper contact. Very grainy, most is friable.
			194-254'	KAOLINIZED SERICITE-QUARTZ SCHIST: Gradual contact. Fine grained, white to light gray.
19°			254-320'	KAOLINIZED CHLORITIZED AMPHIBOLE CHLORITE SCHIST: Sharp contact. Fine grained, medium to dak green, light gray-green chlorite schist. Altered amphibole 1 x 3 mm.
			320'	END OF HOLE

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GREAT [illegible] EXPLORATION

PLANNED

HOLE NO 22-99

SECTION 410

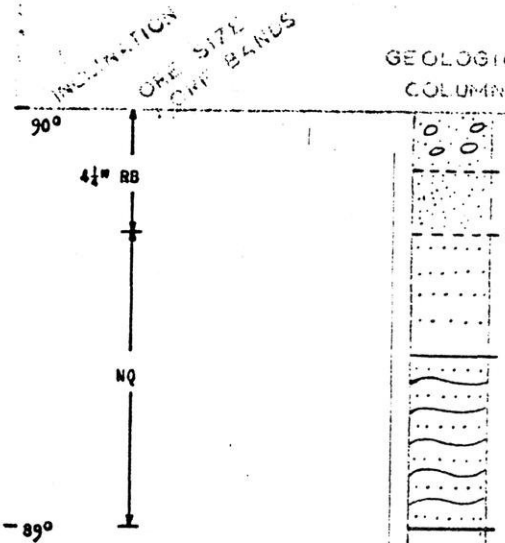
COORDINATES 40,383.60 N, 39,687,87 E

AZIMUTH

ELEVATION 1121.75 ft.

DATE STARTED 6/11/70
DATE COMPLETED 6/15/70

LENGTH OF HOLE 130 ft.



DESCRIPTION

0 - 18'	PLEISTOCENE TILL:
0 - 38'	TRICONE: Till - ss contact at 18'. SS - Precambrian contact at 38'.
18 - 38'	CAMBRIAN SANDSTONE:
38-76'	QUARTZ-KAOLIN: Rock very fine grained, white and light gray. 38 - 42: Massive kaolin, still shows bedding. Minor limonite staining. 42 - 55: Limonite stained kaolin thruout, many pits containing earthy hematite, Minor qtz fragments Friable.
	60 - 76: Massive kaolin with qtz frag. Predominant pattern of white kaolinized "pyroclastic frag. (?)" in web of gray kaolin material.
76-130'	CHLORITE SCHIST: Minor qtz increasing downhole. Sharp contact. Semi-bleached and/or hematite stained down to 110. Quite broken down to 106; local clay.
130'	END OF HOLE

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GREAT [illegible]

FLAMBEAU

HOLE No. 22-101

SECTION 410

COORDINATES 40,537/20 N, 39,544.20 E

AZIMUTH

ELEVATION 1126.70 ft.

STARTED 6/16/70
COMPLETED 6/17/70

[illegible] OF HOLE 210 ft.

INCLINATION	CORE SIZE, CASING	GEOLOGIC COLUMN		
-90°			0-27'	PLEISTOCENE TILL.
	4¼" RB		27-46'	CAMBRIAN SANDSTONE
	NQ		46-210'	ANDALUSITE-BIOTITE-SERICITE-QUARTZ-CHLORITE SCHIST: Strongly oxidized to 147. Bleached and kaolinized to bottom with minor hematite on fractures. 58-147; Much hematite, friable, some places muddy. 125-126; Several bands of massive botyriodal hematite up to 20 mm wide.
-87°			210'	END OF HOLE

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22-126

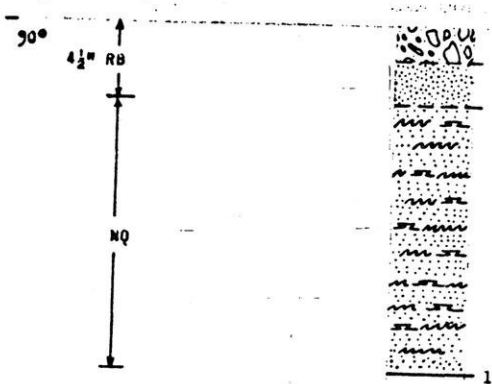
410

40,456.90 N, 39,614.94 E

1120.18 ft.

5/7/74
5/8/74

108.2 ft.



14'	0 - 14'	RECENT ALLUVIUM AND PLEISTOCENE GLACIAL DRIFT, unconsolidated clay, silt, sand and boulders. Tricone, no core.
24.8'	14 - 24.8'	CAMBRIAN(?) SANDSTONE. Lt. gray, fn. to med. grained, well rounded, poorly sorted quartz (>95%). 1% gray-green clay (especially in seams at 20.5', 23.5'), 2% yellowish-brown iron oxide staining (particularly at 23.5-24.8')
108.2'	24.8-108.2'	PRECAMBRIAN TALC-QUARTZ-SERICITE SCHIST, lt. and silver gray, fine grained w/strong schistosity. Folia ave. 2 mm thick. Rock consists of 40% sericite, now highly altered to white kaolinite, 30% quartz, 20% talc in separate folia up to 2 cms thick, 10% sulfides. Base of red-brown iron oxides is 45'. 24.8-27': cream-yellow, soft, sericite-clay mixture. 27.4-30': dense, highly fractured and broken metachert. A few cm-size fragments, possibly felsic lapilli.
108.2'		END OF HOLE

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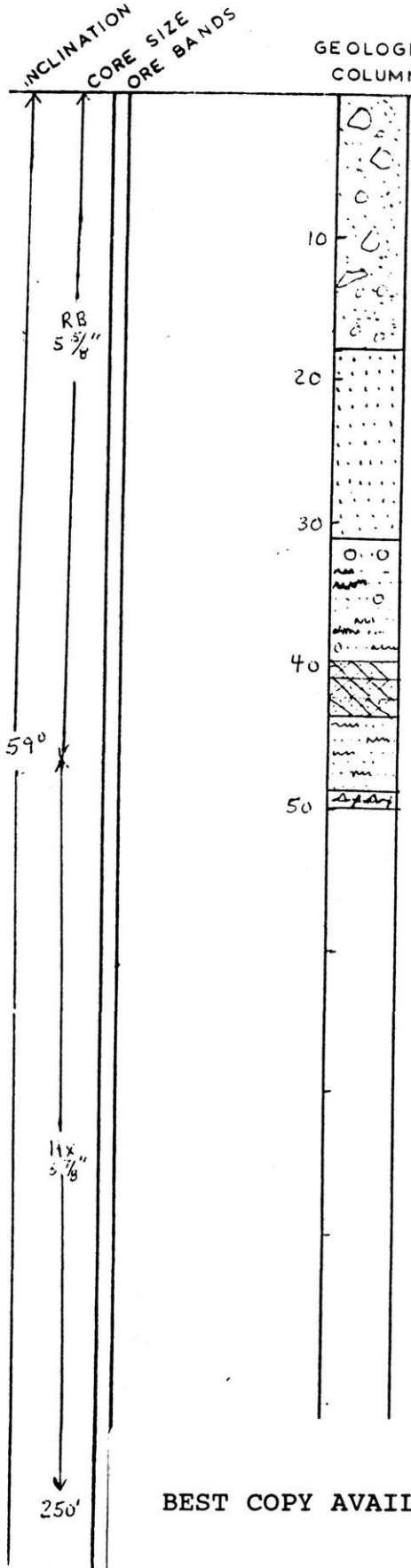
Hole 22-136

SECTION 410
COORDINATES 40406.3794N, 39666.1500E
AZIMUTH 135°
ELEVATION 1121.70

DATE STARTED 10-27-87
COMPLETED 11-5-87
LENGTH OF HOLE 250'
% ORE RECOVERY —



	GEOLOGIC DESCRIPTION
0-18'	GLACIAL OVERBURDEN Cuttings typically iron-oxide stained, consisting of fine quartz, medium-coarse-grained feldspar, black mafic minerals and rare micaceous grains; local clay horizons, especially near base of unit, stained deep red.
18-31'	CAMBRIAN SANDSTONE Drilling fluid turns yellow brown or gray. Distinct large well-rounded quartz grains predominate cuttings. Local oxidized clay layers as in glacial till.
31-39.8'	QUARTZ-EYE-SERICITE-FELSIC CRYSTAL TUFF (UNIT 1b) Gray, porphyritic, aphanitic, coarse-grained, compact, brittle. 7-12% feathery sericite define an incompletely developed foliation. 10-15% medium-very coarse-grained (up to 5mm), blue-gray-white, sub-angular-angular quartz "eyes" set in silceous aphanitic matrix. 5-7% irregular, stretched vugs may be glass vacancies; more blocky, iron-oxide-stained spaces may be former pyrite sites; more sericite-rich interlayers (1-3" wide) have weathered to a crusty yellow-white material, locally impregnated by secondary quartz (as 33-36'). Cherty lithic fragments (up to 3 cm) are observed rarely in 2-3" zones (as 32.5' and 38.5'). Irregular, yellow-brown patches of finely-milled quartz-eye tuff engulf larger fragments in a few areas between 34-36'
39.8-43.4'	METACHERT (UNIT 1b) Leached limonite cap; medium-grained-very fine grained, purple/black/gray-green, very thinly bedded (⅛-½ cm) metachert, locally interlayered with above quartz-eye unit. Discrete layers are strongly limonite-stained and vuggy. The chert is locally brecciated along bedding until 40.7'; after which the sequence is largely brecciated chert and quartz fragments (up to 3.5 cm), sealed by fine-grained quartz-limonite. The vugs can

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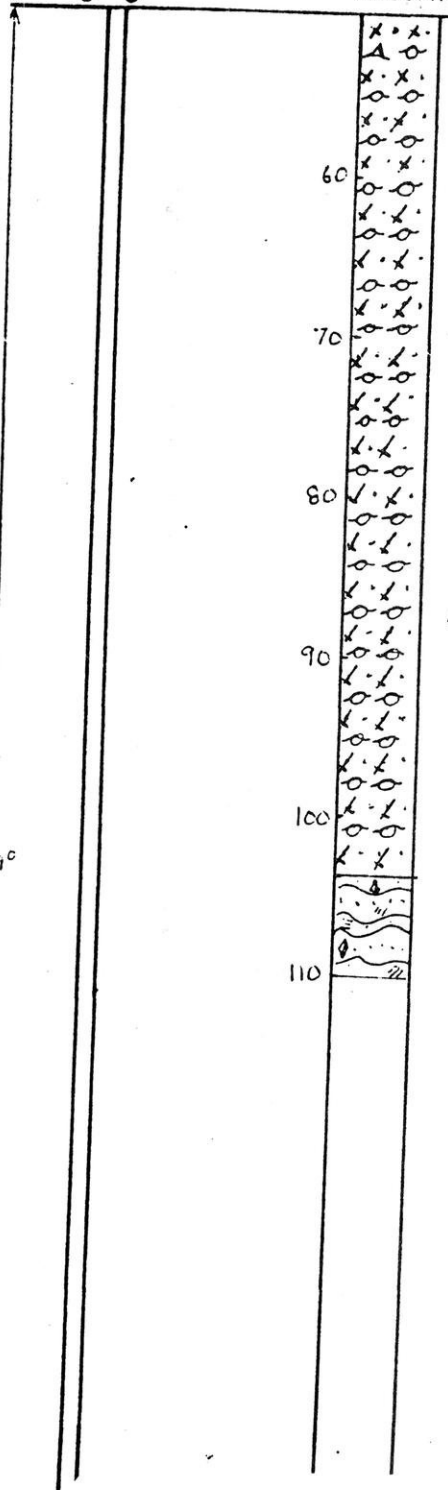
BEAR CREEK MINING CO.

Hole 22-136

SECTION 410
COORDINATES 40406.3794N, 39666.1500E
AZIMUTH 135°
ELEVATION 1121.70

DATE STARTED 10-27-87
COMPLETED 11-5-87
LENGTH OF HOLE 250'
% ORE RECOVERY —



GEOLOGIC DESCRIPTION

39.8-43.4' (cont'd) approach several cm's in size and are often lined with white, powdery clay minerals. The top several inches of the unit is typical leached gossan caprock. Fine-medium-grained, squarish pyrite vacancies (3%) are evident throughout footage; trace manganese-oxide.

43.4-49.6' SERICITE QUARTZ SCHIST (UNIT 1a)
45-48.5' sequence almost completely kaolinized-white, very soft, friable; local fractures coated with manganese-oxide and iron-oxide.

48.5-49.6' kaolinized sericite quartz schist with 5-7% fine, blue-gray quartz eyes still preserved.

Gradational contact.

49.6-103.8' PORPHYRITIC METADACITE (UNIT 5)
49.6-66' white, soft, moderately-kaolinized quartz-feldspar crystal tuff; strong iron-oxide staining along fractures. Lathlike and rectangular remnant, saussuritized remnant feldspars (15-25%) still evident

66-81' less altered version of above; wispy chlorite (altered to illitic clays) wraps around saussuritized feldspar, forming a weak-moderate foliation. Trace-2% very fine-grained pyrite as disseminated grains or as discontinuous lenses along foliation (first observable fresh pyrite); mild iron-oxide staining along fractures

Local kaolinized fractures.

81-103.8' still fresher sequence. Partially altered, blue-gray, porphyritic (coarse/fine-grained), weakly-moderately foliated intermediate-mafic crystal lithic tuff. Consists of 10-15% medium-coarse-grained, blocky, altered feldspar, 1-2% medium-coarse-grained biotite, 3-6% fine-grained, anhedral, blue-gray quartz, (usually masked by groundmass) 3-6% partially altered blue-black chlorite, 1% lensoidal or ovoid, quartz-feldspar. Lithic fragments. The groundmass is mainly altered fine-grained chlorite. Trace euhedral-subhedral, very fine-fine-grained pyrite.

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Hole 22-136

SECTION 410

COORDINATES 40406.3794N, 39666.1500E

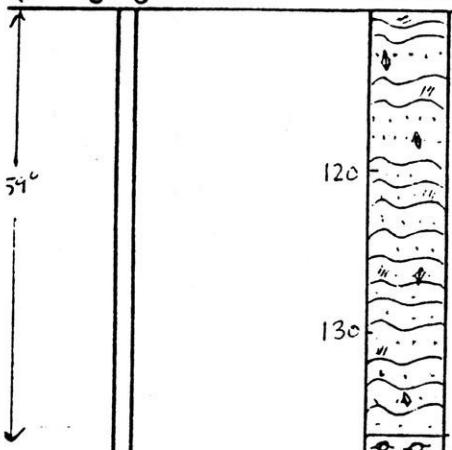
AZIMUTH 135°

ELEVATION 1121.70

DATE STARTED 10-27-87
COMPLETED 11-5-87

LENGTH OF HOLE 250'

% ORE RECOVERY —



GEOLOGIC DESCRIPTION

49.6-103.8' (cont'd) After 90' this unit becomes quite heterogenous, and has intercalated units of chlorite phyllite, altered, massive actinolite-chlorite (metabasalts or andesites) and tuffaceous rocks with 3-5% lithic fragments and very few crystal phenocrysts.

Gradational contact.

103.8-136.5' ANDALUSITE-BIOTITE-QUARTZ-CHLORITE SCHIST (UNIT 2c)
Mainly a well-foliated, chlorite phyllite with very few observable accessory minerals.

Hematite-coated partially-completely weathered, fine-medium-grained pyrite is more or less ubiquitous from trace-2% to 3-5%. Much of the footage is iron-oxide-stained and shows argillic alteration and bleaching of the chlorite minerals.

103.8-104.5', a gray-white, translucent, 1-2" wide chlorite-bearing quartz vein separates Units 3a and 2. Just above the vein the chlorite phyllite has almost completely been altered to white kaolinite. Better preserved layers show partial serpentinization of the chlorite and elongated gray quartz lapilli. A second foliation, crosscutting the primary foliation is well-developed, locally. This grades into an argillized, iron-oxide-stained chlorite phyllite.

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Hole 22-136

SECTION 410
COORDINATES 40406.3794N, 39666.1500E
AZIMUTH 135°
ELEVATION 1121.70

DATE STARTED 10-27-87
COMPLETED 11-5-87
LENGTH OF HOLE 250'
% ORE RECOVERY —

INCLINATION	CORE SIZE ORE BANDS	GEOLOGIC COLUMN	GEOLOGIC DESCRIPTION
			103.8-136.5' (cont'd) Locally, especially between 110-120', discontinuous lenses and occasionally coarse-grain aggregates of pyrite are more common. These pyritiferous areas sometimes form more strongly stained hematitic layers 1/4-3/4" wide and may have 6-10% altered pyrite. Minor fracture zones (½-2" wide) occur throughout the interval and are marked by quartz-stringer infilling along fracture planes, the most prominent at 101.9, 114', 114.8'. Open hematite and manganese-oxide-coated fractures are also observable locally, and generally parallel to foliation (122.6', 122.9', 124-125', 127', 130'). Numerous, minute hematite-filled fractures occur throughout. Sometimes the fractures border notably softer iron-oxide-stained layers In several areas (as between 111-112') a set of filament fractures are perpendicular to foliation and exhibit left-lateral displacement. The chlorite phyllites show a gradational contact back into a sequence dominated by the crystal and crystal-lithic tuffs described at 49.6-103.8'.
			136.5-151.4' PORPHYRITIC METADACITE (UNIT 5) As 49.6-103.8'. Trace-3% fine-grained, euhedral pyrite and subhedral-anhedral fracture smears; less pyrite after 140'.

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Hole 22-136

SECTION 410
COORDINATES 40406.3794N, 39666.1500E
AZIMUTH 135°
ELEVATION 1121.70

DATE STARTED 10-27-87
COMPLETED 11-5-87
LENGTH OF HOLE 250'
% ORE RECOVERY —

INCLINATION / CORE SIZE / ORE BANDS	GEOLOGIC COLUMN	GEOLOGIC DESCRIPTION
60°	160 170 180	151.4-161' ANDALUSITE-BIOTITE-QUARTZ-SERICITE-CHLORITE SCHIST (UNIT 2a) Yellow (W), white-brown (F) sericite phyllite and bleached chlorite with fine-medium-grained quartz (1-3%), trace of gray-white fine-medium-grained "knobby" andalusite and 1-3% black-brown biotite. The biotite occurs as individual sub-grains or in patchy irregular grain aggregates Quartz also occurs as large gray-white lithic fragments, stretched along foliation (trace-½%). Local fractures are iron-oxide stained. Discontinuous, wispy pyrite lenses (trace-2%) form hematite-stained streaky patches, parallel to foliation. Chlorite phyllite is occasionally interlayered and forms a gradational contact toward the bottom of the sequence. Gradational contact. 161-174.3' PORPHYRITIC METADACITE (UNIT 5) Similar to 49.6', but generally has a more abundant lithic component. These lithic fragments (up to 3 cm) are stretched along foliation and consist mainly of quartz and altered feldspar. The fragments can make up to 15-20% of the core, locally. Pyrite occurs as local fracture smears (1%) plus fine-grained euhedral-subhedral disseminations (1-2%). Trace-1% epidote along fractures. Minor quartz-replaced zones (2") at 170.1'. 174.3-180' ANDALUSITE-BIOTITE-QUARTZ-SERICITE-CHLORITE SCHIST (UNIT 2a) Similar to earlier-described above unit, but with much more abundant andalusite (3-6%), as squarish, red-brown, coarse-grained crystal sections. Locally, andalusite up to 7-10%. Pyrite as very fine disseminations and as patches parallel to foliation (½-1%). Gradual contact with porphyritic metadacite after 178'.

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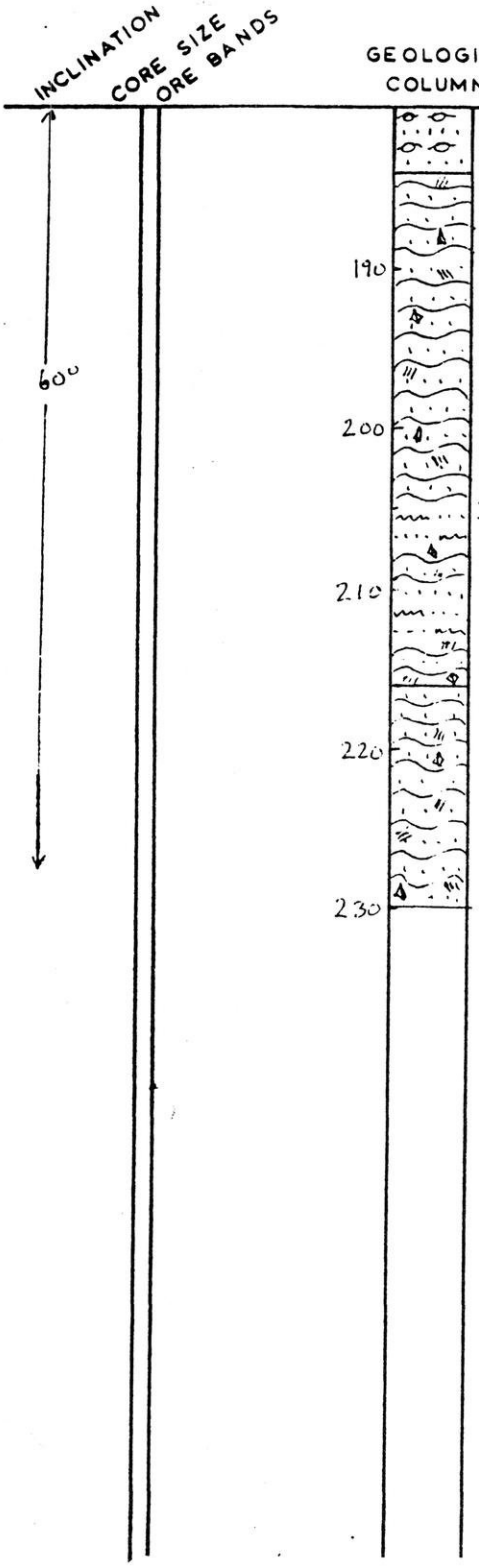
Hole 22-136

SECTION 410
COORDINATES 40406.3794N, 39666.1500E
AZIMUTH 135°
ELEVATION 1121.70

DATE STARTED 10-27-87
COMPLETED 11-5-87
LENGTH OF HOLE 250'
% ORE RECOVERY —



GEOLOGIC DESCRIPTION

180-184' PORPHYRITIE METADACITE (UNIT 5)
Crystal and crystal-lithic tuffs. Locally biotite-rich (6-8% coarse-grained, subhedral); local quartz stringers. Trace-1% pyrite.

184-185.3' QUARTZ VEIN
Gray-white, medium-coarse-grained, translucent, chlorite-bearing fractures. Trace-½% fine-coarse-grained, subhedral pyrite.

185.3-205' ANDALUSITE-BIOTITE-QUARTZ-CHLORITE SCHIST (UNIT 2c)
Mainly chlorite phyllite with intercalated porphyritic metadacite. Pyrite generally leached and not as well preserved as previous sequences. Local pyrite-biotite-rich, iron-oxide-stained layers. Local, quartz-chlorite fractures crosscutting prominent foliation. Hematite-stained fractures particularly prevalent from 187-187.3' and 191-191.5'. Occasional 1/4-3/4" wide quartz-impregnated stringer zones.

After 192' coarser, wispy chlorite appears.

205-216' INTERCALATED ANDALUSITE-BIOTITE-QUARTZ-CHLORITE and ANDALUSITE-BIOTITE-QUARTZ-SERICITE UNITS (CHLORITE AND SERICITE SCHISTS)
Sericitic schists are creamy white and have a pearly luster. Locally, foliation is kinked; a larger zone (3") occurs at 209.2'. Trace-1% hematite-stained pyrite vacancies.

216-231' ANDALUSITE-BIOTITE-QUARTZ-CHLORITE SCHIST (UNIT 2c)
Typical chlorite-rich andalusite-biotite-quartz-chlorite schist with 10% large (up to 3.5 cm) lensoidal pyrite-biotite clasts stretched along foliation. 8-12% blue-gray quartz eyes (fine-grained, subhedral). Pyrite also present as medium-grained, subhedral grains and aggregates and as smears along foliation (1-3% overall.

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Hole 22-136

SECTION 410

COORDINATES 40406.3794N, 39666.1500E

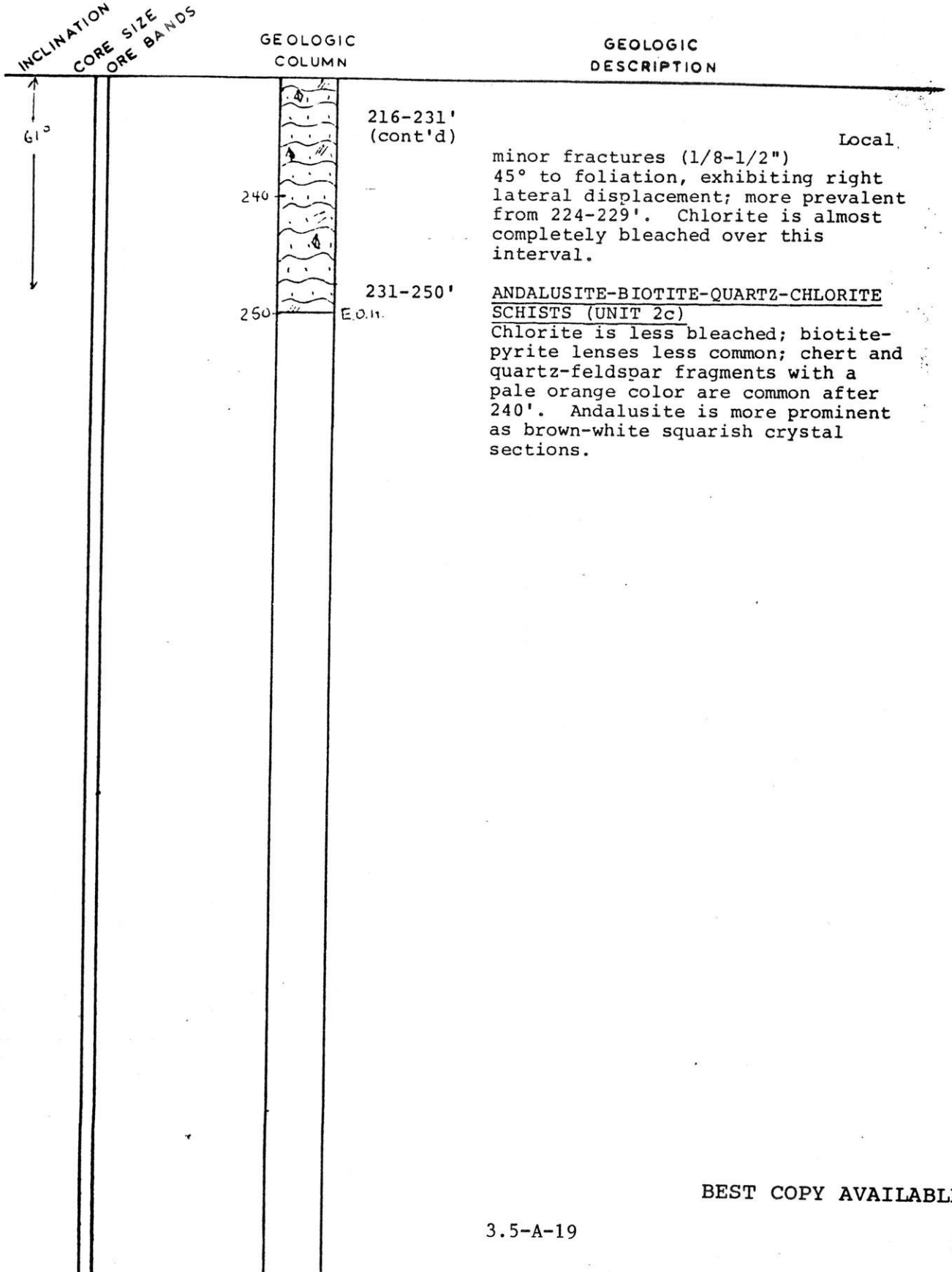
AZIMUTH 135°

ELEVATION 1121.70

DATE STARTED 10-27-87
COMPLETED 11-5-87

LENGTH OF HOLE 250'

% ORE RECOVERY —



GEOLOGIC DESCRIPTION

216-231' (cont'd)

Local minor fractures (1/8-1/2") 45° to foliation, exhibiting right lateral displacement; more prevalent from 224-229'. Chlorite is almost completely bleached over this interval.

231-250' ANDALUSITE-BIOTITE-QUARTZ-CHLORITE SCHISTS (UNIT 2c)

Chlorite is less bleached; biotite-pyrite lenses less common; chert and quartz-feldspar fragments with a pale orange color are common after 240'. Andalusite is more prominent as brown-white squarish crystal sections.

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Hole 22-137-A

SECTION 401

COORDINATES 40034.7509N, 38723.6845E

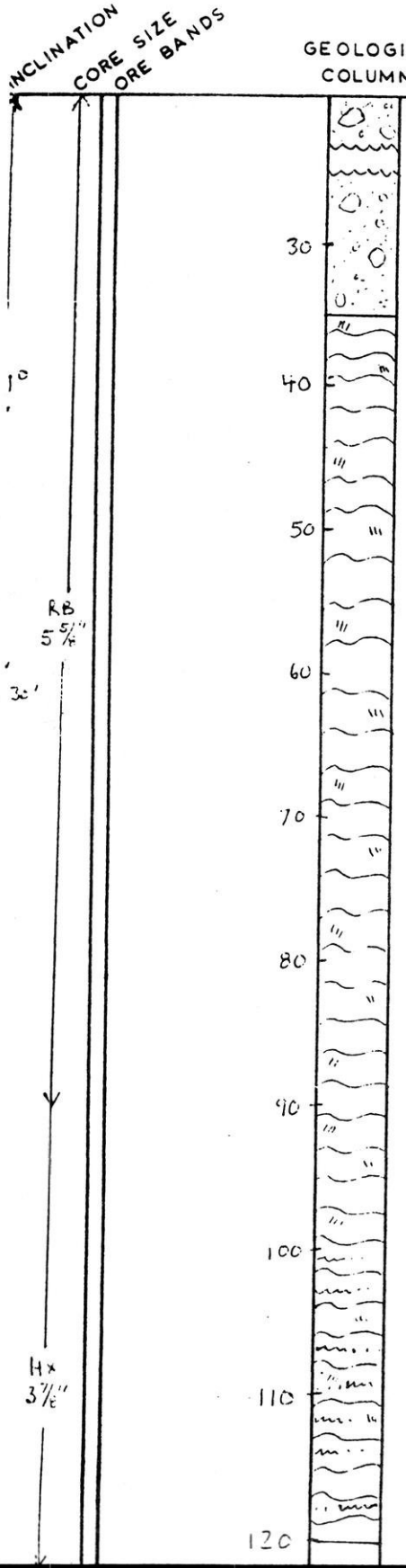
AZIMUTH 135°

ELEVATION 1101.12

DATE STARTED 12-18-87
COMPLETED 12-20-87

LENGTH OF HOLE 230'

% ORE RECOVERY



GEOLOGIC DESCRIPTION

0-35' GLACIAL OVERBURDEN
Sandy till with boulders and cobbles. Local clean sand layers toward bottom of interval.
Rotary drilling - no core.

35-90' PRECAMBRIAN CONTACT
First micaceous flakes appear at 35'. The drilling pressures indicated the first 5-8' of the sequence were clay rich, probably saprolitic Precambrian.
Rotary drilling - no core.

90-100' BIOTITE-CHLORITE SCHIST (UNIT 2c)
Strongly-stained along foliation and fine fractures. 6-8% iron-oxide stained, fine-grained, tabular and squarish, relict crystal sites, probably of pyrite and a mafic mineral.

100-222' BIOTITE-CHLORITE SCHIST (UNIT 2c, LOCAL 2a)
Same as 90-100', but generally less altered. Core is more typical chloritic green. Local quartz stringers parallel to foliation.

105.7-107.3' better argillized, iron-oxide-stained; biotite stands out as altered bronzey grains, local relict quartz fragments.

123.8-128' better argillized.

100-135' generally intercalated with more sericitic Unit 2a.

After 132' biotite is more common, occasionally concentrated in discontinuous lenses or thin beds. Typical bronzey-brown and partially iron-oxide-stained weathered surface (3-6%). Trace-1% partially leached fine-grained pyrite.

152-164', 171-172'. Although lithic fragments occur locally as quartz, or quartz-sericite/kaolinite, lithic fragments are particularly abundant over limited intervals.
The most obvious fragments (2-4%) are 1/4-3/4", irregular, sub-rounded and typically iron-oxide-stained quartz-sericite schist fragments; sericite usually altered in some degree to kaolinite. The iron-oxide staining is usually along the fragment selvedges; trace-1% iron-oxide-stained pyrite vacancies.

(continued next page)

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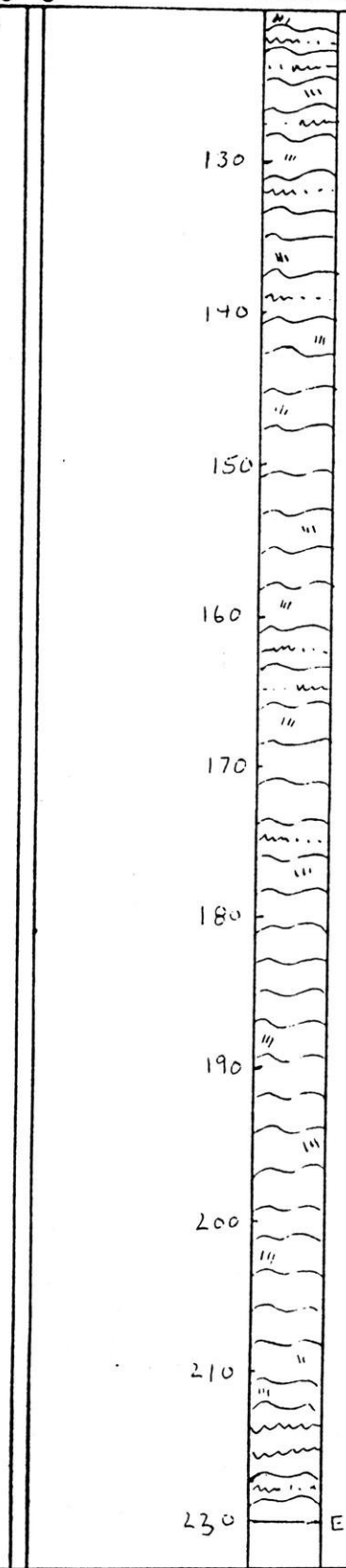
Hole 22-137-A

SECTION 401
COORDINATES 40034.7509N, 38723.6845E
AZIMUTH 135°
ELEVATION 1101.12

DATE STARTED 12-18-87
COMPLETED 12-20-87
LENGTH OF HOLE 230'
% ORE RECOVERY

INCLINATION | CORE SIZE | ORE BANDS | GEOLOGIC COLUMN | GEOLOGIC DESCRIPTION



100-222' (cont'd)

After 102', core is commonly mildly-strongly stained by small amounts of iron-oxide concentrated along hairlike-filament fractures, generally not over 1/16" wide. The fractures are prevalent in minor (½-3") zones between 185-195' and 200-213'.

216-222' locally fractures open up into stringers ½-3" wide; these wider, healed fractures usually consist of light-gray, coarse-grained quartz with minor hematite-stained fracture smears. Trace of blue-green chlorite; trace partially altered pyrite sites. This quartz infills local, minor (<2" wide), mildly brecciated chlorite schist.

222-230' BIOTITE-CHLORITE-SCHIST AND BIOTITE-SERICITE-QUARTZ-CHLORITE SCHIST (UNIT 2c and 2a)

Sub-units of lithic-rich (up to 20%) rocks become intercalated with more typical biotite-chlorite schist. Lithic fragments are usually either gray quartz-dark quartz-sericite schist.

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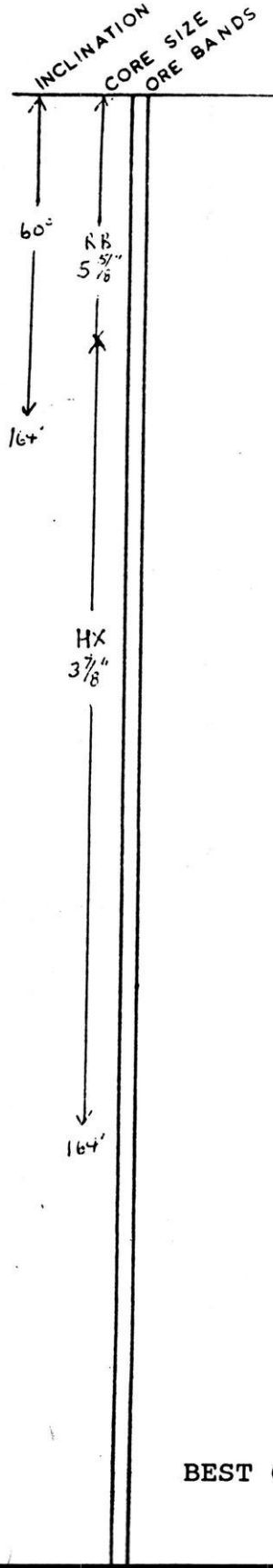
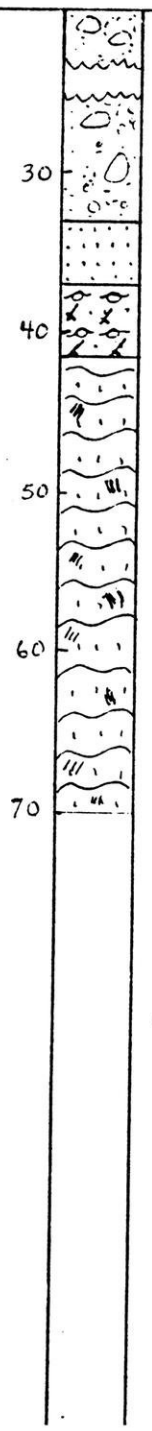
Hole 22-137

SECTION 401
COORDINATES 40029.8900N, 38751.3102E
AZIMUTH 135°
ELEVATION 1101.40

DATE STARTED 11-7-87
COMPLETED 11-11-87
LENGTH OF HOLE 164'
% ORE RECOVERY





GEOLOGIC DESCRIPTION

0-33' GLACIAL OVERBURDEN
Large boulders up to 2' were encountered. Red clay layers particularly prevalent toward bottom of interval.
Rotary drilling - no core.

33-37' PRECAMBRIAN
Sericite or bleached chlorite grains first appear in cuttings at 33',

Drilling still "soft".
Set casing at 37'.
Rotary drilling - no core.

37-41.5' PORPHYRITIC METADACITE (UNIT 5)
Green, porphyritic (aphanitic, fine-grained/coarse grained), foliated muscovite/sericite-chlorite schist. Variable (3-20%) coarse-grained sericite in blocky growths,

Large (up to 2.5 cm) iron-oxide-stained, sericite crystal aggregates

Local fine-grained, bronzey, weathered biotite; fine-grained, kaolinized feldspar crystals (trace-1%).

Iron-oxide staining common along foliation. Core is extremely soft and friable.
Iron-oxide stained, chlorite-bearing, ½" wide quartz stringer at 37.2'.

41.5-73.3' BIOTITE-QUARTZ-CHLORITE SCHIST (UNIT 2c)
Weathered bleached white-green, iron-oxide-red, well foliated chlorite phyllite with rare partially altered medium-coarse-grained biotite. Trace coarse-grained, leached, hematite-stained, squarish pyrite vacancies. Local quartz-feldspar fragments (½%) stretched along foliation

Sequence from 61.4-64' particularly iron-oxide stained and soft; in several areas between 54-66' the foliation is kinked or a second foliation is partially developed. Chlorite has weathered in varying degrees to purplish-white or blue-green clay and alteration minerals.

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Hole 22-137

SECTION 401
COORDINATES 40029.8900N, 38751.3102E
AZIMUTH 135°
ELEVATION 1101.40

DATE STARTED 11-7-87
COMPLETED 11-11-87
LENGTH OF HOLE 164'
% ORE RECOVERY

INCLINATION / CORE SIZE / ORE BANDS	GEOLOGIC COLUMN	GEOLOGIC DESCRIPTION
	80	41.5'-73.3' (cont'd) Quartz has replaced several fracture seams between 46-47' and opens up into a 3" wide, iron-oxide stained, chlorite-bearing quartz stringer at 47'. Trace of black, boitryoidal iron-oxide
	90	73.3-91.5' BIOTITE-QUARTZ-CHLORITE SCHIST (UNIT 2c and 2a) Less-weathered version of above interval Most of the core has more typical chloritic green color. Trace-½% medium-grained pyrite vacancies.
	100	
	110	91.5-114.3' SERICITE-BIOTITE-QUARTZ-CHLORITE SCHIST (UNITS 2c and 2a) Similar to previously described units except biotite is generally more common (3-6%) and frequently forms segregated, biotite-rich interlayers. The biotite has weathered to a reddish bronze color. These interlayers are slightly richer in leached, medium-grained pyrite vacancies than the rest of the core. Local kaolinization along fractures and fine foliation. Occasional, large (1-2 cm) quartz-weathered feldspar. Lithic fragments.

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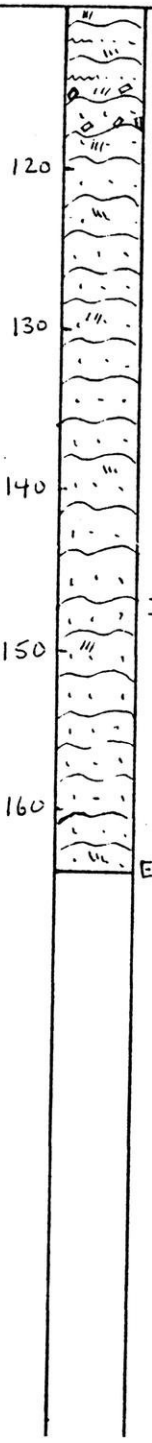
Hole 22-137

SECTION 401
COORDINATES 40029.8900N, 38751.3102E
AZIMUTH 135°
ELEVATION 1101.40

DATE STARTED 11-7-87
COMPLETED 11-11-87
LENGTH OF HOLE 164'
% ORE RECOVERY

INCLINATION | CORE SIZE | ORE BANDS | GEOLOGIC COLUMN



GEOLOGIC DESCRIPTION

114.3-117' BIOTITE-QUARTZ-CHLORITE SCHIST (UNIT 2c)
Footage has choppy core return, clay and iron-oxide alteration, and is marked by local ½-2" wide layers of distinct coarse-grained rock that occur parallel to foliation. This rock consists of 35-45% coarse-grained, blocky weathered white feldspar crystals set in a chlorite matrix.

Toward the top of the sequence the rock has an abundance of quartz and kaolinized, quartz-bearing lithic fragments or clasts.

117-130.4' BIOTITE-QUARTZ-CHLORITE SCHIST
Typical of unit as described at 91.5-114.3'.

130.4-164' BIOTITE-QUARTZ-CHLORITE SCHIST (UNIT 2c)
130.4-133' the core is ground to large fragments and small pieces up to 4" long. Most of the material is finely foliated chlorite phyllite.
Large fragments of chlorite-bearing, gray-white, transluscent quartz are commonly encountered.

E.O.H.

After 133' the andalusite-biotite-quartz schist becomes more competent, the chlorite is slightly fresher, and partially leached, medium-coarse-grained, subhedral pyrite grains become more common. Pyrite generally 1-3%, up to 5-8%, over significant footages. The pyrite is often more concentrated along purplish interlayers that are strongly iron-oxide stained. Local intercalated biotite-quartz-chlorite schist (as 91.5') and porphyritic meta-dacite. Carbonate-bearing, limonite-stained filament fractures are commonly observed, especially from 140-147'.
Two distinct sets are present: (1) pre-foliation-crosscut by foliation in a left-lateral direction, and (2) post-foliation-crosscutting foliation in a right-lateral direction. Local quartz and carbonite-smeared fractures, also better-observed from 140-147'.

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(continued next page)

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Hole 22-137

SECTION 401

COORDINATES 40029.8900N, 38751.3102E

AZIMUTH 135°

ELEVATION 1101.40

DATE STARTED 11-7-87
COMPLETED 11-11-87

LENGTH OF HOLE 164'

% ORE RECOVERY

INCLINATION	CORE SIZE ORE BANDS	GEOLOGIC COLUMN	GEOLOGIC DESCRIPTION
			130.4-164' (cont'd) 153-164' local quartz-replaced zones more frequent, the major ones occurring from 153-153.4' and 162-163'. In these zones, fragments of schist are sealed by two types of quartz: (1) fine-medium-grained, sugary, white quartz with carbonite-smeared fractures, and (2) coarse-grained, gray-white, transluscent quartz. Both calcite and dolomite are found as carbonate infillings.

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Hole 22-138

SECTION 401

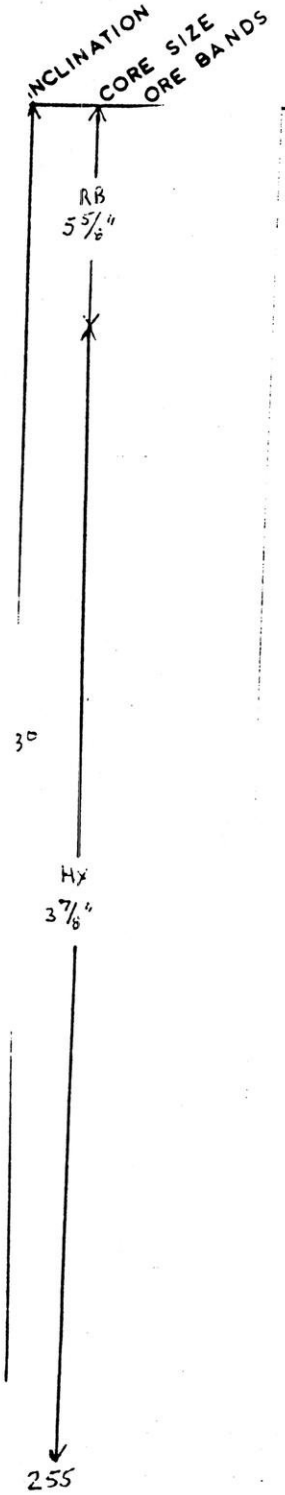
COORDINATES 39823.9677N, 38975.9522E

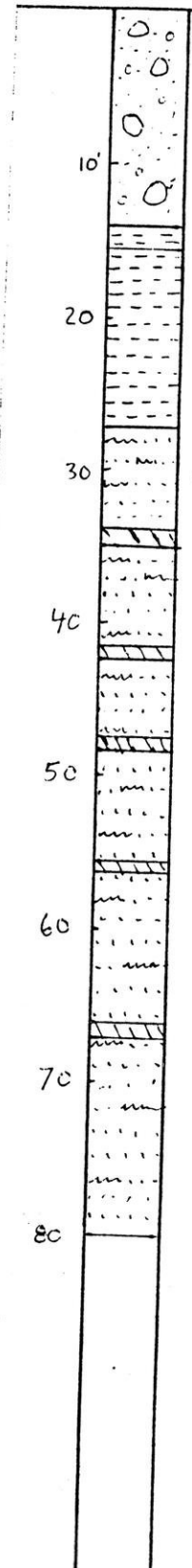
AZIMUTH 135°

ELEVATION 1103.05

DATE STARTED 11-17-87
COMPLETED 11-19-87

LENGTH OF HOLE 255'





GEOLOGIC DESCRIPTION

0-14' GLACIAL OVERBURDEN
Sandy, poorly sorted till with local clay-rich zones; local boulders and cobbles.

14-27.3' GOSSAN-LEACHED CAPROCK
Leached, vuggy, limonitic clay with pervasively iron-oxide-stained, medium-coarse-grained, subangular, moderately-poorly cemented chert. Relict "quartz eyes" to .4", observed locally.

27.3-91.4' SERICITE QUARTZ SCHIST WITH LOCAL SEMI-MASSIVE-MASSIVE SULPHIDES (UNIT 1a)
Bleached white, well-foliated, sericite-quartz schist. Fine-grained quartz grains, lenses and laminated bands (40-60%) in a partially kaolinized sericite schist. Sulphide-bearing-averaging 7-9% pyrite disseminated grains, discontinuous lenses and laminations or thin beds.

(continued next page)

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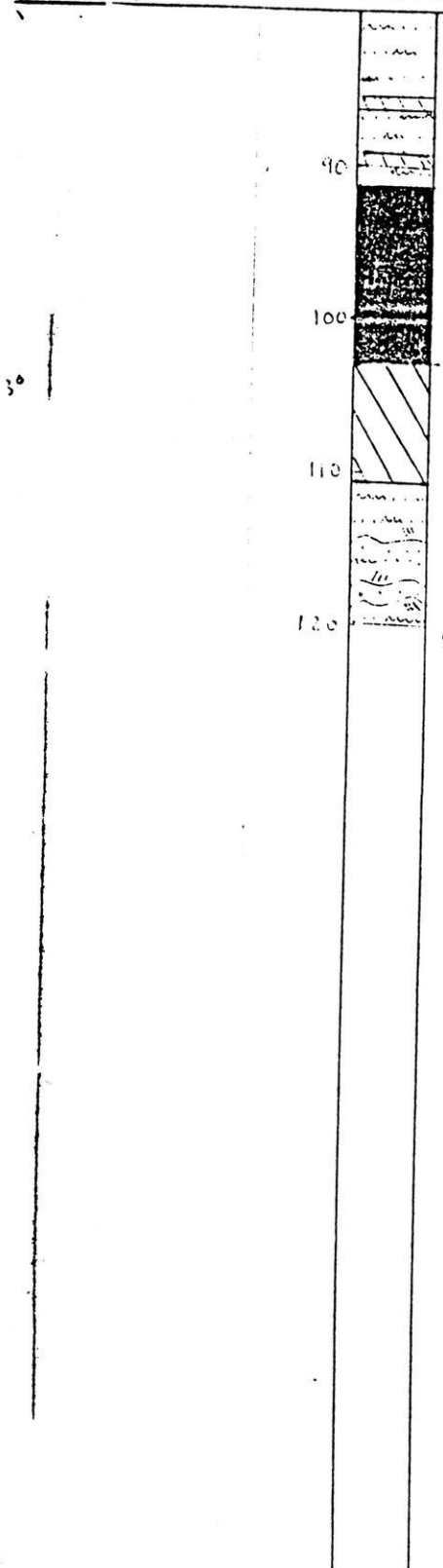
Hole 22-138

SECTION 401
COORDINATES 39823.9677N, 38975.9522E
AZIMUTH 135°
ELEVATION 1103.05

DATE STARTED 11-17-87
COMPLETED 11-19-87
LENGTH OF HOLE 255'

INCLINATION | CORE SIZE | ORE BANDS | GEOLOGIC COLUMN | GEOLOGIC DESCRIPTION



27.3-91.4' (cont'd)

91.4-103' MASSIVE SULPHIDE

103-110.4' SEMI-MASSIVE SULPHIDE
103.5-105.2', pyrite interlayers in sericite-quartz schist;

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Hole 22-138

SECTION 401
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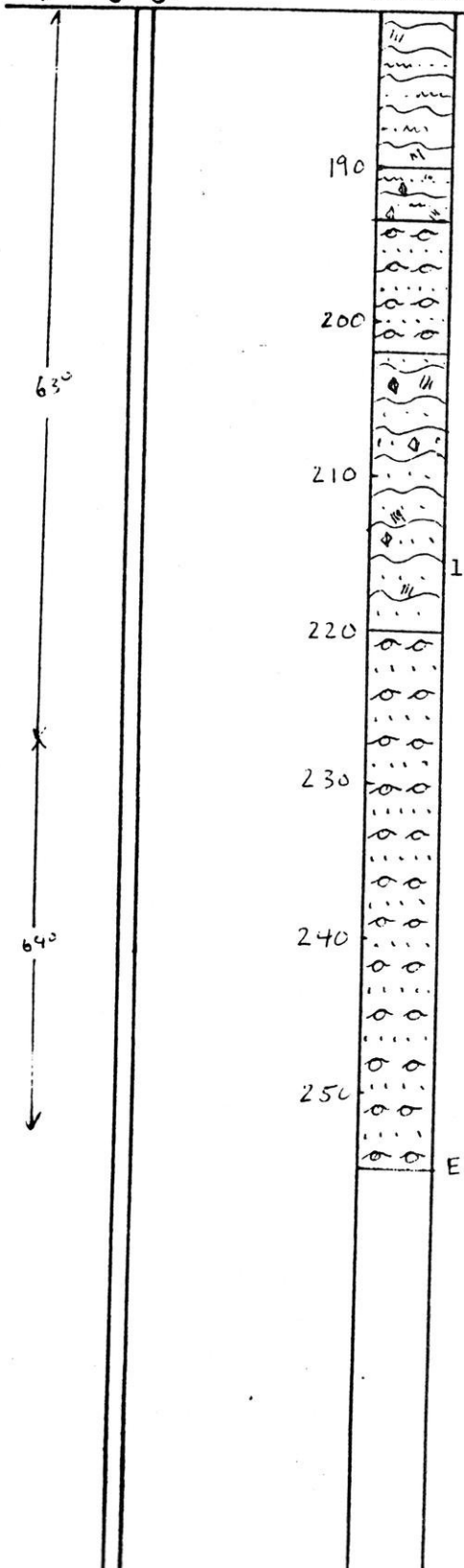
AZIMUTH 135°
ELEVATION 1103.05

DATE STARTED 11-17-87
COMPLETED 11-19-87
LENGTH OF HOLE 255'



GEOLOGIC DESCRIPTION

178-190' BIOTITE-QUARTZ-SERICITE-CHLORITE SCHIST (UNIT 2a)
Light-dark green, moderately-poorly foliated, chloritic phyllite with isolated grains or lenses of biotite-sericite.

Local, < 1/16-1/4" argillite-filled fractures with iron-oxide staining selvedges, especially 181.3-185'.

190-193.4' ANDALUSITE-BIOTITE-QUARTZ-CHLORITE-SERICITE SCHIST (UNIT 2a)
Bleached chlorite, local greasy yellow-white sericite. 3-4% biotite; trace-½% blocky, fine-grained, red-brown andalusite. A few local slickenside surfaces and iron-oxide-clay-filled fractures.

193.4-202' QUARTZ AUGEN SCHIST (UNIT 3a WITH LOCAL 2a)
Distinct, sub-rounded, medium-grained, blue-gray quartz eyes (3-6%), 6-8% white-gray, coarse-grained stretched quartz lithic fragments, 5% rectangular, saussuritized or kaolinized relict feldspar crystals. Local 1/8-1/4" healed quartz-filled, iron-oxide stained fractures. Local interlayers of Unit 2a.

202-220' ANDALUSITE-BIOTITE-QUARTZ-CHLORITE (UNIT 2a)
As 178-190'.
Local iron-oxide-stained, clay-filled filament fractures.

220-255' QUARTZ AUGEN SCHIST (UNIT 3a)
As 193.4-202'.
Rare quartz-healed, tight fractures (especially 224-227'). Local slickenside surfaces, in sericitic interlayers 225-230'.
252.6, 3/4", white, coarse-grained, quartz stringer within kinked foliation surfaces.

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Hole 22-138

SECTION 401

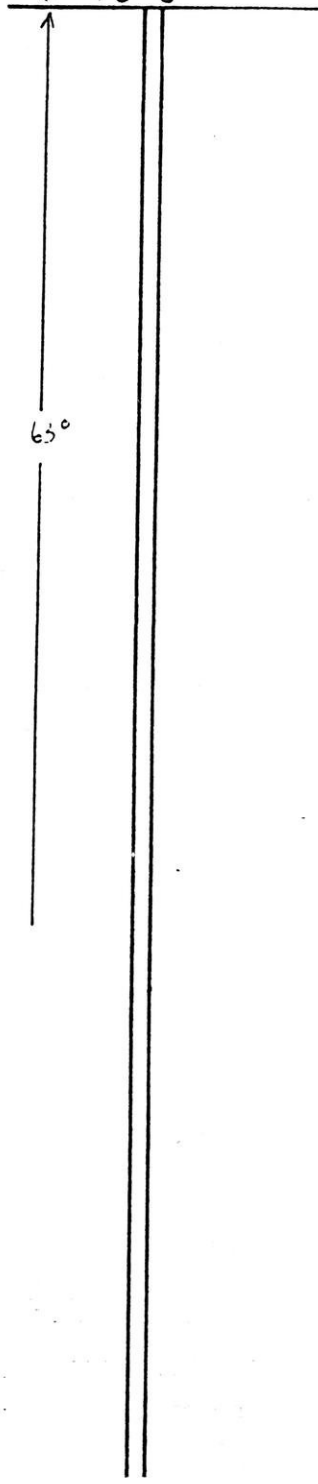
COORDINATES 39823.9677N, 38975.9522E

AZIMUTH 135°

ELEVATION 1103.05

DATE STARTED 11-17-87
COMPLETED 11-19-87

LENGTH OF HOLE 255'



110.4-135.7' QUARTZ-SERICITE SCHIST WITH BIOTITE-QUARTZ-CHLORITE SCHIST (UNIT 2b with 2a)
Moderately-strongly kaolinized, bleached sericite-rich schist. Similar to 27.3-91.4', but with less quartz. Trace-3% medium-coarse-grained pyrite
Intercalated biotite-chlorite-rich schist (2a).

135.7-160.2' BIOTITE-QUARTZ-SERICITE-CHLORITE SCHIST (UNIT 2a)
Bleached chlorite, locally sericite-rich phyllite. Trace-½% sub-rounded fine-coarse, gray-white quartz and fine-grained crystals of biotite. Trace-2% pyrite.
Sericite areas better argillized.

149-155' less sulphides (trace-½%).

160.2-165' CHLORITE SCHIST (UNIT 4a)
Heterogenous unit with distinct mafic lithic tuff and moderate-dark green chlorite schist. Porphyritic (very coarse to fine-grained), gray-green well-foliated lithic tuff. 10-15% dark green, soft, very coarse (up to .3") chloritic lithic fragments with whitish, blocky relict feldspar crystals. The fragments have a feathered texture and white altered rims. 1-3% pyrite-bearing medium-coarse grained, elongated chlorite lithic fragments. Pyrite (trace-1%) along foliation and local fractures. Intercalated with moderately-poorly foliated chlorite schists

165-178' CHLORITE SCHIST (UNIT 4a)
Same as above sequence but core is generally iron-oxide stained. A few minor (<¼-½") fractures filled with earthy iron-oxides, quartz and clay. Chlorite is usually bleached and partially altered to bluish-green argillite.

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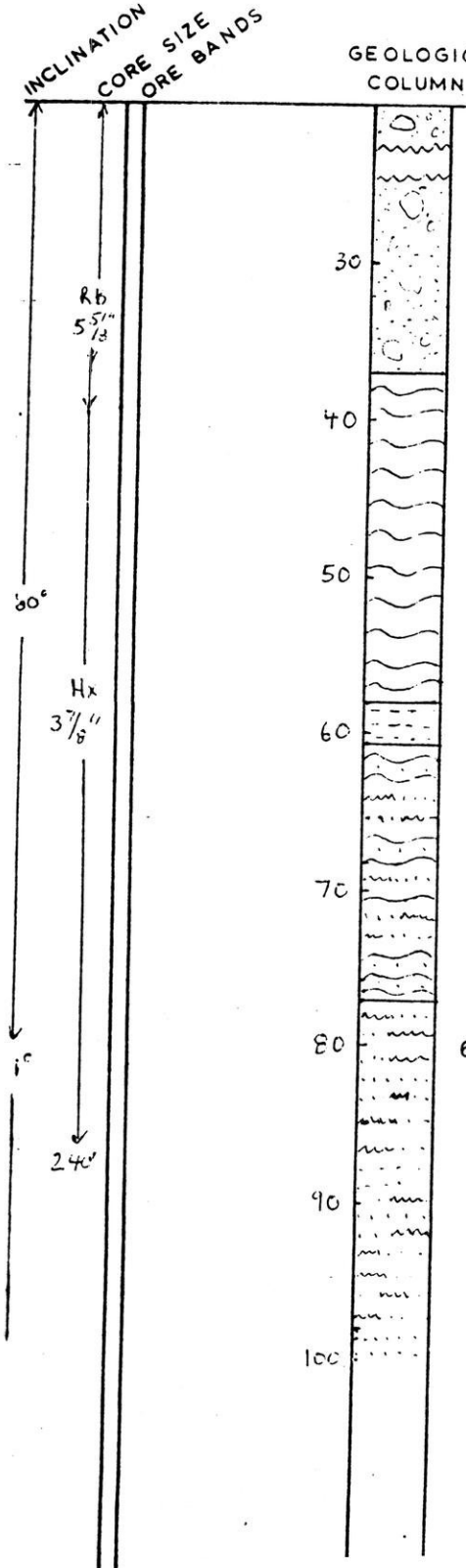
Hole 22-139

SECTION 401.65
COORDINATES 39980.7130N, 38911.5264E
AZIMUTH 0°
ELEVATION 1101.21

DATE STARTED 11-20-87
COMPLETED 11-23-87
LENGTH OF HOLE 240'



0-37'	GLACIAL OVERBURDEN Sandy, poorly-sorted till with frequent cobbles and boulders. First sericite or bleached chlorite in cuttings at 37'.
37-58'	CHLORITE SCHIST Soft, weathered, argillized, moderately-foliated chlorite-schist. Commonly iron-oxide stained, and chlorite has altered in some degree to bluish-gray-maroon clay minerals. 39-43' very soft, clay-rich interval with local relict quartz fragments.
58-60.3'	HEMATITE-RICH METASEDIMENT Iron-oxide stained, massive, medium-coarse-grained "dirty" hematite-rich interlayer. Locally, quite vuggy (5% of interval). 40-55% hematite, frequently pisolitic-colloidal growths, coated with a limonite "shell". The vugs are lined with drusy very fine-grained, dark green crystalline mineral (probably epidote). The remainder of this rock is fine-grained non-descript, red-brown argilliceous matrix. Trace of carbonate along vugs. Trace-½% rectangular, leached pyrite vacancies. Local hematite/epidote veinlets.
60.3-68'	WEATHERED SERICITE-QUARTZ-CHLORITE SCHIST (UNIT 2a) As 37-58'.
68-77'	SERICITE-QUARTZ-CHLORITE SCHIST (UNIT 2a) Similar to above, but less weathered. Chlorite bleached, but only weakly argillized. Partially-leached, squarish, fine-medium-grained pyrite vacancies (trace-½%). Local quartz-sericite laminations, better altered; more frequent toward bottom of interval. Gradational contact.
77-98'	QUARTZ-SERICITE SCHIST WITH SERICITE-QUARTZ SCHIST (UNIT 2b with 1a) White, bleached, well-foliated Local gray, cherty laminations.

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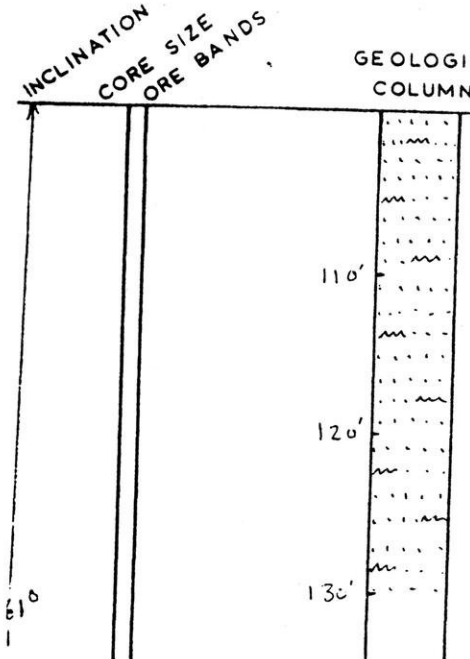
Hole 22-139

SECTION 401.65
COORDINATES 39980.7130N, 38911.5264E
AZIMUTH 0°
ELEVATION 1101.21

DATE STARTED 11-20-87
COMPLETED 11-23-87
LENGTH OF HOLE 240'



GEOLOGIC DESCRIPTION

98-109' SERICITE-QUARTZ SCHIST (UNIT 1a)
Quartz increases as cherty blue-gray laminae and thin beds; local large (up to 3.5 cm) subangular white quartz lapilli. Fine-very fine-grained pyrite as fracture/foliation smears (trace-½%).

109-136.8' SERICITE-QUARTZ SCHIST (UNIT 1a)
Similar to above, but with a continued increase of cherty interlayers and lenses.

Local zones (½-1½") of white, very coarse-grained (up to 2cm) kaolinized fragments

Foliation/bedding forms convoluted laminations wrapping the fragments

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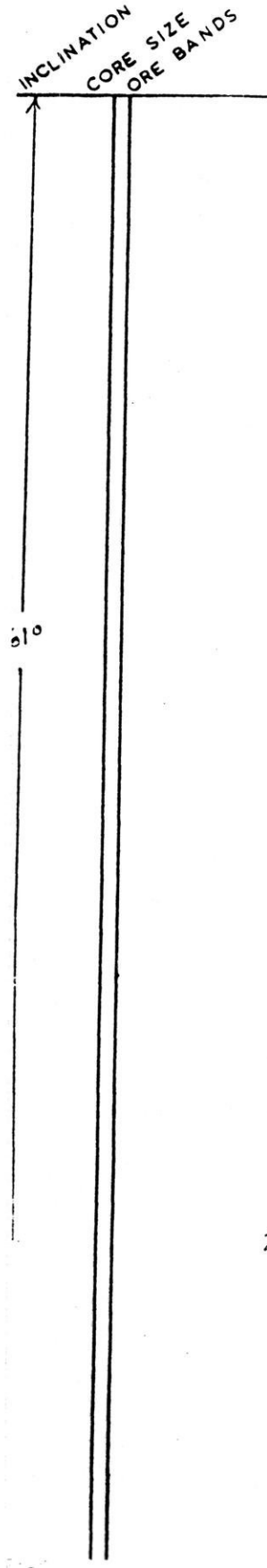
Hole 22-139

SECTION 401.65
COORDINATES 39980.7130N, 38911.5264E
AZIMUTH 0°
ELEVATION 1101.21

DATE STARTED 11-20-87
COMPLETED 11-23-87
LENGTH OF HOLE 240'



GEOLOGIC DESCRIPTION

136.8-144.6' METACHERT
Gray, compact, very fine-grained aphanitic chert with local pyrite as euhedral, medium-fine-grained disseminations and lenses (2-4%). Local vuggy quartz stringers up to 2" wide with trace partially-altered pyrite

144.6-159' SERICITE QUARTZ SCHIST (UNIT 1a)
As 109-136.8'.
Local quartz stringers at angle to foliation (as at 156').

159-186.6' SERICITE-QUARTZ-CHLORITE SCHIST (UNIT 2a)
Dark-moderate green, well-foliated chlorite schist with 1-3% fine-medium-grained, subhedral-euhedral pyrite. Local pyrite-rich laminations (3-5% of interval). Pyrite sometimes partially leached. Occasional very coarse-grained porphyroblastic grain aggregates. Pyrite-bearing, iron-oxide-stained filament fractures between 159-161.8' and 170-172'.
Local intervals of pyritiferous quartz-sericite schist especially after 174'.

Gradational contact.

186.6-212.6' SERICITE-QUARTZ SCHIST (UNIT 1a)
Similar to 109-136.8'.

3-6% pyrite along local foliation planes; pyrite (½-2%) as fine disseminated grains also.

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Sharp contact

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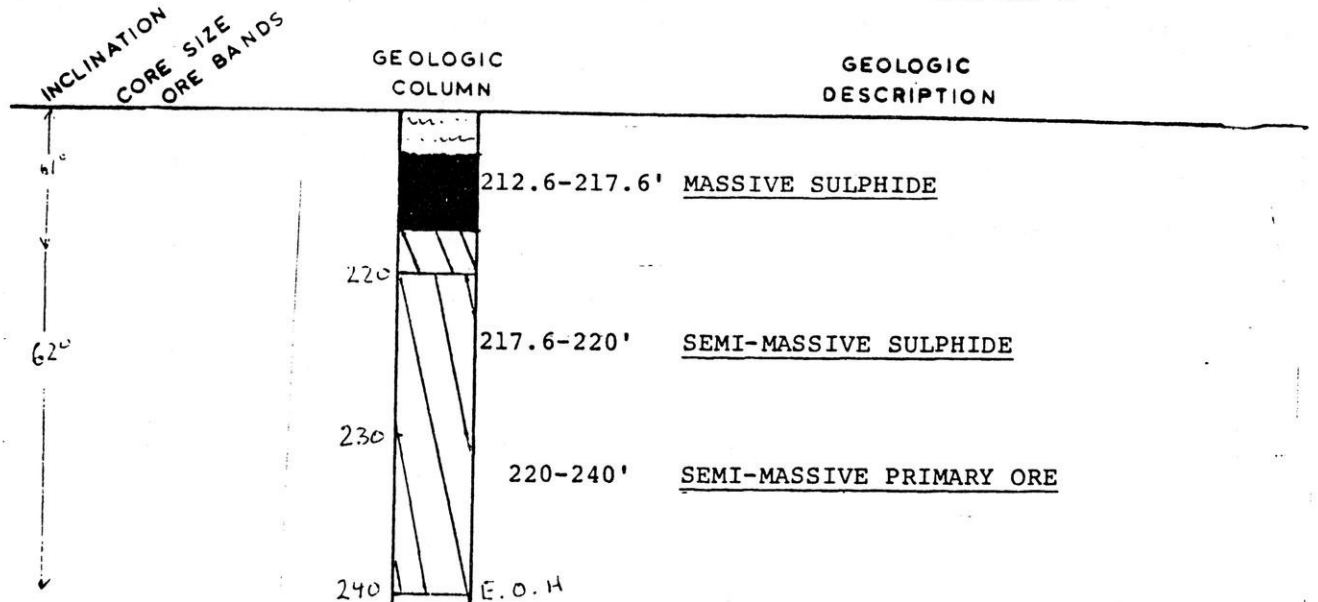
Hole 22-139

SECTION 401.65
COORDINATES 39980.7130N, 38911.5264E
AZIMUTH 0°
ELEVATION 1101.21

DATE STARTED 11-20-87
COMPLETED 11-23-87
LENGTH OF HOLE 240'
% ORE RECOVERY 91%



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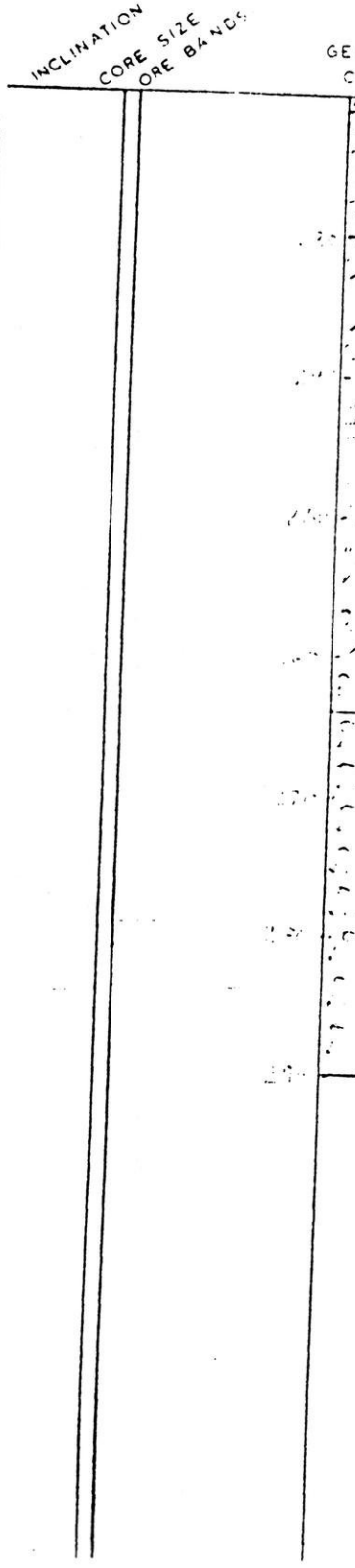
Hole 22-142

SECTION 422
COORDINATES 41290.2697N, 40476.3052E
AZIMUTH 135°
ELEVATION 1139.80

DATE STARTED 12-7-87
COMPLETED 12-16-87
LENGTH OF HOLE 290'



GEOLOGIC DESCRIPTION

221-264' BIOTITE-QUARTZ-CHLORITE SCHIST, PORPHYRITIC META-ANDESITE/DACITE, AND AMPHIBOLE CHLORITE SCHIST

Heterogenous sequence, dominated by biotite-quartz-chlorite schist (Unit 2c).

229-230', 222-223', quartz and weathered chlorite fills foliation and sometimes replaces patchy areas; mild iron-oxide staining.

After 245' pyrite increases to 1-3%.

265.7', 266.7', 277', 278.3', minor, brecciated zones (<2") sealed by iron carbonate (probably ankerite), quartz, chlorite. Pink carbonate (callite) as stringers in filament fractures. Local pyrite.

Gradational contact.

264-290' PORPHYRITIC METADACITE/ANDESITE (UNIT 5)

Moderate-dark green, moderately-well-foliated lithic, crystal tuff.
12-13% medium-very coarse (3/4" up to 3-1/2"), gray quartz fragments with chlorite-bearing fractures.
11-22% pale green, partially argillized fragments.
5-7% white, argillized, tabular, relict feldspar.
Locally, the fragments can make up 75% of the core.
Bleaching of chlorite along foliation sometimes gives core a fragmental appearance.

E.O.H.

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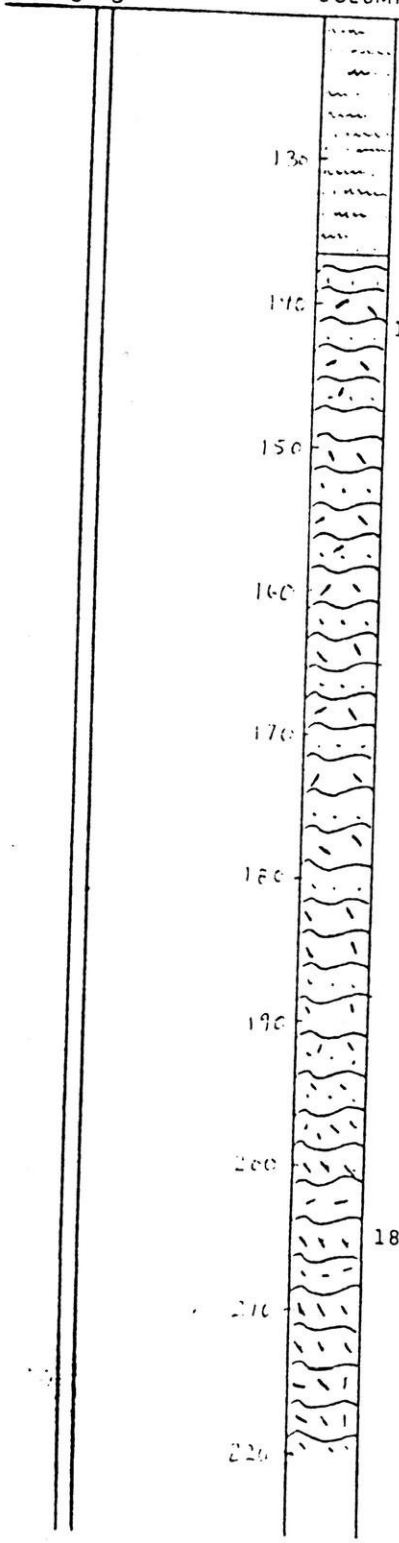
Hole 22-142

SECTION 422
COORDINATES 41290.2697N, 40476.3052E
AZIMUTH 135°
ELEVATION 1139.80

DATE STARTED 12-7-87
COMPLETED 12-16-87
LENGTH OF HOLE 290'

INCLINATION | CORE SIZE | ORE BANDS | GEOLOGIC COLUMN | GEOLOGIC DESCRIPTION



115.3-136.6' SERICITE-QUARTZ SCHIST (UNIT 1a)
Similar to above, but more sericite-rich and better argillized. Trace-2% leached iron-oxide-stained pyrite sites. Local intercalated with lapilli-rich tuff.

125-129' rare, coarse (up to ¼"), brown-white, tabular-square andalusite crystals. Iron-oxide is more abundant (lenses or Unit 2b).

136.6-188.8' QUARTZ-CHLORITE AND AMPHIBOLE-CHLORITE SCHISTS (UNITS 4a and 4c)
Dark green, moderately-poorly foliated, chlorite phyllite intercalated with amphibole-bearing chlorite schist. Amphibole as fine, prismatic crystals (½-2%). Local fragments or lapilli of dark green, wispy chlorite, quartz, with carbonate-filled filament fractures.

136.6-139.2' lighter-colored, better-argillized bleached chlorite.

139.2', 149', 155-156', 162-162.4', chlorite generally argillized to blue-green clays. Mild iron-oxide staining as smears along minute fractures.

After 160' amphibole-bearing schists increase, and predominate core by 188.8'.

3-5% biotite, mainly as replacement after amphibole.
1-2% chlorite-rich lithic fragments.
3-5% white, waxy, tabular, altered feldspar.
Trace-½% very fine-grained, euhedral pyrite.
6-8% fine-grained quartz and chlorite as lenses parallel to foliation. Chlorite as feathery recrystallized needles along foliation planes and minor fractures.

The coarser, mafic minerals give core a "grainy" appearance.

Gradational contact.

188.8-221' AMPHIBOLE CHLORITE SCHIST (UNIT 4c)
As described above.
After 200' biotite-quartz-chlorite schist (Unit 2c) becomes intercalated with Unit 4c.

Gradational contact.

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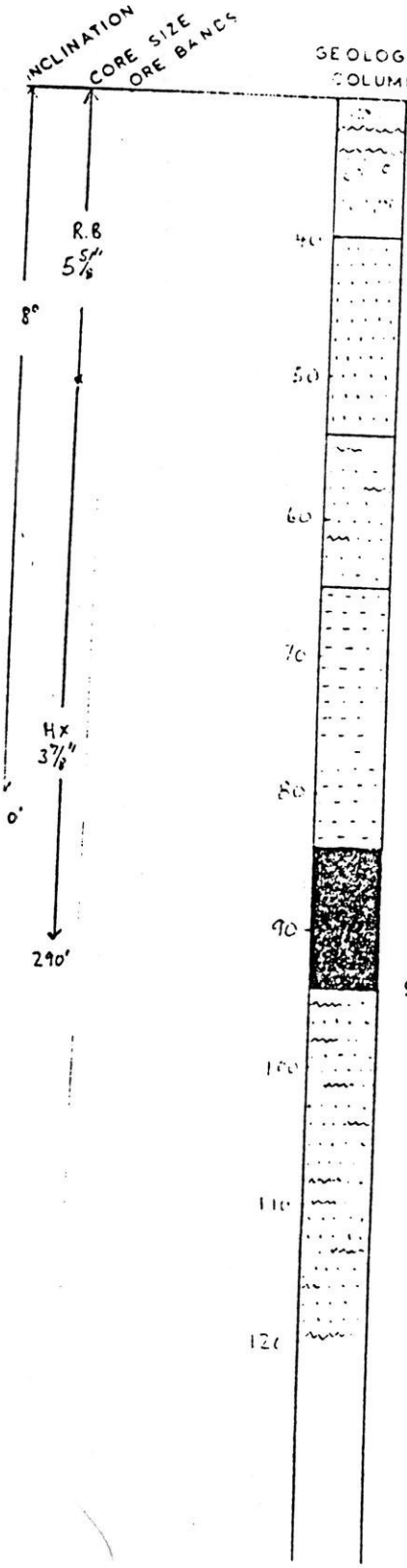
Hole 22-142

SECTION 422
COORDINATES 41290.2697N, 40476.3052E
AZIMUTH 135°
ELEVATION 1139.80

DATE STARTED 12-7-87
COMPLETED 12-16-87
LENGTH OF HOLE 290'



	GEOLOGIC DESCRIPTION
0-40'	GLACIAL OVERBURDEN Mainly sandy till with local cobbles and clay lenses. Rotary drilling - no core.
40-54'	CAMBRIAN SANDSTONE Yellow, iron-oxide-stained, medium-coarse-grained, moderately-poorly sorted, well-rounded, weakly bedded-massive sandstone. Generally poorly consolidated. Local clay and gravel horizons. Both clay and gravel are concentrated near contact with Precambrian. Rotary drilling to 51'; core dilling 51'.
54-65'	WEATHERED PRECAMBRIAN Soft, saprolitic, mottled, yellow-gray and white argilliceous schists. Relict foliation.
65-84'	GOSSAN Brick-red, massive, argilliceous gossan with local vuggy patches. Occasional sub-rounded, gray chert lithic fragments and more angular, white quartz vein shards. Limonite staining in vugs and along fractures.
84-94.3'	MASSIVE SULPHIDE Black, massive, medium-coarse-grained.
94.3-115.3'	SERICITE-QUARTZ SCHIST (UNIT 1a) Gray-white, finely foliated, moderately-well kaolinized schist. 10-15% wispy, stretched, kaolinized lithic fragments. 4-6% sulphides, 85.6' local filament fracture with hematite staining and white carbonate stringers.

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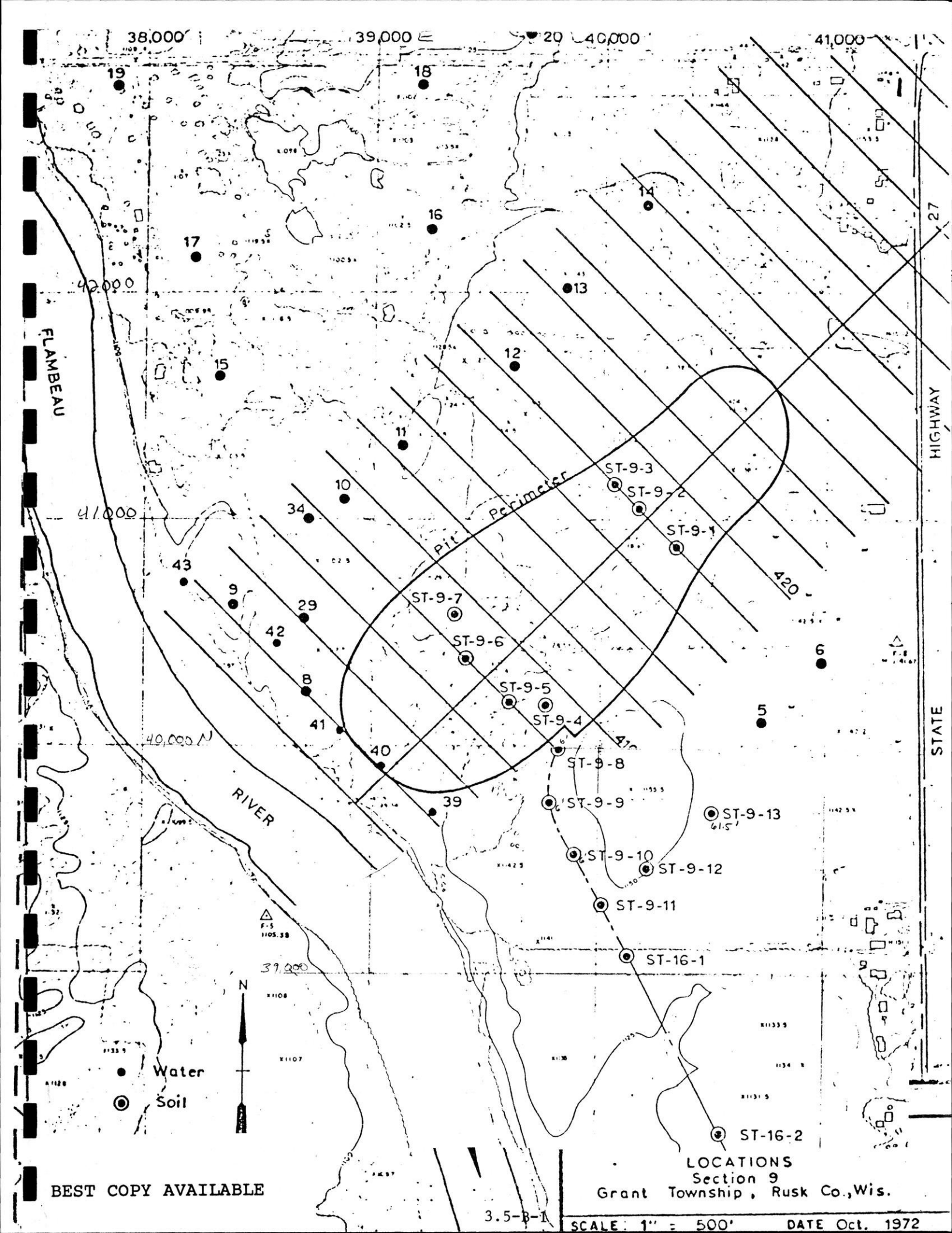
APPENDIX 3.5-B

Geologic Logs and Soil Test Data for Borings Completed by STS Consultants, Ltd., 1972 through 1975



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3.5-3-1

LOCATIONS
Section 9
Grant Township, Rusk Co., Wis.

SCALE 1" = 500' DATE Oct. 1972

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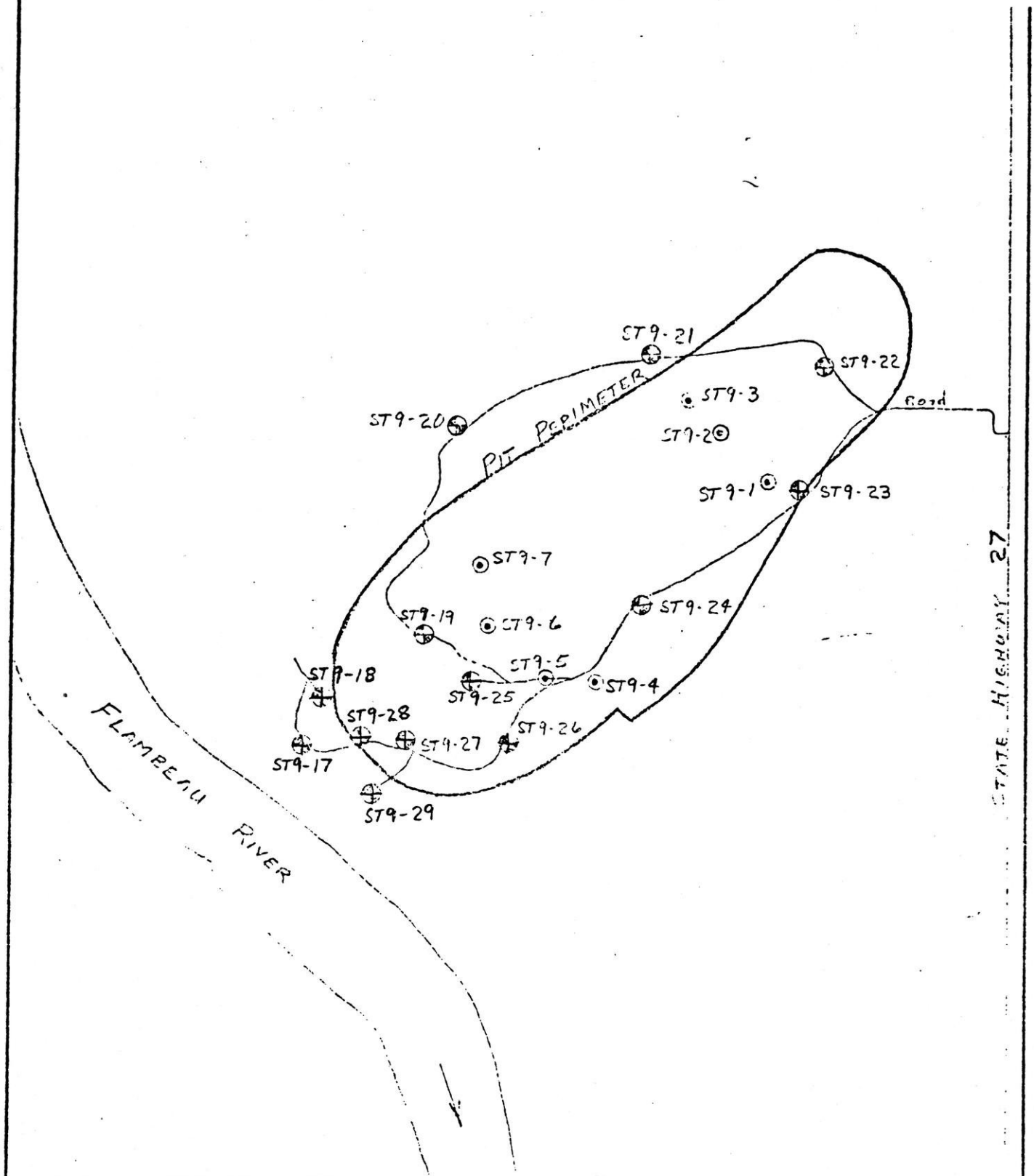

SOIL BORING LOCATION DIAGRAM
PROPOSED MINE DEVELOPMENT
LADYSMITH, WISCONSIN

N

SOIL TESTING SERVICES OF WISCONSIN, INC.
540 LAMBEAU ST. GREEN BAY, WISCONSIN 54303

4970A	F.M.	7/11/75	1" = 50'

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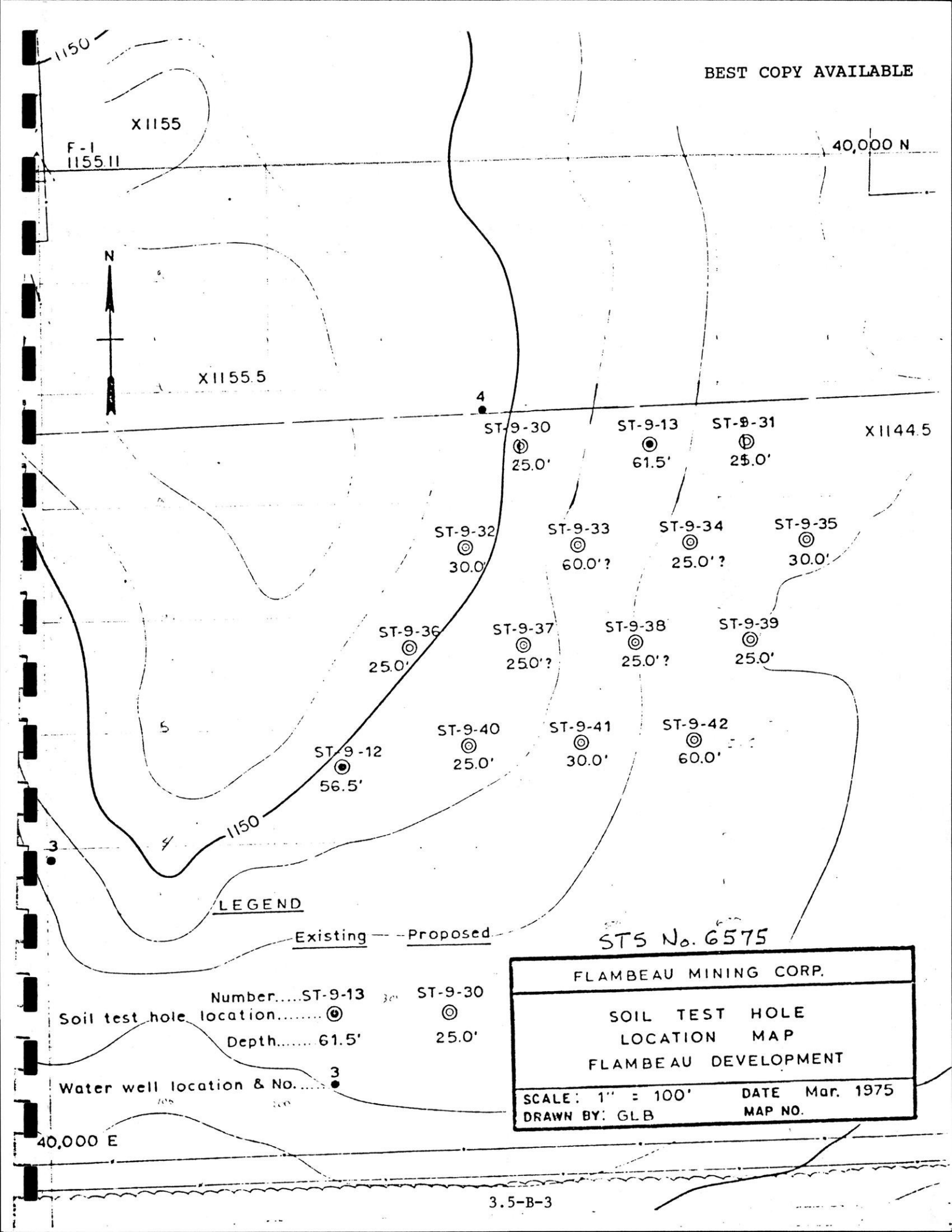

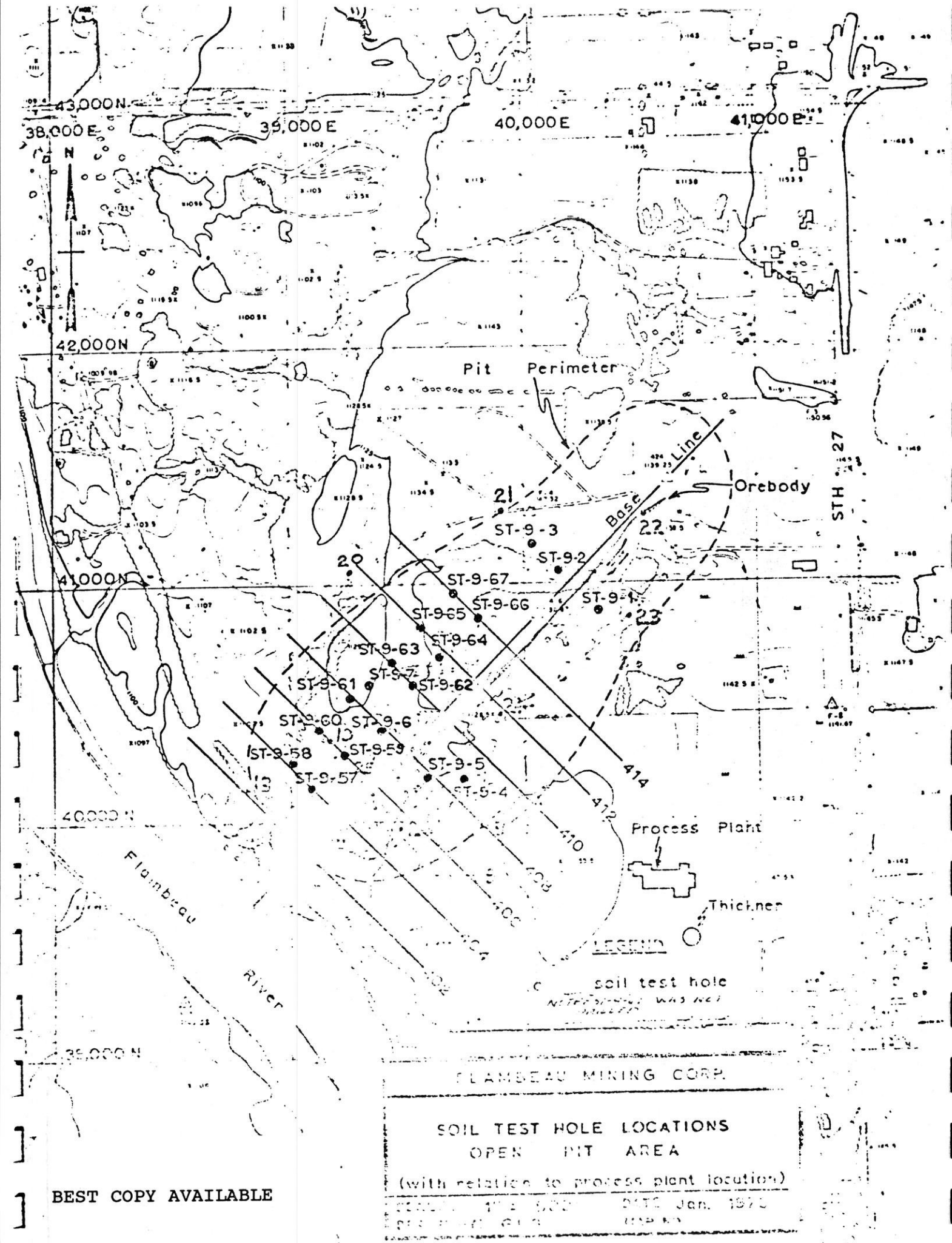

FLAMBEAU MINING CORP.

SOIL TEST HOLE LOCATIONS
OPEN PIT AREA
(with relation to process plant location)

DATE Jan. 1978

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GENERAL NOTES

1950 Chicago Building Code Soil Classifications are Used Except Where Noted

DRILLING & SAMPLING SYMBOLS

SS : Split-Spoon – 1⅜" I.D., 2" O.D., except where noted
ST : Shelby Tube – 2" O.D., except where noted
PA : Power Auger Sample
DB : Diamond Bit – NX: BX: AX:
CB : Carboloy Bit – NX: BX: AX:
OS : Osterberg Sampler – 3" Shelby Tube
HS : Housel Sampler
WS : Wash Sample
FT : Fish Tail
RB : Rock Bit
WO: Wash Out

Standard "N" Penetration: Blows per foot of a 140 pound hammer falling 30 inches on a 2 inch OD split spoon, except where noted.

WATER LEVEL MEASUREMENT SYMBOLS

WL : Water Level
WCI: Wet Cave In
DCI : Dry Cave In
WS : While Sampling
WD : While Drilling
BCR : Before Casing Removal
ACR : After Casing Removal
AB : After Boring

Water levels indicated on the boring logs are the levels measured in the boring at the times indicated. In pervious soils, the indicated elevations are considered reliable ground water levels. In impervious soils, the accurate determination of ground water elevations is not possible in even several days observation, and additional evidence on ground water elevations must be sought.

CLASSIFICATION

COHESIONLESS SOILS

"Trace"	1% to 10%	
"Trace to some"	10% to 20%	
"Some"	20% to 35%	
"And"	35% to 50%	
Loose	0 to 9 Blows	or equivalent
Medium Dense	10 to 29 Blows	
Dense	30 to 59 Blows	
Very Dense	≥ 60 Blows	

COHESIVE SOILS

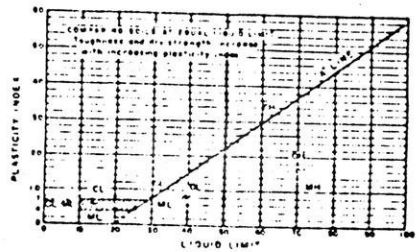
If clay content is sufficient so that clay dominates soil properties, then clay becomes the principle noun with the other major soil constituent as modifier; i.e., silty clay. Other minor soil constituents may be added according to classification breakdown for cohesionless soils; i.e., silty clay, trace to some sand, trace gravel.

Soft	0.00 — 0.59	tons/ft²
Stiff	0.60 — 0.99	tons/ft²
Tough	1.00 — 1.99	tons/ft²
Very tough	2.00 — 3.99	tons/ft²
Hard	≥ 4.00	tons/ft²

UNIFIED SOIL CLASSIFICATION
INCLUDING IDENTIFICATION AND DESCRIPTION

FIELD IDENTIFICATION PROCEDURES (Excluding particles larger than 3 inches and basing fractions on estimated weights)				GROUP SYMBOLS	TYPICAL NAMES	INFORMATION REQUIRED FOR DESCRIBING SOILS	LABORATORY CLASSIFICATION CRITERIA
COARSE GRAINED SOILS More than half of material is larger than No 200 sieve size b	GRAVELS More than half of coarse fraction is larger than No 4 sieve size (For visual classifications, the 1/4" size may be used as equivalent to the No 4 sieve size)	CLEAN GRAVELS (Little or no fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes	GW	Well graded gravels, gravel-sand mixtures, little or no fines	Give typical name; indicate approximate percentages of sand and gravel, max size, angularity, surface condition, and hardness of the coarse grains; local or geologic name and other pertinent descriptive information, and symbol in parentheses For undisturbed soils add information on stratification, degree of compactness, cementation, moisture conditions and drainage characteristics EXAMPLE:- Silty sand, gravelly; about 20% hard, angular gravel particles 1/2 in maximum size, rounded and subangular sand grains coarse to fine, about 15% nonplastic fines with low dry strength; well compacted and moist in place; alluvial sand; (SM)	$C_u = \frac{D_{60}}{D_{10}}$ Greater than 4 $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between one and 3 Not meeting all gradation requirements for GW Atterberg limits below "A" line, or PI less than 4 — Above "A" line with PI between 4 and 7 are borderline cases requiring use of dual symbols Atterberg limits above "A" line with PI greater than 7
			Predominantly one size or a range of sizes with some intermediate sizes missing	GP	Poorly graded gravels, gravel-sand mixtures, little or no fines		
		GRAVELS WITH FINES (Appreciable amount of fines)	Non plastic fines (for identification procedures see ML below)	GM	Silty gravels, poorly graded gravel-sand-silt mixtures		
			Plastic fines (for identification procedures see CL below)	GC	Clayey gravels, poorly graded gravel-sand-clay mixtures		
	SANDS More than half of coarse fraction is smaller than No 4 sieve size	CLEAN SANDS (Little or no fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes	SW	Well graded sands, gravelly sands; little or no fines		$C_u = \frac{D_{60}}{D_{10}}$ Greater than 6 $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between one and 3 Not meeting all gradation requirements for SW Atterberg limits below "A" line or PI less than 4 — Above "A" line with PI between 4 and 7 are borderline cases requiring use of dual symbols Atterberg limits above "A" line with PI greater than 7
			Predominantly one size or a range of sizes with some intermediate sizes missing	SP	Poorly graded sands, gravelly sands; little or no fines		
		SANDS WITH FINES (Appreciable amount of fines)	Non plastic fines (for identification procedures see ML below)	SM	Silty sands, poorly graded sand-silt mixtures		
			Plastic fines (for identification procedures see CL below)	SC	Clayey sands, poorly graded sand-clay mixtures		
FINE GRAINED SOILS More than half of material is smaller than No 200 sieve size (The No 200 sieve size is about the smallest particle visible to the naked eye)	IDENTIFICATION PROCEDURES ON FRACTION SMALLER THAN NO 40 SIEVE SIZE						
	SILTS AND CLAYS Liquid limit less than 50	DRY STRENGTH (CRUSHING CHARACTERISTICS)	DILATANCY (REACTION TO SHAKING)	TOUGHNESS (CONSISTENCY NEAR PLASTIC LIMIT)			
		None to slight	Quick to slow	None	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands with slight plasticity	Determine percentages of gravel and sand from grain size curve Depending on percentage of fines (fraction smaller than No 200 sieve size) coarse grained soils are classified as follows:- Less than 5% — GW, GP, SW, SP More than 12% — GM, GC, SM, SC 5% to 12% — Borderline cases requiring use of dual symbols
		Medium to high	None to very slow	Medium	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	
		Slight to medium	Slow	Slight	OL	Organic silts and organic silt-clays of low plasticity	
	SILTS AND CLAYS Liquid limit greater than 50	Slight to medium	Slow to none	Slight to medium	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts	
		High to very high	None	High	CH	Inorganic clays of high plasticity, fat clays	
		Medium to high	None to very slow	Slight to medium	OH	Organic clays of medium to high plasticity	
HIGHLY ORGANIC SOILS		Readily identified by color, odor, spongy feel and frequently by fibrous texture			Pt	Peat and other highly organic soils	

Use grain size curve in identifying the fractions as given under field identification



PLASTICITY CHART
FOR LABORATORY CLASSIFICATION OF FINE GRAINED SOILS

a Boundary classifications: Soils possessing characteristics of two groups are designated by combinations of group symbols For example: GW-GC, well graded gravel-sand mixture with clay binder

b All sieve sizes on this chart are U.S. standard

FIELD IDENTIFICATION PROCEDURES FOR FINE GRAINED SOILS OR FRACTIONS

These procedures are to be performed on the minus No 40 sieve size particles, approximately 1/2 in For field classification purposes, screening is not intended, simply remove by hand the coarse particles that interfere with the tests

DILATANCY (Reaction to shaking)

After removing particles larger than No 40 sieve size, prepare a pat of moist soil of the volume of about one half cubic inch Add enough water if necessary to make the soil stiff but not sticky

Place the pat in the open palm of one hand and shake horizontally, striking vigorously against the other hand several times A positive reaction consists of the appearance of water on the surface of the pat which changes to a very soft consistency and becomes glossy When the sample is squeezed between the fingers, the water and gloss disappear from the surface, the pat stiffens, and finally it cracks or crumbles The rapidity of appearance of water during shaking and of its disappearance during squeezing assist in identifying the character of the fines in a soil

Very fine clean sands give the quickest and most distinct reaction whereas a plastic clay has no reaction Inorganic silts, such as a typical rock flour, show a moderately quick reaction

DRY STRENGTH (Crushing characteristics)

After removing particles larger than No 40 sieve size, mold a pat of soil to the consistency of putty, adding water if necessary Allow the pat to dry completely by oven, sun, or air drying, and then test its strength by breaking and crumbling between the fingers This strength is a measure of the character and quantity of the colloidal fraction contained in the soil The dry strength increases with increasing plasticity

High dry strength is characteristic for clays of the CH group A typical inorganic silt possesses only very slight dry strength Silty fine sands and silts have about the same slight dry strength, but can be distinguished by the feel when powdering the dried specimen Fine sand feels gritty, whereas a typical silt has the smooth feel of flour

TOUGHNESS (Consistency near plastic limit)

After removing particles larger than the No 40 sieve size, a specimen of soil about one-half inch cube in size is molded to the consistency of putty If too dry, water must be added and if sticky, the specimen should be spread out in a thin layer and allowed to lose some moisture by evaporation Then the specimen is rolled out by hand on a smooth surface or between the palms into a thread about one-eighth inch in diameter The thread is then folded and rerolled repeatedly During this manipulation the moisture content is gradually reduced and the specimen stiffens, finally loses its plasticity, and crumbles when the plastic limit is reached

After the thread crumbles, the pieces should be lumped together and a slight kneading action continued until the lump crumbles

The tougher the thread near the plastic limit and the stiffer the lump when it finally crumbles, the more potent is the colloidal clay fraction in the soil Weakness of the thread at the plastic limit and quick loss of coherence of the lump below the plastic limit indicate either inorganic clay of low plasticity, or materials such as kaolin-type clays and organic clays which occur below the A-line

Highly organic clays have a very weak and spongy feel at the plastic limit

a/ CORPS OF ENGINEERS AND BUREAU OF RECLAMATION - JANUARY 1969

Unified soil classification chart

D-3

3.5-B-6

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LOG OF BORING NO. ST 9-1

OWNER: Great Lakes Exploration Company

ARCHITECT-ENGINEER:

SITE: Ladysmith, Wisconsin

PROJECT NAME: Proposed Copper Mine Development

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	SAMPLE O.D. I.D. RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./CU. FT.	UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² / PLASTIC LIMIT % / WATER CONTENT % / LIQUID LIMIT % / STANDARD "N" PENETRATION (BLOWS/FT.)
				SURFACE ELEVATION 1137.2		
	1	SS		Soft dark brown silty and sandy top soil (OL)		
	1A	SS		Silty fine sand-trace gravel-brown (SM)		
	2	SS				
10	3	SS		Silty fine medium sand-trace to some gravel-brown (SM)		
	4	SS		Fine coarse sand-some fine coarse subangular gravel-trace silt-brown (SW)		
20	5	SS		Silty fine sand-trace to some gravel-brown-slightly cemented (SM)		
	6	SS		Fine-medium sand-some fine coarse gravel-trace silt and coarse sand-brown (SW)		
30						
	7	RB		Poorly cemented sandstone		
50	8	RB				
60						
	9	SS		Saprolite-gray to rusty brown to orangish brown-silt-trace clay and angular rock fragments (ML)		
	10	SS				
	11	SS				
	12	SS				
	13	SS				
	14	SS				
	15	SS		Saprolite-reddish brown trace light brown-hit darker purple at 65'-silt trace clay and angular rock fragments-more rock fragments starting at 67.5'		
	16	SS				
	17	SS				
	18	SS				
77						
	19	SS		End of Boring 50' of 4" Casing 30' of 5" Casing		

WATER LEVEL OBSERVATIONS

W1 45 WHILE DRILLING

W2 16.2' ACR 17' ACR

W3

SOIL TESTING SERVICES OF WIS. INC.

GREEN BAY, WISCONSIN
540 LAMBEAU STREET

BORING STARTED 9 13 72

BORING COMPLETED 9 14 72

DRAWN MH

JOB # 920

APPROVED

SHEET

The stratification lines represent the approximate boundary between soil

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SOIL TESTING SERVICES, OF WIS., INC.

Project No. ____

STS Job No. 4970

Date 10-4-72

Report No. ____

PERMEABILITY TEST

Constant Head

Sample ST 9-1 Sample 9, 10 & 11 Combined

Soil Description Saprolite-gray to rusty brown and orangish brown silt-trace clay and rock fragments (ML)

Mark No.

Compacted Dry Density = 105.8 PCF Water Content = 14.6% Liquid Limit = 28.4%

Plastic Limit= Non-Plastic

% Compaction = 94.8% of ASTM D698-70

Sample Diameter = 3.0 inch **Sample Height** = 6.0 inch

Run No.	Head, inches	Duration, seconds	Permeability cm/sec	Remarks
1	194.6	69,300	1.0×10^{-6}	
2	333	13,200	1.0×10^{-6}	
3	333	8,700	1.2×10^{-6}	
			Avg. = 1.1×10^{-6}	

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SOIL TESTING SERVICES OF WISCONSIN, INC.
540 LAMBEAU ST., GREEN BAY, WIS. 54303
PHONE (414) 494-9656

Date 10-3-72

Job No. 4970

COMPACTION CONTROL REPORT

1. Laboratory Compaction Test Data

A. Description of Soil: Saprolite-Gray to rusty brown and orangish brown silt (sericite) trace clay and angular rock fragments

Material Mark _____ Classification ML AASHO BPR

Source of Material Boring ST 9-1 Samples 9, 10 and 11 combined

Natural Water Content 13.1-16.1% Natural Dry Density _____ PCF Specific Gravity _____

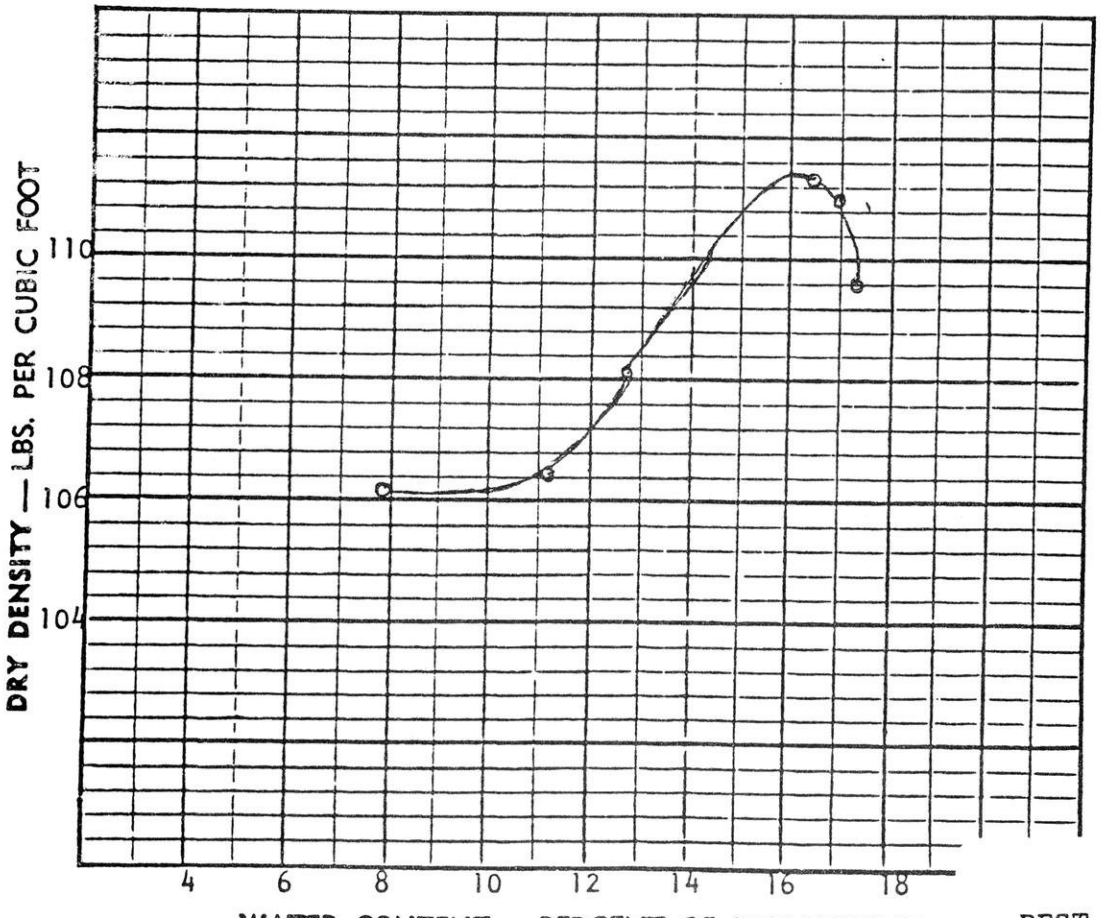
Liquid Limit 28.4 % Plastic Limit Non-plastic % Plasticity Index _____

B. Test Procedure Used: ASTM D-698-70 Method C

C. Test Results:

Maximum Dry Density 111.4 PCF Optimum Water Content 16.0 %

(at a Wet Density of _____ PCF)



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OWNER: Great Lakes Exploration Company

ARCHITECT-ENGINEER

SITE: Ladysmith, Wisconsin

PROJECT NAME: Proposed Copper Mine Development

9-2

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	BLOWS PER 6"	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.³	UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² / PLASTIC LIMIT % / WATER CONTENT % / LIQUID LIMIT % / STANDARD "N" PENETRATION (BLOWS/FT.)
				SURFACE ELEVATION 1125.5		10 20 30 40 50
	1	SS		Silty and sandy (SUBSOIL) (CL)		
	2	SS		Fine coarse sand-some fine medium gravel-trace silt-medium dark brown (SW)		54/6"
16	3	SS		Silty fine sand-trace to some fine-coarse gravel-brown (SM) lenses of fine medium sand		76
	4	SS		Fine sand-trace to some silt-trace gravel-brown (SP-SM)		123
24	5	SS	12			171
	6	SS		Fine sand-trace silt-brown-moist to wet (SP)		140
32	7	SS				133
	8	SS		Fine sand-trace to some silt-brown (SM)		123
40	9	SS		Silty very fine sand-brown (SM)		141
	10	SS	43			171
50	11	WS		Fine coarse sand-some fine medium gravel-trace silt-dark brown to rusty brown-wet (SW) Sandstone		144/3"
62	12	WS				
	13	WS				
	14	SS		Saprolite-gray and white with rusty brown streaks only to 65'-talcy feel-silt with fine coarse angular rock fragments rock fragments platy at 75'		54/6" 20.0% 26% 44" 78"/6" 54/6"
72	15	SS				
	16	SS				
	17	SS				
	18	PS		Gray and white highly weathered schist		
78	19	DB				
				End of Boring		
				65' of 5" Casing		

WATER LEVEL OBSERVATIONS

W.L. 5' at 0 HR W.D.

W.L. B.C.R. 35' A.C.R.

W.L.

SOIL TESTING SERVICES OF WIS. INC.

GREEN BAY, WISCONSIN

540 LAMBEAU STREET

BORING STARTED

BORING COMPLETED

RIG

DRAWN

JOB #

COLEMAN

APPROVED

SHEET

PP No. 4 TM

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

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SOIL TESTING SERVICES, OF WIS., INC.

Project No. [illegible]

S Job No. 4970

Date 10-24-72

Report No.

PERMEABILITY TEST

Constant Head

Sample Boring ST 9-2 Combined Samples 14,15,16,17 & 18 65' to 77'

Soil Description Saprolite-gray and white with rusty brown streaks-silt with angular rock fragments-talcy feel (sericite) ML

Mark No.

Compacted Dry Density = 128.9 PCF

% Compaction = 95.8%

Sample Diameter = 3 1/16 inch **Sample Height =** 6.0 inch

Run No.	Head, inches	Duration, seconds	Permeability cm/sec	Remarks
1	56	30,600	4.4×10^{-6}	
2	56	60,600	5.5×10^{-6}	
3	56	75,600	5.4×10^{-6}	

Avg.= 5.0×10^{-6}

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SOIL TE..ING SERVICES OF WISCONSIN, INC.
540 LAMBEAU ST., GREEN BAY, WIS. 54303
PHONE (414) 494-9656

Date _____ Job No. 4970

COMPACTION CONTROL REPORT

1. Laboratory Compaction Test Data

A. Description of Soil: Saprolite-gray and white with rusty brown streaks-silt with angular rock fragments-talcy feel (sericite)

Material Mark Boring ST 9-2 Classification ML AASHO BPR

Source of Material Boring ST 9-2 Combined samples 14, 15, 16, 17, and 18,65' - 77'

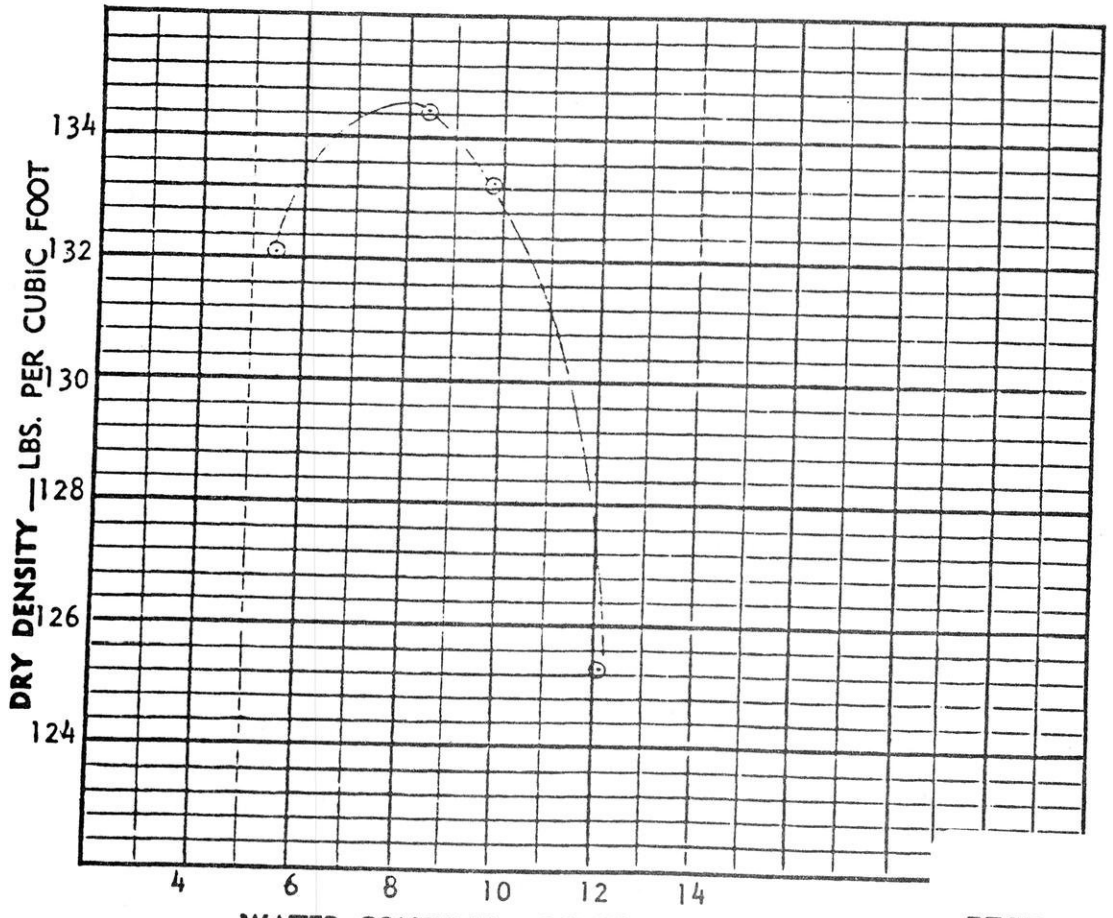
Natural Water Content 8.2-10.4 % Natural Dry Density _____ PCF Specific Gravity _____

Liquid Limit _____ % Plastic Limit _____ % Plasticity Index _____

B. Test Procedure Used: ASTM D-698-70 Method A

C. Test Results:

Maximum Dry Density 134.6 PCF Optimum Water Content 8.0 % (at a Wet Density of _____ PCF)



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LOG OF BORING NO. ST 9-3

OWNER: Great Lakes Exploration Company

ARCHITECT-ENGINEER:

SITE: Ladysmith, Wisconsin

PROJECT NAME: Proposed Copper Mine Development

9-3

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	SAMPLE O.D.	RECOVERY	DESCRIPTION OF MATERIAL
					SURFACE ELEVATION 1136.5
	1	SS			Dark brown sandy topsoil (TL)
	2	SS			Fine sand and silt-brown (SM-ML)
	3	SS			Silty fine-medium sand-trace to some fine coarse gravel-trace clay-brown-trace rusty brown to 16' - dense slightly cemented (SM)
	4	SS			
	5	SS			
	6	SS			
	7	SS			Fine-coarse sand-some fine-coarse gravel-trace silt-rusty brown to brown (SW) 1 1/2" very fine sandy silt seams @ 36'
	8	SS			
	9	SS			
50	10	SS			Silty fine-medium sand-trace to some gravel-reddish brown-dense-slightly cemented (SM)
	11	SS			
	12	SS			Poorly cemented light brown sandstone
	13	SS			Saprolite-rusty brown-trace orange brown and brown silty fine-coarse angular sand and fine-coarse angular rock fragments (SP-SM)
	14	SS			Saprolite-gray and white-trace orange brown-talcy feel-silt with fine-coarse angular rock fragments
	15	SS			
	16	SS			Saprolite-orange brown-trace light brown silt with angular rock fragments
75.3	17	SS			Saprolite-gray and white-trace orange brown-talcy feel-silt with angular rock fragments

End of Boring
65' 5" casing

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.²
PLASTIC LIMIT % | WATER CONTENT % | LIQUID LIMIT %
STANDARD "N" PENETRATION (BLOWS/FT.)
UNIT DRY WT. LBS/FT.³

WATER LEVEL OBSERVATIONS
W.L. 25.5 B.C.R. 55' A.C.R.

SOIL TESTING SERVICES OF WIS., INC.
GREEN BAY, WISCONSIN
540 LAMBEAU STREET

BORING STARTED 9-21-72
BORING COMPLETED 9-26-72
RIG W-15 FOREMAN ER
DRAWN RM APPROVED WMP
JOB # 4970 SHEET

PF No. 4-1M

The stratification lines represent the approximate boundary between soil

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SOIL TESTING SERVICES, OF WIS., INC.

Project No.

STS Job No. 4970

Date 10-21-72

Report No.

PERMEABILITY .EST

Constant Head

Sample Boring ST 9-3 Combined Samples 14,15,16, & 18 65' to 75'

Soil Description Saprolite-gray and white traces orange brown-silt with fine to coarse angular rock fragments

Mark No.

Compacted Dry Density = 110.7 PCF

% Compaction = 88.5%

Sample Diameter = 3 1/6 inch **Sample Height =** 6.0 inch

Run No.	Head, inches	Duration, seconds	Permeability cm/sec	Remarks
1	56	79,200	6.7×10^{-6}	
2	56	76,200	6.8×10^{-6}	
3	56	36,000	5.8×10^{-6}	
4	56	69,000	6.3×10^{-6}	
5	56	71,700	6.2×10^{-6}	
			Avg = 6.4×10^{-6}	

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SOIL TESTING SERVICES OF WISCONSIN, INC.
540 LAMBEAU ST., GREEN BAY, WIS. 54303
PHONE (414) 494-9656

Date 10-21-72 Job No. 4970

COMPACTION CONTROL REPORT

1. Laboratory Compaction Test Data

A. Description of Soil: Saprolite-gray and white trace orange brown silt with angular rock fragments

Material Mark ML Classification AASHO BPR

Source of Material Boring St 9-3 Combined samples 14, 15, 16, 18 65' to 75'

Natural Water Content 7.9 % Natural Dry Density _____ PCF Specific Gravity _____

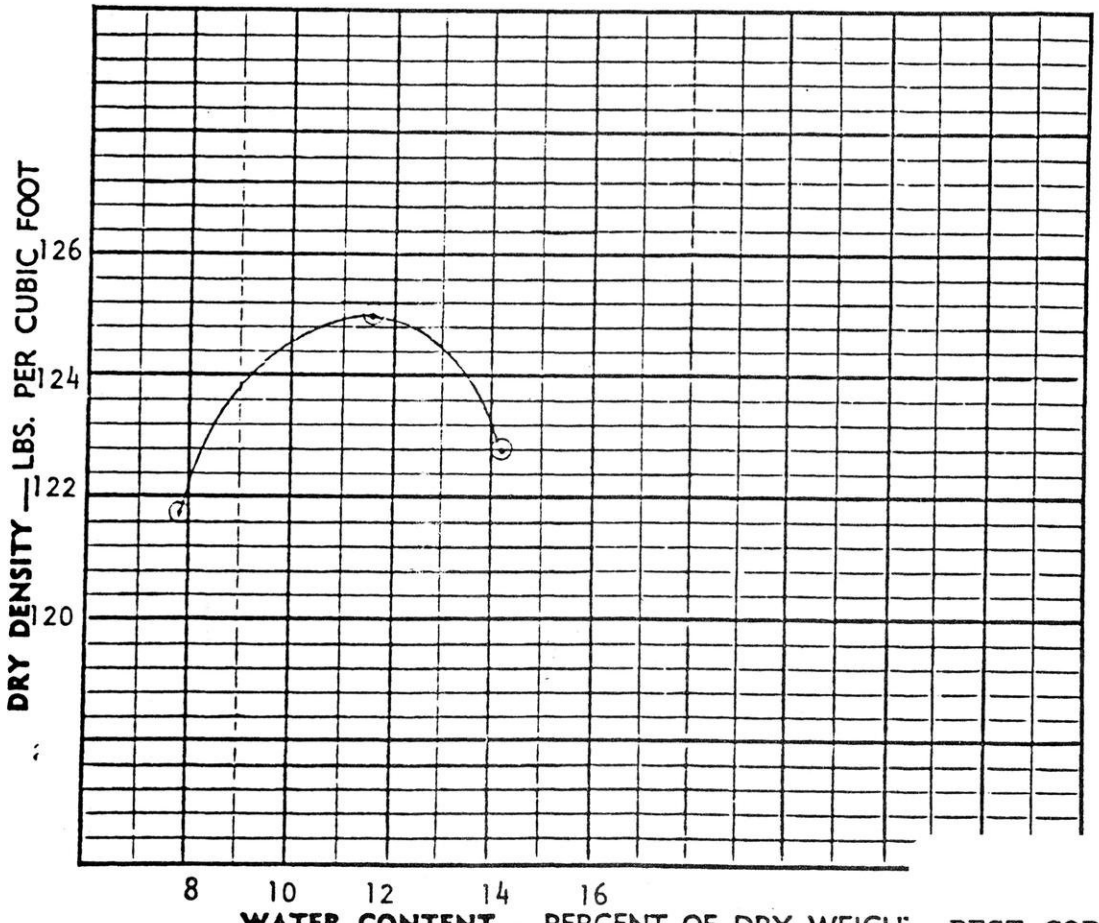
Liquid Limit _____ % Plastic Limit _____ % Plasticity Index _____

B. Test Procedure Used: ASTM D-698-70 Method "C"

C. Test Results:

Maximum Dry Density 125.0 PCF (at a Wet Density of _____ PCF)

Optimum Water Content 11.5 %



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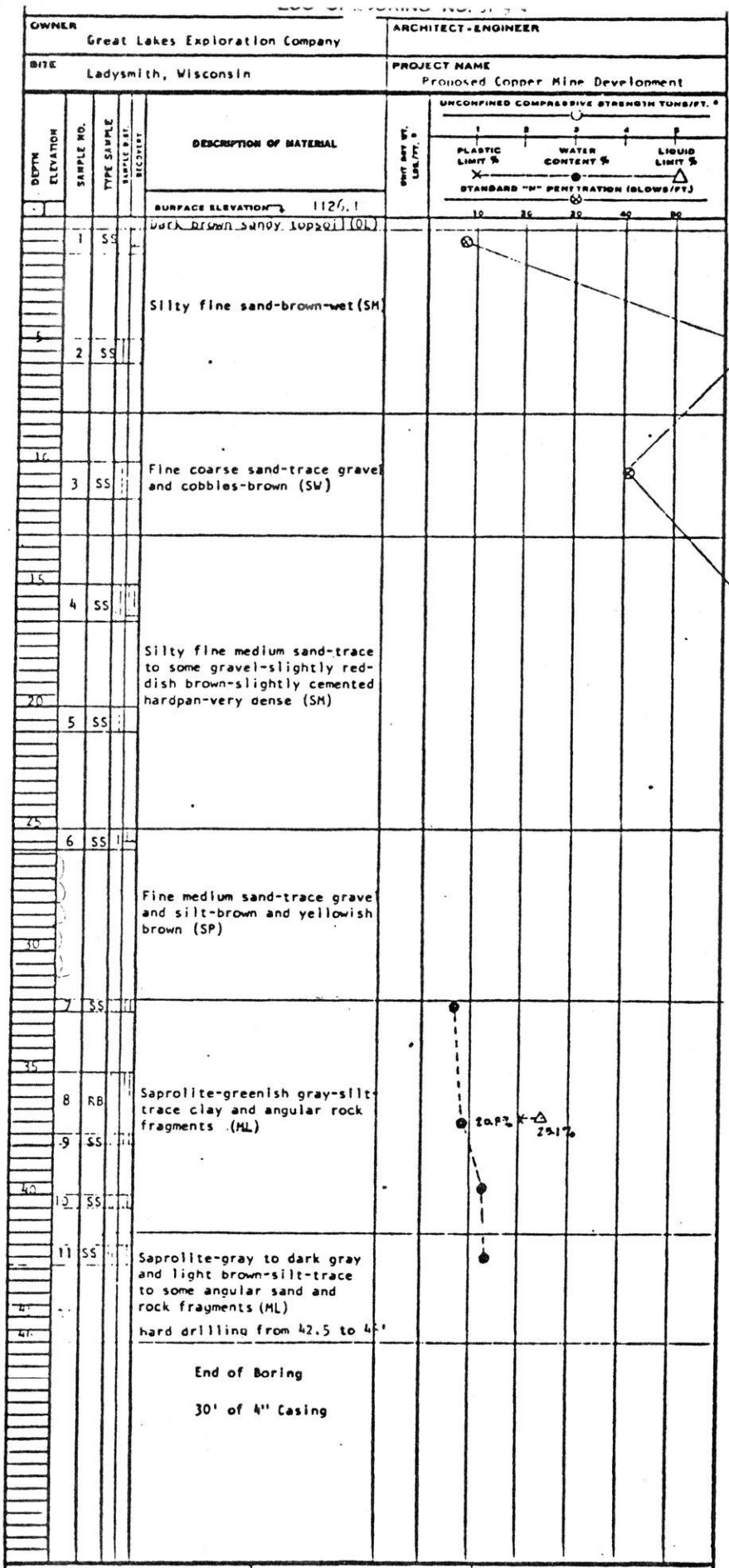

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

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SOIL TESTING SERVICES, OF [illegible], INC.

PERMEABILITY TEST

Constant Head

ST Job No. 4970

Date 11-4-72

Report No.

Sample Boring ST9-4 Combined sample 7,9,10., & 11 32' to 43'

Soil Description Saprolite-grenish gray-silt trace clay and angular rock fragments (ML)
Liquid limit = 25.1%
Plastic limit 20.8%

Mark No.

Compacted Dry Density = 115.8 PCF

Compaction = 95.4%

Sample Diameter = 3 1/16 inch

Sample Height = 6.0 inch

Run No.	Head inches	Duration seconds	Permeability cm/sec	Remarks
1	173	63,300	1.0×10^{-6}	
2	118	20,400	1.1×10^{-6}	
3	173	12,900	1.2×10^{-6}	
4	35	54,600	1.1×10^{-6}	
5	118	82,800	7.2×10^{-7}	
		Avg.	$=1.1 \times 10^{-6}$	

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SOIL TE. ,NG SERVICES OF WISCONSIN, INC.
540 LAMBEAU ST., GREEN BAY, WIS. 54303
PHONE (414) 494-9656

Date _____ Job No. 4970

COMPACTION CONTROL REPORT

1. Laboratory Compaction Test Data

A. Description of Soil: Saprolite - greenish gray-silt-trace clay & angular rock fragments

Material Mark _____ Classification ML AASHO BPR

Source of Material ST 9-4 S 7, 9, 10, 11 32' to 43'

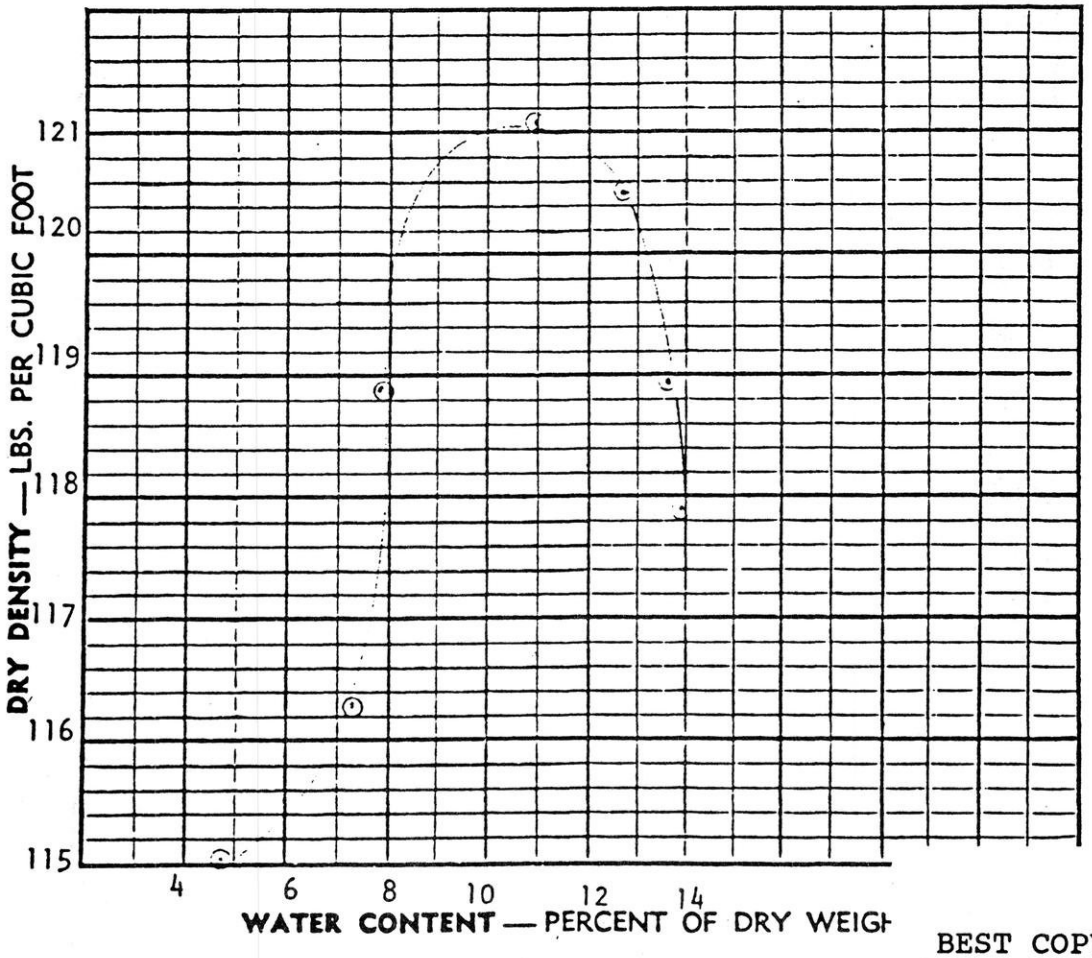
Natural Water Content _____ % Natural Dry Density _____ PCF Specific Gravity _____

Liquid Limit 25.1 % Plastic Limit 20.8 % Plasticity Index 4.3

B. Test Procedure Used: ASTM D-698-70 Method C

C. Test Results: Optimum Water Content 10.5 %

Maximum Dry Density 121.2 PCF (at a Wet Density of _____ PCF)



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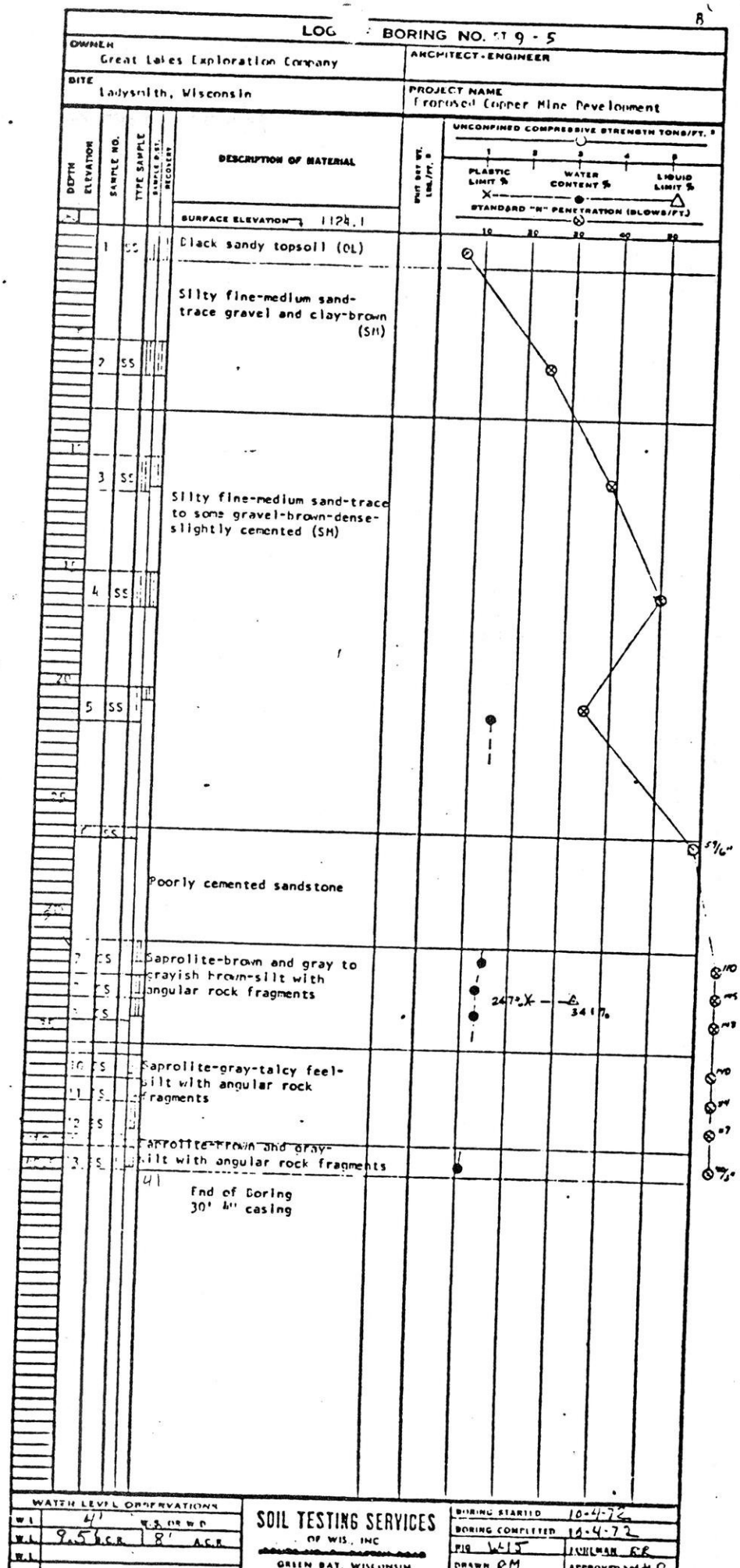

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SOIL TESTING SERVICES, OF [illegible], INC.

PERMEABILITY TEST

Constant Head

ST Job No. 4970

Date 10-26-72

Report No.

Sample Boring ST9-5 Combined samples 7, 8, 9, 12 & 13 31' to 41'

Soil Description Saprolite - brown and gray-silt with angular rock fragments (ML)

Mark No.

Compacted Dry Density = 103.9 PCF

Compaction = 94.1%

Sample Diameter = 3 1/16 inch Sample Height = 6.0 inch

Run No.	Head, inches	Duration, seconds	Permeability cm/sec	Remarks
1	22.5	4140	6.4×10^{-5}	
2	22.5	11,700	5.9×10^{-5}	
3	22.5	4,680	6.1×10^{-5}	
		Avg.=	6.1×10^{-5}	

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SOIL TESTING SERVICES OF WISCONSIN, INC.
540 LAMBEAU ST., GREEN BAY, WIS. 54303
PHONE (414) 494-9656

Date 10-31-72 Job No. 4970

COMPACTION CONTROL REPORT

1. Laboratory Compaction Test Data

A. Description of Soil: Saprolite-brown and gray-silt with angular rock fragments (ML)

Material Mark _____ Classification ML AASHO BPR

Source of Material ST9-5 Sample 7, 8, 9, 12 & 13 31' to 41'

Natural Water Content _____% Natural Dry Density _____PCF Specific Gravity _____

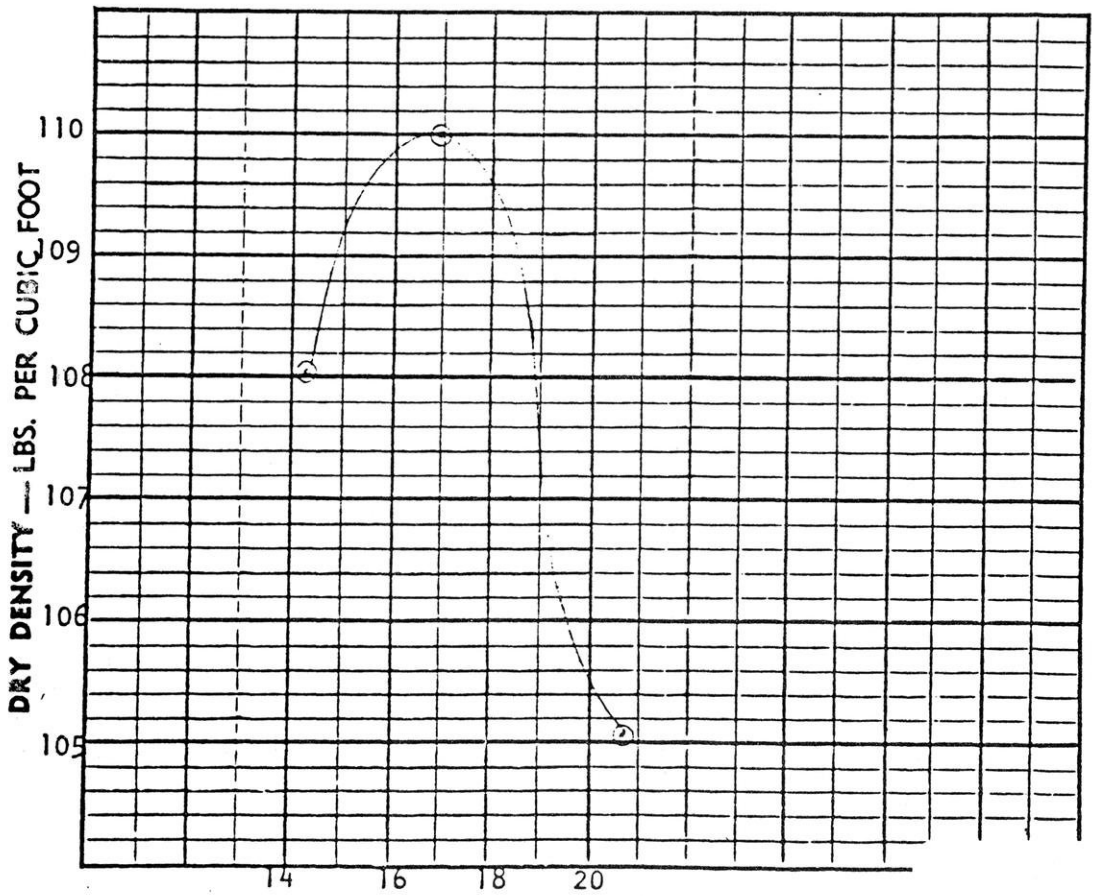
Liquid Limit 34.1 % Plastic Limit 24.7 % Plasticity Index 9.4

B. Test Procedure Used: ASTM D 698-70

C. Test Results:

Maximum Dry Density 110.0 PCF (at a Wet Density of _____PCF)

Optimum Water Content 16.8 %



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LOG — BORING NO. ST 9-6

OWNER: Great Lakes Exploration Company

ARCHITECT-ENGINEER:

SITE: Ladysmith, Wisconsin

PROJECT NAME: Proposed Copper Mine Development

SURFACE ELEVATION: 1113.6

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	SAMPLE O.D. IN.	RECOVERY	DESCRIPTION OF MATERIAL	DRY WT. LBS./FT.³
	1	SS			Silty fine sand-dark rusty brown-wet (SM)	
5	2	WS			Fine coarse sand-some fine medium gravel-trace silt-brown-wet (SW)	
10	3	WS			Fine medium sand-trace silt-brown (SP)	
15	4	SS			White and light brown poorly cemented sandstone	
20	5	WS				
25					26.5	
	6	SS			Saprolite-orange brown trace light brown and dark gray fine sand and silt-some angular rock fragments	
30	7	SS			Saprolite-reddish brown with white seams-clayey silt some platy rock fragments and sandstone pieces	
	8	DB			Harder rock-dark purple with yellow brown schist	
35	9	SS			Saprolite-reddish brown trace light brown clayey silt some fine coarse angular rock fragments (CL-GC)	
40	10	DB			Dark purple, trace yellow brown and brown highly weathered schist-platy structure near vertical	
					End of Boring	
					30' of 5" Casing	

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.²: 1 2 3 4 5

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %

STANDARD "N" PENETRATION (BLOWS/FT.): 10 20 30 40 50

50/5"

50/6"

19.9% — 26.2%

15.6% — 19.2%

WATER LEVEL OBSERVATIONS

W.L. 2' B.C.R. — W.S. OR W.D. 1' A.C.R.

W.L.

W.L.

SOIL TESTING SERVICES OF WIS. INC.
GREEN BAY, WISCONSIN
540 LAMBEAU STREET

BORING STARTED

BORING COMPLETED

RIG — FOREMAN

DRAWN — APPROVED

JOB # 4970 — SHEET

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LOG OF BORING NO. St 9-7

OWNER: Green Lakes Exploration Company
ARCHITECT-ENGINEER:
SITE: Ladysmith, Wisconsin
PROJECT NAME: Proposed Copper Mine Development

SURFACE ELEVATION 1117.1

DEPTH	ELEVATION	SAMPLE NO.	TYPE SAMPLE	BLOWS/FT.	RECOVERY	DESCRIPTION OF MATERIAL
			SS			Black sandy topsoil (OL)
		1A	SS			Silty fine sand-brown (SM)
		2	SS			Fine medium sand-trace to some gravel and silt-brown (SM)
		3	SS			
		3A	SS			
		4	SS			Fine coarse sand-trace to some fine medium gravel-trace silt-brown-wet (SW)
		5	SS			
		6	SS			Fine coarse sand and fine coarse subangular gravel-trace silt-brown (SW-GW)
		7	SS			
		8	RB			Light brown poorly cemented sandstone
		9	SS			
		10	SS			Saprolite-white to greenish gray and pink-clayey silt-trace angular rock fragments (CL-ML)
		11	SS			
		11A	SS			
		12	RB			
		12A	SS			Saprolite-light reddish brown to reddish brown-silty clay-trace sand and angular rock fragments (CH)
		12B	SS			
		13	RB			
		14	SS			
		15	SS			
		16	RB			
		17	SS			
		18	SS			
		19	ST			
			Jube			Unit 5
						End of Boring 49' of 4" Casing

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.²
PLASTIC LIMIT % | WATER CONTENT % | LIQUID LIMIT %
STANDARD "N" PENETRATION (BLOWS/FT.)

WATER LEVEL OBSERVATIONS
W.L. 22' WS CRWD 6' A.C.
W.L.
W.L.

SOIL TESTING SERVICES
OF WIS., INC.
ROUTE NO. 7—BATTEN ROAD
GREEN BAY, WISCONSIN

BORING STARTED 11-22-72
BORING COMPLETED 11-22-72
RIG W-14 FOREMAN RR
DRAWN APPROVED
JOB # 4072 SHEET

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

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SOIL TESTING SERVICES, OF WIS., INC.

PERMEABILITY TEST

Constant Head

Job No. 4970

Date 9-28-72

Report No.

Sample ST 9-7 Samples 12B, 15, 18 & 19 Combined

Soil Description Saprolite - light reddish brown silty clay-trace sand size and angular rock fragments (CH)

Mark No.

Compacted Dry Density = 119.8 PCF **Water Content =** 24.9% **Liquid Limit=** 56.0% **Plastic Limit=** 30.4%

% Compaction = 98% of ASTM D698-70

Sample Diameter = 3.0 inch **Sample Height =** 6.0 inch

Run No.	Head, inches	Duration, seconds	Permeability cm/sec	Remarks
1	328	67,500	2.4×10^{-8}	
2	328	36,000	2.5×10^{-8}	
3	328	72,000	2.6×10^{-8}	Sample swelled about 1/2" at top after test

Avg.= 2.5×10^{-8}

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SOIL TESTING SERVICES OF WISCONSIN, INC.
540 LAMBEAU ST., GREEN BAY, WIS. 54303
PHONE (414) 494-9656

Date 9-27-72 Job No. 4970

COMPACTION CONTROL REPORT

1. Laboratory Compaction Test Data

A. Description of Soil: Saprolite - light reddish brown silty clay-trace sand size and angular rock fragments

Material Mark _____ Classification CH AASHO BPR

Source of Material Boring ST 9-7 Samples 12B, 15, 18 & 19 combined

Natural Water Content 33.1-25.1% Natural Dry Density _____ PCF Specific Gravity _____

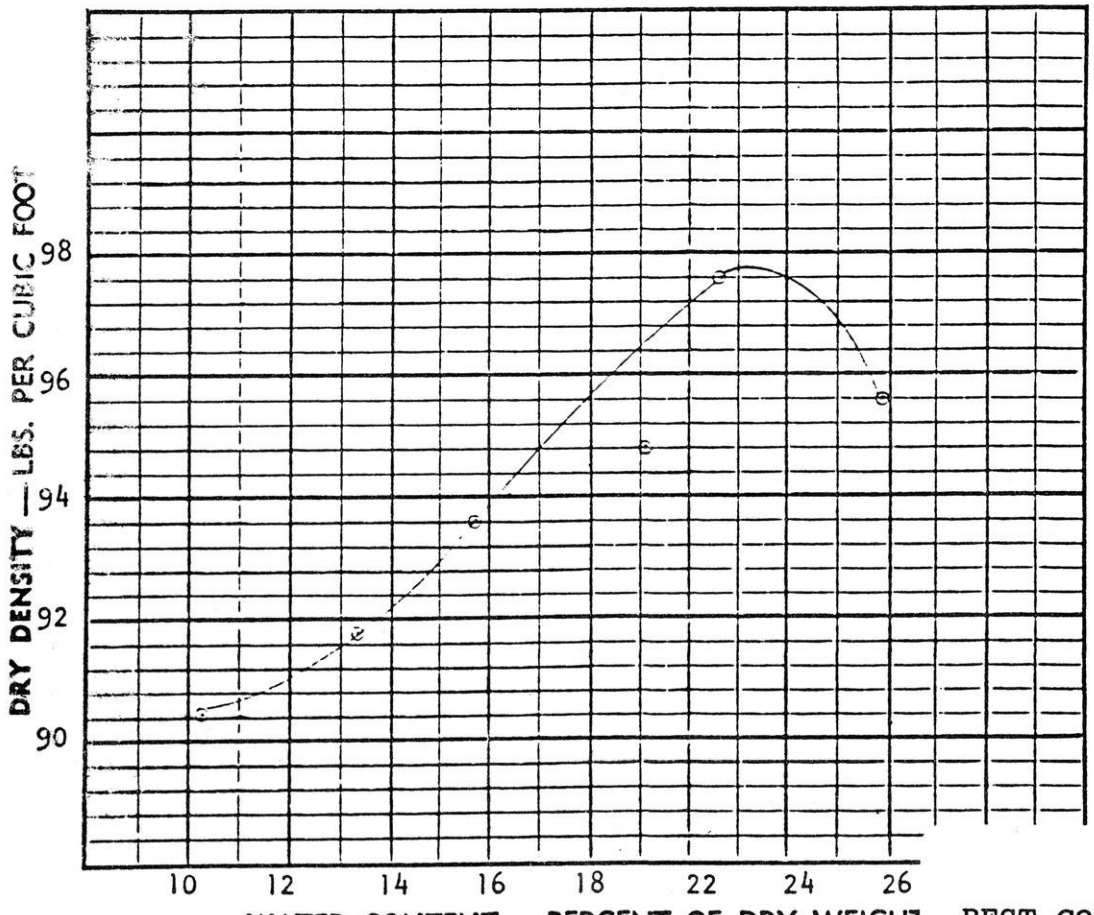
Liquid Limit 56.0 % Plastic Limit 30.4 % Plasticity Index 25.6

B. Test Procedure Used: ASTM D-698-70 Method C

C. Test Results:

Maximum Dry Density 97.8 PCF (at a Wet Density of _____ PCF)

Optimum Water Content 23.1 %



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LOG OF BORING NO. ST 9-

OWNER: Great Lakes Exploration Company

ARCHITECT-ENGIN. .R

SITE: Ladysmith, Wisconsin

PROJECT NAME: Proposed Haul Road ST-9-8

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	SAMPLE DIST.	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.³
SURFACE ELEVATION →						
	1	AS			Black silty topsoil (OL)	
	2	AS			Silty fine sand-trace clay-brown-sample 3 wet (SM)	
5	3	AS				
6					End of Boring	

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.²
1 2 3 4 5
PLASTIC LIMIT % WATER CONTENT % LIQUID LIMIT %
STANDARD "N" PENETRATION (BLOWS/FT.)
10 20 30 40 50

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WATER LEVEL OBSERVATIONS

W.L.	W.S. OR W.D.	
W.L.	B.C.R.	A.C.R.
W.L.	4.9' AB	

SOIL TESTING SERVICES
OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

BORING STARTED	10-25-72		
BORING COMPLETED	10-25-72		
RIG	Bomb.	FOREMAN	TM
DRAWN	HH	APPROVED	WMP
JOB #	4970	SHEET	

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

BBS-81471

LOG OF BORING NO. ST 9

OWNER Great Lakes Exploration Company

ARCHITECT-ENGINEER

SITE Ladysmith, Wisconsin

PROJECT NAME Proposed Haul Road ST-9-9

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	SAMPLE DIST.	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.³	UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² (1 2 3 4 5) PLASTIC LIMIT % WATER CONTENT % LIQUID LIMIT % STANDARD "N" PENETRATION (BLOWS/FT.) (10 20 30 40 50)
SURFACE ELEVATION							
	1	AS			Dark brown sandy topsoil (OL-SM)		
	2	AS			Silty very fine sand-brown-wet (SM)		
5	3	AS			Silty fine sand-trace clay-brown (SM-SC)		
6.0					End of Boring		

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WATER LEVEL OBSERVATIONS		
W.L.	W.S. OR W.D.	
W.L.	B.C.R.	A.C.R.
W.L.	5.0' AB	

SOIL TESTING SERVICES
OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

BORING STARTED	10-25-72		
BORING COMPLETED	10-25-72		
RIG	Bcmb.	FOREMAN	TM
DRAWN	HH	APPROVED	WMP
JOB #	4970	SHEET	

The stratification lines represent the approximate boundary between soil types and the transition may be gradual

3.5-B-27

BBS-81471

LOG OF BORING NO. ST `-10

OWNER Great Lakes Exploration Company	**ARCHITECT-ENGINEER**
SITE Ladysmith, Wisconsin	**PROJECT NAME** Proposed Haul Road ST-9-10

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	SAMPLE DIST.	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.³	UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² (1 2 3 4 5) PLASTIC LIMIT % WATER CONTENT % LIQUID LIMIT % STANDARD "N" PENETRATION (BLOWS/FT.) (10 20 30 40 50)
					SURFACE ELEVATION ↓		
	1	AS			Black silty topsoil (OL)		
	2	AS			Silty very fine sand-brown (SM)		
	3	AS			Silty fine sand-trace clay-brown (SM-SC)		
5	4	AS			Silty fine sand-brown-wet (SM)		
					End of Boring		

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WATER LEVEL OBSERVATIONS		
W.L.	W.S. OR W.D.	
W.L.	B.C.R.	A.C.R.
W.L.	4.2' AB	

SOIL TESTING SERVICES
OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

BORING STARTED	10-25-72		
BORING COMPLETED	10-25-72		
RIG	bomb.	FOREMAN	TM
DRAWN	HH	APPROVED	WMP
JOB #	4970	SHEET	

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

BBS-81471

LOG OF BORING NO. ST - 9 - 11

OWNER Great Lakes Exploration Company	ARCHITECT-ENGINEER
SITE Ladysmith, Wisconsin	PROJECT NAME Proposed Haul Road ST-9-11

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	SAMPLE DIST.	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.³
SURFACE ELEVATION →						
	1	AS			Dark brown sandy topsoil (OL)	
	2	AS			Silty fine sand-brown (SM)	
5	3	AS			Clayey fine sand-brown-wet (SC)	
					End of Boring	

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.²
1 2 3 4 5
PLASTIC LIMIT % WATER CONTENT % LIQUID LIMIT %
STANDARD "N" PENETRATION (BLOWS/FT.)
10 20 30 40 50

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WATER LEVEL OBSERVATIONS		
W.L.	W.S. OR W.D.	
W.L.	B.C.R.	A.C.R.
W.L.	5.5' AB	

SOIL TESTING SERVICES
OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

BORING STARTED	10-25-72		
BORING COMPLETED	10-25-72		
RIG	Bomb.	FOREMAN	TM
DRAWN	HH	APPROVED	WMP
JOB #	4970	SHEET	

The stratification lines represent the approximate boundary between soil types and the transition may be gradual

BBS-81471

LOG OF BORING NO. ST-9-12

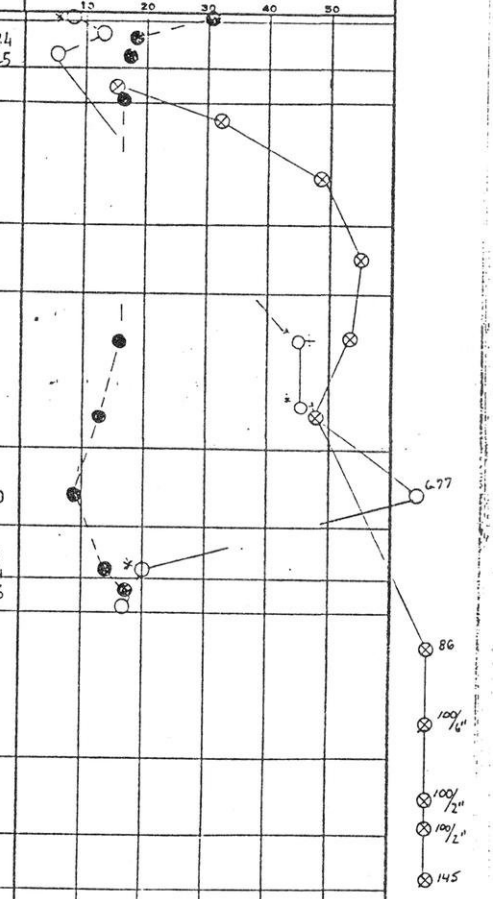
OWNER: Great Lakes Exploration Company	ARCHITECT-ENGINEER
SITE: Ladysmith, Wisconsin	PROJECT NAME: Proposed Copper Mine Development

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	SAMPLE DIST.	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.³
					SURFACE ELEVATION	
	1	ST			Dark brown silty and sandy topsoil (OL)	
	1A	ST			Silt and very fine sand brown to rusty brown (SM)	84
	2	ST				125
	3	SS			Silty and clayey fine sand brown (SC)	
	4	SS			Fine-medium sand-trace gravel and silt-brown-dense-moist to wet (SP)	
10	5	SS				
	6	SS			Fine sand-trace to some silt-brown-dense (SM)	
20	7	SS			Silty and sandy clay-trace gravel-brown trace gray and rusty brown-hard (CL)	
	8	SS				
30	9	ST			Silty clay-mottled dark brown and light brown-hard (CL)	120
	10	ST			Silty and clayey sand-trace gravel-dark-rusty brown (SC)	114
	10A	ST			Silty and sandy clay-trace gravel-brown (CL)	116
40	11	SS			Silty and clayey sand-trace gravel-brown-very dense (SC)	
	12	SS				
50	13	SS			Poorly cemented sandstone	
	14	SS				
56.5	15	SS			Saprolite-white and gray with reddish brown streaks-silt with angular rock fragments-talcy feel (ML)	
					End of Boring 20' NX Casing	

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.²

PLASTIC LIMIT % | WATER CONTENT % | LIQUID LIMIT %

STANDARD "N" PENETRATION (BLOWS/FT.)



*Calibrated Penetrometer

WATER LEVEL OBSERVATIONS			
W.L.	4'-5.5'	W.S. OR W.D.	XX
W.L.	15' B.C.R.	7' A.C.R.	
W.L.			

SOIL TESTING SERVICES
OF WIS., INC.
ROUTE NO. 7—BAETEN ROAD
GREEN BAY, WISCONSIN

BORING STARTED	10-5-72		
BORING COMPLETED	10-5-72		
RIG	V-15	FOREMAN	RR
DRAWN	RM	APPROVED	WMP
JOB #	4970	SHEET	

The stratification lines represent the approximate boundary between soil types and the transition may be gradual

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LOG OF BORING NO. ST 9 -13

12

OWNER: Great Lakes Exploration Company	ARCHITECT - ENGINEER
SITE: Ladysmith, Wisconsin	PROJECT NAME: Proposed Copper Mine Development

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	SAMPLE DIST. RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.³
SURFACE ELEVATION	1	SS		Dark brown silty and sandy topsoil (OL)	
	1A	SS		Silty very fine sand-brown trace rusty brown (SM-ML)	
	2	SS		Silty fine sand-trace gravel-brown-wet (SM)	
	3	SS			
10	4	SS		Fine-coarse sand-trace to some gravel-trace silt-brown (SM)	
	5	SS			
	6	SS			
20	7	SS		Clayey sand-trace gravel-brown-dense (SC)	
	8	SS		Silty and sandy clay-trace gravel-brown (CL)	
30	9	ST		Silty clay-trace sand and gravel-gray to rusty brown-very tough (CL)	107
	10	ST		Silty fine-coarse sand-trace clay and rock fragments rusty brown (SC)	
40	11	SS		Silty fine-medium sand-trace gravel-rusty brown (SM)	
	12	SS		Silty very fine sand-brown and gray-very dense (SM)	
50	13	SS		Fine-medium sand-trace to some fine medium gravel-trace silt-brown-wet-dense (SP)	
	14	SS		Fine-coarse sand-some fine coarse gravel-trace silt-grayish brown-wet -dense (SW)	
60					
61.5	15	SS		Saprolite-white and greenish gray silt	
				End of Boring 60' NX Casing	

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² (1 2 3 4 5)

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %

STANDARD "N" PENETRATION (BLOWS/FT.) (10 20 30 40 50)

*Calibrated Penetrometer

WATER LEVEL OBSERVATIONS		
W.L.	W.S. OR W.D.	
W.L.	17.8' B.C.R.	16' A.C.R.
W.L.		

SOIL TESTING SERVICES
OF WIS., INC.
ROUTE NO. 7—BAETEN ROAD
GREEN BAY, WISCONSIN

BORING STARTED	10-5-72		
BORING COMPLETED	10-5-72		
RIG	U-15	FOREMAN	RR
DRAWN	RM	APPROVED	WMP
JOB #	4970	SHEET	

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

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LOG OF BORING NO. ST9 - 17A

OWNER Bear Creek Mining Company	ARCHITECT-ENGINEER 17A
SITE Ladysmith, Wisconsin	PROJECT NAME Proposed Mine Development

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	SAMPLE DIST.	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.³	UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² (1 2 3 4 5) PLASTIC LIMIT % WATER CONTENT % LIQUID LIMIT % STANDARD "N" PENETRATION (BLOWS/FT.) (10 20 30 40 50)
					SURFACE ELEVATION 1100		
					No samples		
20							
	1	SS					
					Silty fine coarse sand-trace to some fine medium gravel-trace clay-trace decomposed gravel pieces at 30 feet-brown to rusty brown(SW)		
25	2	SS					
30	3	SS					
35							
	4	SS			Fine coarse sand-trace to some fing medium gravel-trace silt-brown(SW)		
40							
	5	SS					
41.5					End of Boring	40' NX Casing	20' of NX Casing left in ho

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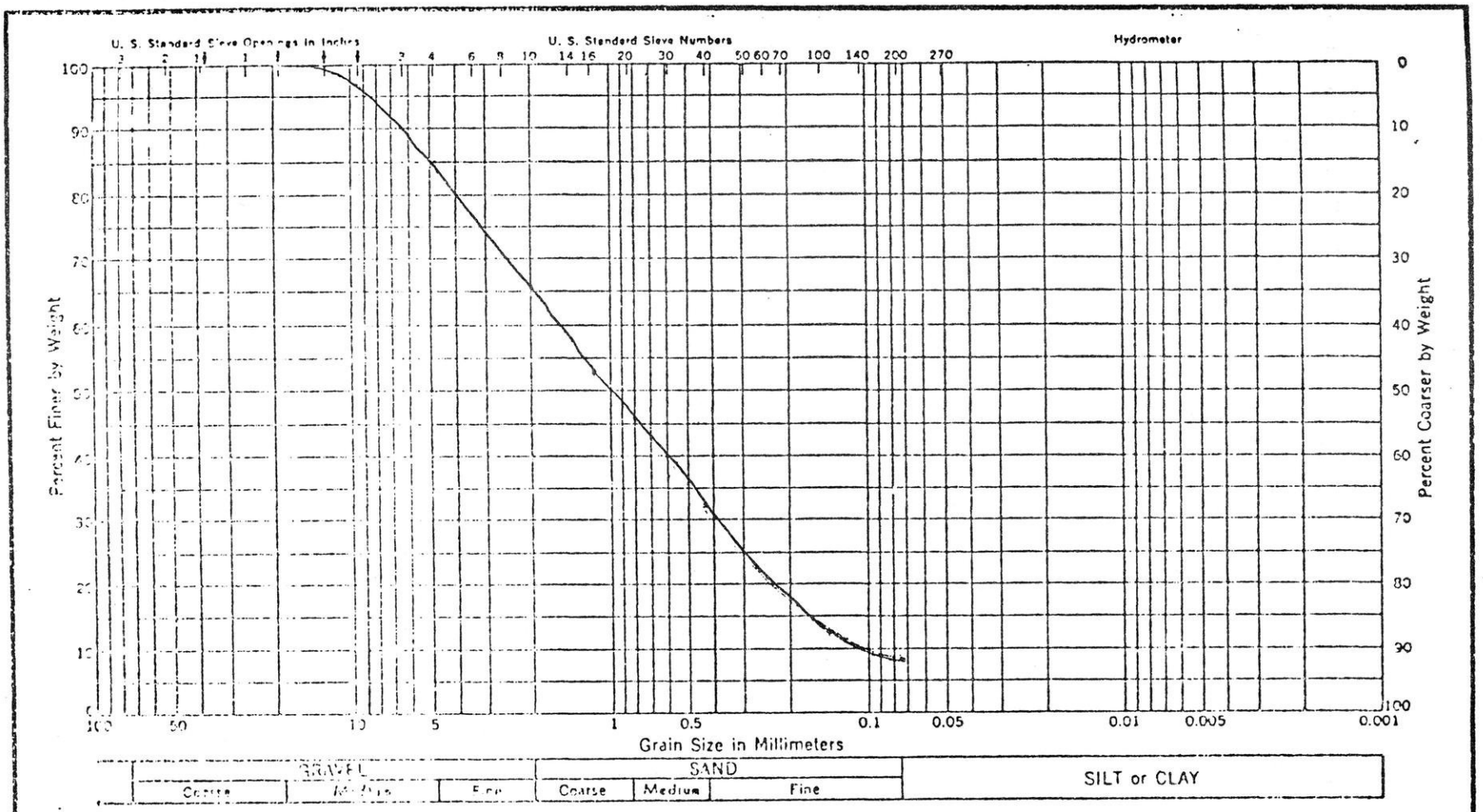
WATER LEVEL OBSERVATIONS			
W.L.	W.S. OR W.D.		
W.L.	11.6' D.C.B	A.C.P	
W.L.			

SOIL TESTING SERVICES
OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

BORING STARTED	6-22-73		
BORING COMPLETED	6-22-73		
RIG	22	FOREMAN	JG
DRAWN		APPROVED	WMP
JOB #	4970 A	SHEET	

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

BBS-81471



SAMPLE NO.	W.C.	LL	PL	PI	CLASSIFICATION
					Fine-coarse sand -some fine medium gravel-
					trace silt (SW)
					%g - S - Si + Cl
					15 - 77 - 8 (F+VD 12/88)

Boring ST9 - 17A

Sample 4 35'-36.5'

Sample Tested = 132.2 gr.

DRAWN	APPROVED	DATE	JOB No.

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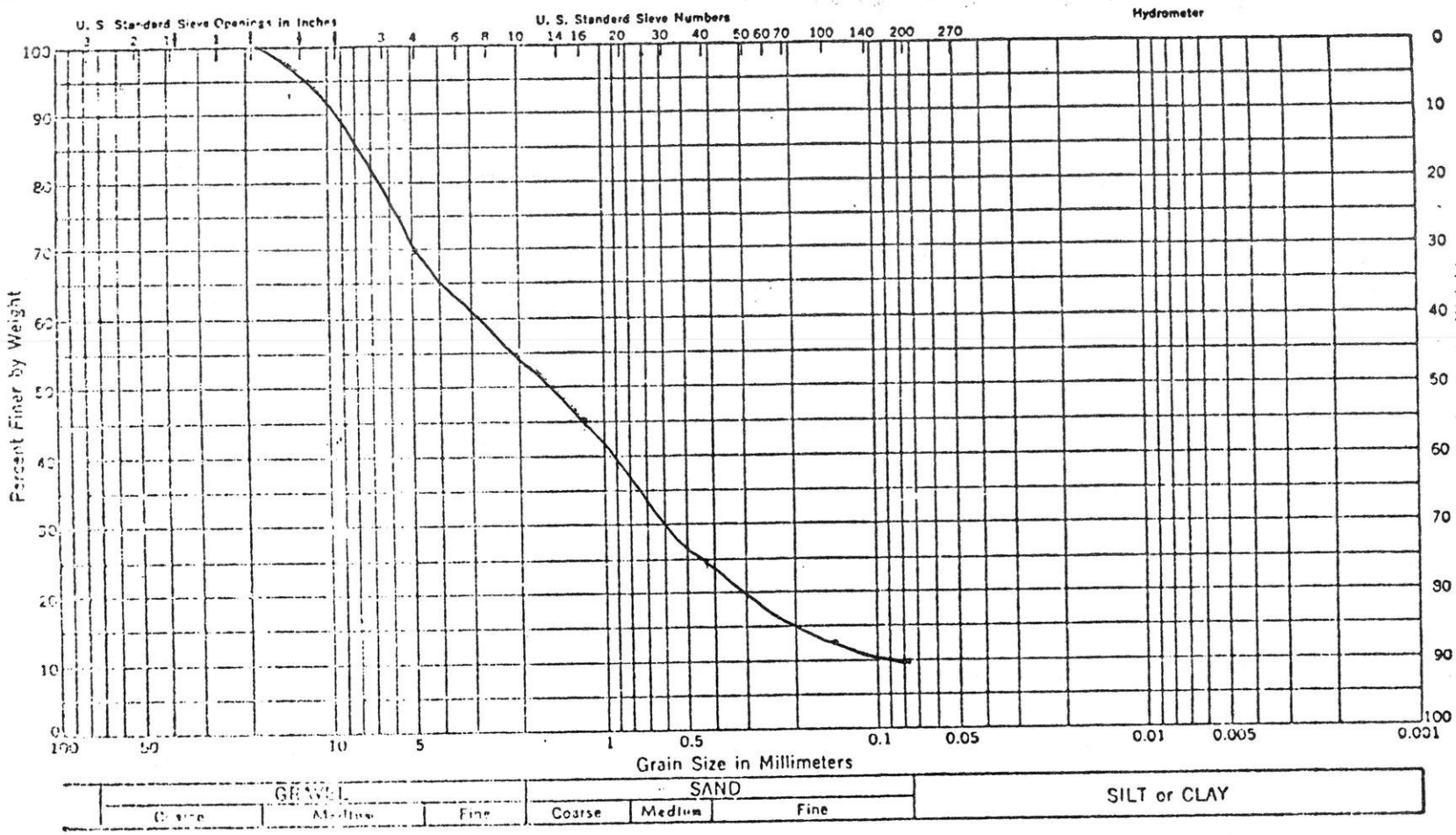

SAMPLE NO.	W.C.	LL	PL	PI	CLASSIFICATION
					Fine-coarse sand-some fine medium gravel-trace silt (SW)
					%g - 5 - sand 30 - 60 - 10 (F+VD 12/88)

Boring ST9 - 17A

Sample 5 40-41.5'

Sample Tested = 170.6 gr.

DRAWN	APPROVED	DATE	JOB No.

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LOG OF BORING NO. STA - 17

OWNER: Bear Creek Mining Company

ARCHITECT-ENGINEER:

SITE: Ladysmith, Wisconsin

PROJECT NAME: Proposed Mine Development

SURFACE ELEVATION: 1100

DEPTH	ELEVATION	SAMPLE NO.	TYPE SAMPLE	BLOWS/0.5' PENETRATION	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.³	UNCONFINED COMPRESSIVE STRENGTH TONS/FT.²	PLASTIC LIMIT %	WATER CONTENT %	LIQUID LIMIT %	STANDARD "N" PENETRATION (BLOWS/FT.)
0					Silty fine coarse sand and fine coarse angular and sub-angular gravel-dense(SM)						
5		1	SS								104
10		2	SS		Fine coarse sand-some fine coarse gravel-trace silt-brown-wet(SW)						115/11"
15		3	SS								47
20		4	SS		Silty and clayey fine coarse sand-trace to some fine coarse gravel-trace weathered gravel at 22 feet-brown to dark rusty brown-wet(SM-SC)						10
		5	SS								84
25		6	SS		Fine medium sand-trace to some fine medium gravel-trace silt and coarse sand-brown-wet(SP)						59
30		7	SS								53
35		8	SS		Fine coarse sand-some fine medium gravel-trace silt-dark brown changing to brown at 40 feet-wet (SW)						61
40		9	SS								107
45		10	SS								57/1"
48.0			RB		Saprolite (wash sample)						
					End of Boring 45' NX Casing						

WATER LEVEL OBSERVATIONS

W.L.	7'	WD.	
W.L.	9'	D.C.R.	A.C.R.
W.L.			

SOIL TESTING SERVICES OF WIS., INC.

BORING STARTED 6-21-73

BORING COMPLETED 6-22-73

DRILLER JG

DRAWN

CHECKED

BEST COPY AVAILABLE

LOG OF BORING NO. ST9-18

OWNER	ARCHITECT-ENGINEER
Bear Creek Mining Company	
SITE Ladysmith, Wisconsin	**PROJECT NAME** Proposed Mine Development

SURFACE ELEVATION → 1102

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² (1, 2, 3, 4, 5)

PLASTIC LIMIT % | WATER CONTENT % | LIQUID LIMIT %

STANDARD "N" PENETRATION (BLOWS/FT.) (10, 20, 30, 40, 50)

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	SAMPLE DIST.	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.³
5	1	SS			Silty fine sand-some fine coarse gravel-trace coarse sand-dark reddish brown(SM)	
10	2	SS			Fine coarse sand-some fine coarse angular to rounded gravel-trace to some silt (SW-SM)	
15	3	SS				
19.5	4	SS			Saprolite-light gray trace brown and yellow brown silt(ML) with layers of clayey silt(CL-ML)	
					End of Boring 18' NX Casing 10' NX Casing left in hole 1 1/2" Ø PVC installed to 13.0'	

44

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WATER LEVEL OBSERVATIONS			
W.L.		W.S. OR W.D.	
W.L.	4.4'	B.C.R.	A.C.R.
W.L.			

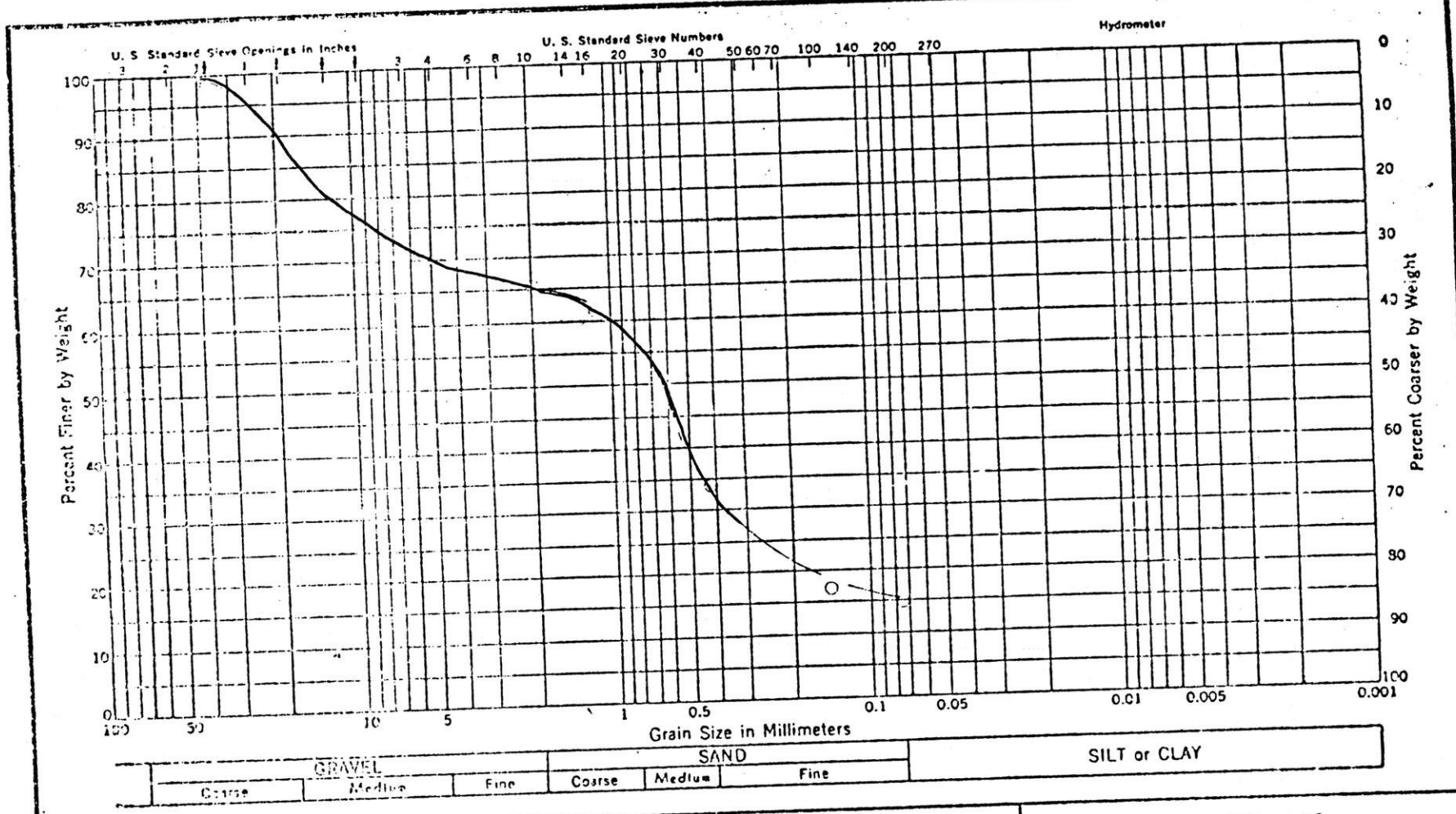
SOIL TESTING SERVICES OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

BORING STARTED	6-21-73
BORING COMPLETED	6-21-73
RIG 22	FOREMAN JG
DRAWN	APPROVED WMP
JOB # 4970 A	SHEET

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

BBS-81471

3-5-B-36



SAMPLE NO.	W.C.	LL	PL	PI	CLASSIFICATION
					Fine coarse sand-some fine coarse gravel-
					trace to some silt (SW-SM)
					%g - s - s+c
					30 - 55 - 15 (FHD 12/88)

Boring ST9 - 18

Sample 3 15' - 16.5'

Sample Tested 261.4 gr.

DRAWN	APPROVED	DATE	JOB No.

3.5-B-37

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LOG OF BORING NO. ST9-19A

OWNER: Bear Creek Mining Company	ARCHITECT-ENGINEER: 19A
SITE: Ladysmith, Wisconsin	PROJECT NAME: Proposed Mine Development

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	SAMPLE DIST.	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.³	UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² (1 2 3 4 5) PLASTIC LIMIT % WATER CONTENT % LIQUID LIMIT % STANDARD "N" PENETRATION (BLOWS/FT.) (10 20 30 40 50)
					SURFACE ELEVATION 1120		
20					No samples-cobbles noted from 4' to 14'-boulders from 14' to 20'		
	1	SS			Fine coarse subangular to rounded gravel-some fine coarse sand-trace silt-wet-dark gray brown to gray brown (GW)		
25.0	2	SS					
					End of Boring 23.5' 4" Casing 19' of 1 1/2" Ø PVC placed in bore hole (Had to drill out 20' of PVC in order to install well)		

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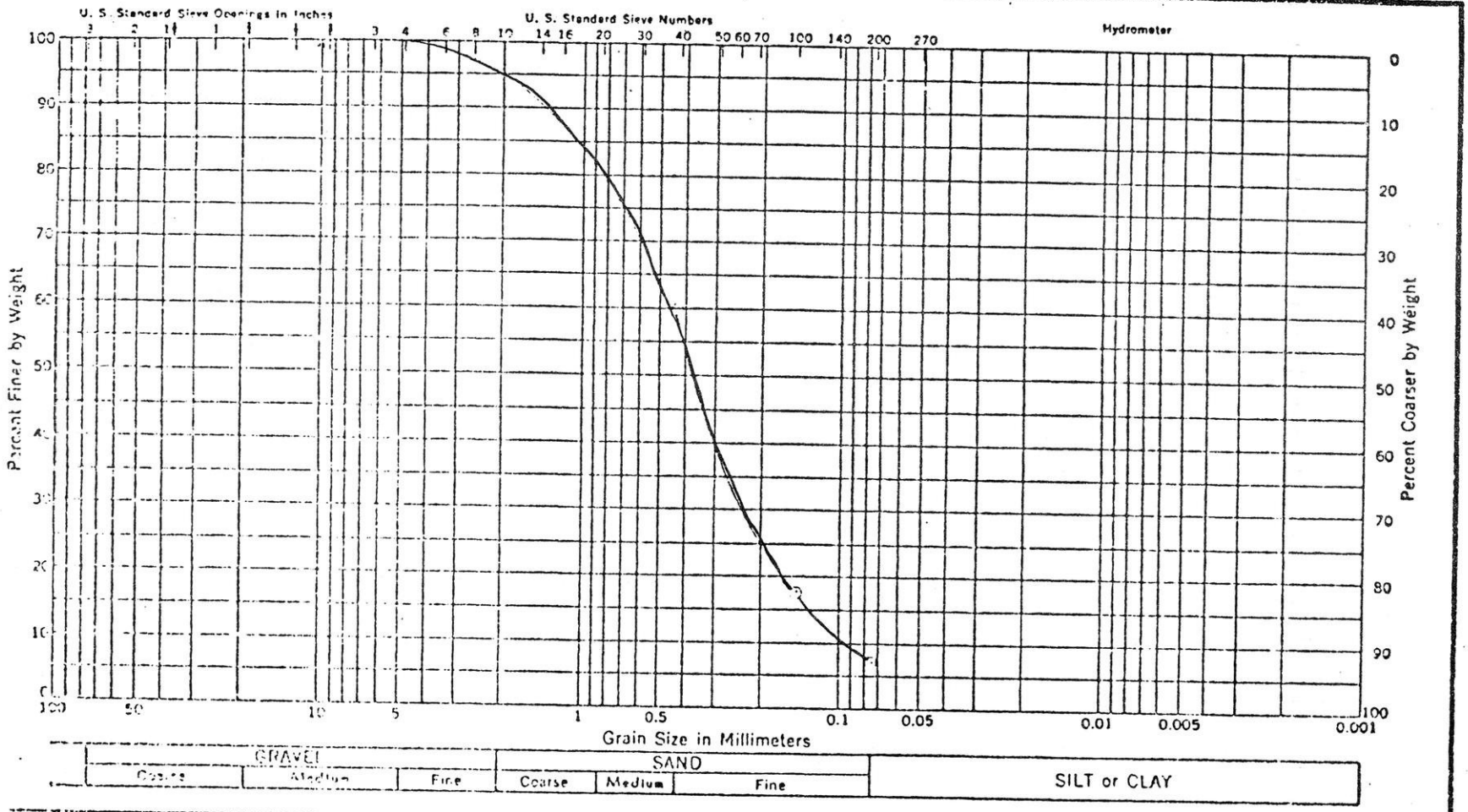
WATER LEVEL OBSERVATIONS			
W.L.		W.S. OR W.D.	
W.L.	10'	D.C.R.	A.C.R.
W.L.	10' AB		

SOIL TESTING SERVICES OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

BORING STARTED	6-14-73
BORING COMPLETED	6-14-73
RIG W-15	FOREMAN RR
DRAWN	APPROVED WMP
JOB # 4970 A	SHEET

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

BBS-81471



SAMPLE NO.	W.C.	LL	PL	PI	CLASSIFICATION
					Fine coarse sand-trace silt-sandstone (SP-SM)
					20-5-sand
					0-93-7 (F+V) 12/88

Boring ST9-19

Sample 6B 28 to 28.5'

Sample Tested= 237.0 gr.

DRAWN	APPROVED	DATE	JOB No.

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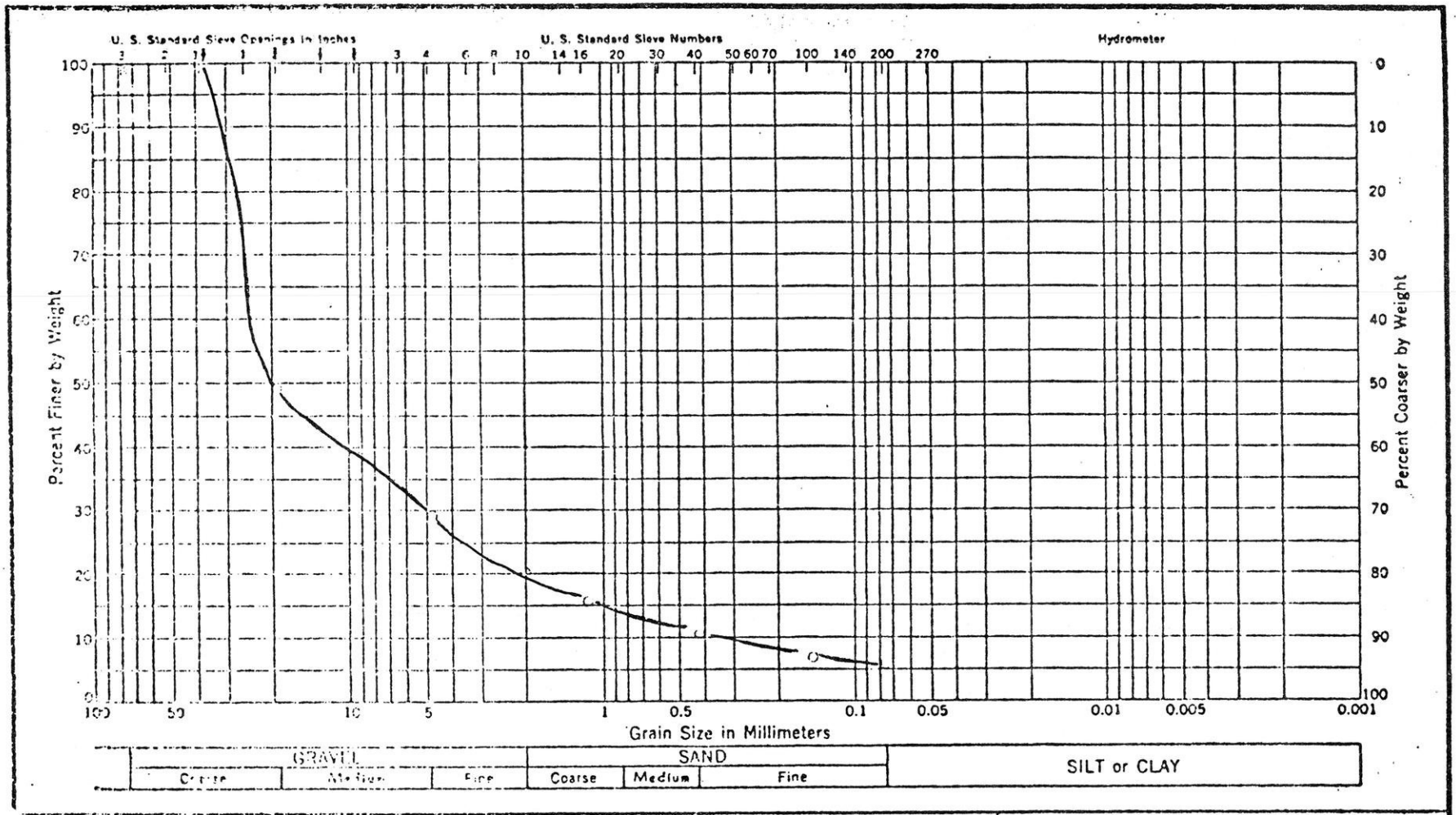

SAMPLE ID.	W.C.	L.L.	P.L.	P.I.	CLASSIFICATION
					Fine coarse angular gravel-some sand-
					trace silt(GW)
					%g - 5 - s tol
					72 - 22 - 6 (F+VD 12/88)

Boring ST9 - 19A

Sample 1 21' - 22.2'

Sample Tested 692.7 gr.

DRAWN	APPROVED	DATE	JOB No.

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LOG OF BORING NO. ST9 - 20

OWNER: Bear Creek Mining Company

ARCHITECT-ENGINEER:

SITE: Ladysmith, Wisconsin

PROJECT NAME: Proposed Mine Development

SURFACE ELEVATION: +1115

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² (1 2 3 4 5)

PLASTIC LIMIT % | WATER CONTENT % | LIQUID LIMIT %

STANDARD "N" PENETRATION (BLOWS/FT.) (10 20 30 40 50)

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	SAMPLE DIST. RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.³	N
5	1	SS		Fine medium sand-trace gravel and silt-brown-wet (SW)		⊗43
10	2	SS		Fine coarse sand-some fine coarse rounded to sub-angular gravel-trace silt-brown and gray brown (SW)		⊗75
15	3	SS		Silty fine coarse sand-trace to some gravel-trace clay-reddish brown (SM-SC)		⊗38
20	4	SS		(SM)		⊗23
25	5	SS		Fine coarse sand and fine coarse sub-angular to rounded gravel-trace silt-brown-wet (SW-GW) SW-SM		⊗101/5"
30	6	SS		Light brown poorly cemented coarse grained sandstone (SP SS) FWD 12/88		⊠35
35	7	SS		Saprolite-white to orangish brown silt (ML)		⊠41
36.5				End of Boring 30' 4" Casing		

⊗ - 140 lbs.-30: drop on 2" O.D. Split Spoon

⊠ - 380 lbs.-28" drop on 3" O.D. Split Spoon

WATER LEVEL OBSERVATIONS

W.L. 3.5' W.S. XXXX

W.L. B.C.R. A.C.R.

W.L.

SOIL TESTING SERVICES
OF WIS., INC.
ROUTE NO. 7—DAETEN ROAD
GREEN BAY, WISCONSIN

BORING STARTED 6-18-73

BORING COMPLETED 6-18-73

RIG W-15 FOREMAN RR

DRAWN APPROVED WMP

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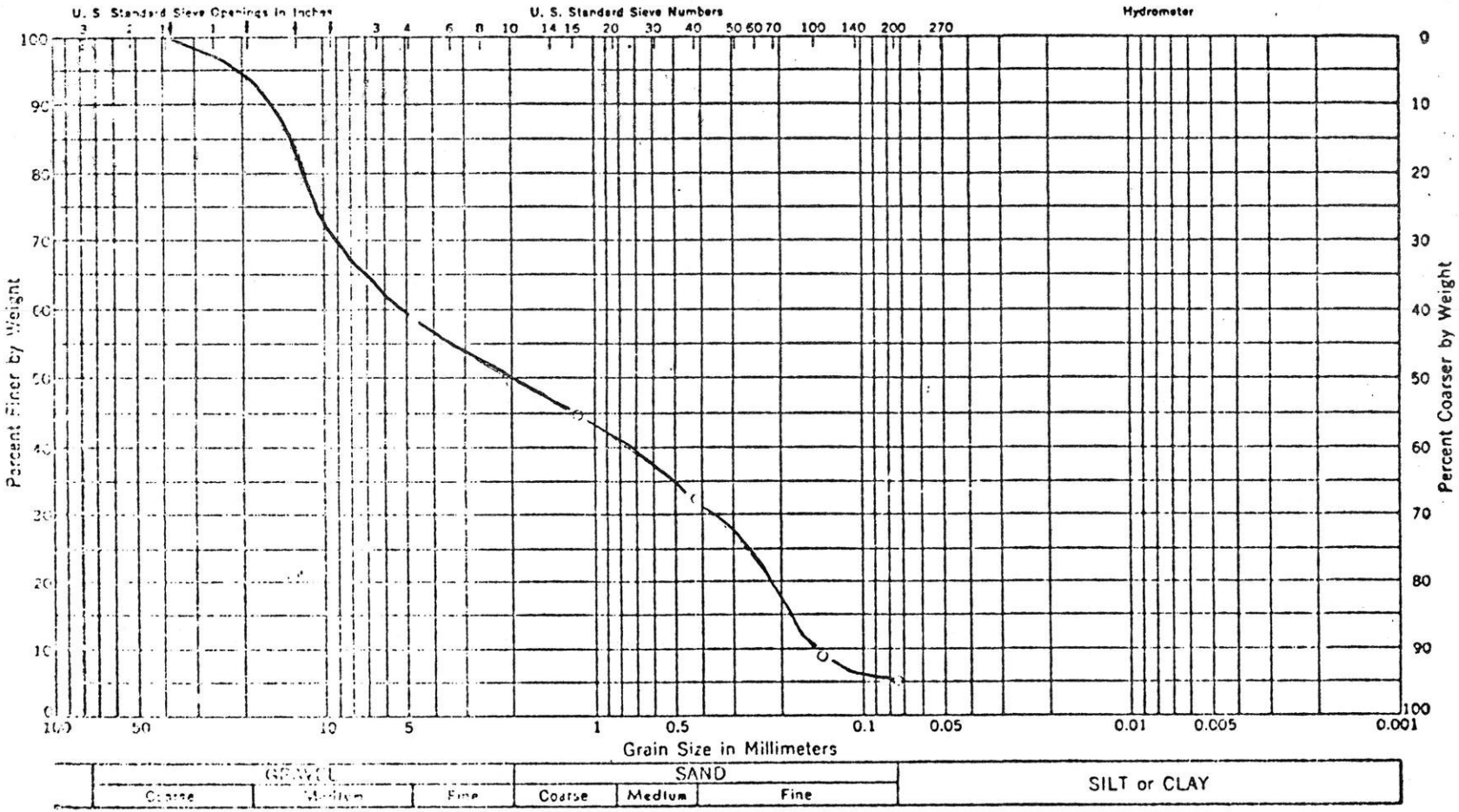

SAMPLE NO.	W.C.	LL	PL	PI	CLASSIFICATION
					Fine coarse sand and fine coarse gravel-
					trace silt (~~SW-GW~~) (SW-SM)
					Well graded sand w/silt and gravel
					%g-s-s+c
					41-54-5 (FHWD 12/88)

Boring ST9 - 20

Sample 5-25' - 26.2'

Sample Tested 621.6 gr.

DRAWN	APPROVED	DATE	JOB No.

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LOG OF BORING NO. ST9 - 20A

OWNER: Bear Creek Mining Company	ARCHITECT-ENGINEER:
SITE: Ladysmith, Wisconsin	PROJECT NAME: Proposed Mine Development

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	SAMPLE DIST.	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.³
					SURFACE ELEVATION +1115	
					No Samples	
25	1	SS			Silty fine medium sand-trace to some fine coarse gravel-trace clay-reddish brown (SM)	
	2	SS			Fine coarse sand-trace to some fine medium gravel-trace silt-brown-wet (SW)	
30		RB			Sandstone (no samples)	
34.5					End of Boring 30' 4" Casing Installed 1½" Ø PVC to 31'	

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.²
1 2 3 4 5
PLASTIC LIMIT % | WATER CONTENT % | LIQUID LIMIT %
STANDARD "N" PENETRATION (BLOWS/FT.)
10 20 30 40 50

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WATER LEVEL OBSERVATIONS			
W.L.	3'	XXXXXX W.D.	
W.L.	3'	B.C.R.	A.C.R.
W.L.			

SOIL TESTING SERVICES
OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

BORING STARTED	6-19-73		
BORING COMPLETED	6-19-73		
FIG.	W-15	FOREMAN	RR
DRAWN		APPROVED	WMP
JOB #	4970 A	SHEET	

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

BBS-81471

LOG OF BORING NO. STG - 71

OWNER: Bear Creek Mining Company

ARCHITECT-ENGINEER:

SITE: Ladysmith, Wisconsin

PROJECT NAME: Proposed Mine Development

BURFACE ELEVATION +1142

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.³
5	1	SS	Silty fine coarse sand-trace to some fine coarse gravel-trace clay-brown(SM)	
10	2	SS	Fine coarse sand-some fine coarse sub-angular to rounded gravel-trace silt-brown-wet (SW)	
	2A	SS	Silty and clayey fine coarse sand-trace to some gravel-reddish brown (SC)	
15	3	SS	Silty fine coarse sand-trace to some gravel-trace clay and pieces of weathered cobbles-slightly cemented-brown and reddish brown-dense(SM)	
20	4	SS		
25	5	SS		
30	6	SS		
35	7	SS		
40	8	WS	Yellowish brown to white at 41' poorly cemented fine to coarse grained sandstone-1" seam of dark rusty brown silty very fine sand at 35'-reddish brown lenses noted while drilling-other color variations noted from 40' to 50'-pieces of clayey material in wash from 40' to 50'	
45				
50	9	WS		
55	10	SS	Saprolite-white to yellowish brown-silt with angular rock fragments-talcy feel(ML)	

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.²

PLASTIC LIMIT % | WATER CONTENT % | LIQUID LIMIT %

STANDARD "N" PENETRATION (BLOWS/FT.)

Note:
△ 140 lbs.-30" drop on 3" O.D. Split Spoon
⊠ 380 lbs.-28" drop on 3" O.D. Split Spoon

△33 △13 △31 △82 ⊠34 ⊠45 ⊠41 ⊠82 ⊠122

End of Boring 36'-50' Casing

Piezometer installed to 41'

WATER LEVEL OBSERVATIONS		
W.L.	9'	8-24-73 W.D.
W.L.	E.O.H.	8-30-73 E.O.H.
W.L.		

SOIL TESTING SERVICES OF WIS., INC.
GREEN BAY, WISCONSIN

BORING STARTED 6-20-73
BORING COMPLETED 6-30-73
DRILL M-15 TECHNICIAN ER
DRAWN TABULATED WMP

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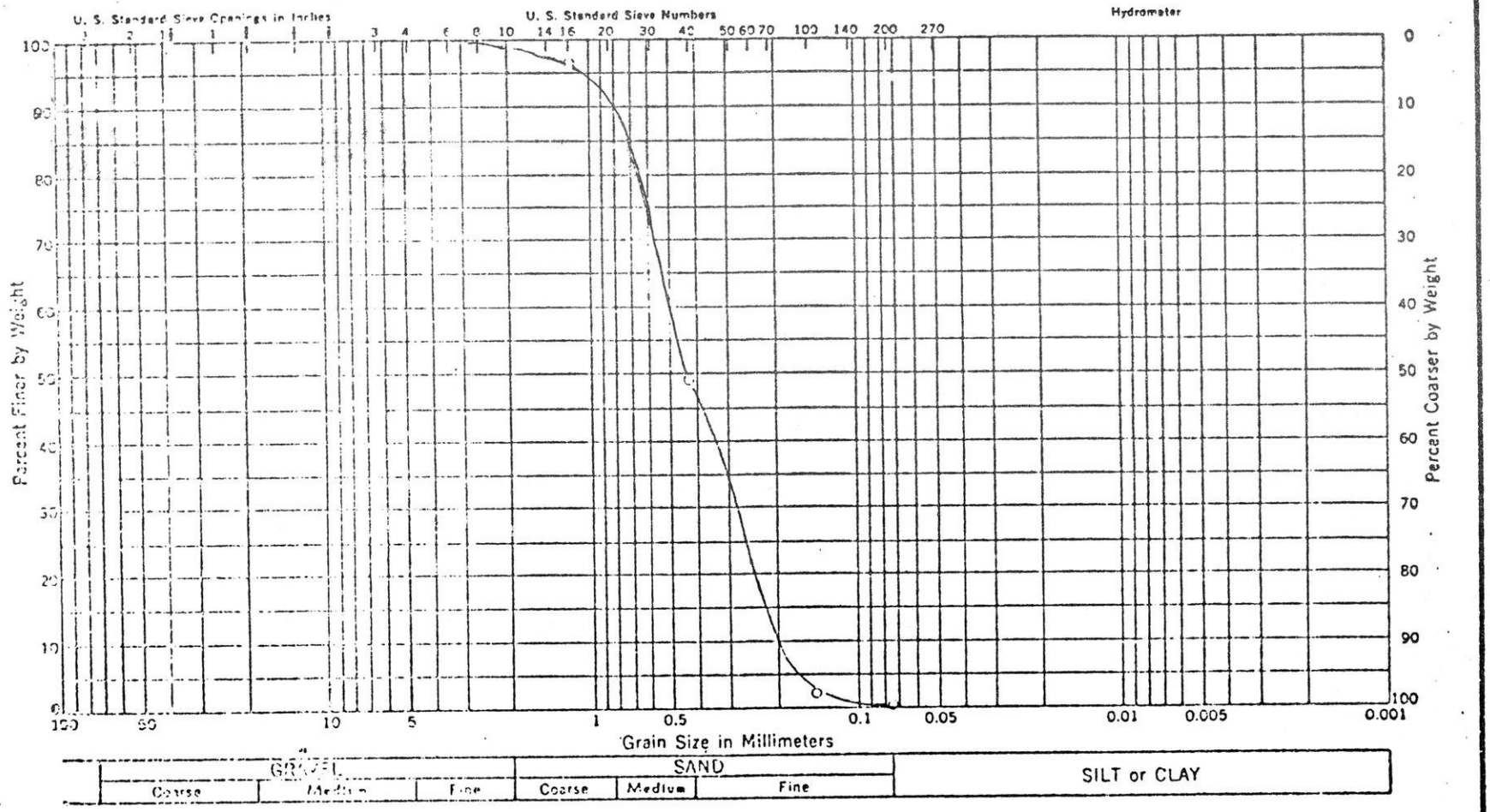

SAMPLE NO.	W.C.	L.L.	P.L.	PI	CLASSIFICATION
					Fine medium sand-trace silt and coarse sand(sandstone)
					%g-s-s+d (SP)
					0-100-0 (F+VD 12/88)

Boring ST9 - 21

Sample 8 - 41'-45'
(wash sample)

Sample Tested 436.4 gr.

DRAWN	APPROVED	DATE	JOB No.

3.5-B-45

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LOG OF BORING NO. ST9 - 22

OWNER: Bear Creek Mining Company
ARCHITECT-ENGINEER:
SITE: Ladysmith, Wisconsin
PROJECT NAME: Proposed Mine Development

SURFACE ELEVATION +1139

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	SAMPLE R.Q.D. RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. (LBS./FT.³)	UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² / PLASTIC LIMIT % / WATER CONTENT % / LIQUID LIMIT % / STANDARD "N" PENETRATION (BLOWS/FT.)
5	1	SS		Silty fine medium sand-trace to some fine coarse sub-angular to rounded gravel-brown (SM)		⊗- 140 lbs.-30" drop on 3" O. D. Split Spoon; ⊠- 380 lbs.-28" drop on 3" O. D. Split Spoon; ⊗ 35
10	2	SS		Fine coarse sand-trace to some fine coarse sub-angular to rounded gravel-trace silt-brown to gray (SW)		⊗ 72 8"; ⊠ 88 6"
15		SS				⊠ 36/6"
	3	SS				
	3A	SS				⊠ 51/6"
20	4	SS		Silty fine medium sand-trace to some gravel-trace clay-dark reddish brown-slightly cemented-dense (SM)		⊠ 76
25	5	SS				⊠ 49
	5A	SS				⊠ 35/6"
30	6	SS		Fine medium sand-trace fine gravel and silt-brown-wet (SP)		⊠ 39
				37.5		
35	7	WS				⊠ 102
40	8	SS		Very light brown to rusty brown at 44' poorly cemented fine medium grained sandstone-occasional silt or shale seam		⊠ 59
45	9	SS				⊠ 57
50						
57.0	10	SS		Saprolite-reddish purple trace orange clay (CH)		13" Ø PVC installed to
60				End of Boring		

WATER LEVEL OBSERVATIONS

W.L.	12.5'	X/X/X W.D.
W.L.	16'	B.C.P. 4-5-73
W.L.		

SOIL TESTING SERVICES OF WIS. INC.
GREEN BAY, WISCONSIN

BORING STARTED 6-15-73
BORING COMPLETED 6-18-73
DRILL B-15 FOREMAN PM
DRAWN APPROVED RHP

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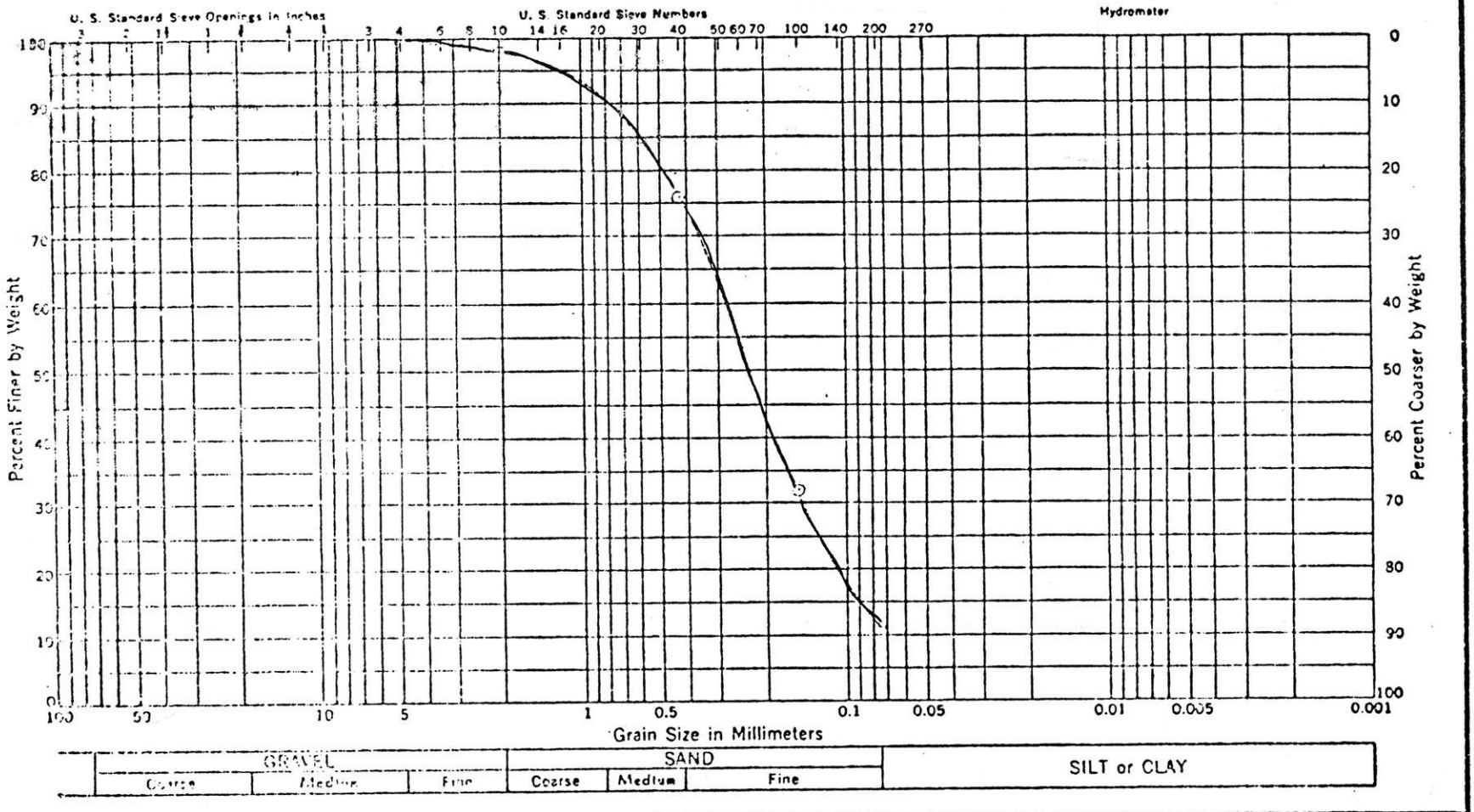

SAMPLE NO.	W.C.	LL.	PL.	PI	CLASSIFICATION
					Fine coarse sand-trace to some silt-
					sandstone
					%g-s-s+c (SP-SM)
					0-90-10 (CF+VD 12/88)

Boring ST9-22

Sample 8 40-41'

Sample Tested= 370.0 gr.

DRAWN	APPROVED	DATE	JOB No.

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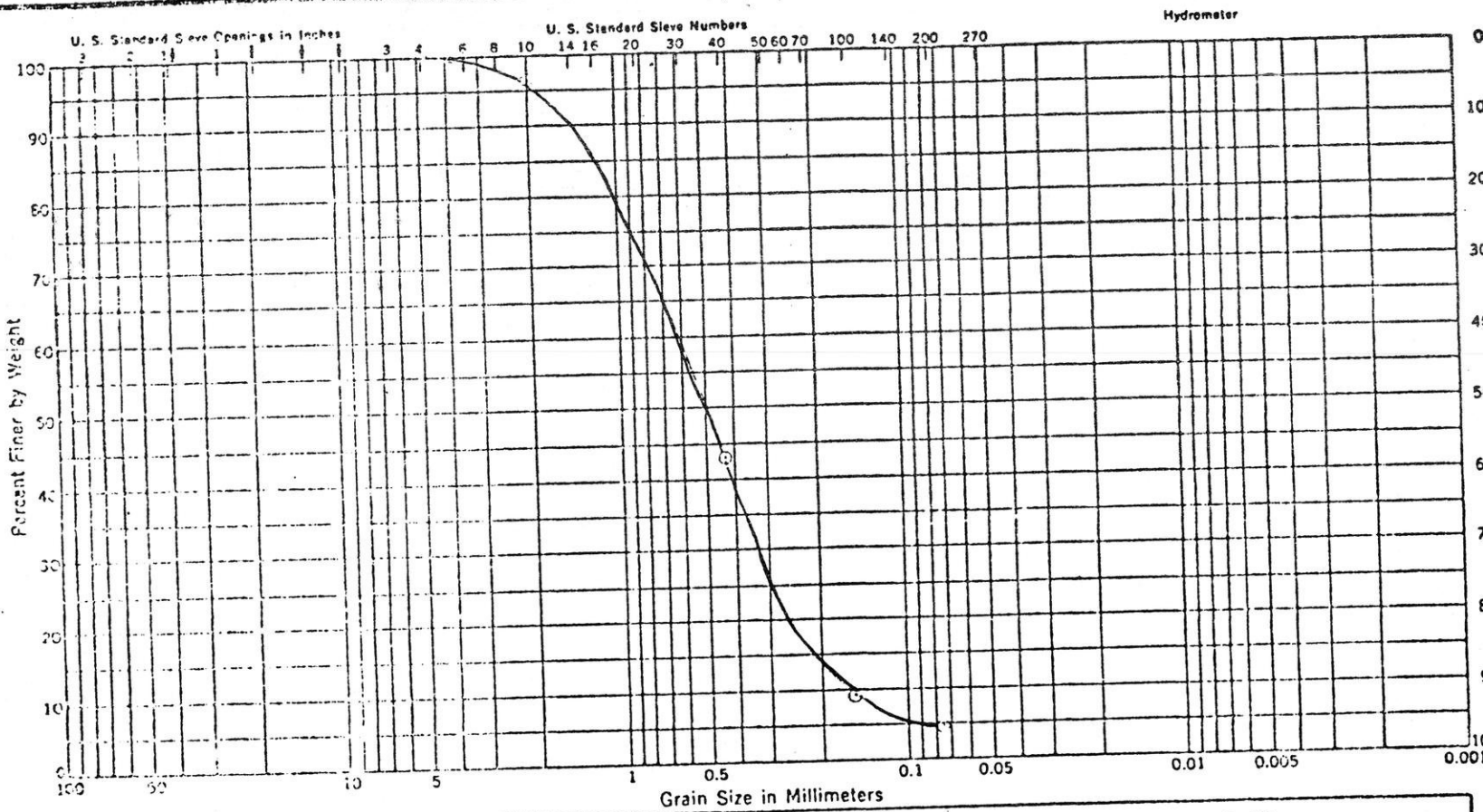

SAMPLE NO.	W.C.	LL	PL	PI	CLASSIFICATION
					Fine-coarse sand-trace silt-sandstone
					9g-5-SM2d (SP)
					0-96-4 (F+VD 12/88)

Boring ST9-22

Sample 9 45'-46.5'

Sample Tested= 749.0 gr.

DRAWN	APPROVED	DATE	JOB No.

3.5-B-48

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LOG OF BORING NO. ST9 - 22A

OWNER: Bear Creek Mining Company	ARCHITECT-ENGINEER: 22A
SITE: Ladysmith, Wisconsin	PROJECT NAME: Proposed Mine Development

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	SAMPLE DIST.	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.³	UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² (1 2 3 4 5) PLASTIC LIMIT % WATER CONTENT % LIQUID LIMIT % STANDARD "N" PENETRATION (BLOWS/FT.) (10 20 30 40 50)
					SURFACE ELEVATION +1139		
5					No samples		
10							
15							
16.5	1	SS			Fine coarse sand-some fine medium gravel-trace silt-dark gray brown-wet(SW)		45
					End of Boring		
					10' NX Casing		
					Left 10' NX Casing in borehole & 1 1/2" Ø PVC to 14'		

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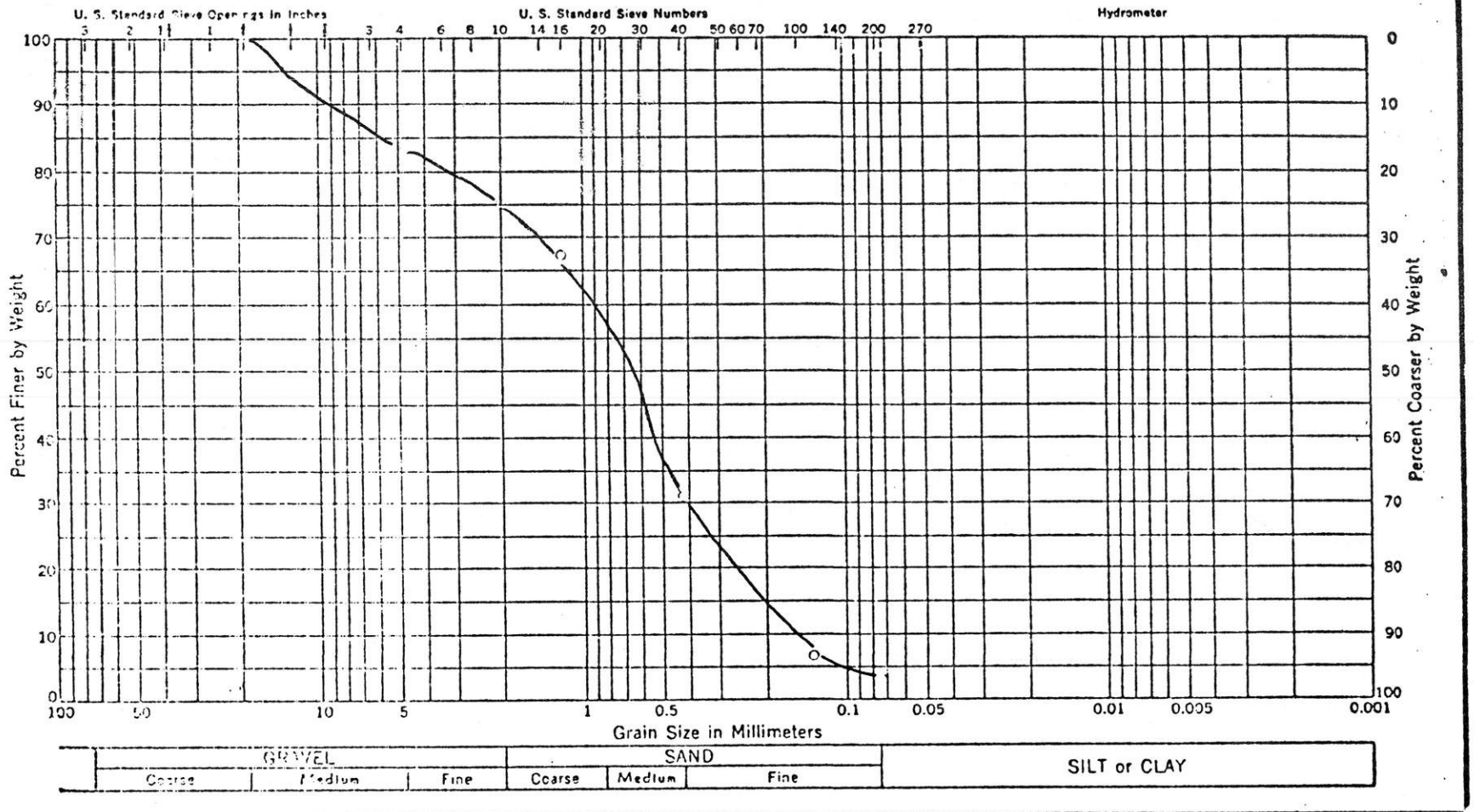
WATER LEVEL OBSERVATIONS			
W.L.	12'	WHILE W.D.	
W.L.		P.C.R.	A.C.R.
W.L.			

SOIL TESTING SERVICES
OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

BORING STARTED	6-27-73		
BORING COMPLETED	6-27-73		
RIG	W-15	FOREMAN	RR
DRAWN		APPROVED	WMP
JOB #	4970 A	SHEET	

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

BBS-81471



SAMPLE NO.	W.C.	LL	PL	PI	CLASSIFICATION
					Fine coarse sand-some fine medium gravel-
					trace silt(SW)
					%g - S - Sand
					14 - 87 - 3 (FTVD 12/88)

Boring ST9 - 22A

Sample 1 15'-16.5'

Sample Tested 160.7 gr.

DRAWN	APPROVED	DATE	JOB No.

3.5-B-50

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LOG OF BORING NO. ST9 - 23

OWNER: Bear Creek Mining Company
ARCHITECT-ENGINEER:
SITE: Ladysmith, Wisconsin
PROJECT NAME: Proposed Mine Development

SURFACE ELEVATION: +1143

DEPTH	ELEVATION	SAMPLE NO.	TYPE SAMPLE	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS/FT.³
5		1	SS	Silty fine medium sand-trace to some gravel-dark reddish brown(SM)could not auger deeper than 14'	
10		2	SS		
15		3	SS	Silty fine coarse sand-trace to some gravel-reddish brown (SM) cobbles from 16' to 17'	
20		4	SS	Fine medium sand-trace fine medium gravel,coarse sand, and silt-brown-wet(SP)	
25		5	SS	Fine coarse sand-trace fine medium gravel and silt-brown(SW)	
30		6	SS	Silty fine sand-brown(SM) seams of fine coarse sand	
35		7	SS		
40		7	WS	Brown and yellow to rusty brown poorly cemented fine to coarse grained sandstone-40 to 50% water loss while drilling (SP)	
45		8	WS		
55		9	SS	Saprolite-gray brown-trace white-silt with quartz fragments-clay feel(ML)	

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.²: 1, 2, 3, 4, 5
PLASTIC LIMIT % | WATER CONTENT % | LIQUID LIMIT %
STANDARD "N" PENETRATION (BLOWS/FT.): 10, 20, 30, 40, 50

⊗ - 140 lbs.-30" drop on 3" O.D. Split Spoon
⊠ - 380 lbs.-28" drop on 3" O.D. Split Spoon

Plotted values: 28, 39, 37, 60, 50, 49, 72, 68, 91

End of Boring 39' 4" Casing 1-1/2" I.D. PVC to 40'

WATER LEVEL OBSERVATIONS
W.L. W.S.F.W.D.
W.L. D.C.R. 4 C.D.
W.L. Dry to 14' while drilling

SOIL TESTING SERVICES OF WIS., INC.
DATE STARTED 6-21-73
BORING COMPLETED 6-21-73
FOREMAN BR

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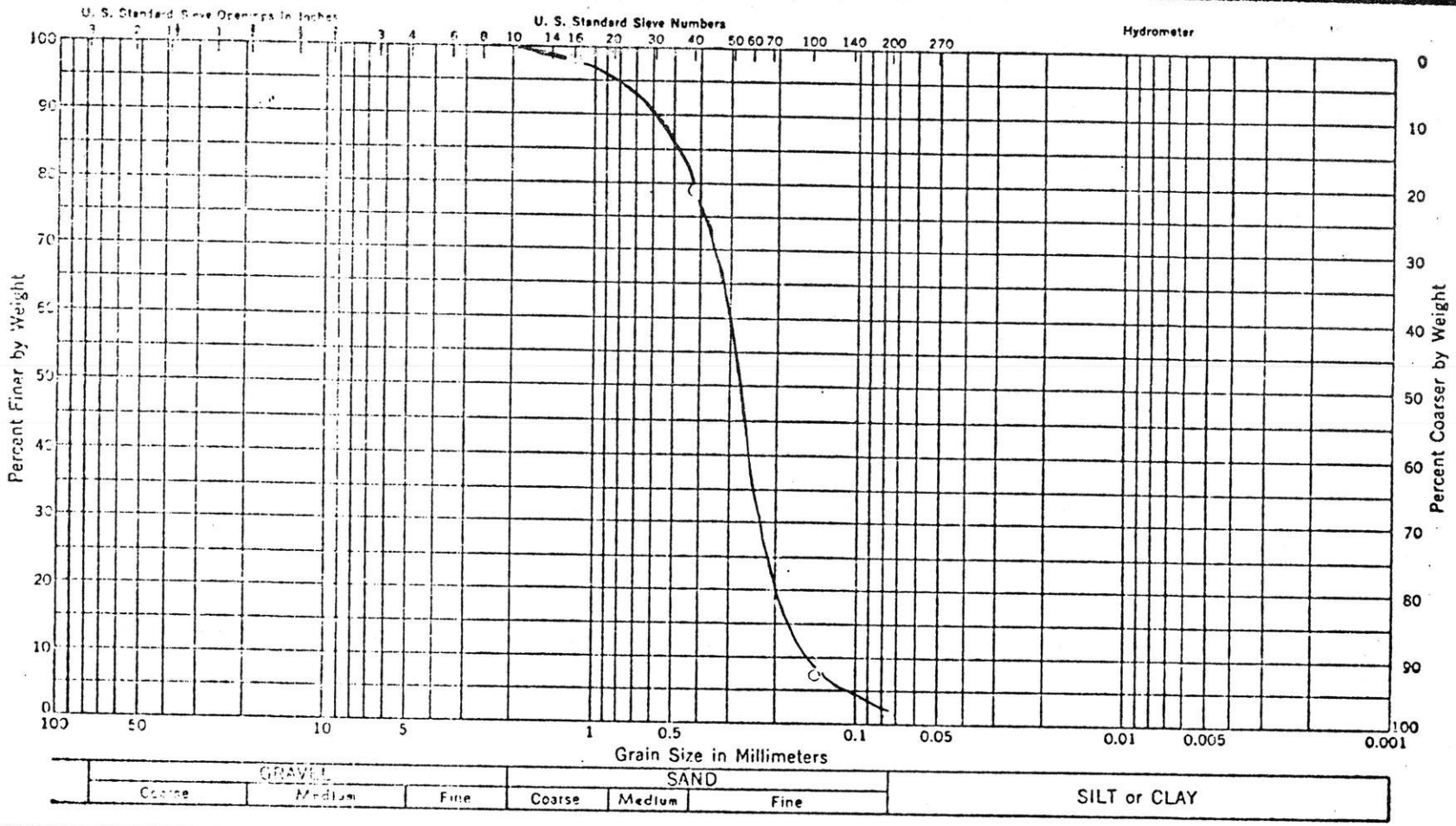

SAMPLE NO.	W.C.	LL	PL	PI	CLASSIFICATION
					Fine medium sand-trace coarse sand and silt(sandstone)
					%g-s-sand (SP)
					0-98-2 (F+VD 12/88)

Boring ST9 - 23

Sample 8 43'-45'
(wash sample)

Sample Tested

DRAWN	APPROVED	DATE	JOB No.

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LOG OF BORING NO. ST9 - 23A

OWNER: Bear Creek Mining Company	ARCHITECT-ENGINEER: 23A
SITE: Ladysmith, Wisconsin	PROJECT NAME: Proposed Mine Development

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	SAMPLE DIST.	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.³
					SURFACE ELEVATION +1144	
					No samples	
20					Silty and clayey sand-trace gravel-brown and reddish brown-	
	1	SS			dense(SC)	
	1A	SS			Fine sand-trace to some silt-light reddish brown(SM)	
25					Fine coarse sand-some fine medium gravel-trace silt and cobbles-brown-wet(SW)	
26.5	2	SS				
					End of Boring	
					25' 4 " Casing	
					Left 25' of 1½" Ø PVC in borehole	

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.²
1 2 3 4 5
PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %
STANDARD "N" PENETRATION (BLOWS/FT.)
10 20 30 40 50

380 lbs.-28" drop on 3" O.D. Split Spoon

25/6"
35/6"
55

BEST COPY AVAILABLE

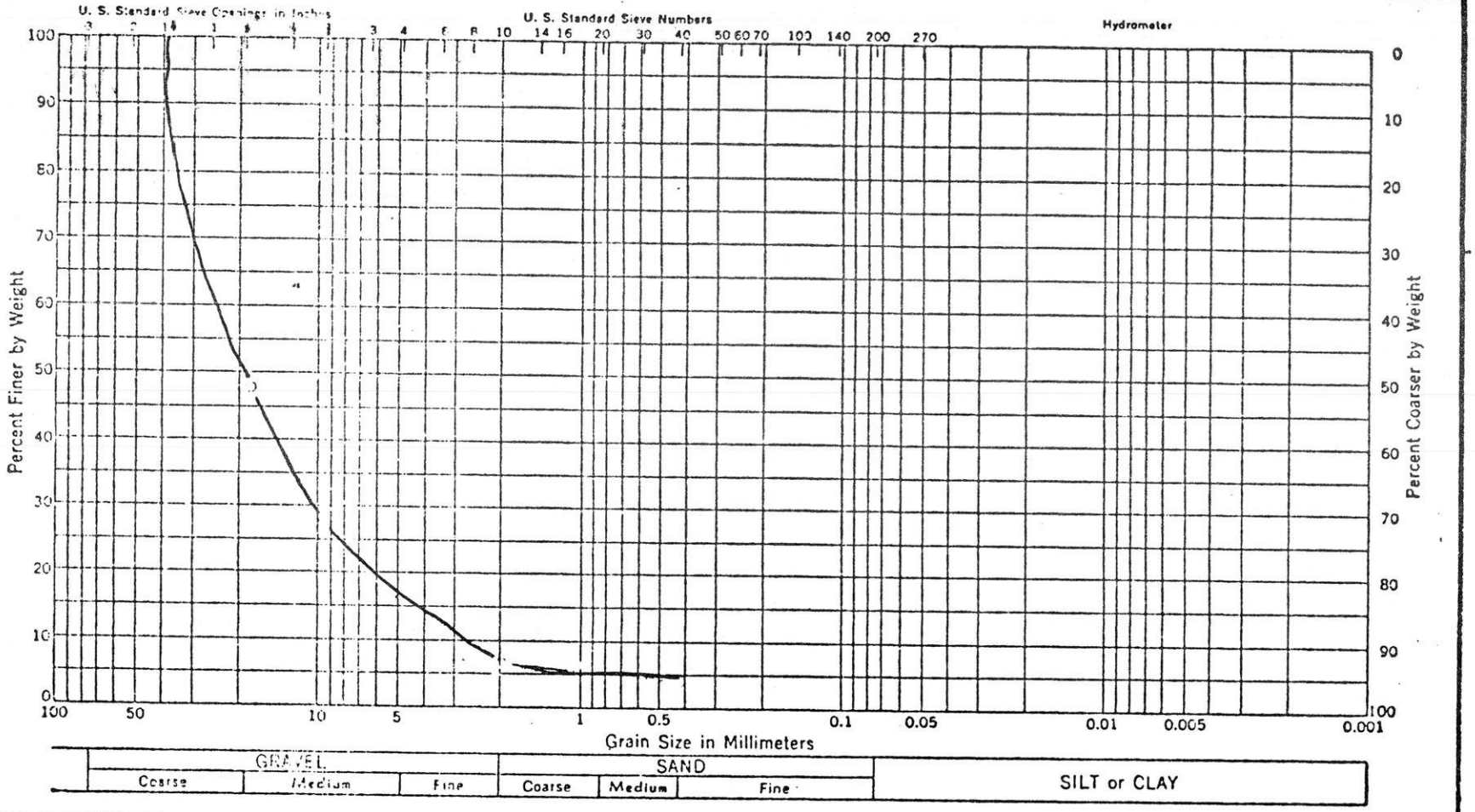
WATER LEVEL OBSERVATIONS	
W.L.	W.S. OR W.D.
W.L.	19' B.C.B. 19' A.C.B.
W.L.	

SOIL TESTING SERVICES
OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

BORING STARTED	6-22-73
BORING COMPLETED	6-22-73
RIG W-15	FOREMAN BR
DRAWN	APPROVED WMP
JOB # 4970 A	SHEET

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

BBS-81471



SAMPLE NO.	W.C.	LL	PL	PI	CLASSIFICATION
					Fine coarse gravel-trace sand(GP)
					%g- S- sand
					83 - 12 - 5 (F+VD 12/88)

Boring ST9 - 23A

Sample 2 25'-26.5'

Sample Tested 305.2 gr.

DRAWN	APPROVED	DATE	JOB No.

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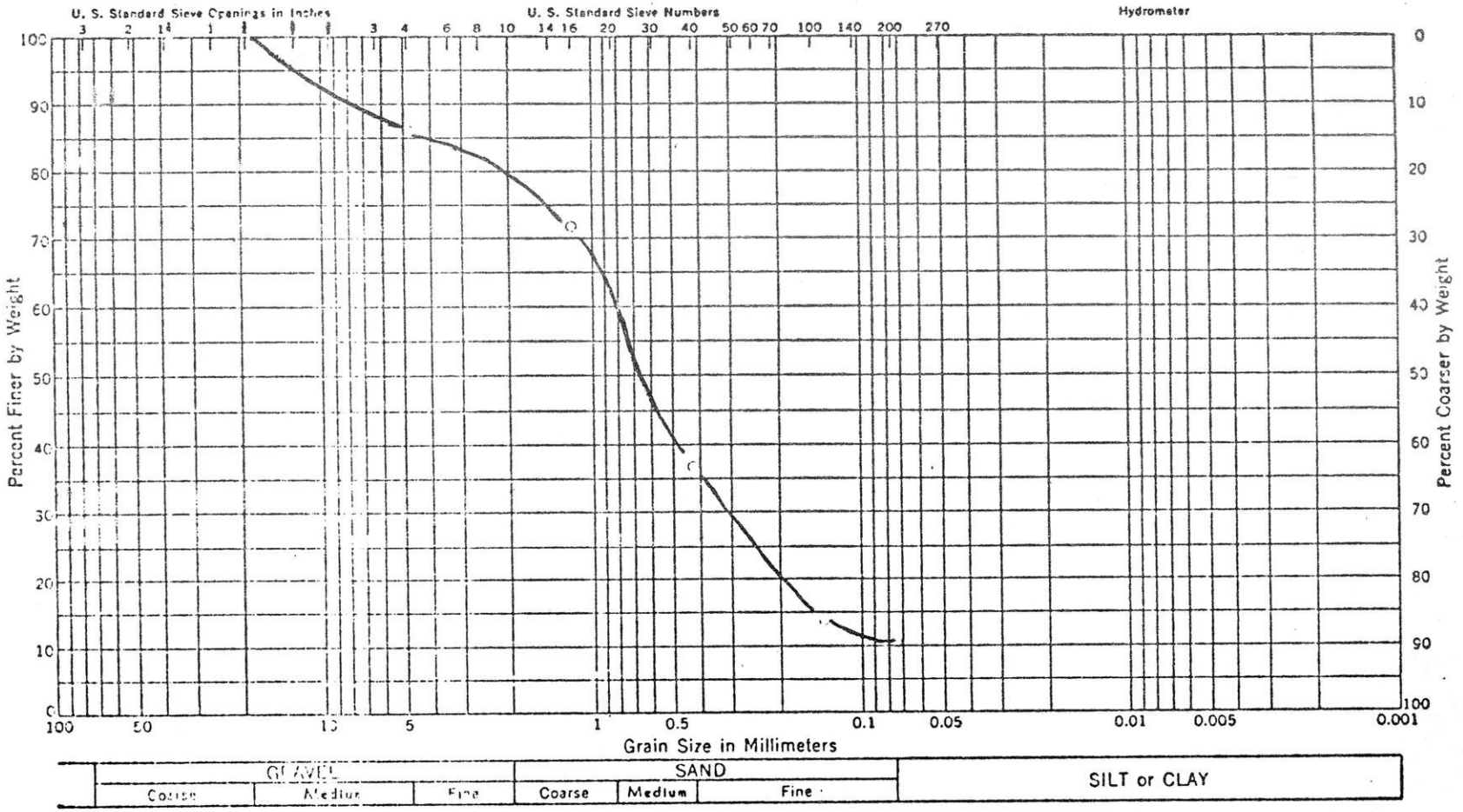

SAMPLE NO.	W.C.	LL	PL	PI	CLASSIFICATION
					Fine coarse sand-some fine medium gravel-
					trace silt(SW)
					%g-s-si+cl
					15-74-11 (F+VD 12/88)

Boring ST9 - 23A

Sample 2A - 25'-26.5'

Sample Tested 291.0 gr.

DRAWN	APPROVED	DATE	JOB No.

3.5-B-55

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LOG OF BORING NO. ST9 - 24

OWNER: Bear Creek Mining Company
ARCHITECT - ENGINEER:
SITE: Ladysmith, Wisconsin
PROJECT NAME: Proposed Mine Development

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	SAMPLE DIST.	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.³
SURFACE ELEVATION +1128						
5	1	SS			Very fine sandy silt-trace clay-mottled gray and rusty brown (ML)	
					Fine coarse sand-trace to some gravel and silt-brown-wet (SM)	
10	2	SS				
15	3	SS			Silty fine coarse sand-trace gravel and clay-reddish brown-dense (SM)	
20	4	SS				
25	5	SS			White changing to yellowish brown at 27.5' poorly cemented fine to coarse grained sand-stone-occasional gray seam near 30 feet	
30	6	SS				
35	7	SS				
40	8	SS			Saprolite-yellow brown trace gray and brown silt with angular rock fragments-talcy feel (ML)	
40.5					End of Boring — 30'-4" Casing left 31'-1¼ Ø PVC in hole	

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² (1, 2, 3, 4, 5)
PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %
STANDARD "N" PENETRATION (BLOWS/FT.) (10, 20, 30, 40, 50)

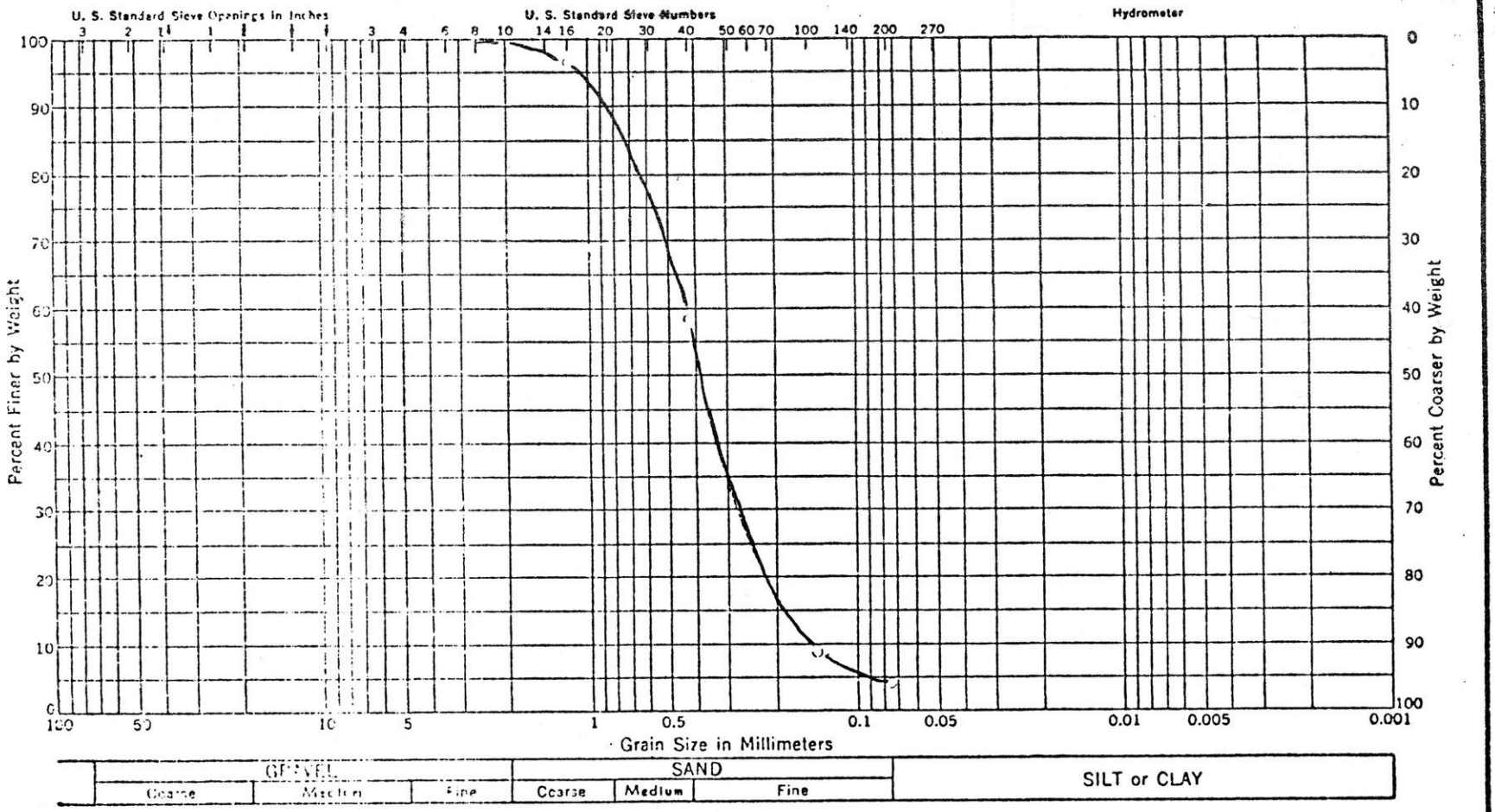
⊗ - 140 lbs.-30" drop on 3" O.D. Split Spoon
⊠ - 380 lbs.-28" drop on 3" O.D. Split Spoon

⊗ 4 1/10"
⊗ 31
⊗ 43
⊠ 33
⊠ 69
45½" ⊠
50/2" ⊠
75

WATER LEVEL OBSERVATIONS
W.L. — W.S. OR W.D.
W.L. 13' B.C.R. — A.C.R.
W.L.

SOIL TESTING SERVICES OF WIS., INC.
ROUTE NO. 7—BAETEN ROAD
GREEN BAY, WISCONSIN

BORING STARTED 6-24-73
BORING COMPLETED 6-24-73
RIG — FOREMAN RR
DRAWN — APPROVED WMP



SAMPLE NO.	W.C.	LL	PL	PI	CLASSIFICATION
					Fine coarse sand-trace silt(sandstone)
					Pog-S-sand (SP)
					0-96-4 (F+VD 12/88)

Boring ST9 - 24

Sample 5 25'-26'

Sample Tested 389.0 gr.

DRAWN	APPROVED	DATE	JOB No.

3.5-B-57

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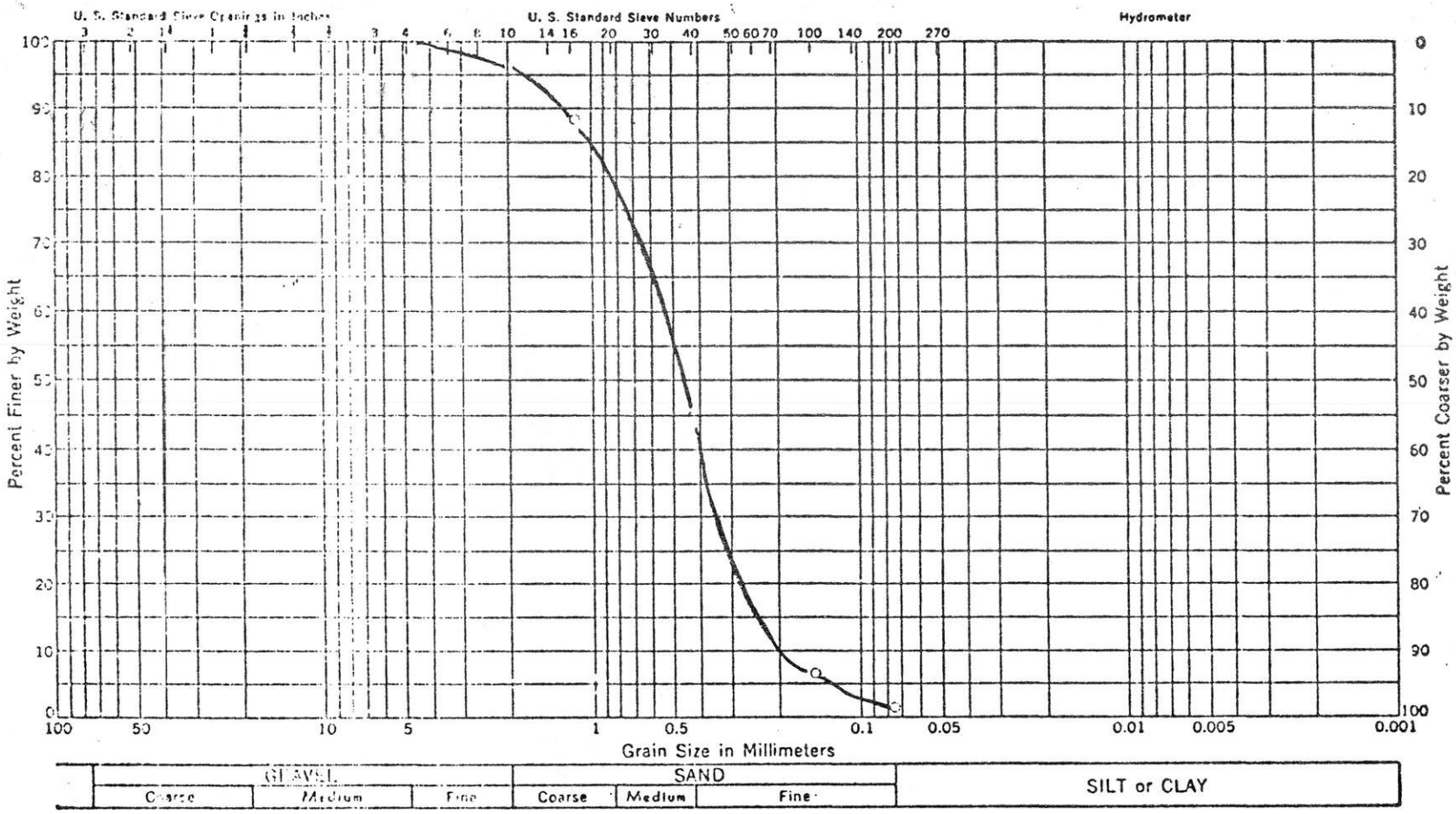

SAMPLE NO.	W.C.	LL	PL	PI	CLASSIFICATION
					Fine coarse sand-trace silt(sandstone)
					%g-S-silt (SP)
					0-99-1 (F+VD 12/88)

Boring ST9 - 24

Sample 6 30-30.2'

Sample Tested 187.9 gr.

DRAWN	APPROVED	DATE	JOB No.

3.5-B-58

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LOG OF BORING NO. B - 25

OWNER: Bear Creek Mining Company	ARCHITECT-ENGINEER:
SITE: Ladysmith, Wisconsin	PROJECT NAME: Proposed Mine Development

SURFACE ELEVATION +1116

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	SAMPLE DIST.	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.³
5	1	SS			Silty fine coarse sand-trace to some gravel-brown (SM)	
10	2	SS			Silty and clayey fine medium sand-trace gravel-reddish brown (SC)	
15	3	SS			Silty fine coarse sand-trace to some gravel and weathered gravel-brown-dense (SM)	
20	Run #1	DB			Saprolite Run #1 was a reddish brown basal conglomerate with white quartzite inclusions-likely a boulder	
21.5					End of Boring 15' 4" Casing Left 1½" Ø PVC to 13' in hole	

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.²
1 2 3 4 5
PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %
STANDARD "N" PENETRATION (BLOWS/FT.)
10 20 30 40 50

⊗ 140 lbs. 30" drop on 3" O.D. Split Spoon
⊠ 380 lbs. -28" drop on 3" O.D. Split Spoon

42 ⊠
99 ⊠
105 ⊠

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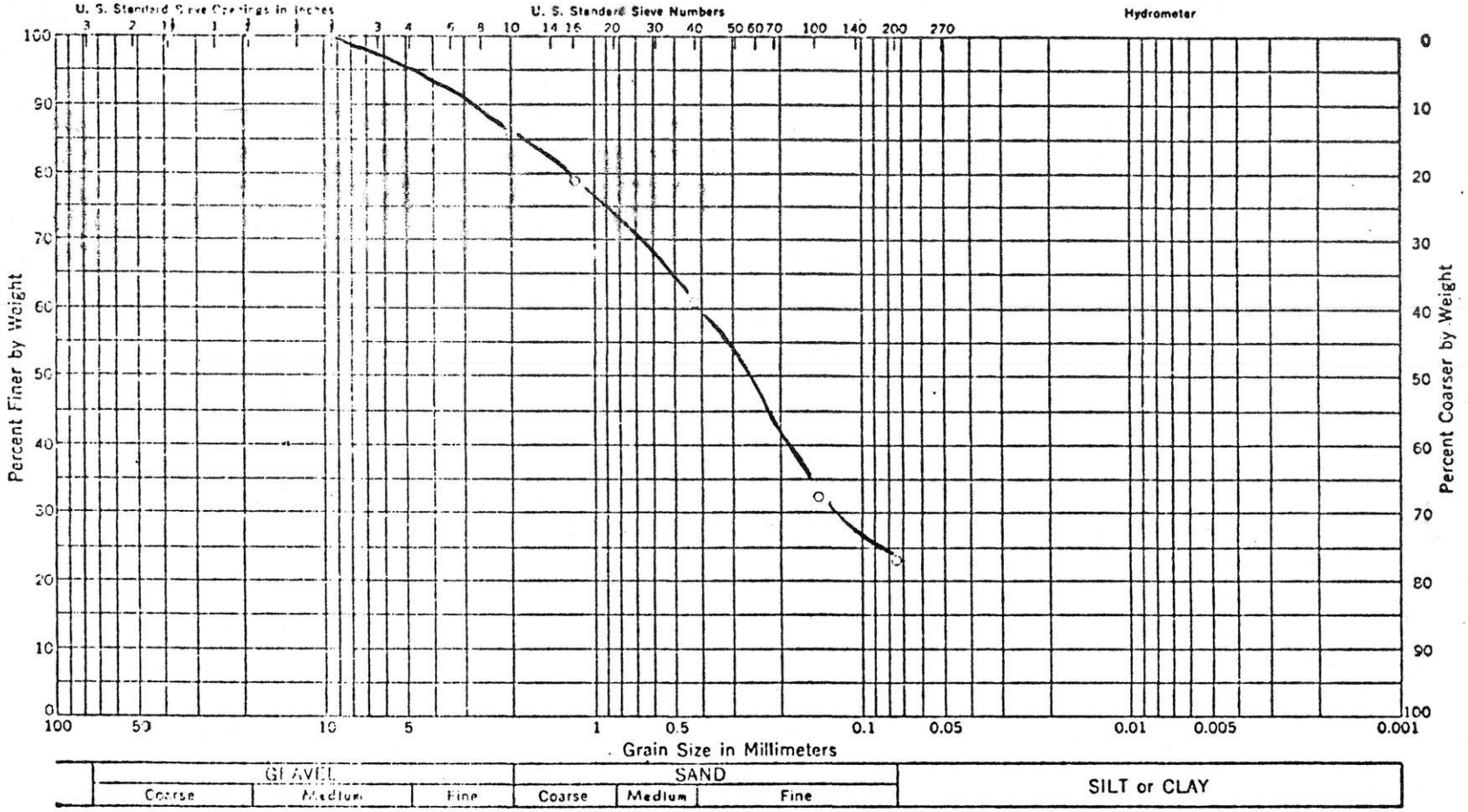
WATER LEVEL OBSERVATIONS		
W.L.	W.S. OR W.D.	
W.L.	B.C.R.	A.C.R.
W.L.		

SOIL TESTING SERVICES
OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

BORING STARTED	6-25-73		
BORING COMPLETED	6-25-73		
RIG	W-15	FOREMAN	RR
DRAWN		APPROVED	WMP
JOB #	4970 A	SHEET	

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

BBS-81471



SAMPLE NO.	W.C.	LL	PL	PI	CLASSIFICATION
					Silty fine coarse sand-trace to some gravel (SM)
					%g- 5 - 51+28
					5 - 72 - 23 (F+VD 12/88)

Boring ST9 - 25

Sample 3 15'-16'

Sample Tested 233.0 gr.

DRAWN	APPROVED	DATE	JOB No.

3.5-B-60

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LOG OF BORING NO. ST9 - 26

OWNER: Bear Creek Mining Company
ARCHITECT-ENGINEER:
SITE: Ladysmith, Wisconsin
PROJECT NAME: Proposed Mine Development

SURFACE ELEVATION: +1128

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	SAMPLE SIZE	RECOVERY	DESCRIPTION OF MATERIAL	DRY WT. LBS./FT.³
0	1	SS				
10	2	SS				
15	3	SS				
20	4	SS			Silty fine coarse sand-trace to some fine coarse gravel-small cobbles at 20 feet-pieces of weathered gravel at 20 & 25 feet-trace clay-brown and slightly reddish brown starting at 15 feet-dense(SH)	
25	5	SS				
30	6	SS				
35	7	SS				
40	8	SS				
45	9	SS				
50	10	SS				
50.5					Saprolite-yellowish brown and gray brown silty sand with angular rock fragments	
55	11	SS				
					Saprolite-gray silt-talcy feel(ML)	
70.3	12	SS			End of Boring	

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.²: 1, 2, 3, 4, 5
PLASTIC LIMIT % | WATER CONTENT % | LIQUID LIMIT %
STANDARD "N" PENETRATION (BLOWS/FT.): 10, 20, 30, 40, 50

140 lbs-30" drop on 3" O.D. Split Spoon
380 lbs.-28" drop on 3" O.D. Split Spoon

20, 90, 37, 21, 22, 28, 57, 31, 43, 37, 98, 130

50' 4" Casing [illegible] 20' 1" PVC in hol

WATER LEVEL OBSERVATIONS
W.L. | W.S. OR W.C. | B.C.R. | A.C.R.
W.L. 15'
W.L.

SOIL TESTING SERVICES OF WIS., INC.
GREEN BAY, WISCONSIN
530 LEMOYNE STREET

BORING STARTED: 6-25-73
BORING COMPLETED: 6-27-73
RIG: [illegible] FOREMAN: LR
DRAWN: APPROVED:
JOB #: [illegible] SHEET:

PP NS 4-1M

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

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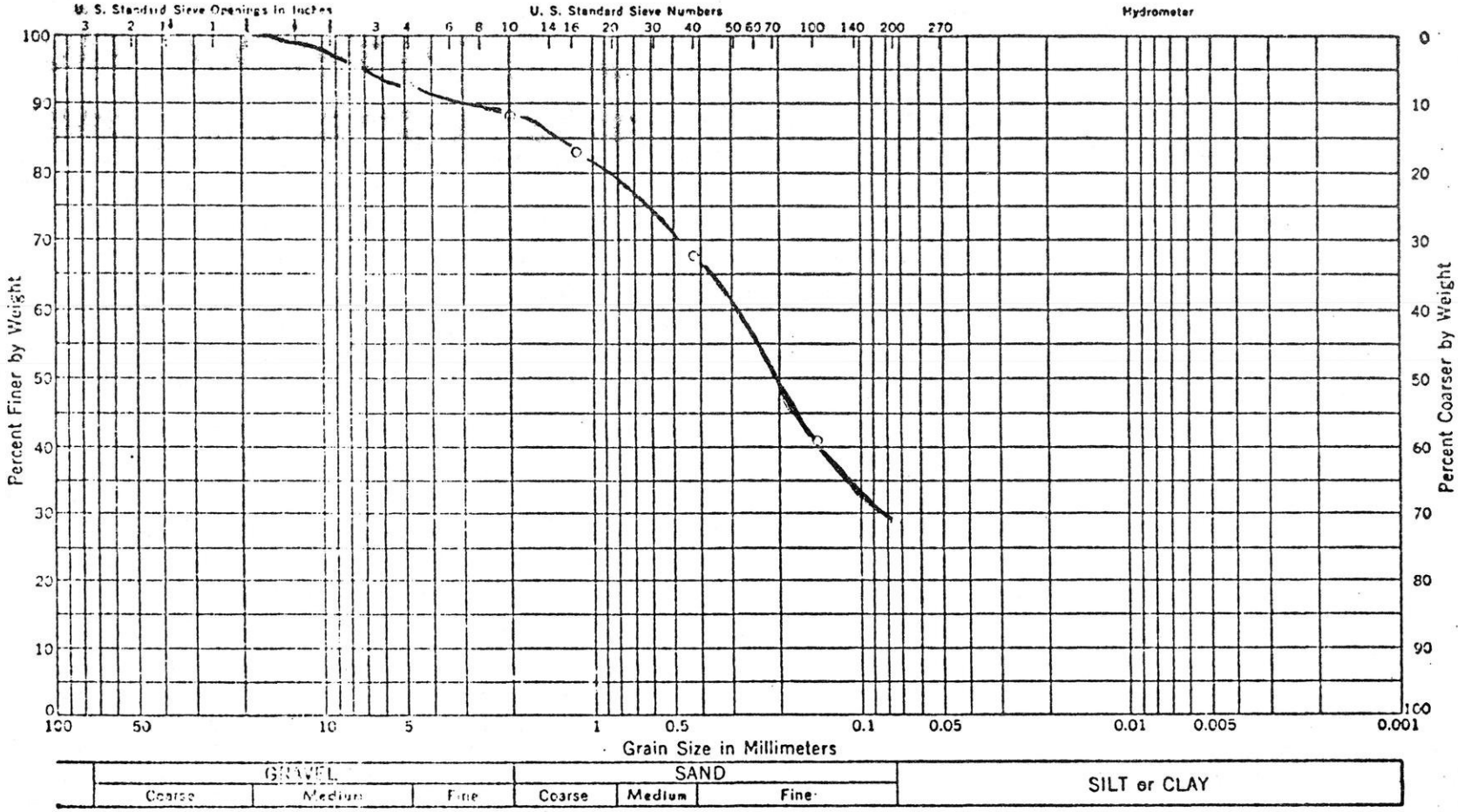

SAMPLE NO.	W.C.	LL	PL	PI	CLASSIFICATION
					Silty fine coarse sand-trace to some gravel (SM)
					%g-s-si+cl
					7-64-29 (F+VD 12/88)

Boring ST9 - 26

Sample 6 30'-31.5'

Sample Tested 200.0 gr.

DRAWN	APPROVED	DATE	JOB No.

3.5-B-62

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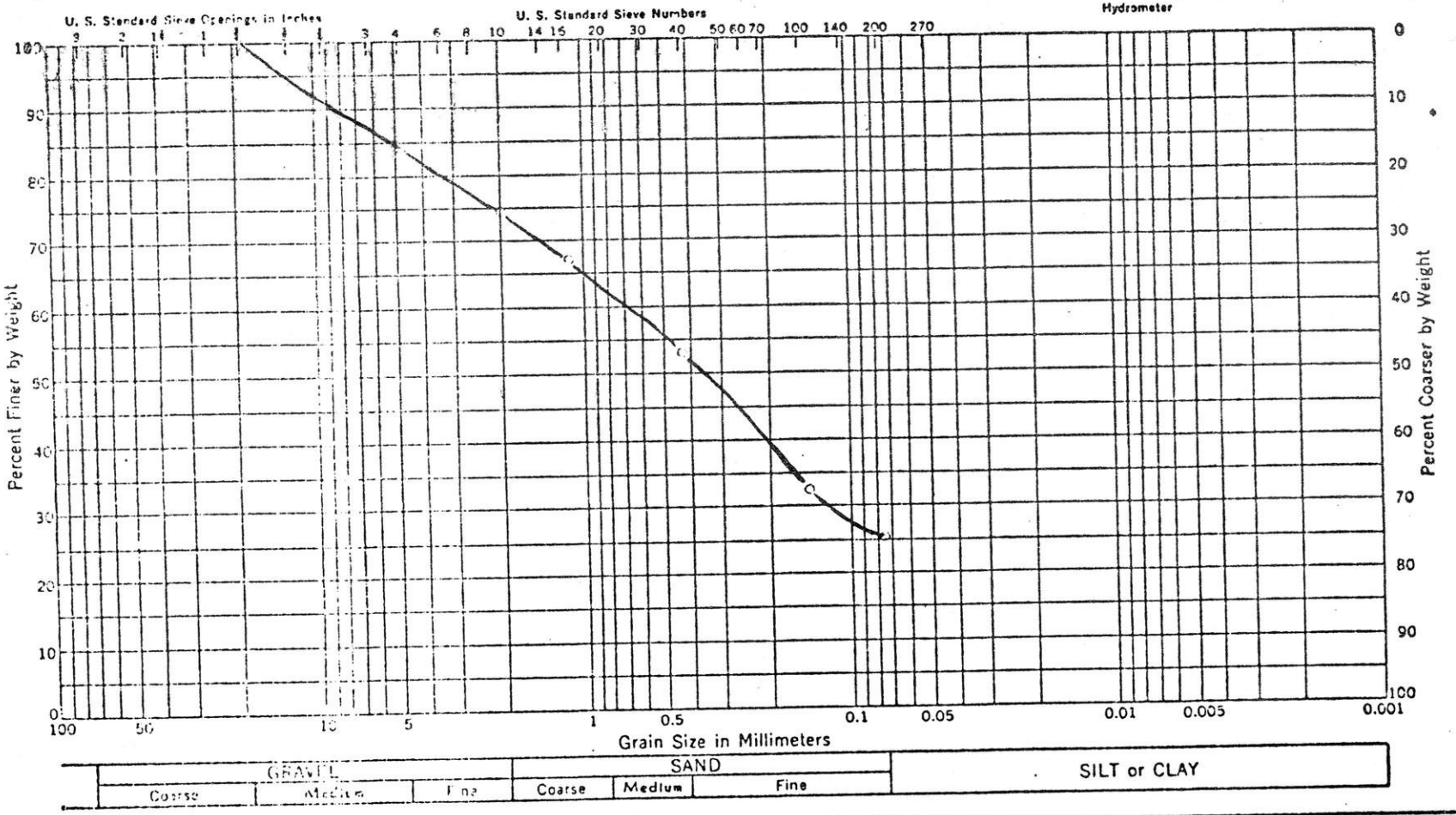

SAMPLE NO.	W.C.	LL	PL	PI	CLASSIFICATION
					Silty fine coarse sand-some fine medium
					gravel (SM)
					90g - S - Sand
					15 - 64 - 21 (F+VD 12/88)

Boring ST9 26

Sample 7 35'-36.5'

Sample Tested 209.4 gr.

DRAWN	APPROVED	DATE	JOB No.

3.5-B-63

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LOG OF BORING NO. T9 - 27B

OWNER: Bear Creek Mining Company	ARCHITECT-ENGINEER: 27B
SITE: Ladysmith, Wisconsin	PROJECT NAME: Proposed Mine Development

SURFACE ELEVATION +1112

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	SAMPLE DIST.	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.³
5					Fine coarse sand-some fine coarse angular and sub-angular gravel-brown(SW) hit many boulders between 5' and 12' had to offset 2 times to get past 10 '	
10	1	SS			Silty fine coarse sand-trace to some fine medium gravel-trace clay-reddish brown(SM)	
15						
19	2	SS			17.5 Saprolite-yellow brown, brown, and white silt(ML)	
	2A	SS				
					End of Boring	
					17.5' NX Casing	
					Left 8' of NX Casing in hole left 1 1/2" Ø PVC to 11'	

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.²
1 2 3 4 5
PLASTIC LIMIT % | WATER CONTENT % | LIQUID LIMIT %
STANDARD "N" PENETRATION (BLOWS/FT.)
10 20 30 40 50

24
18
41

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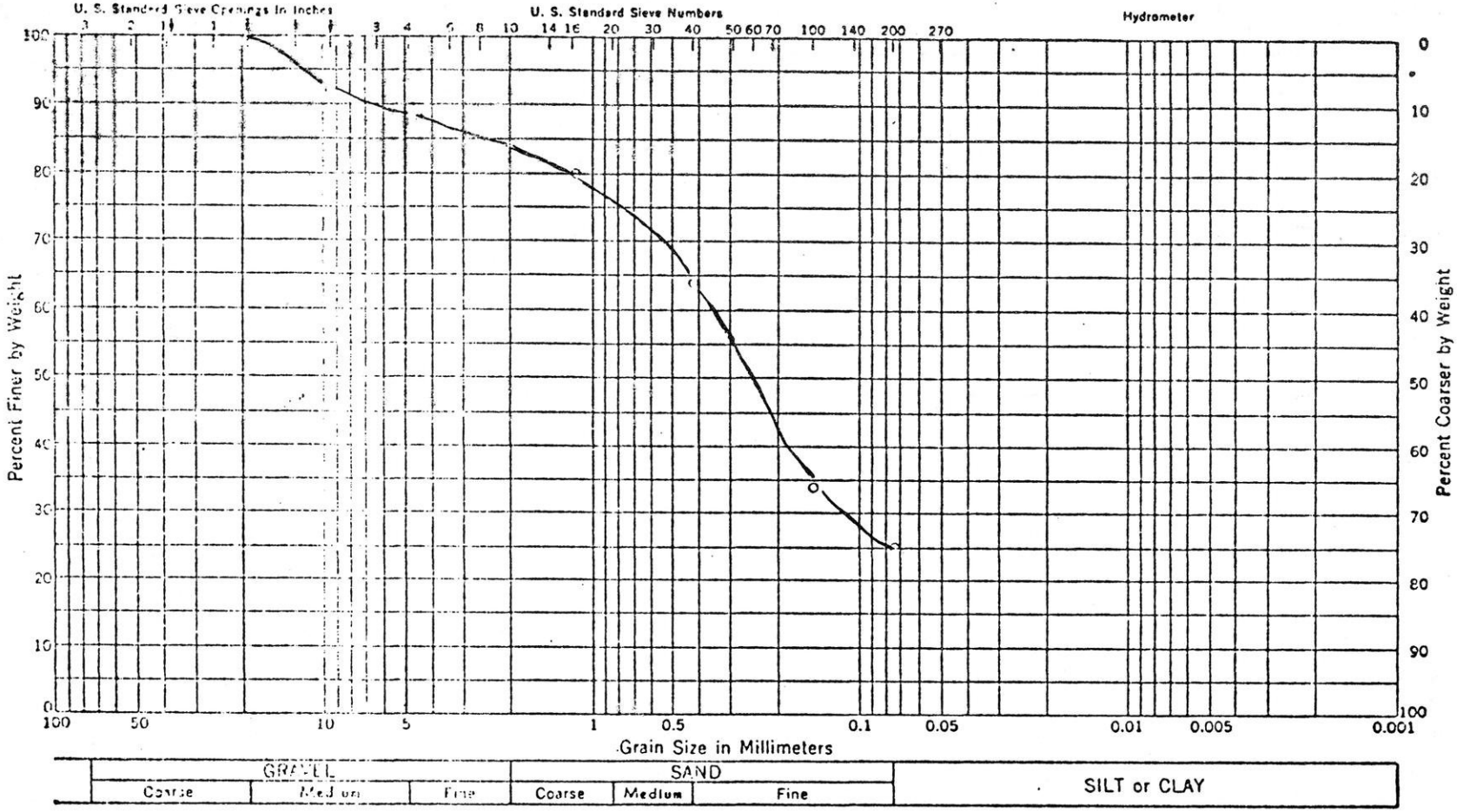
WATER LEVEL OBSERVATIONS		
W.L.	W.S. OR W.D.	
W.L.	2' B.C.R.	A.C.R.
W.L.		

SOIL TESTING SERVICES
OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

BORING STARTED	6-23-73		
BORING COMPLETED	6-23-73		
RIG W-15		FOREMAN RR	
DRAWN		APPROVED WMP	
JOB # 4970 A		SHEET	

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

BBS-81471



SAMPLE NO.	W.C.	LL	PL	PI	CLASSIFICATION
					Silty fine coarse sand-trace to some
					fine medium gravel(SM)
					%g- S - Sand
					12 - 63 - 25 (F+VD 12/88)

Boring STS 27B

Sample 1 10'-11.5'

Sample Tested 291.4 gr.

DRAWN	APPROVED	DATE	JOB No.

3.5-B-65

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LOG OF BORING NO. SW - 28

OWNER: Bear Creek Mining Company	ARCHITECT-ENGINEER
SITE: Ladysmith, Wisconsin	PROJECT NAME: Proposed Mine Development

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	SAMPLE DIST.	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.³	UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² (1 2 3 4 5) / PLASTIC LIMIT % / WATER CONTENT % / LIQUID LIMIT % / STANDARD "N" PENETRATION (BLOWS/FT.) (10 20 30 40 50)
					SURFACE ELEVATION → +1104		
5					No samples-very hard drilling- 5' NX casing broke off at 10 feet		
10							
11.5					End of Boring		

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WATER LEVEL OBSERVATIONS		
W.L.	W.S. OR W.D.	
W.L.	B.C.R.	A.C.R.
W.L.		

SOIL TESTING SERVICES
OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

BORING STARTED	6-23-73		
BORING COMPLETED	6-23-73		
RIG	22	FOREMAN	JG
DRAWN		APPROVED	WMP
JOB #	4970 A	SHEET	

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

BBS-81471

LOG OF BORING NO. 9 - 28A

OWNER: Bear Creek Mining Company	ARCHITECT-ENGINEER: 28A
SITE: Ladysmith, Wisconsin	PROJECT NAME: Proposed Mine Development

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	SAMPLE DIST.	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.³	UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² (1 2 3 4 5) · PLASTIC LIMIT % · WATER CONTENT % · LIQUID LIMIT % · STANDARD "N" PENETRATION (BLOWS/FT.) (10 20 30 40 50)
					SURFACE ELEVATION 40' SE of 9-28		
5					No samples-very hard drilling-sandstone at 15.7'-bottom 5' of NX casing broke off		
10							
15							
16.3					End of Boring		

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WATER LEVEL OBSERVATIONS			
W.L.	W.S. OR W.D.		
W.L.	P.C.B.	A.C.B.	
W.L.			

SOIL TESTING SERVICES OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

BORING STARTED	6-23-73
BORING COMPLETED	6-23-73
RIG 22	FOREMAN JG
DRAWN	APPROVED WHP
JOB # 4970 A	SHEET

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

BBS-91471

LOG OF BORING NO. 9- 28B

OWNER: Bear Creek Mining Company	ARCHITECT-ENGINEER:
SITE: Ladysmith, Wisconsin	PROJECT NAME: Proposed Mine Development

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	SAMPLE DIST.	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.³	UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² (1 2 3 4 5) PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT % — STANDARD "N" PENETRATION (BLOWS/FT.) (10 20 30 40 50)
SURFACE ELEVATION							
5	1	SS			Fine coarse sand-trace to some silt-trace gravel-dark reddish brown to brown (SM)		⊗54
10	2	SS					
13.5					Saprolite-reddish purple clay with sand and angular rock fragments		
15	3	SS					
16.5					End of Boring 15' NX Casing Left 5' of NX Casing in hole Left 1 1/2" Ø PVC to 9'		

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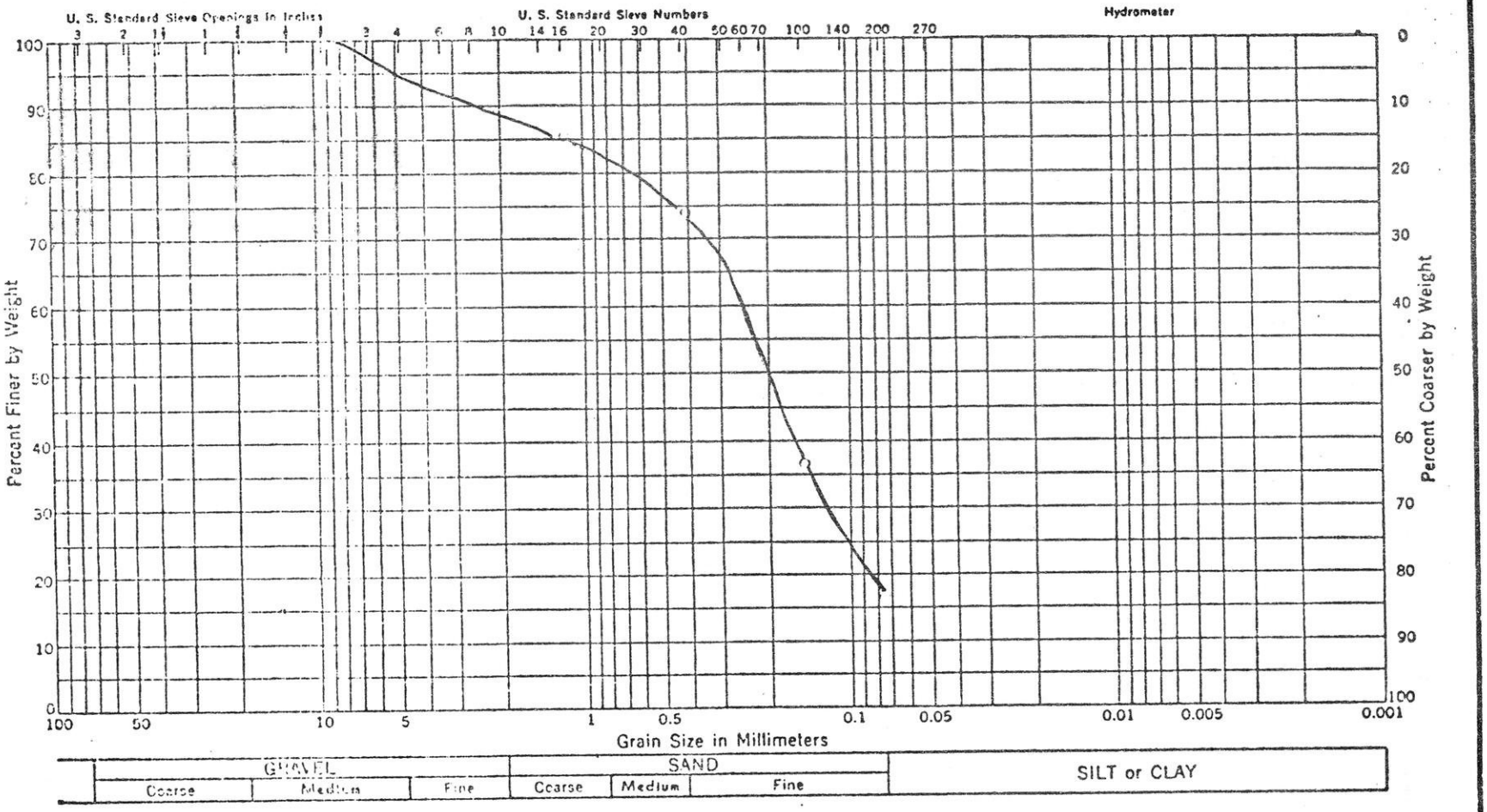
WATER LEVEL OBSERVATIONS			
W.L.		W.S. OR W.D.	
W.L.	4'	P.C.R.	A.C.R.
W.L.			

SOIL TESTING SERVICES OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

BORING STARTED	6-23-73		
BORING COMPLETED	6-23-73		
RIG	22	FOREMAN	JG
DRAWN		APPROVED	WMP
JOB #	4970 A	SHEET	

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

BBS-81471



SAMPLE NO.	W.C.	LL	PL	PI	CLASSIFICATION
					Fine coarse sand-trace to some silt-
					trace gravel (SM)
					%g-5-sieve
					5-78-17 (F+VD 12/88)

Boring ST9 28B

Sample 2 10'-11.2'

Sample Tested 171.3 gr.

DRAWN	APPROVED	DATE	JOB No.

3.5-B-69

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LOG OF BORING NO. 9 - 29

OWNER Bear Creek Mining Company	ARCHITECT-ENGINEER 29
SITE Ladysmith, Wisconsin	PROJECT NAME Proposed Mine Development

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	SAMPLE DIST.	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.³	UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² (1 2 3 4 5) PLASTIC LIMIT % WATER CONTENT % LIQUID LIMIT % STANDARD "N" PENETRATION (BLOWS/FT.) (10 20 30 40 50)
SURFACE ELEVATION +1101							
5	1	SS			Silty fine coarse sand-trace to some fine medium gravel-reddish brown(SM) large boulders to 5'-had to offset 3 times to get past 5 feet		⊗33
10	2	SS					9½ ⊗
11.5	2A	SS			Saprolite-white and brown silt(ML)		⊗24
					End of Boring 10' NX Casing 1 1/2" Ø PVC installed to 9' pea gravel from 11.5' to 5' bentonite from 5' to 2' sand and gravel 2 feet to ground surface-left 5' NX casing in hole		

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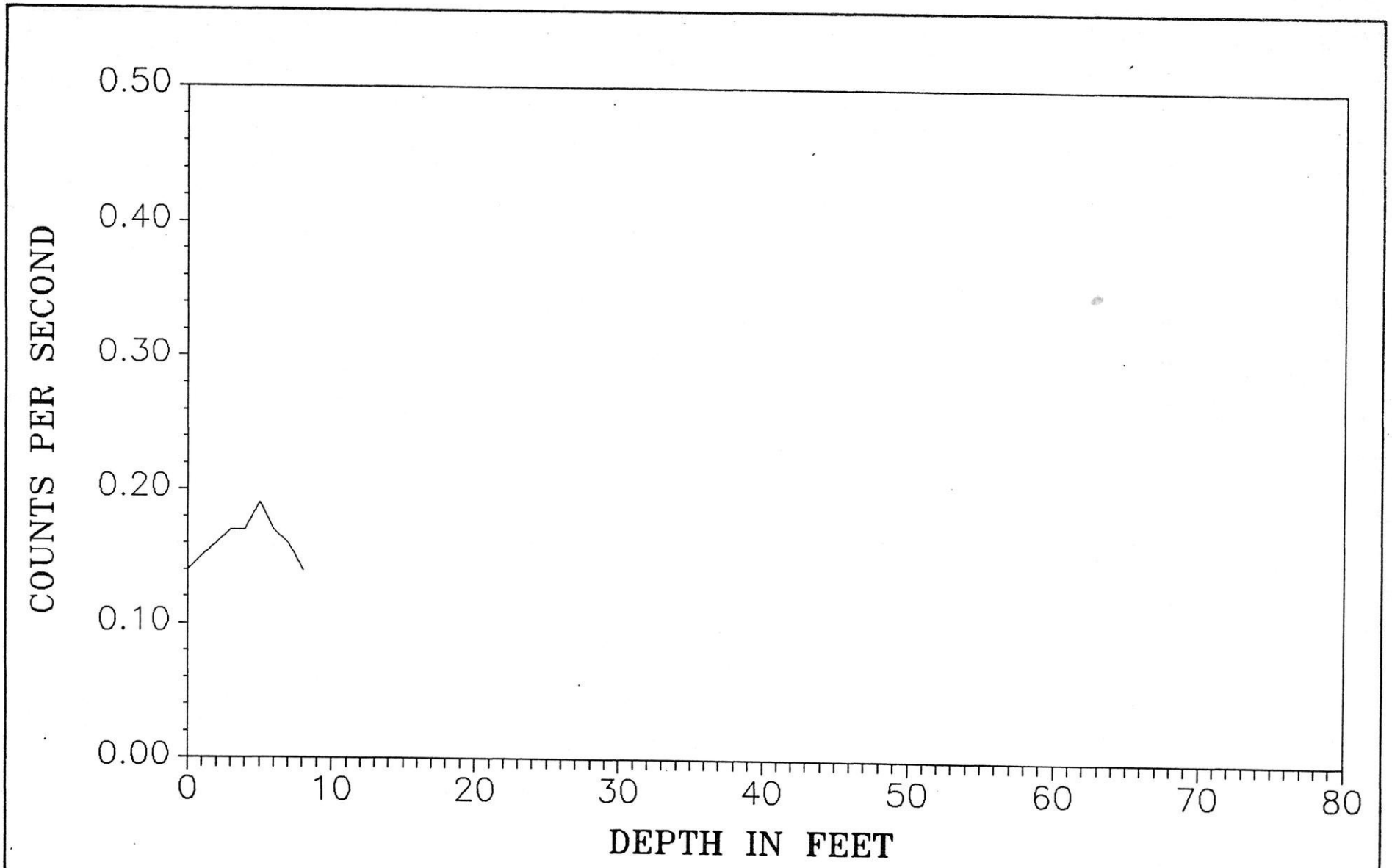
WATER LEVEL OBSERVATIONS			
W.L.	W.S. OR W.D.		
W.L.	4.5' B.C.P.	A.C.P.	
W.L.			

SOIL TESTING SERVICES
OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

BORING STARTED	6-23-73
BORING COMPLETED	6-23-73
RIG W-15	FOREMAN BB
DRAWN	APPROVED WMP
JOB # 4970 A	SHEET

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

BDS-81471



DATA TAKEN 1-13-89 BY BJS
TIME CONSTANT = 5 SECONDS
RANGE SETTING = 20 K

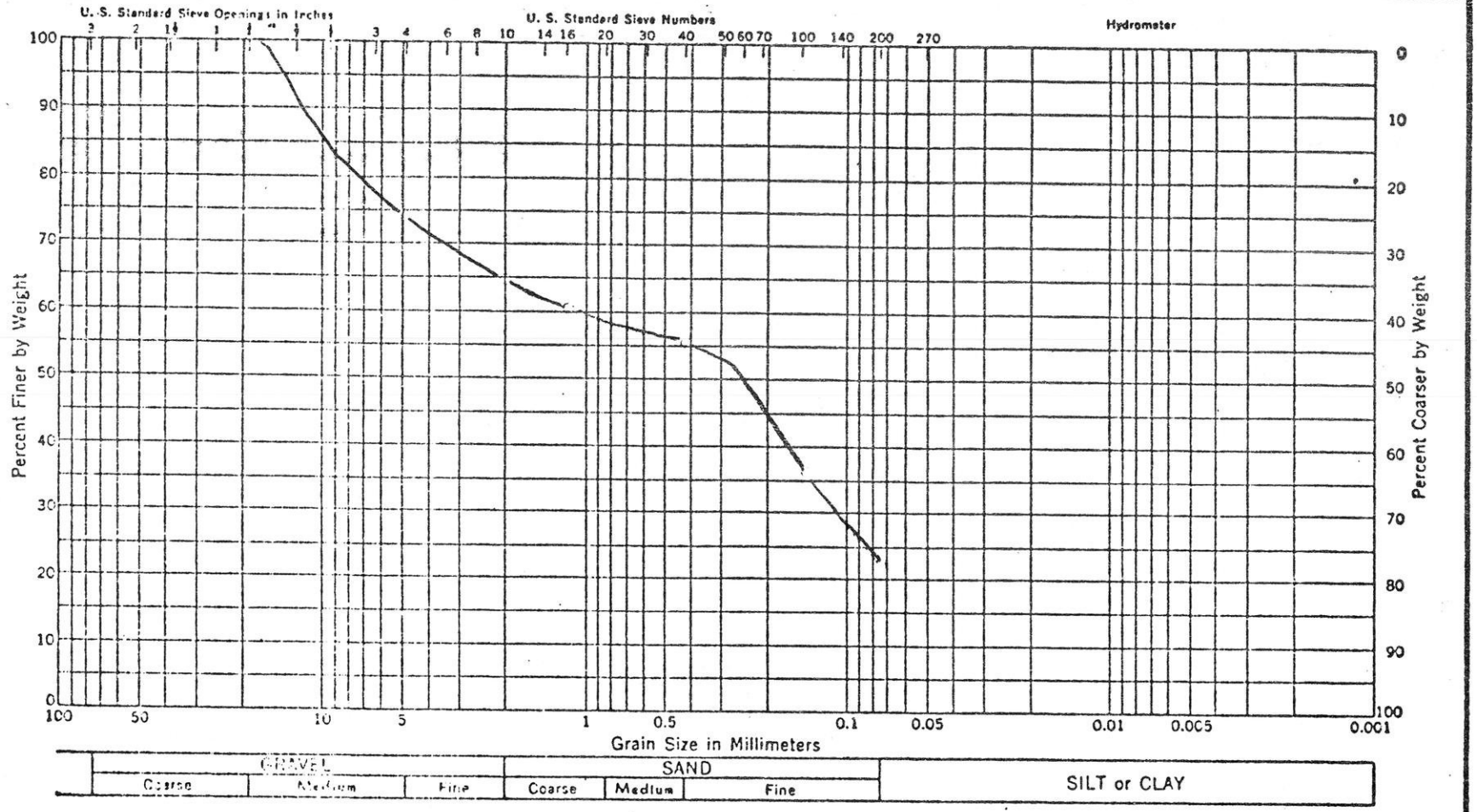
FOTH & VAN DYKE
GEOSCIENCES & ENVIRONMENTAL MANAGEMENT DIVISION
GREEN BAY, WISCONSIN

KENNECOTT MINERALS COMPANY
FLAMBEAU PROJECT
LADYSMITH, WISCONSIN

GAMMA LOG
WELL ST-9-29

No	REVISIONS	NOTES	APPROVAL	DATE
			DESIGNED BY	
			DRAWN BY SJL	2/89
			CHECKED BY	
			APPROVED BY	
			CAD No.	SCALE AS SHOWN

Job No | Dwg No | REV



SAMPLE NO.	W.C.	LL	PL	PI	CLASSIFICATION
					Silty fine medium sand-some fine medium gravel-trace coarse sand (SM)
					28-5-silt
					26-52-22 (F+VD 12/88)

Boring ST9 29

Sample 1 5'-6.5'

Sample Tested 353.8 gr.

DRAWN	APPROVED	DATE	JOB No.

3.5-B-72

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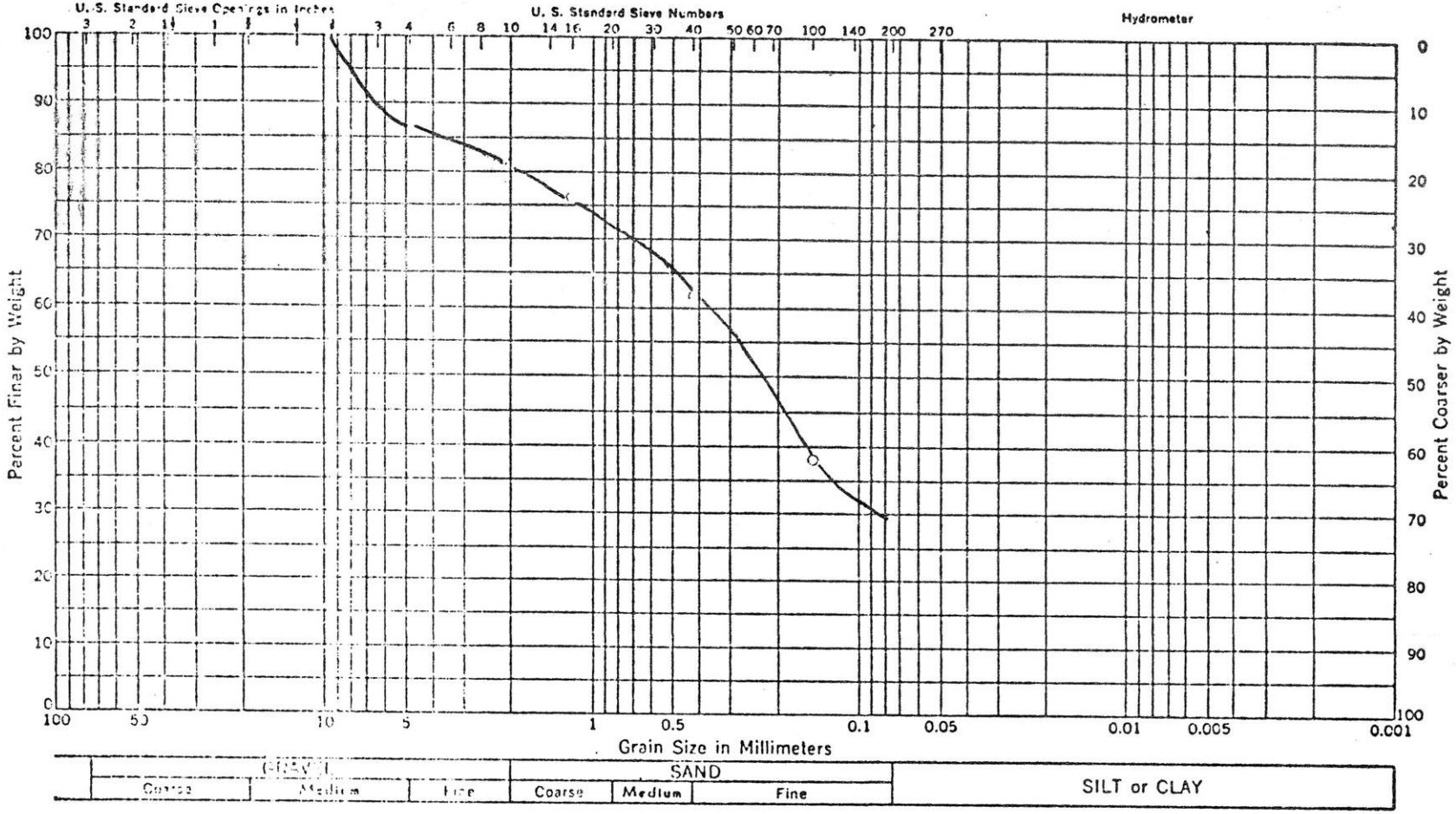

SAMPLE No.	W.C.	LL.	PL	PI	CLASSIFICATION
					Silty fine coarse sand-trace to some
					~~fine medium gravel (SM)~~
					% g - S - sand
					13 - 59 - 28 (F+V D 12/88)

Boring ST9 29

Sample 2 10'-10.5'

Sample Tested 110.0 gr.

DRAWN	APPROVED	DATE	JOB No.

3.5-B-73

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LOG OF BORING NO. ST-9-30

ST-9-30

OWNER Flambeau Mining Corporation	ARCHITECT-ENGINEER
SITE Flambeau Mine, Ladysmith, Wisconsin	PROJECT NAME Proposed Ore Process Plant

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	SAMPLE DIST.	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.³
					SURFACE ELEVATION 1149.6	
					Dark brown silty topsoil-(OL) frozen	
	1	SS			Brown very fine sandy silt, trace fine roots, trace clay, with thin seams of brown clayey silt (CL-ML)	
	2	SS			loose to medium dense-damp-(ML)	
5	3	SS			Brown clavey sandy silt-medium dense-damp-(ML-CL)	
	4	SS			Brown fine to coarse sand, trace to some fine to medium gravel, trace silt-dense-damp (SW)	
10	5	SS			Brown fine to medium sand, trace silt-dense-damp-(SM)	
15	6	SS			Brown silty very fine to fine sand, with some fine to coarse angular gravel (possible decomposed cobbles)-very dense saturated-(SM-ML)	
20	7	SS			Dark red brown silt, some fine sand, trace fine gravel, with occasional very thin (1/16") seams of red clay-very dense saturated-(ML)	
25						
26.0	8	SS			End of Boring Auger boring full depth No casing or wash water used	

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.²
1 2 3 4 5
PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %
STANDARD "N" PENETRATION (BLOWS/FT.)
10 20 30 40 50

9 22 26 36 41 93/11 BOUNCING 71/6 BOUNCING 70/6 BOUNCING

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WATER LEVEL OBSERVATIONS			
W.L.	15'-16.5'	W.S. OR W.D.	
W.L.	B.C.R.		A.C.R.
W.L.	14.5' AR		
	12.7' 3 Days AB		

SOIL TESTING SERVICES OF WIS., INC.
GREEN BAY, WISCONSIN
540 LAMBEAU ST

BORING STARTED	4-1-75		
BORING COMPLETED	4-1-75		
RIG	W-22	FOREMAN	CF
DRAWN	JK	APPROVED	WCK
JOB #	6575	SHEET	

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

B9SA1671

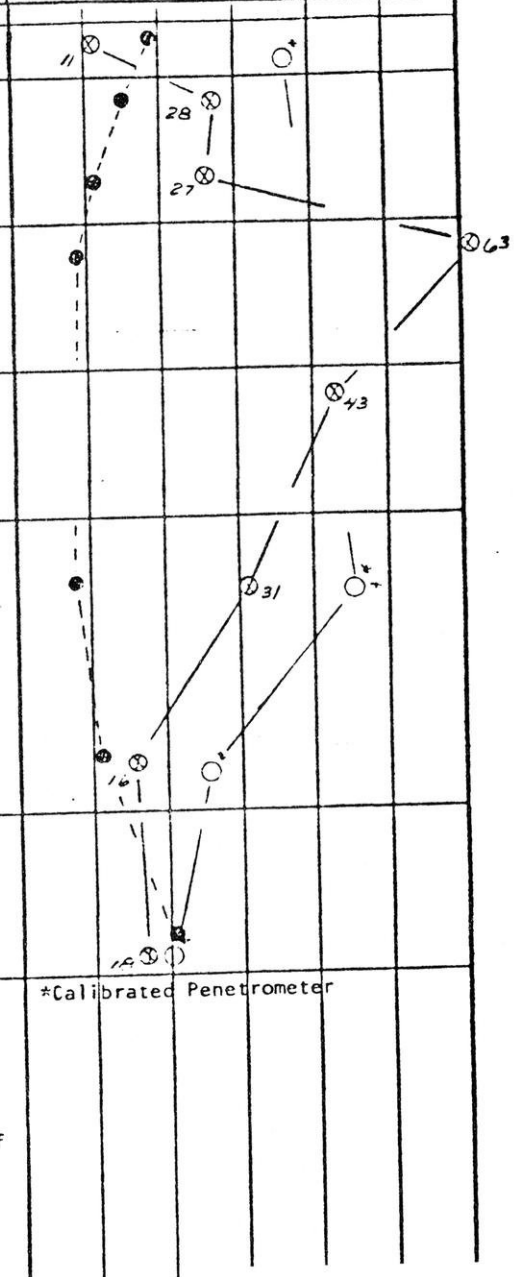
LOG OF BORING NO. ST-9-31

OWNER Flambeau Mining Corporation	ARCHITECT-ENGINEER
SITE Flambeau Mine, Ladysmith, Wisconsin	PROJECT NAME Proposed Ore Process Plant

SURFACE ELEVATION 1143.8

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	SAMPLE DIST.	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.³
	1	SS			Dark brown silty topsoil-(OL) See Note "A"	
	2	SS			Brown sandy silt, trace clay-very tough-moist-(ML)	
5	3	SS				
	4	SS			Brown silty fine sand and silty fine to coarse sand, trace to some fine to coarse gravel, with 1/2" seams of dark red brown silty clay-(CL)-very dense-damp-(SM)	
10	5	SS			Brown silty fine sand, trace fine gravel-dense-saturated-(SM-ML)	
15	6	SS			Brown silty clayey fine to medium sand, trace fine gravel tough to hard-(SC)	
20	7	SS				
25	8	SS			Mottled brown clayey silt, trace fine sand-tough-(CL-ML)	
26.5					End of Boring Auger boring full depth No casing or wash water used Note A: Mottled yellow brown, brown and gray silt, trace fine sand and clay with thin seams of yellow brown fine sand-(SP)-very tough-(ML)	

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.²
1 2 3 4 5
PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %
STANDARD "N" PENETRATION (BLOWS/FT.)
10 20 30 40 80



*Calibrated Penetrometer

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WATER LEVEL OBSERVATIONS		
W.L.	14'	XW.S.O.R W.D.
W.L.	B.C.R.	A.C.R.
W.L.	14.3' AB	
W.L.	14.5' 1 Day AB	

SOIL TESTING SERVICES
OF WIS., INC.
GREEN BAY, WISCONSIN
540 LAMBEAU ST

BORING STARTED	4-1-75		
BORING COMPLETED	4-2-75		
RIG	W-22	FOREMAN	CF
DRAWN	JK	APPROVED	WCK
JOB #	6575	SHEET	

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

BRS-A1671

LOG OF BORING NO. ST-9-32

ST-9-32

OWNER: Flambeau Mining Corporation	ARCHITECT-ENGINEER:
SITE: Flambeau Mine, Ladysmith, Wisconsin	PROJECT NAME: Proposed Ore Process Plant

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	SAMPLE DIST.	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.³
					SURFACE ELEVATION 1149.6	
	1	SS			Dark brown silty topsoil-(OL)	
	2	SS			Mottled brown silty very fine sand-medium dense-dry-(SM-ML)	
5	3	SS			Mottled yellow red brown and gray brown sandy clayey silt-very tough-(ML-CL)	
	4	SS			Brown sandy silt, trace fine gravel-very tough-moist-(ML)	
10	5	SS			Brown fine to medium sand, trace silt and fine gravel-dense to medium dense-damp, changing to wet at 15'-(SP)	
	6	SS				
15	7	SS				
20	8	SS				
25	9	SS			Brown silty sandy clay, trace to some fine to medium gravel-very tough-saturated-(CL-SC)	
					Mottled brown, gray, and yellow brown silty clay, trace sand-hard-(CL-ML)	
30	10	SS				
31.5					End of Boring Auger boring to 15 feet Wash boring below 15 feet 25 feet of NX casing	

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² (1, 2, 3, 4, 5)
PLASTIC LIMIT % | WATER CONTENT % | LIQUID LIMIT %
STANDARD "N" PENETRATION (BLOWS/FT.) (10, 20, 30, 40, 50)

*Calibrated Penetrometer

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WATER LEVEL OBSERVATIONS			
W.L.	14'	W.S. 8A W.S. XXXXX	
W.L.	6.5' B.C.R	7.4' A.C.R.	
W.L.			

SOIL TESTING SERVICES
OF WIS., INC.
GREEN BAY, WISCONSIN
540 LAMBEAU ST.

BORING STARTED	3-19-75		
BORING COMPLETED	3-19-75		
RIG	'8	FOREMAN	EV
DRAWN	JK	APPROVED	WCK
JOB #	6575	SHEET	

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

BRS-81671

LOG OF BORING NO. ST-9-33

OWNER: Flambeau Mining Corporation

ARCHITECT-ENGINEER:

SITE: Flambeau Mine, Ladysmith, Wisconsin

PROJECT NAME: Proposed Ore Process Plant

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	STRATA CHANGE	DESCRIPTION OF MATERIAL	BLOWS PER 6 INCHES
				SURFACE ELEVATION 1156.7	
				Dark brown silty topsoil (OL) frozen	
	1	SS		Brown silty fine to coarse sand, some fine gravel, trace clay-medium dense-damp-(ML)	11
	2	SS		Mottled brown, yellow brown and gray clayey silt, trace to some fine sand-tough-(CL-ML)	24
	3	SS		Brown fine to medium sand, trace fine to medium gravel, trace silt-dense-damp-(SP)	30
	4	SS		Brown silty very fine sand, trace fine gravel-dense-damp-(SM-ML)	44
	5	SS		Brown silty fine to medium sand, trace fine gravel-dense-wet-(SM)	46
	6	SS		Dark red brown sandy silt, trace clay and fine to medium gravel-dense-saturated-(ML)	39
	7	SS		Brown silty fine to coarse sand, trace fine gravel, with seams of red brown and gray brown silty clay (CL-ML) dense-saturated-(SM)	43
	8	SS		Brown silty clayey fine to medium sand, trace fine to medium gravel, with thin seams of brown silty fine sand-medium dense-saturated-(SC)	27
	9	SS		Brown fine sand, trace to some silt, trace fine to medium gravel-dense-saturated-(SP-SM)	30
	10	SS		Brown silty clayey sand with seams of brown silty fine to coarse sand-(SM) trace fine to medium gravel-dense-saturated-(SC)	56
	11	SS		Dark red brown silty clayey sand, trace fine gravel-hard-saturated-(SC-CL)	50/2"
	12	SS			
	13	SS		Yellow brown silt, trace clay, sand and fine gravel-dense to very dense-saturated-(ML)	50
	14	SS			61
	15	SS		Mottled brown and yellow red silty sandy clay, some fine to medium gravel-hard-saturated-(CL-SC)	70
	16	SS		Yellow red sandy silt, trace to some fine to medium gravel, trace clay-very dense-saturated-(ML)	75
	17	SS		Yellow red silty fine sand, trace fine gravel-dense-wet-(SM)	63
	18	SS		Saprolite-yellowish white and gray silt with angular gravel fragments-talcy feel-very dense-(ML)	91
	19	SS			72
				End of Boring 27.5' of 4 inch casing used 60' of Revert used Auger boring to 20 feet Wash boring below 20 feet	

*Calibrated Penetrometer

WATER LEVEL OBSERVATIONS

SOIL TESTING SERVICES
OF WIS., INC.

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

ST-9-33

ST-9-33

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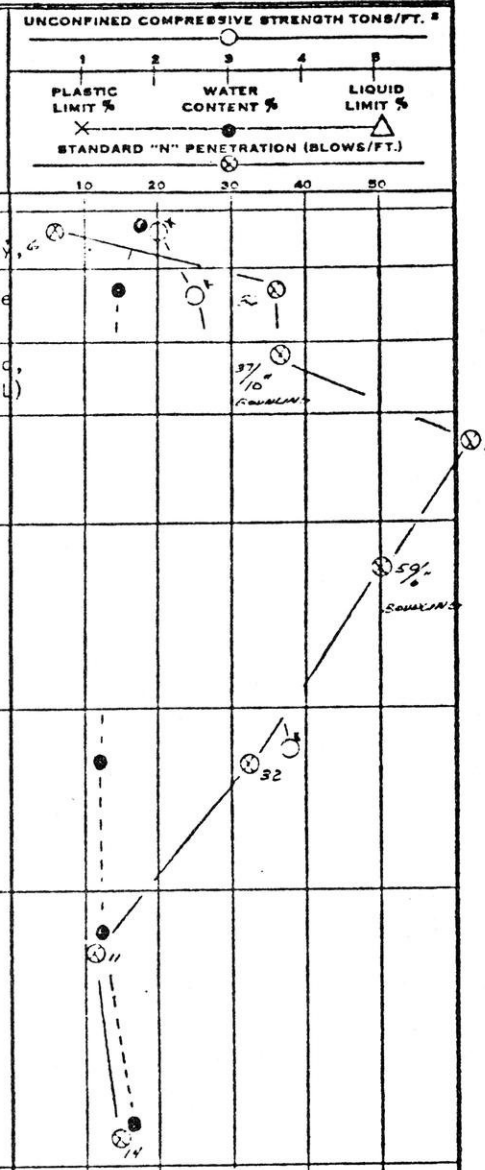
LOG OF BORING NO. ST-9-34

OWNER: Flambeau Min[illegible], Corporation	ARCHITECT-ENGINEER
SITE: Flambeau Mine, Ladysmith, Wisconsin	PROJECT NAME: Proposed Ore Process Plant

ST-9-34

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	SAMPLE DIST.	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.³
					SURFACE ELEVATION 1145.4	
					Dark brown silty topsoil-(OL) frozen	
	1	SS			Mottled brown and yellow red silt, trace to some fine sand, trace clay, trace fine roots-very tough-(ML)	
	2	SS			Dark brown sandy clayey silt, trace to some fine sand, with seams of brown silty fine sand-(SM) very tough-(ML)	
5	3	SS			Brown silty very fine to fine sand, trace fine gravel, with few seams of dark brown sandy silt-(ML) very dense-damp-(SM)	
	4	SS			Brown fine to coarse sand, some fine to coarse gravel, trace silt-very dense-(SW)	
10	5	SS			Dark brown silty fine to coarse sand, trace to some fine gravel-very dense-damp-(SM-SW)	
15	6	SS			Brown silt, trace to some very fine sand, trace clay, with irregular thin seams of brown fine sand-(SP)-very tough-(ML)	
20	7	SS			Brown silty fine to coarse sand, trace sandy silt, trace fine gravel-medium dense-saturated-(SM-ML)	
25	8	SS				
26.5					End of Boring Auger boring full depth No casing or wash water used Small cobbles and coarse gravel noted throughout boring	



*Calibrated Penetrometer

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WATER LEVEL OBSERVATIONS		
W.L.	W.S. OR W.D.	
W.L.	B.C.R.	A.C.R.
W.L.	14' WD with augers	
	13.5' AB	
	9.5' 15 Days AB	

SOIL TESTING SERVICES
OF WIS., INC.
GREEN BAY, WISCONSIN
540 LAMBEAU ST

BORING STARTED	3-19-75		
BORING COMPLETED	3-19-75		
RIG	8	FOREMAN	EV
DRAWN	JK	APPROVED	EV
JOB #	6575	SHEET	

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

BBS81671

LOG OF BORING NO. ST-9-35

ST-9-35

OWNER: Flambeau Mining Co ration	ARCHITECT-ENGINEER:
SITE: Flambeau Mine, Ladysmith, Wisconsin	PROJECT NAME: Proposed Ore Process Plant

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² — 1 2 3 4 5

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %

STANDARD "N" PENETRATION (BLOWS/FT.) — 10 20 30 40 50

SURFACE ELEVATION 1142.9

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	SAMPLE DIST.	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.³
	1	ST			Dark brown silty topsoil-(OL) frozen	
	1A	ST			Mottled light brown and yellow red silt, trace fine sand-very tough (ML)	102
	2	SS			Mottled brown very fine sandy silt, trace to some clay-very tough-(ML-CL)	
5	3	SS			Brown silt, trace to some very fine sand, trace clay-very tough-damp-(ML)	
	4	SS			Brown silty very fine sand, trace fine gravel, trace clay-medium dense-moist-(SM-ML)	
10	5	SS				
	6	SS			Brown silt, trace fine sand, clay and gravel-hard-damp-(ML)	
15	7	SS			Red brown silty sandy clay, trace to some fine to coarse gravel-very tough-(CL)	
20	8	ST			Mottled yellow brown, tan, and gray silt, trace clay, with 1/4" to 1/2" seams silty fine sand-(SM) very tough-(CL-ML)	110
25	9	ST				98
30	10	ST			Dark gray brown silty sandy clay, trace to some fine gravel, with thin dark rust brown discolored seams-tough-(CL)	113
32.0					End of Boring 15' of NX Casing used Auger boring to 6 feet Wash boring below 6 feet	

*Calibrated Penetrometer

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WATER LEVEL OBSERVATIONS		
W.L.	W.S. OR W.D.	
W.L.	6.0' B.C.R.	7.5' A.C.R.
W.L.	Dry to 6' WD with augers	
W.L.		

SOIL TESTING SERVICES OF WIS., INC.
GREEN BAY, WISCONSIN
540 LAMBEAU ST.

BORING STARTED	3-19-75		
BORING COMPLETED	3-19-75		
RIG	D	FOREMAN	EV
DRAWN	JK	APPROVED	WCK
JOB #	6575	SHEET	

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

BBS-81671

LOG OF BORING NO. ST-9-36

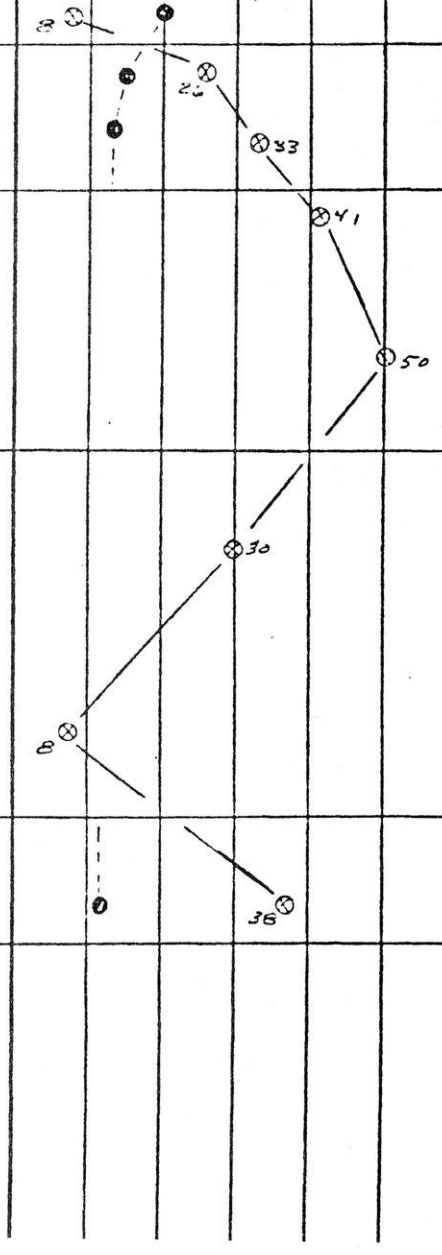
ST-9-36

OWNER	ARCHITECT-ENGINEER
Flambeau Mining Corporation	
SITE Flambeau Mine, Ladysmith, Wisconsin	**PROJECT NAME** Proposed Ore Process Plant

SURFACE ELEVATION 1150.6

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	SAMPLE DIST.	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.³
	1	SS			Dark brown silty topsoil-(OL)-frozen Dark brown fine sandy silt, trace fine roots-loose-moist-(ML)	
	2	SS			Mottled brown, yellow red, and gray fine sandy silt-medium dense to dense-damp-(ML)	
5	3	SS				
	4	SS			Brown fine to coarse sand, trace to some fine to coarse gravel, trace silt-dense-damp-(SW)	
10	5	SS				
15	6	SS			Brown fine to medium sand, trace silt-dense to loose-wet-(SP)	
20	7	SS				
25					Brown silty sandy clay, trace fine to medium gravel-hard-(CL)	
26.5	8	SS				
					End of Boring Auger boring full depth No casing or wash water used Cobbles and coarse gravel noted throughout boring	

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.²
1 2 3 4 5
PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %
STANDARD "N" PENETRATION (BLOWS/FT.)
10 20 30 40 50



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WATER LEVEL OBSERVATIONS		
W.L.	15'-16.5'	W.S. DRILLED
W.L.	B.C.R.	A.C.R.
W.L.	WCI 14.2' AB	

SOIL TESTING SERVICES
OF WIS., INC.
[redacted] ROUTE NO. [redacted] PATTY'S ROAD
GREEN BAY, WISCONSIN
540 LAMBEAU ST.

BORING STARTED	4-3-75		
BORING COMPLETED	4-3-75		
RIG	W-22	FOREMAN	CF
DRAWN	J K	APPROVED	WCK
JOB #	6575	SHEET	

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

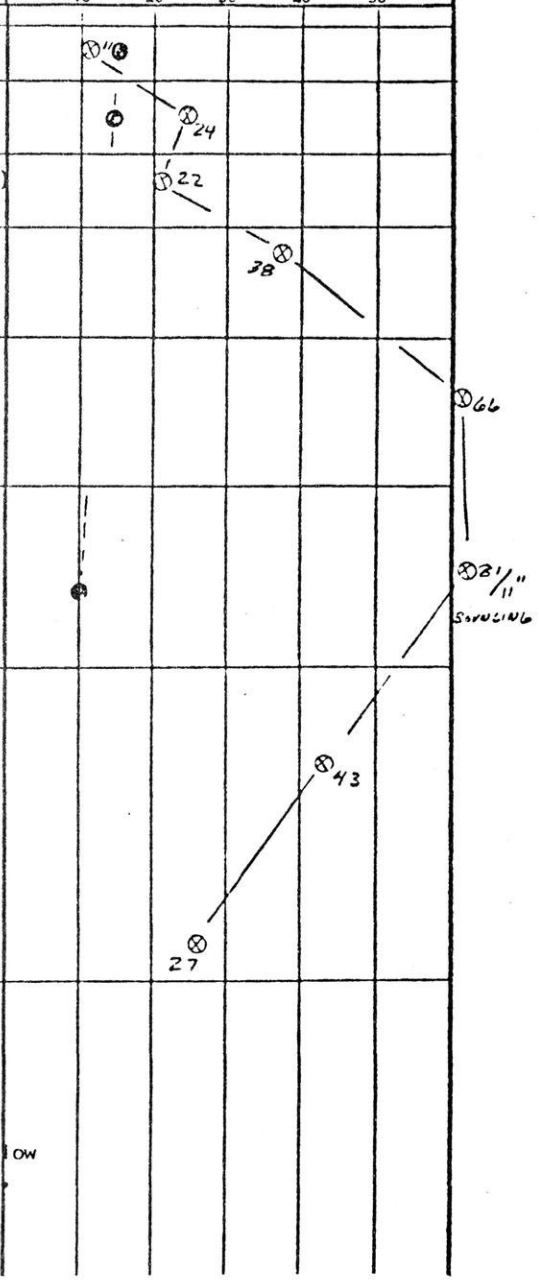
LOG OF BORING NO. ST-9-37

OWNER	ARCHITECT-ENGINEER
Flambeau Mining Co ration	
SITE Flambeau Mine Ladysmith Wisconsin	**PROJECT NAME** Proposed Ore Process Plant

ST-9-37

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	SAMPLE DIST.	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.³
					SURFACE ELEVATION 1147.2	
	1	SS			Dark brown silty topsoil-(OL) See Note "A"	
	2	SS			Brown sandy silt, trace fine to some fine sand, trace clay-medium dense-damp-(ML)	
5	3	SS			Brown fine sand, trace silt, with lenses of brown silty fine sand (SM) medium dense-damp-(SP)	
	4	SS			Brown fine to coarse sand, trace silt and fine gravel-dense-wet-(SW)	
10	5	SS			Brown silty very fine sand-very dense-saturated-(SM-ML)	
15	6	SS			Dark brown silty very fine sand, trace fine to medium gravel-very dense-saturated-(SM)	
20	7	SS			Brown fine sand trace to some fine to medium gravel, trace silt-dense to medium dense-wet-(SP)	
25						
26.5	8	SS				
					End of Boring Auger boring full depth No casing or wash water used Cobbles and coarse gravel noted throughout boring Note A: Mottled gray, brown, and yellow brown silt, trace to some fine sand, trace clay-medium dense-damp-(ML)	

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.²
1 2 3 4 5
PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %
STANDARD "N" PENETRATION (BLOWS/FT.)
10 20 30 40 50



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WATER LEVEL OBSERVATIONS		
W.L.	15'-16.5'	W.S. XXXXX
W.L.	B.C.R.	A.C.R.
W.L.	16.3' AB	
	WCI 21' AB	
	WCI 13.3' 4 Hrs. AB	

SOIL TESTING SERVICES
OF WIS., INC.
GREEN BAY, WISCONSIN
540 LAMBEAU ST

BORING STARTED	4-3-75		
BORING COMPLETED	4-3-75		
RIG	W-22	FOREMAN	CF
DRAWN	JK	APPROVED	WCK
JOB #	6575	SHEET	

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

BBS-81671

LOG OF BORING NO. ST-9-38

ST-9-38

OWNER: Flambeau Mining Co ation	ARCHITECT-ENGINEER:
SITE: Flambeau Mine, Ladysmith, Wisconsin	PROJECT NAME: Proposed Ore Process Plant

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	SAMPLE DIST.	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.³
					SURFACE ELEVATION 1144.5	
	1	SS			Dark brown silty topsoil-(OL) Frozen Mottled brown sandy silt-medium dense-damp-(SM-ML)	
	2	SS			Brown sandy silt, trace clay-hard-damp-(ML)	
5	3	SS			Brown silty very fine sand with seams of brown fine to coarse sand, trace fine gravel-(SP) medium dense-damp-(SM-ML)	
	4	SS			Brown sandy silt, trace fine gravel, with seams of brown fine to coarse sand-(SW) dense-damp-(ML)	
10	5	SS			Red brown sandy silt, trace clay and fine to medium gravel-dense-damp-(ML)	
15	6	SS			Brown silty clayey sand, trace fine gravel-medium dense-saturated-(SC-CL)	
20	7	SS				
25	8	SS			Mottled brown and yellow brown silty clay, trace fine sand-very tough-(CL-ML)	
26.5					End of Boring	

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.²
1 2 3 4 5
PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %
STANDARD "N" PENETRATION (BLOWS/FT.)
10 20 30 40 50

*Calibrated Penetrometer

Auger boring full depth
No casing or wash water used
Cobbles and coarse gravel noted throughout boring

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WATER LEVEL OBSERVATIONS		
W.L.	15'-16.5'	W.S. ON XX
W.L.	B.C.R.	A.C.R.
W.L.	15.3' AB	
	14.6' Few Hours AB	

SOIL TESTING SERVICES OF WIS., INC.
GREEN BAY, WISCONSIN
540 LAMBEAU ST

BORING STARTED	4-13-75		
BORING COMPLETED	4-13-75		
RIG	W-22	FOREMAN	CF
DRAWN	JK	APPROVED	WCK
JOB #	6575	SHEET	

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

LOG OF BORING NO. ST-9-39

OWNER Flambeau Mining Corporation	**ARCHITECT - ENGINEER**
SITE Flambeau Mine, Ladysmith. Wisconsin	**PROJECT NAME** Proposed Ore Process Plant

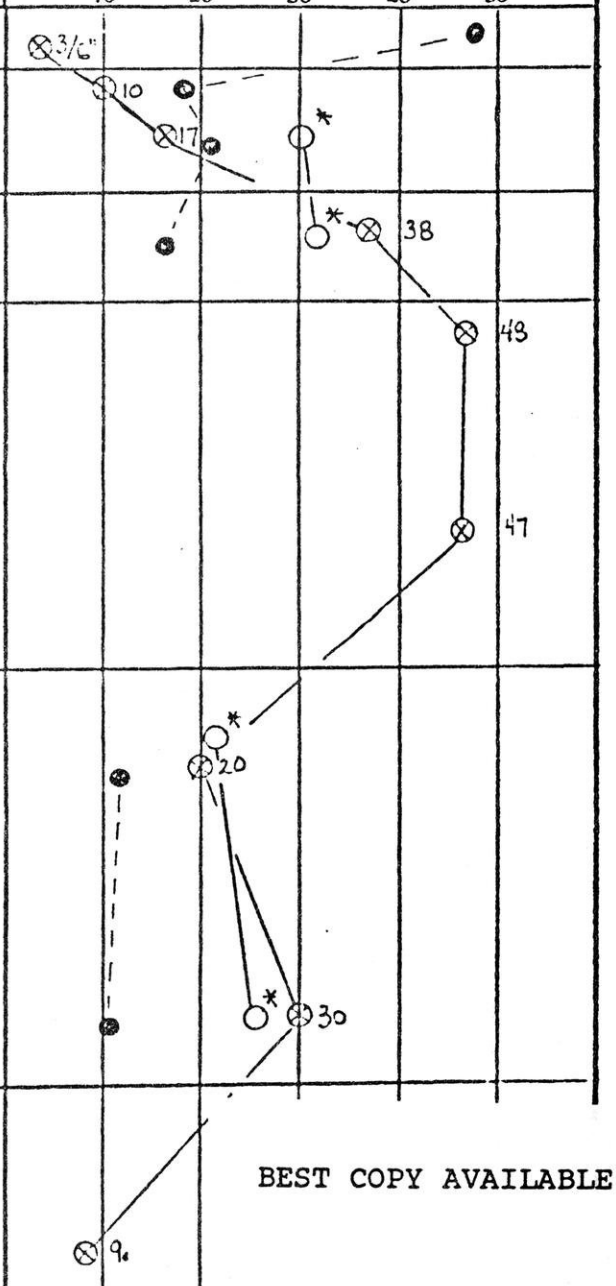
ST-9-39

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	SAMPLE DIST.	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.³
					SURFACE ELEVATION 1141.9	
	1	SS			Black silty topsoil-(OL-frozen	
	1A	SS			Mottled yellow brown and gray silt, trace fine sand and clay-very tough-damp-(ML)	
	2	SS				
5	3	SS			Mottled gray and dark brown sandy silt-very tough-damp-(ML)	
	4	SS			Brown silty fine to medium sand, trace to some fine to medium gravel-dense-moist-(SM)	
10	5	SS				
15	6	SS			Brown and red brown silty clayey sand, trace to some fine to medium gravel-medium dense to dense-wet at 15'-(SC-CL)	
20	7	SS				
25	8	SS			Brown silty fine to coarse sand, trace to some fine to medium gravel-loose-wet-(SM)	
26.5					End of Boring	

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² (1, 2, 3, 4, 5)

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %

STANDARD "N" PENETRATION (BLOWS/FT.) (10, 20, 30, 40, 50)



*Calibrated Penetrometer

Auger boring full depth-no casing or wash water used

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WATER LEVEL OBSERVATIONS		
W.L.	15-16.5'	W.S. OR WW
W.L.	B.C.R.	A.C.R.
W.L.	14.5' AB	
	9.5' 1 Day AB	

SOIL TESTING SERVICES
OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

BORING STARTED	4-2-75		
BORING COMPLETED	4-2-75		
RIG	W-22	FOREMAN	CF
DRAWN	WW	APPROVED	WCK
JOB #	6575	SHEET	

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

3.5-B-83

BBS-81471

LOG OF BORING NO. ST-9-40

OWNER Flambeau Mining Corporation

ARCHITECT-ENGINEER

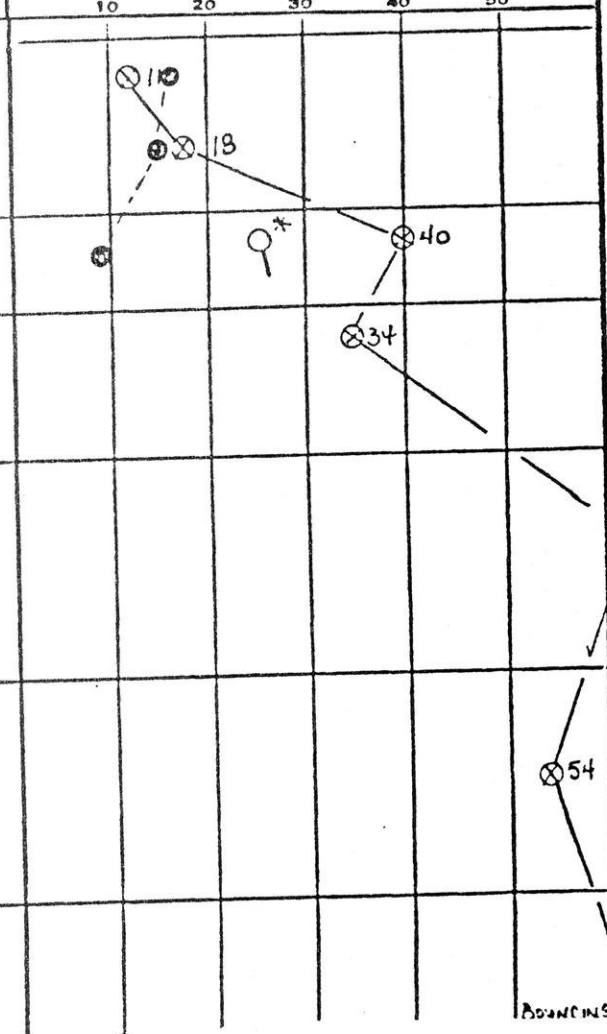
SITE Flambeau Mine
Ladysmith, Wisconsin

PROJECT NAME Proposed Ore Process Plant

ST-9-40

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² (1, 2, 3, 4, 5)
PLASTIC LIMIT % | WATER CONTENT % | LIQUID LIMIT %
STANDARD "N" PENETRATION (BLOWS/FT.) (10, 20, 30, 40, 50)

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	SAMPLE DIST.	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.³
					SURFACE ELEVATION 1148.4	
	1	SS			Dark brown silty topsoil-(OL) frozen	
	2	SS			Mottled brown silt.trace fine sand and clay,with thin seams of brown fine sand-(SP)medium dense-damp-(ML)	
5	3	SS			Brown silty clayey sand,trace to some fine to medium gravel-dense-damp-(SC-CL)	
	4	SS			Brown fine to coarse sand,trace to some fine to medium gravel trace silt-dense-damp-(SW)	
10	5	SS			Brown silty very fine sand-very dense-moist-(SM-ML)	
15	6	SS			Brown fine to medium sand, trace silt and fine gravel-dense-wet-(SP)	
20	7	SS			Brown silty clayey sand,trace fine gravel-very dense-saturated-(SC)	
25						
26.0	8	SS			End of Boring Auger boring full depth-no casing or wash water used-cobbles and coarse gravel noted through boring	



*Calibrated Penetrometer

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WATER LEVEL OBSERVATIONS		
W.L.	15-16.5'	W.S. XXXX D.
W.L.	B.C.R.	A.C.R.
W.L.	15.5' AB	
	WCI 14.9' 1 Day AB	

3.5-B-84

SOIL TESTING SERVICES
OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

BORING STARTED	4-2-75		
BORING COMPLETED	4-2-75		
RIG	W-22	FOREMAN	CF
DRAWN	WW	APPROVED	WCK
JOB #	6575	SHEET	

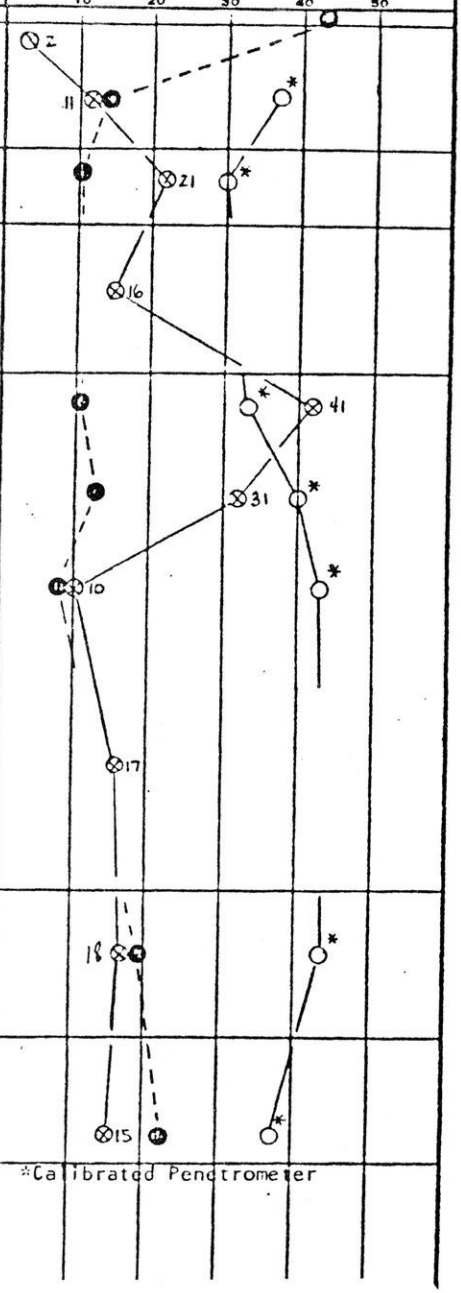
The stratification lines represent the approximate boundary between soil types and the transition may be gradual

LOG OF BORING NO. ST-9-41

ST-9-41

OWNER Flambeau Mining Cor ation	ARCHITECT-ENGINEER
SITE Flambeau Mine Ladysmith, Wisconsin	PROJECT NAME Proposed Ore Process Plant

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	SAMPLE DIST.	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.³
					SURFACE ELEVATION 1145.5	
	1	SS			Dark brown silty topsoil-(OL)	
	1A	SS			Yellow brown sandy clayey silt-very tough-(ML-CL)	
	2	SS				
5	3	SS			Brown very fine sandy silt, trace fine gravel-medium dense-damp-(ML)	
	4	SS			Brown silty fine sand, trace fine gravel-medium dense-damp-(SM) cobble at 6 feet	
10	5	SS			Brown silty very fine sand to sandy silt, trace to some fine to coarse gravel-medium dense-(SM-ML)	
	6	SS				
15	7	SS				
20	8	SS				
					Mottled yellow gray and gray silty clay, trace fine sand-hard-(CL-ML)	
25	9	SS				
					Dark red brown and red gray silty clay trace fine sand and fine gravel-very tough-(CL-ML)	
30	10	SS				
31.5					End of Boring 25' of NX Casing used Auger boring to 7 feet Wash boring below 7 feet	



*Calibrated Penetrometer

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WATER LEVEL OBSERVATIONS		
W.L.		W.S. OR W.D.
W.L.	6.7' B.C.R	7.1' A.C.R.
W.L.	Dry to 6' WD with augers	

SOIL TESTING SERVICES
OF WIS., INC.
GREEN BAY, WISCONSIN
540 LAMBEAU ST

BORING STARTED	3-19-75		
BORING COMPLETED	3-19-75		
RIG 8		FOREMAN EV	
DRAWN WW		APPROVED WCK	
JOB # 0575		SHEET	

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

BRS-81671

LOG OF BORING NO. ST-9-42

OWNER: Flambeau Mining Corporation

ARCHITECT-ENGINEER:

SITE: Flambeau Mine, Ladysmith, Wisconsin

PROJECT NAME: Proposed Ore Process Plant

Depth Elevation	Sample No.	Type Sample	Description of Material	Soil Type USCS	Unconfined Compressive Strength Tons/Ft² / Standard "N" Penetration Blows/Ft.
			Surface Elevation 1141.1 ft		Plastic Limit % — Water Content % — Liquid Limit %
	1	SS	Dark brown silty topsoil-(OL) frozen		
			Brown sandy silt,trace fine gravel-medium dense-damp-(ML)	grave	
	2	SS	Mottled brown and yellow brown clayey silt,trace fine sand,with thin seams of brown fine sand(SP) very tough-(ML-CL)		
	3	SS	Brown fine sandy silt,trace fine to coarse gravel-very dense-moist-(ML)	fine	
	4	SS	Brown fine sand,trace to some silt,trace to some fine to coarse gravel-very dense to dense-damp-changing to wet at 10'-(SP-SM)		
	5	SS			
	6	SS			
	7	SS	Brown silty clayey fine to coarse sand,trace to some fine to coarse gravel-dense-saturated-(SC-CL)		
	8	SS	Brown sandy silt,trace fine gravel-dense to very dense-moist-(ML)		
	9	SS			
	10	SS	Brown silty clayey fine to coarse sand,trace fine grave -		
	11	SS	dense to loose-saturated-(SC-CL)		
	12	SS			
	13	SS	Gray brown silty clay,trace fine sand-hard-(CL)	112	
	14	SS	Dark yellow brown(mottled) silty clay,trace to some fine gravel,trace silt-hard-(CL)		
	15	SS	Stratum of cobbles and boulders,in probable sand matrix-could not sample-rock bit		
	16	SS	Dark gray brown silty very fine sand,trace to some fine to coarse gravel-dense to very dense-saturated-(SM-ML)		
	17	SS			
	18	SS	Gray brown fine to coarse sand,trace to some fine to coarse gravel,trace silt-very dense-saturated-(SW)		
	19	SS	End of Boring 20' of 4" casing used 60' of drilling mud used(Hi-vert) Auger boring to 17.5 feet Wash boring below 17.5 feet		

*Calibrated Penetrometer

WATER LEVEL OBSERVATIONS

SOIL TESTING SERVICES

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

ST-9-42

ST-

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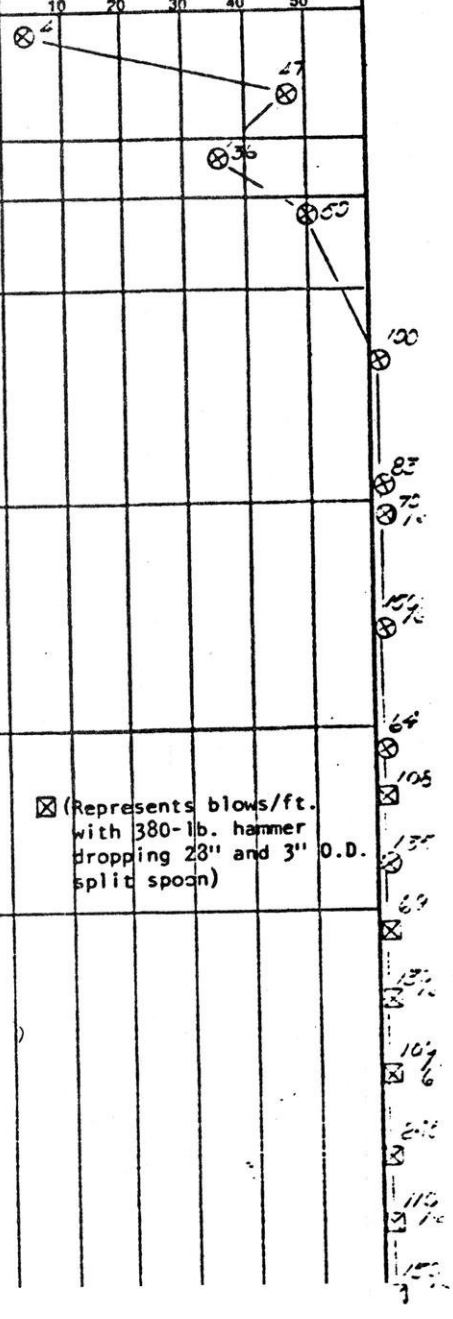
LOG OF BORING NO. ST-9-57

OWNER Flambeau Mining Company	ARCHITECT-ENGINEER ST-9-57
SITE Ladysmith, Wisconsin	PROJECT NAME Proposed Mine Development

DEPTH ELEVATION	SAMPLE NO	TYPE SAMPLE	SAMPLE DIST.	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.³
					SURFACE ELEVATION 1111	
	1	SS			Silty SAND(SM),non to slightly plastic, trace roots in upper foot,dark reddish brown, wet, waterbearing, loose to dense, outwash	
	2	SS				
5	3	SS			Slightly silty fine to coarse SAND(SW-SM), some gravel,yellowish red,waterbearing, dense,outwash	
	4	SS			Silty very fine SAND (SM), nonplastic, red, waterbearing, dense,outwash	
10	5	SS			Sandy GRAVEL (GW), trace silt, some cobbles and boulders, weak red, water bearing, very dense, outwash	
15	6	SS			Sandstone, quartz grains in layers ranging from silt size to medium sand size, white mottled pink to light gray, weakly cemented, waterbearing	
	6A	SS				
20	7	SS				
	8	SS			SAPROLITE, SILT(ML), light gray mottled reddish yellow, pearly lustre, moist, very dense	
25	9	SS				
	10	SS				
30	11	SS			SAPROLITE, sandy silt to silt(ML), trace to some fine to coarse grains of QUARTZ, zone of silty sand between 32 & 33 feet; red marbled yellow or white; reddish yellow, yellowish red and white between 32 and 36 feet, moist, very dense	
	12	SS				
35	13	SS				
	14	SS				
40	15	SS				
43	16	SS			End of Boring Boring advanced to 6 feet by power auger, to 23' by 4" casing, Revert and cutting bits, to 43' by Revert and cutting bits.	

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.²
1 2 3 4 5
PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %
STANDARD "N" PENETRATION (BLOWS/FT.)
10 20 30 40 50



☒ (Represents blows/ft. with 380-lb. hammer dropping 23" and 3" O.D. split spoon)

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WATER LEVEL OBSERVATIONS		
WL	2.5' WD	
WL	BCR	A.C.R
WL		

SOIL TESTING SERVICES
OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

BORING STARTED	Oct. 23, 1975
BORING COMPLETED	Oct. 27, 1975
RIG #8	FOREMAN EV
DRAWN KO	APPROVED BMT
JOB # 6971	SHEET 1 of 1

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

LOG OF BORING NO. ST-9-58

OWNER: Flambeau Mining Company	ARCHITECT-ENGINEER: ST-9-54
SITE: Ladysmith, Wisconsin	PROJECT NAME: Proposed Mine Development

DEPTH ELEVATION	SAMPLE NO	TYPE SAMPLE	SAMPLE DIST.	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.3
					SURFACE ELEVATION 1110.9	
	1	SS			Silty SAND(SM), non to slightly plastic, trace to some gravel, red,wet,medium dense,outwash	
					Silty sandy GRAVEL (GM), nonplastic, red, waterbearing, till	
5	2	SS				
	3	SS			Silty very fine SAND (SM), nonplastic, red, waterbearing, outwash	
					Sandy GRAVEL (GP), dark reddish gray, waterbearing, outwash	
10	4	SS				
	4A	SS				
15					SANDSTONE, quartz grains ranging in size from uniformly fine at the 11-foot depth to fine to coarse at the 20 and 25-foot depths, light pink to light gray, weakly cemented, waterbearing	
	5	SS				
20	6	SS				
	7	SS				
25	8	SS				
30						
	9	SS				
	10	SS				
35	11	ST			SAPROLITE, slightly clayey silt(ML),slightly plastic, laminated structure at vertical or near vertical orientation; reddish yellow and yellow brown to 35 feet, silvery gray and dark gray below 35 feet; pearly lustre, moist, very dense	
	Run #1	DB NX			RQD from 35.3 to 38.3'= 55%	
40					RAD from 40.3 to 47.3'= 46%	
	12	ST				
	Run #2	DB NX				
47.3					End of Boring	

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.²
1 2 3 4 5
PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %
STANDARD "N" PENETRATION (BLOWS/FT.)
10 20 30 40 50

⊠ (Represents blows/ft. with 330-lb. hammer dropping 28" on a 3" O. D. spoon)

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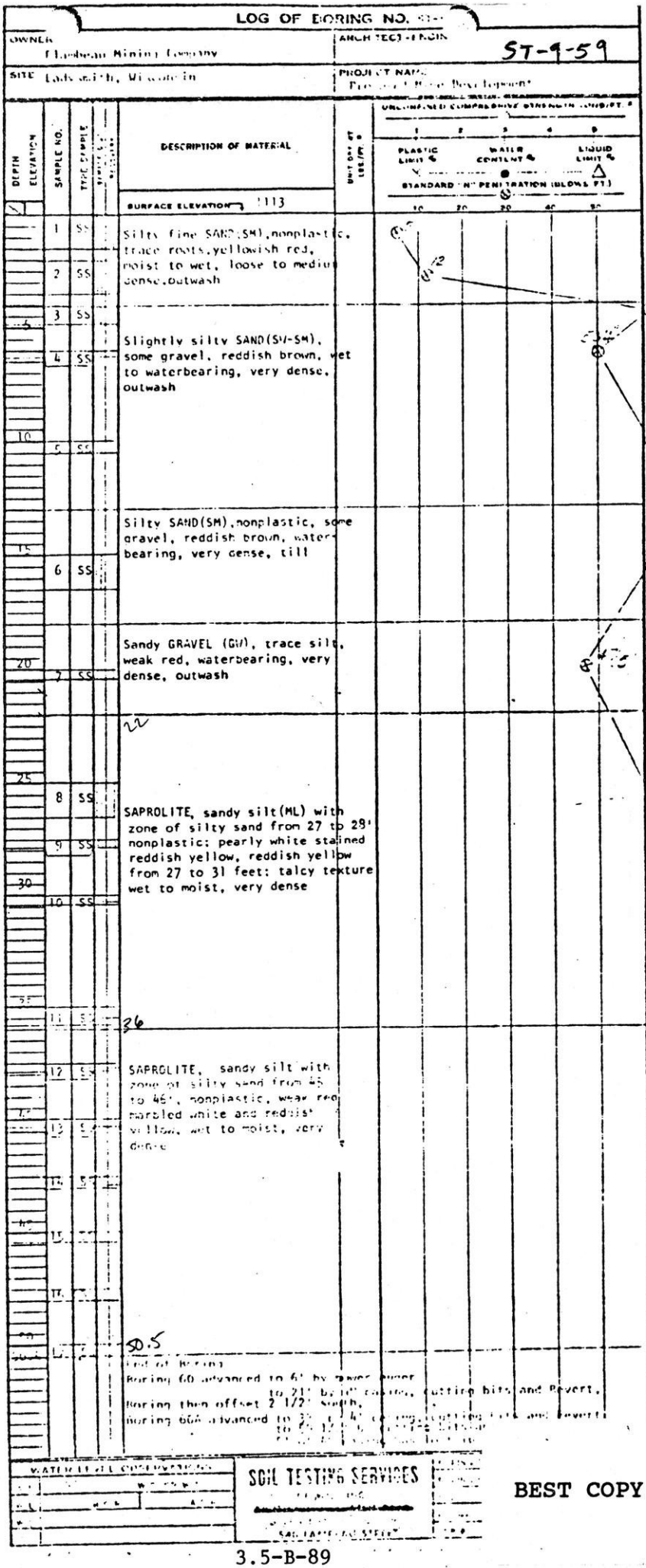
Boring advanced to 6 feet by power auger, to 13 feet with 4" casing, cutting bits and Revert, to 35.3' with Revert and cutting bits, to 47.3' with DB and Revert

WATER LEVEL OBSERVATIONS
WL 2.7' WS
WL B.C.R. A.C.R.
WL Cave-in at 3' while augering

SOIL TESTING SERVICES
OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

BORING STARTED	Oct. 22, 1975
BORING COMPLETED	Oct. 23, 1975
RIG #8	FOREMAN EV
DRAWN KO	APPROVED BMT
JOB # 6971	SHEET 1 of 1

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.



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LOG OF BORING NO. ST-9-60

OWNER	ARCHITECT-ENGINEER
Flambeau Mining Company	
SITE Ladysmith, Wisconsin	PROJECT NAME Proposed Mine Development

DEPTH ELEVATION	SAMPLE NO	TYPE SAMPLE	SAMPLE DIST.	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.3	UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² (1 2 3 4 5) PLASTIC LIMIT % / WATER CONTENT % / LIQUID LIMIT % / STANDARD "N" PENETRATION (BLOWS/FT.) (10 20 30 40 50)
					SURFACE ELEVATION → 1120		
	1	SS			Silty SAND(SM), non to slightly plastic, trace gravel, trace roots, dark brown, wet, loose, outwash		4
	2	SS			Medium SAND(SP), trace gravel, yellowish red, moist, medium dense, outwash		24
5	3	SS			Medium to coarse SAND(SP), some gravel, yellowish red to reddish brown to weak red, moist to waterbearing, very dense, outwash		111
	4	SS					64
10	5	SS					87
					Slighty silty Sandy GRAVEL (GW-GM), weak red, waterbearing, very dense, till		
15	6	SS			* 1' layer of cobbles and boulders at 17' depth		100
					Fine SAND (SP), trace to some gravel, reddish brown, waterbearing, very dense, outwash		
20	7	SS					67
25							58
	8	SS			SANDSTONE, quartz grains ranging in size from fine to coarse at 25' to fine at 35', light gray stained reddish yellow, very weakly cemented, waterbearing		
30	9	SS					62
35							41
	10	SS					50
	11	ST			SAPROLITE, slightly clayey silt(ML), slightly plastic, laminated structure at near vertical orientation; pearly white and yellow changing to dark gray and yellowish brown with depth; moist, very dense	111	
40	12	ST					
	13	ST				131	4.5+
45							
45.7	14	ST				133	
					Continued on next sheet		

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WATER LEVEL OBSERVATIONS			
W.L			
W.L	B.C.R.	A.C.R.	
W.L			

SOIL TESTING SERVICES
OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS 54303

BORING STARTED	Oct. 30, 1975		
BORING COMPLETED	Oct. 30, 1975		
RIG	48	FOREMAN	EV
DRAWN	KO	APPROVED	BMT
JOB #	6971	SHEET	1 of 2

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

OWNER	ARCHITECT-ENGINEER
Flambeau Mining Company	
SITE	**PROJECT NAME**
Ladysmith, Wisconsin	Proposed Mine Development

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	SAMPLE DIST.	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.3	UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² (1 2 3 4 5) · PLASTIC LIMIT % · WATER CONTENT % · LIQUID LIMIT % · STANDARD "N" PENETRATION (BLOWS/FT.) (10 20 30 40 50)
					SURFACE ELEVATION → 1120		
					Continued from previous sheet		
45.7							
	15	SS			SAPROLITE, silt(ML), nonplastic, laminated structure at near vertical orientation, pearly light gray and gray changing to silvery gray and pinkish gray at depth, moist, very dense		
50	16	SS			RQD from 52-1/2 to 53-1/2'=71%		
53.5	17 Run #1	SS DB NX					
					End of Boring		
					Boring advanced to 6 feet by power auger, to 20' by 4" casing, cutting bits & Revert, to 52 1/2' by cutting bits and Revert, to 53 1/2' by DB and Revert		

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WATER LEVEL OBSERVATIONS		
W.L.		
W.L.	B.C.R.	A.C.R.
W.L.		

SOIL TESTING SERVICES
OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

BORING STARTED	Oct 30, 1975		
BORING COMPLETED	Oct. 30, 1975		
RIG	#8	FOREMAN	EV
DRAWN	KO	APPROVED	BMT
JOB #	6971	SHEET	

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

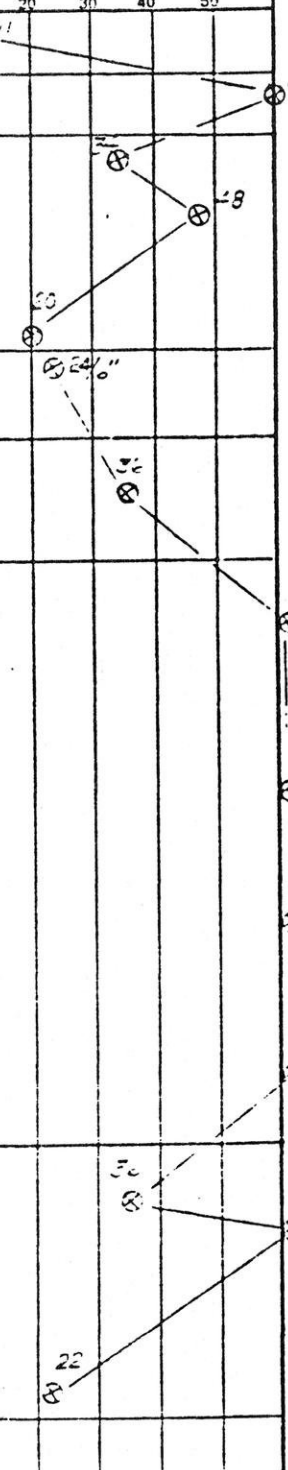
LOG OF BORING NO. ST-9-61

OWNER: Flambeau Mining Company	ARCHITECT-ENGINEER
SITE: Ladysmith, Wisconsin	PROJECT NAME: Proposed Mine Development ST-9-61

SURFACE ELEVATION 1126.7

DEPTH ELEVATION	SAMPLE NO	TYPE SAMPLE	SAMPLE DIST.	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.3
	1	SS			Silty SAND to sandy SILT(SM to ML), nonplastic, trace gravel, yellowish red, moist, medium dense, outwash	
	2	SS			Slightly silty fine to coarse SAND(SW-SM), some gravel, yellowish red, slightly moist, very dense, outwash	
5	3	SS			Uniformly graded fine to medium SAND(SP), trace gravel, yellowish red, slightly moist, medium dense to dense, outwash	
	4	SS				
10	5	SS				
					Fine SAND(SP), trace gravel, reddish brown, slightly moist, dense, outwash	
15	6	SS			Fine to medium SAND(SP), some gravel, reddish brown, slightly moist, dense, outwash	
20	7	SS			Slightly silty sandy GRAVEL (GW-GM), reddish brown, wet, very dense, till (The material recovered in samples 7, 9 & 10 was coarse gravel, but it is our opinion that this material represented a coarse fraction which was not pulverized and washed to the surface. Other borings also encountered till above the sandstone)	
25	8	SS				
30	9	SS				
35						
40	11	SS			Sandstone, quartz grains, layered, with grain sizes ranging from fine to medium and coarse, light gray (stained black in upper portion), weakly cemented to uncemented, waterbearing.	
	12	SS				
45						
46.5	13	SS				
					Continued on next sheet	

UNCONFINED COMPRESSIVE STRENGTH TONS FT.²
1 2 3 4 5
PLASTIC LIMIT % WATER CONTENT % LIQUID LIMIT %
STANDARD "N" PENETRATION (BLOWS/FT)
10 20 30 40 50



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WATER LEVEL OBSERVATIONS

C.R

SOIL TESTING SERVICES
OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

BORING STARTED	Oct. 28, 1975
BORING COMPLETED	Oct. 29, 1975
RIG #8	FOREMAN EV
DRAWN KO	APPROVED BMT
JOB # 6971	SHEET 1 of 2

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

LOG OF BORING NO. ST- 61 (continued)

OWNER	ARCHITECT-ENGINEER
Flambeau Mining Company	ST-9-61 (cont'd)
SITE	**PROJECT NAME**
Ladysmith, Wisconsin	Proposed Mine Development

SURFACE ELEVATION 1126.7

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² (1 2 3 4 5)

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %

STANDARD "N" PENETRATION (BLOWS/FT.) (10 20 30 40 50)

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	SAMPLE DIST.	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT. 3
45					Continued from previous sheet	
46.5					Sandstone, quartz grains, layered, with grain sizes ranging from fine to medium and coarse, light gray (stained black in upper portion), weakly cemented to uncemented, waterbearing	
50	14	ST			SAPROLITE, silty clay (CL), plastic, laminated structure with near vertical orientation, red to reddish brown laminated white to light gray, moist, hard	105
	15	ST				
55	16	ST			SAPROLITE, slightly clayey silt (ML), slightly plastic, cobble of igneous origin at 56' depth, contorted laminated structure, dark gray and dark red, moist, very dense	103
	17	ST				
60	18	ST				96
	19	ST				104
65	20	SS				
65.5					End of Boring	
					Boring advanced to 15' by power augen, to 40' by 4" casing, cutting bit and Revert, to 65 1/2' by cutting bit and Revert	

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WATER LEVEL OBSERVATIONS		
W.L.		
W.L.	B.C.R.	A.C.R.
W.L.		

SOIL TESTING SERVICES OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

BORING STARTED	Oct. 28, 1975
BORING COMPLETED	Oct. 28, 1975
RIG #8	FOREMAN EV
DRAWN KO	APPROVED BMT
JOB # 6971	SHEET 2 of 2

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

LOG OF BORING NO. ST-9-63

OWNER	ARCHITECT-ENGINEER
Flambeau Mining Company	ST-9-63
SITE Ladysmith, Wisconsin	**PROJECT NAME** Proposed Mine Development

DEPTH ELEVATION	SAMPLE NO	TYPE SAMPLE	SAMPLE DIST	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.3	UNCONFINED COMPRESSIVE STRENGTH TONS/FT.2 (1 2 3 4 5) PLASTIC LIMIT % / WATER CONTENT % / LIQUID LIMIT % — STANDARD "N" PENETRATION (BLOWS/FT.) (10 20 30 40 50)
					SURFACE ELEVATION 1116.8		
	1	SS			Slightly silty very fine SAND(SP-SM), yellowish red, moist, medium dense, outwash		12
	2	SS			Gray fine to medium SAND(SP), some gravel , yellowish red, moist, very dense, outwash		8
5	3	SS					
	4	SS			Slighty silty gravelly fine to medium SAND(SW-SM), yellowish red, moist to wet, very dense to dense, till		10
10	5	SS					47
15	6	SS			Sandstone, quartz grains, mostly fine-grained but some layers fine to medium grained, a few seams of sandy silt and sandy clayey silt, white to light gray, waterbearing, uncemented to weakly cemented.		35
20	7	SS					10
25	8	SS					
30	9	SS					
35	10	SS					27
40	11	SS			SAPROLITE, slightly clayey silt (ML), cobbles and pebbles of igneous origin at 53' depth, slightly plastic, laminated structure at near vertical orientation, taicy texture, silvery gray and dark gray, moist, very dense		
	12	SS					
	13	ST					
45					Units FWD 2/88		
45.0	14	ST					
					Continued on next sheet		

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WATER LEVEL OBSERVATIONS			
W.L			
W.L	B.C.R.		A.C.R
W.L			

SOIL TESTING SERVICES
OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

BORING STARTED			Oct. 21, 1975
BORING COMPLETED			Oct. 22, 1975
RIG	#8	FOREMAN	EV
DRAWN	KO	APPROVED	BMT
JOB #	6971	SHEET	1 of 2

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

LOG OF BORING NO. ST-9- (continued)

OWNER Flambeau Mining Company

ARCHITECT-ENGINEER ST-9-63 (cont.)

SITE Ladysmith, Wisconsin

PROJECT NAME Proposed Mine Development

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	SAMPLE DIST.	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.3	UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² (1 2 3 4 5) / PLASTIC LIMIT % / WATER CONTENT % / LIQUID LIMIT % / STANDARD "N" PENETRATION (BLOWS/FT.) (10 20 30 40 50)
					SURFACE ELEVATION 1116.8		
46							
	15	ST				122	
50	16	ST			SAPROLITE, slightly clayey silt(ML), cobbles and pebbles of igneous origin at 53' depth, slightly plastic, laminated structure at near vertical irientation, talcy texture, silvery gray and dark gray, moist, very dense		
	17	ST					
55					Unit 5 F+VD 2/82		
58.0	18	ST					
					End of Boring		

Boring advanced to 6' by power auger, to 17' by 4" casing, roller bit and Revert, to 58' by roller bit and Revert

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WATER LEVEL OBSERVATIONS

W.L.

W.L. B.C.R. A.C.R

W.L.

SOIL TESTING SERVICES OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

BORING STARTED Oct. 21, 1975
BORING COMPLETED Oct. 22, 1975
RIG #8 FOREMAN EV
DRAWN KO APPROVED BMT
JOB # 6971 SHEET 2 of 2

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

LOG OF BORING NO. ST-9-64

OWNER	ARCHITECT-ENGINEER
Flambeau Mining Company	ST-9-64
SITE Ladysmith, Wisconsin	**PROJECT NAME** Proposed Mine Development

DEPTH ELEVATION	SAMPLE NO	TYPE SAMPLE	SAMPLE DIST	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT. 3	UNCONFINED COMPRESSIVE STRENGTH TONS/FT² (1 2 3 4 5) · PLASTIC LIMIT % · WATER CONTENT % · LIQUID LIMIT % · STANDARD "N" PENETRATION (BLOWS/FT) (10 20 30 40 50)
					SURFACE ELEVATION 1126.3		
	1	SS			Silty SAND(SM), nonplastic, trace roots, yellowish red, moist, loose, outwash		4
	2	SS			Very fine sandy SILT(ML), nonplastic, lens of slightly organic silt, seam slightly silty fine sand, reddish brown, moist, medium dense, outwash		11
5	3	SS			Silty sandy GRAVEL (GW-GM), nonplastic, reddish brown, moist, very dense, till		64
	4	SS			Fine and fine to medium SAND(SP), trace gravel, reddish brown, moist, outwash		53
10	5	SS					62
15	6	SS			Silty fine SAND (SM), non to slightly plastic, trace gravel, reddish brown, wet, very dense to dense, till (Two attempts made to recover sample at 15'-16' depth)		50/3"
20	7	SS					45
25	8	SS			Sandstone, quartz grains, layers ranging in grain size from very fine sand to silt size at 25' to medium to coarse sand-size at 35', white and light gray, laminated with pale yellow at 25', pale brown at 40', waterbearing, weakly cemented		50/3"
30	9	SS					50/3"
35	10	SS					50/3"
40	11	SS					50/3"
45	12	ST			SAPROLITE, silt(ML), nonplastic, laminated structure at near vertical orientation, gray and light gray, pearly lustre and talcy texture, moist, very dense		
					Continued on next sheet		

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WATER LEVEL OBSERVATIONS		
W.L		
W.L	B.C.R.	A.C.R.
W.L		

SOIL TESTING SERVICES
OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

BORING STARTED	Nov. 4, 1975		
BORING COMPLETED	Nov. 4, 1975		
RIG	28	FOREMAN	EV
DRAWN	KO	APPROVED	BMT
JOB #	6971	SHEET	1 of 2

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

LOG OF BORING NO. ST-9-64 (continued)

OWNER	ARCHITECT-ENGINEER
Flambeau Mining Company	ST-9-64 cont.
SITE Ladysmith, Wisconsin	**PROJECT NAME** Proposed Mine Development

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	SAMPLE DIST.	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.3	UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² (1 2 3 4 5) / PLASTIC LIMIT % / WATER CONTENT % / LIQUID LIMIT % / STANDARD "N" PENETRATION (BLOWS/FT.) (10 20 30 40 50)
					SURFACE ELEVATION 1126.3		
					Continued from previous sheet		
45.4							
	13	SS			SAPROLITE, silt(ML), nonplastic, laminated structure at near vetical orientation, gray and light gray, pearly lustre and talcy texture, moist, very dense		
50	14	SS					
	15	SS					
55							
55.3	16	SS					
					End of Boring		
					Boring advanced to 10' by power auger, to 11' by 4" casing, cutting bit and Revert, to 55.3' by cutting bit and Revert		

BEST COPY AVAILABLE

WATER LEVEL OBSERVATIONS		
W.L	4.9' WD	
W.L.	B.C.R.	A.C.R.
W.L.		

SOIL TESTING SERVICES
OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

BORING STARTED	Nov. 4, 1975		
BORING COMPLETED	Nov. 4, 1975		
RIG	#8	FOREMAN	EV
DRAWN	KO	APPROVED	BMT
JOB #	6971	SHEET	2 of 2

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

ST-9-65

Flambeau Mining Company

SITE: Ladysmith, Wisconsin

PROJECT NAME: Proposed Mine Development

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS/CU. FT.	UNCONFINED COMPRESSIVE STRENGTH TONS/SQ. FT.
			SURFACE ELEVATION 1122		
	1	SS	8" topsoil underlain by 4' of [illegible] very fine SAND(SM), nonplastic, yellowish red, moist, loose to medium dense, outwash		
	2	SS			
	3	SS	Slightly silty fine to coarse SAND(SW-SM), some gravel, yellowish red, dry, very dense, outwash		
	4	SS	Fine to medium SAND(SP), a few lenses of silt, yellowish red, slightly moist, dense, outwash		
10	5	SS	Slightly silty fine to coarse SAND(SW-SM), some gravel, yellowish red, wet, very dense, till		
15	6	SS			
	7	SS	Sandstone, quartz grains, mostly fine-grained with a layer of silt-size grains at 20' and medium sand-size grains at 30', white mottled gray and pink, weakly cemented		
20	8	SS			
	9	SS			
25	10	SS			
	11	SS			
30	12	SS			
	13	SS			
35	14	SS			
	15	SS	SAPROLITE, slightly clayey silt (ML), slightly plastic, laminated structure at near vertical orientation, light yellowish brown, reddish brown, reddish yellow and olive brown, flaky texture, moist, very dense	116	
	16				
	17				
			SAPROLITE, clayey silt(ML), plastic, pearly white mottled reddish yellow, moist, very dense		
			End of Boring Boring advanced to 10' by [illegible] and [illegible], to 15' by [illegible] bit and [illegible], to 45.7' by [illegible] bit and [illegible], to 50.7' by diamond bit and [illegible]		

WATER LEVEL OBSERVATION

SOIL TESTING SERVICES

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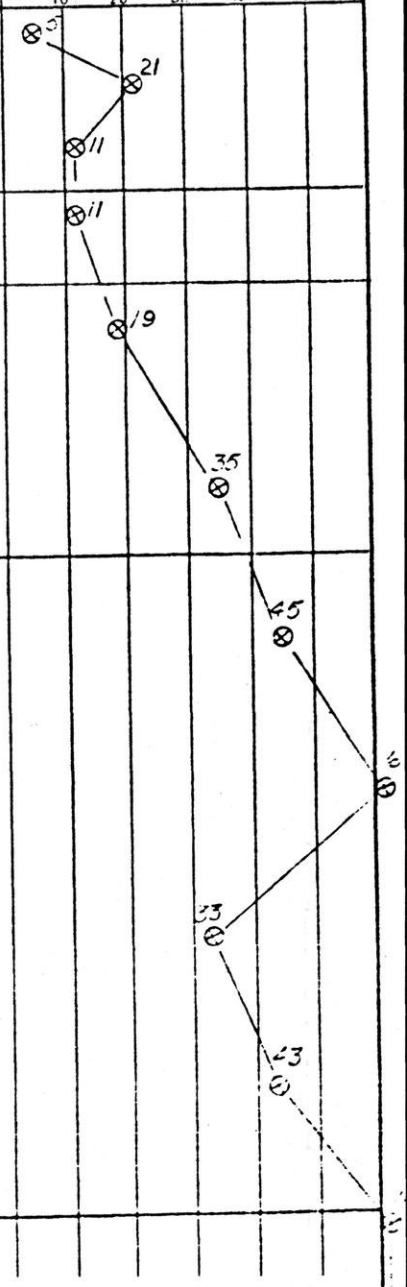
LOG OF BORING NO. ST-9-66

OWNER Flambeau Mining Company	ARCHITECT-ENGINEER ST-9-66
SITE Ladysmith, Wisconsin	PROJECT NAME Proposed Mine Development

DEPTH ELEVATION	SAMPLE NO	TYPE SAMPLE	SAMPLE DIST	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS/FT.3
					SURFACE ELEVATION 1144	
	1	SS			Silty very fine SAND(SM), nonplastic, yellowish red, moist, loose to medium dense, outwash	
	2	SS				
5	3	SS				
	4	SS			Silty fine SAND (SM), nonplastic, trace gravel, moist, medium dense, outwash	
10	5	SS			Fine to medium SAND (SP), trace gravel, yellowish red to reddish brown, moist, medium dense to dense, outwash	
15	6	SS				
20	7	SS			Silty fine SAND (SM), nonplastic, trace gravel, red, moist, dense to very dense, till	
25	8	SS				
30	9	SS				
35	10	SS				
40	11	SS			Sandstone, quartz grains in sizes ranging from silt-size to medium sand-size, white mottled dark gray and reddish yellow, weakly cemented	
45	12	SS				
					Continued on next sheet	

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.²
1 2 3 4 5
PLASTIC LIMIT % WATER CONTENT % LIQUID LIMIT %
STANDARD "N" PENETRATION (BLOWS/FT.)
10 20 30 40 50



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WATER LEVEL OBSERVATIONS		
W.L.	5.3' WS	
W.L.	BCR	ACR
W.L.		

SOIL TESTING SERVICES
OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS 54303

BORING STARTED	Oct. 15, 1975
BORING COMPLETED	Oct. 20, 1975
RIG 8	FOREMAN EV
DRAWN KÖ	APPROVED BMT
JOB # 6971	SHEET 1 of 2

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

LOG OF BORING NO. ST-9-66 (continued)

OWNER: Flambeau Mining Company

ARCHITECT-ENGINEER: ST-9-66 cont.

SITE: Ladysmith, Wisconsin

PROJECT NAME: Proposed Mine Development

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	SAMPLE DIST.	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.³	UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² (1 2 3 4 5) / PLASTIC LIMIT % / WATER CONTENT % / LIQUID LIMIT % / STANDARD "N" PENETRATION (BLOWS/FT.) (10 20 30 40 50)
					SURFACE ELEVATION → 1144		
					Continued from previous sheet		
45.2							
					Sandstone, quartz grains in sizes ranging from silt-size to medium sand-size, white mottled dark gray and reddish yellow weakly cemented		
50	13	SS					
					<2		
	14	SS					
	15	SS					
55	Run #1	DB BX					
					SAPROLITE, slightly clayey silt(ML), slightly plastic, foliated in near vertical orientation, light gray and white marbled red and yellow, pearly lustre, moist, very dense	118	
60	Run #2	DB BX					
	16	ST				119	
	17	ST					4.5+
65							
	18	ST					
	Run #3	DB BX			SAPROLITE, silt(ML), laminated structure at near vertical orientation, light gray mottled red,		
68.3	19	SS			moist, very dense		
					End of Boring		
					Boring advanced to 10' by power auger, to 30' by 4' casing, cutting bit and Revert, to 55' by NX casing, cutting bit and Revert, to 68.3' by diamond bit, cutting bit and Revert		

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WATER LEVEL OBSERVATIONS

W.L.	5.3' WS		
W.L.	B.C.R.	A.C.R.	
W.L.			

SOIL TESTING SERVICES
OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

BORING STARTED	Oct. 15, 1975		
BORING COMPLETED	Oct. 20, 1975		
RIG	#8	FOREMAN	EV
DRAWN	KO	APPROVED	BMT
JOB #	6971	SHEET	2 of 2

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

LOG OF BORING NO. ST-9-67

OWNER	ARCHITECT-ENGINEER
Flambeau Mining Company	ST-9-67
SITE	**PROJECT NAME**
Ladysmith, Wisconsin	Proposed Mine Development

DEPTH ELEVATION	SAMPLE NO	TYPE SAMPLE	SAMPLE DIST.	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.3	UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² (1 2 3 4 5) · PLASTIC LIMIT % · WATER CONTENT % · LIQUID LIMIT % · STANDARD "N" PENETRATION (BLOWS/FT.) (10 20 30 40 50)
					SURFACE ELEVATION 1135		
	1	SS			Silty very fine SAND (SM), nonplastic, reddish brown to yellowish brown, moist, loose to medium dense, outwash		3 16
	2	SS					
5	3	SS			Silty fine to coarse SAND (SM), nonplastic, some gravel, reddish brown, slightly moist, very dense, till		61
	4	SS			Fine to coarse SAND (SP), some gravel, reddish brown, slightly moist, outwash		50
10	5	SS			Slightly silty very fine SAND (SP-SM), reddish brown, moist, medium dense, outwash		17
15	6	SS			Silty fine SAND (SM), trace gravel, lenses of SAND, reddish brown, wet, medium dense, till		15
20	7	SS			Slightly silty fine SAND (SP-SM) and silty SAND (SM), some gravel, reddish brown to red, wet, very dense, till		50/5"
25	8	SS					50/5"
30	9	SS					50/10"
	10	SS					50/3"
35	11	SS			Sandstone; quartz grains; mostly silt-sized particles from 32 to 38.6' with a trace of clay. Mostly fine to medium sand-sized grains from 38.6 to 49.8' except for some seams and layers of silt-sized grains; upper 6.6' light gray with streaks of yellowish red and dark brown, lower 11.2' is light gray banded with yellow, black, and reddish yellow; waterbearing; weakly cemented		
	Run 1 #1	BX					
	Run 1 #2	BX					
40	Run 2 #3	BX					
45							
46.1							
					Continued on next sheet		

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WATER LEVEL OBSERVATIONS

WL
WL
WL

SOIL TESTING SERVICES
OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

BORING STARTED	Oct. 16, 1975
BORING COMPLETED	Oct. 20, 1975
RIG 8	FOREMAN EV
DRAWN KO	APPROVED BMT
JOB # 6971	SHEET 1 of 2

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

LOG OF BORING NO ST-9- (cont'd)

OWNER: Flambeau Mining Company

ARCHITECT-ENGINEER: ST-9-67 cont

SITE: Ladysmith, Wisconsin

PROJECT NAME: Proposed Mine Development

DEPTH ELEVATION	SAMPLE NO.	TYPE SAMPLE	SAMPLE DIST. RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.3	UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² (1 2 3 4 5) / PLASTIC LIMIT % / WATER CONTENT % / LIQUID LIMIT % / STANDARD "N" PENETRATION (BLOWS/FT.) (10 20 30 40 50)
				SURFACE ELEVATION 1135		
46.1				Continued from previous sheet		
	Run #4	DB NX		Sandstone (continued)		
50				SAPROLITE, clayey silt(ML), plastic, laminated structure at near vertical orientation; yellowish red and red, silvery gray and yellowish red below 55'; talcy texture, moist, very dense RQD from 46.1 to 51.1'=0% RQD from 51.1 to 51.9'= 78%		
	Run #5	DB NX				
	12	ST			110	O* 1.5+
55						
	13	ST			130	O* 1.5+
	14	ST				
60				SAPROLITE, slightly clayey silt(ML), slightly plastic, laminated structure with near vertical orientation, silvery gray and dark gray, moist, very dense RQD from 62-1/2 to 67-1/2=63%		
	15	ST				
	16	SS				
	17	SS				
	Run #6	DB NX				
65						
67.5				End of Boring Boring advanced to 10' by power auger, to 15' by 4" casing, cutting bit and Revert, to 35.7' by cutting bit and Revert to 51.9' by diamond bit and Revert to 62.5' by cutting bit and Revert, to 67.5' by diamond bit and Revert		
70						

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WATER LEVEL OBSERVATIONS

W.L.		
W.L.	B.C.R.	A.C.R.
W.L.		

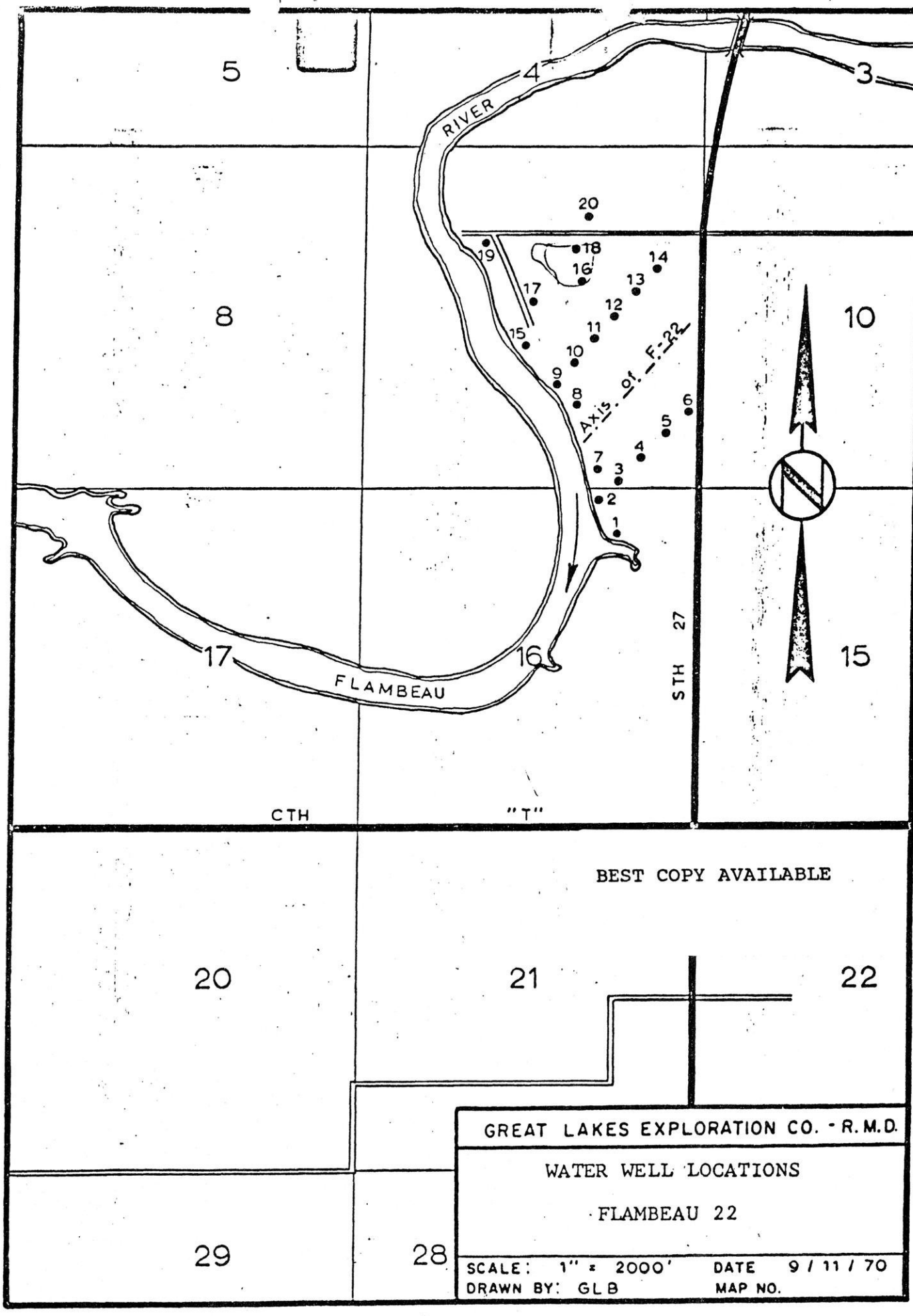
SOIL TESTING SERVICES
OF WIS., INC.
540 LAMBEAU STREET
GREEN BAY, WIS. 54303

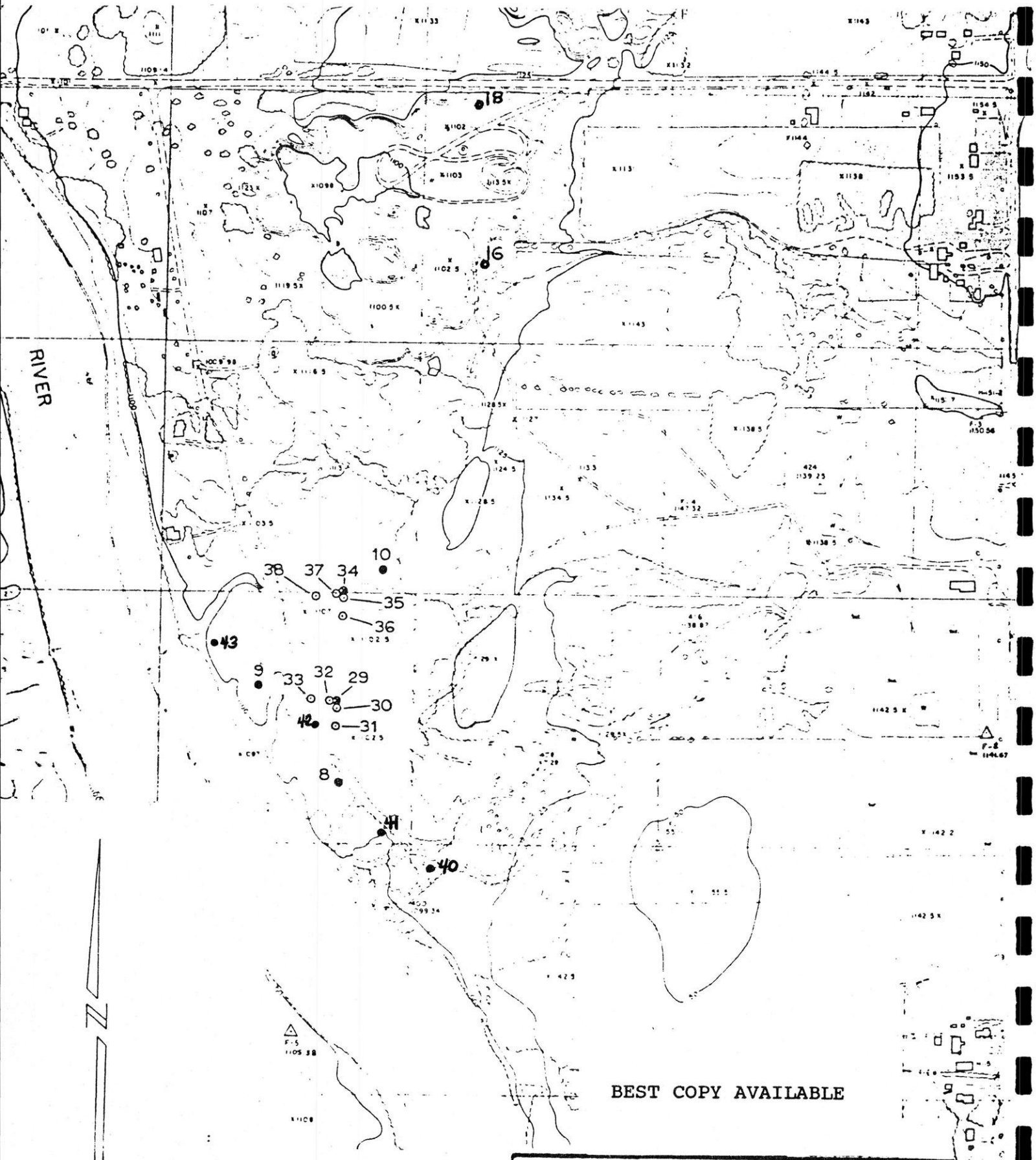
BORING STARTED	Oct 16, 1975		
BORING COMPLETED	Oct. 20, 1975		
RIG	8	FOREMAN	EV
DRAWN	KO	APPROVED	BMT
JOB #	6971	SHEET	2 of 2

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

APPENDIX 3.5-C

Logs of Water Wells Completed in 1970, 1971 and 1972


5
4
3
RIVER
20
19
18
16
14
13
17
12
8
15
11
10
10
9
AXIS OF F-22
8
6
5
4
7
3
2
1
17
16
FLAMBEAU
STH 27
15
CTH "T"
BEST COPY AVAILABLE
20
21
22
29
28
GREAT LAKES EXPLORATION CO. - R.M.D.
WATER WELL LOCATIONS
FLAMBEAU 22
SCALE: 1" = 2000'
DATE 9 / 11 / 70
DRAWN BY: GLB
MAP NO.



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LEGEND

⊙ = 1971 Observation Wells

● = Pump Test Wells

● = 1970 Observation Wells

3.5-C-2

FLAMBEAU MINING CORP.

TEST WELLS 1971 and 1972

SCALE: 1" = 500' DATE 3 / 15 / 71

DRAWN BY GLB MAP NO -A-

GREAT LAKES EXPLORATION

FLAMBEAU 22

Well No 1 (OW-1)

FtVD 2/89

SECTION

COORDINATES 38,383.93 N, 39,841.78 E

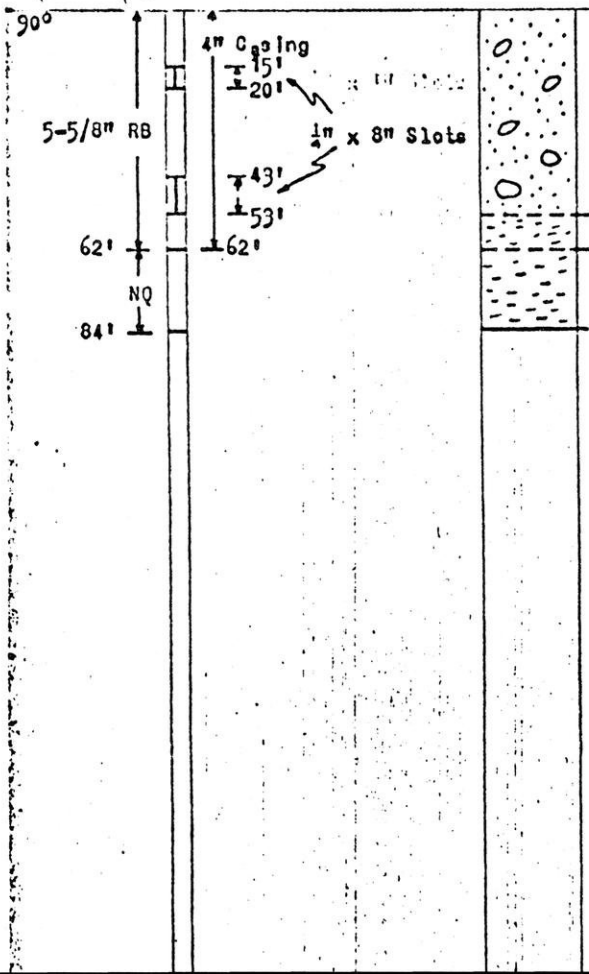
AZIMUTH

ELEVATION

DATE STARTED 8/14/70
COMPLETED 8/17/70

LENGTH OF HOLE 84 ft.

% RECOVERY



0-53'	PLEISTOCENE TILL:
53-62'	PRECAMBRIAN SCHIST (?):
62-84'	PHYLLITE: Ash grey, aphanitic, very finely lam., few coarse bio. flakes, good fol., soft, weathered. C - B angle 16°.
84'	END OF HOLE

3.5-C-3

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GREAT LAKES EXPLORATION

FLAMBEAU 22

Well No 2-S (OW-2)

FWD 7/89

SECTION

COORDINATES

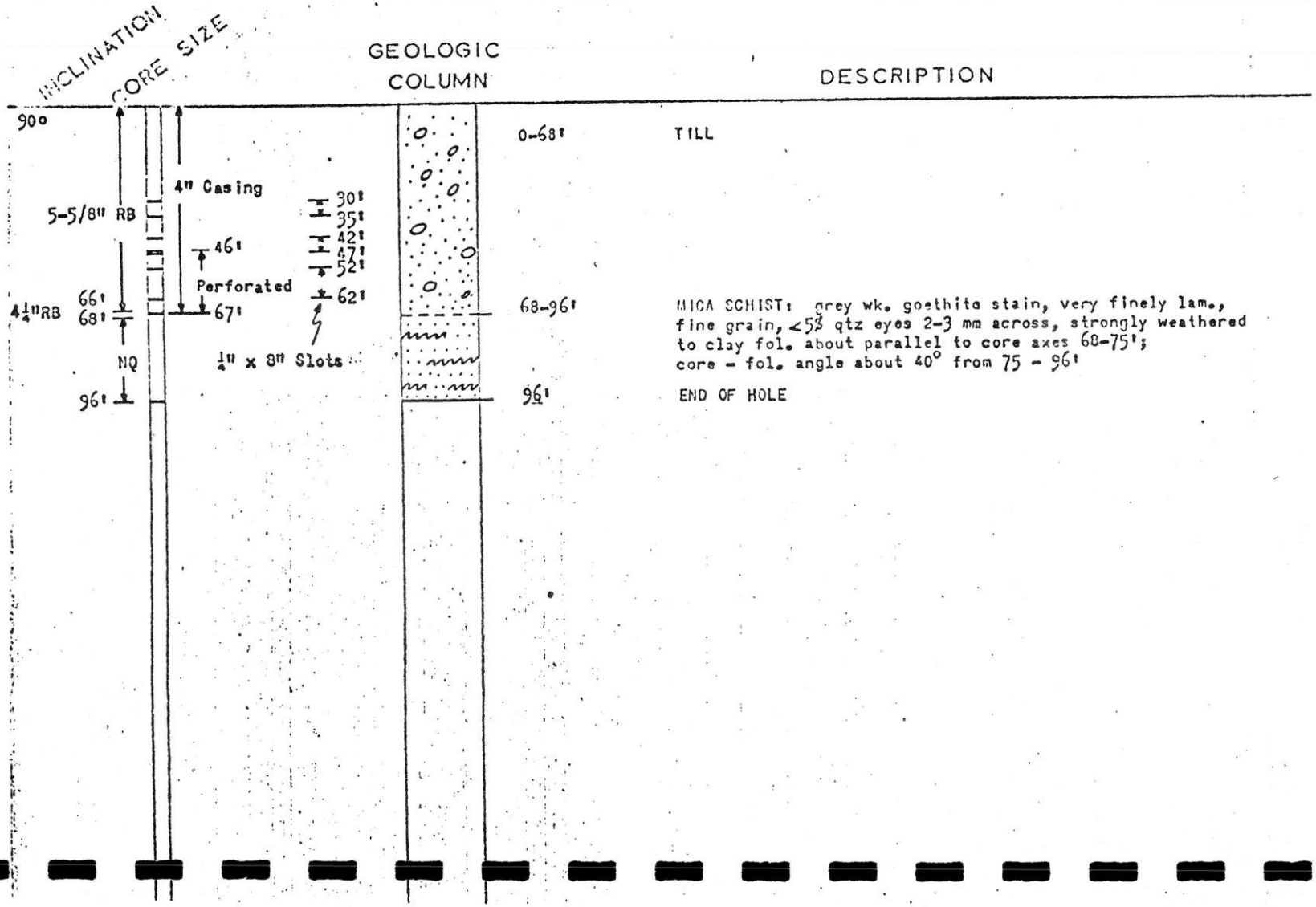
AZIMUTH

ELEVATION

DATE STARTED 7/9/70
DATE COMPLETED 7/13/70

LENGTH OF HOLE 96 ft.

% RECOVERY



3.5-C-4

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GREAT LAKES EXPLORATION

FLAMBEAU 22

Well No. 3 (OW-3)

F+UD 7/89

SECTION

COORDINATES 39,397.76 N, 40,004.73 E

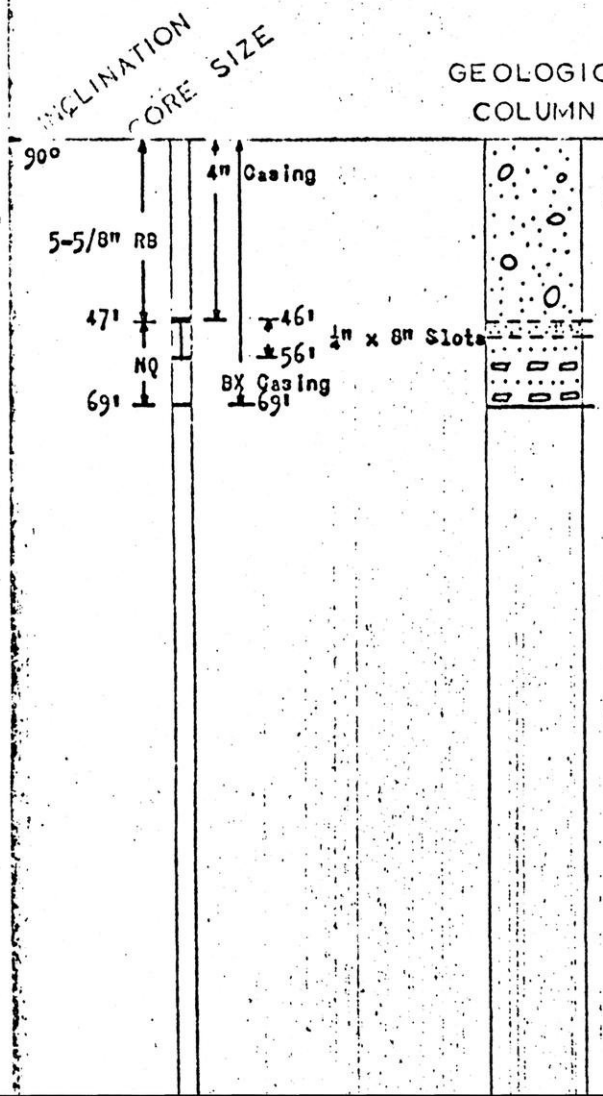
AZIMUTH

ELEVATION 1133.50 ft.

DATE STARTED 8/13/70
DATE COMPLETED 8/14/70

LENGTH OF HOLE 69 ft.

% RECOVERY



	DESCRIPTION
0-47'	PLEISTOCENE TILL:
47-51'	CAMBRIAN SANDSTONE: Wh., stained yellow, med.-coarse grain, some granule sized clasts soft, friable, grains very well rounded.
51-69'	META-CRYSTAL TUFF: Pinkish-grey, >50% xls of qtz and fldspr. up to 3 mm. in aphonitic matrix, discontinuous bio. layers <1 mm. th. define mod. fol.; soft, weathered fldspr. argillitized. C - B angle 40°.
69'	END OF HOLE.

3.5-C-5

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GREAT LAKES EXPLORATION

FLAMBEAU 22

Well No 4-S (OW-4) F+VD 2/89

SECTION

COORDINATES

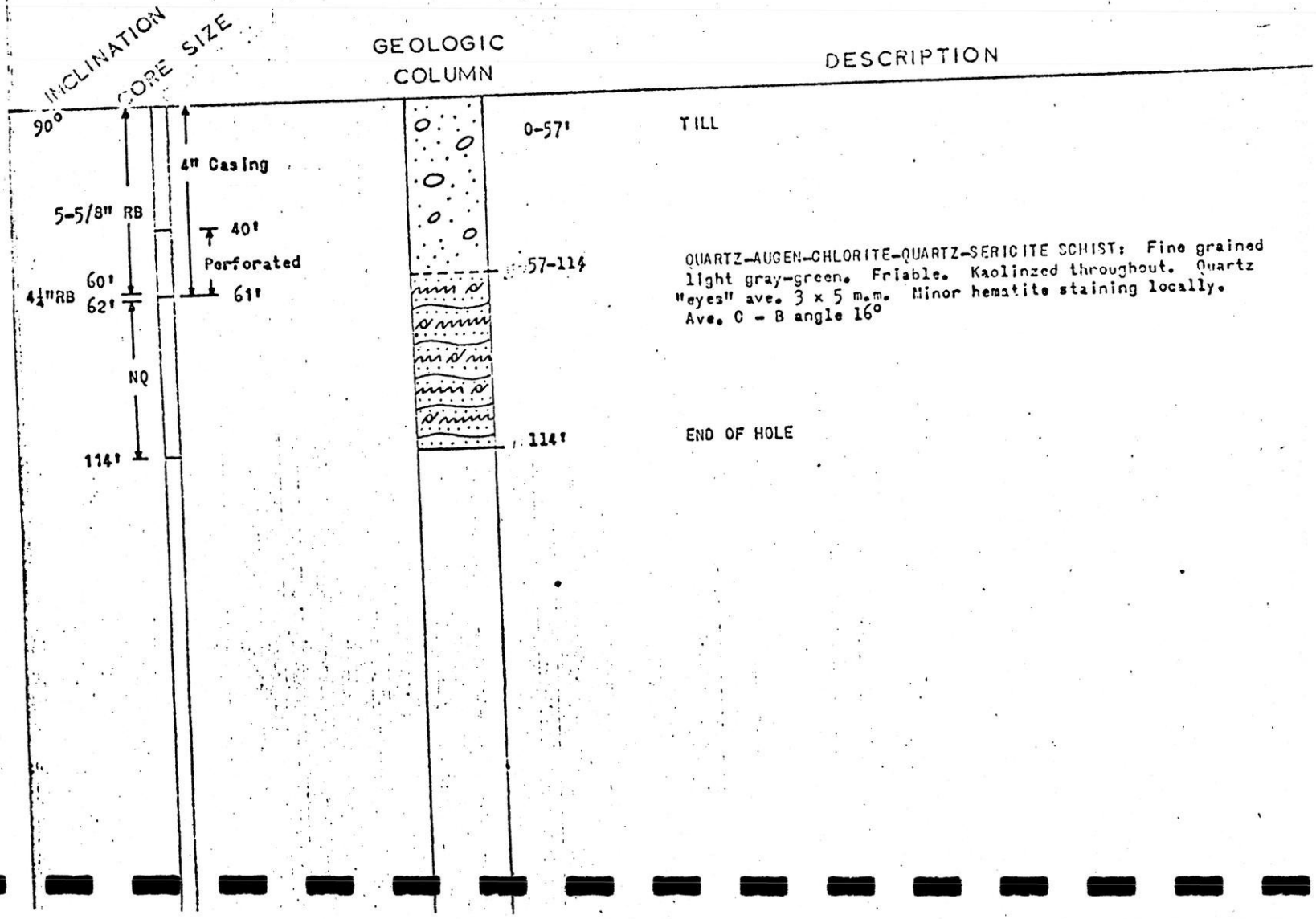
AZIMUTH

ELEVATION

DATE STARTED 7/6/70
DATE COMPLETED 7/8/70

LENGTH OF HOLE 114 ft.

% RECOVERY



3.5-C-6

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GREAT LAKES EXPLORATION

FLAMBEAU 22

Well No 5-T (ow-5) 2/89

SECTION

COORDINATES ~N 40,110 E 40,710 F+VD 1/89

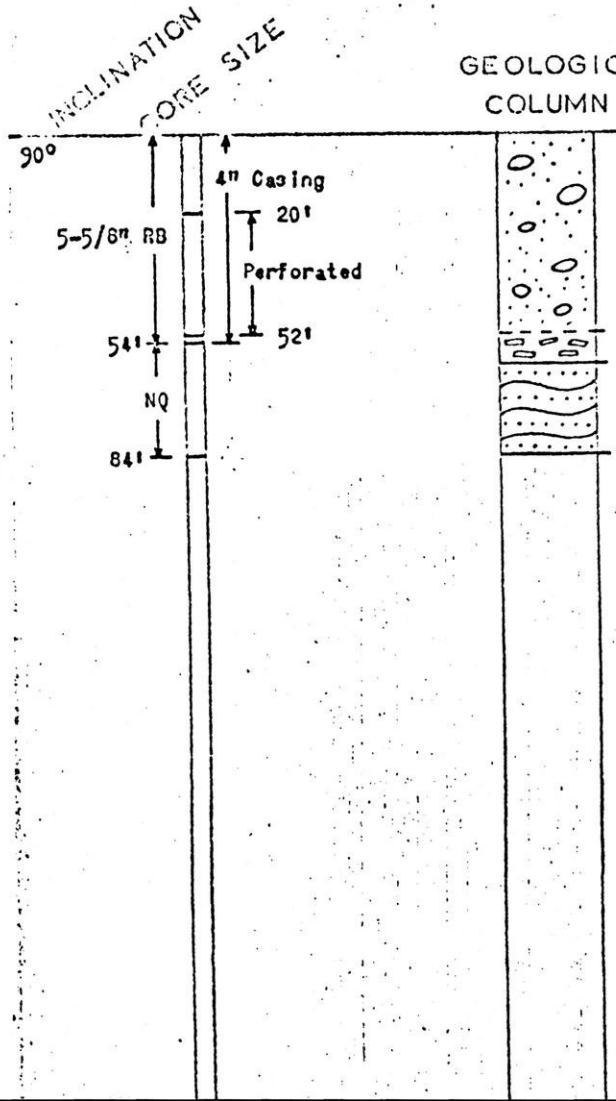
AZIMUTH

ELEVATION

DATE STARTED 6/29/70
COMPLETED 7/6/70

LENGTH OF HOLE 84 ft.

% RECOVERY



GEOLOGIC COLUMN

	DESCRIPTION
0-52'	PLEISTOCENE TILL:
52-60'	CRYSTAL TUFF: Fine grained groundmass. Ave. 3 x 4 mm. Kaolinized. Feldspar xls and fragments are subhedral, angular and some tend to be rounded. Color is 2' light green chloritic, 2' red hematitic and 2' dirty white. 59-60; Finer fragments and bedding - white color. Metallic dark gray subhedral xls ∠0.5%. Tight folding around 60
60-84'	QUARTZ-CHLORITE SCHIST: Sharp contact. Fine grained, light green and purplish red.
84'	END OF HOLE

3.5-C-7

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GREAT LAKES EXPLORATION

FLAMBEAU 22

Well No 6-S (OW-6)

F+VD 2/89

SECTION

COORDINATES ~ N 40,375 E 40,975 F+VD 1/89

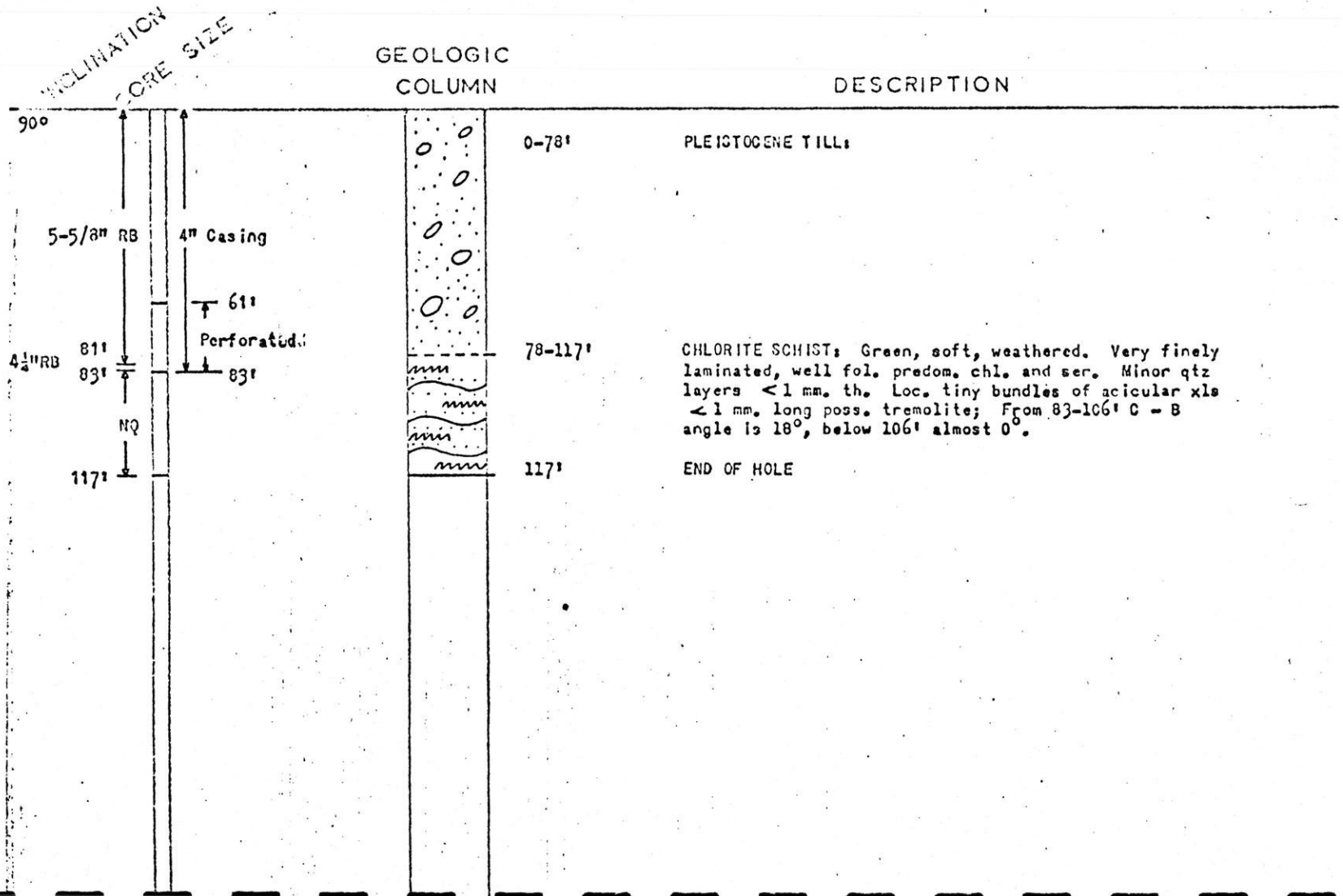
AZIMUTH

ELEVATION

DATE STARTED 6/1/70
COMPLETED 6/26/70

LENGTH OF HOLE 117 ft.

% RECOVERY



3.5-C-8

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GREAT LAKES EXPLORATION

FLAMBEAU 22

Well No. 7-T (OW-7)
FND 2/89

SECTION

COORDINATES

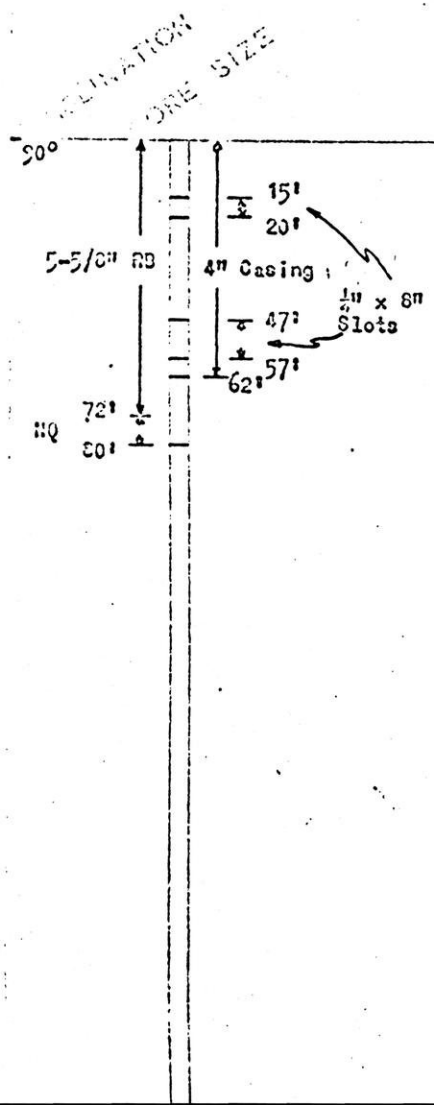
AZIMUTH

ELEVATION

DATE STARTED 7/14/70
COMPLETED 7/16/70

LENGTH OF HOLE 80 ft.

% RECOVERY



GEOLOGIC COLUMN

DESCRIPTION

0-57'	PLEISTOCENE TILL:
57-72'	PRE-CAMBRIAN, ROTARY TRICONE, 1' th. qtz. vein cored at 53'.
72-80'	MICA-QUARTZ SCHIST, wh., qtz. rich layers 2-5mm, alternate with clay layers highly weathered; mod gooth. stain.
80'	END OF HOLE:

3.5-C-9

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GREAT LAKES EXPLORATION

FLAMBEAU 22

Well No 8-T (OW-8)

F+VD 2/89

SECTION

COORDINATES

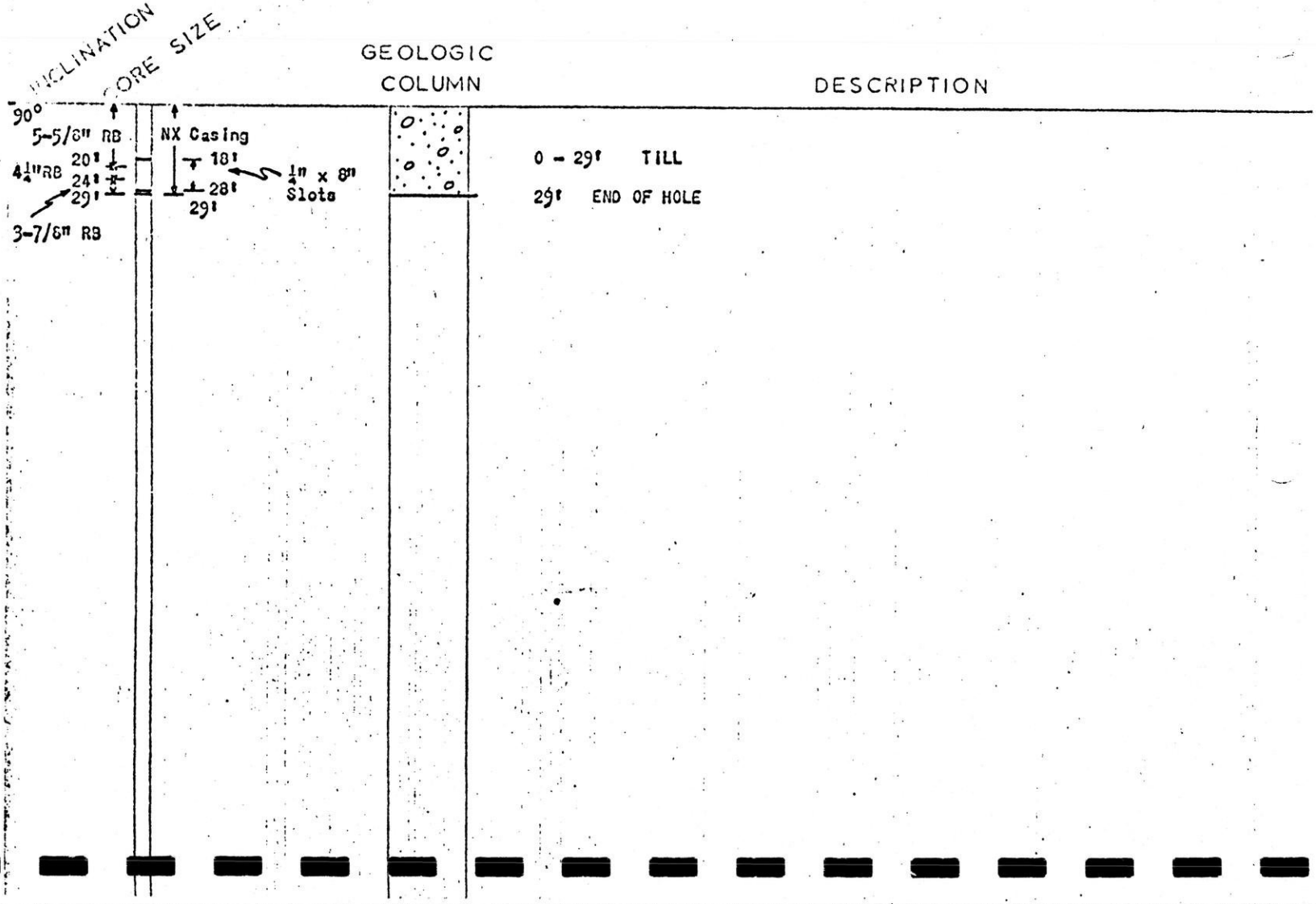
AZIMUTH

ELEVATION

DATE STARTED 7/17/70
COMPLETED 7/20/70

LENGTH OF HOLE 29 ft.

% RECOVERY



3.5-C-10

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GREAT LAKES EXPLORATION

FLAMBEAU 22

Well No 9-S (OW-9)

F+VD 2/89

SECTION

COORDINATES

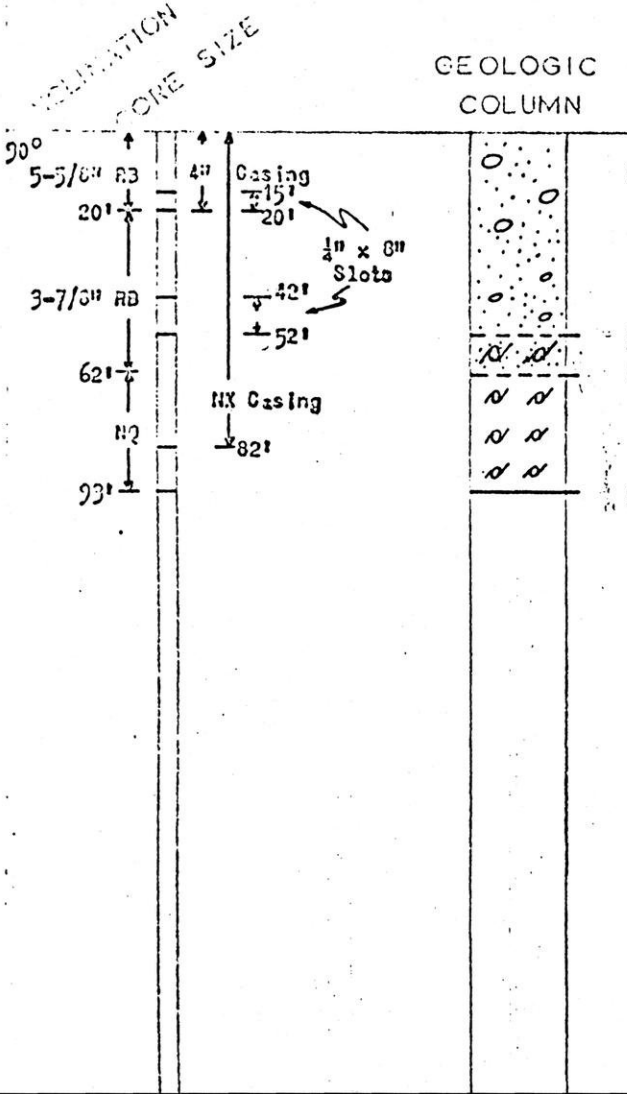
AZIMUTH

ELEVATION

DATE STARTED 7/21/70
COMPLETED 7/22/70

LENGTH OF HOLE 93 ft.

% RECOVERY



GEOLOGIC COLUMN

DESCRIPTION

0-52'	PLEISTOCENE TILL:
52-62'	PRE-CAMBRIAN SCHIST (?):
62-93'	QUARTZ-AUGEN SCHIST, wh., very strong weathered, soft, 10% qtz. eyes in fine grain matrix of ser. and clay, recovery is poor, mass, wh. vein qtz. 57-59, 91-93, several 3" - 6" qtz. veins between 66-75'.
93	END OF HOLE:

3.5-C-11

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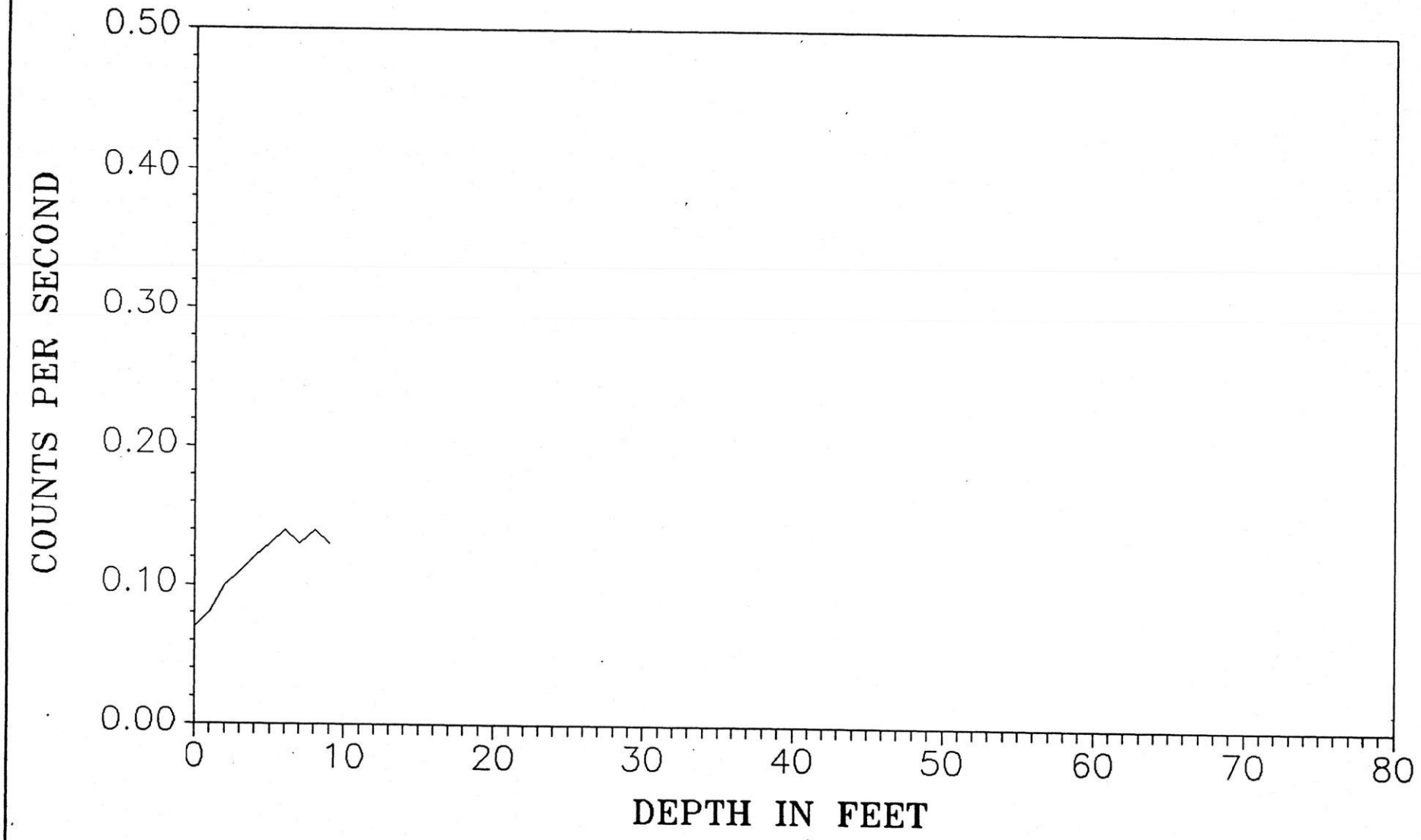


DATA TAKEN 1-13-89 BY BJS
TIME CONSTANT = 5 SECONDS
RANGE SETTING = 20 K

FOTH & VAN DYKE
GEOSCIENCES & ENVIRONMENTAL MANAGEMENT DIVISION
GREEN BAY, WISCONSIN

KENNECOTT MINERALS COMPANY
FLAMBEAU PROJECT
LADYSMITH, WISCONSIN

GAMMA LOG
WELL OW-9

No	REVISIONS	NOTES	APPROVAL	DATE
			DESIGNED BY	
			DRAWN BY SJL	2/89
			CHECKED BY	
			APPROVED BY	
			CAD No.	SCALE AS SHOWN

Job No | Dwg No | REV

GREAT LAKES EXPLORATION

FLAMBEAU 22

Well No 10-T (OW-10)

FHVD 2/89

SECTION

COORDINATES

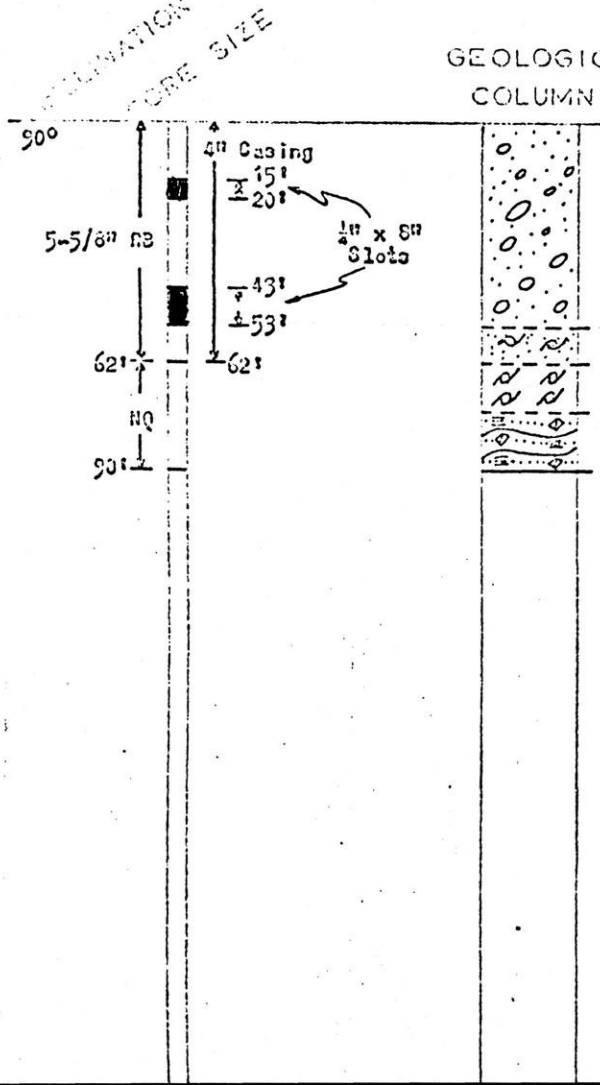
AZIMUTH

ELEVATION 1111.88 grd 1112.23 Casing (FHVD 1/89)

DATE STARTED 7/22/70
COMPLETED 7/23/70

LENGTH OF HOLE 90 ft.

% RECOVERY



	DESCRIPTION
0-53'	PLEISTOCENE TILL:
53-62'	PRE-CAMBRIAN SCHIST (?):
62-75'	QUARTZ-AUGEN SCHIST, lt. grey, soft, highly weathered, 5-10% qtz. eyes up to 3mm in very finely fol. matrix of ser. and minor qtz. , Ave. c-b angle is 17°.
75-90'	ANDALUSITE-BIOTITE-QUARTZ-CHLORITE SCHIST, well fol., very fine qtz. - ser. lam. (also ser.?) some 6" intervals with 20% andalusite xls. gen. <5%, loc. 30% coarse bio. plates which parallel bd., few qtz. eyes; soft weathered hem. stain 85-90', Ave. c-b angle is 27°.
90'	END OF HOLE:

BTW 18.9'

3.5-C-13

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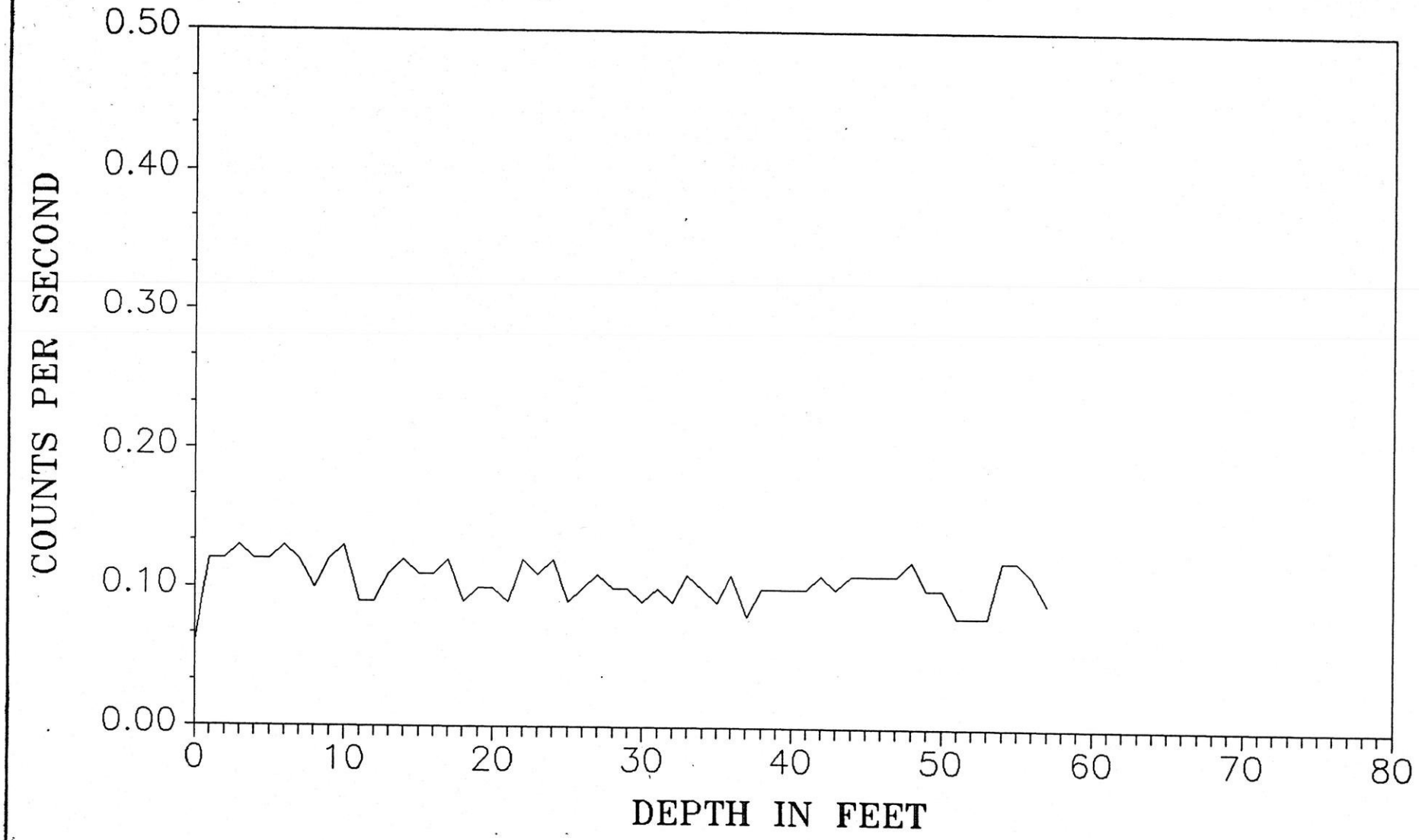


DATA TAKEN 1-13-89 BY BJS
TIME CONSTANT = 5 SECONDS
RANGE SETTING = 20 K

FOTH & VAN DYKE
GEOSCIENCES & ENVIRONMENTAL MANAGEMENT DIVISION
GREEN BAY, WISCONSIN

KENNECOTT MINERALS COMPANY
FLAMBEAU PROJECT
LADYSMITH, WISCONSIN

GAMMA LOG
WELL OW-10

No	REVISIONS	NOTES	APPROVAL	DATE
			DESIGNED BY	
			DRAWN BY SJL	2/89
			CHECKED BY	
			APPROVED BY	
			CAD No.	SCALE AS SHOWN

Job No | Dwg No | REV

GREAT LAKES EXPLORATION

FLAMBEAU 22

Well No 11-3 (OW-11)

F+VD 2/89

SECTION -

COORDINATES 41,344.8 N, 39,117.7 E

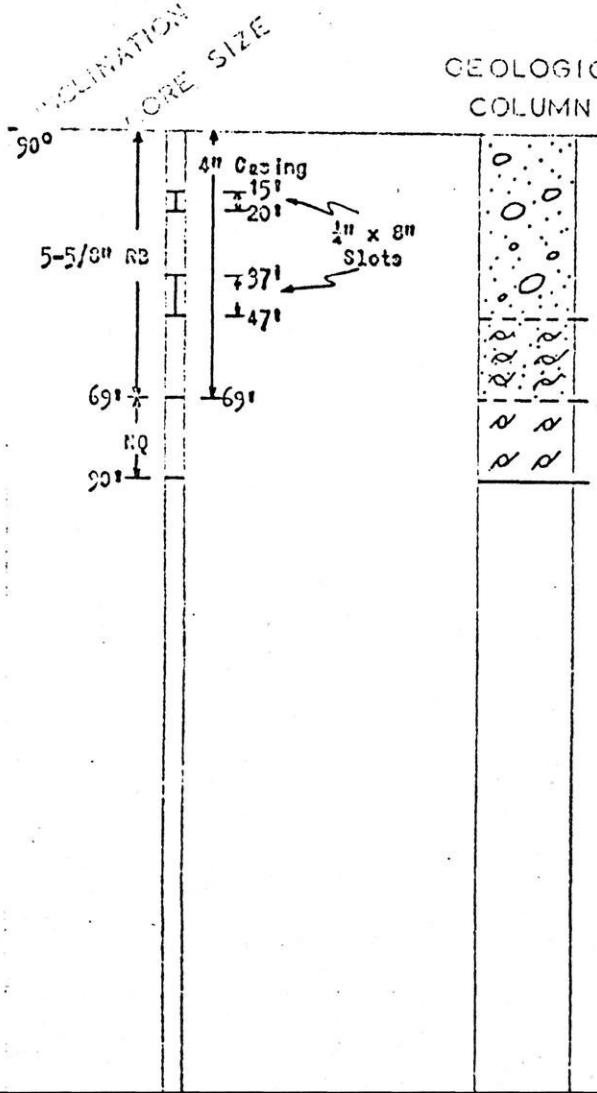
AZIMUTH

ELEVATION 1125.00 ft.

DATE STARTED 7/23/70
COMPLETED 7/28/70

LENGTH OF HOLE 90 ft.

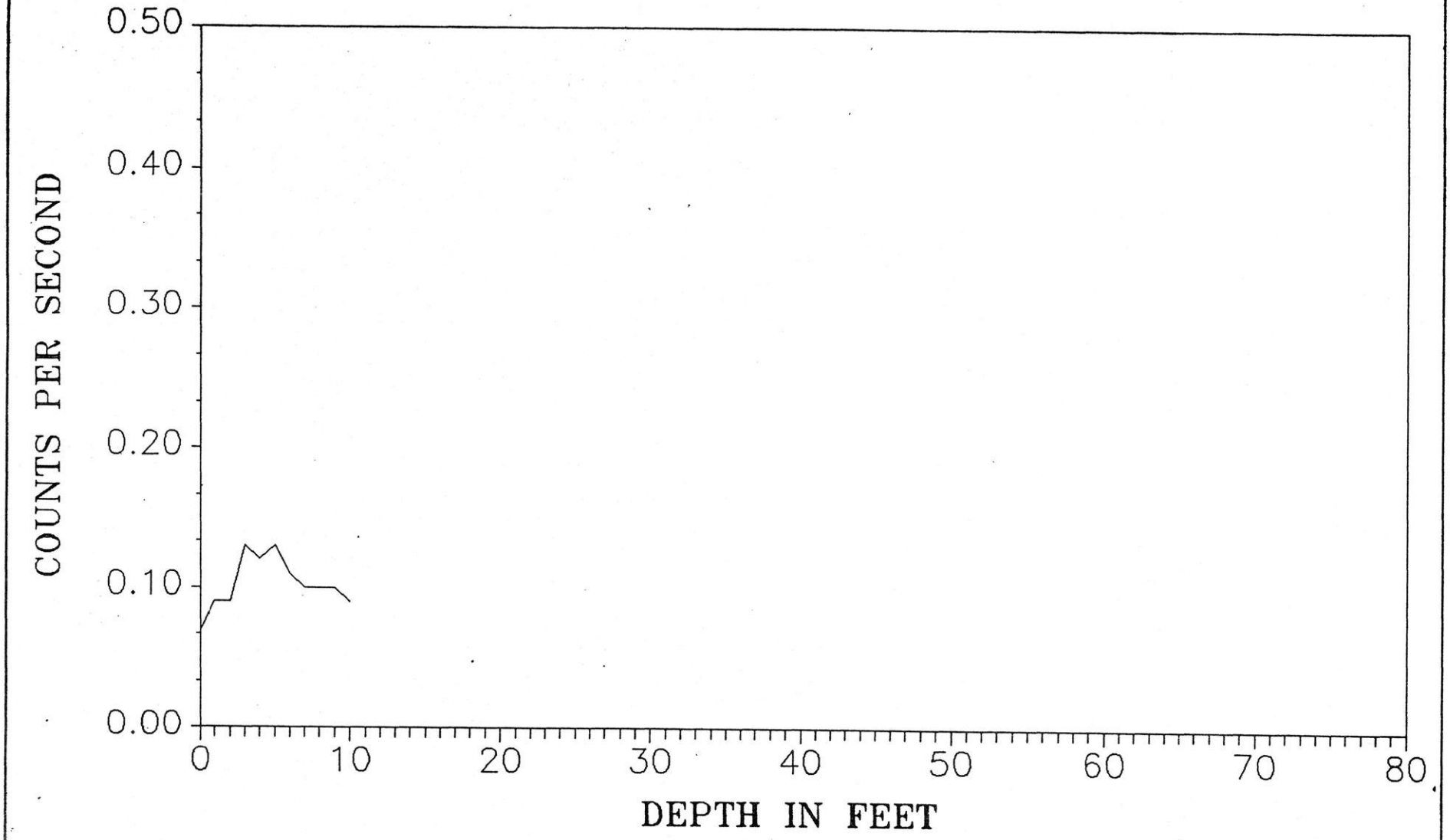
% RECOVERY



0-47'	PLEISTOCENE TILL:
47-69'	PRE-CAMBRIAN SCHIST (?):
69-90'	QUARTZ-AUGEN SCHIST, wh. - lt. grey qtz. eyes up to 5mm across in very fine lam. fine grain matrix of ser. (possibly some bleached chl.) and minor qtz., 84-86', poor recovery, much vein qtz. Ave. c-b angle 20°.
90'	END OF HOLE:

3.5-C-15

BEST COPY AVAILABLE



DATA TAKEN 1-13-89 BY BJS
TIME CONSTANT = 5 SECONDS
RANGE SETTING = 20 K

FOTH & VAN DYKE
GEOSCIENCES & ENVIRONMENTAL MANAGEMENT DIVISION
GREEN BAY, WISCONSIN

KENNECOTT MINERALS COMPANY
FLAMBEAU PROJECT
LADYSMITH, WISCONSIN

GAMMA LOG
WELL OW-11

No	REVISIONS	NOTES	APPROVAL	DATE
			DESIGNED BY	
			DRAWN BY SJL	2/89
			CHECKED BY	
			APPROVED BY	
			CAD No. SCALE AS SHOWN	

Job No | Dwg No | REV

3.5-C-16

GREAT LAKES EXPLORATION

FLAMBEAU 22

Well No 12-T (OW-12)

FWD 2/89

SECTION

COORDINATES

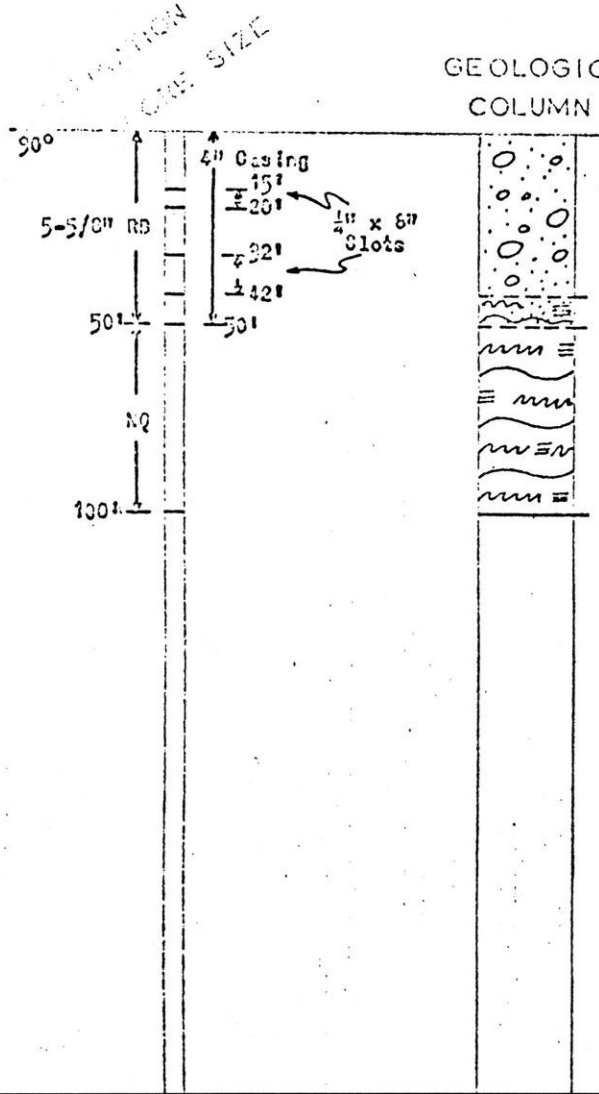
AZIMUTH

ELEVATION

DATE STARTED 7/28/70
COMPLETED 7/28/70

LENGTH OF HOLE 100 ft.

% RECOVERY

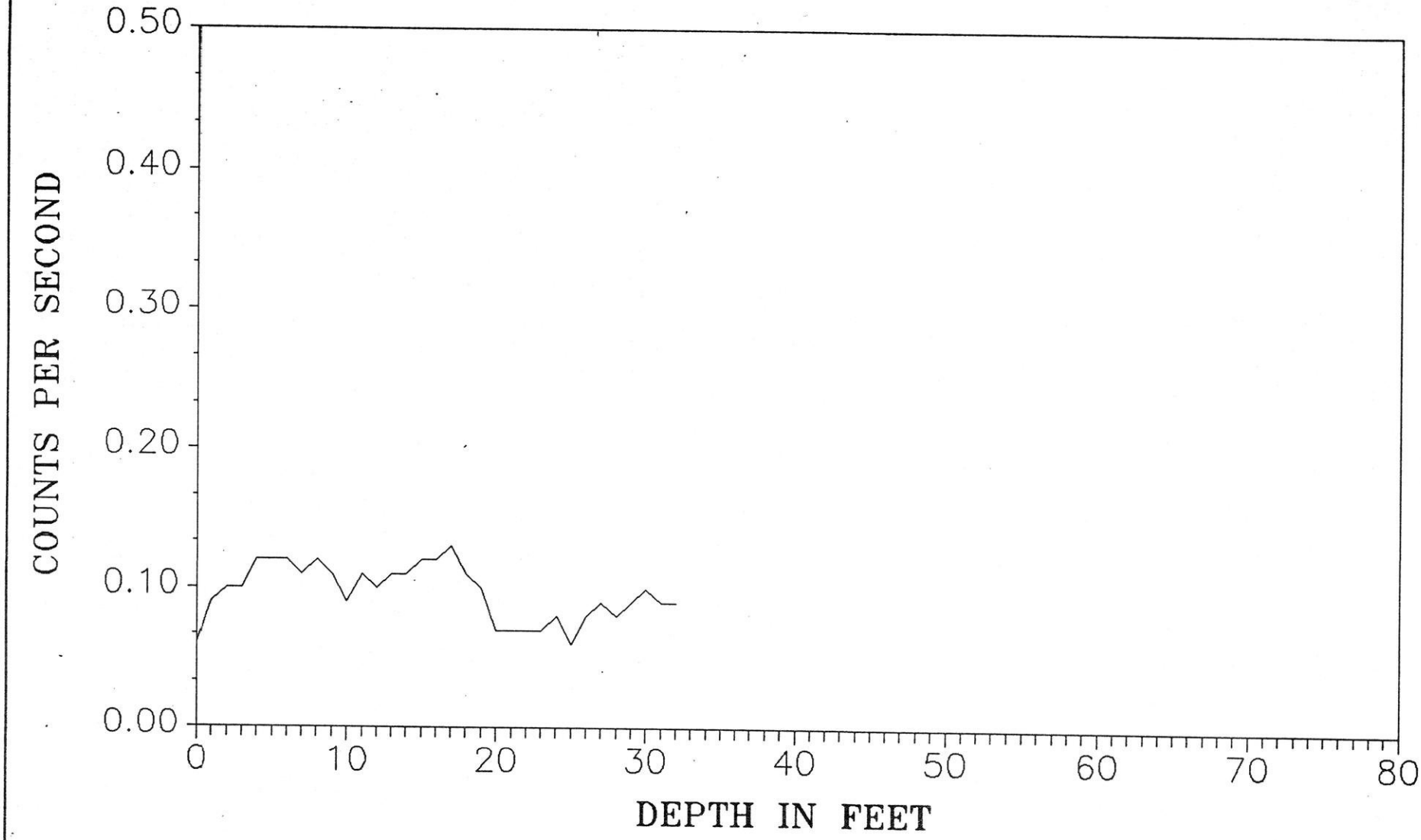


GEOLOGIC COLUMN

	DESCRIPTION
0-42'	PLEISTOCENE TILL:
42-50'	PRE-CAMBRIAN SCHIST (?):
50-100'	BIOTITE-SERICITE-CHLORITE SCHIST, dk. green loc. wh., predom. very fine grain green material (weathered chl.) with bio. xls. many > 2mm often cross cutting fol. but gen. parallel; soft, highly weathered; Ave. c-b angle is 10°.
100'	END OF HOLE:

3.5-C-17

BEST COPY AVAILABLE



DATA TAKEN 1-13-89 BY BJS
TIME CONSTANT = 5 SECONDS
RANGE SETTING = 20 K

FOTH & VAN DYKE
GEOSCIENCES & ENVIRONMENTAL MANAGEMENT DIVISION
GREEN BAY, WISCONSIN

KENNECOTT MINERALS COMPANY
FLAMBEAU PROJECT
LADYSMITH, WISCONSIN

GAMMA LOG
WELL OW-12

No	REVISIONS	NOTES	APPROVAL	DATE
			DESIGNED BY	
			DRAWN BY SJL	2/89
			CHECKED BY	
			APPROVED BY	
			CAD No.	SCALE AS SHOWN

Job No | Dwg No | REV

GREAT LAKES EXPLORATION

FLAMBEAU 22

Well No 13 (OW-13)

F+VD 2/89

SECTION

COORDINATES 42,045.39 N, 39,831.03 E

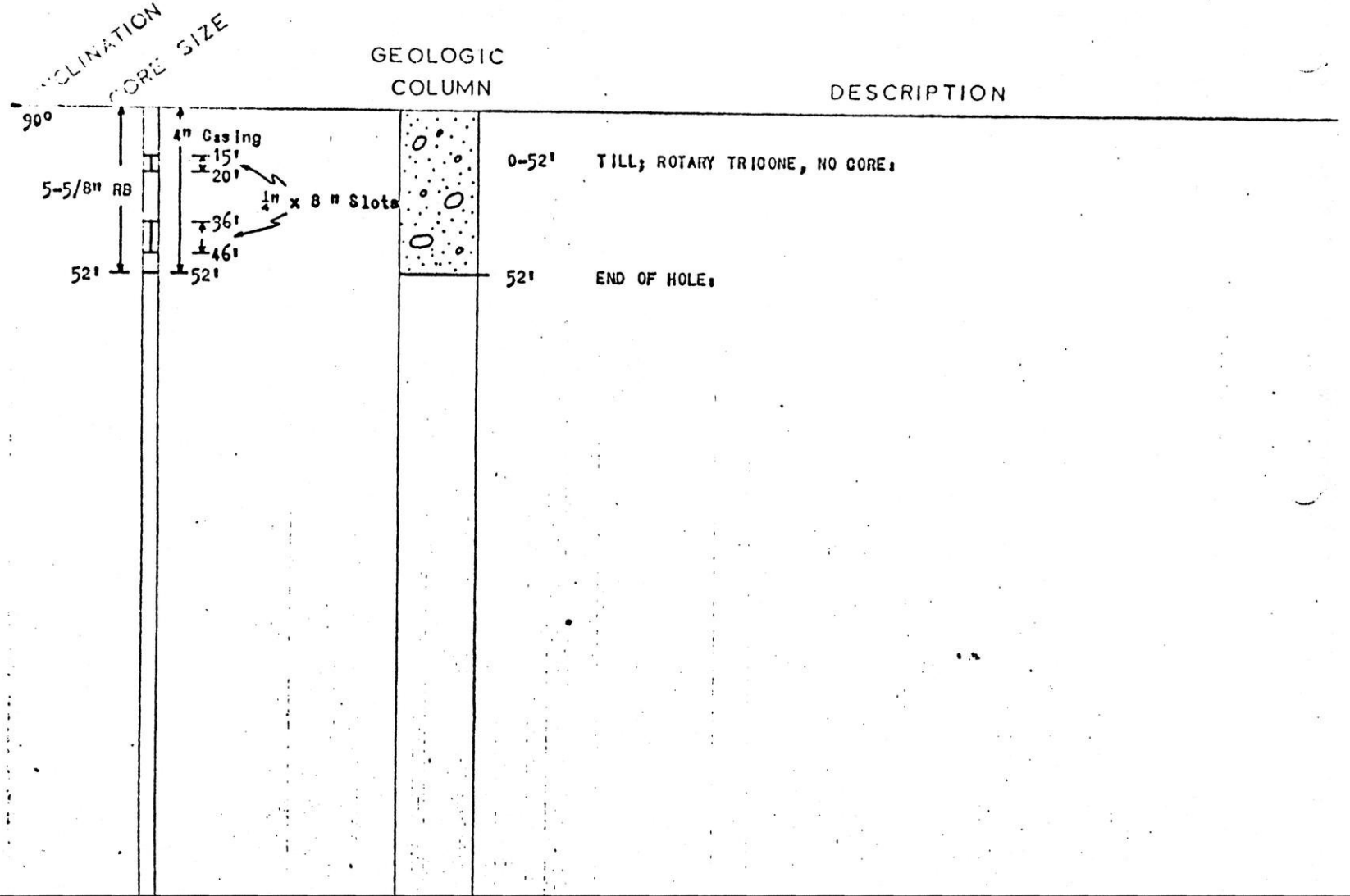
AZIMUTH

ELEVATION

DATE STARTED 8/17/70
COMPLETED 8/18/70

LENGTH OF HOLE 52 ft.

% RECOVERY



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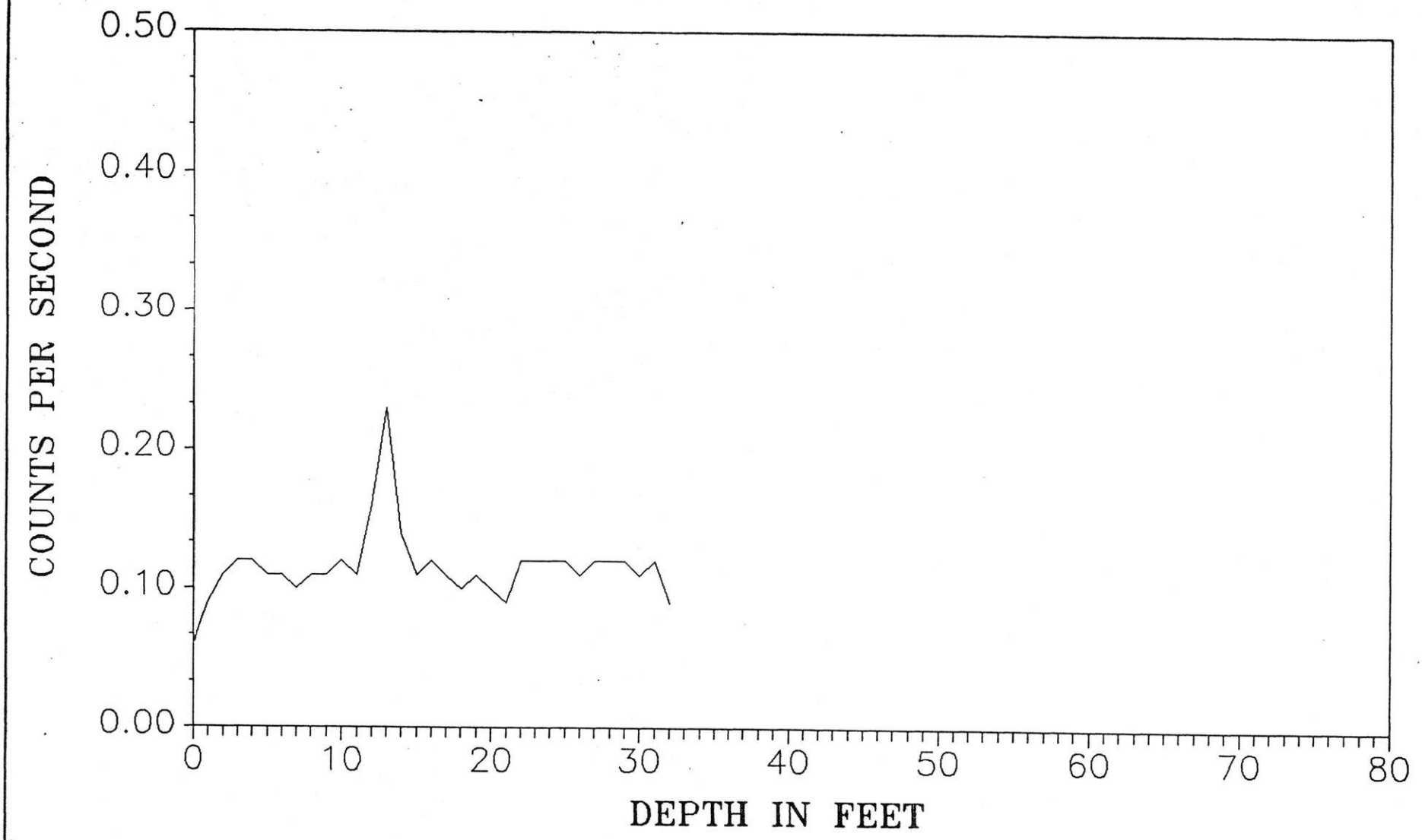


DATA TAKEN 1-13-89 BY BJS
TIME CONSTANT = 5 SECONDS
RANGE SETTING = 20 K

FOTH & VAN DYKE
GEOSCIENCES & ENVIRONMENTAL MANAGEMENT DIVISION
GREEN BAY, WISCONSIN

KENNECOTT MINERALS COMPANY
FLAMBEAU PROJECT
LADYSMITH, WISCONSIN

GAMMA LOG
WELL OW-13

No	REVISIONS	NOTES	APPROVAL	DATE
			DESIGNED BY	
			DRAWN BY SJL	2/89
			CHECKED BY	
			APPROVED BY	
			CAD No.	SCALE AS SHOWN

Job No | Dwg No | REV

GREAT LAKES EXPLORATION

FLAMBEAU 22

Well No 14-T (OW-14) FTVD 2/89

SECTION

COORDINATES

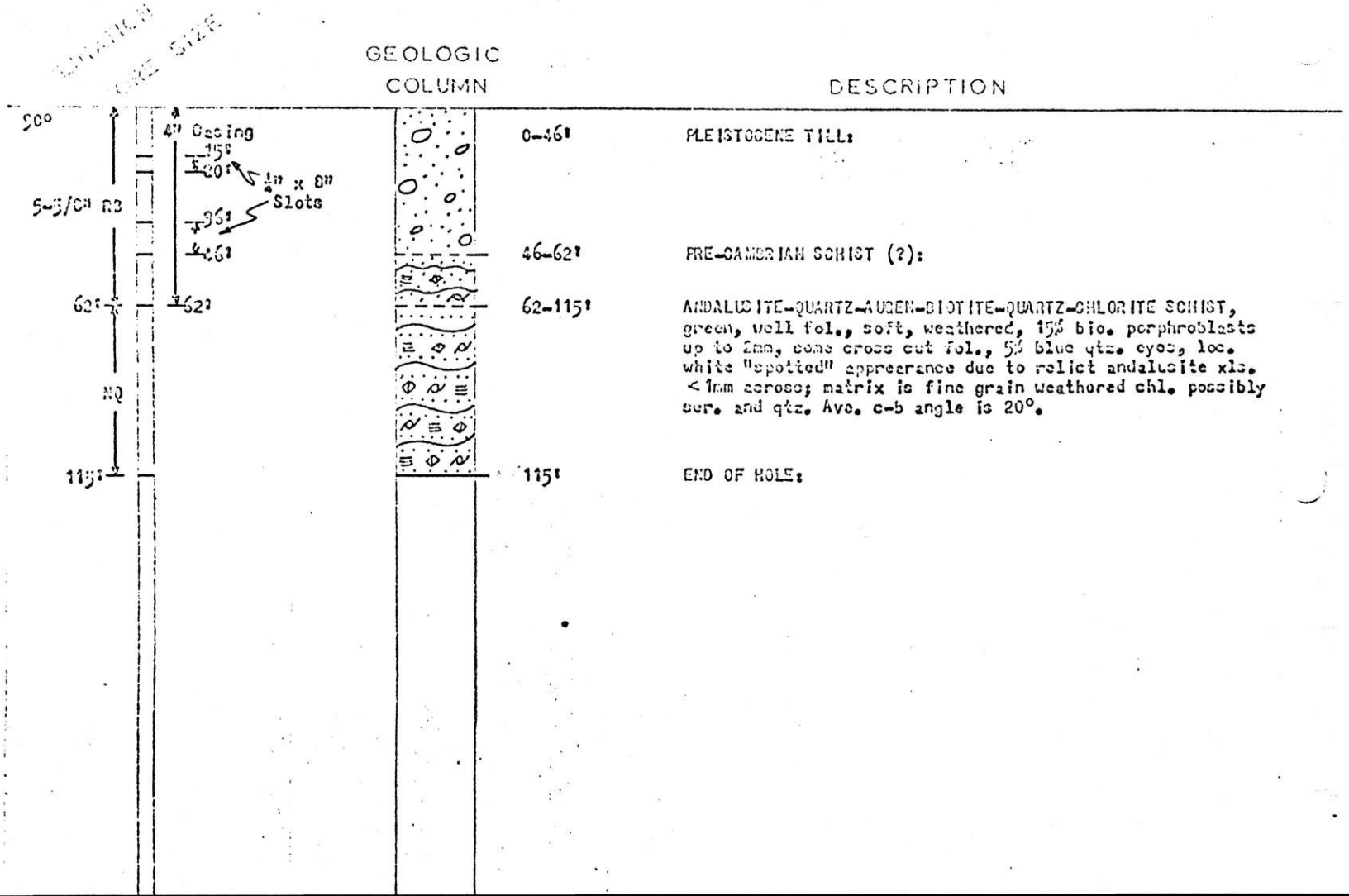
AZIMUTH

ELEVATION

DATE STARTED 7/29/70
COMPLETED 7/30/70

LENGTH OF HOLE 115 ft.

% RECOVERY



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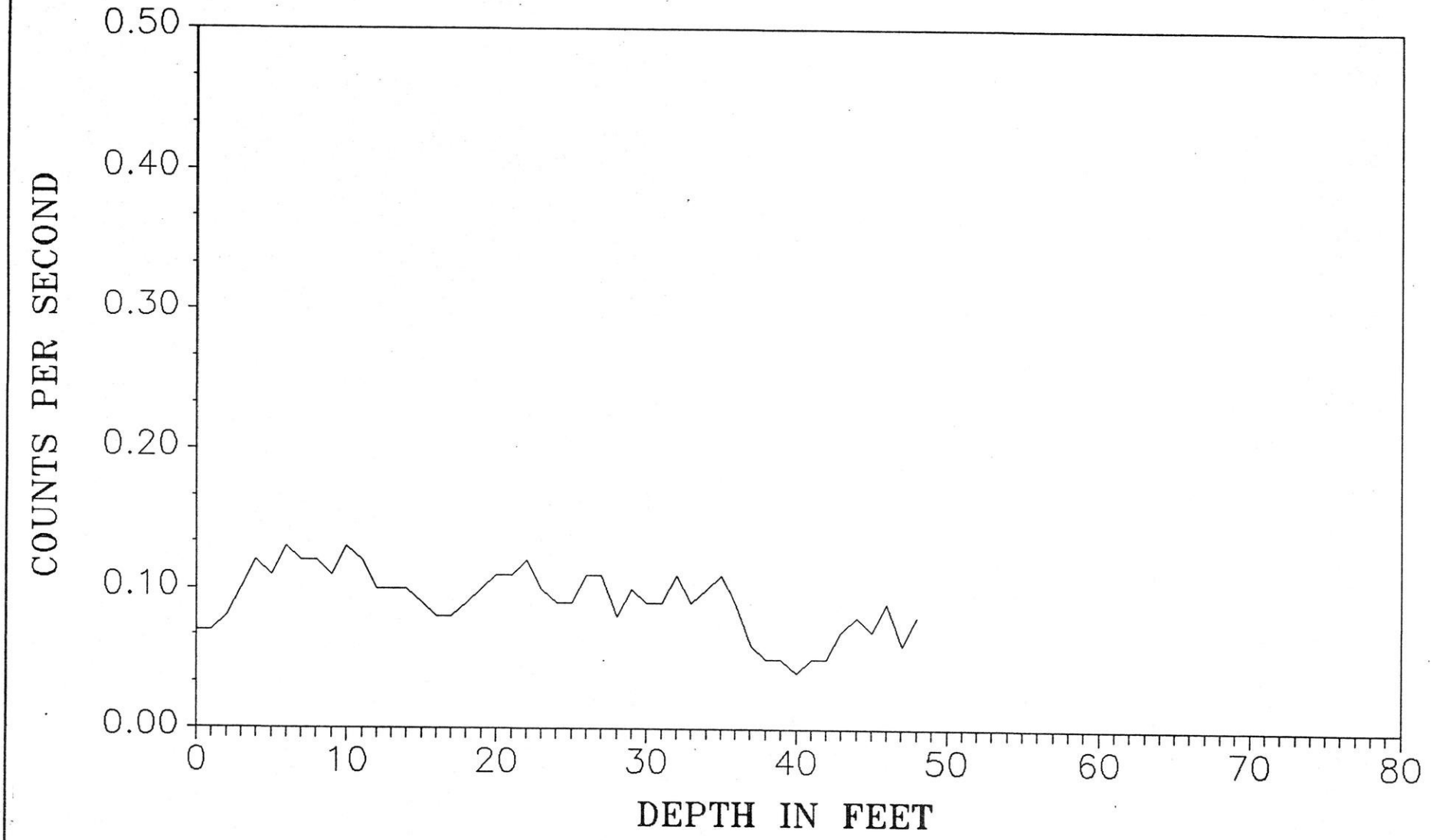


DATA TAKEN 1-13-89 BY BJS
TIME CONSTANT = 5 SECONDS
RANGE SETTING = 20 K

FOTH & VAN DYKE
GEOSCIENCES & ENVIRONMENTAL MANAGEMENT DIVISION
GREEN BAY, WISCONSIN

KENNECOTT MINERALS COMPANY
FLAMBEAU PROJECT
LADYSMITH, WISCONSIN

GAMMA LOG
WELL OW-14

No	REVISIONS	NOTES	APPROVAL	DATE
			DESIGNED BY	
			DRAWN BY SJL	2/89
			CHECKED BY	
			APPROVED BY	
			CAD No.	SCALE AS SHOWN

Job No | Dwg No | REV

GREAT LAKES EXPLORATION

FLAMBEAU 22

Well No 15-T (OW-15)

F+VD 2/89

SECTION

COORDINATES 41,645N 38,320E (Approx)

AZIMUTH

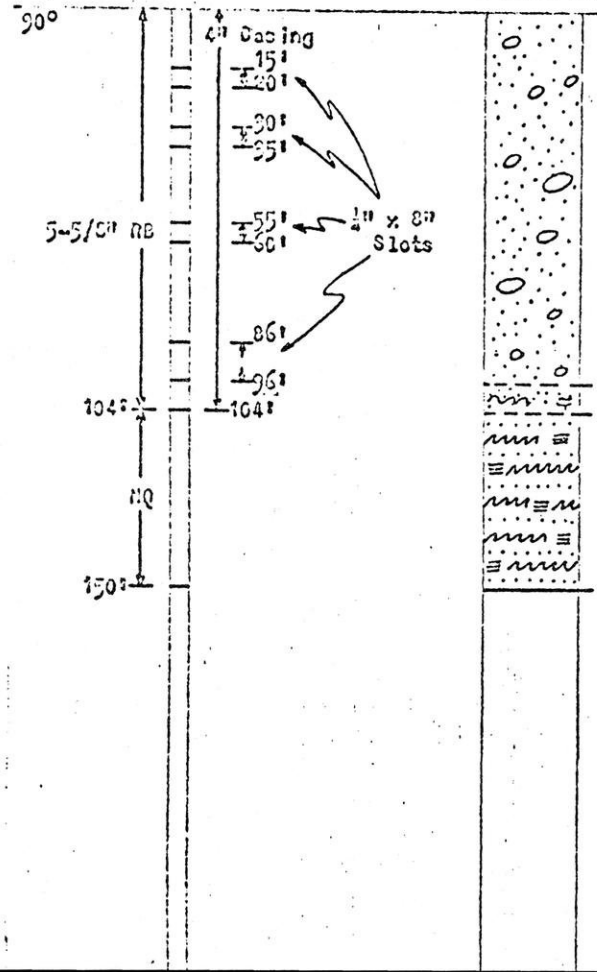
ELEVATION (F+VD 1/89)

DATE STARTED 7/30/70

DATE COMPLETED 7/31/70

LENGTH OF HOLE 150 ft.

% RECOVERY



	DESCRIPTION
0-96'	PLEISTOCENE TILL:
96-104'	PRE-CAMBRIAN SCHIST (?):
104-150'	BIOTITE-QUARTZ-SERICITE SCHIST, grey to greenish grey in general aspect; conspicuous bio. porphroblasts many 2mm across gen. parallel. Well defined fol. some cross cut. Bio. rich layers are separated by wh. layers of very fine grain ser. and qtz. (possibly much clay), chl. rich bands up to 1 cm th. occur locally. Few qtz. grains 1-2mm; rock is soft and weathered, wk. hem. stain down to 117', several 2" qtz. veins 128-133' Ave. c-b angle is 35°.
150'	END OF HOLE:

3.5-C-23

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GREAT LAKES EXPLORATION

FLAMBEAU 22

Well No 16 (OW-16)

F+VD 2/89

SECTION

COORDINATES 42,295 N 39,235 E (F+VD 1/89)

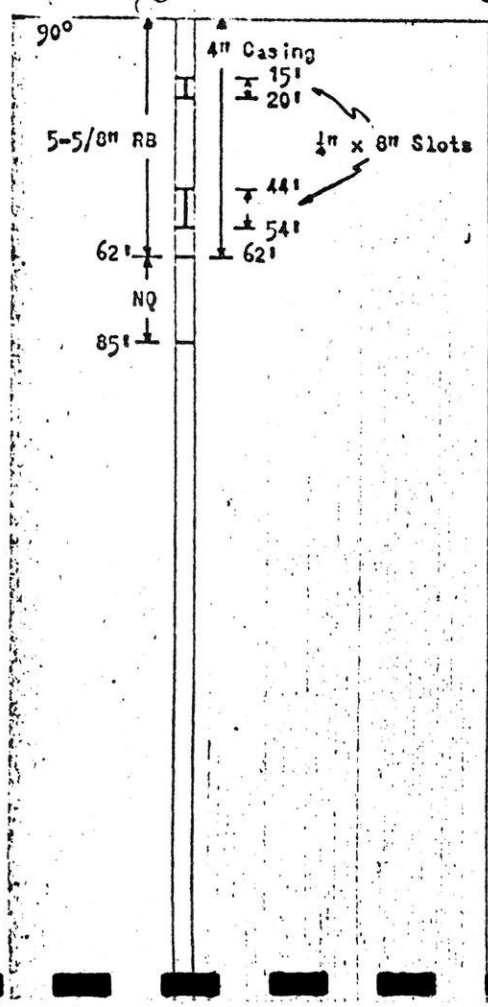
AZIMUTH

ELEVATION ~1105

DATE STARTED 8/10/70
COMPLETED 8/11/70

LENGTH OF HOLE 85 ft.

% RECOVERY



DESCRIPTION

0-54' TILL

54-62' PRECAMBRIAN: Rotary tricone, no core.

62-75' VEIN QUARTZ: Broken up, recovery about 20%.

75-85' QUARTZ-AUGEN-BIOTITE-QUARTZ-SERICITE SCHIST: White, soft and weathered, very fine grain matrix of quartz and sericite with bio. folia up to 1 mm. th. Bio bleached to chl., few scattered qtz. eyes 1 - 2 mm. in dia. C - B angle estimated at 20°.

85' END OF HOLE

(2) (3)

3.5-C-24

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GREAT LAKES EXPLORATION

FLAMBEAU 22

Well No 17-S (OW-17)

P+VD 2/89

SECTION

COORDINATES 42,165 N 38,205 E (Approx) (P+VD 1/89)

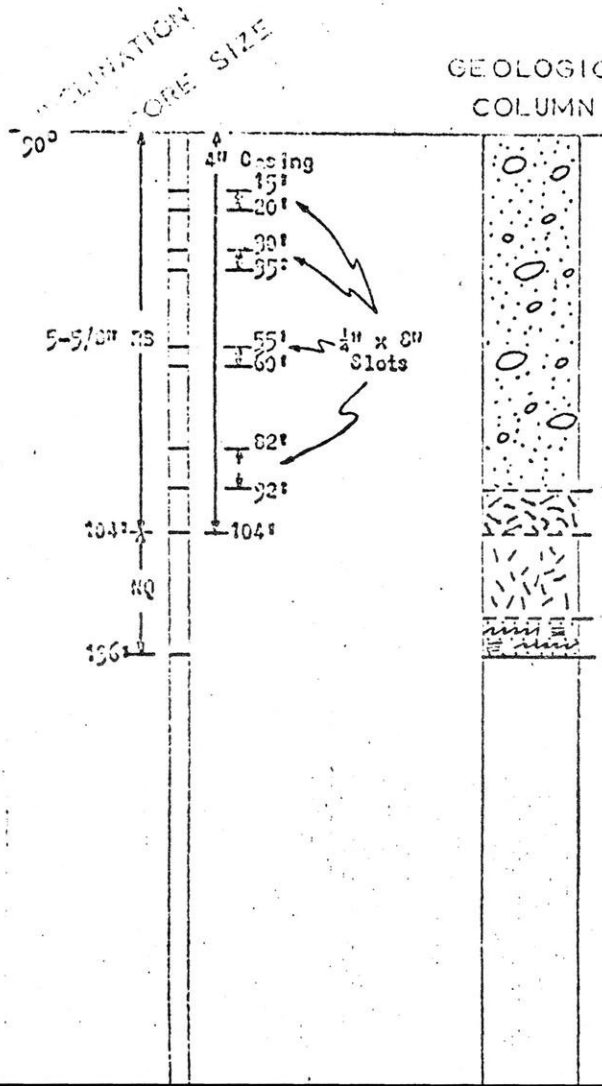
AZIMUTH

ELEVATION ~1110

DATE STARTED 7/31/70
COMPLETED 8/4/70

LENGTH OF HOLE 136 ft.

% RECOVERY



0-92'	PLEISTOCENE TILL:
92-104'	PRE-CAMBRIAN SCHIST (?):
104-126'	BASALT (?) red., soft, deeply weathered, Very strong dark red-brown hematite stain, very fine grain no foliation.
126-136	BIOTITE-QUARTZ-SERICITE SCHIST, wh., bio. porphroblasts up to 2mm gen. parallel fol., in matrix of fine grain ser. (possibly clay) and minor qtz.(?), qtz. also occurs as occasional grains 1-2mm across; several highly contorted qtz. veins ¼" thick. Ave. c-b angle is 10°.
136'	END OF HOLE:

3.5-C-25

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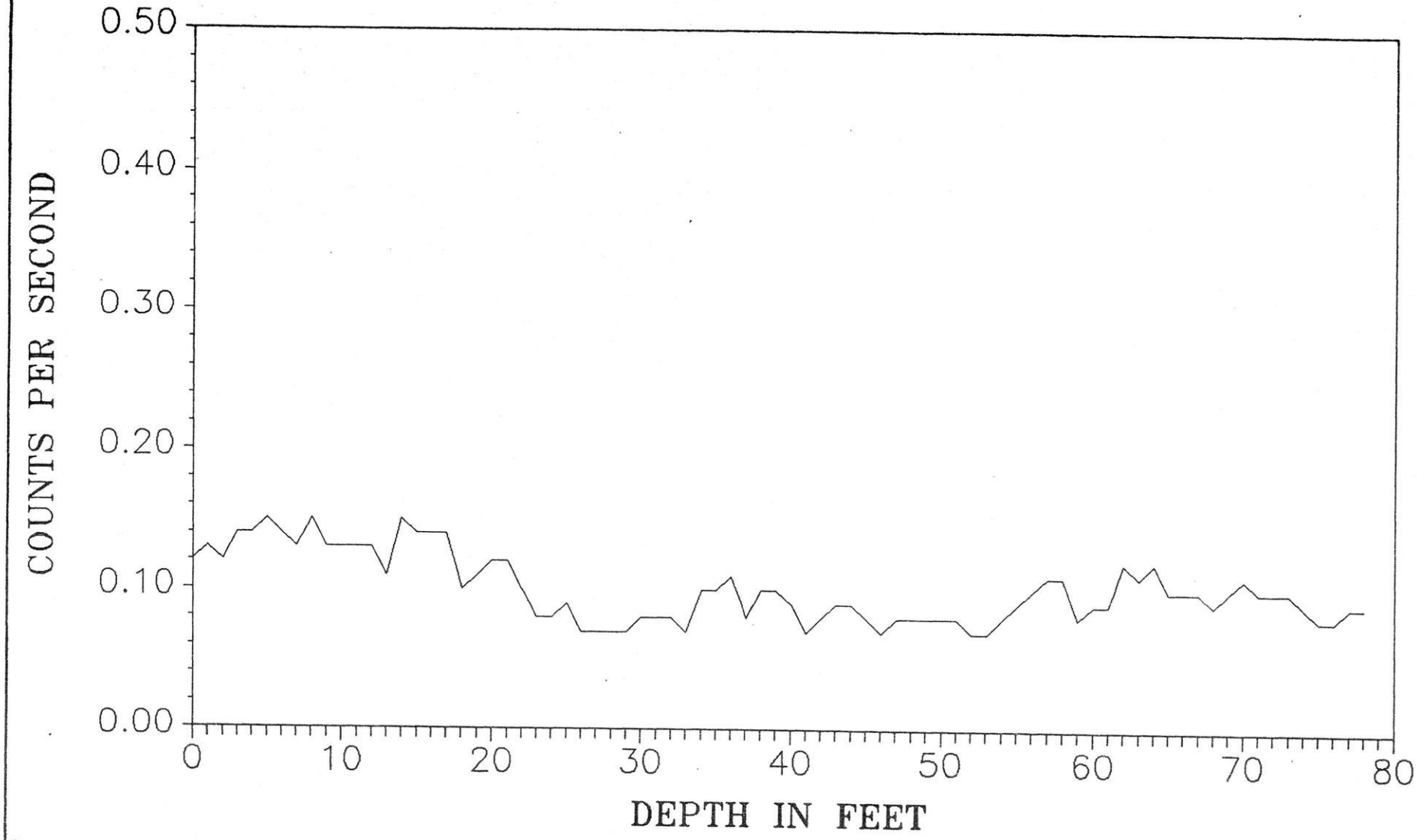


DATA TAKEN 1-13-89 BY BJS
TIME CONSTANT = 5 SECONDS
RANGE SETTING = 20 K

FOTH & VAN DYKE
GEOSCIENCES & ENVIRONMENTAL MANAGEMENT DIVISION
GREEN BAY, WISCONSIN

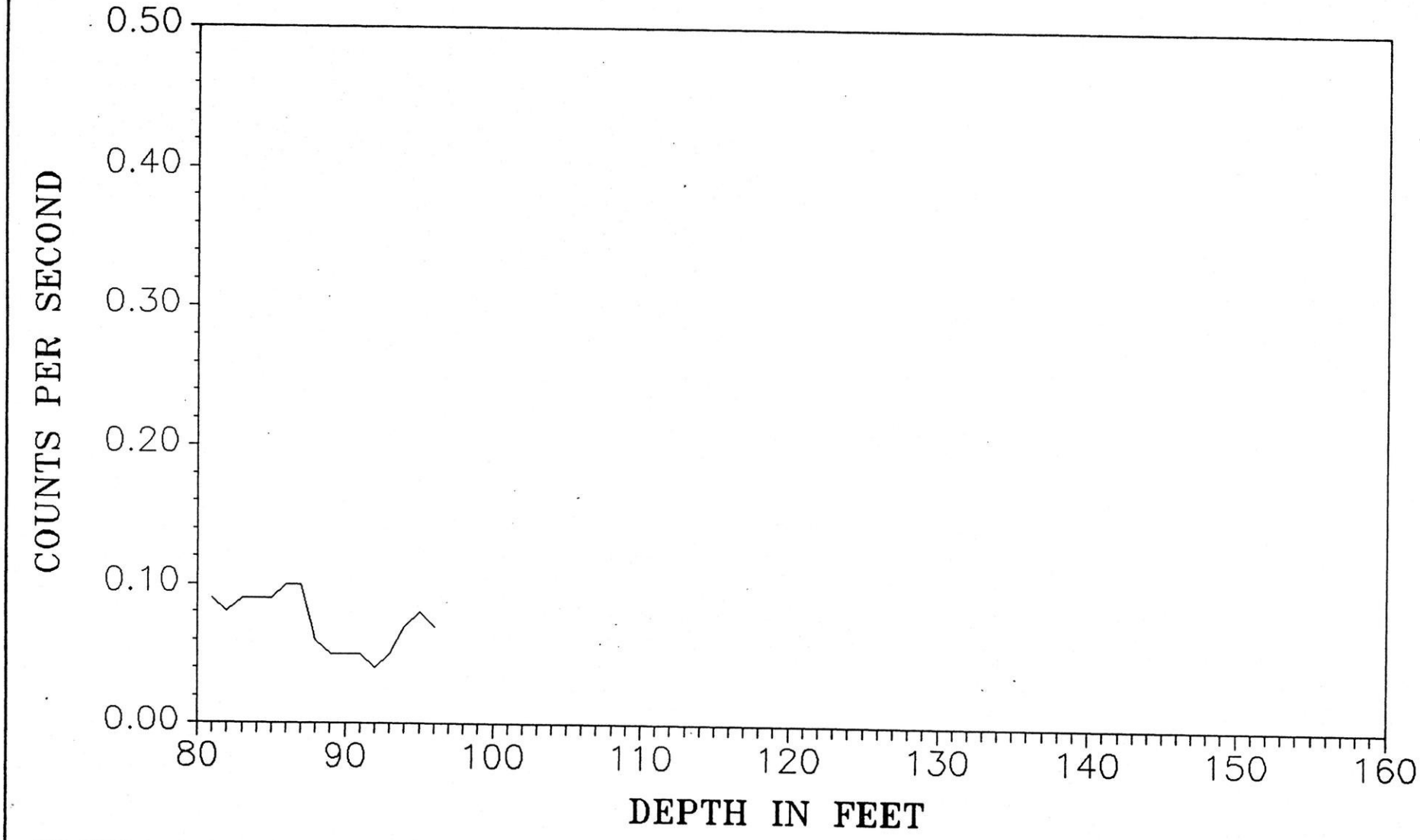
KENNECOTT MINERALS COMPANY
FLAMBEAU PROJECT
LADYSMITH, WISCONSIN

GAMMA LOG
WELL OW-17

No	REVISIONS	NOTES	APPROVAL	DATE
			DESIGNED BY	
			DRAWN BY SJL	2/89
			CHECKED BY	
			APPROVED BY	
			CAD No.	SCALE AS SHOWN

Job No | Dwg No | REV

3.5-C-26



DATA TAKEN 1-13-89 BY BJS
TIME CONSTANT = 5 SECONDS
RANGE SETTING = 20 K

FOTH & VAN DYKE
GEOSCIENCES & ENVIRONMENTAL MANAGEMENT DIVISION
GREEN BAY, WISCONSIN

KENNECOTT MINERALS COMPANY
FLAMBEAU PROJECT
LADYSMITH, WISCONSIN

GAMMA LOG
WELL OW-17 (CONTINUED)

No	REVISIONS	NOTES	APPROVAL	DATE
			DESIGNED BY	
			DRAWN BY SJL	2/89
			CHECKED BY	
			APPROVED BY	
			CAD No.	SCALE AS SHOWN

Job No | Dwg No | REV

GREAT LAKES EXPLORATION

FLAMBEAU 22

Well No 18-C (OW-18)

FTVD 2/89

SECTION

COORDINATES

AZIMUTH

ELEVATION

INCLINATION

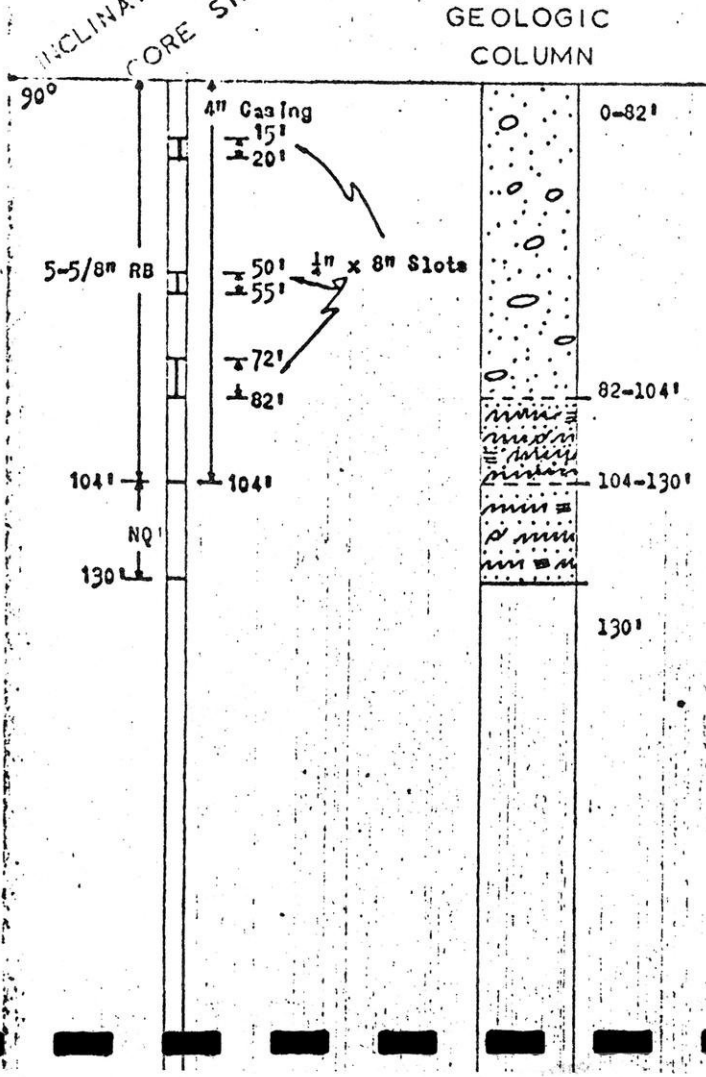
CORE SIZE

DATE STARTED 8/6/70

DATE COMPLETED 8/10/70

LENGTH OF HOLE 130 ft.

% RECOVERY



GEOLOGIC COLUMN

DESCRIPTION

0-82'	TILL
82-104'	PRECAMBRIAN: Rotary tricone, no core.
104-130'	QUARTZ AUGEN-BIOTITE-QUARTZ-SERICITE SCHIST: Wh., soft; very fine grain qtz-ser. (clay?) matrix with bio. rich folia up to 5 mm. long and gen. <1 mm th., at 115' is broken vein qtz., recovery 104-116 is about 30%; almost no recovery below 116'. C - B angle estimated at 30°.
130'	END OF HOLE

3.5-C-28

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GREAT LAKES EXPLORATION

FLAMBEAU 22

Well No 19-T (OW-19)

F+VD 2/89

SECTION

COORDINATES

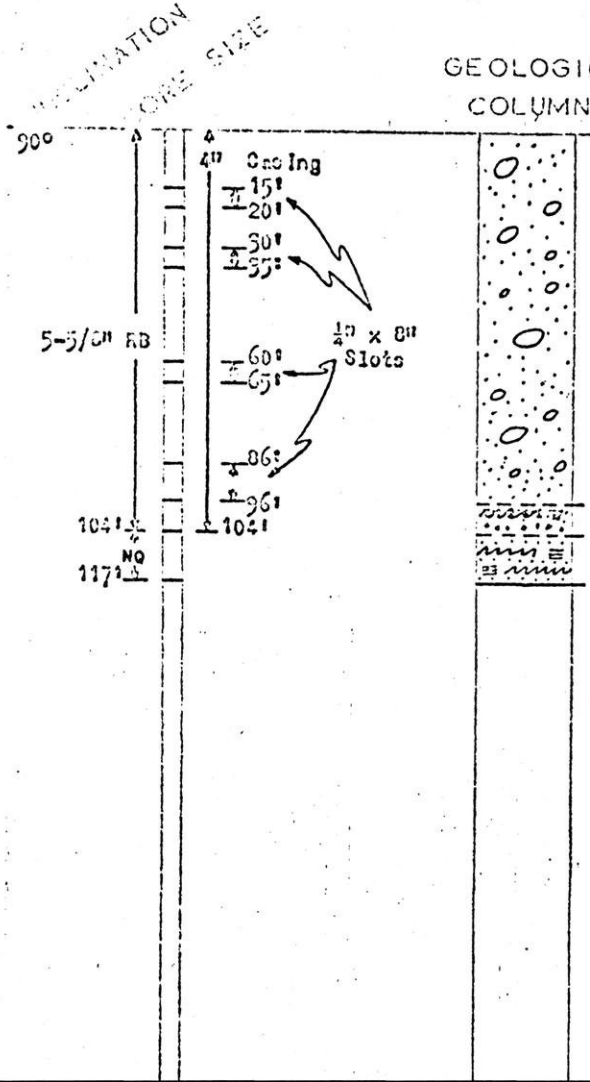
AZIMUTH

ELEVATION

DATE STARTED 8/4/70
COMPLETED 8/6/70

LENGTH OF HOLE 117 ft.

% RECOVERY



	DESCRIPTION
0-96'	PLEISTOCENE TILL:
96-104'	PRE-CAMBRIAN SCHIST (?):
104-117'	BIOTITE-QUARTZ-SERICITE SCHIST, grey, bio. occurs as plates <1mm across and parallel foliation very evenly distributed throughout rock; qtz. occurs as grains 1-2mm across up to 10%; matrix of very fine ser. (possibly clay) tiny wh. spots 1-2mm across possibly relict feldspar phen., occasional needles of tremolite (?), 1-2mm long. On cut surface are lenzoid patches 20mm x 5mm which parallel foliation. Foliation almost parallels core axis.
117'.	END OF HOLE:

3.5-C-29

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GREAT LAKES EXPLORATION

FLAMBEAU 22

Well No 20 (OW-20)

FtVD 2/89

SECTION

COORDINATES

AZIMUTH

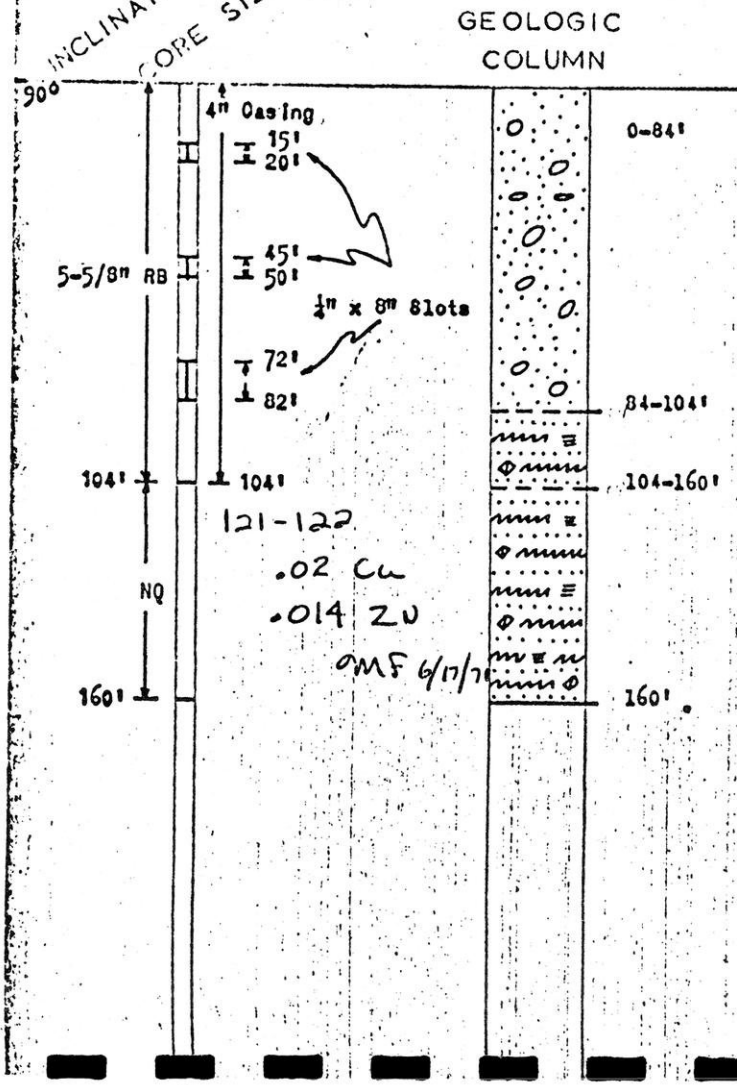
ELEVATION

DATE STARTED 8/11/70

COMPLETED 8/13/70

LENGTH OF HOLE 160 ft.

% RECOVERY



DESCRIPTION

PLEISTOCENE TILL:

PRECAMBRIAN SCHIST (?):

ANDALUSITE-BIOTITE-QUARTZ-SERICITE SCHIST: Wh. to lt. grey, few scattered relict andalusite xls <1 cm., bio plates 1 - 2 mm., gen. parallel fol., often concentrated in layers 2 - 5 mm. th. Matrix is fine mixture of ser. and qtz; py., diss. as grains and granular aggregate overall 2%, between 120 - 123 5%; hem. stain conspic. down to 125', below 140' rock is greenish grey perhaps due to fine chl. C - B angle 24°.

END OF HOLE:

3.5-C-30

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GREAT LAKES EXPLORATION

FLAMBEAU 22

Well No 29 (OTW-29)

FVD 2/89

SECTION

COORDINATES 40,558.8 N, 38,679.8 E

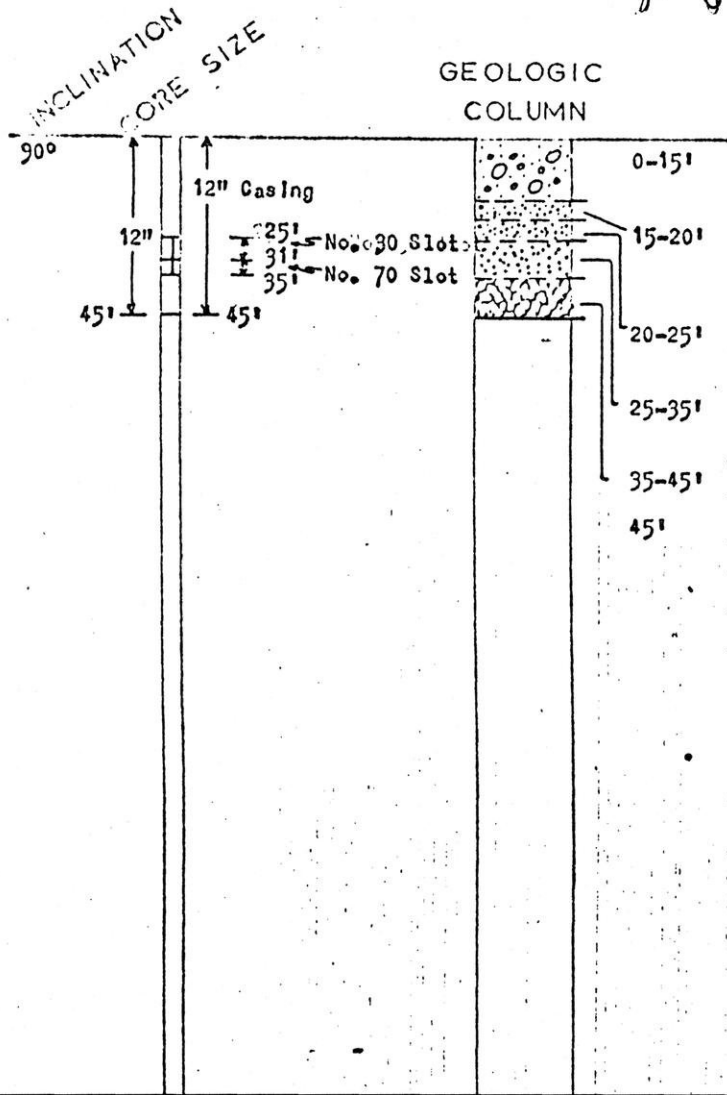
AZIMUTH

ELEVATION 1104.61 ft. Top of casing

DATE STARTED 3/19/71
COMPLETED 4/3/71

LENGTH OF HOLE 45 ft.

% RECOVERY



DESCRIPTION

0-15' CLAY, GRAVEL, NUMEROUS BOULDERS: 11-15' many boulders, cobbles up to 4" across in matrix of med. sand and brown silt.

15-20' CLAY AND SAND: olive grey sticky clay with 50% coarse sand and granules, estimate 10% coarse gravel, many well rounded pebbles up to 3" across.

20-25' CLAY AND SAND: brown plastic clay with 20% admixed med. - fine sand.

25-35' SAND: med. - coarse sand, minor brown silt, 10% fine gravel gen. ≤ ½" across.

35-45' PRECAMBRIAN: white clay-sericite, abundant broken vein qtz.

45' END OF HOLE:

3.5-C-31

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GREAT LAKES EXPLORATION

FLAMBEAU 22

Well No 34 (OTW-34)

F+VD 2/89

SECTION

COORDINATES 41,017.3 N, 38,709.7 E

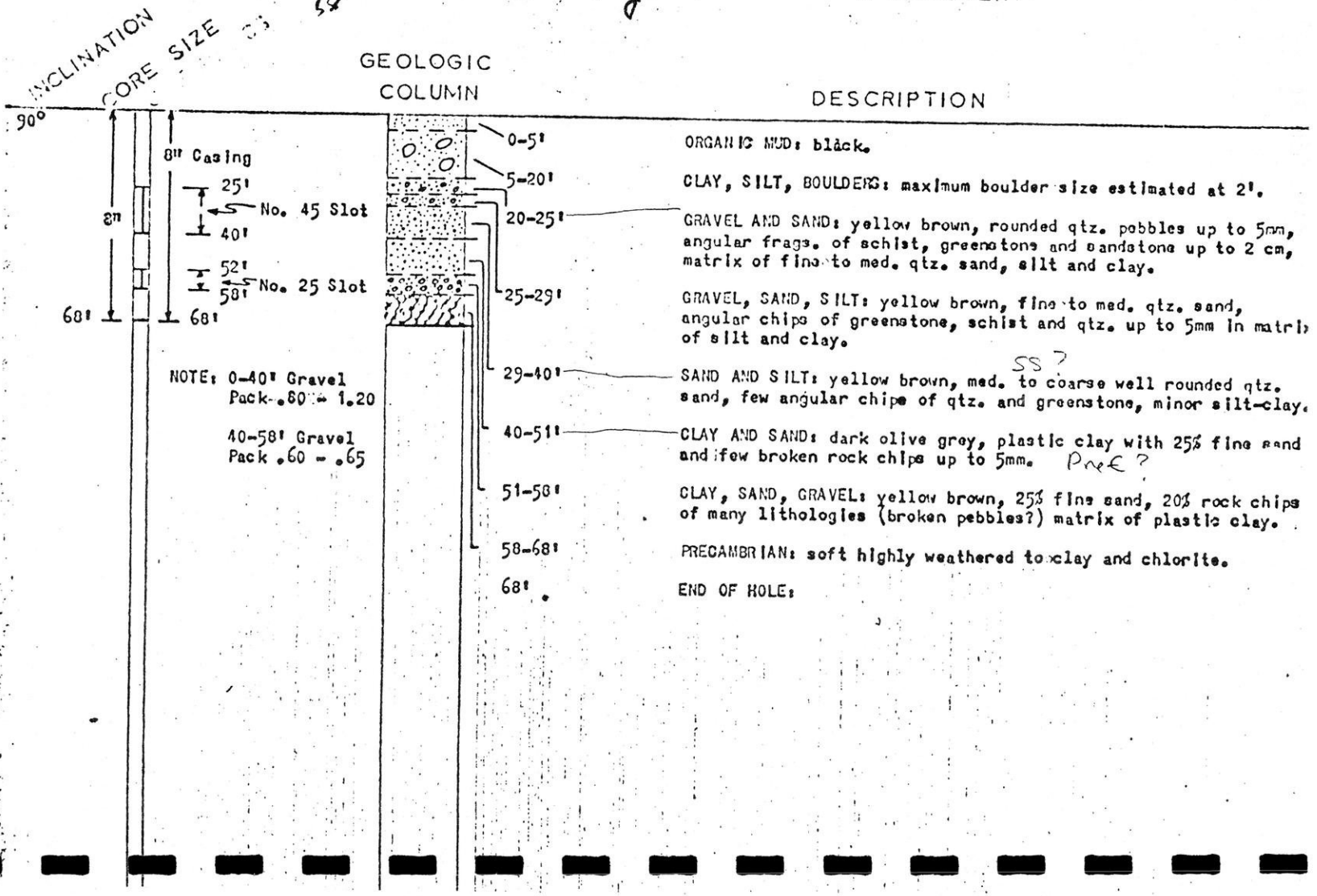
AZIMUTH

ELEVATION 1105.47 ft. — Casing el. 58

DATE STARTED 3/3/71
COMPLETED 3/18/71

LENGTH OF HOLE 68 ft.

% RECOVERY



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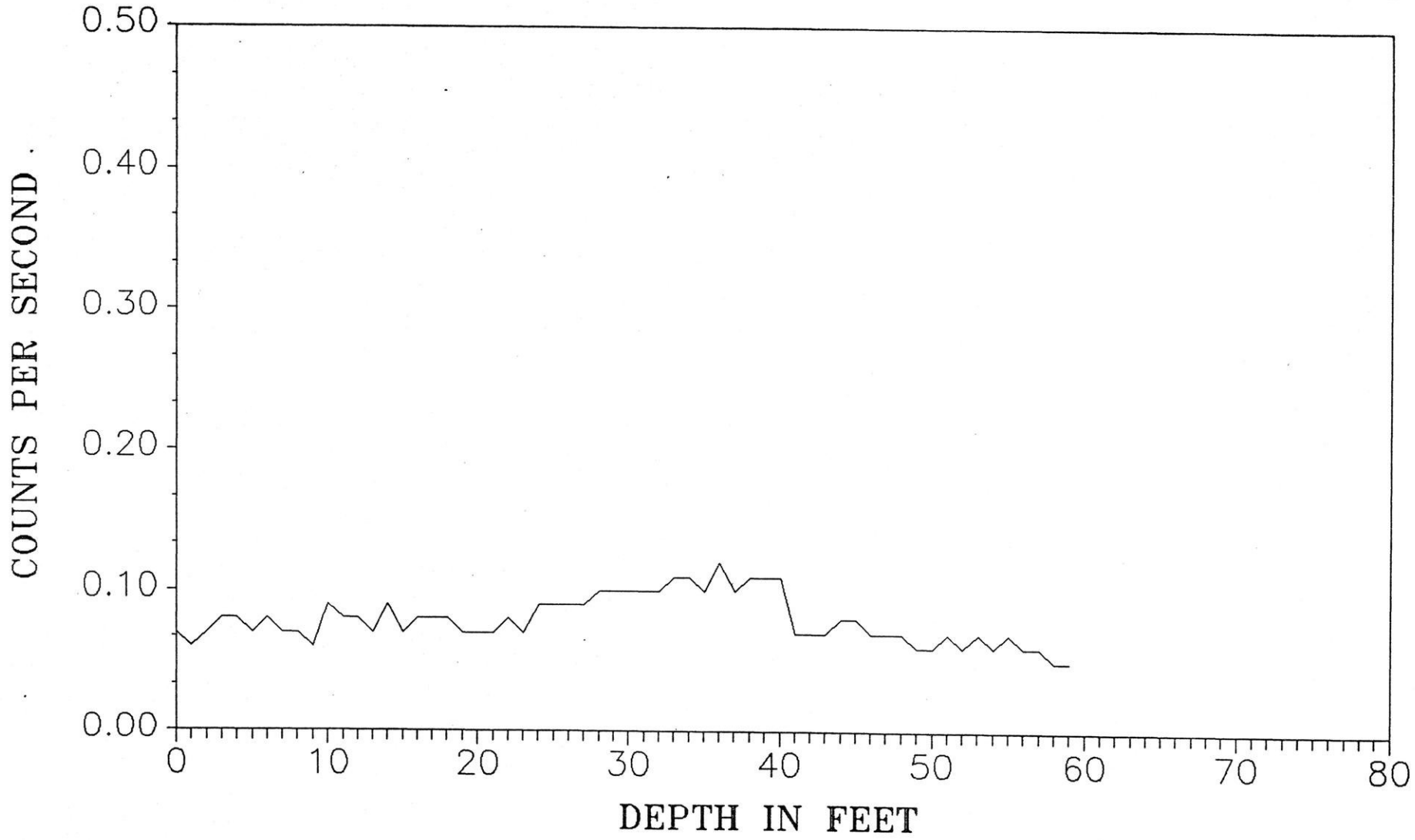

DATA TAKEN 1-13-89 BY BJS
TIME CONSTANT = 5 SECONDS
RANGE SETTING = 20 K

FOTH & VAN DYKE
GEOSCIENCES & ENVIRONMENTAL MANAGEMENT DIVISION
GREEN BAY, WISCONSIN

KENNECOTT MINERALS COMPANY
FLAMBEAU PROJECT
LADYSMITH, WISCONSIN

GAMMA LOG
WELL OTW-34

No	REVISIONS	NOTES	APPROVAL	DATE
			DESIGNED BY	
			DRAWN BY SJL	2/89
			CHECKED BY	
			APPROVED BY	
			CAD No.	SCALE AS SHOWN

Job No | Dwg No | REV

GREAT LAKES EXPLORATION

Flambeau

Well No. 39 (OW-39)

F+VD 2/89

SECTION 402

COORDINATES 39,711.44 N, 39,270.38E

AZIMUTH

ELEVATION Cap: 1117.8 ft
Ground: 1117.4 ft

DATE STARTED 9-7-72
COMPLETED 9-7-72

LENGTH OF HOLE 44 ft

% ORE RECOVERY

INCLINATION	CORE SIZE / CORE BANDS	GEOLOGIC COLUMN	GEOLOGIC DESCRIPTION
90°	4" Steel Casing to 10' 5-5/8" RB 6" Slots on 12" Spacing	41 44	0-41 Pleistocene Till. Poorly sorted and stratified sands, silty sands and till. 41-44 Precambrian. Badly decomposed schist. End of Hole 44' Pump test 1.5

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GREAT LAKES EXPLORATION

Flambeau

Well No. 40 (OW-40)

F+VD 2/89

SECTION 402

COORDINATES 39,901.18 N, 39,048.05 E

AZIMUTH

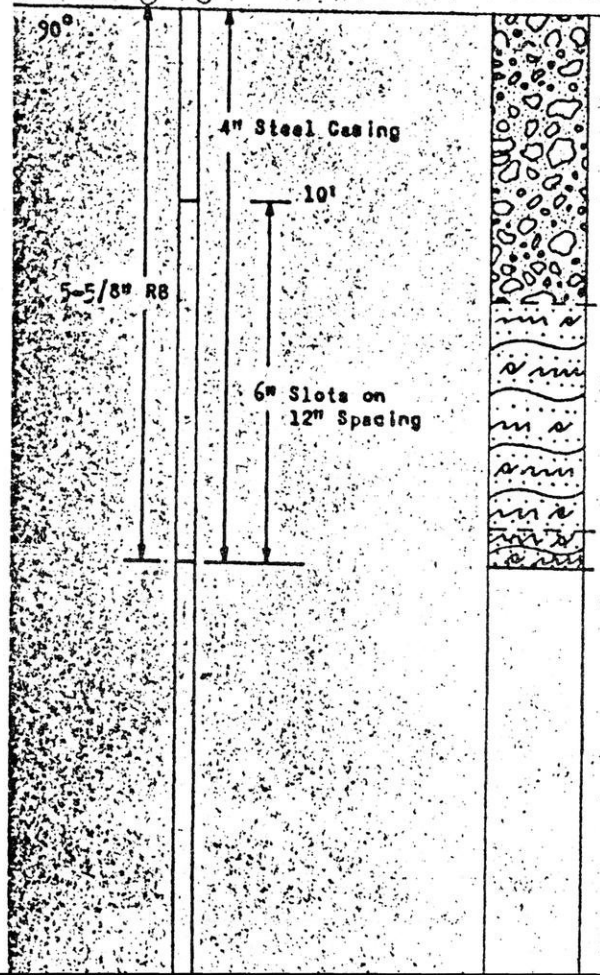
ELEVATION Cap: 1107.9 ft
Ground: 1106.7 ft

DATE STARTED 9-5-72
COMPLETED 9-7-72

LENGTH OF HOLE 29 ft

% ORE RECOVERY

INCLINATION | CORE SIZE | ORE BANDS | GEOLOGIC COLUMN | GEOLOGIC DESCRIPTION



0-15 Pleistocene till. Poorly sorted sands and gravel. Boulders 12-24'.

15-27 Precambrian? Hard white quartz rich rock 15-18'. Increase in reddy brown very fine grained sandstone or quartzite below 18'. Could be fine grained Cambrian?

27-29 Precambrian. Considerable amounts of pyrite and steely chalcocite with insubordinate limonite, malachite with some cuprite. Gossan probably on fractures. Top of Precambrian very hard to determine.

End of Hole 29'

Pump test 2.2 gpm

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GREAT LAKES EXPLORATION

Flambeau

Well No. 41 (ow-41)

F-VII
2/67

SECTION 402

COORDINATES 40,065.23 N, 38,867.32 E

AZIMUTH

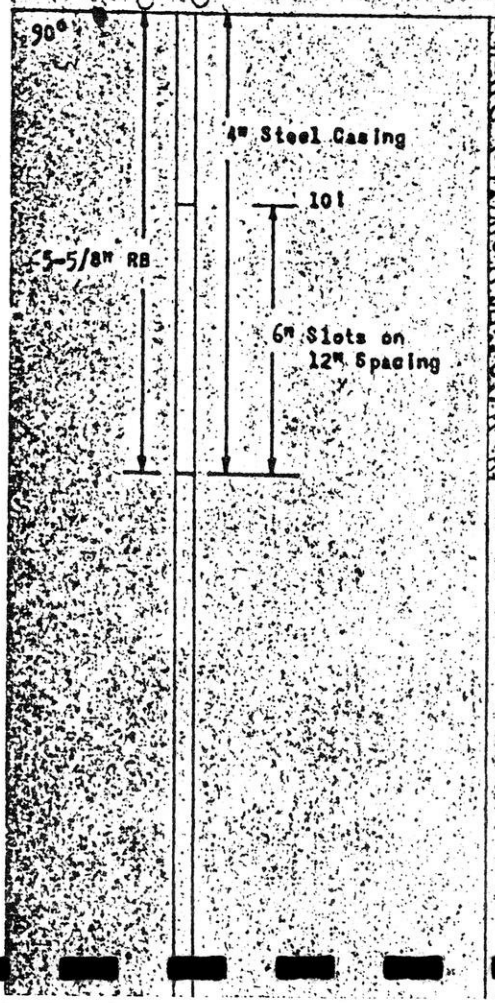
ELEVATION Cap: 1102.4 ft
Ground: 1101.2 ft

DATE STARTED 9-1-72
DATE COMPLETED 9-1-72

LENGTH OF HOLE 24 ft

% ORE RECOVERY

INCLINATION | CORE SIZE | ORE BANDS | GEOLOGIC COLUMN | GEOLOGIC DESCRIPTION



20	0-20	Pleistocene Till with interbedded sands, silty sands, and gravels, 6" boulder at 3'. Gravels increase below 14'.
24	20-24	Precambrian. Badly decomposed and rotten schist.
		End of Hole 24'
		Pump Test 12.4 gpm

BEST COPY AVAILABLE

GREAT LAKES EXPLORATION

Flambeau

Well No. 42 (OW-42) F+VD 2/89

SECTION 402

COORDINATES 40,457.70 N, 38,589.73 E

AZIMUTH

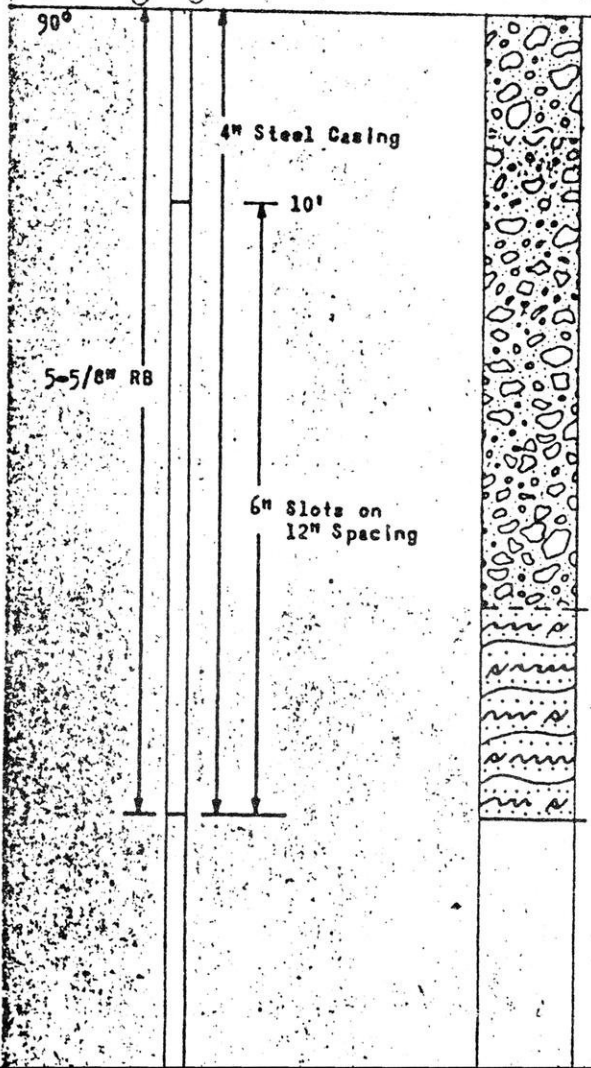
ELEVATION Cap: 1102.21 ft
Ground: 1100.27 ft

DATE STARTED 9-8-72
COMPLETED 9-9-72

LENGTH OF HOLE 42 ft

% ORE RECOVERY

INCLINATION | CORE SIZE | ORE BANDS | GEOLOGIC COLUMN | GEOLOGIC DESCRIPTION



0-31	Pleistocene Till. Silty sand from 0-3' with an increase in gravel and boulders to 16'. Sand and gravel with a silty matrix 16 to 25'. Well sorted silty fine grained sand 25 to 30 feet. Gravelly at 3'. Fine grained brown sand pumped out of hole during testing.
31-42	Precambrian. Badly decomposed schist with white to tan clay material. Chlorite-sericite fragments below 35'.

End of Hole 42'

Pump Test 7.0 gpm

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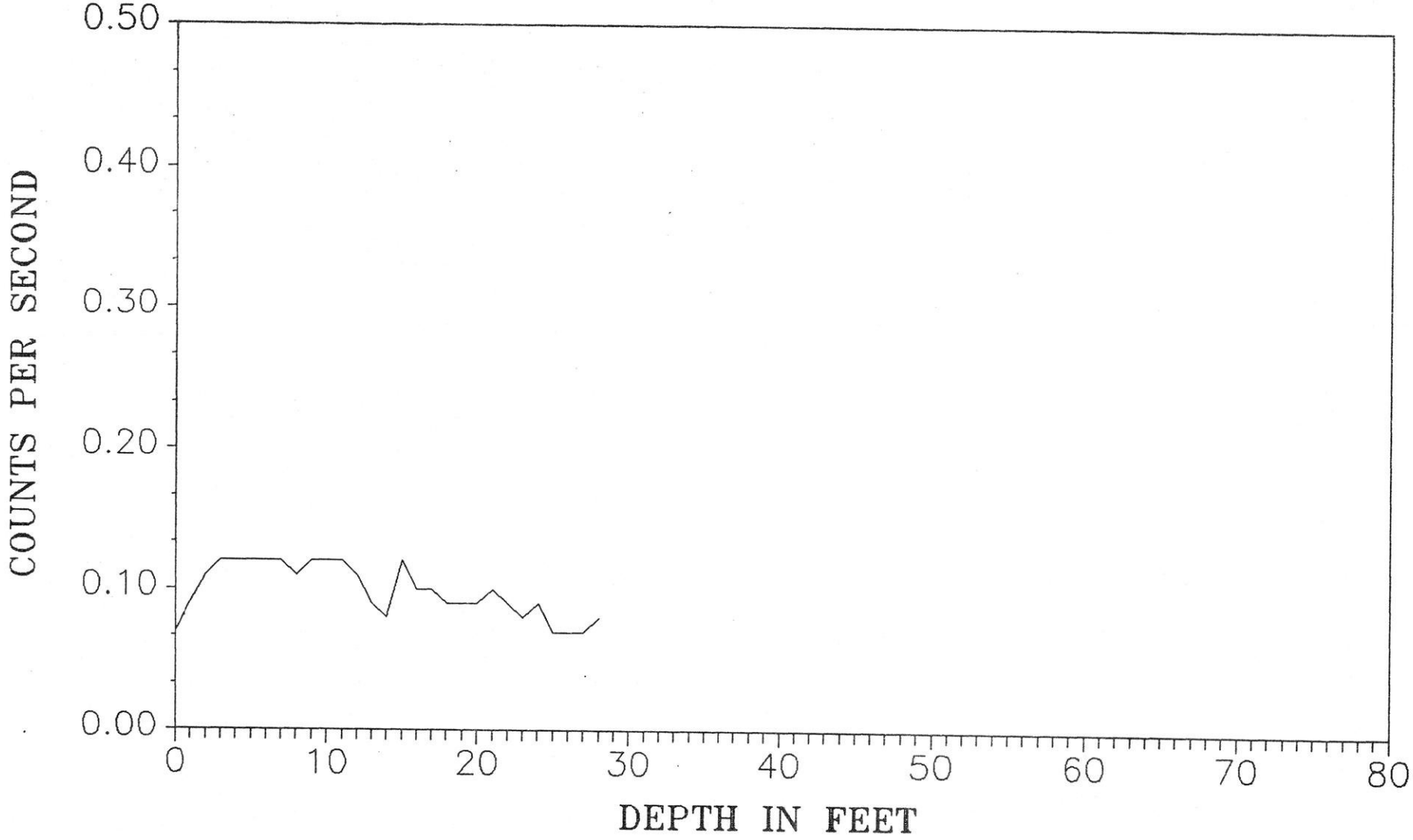


DATA TAKEN 1-13-89 BY BJS
TIME CONSTANT = 5 SECONDS
RANGE SETTING = 20 K

FOTH & VAN DYKE
GEOSCIENCES & ENVIRONMENTAL MANAGEMENT DIVISION
GREEN BAY, WISCONSIN

KENNECOTT MINERALS COMPANY
FLAMBEAU PROJECT
LADYSMITH, WISCONSIN

GAMMA LOG
WELL OW-42

No	REVISIONS	NOTES	APPROVAL	DATE
			DESIGNED BY	
			DRAWN BY SJL	2/89
			CHECKED BY	
			APPROVED BY	
			CAD No.	SCALE AS SHOWN

Job No | Dwg No | REV

GREAT LAKES EXPLORATION

Flambeau

Well No. 43 (OW-43)

F+VD 2/89

SECTION 402

COORDINATES 40,716.47 N, 38,174.50 E

AZIMUTH

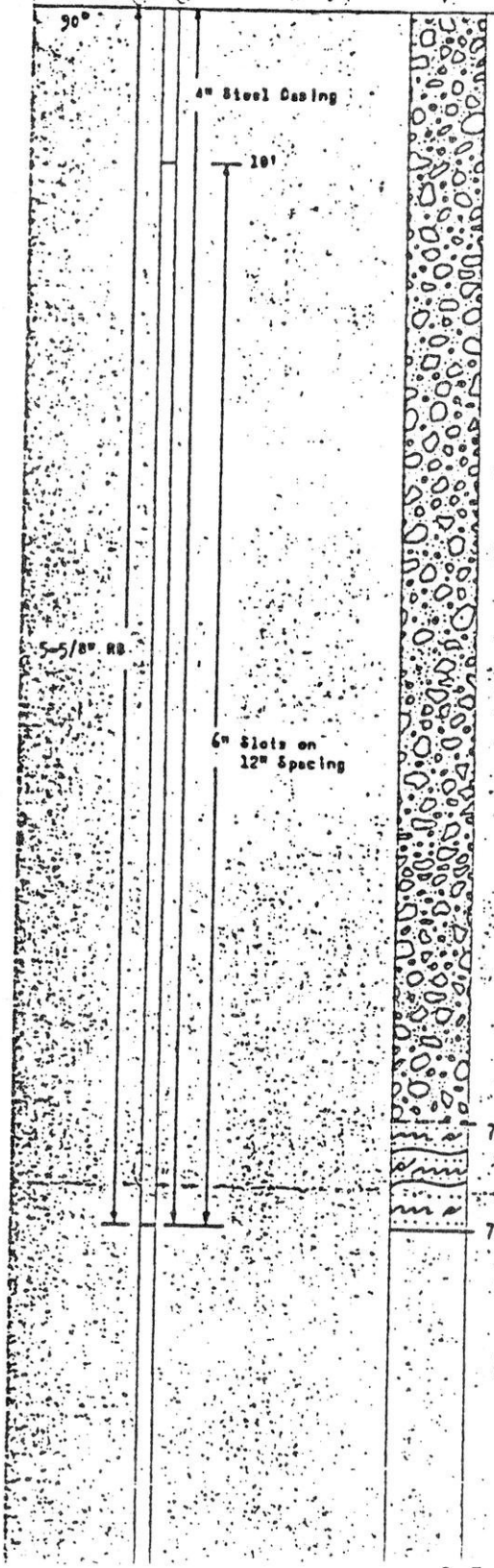
ELEVATION Cap: 1102.41 ft
Ground: 1099.8 ft

DATE STARTED 8-
COMPLETED 9-

LENGTH OF HOLE 78 ft

% ORE RECOVERY

INCLINATION | CORE SIZE | ORE BANDS | GEOLOGIC COLUMN | GEOLOGIC DESCRIPTION



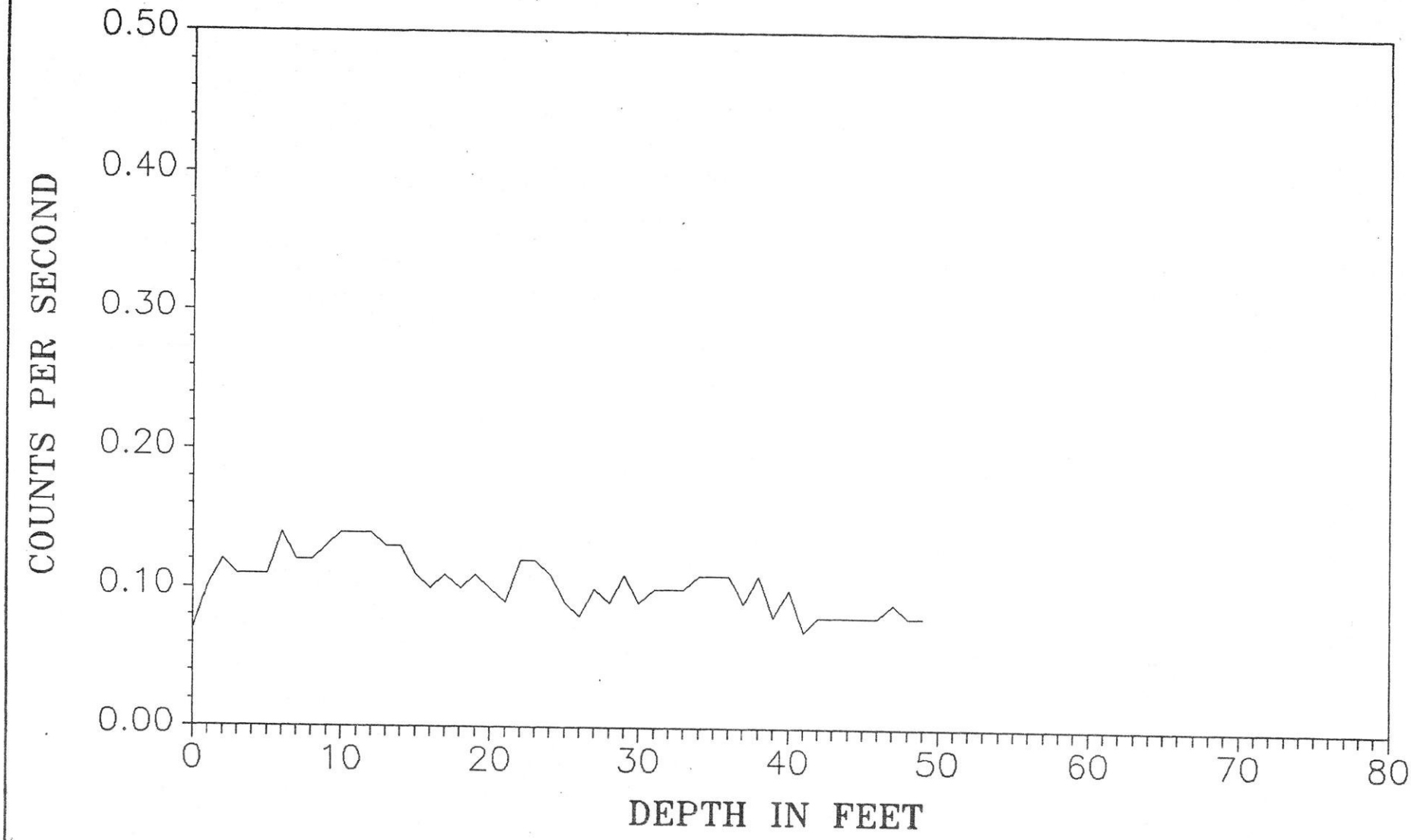
72 | 0-72 | Pleistocene Till interbedded silty sand, sand, and gravels. Possible sand 0-9', coarse sand and gravel 9-35', silty sand 38-48', gravels and coarse sand 48-72'.

78 | 72-78 | Precambrian. Badly decomposed schist.

End of Hole 78'

Pump Test 38+ gpm

BEST COPY AVAILABLE



DATA TAKEN 1-13-89 BY BJS
TIME CONSTANT = 5 SECONDS
RANGE SETTING = 20 K

FOTH & VAN DYKE
GEOSCIENCES & ENVIRONMENTAL MANAGEMENT DIVISION
GREEN BAY, WISCONSIN

KENNECOTT MINERALS COMPANY
FLAMBEAU PROJECT
LADYSMITH, WISCONSIN

GAMMA LOG
WELL OW-43

No	REVISIONS	NOTES	APPROVAL	DATE
			DESIGNED BY	
			DRAWN BY SJL	2/89
			CHECKED BY	
			APPROVED BY	
			CAD No.	SCALE AS SHOWN

Job No | Dwg No | REV

3.5-C-40

APPENDIX 3.4-D

Geologic Logs, Well Construction Diagrams, and Well Development Forms for the Baseline Groundwater Monitoring Program, 1987

LOG OF TEST BORING NO.: MW-1000, 1000P

CLIENT: Kennecott
PROJECT: Flambeau-Baseline Ground Water Monitoring
PROJECT NUMBER: 87K10-7
LOCATION: River Pillar
COORDINATES: 39725 N 38958 E (APPROX)

SURFACE ELEVATION: 1099.6
BORING DEPTH: 55.0
DATE: 09/30/87

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLE NOTES
1099.6	--0.0						Surface-Lt brn poorly graded SAND w/silt fn, loose, dry. Lg bldrs at 2-6', cuttings w/red brn sand	SP-SM		
1094.6	--5.0	6.0-7.5	ss	1	P	0.4	Red brn silty SAND, fn w/med & cse sand, fn & cse gvl, diamict, saturated	SM		
1089.6	--10.0	10.0-11.5	ss	2	P	1.2	Same as above to 10.5', then SILT, white red, yel varigated, soft, wet (saprolite)	ML		
1084.6	--15.0	15.0-16.5	ss	3	P	1.2	Same except darker red, brn, brittle, crumbly, w/qtz laminae (altered schist)	"ML"		
1079.6	--20.0	20.0-21.5	ss	4	P	0.6	Same except mostly white w/brn, w/flecks pyrite			
1074.6	--25.0	25.0-32.0	c	5		5.5	Cored 25-32 ft. Breaks at 25.4, 25.9, 26.4, 27.1, 28.1, 28.6, 29.6, & 30.5 ft. 25-28'-Lt gry & dk gry SCHIST, slightly altered, schistocity planes at about 45 degrees, rust brn (ox) parallel to schistocity, disseminated pyrite along schistocity. Vertical fracture w/iron stain at 26.3 to 26.7'. At 28', green & white schist, vert break from 28-28.3' horz break at 28.3'. Pyrite vein at 28.3 to 28.8'. At 28.3' white, lt gray, dk gray schist, more altered than above, w/near vertical breaks	RK	RQD = 79% Frac freq = 1.2/ft	
1072.1	--27.5							1a		
1069.6	--30.0									
1067.1	--32.5	32.0-42.0	c	6		3.9	Cored 32-42 ft. As above, white, gray SCHIST, altered, w/disseminated pyrite, near vertical planes of schistocity, brittle, broken in core barrel, longest pieces 0.7, 0.4, 0.6, 0.4, 0.4 ft long Oxidation (iron stain) along schistocity At bottom of core, vy soft, lt gray schist w/pyrite vein, breaks parallel to foliations		RQD = 39% Frac freq = 2/ft	
1064.6	--35.0									
1062.1	--37.5						(Sericite - Quartz Schist)			P - Pushed
1059.6	--40.0									

DRILLING DATA

START DATE: 09/30/87
COMPLETION DATE: 10/01/87
LOGGED BY: BJS
DRILLING METHOD: Mud rotary, tricone bit to 25', carbide bit 25-55'
DRILLING CONTRACTOR: Luisier Drilling, Inc.

WATER LEVEL INFORMATION

DEPTH AT COMPLETION:
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:
DRILLING LOSSES:

LOG OF TEST BORING NO.: MW-1000, 1000P

CLIENT: Kennecott
PROJECT: Flambeau-Baseline Ground Water Monitoring
PROJECT NUMBER: 87K10-7
LOCATION: River Pillar
COORDINATES: 39725 N 38958 E (APPROX)

SURFACE ELEVATION: 1099.5
BORING DEPTH: 55.0
DATE: 09/30/87

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLE NOTES
1059.5	--40.0									
		42.0-46.0	c	7		4.0	Gray, white altered schist w/dissem. pyrite, brittle, slightly harder than above, w/near vertical breaks along foliation. Breaks at 42.3, 42.75, 43.05, 43.35, 43.70, 44.0, 44.6, 45.3, 45.7, 46.15 ft. At about 43.5 & 44.0 ft, horz breaks w/clay & silt layer, soft, wet, red brn		RQD = 71% Frac freq = 2.3/ft	
1057.0	--42.5									
1054.5	--45.0									
		46.0-51.0	c	8		4.8	Gray, white altered schist w/dissem. pyrite & pyrite in veins up to 0.8" thick, brittle, more cohesive than above Breaks are about 30 degrees from vert. Breaks at 46.8, 47.5, 48.0, 48.3, 48.8, 49.8, 50.8 ft.	RK 1a	RQD = 94% Frac freq = 1.3/ft	
1052.0	--47.5									
1049.5	--50.0									
		51.0-55.0	c	9		4.0	Same as above. Breaks at 51.6, 52.2, 52.6, 53.6, 53.9, & 55.0 ft. Soft clayey layer about 3" thick @ approx 52.4'		RQD = 95% Frac freq = 1.5/ft	
1047.0	--52.5									
1044.5	--55.0						55'-End of boring in altered sericite schist	=====		
1042.0	--57.5									
1039.5	--60.0									
1037.0	--62.5									
1034.5	--65.0									
1032.0	--67.5									

DRILLING DATA

START DATE: 09/30/87
COMPLETION DATE: 10/01/87
LOGGED BY: BJS
DRILLING METHOD: Mud rotary, tricone bit to 25', carbide bit 25-55'
DRILLING CONTRACTOR: Luisier Drilling, Inc.

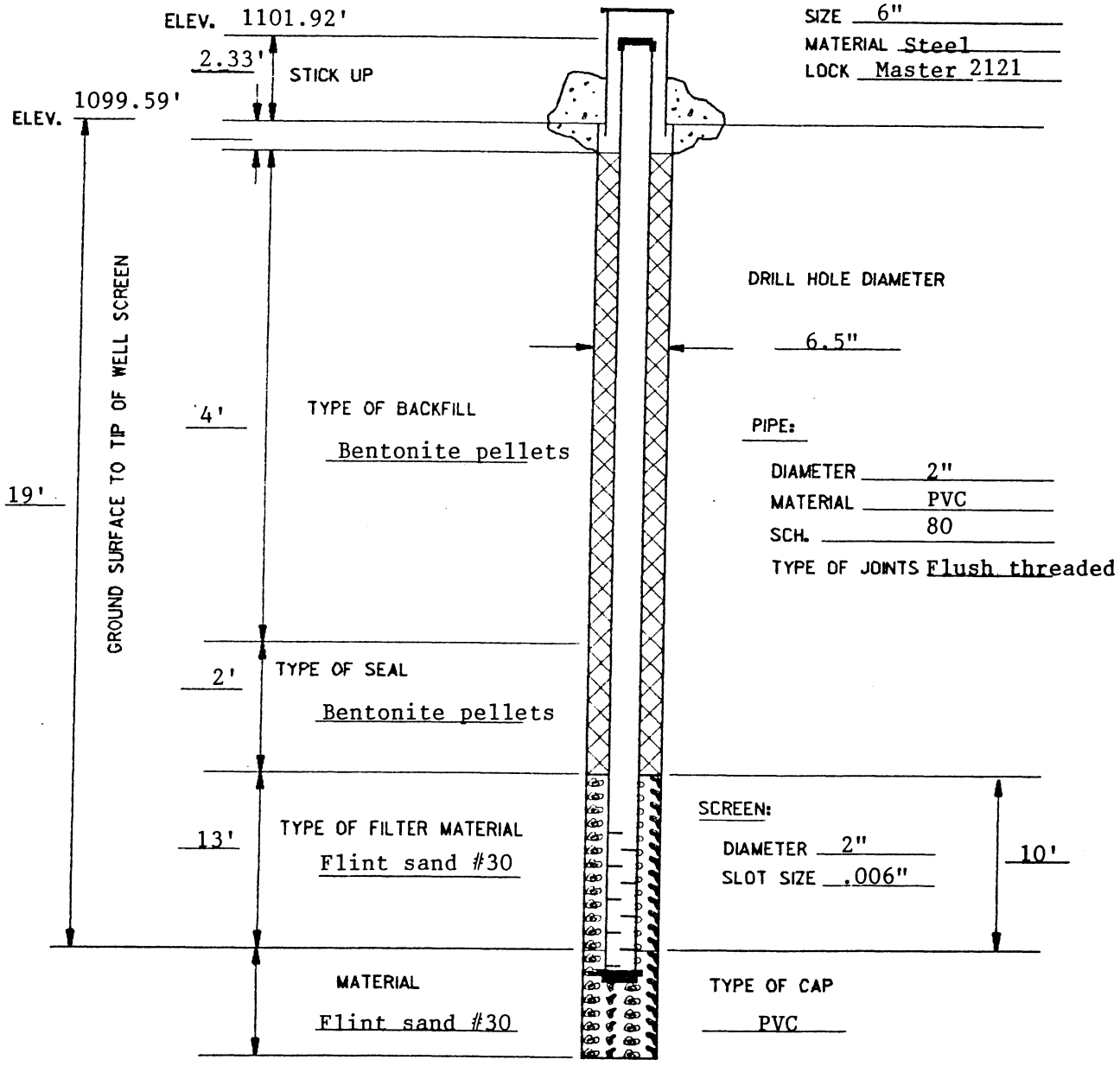
WATER LEVEL INFORMATION

DEPTH AT COMPLETION:
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:
DRILLING LOSSES:

MONITORING WELL INSTALLATION DIAGRAM

WELL NO: MW-1000
DATE INSTALLED: 10-01-87
DRILLER: Luisier Well Drilling
DRILLING METHOD: Mud rotary
COORDINATES: 39,725.52N 38,958.70E

CLIENT: Kennecott
PROJECT: Baseline G.W. Monitoring
SCOPE I.D.: 87K10-7
BY: BJS



Foth & Van Dyke
Geosciences & Environmental Management Division

MONITORING WELL DEVELOPMENT

WELL NUMBER MW-1000

WELL DIAMETER 2"

TOTAL DEPTH OF WELL 19'

DEPTH TO WATER — TIME OF MEASUREMENT

BEFORE _____ _____

AFTER 19' (Dry) _____

CLIENT Kennecott

PROJECT Baseline G.W. Monitoring

SCOPE I.D. 87K10-7

BY K.M. Luisier Well Drilling

DATE 10-5-87

DESCRIPTION OF DEVELOPMENT METHOD

Well was alternately surged and bailed using a foot valve installed on a 3/4" flexible PVC pipe. The pipe and foot valve were moved up and down in the well by a motor-driven pitcher-pump.

VOLUME OF WATER REMOVED FROM WELL 4 gallons

CLARITY OF WATER IN WELL BEFORE DEVELOPMENT dark, silty, clayey

CLARITY OF WATER IN WELL AFTER DEVELOPMENT light, silty, clayey

PRESENCE OF SEDIMENT AT THE BOTTOM OF THE WELL _____

VOLUME OF WATER ADDED TO WELL None

SOURCE OF WATER ADDED TO WELL _____

TIME SPENT FOR DEVELOPMENT 45 min.

STABILIZATION READINGS

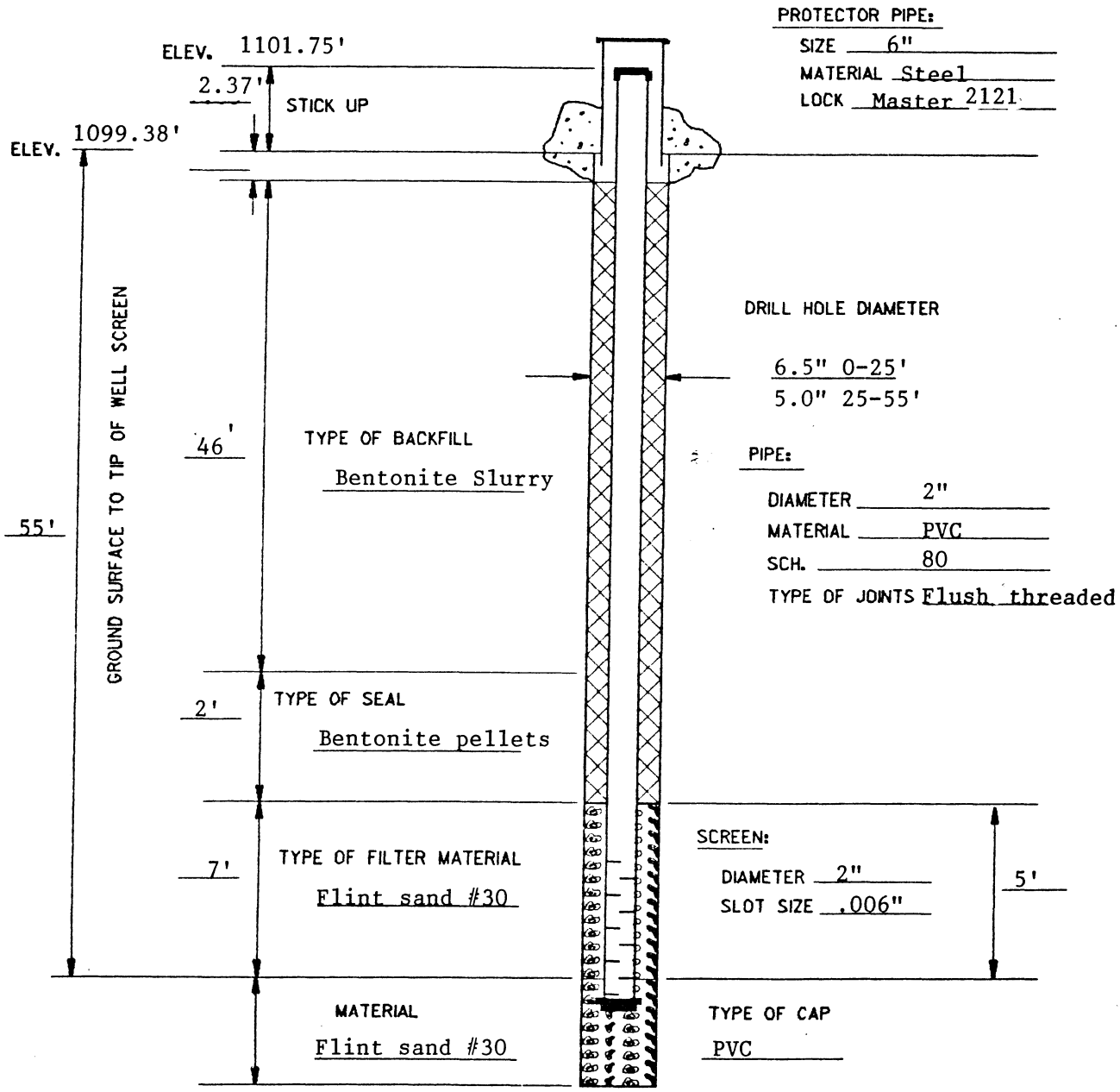
GAL. REMOVED	TIME	FIELD TEMPERATURE	FIELD SPEC. COND.	FIELD pH

FOTH AND VAN DYKE

MONITORING WELL INSTALLATION DIAGRAM

WELL NO: MW-1000P
DATE INSTALLED: 10-01-87
DRILLER: Luisier Well Drilling
DRILLING METHOD: Mud rotary
COORDINATES: 39,720.95N 38,950.72E

CLIENT: Kennecott
PROJECT: Baseline G.W. Monitoring
SCOPE I.D.: 87K10-7
BY: BJS



Foth & Van Dyke
Geosciences & Environmental Management Division

MONITORING WELL DEVELOPMENT

WELL NUMBER MW-1000P

WELL DIAMETER 2"

TOTAL DEPTH OF WELL 54.5'

DEPTH TO WATER TIME OF MEASUREMENT

BEFORE _____ _____

AFTER 54.5' (Dry) _____

CLIENT Kennecott

PROJECT Baseline G.W. Monitoring

SCOPE I.D. 87K10-7

BY K.M. Luisier Well Drilling

DATE 10-5-87

DESCRIPTION OF DEVELOPMENT METHOD

Well was alternately surged and bailed using a foot valve installed on a 3/4" flexible PVC pipe. The pipe and foot valve were moved up and down in the well by a motor-driven pitcher-pump.

VOLUME OF WATER REMOVED FROM WELL 6 gallons

CLARITY OF WATER IN WELL BEFORE DEVELOPMENT brown

CLARITY OF WATER IN WELL AFTER DEVELOPMENT _____

PRESENCE OF SEDIMENT AT THE BOTTOM OF THE WELL None

VOLUME OF WATER ADDED TO WELL None

SOURCE OF WATER ADDED TO WELL _____

TIME SPENT FOR DEVELOPMENT 1 hour

STABILIZATION READINGS

GAL. REMOVED	TIME	FIELD TEMPERATURE	FIELD SPEC. COND.	FIELD pH

FOTH AND VAN DYKE

LOG OF TEST BORING NO.: MW-1001, 1001G

CLIENT: Kennecott
PROJECT: Flambeau-Baseline Ground Water Monitoring
PROJECT NUMBER: 87K10-7
LOCATION: South of southwest end of pit
COORDINATES: 39537 N 39560 E (APPROX)

SURFACE ELEVATION: 1141.0
BORING DEPTH: 53.5
DATE: 09/24/87

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLE NOTES
1141.0	--0.0						Surface-Yel brn (10YR 5/8) prly graded SAND w/silt, fn, loose. (Aeolian v fn s)	SP-SM		
		3.0-4.5	ss	1	35	0.0	As above to 4', vy fn sand, loose, dry			
1136.0	--5.0	5.0-6.5	ss	2	27	1.2	4-5' w/fn gvl, hard drilling (till as below)			
							Dk red brn (5YR 3/4) silty SAND, fine w/med & cse sand, fn & cse gvl, dense, cohesive, brittle, vy slightly moist, diamict (till)			
1131.0	--10.0	10.0-11.5	ss	3	100	0.4	Cored bldr (greenstone). Cuttings as above, dry to slightly moist	SM		
1126.0	--15.0	15.0-16.5	ss	4	100	0.4	Core bldr (vy cse grained granite, much pink feldspar). Cutting str brn (7.5YR 5/6) clayey SAND (till), slightly moist			
1121.0	--20.0	20.0-21.5	ss	5	26	0.4	Till as above, str brn (7.5YR 4/6) silty SAND			
1116.0	--25.0	25.0-26.5	ss	6	17	1.0	As above, except wet.			
1111.0	--30.0	30.0-31.5	ss	7	15	0.8	As above except slightly more clay, massive, uniform color, slight textural variation			
1106.0	--35.0	35.0-36.5	ss	8	16	1.5	Same			
1101.0	--40.0	40.0-41.5	ss	9	26	1.5	Same, soft, cohesive w/pebble concentrations, saturated			
1096.0	--45.0	45.0-46.5	ss	10	29	0.8	Same except slightly more sandy, w/slight textural & color layering. Hard drilling at 48.5'			
1091.0	--50.0	50.0-51.5	ss	11	29	0.5	Str brn (7.5YR 5/8) poorly graded SAND w/silt, fn, loose, sticky qtz sand (weathered sandstone)	SP-SM (SS)		
		52.0-53.5	ss	12	22	0.8	White & yel brn SILT plastic, saturated at top of sample, dry brittle at tip of spoon (altered schist) (saprolite)	ML		
1086.0	--55.0						53.5'-End of Boring in saprolite	=====		

DRILLING DATA

START DATE: 09/24/87
COMPLETION DATE: 09/25/87
LOGGED BY: BJS
DRILLING METHOD: Hollow stem augers, 4 1/4" ID
DRILLING CONTRACTOR: Wisconsin Test Drilling, Inc.

WATER LEVEL INFORMATION

DEPTH AT COMPLETION:
LATER TIME/DEPTH: 15 hr/26.4'
LATER TIME/DEPTH:
CAVE IN DEPTH:
DRILLING LOSSES:

LOG OF TEST BORING NO.: MW-1001P

CLIENT: Kennecott
PROJECT: Flambeau-Baseline Ground Water Monitoring
PROJECT NUMBER: 87K10-7
LOCATION: South of southwest end of pit
COORDINATES: 39543.90 N 39552.90 E

SURFACE ELEVATION: 1140.78
BORING DEPTH: 95.0
DATE: 10/02/87

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLE NOTES
1140.8	--0.0						Drilled to 52' without sampling See log for MW-1001, 1001G			
1090.8	--50.0									
		52.0-53.5	c	1	P	1.5	Lt yel brn SILT, brittle, dry, foliated (saprolite)	ML		
1085.8	--55.0									
		57.0-58.5	c	2	P	1.8	Same to about 58.5'; grn gray SILT/silty CLAY at tip of spoon, slightly moist, brittle to plastic when wet	ML, CL-ML		
1080.8	--60.0									
		62.0-63.5	c	3	P	0.5	Green gray altered SCHIST, foliated, brittle	"ML"		
1075.8	--65.0									
		65.0-72.0	c	4		4.2	Lt green gray (5G 7/1 & 5BG 7/1) altered SCHIST, vy soft, brittle. Top 2' clayey schistocity more distinct in bottom 2' Core soft, sticks to core barrel; probably no natural breaks in core		RQD = 60%	
1070.8	--70.0									
		72.0-84.0	c	5		2.2	White (5YR 8/1) and pink (5YR 8/4) "SILT", extr. altered schist/saprolite, much kaolinite, breaks at about 25 degrees from vertical, soft, moist Breaks at 0.4, 0.8, & 1.0 ft.		RQD = 18% Fract freq = 2.3/ft	
1065.8	--75.0									
1060.8	--80.0									
		84.0-89.5	c	6		4.0	Green gray altered SCHIST, soft, brittle to about 86' then soft clayey, white, & lt grn; bottom 0.8 ft broken qtz w/white & pink (kaolinite) clay. Qtz pieces up to 1.5" dia. Core soft, sticking to barrel, breaks near vertical & horizontal		RQD = 58% Fract freq = 2.8/ft	
1055.8	--85.0							QTZ		
1050.8	--90.0						QTZ as above, fn & cse gvl up to 3" dia.			
		89.5-95.0	c	7		4.0	to 91'; then lt grn gray lean CLAY/SILT altered schist, vy soft, plastic. Bottom 1' white & pink altered schist, soft, crumbly, moist.	"CL/ ML"	RQD = 89%	P - Pushed
1045.8	--95.0						Core soft, sticking to barrel, probably no natural breaks except in quartz 95.0'-End of Boring in altered schist	=====		
1040.8	--100.0									

DRILLING DATA

START DATE: 10/02/87
COMPLETION DATE: 10/02/87
LOGGED BY: BJS
DRILLING METHOD: Mud rotary, 4 7/8" carbide bit, 3 1/4" core
DRILLING CONTRACTOR: Luisier Drilling, Inc.

WATER LEVEL INFORMATION

DEPTH AT COMPLETION:
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:
DRILLING LOSSES:

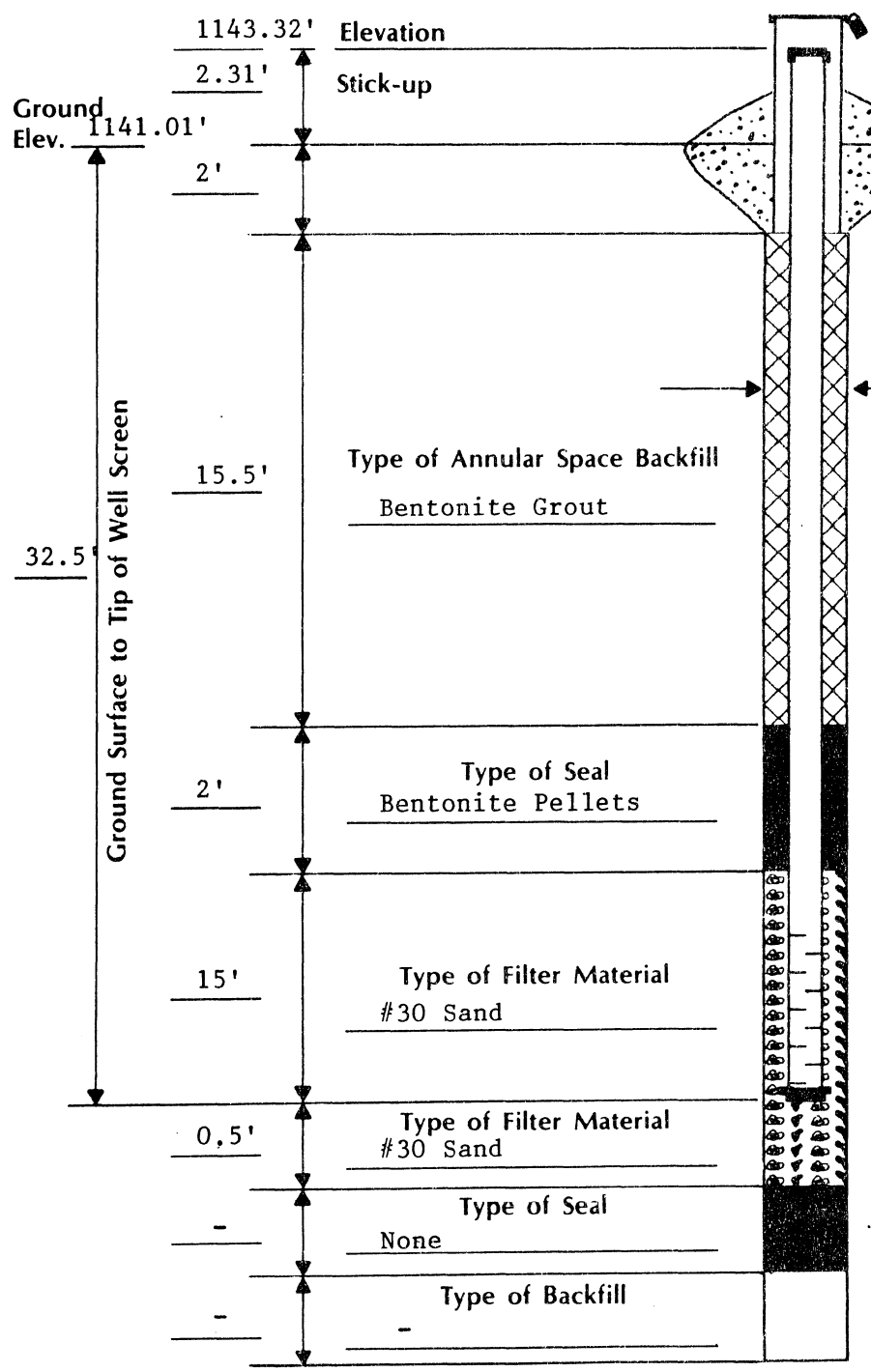
Foth & Van Dyke

Client: Kennecott — Scope I.D.: 87K10
Project: Baseline Groundwater Monitoring — Page: 1
Prepared by: BJS — Date: 9-28-87
Checked by: BJS — Date: 12-14-88

MONITORING WELL CONSTRUCTION DIAGRAM

Driller: Wisconsin Test Drilling, Inc.
Drilling Method: Hollow Stem Augers 4.25" ID
Coordinates: 39,537.00N 39,561.02E

Well No: MW-1001
Date Installed: 9-28-87



Type of Annular Space Backfill: Bentonite Grout

Type of Seal: Bentonite Pellets

Type of Filter Material: #30 Sand

Type of Filter Material: #30 Sand

Type of Seal: None

Type of Backfill: -

Protector Pipe:
Size: 4"
Material: Steel
Lock No.: 2121

Surface Seal Material: Cement

Drill Hole Diameter: 7"

Riser:
Diameter: 2"
Material: PVC
Sch.: 40
Type of Joints: Flush threaded
Stenciled? -

Screen:
Diameter: 2"
Material: PVC
Slot Size: 0.010"
Length: 10'

Type of Cap: PVC

Centralizer: Used ☐ Not Used ☒

Depth to Water From Top of Riser at Completion: 27'

NOTE: Not to Scale

FORM #309 GEM (Rev. 11/88)

MONITORING WELL DEVELOPMENT

WELL NUMBER MW-1001

WELL DIAMETER 2"

TOTAL DEPTH OF WELL 32.5'

DEPTH TO WATER TIME OF MEASUREMENT

BEFORE 26.0'

AFTER 29.25'

CLIENT Kennecott

PROJECT Baseline G.W. Monitoring

SCOPE I.D. 87K10-7

BY M.M. Wisc. Test Drilling, Inc.

DATE 9-30-87

DESCRIPTION OF DEVELOPMENT METHOD

Well was alternately surged and bailed using a PVC hand pump.

VOLUME OF WATER REMOVED FROM WELL 5 gallons

CLARITY OF WATER IN WELL BEFORE DEVELOPMENT brown, sandy, silty

CLARITY OF WATER IN WELL AFTER DEVELOPMENT brown, sandy, silty

PRESENCE OF SEDIMENT AT THE BOTTOM OF THE WELL

VOLUME OF WATER ADDED TO WELL None

SOURCE OF WATER ADDED TO WELL

TIME SPENT FOR DEVELOPMENT 0.5 hours

STABILIZATION READINGS

GAL. REMOVED	TIME	FIELD TEMPERATURE	FIELD SPEC. COND.	FIELD pH

FOTH AND VAN DYKE

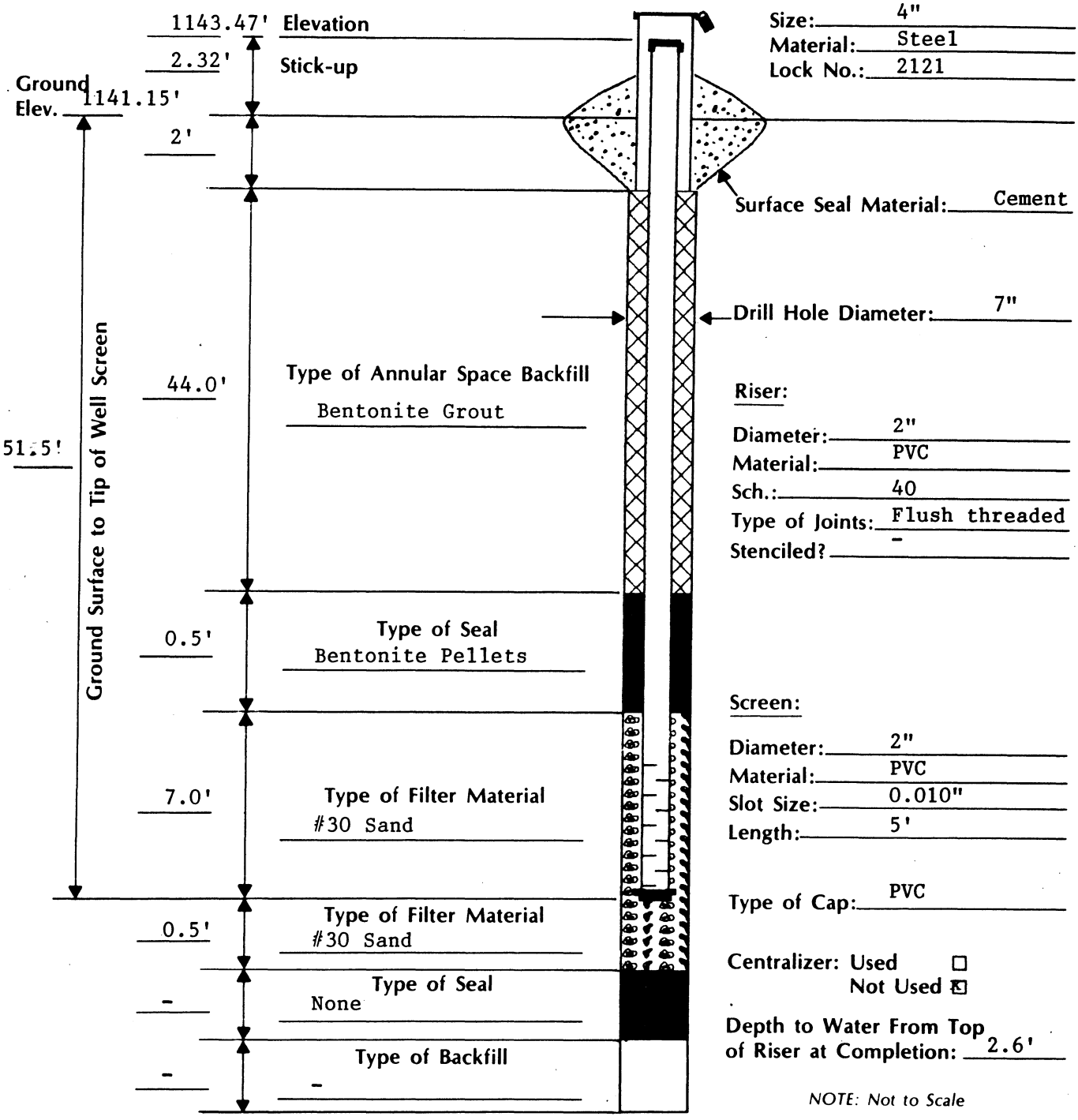
Foth & Van Dyke

Client: Kennecott — Scope I.D.: 87K10
Project: Baseline Groundwater Monitoring — Page: 1
Prepared by: BJS — Date: 9-25-87
Checked by: BJS — Date: 12-14-88

MONITORING WELL CONSTRUCTION DIAGRAM

Driller: Wisconsin Test Drilling, Inc.
Drilling Method: Hollow Stem Augers
Coordinates: 39,534.85N 39,553.22E

Well No: MW-1001G
Date Installed: 9-25-87



Protector Pipe:
Size: 4"
Material: Steel
Lock No.: 2121

Surface Seal Material: Cement

Drill Hole Diameter: 7"

Riser:
Diameter: 2"
Material: PVC
Sch.: 40
Type of Joints: Flush threaded
Stenciled? -

Screen:
Diameter: 2"
Material: PVC
Slot Size: 0.010"
Length: 5'

Type of Cap: PVC

Centralizer: Used ☐
Not Used ☒

Depth to Water From Top of Riser at Completion: 2.6'

NOTE: Not to Scale

MONITORING WELL DEVELOPMENT

WELL NUMBER MW-1001G
WELL DIAMETER 2"
TOTAL DEPTH OF WELL 51.5'
DEPTH TO WATER — TIME OF MEASUREMENT
BEFORE 26.9' ____
AFTER 27.4' ____

CLIENT Kennecott
PROJECT Baseline G.W. Monitoring
SCOPE I.D. 87K10-7
BY M.M. Wisc. Test Drilling, Inc.
DATE 9-30-87

DESCRIPTION OF DEVELOPMENT METHOD

Well was alternately surged and bailed using a PVC hand pump.

VOLUME OF WATER REMOVED FROM WELL 25 gallons
CLARITY OF WATER IN WELL BEFORE DEVELOPMENT brown, sandy, silty
CLARITY OF WATER IN WELL AFTER DEVELOPMENT brown, sandy
PRESENCE OF SEDIMENT AT THE BOTTOM OF THE WELL
VOLUME OF WATER ADDED TO WELL None
SOURCE OF WATER ADDED TO WELL
TIME SPENT FOR DEVELOPMENT 20 Minutes

STABILIZATION READINGS

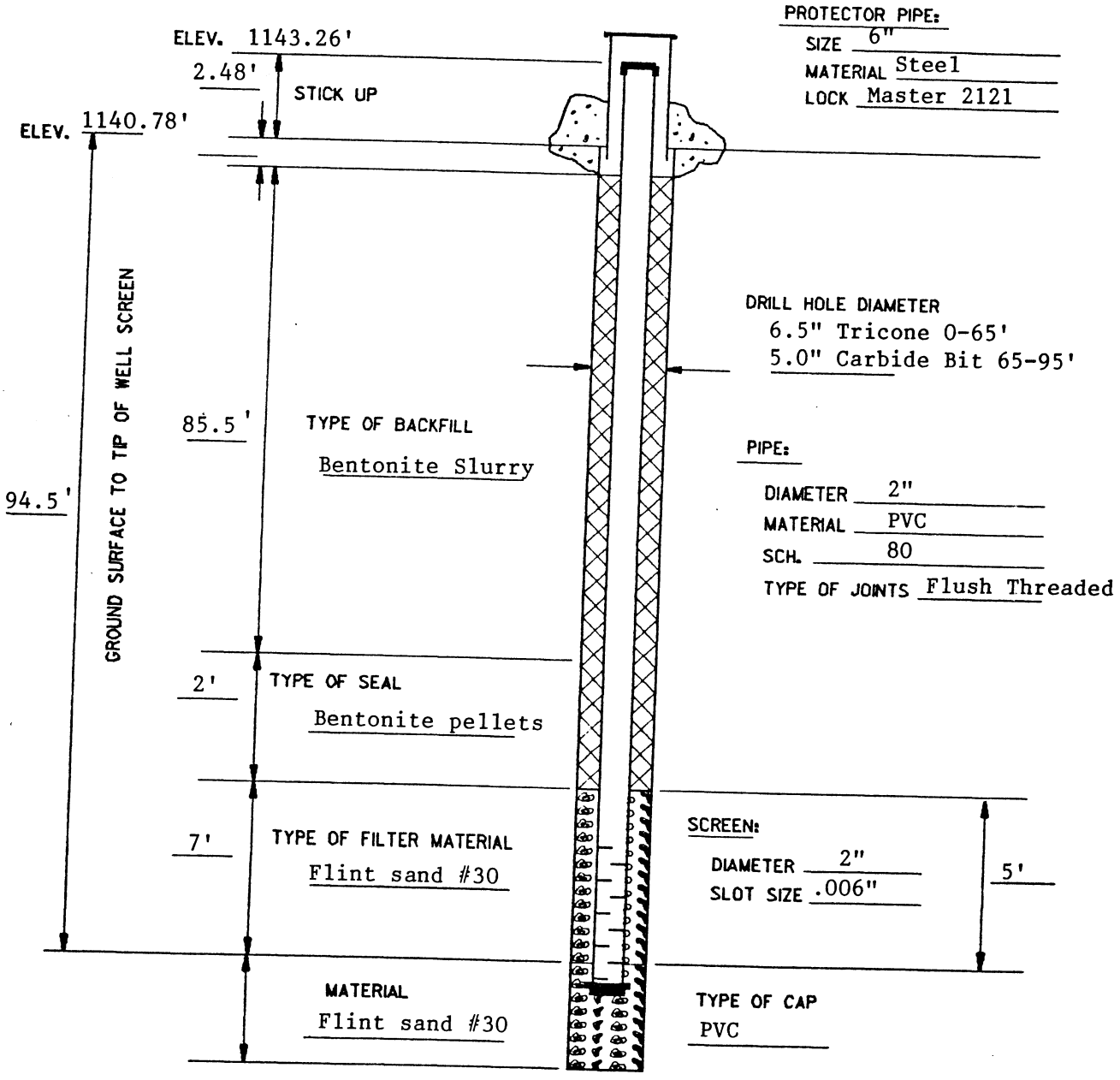
GAL. REMOVED	TIME	FIELD TEMPERATURE	FIELD SPEC. COND.	FIELD pH

FOTH AND VAN DYKE

MONITORING WELL INSTALLATION DIAGRAM

WELL NO: MW-1001P
DATE INSTALLED: 10-02-87
DRILLER: Luisier Drilling Inc.
DRILLING METHOD: Mud rotary
COORDINATES: 39,543.90N 39,552.90 E

CLIENT: Kennecott
PROJECT: Baseline G.W. Mon.
SCOPE I.D.: 87K10-BL 7
BY: BJS



Foth & Van Dyke
Geosciences & Environmental Management Division

MONITORING WELL DEVELOPMENT

WELL NUMBER MW-1001P

WELL DIAMETER 2"

TOTAL DEPTH OF WELL 94.0'

DEPTH TO WATER — TIME OF MEASUREMENT

BEFORE _____ _____

AFTER 94' (Dry) _____

CLIENT Kennecott

PROJECT Baseline G.W. Monitoring

SCOPE I.D. 87K10-7

BY K.M. Luisier Well Drilling

DATE 10-5-87

DESCRIPTION OF DEVELOPMENT METHOD

Well was alternately surged and bailed using a foot valve installed on a 3/4" flexible PVC pipe. The pipe and foot valve were moved up and down in the well by a motor-driven pitcher-pump.

VOLUME OF WATER REMOVED FROM WELL 7 gallons

CLARITY OF WATER IN WELL BEFORE DEVELOPMENT brown

CLARITY OF WATER IN WELL AFTER DEVELOPMENT _____

PRESENCE OF SEDIMENT AT THE BOTTOM OF THE WELL None

VOLUME OF WATER ADDED TO WELL None

SOURCE OF WATER ADDED TO WELL _____

TIME SPENT FOR DEVELOPMENT 1 hour

STABILIZATION READINGS

GAL. REMOVED	TIME	FIELD TEMPERATURE	FIELD SPEC. COND.	FIELD pH

FOTH AND VAN DYKE

LOG OF TEST BORING NO.: MW-1002, 1002G

CLIENT: Kennecott
PROJECT: Flambeau-Baseline Ground Water Monitoring
PROJECT NUMBER: 87K10-7
LOCATION: Gravel pit northwest of pit area
COORDINATES: 42585 N 38750 E (APPROX)

SURFACE ELEVATION: 1101.6
BORING DEPTH: 52.0
DATE: 09/20/87

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLE NOTES
1101.6	--0.0						Surface-Gvl pit excav., GRAVEL, cse w/fn w/fn & med sand. Lk Superior source, ig & meta & volc rocks. Much greenstone, schist, granite, qtzte, congl. Bldrs up to 8' dia			Vy difficult drilling- many cobbles bldrs from 5-10' (Fill, bldrs from gvl pit operation?) & 35-50' Lost about 500 gals drilling fluid to formation Drilled & sampled MW-1002 to 17', moved over about 10' and drilled to 20' without sampling
1099.1	--2.5	2.0-3.5	ss	1	100	0.8	Brn well graded GRAVEL w/silt, broken rock in spoon, weath w/sand, fn & med loose. Cutting to 5', fn gvl 1-2" dia vy well rounded w/little sand	GW-GM		
1096.6	--5.0	5.0-6.5	ss	2	110	0.0	Pushed rock, couldn't auger through, moved over twice. Cutting gvl, cobbles, boulders			
1091.6	--10.0	10.0-11.5	ss	3	34	1.0	Red brn (5YR 4/4) well graded SAND w/silt & gravel, fn w/med & cse sand, fn gvl, loose, dense, wet, indistinctly bedded	SW-SM		
1086.6	--15.0	15.0-16.5	ss	4	26	0.5	Same, wet			
1081.6	--20.0	20.0-21.5	ss	5	36	0.4	Cse gvl, cave, cobbles, bldrs falling in hole, rod plugging up			
1076.6	--25.0	25.0-26.5	ss	6	36	0.8	Str brn (7.5YR 4/6) poorly graded SAND w/silt, fn w/med & trace cse sand, loose, wet	SP-SM		
1071.6	--30.0	30.0-31.5	ss	7	30	1.0	Same except layered (1-3" thick), fine, med, loose			
1066.6	--35.0	35.0-36.5	ss	8	49	0.0	Drilled like sand w/cobbles			
1064.1	--37.5	37.0-38.5	ss	9	63	1.0	Str brn (7.5YR 4/6) poorly graded SAND w/silt as above, one 2" thick silt layer laminated, firm, saturated			
1061.6	--40.0									
1059.1	--42.5	42.0-43.5	ss	10	30	0.0	Drilled like sand w/gvl (cobbles, bldrs)			

DRILLING DATA

START DATE: 09/20/87
COMPLETION DATE: 09/22/87
LOGGED BY: BJS
DRILLING METHOD: Mud rotary, 6" tricone
DRILLING CONTRACTOR: Wisconsin Test Drilling, Inc.

WATER LEVEL INFORMATION

DEPTH AT COMPLETION:
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:
DRILLING LOSSES:

LOG OF TEST BORING NO.: MW-1002, 1002G

CLIENT: Kennecott
PROJECT: Flambeau-Baseline Ground Water Monitoring
PROJECT NUMBER: 87K10-7
LOCATION: Gravel pit northwest of pit area
COORDINATES: 42585 N 38750 E (APPROX)

SURFACE ELEVATION: 1101.6
BORING DEPTH: 52.0
DATE: 09/20/87

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLE NOTES
1059.1	--42.5									
								SP-SM		
1056.6	--45.0									
		47.0-48.5	ss	11	28	0.5	Dk yel brn (10YR 4/4) w/yel brn		27	
1054.1	--47.5						(10YR 5/6) silty SAND/SILT, fn (vy fn sand w/silt), soft, cohesive w/fn gvl, trace black organics, saturated, (weathered, oxidized)	SM/ML		
		49.0-50.5	ss	12	70	0.0	No recovery		2	
1051.6	--50.0							SW-SM		
							(Mixed new mud, pounded ss at 51' through about 1.5' of cave)			
		51.0-52.5	ss	13	144	1.2	Yel brn & dk yel brn well graded SAND w/silt & gvl, fn w/med & cse sand, fn & cse gvl (weathered, oxidized)			
1049.1	--52.5						52'-End of Boring in Sand & Gravel	=====	2	
1046.6	--55.0									
1044.1	--57.5									
1041.6	--60.0									
1039.1	--62.5									
1036.6	--65.0									
1034.1	--67.5									
1031.6	--70.0									

DRILLING DATA

START DATE: 09/20/87
COMPLETION DATE: 09/22/87
LOGGED BY: BJS
DRILLING METHOD: Mud rotary, 6" tricone
DRILLING CONTRACTOR: Wisconsin Test Drilling, Inc.

WATER LEVEL INFORMATION

DEPTH AT COMPLETION:
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:
DRILLING LOSSES:

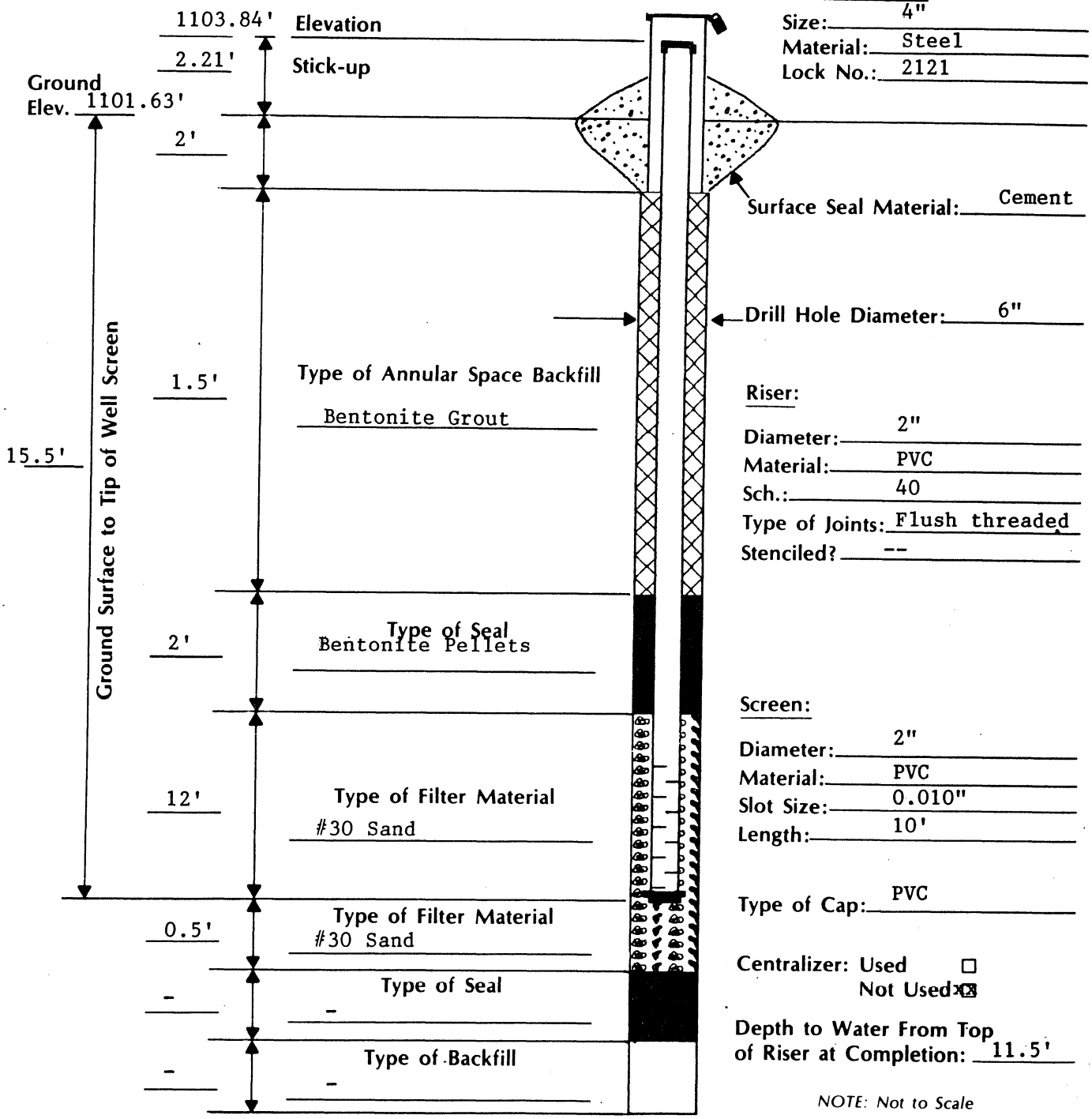
Foth & Van Dyke

Client: Kennecott — Scope I.D.: 87K10
Project: Baseline Groundwater Monitoring — Page: 1
Prepared by: BJS — Date: 9-21-87
Checked by: BJS — Date: 12-14-88

MONITORING WELL CONSTRUCTION DIAGRAM

Driller: Wisconsin Test Drilling, Inc.
Drilling Method: Mud Rotary 6" Tricone
Coordinates: 42,582.14N 38,743.56E

Well No: MW-1002
Date Installed: 9-21-88



Protector Pipe:
Size: 4"
Material: Steel
Lock No.: 2121

Surface Seal Material: Cement

Drill Hole Diameter: 6"

Riser:
Diameter: 2"
Material: PVC
Sch.: 40
Type of Joints: Flush threaded
Stenciled? --

Screen:
Diameter: 2"
Material: PVC
Slot Size: 0.010"
Length: 10'

Type of Cap: PVC

Centralizer: Used ☐
Not Used ☒

Depth to Water From Top of Riser at Completion: 11.5'

NOTE: Not to Scale

MONITORING WELL DEVELOPMENT

WELL NUMBER MW-1002
WELL DIAMETER 2"
TOTAL DEPTH OF WELL 16.0'
DEPTH TO WATER — TIME OF MEASUREMENT
BEFORE 11.5' _____
AFTER 15.1' _____

CLIENT Kennecott
PROJECT Baseline G.W. Monitoring
SCOPE I.D. 87K10-7
BY M.M. Wisc. Test Drilling, Inc.
DATE 9-30-87

DESCRIPTION OF DEVELOPMENT METHOD

Well was alternately surged and bailed using a PVC hand pump.

VOLUME OF WATER REMOVED FROM WELL 7 gallons
CLARITY OF WATER IN WELL BEFORE DEVELOPMENT brown, sandy, silty
CLARITY OF WATER IN WELL AFTER DEVELOPMENT Very light brown
PRESENCE OF SEDIMENT AT THE BOTTOM OF THE WELL _____
VOLUME OF WATER ADDED TO WELL None
SOURCE OF WATER ADDED TO WELL _____
TIME SPENT FOR DEVELOPMENT 0.5 hours

STABILIZATION READINGS

GAL. REMOVED	TIME	FIELD TEMPERATURE	FIELD SPEC. COND.	FIELD pH

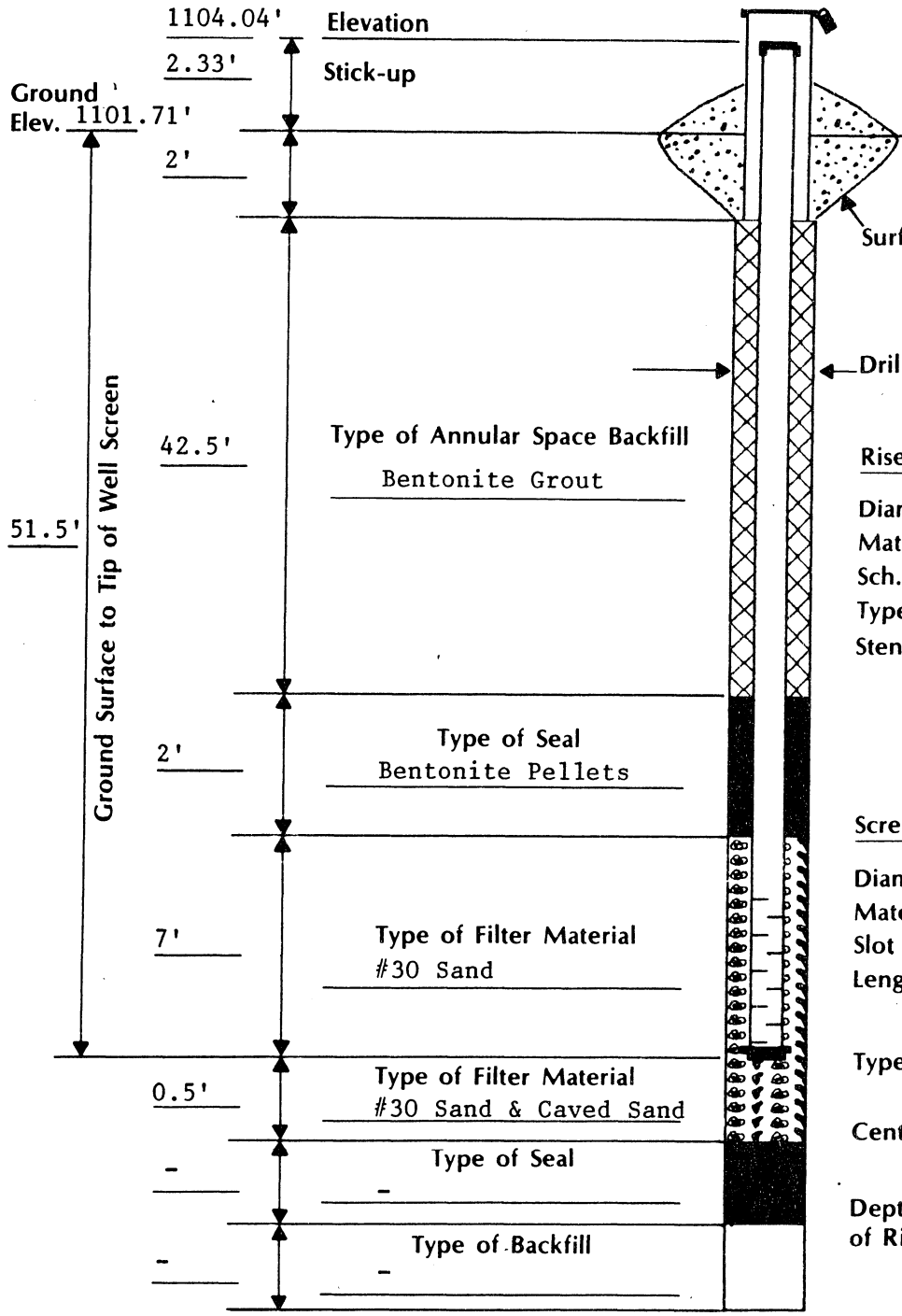
FOTH AND VAN DYKE

Foth & Van Dyke

Client: Kennecott — Scope I.D.: 87K10
Project: Baseline Groundwater Monitoring — Page: 1
Prepared by: BJS — Date: 9-22-87
Checked by: BJS — Date: 12-14-88

MONITORING WELL CONSTRUCTION DIAGRAM

Driller: Wisconsin Test Drilling, Inc.
Well No: MW-1002G
Drilling Method: Mud Rotary 6" Tricone
Date Installed: 9-22-88
Coordinates: 42,587.94N 38,753.83E



Protector Pipe:
Size: 4"
Material: Steel
Lock No.: 2121

Surface Seal Material: Cement

Drill Hole Diameter: 6"

Riser:
Diameter: 2"
Material: PVC
Sch.: 40
Type of Joints: Flush threaded
Stenciled? —

Screen:
Diameter: 2"
Material: PVC
Slot Size: 0.010"
Length: 5'

Type of Cap: PVC

Centralizer: Used ☐
Not Used ☒

Depth to Water From Top of Riser at Completion: 12'

NOTE: Not to Scale

MONITORING WELL DEVELOPMENT

WELL NUMBER MW-1002G

WELL DIAMETER 2"

TOTAL DEPTH OF WELL 51.5'

DEPTH TO WATER — TIME OF MEASUREMENT

BEFORE 11.8' _____

AFTER 12.1' _____

CLIENT Kennecott

PROJECT Baseline G.W. Monitoring

SCOPE I.D. 87K10-7

BY M.M. Wisc. Test Drilling, Inc.

DATE 9-30-87

DESCRIPTION OF DEVELOPMENT METHOD

Well was alternately surged and bailed using a PVC hand pump.

VOLUME OF WATER REMOVED FROM WELL 25 gallons

CLARITY OF WATER IN WELL BEFORE DEVELOPMENT brown, sandy, silty

CLARITY OF WATER IN WELL AFTER DEVELOPMENT light brown

PRESENCE OF SEDIMENT AT THE BOTTOM OF THE WELL _____

VOLUME OF WATER ADDED TO WELL None

SOURCE OF WATER ADDED TO WELL _____

TIME SPENT FOR DEVELOPMENT _____

STABILIZATION READINGS

GAL. REMOVED	TIME	FIELD TEMPERATURE	FIELD SPEC. COND.	FIELD pH

FOTH AND VAN DYKE

LOG OF TEST BORING NO.: MW-1003

CLIENT: Kennecott
PROJECT: Flambeau-Baseline Ground Water Monitoring
PROJECT NUMBER: 87K10-7
LOCATION: North of NE end of pit
COORDINATES: 41318.95 N 39915.14 E

SURFACE ELEVATION: 1143.41
BORING DEPTH: 40.8
DATE: 09/16/87

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLE NOTES
1143.4	--0.0									
		2.0-3.5	ss	1	15	1.5	Str brn (7.5YR 5/6) poorly graded SAND, fn, loose, slightly moist (Aeolian sand)	SP		
1138.4	--5.0	5.0-6.5	ss	2	18	1.5	Same Cutting at about 8', poorly graded SAND w/fn & cse, well rounded gvl			
1133.4	--10.0	10.0-11.5	ss	3	51	1.2	Dk brn silty SAND, layered w/poorly graded SAND, fn, loose, dry Cobbles at about 12 ft.	SM, SP		
1128.4	--15.0	15.0-16.5	ss	4	48	1.4	Red brn (5YR 4/4) silty SAND, fn w/med & cse sand, fn gvl, diamict (till) 4" purple volc. rock at approx. 16' then till as above except yel red (5Yr 4/6)	SM		
1123.4	--20.0	20.0-21.5	ss	5	50	1.0	Red brn & yel red (5YR 4/4 & 4/6) till as above			
1118.4	--25.0	25.0-26.5	ss	6	212	0.0	Pounded rock. Cutting 25-27 ft, silty SAND as above w/much fn angular gravel, cobbles, dry (till) Vy slightly moist at 27'			
1113.4	--30.0	30.0-31.5	ss	7	40	1.5	Silty SAND, as above, layered (1-2" thick) red brn & yel brn diamict, distinctly laminated w/few clayey, plastic layers			
1108.4	--35.0	35.0-36.5	ss	8	100	0.6	Brn yel (10YR 6/6) poorly graded SAND w/silt, fn, dense. Few silty layers (1" thick) (sandstone)	SP-SM (SS)	N - 100/0.6'	Cuttings saturated at about 34 ft.
1103.4	--40.0	40.0-41.5	ss	9	91	0.8	Lt gray (2.5Y 7/2) poorly graded SAND w/silt, fn w/med & cse w/few yel brn silty layers (sandstone) 40.8'-End of Boring in Sandstone	=====		
1098.4	--45.0									
1093.4	--50.0									
1088.4	--55.0									

DRILLING DATA

START DATE: 09/16/87
COMPLETION DATE: 09/16/87
LOGGED BY: BJS
DRILLING METHOD: Hollow stem augers, 4 1/4" ID
DRILLING CONTRACTOR: Wisconsin Test Drilling, Inc.

WATER LEVEL INFORMATION

DEPTH AT COMPLETION: 33.5'
LATER TIME/DEPTH: 9 days/32 ft
LATER TIME/DEPTH:
CAVE IN DEPTH: 38.5'-blowup
DRILLING LOSSES:

LOG OF TEST BORING NO.: MW-1003P

CLIENT: Kennecott
PROJECT: Flambeau-Baseline Ground Water Monitoring
PROJECT NUMBER: 87K10-7
LOCATION: North of NE end of pit
COORDINATES: 41328.21 N 39919.45 E

SURFACE ELEVATION: 1143.16
BORING DEPTH: 86.5
DATE: 10/03/87

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLE NOTES
1143.2	--0.0						Drilled to 45' wo/sampling See log for MW-1003			
								=====		
1098.2	--45.0	45.0-45.5	ss	1		0.5	Lt brn gray poorly graded SAND, fine, loose, qtz, vy dense (sandstone)		Drove - 10 sec	No recovery w/3 attempts to push spoon @ 45'
							Cuttings, cemented sandstone, no attempt to sample w/spoon	SS		
1093.2	--50.0	50.0-52.0	w	2			Lt brn SANDSTONE, cse, w/cemented fn sandstone pieces, vy well rounded, qtz. @ 52' white & pink soft clay (Kaolinite)			
1090.7	--52.5	52.0-53.5	ss	3		1.2	Yel (10YR 8/6) & yel red (5YR 6/8) sandy SILT, soft, brittle w/qtz laminae, altered mica, cohesive (saprolite)		Pushed	
1085.7	--57.5	57.0-57.6	ss	4		0.6	Same except last 0.3 ft, much harder, brittle	"ML"	Drove - 40 sec	
1083.2	--60.0	57.6-62.0	c	5		4.6	Same to 60', then lt grn gray (5GY 7/1) SILT, soft, brittle, schistocity appar., talcy. At 61.5' lt gray (5Y 7/1) silty CLAY, ext. altered (kaolinite) massive to indist. foliated, soft, brittle, powdery, vy slightly moist		RQD = 100%	No breaks in core barrel
1078.2	--65.0	62.0-69.0	c	6		0.0	Drilled vy fast, soft, cuttings w/lt grn med sand size tabular crystals		RQD = 0%	
1073.2	--70.0	69.0-75.0	c	7		2.7	2'- grn gray alterd SCHIST, soft, very brittle w/qtz lam., lt grn crystalline laminae, dk dusky red (hematite) 0.7'- Lt grn gray "silty CLAY" w/fn sand brittle, powdery, vy slightly moist		RQD = 45% Fract freq = 1.8/ft	
1068.2	--75.0	75.0-81.0	c	8		5.8	Green gray altered SCHIST w/dk red (hematite) & qtz laminae, soft to firm, brittle, wet, qtz laminae up to 1" thick at 80-81'		RQD = 97%	No breaks in core in core barrel
1063.2	--80.0	81.0-86.5	c	9		3.5	Broken qtz, white w/lt red (iron) stain, qtz in cse gvl size pieces up 2" dia to 82'. Bottom 2.5'- gray grn altrd schist, w/much dk red (hematite) laminae, breaks along near vertical schistocity planes, firm, brittle w/much qtz laminae	Qtz RK 3a	RQD = 42% Fract freq = 1.2/ft	
1058.2	--85.0						86.5'-End of Boring in altered schist	=====		
1053.2	--90.0						(Quartz-Augen Schist)			

DRILLING DATA

START DATE: 10/03/87
COMPLETION DATE: 10/03/87
LOGGED BY: BJS
DRILLING METHOD: Mud rotary, 6.5" tricone 0-45', 4 7/8" carbide bit, 3 1/4" core
DRILLING CONTRACTOR: Luisier Drilling, Inc.

WATER LEVEL INFORMATION

DEPTH AT COMPLETION:
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:
DRILLING LOSSES:

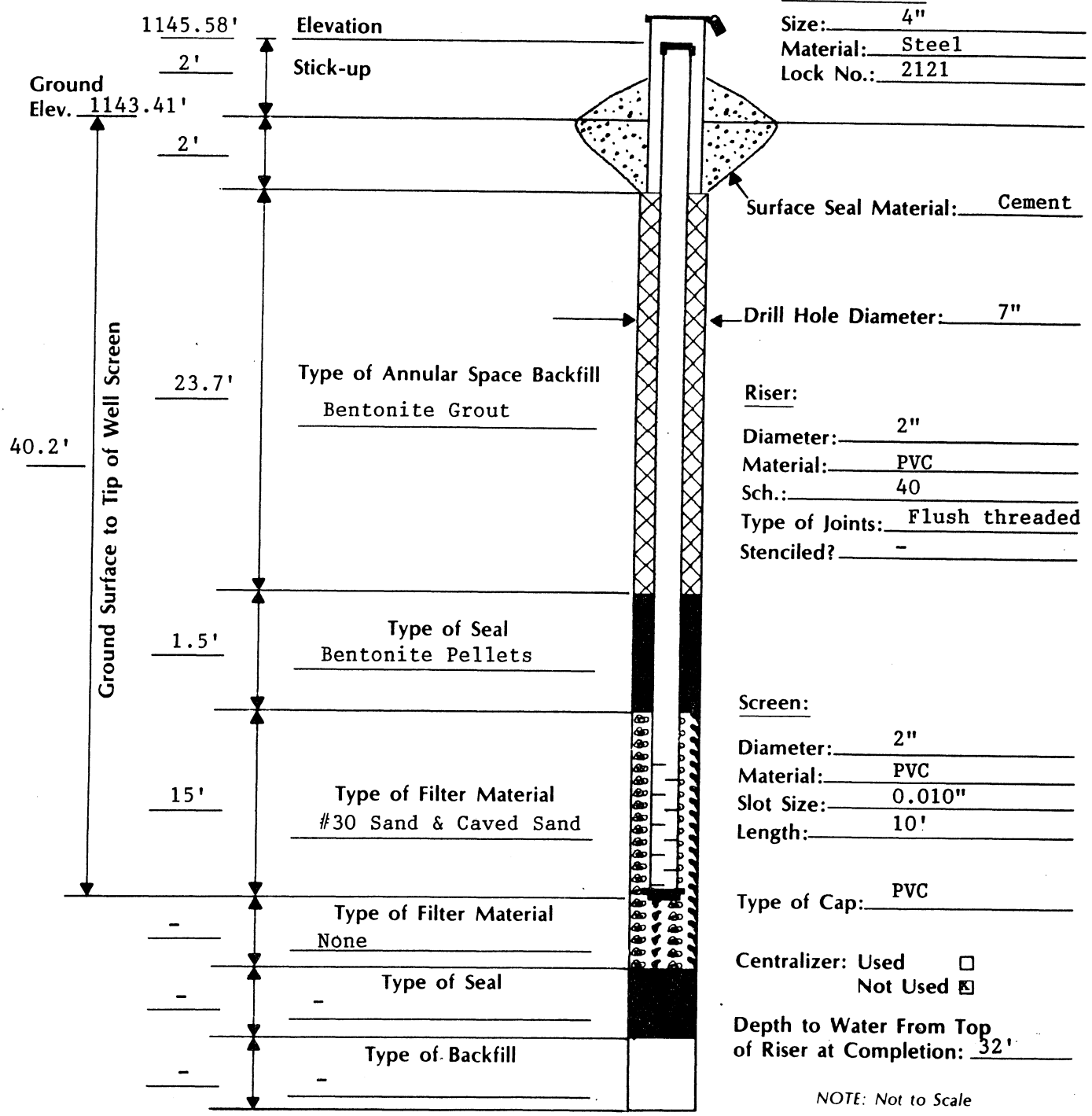
Foth & Van Dyke

Client: Kennecott — Scope I.D.: 87K10
Project: Baseline Groundwater Monitoring — Page: 1
Prepared by: BJS — Date: 9-16-87
Checked by: BJS — Date: 12-14-88

MONITORING WELL CONSTRUCTION DIAGRAM

Driller: Wisconsin Test Drilling, Inc.
Drilling Method: Hollow Stem Augers 4.25" ID
Coordinates: 41,318.95N 39,915.14E

Well No: MW-1003
Date Installed: 9-16-87



Protector Pipe:
Size: 4"
Material: Steel
Lock No.: 2121

Surface Seal Material: Cement

Drill Hole Diameter: 7"

Riser:
Diameter: 2"
Material: PVC
Sch.: 40
Type of Joints: Flush threaded
Stenciled? -

Screen:
Diameter: 2"
Material: PVC
Slot Size: 0.010"
Length: 10'

Type of Cap: PVC

Centralizer: Used ☐
Not Used ☒

Depth to Water From Top of Riser at Completion: 32'

NOTE: Not to Scale

MONITORING WELL DEVELOPMENT

WELL NUMBER MW-1003

WELL DIAMETER 2"

TOTAL DEPTH OF WELL 40.2'

DEPTH TO WATER TIME OF MEASUREMENT

BEFORE 32.0'

AFTER 38.6'

CLIENT Kennecott

PROJECT Baseline G.W. Monitoring

SCOPE I.D. 87K10-7

BY M.M. Wisc. Test Drilling, Inc.

DATE 9-30-87

DESCRIPTION OF DEVELOPMENT METHOD

Well was alternately surged and bailed using a PVC hand pump.
10-04-87
Well was bailed and surged with a PVC hand bailer by BJS, Foth & Van Dyke
Depth to water at 8:15 a.m. - 32.4'
Depth to water at 8:30 a.m. - 39.2' after removing 3 gallons, yellow brown, silty water.

VOLUME OF WATER REMOVED FROM WELL 6 gallons

CLARITY OF WATER IN WELL BEFORE DEVELOPMENT brown, sandy, silty

CLARITY OF WATER IN WELL AFTER DEVELOPMENT brown, sandy, silty

PRESENCE OF SEDIMENT AT THE BOTTOM OF THE WELL

VOLUME OF WATER ADDED TO WELL None

SOURCE OF WATER ADDED TO WELL

TIME SPENT FOR DEVELOPMENT 0.5 hours

STABILIZATION READINGS

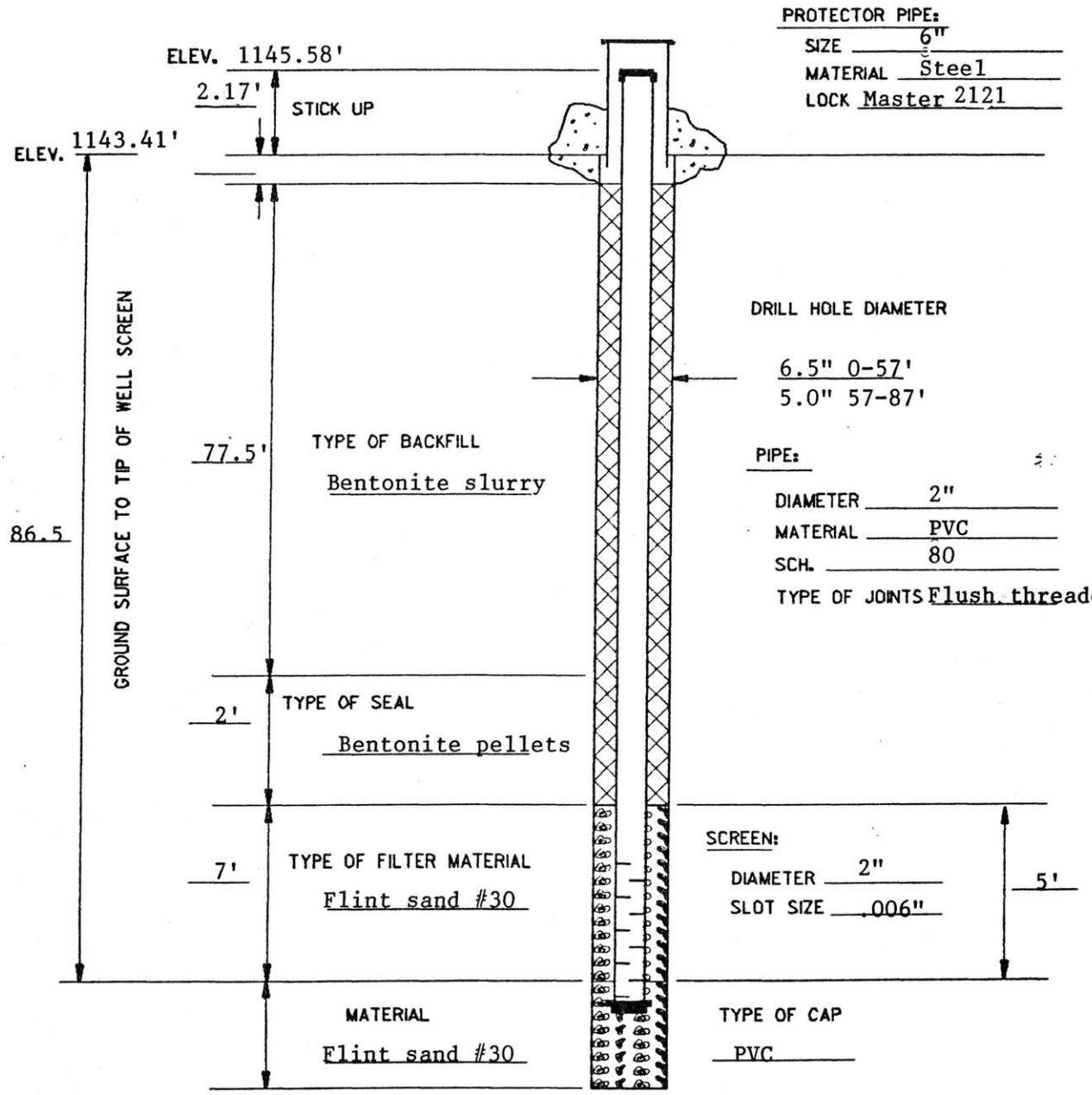
GAL. REMOVED	TIME	FIELD TEMPERATURE	FIELD SPEC. COND.	FIELD pH

FOTH AND VAN DYKE

MONITORING WELL INSTALLATION DIAGRAM

WELL NO: MW-1003P
DATE INSTALLED: 10-03-87
DRILLER: Luisier Well Drilling
DRILLING METHOD: Mud rotary
COORDINATES: 41,328.21N 39,919.45E

CLIENT: Kennecott
PROJECT: Baseline G.W. Monitoring
SCOPE I.D.: 87K10-7
BY: BJS



Foth & Van Dyke
Geosciences & Environmental Management Division

MONITORING WELL DEVELOPMENT

WELL NUMBER MW-1003P

WELL DIAMETER 2"

TOTAL DEPTH OF WELL 86'

DEPTH TO WATER TIME OF MEASUREMENT

BEFORE _____ _____

AFTER 86' (Dry) _____

CLIENT Kennecott

PROJECT Baseline G.W. Monitoring

SCOPE I.D. 87K10-7

BY K.M. Luisier Well Drilling

DATE 10-5-87

DESCRIPTION OF DEVELOPMENT METHOD

Well was alternately surged and bailed using a foot valve installed on a 3/4" flexible PVC pipe. The pipe and foot valve were moved up and down in the well by a motor-driven pitcher-pump.

VOLUME OF WATER REMOVED FROM WELL 7 gallons

CLARITY OF WATER IN WELL BEFORE DEVELOPMENT light brown

CLARITY OF WATER IN WELL AFTER DEVELOPMENT _____

PRESENCE OF SEDIMENT AT THE BOTTOM OF THE WELL None

VOLUME OF WATER ADDED TO WELL None

SOURCE OF WATER ADDED TO WELL _____

TIME SPENT FOR DEVELOPMENT 0.5 hours

STABILIZATION READINGS

GAL. REMOVED	TIME	FIELD TEMPERATURE	FIELD SPEC. COND.	FIELD pH

FOTH AND VAN DYKE

LOG OF TEST BORING NO.: MW-1004, 1004S

CLIENT: Kennecott
PROJECT: Flambeau-Baseline Ground Water Monitoring
PROJECT NUMBER: 87K10-7
LOCATION: North side of SW end of pit
COORDINATES: 40700 N 39123 E (APPROX)

SURFACE ELEVATION: 1123.8
BORING DEPTH: 38.5
DATE: 09/17/87

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLE NOTES
1123.8	--0.0						Surface-brn (7.5YR 5/4) silty SAND, fn & cse gvl, well graded, dry, loose (Fluvial)	SM		
		2.0-3.5	ss	1	86	1.0				
1121.3	--2.5						Brn poorly graded SAND w/silt, fine, w/much fn & cse gvl, loose, dry. Cuttings 2-5', cse gvl, rounded 2-3" dia (Fluvial)	SP-SM		Drilled & sampled MW-1004 to 23.5'; moved over about 10' & drilled to 25' wo/samp. Many bldrs @ 10-20' in MW-1004S, hrd drilling
1118.8	--5.0	5.0-6.5	ss	2	81	0.8	Poorly graded GRAVEL, cse, cored rocks, purple, red volc, rhyolite, little sand, dry, loose. Cuttings 5-8', fn gvl up to 1" dia grades to 5 w/cse gvl at 10'	GP		
1113.8	--10.0	10.0-11.5	ss	3	29	1.2	Brn well graded SAND, med w/fn & cse sand, fn gvl, indistinctly bedded, loose slightly moist	SW		
1108.8	--15.0	15.0-16.5	ss	4	12	0.8	Same except cse sand w/few silty sand layers, saturated			
1103.8	--20.0	20.0-21.5	ss	5	45	1.5	Brn poorly graded SAND, med & cse layers w/poorly graded GRAVEL, fn & cse, beds up to 6" thick, loose, saturated (About 2' of blow-up in augers)	SP, GP		
1101.3	--22.5	22.0-23.5	ss	6	37	1.2	Brn poorly graded SAND w/silt, cse, w/gvl to 22.5' then red brn, fn, loose, saturated	SP-SM		
1098.8	--25.0	25.0-26.5	ss	7	47	0.0	Pounded rock			
1096.3	--27.5	27.0-28.5	ss	8	57	0.8	Lt gray (2.5Y 7/2) poorly graded SAND, fn w/med & cse sand, loose, dense, saturated, qtz (sandstone)	SP (SS)		
1091.3	--32.5	32.0-33.5	ss	9	77	1.0	Yel brn (10YR 5/4) poorly & well graded SAND, layered, fn, med, cse, qtz, dense, loose, soft, saturated (sandstone)	SP, SW (SS)		
1086.3	--37.5	37.0-38.5	ss	10	43	1.0	Yel brn (10YR 5/6) varigated w/red layers SILT, laminated, soft, brittle, micaceous, vy slightly moist (saprolite/ altered schist)	ML		
							38.5'-End of Boring in saprolite/altered schist	=====		
1083.8	--40.0									

DRILLING DATA

START DATE: 09/17/87
COMPLETION DATE: 09/18/87
LOGGED BY: BJS
DRILLING METHOD: HSA (4 1/4" ID) 0-25', Mud rotary w/6" tricone 25-38.5'
DRILLING CONTRACTOR: Wisconsin Test Drilling, Inc.

WATER LEVEL INFORMATION

DEPTH AT COMPLETION: 15.9' @ 19'
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:
DRILLING LOSSES:

LOG OF TEST BORING NO.: MW-1004P

CLIENT: Kennecott
PROJECT: Flambeau-Baseline Ground Water Monitoring
PROJECT NUMBER: 87K10-7
LOCATION: North side of SW end of pit
COORDINATES: 40686.78 N 39123.60 E

SURFACE ELEVATION: 1123.91
BORING DEPTH: 87.5
DATE: 09/29/87

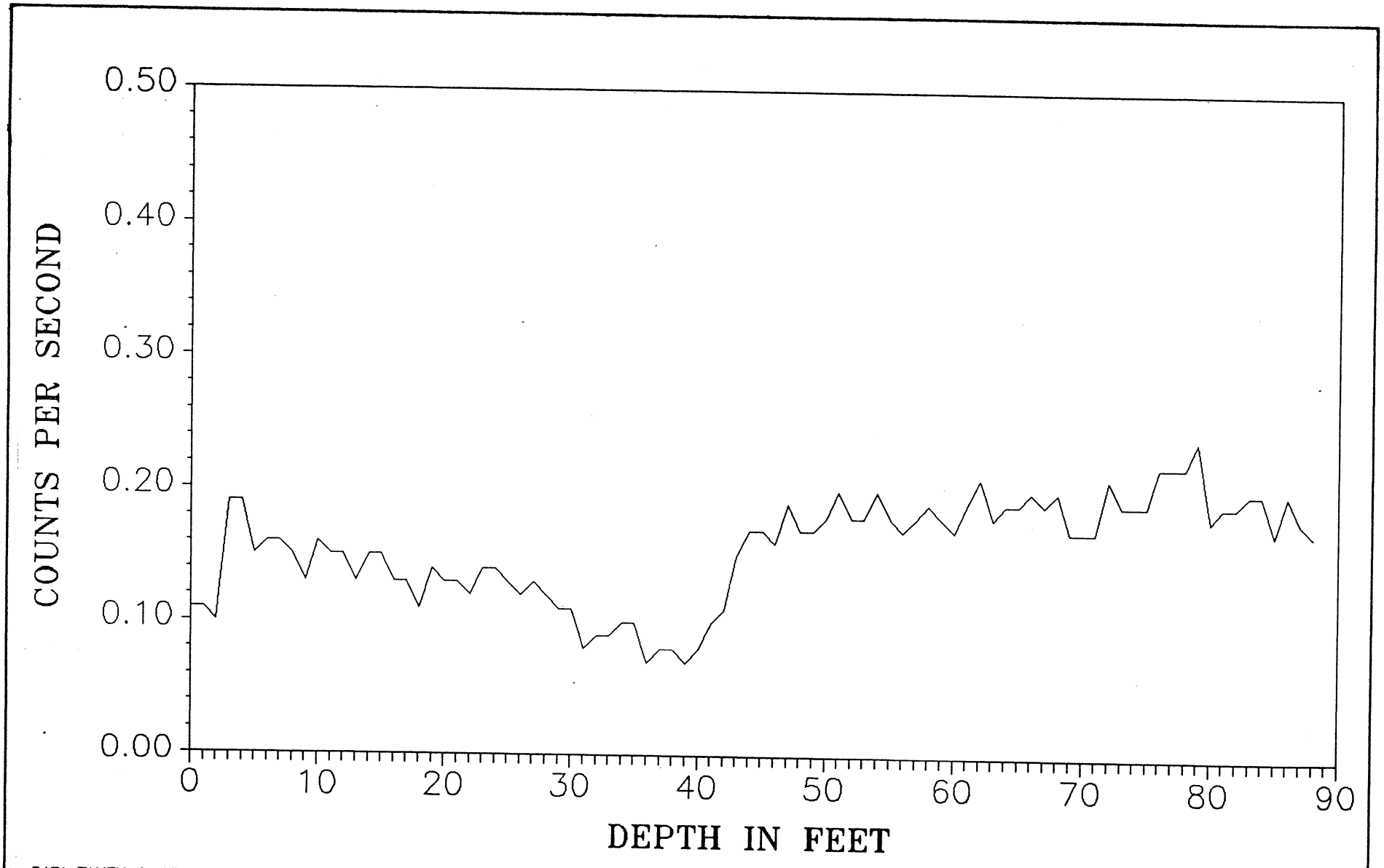
MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLE NOTES
1123.9	--0.0						Drilled to 37' wo/sampling. See log for MW-1004, 1004S. Cuttings at 37' w/saprolite			
								=====		
1088.9	--35.0						Drove sampler 3.5' (sample slid out) White, pink, gray silty CLAY, vy soft, slightly micaceous (saprolite)	CL-ML ML	Drove 60 secs	
		37.0-40.0	ss	1		0.2	Cuttings to 40' lt red, white, laminated lean CLAY/SILT vy soft			
1083.9	--40.0						Cuttings 40-42', gray micaceous silty CLAY/SILT, soft			
		42.0-43.5	ss	2		0.0	Split sampler, lost down hole. Cuttings to 45.5', gray w/dk red laminated silty CLAY		Drove 60 secs	
1078.9	--45.0									
		45.5-47.0	ss	3		1.2	Dk grn & dusky red (10YR 3/2) "SILT", foliated, hard to soft, brittle, flaky, saturated (altered schist)		Drove 55 secs	
1073.9	--50.0	50.0-51.5	ss	4		1.5	Same w/much dk red (hematite), lt yel green alteration		Drove 40 secs	
		54.0-68.0	c	5		9.0	Grn gray (5GY 5/1) & dusky red & dk red (10R 3/3 , 3/4, 3/6) layered "SILT", altered schist, soft to hard, broken, crumbly, sticking to core barrel, few clayey layers	"ML"	RQD = 33% Fract freq = 1.8/ft	
1068.9	--55.0									
1063.9	--60.0						Length of core pieces from 54'- 0.6, 0.5 1.1, 0.4, 0.25, 0.8, 0.3, 0.35, 0.6.			
1058.9	--65.0									
		68.0-74.0	c	6		5.1	Same as above except firmer, more cohesive. Breaks in core in barrel at 70.6, 71.2. Soft clayey layers at 71.6 & 72.2 ft.	RK 5	RQD = 85% Fract freq = 0.4/ft	
1053.9	--70.0									
1048.9	--75.0	74.0-87.5	c	7		12.5	Same to 83.5 ft, then firmer. Breaks at 74.7, 75.4, 78.6, 80.5, 81.0, 82.0, 82.4, 83.9, & 86.7		RQD = 91% Fact freq = 0.7/ft	
1043.9	--80.0									
							87.5'- End of Boring in altered schist	=====		
1033.9	--90.0						(Metadacite)			

DRILLING DATA

START DATE: 09/20/87
COMPLETION DATE: 09/22/87
LOGGED BY: BJS
DRILLING METHOD: Mud rotary, 6" tricone
DRILLING CONTRACTOR: Luisier Drilling, Inc.

WATER LEVEL INFORMATION

DEPTH AT COMPLETION:
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:
DRILLING LOSSES:



DATA TAKEN 1-13-89 BY BJS
TIME CONSTANT = 5 SECONDS
RANGE SETTING = 20 K

FOTH & VAN DYKE
GEOSCIENCES & ENVIRONMENTAL MANAGEMENT DIVISION
GREEN BAY, WISCONSIN

KENNECOTT MINERALS COMPANY
FLAMBEAU PROJECT
LADYSMITH, WISCONSIN

GAMMA LOG
WELL MW-1004P

No	REVISIONS	NOTES	APPROVAL	DATE
			DESIGNED BY	
			DRAWN BY SJL	2/89
			CHECKED BY	
			APPROVED BY	
			CAD No.	SCALE AS SHOWN

Job No | Dwg No | REV

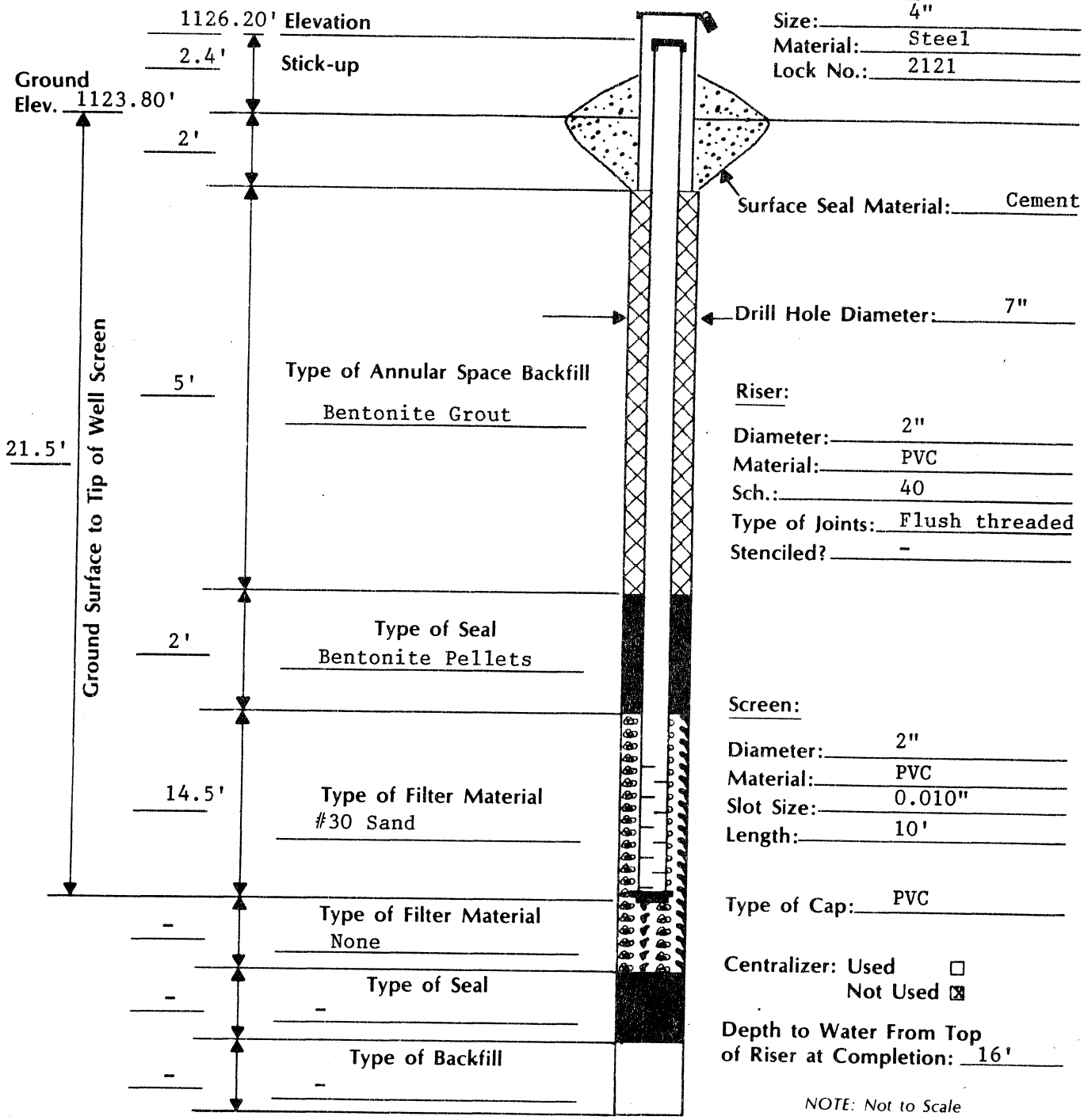
Foth & Van Dyke

Client: Kennecott — Scope I.D.: 87K10
Project: Baseline Groundwater Monitoring — Page: 1
Prepared by: BJS — Date: 9-17-87
Checked by: BJS — Date: 12-14-88

MONITORING WELL CONSTRUCTION DIAGRAM

Driller: Wisconsin Test Drilling, Inc.
Drilling Method: Hollow Stem Augers 4.25" ID
Coordinates: 40,694.39N 39,123.41E

Well No: MW-1004
Date Installed: 9-17-87



Type of Annular Space Backfill: Bentonite Grout

Type of Seal: Bentonite Pellets

Type of Filter Material: #30 Sand

Type of Filter Material: None

Type of Seal: -

Type of Backfill: -

Protector Pipe:
Size: 4"
Material: Steel
Lock No.: 2121

Surface Seal Material: Cement

Drill Hole Diameter: 7"

Riser:
Diameter: 2"
Material: PVC
Sch.: 40
Type of Joints: Flush threaded
Stenciled? -

Screen:
Diameter: 2"
Material: PVC
Slot Size: 0.010"
Length: 10'

Type of Cap: PVC

Centralizer: Used ☐ Not Used ☒

Depth to Water From Top of Riser at Completion: 16'

NOTE: Not to Scale

MONITORING WELL DEVELOPMENT

WELL NUMBER MW-1004
WELL DIAMETER 2"
TOTAL DEPTH OF WELL 21.5'
DEPTH TO WATER TIME OF MEASUREMENT
BEFORE 15.8'
AFTER 18.3'

CLIENT Kennecott
PROJECT Baseline G.W. Monitoring
SCOPE I.D. 87K10-7
BY M.M. Wisc. Test Drilling, Inc.
DATE 9-30-87

DESCRIPTION OF DEVELOPMENT METHOD

Well was alternately surged and bailed using a PVC hand pump.

VOLUME OF WATER REMOVED FROM WELL 25 gallons
CLARITY OF WATER IN WELL BEFORE DEVELOPMENT dark brown, sandy
CLARITY OF WATER IN WELL AFTER DEVELOPMENT light brown
PRESENCE OF SEDIMENT AT THE BOTTOM OF THE WELL
VOLUME OF WATER ADDED TO WELL None
SOURCE OF WATER ADDED TO WELL
TIME SPENT FOR DEVELOPMENT 15 Minutes

STABILIZATION READINGS

GAL. REMOVED	TIME	FIELD TEMPERATURE	FIELD SPEC. COND.	FIELD pH

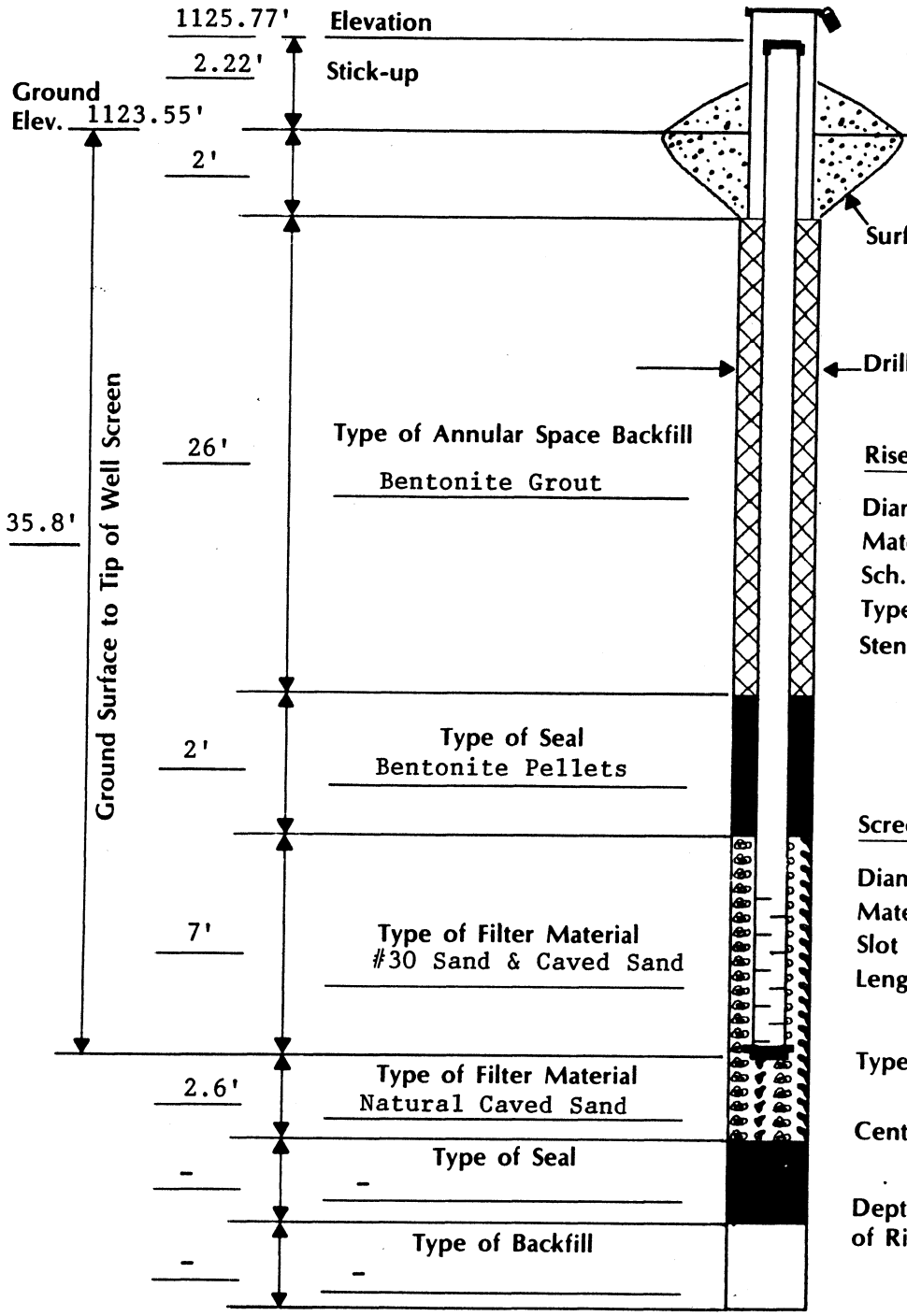
FOTH AND VAN DYKE

Foth & Van Dyke

Client: Kennecott — Scope I.D.: 87K10
Project: Baseline Groundwater Monitoring — Page: 1
Prepared by: BJS — Date: 9-18-87
Checked by: BJS — Date: 12-14-88

MONITORING WELL CONSTRUCTION DIAGRAM

Driller: Wisconsin Test Drilling, Inc.
Well No: MW-1004S
Drilling Method: Mud Rotary 6" Tricone
Date Installed: 9-18-87
Coordinates: 40,703.24N 39,122.29E



Type of Annular Space Backfill: Bentonite Grout

Type of Seal: Bentonite Pellets

Type of Filter Material: #30 Sand & Caved Sand

Type of Filter Material: Natural Caved Sand

Type of Seal: -

Type of Backfill: -

Protector Pipe:
Size: 4"
Material: Steel
Lock No.: 2121

Surface Seal Material: Cement

Drill Hole Diameter: 6"

Riser:
Diameter: 2"
Material: PVC
Sch.: 40
Type of Joints: Flush threaded
Stenciled? -

Screen:
Diameter: 2"
Material: PVC
Slot Size: 0.010"
Length: 5'

Type of Cap: PVC

Centralizer: Used ☐ Not Used ☒

Depth to Water From Top of Riser at Completion: 15.5'

NOTE: Not to Scale

MONITORING WELL DEVELOPMENT

WELL NUMBER MW-1004S
WELL DIAMETER 2"
TOTAL DEPTH OF WELL 35.8'
DEPTH TO WATER TIME OF MEASUREMENT
BEFORE 15.6' _____
AFTER 17.1' _____

CLIENT Kennecott
PROJECT Baseline G.W. Monitoring
SCOPE I.D. 87K10-7
BY M.M. Wisc. Test Drilling, Inc.
DATE 9-30-87

DESCRIPTION OF DEVELOPMENT METHOD

Well was alternately surged and bailed using a PVC hand pump.

VOLUME OF WATER REMOVED FROM WELL 25 gallons
CLARITY OF WATER IN WELL BEFORE DEVELOPMENT red brown, silty
CLARITY OF WATER IN WELL AFTER DEVELOPMENT red brown, silty
PRESENCE OF SEDIMENT AT THE BOTTOM OF THE WELL _____
VOLUME OF WATER ADDED TO WELL None
SOURCE OF WATER ADDED TO WELL _____
TIME SPENT FOR DEVELOPMENT 20 Minutes

STABILIZATION READINGS.

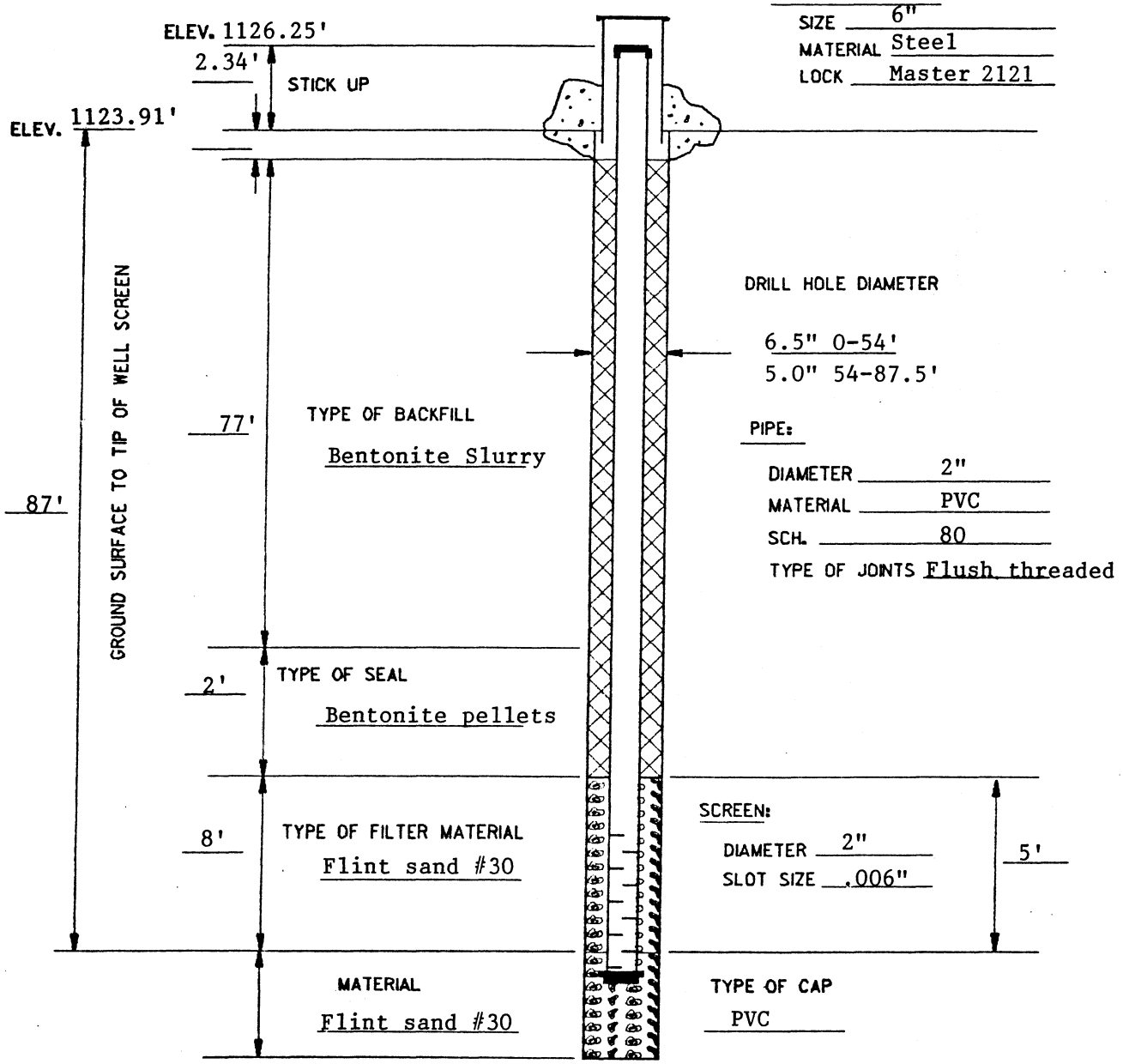
GAL. REMOVED	TIME	FIELD TEMPERATURE	FIELD SPEC. COND.	FIELD pH

FOTH AND VAN DYKE

MONITORING WELL INSTALLATION DIAGRAM

WELL NO: MW-1004P
DATE INSTALLED: 9-30-87
DRILLER: Luisier Well Drilling
DRILLING METHOD: Mud rotary
COORDINATES: 40,686.78N 39,123.60E

CLIENT: Kennecott
PROJECT: Baseline G.W. Monitoring
SCOPE I.D.: 87K10-7
BY: BJS



Foth & Van Dyke
Geosciences & Environmental Management Division

MONITORING WELL DEVELOPMENT

WELL NUMBER MW-1004P

WELL DIAMETER 2"

TOTAL DEPTH OF WELL 87'

DEPTH TO WATER — TIME OF MEASUREMENT

BEFORE _____ _____

AFTER 87' (Dry) _____

CLIENT Kennecott

PROJECT Baseline G.W. Monitoring

SCOPE I.D. 87K10-7

BY K.M. Luisier Well Drilling

DATE 10-5-87

DESCRIPTION OF DEVELOPMENT METHOD

Well was alternately surged and bailed using a foot valve installed on a 3/4" flexible PVC pipe. The pipe and foot valve were moved up and down in the well by a motor-driven pitcher-pump.

VOLUME OF WATER REMOVED FROM WELL 8 gallons

CLARITY OF WATER IN WELL BEFORE DEVELOPMENT light brown

CLARITY OF WATER IN WELL AFTER DEVELOPMENT _____

PRESENCE OF SEDIMENT AT THE BOTTOM OF THE WELL None

VOLUME OF WATER ADDED TO WELL _____

SOURCE OF WATER ADDED TO WELL _____

TIME SPENT FOR DEVELOPMENT 0.5 hours

STABILIZATION READINGS

GAL. REMOVED	TIME	FIELD TEMPERATURE	FIELD SPEC. COND.	FIELD pH

FOTH AND VAN DYKE

LOG OF TEST BORING NO.: MW-1005, 1005S

CLIENT: Kennecott
PROJECT: Flambeau-Baseline Ground Water Monitoring
PROJECT NUMBER: 87K10-7
LOCATION: Adjacent to Hwy 27, south of H & H Bldg.
COORDINATES: 40434 N 41340 E (APPROX)

SURFACE ELEVATION: 1141.9
BORING DEPTH: 50.8
DATE: 09/29/87

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLE NOTES
1141.9	--0.0						Black SILT w/organics, moist, soft (Aeolian silt w/peat)			
1139.4	--2.5	2.0-3.5	ss	1	15	1.5	Black (10YR 2/1) SILT, moist, soft, cohesive to 2.5', then gray brn (2.5Y 5/2) poorly graded SAND w/silt, fn, moist, loose	ML, SM		
1136.9	--5.0	5.0-6.5	ss	2	13	1.0	Black & gray brn SILT, laminated, moist, few rust brn mottles, last 4" yel red (5YR 5/8, 4/6) poorly graded SAND w/silt fine			Cuttings at 7', silty sand
1131.9	--10.0	10.0-12.0	ss	3	31	2.0	Red brn (5YR 4/4) silty SAND, fine w/med & cse sand, fn gvl, moist w/few fn sand partings, laminae, many dusky red (10YR 3/4) iron? coatings on joints, cohesive, brittle	SM		
1126.9	--15.0	15.0-16.5	ss	4	19	1.0	Dk brn (10YR 4/3) silty SAND, as above, diamict w/dk green gray (5G 4/1) stringer in diamict. Much water at 19 ft.			
1121.9	--20.0	20.0-21.5	ss	5	11	0.5	As above, vy soft, saturated Much water at 20-25 ft.			
1116.9	--25.0	25.0-26.5	ss	6	8	0.5	As above dk brn & red brn silty SAND, vy soft			
1111.9	--30.0	30.0-31.5	ss	7	29	1.5	Dk brn clayey SAND, CLAY, laminated, w/dk green gray stringers (as above) to 30.2'. Then red brn silty SAND, diamict, laminated, w/fn angular gravel			
1106.9	--35.0	35.0-36.5	ss	8	22	2.0	Red brn till as above. 0.5' sand at 35', fn, loose, saturated			
1101.9	--40.0	40.0-42.0	ss	9	41	2.0	Yel brn poorly graded SAND, fn & med to 41', then green gray (5GY 6/1) w/few clay layers <1" thick, soft, unconsol., sandstone	SP (SS)		
1096.9	--45.0	45.0-46.5	ss	10	95	0.4	As above except lt gray (7.5YR 5/1), dense, loose to weakly consolidated			Abrupt contact between ss & saprolite
1091.9	--50.0	50.0-50.8	ss	11	33	0.8	Same to 50.4', then lt gray green SILT, brittle, vy slightly moist (saprolite) 50.8'-End of Boring in Saprolite	ML =====		

DRILLING DATA

START DATE: 09/28/87
COMPLETION DATE: 09/29/87
LOGGED BY: BJS
DRILLING METHOD: Hollow stem augers 4 1/4" ID
DRILLING CONTRACTOR: Wisconsin Test Drilling, Inc.

WATER LEVEL INFORMATION

DEPTH AT COMPLETION: 11.2' at 20'
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:
DRILLING LOSSES:

LOG OF TEST BORING NO.: MW-1005P

CLIENT: Kennecott
PROJECT: Flambeau-Baseline Ground Water Monitoring
PROJECT NUMBER: 87K10-7
LOCATION: Adjacent Hwy 27, South of H & H Bldg.
COORDINATES: 40439.38 N 41350.91 E

SURFACE ELEVATION: 1141.67
BORING DEPTH: 91.5
DATE: 10/04/87

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLE NOTES
1141.7	--0.0						Drilled to 55 ft wo/sampling See log for MW-1005, 1005S			
							Core broken at 56, 58, 60 ft. Green gray w/white, altered breccia, "SILT", firm,	===== "ML"	RQD = 85% Fract freq = 0.4/ft	
1086.7	--55.0	55.0-65.0	c	1		8.5	brittle to 56'. At 56' red gray (10R5/1) silty CLAY (saprolitic schist), soft, cohesive, plastic, foliation distinct to indistinct to 57'. At 56.1 & 56.4', vy soft green gray (5G 6/1) layers 1-2", break at 60 degrees from vertical.	CL-ML		
1081.7	--60.0						57-58.3 - Same as above except dk gray (2.5YR 4/1), slightly moist, cohesive, firm to platy, crumbly, yel brn (limonite) along planes at 45 degrees from vert., grades to dusky red (2.5YR 3/2) saprolitic schist, soft to firm, brittle, much gray grn (5G 5/2) coatings, layers (chlorite?) on breaks	RK		
1076.7	--65.0									
1071.7	--70.0	65.0-72.5	c	2		7.5	As above except firmer, dusky red w/gray green layers, few yel brn (limonite) layer; at 71.5' hematite on fracture 35 degrees from vertical		RQD = 100% Fract freq = 0.5/ft	Core sticks to barrel
1066.7	--75.0	72.5-79.0	c	3		6.5	Same as above w/much green coating on fractures (vert, horz, & near vert.) some yel brn (limonite) coatings		RQD = 100% Fract freq = 0.5/ft	
1061.7	--80.0	79.0-85.0	c	4		6.0	Same except harder, more hematite coatings on fractures		RQD = 100% Fract freq = 0/ft	No breaks in core in barrel
1056.7	--85.0	85.0-91.5	c	5		6.5	Same as above, thick green coatings on fractures		RQD = 100% Fract freq = 0/ft	No breaks in core in barrel
1051.7	--90.0						91.5'-End of Boring in altered (chlorite) schist MW-1005P installed in boring at 91'			
1046.7	--95.0									
1041.7	--100.0									
1036.7	--105.0									

DRILLING DATA

START DATE: 10/04/87
COMPLETION DATE: 10/04/87
LOGGED BY: BJS
DRILLING METHOD: Mud rotary, 6" tricone, 5" carbide bit 55-91.5'
DRILLING CONTRACTOR: Luisier Drilling, Inc.

WATER LEVEL INFORMATION

DEPTH AT COMPLETION:
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:
DRILLING LOSSES:

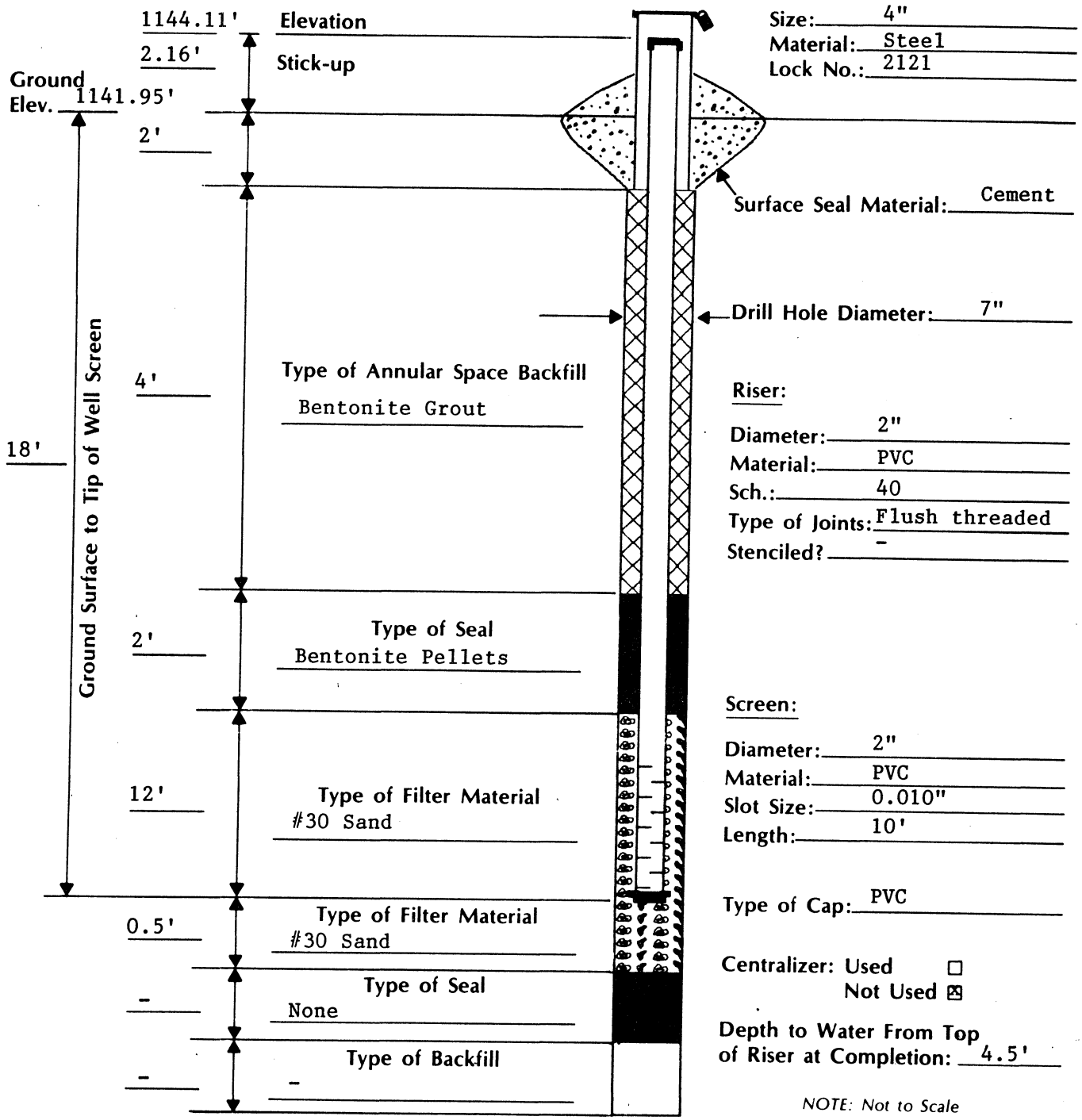
Foth & Van Dyke

Client: Kennecott — Scope I.D.: 87K10
Project: Baseline Groundwater Monitoring — Page: 1
Prepared by: BJS — Date: 9-29-87
Checked by: BJS — Date: 12-14-88

MONITORING WELL CONSTRUCTION DIAGRAM

Driller: Wisconsin Test Drilling, Inc.
Drilling Method: Hollow Stem Augers 4.25" ID
Coordinates: 40,435.82N 41,339.38E

Well No: MW-1005
Date Installed: 9-29-87



Protector Pipe:
Size: 4"
Material: Steel
Lock No.: 2121

Surface Seal Material: Cement

Drill Hole Diameter: 7"

Riser:
Diameter: 2"
Material: PVC
Sch.: 40
Type of Joints: Flush threaded
Stenciled? -

Screen:
Diameter: 2"
Material: PVC
Slot Size: 0.010"
Length: 10'

Type of Cap: PVC

Centralizer: Used ☐
Not Used ☒

Depth to Water From Top of Riser at Completion: 4.5'

NOTE: Not to Scale

MONITORING WELL DEVELOPMENT

WELL NUMBER MW-1005

WELL DIAMETER 2"

TOTAL DEPTH OF WELL 18.0'

DEPTH TO WATER — TIME OF MEASUREMENT

BEFORE 4.5' _____

AFTER 3.8' _____

CLIENT Kennecott

PROJECT Baseline G.W. Monitoring

SCOPE I.D. 87K10-7

BY M.M. Wisc. Test Drilling, Inc.

DATE 9-30-87

DESCRIPTION OF DEVELOPMENT METHOD

Well was alternately surged and bailed using a PVC hand pump.

VOLUME OF WATER REMOVED FROM WELL 25 gallons

CLARITY OF WATER IN WELL BEFORE DEVELOPMENT brown, sandy, silty

CLARITY OF WATER IN WELL AFTER DEVELOPMENT brown, sandy

PRESENCE OF SEDIMENT AT THE BOTTOM OF THE WELL _____

VOLUME OF WATER ADDED TO WELL None

SOURCE OF WATER ADDED TO WELL _____

TIME SPENT FOR DEVELOPMENT 20 Minutes

STABILIZATION READINGS

GAL. REMOVED	TIME	FIELD TEMPERATURE	FIELD SPEC. COND.	FIELD pH

FOTH AND VAN DYKE

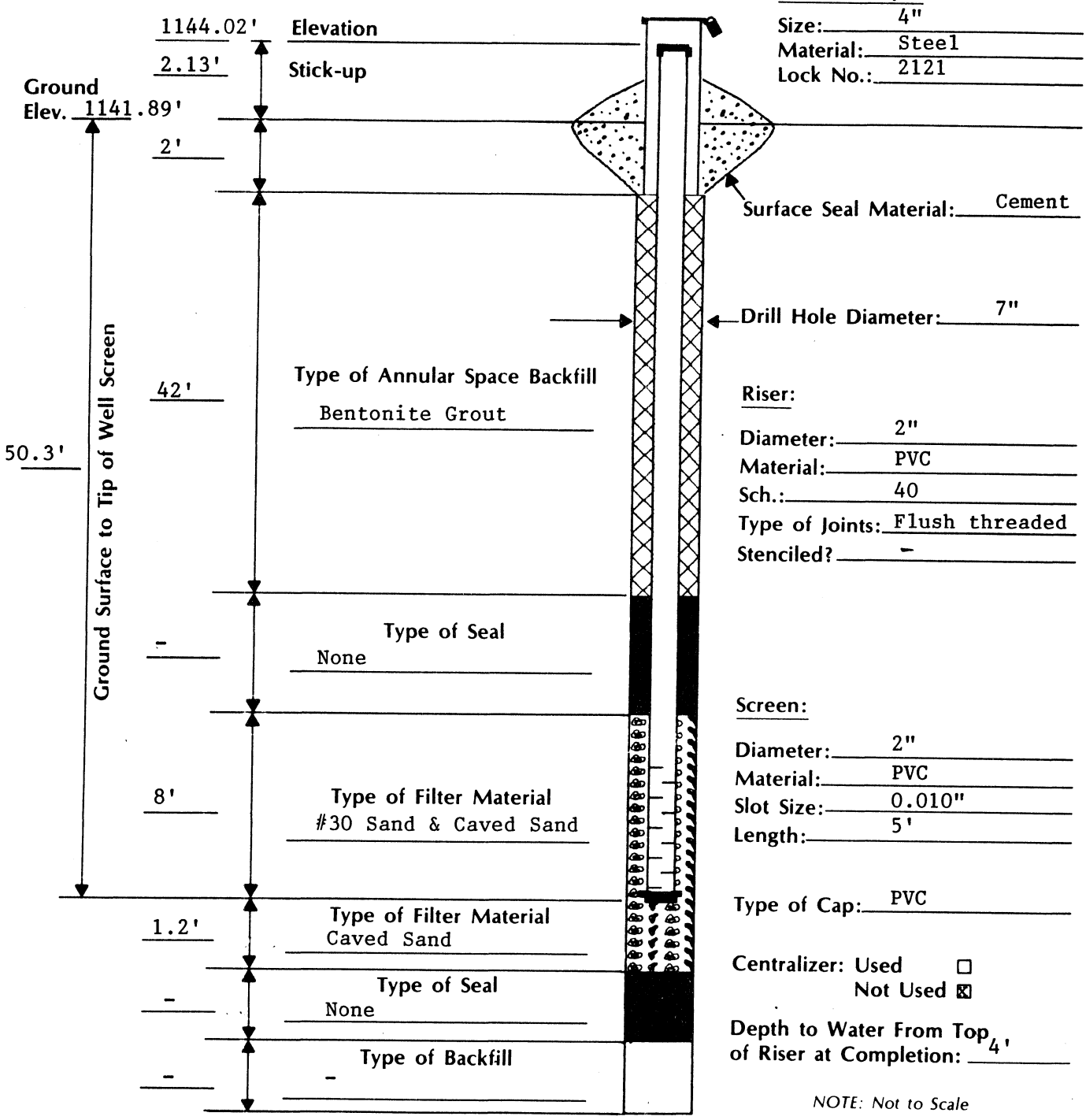
Foth & Van Dyke

Client: Kennecott — Scope I.D.: 87K10
Project: Baseline Groundwater Monitoring — Page: 1
Prepared by: BJS — Date: 9-29-87
Checked by: BJS — Date: 12-14-88

MONITORING WELL CONSTRUCTION DIAGRAM

Driller: Wisconsin Test Drilling, Inc.
Drilling Method: Hollow Stem Auger 4.25" ID
Coordinates: 40,433.45N 41,343.04E

Well No: MW-1005S
Date Installed: 9-29-87



Protector Pipe:
Size: 4"
Material: Steel
Lock No.: 2121

Surface Seal Material: Cement

Drill Hole Diameter: 7"

Riser:
Diameter: 2"
Material: PVC
Sch.: 40
Type of Joints: Flush threaded
Stenciled? -

Screen:
Diameter: 2"
Material: PVC
Slot Size: 0.010"
Length: 5'

Type of Cap: PVC

Centralizer: Used ☐
Not Used ☒

Depth to Water From Top of Riser at Completion: 4'

NOTE: Not to Scale

MONITORING WELL DEVELOPMENT

WELL NUMBER MW-1005S

WELL DIAMETER 2"

TOTAL DEPTH OF WELL 50.3'

DEPTH TO WATER TIME OF MEASUREMENT

BEFORE 3.8'

AFTER 6.2'

CLIENT Kennecott

PROJECT Baseline G.W. Monitoring

SCOPE I.D. 87K10-7

BY M.M. Wisc. Test Drilling, Inc.

DATE 9-30-87

DESCRIPTION OF DEVELOPMENT METHOD

Well was alternately surged and bailed using a PVC hand pump.

VOLUME OF WATER REMOVED FROM WELL 25 gallons

CLARITY OF WATER IN WELL BEFORE DEVELOPMENT very light brown, sandy, silty

CLARITY OF WATER IN WELL AFTER DEVELOPMENT very light brown

PRESENCE OF SEDIMENT AT THE BOTTOM OF THE WELL:

VOLUME OF WATER ADDED TO WELL None

SOURCE OF WATER ADDED TO WELL

TIME SPENT FOR DEVELOPMENT 20 Minutes

STABILIZATION READINGS

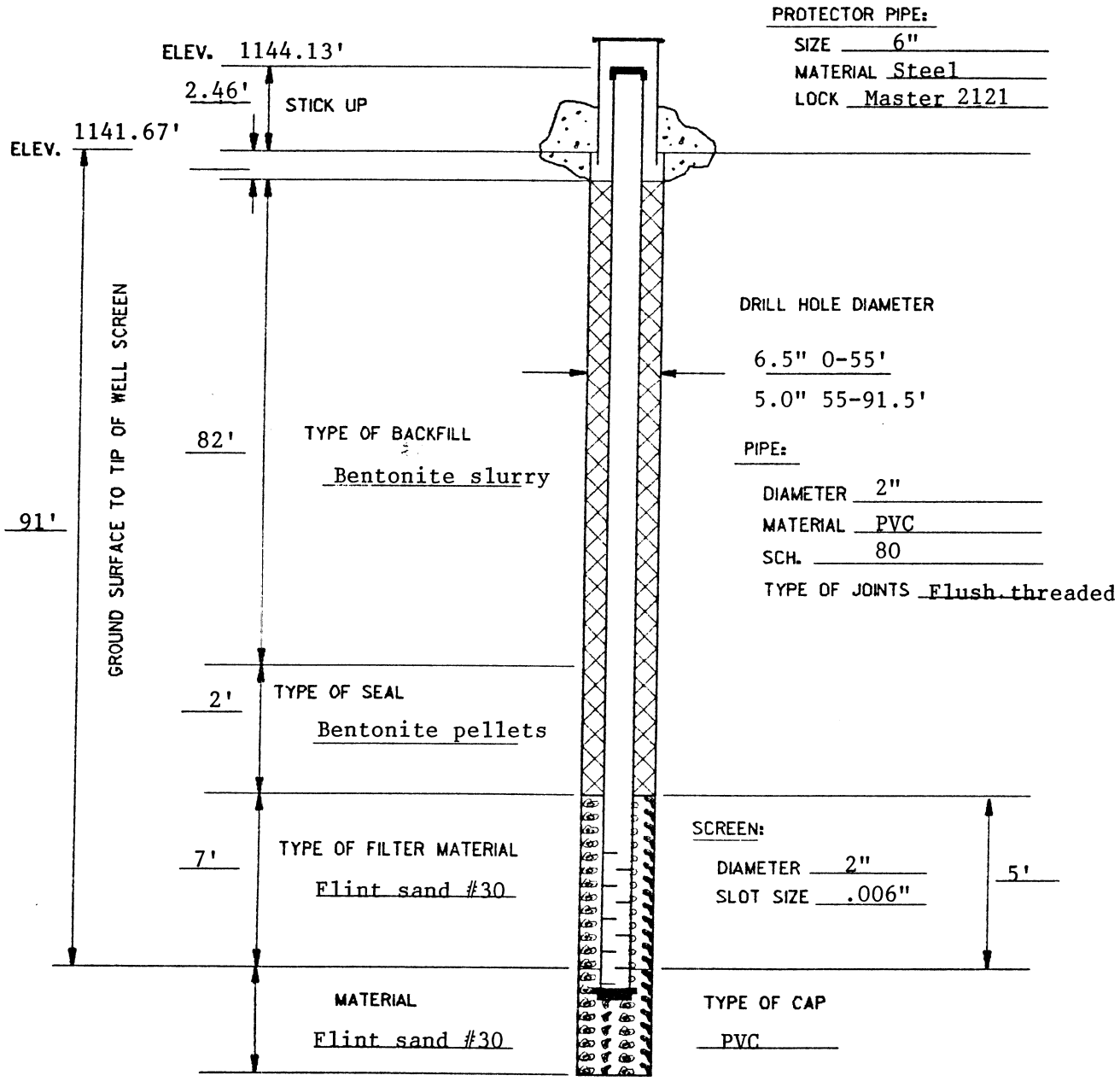
GAL. REMOVED	TIME	FIELD TEMPERATURE	SPEC. COND.	pH

FOTH AND VAN DYKE

MONITORING WELL INSTALLATION DIAGRAM

WELL NO: MW-1005P
DATE INSTALLED: 10-04-87
DRILLER: Luisier Well Drilling
DRILLING METHOD: Mud rotary
COORDINATES: 40,439.38N 41,350.91E

CLIENT: Kennecott
PROJECT: Baseline G.W. Monitoring
SCOPE I.D.: 87K10-7
BY: BJS



Foth & Van Dyke
Geosciences & Environmental Management Division

MONITORING WELL DEVELOPMENT

WELL NUMBER MW-1005P

WELL DIAMETER 2"

TOTAL DEPTH OF WELL 90'

DEPTH TO WATER — TIME OF MEASUREMENT

BEFORE _____ _____

AFTER 90' (Dry) _____

CLIENT Kennecott

PROJECT Baseline G.W. Monitoring

SCOPE I.D. 87K10-7

BY K.M. Luisier Well Drilling

DATE 10-5-87

DESCRIPTION OF DEVELOPMENT METHOD

Well was alternately surged and bailed using a foot valve installed on a 3/4" flexible PVC pipe. The pipe and foot valve were moved up and down in the well by a motor-driven pitcher-pump.

VOLUME OF WATER REMOVED FROM WELL 7 gallons

CLARITY OF WATER IN WELL BEFORE DEVELOPMENT light brown

CLARITY OF WATER IN WELL AFTER DEVELOPMENT _____

PRESENCE OF SEDIMENT AT THE BOTTOM OF THE WELL None

VOLUME OF WATER ADDED TO WELL None

SOURCE OF WATER ADDED TO WELL _____

TIME SPENT FOR DEVELOPMENT 0.5 hours

STABILIZATION READINGS

GAL. REMOVED	TIME	FIELD TEMPERATURE	FIELD SPEC. COND.	FIELD pH

FOTH AND VAN DYKE

APPENDIX 3.5-E

Geologic Logs, Well Construction Diagrams, and Well Development Forms for Wetlands Investigation, 1987

LOG OF TEST BORING NO.: PZ-1A, 1B

CLIENT: Kennecott
PROJECT: Wetlands
PROJECT NUMBER: 87K10-13
LOCATION: River backwater
COORDINATES: 40601.44 N 38737.67 E

SURFACE ELEVATION: 1103.5
BORING DEPTH: 6.0
DATE: 10/30/87

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLE NOTES
1103.5	--0	0.0-1.5	ss	1	5	0.7	Dk gray organic silt (4") over lt gray silty SAND, fn, vy soft, saturated (vy fine sand)	SM		
1102.5	--1									
1101.5	--2	1.5-3.0	ss	2	7	0.9	Same to about 2 ft; at 2 ft red brn silty SAND, fn, w/med & cse sand, fn & cse gvl, saturated			
1100.5	--3	3.0-4.5	ss	3	29	1.2	Gray & red brn well graded SAND w/silt, fn sand w/fn gvl, saturated, dense, w/dk yel brn (10YR 4/4) mottles. Very irreg., indistinct bedding	SW-SM		
1099.5	--4									
1098.5	--5	4.5-6.0	ss	4	36	1.0	Same as above except massive			
1097.5	--6						6'-End of Boring in Sand & Gravel PZ-1A installed in boring PZ-1B installed in unsampled boring about 5 ft south. PZ-1B at 40599.83 N 38739.21 E			
1096.5	--7									
1095.5	--8									
1094.5	--9									
1093.5	--10									
1092.5	--11									

DRILLING DATA

START DATE: 10/30/87
COMPLETION DATE: 10/30/87
LOGGED BY: BJS
DRILLING METHOD: 4 1/4" ID Hollow stem auger
DRILLING CONTRACTOR: Wisconsin Test Drilling, Inc.

WATER LEVEL INFORMATION

DEPTH AT COMPLETION:
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:
DRILLING LOSSES:

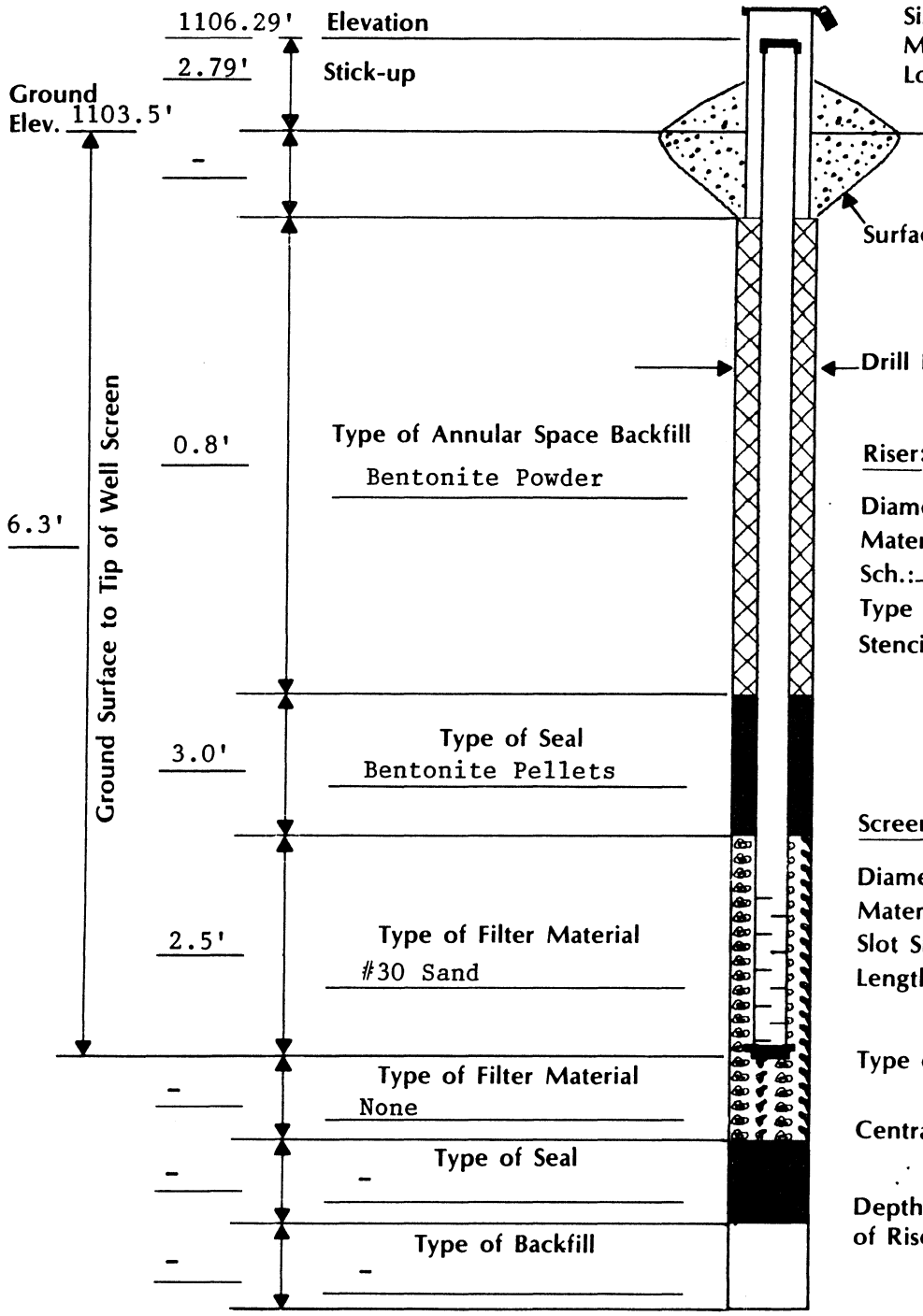
Foth & Van Dyke

Client: Kennecott — Scope I.D.: 87K10
Project: Wetlands — Page: 1
Prepared by: BJS — Date: 10-30-87
Checked by: BJS — Date: 12-14-88

MONITORING WELL CONSTRUCTION DIAGRAM

Driller: Wisconsin Test Drilling, Inc.
Drilling Method: Hollow Stem Augers 4.25" ID
Coordinates: 40,601.44N 38,737.67E

Well No: PZ-1A
Date Installed: 10-30-87



Type of Annular Space Backfill: Bentonite Powder

Type of Seal: Bentonite Pellets

Type of Filter Material: #30 Sand

Type of Filter Material: None

Type of Seal: -

Type of Backfill: -

Protector Pipe:
Size: --
Material: --
Lock No.: --

Surface Seal Material: None

Drill Hole Diameter: 7"

Riser:
Diameter: 2"
Material: PVC
Sch.: 40
Type of Joints: Flush threaded
Stenciled? -

Screen:
Diameter: 2"
Material: PVC
Slot Size: 0.010"
Length: 2'

Type of Cap: PVC

Centralizer: Used ☐ Not Used ☒

Depth to Water From Top of Riser at Completion: -

NOTE: Not to Scale

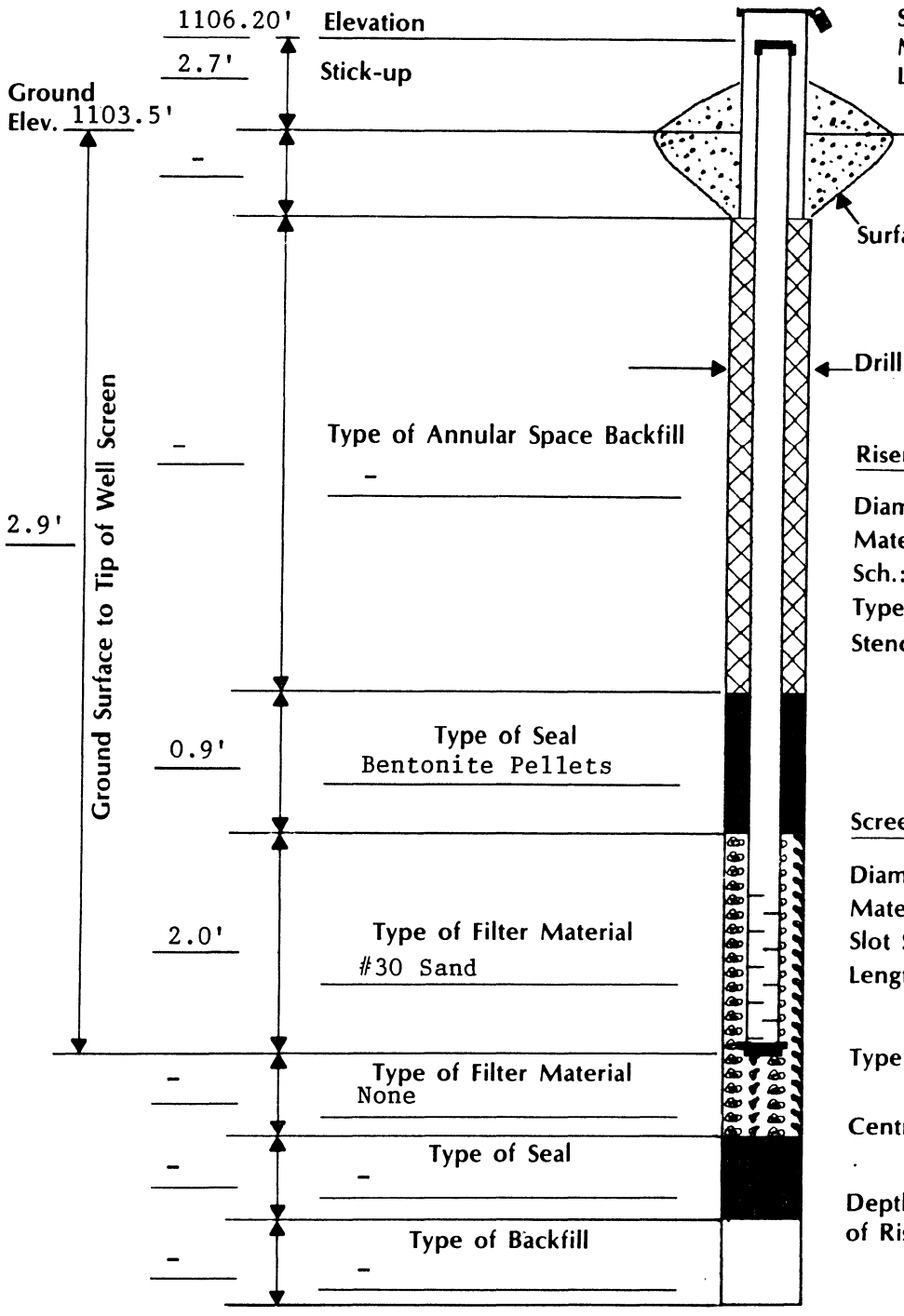
Foth & Van Dyke

Client: Kennecott — Scope I.D.: 87K10
Project: Wetlands — Page: 1
Prepared by: BJS — Date: 10-30-87
Checked by: BJS — Date: 12-14-87

MONITORING WELL CONSTRUCTION DIAGRAM

Driller: Wisconsin Test Drilling, Inc.
Drilling Method: Hollow Stem Augers 4.25" ID
Coordinates: 40,599.83 38,739.21

Well No: PZ-1B
Date Installed: 10-30-87



Protector Pipe:
Size: -
Material: -
Lock No.: -

Surface Seal Material: None

Drill Hole Diameter: 7"

Riser:
Diameter: 2"
Material: PVC
Sch.: 40
Type of Joints: Flush threaded
Stenciled? -

Screen:
Diameter: 2"
Material: PVC
Slot Size: 0.010"
Length: 2'

Type of Cap: PVC

Centralizer: Used ☐
Not Used ☒

Depth to Water From Top of Riser at Completion: -

NOTE: Not to Scale

LOG OF TEST BORING NO.: PZ-1006, 1006G, 1006S

CLIENT: Kennecott
PROJECT: Flambeau-Baseline Ground Water Monitoring
PROJECT NUMBER: 87K10-7
LOCATION: West of Hwy 27 100', & north of H & H Bldg 380'
COORDINATES: 41425 N 41315 E (APPROX)

SURFACE ELEVATION: 1147.5
BORING DEPTH: 54.0
DATE: 09/23/87

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLE NOTES
1147.5	--0.0						Surface - Lt brn prly graded SAND, fn, loose, dry (Aeolian)	SP		
		2.0-3.5	ss	1	36	1.5	Dk yel brn (10YR 4/6) silty SAND/SILT, fn, (vy fn sand & silt), cohes., sltly moist (B-horizon in aeolian sand & silt)	SM/ML		
1142.5	--5.0	5.0-6.5	ss	2	78	1.0	As above to 5.5' w/mottles. At 5.5' poorly graded GRAVEL, cse, loose, dry, w/fn sand, (gravel broken)	GP		
1137.5	--10.0	10.0-11.5	ss	3	51	1.1	Red brn (5YR 4/4) silty SAND, fn w/med & cse sand, fn gvl, moist, diamict w/color & textural laminations & few yel red sand laminae	SM		MW-1006 set in adjacent unsampled boring at depth of 10'
1132.5	--15.0	15.0-16.5	ss	4	68	0.5	Same, moist			
1127.5	--20.0	20.0-21.5	ss	5	12	0.8	Same, except massive, saturated			
1122.5	--25.0	25.0-26.5	ss	6	16	0.8	Same, saturated, vy soft			
1117.5	--30.0	30.0-31.5	ss	7	40	1.0	Same, soft to firm, weath. cobble in shoe, crumbly, soft			
1112.5	--35.0	35.0-36.5	ss	8	99	1.0	Str brn (7.5YR 4/6) to yel red (5YR 4/6) silty SAND, fn diamict w/textural layering			MW-1006G set in adjacent unsampled boring at depth of 33'
1107.5	--40.0	40.0-41.5	ss	9	41	1.0	Same as above, moist, cohesive, firm			
1102.5	--45.0	45.0-46.5	ss	10	51	1.6	Str brn poorly graded SAND, fn, w/trace med & cse, loose, saturated to 45.8' (Mixed glacial & sandstone sand.) At 45.8', lt ol brn (2.5Y 5/6) poorly graded SAND, fn, soft, saturated	SP (SS)		
1097.5	--50.0	50.0-51.5	ss	11	95	1.3	At 50', 1.5' blow-up. Sample mix of cave & blow-up, glacial sand & sandstone. Vy slow drilling from 50 to 52.5'	SP		MW-1006S set in boring at 52'
		52.5-54.0	ss	12	95	1.2	Red, grn, gray varigated lean CLAY, soft wet to 53.5', then hard, brittle, dense, altered schist, foliation apparent	CL "SM/ML"		
1092.5	--55.0						54'-End of Boring in altered schist	=====		

DRILLING DATA

START DATE: 09/23/87
COMPLETION DATE: 09/23/87
LOGGED BY: BJS
DRILLING METHOD: Hollow stem augers, 4 1/4" ID
DRILLING CONTRACTOR: Wisconsin Test Drilling, Inc.

WATER LEVEL INFORMATION

DEPTH AT COMPLETION: At 45'
LATER TIME/DEPTH: 0.5 hr/18.2'
LATER TIME/DEPTH: 1.0 hr/14.5'
CAVE IN DEPTH:
DRILLING LOSSES:

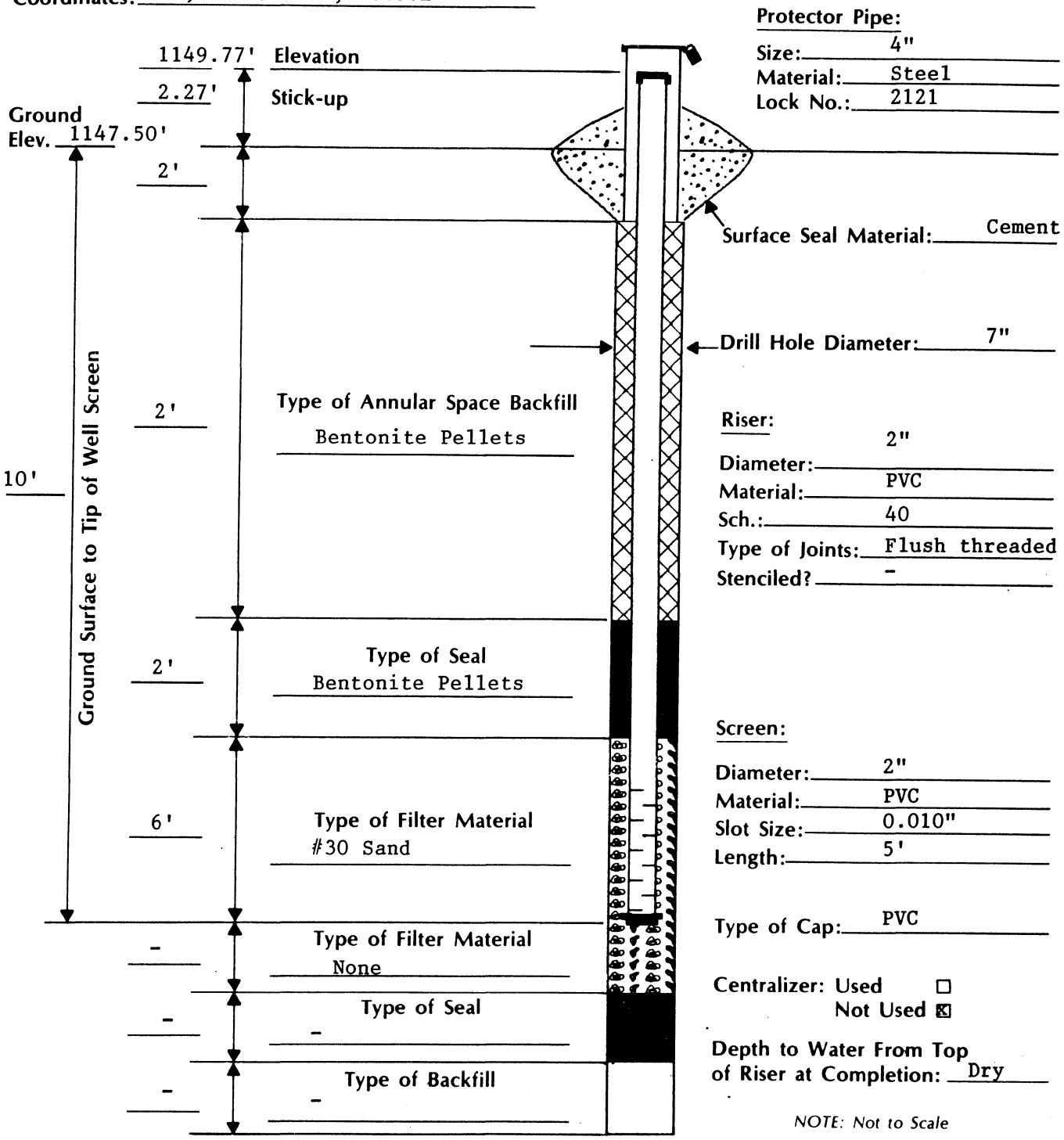
Foth & Van Dyke

Client: Kennecott — Scope I.D.: 87K10
Project: Wetlands — Page: 1
Prepared by: BJS — Date: 9-24-87
Checked by: BJS — Date: 12-14-88

MONITORING WELL CONSTRUCTION DIAGRAM

Driller: Wisconsin Test Drilling, Inc.
Drilling Method: Hollow Stem Augers 4.25" ID
Coordinates: 41,427.59N 41,318.30E

Well No: PZ-1006
Date Installed: 9-24-87



Protector Pipe:
Size: 4"
Material: Steel
Lock No.: 2121

Surface Seal Material: Cement

Drill Hole Diameter: 7"

Type of Annular Space Backfill: Bentonite Pellets

Riser:
Diameter: 2"
Material: PVC
Sch.: 40
Type of Joints: Flush threaded
Stenciled? -

Type of Seal: Bentonite Pellets

Screen:
Diameter: 2"
Material: PVC
Slot Size: 0.010"
Length: 5'

Type of Filter Material: #30 Sand

Type of Cap: PVC

Type of Filter Material: None

Centralizer: Used ☐ Not Used ☒

Type of Seal: -

Depth to Water From Top of Riser at Completion: Dry

Type of Backfill: -

NOTE: Not to Scale

FORM #309 GEM (Rev. 11/88)

MONITORING WELL DEVELOPMENT

WELL NUMBER PZ-1006

WELL DIAMETER 2"

TOTAL DEPTH OF WELL 10.0'

DEPTH TO WATER TIME OF MEASUREMENT

BEFORE Dry

AFTER

CLIENT Kennecott

PROJECT Baseline G.W. Monitoring

SCOPE I.D. 87K10-7

BY M.M. Wisc. Test Drilling, Inc.

DATE 9-30-87

DESCRIPTION OF DEVELOPMENT METHOD

VOLUME OF WATER REMOVED FROM WELL None

CLARITY OF WATER IN WELL BEFORE DEVELOPMENT -

CLARITY OF WATER IN WELL AFTER DEVELOPMENT -

PRESENCE OF SEDIMENT AT THE BOTTOM OF THE WELL -

VOLUME OF WATER ADDED TO WELL None

SOURCE OF WATER ADDED TO WELL

TIME SPENT FOR DEVELOPMENT

STABILIZATION READINGS

GAL. REMOVED	TIME	FIELD TEMPERATURE	SPEC. COND.	pH

FOTH AND VAN DYKE

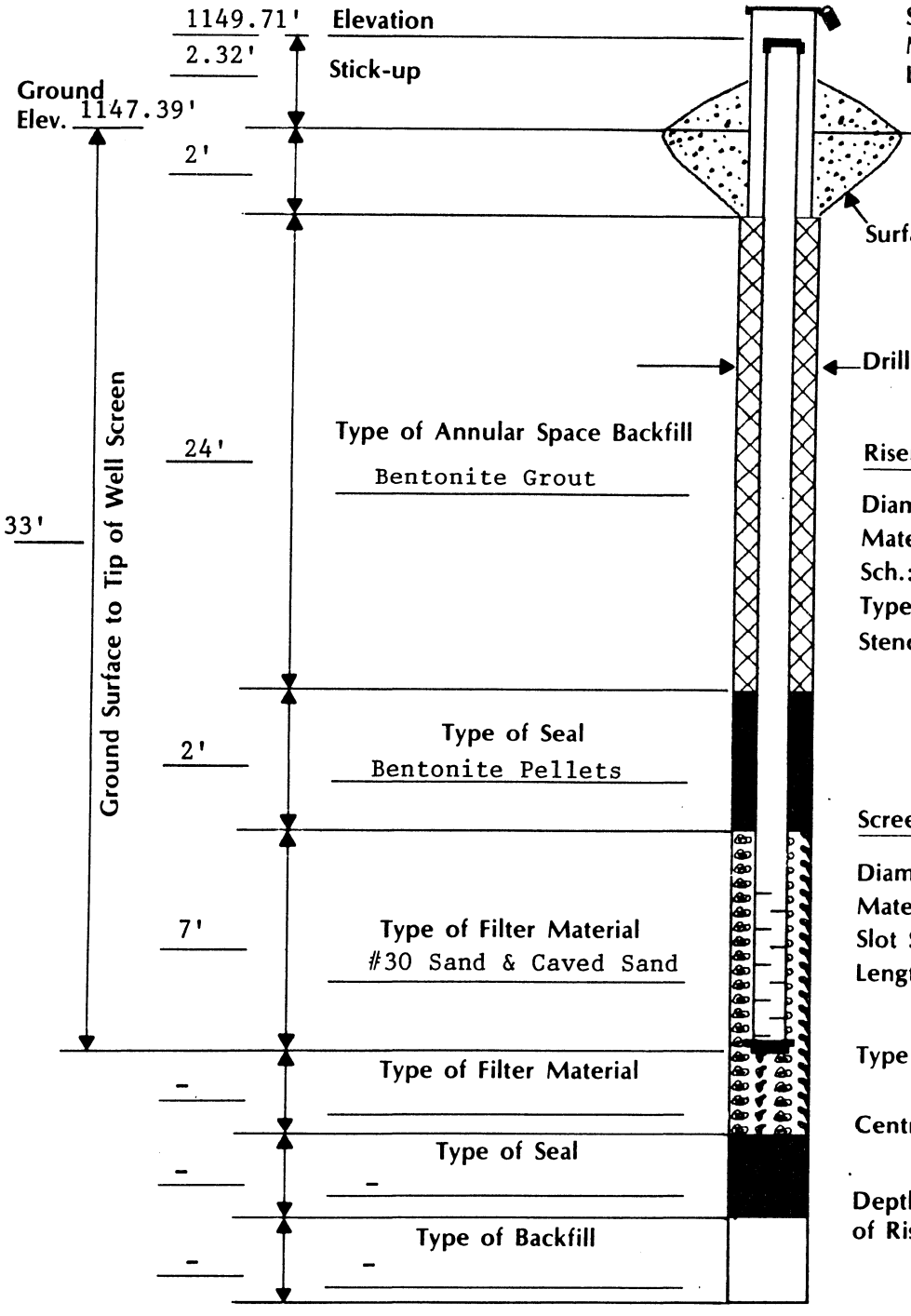
Foth & Van Dyke

Client: Kennecott — Scope I.D.: 87K10
Project: Baseline Groundwater Monitoring — Page: 1
Prepared by: BJS — Date: 9-24-87
Checked by: BJS — Date: 12-14-88

MONITORING WELL CONSTRUCTION DIAGRAM

Driller: Wisconsin Test Drilling, Inc.
Drilling Method: Hollow Stem Augers
Coordinates: 41,430.29N 41,311.21E

Well No: PZ-1006G
Date Installed: 9-24-87



Protector Pipe:
Size: 4"
Material: Steel
Lock No.: 2121

Surface Seal Material: Cement

Drill Hole Diameter: 7"

Riser:
Diameter: 2"
Material: PVC
Sch.: 40
Type of Joints: Flush threaded
Stenciled? -

Screen:
Diameter: 2"
Material: PVC
Slot Size: 0.010"
Length: 5'

Type of Cap: PVC

Centralizer: Used ☐
Not Used ☒

Depth to Water From Top of Riser at Completion: 12.5'

NOTE: Not to Scale

MONITORING WELL DEVELOPMENT

WELL NUMBER PZ-1006G

WELL DIAMETER 2"

TOTAL DEPTH OF WELL 33.1'

DEPTH TO WATER — TIME OF MEASUREMENT

BEFORE 12.8' _____

AFTER 33' (Dry) _____

CLIENT Kennecott

PROJECT Baseline G.W. Monitoring

SCOPE I.D. 87K10-7

BY M.M. Wisc. Test Drilling, Inc.

DATE 9-30-87

DESCRIPTION OF DEVELOPMENT METHOD

Well was alternately surged and bailed using a PVC hand pump.

VOLUME OF WATER REMOVED FROM WELL 10 gallons

CLARITY OF WATER IN WELL BEFORE DEVELOPMENT brown, sandy, silty

CLARITY OF WATER IN WELL AFTER DEVELOPMENT light brown

PRESENCE OF SEDIMENT AT THE BOTTOM OF THE WELL _____

VOLUME OF WATER ADDED TO WELL None

SOURCE OF WATER ADDED TO WELL _____

TIME SPENT FOR DEVELOPMENT 15 Minutes

STABILIZATION READINGS

GAL. REMOVED	TIME	FIELD TEMPERATURE	FIELD SPEC. COND.	FIELD pH

FOTH AND VAN DYKE

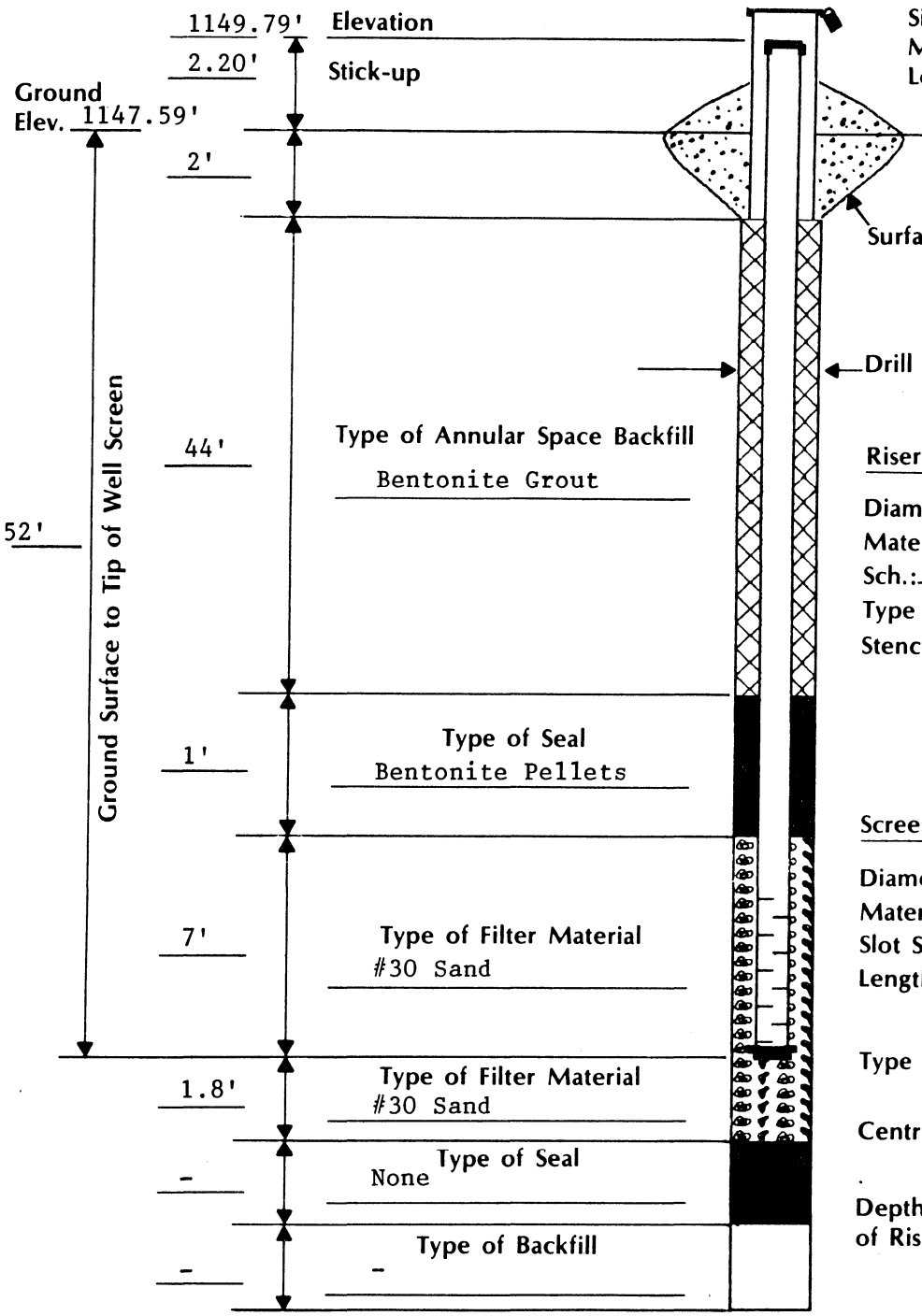
Foth & Van Dyke

Client: Kennecott — Scope I.D.: 87K10
Project: Baseline Groundwater Monitoring — Page: 1
Prepared by: BJS — Date: 9-23-87
Checked by: BJS — Date: 12-14-88

MONITORING WELL CONSTRUCTION DIAGRAM

Driller: Wisconsin Test Drilling, Inc.
Drilling Method: Hollow Stem Augers 4.25" ID
Coordinates: 41,420.45N 41,317.34E

Well No: PZ-1006S
Date Installed: 9-23-87



Protector Pipe:
Size: 4"
Material: Steel
Lock No.: 2121

Surface Seal Material: Cement

Drill Hole Diameter: 7"

Riser:
Diameter: 2"
Material: PVC
Sch.: 40
Type of Joints: Flush threaded
Stenciled? -

Screen:
Diameter: 2"
Material: PVC
Slot Size: 0.010"
Length: 5'

Type of Cap: PVC

Centralizer: Used ☐
Not Used ☒

Depth to Water From Top of Riser at Completion: 14'

NOTE: Not to Scale

MONITORING WELL DEVELOPMENT

WELL NUMBER PZ-1006S

WELL DIAMETER 2"

TOTAL DEPTH OF WELL 52.0'

DEPTH TO WATER TIME OF MEASUREMENT

BEFORE 14.2'

AFTER 13.5'

CLIENT Kennecott

PROJECT Baseline G.W. Monitoring

SCOPE I.D. 87K10-7

BY M.M. Wisc. Test Drilling

DATE 9-30-87

DESCRIPTION OF DEVELOPMENT METHOD

Well was alternately surged and bailed using a PVC hand pump.

VOLUME OF WATER REMOVED FROM WELL 50 gallons

CLARITY OF WATER IN WELL BEFORE DEVELOPMENT brown, sandy

CLARITY OF WATER IN WELL AFTER DEVELOPMENT light brown

PRESENCE OF SEDIMENT AT THE BOTTOM OF THE WELL

VOLUME OF WATER ADDED TO WELL None

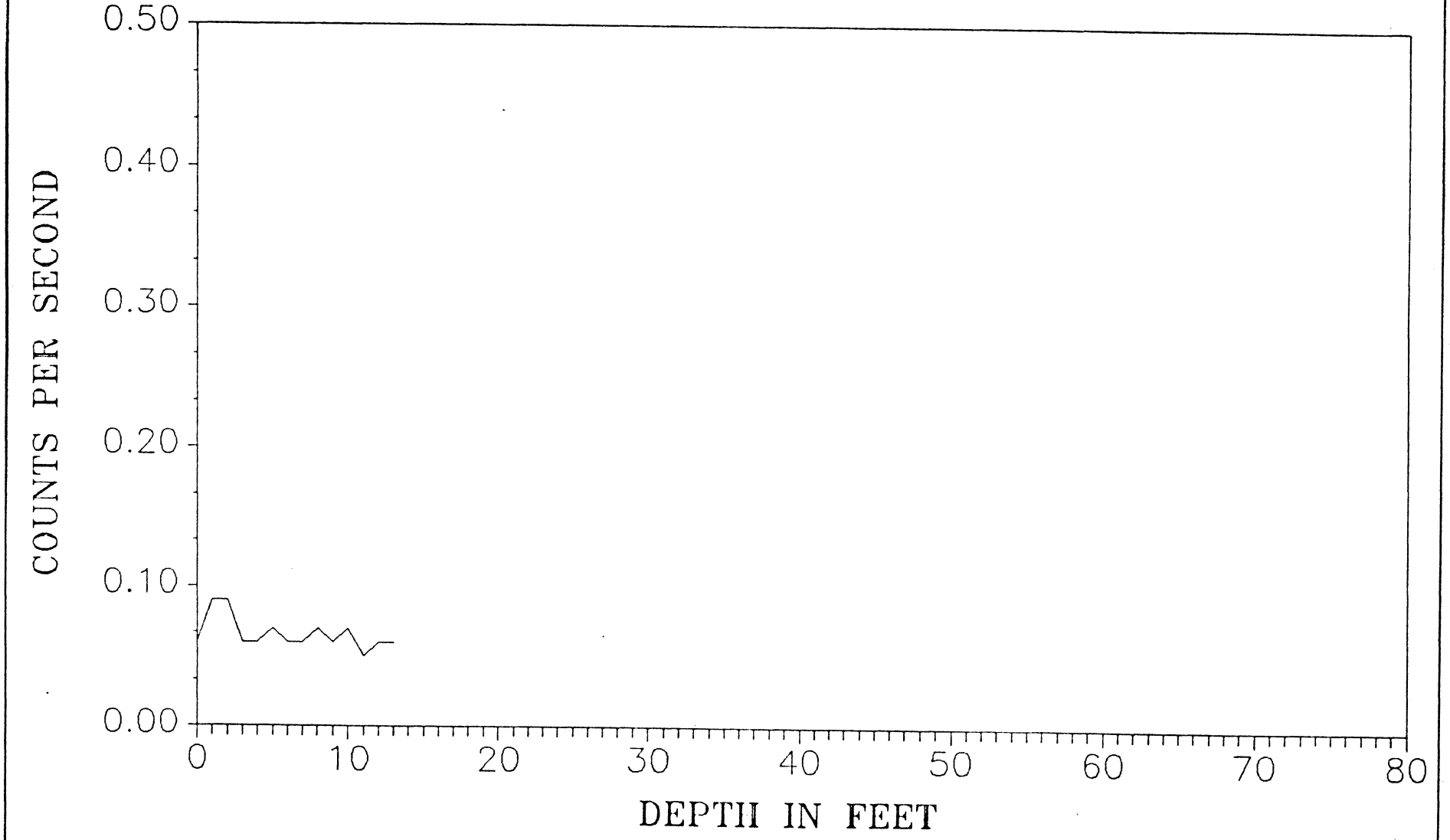
SOURCE OF WATER ADDED TO WELL

TIME SPENT FOR DEVELOPMENT 0.5 hours

STABILIZATION READINGS

GAL. REMOVED	TIME	FIELD TEMPERATURE	FIELD SPEC. COND.	FIELD pH

FOTH AND VAN DYKE



DATA TAKEN 1-13-89 BY BJS
TIME CONSTANT = 5 SECONDS
RANGE SETTING = 20 K

FOTH & VAN DYKE
GEOSCIENCES & ENVIRONMENTAL MANAGEMENT DIVISION
GREEN BAY, WISCONSIN

No	REVISIONS	NOTES	APPROVAL	DATE
			DESIGNED BY	
			DRAWN BY SJL	2/89
			CHECKED BY	
			APPROVED BY	
			CAD No.	SCALE AS SHOWN

KENNECOTT MINERALS COMPANY
FLAMBEAU PROJECT
LADYSMITH, WISCONSIN

GAMMA LOG
WELL DDH22-88

Job No | Dwg No | REV

APPENDIX 3.5-F

Geologic Logs and Soil Test Data for the Waste Characterization Borings, 1987

LOG OF TEST BORING NO.: B-WC1

CLIENT: Kennecott
PROJECT: Waste Characterization
PROJECT NUMBER: 87K10-6
LOCATION: South end of pit, Section 403, 25' North baseline
COORDINATES: 39964 N, 39112 E (Approx.)

SURFACE ELEVATION: 1111.5'
BORING DEPTH: 19.5'
DATE: 12/06/87

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLE NOTES
1111.5	--0.0	0.0-2.0	ss	1		2.0	Brown silty SAND, fn, poorly graded, soft, slightly cohesive, moist, (very fine sand) (Aeolian). At 1.8' cse gvl, weathered dk bldr	SM		
		2.0-4.0	ss	2		2.0	Weath. dk bldr to about 3.5'			
1109.0	--2.5						3.5-4.0: Red brn silty SAND, fn w/med & cse sand, fn & cse gvl, loose to dense, cohesive, moist, diamict	SM		
		4.0-6.0	ss	3		2.0	Brn well graded GRAVEL w/silt, layered w/silty SAND w/gvl, fn & cse gvl, dense			
1106.5	--5.0									
		6.0-8.0	ss	4		2.0	Same as above, purple & red volcanics, dark igneous & metamorphic	GW-GM		
1104.0	--7.5									
1101.5	--10.0	10.0-12.0	ss	5		2.0	Same to 11', then red brn silty SAND, fn well graded w/fn & cse gvl (diamict), dense, cohesive, satur., uniform (till)			
		12.0-14.0	ss	6		2.0	As above w/few sand layers <2" thick. Very dk gray coating on sand in shoe	SM		
1099.0	--12.5									
		14.0-16.0	ss	7		0.5	Bldrs to about 14.5' w/black coating. Cuttings at 14.5-16.5', yel brn (sericite?) schist, hard			
1096.5	--15.0									
		16.5-18.0	ss	8		1.5	Yel brn altered rock (tuff?), hard	RK		
1094.0	--17.5									
		18.0-19.5	ss	9		1.5	Same except crumbly, saturated.			
							19.5'-End of Boring in altered rock			
1091.5	--20.0									
1089.0	--22.5									
1086.5	--25.0									
1084.0	--27.5									

DRILLING DATA

START DATE: 12/06/87
COMPLETION DATE: 12/06/87
LOGGED BY: BJS
DRILLING METHOD: Air rotary
DRILLING CONTRACTOR: Luiser Drilling, Inc.

WATER LEVEL INFORMATION

DEPTH AT COMPLETION: 16 ft
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:
DRILLING LOSSES:

LOG OF TEST BORING NO.: B-WC1A

CLIENT: Kennecott
PROJECT: Waste Characterization
PROJECT NUMBER: 87K10-6
LOCATION: South end of pit Section 403, 25' North baseline
COORDINATES: 39964 N, 39112 E (Approx.)

SURFACE ELEVATION: 1111.5'
BORING DEPTH: 19.5'
DATE: 12/06/87

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLE NOTES
1111.5	--0.0	0.0-2.0	ss	1		2.0	Brn silty SAND, fn, poorly graded, w/org (topsoil), cohesive, slightly moist (bldr at 2'-moved rig over)	SM		
1109.0	--2.5	2.0-4.0	ss	2		2.0	Brn well graded GRAVEL, well graded SAND fn & cse gvl, fn to cse sand, layered 4-6", loose to cohesive, slightly moist	GW, SW		
1106.5	--5.0	4.0-6.0	ss	3		2.0	Brn well graded GRAVEL, cse w/fn, well rounded (broken w/sampler). Much volc. w/igneous & metamorphic	GW		
		6.0-8.0	ss	4		1.8	Same			
1104.0	--7.5	8.0-9.0	ss	5		1.0	Same			
1101.5	--10.0	9.0-11.0	ss	6		1.0	Same, wet			
1099.0	--12.5	12.0-14.0	ss	7		2.0	Red brn silty SAND, fn w/med & cse sand, fn & cse gvl, well graded (diamict), moist, dense, cohesive (till)	SM		
1096.5	--15.0	14.0-16.0	ss	8		2.0	Same except saturated			
		16.0-16.3	ss	9		0.3	Same w/weath. rock, on bedrock? Hard, drilled through to 18.5'			
1094.0	--17.5	18.5-19.5	ss	10		0.7	Yel brn (limonite?) coating on silicious (tuff?) rock, crumbly, saturated	RK		
1091.5	--20.0						19.5'-End of Boring in altered rock			
1089.0	--22.5									
1086.5	--25.0									
1084.0	--27.5									

DRILLING DATA

START DATE: 12/06/87
COMPLETION DATE: 12/06/87
LOGGED BY: BJS
DRILLING METHOD: Air rotary
DRILLING CONTRACTOR: Luiser Drilling, Inc.

WATER LEVEL INFORMATION

DEPTH AT COMPLETION:
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:
DRILLING LOSSES:

LOG OF TEST BORING NO.: B-WC1B

CLIENT: Kennecott
PROJECT: Waste Characterization
PROJECT NUMBER: 87K10-6
LOCATION: South end of pit, Section 403, 20' North baseline
COORDINATES: 39964 N, 39112 E (Approx.)

SURFACE ELEVATION: 1111.5'
BORING DEPTH: 18.5'
DATE: 12/06/87

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLE NOTES
1111.5	--0.0	0.0-2.0	ss	1		2.0	Brn silty SAND, fn, poorly graded, soft, cohesive (fn & vy fn sand) (Aeolian sand w/organics, topsoil)	SM		
1109.0	--2.5						Boulders from 2 to 5'-Hammer drilled			
1106.5	--5.0	5.0-7.0	ss	2		2.0	Brn well graded GRAVEL w/silt, cse w/fn (broken by sampler)	GW-GM		
1104.0	--7.5	7.0-9.0	ss	3		2.0	As above, bldrs in diamict matrix			
1101.5	--10.0	9.0-11.0	ss	4		2.0	Same to 10', then red brn silty SAND, diamict w/much cse gvl (cobbles)			
		11.0-12.0	ss	5		0.9	Red brn silty SAND w/cobbles, loose			
1099.0	--12.5	12.0-14.0	ss	6		2.0	Red brn silty SAND, diamict, layered, variable texture (sandier than usual till), dense, saturated	SM		
1096.5	--15.0	14.0-16.0	ss	7		2.0	Same to 14.5', then well graded GRAVEL w/silt (w/yel brn altered bedrock, soft)	GW-GM		
		@ 16.0	ss	8		0.0	At 15.5'-yel brn altered rock siliceous (tuff?), dense, crumbly, soft.			
		16.0-16.4	ss	9		0.0	@ 16'-No recovery, cave (till) Drove 16-16.4'-Hard, cracked shoe on split spoon. Drilled through to 17.5'	RK		
1094.0	--17.5	17.5-18.5	ss	10		1.0	Vy pale yel altered rock, siliceous (tuff?), crumbly, vy dense, w/vy hard pieces rock			
1091.5	--20.0						18.5'-End of Boring in rock			
1089.0	--22.5									
1086.5	--25.0									
1084.0	--27.5									

DRILLING DATA

START DATE: 12/06/87
COMPLETION DATE: 12/06/87
LOGGED BY: BJS
DRILLING METHOD: Air rotary
DRILLING CONTRACTOR: Luiser Drilling, Inc.

WATER LEVEL INFORMATION

DEPTH AT COMPLETION:
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:
DRILLING LOSSES:

LOG OF TEST BORING NO.: B-WC2

CLIENT: Kennecott
PROJECT: Waste Characterization
PROJECT NUMBER: 87K10-6
LOCATION: Center of pit, Section 415, 50' South baseline
COORDINATES: 40669 N, 39990 E (Approx.)

SURFACE ELEVATION: 1134.9'
BORING DEPTH: 40.5'
DATE: 12/05/87

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLE NOTES
1134.9	--0.0	0.0-2.0	ss	1		2.0	Brn silty SAND, fn, poorly graded, cohesive, soft, moist, saturated. (Aeolian sand)	SM		
		2.0-4.0	ss	2		2.0	Same to 3', then red brn silty SAND, diamict w/fn gvl, clayey layers			
1132.4	--2.5							SM		
		4.0-6.0	ss	3		2.0	Brn silty SAND, fn, poorly graded, soft, cohesive, laminated to 5', then silty SAND as above.			
1129.9	--5.0									
		6.0-8.0	ss	4		1.5	Brn well graded SAND w/silt, med, w/fine gravel, loose, moist to wet			
1127.4	--7.5									
		8.0-10.0	ss	5		1.0	Brn poorly graded SAND, fn, laminated, loose, dry	SP		
1124.9	--10.0	10.0-13.0	ss	6		2.5	As above. (Pushed rock, no recovery; drove 10-13')			
1122.4	--12.5									
		13.0-15.0	ss	7		1.0	(Drove to 16') Brown poorly graded SAND as above w/silty SAND layer at 13.5', dry			
1119.9	--15.0	15.0-17.0	ss	8		2.0	(Drove 15-18.5') As above, dry			
		17.0-20.0	ss	9		2.0	Same to 18.5', then layered red brn silty SAND, sandy lean CLAY, laminated diamict w/fn gravel			
1117.4	--17.5							SM, CL		
1114.9	--20.0	20.0-22.0	ss	10		2.0	Silty sand, fn, loose to 20.2', then red brn silty SAND, fn, w/med & cse gvl, diamict, dense, cohesive, moist, (till)	SM		
		22.0-24.0	ss	11		2.0	Same as above, saturated at about 23', soft, cohesive			
1112.4	--22.5									
		24.0-26.0	ss	12		2.0	Same to 25', then lt yel brn & white poorly graded SAND, fn w/med, loose, dense, saturated. Blk stain on horz. layers (ss)			
1109.9	--25.0							SP (SS)	%g - s - si&el 1 -98 - 1	
		26.0-28.0	ss	13		1.8	Sandstone as above w/few weakly cemented layers			
1107.4	--27.5									

DRILLING DATA

START DATE: 12/05/87
COMPLETION DATE: 12/05/87
LOGGED BY: BJS
DRILLING METHOD: Mud rotary
DRILLING CONTRACTOR: Luiser Drilling, Inc.

WATER LEVEL INFORMATION

DEPTH AT COMPLETION:
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:
DRILLING LOSSES:

LOG OF TEST BORING NO.: B-WC2

CLIENT: Kennecott
PROJECT: Waste Characterization
PROJECT NUMBER: 87K10-6
LOCATION: Center of pit; Section 415, 50' South baseline
COORDINATES: 40669 N, 39990 E (Approx.)

SURFACE ELEVATION: 1134.9'
BORING DEPTH: 40.5'
DATE: 12/05/87

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLE NOTES
1107.4	--27.5						Sandstone, vy dense, could not drive.			
		28.0-28.5	ss	14		0.5	Drill to 29', cuttings cse qtz sand, w/white clay (kaolinite)			
		29.0-29.5	ss	15		0.5	Vy lt brn SANDSTONE, fn w/med & cse sand	SP-SM		
1104.9	--30.0						vy dense, loose cemented, cohesive, w/kaol. coating. Drill to 33', cuttings cse qtz sand; at 33' green sandy lean clay (incorp. saprolite)	(SS)		
1102.4	--32.5									
		34.0-34.5	ss	16		0.5	Lt brn sandstone, fn w/med & cse sand, cemented, brittle, kaolinite matrix			
1099.9	--35.0									
		34.5-39.5	c	17		1.2	Lt yel brn & lt gray brn (2.5Y 6/2 &			
1097.4	--37.5						6/4) SANDSTONE, fn w/med & med w/cse, layered, cemented w/kaolinite in matrix. Few green gray (5G 5/1) vy fn sandstone layers w/much silt in matrix. (Pieces 1/2-4" long)	SS		
1094.9	--40.0						Hard at 39.5'. Drilled w/roller bit to 40.5'. Cuttings red & yellow chert (gossan).	RK		
							End of Boring at 40.5' in gossan.	=====		
1092.4	--42.5									
1089.9	--45.0									
1087.4	--47.5									
1084.9	--50.0									
1082.4	--52.5									
1079.9	--55.0									

DRILLING DATA

START DATE: 12/05/87
COMPLETION DATE: 12/05/87
LOGGED BY: BJS
DRILLING METHOD: Mud rotary; carbide bit 34.5-39.5'
DRILLING CONTRACTOR: Luisier Drilling, Inc.

WATER LEVEL INFORMATION

DEPTH AT COMPLETION:
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:
DRILLING LOSSES:

LOG OF TEST BORING NO.: B-WC2A

CLIENT: Kennecott
PROJECT: Waste Characterization
PROJECT NUMBER: 87K10-6
LOCATION: Center of pit; Section 415, 50′ South baseline
COORDINATES: 40669 N, 39990 E (Approx)

SURFACE ELEVATION: 1134.9′
BORING DEPTH: 26.0′
DATE: 12/05/87

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLE NOTES
1134.9	--0.0	0.0-2.0	ss	1		2.0	Brn silty SAND, fn, poorly graded, w/organics, massive			
1132.4	--2.5	2.0-4.0	ss	2		2.0	Same, cohesive, moist, soft, massive to weakly laminated	SM		
1129.9	--5.0	4.0-6.0	ss	3		2.0	Same except wet. At 5′, brn well graded SAND/well graded GRAVEL, fn & med sand w/cse sand, & fn & cse gvl, loose, dry			
1127.4	--7.5	6.0-8.0	ss	4		2.0	As above except slightly moist	SW/GW		
		8.0-10.0	ss	5		2.0	Same to 9′, then red brn silty SAND, fn w/med & cse sand, fn & cse gvl (diamict w/variable texture)	SM		
1124.9	--10.0	10.0-12.0	ss	6		2.0	Same to 10.5′, then well graded SAND, med w/cse sand, fn gvl, loose, dry, bedded w/layers silty SAND, fn	SP		
1122.4	--12.5	12.0-14.0	ss	7		2.0	Lt brn poorly graded SAND w/silt, fn, loose, dry, laminated	SP-SM		
1119.9	--15.0	14.0-16.0	ss	8		2.0	Lt brn silty SAND, layered w/poorly graded SAND (vy fn sand) irreg. laminated, dry			
1117.4	--17.5	16.0-18.0	ss	9		2.0	Same to 17.5′, then laminated w/med brn lean CLAY, vy stiff, cohesive			
1114.9	--20.0	18.0-20.0	ss	10		2.0	Poorly graded SAND, fn, loose, dry to 18.5′. Weath. cse grained granite bldr (much k-feldspar) at 18.5-19′, then red brn silty SAND, fn, diamict, vy firm, slightly moist	SM, SP-SM, SP		
1112.4	--22.5	20.0-22.0	ss	11		2.0	Brn poorly graded SAND w/silt, med, loose, wet. At 21′, brn silty SAND, diamict, variable texture, angular fn & cse gvl, vy dense to soft, moist			
1109.9	--25.0	22.0-24.0	ss	12		2.0	Brn silty SAND, fn, poorly graded (vy fn sand), massive to indistinctly layered, saturated at 23′	SM		
		24.0-26.0	ss	13		2.0	Red brn silty SAND, fn, diamict. At 24.3′, white poorly graded SAND, fn w/med, loose, dense, qtz (sandstone), saturated	SP (SS)		
1107.4	--27.5						End of Boring at 26′ in sandstone	=====		

DRILLING DATA

START DATE: 12/05/87
COMPLETION DATE: 12/05/87
LOGGED BY: BJS
DRILLING METHOD: Air rotary
DRILLING CONTRACTOR: Luisier Drilling, Inc.

WATER LEVEL INFORMATION

DEPTH AT COMPLETION:
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:
DRILLING LOSSES:

Foth & Van Dyke
Engineers/Architects
2737 S. Ridge Road
P. O. Box 19012
Green Bay, Wisconsin 54307-9012
414/497-2500

PROJECT NO.: _____
JOB NO.: 87K10
DATE: February 2-3, 1988
REPORT NO.: SB6

REPORT OF ANALYSIS OF AGGREGATES

ARCHITECT/ENGINEER: Foth & Van Dyke CONTRACTOR: _____
PROJECT: Kennecott Geotechnical - Granular Blanket SOURCE: _____
REPORT OF TESTS OF: Verification of Proposed Granular Blanket Material

Sieve Size or No.	Weight Retained	% Retained	% Passing	Specifications
3-Inch				
2-Inch				
1 1/2-Inch				
1-Inch				
3/4-Inch				
1/2-Inch	0	0	100	
3/8-Inch	1.5	0.5	99.5	
No. 4	0.5	0.2	99.3	
No. 8				
No. 10	2.7	0.9	98.4	
No. 16				
No. 20				
No. 30				
No. 40	60.8	21.2	77.2	
No. 50				
No. 80	151.0	52.7	24.5	
No. 100	29.0	10.1	14.4	
No. 200	38.1	13.3	1.1	
Pan	2.9	1.0		

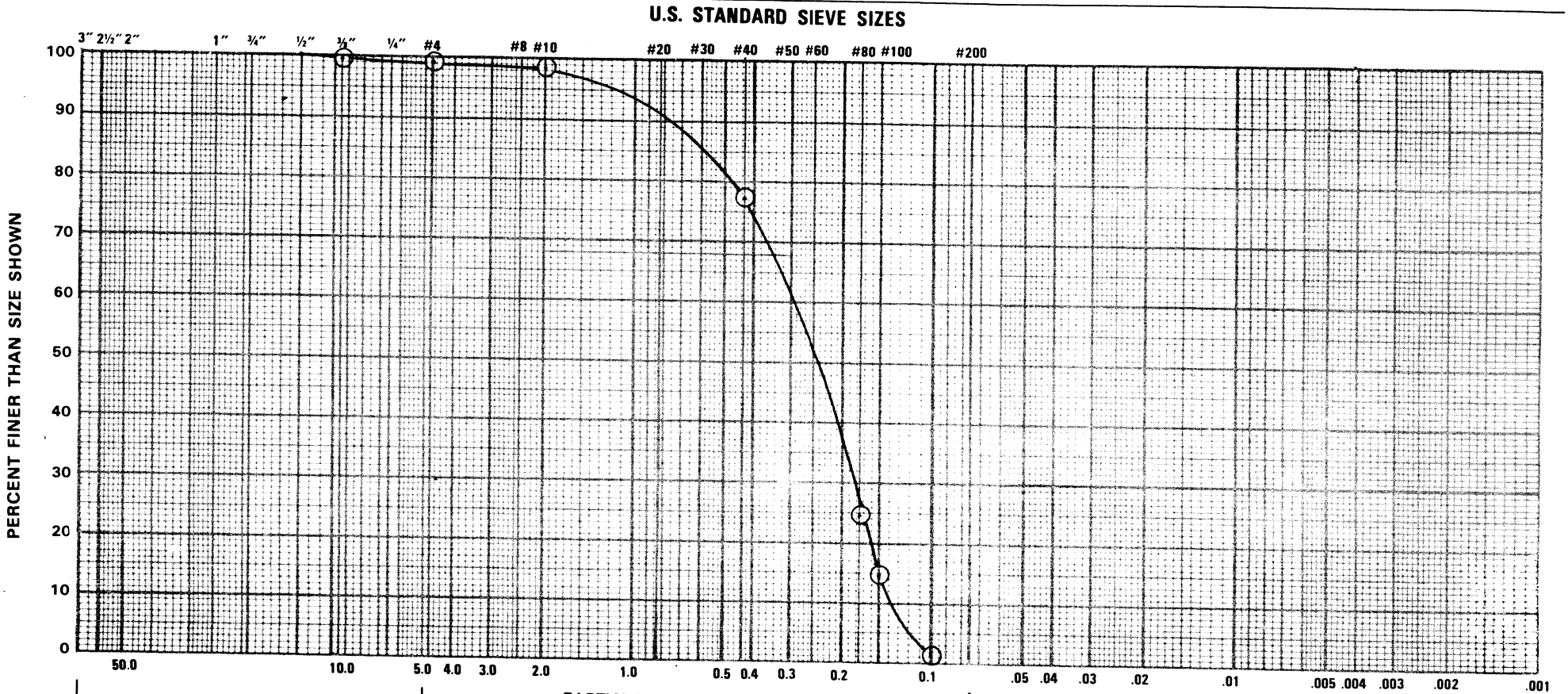
RECEIVED AT LABORATORY: February 2, 1988
QUANTITY REPRESENTED: 286.5 grams
SUBMITTED BY: Betty Socha of F&VD
SAMPLED FROM: Boring No.: B-WC2A
IDENTIFICATION: Sample No.: WC2A Depth: 24'-26'
DATE SAMPLED: December 1987
INTENDED USE: Granular Blanket
WASHED GRADATION: No
PERCENT PASSING NO. 200 SIEVE 1.0 %
COLOR: 10 YR. 7/2 - light gray

CHECKED BY: RRR

FORM #329 A-1 SL (Rev. 11/86)

Foth & Van Dyke and Associates Inc.

GRAIN SIZE DISTRIBUTION CURVE



GRAVEL		SAND			SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE		
% =	% = 0.7	% = 0.9	% = 21.2	% = 76.2	% = 1.0	% =

PROJECT: Kennecott Geotechnical - Granular Blanket DATE: 2/3/88 SAMPLE NO.: SB6

LOCATION SAMPLED: Boring No.: B-WC2A ELEV. OR DEPTH: 24'-26' DRAWN BY: POK APPROVED BY: RRR

ATTERBERG LIMITS: LL _____ PL _____ PI _____ SAMPLED MOISTURE CONTENT (%): _____ COEFFICIENTS: Cc = 0.8 Cu = 2.1

SAMPLE SOURCE: _____ MUNSELL COLOR CODE: 10 YR. 7/2 DATE SAMPLED: December 1987

SOIL CLASSIFICATION (ASTM: D2487) SAND, fine to medium grained, light gray (SP)

FORM #411 SL (2/87)

3.5-F-8

LOG OF TEST BORING NO.: B-WC3

CLIENT: Kennecott
PROJECT: Waste Characterization
PROJECT NUMBER: 87K10-6
LOCATION: North end; Section 422, 2' North baseline
COORDINATES: 41293 N, 40505 E (Approx.)

SURFACE ELEVATION: 1140.3'
BORING DEPTH: 48.0'
DATE: 12/02/87

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLE NOTES
1140.3	--0.0									
		1.0-2.5	ss	1	P	1.5	Yel brn silty SAND, fn, poorly graded, slightly moist, cohesive (Aeolian sand w/soil horizons)	SM		
1137.8	--2.5									
1135.3	--5.0	5.0-7.5	ss	2	P	1.2	Brn well graded SAND, med w/fn & cse sand, fn gravel, loose, dry. (Fluvial sand & gravel)	SW		
1132.8	--7.5									
1130.3	--10.0	10.0-11.5	ss	3	P	1.5	Brn poorly sorted SAND w/silt, fn, layered w/well graded SAND, med w/fn & cse sand, fn & cse gvl <2" dia, loose, moist	SP-SM SW		
1127.8	--12.5									
1125.3	--15.0	15.0-16.5	ss	4	P	1.2	Red brn silty SAND, fn w/med & cse sand, fn gvl, dense, cohesive, wet, w/weath. igneous/meta. pebbles, diamict (till)	SM		
1122.8	--17.5									
1120.3	--20.0	20.0-21.5	ss	5	P	1.1	Same as above			
1117.8	--22.5									
1115.3	--25.0	25.0-26.5	ss	6	P	1.5	Brn poorly graded SAND w/silt, fn & med layered, loose, saturated. 4" silty SAND, fn (vy fn sand) cohesive, very slightly moist at 26.5'	SP-SM		P - Pushed D - Drove
1112.8	--27.5									

DRILLING DATA

START DATE: 12/02/87
COMPLETION DATE: 12/04/87
LOGGED BY: BJS
DRILLING METHOD: Mud rotary
DRILLING CONTRACTOR: Luisier Drilling, Inc.

WATER LEVEL INFORMATION

DEPTH AT COMPLETION:
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:
DRILLING LOSSES:

LOG OF TEST BORING NO.: B-WC3

CLIENT: Kennecott
PROJECT: Waste Characterization
PROJECT NUMBER: 87K10-6
LOCATION: North end; Section 422, 2′, North baseline
COORDINATES: 41293 N, 40505 E (Approx.)

SURFACE ELEVATION: 1140.3′
BORING DEPTH: 48.0′
DATE: 12/02/87

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLE NOTES
1112.8	--27.5									
1110.3	--30.0	30.0-31.5	ss	7	P	1.5	Lt yel & white layered (1-2") poorly graded SAND, fn w/med, loose, saturated, dense (sandstone)		%g - s - si&cl 0 -96 - 4 K(L)=2.8x0.001 (Recompacted)	
		31.5-34.0	ss	8	D	2.0	As above, except cse at 33.8′			
1107.8	--32.5									
		34.0-35.5	ss	9	D	1.5	As above w/few thin (<2") cse sand layers	SP (SS)		
1105.3	--35.0									
		35.5-38.5	ss	10	D	2.5	Vy lt brn poorly graded SAND, med w/cse, vy dense, unconsol. (Sandstone)			
1102.8	--37.5									
		38.5-39.5	ss	11	D	1.0	Lt gray w/lt brn poorly graded SAND, med w/cse, unconsol w/few consol pieces, weakly cemented at 39-39.5′. Dk gray coating on horz layers 2-3" thick			Broke drive head on air hammer
1100.3	--40.0	39.5-41.5	st	12	D	0.0	Sample taken w/24" length of (3.0 ID) galvanized pipe. Med sandstone w/vy dark gray coating on sampler.			Tube ripped off when pulling up
		41.5-42.0	st	13		0.0	Cuttings yel, white SILT, silty CLAY. Drilled hard, couldn't drive pipe	SS		
1097.8	--42.5	42.0-44.0	c	14		2.0	42-42.5′-Brn horz lamin. sandstone, fn & med, iron stain on some laminae, vy hard 42.5-43′-Cemented w/green yel CLAY			
		44.0-47.5	c	15		0.0	laminae (much incorp. saprolite) 43-44′-White & yel altered (sericite) schist/saprolite, hard, brittle, iron stained, near vert. foliation apparent 44-47.5′-Cored like alternating hard & soft layers	RK		
1095.3	--45.0									
1092.8	--47.5	47.5-48.0	ss	16	D	0.0	Drove to 48′, very hard 48′-End of Boring in altered schist	=====		
1090.3	--50.0									
1087.8	--52.5									
1085.3	--55.0									

DRILLING DATA

START DATE: 12/02/87
COMPLETION DATE: 12/04/87
LOGGED BY: BJS
DRILLING METHOD: Mud rotary
DRILLING CONTRACTOR: Luisier Drilling, Inc.

WATER LEVEL INFORMATION

DEPTH AT COMPLETION:
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:
DRILLING LOSSES:

Foth & Van Dyke
Engineers/Architects
2737 S. Ridge Road
P. O. Box 19012
Green Bay, Wisconsin 54307-9012
414/497-2500

PROJECT NO.: _____
JOB NO.: 87K10
DATE: February 2-3, 1988
REPORT NO.: SB5

REPORT OF ANALYSIS OF AGGREGATES

ARCHITECT/ENGINEER: Foth & Van Dyke CONTRACTOR: _____

PROJECT: Kennecott Geotechnical - Granular Blanket SOURCE: _____

REPORT OF TESTS OF: Verification of Proposed Granular Blanket Material

Sieve Size or No.	Weight Retained	% Retained	% Passing	Specifications
3-Inch				
2-Inch				
1 1/2-Inch				
1-Inch				
3/4-Inch				
1/2-Inch				
3/8-Inch	0	0	100	
No. 4	1.7	0.5	99.5	
No. 8				
No. 10	5.3	1.4	98.1	
No. 16				
No. 20				
No. 30				
No. 40	83.0	22.7	75.4	
No. 50				
No. 80	179.1	49.0	26.4	
No. 100	34.7	9.5	16.9	
No. 200	49.3	13.5	3.4	
Pan	12.7	3.5		

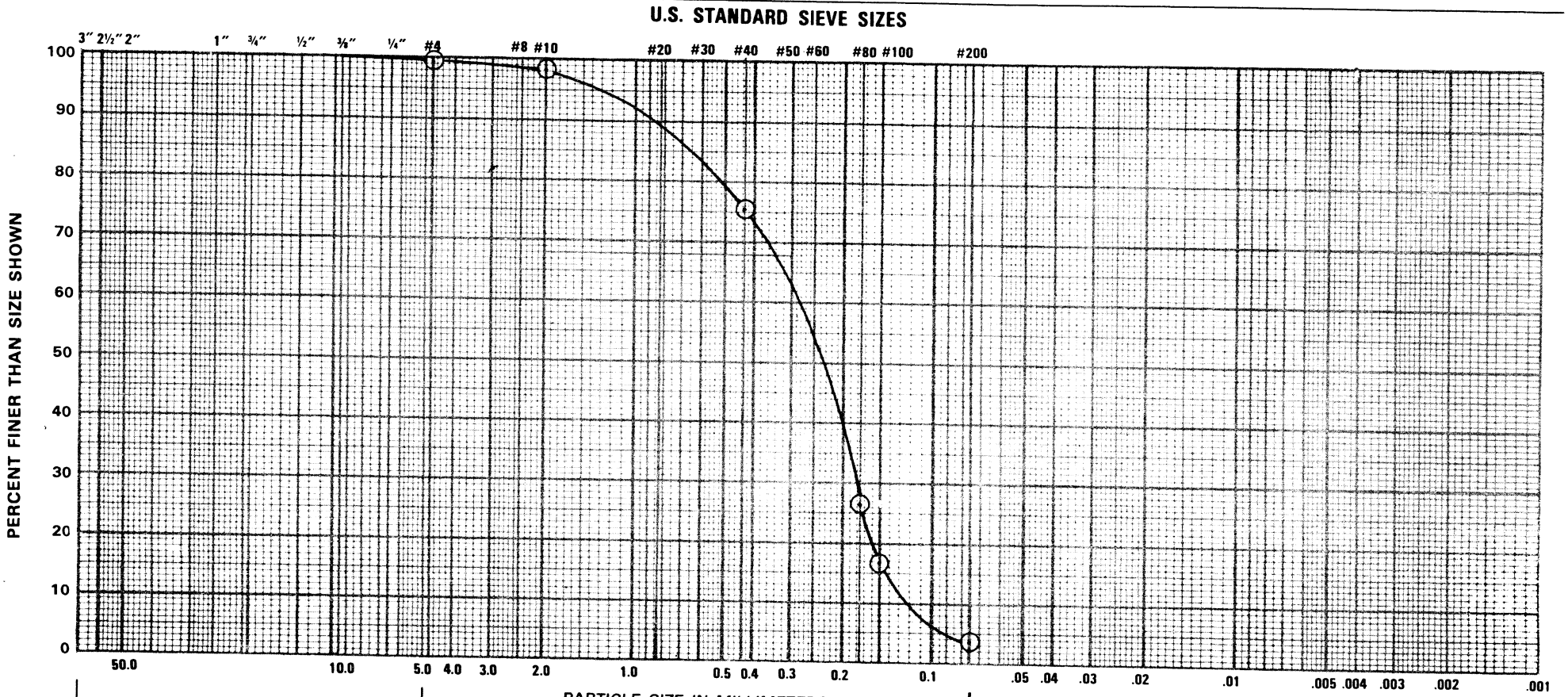
RECEIVED AT LABORATORY: February 2, 1988
QUANTITY REPRESENTED: 365.8 grams
SUBMITTED BY: Betty Socha of F&VD
SAMPLED FROM: Boring No.: B-WC3
IDENTIFICATION: Sample No.: WC3 Depth: 31'-34'
DATE SAMPLED: December 1987
INTENDED USE: Granular Blanket
WASHED GRADATION: No
PERCENT PASSING NO. 200 SIEVE 3.5 %
COLOR: 10 YR, 6/3 - pale brown

CHECKED BY: RRR

FORM #329 A-1 SL (Rev. 11/86)

Foth & Van Dyke and Associates Inc.

GRAIN SIZE DISTRIBUTION CURVE



GRAVEL		SAND			SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE		
% =	% = 0.5	% = 1.4	% = 22.7	% = 71.9	% = 3.5	% =

PROJECT: Kennecott Geotechnical - Granular Blanket DATE: 2/3/88 SAMPLE NO.: SB5

LOCATION SAMPLED: Boring No. B-WC3 ELEV. OR DEPTH: 31'-34' DRAWN BY: POK APPROVED BY: RRR

ATTERBERG LIMITS: LL _____ PL _____ PI _____ SAMPLED MOISTURE CONTENT (%): _____ COEFFICIENTS: Cc = 1.0 Cu = 2.3

SAMPLE SOURCE: _____ MUNSELL COLOR CODE: 10 YR. 6/3 DATE SAMPLED: December 1987

SOIL CLASSIFICATION (ASTM: D2487) SAND, fine to medium grained, pale brown (SP)

FORM #411 SL (2/87)

3.5-F-12

Foth & Van Dyke
Engineers/Architects

2737 S. Ridge Road
P. O. Box 19012
Green Bay, Wisconsin 54307-9012
414/497-2500

PROJECT: Kennecott Geotechnical

JOB NO.: 87K10

DATE: February 10 to 12, 1988

PERMEABILITY TEST
CONSTANT HEAD

SAMPLE NO.: Boring: B-WC3 Depth: 31'-34'

SOIL DESCRIPTION: SAND, fine to medium grained, pale brown (SP)

% COMPACTION 90.0

COMPACTED DRY DENSITY = 102.5 pcf

MOISTURE = 11.7%

SAMPLE DIAMETER = 4.00"

SAMPLE HEIGHT = 4.25"

RUN NO.	HEAD, cm	DURATION, Seconds	PERMEABILITY, CM/SEC.	REMARKS
1	175	30	2.94×10^{-3}	
2	175	30	2.98×10^{-3}	
3	175	30	3.02×10^{-3}	
4	175	30	2.81×10^{-3}	
5	175	30	2.74×10^{-3}	
6	175	30	2.68×10^{-3}	
7	175	30	2.62×10^{-3}	

Average of Perm Readings = 2.8×10^{-3}

Project Specification = 1.0×10^{-3} or faster

REMARKS: Based on the results of the sample submitted and tested, this material would meet the permeability rate as noted above.

FORM #370 SL 1/86)

LOG OF TEST BORING NO.: B-WC3A

CLIENT: Kennecott
PROJECT: Waste Characterization
PROJECT NUMBER: 87K10-6
LOCATION: North end; Section 422, 2' N baseline about 10' N of B-WC3
COORDINATES: 41293 N, 40505 E (Approx.)

SURFACE ELEVATION: 1140.3'
BORING DEPTH: 28.0'
DATE: 12/04/87

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLE NOTES
1140.3	--0.0									
1137.8	--2.5	2.5-4.5	ss	1	P	2.0	Brn silty SAND, fn, poorly graded, slightly cohesive, moist. (Aeolian sand w/B-horizon at 2.5-3.5')	SM		
1135.3	--5.0	4.5-7.0	ss	2	P	2.0	As above to 6', then poorly graded SAND w/silt, fn w/med & cse sand, fn gvl., loose, dry. (Fluvial sand & gvl)			
1132.8	--7.5	7.0-9.0	ss	3	P	2.0	As above except layered fn & med, loose, dry	SP-SM		
		9.0-9.5	ss	4	P	0.5	As above (pushed bldr)			
1130.3	--10.0	9.5-10.0	ss	5	P	0.5	Brn poorly graded SAND w/silt, fn, loose (Bldr at 10')			
		10.0-12.0	ss	6	D	2.0	As above w/layers well graded SAND w/silt, med w/fn & cse sand, fn & cse gvl, saturated, (w/drilling water)	SP-SM SW-SM		
1127.8	--12.5	12.0-14.0	ss	7	D	2.0	As above, loose, dry, silty SAND layer (2" thick) at 13'			
1125.3	--15.0	14.0-16.0	ss	8	D	1.5	Brn well graded SAND w/silt, cse, w/fn & med, fn gvl, loose, saturated, much feldspar	SW-SM		
1122.8	--17.5	16.0-18.0	ss	9	D	2.0	As above to 17', then red brn silty SAND, well graded (diamict), firm, cohesive, moist, (till)			
		18.0-20.0	ss	10	D	2.0	As above to 19', then brn poorly graded SAND, fn, saturated, slightly cohesive	SM		
1120.3	--20.0	20.0-22.0	ss	11	D	2.0	As above to 21', then red brn silty SAND, fn, well graded (diamict), firm, cohesive, moist (till)	SP-SM		
1117.8	--22.5	22.0-24.0	ss	12	D	2.0	As above, uniform, dense, cohesive	SM		
1115.3	--25.0	24.0-26.0	ss	13	D	2.0	Same to 25.5', then red brn layered, well graded SAND, fn w/med & fn gvl, saturated			P - Pushed D - Drove
		26.0-28.0	ss	14	D	2.0	Red brn silty SAND (till) as above to 27.7', then vy pale yel poorly graded SAND, fn, loose, saturated (sandstone)	SW SM SP		
1112.8	--27.5						28'-End of Boring in sandstone	=====		

DRILLING DATA

START DATE: 12/04/87
COMPLETION DATE: 12/04/87
LOGGED BY: BJS
DRILLING METHOD: Mud rotary
DRILLING CONTRACTOR: Luisier Drilling, Inc.

WATER LEVEL INFORMATION

DEPTH AT COMPLETION:
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:
DRILLING LOSSES:

APPENDIX 3.5-G

Geologic Logs, Well Construction Diagrams, and Well Development Forms for Permeability Test Wells, 1988

LOG OF TEST BORING NO.: TW - K1

CLIENT: Kennecott
PROJECT: Rock Permeability
PROJECT NUMBER: 87K10 - W066
LOCATION: River pillar, about 80' E. of PZ - S1
COORDINATES: N40043.59, E38784.33

SURFACE ELEVATION: 1102.5 Feet
BORING DEPTH: 193.0 Feet
DATE: 03-07-88

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLING NOTES
1102.5	--0						Drilled wo/sampling 0 - 28'			
							Bldrs 0 - 8';10 - 15'			
							Cuttings redbrown SILTY SAND	SM		
1082.5	--20									
							At 20', lt. yel brn SILT, soft, altered shist.			
							Rock soft to about 44 ft.	ML		
		33'-43'	*g							
1062.5	--40									
		43'-63'	g							
							Cuttings predominantly powder with few chips, dry.			
		53'-63'	g							
1042.5	--60						Gray, red, green biotite schist.			
		63'-73'	g							
		73'-83'	g							
1022.5	--80						Biotite-quartz-chlonite schist and biotite-chlorite-quartz-sericite schist	PC (2c), (2a)		
		83'-93'	g							
		93'-103'	g							
1002.5	--100									
		103'-113'	g							
		113'-123'	g							
982.5	--120									
		123'-133'	g							
		133'-143'	g							
962.5	--140									
		143'-153'	g							
		153'-163'	g							
942.5	--160									
		163'-173'	g							
		173'-183'	g							
922.5	--180									
		183'-193'	g							
							EOB at 193' in biotite schist.			*g=grab samples of cuttings.
902.5	--200									
882.5	--220									

DRILLING DATA

START DATE: 03/07/88
COMPLETION DATE: 03/07/88
LOGGED BY: BJS
DRILLING METHOD: Mud rotary 0-28'; air 28-193'
DRILLING CONTRACTOR: Luisier Drilling, Inc.

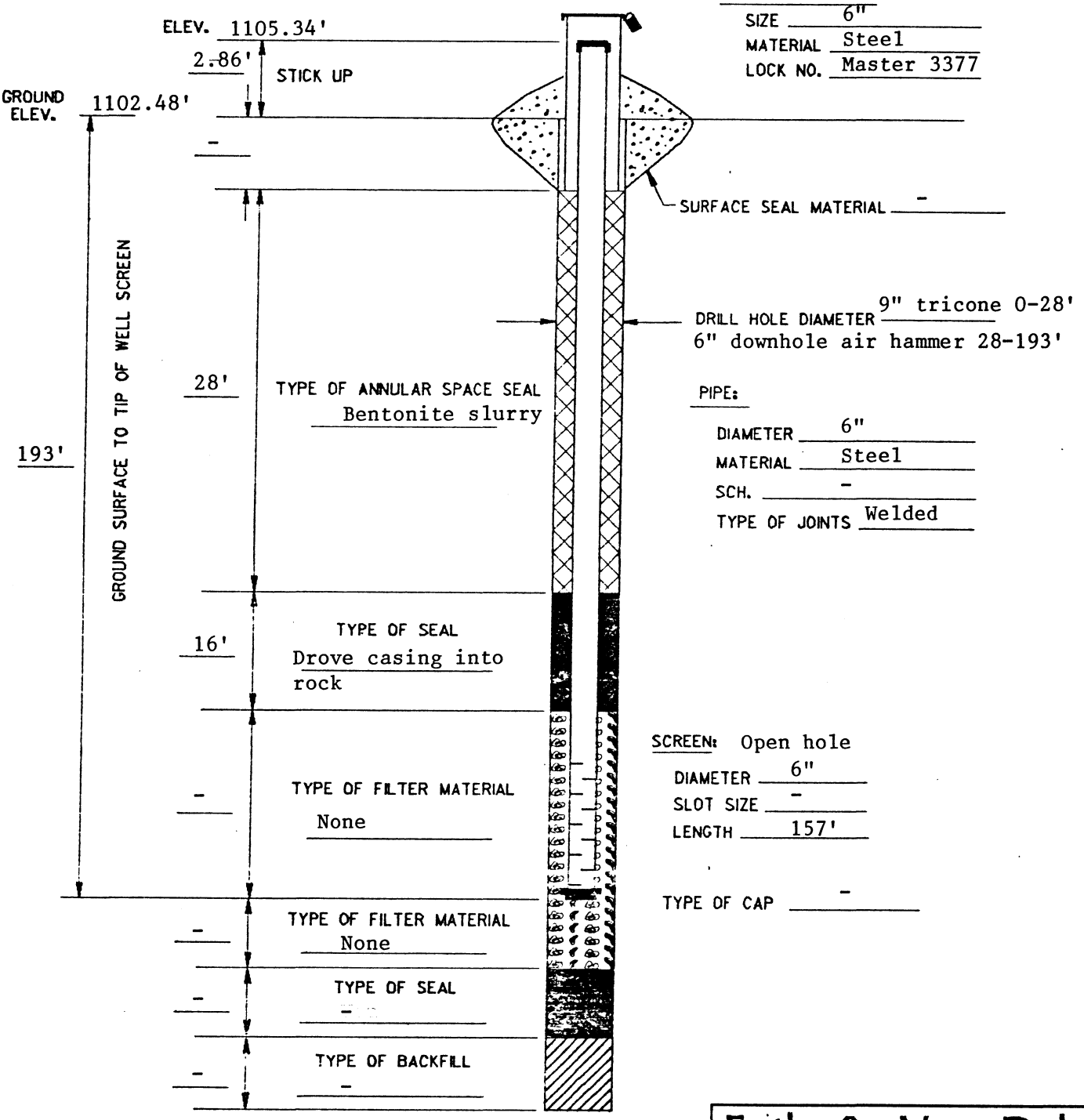
WATER LEVEL INFORMATION

DEPTH AT COMPLETION: DRY
LATER TIME/DEPTH: 03-08-88
LATER TIME/DEPTH: 7:55 AM/117'
CAVE IN DEPTH: 185'
DRILLING LOSSES:

MONITORING WELL CONSTRUCTION DIAGRAM

WELL NO: TW-K1
DATE INSTALLED: 3-7-88
DRILLER: Luisier Drilling, Inc.
DRILLING METHOD: Mud rotary, air

CLIENT: Kennecott
PROJECT: Rock permeability
SCOPE I.D.: 87K10-W.O. 66
BY: BJS



PROTECTOR PIPE:
SIZE 6"
MATERIAL Steel
LOCK NO. Master 3377

SURFACE SEAL MATERIAL -

DRILL HOLE DIAMETER 9" tricone 0-28'
6" downhole air hammer 28-193'

TYPE OF ANNULAR SPACE SEAL
Bentonite slurry

PIPE:
DIAMETER 6"
MATERIAL Steel
SCH. -
TYPE OF JOINTS Welded

TYPE OF SEAL
Drove casing into rock

TYPE OF FILTER MATERIAL
None

SCREEN: Open hole
DIAMETER 6"
SLOT SIZE -
LENGTH 157'

TYPE OF CAP -

TYPE OF FILTER MATERIAL
None

TYPE OF SEAL
-

TYPE OF BACKFILL
-

Foth & Van Dyke
Geosciences & Environmental Management Division
Revised 3/88 By BJS
Drawn By MRS

MONITORING WELL DEVELOPMENT

WELL NUMBER TW-K1 | CLIENT Kennecott

WELL DIAMETER 6" | PROJECT Rock permeability

TOTAL DEPTH OF WELL 193' | SCOPE I.D. 87K10-W.O. 66

DEPTH TO WATER | TIME OF MEASUREMENT | BY BJS

BEFORE 23.85' | 1:35 p.m. | DATE 3-9-88

AFTER Dry | 2:08 p.m.

DESCRIPTION OF DEVELOPMENT METHOD

Well was dry on completion on 3-7-88.
On 3-9-88, well was surged with cable tool rock bailer (13' x 4.5" OD) for 8 min., then bailed dry.

VOLUME OF WATER REMOVED FROM WELL Approx. 250 gals.

CLARITY OF WATER IN WELL BEFORE DEVELOPMENT Red brn. silty

CLARITY OF WATER IN WELL AFTER DEVELOPMENT Red brn. silty

PRESENCE OF SEDIMENT AT THE BOTTOM OF THE WELL Silt

VOLUME OF WATER ADDED TO WELL None

SOURCE OF WATER ADDED TO WELL -

TIME SPENT FOR DEVELOPMENT 0.8 hrs.

STABILIZATION READINGS

GAL. REMOVED	TIME	FIELD TEMPERATURE	FIELD SPEC. COND.	FIELD pH

FOTH AND VAN DYKE

LOG OF TEST BORING NO.: TW - K2 (PZ - K2P, PZ - K2PP)

CLIENT: Kennecott
PROJECT: Rock Permeability
PROJECT NUMBER: 87K10 - W066
LOCATION: River pillar, about 40' SW of baseline.
COORDINATES: N39750.05, E39015.57

SURFACE ELEVATION: 1102.3 Feet
BORING DEPTH: 193.0 Feet
DATE: 03-08-88

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLING NOTES
1102.3	--0						Drilled wo/sampling to 30'			
	-						Red brn silty SAND w/grl.	SM		
	-									
	-									
	-									
1082.3	--20						Bright red, soft, gossan.	PC(6)		
	-									
	-	30'-32'	*g				Dk gray massive sulfide, w/chert band at 30', hard, 0.5-1 gpm water.	(1c)		
	-									
1062.3	--40									
	-									
	-						White metachert, w/copper oxides coatings, v. hard, 10-15 gpm water @ 63'.	(1b)		
	-									
1042.3	--60									
	-	63'-73'	g				Biotite-sericite-quartz-chlorite-schist.			
	-									
	-	73'-83'	g							
1022.3	--80									
	-	83'-93'	g							
	-									
	-	93'-103'	g							
1002.3	--100									
	-	103'-113'	g							
	-									
	-	113'-123'	g							
982.3	--120									
	-	123'-133'	g					(2a)		
	-									
	-	133'-143'	g							
962.3	--140									
	-	143'-153'	g							
	-									
	-	153'-163'	g							
942.3	--160									
	-	163'-173'	g							
	-									
	-	173'-183'	g							
922.3	--180									
	-	183'-193'	g							
	-									
	-						==========	=====		
	-						EOB at 193' in biotite schist.			*g=grab samples of cuttings.
902.3	--200									
	-									
	-									
	-									
882.3	--220									

DRILLING DATA

START DATE: 03/08/88
COMPLETION DATE: 03/08/88
LOGGED BY: BJS
DRILLING METHOD: Mud rotary 0-30'; air 30-193'
DRILLING CONTRACTOR: Luisier Drilling, Inc.

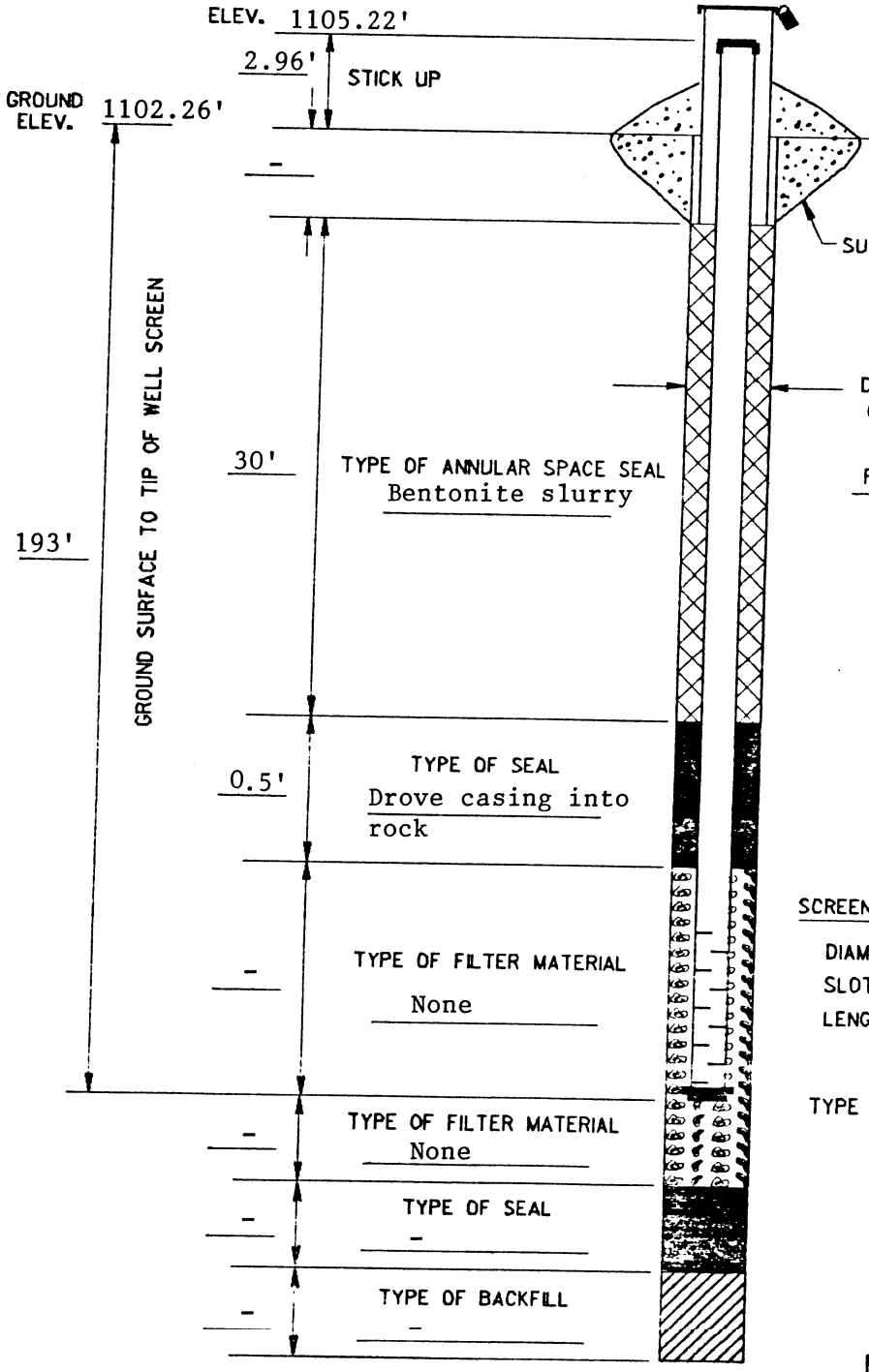
WATER LEVEL INFORMATION

DEPTH AT COMPLETION: 17.25 Feet
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:
DRILLING LOSSES:

MONITORING WELL CONSTRUCTION DIAGRAM

WELL NO: TW-K2
DATE INSTALLED: 3-8-88
DRILLER: Luisier Drilling, Inc.
DRILLING METHOD: Mud rotary, air

CLIENT: Kennecott
PROJECT: Rock permeability
SCOPE I.D.: 87K10-W.O. 66
BY: BJS



PROTECTOR PIPE:
SIZE 6"
MATERIAL Steel
LOCK NO. Master 3377

SURFACE SEAL MATERIAL -

DRILL HOLE DIAMETER 9" tricone 0-30'
6" down hole hammer 30-193'

TYPE OF ANNULAR SPACE SEAL
Bentonite slurry

PIPE:
DIAMETER 6"
MATERIAL Steel
SCH. -
TYPE OF JOINTS Welded

TYPE OF SEAL
Drove casing into rock

TYPE OF FILTER MATERIAL
None

SCREEN: Open hole
DIAMETER 6"
SLOT SIZE -
LENGTH 163'

TYPE OF CAP -

TYPE OF FILTER MATERIAL
None

TYPE OF SEAL
-

TYPE OF BACKFILL
-

Foth & Van Dyke
Geosciences & Environmental Management Division
Revised 3/88 By BJS
Drawn By MRS

MONITORING WELL DEVELOPMENT

WELL NUMBER TW-K2 | CLIENT Kennecott

WELL DIAMETER 6" | PROJECT Rock permeability

TOTAL DEPTH OF WELL 193' | SCOPE I.D. 87K10-W.O. 66

DEPTH TO WATER | TIME OF MEASUREMENT | BY BJS

BEFORE 13.4' | 3:25 p.m. | DATE 3-9-88

AFTER 26.4' | 3:40 p.m.

DESCRIPTION OF DEVELOPMENT METHOD

At completion on 3-6-88, blew out about 10 gpm for 10 min.
On 3-9-88, well was surged with cable tool rock bailer (13' x 4.5" OD) for 11 min., then bailed down to static water level.

VOLUME OF WATER REMOVED FROM WELL: Approx. 170 gal. (total)

CLARITY OF WATER IN WELL BEFORE DEVELOPMENT: Red brn. silty

CLARITY OF WATER IN WELL AFTER DEVELOPMENT: Lt. red brn., slightly silty

PRESENCE OF SEDIMENT AT THE BOTTOM OF THE WELL: Silt

VOLUME OF WATER ADDED TO WELL: None

SOURCE OF WATER ADDED TO WELL: -

TIME SPENT FOR DEVELOPMENT: 1 hr.

STABILIZATION READINGS

GAL. REMOVED	TIME	FIELD TEMPERATURE	FIELD SPEC. COND.	FIELD pH

FOTH AND VAN DYKE

LOG OF TEST BORING NO.: TW - K3, TW - K3R

CLIENT: Kennecott
PROJECT: Rock Permeability
PROJECT NUMBER: 87K10 - W066
LOCATION: Sec. 410, about 150' SW.
COORDINATES: N40,350.49 E39,746.34

SURFACE ELEVATION: 1124.6 Feet
BORING DEPTH: 163.0 Feet
DATE: 03-06-88

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLING NOTES
1124.6	--0						Drilled wo/sampling to 38'			
	-						Red brn silty SAND w/grl.			
	-							SM		
	-									
	-									
1104.6	--20									
	-						Lt. brn sandstone.	SP		
	-									
	-									
	-	38'-43'	*g				Lt. yel. brn SILT, altered biotite schist,moist			
1084.6	--40						Cuttings mostly powder.			
	-	43'-53'	g					ML		
	-									
	-									
	-	53'-63'	g							
1064.6	--60						Biotite schist, interbedded			
	-	63'-73'	g				biotite-quartz-chlorite schist			
	-						and biotite-sericite quartz-			
	-						chlorite schist.			
	-	73'-83'	g							
1044.6	--80									
	-	83'-93'	g					PC		
	-									
	-							(2a)		
	-	93'-103'	g				At about 100', cuttings			
1024.6	--100						hematitic, moist, sticky.	(2c)		
	-	103'-113'	g							
	-									
	-								Drilled with	
	-	113'-123'	g						air and water	
1004.6	--120								from 113'.	
	-	123'-133'	g							
	-									
	-									
	-	133'-143'	g							
984.6	--140									
	-	143'-153'	g							
	-									
	-									
	-	153'-163'	g				==========	=====		
964.6	--160						EOB at 163' in biotite schist.			
	-		g							
	-									
	-									
	-		g							
944.6	--180									
	-		g							
	-									
	-									
	-									
924.6	--200									*g=grab samples of cuttings.
	-									
	-									
	-									
904.6	--220									

DRILLING DATA

START DATE: 03/06/88
COMPLETION DATE: 03/06/88
LOGGED BY: BJS
DRILLING METHOD: Mud rotary 0-38'; air 38-163'
DRILLING CONTRACTOR: Luisier Drilling, Inc.

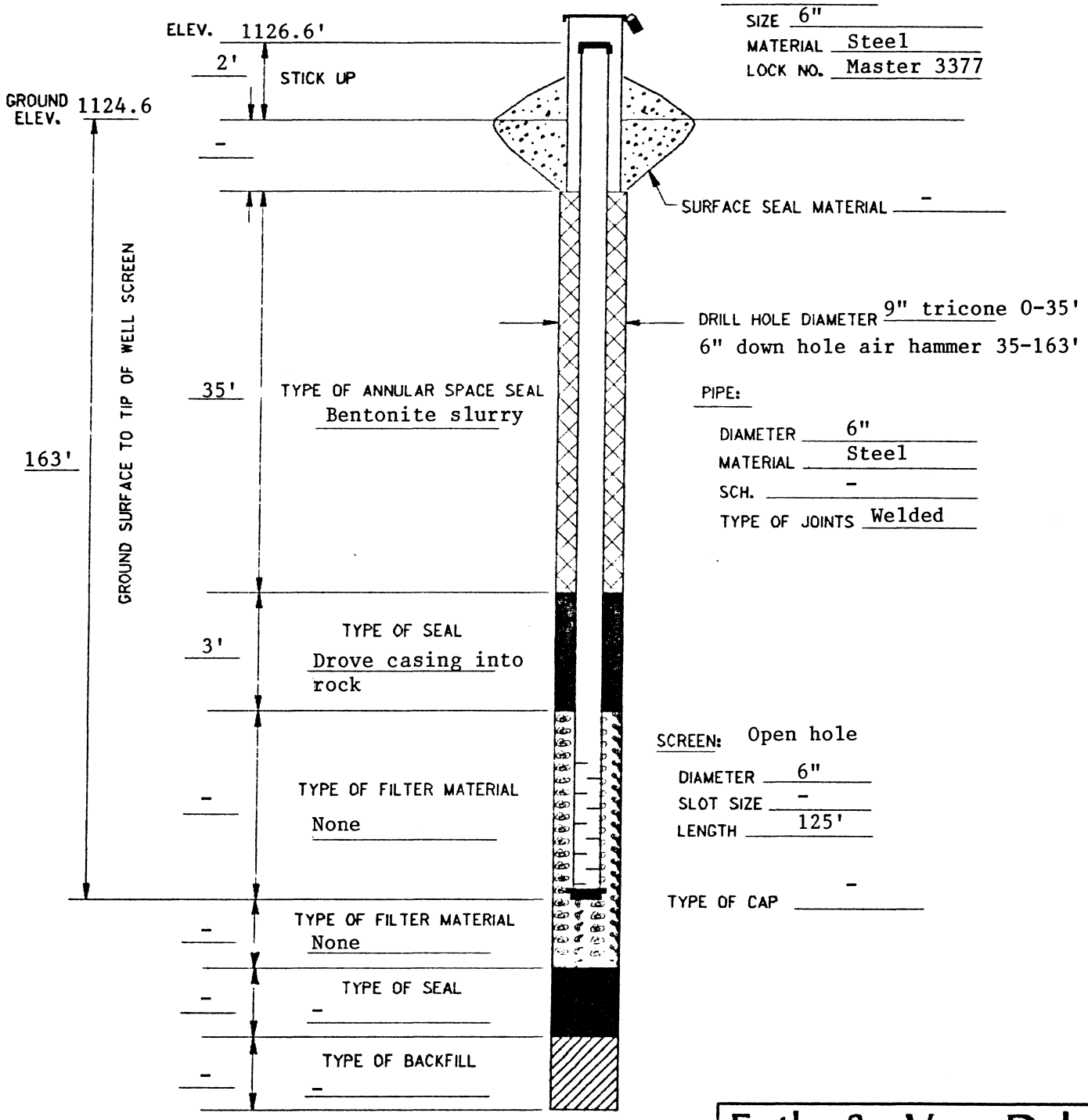
WATER LEVEL INFORMATION

DEPTH AT COMPLETION:
LATER TIME/DEPTH: 03-07-88
LATER TIME/DEPTH: 7:30AM/14.2'
CAVE IN DEPTH: 123'
DRILLING LOSSES:

MONITORING WELL CONSTRUCTION DIAGRAM

WELL NO: TW-K3
DATE INSTALLED: 3-6-88
DRILLER: Luisier Drilling, Inc.
DRILLING METHOD: Mud rotary, air

CLIENT: Kennecott
PROJECT: Rock permeability
SCOPE I.D.: 87K10-W.O. 66
BY: BJS



PROTECTOR PIPE:
SIZE 6"
MATERIAL Steel
LOCK NO. Master 3377

SURFACE SEAL MATERIAL -

DRILL HOLE DIAMETER 9" tricone 0-35'
6" down hole air hammer 35-163'

TYPE OF ANNULAR SPACE SEAL
Bentonite slurry

PIPE:
DIAMETER 6"
MATERIAL Steel
SCH. -
TYPE OF JOINTS Welded

TYPE OF SEAL
Drove casing into rock

TYPE OF FILTER MATERIAL
None

SCREEN: Open hole
DIAMETER 6"
SLOT SIZE -
LENGTH 125'

TYPE OF CAP -

TYPE OF FILTER MATERIAL
None

TYPE OF SEAL
-

TYPE OF BACKFILL
-

Foth & Van Dyke
Geosciences & Environmental Management Division
Revised 3/88 By BJS
Drawn By MRS

MONITORING WELL DEVELOPMENT

WELL NUMBER TW-K3
WELL DIAMETER 6"
TOTAL DEPTH OF WELL 163'
DEPTH TO WATER — TIME OF MEASUREMENT
BEFORE 12.5' — 8:33 a.m.
AFTER 114' — 9:12 a.m.

CLIENT Kennecott
PROJECT Rock permeability
SCOPE I.D. 87K10-W.O. 66
BY BJS
DATE 3-9-88

DESCRIPTION OF DEVELOPMENT METHOD

At completion on 3-6-88, blew out 0.5-1 gpm for 25 min.
On 3-9-88, well was surged with cable tool rock bailer (13' x 4.5" OD) for 5 min., then bailed down to 114 ft.

At 10:12 to 10:20 a.m. bailed out an additional 80 gals.
At 10:12 a.m. DTW = 14 ft.
At 10:20 a.m. DTW = 90 ft.

VOLUME OF WATER REMOVED FROM WELL Approx. 350 gals. (total)
CLARITY OF WATER IN WELL BEFORE DEVELOPMENT Red brn., silty
CLARITY OF WATER IN WELL AFTER DEVELOPMENT Lt. red brn., slightly silty
PRESENCE OF SEDIMENT AT THE BOTTOM OF THE WELL Silt
VOLUME OF WATER ADDED TO WELL None
SOURCE OF WATER ADDED TO WELL -
TIME SPENT FOR DEVELOPMENT 1 hr.

STABILIZATION READINGS

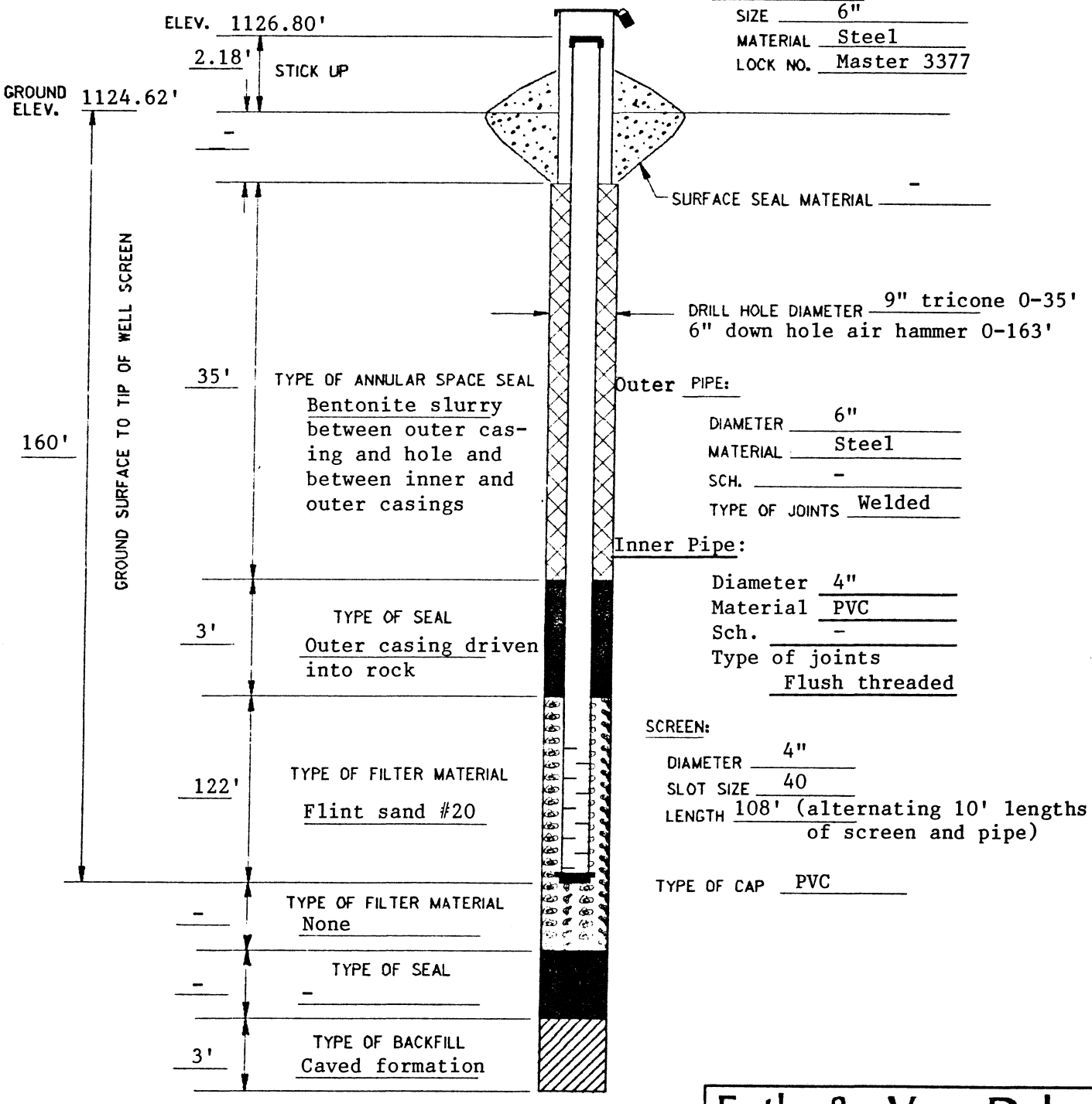
GAL. REMOVED	TIME	FIELD TEMPERATURE	FIELD SPEC. COND.	FIELD pH

FOTH AND VAN DYKE

MONITORING WELL CONSTRUCTION DIAGRAM

WELL NO: TW-K3R
DATE INSTALLED: 3-23-88
DRILLER: Luisier Drilling, Inc.
DRILLING METHOD: Mud rotary, air

CLIENT: Kennecott
PROJECT: Rock permeability
SCOPE I.D.: 87K10-W.O. 66
BY: BJS



Note: TW-K3R was installed in open hole well TW-K3. Hole had caved to 120 feet and was redrilled to 163 feet.

Foth & Van Dyke
Geosciences & Environmental Management Division
Revised 3/88 By BJS
Drawn By MRS

MONITORING WELL DEVELOPMENT

WELL NUMBER TW-K3R

WELL DIAMETER 4"

TOTAL DEPTH OF WELL 160'

DEPTH TO WATER — TIME OF MEASUREMENT

BEFORE - -

AFTER - -

CLIENT Kennecott

PROJECT Rock permeability

SCOPE I.D. 87K10-W.O. 66

BY BJS

DATE 3-23-88

DESCRIPTION OF DEVELOPMENT METHOD

At completion of drilling, blew out 1 to 1.5 gpm from open hole from 12:45 p.m. to 1:15 p.m.
Set 40 ft. of A-rod in 4" PVC well and surged with air for 5 min.
Blew out about 1 gpm from 5:00 p.m. to 5:20 p.m.

VOLUME OF WATER REMOVED FROM WELL Approx. 60 gals. (total)

CLARITY OF WATER IN WELL BEFORE DEVELOPMENT Red brn., silty

CLARITY OF WATER IN WELL AFTER DEVELOPMENT Lt. red brn., slightly silty

PRESENCE OF SEDIMENT AT THE BOTTOM OF THE WELL Silt

VOLUME OF WATER ADDED TO WELL None

SOURCE OF WATER ADDED TO WELL -

TIME SPENT FOR DEVELOPMENT 0.8 hrs.

STABILIZATION READINGS

GAL. REMOVED	TIME	FIELD TEMPERATURE	FIELD SPEC. COND.	FIELD pH

FOTH AND VAN DYKE

LOG OF TEST BORING NO.: TW - K4 (PZ - K4P, PZ - K4PP)

CLIENT: Kennecott
PROJECT: Rock Permeability
PROJECT NUMBER: 87K10 - W066
LOCATION: NE end of pit, near PZ - S4
COORDINATES: N41,204.15, E40,662.92

SURFACE ELEVATION: 1140.1 Feet
BORING DEPTH: 193.0 Feet
DATE: 03-06-88

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLING NOTES
1140.1	--0						Drilled wo/sampling to 52'			
	-						Cuttings brn sand and grl, to 15'	SP,		
	-						red brn SILTY SAND (till) to about	GP,		
	-						30'.			
	-									
1120.1	--20									
	-									
	-						At about 30' v.fn. silty sandstone	SM		
	-						w/shale layers to 47', then			
	-						yel. brn., SILT, soft.			
1100.1	--40							SM		
	-							(ss)		
	-									
	-							ML		
	-	52'-63'	*g							
1080.1	--60									
	-	63'-73'	g				Cuttings to 103', red brn.,			
	-						hematitic, moist.			
	-						Interbedded biotite schist and			
	-	73'-83'	g				metadacite			
1060.1	--80							PC		
	-	83'-93'	g					(2c)		
	-									
	-							(5)		
	-	93'-103'	g							
1040.1	--100									
	-	103'-113'	g				At 113' red brn, hematitic, w/fn			
	-						grl. size chips, wet, clayey.			
	-									
	-	113'-123'	g							
1020.1	--120									
	-	123'-133'	g				Water at about 123', 2-3gpm			
	-						metadacite.			
	-									
	-	133'-143'	g					(5)		
1000.1	--140									
	-	143'-153'	g							
	-									
	-									
	-	153'-163'	g							
980.1	--160									
	-	163'-173'	g							
	-									
	-									
	-	173'-183'	g							
960.1	--180									
	-	183'-193'					==========	=====		
	-						EOB at 193' in metadacite.			
	-									
	-									
940.1	--200									*g=grab samples of cuttings.
	-									
	-									
	-									
920.1	--220									

DRILLING DATA

START DATE: 03/06/88 7:30AM
COMPLETION DATE: 03/06/88 12:30PM
LOGGED BY: BJS
DRILLING METHOD: Mud rotary to 50'; air 193'.
DRILLING CONTRACTOR: Luisier Drilling, Inc.

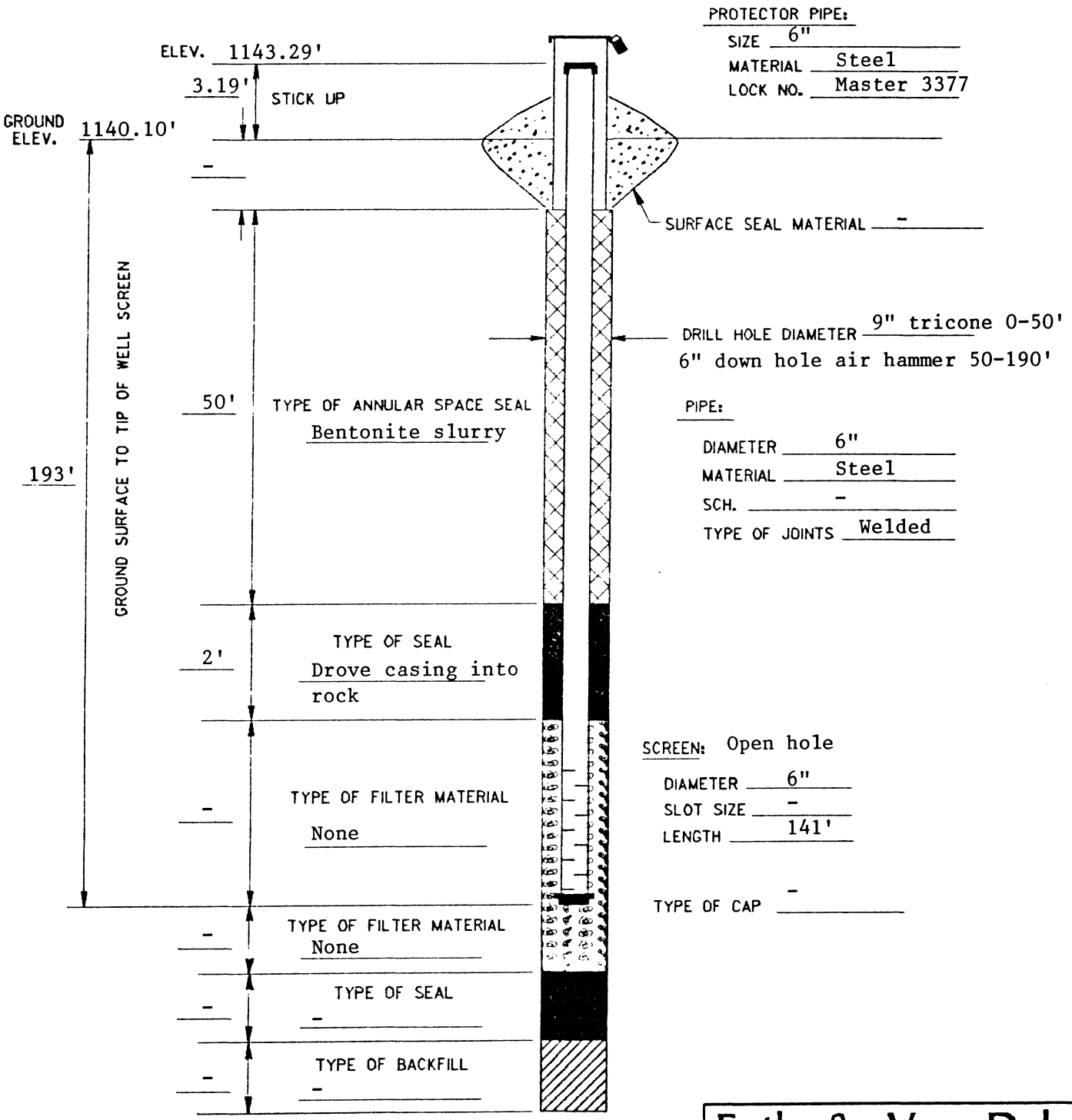
WATER LEVEL INFORMATION

DEPTH AT COMPLETION: 110 Feet
LATER TIME/DEPTH: 1:45PM/35'
LATER TIME/DEPTH: 5:15PM/27.4'
CAVE IN DEPTH:
DRILLING LOSSES:

MONITORING WELL CONSTRUCTION DIAGRAM

WELL NO: TW-K4
DATE INSTALLED: 3-6-88
DRILLER: Luisier Drilling, Inc.
DRILLING METHOD: Mud rotary, air

CLIENT: Kennecott
PROJECT: Rock permeability
SCOPE I.D.: 87K10-W.O. 66
BY: BJS



PROTECTOR PIPE:
SIZE 6"
MATERIAL Steel
LOCK NO. Master 3377

SURFACE SEAL MATERIAL -

DRILL HOLE DIAMETER 9" tricone 0-50'
6" down hole air hammer 50-190'

PIPE:
DIAMETER 6"
MATERIAL Steel
SCH. -
TYPE OF JOINTS Welded

SCREEN: Open hole
DIAMETER 6"
SLOT SIZE -
LENGTH 141'

TYPE OF CAP -

Foth & Van Dyke
Geosciences & Environmental Management Division
Revised 3/88 By BJS
Drawn By MRS

MONITORING WELL DEVELOPMENT

WELL NUMBER TW-K4 | CLIENT Kennecott

WELL DIAMETER 6" | PROJECT Rock permeability

TOTAL DEPTH OF WELL 193' | SCOPE I.D. 87K10-W.O. 66

DEPTH TO WATER | TIME OF MEASUREMENT | BY BJS

BEFORE - | 11:50 a.m. | DATE 3-6-88

AFTER 110' | 12:45 p.m.

DESCRIPTION OF DEVELOPMENT METHOD

Well completed at 11:50 a.m. on 3-6-88; blew out 3-4 gpm for 30 min.

VOLUME OF WATER REMOVED FROM WELL Approx. 110 gals.

CLARITY OF WATER IN WELL BEFORE DEVELOPMENT Red brn., silty

CLARITY OF WATER IN WELL AFTER DEVELOPMENT Lt. red brn., silty

PRESENCE OF SEDIMENT AT THE BOTTOM OF THE WELL Silt

VOLUME OF WATER ADDED TO WELL None

SOURCE OF WATER ADDED TO WELL -

TIME SPENT FOR DEVELOPMENT 0.7 hrs.

STABILIZATION READINGS

GAL. REMOVED	TIME	FIELD TEMPERATURE	FIELD SPEC. COND.	FIELD pH

FOTH AND VAN DYKE

LOG OF TEST BORING NO.: TW - K5, TW - K5R

CLIENT: Kennecott
PROJECT: Rock Permeability
PROJECT NUMBER: 87K10 - W066
LOCATION: River pillar, about 40' SW of baseline.
COORDINATES: N41490.04, E40444.96 (TW-KSR)

SURFACE ELEVATION: 1102.3 Feet
BORING DEPTH: 193.0 Feet
DATE: 03-05-88

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLING NOTES
1102.3	--0						Drilled wo/sampling to 55'			
							Silt to about 10', then silty sand till to about 30'	ML		
1082.3	--20							SM		
							At about 30', cse & med. qtz sand (sandstone).			
1062.3	--40							SP		
		55'-63'	*g				At about 47' yel. brn. extremely altered schist (silt).	(ss)		
								"ML"		
1042.3	--60									
		63'-73'	g				Cuttings mostly lt. blue gray powder (biotite, chlorite, quartz, sericite schist.)			
		73'-83'	g							
1022.3	--80							PC		
		83'-93'	g				Cuttings from 80' to about 100' w/grl size pieces, chert, hard w/pyrite in schist.	(2b)		
		93'-103'	g							
1002.3	--100									
		103'-113'	g							
		113'-123'	g							
982.3	--120									
		123'-133'	g				Cuttings to bottom of hole, mostly powder.			
		133'-143'	g							
962.3	--140									
		143'-153'	g							
		153'-163'	g							
942.3	--160									
		163'-173'	g							
		173'-183'	g							
922.3	--180									
		183'-193'	g							
							==========	=====		
902.3	--200						EOB at 193' in biotite schist.			*g=grab samples of cuttings.
882.3	--220									

DRILLING DATA

START DATE: 03/05/88 2:30PM
COMPLETION DATE: 03/05/88 5:30PM
LOGGED BY: BJS
DRILLING METHOD: Mud rotary to 55'; air to 193'.
DRILLING CONTRACTOR: Luisier Drilling, Inc.

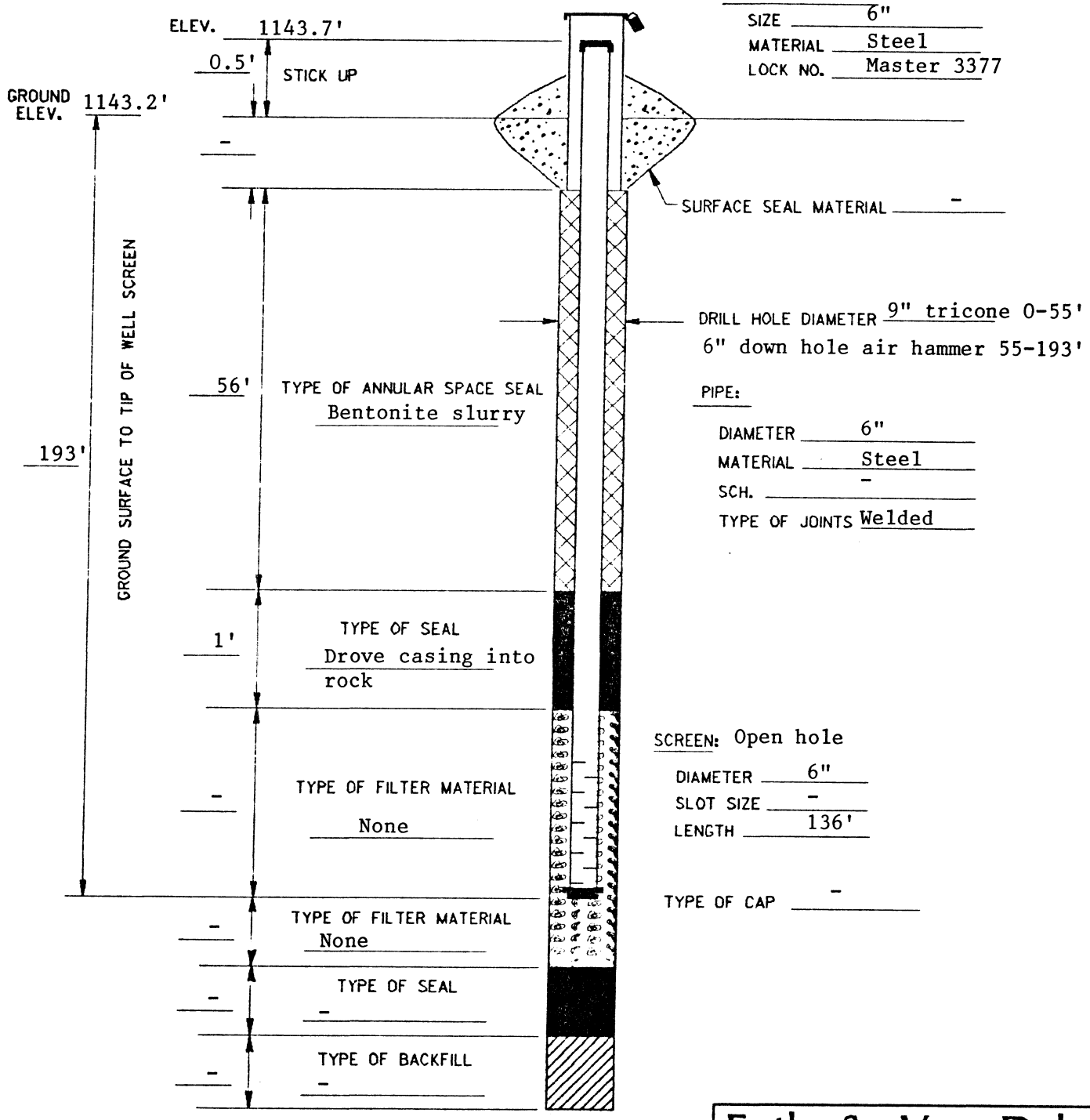
WATER LEVEL INFORMATION

DEPTH AT COMPLETION: DRY
LATER TIME/DEPTH: 7:30AM/3-6/90'
LATER TIME/DEPTH: 7:30AM/3-7/36'
CAVE IN DEPTH: 56'
DRILLING LOSSES:

MONITORING WELL CONSTRUCTION DIAGRAM

WELL NO: TW-K5
DATE INSTALLED: 3-5-88
DRILLER: Luisier Drilling, Inc.
DRILLING METHOD: Mud rotary, air

CLIENT: Kennecott
PROJECT: Rock permeability
SCOPE I.D.: 87K10-W.O. 66
BY: BJS



PROTECTOR PIPE:
SIZE 6"
MATERIAL Steel
LOCK NO. Master 3377

SURFACE SEAL MATERIAL -

DRILL HOLE DIAMETER 9" tricone 0-55'
6" down hole air hammer 55-193'

TYPE OF ANNULAR SPACE SEAL
Bentonite slurry

PIPE:
DIAMETER 6"
MATERIAL Steel
SCH. -
TYPE OF JOINTS Welded

TYPE OF SEAL
Drove casing into rock

TYPE OF FILTER MATERIAL
None

SCREEN: Open hole
DIAMETER 6"
SLOT SIZE -
LENGTH 136'

TYPE OF CAP -

TYPE OF FILTER MATERIAL
None

TYPE OF SEAL
-

TYPE OF BACKFILL
-

Foth & Van Dyke
Geosciences & Environmental Management Division
Revised 3/88 By BJS
Drawn By MRS

MONITORING WELL DEVELOPMENT

WELL NUMBER TW-K5 | CLIENT Kennecott

WELL DIAMETER 6" | PROJECT Rock permeability

TOTAL DEPTH OF WELL 193' | SCOPE I.D. 87K10-W.O. 66

DEPTH TO WATER | TIME OF MEASUREMENT | BY BJS

BEFORE 90' | 7:30 a.m. | DATE 3-6-88

AFTER Dry | 8:00 a.m.

DESCRIPTION OF DEVELOPMENT METHOD

Well was dry on completion at 5:15 p.m. on 3-5-88.
Well was blown out with air on 3-6-88.
Well caved to bottom of steel casing before it could be developed with cable tool rock bailer on 3-9-88.

VOLUME OF WATER REMOVED FROM WELL Approx. 145 gals.

CLARITY OF WATER IN WELL BEFORE DEVELOPMENT Lt. gray silty

CLARITY OF WATER IN WELL AFTER DEVELOPMENT Lt. gray silty

PRESENCE OF SEDIMENT AT THE BOTTOM OF THE WELL Silt

VOLUME OF WATER ADDED TO WELL None

SOURCE OF WATER ADDED TO WELL -

TIME SPENT FOR DEVELOPMENT 0.5 hrs.

STABILIZATION READINGS

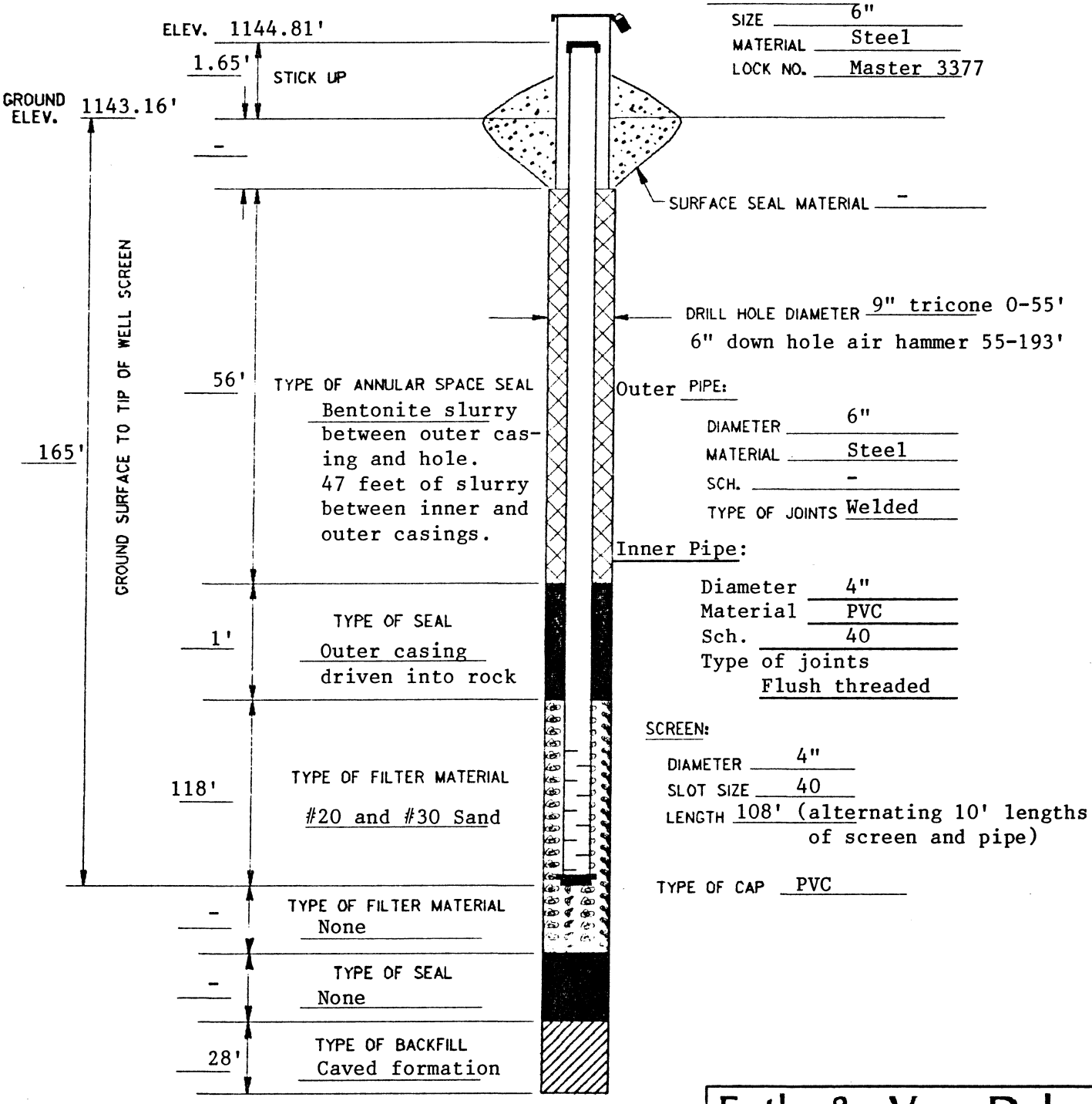
GAL. REMOVED	TIME	FIELD TEMPERATURE	FIELD SPEC. COND.	FIELD pH

FOTH AND VAN DYKE

MONITORING WELL CONSTRUCTION DIAGRAM

WELL NO: TW-K5R
DATE INSTALLED: 3-26-88
DRILLER: Luisier Drilling, Inc.
DRILLING METHOD: Mud rotary, air

CLIENT: Kennecott
PROJECT: Rock permeability
SCOPE I.D.: 87K10-W.O. 66
BY: BJS



PROTECTOR PIPE:
SIZE 6"
MATERIAL Steel
LOCK NO. Master 3377

SURFACE SEAL MATERIAL -

DRILL HOLE DIAMETER 9" tricone 0-55'
6" down hole air hammer 55-193'

Outer PIPE:
DIAMETER 6"
MATERIAL Steel
SCH. -
TYPE OF JOINTS Welded

Inner Pipe:
Diameter 4"
Material PVC
Sch. 40
Type of joints Flush threaded

SCREEN:
DIAMETER 4"
SLOT SIZE 40
LENGTH 108' (alternating 10' lengths of screen and pipe)

TYPE OF CAP PVC

Note: TW-K5R was installed in open hole well TW-K5. Hole had caved to 56 feet and was redrilled to 193 feet.

Foth & Van Dyke
Geosciences & Environmental Management Division
Revised 3/88 By BJS
Drawn By MRS

MONITORING WELL DEVELOPMENT

WELL NUMBER TW-K5R

WELL DIAMETER 4"

TOTAL DEPTH OF WELL 165'

DEPTH TO WATER — TIME OF MEASUREMENT

BEFORE - -

AFTER - -

CLIENT Kennecott

PROJECT Rock permeability

SCOPE I.D. 87K10-W.O. 66

BY BJS

DATE 3-26-88

DESCRIPTION OF DEVELOPMENT METHOD

At completion of drilling, blew out 2 to 3 gpm from open hole from 11:54 a.m. to 12:02 p.m.
Set A-rod in the 4" PVC well and surged with air for 5 min.
Blew out about 2 gpm from 4:24 to 4:29 p.m.

VOLUME OF WATER REMOVED FROM WELL Approx. 30 gals. (total)

CLARITY OF WATER IN WELL BEFORE DEVELOPMENT Lt. gray, silty

CLARITY OF WATER IN WELL AFTER DEVELOPMENT Lt. gray, silty

PRESENCE OF SEDIMENT AT THE BOTTOM OF THE WELL Silt

VOLUME OF WATER ADDED TO WELL None

SOURCE OF WATER ADDED TO WELL -

TIME SPENT FOR DEVELOPMENT 0.5 hrs.

STABILIZATION READINGS

GAL. REMOVED	TIME	FIELD TEMPERATURE	FIELD SPEC. COND.	FIELD pH

FOTH AND VAN DYKE

LOG OF TEST BORING NO.: TW - K6, TW - K6R

CLIENT: Kennecott
PROJECT: Rock Permeability
PROJECT NUMBER: 87K10 - W066
LOCATION: Center of pit, west side.
COORDINATES: N40,397.05, E39,248.53 (TW - K6R)

SURFACE ELEVATION: 1118.2 Feet
BORING DEPTH: 183.0 Feet
DATE: 03-07-88

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLING NOTES
1118.2	--0						Drilled wo/sampling to 43'			
	-						Cuttings sand and grl, and			
	-						silty sand (till).	SP,		
	-							GP,		
1098.2	--20							SM		
	-									
	-						Sandstone.	SS		
	-									
1078.2	--40									
	-	43'-53'	*g							
	-						Cuttings red brn and purple red,			
	-						v. soft, sticky, drill w/foam.			
	-	53'-63'	g							
1058.2	--60						Altered schist.			
	-	63'-73'	g				(Metadacite)			
	-									
	-	73'-83'	g							
1038.2	--80									
	-	83'-93'	g					PC		
	-									
	-	93'-103'	g					(5)		
1018.2	--100									
	-	103'-113'	g							
	-									
	-	113'-123'	g							
998.2	--120									
	-	123'-133'	g							
	-									
	-	133'-143'	g							
978.2	--140									
	-	143'-153'	g							
	-									
	-	153'-163'	g							
958.2	--160									
	-	163'-173'	g							
	-									
	-	173'-183'	g				==========			
938.2	--180						EOB at 183' in altered schist.			
	-						(Metadacite)			
	-									
	-									
918.2	--200									*g=grab samples of cuttings.
	-									
	-									
	-									
898.2	--220									

DRILLING DATA

START DATE: 03/07/88 7:00AM
COMPLETION DATE: 03/07/88 11:30AM
LOGGED BY: BJS
DRILLING METHOD: Mud rotary to 43'; air w/foam to 183'.
DRILLING CONTRACTOR: Luisier Drilling, Inc.

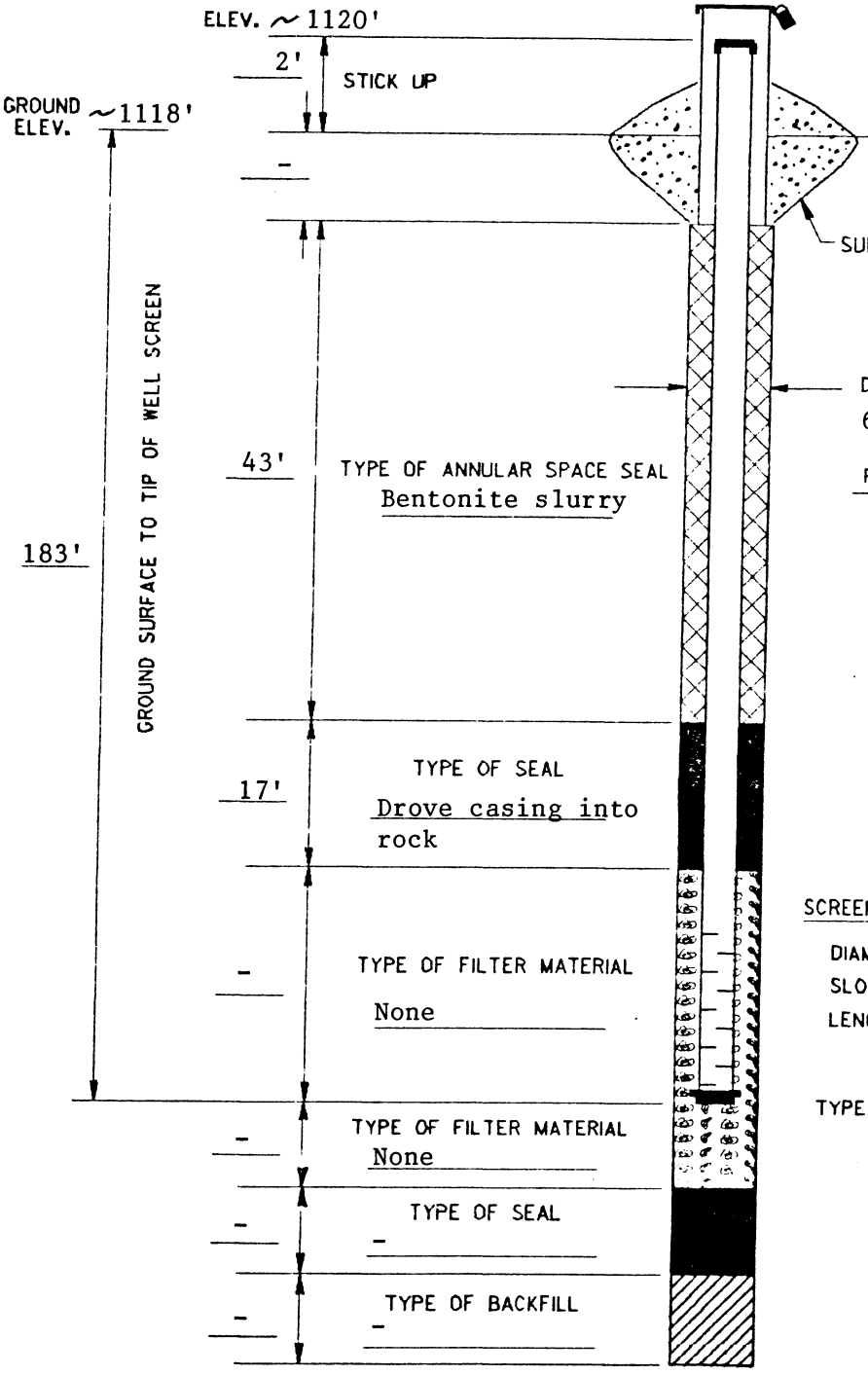
WATER LEVEL INFORMATION

DEPTH AT COMPLETION: DRY
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:
DRILLING LOSSES:

MONITORING WELL CONSTRUCTION DIAGRAM

WELL NO: TW-K6 (Abandoned)
DATE INSTALLED: 3-7-88
DRILLER: Luisier Drilling, Inc.
DRILLING METHOD: Mud rotary, air

CLIENT: Kennecott
PROJECT: Rock permeability
SCOPE I.D.: 87K10-W.O. 66
BY: BJS



PROTECTOR PIPE:
SIZE 6"
MATERIAL Steel
LOCK NO. Master 3377

SURFACE SEAL MATERIAL -

DRILL HOLE DIAMETER 9" tricone 0-43'
6" down hole air hammer 43-183'

PIPE:
DIAMETER 6"
MATERIAL Steel
SCH. -
TYPE OF JOINTS Welded

SCREEN: Open hole
DIAMETER 6"
SLOT SIZE -
LENGTH 123'

TYPE OF CAP -

Foth & Van Dyke
Geosciences & Environmental Management Division
Revised 3/88 By BJS
Drawn By MRS

MONITORING WELL DEVELOPMENT

WELL NUMBER TW-K6

WELL DIAMETER 6"

TOTAL DEPTH OF WELL 183'

DEPTH TO WATER — TIME OF MEASUREMENT

BEFORE - 11:15 a.m.

AFTER 179.4' 12:45 p.m.

CLIENT Kennecott

PROJECT Rock permeability

SCOPE I.D. 87K10-W.O. 66

BY BJS

DATE 3-7-88

DESCRIPTION OF DEVELOPMENT METHOD

At 11:15 a.m. on completion, blew out well with air. Blew out approximately 0.3 gpm for 10 min.
Well caved to the bottom of the steel casing before it could be developed with cable tool rock bailer on 3-9-88.

VOLUME OF WATER REMOVED FROM WELL Approx. 3 gals.

CLARITY OF WATER IN WELL BEFORE DEVELOPMENT Red brn., silty

CLARITY OF WATER IN WELL AFTER DEVELOPMENT Red brn., silty

PRESENCE OF SEDIMENT AT THE BOTTOM OF THE WELL Silt

VOLUME OF WATER ADDED TO WELL None

SOURCE OF WATER ADDED TO WELL -

TIME SPENT FOR DEVELOPMENT 0.5 hrs.

STABILIZATION READINGS

GAL. REMOVED	TIME	FIELD TEMPERATURE	FIELD SPEC. COND.	FIELD pH

FOTH AND VAN DYKE

State of Wisconsin
Department of Natural Resources

WELL/DRILLHOLE ABANDONMENT

Form 3300-5 Rev. 6-87

(1) GENERAL INFORMATION

Well/Drillhole Location | County: Rusk

SW 1/4 of SE 1/4 of Sec. 9 ; T. 34 N; R. 6 ☐ E ☒ W

(If applicable) – Gov't Lot – Grid Number

Civil Town Name: Grant

Street Address of Well: –

City, Village: Ladysmith

Date of Abandonment: 3-24-88

(2) FACILITY NAME

Original Well Owner (If Known): Kennecott

Present Well Owner: Same

Street or Route: 1515 Mineral Square

City, State, Zip Code: Salt Lake City, UT 84112

Well Number and/or Name (If Applicable): TW-K6

Reason For Abandonment: Well was caved from 183 to 60 feet

WELL/DRILLHOLE INFORMATION

(3) Original Well/Drillhole Construction Completed on (Date) 3-7-88

☒ Water Well ☐ Drillhole | Construction Report Available? ☒ Yes ☐ No

Construction Type:
☒ Drilled ☐ Driven (Sandpoint) ☐ Dug
☐ Other (Specify)

Well Type:
☐ Unconsolidated Formation Well ☒ Bedrock Well

Total Well Depth (ft.) 183' Casing Diameter (ins.) 6"

Casing Depth (ft.) 60'

Was Well Annular Space Grouted? ☒ Yes ☐ No ☐ Unknown
If Yes, To What Depth? 43 Feet

(4) Depth to Water (Feet) 9

Pump & Piping Removed?	☐ Yes	☐ No	☒ Not Applicable
Liner(s) Removed?	☐ Yes	☐ No	☒ Not Applicable
Screen Removed?	☐ Yes	☐ No	☒ Not Applicable
Casing Left in Place?	☒ Yes	☐ No	

If No, Explain

Was Casing Cut Off Below Surface?	☒ Yes	☐ No
Did Sealing Material Rise to Surface?	☒ Yes	☐ No
Did Material Settle After 24 Hours?	☐ Yes	☒ No
If Yes, Was Drillhole Retopped?	☐ Yes	☐ No

(5) Required Method of Placing Sealing Material
☒ Conductor Pipe-Gravity ☐ Conductor Pipe-Pumped
☐ Dump Bailer ☐ Other (Explain)

(6) Acceptable Sealing Materials
Neat Cement Grout; Concrete Grout; Concrete; Clay Slurry; (Sodium Bentonite Slurry)

(7) Kind of Sealing Material	From (Ft.)	To (Ft.)	No. Yards or Sacks Sealant	Mix Ratio or Mud Weight
Clayey cuttings	Surface	2'	–	–
Bentonite slurry	2	60'	1 bag	Approx. 50 lbs./50 gals.

(8) Comments:

(9) Name of Person or Firm Doing Sealing Work: Luisier Drilling, Inc.

Signature of Person Doing Work: Keith Meyers | Date Signed:

Street or Route: 7391 Porcupine Lake Rd. | Telephone Number: (414) 829-5239

City, State, Zip Code: Lena, WI 54139

(10) FOR DNR OR COUNTY USE ONLY

Date Received/Inspected | District/County

Reviewer/Inspector

Follow-up Necessary

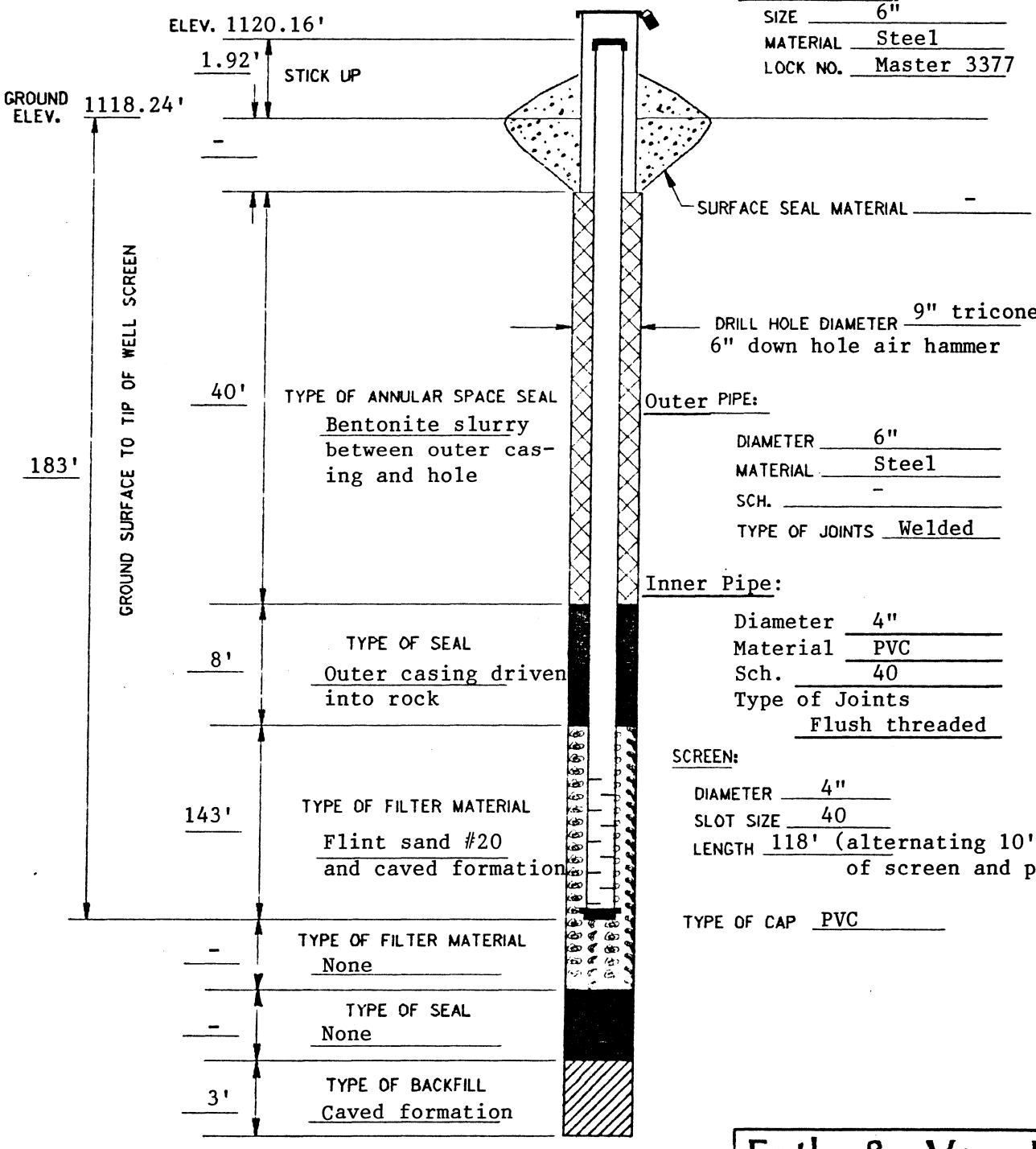
3.5-G-23

DNR/COUNTY

MONITORING WELL CONSTRUCTION DIAGRAM

WELL NO: TW-K6R
DATE INSTALLED: 3-24-88
DRILLER: Luisier Drilling, Inc.
DRILLING METHOD: Mud rotary, air

CLIENT: Kennecott
PROJECT: Rock permeability
SCOPE I.D.: 87K10-W.O. 66
BY: BJS



PROTECTOR PIPE:
SIZE 6"
MATERIAL Steel
LOCK NO. Master 3377

SURFACE SEAL MATERIAL -

DRILL HOLE DIAMETER 9" tricone 0-40'
6" down hole air hammer

TYPE OF ANNULAR SPACE SEAL
Bentonite slurry between outer casing and hole

Outer PIPE:
DIAMETER 6"
MATERIAL Steel
SCH. -
TYPE OF JOINTS Welded

Inner Pipe:
Diameter 4"
Material PVC
Sch. 40
Type of Joints Flush threaded

TYPE OF SEAL
Outer casing driven into rock

SCREEN:
DIAMETER 4"
SLOT SIZE 40
LENGTH 118' (alternating 10' lengths of screen and pipe)

TYPE OF FILTER MATERIAL
Flint sand #20 and caved formation

TYPE OF CAP PVC

TYPE OF FILTER MATERIAL
None

TYPE OF SEAL
None

TYPE OF BACKFILL
Caved formation

Note: TW-K6R was drilled about 15' south of TW-K6.
TW-K6 caved to 60 ft.

Foth & Van Dyke
Geosciences & Environmental Management Division
Revised 3/88 By BJS
Drawn By MRS

MONITORING WELL DEVELOPMENT

WELL NUMBER TW-K6R

WELL DIAMETER 4"

TOTAL DEPTH OF WELL 183'

DEPTH TO WATER — TIME OF MEASUREMENT

BEFORE 13.5' — 8:30 a.m.

AFTER 175.7' — 9:10 a.m.

CLIENT Kennecott

PROJECT Rock permeability

SCOPE I.D. 87K10-W.O. 66

BY BJS

DATE 3-25-88

DESCRIPTION OF DEVELOPMENT METHOD

Set 57 ft. of A-rod in the 4" PVC well and surged with air for 10 min.
Filled well with water twice.
Blew out dry.

VOLUME OF WATER REMOVED FROM WELL 250 gals.

CLARITY OF WATER IN WELL BEFORE DEVELOPMENT Red brn., silty

CLARITY OF WATER IN WELL AFTER DEVELOPMENT Red brn., silty

PRESENCE OF SEDIMENT AT THE BOTTOM OF THE WELL Silt

VOLUME OF WATER ADDED TO WELL 400 gals.

SOURCE OF WATER ADDED TO WELL On-site water supply well

TIME SPENT FOR DEVELOPMENT 1 hr.

STABILIZATION READINGS

GAL. REMOVED	TIME	FIELD TEMPERATURE	FIELD SPEC. COND.	FIELD pH

FOTH AND VAN DYKE

LOG OF TEST BORING NO.: TW-K7

CLIENT: Kennecott
PROJECT: Pit Inflow
PROJECT NUMBER: 87K10
LOCATION: River Pillar
COORDINATES: 39896.18 N 38813.28 E

SURFACE ELEVATION: 1098.18
BORING DEPTH: 31'
DATE: 09/20/88

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N Sec	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLING NOTES
1098.2	--0									
		1-3	SB	1	P	2.0	Brown poorly graded SAND, fine, loose w/ roots & organics, dry, (very fine aeolian sand), boulders at 3 feet	SP		
1093.2	--5	5-7	SB	2	P	1.5	5-5.5 Lt. brown poorly graded SAND fine with coarse gravel (cobble). 5.5-6 Red brown silty SAND, fine, diamict. 6-6.5 Red brown well graded gravel, fine to coarse w/red brown silty SAND	SP, SM, GW		
1088.2	--10									
		10-12	SB	3	P	0.5	Well graded GRAVEL, cored granite			
		11-13	SB	4	20	2.0	Red brown (5YR 4/3) silty GRAVEL, well graded, coarse w/fine w/fine to coarse sand, well rounded gravel. Few 1" thick SP layers, much gravel, boulders to 15'	GM		
1083.2	--15									
		16-18	SB	5	20	2.0	Red brown (5YR 4/3) poorly graded SAND, fine, laminated, saturated	SP		
1078.2	--20	20-22	SB	6	20	0.5	Black (10YR 2/1) well graded GRAVEL w/ silt, coarse with fine, stained with few brown yellow mottles (10YR 6/8), dense, little sand	GW-GM	Pump Test Permeability: K=5.4 x 10E-3 cm/sec K=4.3 x 10E-3 cm/sec (recovery)	Many cobbles, boulders, 20-30 feet.
1073.2	--25	25-27	SB	7	80	1.0	Same as above except yellow brown with little black mottling			
1068.2	--30	30-32	SB	8	85	1.3	Top 0.3' gravel as above, dark red brown (2.5YR 2.5/4) and yellow brown (10YR 5/6) SILT, color laminated, soft, brittle (altered schist) w/ broken very hard chert layers	ML (2a)		
1063.2	--35						31.0'-End of Boring			
1058.2	--40									
1053.2	--45									
1048.2	--50									
1043.2	--55									

DRILLING DATA

START DATE: 09/20/88
COMPLETION DATE: 09/20/88
LOGGED BY: BJS
DRILLING METHOD: Air to 10 feet, mud rotary to 31 feet, 6" bit
DRILLING CONTRACTOR: Luisier Well Drilling, Inc.

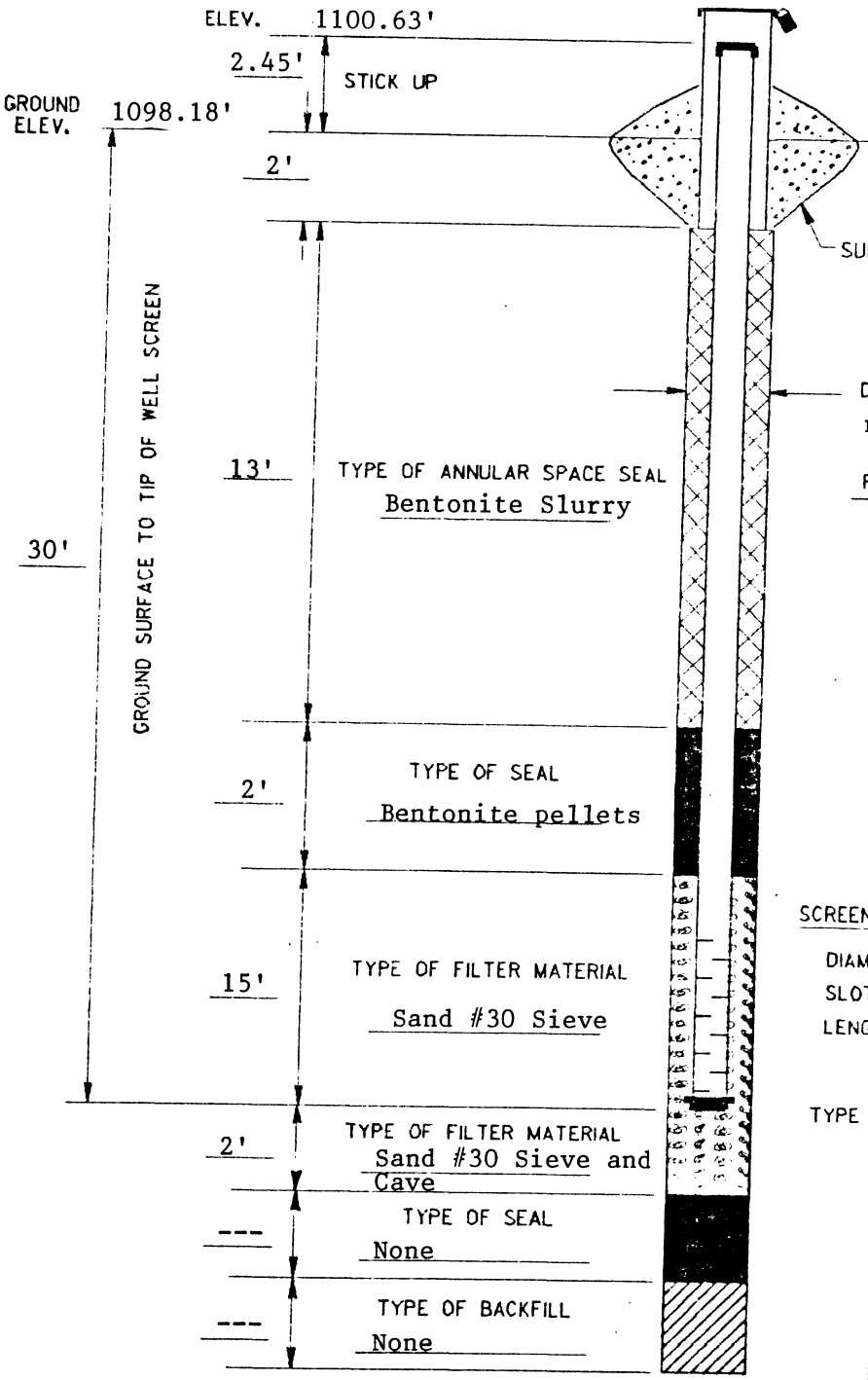
WATER LEVEL INFORMATION

DEPTH AT COMPLETION:
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:
DRILLING LOSSES:

MONITORING WELL CONSTRUCTION DIAGRAM

WELL NO: TW-K7
DATE INSTALLED: 9-21-88
DRILLER: Luisier Drilling, Inc.
DRILLING METHOD: Air/Mud Rotary
COORDINATES: 39912.28N 38, 811.98E

CLIENT: Kennecott
PROJECT: Pit Inflow
SCOPE I.D.: 87K10
BY: BJS



PROTECTOR PIPE:
SIZE 6"
MATERIAL steel
LOCK NO. 2121

SURFACE SEAL MATERIAL cement

DRILL HOLE DIAMETER 9"
reamed hole from 6 to 9 inches.

TYPE OF ANNULAR SPACE SEAL
Bentonite Slurry

PIPE:
DIAMETER 4"
MATERIAL PVC
SCH. 40
TYPE OF JOINTS Flush/threaded

TYPE OF SEAL
Bentonite pellets

SCREEN:
DIAMETER 4"
SLOT SIZE 0.04"
LENGTH 10

TYPE OF FILTER MATERIAL
Sand #30 Sieve

TYPE OF CAP PVC-flat

TYPE OF FILTER MATERIAL
Sand #30 Sieve and Cave

TYPE OF SEAL
None

TYPE OF BACKFILL
None

Foth & Van Dyke
Geosciences & Environmental Management Division
Revised 3/88 By BJS
Drawn By MRS

MONITORING WELL DEVELOPMENT

WELL NUMBER TW-K7 CLIENT Kennecott

WELL DIAMETER 4" PROJECT Pit Inflow

TOTAL DEPTH OF WELL 30' SCOPE I.D. 87K10

DEPTH TO WATER	TIME OF MEASUREMENT	BY BJS
BEFORE ---	---	DATE 9-21-88
AFTER ---	---	

DESCRIPTION OF DEVELOPMENT METHOD

Surged with air from 11:39 to 11:42 a.m. Blew out about 4 gpm from 11:42 to 11:52 a.m. Jetted moving drill rod up and down in well from 11:52 to 11:55 a.m. Produced v. dk red brn silty water. Blew out about 7 gpm from 11:55 to 12:06 p.m. Surged at 12:06 p.m. Continued to blow out to 12:25 p.m. Surged at 12:26 p.m. Water dk brn, v. silty. Continued to blow out about 7 gpm. Jetted at 12:40 p.m. Surged at 12:53 p.m. Blew out 1:22 p.m. Water clear, v. pale brn.

VOLUME OF WATER REMOVED FROM WELL 200 gallons

CLARITY OF WATER IN WELL BEFORE DEVELOPMENT V. dark red brn, silty

CLARITY OF WATER IN WELL AFTER DEVELOPMENT V. pale brown

PRESENCE OF SEDIMENT AT THE BOTTOM OF THE WELL slightly silty

VOLUME OF WATER ADDED TO WELL none

SOURCE OF WATER ADDED TO WELL ---

TIME SPENT FOR DEVELOPMENT 45 Minutes

STABILIZATION READINGS

GAL. REMOVED	TIME	FIELD TEMPERATURE	FIELD SPEC. COND.	FIELD pH

FOTH AND VAN DYKE

LOG OF TEST BORING NO.: PZ-K8

CLIENT: Kennecott
PROJECT: Pit Inflow
PROJECT NUMBER: 87K10
LOCATION: River Pillar
COORDINATES: 39840.93 N 38905.02 E

SURFACE ELEVATION: 1099.70
BORING DEPTH: 27'
DATE: 09/21/88

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N Sec	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLING NOTES
1099.7	--0									
		1-3	SB	1	P	2.0	Brown poorly graded SAND w/silt, fine, dense, loose, top 6" w/organics (topsoil). (Windblown sand)	SP-SM		Many boulders, cobbles from 3 to 6 feet.
1094.7	--5									
		6-8	SB	2	10	1.5	Red brown silty SAND, fine-coarse w/fine and coarse gravel, diamict. Top 6" cored cobble, well graded GRAVEL w/silt, fine-coarse gravel	SM, GW-GM		
1089.7	--10	10-12	SB	3	30	1.0	Red brown silty GRAVEL/SAND, coarse gravel w/fine to coarse, matrix supported gravel, cohesive, dense. Cuttings at 14', SILT, (Precambrian)	GM/SM		
1084.7	--15	15-17	SB	4	30	2.0	Light yellow, red brown SILT and silty SAND, very brittle, soft to hard, little moisture (Altered schist)		Bail Test Permeability: K=1.2 x 10E-5 cm/sec	
1079.7	--20	20-22	SB	5	70	2.0	As above	SM and ML		
1074.7	--25	25-27	SB	6	80	2.0	Dusky red w/ white SILT and silty SAND as above, last 8" mostly very pale green w/ bright green and white sugary (quartz?) laminae			
1069.7	--30						27.0'-End of Boring			
1064.7	--35									
1059.7	--40									
1054.7	--45									
1049.7	--50									
1044.7	--55									

DRILLING DATA

START DATE: 09/21/88
COMPLETION DATE: 09/21/88
LOGGED BY: BJS
DRILLING METHOD: Mud Rotary, 6" bit
DRILLING CONTRACTOR: Luisier Well Drilling, Inc.

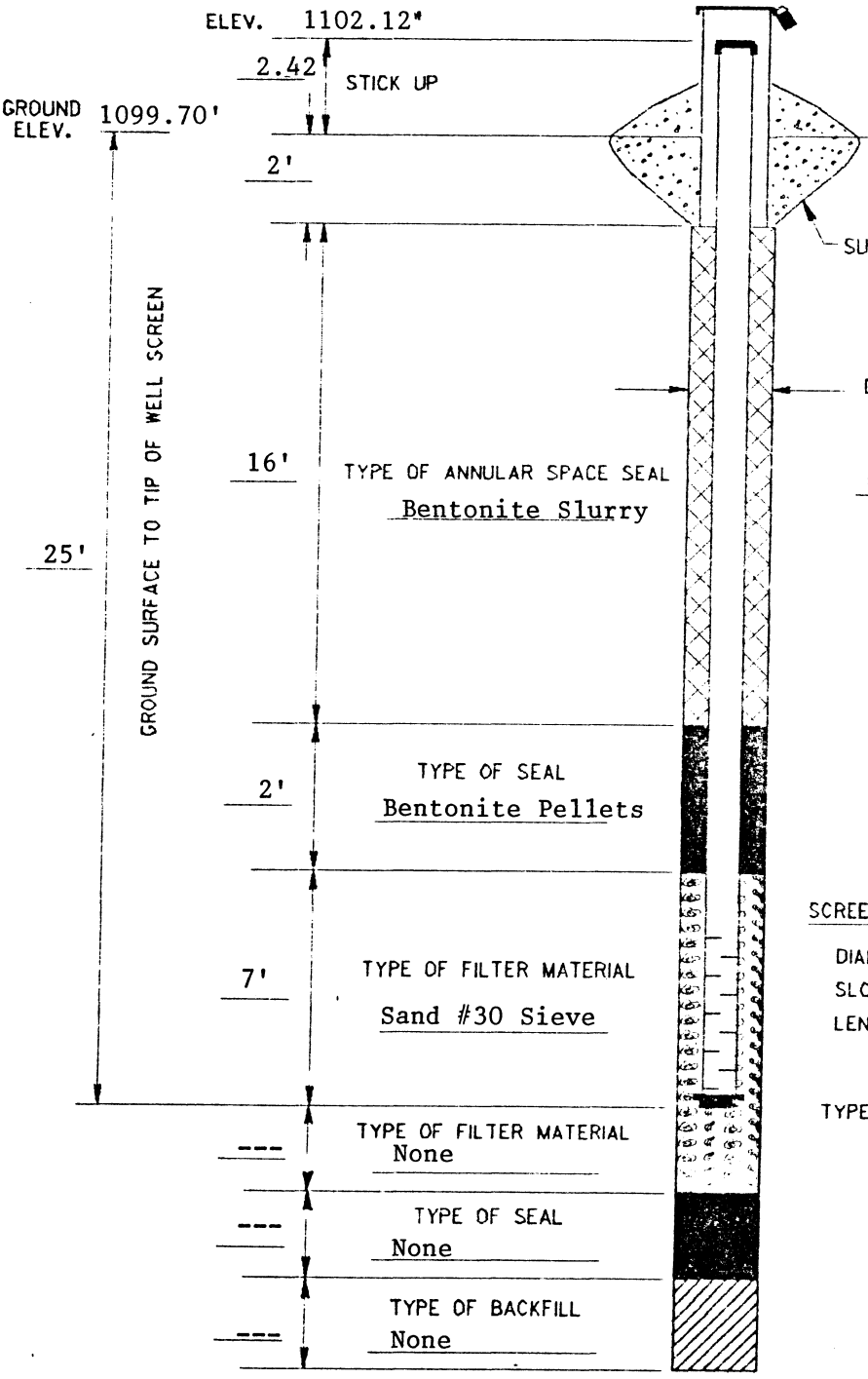
WATER LEVEL INFORMATION

DEPTH AT COMPLETION:
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:
DRILLING LOSSES:

MONITORING WELL CONSTRUCTION DIAGRAM

WELL NO: PZ-K8
DATE INSTALLED: 9-21-88
DRILLER: Luisier Drilling, Inc.
DRILLING METHOD: Mud Rotary
COORDINATES: 39,855.80N 38902.96E

CLIENT: Kennecott
PROJECT: Pit Inflow
SCOPE I.D.: 87K10
BY: BJS



PROTECTOR PIPE:
SIZE 6"
MATERIAL steel
LOCK NO. 2121

SURFACE SEAL MATERIAL cement

DRILL HOLE DIAMETER 6"

PIPE:
DIAMETER 2"
MATERIAL PVC
SCH. 80
TYPE OF JOINTS Flush/threaded

SCREEN:
DIAMETER 2"
SLOT SIZE 0.01"
LENGTH 5'

TYPE OF CAP PVC flat

Foth & Van Dyke
Geosciences & Environmental Management Division
Revised 3/88 By BJS
Drawn By MRS

MONITORING WELL DEVELOPMENT

WELL NUMBER PZ-K8 CLIENT Kennecott

WELL DIAMETER 2" PROJECT Pit Inflow

TOTAL DEPTH OF WELL 25' SCOPE I.D. 87K10

DEPTH TO WATER TIME OF MEASUREMENT BY BJS

BEFORE 3.3' 6:45 p.m. DATE 9-21-88

AFTER 11.5' 7:19 p.m.

DESCRIPTION OF DEVELOPMENT METHOD

Surged and bailed with PVC hand bailer.

VOLUME OF WATER REMOVED FROM WELL 23 gallons

CLARITY OF WATER IN WELL BEFORE DEVELOPMENT lt. red brn. slightly silty

CLARITY OF WATER IN WELL AFTER DEVELOPMENT lt. red brn.

PRESENCE OF SEDIMENT AT THE BOTTOM OF THE WELL slightly silty

VOLUME OF WATER ADDED TO WELL None

SOURCE OF WATER ADDED TO WELL ---

TIME SPENT FOR DEVELOPMENT 30 Minutes

STABILIZATION READINGS

GAL. REMOVED	TIME	FIELD TEMPERATURE	FIELD SPEC. COND.	FIELD pH

FOTH AND VAN DYKE

LOG OF TEST BORING NO.: TW-K17B

CLIENT: Kennecott
PROJECT: Pit Inflow
PROJECT NUMBER: 87K10
LOCATION: River Pillar at ST-9-17A
COORDINATES: 39943.30 N 38746.81 E

SURFACE ELEVATION: 1099.99
BORING DEPTH: 46'
DATE: 09/19/88

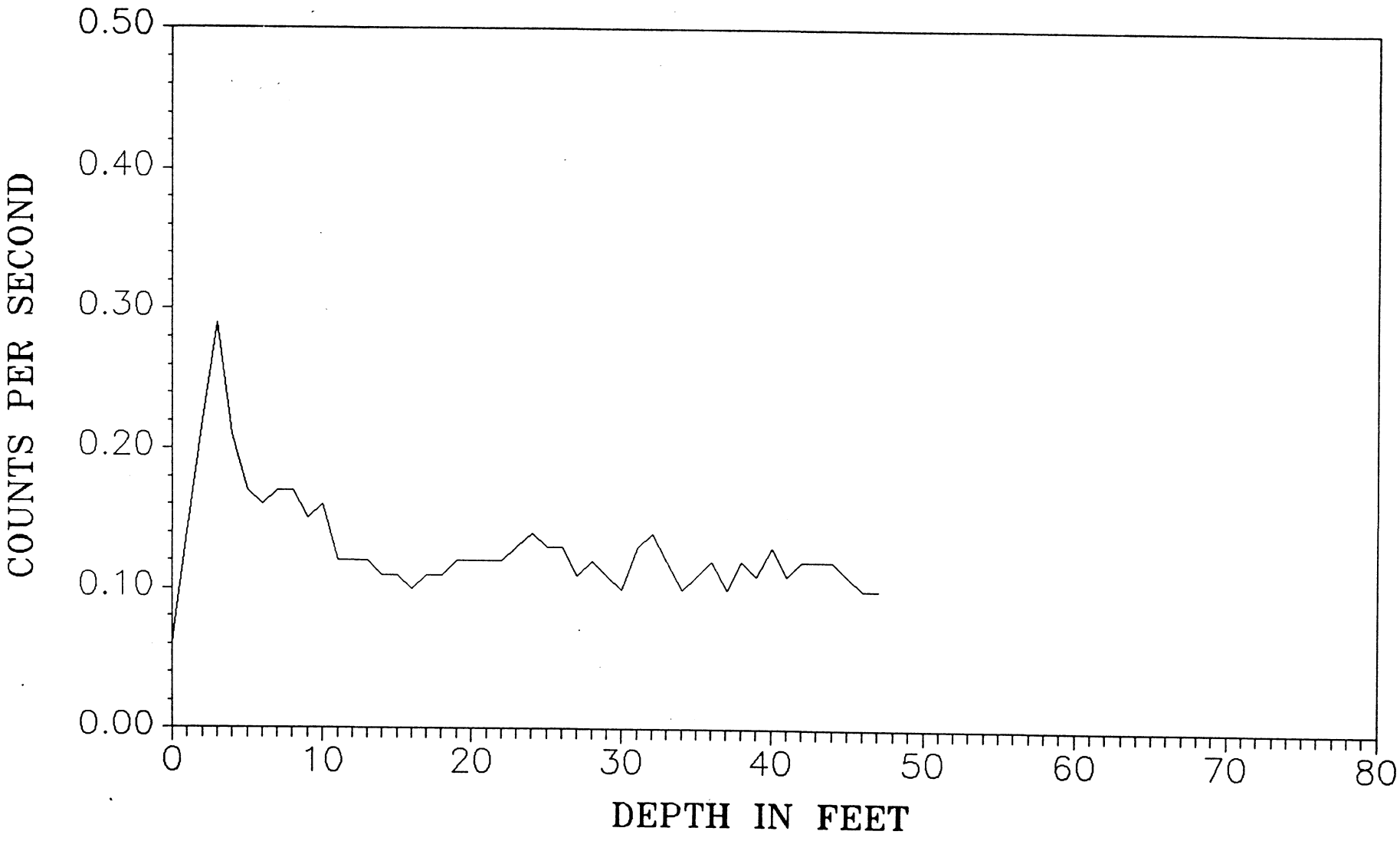
MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N Sec	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLING NOTES
1100.0	--0									
		1-3	SB	1	P	2.0	Str. brown (7.5YR 4/6) poorly graded SAND w/silt, fine, very slightly moist, indistinctly laminated, boulders starting at 3'	SP-SM		
1095.0	--5	5-6.5	SB	2	P	1.5	Dk red brown (5YR 3/4) silty clayey SAND, fine-coarse w/fine coarse gravel, stiff, moist coarse gravel diamict, brittle to cohesive, very well rounded gravel at 10-12 feet	SC-SM		
1090.0	--10	10-12	SB	3	P	2.0	Str. brown well graded SAND, fine to coarse w/much coarse gravel. At 11.5' poorly graded SAND, fine laminated, saturated at tip of barrel	SW SP		
1085.0	--15	15-17	SB	4	P	2.0	Red brown well graded SAND w/silt w/layers coarse (1" diam) rounded gravel, saturated, dense. At 16', str. brown silty clayey SAND,	SW-SM,		
1080.0	--20						fine to coarse w/fine and coarse gravel, indistinctly stratified diamict, cohesive, dense	SC-SM		
		20-20.5	SB	5	P	0.5	Red brown diamict, as above			
		20-23	SB	5A	P	0.3	Same, stratified diamict			
		24-26	SB	6	30	2.0	Dark brown (7.5YR 4/4) silty GRAVEL/SAND, mottled, well graded, fine, coarse gravel, rounded and broken, fine-coarse sand, w/clay. At 25', dark brown (7.5YR 4/4) poorly graded SAND, fine, loose			
1075.0	--25									
1070.0	--30	30-32	SB	7	30	2.0	Silty GRAVEL/SAND, as above	GM/SM		
1065.0	--35	35-37	SB	8	85	1.0	35-35.5' red brn. silty SAND, fine well graded, diamict. 35.5-36' well graded GRAVEL, fine & coarse w/fine to coarse sand, w/much dark gray staining. Lt. pink granite cobble (2") coned in tip of barrel	GW	Pump Test Permeability: K=5.9 x 10E-3 cm/sec (drawdown) K=7.1 x 10E-3 cm/sec (recovery)	
1060.0	--40	40-42	SB	9	45	0.0	Cuttings, fine gravel, rounded	GW		
		43-46	SB	10	50	3.0	Dark yellow brown (10YR 4/6) well graded GRAVEL w/silt, fine and			
1055.0	--45						coarse gravel, fine to coarse sand w/clay, very dense w/black staining (10YR 2/1) in irregular layers At 45 ' weak red (2.5YR 4/2) and dusky red (2.5YR 2.5/2) silty	GM		P - Split barrel sampler was pushed or sampler was driven with an air hammer for length of time as indicated.
1050.0	--50						GRAVEL (Altered schist, fractured) w/sand and fine gravel along fractures. Soft to cohesive, brittle, relict schistocity apparent			
1045.0	--55						46.0'-End of Boring			

DRILLING DATA

START DATE: 09/19/88
COMPLETION DATE: 09/19/88
LOGGED BY: BJS
DRILLING METHOD: Air to 15 feet, Mud Rotary to 46 feet, 6" bit
DRILLING CONTRACTOR: Luisier Well Drilling, Inc.

WATER LEVEL INFORMATION

DEPTH AT COMPLETION:
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:
DRILLING LOSSES:



DATA TAKEN 1-13-89 BY BJS
TIME CONSTANT = 5 SECONDS
RANGE SETTING = 20 K

FOTH & VAN DYKE
GEOSCIENCES & ENVIRONMENTAL MANAGEMENT DIVISION
GREEN BAY, WISCONSIN

KENNECOTT MINERALS COMPANY
FLAMBEAU PROJECT
LADYSMITH, WISCONSIN

GAMMA LOG
WELL TW-K17B

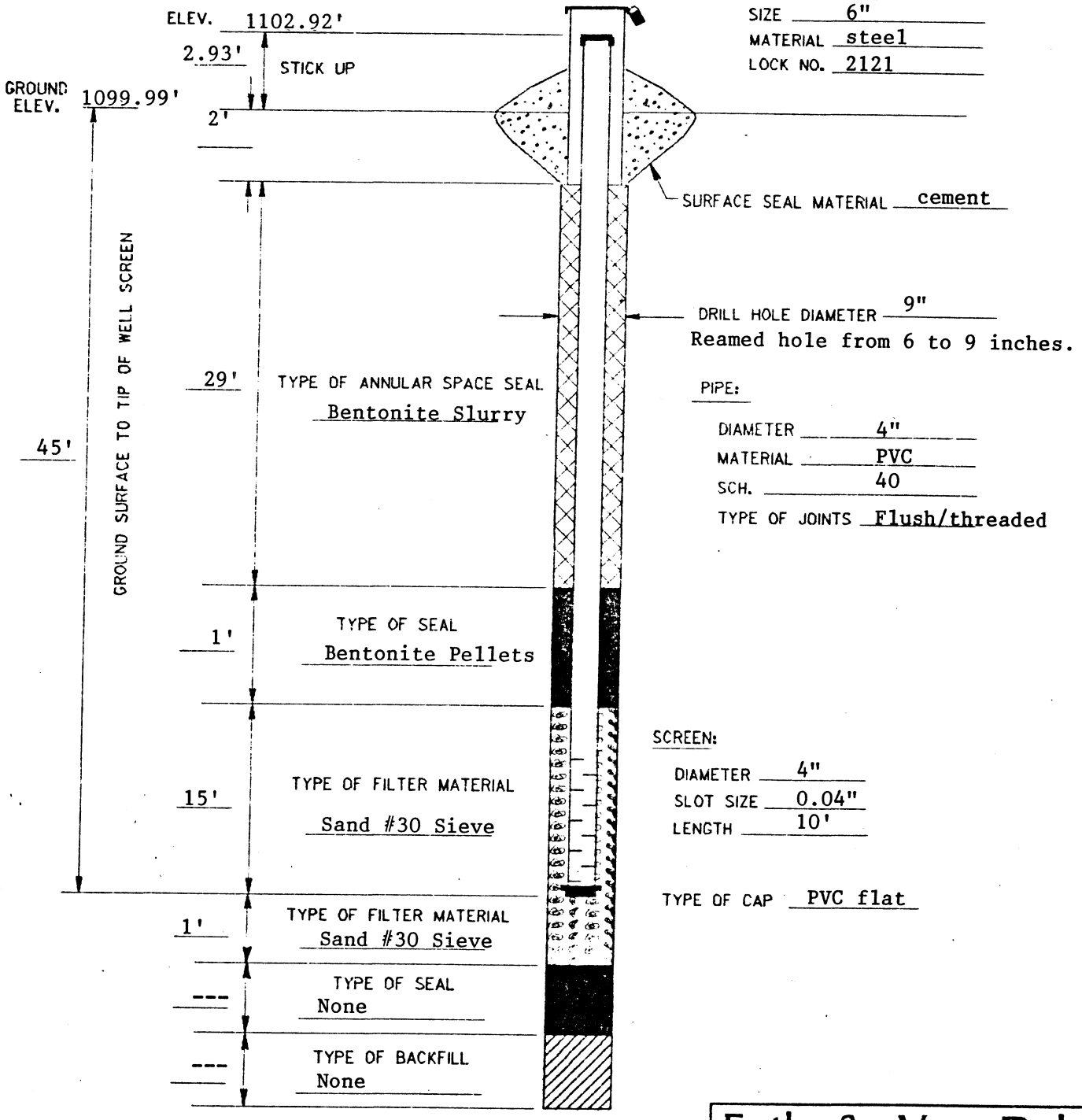
No	REVISIONS	NOTES	APPROVAL	DATE
			DESIGNED BY	
			DRAWN BY SJL	2/89
			CHECKED BY	
			APPROVED BY	
			CAD No.	SCALE AS SHOWN

Job No | Dwg No | REV

MONITORING WELL CONSTRUCTION DIAGRAM

WELL NO: TW-K17B
DATE INSTALLED: 9-20-88
DRILLER: Luisier Drilling, Inc.
DRILLING METHOD: Air/Mud Rotary
COORDINATES: 39,960.29N 38,746.15E

CLIENT: Kennecott
PROJECT: Pit Inflow
SCOPE I.D.: 87K10
BY: BJS



PROTECTOR PIPE:
SIZE 6"
MATERIAL steel
LOCK NO. 2121

SURFACE SEAL MATERIAL cement

DRILL HOLE DIAMETER 9"
Reamed hole from 6 to 9 inches.

PIPE:
DIAMETER 4"
MATERIAL PVC
SCH. 40
TYPE OF JOINTS Flush/threaded

SCREEN:
DIAMETER 4"
SLOT SIZE 0.04"
LENGTH 10'

TYPE OF CAP PVC flat

Foth & Van Dyke
Geosciences & Environmental Management Division
Revised 3/88 By BJS
Drawn By MRS

MONITORING WELL DEVELOPMENT

WELL NUMBER TW-K17B

WELL DIAMETER 4"

TOTAL DEPTH OF WELL 45'

DEPTH TO WATER — TIME OF MEASUREMENT

BEFORE --- ---

AFTER --- ---

CLIENT Kennecott

PROJECT Pit Inflow

SCOPE I.D. 88K10

BY BJS

DATE 9-20-88

DESCRIPTION OF DEVELOPMENT METHOD

Surged with air starting at 4:55 p.m. to 5:00 p.m.
Blew out about 15 gpm from 5:00 to 5:08 p.m.
Jetted with air while pulling drill rod up and down in sand packed interval.
Jetted from 5:08 to 5:16 p.m. Blew out about 20 gpm from 5:16 to 5:23 p.m.
On 9-21-88 pumped out about 800 gallons at about 15 gpm.

VOLUME OF WATER REMOVED FROM WELL 400 gallons

CLARITY OF WATER IN WELL BEFORE DEVELOPMENT lt red brn, silty

CLARITY OF WATER IN WELL AFTER DEVELOPMENT clear

PRESENCE OF SEDIMENT AT THE BOTTOM OF THE WELL none

VOLUME OF WATER ADDED TO WELL none

SOURCE OF WATER ADDED TO WELL ---

TIME SPENT FOR DEVELOPMENT 30 Minutes

STABILIZATION READINGS

GAL. REMOVED	TIME	FIELD TEMPERATURE	SPEC. COND.	pH

FOTH AND VAN DYKE

APPENDIX 3.5-H

Geologic Logs, Soil Test Data, Well Construction Diagrams, and Well Development Forms for Groundwater Modeling, 1988

LOG OF TEST BORING NO.: PZ-1007S

CLIENT: Kennecott
PROJECT: Groundwater Modeling
PROJECT NUMBER: 87K10
LOCATION: Ladysmith, Wisconsin
COORDINATES: 42939.60 N 41271.95 E

SURFACE ELEVATION: 1153.15'

BORING DEPTH: 64.6'

DATE: 11/07/88

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLING NOTES
1153.2	--0									
								ML		
1148.2	--5	5.0-6.5	SS	1	22	1.4	Br fgr sandy SILT, med & fn s			
1143.2	--10	10.0-11.5	SS	2	100	0.4	Red br silty SAND, fn w/ grvl and cobbles			
1138.2	--15	15.0-16.5	SS	3	49	1.1	Red br fgr-cgr silty SAND w/ grvl			
1133.2	--20	20.0-21.5	SS	4	73	0	No Recovery	SM		
1128.2	--25	25.0-26.5	SS	5	38	1.2	Same as 15.0-16.5			
1123.2	--30	30.0-31.5	SS	6	67	1.1	Red br fgr-cgr silty SAND w/ grvl and cobbles, more dense, grey to green coating along fractures			
1118.2	--35	35.0-36.5	SS	7	100	0.2	Same as above			
1113.2	--40	40.0-41.5	SS	8	100	0	Bright yel br poorly graded SAND w/silt, little cementation (Sandstone)			Water at 40.0 feet
1108.2	--45	45.0-46.5	SS	9	100	0.4	Same as above, hard, orange banding	SP-SM (SS)		
1103.2	--50	50.0-51.5	SS	10	100	0.4	Same as above, less cemented			
1098.2	--55									

DRILLING DATA

START DATE: 11/07/88
COMPLETION DATE: 11/07/88
LOGGED BY: FJD
DRILLING METHOD: HSA to 50', Mud rotary to 65'.
DRILLING CONTRACTOR: Wisconsin Test Drilling

WATER LEVEL INFORMATION

DEPTH AT COMPLETION: NA
LATER TIME/DEPTH: NA
LATER TIME/DEPTH: NA
CAVE IN DEPTH: NA
DRILLING LOSSES: NA

LOG OF TEST BORING NO.: PZ-1007S

CLIENT: Kennecott
PROJECT: Groundwater Modeling
PROJECT NUMBER: 87K10
LOCATION: Ladysmith, Wisconsin
COORDINATES: 42939.60 N 41271.95 E

SURFACE ELEVATION: 1153.2
BORING DEPTH: 64.6'
DATE: 11/07/88

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLING NOTES
1098.2	--55	55.0-56.5	SS	11	100	0.4	Lt ol brn(2.5Y 5/4) poorly graded SAND w/silt w/grvl. less cemented (Sandstone)	SP-SM (SS)	%g - s - si&cl 4 -87 - 9	
1093.2	--60	60.0-61.5	SS	12	100	0.4	Whitish grey poorly graded SAND w/silt w/grvl, less cemented, brn band			
1088.2	--65	64.0-64.6	SS	13	100	0.4	Red, yellow, white SILT, brittle to plastic, vertical fracturing, (altered rock)	ML		
							End of Boring at 64.6 feet			
1083.2	--70									
1078.2	--75									
1073.2	--80									
1068.2	--85									
1063.2	--90									
1058.2	--95									
1053.2	--100									
1048.2	--105									
1043.2	--110									

DRILLING DATA

START DATE: 11/07/88
COMPLETION DATE: 11/07/88
LOGGED BY: FJD
DRILLING METHOD: HSA to 50', Mud rotary to 65'.
DRILLING CONTRACTOR: Wisconsin Test Drilling

WATER LEVEL INFORMATION

DEPTH AT COMPLETION: NA
LATER TIME/DEPTH: NA
LATER TIME/DEPTH: NA
CAVE IN DEPTH: NA
DRILLING LOSSES: NA

Foth & Van Dyke and Associates Inc.

2737 S. Ridge Road P. O. Box 19012 Green Bay, WI 54307-9012 414/497-2500

REPORT OF:

SIEVE ANALYSIS OF COARSE TO FINE AGGREGATES

PROJECT: Monitoring Well - Soil Sample
Groundwater Modeling

SCOPE I.D. #: 87K10

DATE TYPED: 12/7/88

REPORTED TO: Kennecott

REPORT NUMBER: 1

TEST PERFORMED IN GENERAL ACCORDANCE OF ASTM: D1140

GENERAL DATA:

SAMPLE LOCATION: PZ-1007S

SAMPLE NUMBER: 11

DEPTH OF SAMPLE: 55-56.5'

SAMPLED BY: Fred Doran of F&VD

DATE SAMPLED: 11/07/88

DATED RECEIVED: 11/17/88

SOURCE OF SAMPLE:

MUNSELL COLOR CODE: 2.5 Y. 5/4

LABORATORY DATA:

DATE TESTED: 11/23/88

TESTED PERFORMED BY: KAS

REVIEWED BY: P.O. Kepler

24 HRS. TURN AROUND ____YES __X__NO

WASHED GRADATION __X__YES ____NO

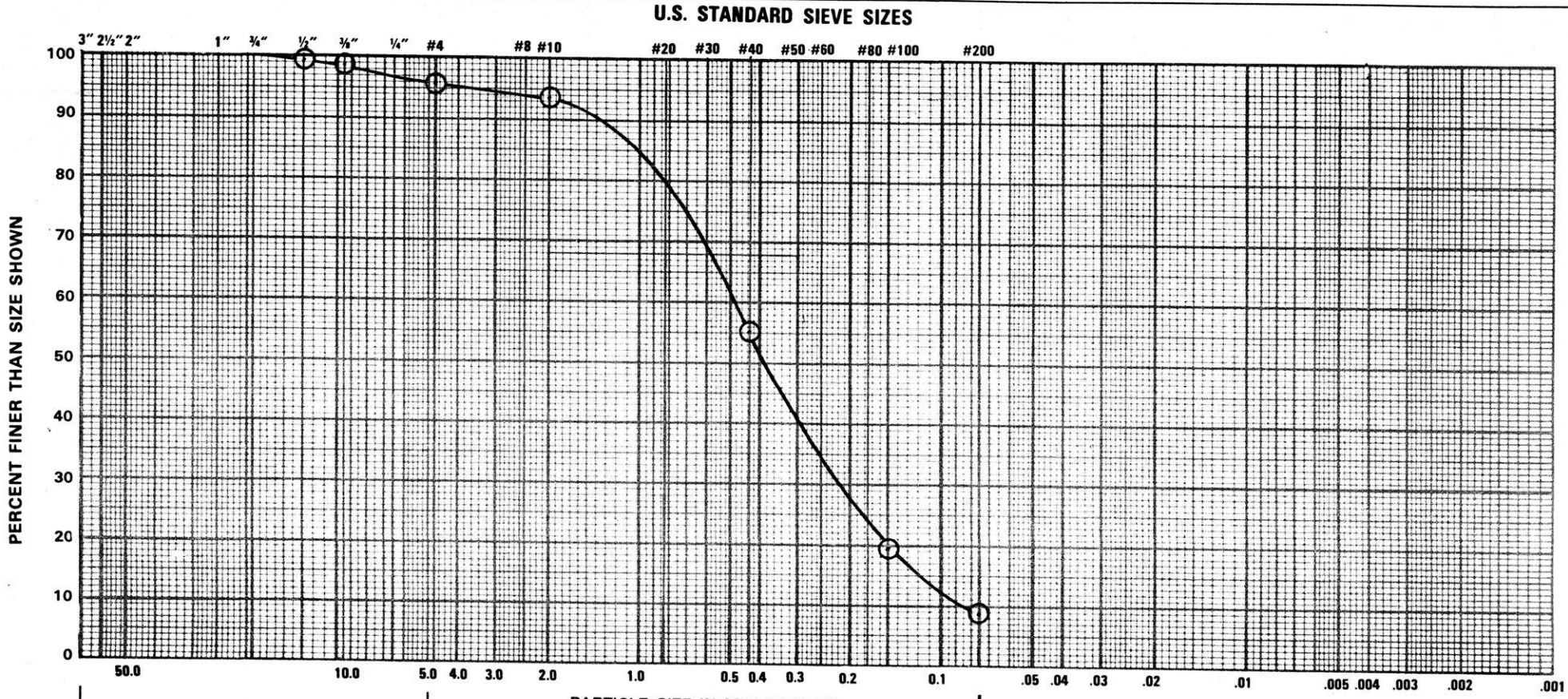
WEIGHT OF TEST SAMPLE 238.9 **GRAMS**

SIEVE SIZE	WEIGHT RETAINED (gms)	% RETAINED	% PASSING	PROJECT SPECIFICATION % PASSING BY WEIGHT	SOURCE OF SPECIFICATION
3"					
1½					
1					
3/4	0	0	100		
1/2	1.8	0.7	99.3		
3/8	1.1	0.5	98.8		
#4	7.1	3.0	95.8		
10	4.9	2.1	93.7		
40	91.8	38.4	55.3		
100	85.3	35.7	19.6		
200	25.7	10.8	8.8		
PAN	21.3	8.9			

REMARKS:

Foth & Van Dyke and Associates Inc.

GRAIN SIZE DISTRIBUTION CURVE



GRAVEL		SAND			SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE		
% =	% = 4.2	% = 2.1	% = 38.4	% = 46.4	% = 8.9	% =

PROJECT: Kennecott Groundwater DATE: 11/29/88 SAMPLE NO.: 1

LOCATION SAMPLED: Boring: PZ-1007S - Sample No. 11 ELEV. OR DEPTH: 55-56.5' DRAWN BY: POK APPROVED BY: RRR

ATTERBERG LIMITS: LL _____ PL _____ PI _____ SAMPLED MOISTURE CONTENT (%): 13.3 COEFFICIENTS: Cc = 5.8 Cu = 1.2

SAMPLE SOURCE: _____ MUNSELL COLOR CODE: 2.5 Y. 5/4 DATE SAMPLED: 11/7/88

SOIL CLASSIFICATION (ASTM: D2487) SAND W/SILT, fine to medium grained, a little gravel, light olive brown (SP-SM)

FORM #411 SL (2/87)

3.5-H-4

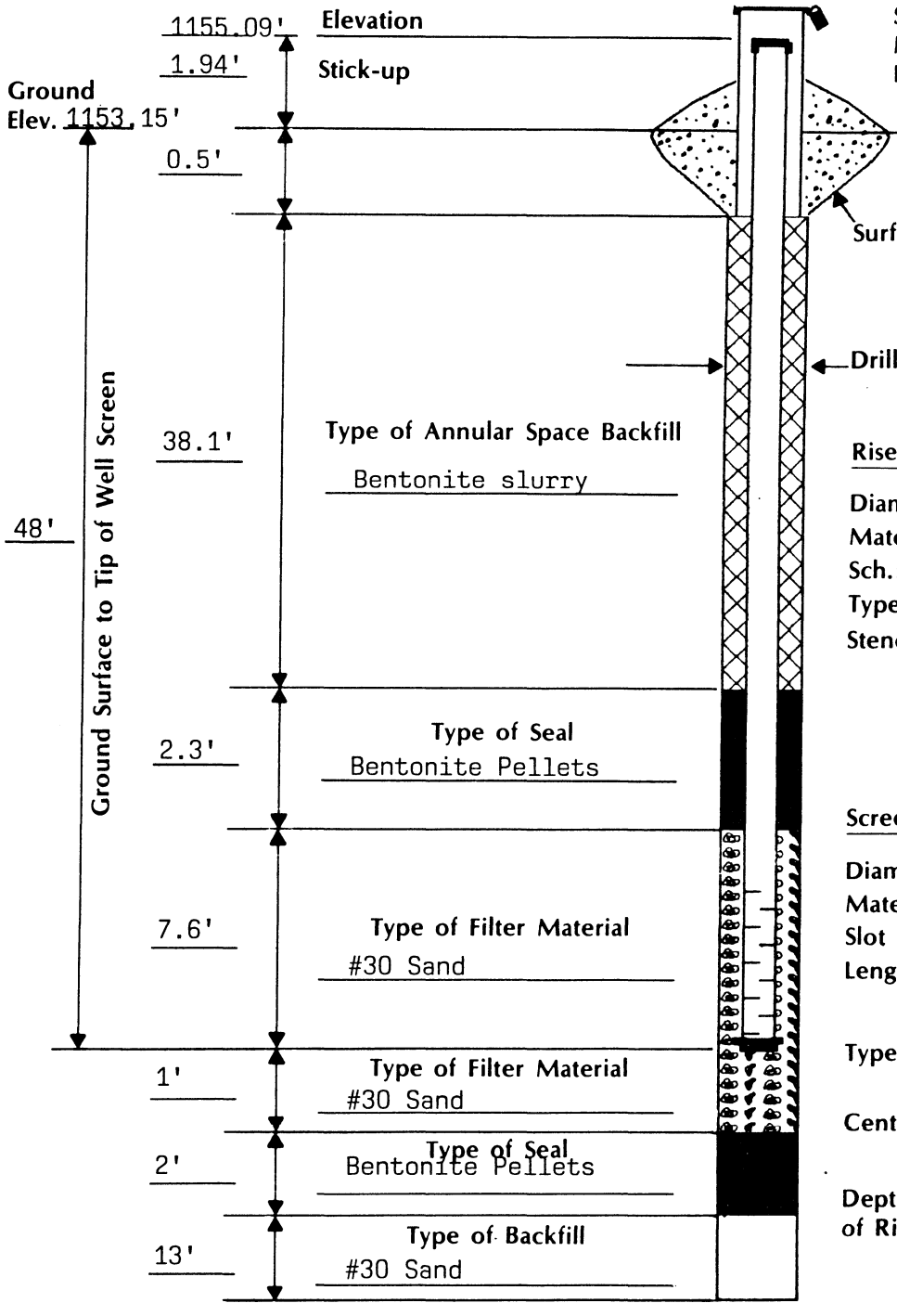
Foth & Van Dyke

Client: Kennecott — Scope I.D.: 87K10
Project: Groundwater Modeling — Page: 1 of 1
Prepared by: KAD — Date: 1
Checked by: BJS — Date: 12/2/88

MONITORING WELL CONSTRUCTION DIAGRAM

Driller: Wisconsin Test Drilling, Inc.
Drilling Method: HSA to 60', Mud Rotary to 64'
Coordinates: N 42,939.60 E 41,312.37

Well No: PZ-1007S
Date Installed: 11/8/88



Protector Pipe:
Size: 4"
Material: Steel
Lock No.: 2121

Surface Seal Material: Cement

Drill Hole Diameter: 8"

Riser:
Diameter: 2"
Material: PVC
Sch.: 40
Type of Joints: Flush threaded
Stenciled? -

Screen:
Diameter: 2"
Material: PVC
Slot Size: 0.010"
Length: 5'

Type of Cap: PVC

Centralizer: Used ☐
Not Used ☒

Depth to Water From Top of Riser at Completion: _____

NOTE: Not to Scale

Foth & Van Dyke

Client: Kennecott Scope I.D.: 87K10
Project: Groundwater Modeling Page: 1
Prepared by: L.E. (WTD) Date: 11-11-88
Checked by: BJS Date: 12-20-88

MONITORING WELL DEVELOPMENT

Well Number: PZ-1007S
Well Diameter: 2"
Total Depth of Well: 48.0'

Depth to Water:
Initial: 39.2'
Final: 43.9'

Time of Measurement:

Description of Development Method:

Bailed and surged with hand bailer.
Bailed dry.

Volume of Water Removed From Well: 2 gallons
Clarity of Water in Well Before Development: Muddy
Clarity of Water in Well After Development: Muddy
Presence of Sediment at the Bottom of the Well: --
Volume of Water Added to Well: None
Source of Water Added to Well: --
Time Spent for Development: 0.5 Hours

Stabilization Readings:

Gal. Removed	Depth to Water	Time	Field Temperature	Spec. Cond.	pH

LOG OF TEST BORING NO.: PZ-1008, 1008G

CLIENT: Kennecott
PROJECT: Groundwater Modeling
PROJECT NUMBER: 87K10
LOCATION: Ladysmith, Wisconsin
COORDINATES: 39026.39 N 41362.47 E

SURFACE ELEVATION: 1145.4'
BORING DEPTH: 56.5'
DATE: 11/09/88

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLING NOTES
1145.4	--0						Cuttings - red br SILT, tr clay and fgr sand, fgr grvl, dry, med dense	ML		
1140.4	--5	5.0-6.5	SS	1	36	1.5	Red br silty fgr SAND, tr fgr-cgr grvl, dry to damp, dense			
1135.4	--10	10.0-11.5	SS	2	52	1.5	Same as above, damp, dense			
1130.4	--15	15.0-16.5	SS	3	100	0.1	Rock in tip of sampler - grey blue quartzite, sugary texture, fine-grained, erratic boulder			
1125.4	--20	20.0-21.5	SS	4	36	1.5	Same as 10.0-11.5', damp, dense	SM		
1120.4	--25	25.0-26.5	SS	5	12	1.3	Same as above only fgr-mgr SAND w/ cgr sand, tr fgr-cgr grvl, wet, soft			
1115.4	--30	30.0-31.5	SS	6	16	1.2	Same as above, wet, soft Dk red brn (5YR 3/3)		%g -s -si -cl 8-62 -20 -10	
1110.4	--35	35.0-36.5	SS	7	16	1.1	Same as above only grey colored in spots, wet, soft			
1105.4	--40	40.0-41.5	SS	8	38	1.0	Top 6" Same as above. Next 6" Blk (5Y 2.5/1)fat CLAY, w/tr lt colored (qtz) s, med, w/disseminated organics (organic smell), then dk gray (5Y 3/1)fat CLAY, w/fn crumbly texture, moist, stiff (paleosol)	CH		
1100.4	--45	45.0-46.5	SS	9	100/.9	0.9	Dk gry (5Y 3/1) clayey SAND/GRAVEL w/med & cses, fn & cse grl, well rounded,some wea, pink granite, greenstone, red volc,basalt, clay skins around grl (weathered surf.)	SC/GC		
1095.4	--50	50.0-51.5	SS	10	32	1.0	V dk grey (10YR 3/2),poorly graded SAND,w/ fgr-cgr grvl, wet, some well rounded grains, mixed lithologies	SP	%g -s -si&cl 18 -78- 4	
1090.4	--55									

DRILLING DATA

START DATE: 11/09/88
COMPLETION DATE: 11/09/88
LOGGED BY: KAD
DRILLING METHOD: HSA to 50', mud rotary from 50' to 56.5'
DRILLING CONTRACTOR: Wisconsin Test Drilling

WATER LEVEL INFORMATION

DEPTH AT COMPLETION: NA
LATER TIME/DEPTH: NA
LATER TIME/DEPTH: NA
CAVE IN DEPTH: NA
DRILLING LOSSES: NA

LOG OF TEST BORING NO.: PZ-1008, 1008G

CLIENT: Kennecott
PROJECT: Groundwater Modeling
PROJECT NUMBER: 87K10
LOCATION: Ladysmith, Wisconsin
COORDINATES: 39026.39 N 41362.47 E

SURFACE ELEVATION: 1145.4'
BORING DEPTH: 56.5'
DATE: 11/09/88

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLING NOTES
1090.4	--55	55.0-56.5	SS	11	70	1.2	Blue green weathered bedrock, greasy" from chlorite, schistose, soft, wet	ML		
							End of boring at 56.5'			
1085.4	--60									
1080.4	--65									
1075.4	--70									
1070.4	--75									
1065.4	--80									
1060.4	--85									
1055.4	--90									
1050.4	--95									
1045.4	--100									
1040.4	--105									
1035.4	--110									

DRILLING DATA

START DATE: 11/09/88
COMPLETION DATE: 11/09/88
LOGGED BY: KAD
DRILLING METHOD: HSA to 50', then mud rotary to 56.5'
DRILLING CONTRACTOR: Wisconsin Test Drilling

WATER LEVEL INFORMATION

DEPTH AT COMPLETION: NA
LATER TIME/DEPTH: NA
LATER TIME/DEPTH: NA
CAVE IN DEPTH: NA
DRILLING LOSSES: NA

Foth & Van Dyke and Associates Inc.

2737 S. Ridge Road P. O. Box 19012 Green Bay, WI 54307-9012 414/497-2500

REPORT OF:

SIEVE ANALYSIS OF COARSE TO FINE AGGREGATES

PROJECT: Monitoring Well - Soil Sample Groundwater Modeling

SCOPE I.D. #: 87K10

DATE TYPED: 12/7/88

REPORTED TO: Kennecott

REPORT NUMBER: 2

TEST PERFORMED IN GENERAL ACCORDANCE OF ASTM: D1140

GENERAL DATA:

SAMPLE LOCATION: PZ-1008G

SAMPLE NUMBER: 6

DEPTH OF SAMPLE: 30-31.5'

SAMPLED BY: Fred Doran of F&VD

DATE SAMPLED: 11/08/88

DATED RECEIVED: 11/17/88

SOURCE OF SAMPLE:

MUNSELL COLOR CODE: 5 YR. 3/3

LABORATORY DATA:

DATE TESTED: 11/23/88

TESTED PERFORMED BY: KAS

REVIEWED BY: P.O. Keplers

24 HRS. TURN AROUND ____YES __X__NO

WASHED GRADATION __X__YES ____NO

WEIGHT OF TEST SAMPLE 171.2 GRAMS

SIEVE SIZE	WEIGHT RETAINED (gms)	% RETAINED	% PASSING	PROJECT SPECIFICATION % PASSING BY WEIGHT	SOURCE OF SPECIFICATION
3"					
1½					
1					
3/4					
1/2	0	0	100		
3/8	4.2	2.5	97.5		
#4	9.7	5.7	91.8		
10	9.3	5.4	86.4		
40	31.7	18.5	67.9		
100	48.8	28.5	39.4		
200	17.0	9.9	29.5		
PAN	50.6	29.6			

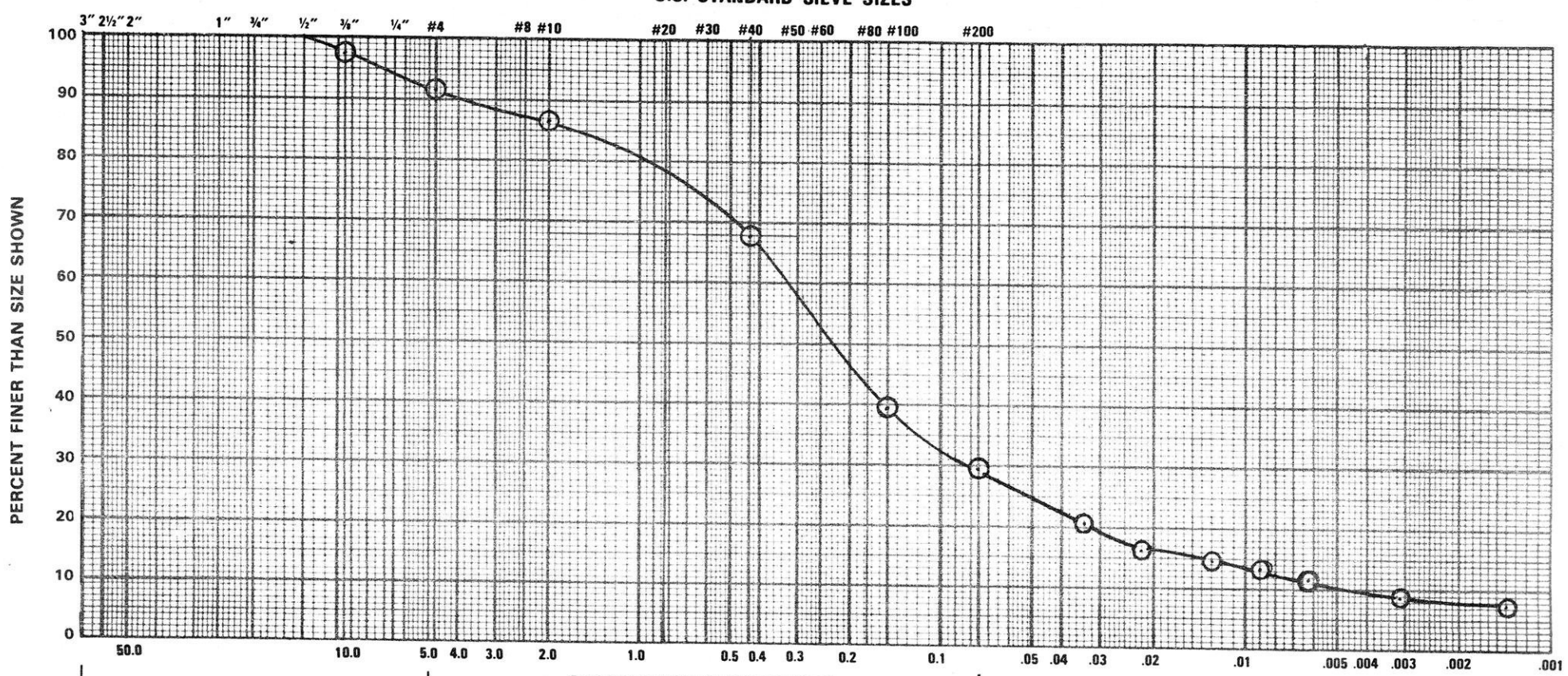
REMARKS:

FORM #329 SLB (Rev. 4/88)

BY: Robert R. Rouse

Foth & Van Dyke and Associates Inc.

GRAIN SIZE DISTRIBUTION CURVE



GRAVEL		SAND			SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE		
% =	% = 8.2	% = 5.4	% = 18.5	% = 38.3	% = 19.6	% = 10.0

PROJECT: Kennecott Groundwater DATE: 11/29/88 SAMPLE NO.: 2

LOCATION SAMPLED: Boring: PZ-1008G - Sample No. 6 ELEV. OR DEPTH: 30-31.5' DRAWN BY: POK APPROVED BY: RRR

ATTERBERG LIMITS: LL _____ PL _____ PI _____ SAMPLED MOISTURE CONTENT (%): 11.4 COEFFICIENTS: Cc = _____ Cu = _____

SAMPLE SOURCE: _____ MUNSELL COLOR CODE: 5 YR. 3/3 DATE SAMPLED: 11/8/88

SOIL CLASSIFICATION (ASTM: D2487) SILTY SAND, fine to medium grained, a little gravel, dark reddish brown (SM)

FORM #411 SL (2/87)

3.5-H-10

Foth & Van Dyke and Associates Inc.

2737 S. Ridge Road P. O. Box 19012 Green Bay, WI 54307-9012 414/497-2500

REPORT OF:

SIEVE ANALYSIS OF COARSE TO FINE AGGREGATES

PROJECT: Monitoring Well - Soil Sample Groundwater Modeling

SCOPE I.D. #: 87K10

DATE TYPED: 12/7/88

REPORTED TO: Kennecott

REPORT NUMBER: 3

TEST PERFORMED IN GENERAL ACCORDANCE OF ASTM: D1140

GENERAL DATA:

SAMPLE LOCATION: PZ-1008G

SAMPLE NUMBER: 10

DEPTH OF SAMPLE: 50.0'

SAMPLED BY: Fred Doran of F&VD

DATE SAMPLED: 11/08/88

DATED RECEIVED: 11/17/88

SOURCE OF SAMPLE:

MUNSELL COLOR CODE: 10 YR. 3/2

LABORATORY DATA:

DATE TESTED: 11/23/88

TESTED PERFORMED BY: KAS

REVIEWED BY: P.O. Kapler

24 HRS. TURN AROUND ____YES __X__NO

WASHED GRADATION __X__YES ____NO

WEIGHT OF TEST SAMPLE 245.7 GRAMS

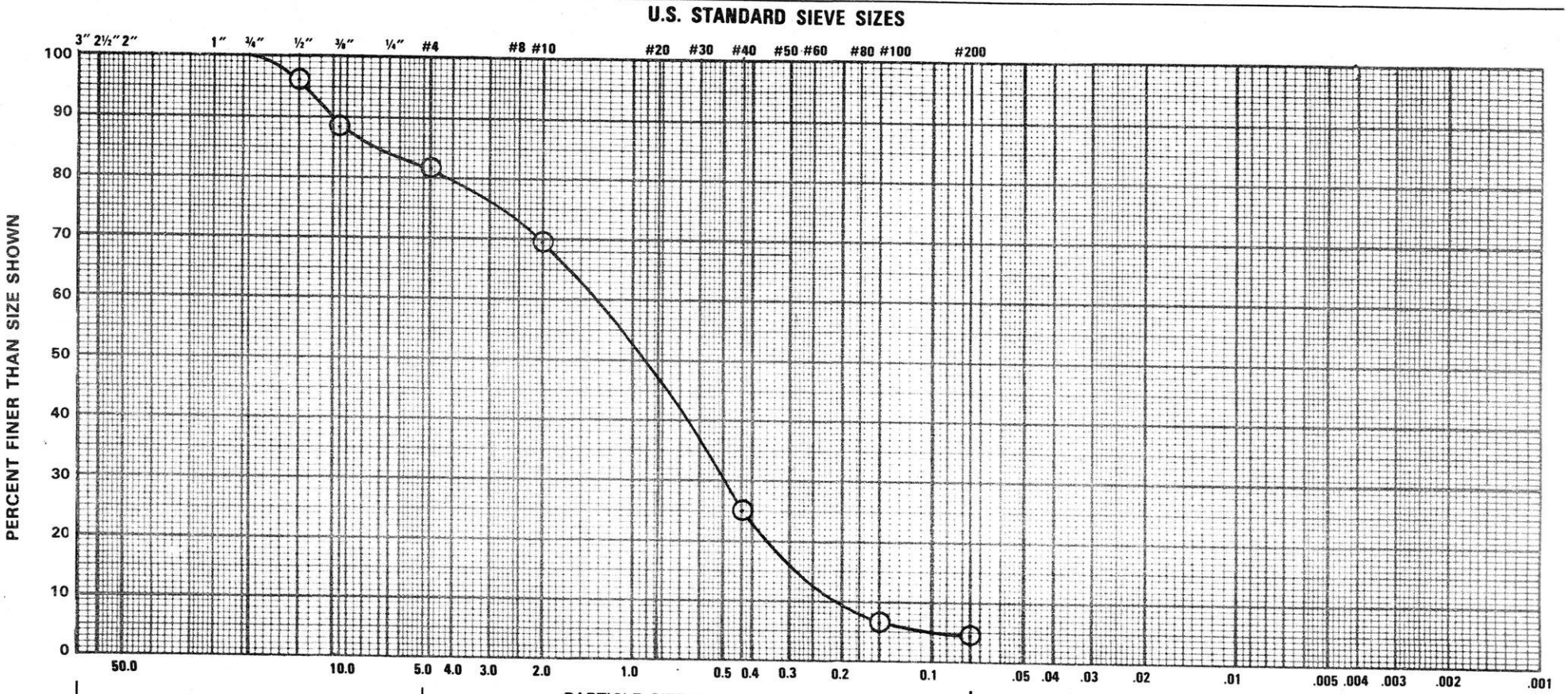
SIEVE SIZE	WEIGHT RETAINED (gms)	% RETAINED	% PASSING	PROJECT SPECIFICATION % PASSING BY WEIGHT	SOURCE OF SPECIFICATION
3"					
1½					
1					
3/4	0	0	100		
1/2	9.6	3.9	96.1		
3/8	18.6	7.6	88.5		
#4	17.0	6.9	81.6		
10	29.7	12.1	69.5		
40	109.3	44.5	25.0		
100	45.9	18.7	6.3		
200	5.2	2.1	4.2		
PAN	10.0	4.1			

REMARKS:

3.5-H-BY: Robert R. Rouse

Foth & Van Dyke and Associates Inc.

GRAIN SIZE DISTRIBUTION CURVE



GRAVEL		SAND			SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE		
% =	% = 18.4	% = 12.1	% = 44.5	% = 20.9	% = 4.1	% =

PROJECT: Kennecott Groundwater DATE: 11/29/88 SAMPLE NO.: 3

LOCATION SAMPLED: Boring: PZ-1008G - Sample No. 10 ELEV. OR DEPTH: 50.0' DRAWN BY: POK APPROVED BY: RRR

ATTERBERG LIMITS: LL _____ PL _____ PI _____ SAMPLED MOISTURE CONTENT (%): 14.2 COEFFICIENTS: Cc = 0.9 Cu = 6.3

SAMPLE SOURCE: _____ MUNSELL COLOR CODE: 10 YR. 3/2 DATE SAMPLED: 11/8/88

SOIL CLASSIFICATION (ASTM: D2487) SAND W/GRAVEL, medium to fine grained, very dark grayish brown (SP)

FORM #411 SL (2/87)

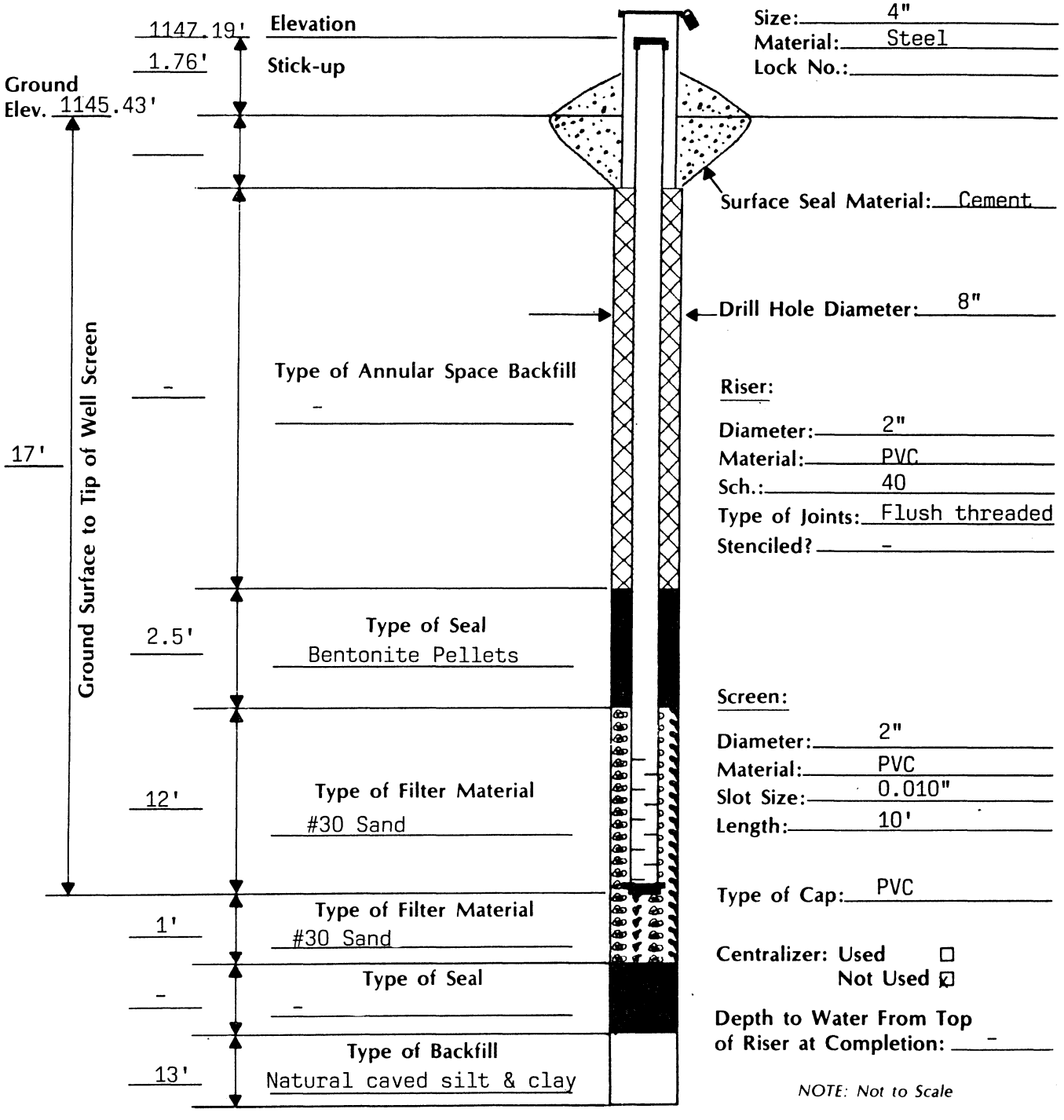
3.5-H-12

Foth & Van Dyke

Client: Kennecott — Scope I.D.: 87K10
Project: Groundwater Modeling — Page: 1
Prepared by: KAD — Date: 11/10/88
Checked by: BJS — Date: 12/5/88

MONITORING WELL CONSTRUCTION DIAGRAM

Driller: Wisconsin Test Drilling, Inc. — Well No: PZ-1008
Drilling Method: Hollow stem augers to 50', mud rotary 50-55' — Date Installed: 11/10/88
Coordinates: N 39028.36 E 41356.68



Protector Pipe:
Size: 4"
Material: Steel
Lock No.:

Surface Seal Material: Cement

Drill Hole Diameter: 8"

Riser:
Diameter: 2"
Material: PVC
Sch.: 40
Type of Joints: Flush threaded
Stenciled? -

Screen:
Diameter: 2"
Material: PVC
Slot Size: 0.010"
Length: 10'

Type of Cap: PVC

Centralizer: Used ☐
Not Used ☑

Depth to Water From Top of Riser at Completion: -

NOTE: Not to Scale

FORM #309 GEM (Rev. 11/88)

Foth & Van Dyke

Client: Kennecott Scope I.D.: 87K10
Project: Groundwater Modeling Page: 1
Prepared by: L.E. (WTD) Date: 11-11-88
Checked by: BJS Date: 12-20-88

MONITORING WELL DEVELOPMENT

Well Number: PZ-1008
Well Diameter: 2"
Total Depth of Well: 17.0'

Depth to Water:
Initial: 10.6'
Final: 15.1'

Time of Measurement:

Description of Development Method:

Bailed and surged with hand bailer.
Bailed dry.

Volume of Water Removed From Well: 6 gallons
Clarity of Water in Well Before Development: Muddy
Clarity of Water in Well After Development: Muddy
Presence of Sediment at the Bottom of the Well: --
Volume of Water Added to Well: None
Source of Water Added to Well: --
Time Spent for Development: 0.5 Hours

Stabilization Readings:

Gal. Removed	Depth to Water	Time	Field Temperature	Spec. Cond.	pH

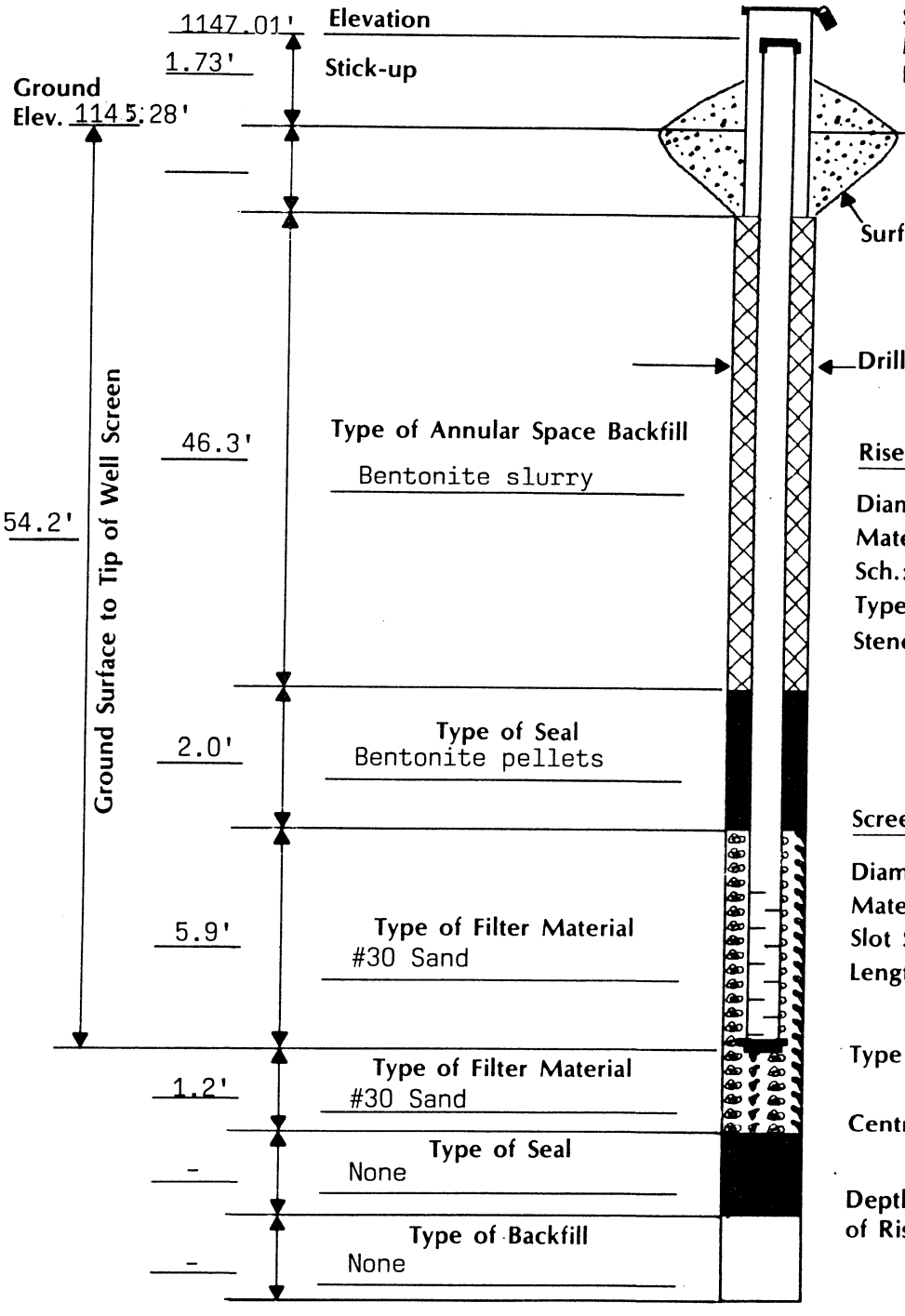
Foth & Van Dyke

Client: Kennecott — Scope I.D.: 87K10
Project: Groundwater Modeling — Page: 1
Prepared by: KAD — Date: 11/9/88
Checked by: BJS — Date: 12/5/88

MONITORING WELL CONSTRUCTION DIAGRAM

Driller: Wisconsin Test Drilling, Inc.
Drilling Method: Hollow stem auger to 50', mud rotary 50-56.5'
Coordinates: N 39026.39 E 41362.47

Well No: PZ-1008G
Date Installed: 11/9/88



Protector Pipe:
Size: 4"
Material: Steel
Lock No.: 2121

Surface Seal Material: Cement

Drill Hole Diameter: 8"

Riser:
Diameter: 2"
Material: PVC
Sch.: 40
Type of Joints: Flush threaded
Stenciled?

Screen:
Diameter: 2"
Material: PVC
Slot Size: 0.010"
Length: 5'

Type of Cap: PVC

Centralizer: Used ☐
Not Used ☒

Depth to Water From Top of Riser at Completion: -

NOTE: Not to Scale

FORM #309 GEM (Rev. 11/88)

Foth & Van Dyke

Client: Kennecott Scope I.D.: 87K10
Project: Groundwater Modeling Page: 1
Prepared by: L.E. (WTD) Date: 11-9-88
Checked by: BJS Date: 12-20-88

MONITORING WELL DEVELOPMENT

Well Number: PZ-1008 G
Well Diameter: 2"
Total Depth of Well: 54.2'

Depth to Water:
Initial: 10.6'
Final: 15.4'

Time of Measurement:

Description of Development Method:

Bailed and surged with hand bailer.

Volume of Water Removed From Well: 30 gallons
Clarity of Water in Well Before Development: Muddy
Clarity of Water in Well After Development: Cloudy
Presence of Sediment at the Bottom of the Well: --
Volume of Water Added to Well: None
Source of Water Added to Well: --
Time Spent for Development: 1.5 Hours

Stabilization Readings:

Gal. Removed	Depth to Water	Time	Field Temperature	Spec. Cond.	pH

LOG OF TEST BORING NO.: PZ-1009, 1009G

CLIENT: Kennecott
PROJECT: Groundwater Modeling
PROJECT NUMBER: 87K10
LOCATION: Ladysmith, Wisconsin
COORDINATES: 41429.42 N 43434.80 E

SURFACE ELEVATION: 1152.5'
BORING DEPTH: 50.0'
DATE: 11/10/88

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLING NOTES
1152.5	--0									
1147.5	--5	5.0-6.5	SS	1		1.5	Top 1' is red br clayey fgr-cgr SAND, tr silt and fgr grvl, dense, dense, damp, next 4" is red br fgr-cgr SAND w/ silt, next 2" same as very top	SC		
1142.5	--10	10.0-11.5	SS	2	56	1.2	Red br silty fgr-cgr SAND, tr clay, damp, dense, slightly cohesive			
1137.5	--15	15.0-16.5	SS	3	54	0.9	Red br silty fgr-cgr SAND, tr clay v. damp, dense, slightly cohesive	SM		
1132.5	--20	20.0-21.5	SS	4	63	1.0	Same as above			
1127.5	--25	25.0-26.5	SS	5	17	1.5	Red br clayey fgr-cgr SAND, tr silt and fgr-cgr grvl, dense, v. damp, cohesive		K= 2.1E - 07 cm/sec	
1122.5	--30	30.0-31.5	SS	6	14	1.0	Same as above only grey br color (except top 2" is red br), soft, wet			
1117.5	--35	35.0-36.5	SS	7	15	1.5	Same as above (grey/br color), soft, wet	SC		
1112.5	--40	40.0-41.5	SS	8	10	1.2	Same as above			
1107.5	--45	45.0-46.5	SS	9	40	1.5	Dk grey (10YR 3/2) fgr-cgr silty SAND, fn, mgr grvl, wet, dence		%g -s -si-cl 1-70 -22- 7	
		50.0-51.5	SS	10	100 /0	0	Very hard, auger refusal, split spoon refusal, assume bedrock			
1102.5	--50						End of Boring at 50.0 feet	RK?		
1097.5	--55									

DRILLING DATA

START DATE: 11/10/88
COMPLETION DATE: 11/10/88
LOGGED BY: KAD
DRILLING METHOD: HSA to 50'
DRILLING CONTRACTOR: Wisconsin Test Drilling

WATER LEVEL INFORMATION

DEPTH AT COMPLETION: NA
LATER TIME/DEPTH: NA
LATER TIME/DEPTH: NA
CAVE IN DEPTH: NA
DRILLING LOSSES: NA

Foth & Van Dyke

Client: Kennecott Explorations Scope I.D.: 87K10
Project: Groundwater Modeling Report Page: 1
Prepared by: Robert Rouse Date: 12-18-88
Checked by: Perry O. Kepler Date: 1-26-89

REPORT OF:

FALLING HEAD PERMEABILITY TEST

Reported to: Kenncott Explorations **Copies to:**

General Data:

Boring/Test Pit Number:	PZ-1009G
Depth of Sample:	25'-27'
Sample Number:	5
Date Sampled:	November 10, 1988
Date Received:	November 17, 1988
Source of Sample:	

Laboratory Data: **Project Specifications**

Method of Test:	3" T.W. Tube (Rigid Wall)
Length of Sample *(inches)*:	5.25
Diameter of Sample *(inches)*:	2.80
Dates Tested:	December 5-12, 1988
Moisture Content *(%)*:	9.7
Dry Density *(pcf)*:	136.9
% Compaction:	
Soil Classification:	SILTY SAND W/GRAVEL, dark reddish brown (SM)
Permeant Used:	Tapwater
Technician:	R. Rouse
Coefficient of Permeability: *(cm/sec)*	2.1×10^{-7}

Atterberg Limits:

Liquid Limit:
Plastic Limit:
Plasticity Index:

Remarks:

Foth & Van Dyke and Associates Inc.

2737 S. Ridge Road P. O. Box 19012 Green Bay, WI 54307-9012 414/497-2500

REPORT OF:

SIEVE ANALYSIS OF COARSE TO FINE AGGREGATES

PROJECT: Groundwater Modeling

SCOPE I.D. #: 87K10

DATE TYPED: 1-26-89

REPORTED TO: Kennecott Explorations

REPORT NUMBER: 5

TEST PERFORMED IN GENERAL ACCORDANCE OF ASTM: D1140

GENERAL DATA:

SAMPLE LOCATION: PZ-1009G

SAMPLE NUMBER: 5

DEPTH OF SAMPLE: 25'-27'

SAMPLED BY: Fred Doran of F&VD

DATE SAMPLED: 11/10/88

DATED RECEIVED: 11/17/88

SOURCE OF SAMPLE:

MUNSELL COLOR CODE: 5 YR. 3/4

LABORATORY DATA:

DATE TESTED: 12/27/88

TESTED PERFORMED BY: KAS

REVIEWED BY: P.O. Kepler 1-3-89

24 HRS. TURN AROUND ____YES __x__NO

WASHED GRADATION __x__YES ____NO

WEIGHT OF TEST SAMPLE 754.1 **GRAMS**

SIEVE SIZE	WEIGHT RETAINED (gms)	% RETAINED	% PASSING	PROJECT SPECIFICATION % PASSING BY WEIGHT	SOURCE OF SPECIFICATION
3"					
1½	0	0	100		
1	53.0	7.0	93.0		
3/4	11.0	1.5	91.5		
1/2.	13.4	1.8	89.7		
3/8	26.9	3.6	86.1		
#4	25.0	3.3	82.8		
10	37.7	5.0	77.8		
40	114.0	15.1	62.7		
100	192.2	25.5	37.2		
200	68.5	9.1	28.1		
PAN	212.3	28.2			

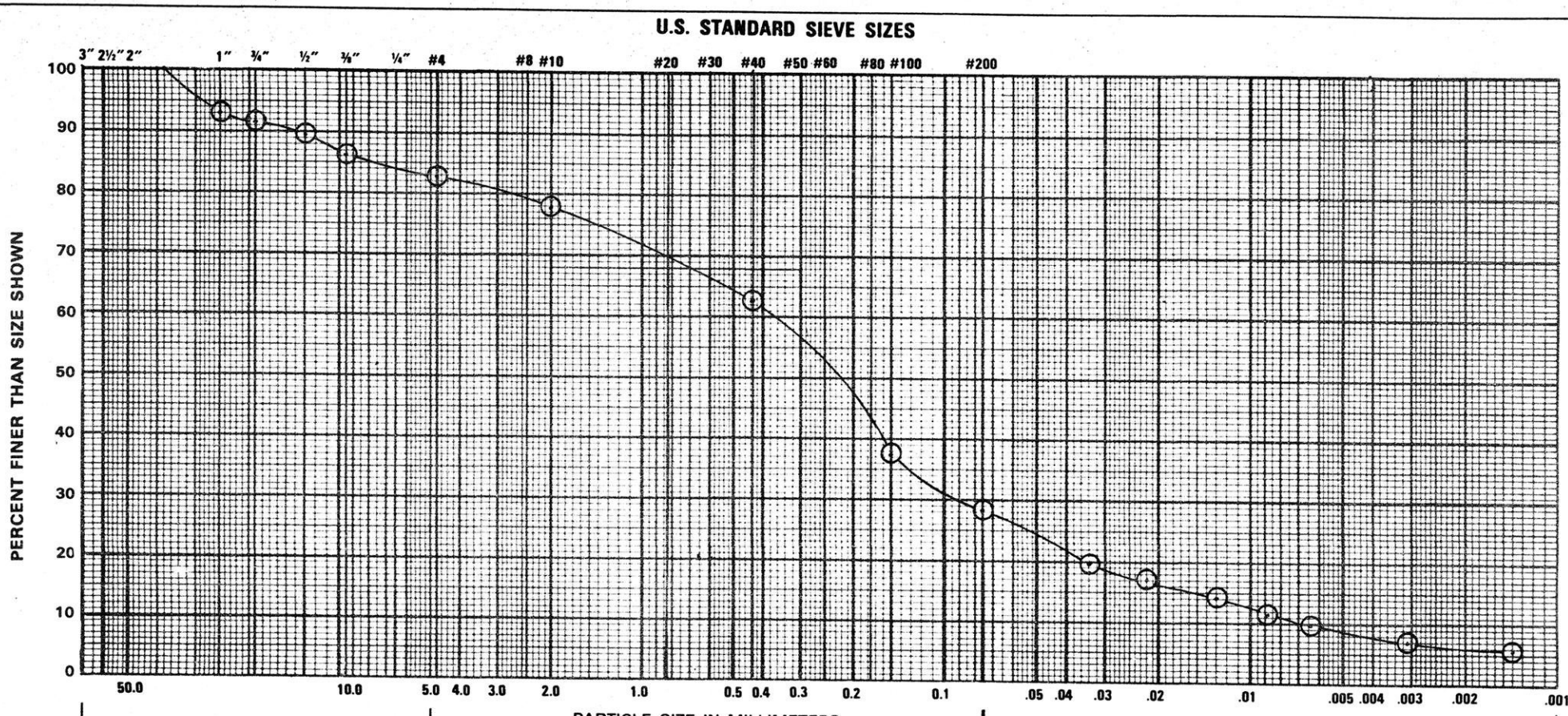
REMARKS:

FORM #329 SLB (Rev. 4/88)

BY: Robert R. Rouse

Foth & Van Dyke and Associates Inc.

GRAIN SIZE DISTRIBUTION CURVE



GRAVEL		SAND			SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE		
% = 8.5	% = 8.7	% = 5.0	% = 15.1	% = 34.5	% = 22.2	% = 6.0

PROJECT: Ground Water Modeling - Kennecott Explorations DATE: 1-3-89 SAMPLE NO.: 5

LOCATION SAMPLED: PZ-1009G Sample No. 5 ELEV. OR DEPTH: 25.0'-27.0' DRAWN BY: POK APPROVED BY: RRR

ATTERBERG LIMITS: LL _____ PL _____ PI N.P. SAMPLED MOISTURE CONTENT (%): _____ COEFFICIENTS: Cc = _____ Cu = _____

SAMPLE SOURCE: _____ MUNSELL COLOR CODE: 5 YR. 3/4 DATE SAMPLED: 11-10-88

SOIL CLASSIFICATION (ASTM: D2487) SILTY SAND W/GRAVEL, fine to medium grained, dark reddish brown (SM)

FORM #411 SL (2/87)

3.5-H-20

Foth & Van Dyke and Associates Inc.

2737 S. Ridge Road P. O. Box 19012 Green Bay, WI 54307-9012 414/497-2500

REPORT OF:

SIEVE ANALYSIS OF COARSE TO FINE AGGREGATES

PROJECT: Monitoring Well - Soil Sample
Groundwater Modeling

REPORTED TO: Kennecott

SCOPE I.D. #: 87K10

DATE TYPED: 12/7/88

REPORT NUMBER: 4

TEST PERFORMED IN GENERAL ACCORDANCE OF ASTM: D1140

GENERAL DATA:

SAMPLE LOCATION: PZ-1009G

SAMPLE NUMBER: 9

DEPTH OF SAMPLE: 45.0'

SAMPLED BY: Fred Doran of F&VD

DATE SAMPLED: 11/10/88

DATED RECEIVED: 11/17/88

SOURCE OF SAMPLE:

MUNSELL COLOR CODE: 10 YR. 3/2

LABORATORY DATA:

DATE TESTED: 11/23/88

TESTED PERFORMED BY: KAS

REVIEWED BY: P.O. Kepler

24 HRS. TURN AROUND ____YES __X__NO

WASHED GRADATION __X__YES ____NO

WEIGHT OF TEST SAMPLE 159.2 GRAMS

SIEVE SIZE	WEIGHT RETAINED (gms)	% RETAINED	% PASSING	PROJECT SPECIFICATION % PASSING BY WEIGHT	SOURCE OF SPECIFICATION
3"					
1½					
1					
3/4					
1/2					
3/8	0	0	100		
#4	1.7	1.1	98.9		
10	8.7	5.5	93.4		
40	18.8	11.8	81.6		
100	61.6	38.7	42.9		
200	22.6	14.2	28.7		
PAN	45.8	28.8			

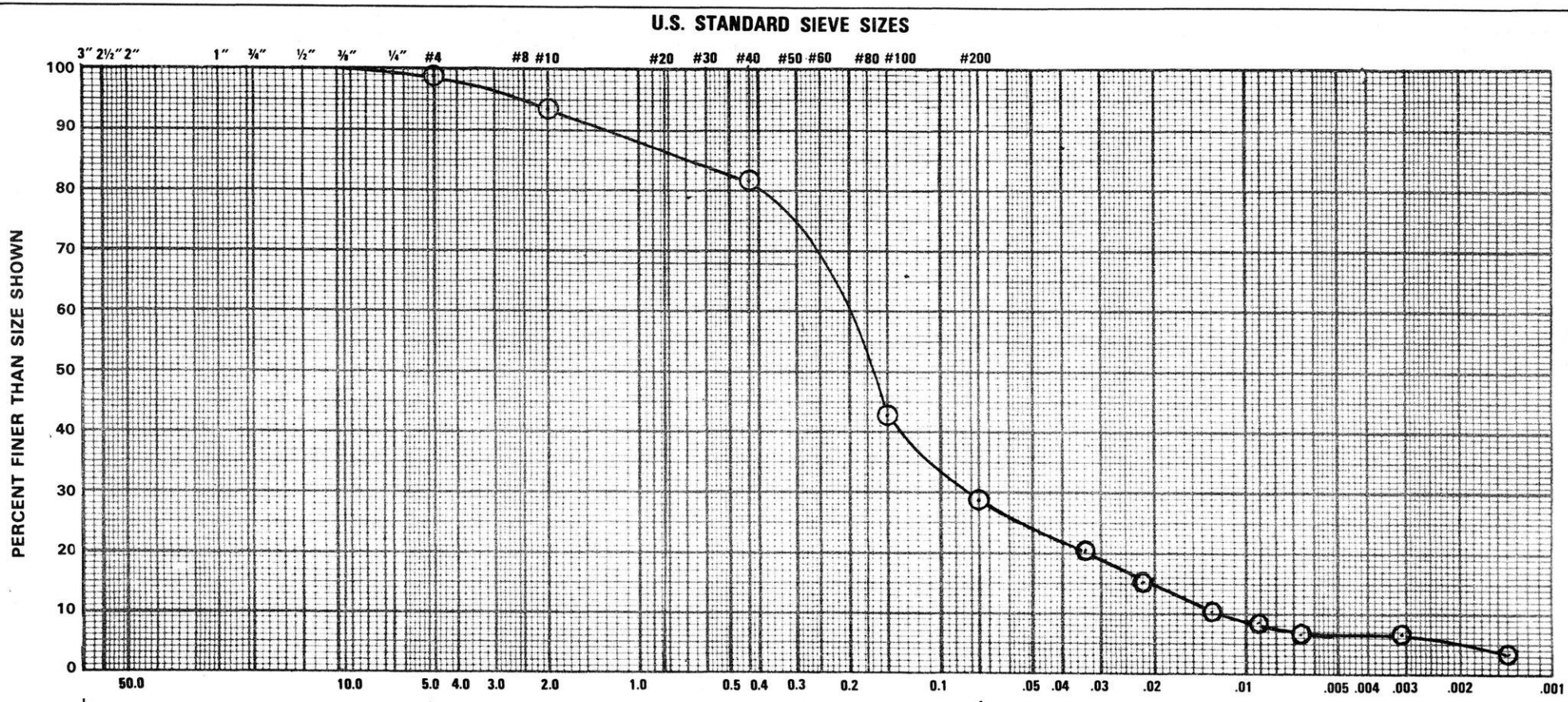
REMARKS:

FORM #329 SLB (Rev. 4/88)

BY: Robert R. Rouse

Foth & Van Dyke and Associates Inc.

GRAIN SIZE DISTRIBUTION CURVE



GRAVEL		SAND			SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE		
% =	% = 1.1	% = 5.5	% = 11.8	% = 52.8	% = 22.1	% = 6.7

PROJECT: Kennecott Groundwater DATE: 11/29/88 SAMPLE NO.: 4

LOCATION SAMPLED: Boring: PZ-1009G - Sample No. 9 ELEV. OR DEPTH: 45.0' DRAWN BY: POK APPROVED BY: RRR

ATTERBERG LIMITS: LL _____ PL _____ PI _____ SAMPLED MOISTURE CONTENT (%): 16.7 COEFFICIENTS: Cc = _____ Cu = _____

SAMPLE SOURCE: _____ MUNSELL COLOR CODE: 10 YR. 3/2 DATE SAMPLED: 11/10/88

SOIL CLASSIFICATION (ASTM: D2487) SILTY SAND, fine grained, very dark grayish brown (SM)

FORM #411 SL (2/87)

3.5-H-22

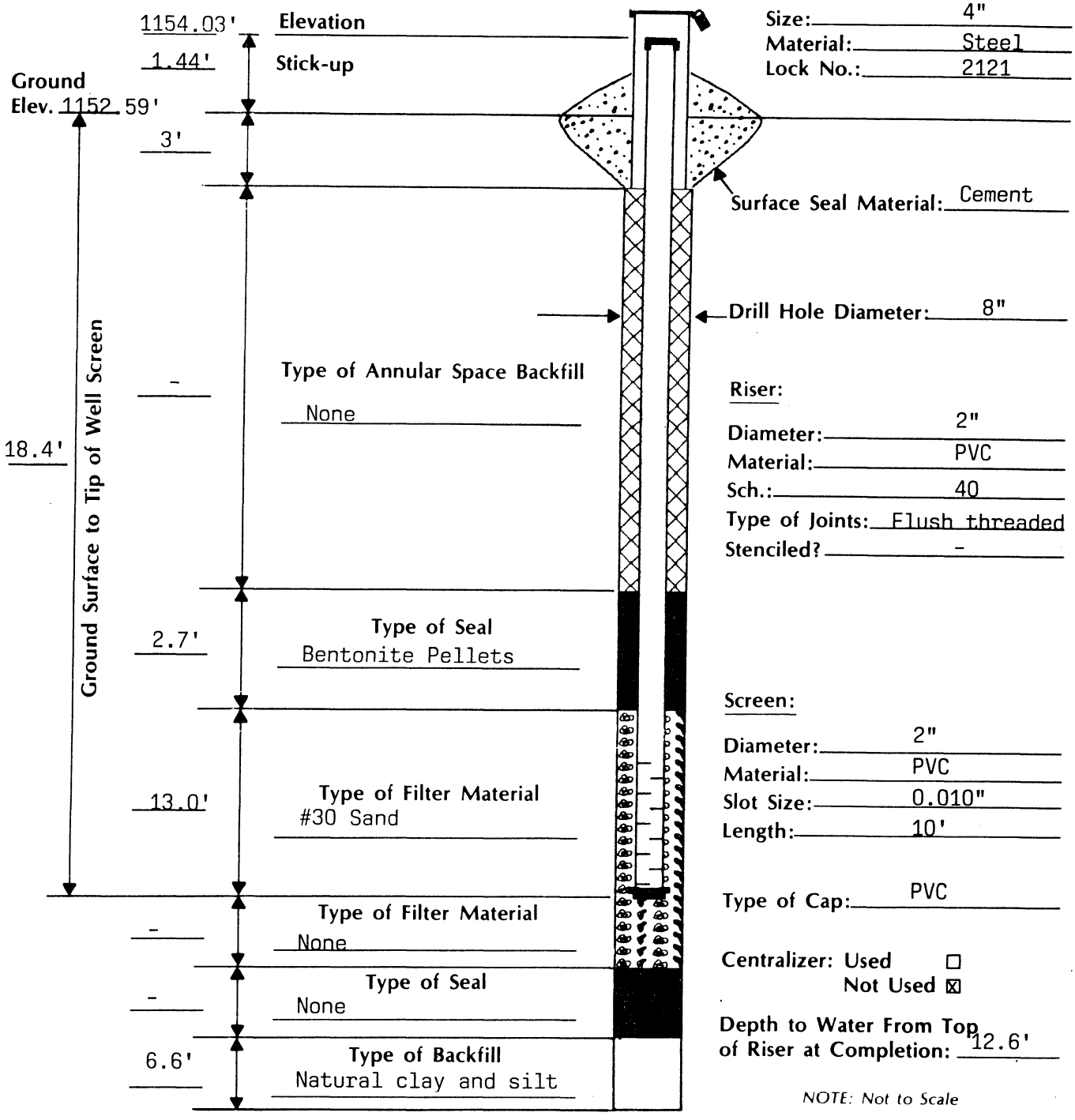
Foth & Van Dyke

Client: Kennecott — Scope I.D.: 87K10
Project: Groundwater Modeling — Page: 1
Prepared by: KAD — Date: 11/12/88
Checked by: BJS — Date: 12/3/88

MONITORING WELL CONSTRUCTION DIAGRAM

Driller: Wisconsin Test Drilling, Inc.
Drilling Method: Hollow stem augers
Coordinates: N 41424.42 E 43437.04

Well No: PZ-1009
Date Installed: 11/12/88



Protector Pipe:
Size: 4"
Material: Steel
Lock No.: 2121

Surface Seal Material: Cement

Drill Hole Diameter: 8"

Riser:
Diameter: 2"
Material: PVC
Sch.: 40
Type of Joints: Flush threaded
Stenciled? -

Screen:
Diameter: 2"
Material: PVC
Slot Size: 0.010"
Length: 10'

Type of Cap: PVC

Centralizer: Used ☐
Not Used ☒

Depth to Water From Top of Riser at Completion: 12.6'

NOTE: Not to Scale

Foth & Van Dyke

Client: Kennecott Scope I.D.: 87K10
Project: Groundwater Modeling Page: 1
Prepared by: L.E. (WTD) Date: 11-11-88
Checked by: BJS Date: 12-20-88

MONITORING WELL DEVELOPMENT

Well Number: PZ-1009
Well Diameter: 2"
Total Depth of Well: 18.4'

Depth to Water:
Initial: 11.8'
Final: 15.3'

Time of Measurement:

Description of Development Method:

Bailed and surged with hand bailer.
Bailed Dry.

Volume of Water Removed From Well: 2 gallons
Clarity of Water in Well Before Development: Muddy
Clarity of Water in Well After Development: Muddy
Presence of Sediment at the Bottom of the Well: --
Volume of Water Added to Well: None
Source of Water Added to Well: --
Time Spent for Development: 0.5 Hours

Stabilization Readings:

Gal. Removed	Depth to Water	Time	Field Temperature	Spec. Cond.	pH

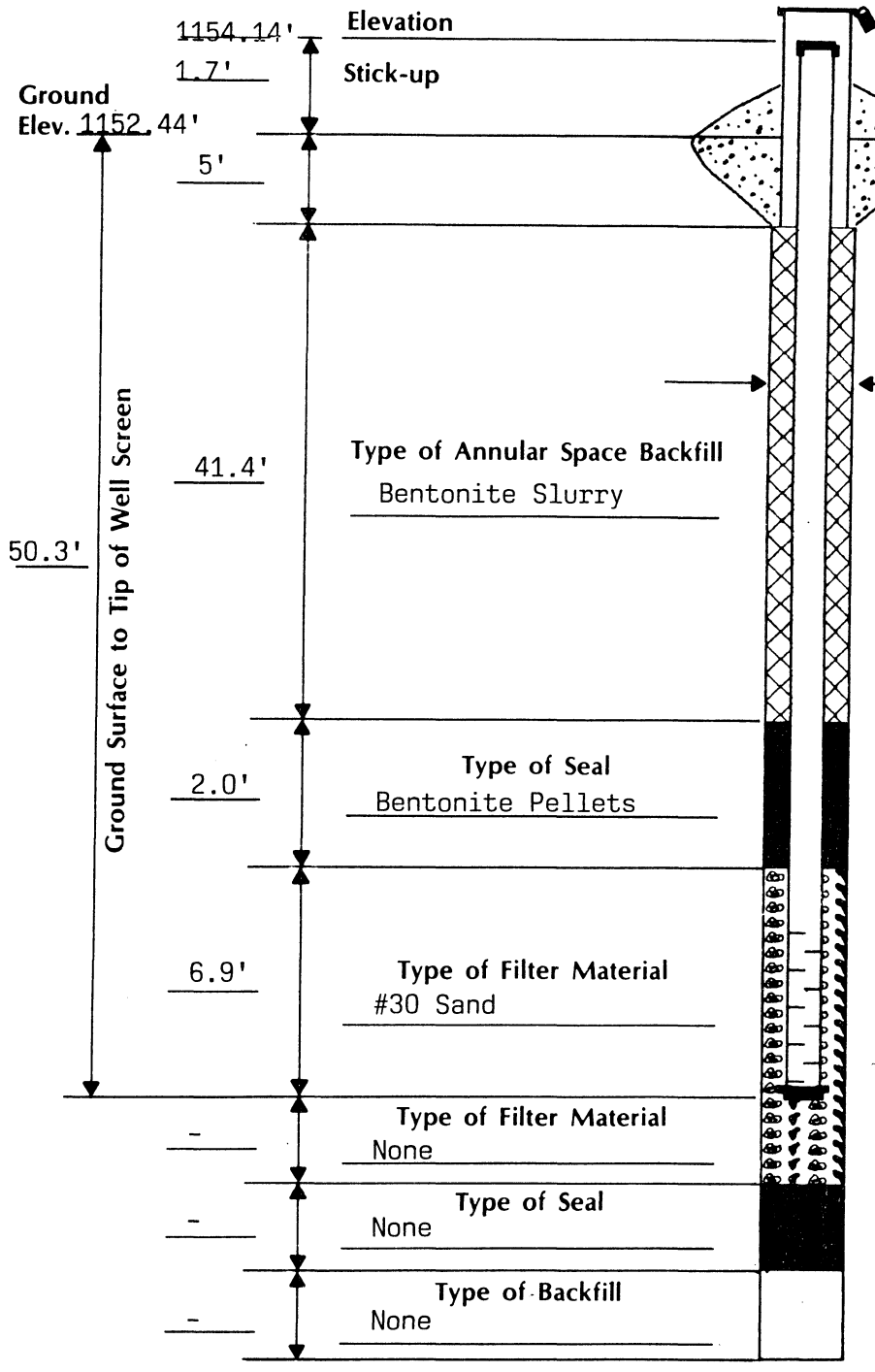
Foth & Van Dyke

Client: Kennecott — Scope I.D.: 87K10
Project: Groundwater Modeling — Page: 1
Prepared by: KAD — Date: 11/11/88
Checked by: BJS — Date: 12/3/88

MONITORING WELL CONSTRUCTION DIAGRAM

Driller: Wisconsin Test Drilling, Inc.
Drilling Method: Hollow stem augers
Coordinates: N 41,429.42 E 43,434.81

Well No: PZ-1009G
Date Installed: 11/11/88



Protector Pipe:
Size: 4"
Material: Steel
Lock No.: 2121

Surface Seal Material: Cement

Drill Hole Diameter: 8"

Riser:
Diameter: 2"
Material: PVC
Sch.: 40
Type of Joints: Flush threaded
Stenciled? -

Screen:
Diameter: 2"
Material: PVC
Slot Size: 0.010"
Length: 5'

Type of Cap: PVC

Centralizer: Used ☐ Not Used ☒

Depth to Water From Top of Riser at Completion: -

NOTE: Not to Scale

FORM #309 GEM (Rev. 11/88)

Foth & Van Dyke

Client: Kennecott Scope I.D.: 87K10
Project: Groundwater Modeling Page: 1
Prepared by: L.E. (WTD) Date: 11-11-88
Checked by: BJS Date: 12-20-88

MONITORING WELL DEVELOPMENT

Well Number: PZ-1009G
Well Diameter: 2"
Total Depth of Well: 50.3'

Depth to Water:
Initial: 12.1'
Final: 46.8'

Time of Measurement:

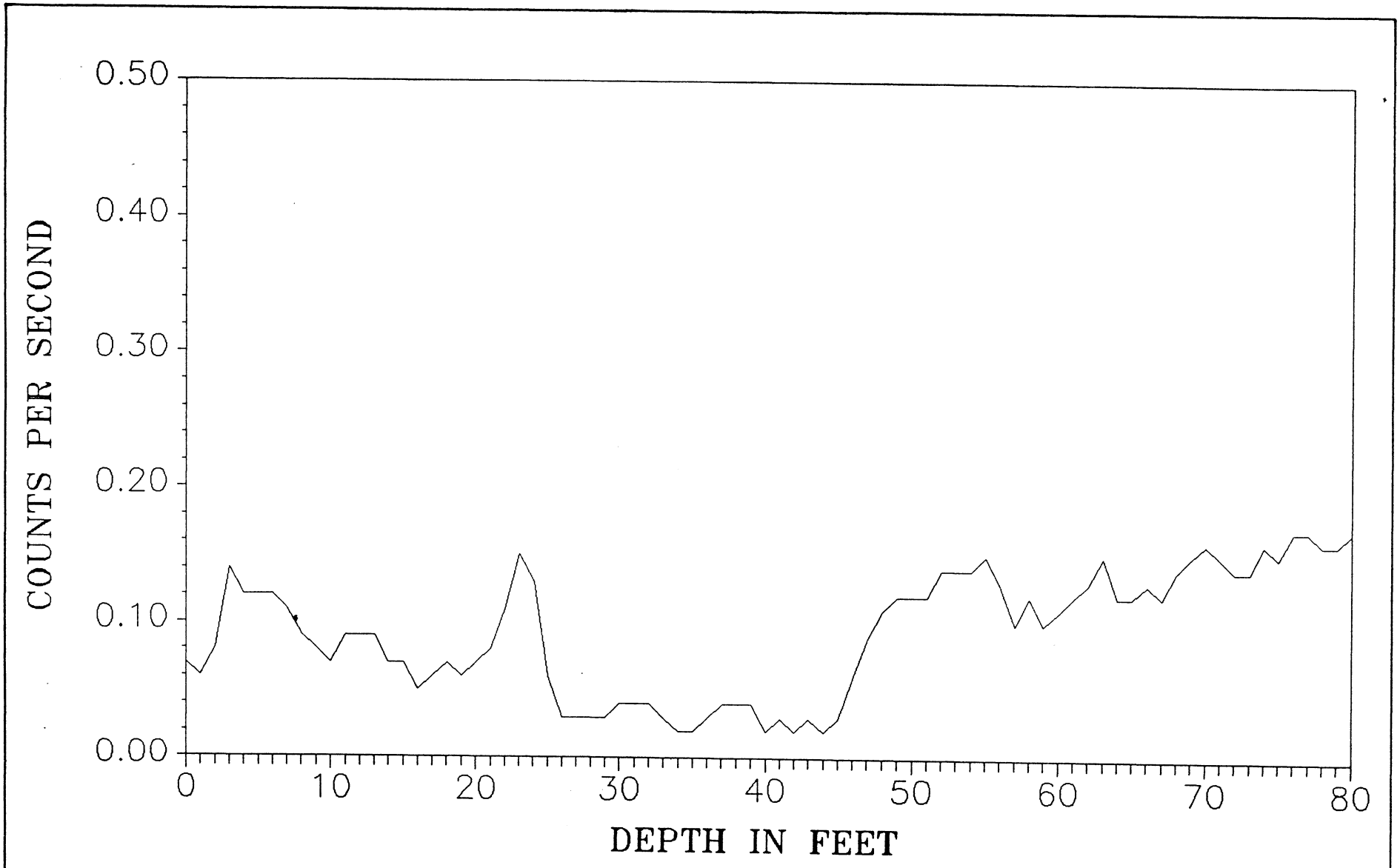
Description of Development Method:

Bailed and surged with hand bailer.
Bailed dry.

Volume of Water Removed From Well: 5 gallons
Clarity of Water in Well Before Development: Muddy
Clarity of Water in Well After Development: Muddy
Presence of Sediment at the Bottom of the Well: --
Volume of Water Added to Well: None
Source of Water Added to Well: --
Time Spent for Development: 0.5 Hours

Stabilization Readings:

Gal. Removed	Depth to Water	Time	Field Temperature	Spec. Cond.	pH



DATA TAKEN 1-13-89 BY BJS
TIME CONSTANT = 5 SECONDS
RANGE SETTING = 20 K

FOTH & VAN DYKE
GEOSCIENCES & ENVIRONMENTAL MANAGEMENT DIVISION
GREEN BAY, WISCONSIN

KENNECOTT MINERALS COMPANY
FLAMBEAU PROJECT
LADYSMITH, WISCONSIN

GAMMA LOG
WELL PZ-K2P, K2PP

No	REVISIONS	NOTES	APPROVAL	DATE
			DESIGNED BY	
			DRAWN BY SJL	2/89
			CHECKED BY	
			APPROVED BY	
			CAD No.	SCALE AS SHOWN

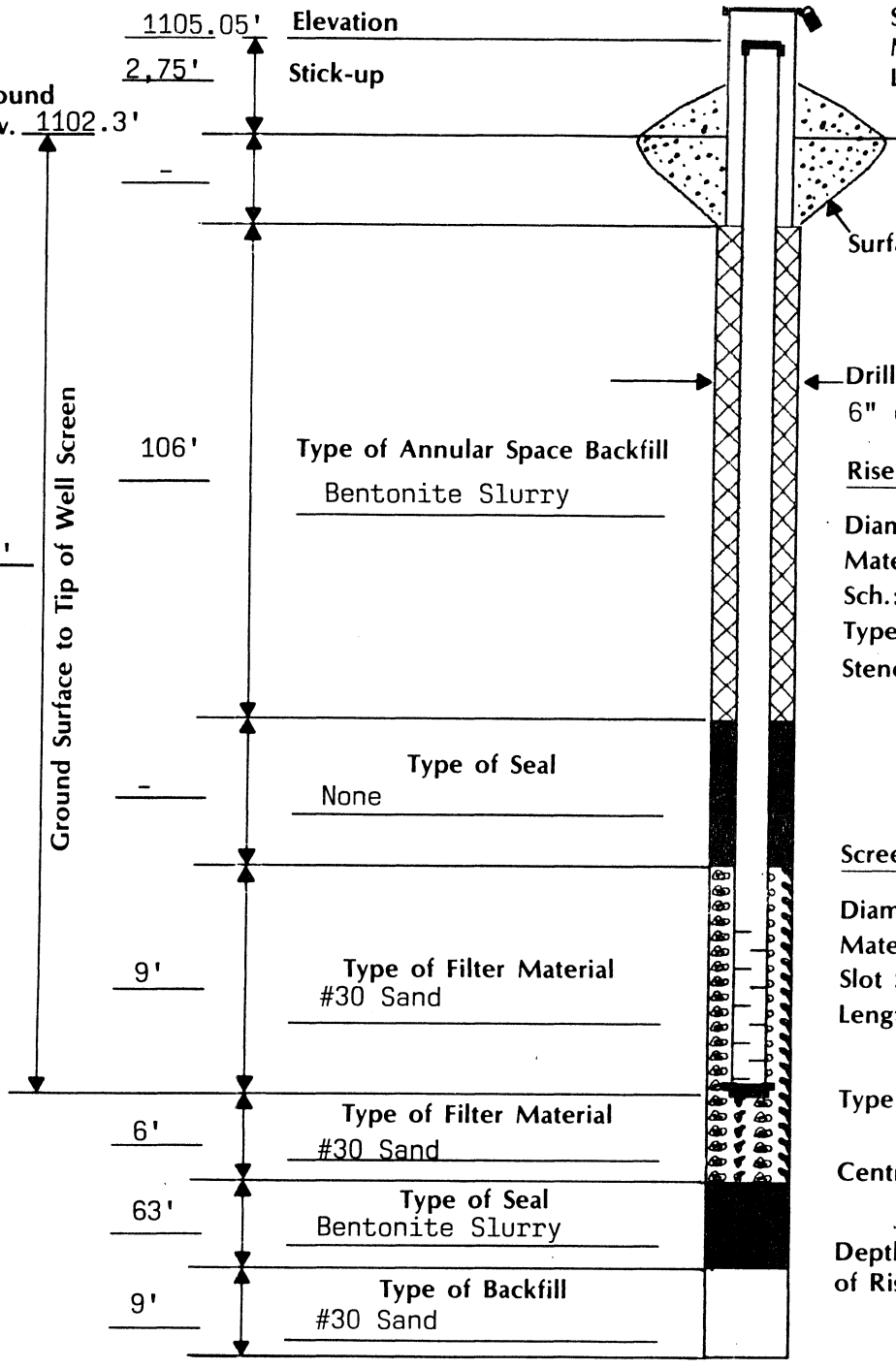
Job No | Dwg No | REV

Foth & Van Dyke

Client: Kennecott — Scope I.D.: 87K10
Project: Groundwater Modeling — Page: 1
Prepared by: KAD — Date: 11/15/88
Checked by: BJS — Date: 12/3/88

MONITORING WELL CONSTRUCTION DIAGRAM

Driller: Luisier Drilling Inc.
Well No: PZ-K2P
Drilling Method: Mud, air rotary (Installed in open hole well TW-K2)
Date Installed: 11/15/88
Coordinates: N 39750.05 E 39015.57



Protector Pipe:
Size: 6"
Material: Steel
Lock No.: 2121

Surface Seal Material: None

Drill Hole Diameter: 9" tricone 0-30'
6" downhole air hammer 30-193'

Riser:
Diameter: 2"
Material: PVC
Sch.: 80
Type of Joints: Flush threaded
Stenciled? -

Screen:
Diameter: 2"
Material: PVC
Slot Size: 0.010"
Length: 5'

Type of Cap: PVC

Centralizer: Used ☐
Not Used ☒

Depth to Water From Top of Riser at Completion: _____

NOTE: Not to Scale

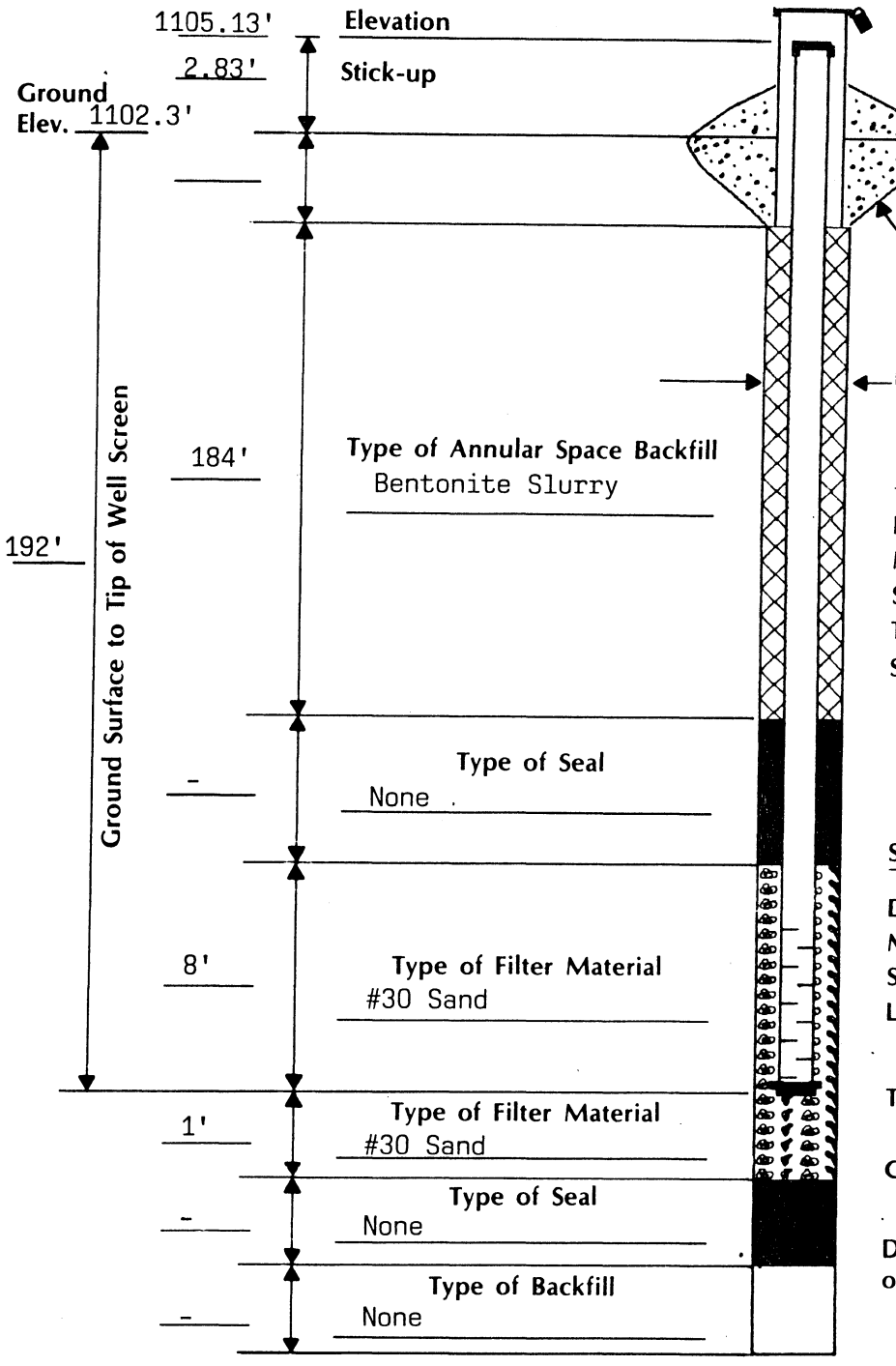
Foth & Van Dyke

Client: Kennecott — Scope I.D.: 87K10
Project: Groundwater Modeling — Page: 1
Prepared by: KAD — Date: 11/14/88
Checked by: BJS — Date: 12/3/88

MONITORING WELL CONSTRUCTION DIAGRAM

Driller: Luisier Drilling Inc.
Drilling Method: Mud, air rotary (Installed in open hole well TW-K2)
Coordinates: N 39750.05 E 39015.57

Well No: PZ -K2PP
Date Installed: 11/14/88



Protector Pipe:
Size: 6"
Material: Steel
Lock No.: 2121

Surface Seal Material: None

Drill Hole Diameter: 9" tricone 0-30'
6" downhole air hammer 30-193'

Riser:
Diameter: 2"
Material: PVC
Sch.: 80
Type of Joints: Flush threaded
Stenciled? -

Screen:
Diameter: 2"
Material: PVC
Slot Size: 0.010"
Length: 5'

Type of Cap: PVC

Centralizer: Used ☐ Not Used ☒

Depth to Water From Top of Riser at Completion: -

NOTE: Not to Scale

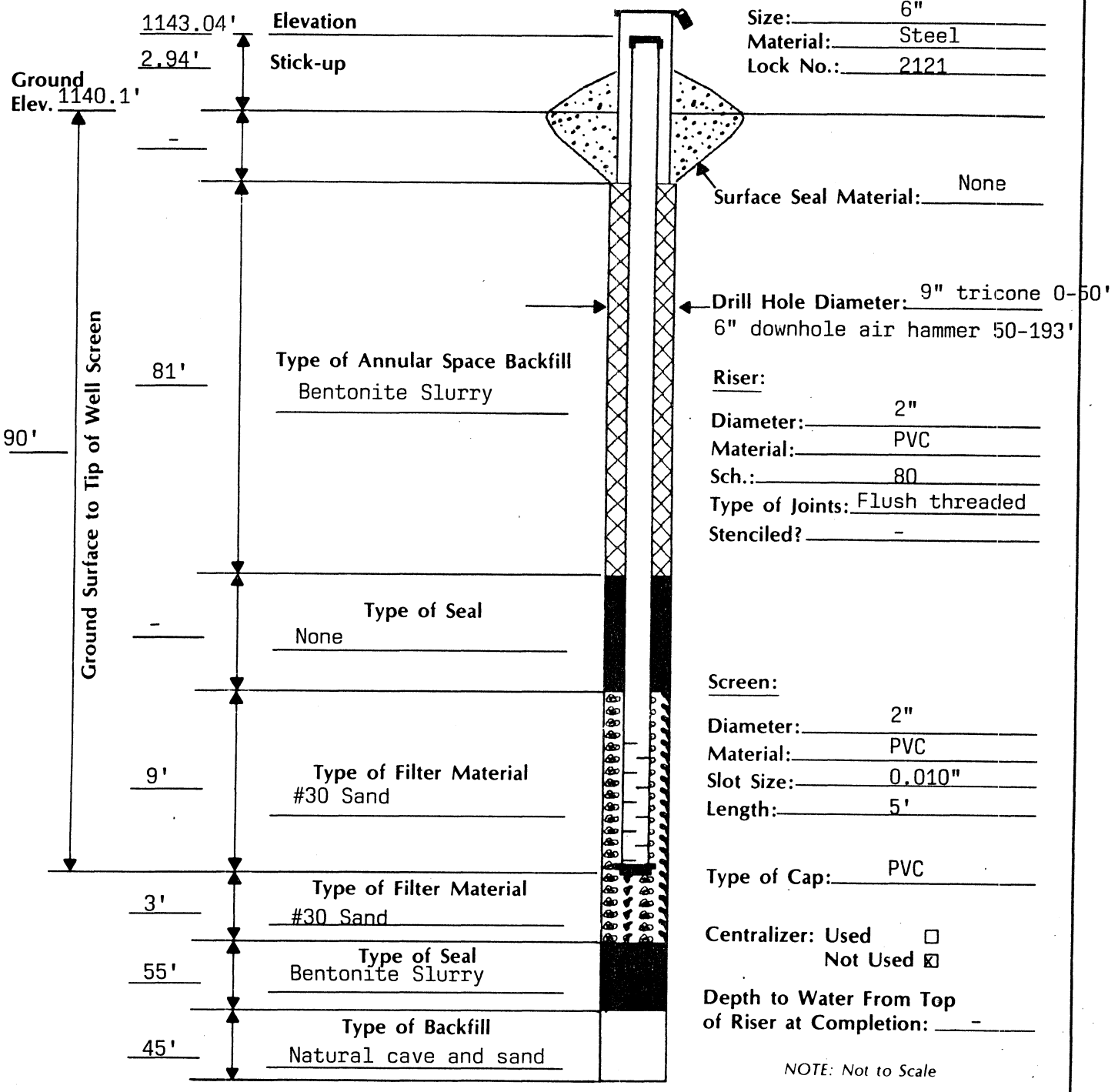
Foth & Van Dyke

Client: Kennecott — Scope I.D.: 87K10
Project: Groundwater Modeling — Page: 1
Prepared by: KAD — Date: 11/15/88
Checked by: BJS — Date: 12/3/88

MONITORING WELL CONSTRUCTION DIAGRAM

Driller: Luisier Drilling, Inc.
Drilling Method: Mud, Air Rotary (Installed in open hole well (TW-K4)
Coordinates: N 41204.15 E 40662.92

Well No: PZ-K4P
Date Installed: 11/15/88



Protector Pipe:
Size: 6"
Material: Steel
Lock No.: 2121

Surface Seal Material: None

Drill Hole Diameter: 9" tricone 0-50'
6" downhole air hammer 50-193'

Riser:
Diameter: 2"
Material: PVC
Sch.: 80
Type of Joints: Flush threaded
Stenciled? -

Screen:
Diameter: 2"
Material: PVC
Slot Size: 0.010"
Length: 5'

Type of Cap: PVC

Centralizer: Used ☐
Not Used ☒

Depth to Water From Top of Riser at Completion: -

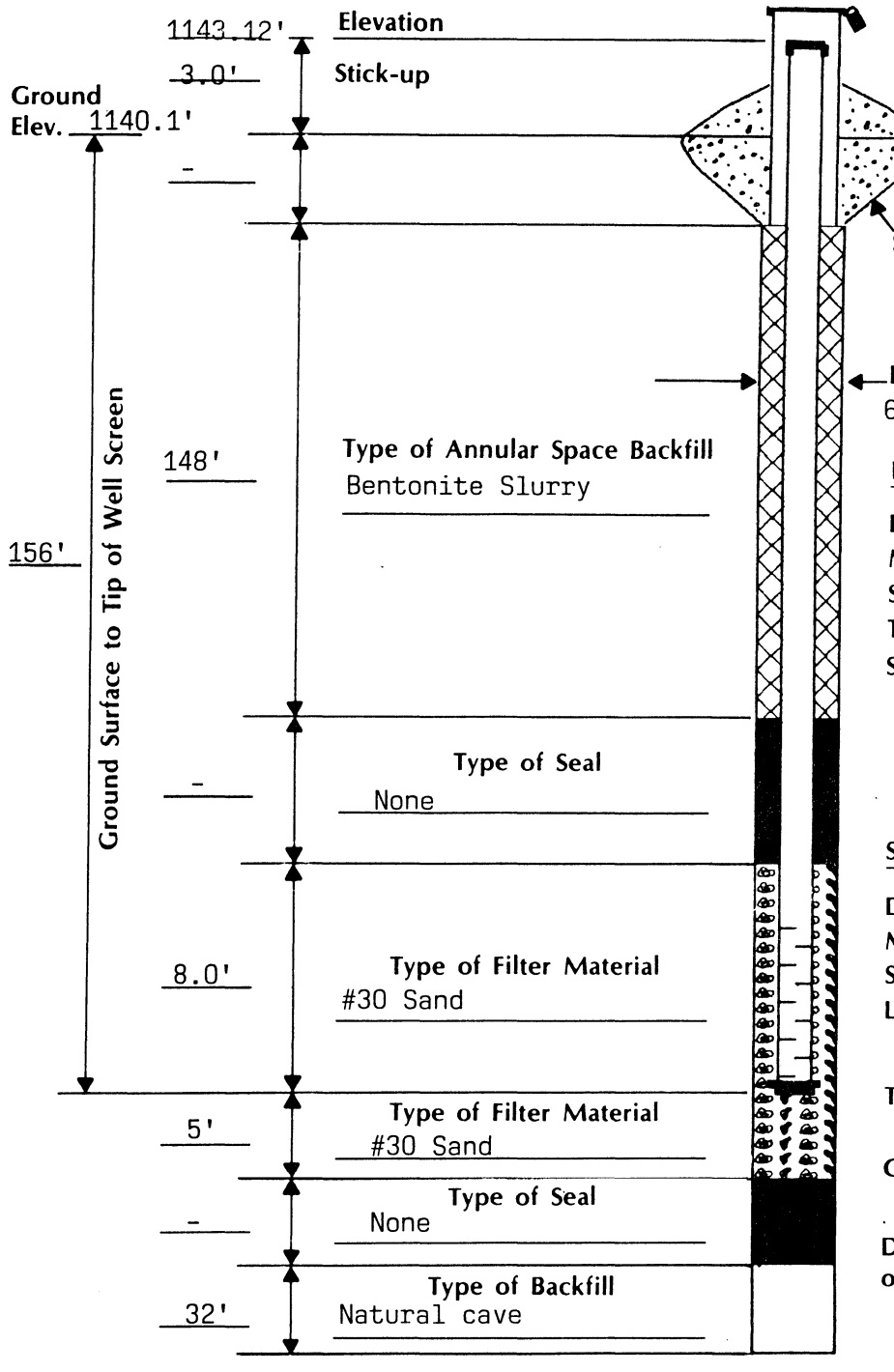
NOTE: Not to Scale

Foth & Van Dyke

Client: Kennecott — Scope I.D.: 87K10
Project: Groundwater Modeling — Page: 1
Prepared by: KAD — Date: 11/14/88
Checked by: BJS — Date: 12/2/88

MONITORING WELL CONSTRUCTION DIAGRAM

Driller: Luisier Drilling, Inc.
Drilling Method: Mud, Air Rotary (Installed in open hole well TW-K4)
Well No: PZ-K4PP
Date Installed: 11/14/88
Coordinates: N 41204.15 E 40662.92



Protector Pipe:
Size: 6"
Material: Steel
Lock No.: 2121

Surface Seal Material: None

Drill Hole Diameter: 9" tricone 0-50'
6" downhole air hammer 50-193'

Riser:
Diameter: 2"
Material: PVC
Sch.: 80
Type of Joints: Flush threaded
Stenciled? -

Screen:
Diameter: 2"
Material: PVC
Slot Size: 0.010"
Length: 5'

Type of Cap: PVC flat

Centralizer: Used ☐
Not Used ☒

Depth to Water From Top of Riser at Completion: -

NOTE: Not to Scale

LOG OF TEST BORING NO.: PZ-SP6

CLIENT: Kennecott
PROJECT: Stockpile Borings
PROJECT NUMBER: 87K10
LOCATION: Ladysmith, Wisconsin
COORDINATES: 39652 N 40205 E

SURFACE ELEVATION: 1154.81
BORING DEPTH: 36.0
DATE: 11/08/88

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLING NOTES
1154.8	--0.0	0.0-1.5	ss	1	6	1.4	Br org SILT, tr fgr sand, topsoil, loose, dry (top 4"?), rest is br fgr sandy SILT, dry, loose, non-plastic, non cohesive, very soft	ML		
1149.8	--5.0	4.5-6.0	ss	2	22	1.2	Br silty fgr-mgr SAND, loose, dry, subang to ang, some Fe-stained sand grains			
1144.8	--10.0	9.5-11.0	ss	3	53	1.3	Same as above only tending to be more fgr, dense, dry	SM		
1139.8	--15.0	14.5-16.0	ss	4	99	1.2	Same as above, dense, damp			
1134.8	--20.0	19.5-21.0	ss	5	51	1.3	Br fgr sandy SILT, non plastic, saturated(wet), dense, becoming more plastic and cohesive w/ depth			
1129.8	--25.0	24.5-26.0	ss	6	58	1.0	Dk red brn (5YR 3/8) fgr sandy SILT, tr clay, slightly plastic, cohesive, wet, dense, firm, more grvl and sand w/ depth	ML	%g-s-si-cl 5-32-46-17 LL=14 PI=0.6	
1124.8	--30.0	29.5-31.0	ss	7	30	1.5	Br fgr sandy SILT w/ fgr grvl and mgr-cgr sand, wet, dense, firm			
1119.8	--35.0	34.5-36.0	ss	8	74	1.4	Br red silty fgr-mgr SAND w/ fgr grvl and cgr sand, damp, firm, dense	SM		
							End of Boring at 36.0 feet			
1114.8	--40.0									
1109.8	--45.0									
1104.8	--50.0									
1099.8	--55.0									

DRILLING DATA

START DATE: 11/08/88
COMPLETION DATE: 11/08/88
LOGGED BY: KAD
DRILLING METHOD: RIG: CME 850 - All Terrain Mud rotary
DRILLING CONTRACTOR: Twin City Testing

WATER LEVEL INFORMATION

DEPTH AT COMPLETION:
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:
DRILLING LOSSES:

Foth & Van Dyke and Associates Inc.

2737 S. Ridge Road P. O. Box 19012 Green Bay, WI 54307-9012 414/497-2500

REPORT OF:

SIEVE ANALYSIS OF COARSE TO FINE AGGREGATES

PROJECT: Proposed Waste Rock Storage

SCOPE I.D. #: 87K10

DATE TYPED: 12-27-88

REPORTED TO: Kennecott Explorations

REPORT NUMBER: 4

TEST PERFORMED IN GENERAL ACCORDANCE OF ASTM: D1140

GENERAL DATA:

SAMPLE LOCATION: PZ-SP6

SAMPLE NUMBER:

DEPTH OF SAMPLE: 24.5'-26.0'

SAMPLED BY: B.J. Socha at F&VD

DATE SAMPLED: 11/8/88

DATED RECEIVED: 12/6/88

SOURCE OF SAMPLE:

MUNSELL COLOR CODE: 5 YR. 3/3

LABORATORY DATA:

DATE TESTED: December 6-8, 1988

TESTED PERFORMED BY: KAS

REVIEWED BY: POK (12-12-88)

24 HRS. TURN AROUND ____ YES __x__ NO

WASHED GRADATION __x__ YES ____ NO

WEIGHT OF TEST SAMPLE 201.8 GRAMS

SIEVE SIZE	WEIGHT RETAINED (gms)	% RETAINED	% PASSING	PROJECT SPECIFICATION % PASSING BY WEIGHT	SOURCE OF SPECIFICATION
3"					
1½					
1					
3/4	0	0	100		
1/2	3.5	1.7	98.3		
3/8	2.1	1.0	97.3		
#4	5.5	2.7	94.6		
10	7.4	3.7	90.9		
40	19.1	9.5	81.4		
100	26.6	13.2	68.2		
200	11.9	5.9	62.3		
PAN	125.9	62.4			

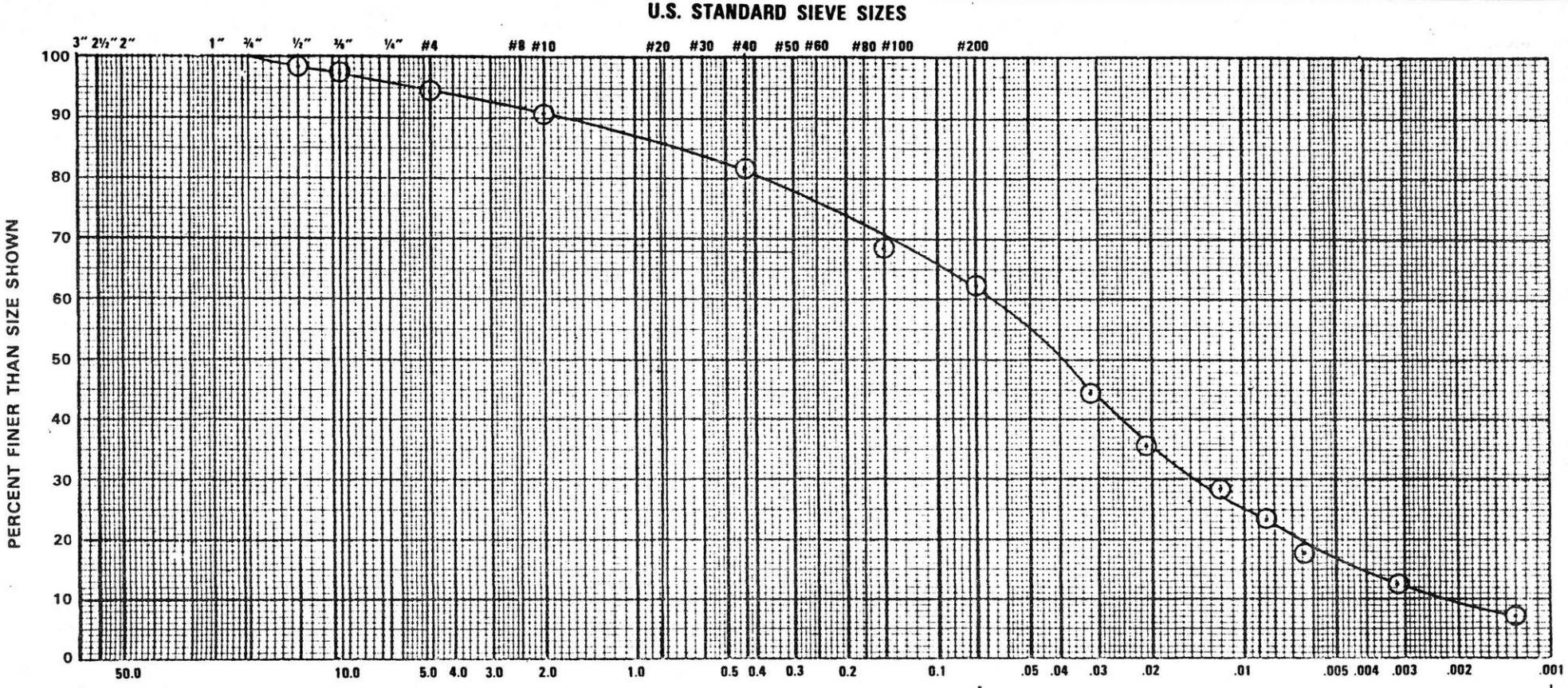
REMARKS:

FORM #329 SLB (Rev. 4/88)

BY: Robert R. Rouse

Foth & Van Dyke and Associates Inc.

GRAIN SIZE DISTRIBUTION CURVE



GRAVEL		SAND			SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE		
% =	% = 5.4	% = 3.7	% = 9.5	% = 19.0	% = 45.6	% = 16.8

PROJECT: Kennecott - Proposed Waste Rock Storage DATE: 12-12-88 SAMPLE NO.: 4

LOCATION SAMPLED: Boring: PZ-SP6 ELEV. OR DEPTH: 24.5'-26.0' DRAWN BY: POK APPROVED BY: RRR

ATTERBERG LIMITS: LL 14.0 PL 13.4 PI 0.6 SAMPLED MOISTURE CONTENT (%): 12.8 COEFFICIENTS: Cc = Cu =

SAMPLE SOURCE: MUNSELL COLOR CODE: 5 YR. 3/3 DATE SAMPLED: 11-8-88

SOIL CLASSIFICATION (ASTM: D2487) SANDY SILT, a little gravel, dark reddish brown, (ML)

FORM #411 SL (2/87)

3.5-H-34

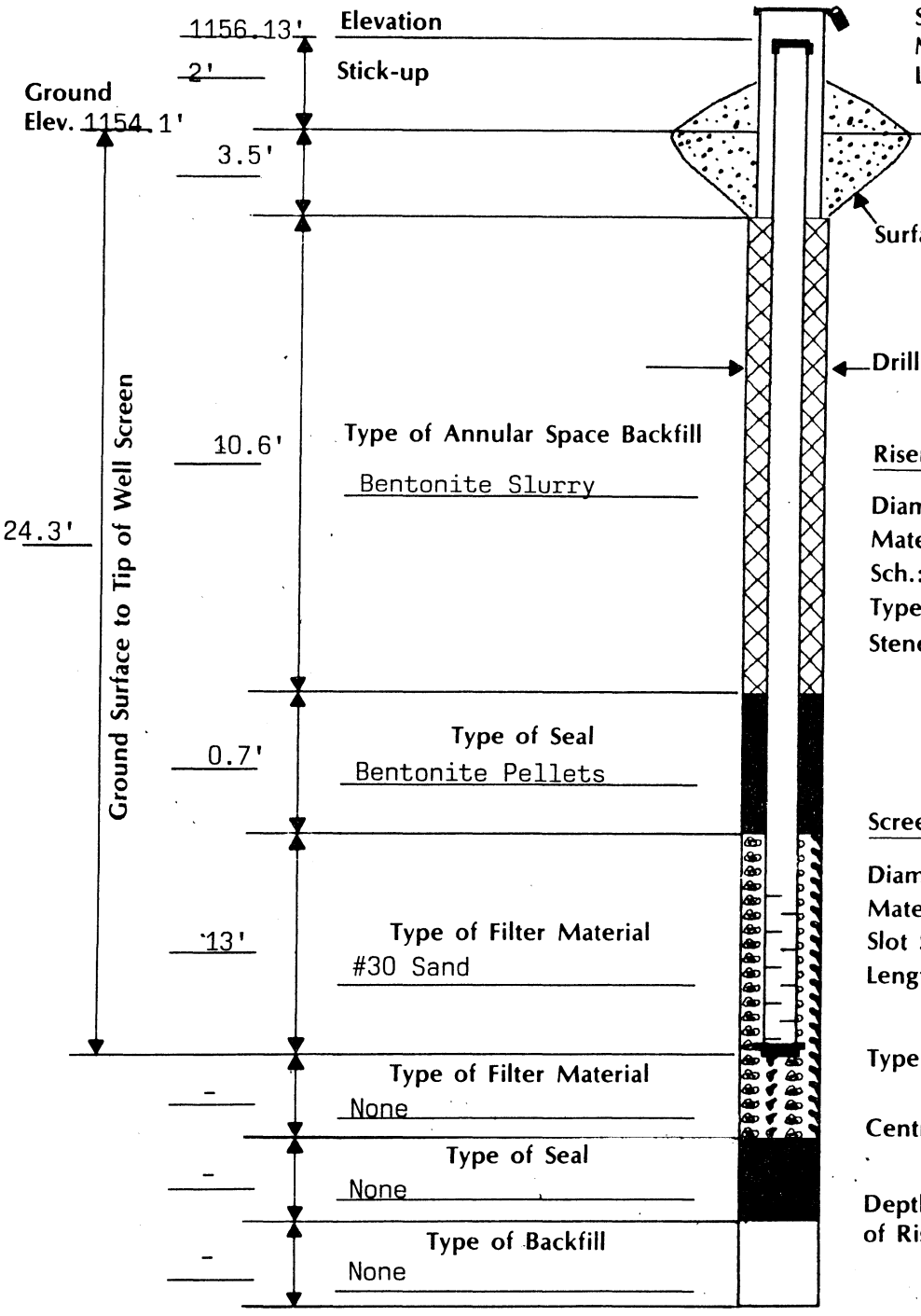
Foth & Van Dyke

Client: Kennecott — Scope I.D.: 87K10
Project: — Page: 1
Prepared by: KAD — Date: 11/15/88
Checked by: BJS — Date: 12/2/88

MONITORING WELL CONSTRUCTION DIAGRAM

Driller: Twin City Testing Corp.
Drilling Method: Hollow Stem Augers
Coordinates: N 39,652.74 E 40,204.73

Well No: PZ-SP6
Date Installed: 11/15/88



Protector Pipe:
Size: 4"
Material: Steel
Lock No.: 2121

Surface Seal Material: Cement

Drill Hole Diameter: 8"

Riser:
Diameter: 2"
Material: PVC
Sch.: 40
Type of Joints: Flush threaded
Stenciled? No

Screen:
Diameter: 2"
Material: PVC
Slot Size: 0.010"
Length: 10'

Type of Cap: PVC

Centralizer: Used ☐
Not Used ☒

Depth to Water From Top of Riser at Completion: 20'

NOTE: Not to Scale

FORM #309 GEM (Rev. 11/88)

LOG OF TEST BORING NO.: PZ-SP8

CLIENT: Kennecott
PROJECT: Stockpile Borings
PROJECT NUMBER: 87K10
LOCATION: Ladysmith, Wisconsin
COORDINATES: 39662 N 40905 E

SURFACE ELEVATION: 1142.79
BORING DEPTH: 36.0
DATE: 11/11/88

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLING NOTES
1142.8	--0.0	0.0-1.5	ss	1	10	1.5	Top .9' is blk fgr sandy SILT w/ org, moist to wet, very soft, next .6' is lt grey to red br mottled fgr sandy SILT, tr fgr-cgr grvl, moist, loose, 2.5-4.5 is red br	OL / ML / ML/CL		
1137.8	--5.0	4.5-6.0	ss	2	42	1.3	sandy, silty CLAY w/ fgr-cgr grvl, moist, v stiff Reddish br to lt br to grey silty SAND w/ fgr-cgr grvl, tr clay, moist, firm to dense, mottled,	SM		
1132.8	--10.0	9.5-11.0	ss	3	17	1.2	cgr grvl/cobbles @ 6' Reddish br clayey SAND w/ silt and fgr-cgr grvl, moist, dense	SC		
1127.8	--15.0	14.5-16.0	ss	4	12	1.5	Reddish br layered silty SAND and clayey SAND w/ fgr-cgr grvl and 1-2" seams of mgr-cgr SAND @ 11.8' & 14.5', saturated, firm to loose, cgr grvl and cobbles @ 10.0-11.5	SC/SM SP		
1122.8	--20.0	19.5-21.0	ss	5	15	1.5	Same.			
1117.8	--25.0	24.5-26.0	ss	6	9	1.1	Red br clayey fgr-cgr SAND, tr silt, firm, dense, plastic, cohesive	SC		
1112.8	--30.0	29.5-31.0	ss	7	7	0.8	Red br fgr-cgr SAND w/ clay and silt, plastic, soft, cohesive			
1107.8	--35.0	34.5-36.0	ss	8	7	0.5	Grey lean CLAY w/ fgr-cgr sand, tr fgr grvl, cohesive, soft, plastic	CL		
							End of Boring at 36.0 feet			
1102.8	--40.0									
1097.8	--45.0									
1092.8	--50.0									
1087.8	--55.0									

DRILLING DATA

START DATE: 11/11/88 @ 10:10 am
COMPLETION DATE: 11/11/88 @ 2:10 pm
LOGGED BY: REM/KAD
DRILLING METHOD: RIG: CME 850 - All Terrain HSA to 19', Mud to 36'
DRILLING CONTRACTOR: Twin City Testing

WATER LEVEL INFORMATION

DEPTH AT COMPLETION: 14.4' @ 16.0'
LATER TIME/DEPTH: 19.3' @ 21.0'
LATER TIME/DEPTH: NA
CAVE IN DEPTH: NA
DRILLING LOSSES: NA

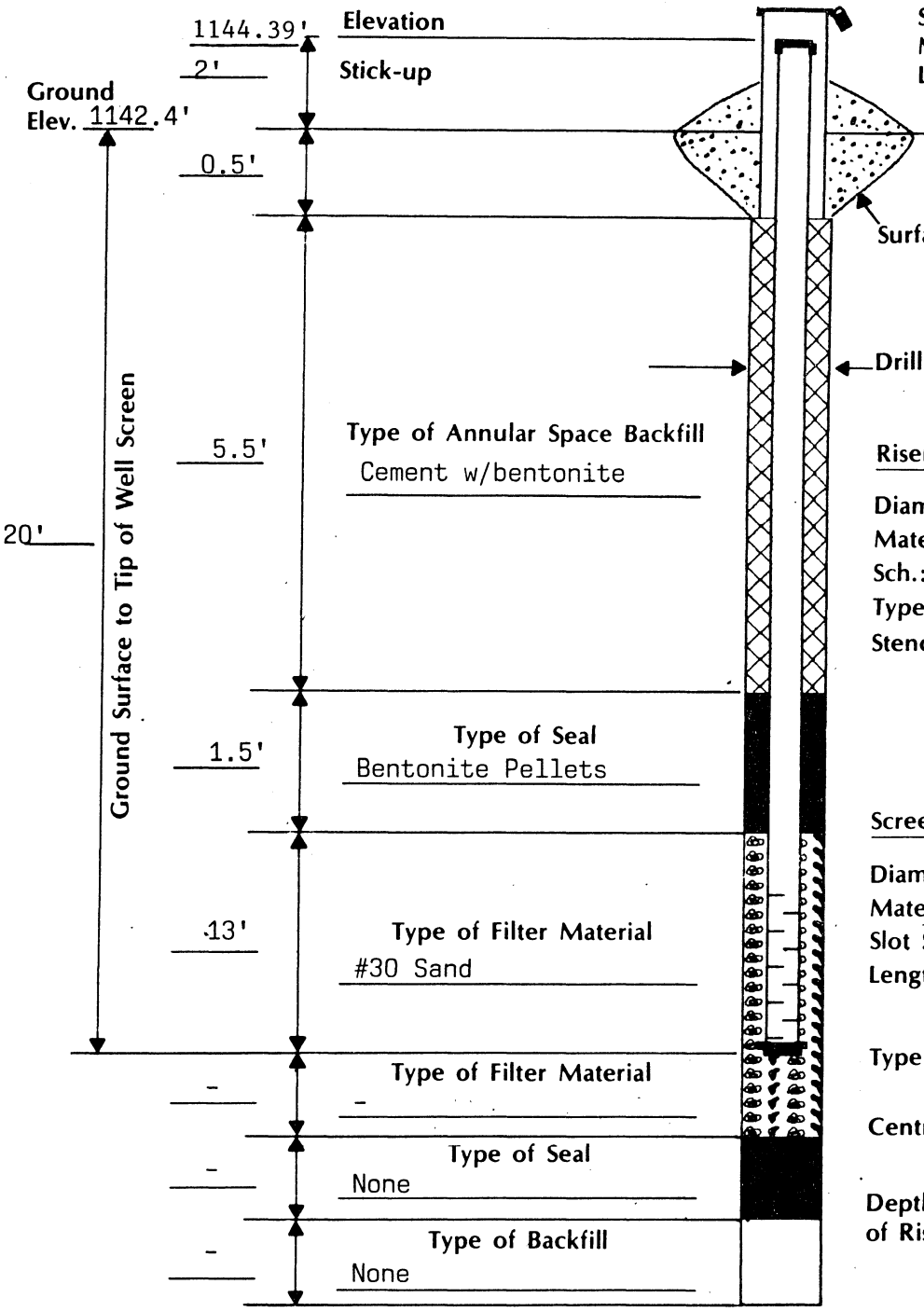
Foth & Van Dyke

Client: Kennecott — Scope I.D.: 87K10
Project: Type II Rock Storage — Page: 1
Prepared by: KAD — Date: 11/15/88
Checked by: BJS — Date: 12/2/88

MONITORING WELL CONSTRUCTION DIAGRAM

Driller: Twin City Testing Corp.
Drilling Method: Hollow Stem Augers
Coordinates: N 39662.24 E 40904.66

Well No: PZ-SP8
Date Installed: 11/15/88



Protector Pipe:
Size: 4"
Material: Steel
Lock No.: 2121

Surface Seal Material: Cement

Drill Hole Diameter: 8"

Riser:
Diameter: 2"
Material: PVC
Sch.: 40
Type of Joints: Flush threaded
Stenciled? -

Screen:
Diameter: 2"
Material: PVC
Slot Size: 0.010"
Length: 10'

Type of Cap: PVC

Centralizer: Used ☐ Not Used ☒

Depth to Water From Top of Riser at Completion: 17'

NOTE: Not to Scale

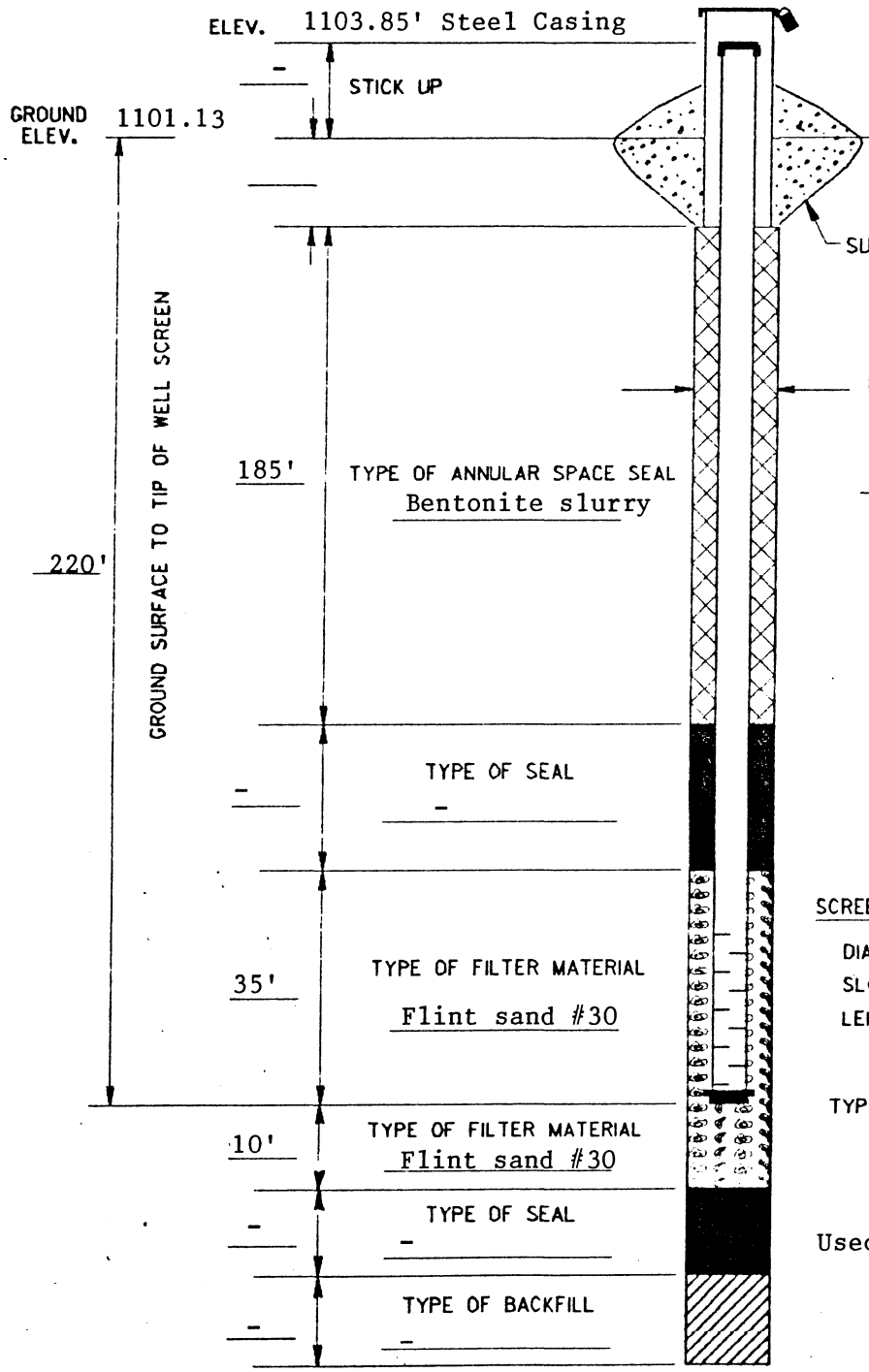
APPENDIX 3.5-I

Geologic Logs, Soil Test Data, Well Construction Diagrams, and Well Development Forms for the Geotechnical Testing Program, 1987

MONITORING WELL CONSTRUCTION DIAGRAM

WELL NO: PZ-R1
DATE INSTALLED: 1-7-88 by Luisier Drilling Inc.
DRILLER: Longyear Company
DRILLING METHOD: Mud rotary
Angle Hole No. 22-137A
oriented S55-60°E at 60° from horizontal

CLIENT: Kennecott
PROJECT: Geotechnical
SCOPE I.D.: 87K10
BY: P.G. (Kennecott)



PROTECTOR PIPE:
SIZE 4"
MATERIAL Steel
LOCK NO. Master 2121

SURFACE SEAL MATERIAL Cement

DRILL HOLE DIAMETER 5-5/8" 0-90'
3-7/8" 90-230'

PIPE:
DIAMETER 1-1/4"
MATERIAL PVC
SCH. 40
TYPE OF JOINTS Flush threaded

SCREEN:
DIAMETER 1-1/4"
SLOT SIZE 0.020"
LENGTH 20'

TYPE OF CAP PVC

Used 4 (100 lb.) bags of sand

Foth & Van Dyke
Geosciences & Environmental Management Division
Revised 3/88 By BJS
Drawn By MRS

BEAR CREEK MINING CO.

Hole 22-137-A

SECTION 401

COORDINATES 40034.7509N, 38723.6845E

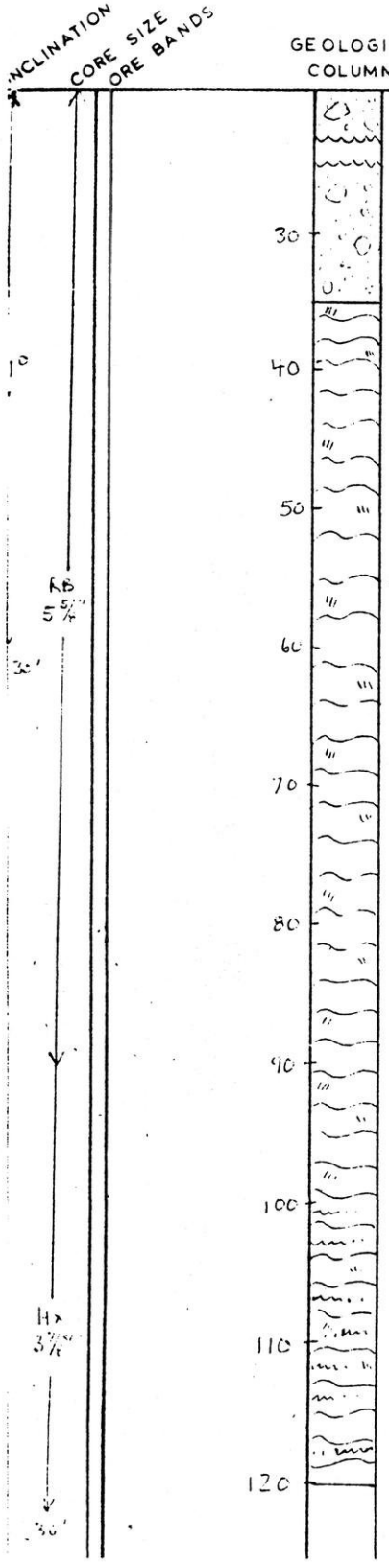
AZIMUTH 135°

ELEVATION 1101.12

DATE STARTED 12-18-87
COMPLETED 12-20-87

LENGTH OF HOLE 230'

% ORE RECOVERY



	GEOLOGIC DESCRIPTION
0-35'	GLACIAL OVERBURDEN Sandy till with boulders and cobbles. Local clean sand layers toward bottom of interval. Rotary drilling - no core.
35-90'	PRECAMBRIAN CONTACT First micaceous flakes appear at 35'. The drilling pressures indicated the first 5-8' of the sequence were clay rich, probably saprolitic Precambrian. Rotary drilling - no core.
90-100'	BIOTITE-CHLORITE SCHIST (UNIT 2c) Strongly-stained along foliation and fine fractures. 6-8% iron-oxide stained, fine-grained, tabular and squarish, relict crystal sites, probably of pyrite and a mafic mineral.
100-222'	BIOTITE-CHLORITE SCHIST (UNIT 2c, LOCAL 2a) Same as 90-100', but generally less altered. Core is more typical chloritic green. Local quartz stringers parallel to foliation. 105.7-107.3' better argillized, iron-oxide-stained; biotite stands out as altered bronzey grains, local relict quartz fragments. 123.8-128' better argillized. 100-135' generally intercalated with more sericitic Unit 2a. After 132' biotite is more common, occasionally concentrated in discontinuous lenses or thin beds. Typical bronzey-brown and partially iron-oxide-stained weathered surface (3-6%). Trace-1% partially leached fine-grained pyrite. 152-164', 171-172'. Although lithic fragments occur locally as quartz, or quartz-sericite/kaolinite, lithic fragments are particularly abundant over limited intervals. The most obvious fragments (2-4%) are 1/4-3/4", irregular, sub-rounded and typically iron-oxide-stained quartz-sericite schist fragments; sericite usually altered in some degree to kaolinite. The iron-oxide staining is usually along the fragment selvedges; trace-1% iron-oxide-stained pyrite vacancies.

(continued next page)

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Hole 22-137-A

SECTION 401
COORDINATES 40034.7509N, 38723.6845E
AZIMUTH 135°
ELEVATION 1101.12

DATE STARTED 12-18-87
COMPLETED 12-20-87
LENGTH OF HOLE 230'
% ORE RECOVERY

INCLINATION / CORE SIZE / ORE BANDS	GEOLOGIC COLUMN		GEOLOGIC DESCRIPTION
	130	100-222' (cont'd)	After 102', core is commonly mildly-strongly stained by small amounts of iron-oxide concentrated along hairlike-filament fractures, generally not over 1/16" wide. The fractures are prevalent in minor (½-3") zones between 185-195' and 200-213'.
	140		216-222' locally fractures open up into stringers ½-3" wide; these wider, healed fractures usually consist of light-gray, coarse-grained quartz with minor hematite-stained fracture smears. Trace of blue-green chlorite; trace partially altered pyrite sites. This quartz infills local, minor (<2" wide), mildly brecciated chlorite schist.
	150		
	160	222-230'	BIOTITE-CHLORITE-SCHIST AND BIOTITE-SERICITE-QUARTZ-CHLORITE SCHIST (UNIT 2c and 2a) Sub-units of lithic-rich (up to 20%) rocks become intercalated with more typical biotite-chlorite schist. Lithic fragments are usually either gray quartz-dark quartz-sericite schist.
	170		
	180		
	190		
	200		
	210		
	230	E.O.H	

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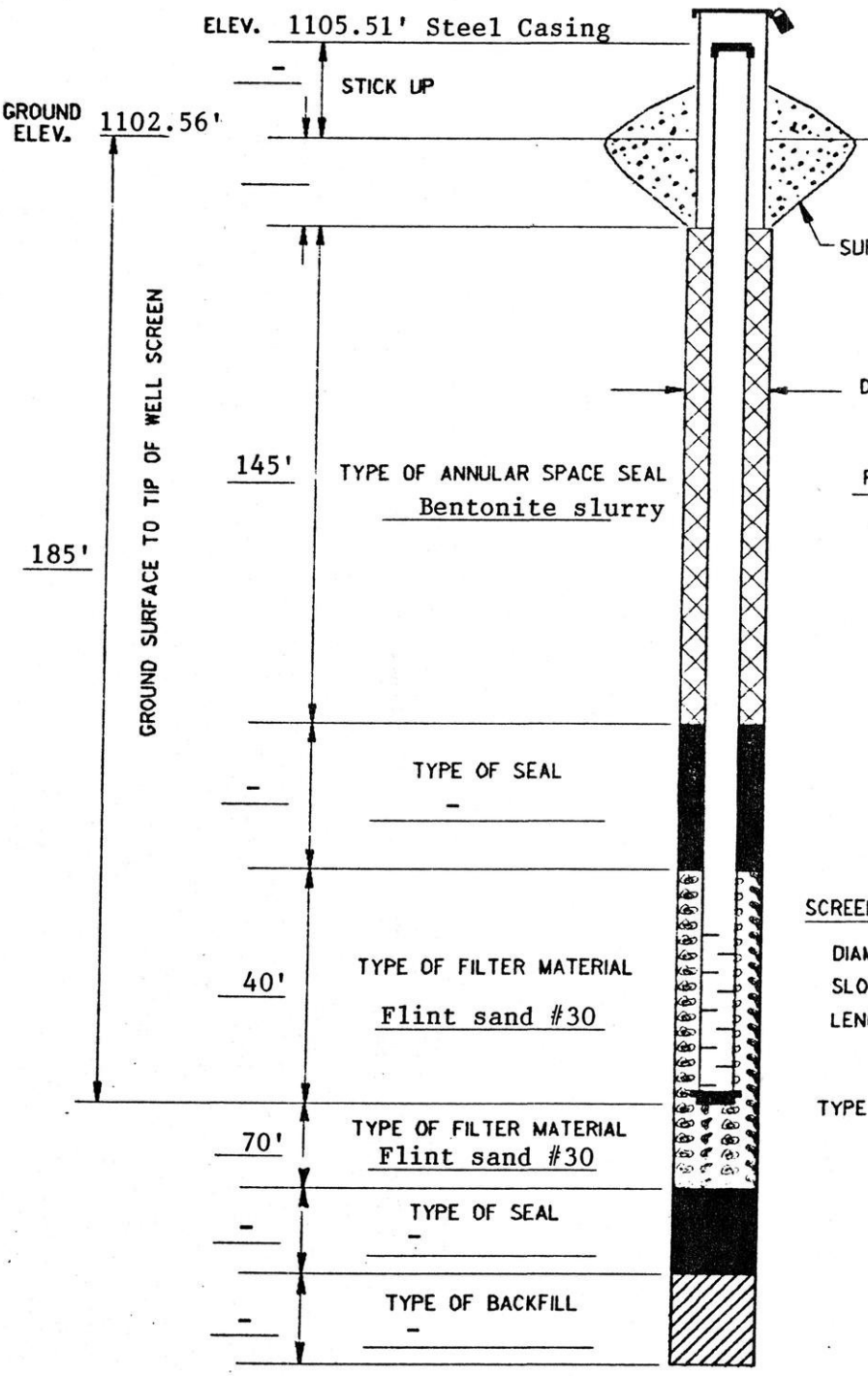
MONITORING WELL CONSTRUCTION DIAGRAM

WELL NO: PZ-R2
DATE INSTALLED: 1-8-88 by Luisier Drilling Inc.
DRILLER: Longyear Company
DRILLING METHOD: Mud rotary

CLIENT: Kennecott
PROJECT: Geotechnical
SCOPE I.D.: 87K10
BY: P.G. (Kennecott)

Angle Hole No. 22-138
Oriented S55-60°E at 60° from horizontal



PROTECTOR PIPE:
SIZE 4"
MATERIAL Steel
LOCK NO. Master 2121

SURFACE SEAL MATERIAL Cement

DRILL HOLE DIAMETER 5-5/8" 0-15'
3-7/8" 15-255'

PIPE:
DIAMETER 1-1/4"
MATERIAL PVC
SCH. 40
TYPE OF JOINTS Flush threaded

SCREEN:
DIAMETER 1-1/4"
SLOT SIZE .020"
LENGTH 20'

TYPE OF CAP PVC

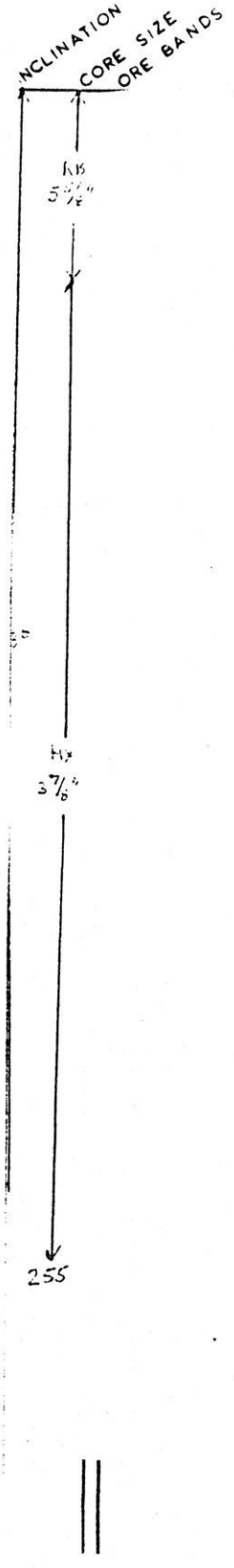
Foth & Van Dyke
Geosciences & Environmental Management Division
Revised 3/88 By BJS
Drawn By MRS

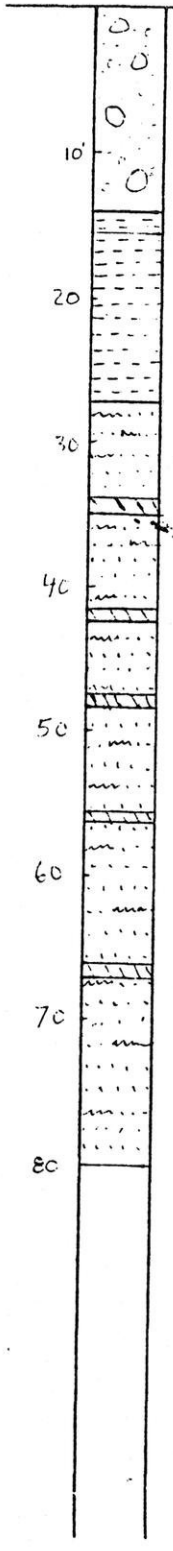
BEAR CREEK MINING CO.

Hole 22-138

SECTION 401
COORDINATES 39823.9677N, 38975.9522E
AZIMUTH 135°
ELEVATION 1103.05

DATE STARTED 11-17-87
COMPLETED 11-19-87
LENGTH OF HOLE 255'





GEOLOGIC DESCRIPTION

0-14' GLACIAL OVERBURDEN
Sandy, poorly sorted till with local clay-rich zones; local boulders and cobbles.

14-27.3' GOSSAN-LEACHED CAPROCK
Leached, vuggy, limonitic clay with pervasively iron-oxide-stained, medium-coarse-grained, subangular, moderately-poorly cemented chert. Relict "quartz eyes" to .4", observed locally.

27.3-91.4' SERICITE QUARTZ SCHIST WITH LOCAL SEMI-MASSIVE-MASSIVE SULPHIDES (UNIT 1a)
Bleached white, well-foliated, sericite-quartz schist. Fine-grained quartz grains, lenses and laminated bands (40-60%) in a partially kaolinized sericite schist. Sulphide-bearing-averaging 7-9% pyrite disseminated grains, discontinuous lenses and laminations or thin beds.

(continued next page)

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Hole 22-138

SECTION 401
COORDINATES 39823.9677N, 38975.9522E
AZIMUTH 135°
ELEVATION 1103.05

DATE STARTED 11-17-87
COMPLETED 11-19-87
LENGTH OF HOLE 255'

INCLINATION / CORE SIZE / ORE BANDS	GEOLOGIC COLUMN	GEOLOGIC DESCRIPTION
		27.3-91.4' (cont'd)
90		
100		
50°		
110		
120		91.4-103' MASSIVE SULPHIDE
		103-110.4' SEMI-MASSIVE SULPHIDE 103.5-105.2', pyrite interlayers in sericite-quartz schist;

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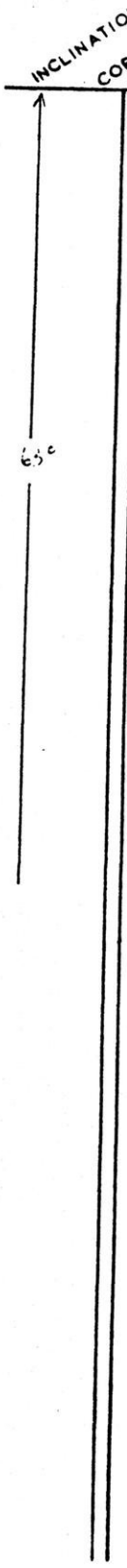
Hole 22-138

SECTION 401
COORDINATES 39823.9677N, 38975.9522E
AZIMUTH 135°
ELEVATION 1103.05

DATE STARTED 11-17-87
COMPLETED 11-19-87
LENGTH OF HOLE 255'



110.4-135.7' QUARTZ-SERICITE SCHIST WITH BIOTITE-QUARTZ-CHLORITE SCHIST (UNIT 2b with 2a)
Moderately-strongly kaolinized, bleached sericite-rich schist. Similar to 27.3-91.4', but with less quartz. Trace-3% medium-coarse-grained pyrite
Intercalated biotite-chlorite-rich schist (2a).

135.7-160.2' BIOTITE-QUARTZ-SERICITE-CHLORITE SCHIST (UNIT 2a)
Bleached chlorite, locally sericite-rich phyllite. Trace-½% sub-rounded fine-coarse, gray-white quartz and fine-grained crystals of biotite. Trace-2% pyrite.
Sericite areas better argillized.
149-155' less sulphides (trace-½%).

160.2-165' CHLORITE SCHIST (UNIT 4a)
Heterogenous unit with distinct mafic lithic tuff and moderate-dark green chlorite schist. Porphyritic (very coarse to fine-grained), gray-green well-foliated lithic tuff. 10-15% dark green, soft, very coarse (up to .3") chloritic lithic fragments with whitish, blocky relict feldspar crystals. The fragments have a feathered texture and white altered rims. 1-3% pyrite-bearing medium-coarse grained, elongated chlorite lithic fragments. Pyrite (trace-1%) along foliation and local fractures. Intercalated with moderately-poorly foliated chlorite schists

165-178' CHLORITE SCHIST (UNIT 4a)
Same as above sequence but core is generally iron-oxide stained. A few minor (<¼-½") fractures filled with earthy iron-oxides, quartz and clay. Chlorite is usually bleached and partially altered to bluish-green argillite.

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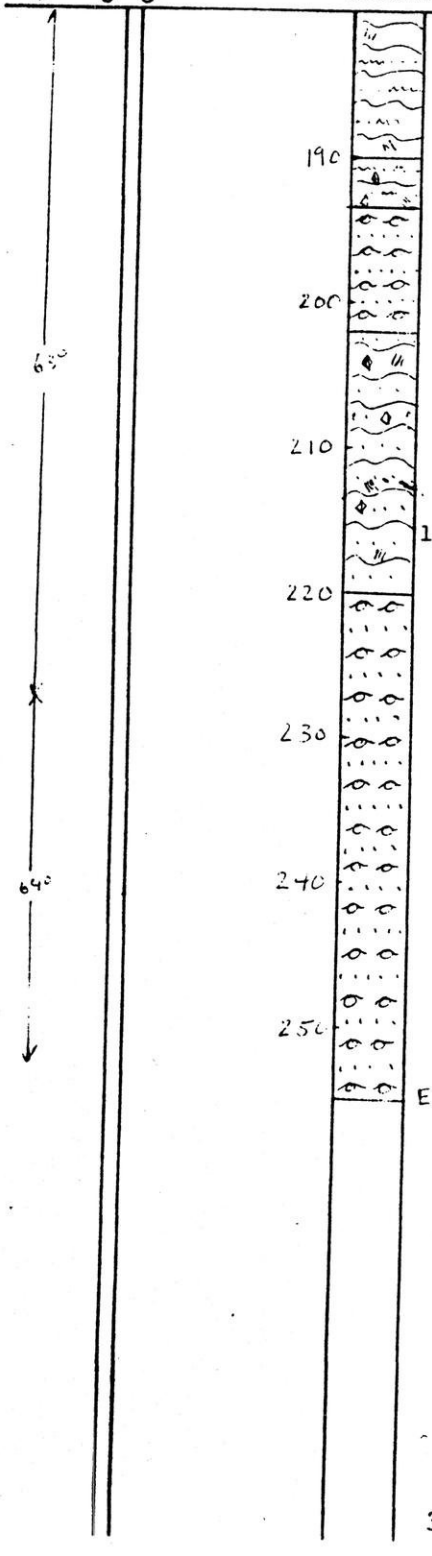
Hole 22-138

SECTION 401
COORDINATES 39823.9677N, 38975.9522E
AZIMUTH 135°
ELEVATION 1103.05

DATE STARTED 11-17-87
COMPLETED 11-19-87
LENGTH OF HOLE 255'



GEOLOGIC DESCRIPTION

178-190' BIOTITE-QUARTZ-SERICITE-CHLORITE SCHIST (UNIT 2a)
Light-dark green, moderately-poorly foliated, chloritic phyllite with isolated grains or lenses of biotite-sericite.

Local, < 1/16-1/4" argillite-filled fractures with iron-oxide staining selvedges, especially 181.3-185'.

190-193.4' ANDALUSITE-BIOTITE-QUARTZ-CHLORITE-SERICITE SCHIST (UNIT 2a)
Bleached chlorite, local greasy yellow-white sericite. 3-4% biotite; trace-½% blocky, fine-grained, red-brown andalusite. A few local slickenside surfaces and iron-oxide-clay-filled fractures.

193.4-202' QUARTZ AUGEN SCHIST (UNIT 3a WITH LOCAL 2a)
Distinct, sub-rounded, medium-grained, blue-gray quartz eyes (3-6%), 6-8% white-gray, coarse-grained stretched quartz lithic fragments, 5% rectangular, saussuritized or kaolinized relict feldspar crystals. Local 1/8-1/4" healed quartz-filled, iron-oxide stained fractures. Local interlayers of Unit 2a.

202-220' ANDALUSITE-BIOTITE-QUARTZ-CHLORITE (UNIT 2a)
As 178-190'.
Local iron-oxide-stained, clay-filled filament fractures.

220-255' QUARTZ AUGEN SCHIST (UNIT 3a)
As 193.4-202'.
Rare quartz-healed, tight fractures (especially 224-227'). Local slickenside surfaces, in sericitic interlayers 225-230'.
252.6, 3/4", white, coarse-grained, quartz stringer within kinked foliation surfaces.

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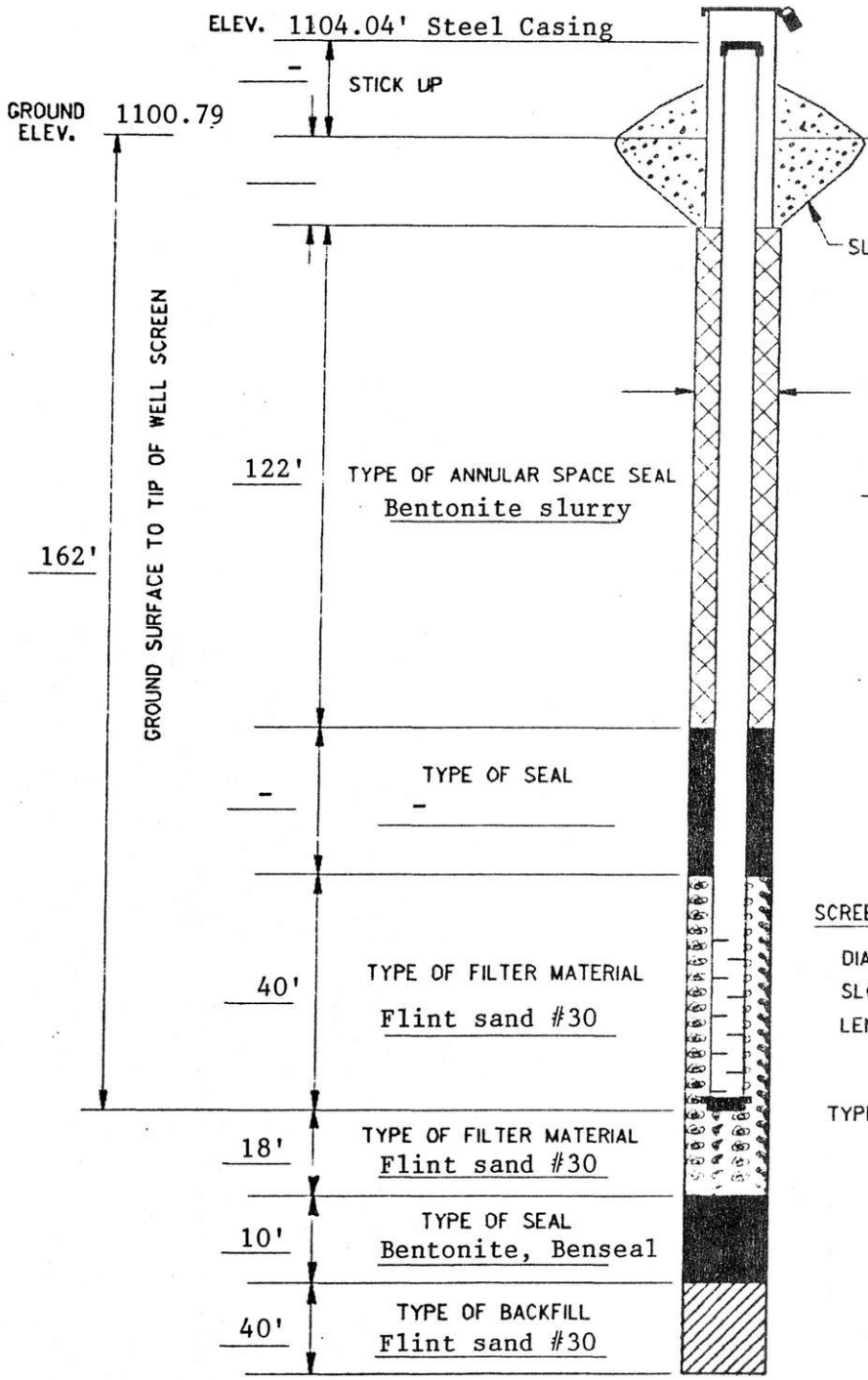
MONITORING WELL CONSTRUCTION DIAGRAM

WELL NO: PZ-R3
DATE INSTALLED: 1-11-88 by Luisier Drilling Inc.
DRILLER: Longyear Company
DRILLING METHOD: Mud rotary

CLIENT: Kennecott
PROJECT: Geotechnical
SCOPE I.D.: 87K10
BY: P.G. (Kennecott)

Angle Hole No. 22-139
Oriented N5-10°E at 60° from horizontal



PROTECTOR PIPE:
SIZE 4"
MATERIAL Steel
LOCK NO. Master 2121

SURFACE SEAL MATERIAL Cement

DRILL HOLE DIAMETER 5-5/8" 0-50'
3-7/8" 50-240'

PIPE:
DIAMETER 1-1/4"
MATERIAL PVC
SCH. 40
TYPE OF JOINTS Flush threaded

SCREEN:
DIAMETER 1-1/4"
SLOT SIZE .020"
LENGTH 20'

TYPE OF CAP PVC

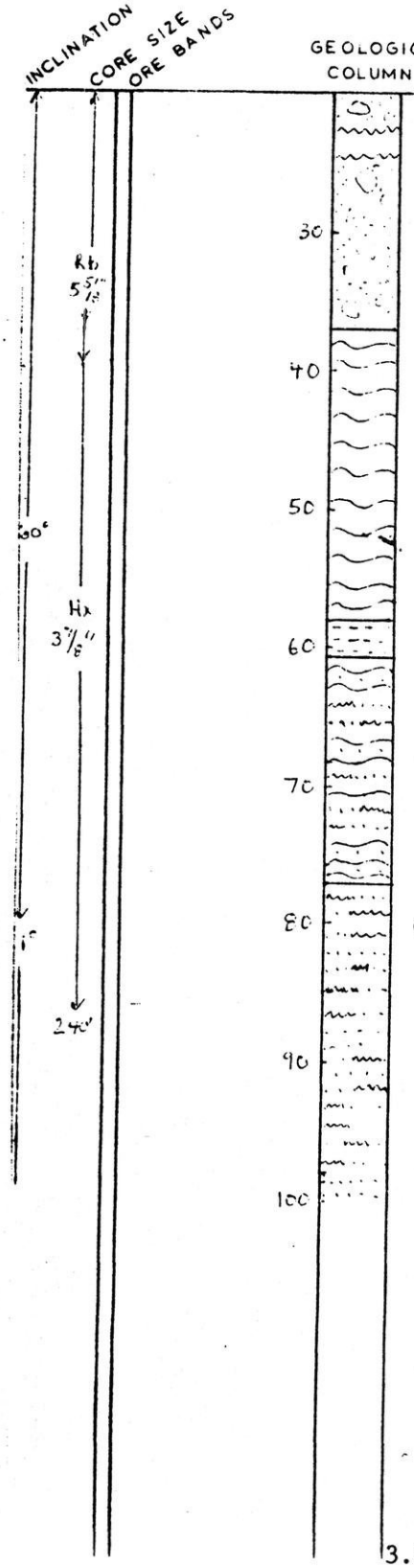
Foth & Van Dyke
Geosciences & Environmental Management Division
Revised 3/88 By BJS
Drawn By MRS

BEAR CREEK MINING CO.

Hole 22-139

SECTION 401.65
COORDINATES 39980.7130N, 38911.5264E
AZIMUTH 0°
ELEVATION 1101.21

DATE STARTED 11-20-87
COMPLETED 11-23-87
LENGTH OF HOLE 240'



GEOLOGIC DESCRIPTION

0-37' GLACIAL OVERBURDEN
Sandy, poorly-sorted till with frequent cobbles and boulders. First sericite or bleached chlorite in cuttings at 37'.

37-58' CHLORITE SCHIST
Soft, weathered, argillized, moderately-foliated chlorite-schist. Commonly iron-oxide stained, and chlorite has altered in some degree to bluish-gray-maroon clay minerals. 39-43' very soft, clay-rich interval with local relict quartz fragments.

58-60.3' HEMATITE-RICH METASEDIMENT
Iron-oxide stained, massive, medium-coarse-grained "dirty" hematite-rich interlayer. Locally, quite vuggy (5% of interval). 40-55% hematite, frequently pisolitic-colloidal growths, coated with a limonite "shell". The vugs are lined with drusy very fine-grained, dark green crystalline mineral (probably epidote). The remainder of this rock is fine-grained non-descript, red-brown argilliceous matrix. Trace of carbonate along vugs. Trace-½% rectangular, leached pyrite vacancies. Local hematite/epidote veinlets.

60.3-68' WEATHERED SERICITE-QUARTZ-CHLORITE SCHIST (UNIT 2a)
As 37-58'.

68-77' SERICITE-QUARTZ-CHLORITE SCHIST (UNIT 2a)
Similar to above, but less weathered. Chlorite bleached, but only weakly argillized. Partially-leached, squarish, fine-medium-grained pyrite vacancies (trace-½%). Local quartz-sericite laminations, better altered; more frequent toward bottom of interval.

Gradational contact.

77-98' QUARTZ-SERICITE SCHIST WITH SERICITE-QUARTZ SCHIST (UNIT 2b with 1a)
White, bleached, well-foliated Local gray, cherty laminations.

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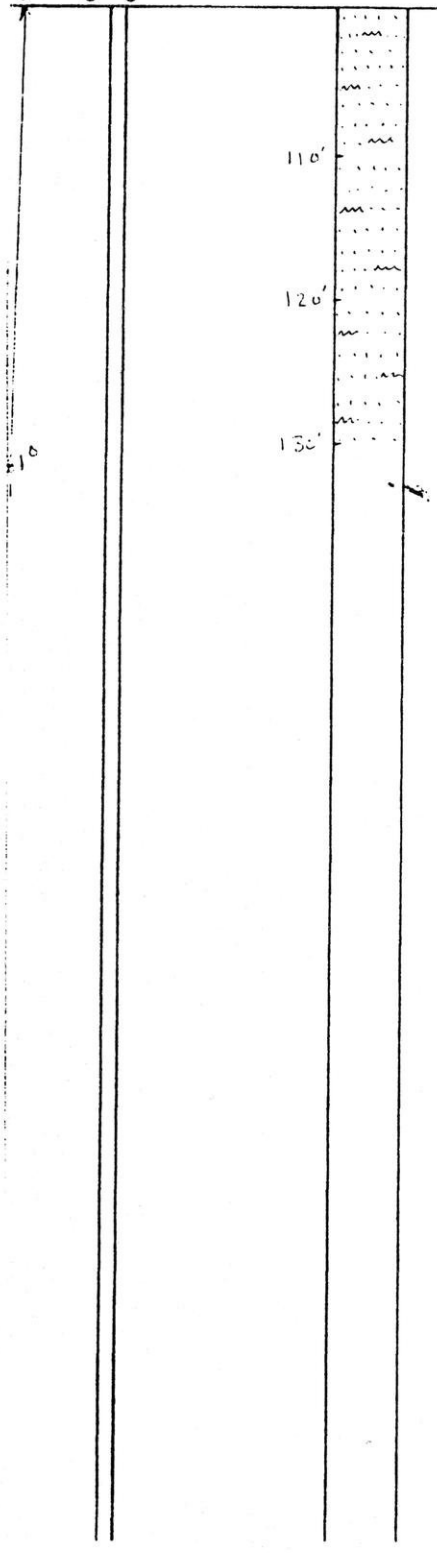
Hole 22-139

SECTION 401.65
COORDINATES 39980.7130N, 38911.5264E
AZIMUTH 0°
ELEVATION 1101.21

DATE STARTED 11-20-87
COMPLETED 11-23-87
LENGTH OF HOLE 240'



GEOLOGIC DESCRIPTION

98-109' SERICITE-QUARTZ SCHIST (UNIT 1a)
Quartz increases as cherty blue-gray laminae and thin beds; local large (up to 3.5 cm) subangular white quartz lapilli. Fine-very fine-grained pyrite as fracture/foliation smears (trace-½%).

109-136.8' SERICITE-QUARTZ SCHIST (UNIT 1a)
Similar to above, but with a continued increase of cherty interlayers and lenses.

Local zones (½-1½") of white, very coarse-grained (up to 2cm) kaolinized fragments

Foliation/bedding forms convoluted laminations wrapping the fragments

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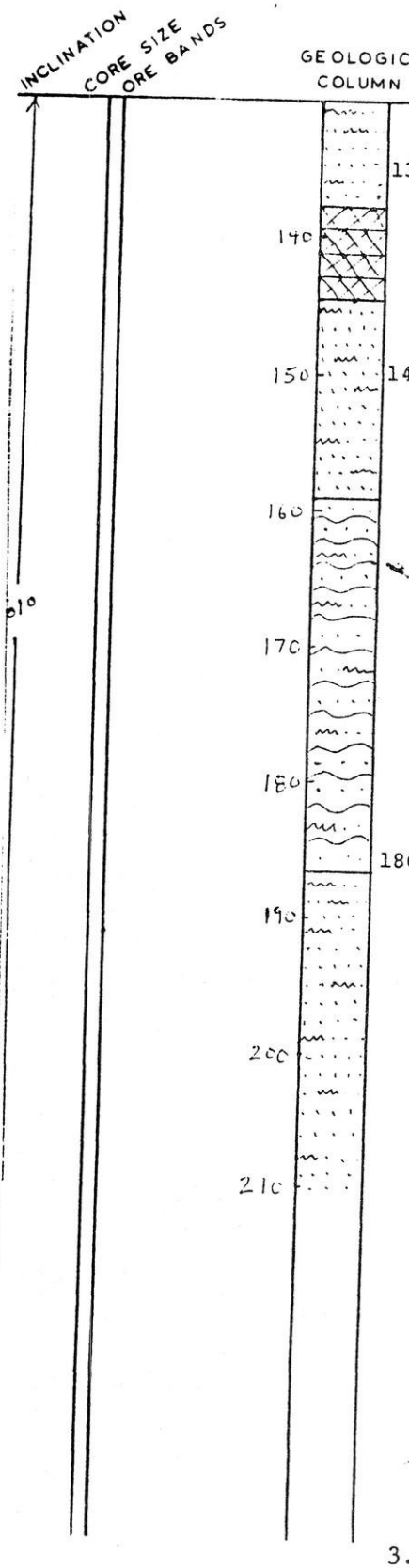
Hole 22-139

SECTION 401.65
COORDINATES 39980.7130N, 38911.5264E
AZIMUTH 0°
ELEVATION 1101.21

DATE STARTED 11-20-87
COMPLETED 11-23-87
LENGTH OF HOLE 240'



GEOLOGIC DESCRIPTION

136.8-144.6' METACHERT
Gray, compact, very fine-grained aphanitic chert with local pyrite as euhedral, medium-fine-grained disseminations and lenses (2-4%). Local vuggy quartz stringers up to 2" wide with trace partially-altered pyrite

144.6-159' SERICITE QUARTZ SCHIST (UNIT 1a)
As 109-136.8'.
Local quartz stringers at angle to foliation (as at 156').

159-186.6' SERICITE-QUARTZ-CHLORITE SCHIST (UNIT 2a)
Dark-moderate green, well-foliated chlorite schist with 1-3% fine-medium-grained, subhedral-euhedral pyrite. Local pyrite-rich laminations (3-5% of interval). Pyrite sometimes partially leached. Occasional very coarse-grained porphyroblastic grain aggregates. Pyrite-bearing, iron-oxide-stained filament fractures between 159-161.8' and 170-172'.
Local intervals of pyritiferous quartz-sericite schist especially after 174'.

Gradational contact.

186.6-212.6' SERICITE-QUARTZ SCHIST (UNIT 1a)
Similar to 109-136.8'.

3-6% pyrite along local foliation planes; pyrite (½-2%) as fine disseminated grains also.

Sharp contact.

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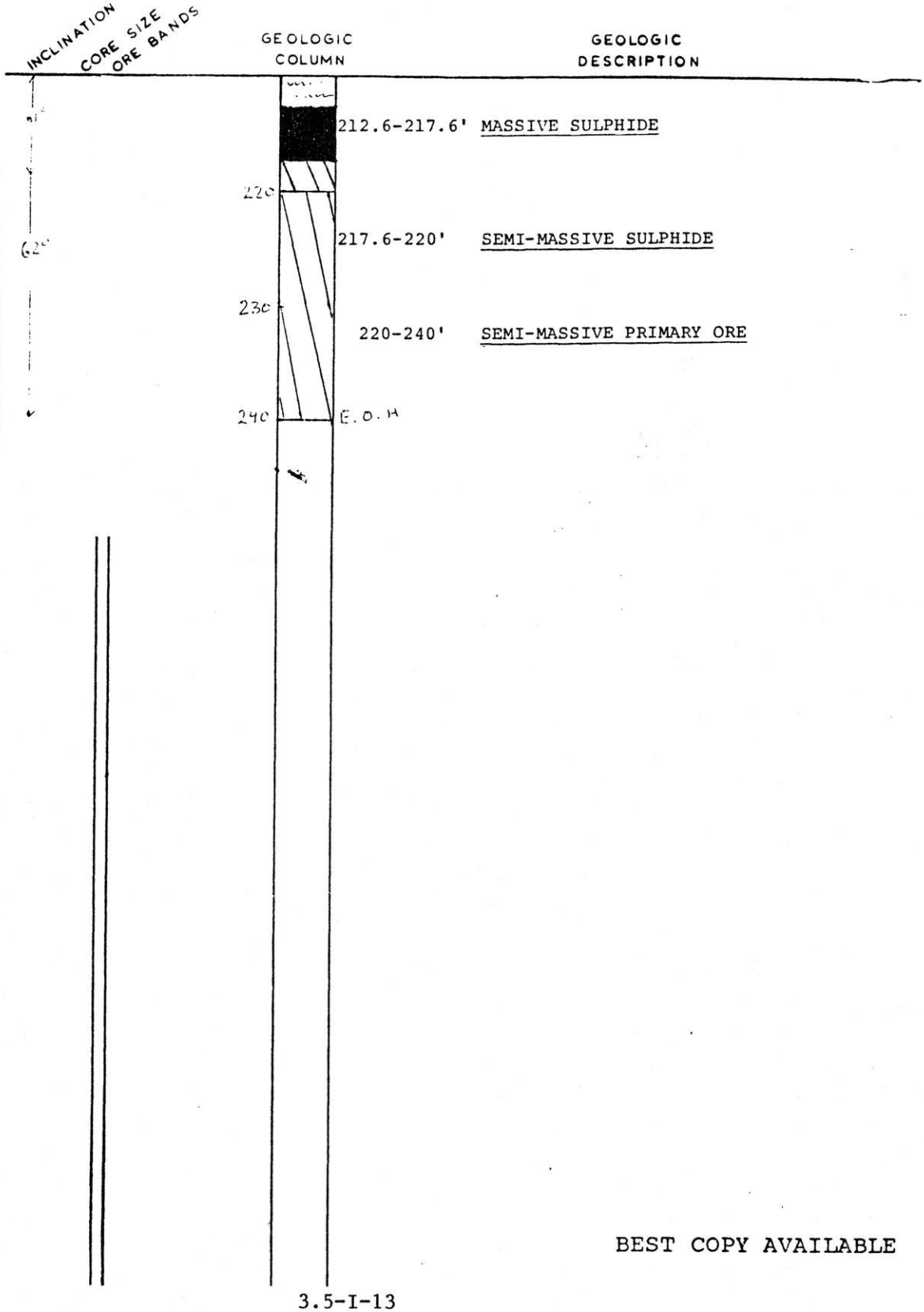
Hole 22-139

SECTION 401.65
COORDINATES 39980.7130N, 38911.5264E
AZIMUTH 0°
ELEVATION 1101.21

DATE STARTED 11-20-87
COMPLETED 11-23-87
LENGTH OF HOLE 240'
% ORE RECOVERY 91°



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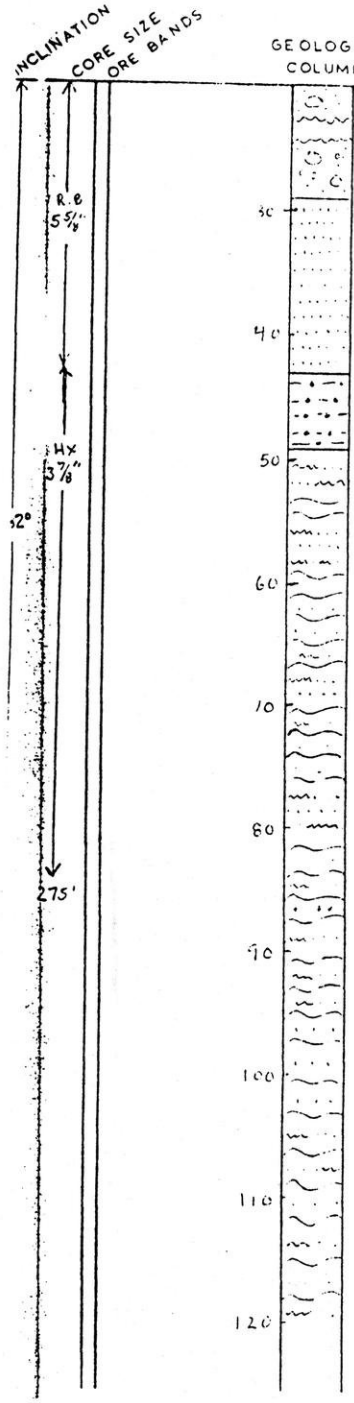
Hole 22-140 (B-R4)

SECTION 406
COORDINATES 40418.3442N, 39086.3310E
AZIMUTH 135°
ELEVATION 1117.35

DATE STARTED 11-23-87
COMPLETED 12-3-87
LENGTH OF HOLE 275'



	GEOLOGIC DESCRIPTION
0-29'	GLACIAL OVERBURDEN Poorly sorted sandy till. Rotary drilling - no core.
29-43'	CAMBRIAN SANDSTONE Cuttings return large well-rounded quartz grains. Rotary drilling - no core.
43-44'	PRECAMBRIAN CONTACT Bleached chlorite grains appear in cuttings. Set casing at 44'.
44-49'	SAPROLITE Mottled red-brown/white, soft saprolite with local relict quartz grains; minor yellow limonite-stained argillite, filling minute local fractures. White, coarse-grained, 3" wide quartz vein at bottom of interval.
49-68.7'	SAPROLITIC QUARTZ-SERICITE-CHLORITE SCHIST (UNIT 2a) Green-green/gray, well-argillized chlorite schist with lesser amounts of sericite and coarse-very coarse-grained quartz fragments. Very soft, but a relict foliation well preserved and chlorite is not completely altered to clay. Mild iron-oxide staining along foliation. Local clear gray/white, coarse-grained quartz vein with trace-½% limonite-stained, squarish pyrite vacancies. Generally minute, fresh pyrite grains still preserved in center of site. Local minor fractures with pyrite, black-green mafic mineral (probably actinolite) and iron-oxide staining. Fractures more prevalent between 58-58.1', 67-68'.
68.7-90'	QUARTZ-SERICITE-CHLORITE SCHIST (UNIT 2a) Similar to above, but less argillized. Gradational contact.
90-118'	QUARTZ-SERICITE-CHLORITE SCHISTS (UNIT 2a) A heterogenous interval of interbedded lapilli-tuffs and moderately-foliated chloritic schists. The lapilli tuffs have varying amounts of whitish, partially kaolinized quartz-feldspar, and gray quartz fragments. Some sub-units have relict mafic crystals now replaced by biotite. Chlorite and sericite compose the matrix. The chloritic phyllite (probably meta-basalt) is locally, partially argillized and bleached.

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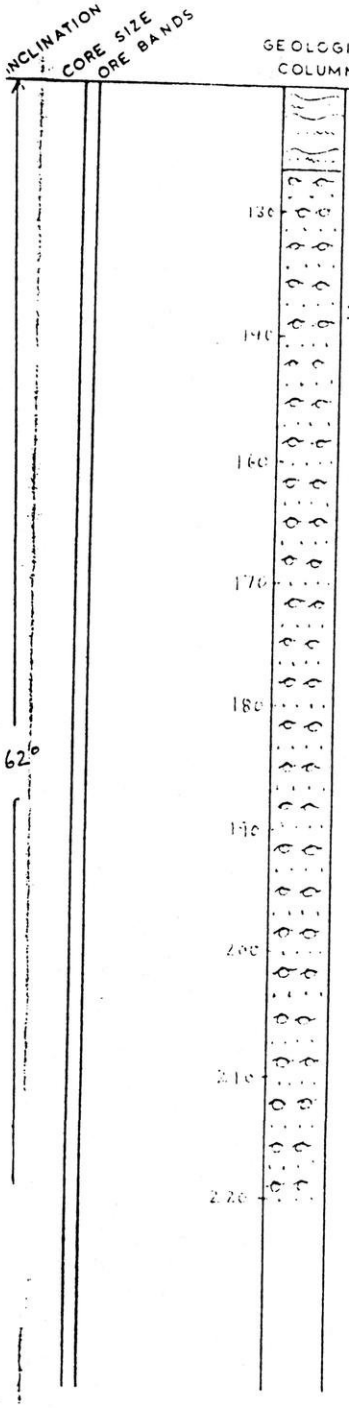
BEAR CREEK MINING CO.

Hole 22-140

SECTION 406
COORDINATES 40418.3442N, 39086.3310E
AZIMUTH 135°
ELEVATION 1117.35

DATE STARTED 11-23-87
COMPLETED 12-3-87
LENGTH OF HOLE 275'



GEOLOGIC DESCRIPTION

118-126.8' QUARTZ-SERICITE-CHLORITE SCHISTS (UNIT 2a)
As above, but generally better altered to bluish argillite.
119-120.4' soft, strongly argillized zone with 30% relict chlorite fragments.

Gradational contact.

126.8-137' QUARTZ-AUGEN SCHIST (AND UNIT 3a)
Intercalated quartz-sericite-chlorite schist and quartz-augen schist.

137-224' QUARTZ-AUGEN SCHIST (UNIT 3a)
Generally iron-oxide stained, porphyry (coarse-grained, aphanitic), well-foliated, moderately-well argillized quartz augen schist. Medium-very coarse grained, blue-gray/white, subangular quartz lapilli or fragments (10-15%) set in a chlorite schist. The fragments are partially stretched along foliation. 2-5% argillized mafic rock fragments; 1-3% fine-medium-grained quartz eyes; trace-2% partially leached pyrite sites. Local healed filament fractures filled by quartz/kaolinized feldspar, quartz, or various clay minerals; fractures and foliation planes sometimes iron-oxide-stained, especially from 138-140', 163-182'.

140-168' core is generally iron-oxide stained.

163-168' more abundant quartz stringers and fractures (1/16-1/4") filled with earthy iron-oxides.
Core is better argillized and return is poor. Possible zone of mild permeability.

Quartz augen schist is occasionally intercalated with biotite-quartz-chlorite schist, or chlorite schist, as at 160'.

168-205' chlorite is less altered and less bleached, having more typical chloritic green color. Local minor iron-oxide-stained fractures.
Trace-1% remnant pyrite sites.

192-194.3' interval of better argillized sericitic schists; 5-8% medium-grained quartz eyes.

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Hole 22-140

SECTION 406
COORDINATES 40418.3442N, 39086.3310E
AZIMUTH 135°
ELEVATION 1117.35

DATE STARTED 11-23-87
COMPLETED 12-3-87
LENGTH OF HOLE 275'

INCLINATION / CORE SIZE / ORE BASIS	GEOLOGIC COLUMN		GEOLOGIC DESCRIPTION
		137-224' (cont'd)	209.5-210' core is softer, iron-oxide stained, and has an S-2 foliation at a steep angle to primary foliation. 221-224' slight increase of fractures/ foliation planes with earthy iron-oxide smears. Gradational contact.
		224-243'	BIOTITE-SERICITE-QUARTZ-CHLORITE SCHIST (UNIT 2a) Variable amounts (5-25%) of coarse-very coarse-grained, tabular biotite clots (most likely retrograde alteration of mafic crystals) set in a well-foliated chlorite schist. 3-6% fine-medium-grained sub-rounded quartz eyes. Local roundish soft patches of white, partially kaolinized feldspar, usually having trace-2% very fine-fine quartz, most likely altered intermediate-mafic lithic fragments. Locally sericite-rich interlayers. 236-239.4' local iron-oxide and manganese-oxide coated filament fractures, generally healed by argillite; fractures sub-parallel to foliation.
		243-263.8'	SERICITE-QUARTZ-BIOTITE-CHLORITE SCHIST (UNIT 2a) Similar to 243-244', but with little or no quartz eyes. Local intervals rich in irregular kaolinized patches (up to ½") that contain fine-grained quartz (probably altered lithic fragments). Local iron-oxide-smeared hairline fractures sometimes with white, argillized selvedges, especially between 252-255', 256.7-256.9'. 256-258' biotite clots sometimes develop an alignment perpendicular to foliation.
		263.8-275'	SERICITE-BIOTITE-QUARTZ-CHLORITE SCHIST (UNIT 2a) Well-foliated, green-gray, biotite-chlorite schist; large biotite clots absent; biotite mainly as fine-medium-grained lathlike crystals. Local sericite.

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BEAR CREEK MINING CO.

Hole 22-140

SECTION 406
COORDINATES 40418.3442N, 39086.3310E
AZIMUTH 135°
ELEVATION 1117.35

DATE STARTED 11-23-87
COMPLETED 12-3-87
LENGTH OF HOLE 275'
% ORE RECOVERY ---

INCLINATION / CORE SIZE / ORE BANDS	GEOLOGIC COLUMN	GEOLOGIC DESCRIPTION
	263.8-275' (cont'd)	Rare, very fine-grained, hard, knobby, red-brown crystals, possibly garnet; discontinuous quartz lenses stretched along foliation (4-6%). Trace-1% crystal, quartz fragments, with trace of anhedral-subhedral, fine-grained pyrite. ½-1% leached, squarish pyrite vacancies. Trace fresh pyrite throughout interval. 261-263' pyrite sites coarser grained. 262-269' local fractures up to ½" wide, coated with earthy iron-oxide, argillized yellow-green chlorite.

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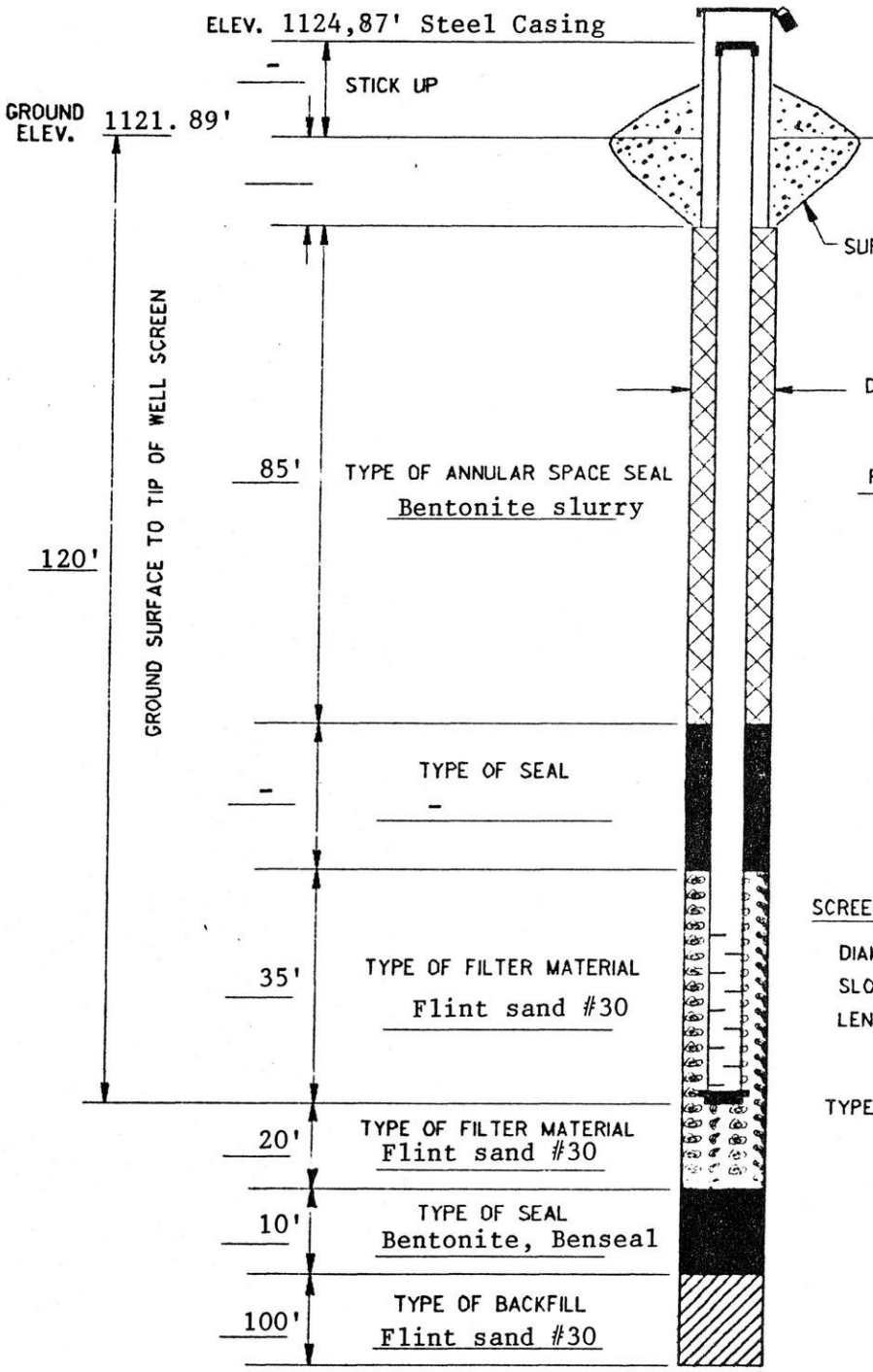
MONITORING WELL CONSTRUCTION DIAGRAM

WELL NO: PZ-R5
DATE INSTALLED: 1-6-88 by Luisier Drilling Inc.
DRILLER: Longyear Company
DRILLING METHOD: Mud rotary
Angle Hole No. 22-136
Oriented S55-60°E at 60° from horizontal

CLIENT: Kennecott
PROJECT: Geotechnical
SCOPE I.D.: 87K10
BY: P.G. (Kennecott)



PROTECTOR PIPE:
SIZE 4"
MATERIAL Steel
LOCK NO. Master 2121

SURFACE SEAL MATERIAL Cement

DRILL HOLE DIAMETER 5-5/8" 0-31'
3-7/8" 31-250'

PIPE:
DIAMETER 1-1/4"
MATERIAL PVC
SCH. 40
TYPE OF JOINTS Flush threaded

SCREEN:
DIAMETER 1 1/4"
SLOT SIZE 0.20"
LENGTH 20'

TYPE OF CAP PVC

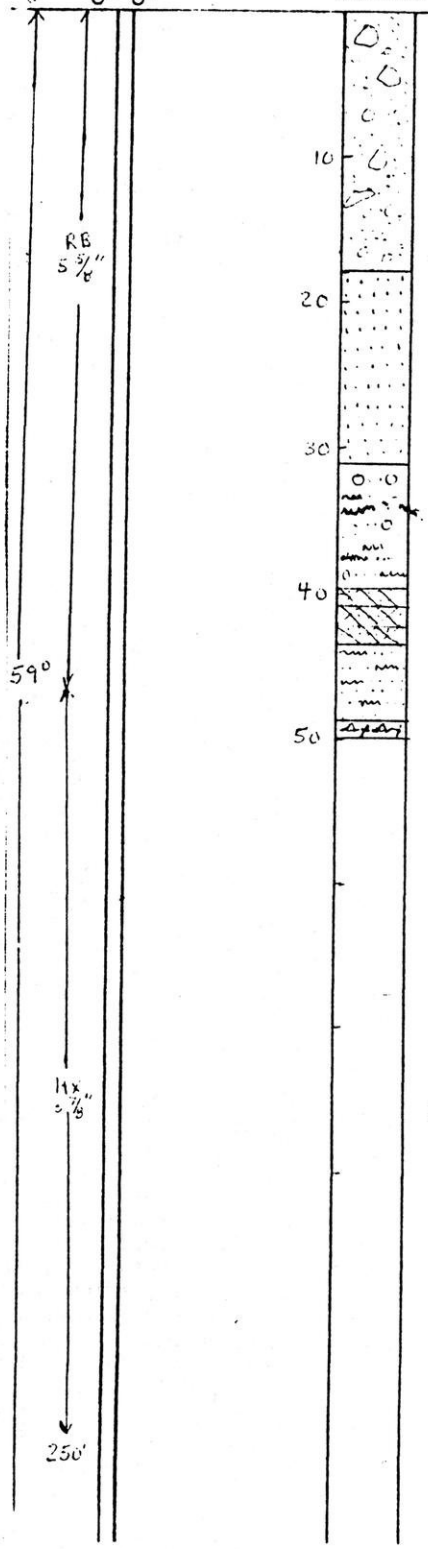
Foth & Van Dyke
Geosciences & Environmental Management Division
Revised 3/88 By BJS
Drawn By MRS

BEAR CREEK MINING CO.

Hole 22-136

SECTION 410
COORDINATES 40406.3794N, 39666.1500E
AZIMUTH 135°
ELEVATION 1121.70

DATE STARTED 10-27-87
COMPLETED 11-5-87
LENGTH OF HOLE 250'
% ORE RECOVERY —



GEOLOGIC DESCRIPTION

0-18' GLACIAL OVERBURDEN
Cuttings typically iron-oxide stained, consisting of fine quartz, medium-coarse-grained feldspar, black mafic minerals and rare micaceous grains; local clay horizons, especially near base of unit, stained deep red.

18-31' CAMBRIAN SANDSTONE
Drilling fluid turns yellow brown or gray. Distinct large well-rounded quartz grains predominate cuttings. Local oxidized clay layers as in glacial till.

31-39.8' QUARTZ-EYE-SERICITE-FELSIC CRYSTAL TUFF (UNIT 1b)
Gray, porphyritic, aphanitic, coarse-grained, compact, brittle.
7-12% feathery sericite define an incompletely developed foliation.
10-15% medium-very coarse-grained (up to 5mm), blue-gray-white, sub-angular-angular quartz "eyes" set in silceous aphanitic matrix.
5-7% irregular, stretched vugs may be glass vacancies; more blocky, iron-oxide-stained spaces may be former pyrite sites; more sericite-rich interlayers (1-3" wide) have weathered to a crusty yellow-white material, locally impregnated by secondary quartz (as 33-36'). Cherty lithic fragments (up to 3 cm) are observed rarely in 2-3" zones (as 32.5' and 38.5'). Irregular, yellow-brown patches of finely-milled quartz-eye tuff engulf larger fragments in a few areas between 34-36'

39.8-43.4' METACHERT (UNIT 1b)
Leached limonite cap; medium-grained-very fine grained, purple/black/gray-green, very thinly bedded (¼-½ cm) metachert, locally interlayered with above quartz-eye unit. Discrete layers are strongly limonite-stained and vuggy. The chert is locally brecciated along bedding until 40.7'; after which the sequence is largely brecciated chert and quartz fragments (up to 3.5 cm), sealed by fine-grained quartz-limonite. The vugs can

(continued next page)

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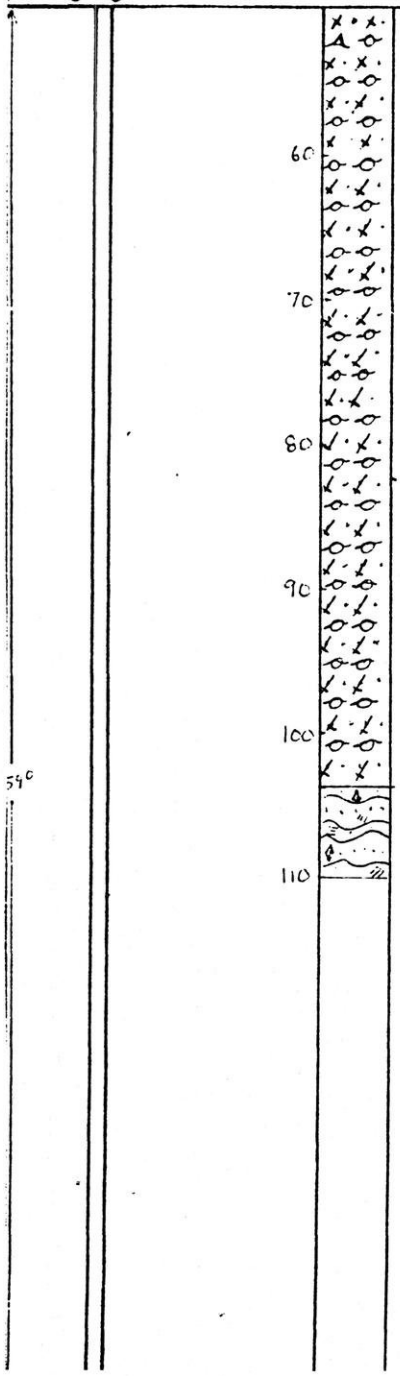
Hole 22-136

SECTION 410
COORDINATES 40406.3794N, 39666.1500E
AZIMUTH 135°
ELEVATION 1121.70

DATE STARTED 10-27-87
COMPLETED 11-5-87
LENGTH OF HOLE 250'
% ORE RECOVERY —



GEOLOGIC DESCRIPTION

39.8-43.4' (cont'd) approach several cm's in size and are often lined with white, powdery clay minerals. The top several inches of the unit is typical leached gossan caprock. Fine-medium-grained, squarish pyrite vacancies (3%) are evident throughout footage; trace manganese-oxide.

43.4-49.6' SERICITE QUARTZ SCHIST (UNIT 1a)
45-48.5' sequence almost completely kaolinized-white, very soft, friable; local fractures coated with manganese-oxide and iron-oxide.

48.5-49.6' kaolinized sericite quartz schist with 5-7% fine, blue-gray quartz eyes still preserved.

Gradational contact.

49.6-103.8' PORPHYRITIC METADACITE (UNIT 5)
49.6-66' white, soft, moderately-kaolinized quartz-feldspar crystal tuff; strong iron-oxide staining along fractures. Lathlike and rectangular remnant, saussuritized remnant feldspars (15-25%) still evident

66-81' less altered version of above; wispy chlorite (altered to illitic clays) wraps around saussuritized feldspar, forming a weak-moderate foliation. Trace-2% very fine-grained pyrite as disseminated grains or as discontinuous lenses along foliation (first observable fresh pyrite); mild iron-oxide staining along fractures

Local kaolinized fractures.

81-103.8' still fresher sequence. Partially altered, blue-gray, porphyritic (coarse/fine-grained), weakly-moderately foliated intermediate-mafic crystal lithic tuff. Consists of 10-15% medium-coarse-grained, blocky, altered feldspar, 1-2% medium-coarse-grained biotite, 3-6% fine-grained, anhedral, blue-gray quartz, (usually masked by groundmass) 3-6% partially altered blue-black chlorite, 1% lensoidal or ovoid, quartz-feldspar. Lithic fragments. The groundmass is mainly altered fine-grained chlorite. Trace euhedral-subhedral, very fine-fine-grained pyrite.

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Hole 22-136

SECTION 410
COORDINATES 40406.3794N, 39666.1500E
AZIMUTH 135°
ELEVATION 1121.70

DATE STARTED 10-27-87
COMPLETED 11-5-87
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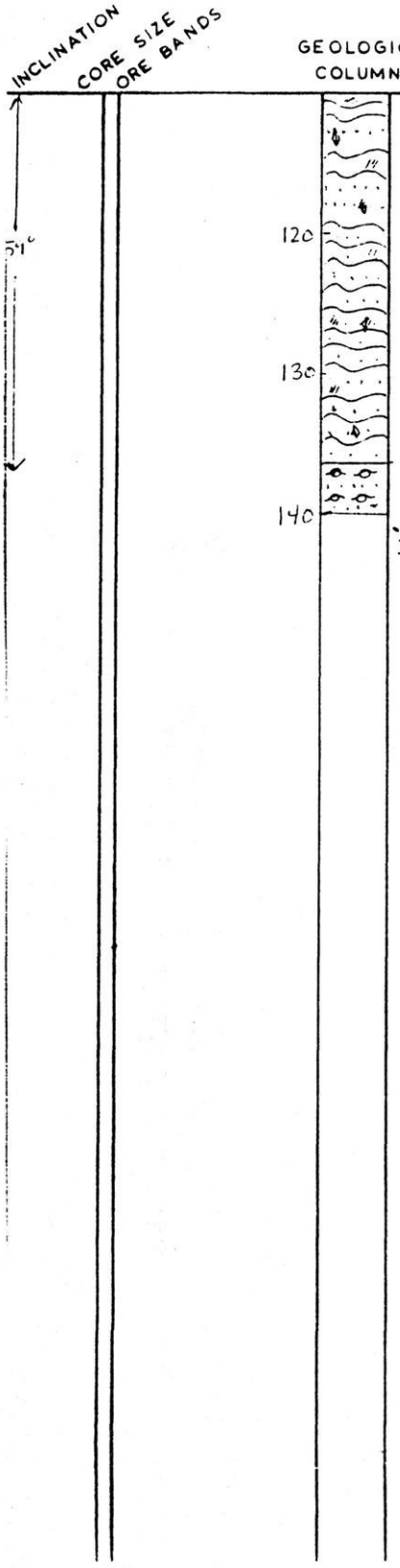
% ORE RECOVERY —



GEOLOGIC DESCRIPTION

49.6-103.8' (cont'd) After 90' this unit becomes quite heterogenous, and has intercalated units of chlorite phyllite, altered, massive actinolite-chlorite (metabasalts or andesites) and tuffaceous rocks with 3-5% lithic fragments and very few crystal phenocrysts.

Gradational contact.

103.8-136.5' ANDALUSITE-BIOTITE-QUARTZ-CHLORITE SCHIST (UNIT 2c)
Mainly a well-foliated, chlorite phyllite with very few observable accessory minerals.

Hematite-coated partially-completely weathered, fine-medium-grained pyrite is more or less ubiquitous from trace-2% to 3-5%. Much of the footage is iron-oxide-stained and shows argillic alteration and bleaching of the chlorite minerals.

103.8-104.5', a gray-white, translucent, 1-2" wide chlorite-bearing quartz vein separates Units 3a and 2. Just above the vein the chlorite phyllite has almost completely been altered to white kaolinite. Better preserved layers show partial serpentinization of the chlorite and elongated gray quartz lapilli. A second foliation, crosscutting the primary foliation is well-developed, locally. This grades into an argillized, iron-oxide-stained chlorite phyllite.

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Hole 22-136

SECTION 410
COORDINATES 40406.3794N, 39666.1500E
AZIMUTH 135°
ELEVATION 1121.70

DATE STARTED 10-27-87
COMPLETED 11-5-87
LENGTH OF HOLE 250'
% ORE RECOVERY —

INCLINATION	CORE SIZE / ORE BANDS	GEOLOGIC COLUMN	GEOLOGIC DESCRIPTION
1 5° ↓			103.8-136.5' (cont'd) Locally, especially between 110-120', discontinuous lenses and occasionally coarse-grain aggregates of pyrite are more common. These pyritiferous areas sometimes form more strongly stained hematitic layers 1/4-3/4" wide and may have 6-10% altered pyrite. Minor fracture zones (½-2" wide) occur throughout the interval and are marked by quartz-stringer infilling along fracture planes, the most prominent at 101.9, 114', 114.8'. Open hematite and manganese-oxide-coated fractures are also observable locally, and generally parallel to foliation (122.6', 122.9', 124-125', 127', 130'). Numerous, minute hematite-filled fractures occur throughout. Sometimes the fractures border notably softer iron-oxide-stained layers In several areas (as between 111-112') a set of filament fractures are perpendicular to foliation and exhibit left-lateral displacement. The chlorite phyllites show a gradational contact back into a sequence dominated by the crystal and crystal-lithic tuffs described at 49.6-103.8'. 136.5-151.4' PORPHYRITIC METADACITE (UNIT 5) As 49.6-103.8'. Trace-3% fine-grained, euhedral pyrite and subhedral-anhedral fracture smears; less pyrite after 140'.

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Hole 22-136

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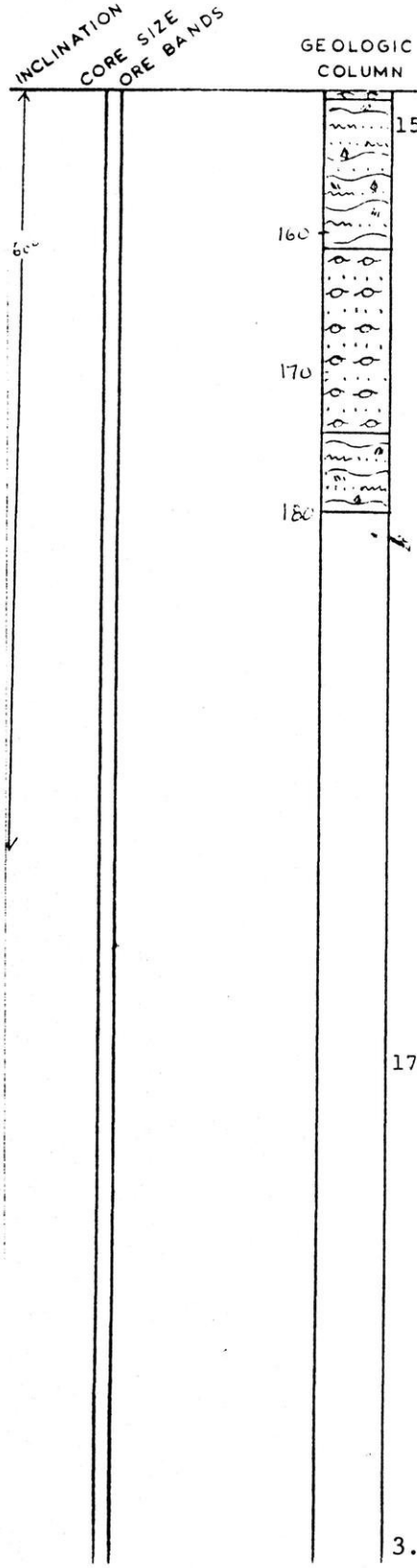
DATE STARTED 10-27-87
COMPLETED 11-5-87
LENGTH OF HOLE 250'
% ORE RECOVERY —



GEOLOGIC DESCRIPTION

151.4-161' ANDALUSITE-BIOTITE-QUARTZ-SERICITE-CHLORITE SCHIST (UNIT 2a)
Yellow (W), white-brown (F) sericite phyllite and bleached chlorite with fine-medium-grained quartz (1-3%), trace of gray-white fine-medium-grained "knobby" andalusite and 1-3% black-brown biotite. The biotite occurs as individual sub-grains or in patchy irregular grain aggregates

Quartz also occurs as large gray-white lithic fragments, stretched along foliation (trace-½%). Local fractures are iron-oxide stained. Discontinuous, wispy pyrite lenses (trace-2%) form hematite-stained streaky patches, parallel to foliation. Chlorite phyllite is occasionally interlayered and forms a gradational contact toward the bottom of the sequence.

Gradational contact.

161-174.3' PORPHYRITIC METADACITE (UNIT 5)
Similar to 49.6', but generally has a more abundant lithic component. These lithic fragments (up to 3 cm) are stretched along foliation and consist mainly of quartz and altered feldspar. The fragments can make up to 15-20% of the core, locally. Pyrite occurs as local fracture smears (1%) plus fine-grained euhedral-subhedral disseminations (1-2%). Trace-1% epidote along fractures. Minor quartz-replaced zones (2") at 170.1'.

174.3-180' ANDALUSITE-BIOTITE-QUARTZ-SERICITE-CHLORITE SCHIST (UNIT 2a)
Similar to earlier-described above unit, but with much more abundant andalusite (3-6%), as squarish, red-brown, coarse-grained crystal sections. Locally, andalusite up to 7-10%. Pyrite as very fine disseminations and as patches parallel to foliation (½-1%).

Gradual contact with porphyritic metadacite after 178'.

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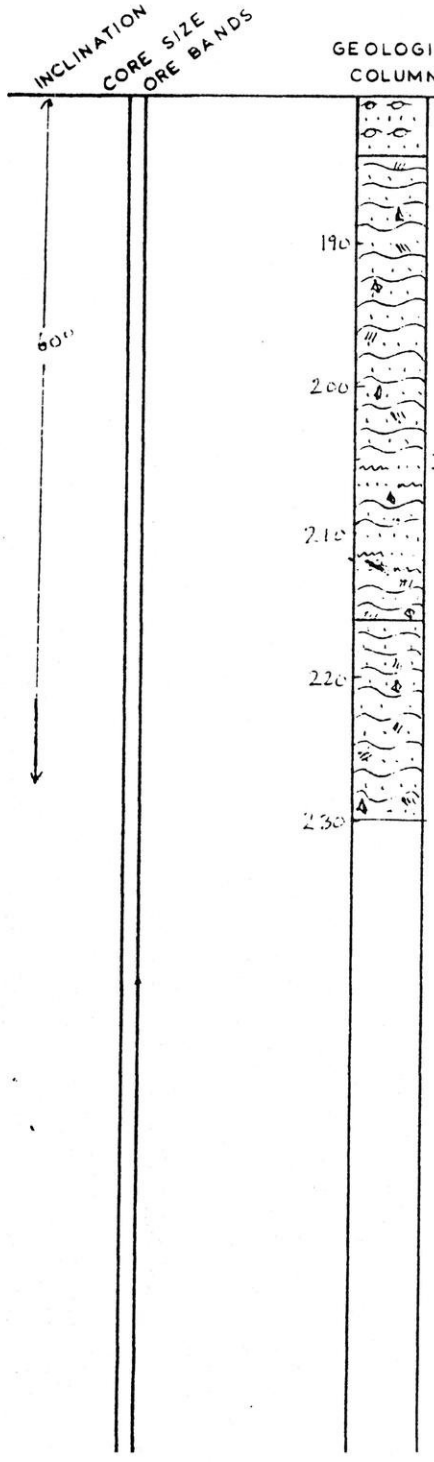
Hole 22-136

SECTION 410
COORDINATES 40406.3794N, 39666.1500E
AZIMUTH 135°
ELEVATION 1121.70

DATE STARTED 10-27-87
COMPLETED 11-5-87
LENGTH OF HOLE 250'
% ORE RECOVERY —



GEOLOGIC DESCRIPTION

180-184' PORPHYRITIE METADACITE (UNIT 5)
Crystal and crystal-lithic tuffs. Locally biotite-rich (6-8% coarse-grained, subhedral); local quartz stringers. Trace-1% pyrite.

184-185.3' QUARTZ VEIN
Gray-white, medium-coarse-grained, translucent, chlorite-bearing fractures. Trace-½% fine-coarse-grained, subhedral pyrite.

185.3-205' ANDALUSITE-BIOTITE-QUARTZ-CHLORITE SCHIST (UNIT 2c)
Mainly chlorite phyllite with intercalated porphyritic metadacite. Pyrite generally leached and not as well preserved as previous sequences. Local pyrite-biotite-rich, iron-oxide-stained layers. Local, quartz-chlorite fractures crosscutting prominent foliation. Hematite-stained fractures particularly prevalent from 187-187.3' and 191-191.5'. Occasional 1/4-3/4" wide quartz-impregnated stringer zones.

After 192' coarser, wispy chlorite appears.

205-216' INTERCALATED ANDALUSITE-BIOTITE-QUARTZ-CHLORITE and ANDALUSITE-BIOTITE-QUARTZ-SERICITE UNITS (CHLORITE AND SERICITE SCHISTS)
Sericitic schists are creamy white and have a pearly luster. Locally, foliation is kinked; a larger zone (3") occurs at 209.2'. Trace-1% hematite-stained pyrite vacancies.

216-231' ANDALUSITE-BIOTITE-QUARTZ-CHLORITE SCHIST (UNIT 2c)
Typical chlorite-rich andalusite-biotite-quartz-chlorite schist with 10% large (up to 3.5 cm) lensoidal pyrite-biotite clasts stretched along foliation. 8-12% blue-gray quartz eyes (fine-grained, subhedral). Pyrite also present as medium-grained, subhedral grains and aggregates and as smears along foliation (1-3% overall.

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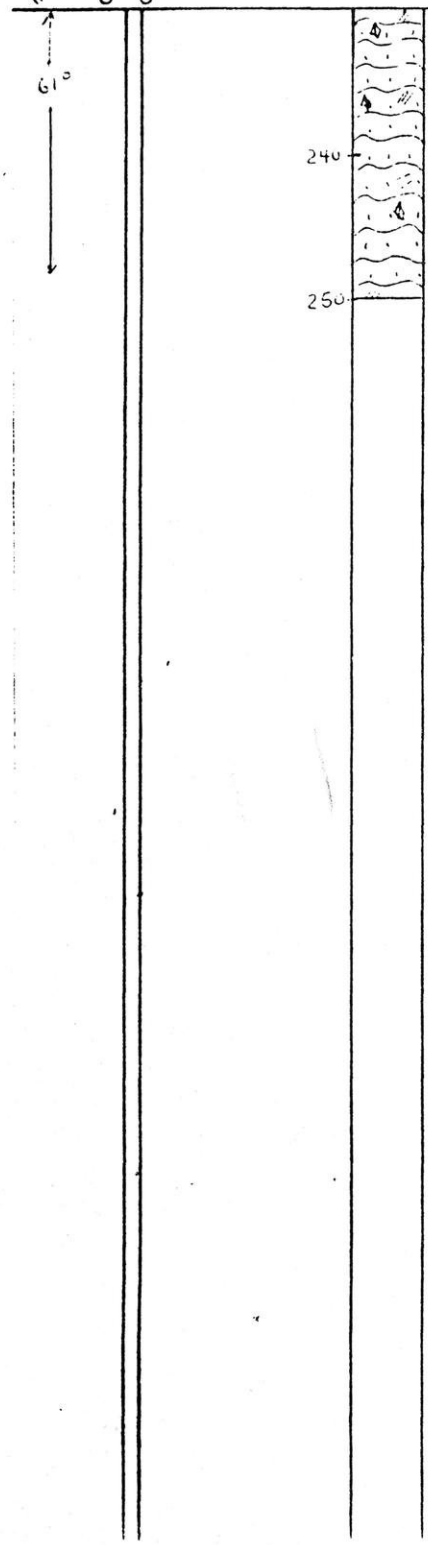
Hole 22-136

SECTION 410
COORDINATES 40406.3794N, 39666.1500E
AZIMUTH 135°
ELEVATION 1121.70

DATE STARTED 10-27-87
DATE COMPLETED 11-5-87
LENGTH OF HOLE 250'
% ORE RECOVERY —



GEOLOGIC DESCRIPTION

216-231' (cont'd) Local minor fractures (1/8-1/2") 45° to foliation, exhibiting right lateral displacement; more prevalent from 224-229'. Chlorite is almost completely bleached over this interval.

231-250' ANDALUSITE-BIOTITE-QUARTZ-CHLORITE SCHISTS (UNIT 2c)
Chlorite is less bleached; biotite-pyrite lenses less common; chert and quartz-feldspar fragments with a pale orange color are common after 240'. Andalusite is more prominent as brown-white squarish crystal sections.

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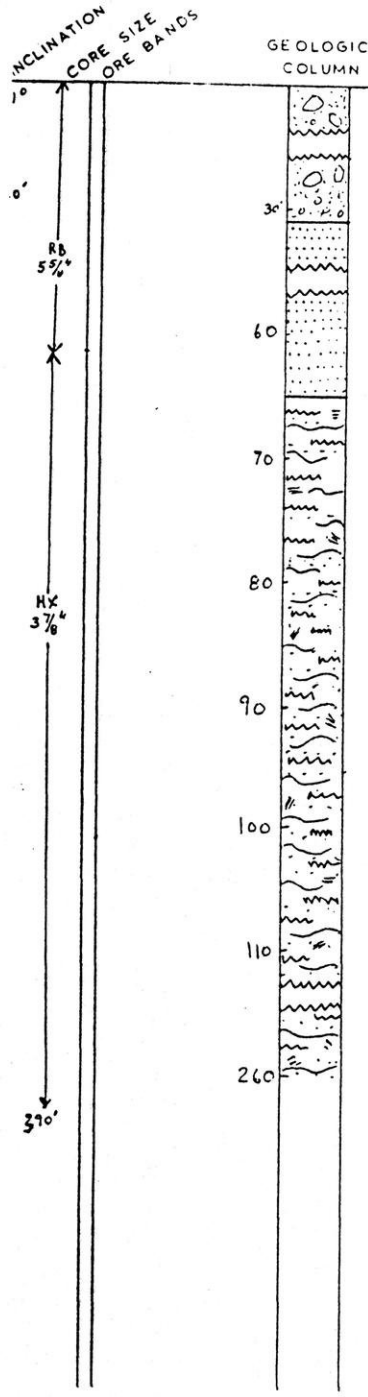
Hole 22-141 (B-R6)

SECTION 421
COORDINATES 41361.3841N, 40267.2862E
AZIMUTH 135°
ELEVATION 1140.78

DATE STARTED 12-4-87
COMPLETED 12-6-87
LENGTH OF HOLE 390'



0-31'	GLACIAL OVERBURDEN Mainly sandy till; local gravelly beds. Rotary drilling - no core.
31-65'	CAMBRIAN SANDSTONE Cuttings typically vary from gray to yellow with local brown-red clay-rich zones. Cuttings mainly well-rounded, coarse-grained quartz. Rotary drilling - no core.
65-90'	PRECAMBRIAN CONTACT Micaceous flakes appear in cuttings at 65'; drilling "soft," probably in well-altered saprolitic Precambrian (cuttings milky brown colored). 88-90' black sulphide streaks occur occasionally at 88'. Finish run and case hole at 90'. Rotary drilling - no core.
90-261'	BIOTITE-QUARTZ-CHLORITE-SERICITE SCHIST (UNIT 2b) Gray-white, finely foliated schist with variable amounts of bleached, green-gray chlorite, pearly moderately-well kaolinized sericite and gray-white cherty quartz interlayers. Local tabular or feathery lenses (up to ¼" long) of biotite, probably replacing earlier mafic mineral (especially prevalent after 180'). 1-3% stretched quartz-rich lapilli, sometimes having pyrite-smeared filament fractures. Trace-3% pyrite as fresh, medium-grained, anhedral-subhedral, patchy masses or coarse crystal aggregates. Sometimes concentrated in foliation as discontinous lenses or laminae. Quartz stringers occur locally, generally as veinlets up to ½" wide along foliation. Larger veins at 100-101.4' (coarse-grained, white, waxy, with sericite-coated fractures, ½-1% fine-grained, subhedral pyrite). 93.5-94.6' fine-grained, gray, cherty quartz with trace-1% subhedral-anhedral pyrite, sericitic fractures.

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BEAR CREEK MINING CO.

Hole 22-141

SECTION 421
COORDINATES 41361.3841N, 40267.2862E
AZIMUTH 135°
ELEVATION 1140.78

DATE STARTED 12-4-87
COMPLETED 12-6-87
LENGTH OF HOLE 390'

INCLINATION / CORE SIZE / ORE BANDS	GEOLOGIC COLUMN	GEOLOGIC DESCRIPTION
		90-261' (cont'd) 160.5' gray, coarse-grained 2" wide quartz stringer with coarse, partially leached, tarnished pyrite (8-10%);
		166.5' larger, white, coarse-grained stringer.
		141-144' partially kaolinized sericite and bleached chlorite; 3% fine-grained pyrite.
		144-172' generally more pyrite-bearing cherty laminae with 2-4% fine-grained pyrite. Local 2-4" wide pyrite-rich interlayers with 4-8% pyrite.
		160.5', 2" wide, gray, coarse-grained, quartz stringer. Partially leached, tarnished pyrite (8-10%).
		178.8' similar ½" wide quartz stringer.
		172-230' core generally richer in bleached chlorite. 209.5-210', 214-215', with patches of very coarse-grained (½ to 2%) pyrite; very fine-grained pyrite disseminations, locally; chert laminae more common.
		230-251' cherty interlayers and sericite increase; interval is similar to 144-172'. 242.3', 1½" wide waxy, fine-grained quartz vein with local coarse-grained tarnished pyrite grains. 245.5-247' chert dominates sequence; ½-2% pyrite.
		251-262' quartz stringers more prevalent, and open into larger veins (up to 1½") between 252-253'. 257.7-260' local coarse-grained chlorite
		Gradational contact.

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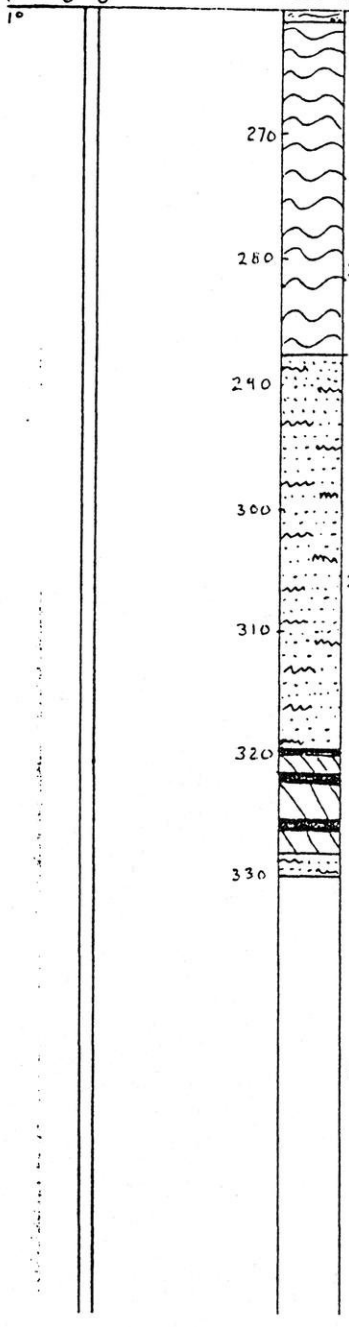
Hole 22-141

SECTION 421
COORDINATES 41361.3841N, 40267.2862E
AZIMUTH 135°
ELEVATION 1140.78

DATE STARTED 12-4-87
COMPLETED 12-6-87
LENGTH OF HOLE 390'



GEOLOGIC DESCRIPTION

261-287.8' CHLORITE PHYLLITE
1-2% pyrite-rich interlayers from ½-1" wide.

276-277' more chert-rich.

280-282' almost completely argillized to green-gray, white clay minerals. Trace medium-coarse grained, subhedral-euhedral, fresh pyrite grains. Local sericite-rich interbeds.

287.8-294.3' KAOLINIZED SERICITE QUARTZ SCHIST (UNIT 1a)
Has relict foliation.
Variable amounts of fine-grained quartz up to 35% of core. 5% subhedral, angular quartz clasts. 1% patchy fine-grained pyrite, trace-½% medium-coarse grained, disseminated, subhedral pyrite grains.

Local laminations with coarse, blue-gray quartz grains and trace coarse-grained pyrite, as 293.8'.

294.3-319.7' SERICITE-QUARTZ SCHIST (UNIT 1a)
As above, but less altered. Occasional large, stretched fragments up to 2". 15% of 1/8 to 1/2" lapilli, sometimes tear-shaped (possible air-fall fragment).

Large (up to 3 x 1") irregular sub-rounded fragments of fine-grained pyrite and gray chert (1-3%).

Fragments of fine-grained pyrite and gray chert (1-3%).

302-304' gray chert more prevalent.

319.7-328.5' SEMI-MASSIVE SULPHIDE (WITH MASSIVE SULPHIDE)
Considerable variation of pyrite content from 20-85%, average 50%. Pyrite is found as a very coarse-grained aggregate mass within a fine-grained sericite-quartz matrix.

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BEAR CREEK MINING CO.

Hole 22-141

SECTION 421

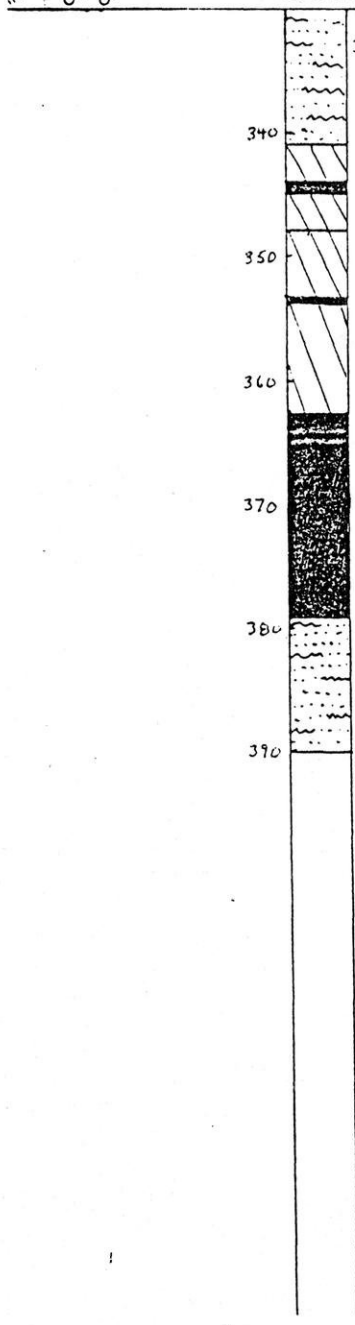
COORDINATES 41361.3841N, 40267.2862E

AZIMUTH 135°

ELEVATION 1140.78

DATE STARTED 12-4-87
COMPLETED 12-6-87

LENGTH OF HOLE 390'



328.5-341' KAOLINIZED SERICITE QUARTZ SCHIST
Moderately-strongly kaolinized schist with mottled appearance. 4-8% fine-grained pyrite as disseminations; local tabular kaolinized feldspar crystals, fine, needle-like mafic mineral (probably amphibole) partially or completely replaced by biotite. 1-2% coarse quartz lapilli.

341-348' SEMI-MASSIVE SULPHIDES (WITH MASSIVE SULPHIDE)
20-75% (average 50%) fine-medium-grained pyrite in kaolinized sericite quartz matrix. Local large cherty fragments (up to 3/4").

348-362.4' SEMI-MASSIVE SULPHIDE IN SERICITE-QUARTZ SCHIST
Variable 15-45% pyrite (20% overall) in kaolinized sericite-quartz schist.

362.4-379' MASSIVE SULPHIDE
70% (varies 40-90%) coarse-grained pyrite in patches and crystal aggregates;
30% sericite quartz matrix. Local coarse-very coarse (up to ½") quartz-chlorite schist rock fragments and gray cherty lithics.

Gray cherty quartz fragments, sericite and degree of kaolinization all increase.

379-390' CHERTY SERICITE QUARTZ SCHIST

½-1% medium-grained pyrite in lenses parallel to foliation.

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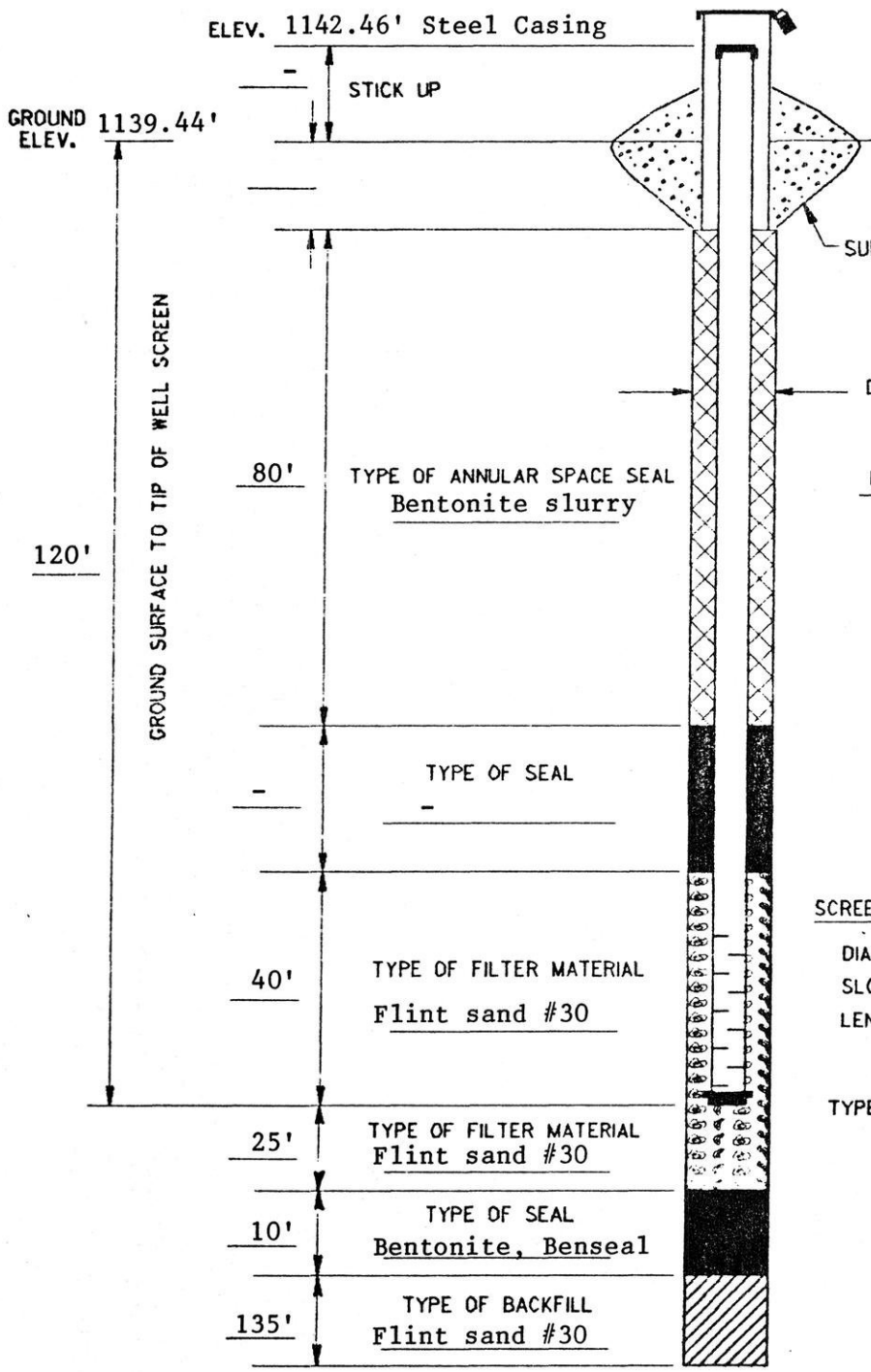
MONITORING WELL CONSTRUCTION DIAGRAM

WELL NO: PZ-R7
DATE INSTALLED: 1-12-88 by Luisier Drilling Inc.
DRILLER: Longyear Company
DRILLING METHOD: Mud rotary

CLIENT: Kennecott
PROJECT: Geotechnical
SCOPE I.D.: 87K10
BY: P.G. (Kennecott)

Angle Hole No. 22-142
Oriented S55-60°E at 55° from horizontal



PROTECTOR PIPE:
SIZE 4"
MATERIAL Steel
LOCK NO. Master 2121

SURFACE SEAL MATERIAL Cement

DRILL HOLE DIAMETER 5-5/8" 0-90'
3-7/8" 90-290'

TYPE OF ANNULAR SPACE SEAL
Bentonite slurry

PIPE:
DIAMETER 1-1/4"
MATERIAL PVC
SCH. 40
TYPE OF JOINTS Flush threaded

TYPE OF SEAL
-

TYPE OF FILTER MATERIAL
Flint sand #30

SCREEN:
DIAMETER 1-1/4"
SLOT SIZE .020"
LENGTH 20

TYPE OF CAP PVC

TYPE OF FILTER MATERIAL
Flint sand #30

TYPE OF SEAL
Bentonite, Benseal

TYPE OF BACKFILL
Flint sand #30

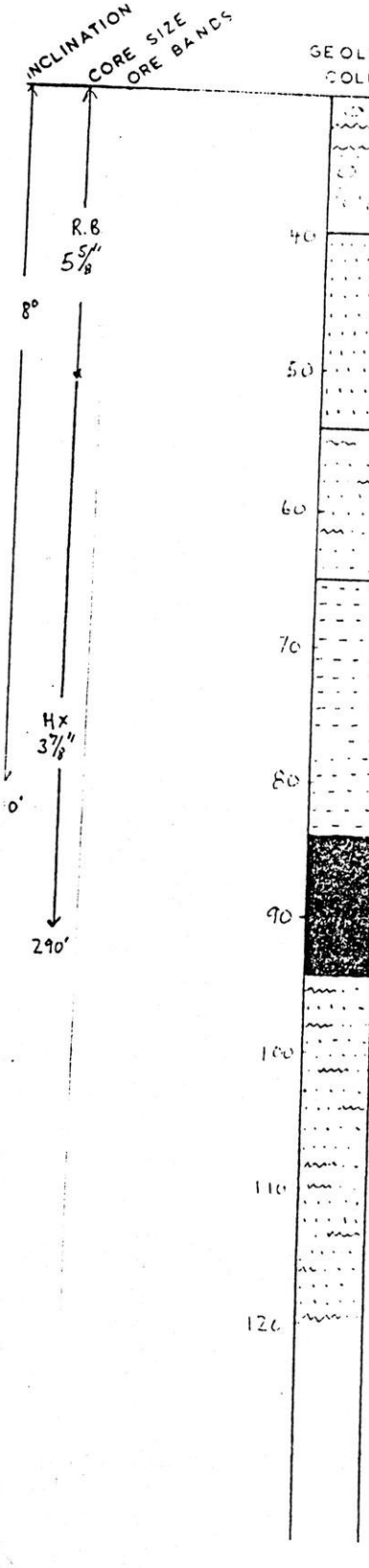
Foth & Van Dyke
Geosciences & Environmental Management Division
Revised 3/88 By BJS
Drawn By MRS

BEAR CREEK MINING CO.

Hole 22-142

SECTION 422
COORDINATES 41290.2697N, 40476.3052E
AZIMUTH 135°
ELEVATION 1139.80

DATE STARTED 12-7-87
COMPLETED 12-16-87
LENGTH OF HOLE 290'



GEOLOGIC DESCRIPTION

0-40' GLACIAL OVERBURDEN
Mainly sandy till with local cobbles and clay lenses.
Rotary drilling - no core.

40-54' CAMBRIAN SANDSTONE
Yellow, iron-oxide-stained, medium-coarse-grained, moderately-poorly sorted, well-rounded, weakly bedded-massive sandstone. Generally poorly consolidated. Local clay and gravel horizons. Both clay and gravel are concentrated near contact with Precambrian.
Rotary drilling to 51';
core dilling 51'.

54-65' WEATHERED PRECAMBRIAN
Soft, saprolitic, mottled, yellow-gray and white argilliceous schists.
Relict foliation.

65-84' GOSSAN
Brick-red, massive, argilliceous gossan with local vuggy patches. Occasional sub-rounded, gray chert lithic fragments and more angular, white quartz vein shards. Limonite staining in vugs and along fractures.

84-94.3' MASSIVE SULPHIDE
Black, massive, medium-coarse-grained.

94.3-115.3' SERICITE-QUARTZ SCHIST (UNIT 1a)
Gray-white, finely foliated, moderately-well kaolinized schist. 10-15% wispy, stretched, kaolinized lithic fragments. 4-6% sulphides,

85.6' local filament fracture with hematite staining and white carbonate stringers.

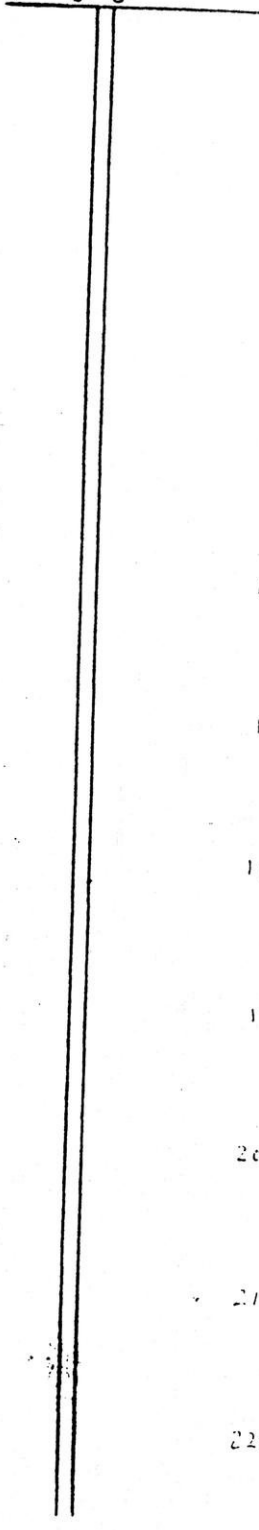
BEST COPY AVAILABLE

BEAR CREEK MINING CO.

Hole 22-142

SECTION 422
COORDINATES 41290.2697N, 40476.3052E
AZIMUTH 135°
ELEVATION 1139.80

DATE STARTED 12-7-87
COMPLETED 12-16-87
LENGTH OF HOLE 290'



GEOLOGIC DESCRIPTION

115.3-136.6' SERICITE-QUARTZ SCHIST (UNIT 1a)
Similar to above, but more sericite-rich and better argillized. Trace-2% leached iron-oxide-stained pyrite sites. Local intercalated with lapilli-rich tuff.

125-129' rare, coarse (up to ¼"), brown-white, tabular-square andalusite crystals. Iron-oxide is more abundant (lenses or Unit 2b).

136.6-188.8' QUARTZ-CHLORITE AND AMPHIBOLE-CHLORITE SCHISTS (UNITS 4a and 4c)
Dark green, moderately-poorly foliated, chlorite phyllite intercalated with amphibole-bearing chlorite schist. Amphibole as fine, prismatic crystals (½-2%). Local fragments or lapilli of dark green, wispy chlorite, quartz, with carbonate-filled filament fractures.

136.6-139.2' lighter-colored, better-argillized bleached chlorite.

139.2', 149', 155-156', 162-162.4', chlorite generally argillized to blue-green clays. Mild iron-oxide staining as smears along minute fractures.

After 160' amphibole-bearing schists increase, and predominate core by 188.8'.

3-5% biotite, mainly as replacement after amphibole.
1-2% chlorite-rich lithic fragments.
3-5% white, waxy, tabular, altered feldspar.
Trace-½% very fine-grained, euhedral pyrite.
6-8% fine-grained quartz and chlorite as lenses parallel to foliation. Chlorite as feathery recrystallized needles along foliation planes and minor fractures.

The coarser, mafic minerals give core a "grainy" appearance.

Gradational contact.

188.8-221' AMPHIBOLE CHLORITE SCHIST (UNIT 4c)
As described above.
After 200' biotite-quartz-chlorite schist (Unit 2c) becomes intercalated with Unit 4c.

Gradational contact.

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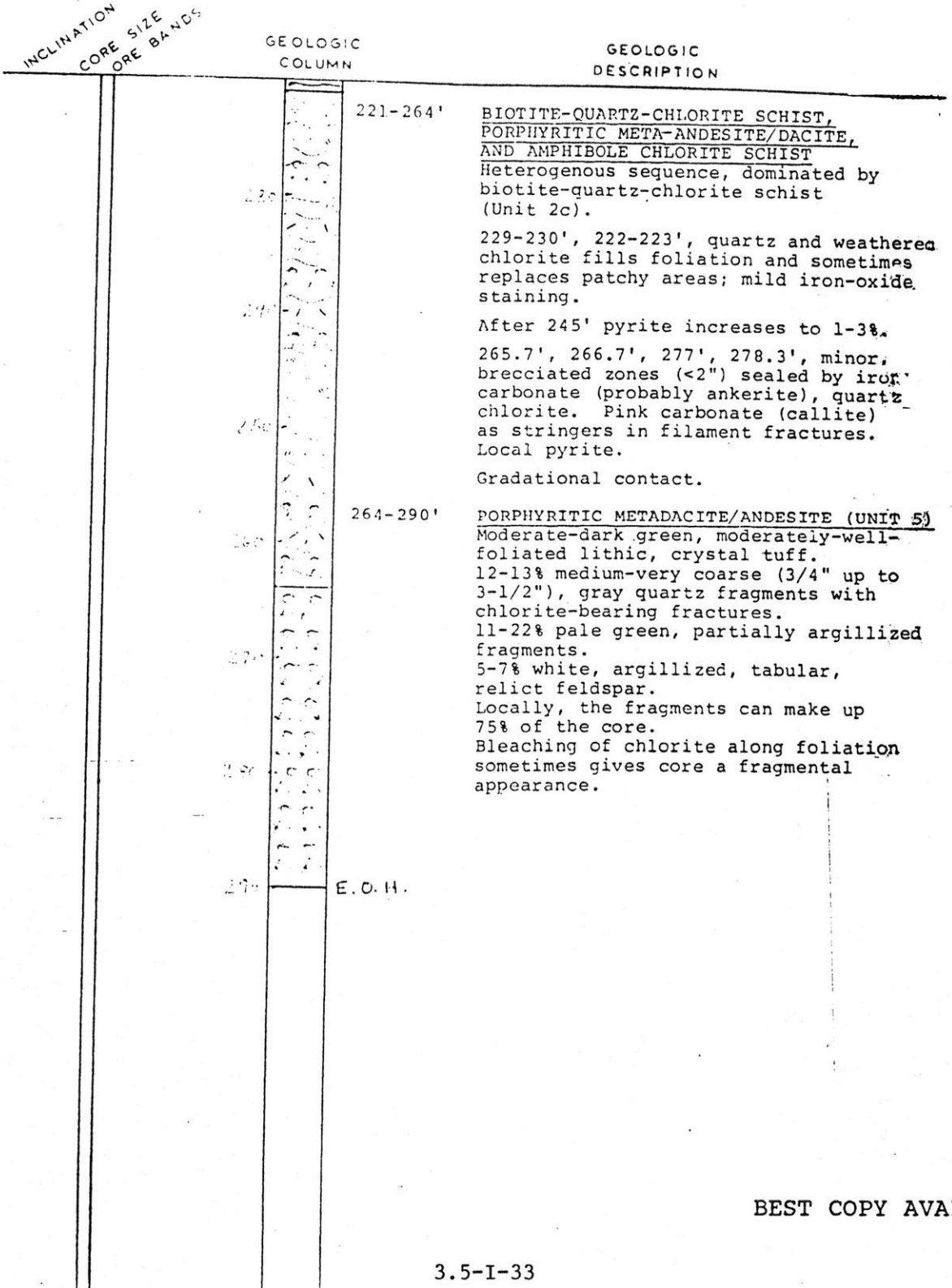
BEAR CREEK MINING CO.

Hole 22-142

SECTION 422
COORDINATES 41290.2697N, 40476.3052E
AZIMUTH 135°
ELEVATION 1139.80

DATE STARTED 12-7-87
DATE COMPLETED 12-16-87
LENGTH OF HOLE 290'



BEST COPY AVAILABLE

LOG OF TEST BORING NO.: PZ-S1

CLIENT: Kennecott
PROJECT: Geotechnical Investigation-Flambeau
PROJECT NUMBER: 87K10-22
LOCATION: NW pit slope; Section 401, 350 ft. N. baseline
COORDINATES: 40064.40 N 38736.18 E

SURFACE ELEVATION: 1101.6
BORING DEPTH: 41.5
DATE: 12/08/87

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLE NOTES
1101.6	--0.0						Surface-brn. silty SAND, fine, w/bldrs.	SM		
1099.1	--2.5									
1096.6	--5.0	5.0-7.0	sb	1		0.5	Red brn (5YR 4/4) silty SAND/silty GRVL, fn sand w/med & cse sand, fn & cse gvl., diamict w/many bldrs.	SM/GM	Noncohesive	
1094.1	--7.5									
1091.6	--10.0	10.0-12.0	sb	2		1.5	Yel. red (5YR 4/6) prly graded GRAVEL, cse & fn gravel w/med & cse sand, slightly cohesive, saturated	GP	Noncohesive	sb2 (GP) 45% cse gvl 21% fn gvl 30% sand 4% si & cl 6.8% moist
1089.1	--12.5									
1086.6	--15.0	15.0-17.0	sb	3		1.8	15-16'-Red brn silty SAND/silty GRAVEL, fn-cse sand w/fn & cse gvl, diamict w/much gvl, dense, sat., slightly cohes.	SM/GM	Noncohesive	
							16-17'-Yel red (5YR 5/6) prly grd SAND fn w/med, layered, qtz w/much dk gray (Mn?) stain, dense, loose, sat, (SS)	SP (SS)	Noncohesive	
1084.1	--17.5	17.0-18.5	sb	4		1.5	17-18'-Same, except pale yel & gray w/fine sand layers			sb4 (SP) 3% cse sand 36% med sand 58% fn sand
1081.6	--20.0	19.0-21.0	sb	5		1.8	Lt. green gray (5GY 7/1) silty SAND, fn, partially cemented, vy fn ss. At 20' vy pale brn (10YR 3/3) fn sandstone		P.P. - 4.5+ @20':Noncohes.	3% si & cl 14.4% moist
		21.0-23.0	sb	6		2.0	Lt yel brn (10YR6/4) & yel brn (10YR6/8) fn ss w/lyrs cse sand <0.5" dia., loose @ 22.8', white (2.5Y 8/2) w/pale yel (2.5Y 8/4) saprolite, laminated, vy soft wet, talcy		Noncohesive @22.8': P.P. - 0.9	sb5 (SP) 1% gvl 2% cse sand 32% med sand 64% fn sand 2% si & cl
1079.1	--22.5									
		23.0-25.0	st	7		2.0	Slightly moist, brittle, altered schist			
1076.6	--25.0	25.0-27.0	st	8		2.0	Same except yel. brn.	"ML"		st8 (ML) 8% gvl 17% sand 75% si & cl
1074.1	--27.5	27.0-29.0	st	9		2.0	Same			LL=33.2 PI= 6.4

DRILLING DATA

START DATE: 12/08/87
COMPLETION DATE: 12/08/87
LOGGED BY: BJS
DRILLING METHOD: Mud rotary, 6" tricone bit
DRILLING CONTRACTOR: Luisier Drilling, Inc.

WATER LEVEL INFORMATION

DEPTH AT COMPLETION:
LATER TIME/DEPTH: 24 hr/6'
LATER TIME/DEPTH:
CAVE IN DEPTH:
DRILLING LOSSES:

LOG OF TEST BORING NO.: PZ-S1

CLIENT: Kennecott
PROJECT: Geotechnical Investigation-Flambeau
PROJECT NUMBER: 87K10-22
LOCATION: NW pit slope; Section 401, 350 ft. N. baseline
COORDINATES: 40064.40 N 38736.18 E

SURFACE ELEVATION: 1101.6
BORING DEPTH: 41.5
DATE: 12/08/87

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLE NOTES
1074.1	--27.5	27.0-29.0	st	9		2.0	Slightly moist, brittle, altered, yellow brown	"ML"		
1071.6	--30.0	29.0-31.0	st	10		2.0	As above except w/few, thin, hard layers Drill to 35' wo/sampling			
1069.1	--32.5									
1066.6	--35.0	35.0-37.0	st	11		1.2	Same w/more hard, micaceous, siliceous layers			
1064.1	--37.5									
1061.6	--40.0	40.0-41.5	st	12		1.0	40.0-40.5'-Same except firmer 40.5'-End of Boring in altered schist PZ-1 installed in boring @ 40'	=====		
1059.1	--42.5									
1056.6	--45.0									
1054.1	--47.5									
1051.6	--50.0									
1049.1	--52.5									
1046.6	--55.0									

DRILLING DATA

START DATE: 12/08/87
COMPLETION DATE: 12/08/87
LOGGED BY: BJS
DRILLING METHOD: Mud rotary, 6" tricone bit
DRILLING CONTRACTOR: Luisier Drilling, Inc.

WATER LEVEL INFORMATION

DEPTH AT COMPLETION:
LATER TIME/DEPTH: 24 hr/6'
LATER TIME/DEPTH:
CAVE IN DEPTH:
DRILLING LOSSES:

Foth & Van Dyke
Engineers/Architects
2737 S. Ridge Road
P. O. Box 19012
Green Bay, Wisconsin 54307-9012
414/497-2500

PROJECT NO.: _____

JOB NO.: 87K10

DATE: December 16-22, 1987

REPORT NO.: 1

REPORT OF ANALYSIS OF AGGREGATES

ARCHITECT/ENGINEER: Foth & Van Dyke CONTRACTOR: _____

PROJECT: Kennecott Geotechnical SOURCE: _____

REPORT OF TESTS OF: Verification of Subsurface Samples

Sieve Size or No.	Weight Retained	% Retained	% Passing	Specifications
3-Inch				
2-Inch	0	0	100	
1 1/2-Inch	87.9	7.8	92.2	
1-Inch	276.3	24.4	67.8	
3/4-Inch	144.9	12.8	55.0	
1/2-Inch	91.9	8.1	46.9	
3/8-Inch	45.9	4.1	42.8	
No. 4	100.1	8.8	34.0	
No. 8				
No. 10	102.1	9.0	25.0	
No. 16				
No. 20				
No. 30				
No. 40	174.9	15.4	9.6	
No. 50				
No. 80				
No. 100	59.3	5.2	4.4	
No. 200	9.7	0.9	3.5	
Pan	39.6	3.5		

RECEIVED AT LABORATORY: December 14, 1987

QUANTITY REPRESENTED: 1132.6 grams

SUBMITTED BY: Betty Socha, Foth & Van Dyke

SAMPLED FROM: Boring No.: PZ-S1

IDENTIFICATION: Depth: 10' - 11.5'

DATE SAMPLED: November-December 1987

INTENDED USE: _____

WASHED GRADATION: yes

PERCENT PASSING NO. 200 SIEVE 3.5 %

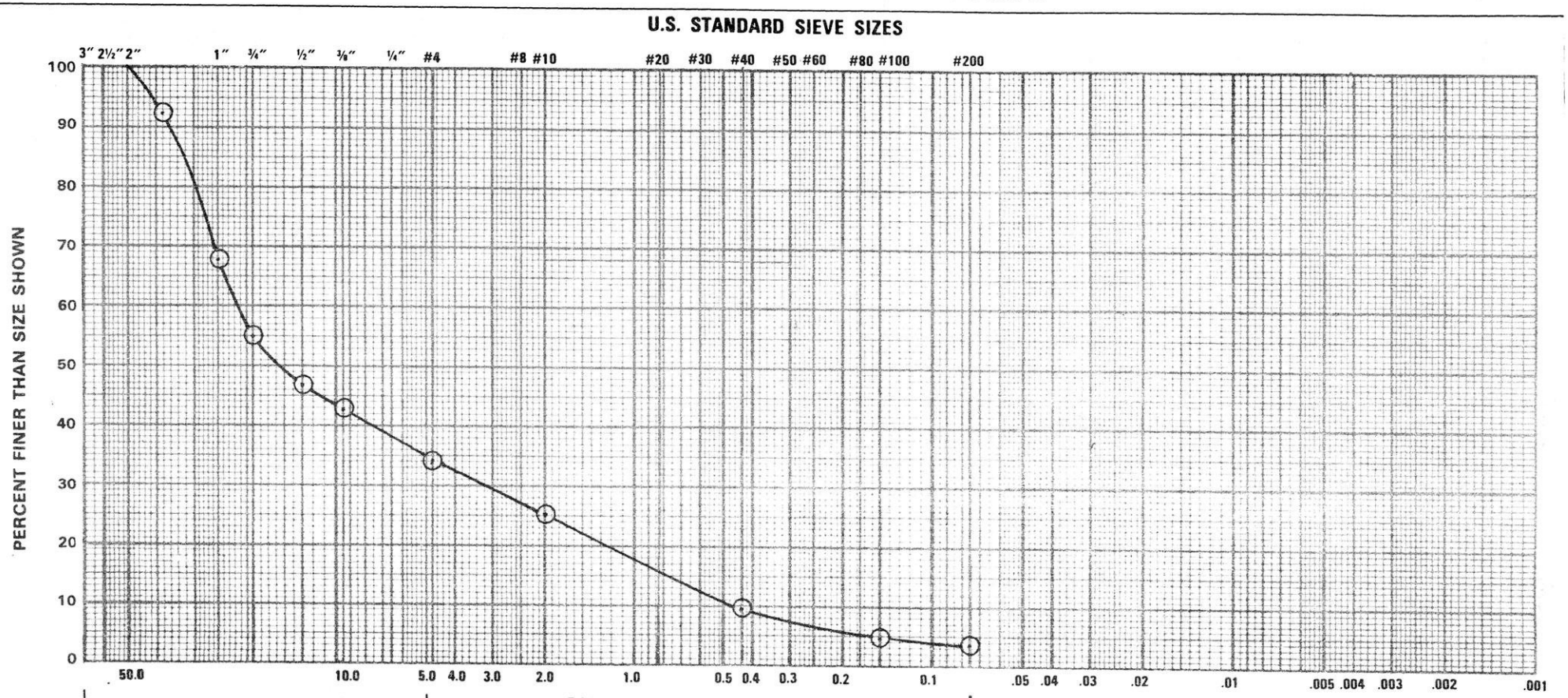
COLOR: 5YR. 4/4 - reddish brown

Moisture Content = 6.8%
(as received)

CHECKED BY: RRR

Foth & Van Dyke and Associates Inc.

GRAIN SIZE DISTRIBUTION CURVE



GRAVEL		SAND			SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE		
% = 45.0	% = 21.0	% = 9.0	% = 15.4	% = 6.1	% = 3.5	% =

PROJECT: Kennecott Geotechnical DATE: 12/22/87 SAMPLE NO.: 1

LOCATION SAMPLED: Boring: PZ-S1 ELEV. OR DEPTH: 10'-11.5' DRAWN BY: POK APPROVED BY: RRR

ATTERBERG LIMITS: LL _____ PL _____ PI _____ SAMPLED MOISTURE CONTENT (%): 6.8 COEFFICIENTS: Cc = 1.0 Cu = 47.8

SAMPLE SOURCE: _____ MUNSELL COLOR CODE: 5YR. 4/4 DATE SAMPLED: Nov.-Dec. 1987

SOIL CLASSIFICATION (ASTM: D2487) GRAVEL, ^{w}/SAND, reddish brown (GP)

FORM #411 SL (2/87)

3.5-I-37

Foth & Van Dyke
Engineers/Architects
2737 S. Ridge Road
P. O. Box 19012
Green Bay, Wisconsin 54307-9012
414/497-2500

PROJECT NO.: _____

JOB NO.: 87K10

DATE: December 16-22, 1987

REPORT NO.: 2

REPORT OF ANALYSIS OF AGGREGATES

ARCHITECT/ENGINEER: Foth & Van Dyke CONTRACTOR: _____

PROJECT: Kennecott Geotechnical SOURCE: _____

REPORT OF TESTS OF: Verification of Subsurface Samples

Sieve Size or No.	Weight Retained	% Retained	% Passing	Specifi-cations
3-Inch				
2-Inch				
1 1/2-Inch				
1-Inch				
3/4-Inch				
1/2-Inch				
3/8-Inch	0	0	100	
No. 4	3.1	0.4	99.6	
No. 8				
No. 10	17.7	2.6	97.0	
No. 16				
No. 20				
No. 30				
No. 40	246.1	35.6	61.4	
No. 50				
No. 80				
No. 100	311.1	45.1	16.3	
No. 200	88.5	12.8	3.5	
Pan	24.0	3.5		

RECEIVED AT LABORATORY: December 14, 1987

QUANTITY REPRESENTED: 690.5 grams

SUBMITTED BY: Betty Socha, Foth & Van Dyke

SAMPLED FROM: Boring No.: PZ-S1

IDENTIFICATION: Depth: 17'-18'

DATE SAMPLED: November - December 1987

INTENDED USE: _____

WASHED GRADATION: yes

PERCENT PASSING NO. 200 SIEVE 3.5 %

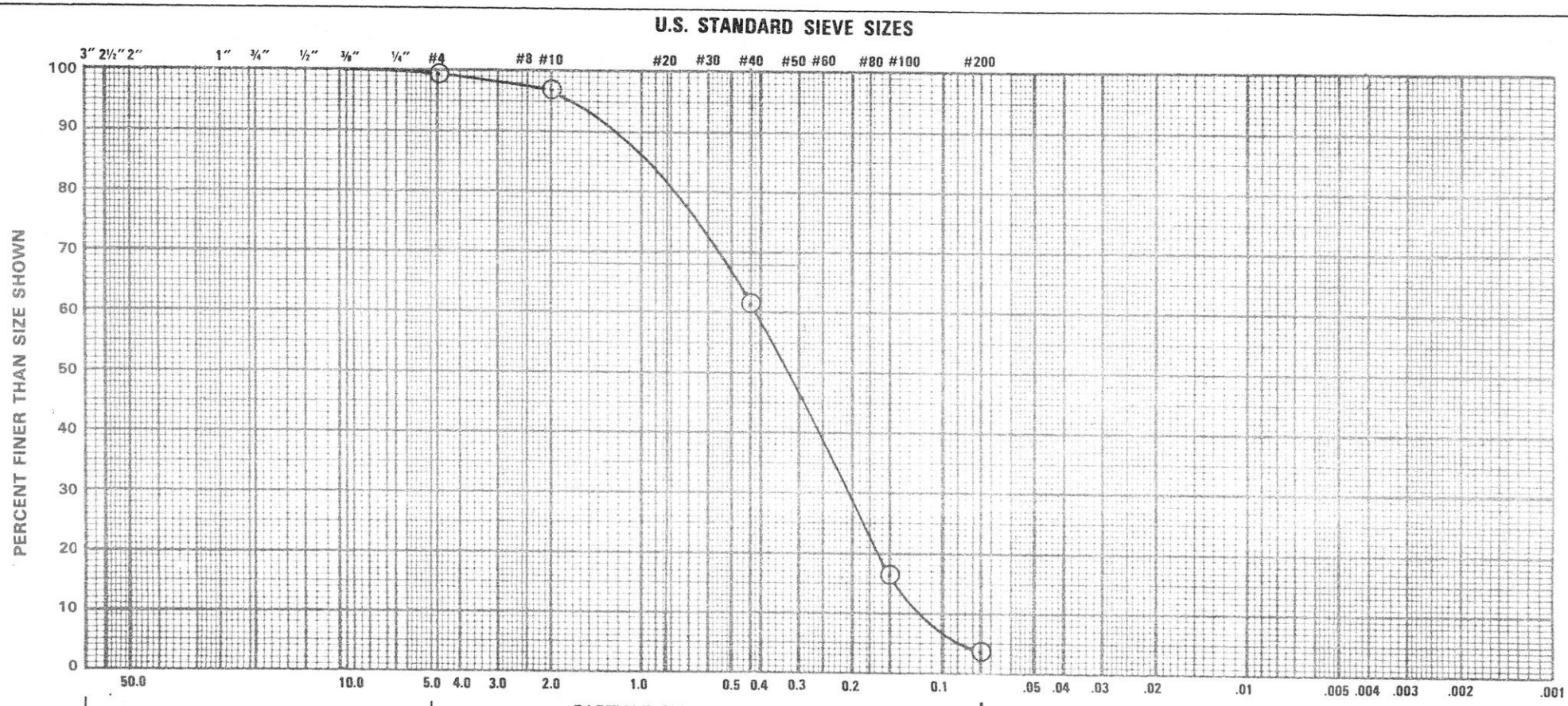
COLOR: 10YR. 6/3 - pale brown

Moisture Content = 14.4%
(as recieved)

CHECKED BY: RRR

Foth & Van Dyke and Associates Inc.

GRAIN SIZE DISTRIBUTION CURVE



GRAVEL		SAND			SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE		
% =	% = 0.4	% = 2.6	% = 35.6	% = 57.9	% = 3.5	% =

PROJECT: Kennecott Geotechnical DATE: 12/22/87 SAMPLE NO.: 2

LOCATION SAMPLED: Boring: PZ-S1 ELEV. OR DEPTH: 17'-18' DRAWN BY: POK APPROVED BY: RRR

ATTERBERG LIMITS: LL _____ PL _____ PI _____ SAMPLED MOISTURE CONTENT (%): 14.4 COEFFICIENTS: Cc = 0.9 Cu = 3.5

SAMPLE SOURCE: _____ MUNSELL COLOR CODE: 10YR. 6/3 DATE SAMPLED: Nov.-Dec. 1987

SOIL CLASSIFICATION (ASTM: D2487) SAND, fine to medium grained, pale brown (SP)

FORM #411 SL (2/87)

3.5-I-39

Foth & Van Dyke
Engineers/Architects

2737 S. Ridge Road
P. O. Box 19012
Green Bay, Wisconsin 54307-9012
414/497-2500

PROJECT NO.: _____

JOB NO.: 87K10

DATE: February 2-3, 1988

REPORT NO.: SB4

REPORT OF ANALYSIS OF AGGREGATES

ARCHITECT/ENGINEER: Foth & Van Dyke CONTRACTOR: _____

PROJECT: Kennecott Geotechnical - Granular Blanket SOURCE: _____

REPORT OF TESTS OF: Verification of Proposed Granular Blanket Material

Sieve Size or No.	Weight Retained	% Retained	% Passing	Specifi-cations
3-Inch				
2-Inch				
1 1/2-Inch				
1-Inch				
3/4-Inch				
1/2-Inch				
3/8-Inch	0	0	100	
No. 4	1.1	0.7	99.3	
No. 8				
No. 10	3.3	2.1	97.2	
No. 16				
No. 20				
No. 30				
No. 40	51.0	32.0	65.2	
No. 50				
No. 80	70.4	44.2	21.0	
No. 100	11.5	7.2	13.8	
No. 200	20.0	12.5	1.3	
Pan	2.1	1.3		

RECEIVED AT LABORATORY: February 2, 1988

QUANTITY REPRESENTED: 159.4 grams

SUBMITTED BY: Betty Socha of F&VD

SAMPLED FROM: Boring No.: PZ-S1

IDENTIFICATION: Sample No.: S1 Depth: 20'-21'

DATE SAMPLED: December 1987

INTENDED USE: Granular Blanket

WASHED GRADATION: No

PERCENT PASSING NO. 200 SIEVE 1.3 %

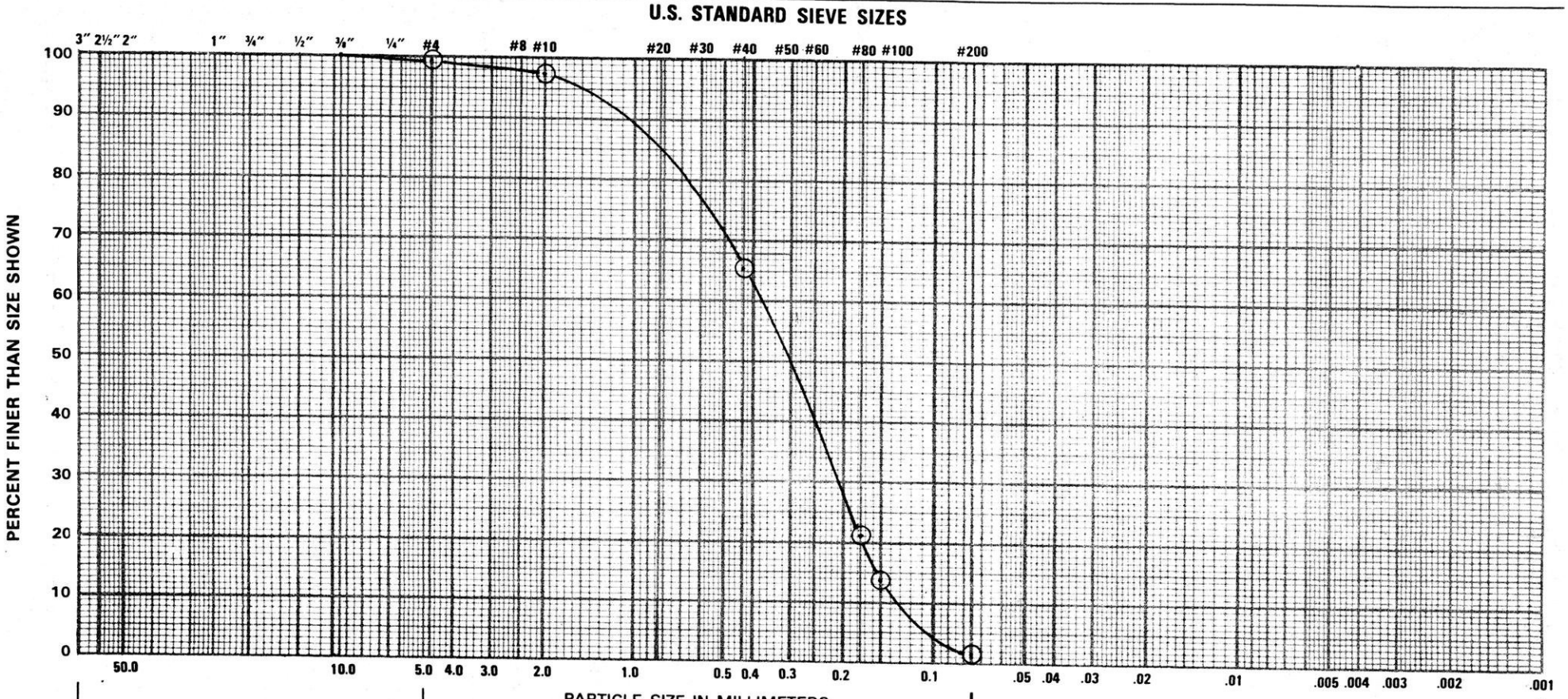
COLOR: 10 YR. 7/2 - light gray

CHECKED BY: RRR

FORM #329 A-1 SL (Rev. 11/86)

Foth & Van Dyke and Associates Inc.

GRAIN SIZE DISTRIBUTION CURVE



GRAVEL		SAND			SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE		
% =	% = 0.7	% = 2.1	% = 32.0	% = 63.9	% = 1.3	% =

PROJECT: Kennecott Geotechnical - Granular Blanket DATE: 2/3/88 SAMPLE NO.: SB4

LOCATION SAMPLED: Boring No.: PZ-S1 ELEV. OR DEPTH: 20'-21' DRAWN BY: POK APPROVED BY: RRR

ATTERBERG LIMITS: LL _____ PL _____ PI _____ SAMPLED MOISTURE CONTENT (%): _____ COEFFICIENTS: Cc = 0.9 Cu = 2.9

SAMPLE SOURCE: _____ MUNSELL COLOR CODE: 10 YR. 7/2 DATE SAMPLED: December 1987

SOIL CLASSIFICATION (ASTM: D2487) SAND, fine to medium grained, light gray (SP)

FORM #411 SL (2/87)

3.5-I-41

Foth & Van Dyke

Engineers/Architects

2737 S. Ridge Road P. O. Box 19012 Green Bay, WI 54307-9012 414/497-2500

REPORT OF:

FALLING HEAD PERMEABILITY TEST

PROJECT: Kennecott Geotechnical

DATE: March 14, 1988

SCOPE I.D. #: 87K10

REPORTED TO: Kenneoctt

COPIES TO:

GENERAL DATA:

Boring/Test Pit Number:	PZ-S1
Depth of Sample:	25' - 27'
Sample Number:	Report #1
Date Sampled:	December 8, 1987
Date Received:	January 28, 1988
Source of Sample:	

LABORATORY DATA **PROJECT SPECIFICATIONS**

Method of Test:	3" Galvanized Tube Section (Rigid Wall)
Length of Sample (inches):	7.50
Diameter of Sample (inches):	3.08
Dates Tested:	March 7 to 14, 1988
Moisture Content (%):	13.2
Dry Density (pcf):	121.2
% Compaction:	101 1/2 ASTM D1557 - Method "A"
Soil Classification:	SILT W/SAND, a little gravel, yellowish brown (ML)
Permeant Used:	Distilled Water
Technician:	R. Rouse
Coefficient of Permeability: (cm/sec)	3.3×10^{-8}

ATTERBERG LIMITS

Liquid Limit (%):	
Plastic Limit (%):	
Plasticity Index:	

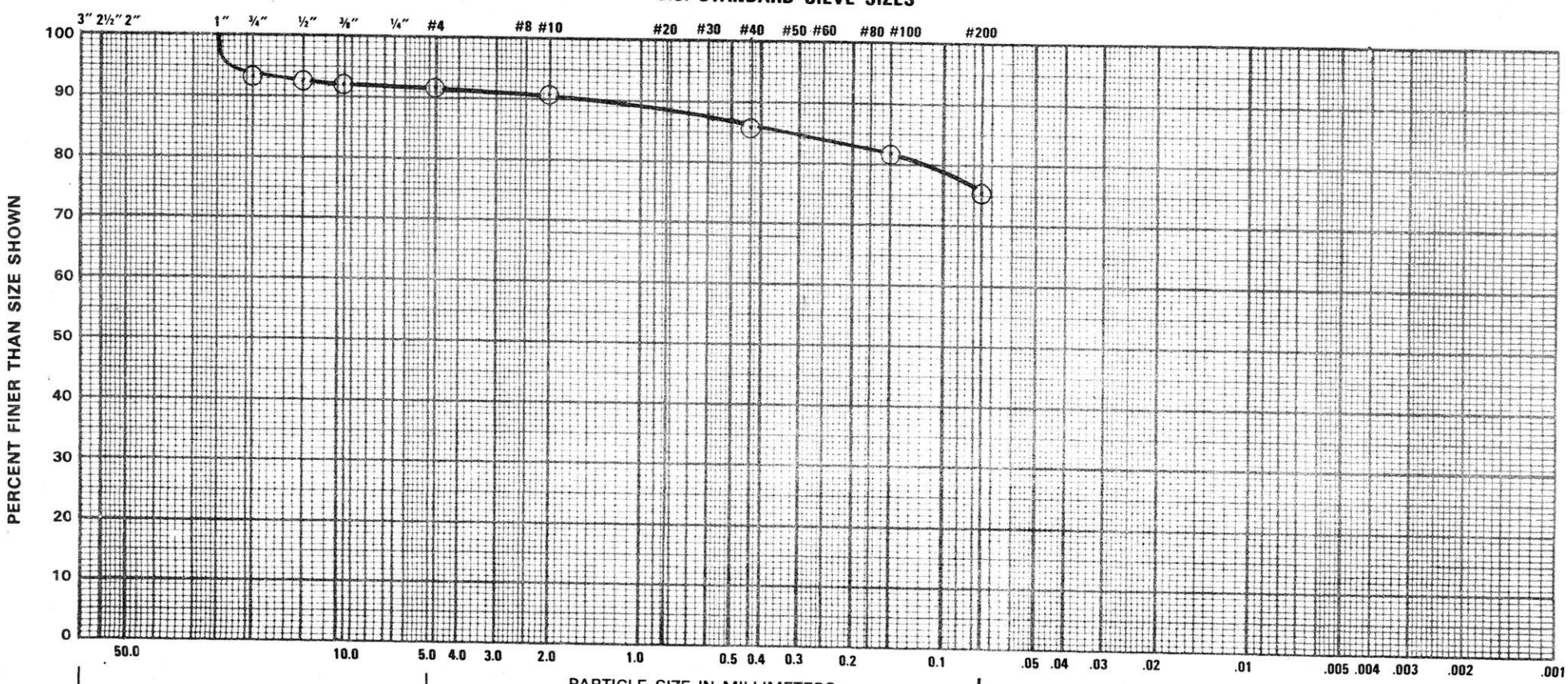
REMARKS:

FORM #407 (12/86)

By: Robert R. Rouse

Foth & Van Dyke and Associates Inc.

GRAIN SIZE DISTRIBUTION CURVE



GRAVEL		SAND			SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE		
% = 6.8	% = 1.3	% = 1.0	% = 5.0	% = 10.7	% =	% =

PROJECT: Kennecott Geotechnical DATE: 3/9/88 SAMPLE NO.: 1

LOCATION SAMPLED: Boring No.: PZ-S1 ELEV. OR DEPTH: 25'-27' DRAWN BY: POK APPROVED BY: RRR

ATTERBERG LIMITS: LL 33.2 PL 26.8 PI 6.4 SAMPLED MOISTURE CONTENT (%): 13.2 COEFFICIENTS: Cc = Cu =

SAMPLE SOURCE: MUNSELL COLOR CODE: 10 YR. 5/8 DATE SAMPLED: Dec. 8, 1987

SOIL CLASSIFICATION (ASTM: D2487) SILT W/SAND, a little gravel, yellowish brown (ML)

FORM #411 SL (2/87)

3.5-I-43

Foth & Van Dyke

Engineers/Architects

2737 S. Ridge Road
P. O. Box 19012
Green Bay, Wisconsin 54307-9012
414/497-2500

PROJECT NO.: _____

JOB NO.: 87K10

DATE: February 1 to March 3, 1988

REPORT NO.: 1

REPORT OF ANALYSIS OF AGGREGATES

ARCHITECT/ENGINEER: Foth & Van Dyke CONTRACTOR: _____

PROJECT: Kennecott Geotechnical SOURCE: _____

REPORT OF TESTS OF: Verification of Subsurface Samples

Sieve Size or No.	Weight Retained	% Retained	% Passing	Specifications
3-Inch				
2-Inch				
1 1/2-Inch				
1-Inch	0	0	100	
3/4-Inch	50.8	6.8	93.2	
1/2-Inch	3.5	0.5	92.7	
3/8-Inch	3.5	0.5	92.2	
No. 4	1.9	0.3	91.9	
No. 8				
No. 10	7.6	1.0	90.9	
No. 16				
No. 20				
No. 30				
No. 40	37.2	5.0	85.9	
No. 50				
No. 80				
No. 100	30.9	4.1	81.8	
No. 200	49.6	6.6	75.2	
Pan	561.8	75.2		

RECEIVED AT LABORATORY: January 28, 1988

QUANTITY REPRESENTED: 746.7 grams

SUBMITTED BY: Betty Socha of F&VD

SAMPLED FROM: Boring No.: PZ-S1

IDENTIFICATION: Depth: 25' - 27'

DATE SAMPLED: December 8, 1987

INTENDED USE: _____

WASHED GRADATION: yes

PERCENT PASSING NO. 200 SIEVE 75.2 %

COLOR: 10 YR. 5/8 - yellowish brown

Moisture Content = 13.2%
(As received)

CHECKED BY: RRR

FORM #329 A-1 SL (Rev. 11/86)

Foth & Van Dyke

Engineers/Architects

2737 S. Ridge Road P. O. Box 19012 Green Bay, Wisconsin 54307-9012 414/497-2500

COMPACTION CONTROL REPORT

DATE: 2-18-88 JOB NAME: Kennecott Geotechnical SCOPE I.D. #: 87K10

1. LABORATORY COMPACTION TEST DATA

A. DESCRIPTION OF SOIL: SILT W/SAND, yellowish brown (ML)

MATERIAL MARK 1 CLASSIFICATION _____ AASHO _____ BPR

SOURCE OF MATERIAL Boring No. PZ-S1 23' - 31'

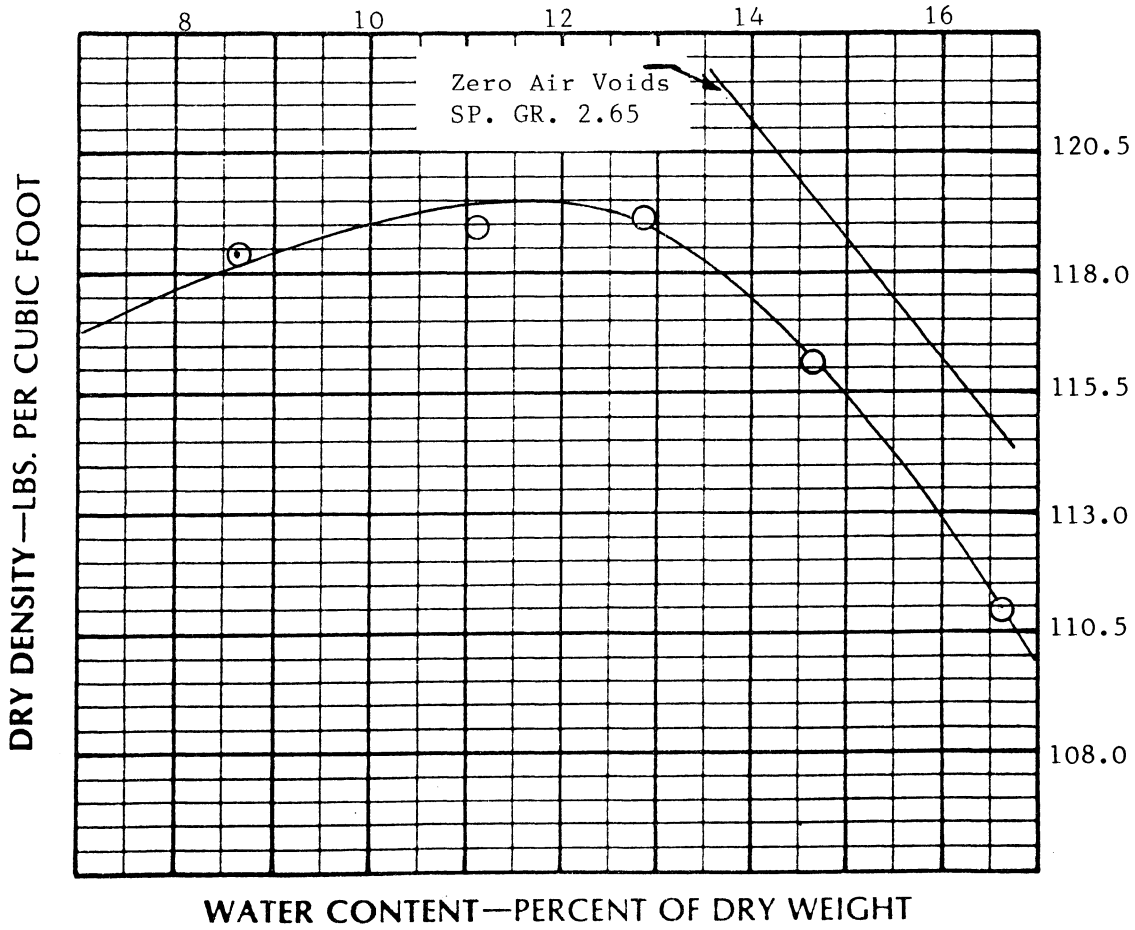
NATURAL WATER CONTENT 13.2 % NATURAL DRY DENSITY _____ PCF SPECIFIC GRAVITY _____

LIQUID LIMIT 33.2 % PLASTIC LIMIT 26.8 % PLASTICITY INDEX 6.4

B. TEST PROCEDURE USED: ASTM D1557 METHOD "A"

C. TEST RESULTS: OPTIMUM WATER CONTENT 11.7 %

MAXIMUM DRY DENSITY 119.5 PCF (AT A WET DENSITY OF 133.5 PCF)

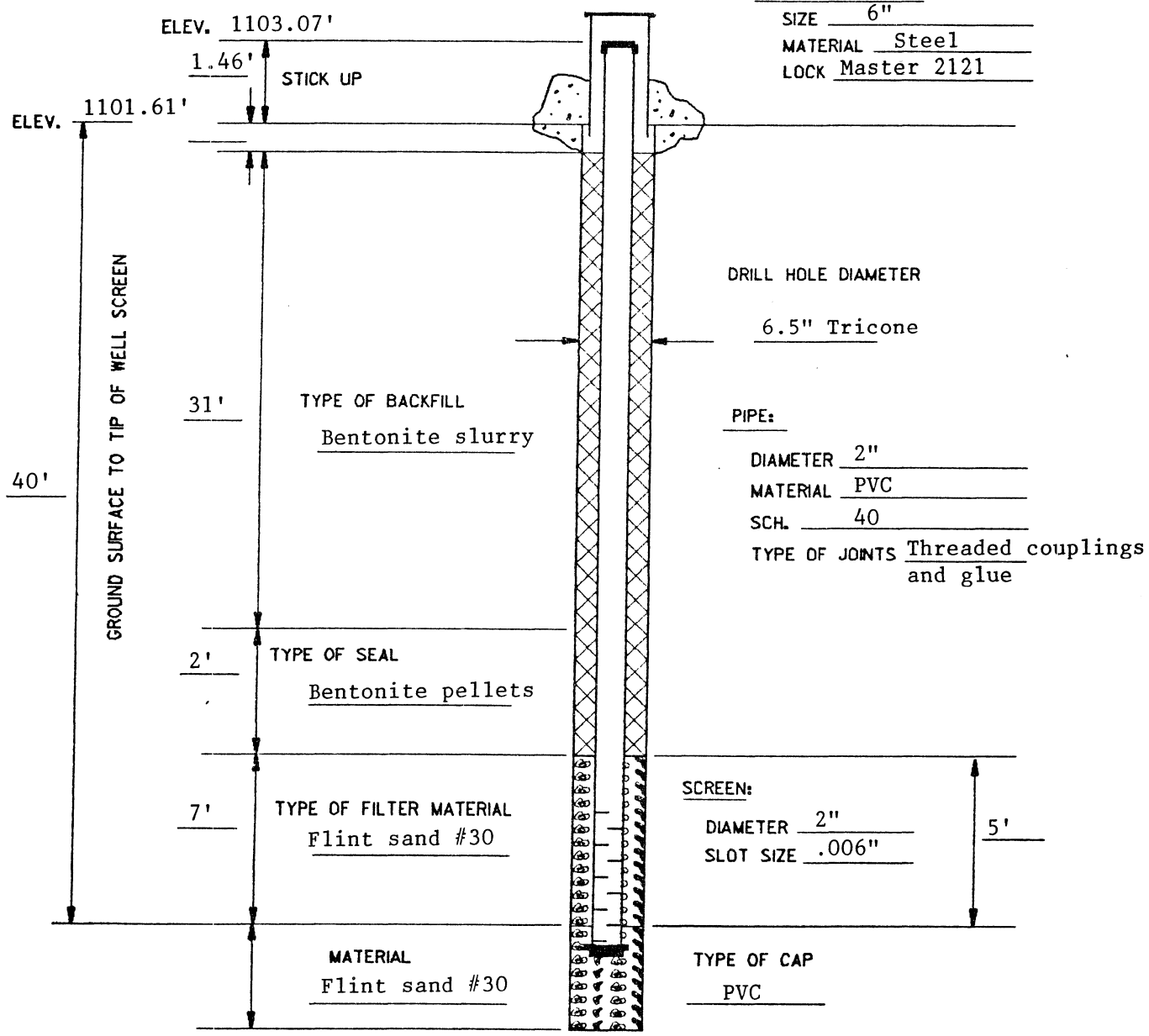


FORM #332 SL (6/85)

MONITORING WELL INSTALLATION DIAGRAM

WELL NO: PZ-S1
DATE INSTALLED: 12-08-87
DRILLER: Luisier Drilling Inc.
DRILLING METHOD: Mud rotary
COORDINATES: 40,064.40N 38,736.18E

CLIENT: Kennecott
PROJECT: Geotechnical
SCOPE I.D.: 87K10-BL22
BY: BJS



PROTECTOR PIPE:
SIZE 6"
MATERIAL Steel
LOCK Master 2121

DRILL HOLE DIAMETER
6.5" Tricone

TYPE OF BACKFILL
Bentonite slurry

PIPE:
DIAMETER 2"
MATERIAL PVC
SCH. 40
TYPE OF JOINTS Threaded couplings and glue

TYPE OF SEAL
Bentonite pellets

TYPE OF FILTER MATERIAL
Flint sand #30

SCREEN:
DIAMETER 2"
SLOT SIZE .006"
5'

TYPE OF CAP
PVC

Foth & Van Dyke
Geosciences & Environmental Management Division

MONITORING WELL DEVELOPMENT

WELL NUMBER PZ-S1
WELL DIAMETER 2"
TOTAL DEPTH OF WELL 42.60'
DEPTH TO WATER TIME OF MEASUREMENT
BEFORE 8.30'
AFTER 36.55'

CLIENT Kennecott
PROJECT Geotechnical Investigation
SCOPE I.D. 87K10-BL 22
BY MJH
DATE 12-18-87

DESCRIPTION OF DEVELOPMENT METHOD

Well was alternately bailed and surged using a PVC hand bailer.

VOLUME OF WATER REMOVED FROM WELL 6 gals.
CLARITY OF WATER IN WELL BEFORE DEVELOPMENT Brn
CLARITY OF WATER IN WELL AFTER DEVELOPMENT Brn
PRESENCE OF SEDIMENT AT THE BOTTOM OF THE WELL Silty
VOLUME OF WATER ADDED TO WELL None
SOURCE OF WATER ADDED TO WELL
TIME SPENT FOR DEVELOPMENT

STABILIZATION READINGS

GAL. REMOVED	TIME	FIELD TEMPERATURE	FIELD SPEC. COND.	FIELD pH

FOTH AND VAN DYKE

LOG OF TEST BORING NO.: PZ-S2

CLIENT: Kennecott
PROJECT: Geotechnical Investigation-Flambeau
PROJECT NUMBER: 87K10-22
LOCATION: SW pit slope; Section 401, 130 ft. S. baseline
COORDINATES: 39703.68 N 39076.85 E

SURFACE ELEVATION: 1103.4
BORING DEPTH: 31.5
DATE: 12/07/87

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLE NOTES
1103.4	--0.0						Surface, silty SAND w/bldrs. (eolian & fluvial sand w/bldrs)	SM		
1100.9	--2.5									
1098.4	--5.0	5.0-7.0	sb	1		2.0	Red brn (5YR 4/4) silty SAND, fn w/med & cse sand, fn & cse gvl, crumbly, sltly moist, cohesive (till)	SM	P.P. - 0.3	sb1 (SM) 26% gvl 51% sand 23% si & cl
1095.9	--7.5									
1093.4	--10.0	10.0-12.0	sb	2		1.0	As above except slightly coarser, bldr @ 11 ft., saturated		P.P. - 3.2	
1090.9	--12.5	12.0-13.4	sb	3		1.4	Dk red brn (5YR 3/2) silty SAND, & prly graded SAND w/silt, layered 1-2" thick, w/gvl, much Fe, Mn stain, sat., cohesive @13.5'-cuttings w/sericite & kaolinite	SM, SP-SM	Noncohesive	
1088.4	--15.0	15.0-16.5	sb	4		1.5	Lt. grn gray (5GY 7/1) w/pale yel (2.5Y8/4) "Silty GRAVEL w/sand", cohes., brittle, moist. Apparent schistocity (saprolite)	"GM"		sb4 (GM) 36% cse gvl 24% fn gvl 23% sand
1085.9	--17.5	17.0-18.5	st	5		1.5	Yel brn (oxidized) altered sericite schist w/distict foliation, hard	"ML"		16% silt 1% clay 11.9% moist
1083.4	--20.0	20.0-21.5	st	6		1.5	Same except crumbly, soft to hard			st5 (SM) K= 3.3E - 07 cm/sec
1080.9	--22.5	22.0-23.0	st	7		1.0	Same except harder			st6 (SM) 22% gvl
		@ 23.0	c	8		0.0	Cored 23-26', One piece 2x3" oxidized sericite schist w/secondary Fe cement along foliation & fractures		P.P. - 4.5+ RQD = 0%	55% sand 23% si & cl
1078.4	--25.0									
		@ 26.0	c	9		1.0	Cored 26.5-28.5', Lt red brn (5Y 6/4) & red yel (5YR6/6) altered sericite schist brittle to very hard		P.P. - 4.5+ RQD = 50%	
1075.9	--27.5									

DRILLING DATA

START DATE: 12/07/87
COMPLETION DATE: 12/07/87
LOGGED BY: BJS
DRILLING METHOD: Mud rotary, 6" tricone, 5" carbide bit
DRILLING CONTRACTOR: Luisier Drilling, Inc.

WATER LEVEL INFORMATION

DEPTH AT COMPLETION:
LATER TIME/DEPTH: 24 hr/12'
LATER TIME/DEPTH:
CAVE IN DEPTH:
DRILLING LOSSES:

LOG OF TEST BORING NO.: PZ-S2

CLIENT: Kennecott
PROJECT: Geotechnical Investigation-Flambeau
PROJECT NUMBER: 87K10-22
LOCATION: SW pit slope; Section 401, 130 ft. S. baseline
COORDINATES: 39703.68 N 39076.85 E

SURFACE ELEVATION: 1103.4
BORING DEPTH: 31.5
DATE: 12/07/87

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLE NOTES
1075.9	--27.5						Cored 26.5-28.5', Lt red brn (5Y 6/4) & red yel (5YR6/6) altered sericite schist brittle to very hard			
1073.4	--30.0	30.5-31.5	st	10		1.0	Yel brn altered sericite schist w/much kaolinite	"ML"		
							31.5'-End of Boring in altered schist PZ-S2 installed in boring at 31 ft			
1070.9	--32.5									
1068.4	--35.0									
1065.9	--37.5									
1063.4	--40.0									
1060.9	--42.5									
1058.4	--45.0									
1055.9	--47.5									
1053.4	--50.0									
1050.9	--52.5									
1048.4	--55.0									

DRILLING DATA

START DATE: 12/07/87
COMPLETION DATE: 12/07/87
LOGGED BY: BJS
DRILLING METHOD: Mud rotary, 6" tricone, 5" carbide bit
DRILLING CONTRACTOR: Luisier Drilling, Inc.

WATER LEVEL INFORMATION

DEPTH AT COMPLETION:
LATER TIME/DEPTH: 24 hr/12'
LATER TIME/DEPTH:
CAVE IN DEPTH:
DRILLING LOSSES:

LOG OF TEST BORING NO.: B-S2A

CLIENT: Kennecott
PROJECT: Geotechnical Investigation-Flambeau
PROJECT NUMBER: 87K10-22
LOCATION: SW pit slope; Section 401, 130 ft. S. baseline

APPROXIMATE SURFACE ELEVATION: 1104.0
BORING DEPTH: 30.0
DATE: 11/30/87

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLE NOTES
1104.0	--0									
1099.0	--5	5.0-6.5	sb	1.0	85	0.8	Red brn (5YR 4/4) silty SAND, fine, w/med & cse sand, fn gvl, dense, sltly moist, cohesive (till)	SM		
1094.0	--10	10.0-11.5	sb	2.0	63	1.5	Strong brn (7.5YR 4/6) prly graded SAND, fn w/trace med & cse, trace fn gvl, loose, dry (fluvial sand & gvl)	SP		
1089.0	--15	15.0-16.5	sb	3.0	89	1.1	White (5YR 8/1) w/lt red brn (5YR 6/4) mottles, "SILT", firm, moist, cohesive (Saprolite)	"ML"		
1084.0	--20	20.0-21.5	sb	4.0	100	0.0	No recovery		N-100/0.9'	
1079.0	--25	25.0-26.5	sb	5.0	100	0.8	Lt red brn (5YR 6/4), white (5YR 8/1), & yellow (10YR 8/8) "SILT", brittle, cohesive, vy firm w/tabular med sand size crystals (altered schist)		N-100/0.9'	
1074.0	--30	30.0-31.5	sb	6.0	100	0.6	Yellow & brn yel (10YR 7/8 & 6/8) "SILT" very brittle to powdery, slightly moist, cohesive	=====	N-100/0.6'	
							30.0'-End of Boring in altered schist Refusal			
1069.0	--35									
1064.0	--40									
1059.0	--45									
1054.0	--50									
1049.0	--55									

DRILLING DATA

START DATE: 11/30/87
COMPLETION DATE: 11/30/87
LOGGED BY: BJS
DRILLING METHOD: Hollow stem augers, 3 1/4" I.D.
DRILLING CONTRACTOR: Wisconsin Test Drilling, Inc.

WATER LEVEL INFORMATION

DEPTH AT COMPLETION: 14.1
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:
DRILLING LOSSES:

Foth & Van Dyke
Engineers/Architects
2737 S. Ridge Road
P. O. Box 19012
Green Bay, Wisconsin 54307-9012
414/497-2500

PROJECT NO.: _____
JOB NO.: 87K10
DATE: March 1 - 3, 1988
REPORT NO.: 2

REPORT OF ANALYSIS OF AGGREGATES

ARCHITECT/ENGINEER: Foth & Van Dyke CONTRACTOR: _____
PROJECT: Kennecott Geotechnical SOURCE: _____
REPORT OF TESTS OF: Verification of Subsurface Samples

Sieve Size or No.	Weight Retained	% Retained	% Passing	Specifications
3-Inch				
2-Inch				
1 1/2-Inch	0	0	100	
1-Inch	74.2	15.2	84.8	
3/4-Inch	9.8	2.0	82.8	
1/2-Inch	13.9	2.9	79.9	
3/8-Inch	9.7	2.0	77.9	
No. 4	20.4	4.2	73.7	
No. 8				
No. 10	21.2	4.3	69.4	
No. 16				
No. 20				
No. 30				
No. 40	70.6	14.5	54.9	
No. 50				
No. 80				
No. 100	118.1	24.2	30.7	
No. 200	37.2	7.6	23.1	
109.1 Pan+3.6	112.7	23.1		

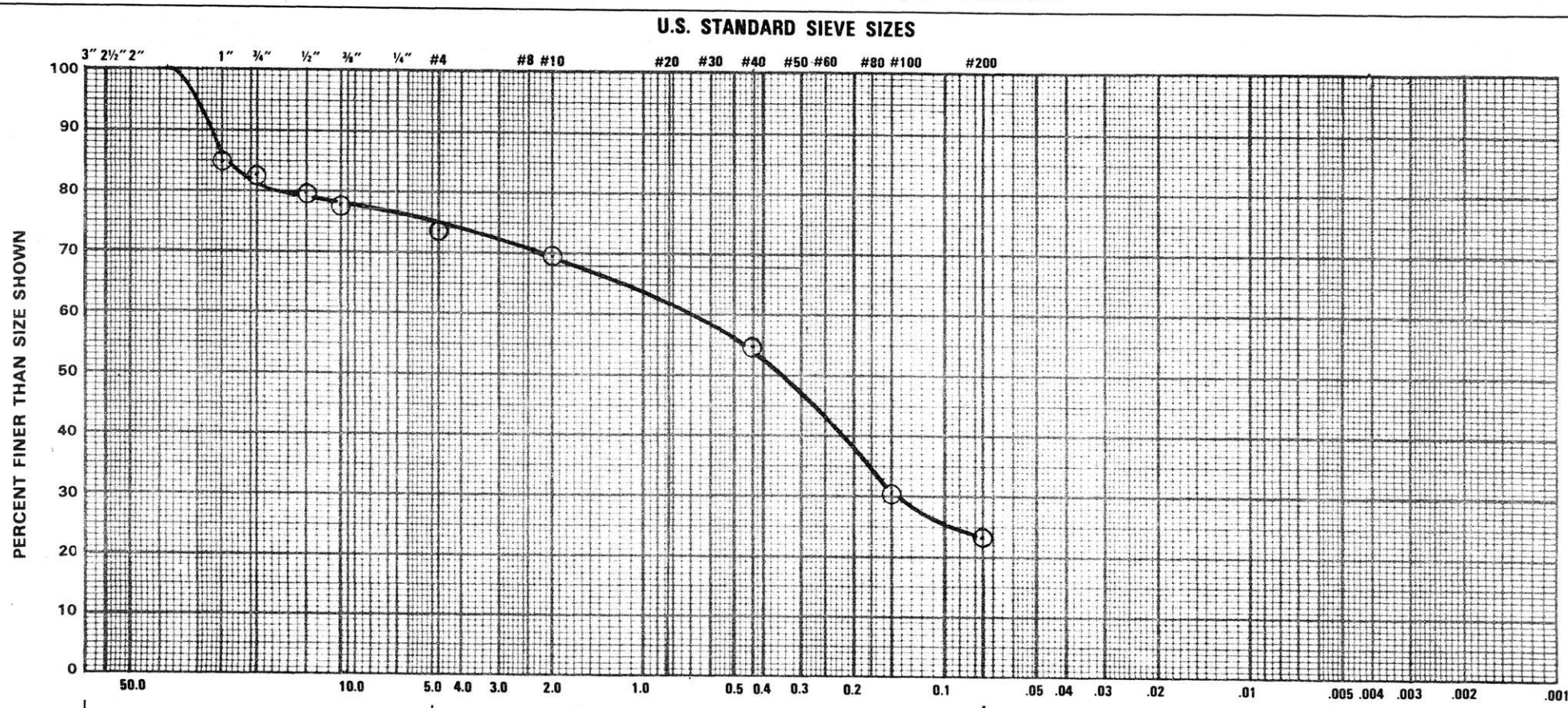
RECEIVED AT LABORATORY: January 28, 1988
QUANTITY REPRESENTED: 487.7 grams
SUBMITTED BY: Betty Socha of F&VD
SAMPLED FROM: Boring No.: PZ-S2
IDENTIFICATION: Depth: 5-7'
DATE SAMPLED: December 7, 1987
INTENDED USE: _____
WASHED GRADATION: yes
PERCENT PASSING NO. 200 SIEVE 23.1 %
COLOR: 5 YR. 3/4 - dark reddish brown
Moisture Content = 8.0% (As received)

CHECKED BY: RRR

FORM #329 A-1 SL (Rev. 11/86)

Foth & Van Dyke and Associates Inc.

GRAIN SIZE DISTRIBUTION CURVE



GRAVEL		SAND			SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE		
% = 17.2	% = 9.1	% = 4.3	% = 14.5	% = 31.8	% =	% =

3.5-I-52

PROJECT: Kennecott Geotechnical DATE: 3-9-88 SAMPLE NO.: 2

LOCATION SAMPLED: Boring No.: PZ-S2 ELEV. OR DEPTH: 5'-7' DRAWN BY: RRR APPROVED BY: POK

ATTERBERG LIMITS: LL _____ PL _____ PI _____ SAMPLED MOISTURE CONTENT (%): 8.0 COEFFICIENTS: Cc = _____ Cu = _____

SAMPLE SOURCE: _____ MUNSELL COLOR CODE: 5 YR. 3/4 DATE SAMPLED: 12-7-87

SOIL CLASSIFICATION (ASTM: D2487) SILTY SAND W/GRAVEL, fine to medium grained, dark reddish brown (SM)

FORM #411 SL (2/87)

Foth & Van Dyke
Engineers/Architects
2737 S. Ridge Road
P. O. Box 19012
Green Bay, Wisconsin 54307-9012
414/497-2500

PROJECT NO.: _____

JOB NO.: 87K10

DATE: December 16-22, 1987

REPORT NO.: 4

REPORT OF ANALYSIS OF AGGREGATES

ARCHITECT/ENGINEER: Foth & Van Dyke CONTRACTOR: _____

PROJECT: Kennecott Geotechnical SOURCE: _____

REPORT OF TESTS OF: Verification of Subsurface Samples

Sieve Size or No.	Weight Retained	% Retained	% Passing	Specifi-cations
3-Inch				
2-Inch				
1 1/2-Inch				
1-Inch	0	0	100	
3/4-Inch	67.6	36.2	63.8	
1/2-Inch	20.9	11.2	52.6	
3/8-Inch	14.2	7.6	45.0	
No. 4	8.8	4.8	40.2	
No. 8				
No. 10	10.6	5.7	34.5	
No. 16				
No. 20				
No. 30				
No. 40	16.5	8.8	25.6	
No. 50				
No. 80				
No. 100	9.2	4.9	20.7	
No. 200	6.4	3.4	17.3	
Pan	32.3	17.3		

RECEIVED AT LABORATORY: December 14, 1987

QUANTITY REPRESENTED: 186.5 grams

SUBMITTED BY: Betty Socha, Foth & Van Dyke

SAMPLED FROM: Boring No.: PZ-S2

IDENTIFICATION: Depth: 15.5' - 17.5'

DATE SAMPLED: November - December 1987

INTENDED USE: _____

WASHED GRADATION: yes

PERCENT PASSING NO. 200 SIEVE 17.3 %

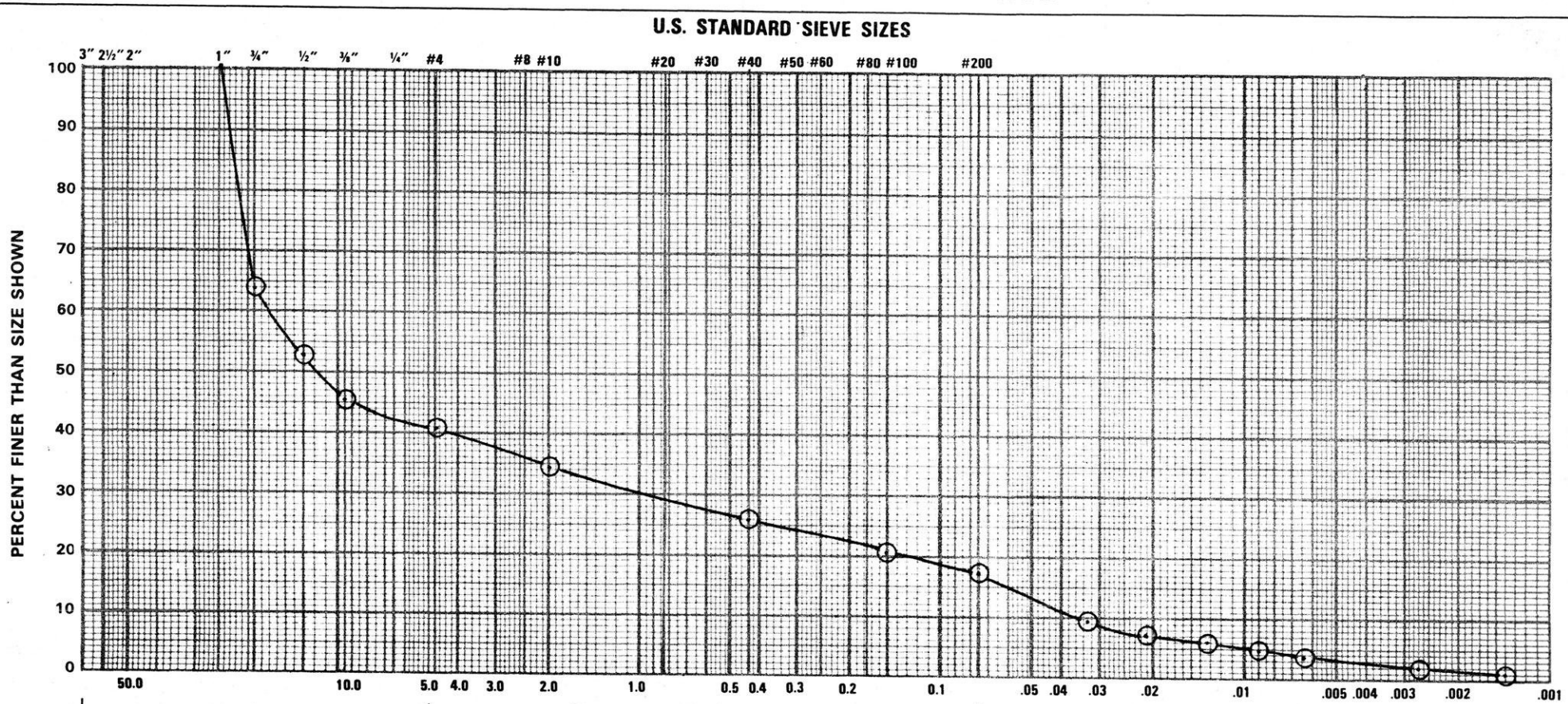
COLOR: 10YR. 8/4 - very pale brown

Moisture Content = 11.9%
(as received)

CHECKED BY: RRR

Foth & Van Dyke and Associates Inc.

GRAIN SIZE DISTRIBUTION CURVE



GRAVEL		SAND			SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE		
% = 36.2	% = 23.6	% = 5.7	% = 8.8	% = 8.4	% = 15.8	% = 1.5

PROJECT: Kennecott Geotechnical DATE: 12/22/87 SAMPLE NO.: 4

LOCATION SAMPLED: Boring: PZ-S2 ELEV. OR DEPTH: 15.5'-17.5' DRAWN BY: POK APPROVED BY: RRR

ATTERBERG LIMITS: LL _____ PL _____ PI N/P SAMPLED MOISTURE CONTENT (%): 11.9 COEFFICIENTS: Cc = _____ Cu = _____

SAMPLE SOURCE: _____ MUNSELL COLOR CODE: 10YR. 8/4 DATE SAMPLED: Nov.-Dec. 1987

SOIL CLASSIFICATION (ASTM: D2487) SILTY GRAVEL W/SAND, very pale brown (GM)

FORM #411 SL (2/87)

3.5-I-54

Foth & Van Dyke

Engineers/Architects

2737 S. Ridge Road P. O. Box 19012 Green Bay, WI 54307-9012 414/497-2500

REPORT OF:

FALLING HEAD PERMEABILITY TEST

PROJECT: Kennecott Geotechnical

DATE: March 9, 1988

SCOPE I.D. #: 87K10

REPORTED TO: Kennecott

COPIES TO:

GENERAL DATA:

Boring/Test Pit Number:	Boring PZ-S2
Depth of Sample:	17.5' to 18.5'
Sample Number:	Report #3
Date Sampled:	December 7, 1987
Date Received:	January 28, 1988
Source of Sample:	

LABORATORY DATA **PROJECT SPECIFICATIONS**

Method of Test:	3" Galvanized Tube
Length of Sample (inches):	8.00
Diameter of Sample (inches):	3.00
Dates Tested:	March 2 to 7, 1988
Moisture Content (%):	10.0
Dry Density (pcf):	
% Compaction:	
Soil Classification:	SILTY SAND W/GRAVEL, yellowish brown (SM)
Permeant Used:	Distilled Water
Technician:	R. Rouse
Coefficient of Permeability: (cm/sec)	3.3×10^{-7}

ATTERBERG LIMITS

Liquid Limit (%):	
Plastic Limit (%):	
Plasticity Index:	

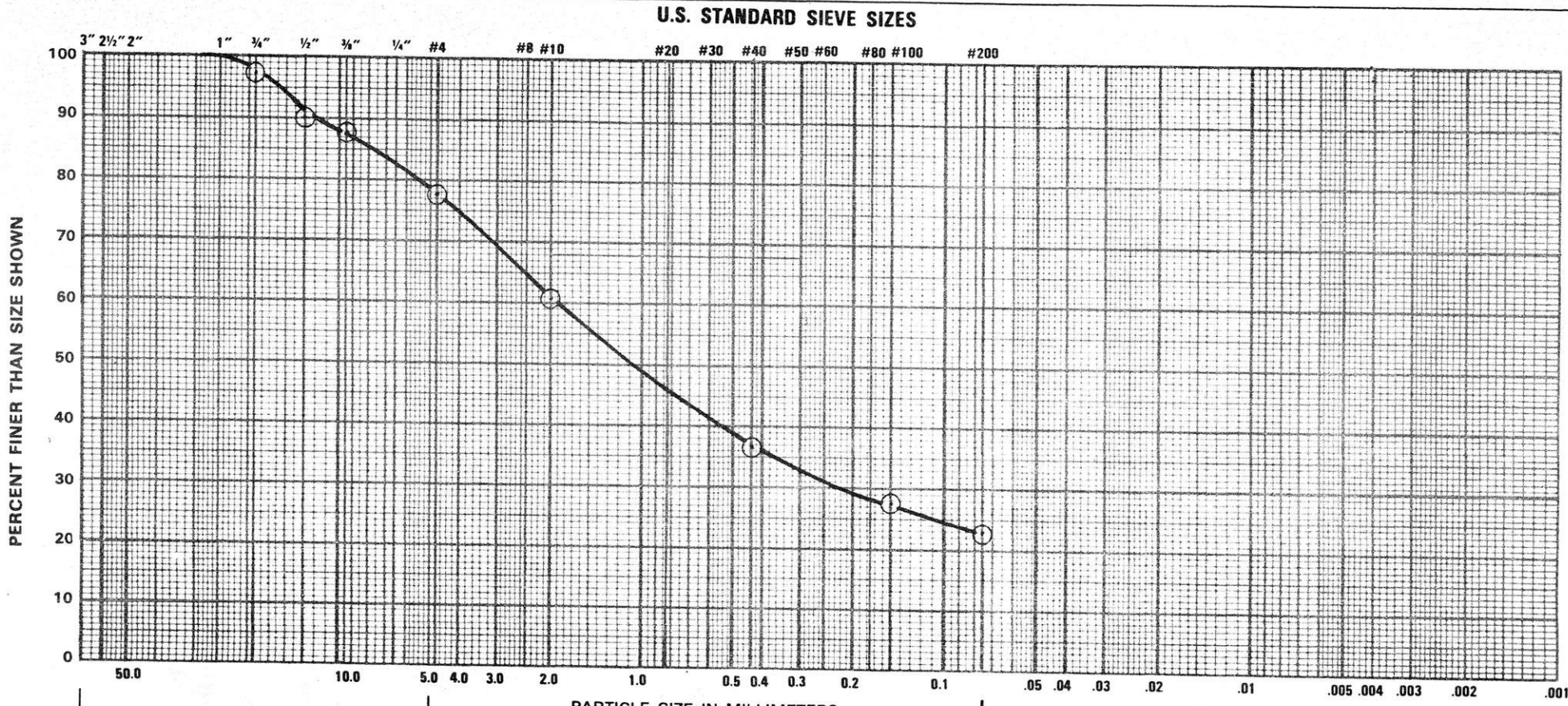
REMARKS:

FORM #407 (12/86)

By: Robert R. Rouse

Foth & Van Dyke and Associates Inc.

GRAIN SIZE DISTRIBUTION CURVE



GRAVEL		SAND			SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE		
% = 2.6	% = 19.5	% = 17.0	% = 24.2	% = 13.8	% =	% =

PROJECT: Kennecott Geotechnical DATE: 3/9/88 SAMPLE NO.: 4

LOCATION SAMPLED: Boring No.: PZ-S2 ELEV. OR DEPTH: 20'-21.5' DRAWN BY: RRR APPROVED BY: POK

ATTERBERG LIMITS: LL _____ PL _____ PI _____ SAMPLED MOISTURE CONTENT (%): 28.3 COEFFICIENTS: Cc = _____ Cu = _____

SAMPLE SOURCE: _____ MUNSELL COLOR CODE: 10 YR. 5/8 DATE SAMPLED: 12/7/87

SOIL CLASSIFICATION (ASTM: D2487) SILTY SAND W/GRAVEL, medium to coarse to fine grained, yellowish brown (SM)

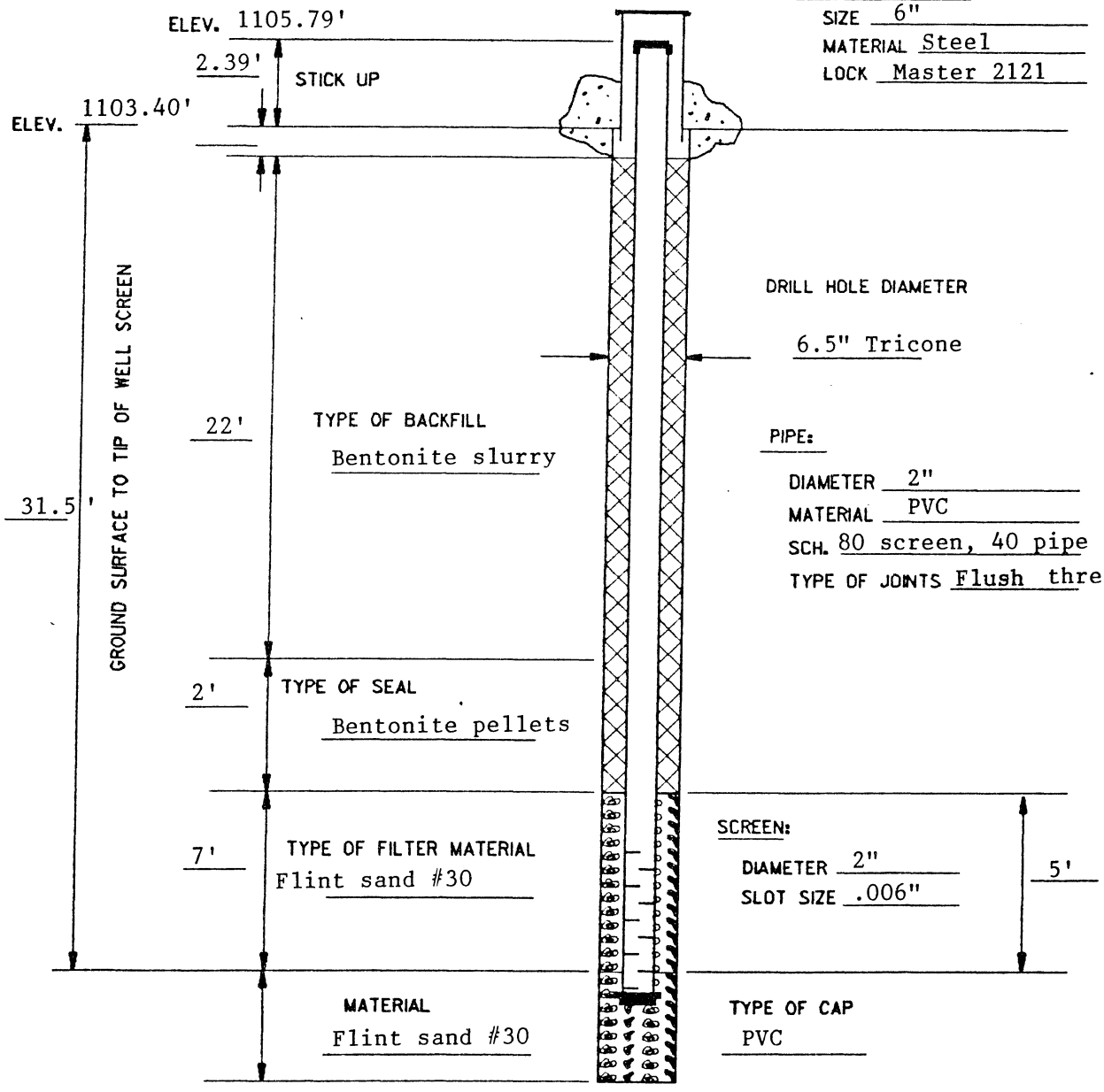
FORM #411 SL (2/87)

3.5-I-56

MONITORING WELL INSTALLATION DIAGRAM

WELL NO: PZ-S2
DATE INSTALLED: 12-07-87
DRILLER: Luisier Drilling Inc.
DRILLING METHOD: Mud rotary
COORDINATES: 39,703.68N 39,076.85E

CLIENT: Kennecott
PROJECT: Geotechnical
SCOPE I.D.: 87K10-BL22
BY: BJS



PROTECTOR PIPE:
SIZE 6"
MATERIAL Steel
LOCK Master 2121

DRILL HOLE DIAMETER
6.5" Tricone

TYPE OF BACKFILL
Bentonite slurry

PIPE:
DIAMETER 2"
MATERIAL PVC
SCH. 80 screen, 40 pipe
TYPE OF JOINTS Flush threaded

TYPE OF SEAL
Bentonite pellets

TYPE OF FILTER MATERIAL
Flint sand #30

SCREEN:
DIAMETER 2"
SLOT SIZE .006"

MATERIAL
Flint sand #30

TYPE OF CAP
PVC

Foth & Van Dyke
Geosciences & Environmental Management Division

MONITORING WELL DEVELOPMENT

WELL NUMBER PZ-S2 CLIENT Kennecott

WELL DIAMETER 2" PROJECT Geotechnical Investigation

TOTAL DEPTH OF WELL 33.45' SCOPE I.D. 87K10-BL 22

DEPTH TO WATER TIME OF MEASUREMENT BY MJH

BEFORE 14.52 DATE 12-18-87

AFTER 29.00

DESCRIPTION OF DEVELOPMENT METHOD

Well was alternately bailed and surged using a PVC hand bailer.

VOLUME OF WATER REMOVED FROM WELL 5 gals.

CLARITY OF WATER IN WELL BEFORE DEVELOPMENT Brn

CLARITY OF WATER IN WELL AFTER DEVELOPMENT Brn

PRESENCE OF SEDIMENT AT THE BOTTOM OF THE WELL Silty

VOLUME OF WATER ADDED TO WELL None

SOURCE OF WATER ADDED TO WELL

TIME SPENT FOR DEVELOPMENT

STABILIZATION READINGS

GAL. REMOVED	TIME	FIELD TEMPERATURE	FIELD SPEC. COND.	FIELD pH

FOTH AND VAN DYKE

LOG OF TEST BORING NO.: PZ-S3

CLIENT: Kennecott
PROJECT: Geotechnical Investigation-Flambeau
PROJECT NUMBER: 87K10-22
LOCATION: Central pit, south slope; Section 410, 230 ft. S. baseline
COORDINATES: 40278.79 N 39794.89 E

SURFACE ELEVATION: 1129.0
BORING DEPTH: 50.5
DATE: 10/29/87

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLE NOTES
1129.0	--0.0	0.0-2.0	sb	1	6	1.5	Red brn silty SAND, fn, poorly graded, moist, organics in top 1' (Eolian sand w/soil horizons)	SM	P.P. - 0.25	
1126.5	--2.5									
1124.0	--5.0	5.0-7.0	sb	2	8	1.2	Same except vy fn sand, more silt			
1121.5	--7.5									
1119.0	--10.0	10.0-12.0	sb	3	106	1.2	Brn poorly graded SAND w/silt layered w/silty SAND, fn, laminated, cobbles at 11'	SP-SM / SM		sb3 (GM-GP) 53% gvl 35% sand 12% si & cl
1116.5	--12.5									
1114.0	--15.0	15.0-16.0	sb	4	100	0.7	Gray, red, well graded SAND w/silt, fn w/med & cse sand, fn gvl, wea granite greenstone, slightly moist-dry		P.P. - 2.5	
		@ 16.0	sb	5	100	0.0	Many cobbles 14.5-16'	SW-SM		
1111.5	--17.5						Boulder from 16.5-18.0', cuttings white, sericite schist			
		19.0-20.2	sb	6		1.2	Red brn silty SAND, fn, w/med & cse sand fn gvl, diamict, wet (till)	SM	P.P. - 4.5+	
1109.0	--20.0									
		21.0-22.0	st	7	77	1.0	As above			st7 (SM) 26% gvl 52% sand 22% si & cl
1106.5	--22.5									
1104.0	--25.0	25.0-26.0	sb	8	86	1.0	As above		P.P. - 3.0	
1101.5	--27.5	27.0-28.0	pl	9	100	0.3	Lt gray poorly graded SAND w/silt, fn, loose, vy dense, qtz, vy well rnd, few cemented angular pieces <0.5" dia (ss)	SP-SM (SS)	Noncohesive	pl9 (SP) K= 8.8E - 05 cm/sec

DRILLING DATA

START DATE: 10/28/87
COMPLETION DATE: 10/29/87
LOGGED BY: BJS
DRILLING METHOD: Hollow stem augers 0-12, mud rotary 12-51
DRILLING CONTRACTOR: Wisconsin Test Drilling, Inc.

WATER LEVEL INFORMATION

DEPTH AT COMPLETION:
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:
DRILLING LOSSES:

LOG OF TEST BORING NO.: PZ-S3

CLIENT: Kennecott
PROJECT: Geotechnical Investigation-Flambeau
PROJECT NUMBER: 87K10-22
LOCATION: Central pit, south slope; Section 410, 230 ft. S. baseline
COORDINATES: 40278.79 N 39794.89 E

SURFACE ELEVATION: 1129.0
BORING DEPTH: 50.5
DATE: 10/29/87

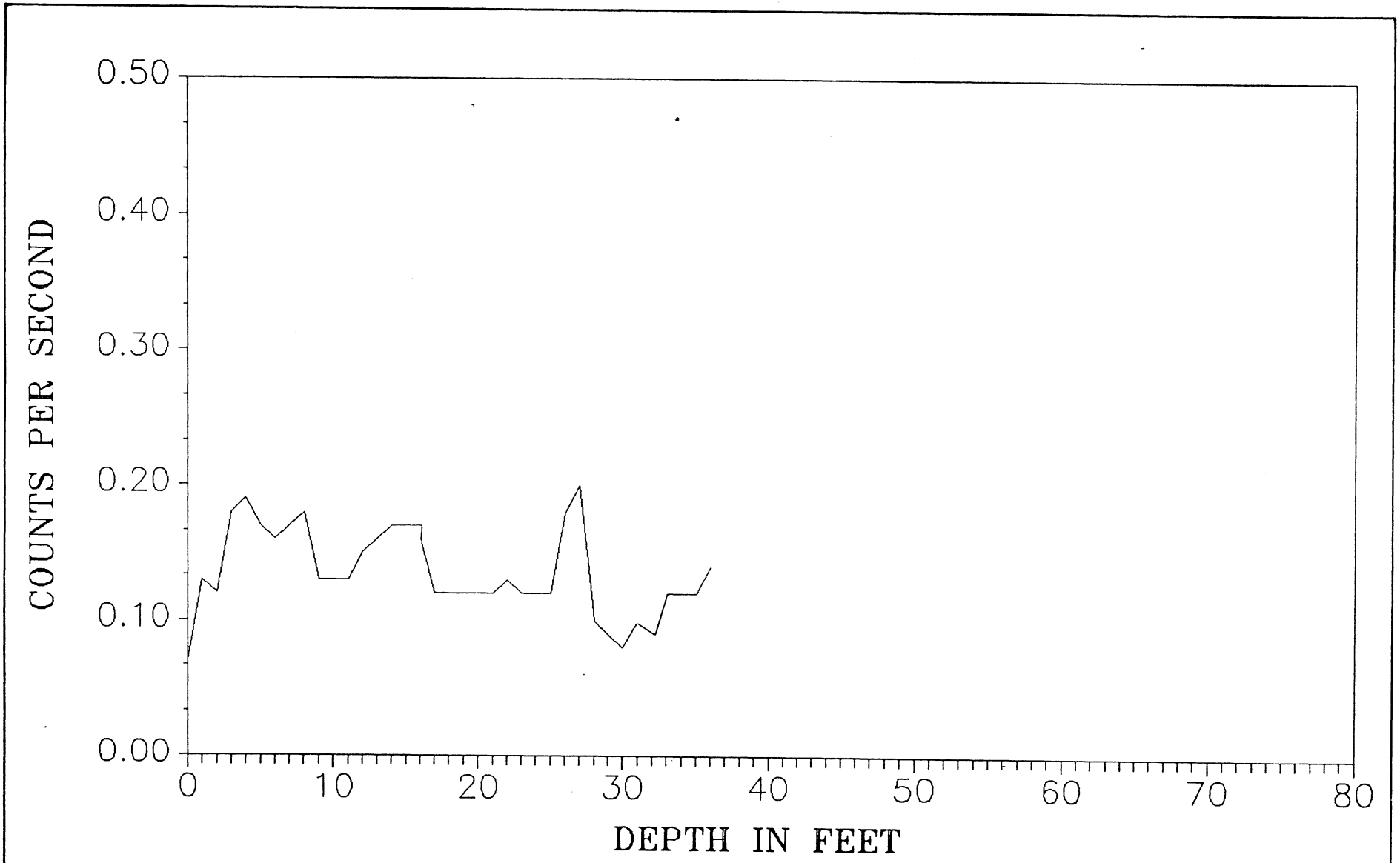
MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLE NOTES
1101.5	--27.5									
	-	28.0-29.0	st	10	320	0.5	Sandstone as above (Drove tube 1 ft, folded in)	SP-SM (SS)	Noncohesive	
	-	29.0-30.0	sb	11	100	0.2	Brn yel (10YR 6/8) poorly graded SAND w/silt, fn, unconsol., soft (ss)		Noncohesive	
1099.0	--30.0									
	-	32.0-33.0	pl	12	100	0.0	(Lt gray clayey SAND on bit) (Sandstone & incorp. saprolite)			
1096.5	--32.5									
	-						Gray green & tan silty CLAY, soft, irreg laminated w/chips lt brn & yel brn ss	CL-ML		
1094.0	--35.0						(Cuttings cse brn qtz sand w/mica to 35'			
	-	35.0-36.0	sb	13		0.2	then yel brn soft micaceous saprolite)			
	-	36.0-37.0	st	14		1.0	Drove 36-37'-Lt ol brn (2.5Y 5/4 & 5/6) "SILT", brittle, platy, slightly moist		N - 100/0.7 P.P. - 4.5+	st14 (ML) 1% gvl
1091.5	--37.5	37.0-38.0	st	15	100	0.9	Drove 37-38'-Yel brn & gray altered		N - 50/0.2	26% sand
	-				50		schist as above		P.P. - 4.5+	73% si & cl
	-	38.0-39.0	st	16	300	0.7	Gy brn (2.5Y 5/2) & lt ol brn (2.5Y 5/4 & 5/6) varigated, "SILT", brittle, dry to vy slightly moist	"ML"	N - 300/0.7 P.P. - 4.5+	LL= 34.3 PI= 8.5
1089.0	--40.0									
	-	40.0-41.0	sb	17	100	1.0	Gray brn & lt ol brn "SILT", soft to brittle, dry to moist, some schistocity apparent		N - 100/0.8' P.P. - 2.5	
	-	41.0-42.0	st	18	300	0.0	41'-Tube crumpled (altered schist as		N - 300/0.2'	
1086.5	--42.5						above)			
1084.0	--45.0									
	-	45.0-47.0	sb	19	100	1.0	Dk grn gray (5G 4/1) w/white (5Y 8/1) "silty CLAY/SILT", moist, schistocity apparent		P.P. - 2.0	
1081.5	--47.5									
										sb20 (ML) 7% sand
1079.0	--50.0									86% silt
	-	50.0-51.0	sb	20	100	1.2	Dk grn gray w/white "SILT", soft, appar. schistocity (altered chlorite schist)			7% clay LL=35.9
	-	51.0-53.0	pl	21	500	1.9	Altered schist as above	=====	N - 500/1.0'	PI=4.2
	-						52'-End of Boring in altered schist			22.7% moist
1076.5	--52.5						PZ-S3 installed in boring at 33.5'			
1074.0	--55.0									

DRILLING DATA

START DATE: 10/28/87
COMPLETION DATE: 10/29/87
LOGGED BY: BJS
DRILLING METHOD: Hollow stem augers 0-12, mud rotary 12-51
DRILLING CONTRACTOR: Wisconsin Test Drilling, Inc.

WATER LEVEL INFORMATION

DEPTH AT COMPLETION:
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:
DRILLING LOSSES:



DATA TAKEN 1-13-89 BY BJS
TIME CONSTANT = 5 SECONDS
RANGE SETTING = 20 K

FOTH & VAN DYKE
GEOSCIENCES & ENVIRONMENTAL MANAGEMENT DIVISION
GREEN BAY, WISCONSIN

KENNECOTT MINERALS COMPANY
FLAMBEAU PROJECT
LADYSMITH, WISCONSIN

GAMMA LOG
WELL PZ-S3

No	REVISIONS	NOTES	APPROVAL	DATE
			DESIGNED BY	
			DRAWN BY SJL	2/89
			CHECKED BY	
			APPROVED BY	
			CAD No.	SCALE AS SHOWN

Job No | Dwg No | REV

Foth & Van Dyke

Engineers/Architects

2737 S. Ridge Road
P. O. Box 19012
Green Bay, Wisconsin 54307-9012
414/497-2500

PROJECT NO.: _____

JOB NO.: 87K10

DATE: February 2-4, 1988

REPORT NO.: SB7

REPORT OF ANALYSIS OF AGGREGATES

ARCHITECT/ENGINEER: Foth & Van Dyke CONTRACTOR: _____

PROJECT: Kennecott Geotechnical - Granular Blanket SOURCE: _____

REPORT OF TESTS OF: Verification of Proposed Granular Blanket Material

Sieve Size or No.	Weight Retained	% Retained	% Passing	Specifi-cations
3-Inch				
2-Inch				
1 1/2-Inch	0	0	100	
1-Inch	59.0	20.9	79.1	
3/4-Inch	25.0	8.8	70.3	
1/2-Inch	26.0	9.2	61.1	
3/8-Inch	9.5	3.4	57.7	
No. 4	31.5	11.1	46.6	
No. 8				
No. 10	22.8	8.1	38.5	
No. 16				
No. 20				
No. 30				
No. 40	29.2	10.3	28.2	
No. 50				
No. 80	30.0	10.6	17.6	
No. 100	4.3	1.5	16.1	
No. 200	11.6	4.1	12.0	
0.5 Pan 33.5	34.0	12.0		

RECEIVED AT LABORATORY: February 2, 1988

QUANTITY REPRESENTED: 282.9 grams

SUBMITTED BY: Betty Socha of F&VD

SAMPLED FROM: Boring No.: PZ-S3

IDENTIFICATION: Sample No.: S-3 Depth: 10'-12'

DATE SAMPLED: December 1987

INTENDED USE: _____

WASHED GRADATION: Yes

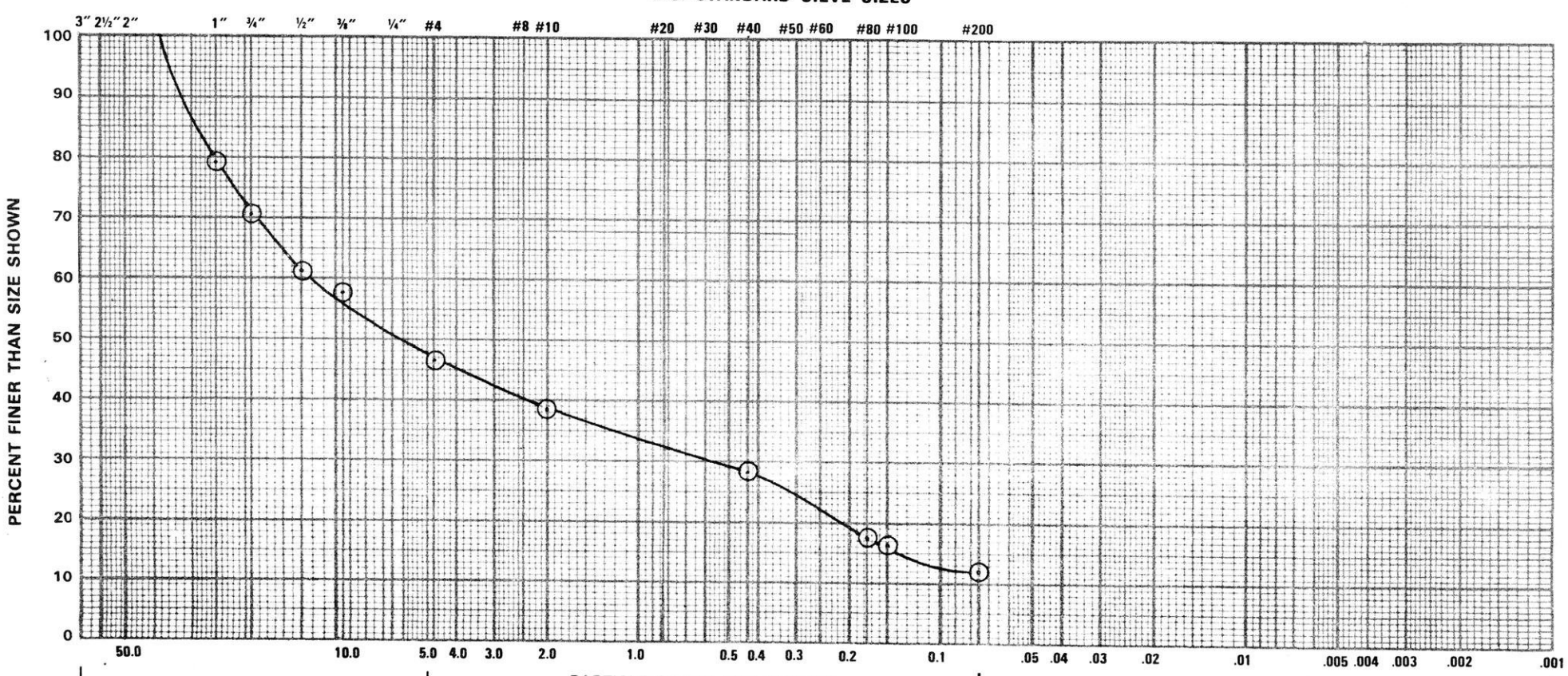
PERCENT PASSING NO. 200 SIEVE 12.0 %

COLOR: 10 YR. 3/3 - dark brown

CHECKED BY: RRR

Foth & Van Dyke and Associates Inc.

GRAIN SIZE DISTRIBUTION CURVE



GRAVEL		SAND			SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE		
% = 29.7	% = 23.7	% = 8.1	% = 10.3	% = 16.2	% = 12.0	% =

PROJECT: Kennecott Geotechnical DATE: 2/4/88 SAMPLE NO.: SB7

LOCATION SAMPLED: Boring No. PZ-S3 ELEV. OR DEPTH: 10'-12' DRAWN BY: POK APPROVED BY: RRR

ATTERBERG LIMITS: LL _____ PL _____ PI _____ SAMPLED MOISTURE CONTENT (%): _____ COEFFICIENTS: Cc = _____ Cu = _____

SAMPLE SOURCE: _____ MUNSELL COLOR CODE: 10 YR. 3/3 DATE SAMPLED: December 1987

SOIL CLASSIFICATION (ASTM: D2487) GRAVEL W/SILT and SAND, dark brown (GM-GP)

FORM #411 SL (2/87)

3.5-I-63

Foth & Van Dyke

Engineers/Architects

2737 S. Ridge Road
P. O. Box 19012
Green Bay, Wisconsin 54307-9012
414/497-2500

PROJECT NO.: _____

JOB NO.: 87K10

DATE: March 1 - 3, 1988

REPORT NO.: 5

REPORT OF ANALYSIS OF AGGREGATES

ARCHITECT/ENGINEER: Foth & Van Dyke CONTRACTOR: _____

PROJECT: Kennocott Geotechnical SOURCE: _____

REPORT OF TESTS OF: Verification of Subsurface Samples

Sieve Size or No.	Weight Retained	% Retained	% Passing	Specifi-cations
3-Inch				
2-Inch				
1 1/2-Inch	0	0	100	
1-Inch	61.1	7.4	92.6	
3/4-Inch	21.9	2.6	90.0	
1/2-Inch	43.8	5.3	84.7	
3/8-Inch	28.6	3.5	81.2	
No. 4	55.7	6.7	74.5	
No. 8				
No. 10	60.4	7.3	67.2	
No. 16				
No. 20				
No. 30				
No. 40	124.1	15.0	52.2	
No. 50				
No. 80	161.8	19.6	32.6	
No. 100	31.8	3.8	28.8	
No. 200	52.6	6.4	22.4	
Pan	185.2	22.4		

RECEIVED AT LABORATORY: January 28, 1988

QUANTITY REPRESENTED: 827.1 grams

SUBMITTED BY: Betty Socha of F&VD

SAMPLED FROM: Boring No.: PZ-S3

IDENTIFICATION: Depth: 21-22'

DATE SAMPLED: October 29, 1987

INTENDED USE: _____

WASHED GRADATION: yes

PERCENT PASSING NO. 200 SIEVE 22.4 %

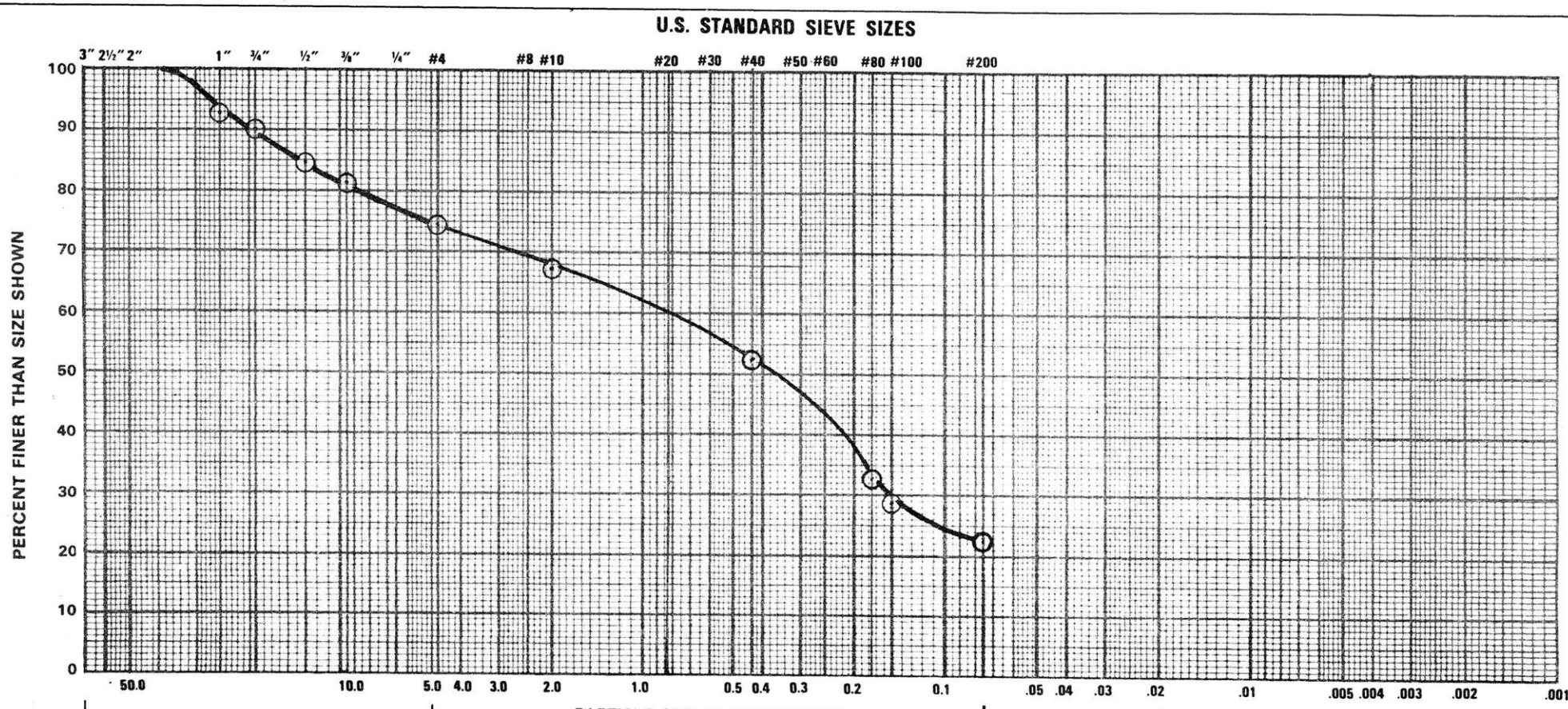
COLOR: 5 YR. 3/4 - dark reddish brown

Moisture Content = 14.8%
(As received)

CHECKED BY: RRR

Foth & Van Dyke and Associates Inc.

GRAIN SIZE DISTRIBUTION CURVE



GRAVEL		SAND			SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE		
% = 10.0	% = 15.5	% = 7.3	% = 15.0	% = 29.8	% =	% =

PROJECT: Kennecott Geotechnical DATE: 3/9/88 SAMPLE NO.: 5

LOCATION SAMPLED: Boring No.: PZ-S3 ELEV. OR DEPTH: 21'-22' DRAWN BY: RRR APPROVED BY: POK

ATTERBERG LIMITS: LL _____ PL _____ PI _____ SAMPLED MOISTURE CONTENT (%): 14.8 COEFFICIENTS: Cc = _____ Cu = _____

SAMPLE SOURCE: _____ MUNSELL COLOR CODE: 5 YR. 3/4 DATE SAMPLED: 10/29/87

SOIL CLASSIFICATION (ASTM: D2487) SILTY SAND W/GRAVEL, fine to medium grained, dark reddish brown (SM)

FORM #411 SL (2/87)

3.5-I-65

Foth & Van Dyke

Engineers/Architects

2737 S. Ridge Road P. O. Box 19012 Green Bay, WI 54307-9012 414/497-2500

REPORT OF:

FALLING HEAD PERMEABILITY TEST

PROJECT: Kennecott Geotechnical

DATE: March 9, 1988

SCOPE I.D. #: 87K10

REPORTED TO: Kennecott

COPIES TO:

GENERAL DATA:

Boring/Test Pit Number:	Boring PZ-S3
Depth of Sample:	27.5'- 28'
Sample Number:	Report #6
Date Sampled:	October 29, 1987
Date Received:	January 28, 1988
Source of Sample:	

LABORATORY DATA **PROJECT SPECIFICATIONS**

Method of Test:	3" thin wall tube section (rigid wall)
Length of Sample (inches):	3.88
Diameter of Sample (inches):	2.80
Dates Tested:	February 26, 1988
Moisture Content (%):	16.9
Dry Density (pcf):	
% Compaction:	
Soil Classification:	SAND W/SILT, fine to medium grained, a little gravel, brownish yellow (SP)
Permeant Used:	Distilled Water
Technician:	R. Rouse
Coefficient of Permeability: (cm/sec)	8.8×10^{-5}

ATTERBERG LIMITS

Liquid Limit (%):	
Plastic Limit (%):	
Plasticity Index:	

REMARKS:

FORM #407 (12/86)

By: Robert R. Rouse

Foth & Van Dyke
Engineers/Architects

2737 S. Ridge Road
P. O. Box 19012
Green Bay, Wisconsin 54307-9012
414/497-2500

PROJECT NO.: _____

JOB NO.: 87K10

DATE: February 1 to 4, 198

REPORT NO.: 7

REPORT OF ANALYSIS OF AGGREGATES

ARCHITECT/ENGINEER: Foth & Van Dyke CONTRACTOR: _____

PROJECT: Kennecott Geotechnical SOURCE: _____

REPORT OF TESTS OF: Verification of Subsurface Samples

Sieve Size or No.	Weight Retained	% Retained	% Passing	Specifi-cations
3-Inch				
2-Inch				
1 1/2-Inch				
1-Inch				
3/4-Inch				
1/2-Inch				
3/8-Inch	0	0	100	
No. 4	1.6	0.6	99.4	
No. 8				
No. 10	7.7	2.8	96.6	
No. 16				
No. 20				
No. 30				
No. 40	28.8	10.6	86.0	
No. 50				
No. 80	17.1	6.3	79.7	
No. 100	3.3	1.2	78.5	
No. 200	13.4	4.9	73.6	
Pan 1.3 197.8	199.1	73.5		

RECEIVED AT LABORATORY: January 28, 1988

QUANTITY REPRESENTED: 271.0 grams

SUBMITTED BY: Betty Socha of F&VD

SAMPLED FROM: Boring No.: PZ-S3

IDENTIFICATION: Depth: 36'-39'

DATE SAMPLED: October 29, 1987

INTENDED USE: _____

WASHED GRADATION: Yes

PERCENT PASSING NO. 200 SIEVE 73.5 %

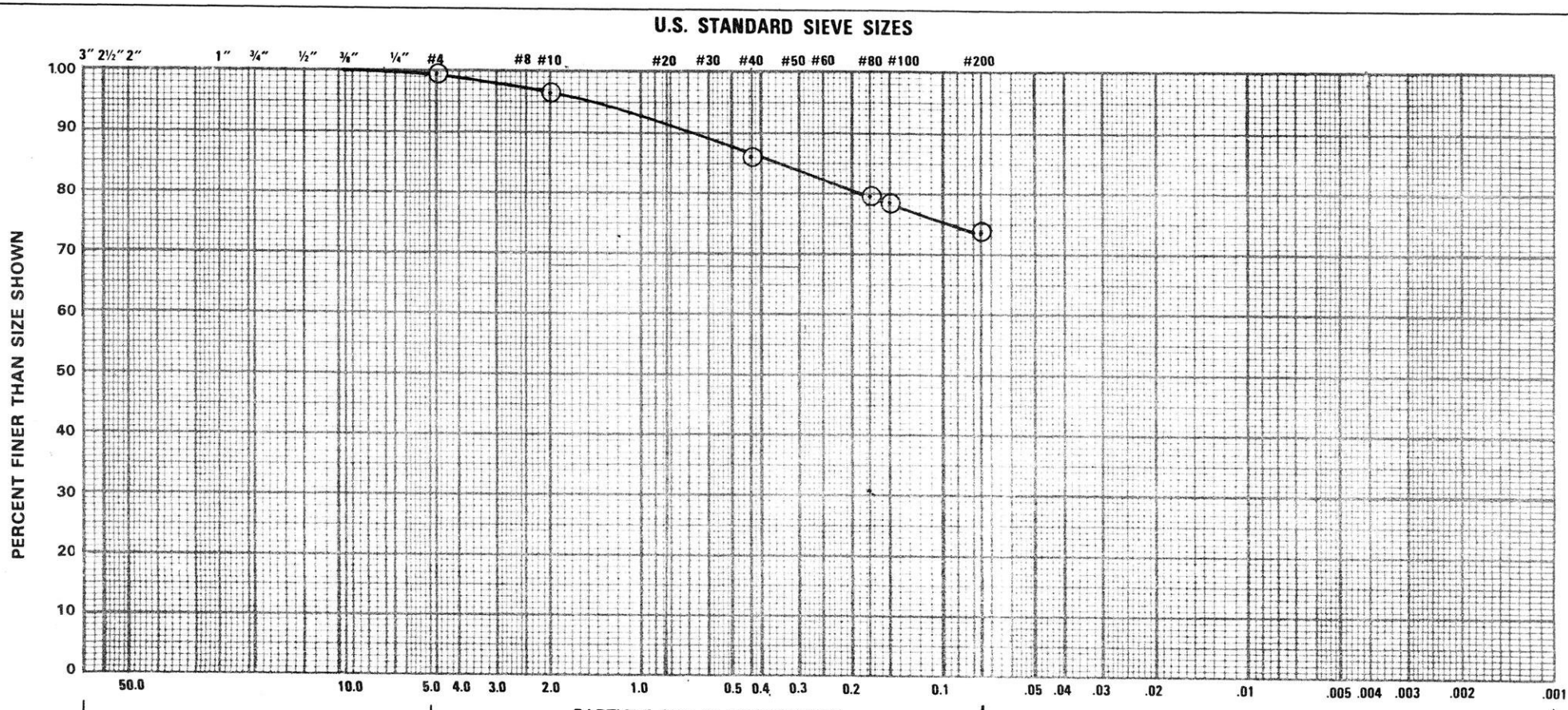
COLOR: 2.5 Y . 5/4 - light olive brown

Moisture Content = 15.3%
(As Received)

CHECKED BY: RRR

Foth & Van Dyke and Associates Inc.

GRAIN SIZE DISTRIBUTION CURVE



GRAVEL		SAND			SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE		
% =	% = 0.6	% = 2.8	% = 10.6	% = 12.4	% =	% =

PROJECT: Kennecott Geotechnical DATE: 2/4/88 SAMPLE NO.: 7

LOCATION SAMPLED: Boring No.: PZ-S3 ELEV. OR DEPTH: 36'-39' DRAWN BY: POK APPROVED BY: RRR

ATTERBERG LIMITS: LL 34.3 PL 25.8 PI 8.5 SAMPLED MOISTURE CONTENT (%): 15.3 COEFFICIENTS: Cc = Cu =

SAMPLE SOURCE: MUNSELL COLOR CODE: 2.5 Y . 5/4 DATE SAMPLED: Oct. 29, 1987

SOIL CLASSIFICATION (ASTM: D2487) SILT W/SAND, light olive brown (ML)

FORM #411 SL (2/87)

3.5-I-68

Foth & Van Dyke

Engineers/Architects

2737 S. Ridge Road
P. O. Box 19012
Green Bay, Wisconsin 54307-9012
414/497-2500

PROJECT NO.: _____

JOB NO.: 87K10

DATE: November 3-5, 1987

REPORT NO.: 1

REPORT OF ANALYSIS OF AGGREGATES

ARCHITECT/ENGINEER: Foth & Van Dyke CONTRACTOR: _____

PROJECT: Kennecott - Geotechnical SOURCE: _____

REPORT OF TESTS OF: Verification of Subgrade Sample

Sieve Size or No.	Weight Retained	% Retained	% Passing	Specifi-cations
3-Inch				
2-Inch				
1 1/2-Inch				
1-Inch				
3/4-Inch				
1/2-Inch				
3/8-Inch				
No. 4	0	0	100	
No. 8				
No. 10	0.2	0.5	99.5	
No. 16				
No. 20				
No. 30				
No. 40	0.9	2.1	97.4	
No. 50				
No. 80				
No. 100	1.0	2.3	95.1	
No. 200	1.1	2.5	92.6	
Pan	40.5	92.7		

RECEIVED AT LABORATORY: November 2, 1987

QUANTITY REPRESENTED: 43.7 grams

SUBMITTED BY: Betty Socha, Foth & Van Dyke

SAMPLED FROM: Boring PZ-S3

IDENTIFICATION: Sample 20 @ 49.5'-50.5'

DATE SAMPLED: October 1987

INTENDED USE: _____

WASHED GRADATION: yes

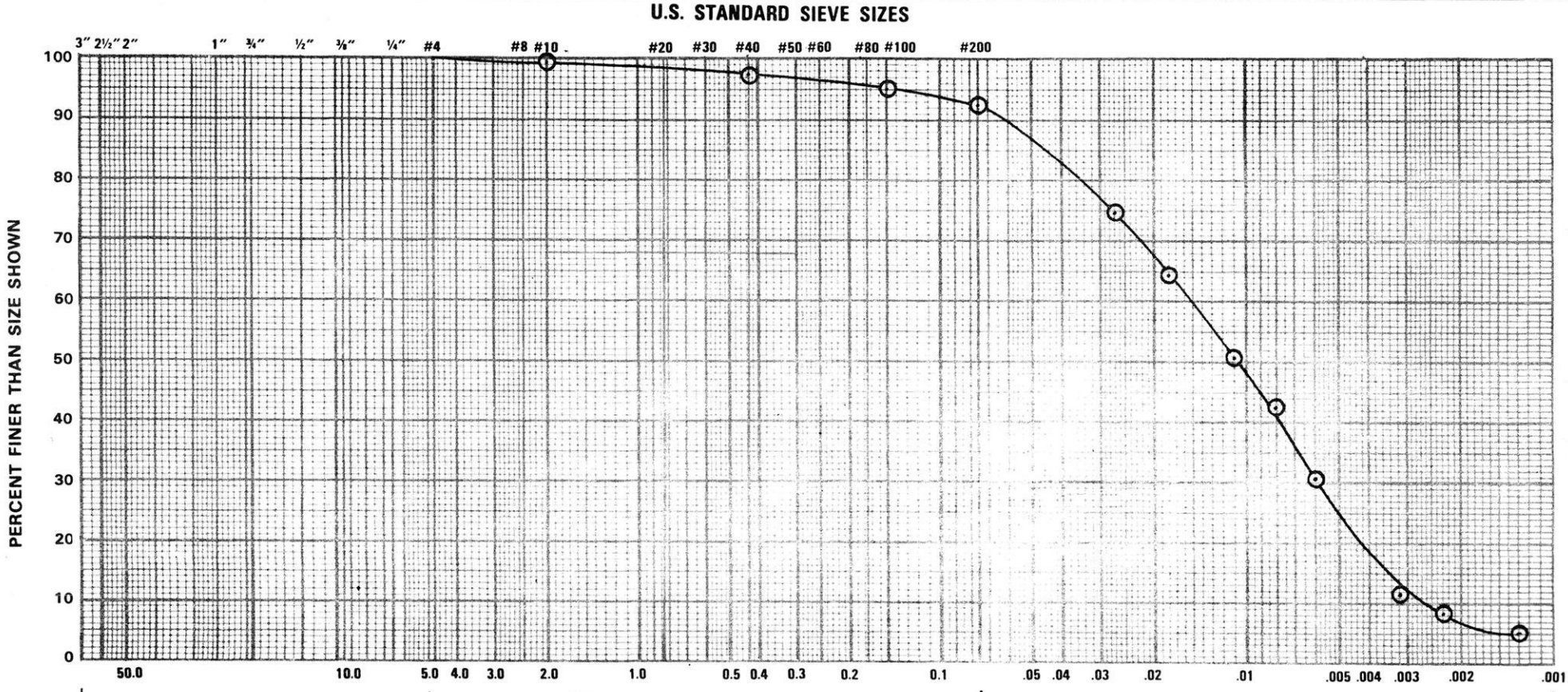
PERCENT PASSING NO. 200 SIEVE 92.7 %

COLOR: 5Y. 5/1 - gray

CHECKED BY: RRR

Foth & Van Dyke and Associates Inc.

GRAIN SIZE DISTRIBUTION CURVE



GRAVEL		SAND			SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE		
% =	% =	% = 0.5	% = 2.1	% = 4.7	% = 85.7	% = 7.0

PROJECT: Kennecott Geotechnical DATE: 11/6/87 SAMPLE NO.: 1

LOCATION SAMPLED: Boring: PZ-S3 Sample: 20 ELEV. OR DEPTH: 49.5'-50.5' DRAWN BY: POK APPROVED BY: RRR

ATTERBERG LIMITS: LL 35.9 PL 31.7 PI 4.2 SAMPLED MOISTURE CONTENT (%): 22.7 COEFFICIENTS: Cc = Cu =

SAMPLE SOURCE: MUNSELL COLOR CODE: 5Y, 5/1 DATE SAMPLED: October 1987

SOIL CLASSIFICATION (ASTM: D2487) SILT, gray, (ML)

FORM #411 SL (2/87)

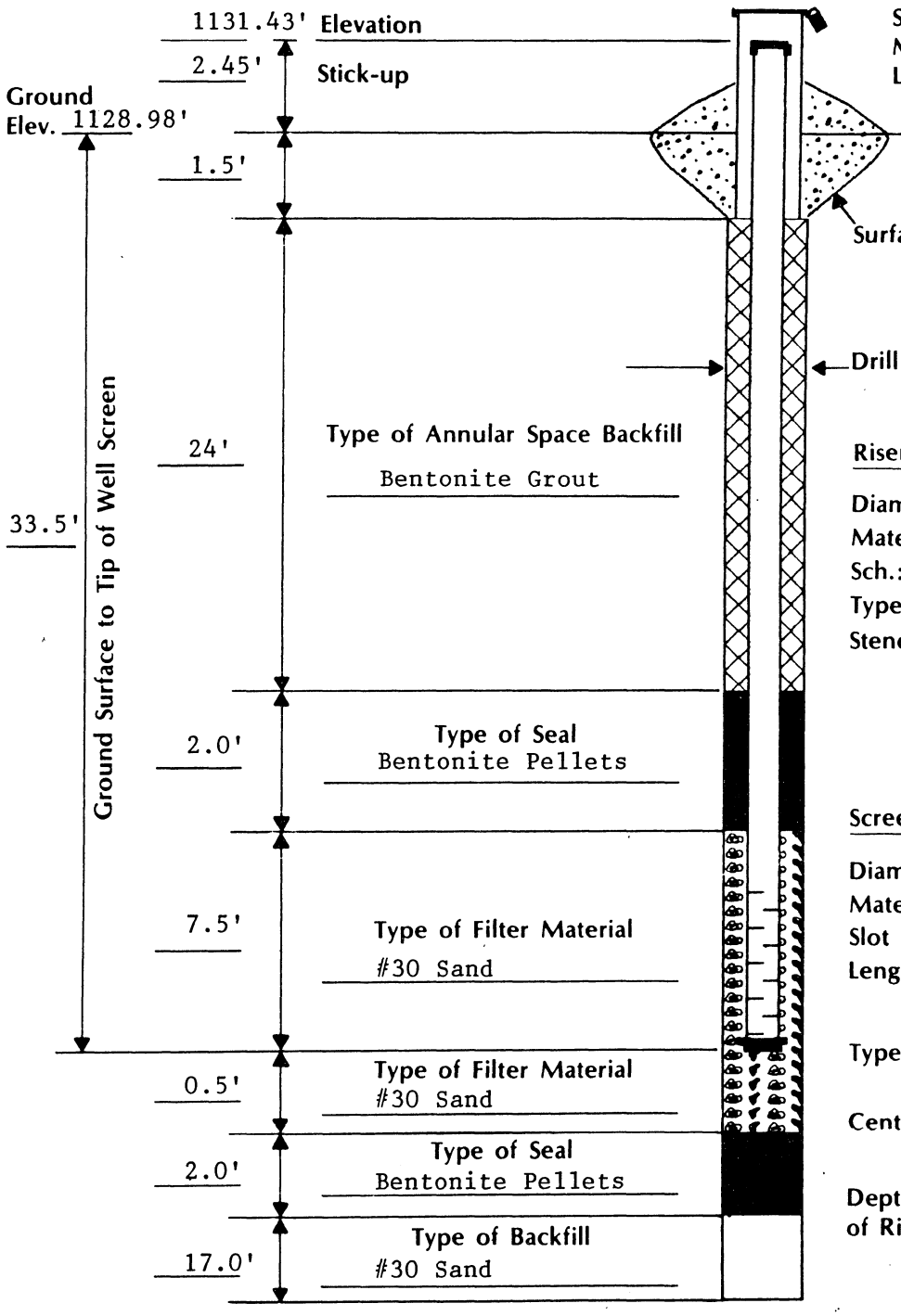
3.5-I-70

Foth & Van Dyke

Client: Kennecott — Scope I.D.: 87K10
Project: Geotechnical — Page: 1
Prepared by: BJS — Date: 10-30-87
Checked by: BJS — Date: 12-14-88

MONITORING WELL CONSTRUCTION DIAGRAM

Driller: Wisconsin Test Drilling, Inc.
Well No: PZ-S3
Drilling Method: Mud Rotary
Date Installed: 10-30-87
Coordinates: 40,278.79N 39,794.89E



Type of Annular Space Backfill: Bentonite Grout

Type of Seal: Bentonite Pellets

Type of Filter Material: #30 Sand

Type of Filter Material: #30 Sand

Type of Seal: Bentonite Pellets

Type of Backfill: #30 Sand

Protector Pipe:
Size: 4"
Material: Steel
Lock No.: 2121

Surface Seal Material: Cement

Drill Hole Diameter: 6"

Riser:
Diameter: 2"
Material: PVC
Sch.: 40
Type of Joints: Flush threaded
Stenciled? -

Screen:
Diameter: 2"
Material: PVC
Slot Size: 0.010"
Length: 5'

Type of Cap: PVC

Centralizer: Used ☐ Not Used ☒

Depth to Water From Top of Riser at Completion: -

NOTE: Not to Scale

MONITORING WELL DEVELOPMENT

WELL NUMBER PZ-S3

WELL DIAMETER 2"

TOTAL DEPTH OF WELL 34'

DEPTH TO WATER — TIME OF MEASUREMENT

BEFORE 17.57' —

AFTER — —

CLIENT Kennecott

PROJECT Geotechnical Invest.

SCOPE I.D. 87K10-BL22

BY FJD (Foth & Van Dyke)

DATE 12-02-87

DESCRIPTION OF DEVELOPMENT METHOD

Bailed and surged with PVC hand bailer

VOLUME OF WATER REMOVED FROM WELL 10 gals.

CLARITY OF WATER IN WELL BEFORE DEVELOPMENT Yel. brn.

CLARITY OF WATER IN WELL AFTER DEVELOPMENT Yel. brn.

PRESENCE OF SEDIMENT AT THE BOTTOM OF THE WELL Silty

VOLUME OF WATER ADDED TO WELL None

SOURCE OF WATER ADDED TO WELL -

TIME SPENT FOR DEVELOPMENT -

STABILIZATION READINGS

GAL. REMOVED	TIME	FIELD TEMPERATURE	FIELD SPEC. COND.	FIELD pH

FOTH AND VAN DYKE

LOG OF TEST BORING NO.: PZ-S4

CLIENT: Kennecott
PROJECT: Geotechnical Investigation-Flambeau
PROJECT NUMBER: 87K10-22
LOCATION: East pit, south slope, Section 422, 215 ft. S. baseline
COORDINATES: 41138.73 N 40630.94 E

SURFACE ELEVATION: 1141.2
BORING DEPTH: 72.5
DATE: 11/30/87

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLE NOTES
1141.2	--0.0									
		1.0-3.0	sb	1		2.0	Yel brn (10YR 4/4) silty SAND, fine, cohesive, vy sltly moist, w/rust brn mottles (Aeolian fn sand & loess)	SM	P.P. - 1.5	
1138.7	--2.5									
1136.2	--5.0									
		5.0-7.0	sb	2		2.0	Strong brn (7.5YR 5/6) silty SAND, fine, dry to slightly moist		P.P. - 1.0	
1133.7	--7.5									
1131.2	--10.0	10.0-11.0	sb	3		0.0	Pushed rock, cse gvl in spoon			
		11.0-13.0	sb	4		1.2	Dk gray, poorly graded, black (5Y 2.5/1) GRAVEL, cse w/fn gvl & silty sand (Black (Mn?) coating on gravel)	GP		sb4 (GP) 76% gvl 20% sand 4% si & cl
1128.7	--12.5									
1126.2	--15.0									
		15.0-17.0	sb	5		1.2	Red brn (5YR 4/4) poorly graded SAND w/silt, fn, laminated (0.6') over silty SAND, fn w/med & cse sand, fn & cse gvl, dense, dry, diamict (till)	SM	P.P. - 4.5+	
1123.7	--17.5									
1121.2	--20.0									
		20.0-22.0	sb	6		1.8	Red brn silty SAND as above, w/laminae of clayey sand, clay, dry, (stratified diamict)		P.P. - 4.5+	
1118.7	--22.5									
1116.2	--25.0	25.0-26.0	st	7		0.0	Tube crumbled when pushed			
		@ 26.0	st	8		0.0	Tube crumbled when pushed		Noncohesive	
		@ 26.0	st	9		0.0	Tube folded when driven w/air hammer, drove 9"			
1113.7	--27.5									

DRILLING DATA

START DATE: 11/30/87
COMPLETION DATE: 12/01/87
LOGGED BY: BJS
DRILLING METHOD: Mud rotary, 6" tricone, 5" carbide bit 56-72'
DRILLING CONTRACTOR: Luisier Drilling, Inc.

WATER LEVEL INFORMATION

DEPTH AT COMPLETION:
LATER TIME/DEPTH: 24 hr/24 ft
LATER TIME/DEPTH:
CAVE IN DEPTH:
DRILLING LOSSES:

LOG OF TEST BORING NO.: PZ-S4

CLIENT: Kennecott
PROJECT: Geotechnical Investigation-Flambeau
PROJECT NUMBER: 87K10-22
LOCATION: East pit south slope; Section 422, 215 ft. S. baseline
COORDINATES: 41138.73 N 40630.94 E

SURFACE ELEVATION: 1141.2
BORING DEPTH: 72.5
DATE: 11/30/87

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLE NOTES
1113.7	--27.5	26.5-27.5	pl	10		1.0	Brn (7.5YR 5/4) prly graded SAND w/silt fn, loose, dense, saturated (4" red brn silty sand (till) in shoe)			
1111.2	--30.0	30.0-31.5	sb	11		0.3	Pale yel (2.5Y 7/4) silty SAND, fn (very fn sandstone) poorly graded, soft, very dense, saturated	SM (SS)	Noncohesive	
		31.5-32.5	pl	12		1.0	Lt brn gray silty SAND/SILT, cohesive, brittle, oxidized along bedding	SM/ML (SS)	P.P. = 3.4	
1108.7	--32.5	32.5-34.0	pl	13		0.8	Lt yel brn poorly graded SAND w/silt, fn w/med, loose, dense, satur. (Sandstone)	SP-SM (SS)	Noncohesive	
1106.2	--35.0	34.0-35.5	sb	14		1.5	Vy pale brn (10YR 7/4) prly grd SAND, fn to 34.5', then med & cse sand w/few thin silty lyrs, brit., cohes-hard		P.P. - 4.5+ & Noncohesive	sb14 (SP) 8% gvl 90% sand
		35.5-37.0	sb	15		1.5	Pale yel (2.5Y 7/4) prly grd SAND, med w/fn, lam. At 36-36.5' layers w/dk gray brn (2.5Y 4/2) coating on qtz grains	SP (SS)	Noncohesive	2% si & cl sb15 (SP)
1103.7	--37.5	37.0-39.0	st	16		0.2	Sandstone, as above.			2% gvl 96% sand 2% silt K= 3.6E - 03 cm/sec
1101.2	--40.0	39.0-41.0	sb	17		2.2	Yel brn (10YR 5/8) prly graded SAND, med vy soft, loose (oxidized) (Sandstone)			
		41.0-43.0	sb	18		2.2	As above w/vy dk red brn staining at 41.8', pods, laminae w/coating		Noncohesive	sb18 (SP) 3% cse sand 65% med sand 30% fn sand
1098.7	--42.5	43.0-45.0	sb	19		2.2	Lt yel brn (10YR6/4) & brn yel (10YR6/6) poorly graded SAND, fn (vy fn sandstone) w/cemented layers up to 2" thick		P.P. - 4.5+ & Noncohesive	2% si & cl 13% moist
1096.2	--45.0	45.0-47.0	sb	20		2.2	As above to 46.5', then lt ol gray (5Y 6/2) silty SAND (vy fn sandstone) soft, consol, brittle to shaley, hard	"SM" (SS)	P.P. - 4.5+ & Noncohesive	sb22 (SM) 32% gvl 41% sand 27% si & cl
1093.7	--47.5	47.0-50.0	sb	21		3.0	Olive yel (2.5Y 6/6) & red (2.5 YR 4/6) "SILT", brittle, cohesive, altered schist. At 48.5' red (2.5YR 4/6) w/olive yel laminae, firm to hard	"ML"	P.P. - 4.5	14.5% moist sb23 (ML/CL-ML)
1091.2	--50.0	50.0-51.5	pl	22		1.1	Same except yel & yel brn (10YR 7/8 & 6/8), softer, slightly more plastic, schistocity apparent		P.P. - 4.5+	6% gvl 43% sand 46% silt 5% clay
1088.7	--52.5	51.5-53.0	pl	23		1.2	Altered schist as above ("sandy SILT" w/gvl) lt grn gray (5G 7/1) w/lt red (2.5Y 6/6)		P.P. - 0.7	LL= 24.7 PI= 3.8 20.1% moist
1086.2	--55.0	53.0-54.5	st	24		1.1	Altered schist as above			

DRILLING DATA

START DATE: 11/30/87
COMPLETION DATE: 12/01/87
LOGGED BY: BJS
DRILLING METHOD: Mud rotary, 6" tricone, 5" carbide bit 56-72.5'
DRILLING CONTRACTOR: Luisier Drilling, Inc.

WATER LEVEL INFORMATION

DEPTH AT COMPLETION:
LATER TIME/DEPTH: 24 hr/24 ft
LATER TIME/DEPTH:
CAVE IN DEPTH:
DRILLING LOSSES:

LOG OF TEST BORING NO.: PZ-S4

CLIENT: Kennecott
PROJECT: Geotechnical Investigation-Flambeau
PROJECT NUMBER: 87K10-22
LOCATION: East pit south slope; Section 472, 215 ft. S. baseline
COORDINATES: 41138.73 N 40630.94 E

SURFACE ELEVATION: 1141.2
BORING DEPTH: 72.5
DATE: 11/30/87

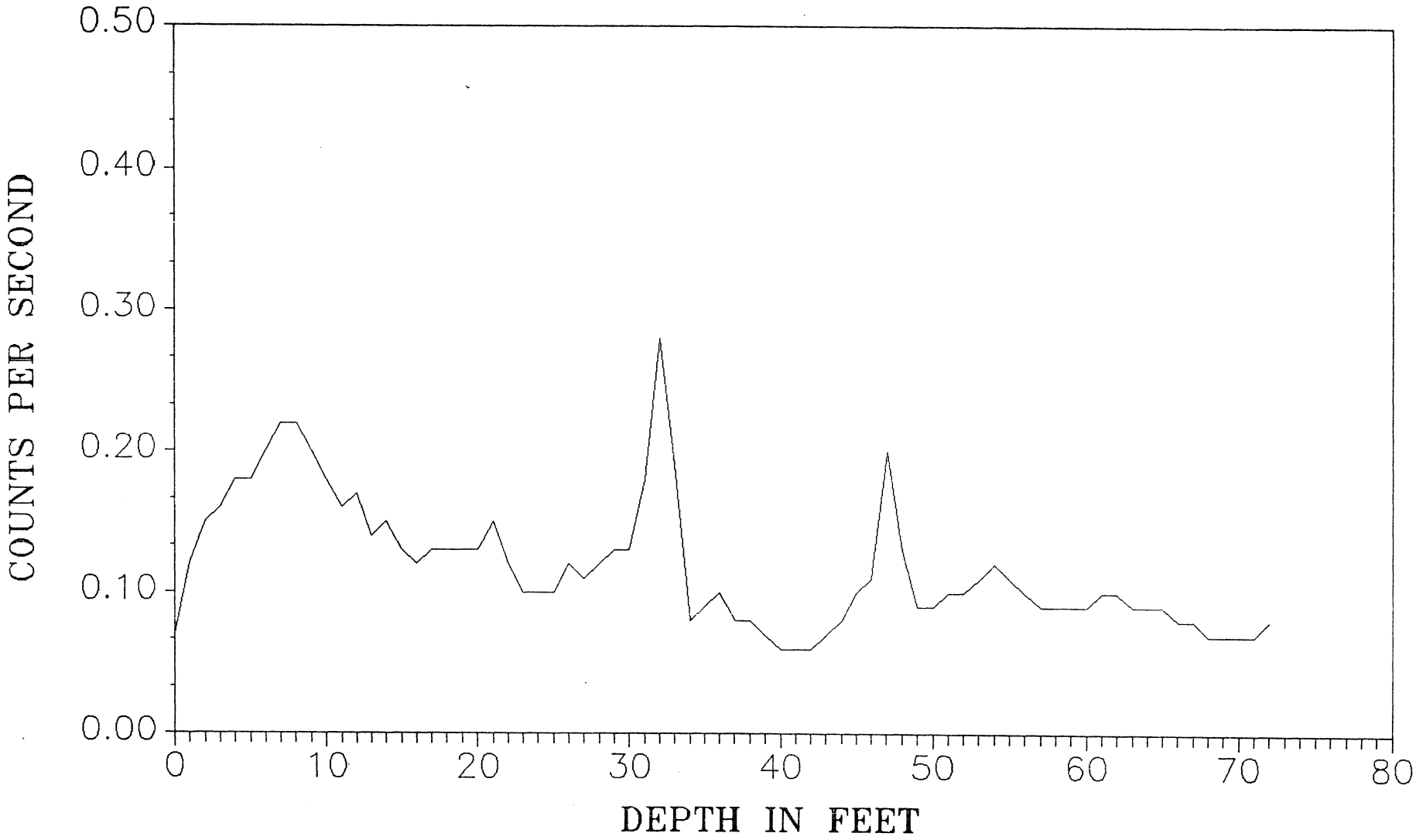
MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLE NOTES
1086.2	--55.0	54.0-56.0	st	24		0.0	Lt. gray (5Y 7/1) w/dk red (10YR 3/4) laminated "SILT", cohesive to crumbly, firm. (Pushed 54-56', crushed tube)	"ML"	P.P.-1.2	
		56.0-60.0	c	25		0.9	Altered schist, pieces 1-5" long, hard & vy hard (Alternating soft & hard rock?)		RQD = 10% Fract freq = 10/ft	
1083.7	--57.5									
1081.2	--60.0						Length of pieces from 60': 0.5', 1.1', 0.5', 0.2'. Altered schist, dk red &		RQD = 70% Fract freq	
		60.0-63.0	c	26		2.3	blue green, schistocity apparent, clayey w/soft yel green laminae (chlorite?)		= 2/ft	
1078.7	--62.5									
		63.0-66.5	c	27		3.3	Length of pieces from 63': 0.9', 1.7', 0.7'. Schist as above w/much hematite.	RK (5)	RQD = 94% Fract freq = 0.3/ft	
1076.2	--65.0									
		66.5-72.5	c	28		6.0	No breaks in core in barrel. Altered sch as above, breaks horizontally at planes 1-4" apart, soft to vy firm		RQD = 100% Fract freq = 0/ft	
1073.7	--67.5									
1071.2	--70.0									
1068.7	--72.5						72.5'-End of Boring in altered schist	=====		
							PZ-S4 installed in boring at 72.5'			
1066.2	--75.0									
1063.7	--77.5									
1061.2	--80.0									
1058.7	--82.5									

DRILLING DATA

START DATE: 11/30/87
COMPLETION DATE: 12/01/87
LOGGED BY: BJS
DRILLING METHOD: Mud rotary, 6" tricone, 5" carbide bit from 56-72.5'
DRILLING CONTRACTOR: Luiser Drilling, Inc.

WATER LEVEL INFORMATION

DEPTH AT COMPLETION:
LATER TIME/DEPTH: 24 hr/24 ft
LATER TIME/DEPTH:
CAVE IN DEPTH:
DRILLING LOSSES:



DATA TAKEN 1-13-89 BY BJS
TIME CONSTANT = 5 SECONDS
RANGE SETTING = 20 K

FOTH & VAN DYKE
GEOSCIENCES & ENVIRONMENTAL MANAGEMENT DIVISION
GREEN BAY, WISCONSIN

No	REVISIONS	NOTES	APPROVAL	DATE
			DESIGNED BY	
			DRAWN BY SJL	2/89
			CHECKED BY	
			APPROVED BY	
			CAD No.	SCALE AS SHOWN

KENNECOTT MINERALS COMPANY
FLAMBEAU PROJECT
LADYSMITH, WISCONSIN

GAMMA LOG
WELL PZ-S4

Job No | Dwg No | REV

3.5-I-76

LOG OF TEST BORING NO.: B-S4A

CLIENT: Kennecott
PROJECT: Geotechnical Investigation-Flambeau
PROJECT NUMBER: 87K10-22
LOCATION: East pit, south slope; Section 422, 215 ft. S. baseline

APPROXIMATE SURFACE ELEVATION: 1140.0
BORING DEPTH: 31.0
DATE: 12/1/87

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLE NOTES
1140.0	--0									
1135.0	--5	5.0-6.5	sb	1.0	31	1.3	Red brn silty SAND, fn, w/med & cse sand fn gvl, slightly moist, dense, cohesive, diamict (till)	SM		
1130.0	--10	10.0-11.5	sb	2.0	100	0.0	Pounded rock			
1125.0	--15	15.0-16.5	sb	3.0	100	0.0	Pounded rock			
1120.0	--20	20.0-21.5	sb	4.0	100	0.1	Brn, well graded SAND w/gvl, med & cse sand w/fn & cse gvl, wet, dense	SW	N-100/0.2'	
1115.0	--25	25.0-26.5	sb	5.0	100	0.4	Brn poorly graded SAND, med w/fn, loose, dense, sataurated	SP	N-100/0.4'	
1110.0	--30	30.0-31.5	sb	6.0	100	1.0	Red brn silty SAND, fn, w/med & cse sand fn gvl, saturated, dense, cohesive, diamict (till). In contact w/pale yellow (2.5Y 7/4) poorly graded sand w/silt, fn (vy fn sand), dense, unconsol, saturated (sandstone)	SM SP-SM	N-100/1.0'	
1105.0	--35						31.0'-End of Boring in Sandstone Refusal	=====		
1100.0	--40									
1095.0	--45									
1090.0	--50									
1085.0	--55									

DRILLING DATA

START DATE: 12/01/87
COMPLETION DATE: 12/01/87
LOGGED BY: BJS
DRILLING METHOD: Hollow stem augers, mud rotary
DRILLING CONTRACTOR: Wisconsin Test Drilling, Inc.

WATER LEVEL INFORMATION

DEPTH AT COMPLETION: 27.6
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:
DRILLING LOSSES:

Foth & Van Dyke
Engineers/Architects

2737 S. Ridge Road
P. O. Box 19012
Green Bay, Wisconsin 54307-9012
414/497-2500

PROJECT NO.: _____

JOB NO.: 87K10

DATE: December 16-22, 1987

REPORT NO.: 5

REPORT OF ANALYSIS OF AGGREGATES

ARCHITECT/ENGINEER: Foth & Van Dyke CONTRACTOR: _____

PROJECT: Kennecott Geotechnical SOURCE: _____

REPORT OF TESTS OF: Verification of Subsurface Samples

Sieve Size or No.	Weight Retained	% Retained	% Passing	Specifi-cations
3-Inch	0	0	100	
2-Inch	225.4	19.7	80.3	
1 1/2-Inch				
1-Inch	215.0	18.8	61.5	
3/4-Inch	210.7	18.4	43.1	
1/2-Inch	111.3	9.7	33.4	
3/8-Inch	46.2	4.0	29.4	
No. 4	60.0	5.2	24.2	
No. 8				
No. 10	52.0	4.5	19.7	
No. 16				
No. 20				
No. 30				
No. 40	105.7	9.2	10.5	
No. 50				
No. 80				
No. 100	53.2	4.6	5.9	
No. 200	14.6	1.3	4.6	
Pan	51.4	4.5		

RECEIVED AT LABORATORY: December 14, 1987

QUANTITY REPRESENTED: 1145.5 grams

SUBMITTED BY: Betty Socha, Foth & Van Dyke

SAMPLED FROM: Boring No.: PZ-S4

IDENTIFICATION: Depth: 11'-12'

DATE SAMPLED: November - December 1987

INTENDED USE: _____

WASHED GRADATION: yes

PERCENT PASSING NO. 200 SIEVE 4.5 %

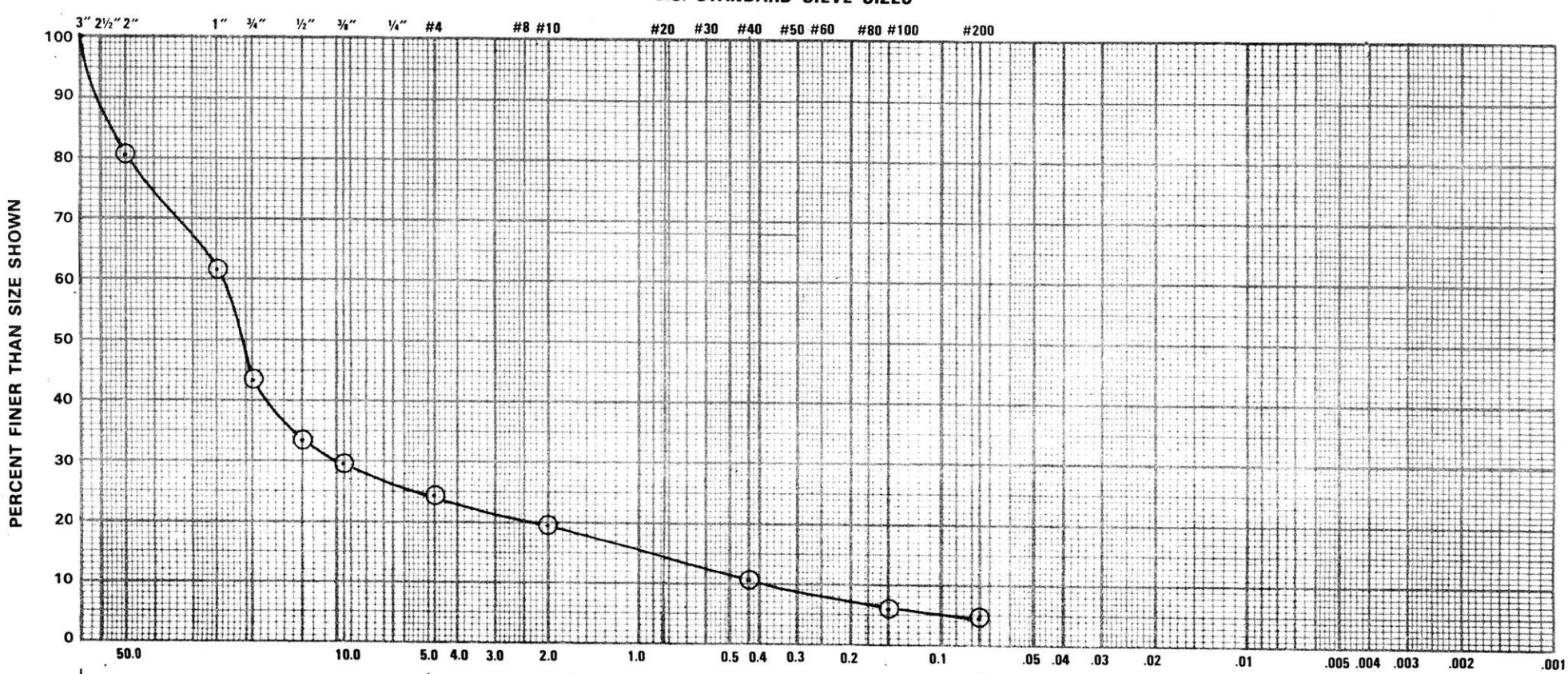
COLOR: 10YR. 3/2 - very dark grayish brown to 2/1 black

Moisture Content = 4.9%
(as received)

CHECKED BY: RRR

Foth & Van Dyke and Associates Inc.

GRAIN SIZE DISTRIBUTION CURVE



GRAVEL		SAND			SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE		
% = 56.9	% = 18.9	% = 4.5	% = 9.2	% = 6.0	% = 4.5	% =

PROJECT: Kennecott Geotechnical DATE: 12/22/87 SAMPLE NO.: 5

LOCATION SAMPLED: Boring: PZ-S4 ELEV. OR DEPTH: 11'-12' DRAWN BY: POK APPROVED BY: RRR

ATTERBERG LIMITS: LL _____ PL _____ PI _____ SAMPLED MOISTURE CONTENT (%): 4.9 COEFFICIENTS: Cc = 11.5 Cu = 60.0

SAMPLE SOURCE: _____ MUNSELL COLOR CODE: 10YR. 3/2 to 2/1 DATE SAMPLED: Nov.-Dec. 1987

SOIL CLASSIFICATION (ASTM: D2487) GRAVEL w/SAND, very dark grayish brown to black, (GP)

FORM #411 SL (2/87)

3.5-I-79

Foth & Van Dyke

Engineers/Architects

2737 S. Ridge Road
P. O. Box 19012
Green Bay, Wisconsin 54307-9012
414/497-2500

PROJECT NO.: _____

JOB NO.: 87K10

DATE: February 10 to 16, 1988

REPORT NO.: 4

REPORT OF ANALYSIS OF AGGREGATES

ARCHITECT/ENGINEER: Foth & Van Dyke CONTRACTOR: _____

PROJECT: Kennecott Geotechnical SOURCE: _____

REPORT OF TESTS OF: Verification of Subsurface Sample

Sieve Size or No.	Weight Retained	% Retained	% Passing	Specifi-cations
3-Inch				
2-Inch				
1 1/2-Inch				
1-Inch	0	0	100	
3/4-Inch	16.6	2.6	97.4	
1/2-Inch	46.7	7.4	90.0	
3/8-Inch	13.0	2.1	87.9	
No. 4	63.3	10.0	77.9	
No. 8				
No. 10	107.2	17.0	60.9	
No. 16				
No. 20				
No. 30				
No. 40	152.5	24.2	36.7	
No. 50				
No. 80				
No. 100	58.3	9.2	27.5	
No. 200	28.9	4.6	22.9	
Pan	144.5	22.9		

RECEIVED AT LABORATORY: January 28, 1988

QUANTITY REPRESENTED: 631.0 grams

SUBMITTED BY: Betty Socha of F&VD

SAMPLED FROM: Boring No.: PZ-S4

IDENTIFICATION: Depth: 20' - 21.5'

DATE SAMPLED: December 7, 1987

INTENDED USE: _____

WASHED GRADATION: yes

PERCENT PASSING NO. 200 SIEVE 22.9 %

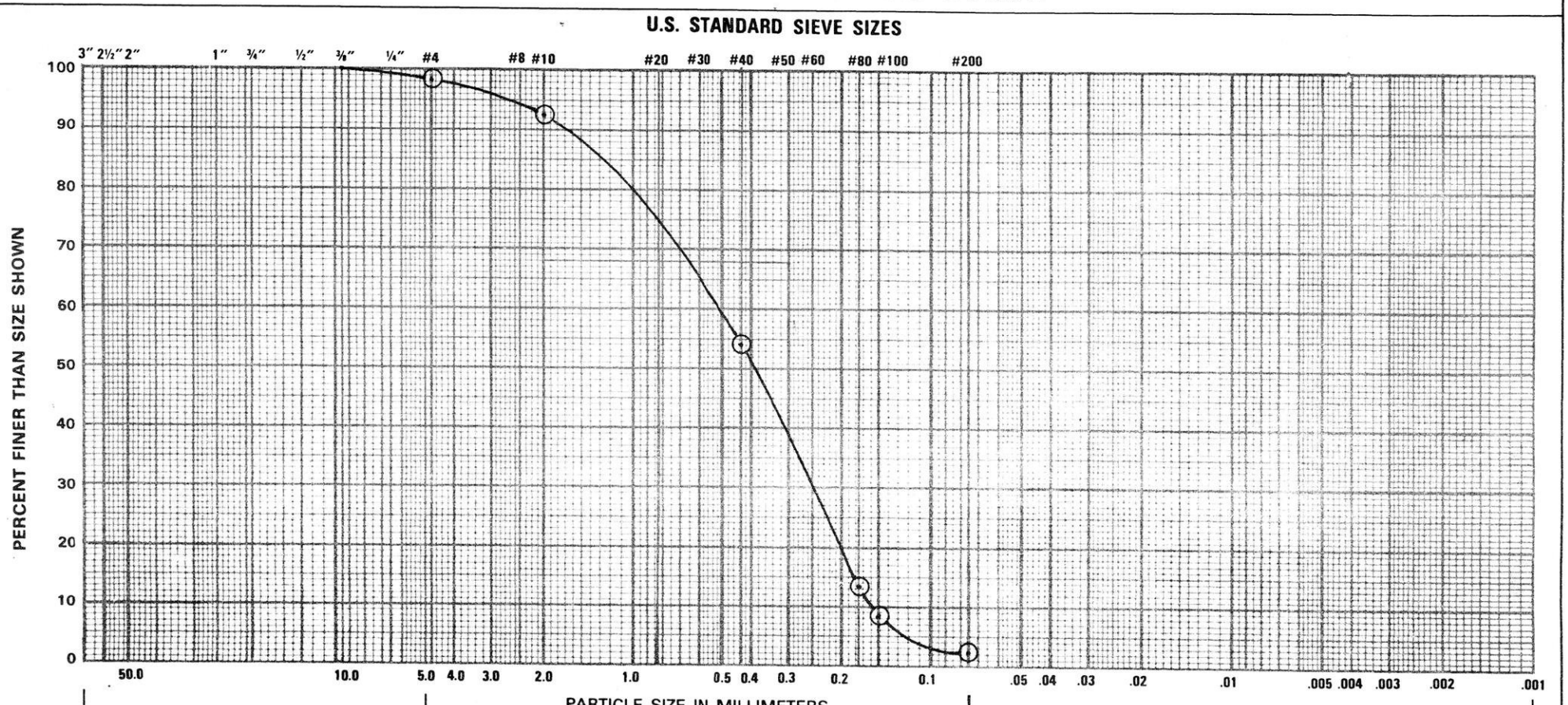
COLOR: 10 YR. 5/8 - yellowish brown

Moisture Content = 28.3%
(As received)

CHECKED BY: RRR

Foth & Van Dyke and Associates Inc.

GRAIN SIZE DISTRIBUTION CURVE



GRAVEL		SAND			SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE		
% =	% = 1.8	% = 5.6	% = 38.6	% = 51.9	% = 2.1	% =

PROJECT: Kennecott Geotechnical - Granular Blanket DATE: 2/3/88 SAMPLE NO.: SB2

LOCATION SAMPLED: Boring No. PZ-S4 ELEV. OR DEPTH: 35.5'-37' DRAWN BY: POK APPROVED BY: RRR

ATTERBERG LIMITS: LL _____ PL _____ PI _____ SAMPLED MOISTURE CONTENT (%): _____ COEFFICIENTS: Cc = 0.8 Cu = 3.3

SAMPLE SOURCE: _____ MUNSELL COLOR CODE: 10 YR. 6/4 DATE SAMPLED: December 1987

SOIL CLASSIFICATION (ASTM: D2487) SAND, fine to medium grained, light yellowish brown (SP)

FORM #411 SL (2/87)

3.5-I-81

Foth & Van Dyke
Engineers/Architects

2737 S. Ridge Road
P. O. Box 19012
Green Bay, Wisconsin 54307-9012
414/497-2500

PROJECT: Kennecott Geotechnical

JOB NO.: 87K10

DATE: February 10 to 12, 1988

PERMEABILITY TEST
CONSTANT HEAD

SAMPLE NO.: Boring: PZ-S4 Depth: 35.5'-37.0'

SOIL DESCRIPTION: SAND, fine to medium grained, light yellowish brown (SP)

% COMPACTION 90.0

COMPACTED DRY DENSITY = 102.5 pcf

MOISTURE = 10.9%

SAMPLE DIAMETER = 4.00"

SAMPLE HEIGHT = 4.00"

RUN NO.	HEAD, cm	DURATION, Seconds	PERMEABILITY, *CM/SEC.*	REMARKS
1	175	30	4.12×10^{-3}	
2	175	30	3.84×10^{-3}	
3	175	30	3.67×10^{-3}	
4	175	30	3.50×10^{-3}	
5	175	30	3.67×10^{-3}	
6	175	30	3.55×10^{-3}	
7	175	30	3.53×10^{-3}	

Average of Perm Readings = 3.6×10^{-3}

Project Specification = 1.0×10^{-3} or faster

REMARKS: Based on the results of the sample submitted and tested, this material would meet the minimum permeability rate as noted above.

FORM #370 SL 1/86)

Foth & Van Dyke

Engineers/Architects

2737 S. Ridge Road
P. O. Box 19012
Green Bay, Wisconsin 54307-9012
414/497-2500

PROJECT NO.: _____

JOB NO.: 87K10

DATE: December 16-22, 1987

REPORT NO.: 6

REPORT OF ANALYSIS OF AGGREGATES

ARCHITECT/ENGINEER: Foth & Van Dyke CONTRACTOR: _____

PROJECT: Kennecott Geotechnical SOURCE: _____

REPORT OF TESTS OF: Verification of Subsurface Samples

Sieve Size or No.	Weight Retained	% Retained	% Passing	Specifi-cations
3-Inch				
2-Inch				
1 1/2-Inch				
1-Inch				
3/4-Inch				
1/2-Inch				
3/8-Inch	0	0	100	
No. 4	1.3	0.2	99.8	
No. 8				
No. 10	21.9	2.8	97.0	
No. 16				
No. 20				
No. 30				
No. 40				
No. 50	499.1	64.6	32.4	
No. 80				
No. 100	226.5	29.3	3.1	
No. 200	6.5	0.8	2.3	
Pan	17.0	2.2		

RECEIVED AT LABORATORY: December 14,1987

QUANTITY REPRESENTED: 772.3 grams

SUBMITTED BY: Betty Socha, Foth & Van Dyke

SAMPLED FROM: Boring No.: PZ-S4

IDENTIFICATION: Depth: 41'-43'

DATE SAMPLED: November - December 1987

INTENDED USE: _____

WASHED GRADATION: yes

PERCENT PASSING NO. 200 SIEVE 2.2 %

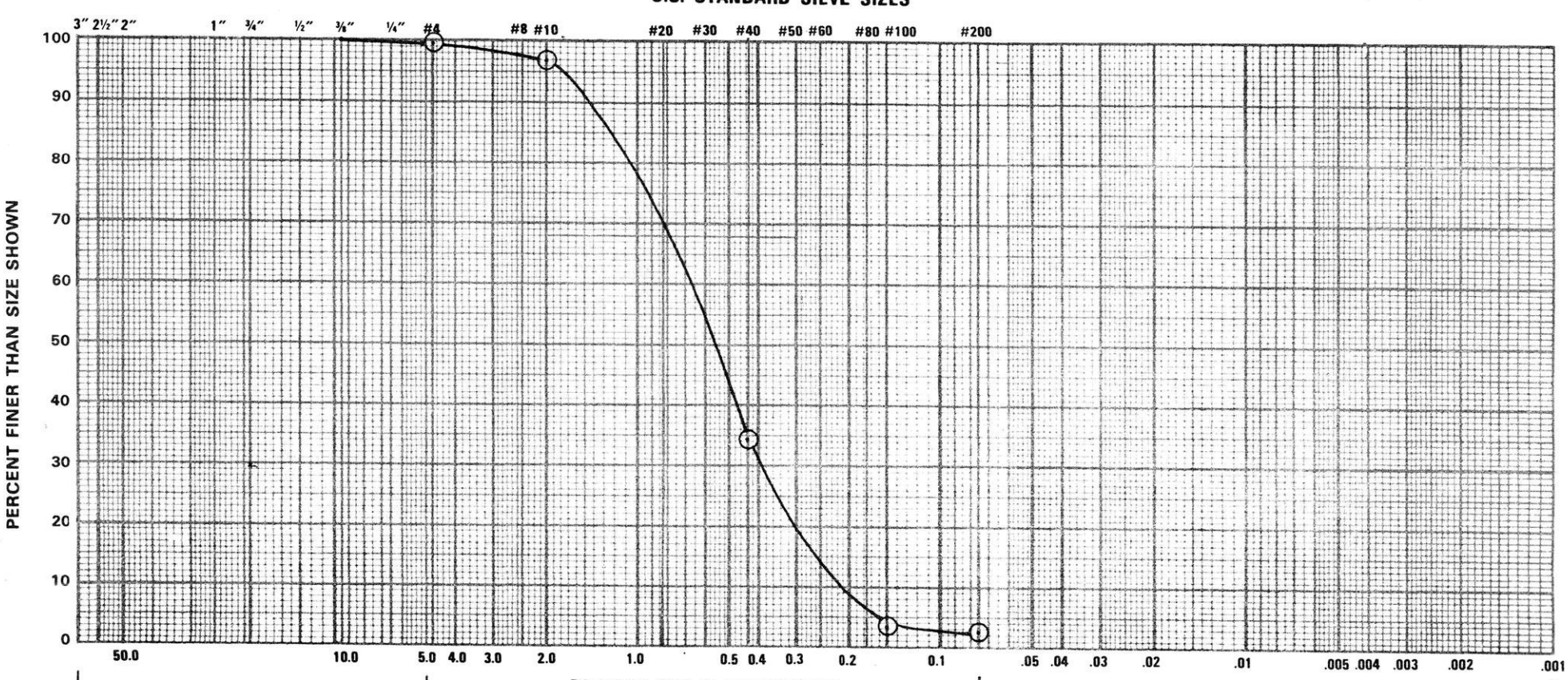
COLOR: 10YR. 4/6 - dark yellowish brown

Moisture Content = 13.4%
(as received)

CHECKED BY: RRR

Foth & Van Dyke and Associates Inc.

GRAIN SIZE DISTRIBUTION CURVE



GRAVEL		SAND			SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE		
% =	% = 0.2	% = 2.8	% = 64.6	% = 30.1	% = 2.2	% =

PROJECT: Kennecott Geotechnical DATE: 12/22/87 SAMPLE NO.: 6

LOCATION SAMPLED: Boring: PZ-S4 ELEV. OR DEPTH: 41'-43' DRAWN BY: POK APPROVED BY: RRR

ATTERBERG LIMITS: LL _____ PL _____ PI _____ SAMPLED MOISTURE CONTENT (%): 13.4 COEFFICIENTS: Cc = 0.9 Cu = 3.1

SAMPLE SOURCE: _____ MUNSELL COLOR CODE: 10YR. 4/6 DATE SAMPLED: Nov.-Dec. 1987

SOIL CLASSIFICATION (ASTM: D2487) SAND, medium to fine grained, dark yellowish brown (SP)

FORM #411 SL (2/87)

3.5-I-84

Foth & Van Dyke
Engineers/Architects
2737 S. Ridge Road
P. O. Box 19012
Green Bay, Wisconsin 54307-9012
414/497-2500

PROJECT NO.: _____
JOB NO.: 87K10
DATE: February 1-4, 1988
REPORT NO.: 10

REPORT OF ANALYSIS OF AGGREGATES

ARCHITECT/ENGINEER: Foth & Van Dyke CONTRACTOR: _____

PROJECT: Kennecott Geotechnical SOURCE: _____

REPORT OF TESTS OF: Verification of Subsurface Samples

Sieve Size or No.	Weight Retained	% Retained	% Passing	Specifications
3-Inch				
2-Inch	0	0	100	
1 1/2-Inch	104.2	6.3	93.7	
1-Inch	23.7	1.4	92.3	
3/4-Inch	16.1	1.0	91.3	
1/2-Inch	153.4	9.2	82.1	
3/8-Inch	80.5	4.8	77.3	
No. 4	153.5	9.2	68.1	
No. 8				
No. 10	235.7	14.2	53.9	
No. 16				
No. 20				
No. 30				
No. 40	303.9	18.3	35.6	
No. 50				
No. 80				
No. 100	88.0	5.3	28.3	
No. 200	54.7	3.3	25.0	
Pan 25.8 390.3	416.1	25.0		

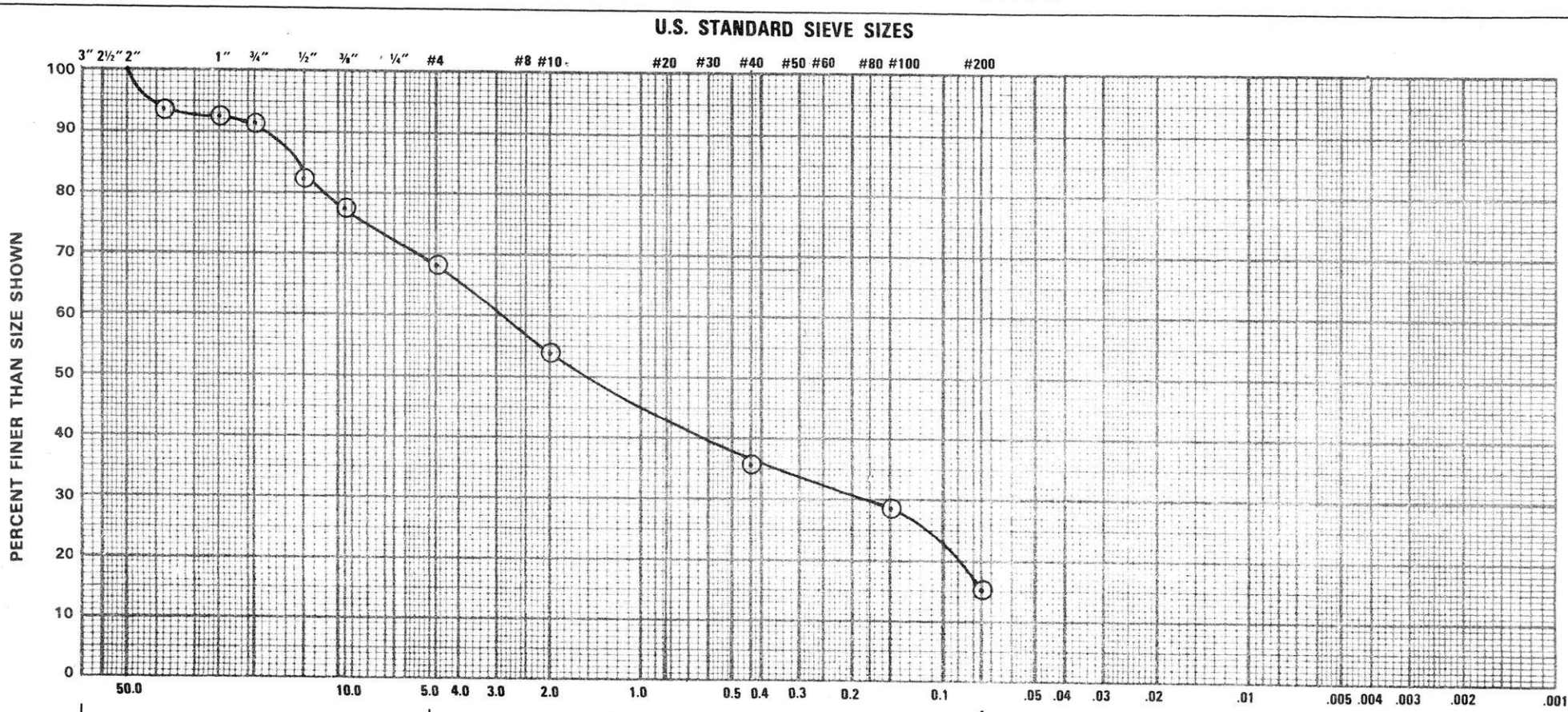
RECEIVED AT LABORATORY: January 28, 1988
QUANTITY REPRESENTED: 1662.9 grams
SUBMITTED BY: Betty Socha of F&VD
SAMPLED FROM: Boring No.: PZ-S4
IDENTIFICATION: Depth: 50.0'-51.5'
DATE SAMPLED: December 1, 1987
INTENDED USE: _____
WASHED GRADATION: Yes
PERCENT PASSING NO. 200 SIEVE 25.0 %
COLOR: 7.5 YR. 4/6 - strong brown to 10 YR. 6/6 - yellowish brown to 10 YR. 7/1 - light gray

Moisture Content = 14.5%
(As Received)

CHECKED BY: RRC

Foth & Van Dyke and Associates Inc.

GRAIN SIZE DISTRIBUTION CURVE



GRAVEL		SAND			SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE		
% = 8.7	% = 23.2	% = 14.2	% = 18.3	% = 8.6	% =	% =

PROJECT: Kennecott Geotechnical DATE: 2/17/88 SAMPLE NO.: 10

LOCATION SAMPLED: Boring No.: PZ-S4 ELEV. OR DEPTH: 50.0'-51.5' DRAWN BY: POK APPROVED BY: RRR

ATTERBERG LIMITS: LL _____ PL _____ PI _____ SAMPLED MOISTURE CONTENT (%): 14.5 COEFFICIENTS: Cc = _____ Cu = _____

SAMPLE SOURCE: _____ MUNSELL COLOR CODE: 7.5 YR. 4/6 to 10 YR. 6/6 to 7/1 DATE SAMPLED: Dec. 1, 1987

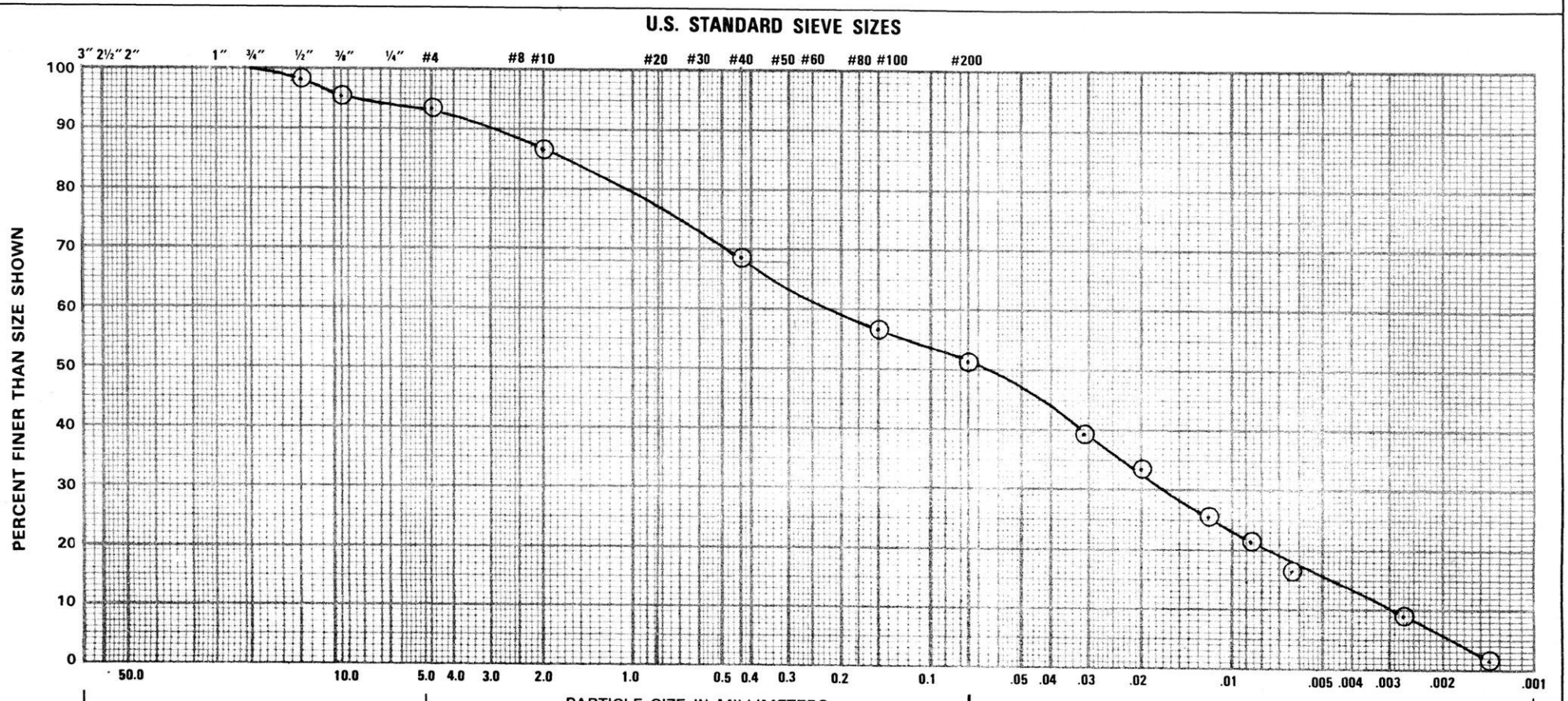
SOIL CLASSIFICATION (ASTM: D2487) SILTY SAND W/GRAVEL, medium to coarse to fine grained, strong brown to light gray (SM)

FORM #411 SL (2/87)

3.5-I-86

Foth & Van Dyke and Associates Inc.

GRAIN SIZE DISTRIBUTION CURVE



GRAVEL		SAND			SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE		
% =	% = 6.4	% = 6.7	% = 18.5	% = 17.3	% = 45.6	% = 5.5

PROJECT: Kennecott Geotechnical DATE: 12/22/87 SAMPLE NO.: 7

LOCATION SAMPLED: Boring No.: PZ-S4 ELEV. OR DEPTH: 51.5'-53' DRAWN BY: POK APPROVED BY: RRR

ATTERBERG LIMITS: LL 24.7 PL 20.9 PI 3.8 SAMPLED MOISTURE CONTENT (%): 20.1 COEFFICIENTS: Cc = Cu =

SAMPLE SOURCE: MUNSELL COLOR CODE: 10YR. 7/1 to 7/6 w/2.5YR.4/6 DATE SAMPLED: Nov.-Dec. 1987

SOIL CLASSIFICATION (ASTM: D2487) SANDY SILT, a little gravel, light gray to yellow with some red, (ML/CL-ML)

FORM #411 SL (2/87)

3.5-I-87

Foth & Van Dyke
Engineers/Architects
2737 S. Ridge Road
P. O. Box 19012
Green Bay, Wisconsin 54307-9012
414/497-2500

PROJECT NO.: _____

JOB NO.: 87K10

DATE: December 16-22, 1987

REPORT NO.: 7

REPORT OF ANALYSIS OF AGGREGATES

ARCHITECT/ENGINEER: Foth & Van Dyke CONTRACTOR: _____

PROJECT: Kennecott Geotechnical SOURCE: _____

REPORT OF TESTS OF: Verification of Subsurface Samples

Sieve Size or No.	Weight Retained	% Retained	% Passing	Specifications
3-Inch				
2-Inch				
1 1/2-Inch				
1-Inch				
3/4-Inch	0	0	100	
1/2-Inch	7.8	1.9	98.1	
3/8-Inch	10.0	2.5	95.6	
No. 4	8.0	2.0	93.6	
No. 8				
No. 10	26.8	6.7	86.9	
No. 16				
No. 20				
No. 30				
No. 40	74.5	18.5	68.4	
No. 50				
No. 80				
No. 100	46.2	11.5	56.9	
No. 200	23.5	5.8	51.1	
Pan	205.5	51.1		

RECEIVED AT LABORATORY: December 14, 1987

QUANTITY REPRESENTED: 402.3 grams

SUBMITTED BY: Betty Socha, Foth & Van Dyke

SAMPLED FROM: Boring No.: PZ-S4

IDENTIFICATION: Depth: 51.5'-53'

DATE SAMPLED: November - December 1987

INTENDED USE: _____

WASHED GRADATION: yes

PERCENT PASSING NO. 200 SIEVE 51.1 %

COLOR: 10YR. 7/1-light gray to 7/6 - yellow with some - 2.5YR. 4/6-red

Moisture Content = 20.1% (as received)

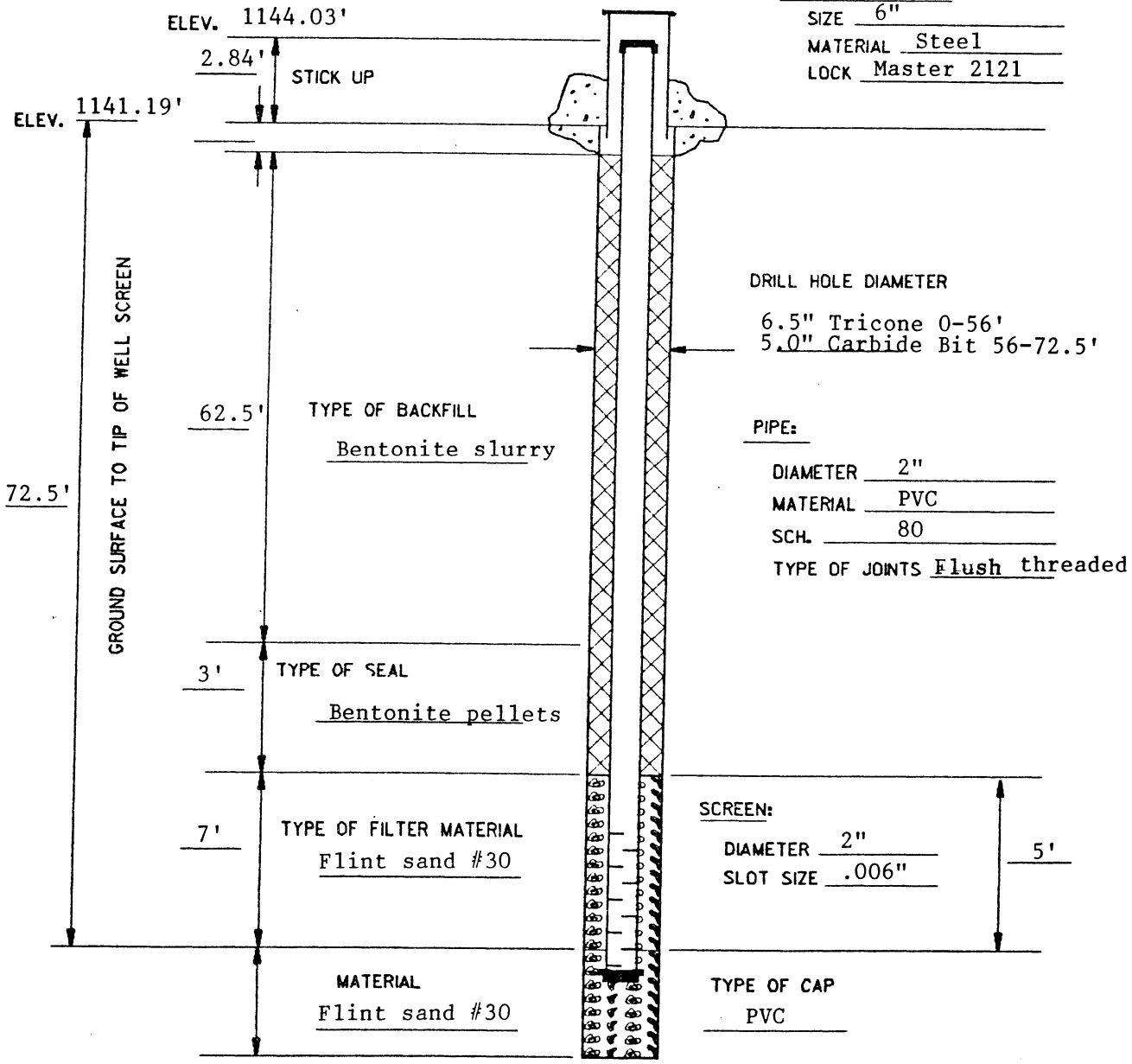
CHECKED BY: RRR

FORM #329 A-1 SL (Rev. 11/86)

MONITORING WELL INSTALLATION DIAGRAM

WELL NO: PZ-S4
DATE INSTALLED: 12-01-87
DRILLER: Luisier Drilling Inc.
DRILLING METHOD: Mud rotary
COORDINATES: 41,138.73N 40,630.94E

CLIENT: Kennecott
PROJECT: Geotechnical
SCOPE I.D.: 87K10-BL22
BY: BJS



Foth & Van Dyke
Geosciences & Environmental Management Division

MONITORING WELL DEVELOPMENT

WELL NUMBER PZ-S4 CLIENT Kennecott

WELL DIAMETER 2" PROJECT Geotechnical Investigation

TOTAL DEPTH OF WELL 75.40 SCOPE I.D. 87K10-BL 22

DEPTH TO WATER TIME OF MEASUREMENT BY MJH

BEFORE 27.60 DATE 12-18-87

AFTER 45.60

DESCRIPTION OF DEVELOPMENT METHOD

Well was alternately bailed and surged using a PVC hand bailer.

VOLUME OF WATER REMOVED FROM WELL 10 gals.

CLARITY OF WATER IN WELL BEFORE DEVELOPMENT Brn.

CLARITY OF WATER IN WELL AFTER DEVELOPMENT Brn

PRESENCE OF SEDIMENT AT THE BOTTOM OF THE WELL Silty

VOLUME OF WATER ADDED TO WELL None

SOURCE OF WATER ADDED TO WELL

TIME SPENT FOR DEVELOPMENT

STABILIZATION READINGS

GAL. REMOVED	TIME	FIELD TEMPERATURE	FIELD SPEC. COND.	FIELD pH

FOTH AND VAN DYKE

LOG OF TEST BORING NO.: B-S5

CLIENT: Kennecott
PROJECT: Geotechnical Investigation-Flambeau
PROJECT NUMBER: 87K10-22
LOCATION: East pit north slope; Section 422, 254 ft. N. baseline
COORDINATES: 41471.54 N 40299.14 E

SURFACE ELEVATION: 1140.3
BORING DEPTH: 67.0
DATE: 12/08/87

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLE NOTES
1140.3	--0						Surface brn silty SAND, fn, (vy fn sand) poorly graded w/bldrs (Aeolian sand & silt w/bldrs)			
	-									
	-									
	-									
	-									sb1 (ML)
1135.3	--5	5.0-7.0	sb	1		2.0	Dk yel (10YR 4/4) sandy SILT, poorly graded, fn (vy fn sand), slightly moist, cohesive, massive to indistinctly lamin. (Aeolian sand & silt)	ML		43% sand 50% silt 7% clay N/P 15.1% moist
	-									
	-									
	-									
1130.3	--10	10.0-12.0	sb	2		2.0	Brn, well graded SAND, cse w/med & fn sand, fn gvl, layered w/silty SAND, fn, cohesive. At 11.8' red brn (5YR 4/4) silty SAND, fn, diamict (till)	SW,SM	P.P.-1.5	
	-									
	-									
	-									
	-									
1125.3	--15	15.0-17.0	sb	3		1.0	Red brn silty SAND as above, moist, crumbly, cohesive, bldr @ 16', dense	SM	P.P.-0.7	sb3 (SM) LL= 17.2 PI= 4.2
	-									
	-	18.0-20.0	sb	4		2.0	As above, except moist, cohesive		P.P.-1.7	sb5 (SM) 11% gvl
1120.3	--20	20.0-22.0	sb	5		1.0	As above. Bldr @ 21'		P.P.-1.2	58% sand 31% si & cl
	-	22.0-24.0	sb	6		2.0	As above (till).		P.P.-1.3	sb7 (SM) 10% gravel
	-									60% sand
1115.3	--25	25.0-27.0	sb	7		2.0	As above (till).			24% silt 6% clay LL=17.6
	-									PI=2.5
	-									
	-									9.9% moist
1110.3	--30	29.8-32.0	sb	8		1.7	Pale brn (10YR 6/3) poorly graded SAND, fn & med w/cse layers, loose to cohesive unconsol, saturated (Sandstone)	SP (SS)	P.P.-1.3	sb8 (SP) 1% gravel 1% cse sand 40% med sand
	-									
	-									
	-									
1105.3	--35	35.0-37.0	sb	9		2.0	Lt gray (10YR 7/2) poorly graded SAND, fn w/med & few vy fn sand layers, cohes. brittle, loose, saturated (Sandstone) Cuttings @ 39'-sandstone cemented w/white (kaolinite) clay		Noncohesive	56% fn sand 3% si & cl 16.3% moist K= 3.5E - 03 cm/sec
	-									
	-									
	-									
1100.3	--40	40.0-42.0	sb	10		2.0	Lt gray poorly graded SAND w/silt, fn, cohesive (vy fn ss w/kaolinte) to 41' At 41', med & cse sandstone, loose, w/dk gray (10YR 4/1) coating on qtz grains.	SP-SM (SS)	Noncohesive	
	-									
	-									
	-									
1095.3	--45	45.0-47.0	sb	11		2.0	Red yel (7.5YR 7/6 & 6/6) SILT, soft, vy brittle, w/relic schistocity (Saprolite)	ML		sb11 (ML) 22% sand
	-	47.0-49.0	st	12		2.0	Yel (10YR 7/8) SILT, soft, cohesive, brittle, moist, w/apparent schistocity			78% si & cl LL= 28.7
	-	49.0-50.0	st	13		1.0	Altered schist w/hrd crystalline laminae			PI= 2.9
1090.3	--50	50.0-51.5	st	14		1.5	@ 50'-"SILT" w/sand & fn gvl. Altered schist as above w/some vy hard laminae	"ML"		15.2% moist
	-									
	-									st12-14 (ML)
	-									LL= 30.6
	-									PI= 3.2
1085.3	--55									

DRILLING DATA

START DATE: 12/08/87
COMPLETION DATE: 12/09/87
LOGGED BY: BJS
DRILLING METHOD: Mud rotary (carbide bit 58-67 ft)
DRILLING CONTRACTOR: Luisier Drilling, Inc.

WATER LEVEL INFORMATION

DEPTH AT COMPLETION:
LATER TIME/DEPTH: 15 hr/29 ft
LATER TIME/DEPTH:
CAVE IN DEPTH:
DRILLING LOSSES:

LOG OF TEST BORING NO.: B-S5

CLIENT: Kennecott
PROJECT: Geotechnical Investigation-Flambeau
PROJECT NUMBER: 87K10-22
LOCATION: East pit north slope; Section 422, 254 ft. N. baseline
COORDINATES: 41471.54 N 40299.14 E

SURFACE ELEVATION: 1140.3
BORING DEPTH: 67.0
DATE: 12/08/87

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLE NOTES
1085.3	--55	55.0-57.0	st	15		2.0	Red yel & yel red (5YR 6/8 & 5/8) "SILT"			st15 (ML)
	-						w/sand & fn gvl, brittle, talcy, as	"ML"		K= 2.2E - 07
	-						above except softer			cm/sec
	-	57.0-58.0	st	16		1.0	Same except harder			
	-	58.0-61.0	c	17		3.0	Core 58-62', no breaks in core in barrel		P.P. - 0.7	c18 (ML)
1080.3	--60						Red (10YR 4/8) "SILT", vy soft, brittle,		RQD = 75%	4% gravel
	-						w/apparent schistocity		Fract freq	5% cse sand
	-								= 0/ft	13% med sand
	-						Core 62-67', broken in barrel into 8-10"			18% fn sand
	-	62.0-67.0	c	18		5.0	pieces. Red yel (5YR5/8) & red (10R 4/8)		P.P. - 1.1	57% silt
1075.3	--65						w/yel (2.5Y8/8) laminated "SILT", w/very		RQD = 100%	3% clay
	-						distinct schistocity, soft, moist		Fract freq	LL = 26.2
	-							=====	= 1.3/ft	PI = 2.7
	-						67'-End of Boring in altered schist			13.9% moist
	-									
1070.3	--70									
	-									
	-									
	-									
1065.3	--75									
	-									
	-									
	-									
1060.3	--80									
	-									
	-									
	-									
1055.3	--85									
	-									
	-									
	-									
1050.3	--90									
	-									
	-									
	-									
1045.3	--95									
	-									
	-									
	-									
1040.3	--100									
	-									
	-									
	-									
1035.3	--105									
	-									
	-									
	-									
1030.3	--110									

DRILLING DATA

START DATE: 12/08/87
COMPLETION DATE: 12/09/87
LOGGED BY: BJS
DRILLING METHOD: Mud rotary, (carbide bit 58-67 ft.)
DRILLING CONTRACTOR: Luisier Drilling, Inc.

WATER LEVEL INFORMATION

DEPTH AT COMPLETION:
LATER TIME/DEPTH: 15 hr/29 ft
LATER TIME/DEPTH:
CAVE IN DEPTH:
DRILLING LOSSES:

LOG OF TEST BORING NO.: B-S5A

CLIENT: Kennecott
PROJECT: Geotechnical Investigation-Flambeau
PROJECT NUMBER: 87K10-22
LOCATION: East pit north slope; Section 422, 254 ft. N. baseline

APPROXIMATE SURFACE ELEVATION: 1140.0
BORING DEPTH: 46.4
DATE: 12/01/87

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLE NOTES
1140.0	--0						Surface sand w/boulders up to 1' dia.	SP-SM		
1135.0	--5	5.0-6.5	sb	1	22	1.5	Yel brn (10YR 5/4) silty SAND, fn, poorly graded, loose, vy slightly moist (aeolian sand)	SM		
1130.0	--10	10.0-11.5	sb	2	46	1.0	Dk yel brn (10YR 4/4) well graded SAND, fn, w/med & cse sand, & fn gvl, loose, vy slightly moist	SW		
1125.0	--15	15.0-16.5	sb	3	100	0.2	Red brn (5YR 4/4) silty SAND, fn, w/med & cse sand, fn gvl, dense, cohesive, slightly moist (till)	SM	N - 100/0.2'	
1120.0	--20	20.0-21.5	sb	4	53	1.5	Same, moist			
1115.0	--25	25.0-26.5	sb	5	89	1.2	Same w/sand layers (SP), fn, moist			
1110.0	--30	30.0-31.5	sb	6	100	0.9	White poorly graded SAND, fn, w/med, loose, dense, wet, w/few cemented pieces (<1" dia) w/1" thick lt grn gry (5G 7/1) layer fat clay (CH) wet	SP (SS)	N-100/0.9'	
1105.0	--35	35.0-36.5	sb	7	62	1.5	Sample mixed w/cave. Poorly graded sand, fn, w/cse qtz sand (up to 0.5" dia) (sandstone)			
1100.0	--40	40.0-41.5	sb	8	100	0.7	Brn (7.5YR 5/4) poorly graded SAND, med w/cse up to 0.5" dia qtz, white, vy well rounded. Loose, saturated w/lt grn gray layer fat clay (CH)			
1095.0	--45	45.0-46.5	sb	9	100	1.3	Lt gray (10YR 7/2) well graded SAND, fn w/med & cse, loose to cemented. White w/yellow (10YR 8/2 & 7/6) "SILT", talcy w/tabular crystals, moist, slightly plastic, relic schistocity apparent (Sandstone/Saprolite)	SW ML =====	N-100/1.4'	
1090.0	--50						46.4'-End of Boring in Saprolite Refusal			
1085.0	--55									

DRILLING DATA

START DATE: 12/01/87
COMPLETION DATE: 12/01/87
LOGGED BY: BJS
DRILLING METHOD: Hollow stem augers
DRILLING CONTRACTOR: Wisconsin Test Drilling, Inc.

WATER LEVEL INFORMATION

DEPTH AT COMPLETION: 28
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:
DRILLING LOSSES:

Foth & Van Dyke

Engineers/Architects

2737 S. Ridge Road
P. O. Box 19012
Green Bay, Wisconsin 54307-9012
414/497-2500

PROJECT NO.: _____

JOB NO.: 87K10

DATE: December 16-22, 1987

REPORT NO.: 8

REPORT OF ANALYSIS OF AGGREGATES

ARCHITECT/ENGINEER: Foth & Van Dyke CONTRACTOR: _____

PROJECT: Kennecott Geotechnical SOURCE: _____

REPORT OF TESTS OF: Verification of Subsurface Samples

Sieve Size or No.	Weight Retained	% Retained	% Passing	Specifi-cations
3-Inch				
2-Inch				
1 1/2-Inch				
1-Inch				
3/4-Inch				
1/2-Inch				
3/8-Inch				
No. 4	0	0	100	
No. 8				
No. 10	0.3	0.1	99.9	
No. 16				
No. 20				
No. 30				
No. 40	11.9	3.1	96.8	
No. 50				
No. 80				
No. 100	108.9	27.9	68.9	
No. 200	47.6	12.2	56.7	
Pan	221.0	56.7		

RECEIVED AT LABORATORY: December 14, 1987

QUANTITY REPRESENTED: 389.7 grams

SUBMITTED BY: Betty Socha, Foth & Van Dyke

SAMPLED FROM: Boring No.: B-S5

IDENTIFICATION: Depth: 5'-7'

DATE SAMPLED: November - December 1987

INTENDED USE: _____

WASHED GRADATION: yes

PERCENT PASSING NO. 200 SIEVE 56.7 %

COLOR: 7.5YR, 4/4-strong brown

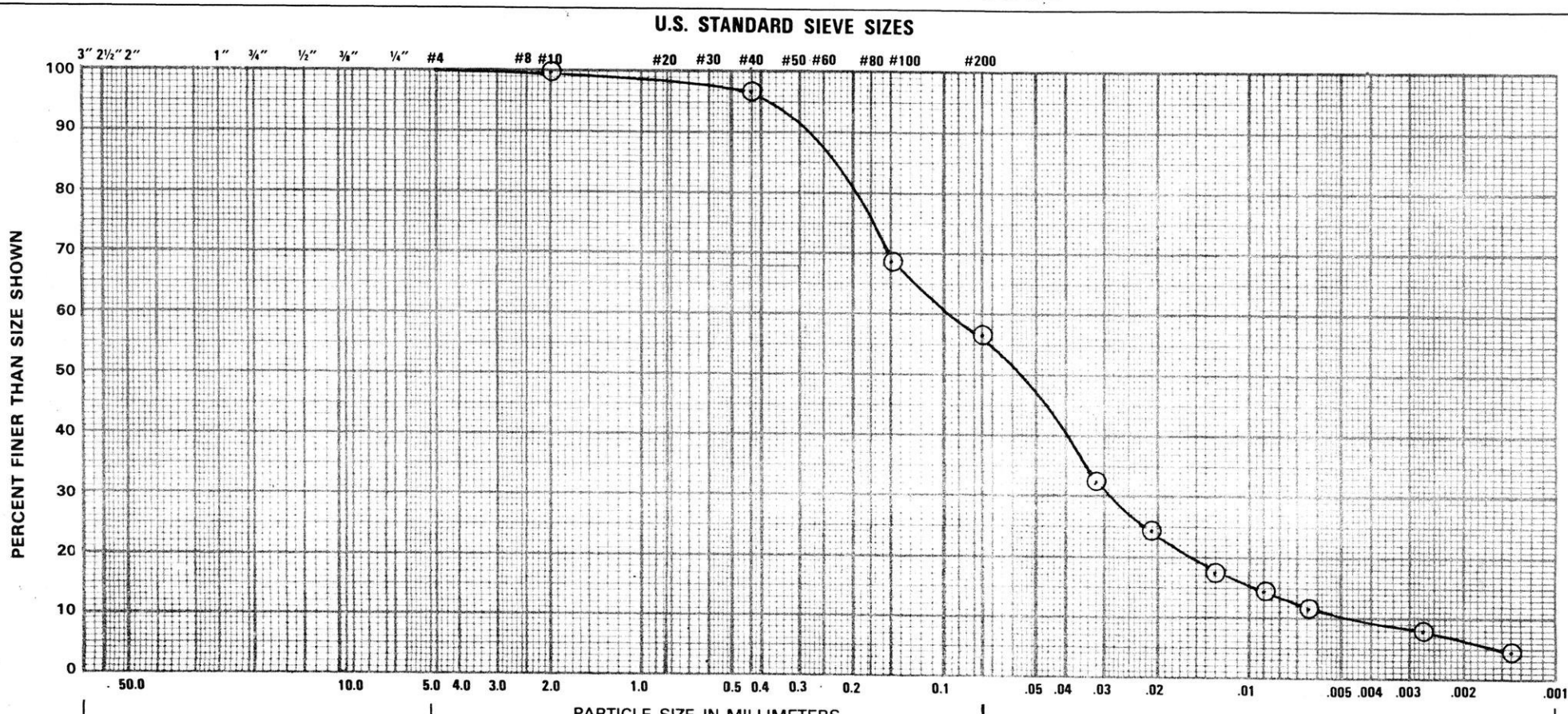
Moisture Content = 15.1%
(as received)

CHECKED BY: RRR

FORM #329 A-1 SL (Rev. 11/86)

Foth & Van Dyke and Associates Inc.

GRAIN SIZE DISTRIBUTION CURVE



GRAVEL		SAND			SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE		
% =	% =	% = 0.1	% = 3.1	% = 40.1	% = 50.2	% = 6.5

PROJECT: Kennecott Geotechnical DATE: 12/22/87 SAMPLE NO.: 8

LOCATION SAMPLED: Boring: B-S5 ELEV. OR DEPTH: 5'-7' DRAWN BY: POK APPROVED BY: RRR

ATTERBERG LIMITS: LL _____ PL _____ PI N/P SAMPLED MOISTURE CONTENT (%): 15.1 COEFFICIENTS: Cc = _____ Cu = _____

SAMPLE SOURCE: _____ MUNSELL COLOR CODE: 7.5YR.4/4 DATE SAMPLED: Nov.-Dec. 1987

SOIL CLASSIFICATION (ASTM: D2487) SANDY SILT, strong brown, (ML)

FORM #411 SL (2/87)

3.5-I-95

Foth & Van Dyke
Engineers/Architects

2737 S. Ridge Road
P. O. Box 19012
Green Bay, Wisconsin 54307-9012
414/497-2500

ATTERBERG LIMITS

Scope I.D. : 87K10

JOB NAME: Kennecott Geotechnical **TEST NO.:** 11

SAMPLE NO.: SS3 **DATE:** February 17 to 18, 1988

LOCATION: **TESTED BY:** POK

BORING NO.: B-S5 **DEPTH:** 15' - 16'

	LIQUID LIMIT			PLASTIC LIMIT			PERCENT WATER
DETERMINATION NO.	37	29	13				
CONTAINER NO.	H1	H2	H3		H4		
CONTAINER & WET SOIL	12.98	12.00	12.69		11.03		
CONTAINER & DRY SOIL	11.34	10.45	10.95		9.92		
WATER WEIGHT	1.64	1.55	1.74		1.11		
CONTAINER WEIGHT	1.40	1.41	1.41		1.37		
DRY SOIL WEIGHT	9.94	9.04	9.54		8.55		
WATER CONTENT %	16.5	17.2	18.2		13.0		
CORRECTED %	17.3	17.5	16.9				

LIQUID LIMIT	PLASTIC LIMIT	NATURAL WATER CONTENT	PLASTICITY INDEX
17.2	13.0		4.2

Soil Classification: SILTY SAND, fine to medium grained, dark reddish brown (SM)
Munsell Color Code : 5 YR. 3/4 - dark reddish brown

3.5-I-96

FORM #342 SL (7/85)

Foth & Van Dyke

Engineers/Architects

2737 S. Ridge Road P. O. Box 19012 Green Bay, Wisconsin 54307-9012 414/497-2500

COMPACTION CONTROL REPORT

DATE: 3/14/88 JOB NAME: Kennecott Geotechnical SCOPE I.D. #: 87K10

1. LABORATORY COMPACTION TEST DATA

A. DESCRIPTION OF SOIL: SILTY SAND, fine to medium grained, a little gravel, dark reddish brown (SM)

MATERIAL MARK _____ CLASSIFICATION _____ AASHO _____ BPR _____

SOURCE OF MATERIAL Boring B-S5 Depth: 15' - 25'

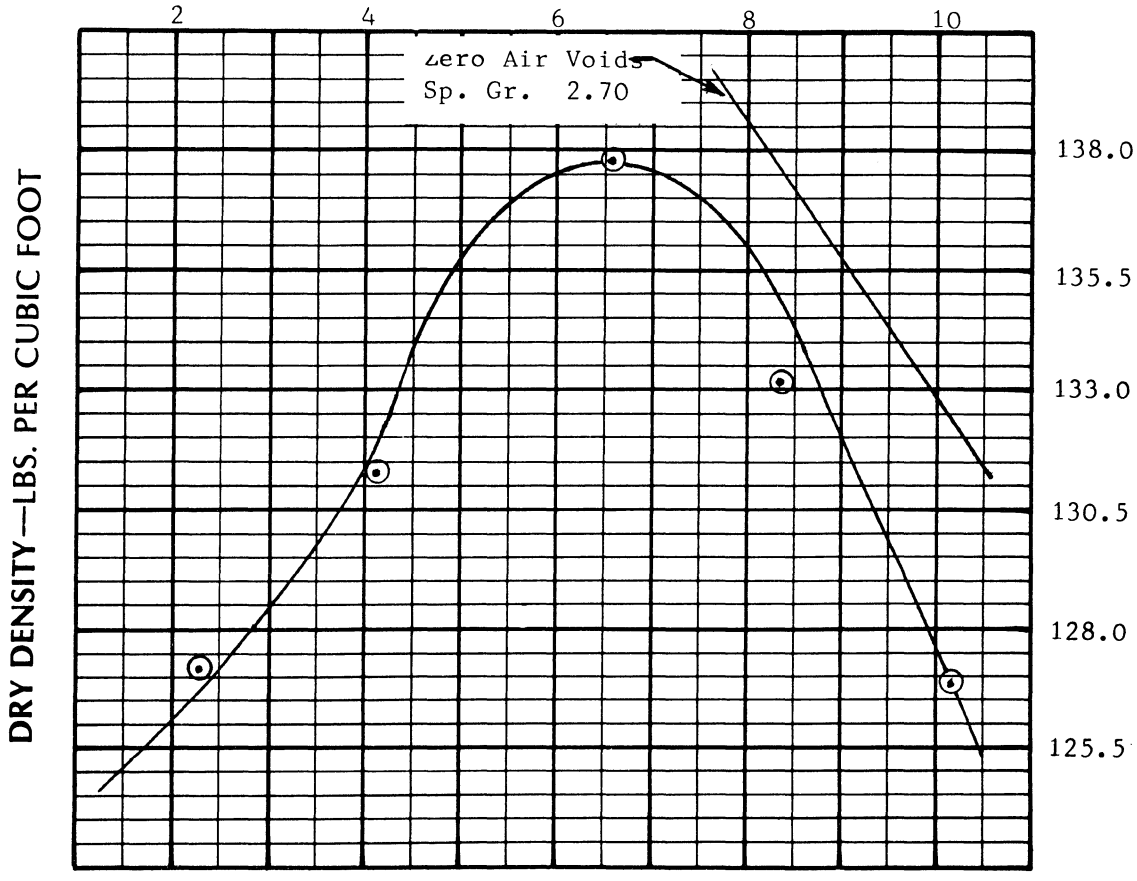
NATURAL WATER CONTENT 10.4 % NATURAL DRY DENSITY 129.4 PCF SPECIFIC GRAVITY _____

LIQUID LIMIT 17.2 % PLASTIC LIMIT 13.0 % PLASTICITY INDEX 4.2

B. TEST PROCEDURE USED: ASTM D 1557 - Method "A"

C. TEST RESULTS: OPTIMUM WATER CONTENT 6.5 %

MAXIMUM DRY DENSITY 137.7 PCF (AT A WET DENSITY OF 146.7 PCF)



FORM #332 SL (6/85)

Foth & Van Dyke

Engineers/Architects

2737 S. Ridge Road
P. O. Box 19012
Green Bay, Wisconsin 54307-9012
414/497-2500

PROJECT NO.: _____

JOB NO.: 87K10

DATE: March 1 - 3, 1988

REPORT NO.: 11

REPORT OF ANALYSIS OF AGGREGATES

ARCHITECT/ENGINEER: Foth & Van Dyke CONTRACTOR: _____

PROJECT: Kennecott Geotechnical SOURCE: _____

REPORT OF TESTS OF: Verification of Subsurface Samples

Sieve Size or No.	Weight Retained	% Retained	% Passing	Specifi-cations
3-Inch				
2-Inch				
1 1/2-Inch				
1-Inch	0	0	100	
3/4-Inch	25.4	4.9	95.1	
1/2-Inch	0			
3/8-Inch	14.0	2.7	92.4	
No. 4	16.6	3.2	89.2	
No. 8				
No. 10	20.9	4.1	85.1	
No. 16				
No. 20				
No. 30				
No. 40	81.4	15.8	69.3	
No. 50				
No. 80				
No. 100	145.3	28.3	41.0	
No. 200	47.9	9.3	31.7	
Pan	162.6	31.6		

RECEIVED AT LABORATORY: January 28, 1988

QUANTITY REPRESENTED: 514.2 grams

SUBMITTED BY: Betty Socha of F&VD

SAMPLED FROM: Boring No.: B-S5

IDENTIFICATION: Depth: 18'-20'

DATE SAMPLED: December 9, 1987

INTENDED USE: _____

WASHED GRADATION: yes

PERCENT PASSING NO. 200 SIEVE 31.6 %

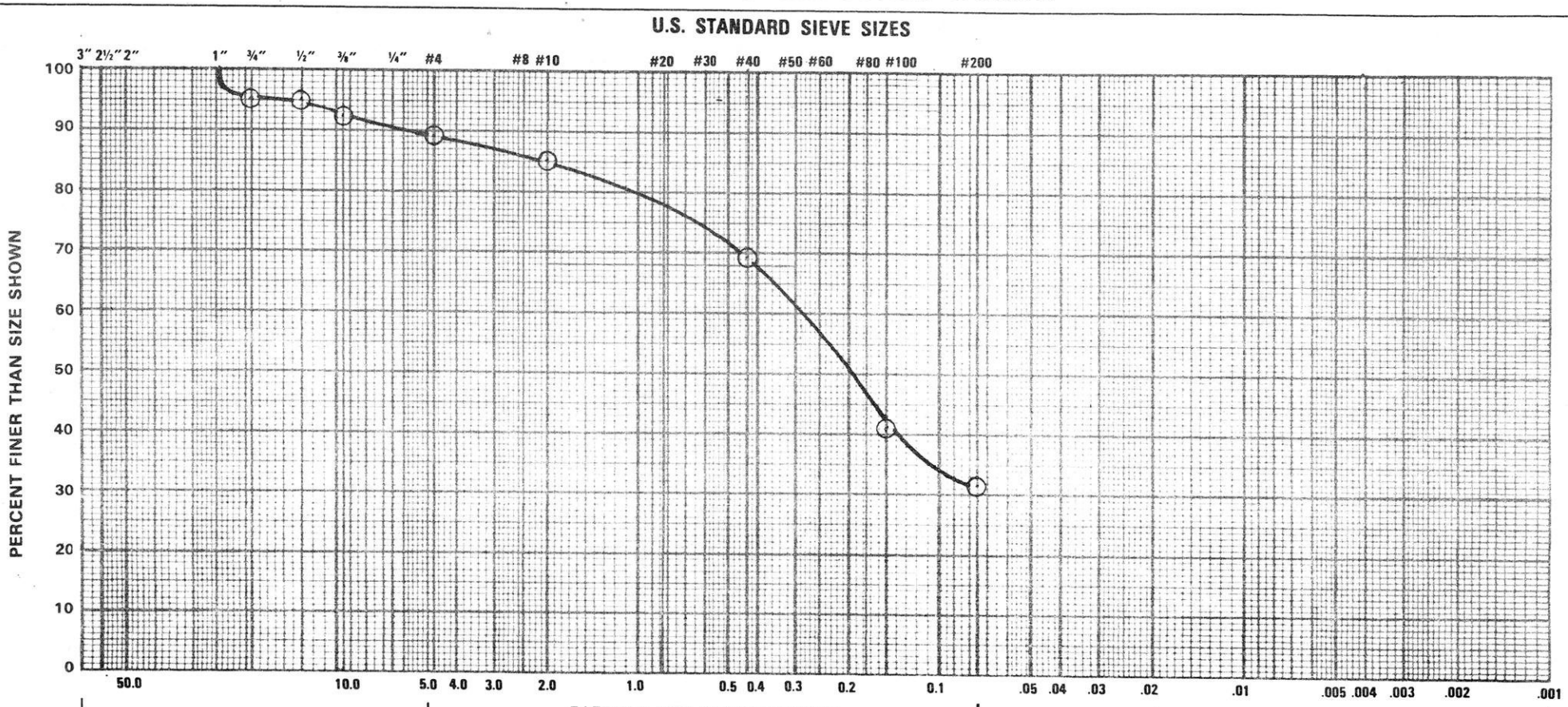
COLOR: 5 YR. 3/4 - dark reddish brown

Moisture Content = 10.4%
(As received)

CHECKED BY: RRR

Foth & Van Dyke and Associates Inc.

GRAIN SIZE DISTRIBUTION CURVE



GRAVEL		SAND			SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE		
% = 4.9	% = 5.9	% = 4.1	% = 15.8	% = 37.7	% =	% =

PROJECT: Kennecott Geotechnical DATE: 3/9/88 SAMPLE NO.: 11

LOCATION SAMPLED: Boring No.: B-S5 ELEV. OR DEPTH: 18'-20' DRAWN BY: RRR APPROVED BY: POK

ATTERBERG LIMITS: LL 17.2 PL 13.0 PI 4.2 SAMPLED MOISTURE CONTENT (%): COEFFICIENTS: Cc = Cu =

SAMPLE SOURCE: MUNSELL COLOR CODE: 5 YR. 3/4 DATE SAMPLED: 12/9/87

SOIL CLASSIFICATION (ASTM: D2487) SILTY SAND, fine to medium grained, a little gravel, dark reddish brown (SM)

FORM #411 SL (2/87)

3.5-I-99

Foth & Van Dyke
Engineers/Architects

2737 S. Ridge Road
P. O. Box 19012
Green Bay, Wisconsin 54307-9012
414/497-2500

PROJECT NO.: _____

JOB NO.: 87K10

DATE: December 16-22, 1987

REPORT NO.: 9

REPORT OF ANALYSIS OF AGGREGATES

ARCHITECT/ENGINEER: Foth & Van Dyke CONTRACTOR: _____

PROJECT: Kennecott Geotechnical SOURCE: _____

REPORT OF TESTS OF: Verification of Subsurface Samples

Sieve Size or No.	Weight Retained	% Retained	% Passing	Specifications
3-Inch				
2-Inch				
1 1/2-Inch				
1-Inch	0	0	100	
3/4-Inch	14.3	2.8	97.2	
1/2-Inch				
3/8-Inch	17.8	3.5	93.7	
No. 4	20.2	4.0	89.7	
No. 8				
No. 10	21.7	4.2	85.5	
No. 16				
No. 20				
No. 30				
No. 40	89.0	17.4	68.1	
No. 50				
No. 80				
No. 100	148.6	29.1	39.0	
No. 200	48.3	9.5	29.5	
Pan	151.1	29.6		

RECEIVED AT LABORATORY: December 14, 1987

QUANTITY REPRESENTED: 511.0 grams

SUBMITTED BY: Betty Socha, Foth & Van Dyke

SAMPLED FROM: Boring No.: B-S5

IDENTIFICATION: Depth: 25'-27'

DATE SAMPLED: November - December 1987

INTENDED USE: _____

WASHED GRADATION: yes

PERCENT PASSING NO. 200 SIEVE 29.6 %

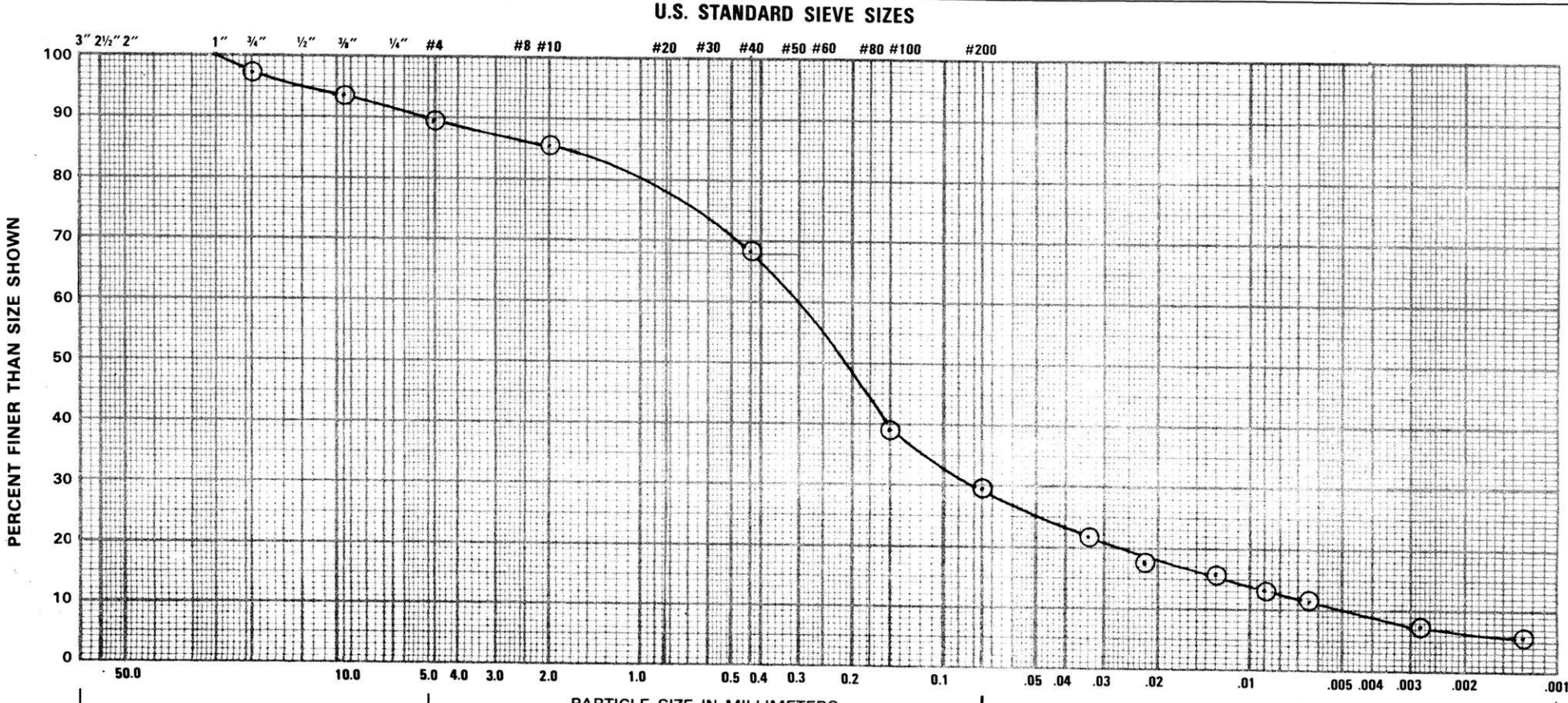
COLOR: 5YR. 3/4-dark reddish brown

Moisture Content = 9.9%
(as received)

CHECKED BY: RRR

Foth & Van Dyke and Associates Inc.

GRAIN SIZE DISTRIBUTION CURVE



GRAVEL		SAND			SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE		
% = 2.8	% = 7.5	% = 4.2	% = 17.4	% = 38.5	% = 23.6	% = 6.0

PROJECT: Kennecott Geotechnical DATE: 12/22/87 SAMPLE NO.: 9

LOCATION SAMPLED: Boring: B-S5 ELEV. OR DEPTH: 25'-27' DRAWN BY: POK APPROVED BY: RRR

ATTERBERG LIMITS: LL 17.6 PL 15.1 PI 2.5 SAMPLED MOISTURE CONTENT (%): 9.9 COEFFICIENTS: Cc = Cu =

SAMPLE SOURCE: MUNSELL COLOR CODE: 5YR. 3/4 DATE SAMPLED: Nov.-Dec. 1987

SOIL CLASSIFICATION (ASTM: D2487) SILTY SAND, fine to medium grained, a little gravel, dark reddish brown (SM)

FORM #411 SL (2/87)

3.5-I-101

Foth & Van Dyke

Engineers/Architects

2737 S. Ridge Road
P. O. Box 19012
Green Bay, Wisconsin 54307-9012
414/497-2500

PROJECT NO.: _____

JOB NO.: 87K10

DATE: December 16-22, 1987

REPORT NO.: 10

REPORT OF ANALYSIS OF AGGREGATES

ARCHITECT/ENGINEER: Foth & Van Dyke CONTRACTOR: _____

PROJECT: Kennecott Geotechnical SOURCE: _____

REPORT OF TESTS OF: Verification of Subsurface Samples

Sieve Size or No.	Weight Retained	% Retained	% Passing	Specifications
3-Inch				
2-Inch				
1 1/2-Inch				
1-Inch				
3/4-Inch				
1/2-Inch				
3/8-Inch	0	0	100	
No. 4	6.5	0.8	99.2	
No. 8				
No. 10	9.9	1.2	98.0	
No. 16				
No. 20				
No. 30				
No. 40	320.8	40.0	58.0	
No. 50				
No. 80				
No. 100	410.5	51.2	6.8	
No. 200	29.0	3.6	3.2	
Pan	25.6	3.2		

RECEIVED AT LABORATORY: December 14, 1987

QUANTITY REPRESENTED: 802.3 grams

SUBMITTED BY: Betty Socha, Foth & Van Dyke

SAMPLED FROM: Boring No.: B-S5

IDENTIFICATION: Depth: 29.8'-31.5'

DATE SAMPLED: November - December 1987

INTENDED USE: _____

WASHED GRADATION: yes

PERCENT PASSING NO. 200 SIEVE 3.2 %

COLOR: 10YR. 6/3-pale brown

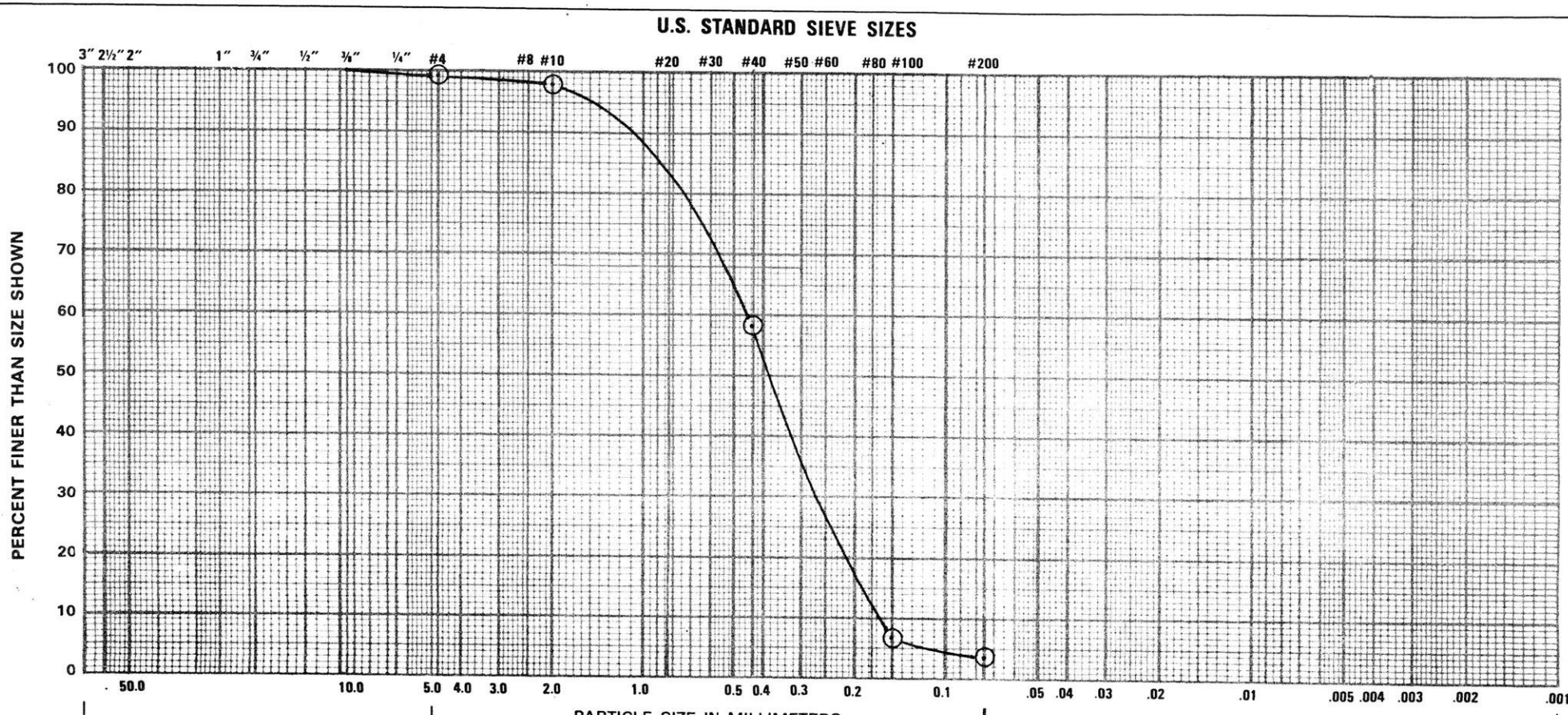
Moisture Content = 16.3%
(as received)

CHECKED BY: RRR

FORM #329 A-1 SL (Rev. 11/86)

Foth & Van Dyke and Associates Inc.

GRAIN SIZE DISTRIBUTION CURVE



GRAVEL		SAND			SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE		
% =	% = 0.8	% = 1.2	% = 40.0	% = 54.8	% = 3.2	% =

PROJECT: Kennecott Geotechnical DATE: 12/22/87 SAMPLE NO.: 10

LOCATION SAMPLED: Boring: B-S5 ELEV. OR DEPTH: 29.8'-31.5' DRAWN BY: POK APPROVED BY: RRR

ATTERBERG LIMITS: LL _____ PL _____ PI _____ SAMPLED MOISTURE CONTENT (%): 16.3 COEFFICIENTS: Cc = 0.9 Cu = 2.7

SAMPLE SOURCE: _____ MUNSELL COLOR CODE: 10YR. 6/3 DATE SAMPLED: Nov.-Dec. 1987

SOIL CLASSIFICATION (ASTM: D2487) SAND, fine to medium grained, pale brown (SP)

FORM #411 SL (2/87)

3.5-I-103

Foth & Van Dyke
Engineers/Architects

2737 S. Ridge Road
P. O. Box 19012
Green Bay, Wisconsin 54307-9012
414/497-2500

PROJECT: Kennecott Geotechnical

JOB NO.: 87K10

DATE: February 10 to 12, 1988

PERMEABILITY TEST
CONSTANT HEAD

SAMPLE NO.: Boring: B-S5 Depth: 29.8'-31.5'

SOIL DESCRIPTION: SAND, medium to fine grained, pale brown (SP)

% COMPACTION 91.5

COMPACTED DRY DENSITY = 104.2 pcf

MOISTURE = 10.9%

SAMPLE DIAMETER = 4.00"

SAMPLE HEIGHT = 3.81"

RUN NO.	HEAD, cm	DURATION, Seconds	PERMEABILITY, *CM/SEC.*	REMARKS
1	175	30	3.82×10^{-3}	
2	175	30	3.65×10^{-3}	
3	175	30	3.58×10^{-3}	
4	175	30	3.51×10^{-3}	
5	175	30	3.42×10^{-3}	
6	175	30	3.39×10^{-3}	
7	175	30	3.30×10^{-3}	

Average of Perm Readings = 3.5×10^{-3}

Project Specification = 1.0×10^{-3} or faster

REMARKS: Based on the results of the sample submitted and tested, this material would meet the minimum permeability rate as noted above.

FORM #370 SL 1/86)

Foth & Van Dyke

Engineers/Architects

2737 S. Ridge Road
P. O. Box 19012
Green Bay, Wisconsin 54307-9012
414/497-2500

PROJECT NO.: _____

JOB NO.: 87K10

DATE: March 1 - 3, 1988

REPORT NO.: 14

REPORT OF ANALYSIS OF AGGREGATES

ARCHITECT/ENGINEER: Foth & Van Dyke CONTRACTOR: _____

PROJECT: Kennecott Geotechnical SOURCE: _____

REPORT OF TESTS OF: Verification of Subsurface Samples

Sieve Size or No.	Weight Retained	% Retained	% Passing	Specifi-cations
3-Inch				
2-Inch				
1 1/2-Inch				
1-Inch				
3/4-Inch				
1/2-Inch				
3/8-Inch				
No. 4	0	0	100	
No. 8				
No. 10	1.4	1.5	98.5	
No. 16				
No. 20				
No. 30				
No. 40	5.8	6.3	92.2	
No. 50				
No. 80				
No. 100	5.3	5.8	86.4	
No. 200	7.8	8.5	77.9	
Pan	71.8	78.0		

RECEIVED AT LABORATORY: January 28, 1988

QUANTITY REPRESENTED: 92.0 grams

SUBMITTED BY: Betty Socha of F&VD

SAMPLED FROM: Boring No.: B-S5

IDENTIFICATION: Depth: 45'-46'

DATE SAMPLED: December 9, 1987

INTENDED USE: _____

WASHED GRADATION: yes

PERCENT PASSING NO. 200 SIEVE 78.0 %

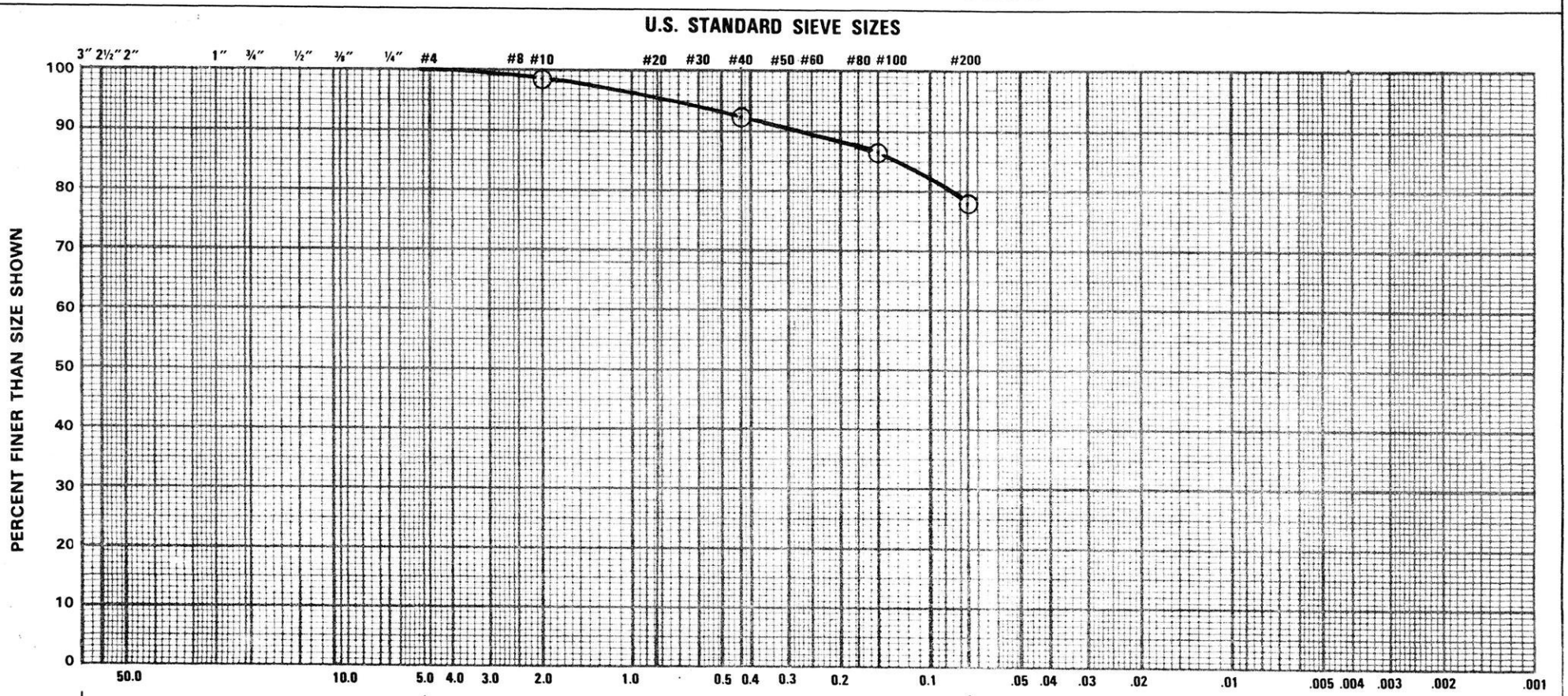
COLOR: 10 YR. 6/8 - brownish yellow

Moisture Content = 15.2%
(As received)

CHECKED BY: RRR

Foth & Van Dyke and Associates Inc.

GRAIN SIZE DISTRIBUTION CURVE



GRAVEL		SAND			SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE		
% =	% =	% = 1.5	% = 6.3	% = 14.3	% =	% =

PROJECT: Kennecott Geotechnical DATE: 3/9/88 SAMPLE NO.: 14

LOCATION SAMPLED: Boring No.: B-S5 ELEV. OR DEPTH: 45-46' DRAWN BY: RRR APPROVED BY: POK

ATTERBERG LIMITS: LL 28.7 PL 25.8 PI 2.9 SAMPLED MOISTURE CONTENT (%): 15.2 COEFFICIENTS: Cc = Cu =

SAMPLE SOURCE: MUNSELL COLOR CODE: 10 YR. 6/8 DATE SAMPLED: 12/9/87

SOIL CLASSIFICATION (ASTM: D2487) SILT W/SAND, brownish yellow (ML)

FORM #411 SL (2/87)

3.5-I-106

Foth & Van Dyke

Engineers/Architects

2737 S. Ridge Road P. O. Box 19012 Green Bay, Wisconsin 54307-9012 414/497-2500

COMPACTION CONTROL REPORT

DATE: 2-18-88 JOB NAME: Kennecott Geotechnical SCOPE I.D. #: 87K10

1. LABORATORY COMPACTION TEST DATA

A. DESCRIPTION OF SOIL: SILT W/SAND, brownish yellow (ML)

MATERIAL MARK 15 CLASSIFICATION _____ AASHO

SOURCE OF MATERIAL Boring No.: B-S5 47' - 51.5' BPR

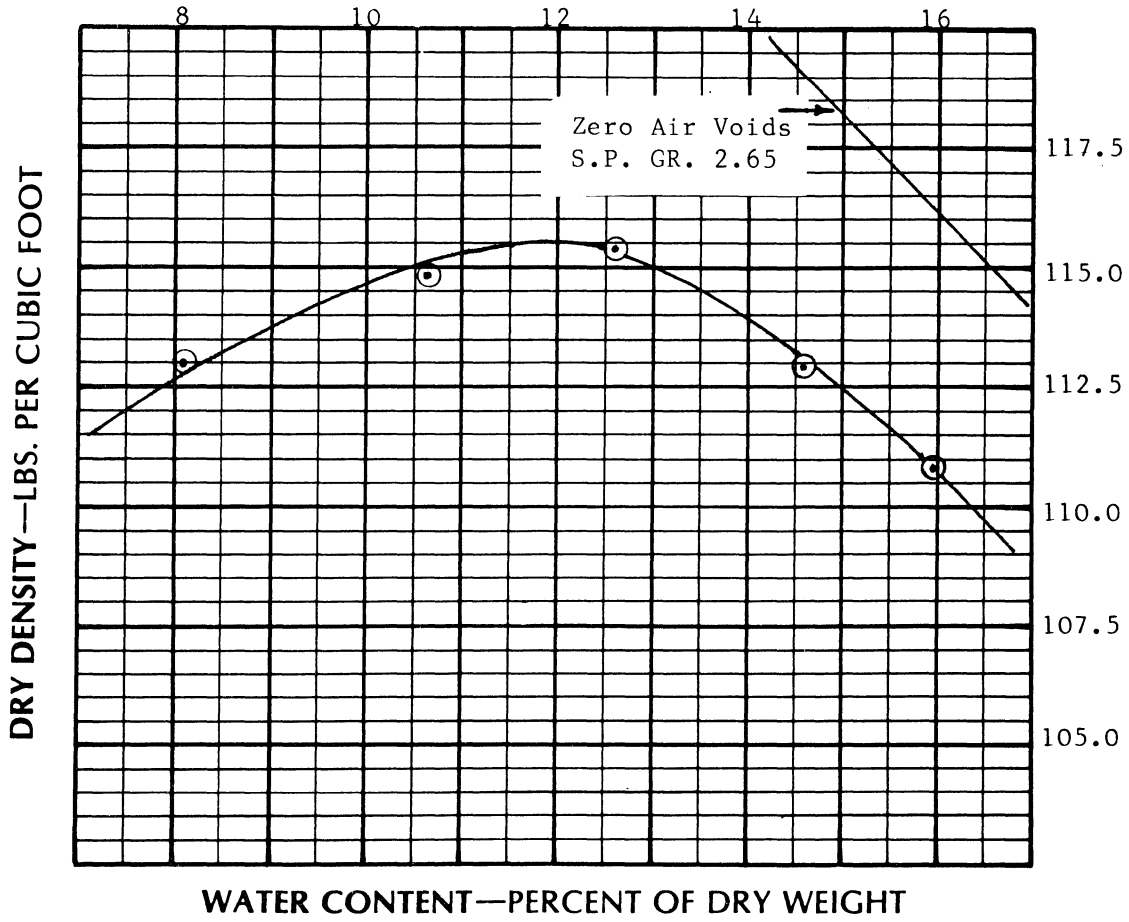
NATURAL WATER CONTENT _____ % NATURAL DRY DENSITY _____ PCF SPECIFIC GRAVITY _____

LIQUID LIMIT 30.6 % PLASTIC LIMIT 27.4 % PLASTICITY INDEX 3.2

B. TEST PROCEDURE USED: ASTM D1557 Method "A"

C. TEST RESULTS: OPTIMUM WATER CONTENT 11.9 %

MAXIMUM DRY DENSITY 115.5 PCF (AT A WET DENSITY OF 129.2 PCF)



FORM #332 SL (6/85)

Foth & Van Dyke
Engineers/Architects

2737 S. Ridge Road
P. O. Box 19012
Green Bay, Wisconsin 54307-9012
414/497-2500

ATTERBERG LIMITS

Scope I.D. : 87K10

JOB NAME: Kennecott Geotechnical **TEST NO.:** 15

SAMPLE NO.: **DATE:** February 17 to 18, 1988

LOCATION: **TESTED BY:** POK

BORING NO.: B-S5 **DEPTH:** 47' - 51.5'

	LIQUID LIMIT				PLASTIC LIMIT		PERCENT WATER
DETERMINATION NO.	31	18	15				
CONTAINER NO.	H5	H6	H7		H8		
CONTAINER & WET SOIL	11.96	12.99	11.30		11.78		
CONTAINER & DRY SOIL	9.50	10.22	8.90		9.55		
WATER WEIGHT	2.46	2.77	2.40		2.23		
CONTAINER WEIGHT	1.40	1.42	1.44		1.41		
DRY SOIL WEIGHT	8.10	8.80	7.46		8.14		
WATER CONTENT %	30.4	31.5	32.2		27.4		
CORRECTED %	31.2	30.3	30.3				

LIQUID LIMIT	PLASTIC LIMIT	NATURAL WATER CONTENT	PLASTICITY INDEX
30.6	27.4		3.2

Soil Classification: SILT W/SAND, brownish yellow (ML)
Munsell Color Code : 10 YR. 6/8 - Brownish yellow

FORM #342 SL (7/85)

3.5-I-108

Foth & Van Dyke

Engineers/Architects

2737 S. Ridge Road P. O. Box 19012 Green Bay, WI 54307-9012 414/497-2500

REPORT OF:

FALLING HEAD PERMEABILITY TEST

PROJECT: Kennecott Geotechnical

DATE: March 15, 1988

SCOPE I.D. #: 87K10

REPORTED TO: Kennecott

COPIES TO:

GENERAL DATA:

Boring/Test Pit Number:	Boring B-S5
Depth of Sample:	55' - 57'
Sample Number:	Report #16
Date Sampled:	December 9, 1987
Date Received:	January 28, 1988
Source of Sample:	

LABORATORY DATA **PROJECT SPECIFICATIONS**

Method of Test:	3" Galvanized Tube Section (Rigid Wall)	
Length of Sample (inches):	6.44	
Diameter of Sample (inches):	3.08	
Dates Tested:	March 10 to 15, 1988	
Moisture Content (%):	8.1	
Dry Density (pcf):	129.4	
% Compaction:	94.0	ASTM D1557 - Method "A"
Soil Classification:	SILT W/SAND, brownish yellow (ML)	
Permeant Used:	Distilled Water	
Technician:	R. Rouse	
Coefficient of Permeability: (cm/sec)	2.2×10^{-7}	

ATTERBERG LIMITS

Liquid Limit (%):	
Plastic Limit (%):	
Plasticity Index:	

REMARKS:

FORM #407 (12/86)

By: Robert R. Rouse

Foth & Van Dyke

Engineers/Architects

2737 S. Ridge Road
P. O. Box 19012
Green Bay, Wisconsin 54307-9012
414/497-2500

PROJECT NO.: _____

JOB NO.: 87K10

DATE: December 16-22, 1987

REPORT NO.: 11

REPORT OF ANALYSIS OF AGGREGATES

ARCHITECT/ENGINEER: Foth & Van Dyke CONTRACTOR: _____

PROJECT: Kennecott Geotechnical SOURCE: _____

REPORT OF TESTS OF: Verification of Subsurface Samples

Sieve Size or No.	Weight Retained	% Retained	% Passing	Specifications
3-Inch				
2-Inch				
1 1/2-Inch				
1-Inch				
3/4-Inch	0	0	100	
1/2-Inch	3.1	0.5	99.5	
3/8-Inch	5.0	0.9	98.6	
No. 4	13.8	2.4	96.2	
No. 8				
No. 10	29.1	5.2	91.0	
No. 16				
No. 20				
No. 30				
No. 40	72.2	12.8	78.2	
No. 50				
No. 80				
No. 100	62.8	11.1	67.1	
No. 200	40.7	7.2	59.9	
Pan	338.2	59.9		

RECEIVED AT LABORATORY: December 14, 1987

QUANTITY REPRESENTED: 564.9 grams

SUBMITTED BY: Betty Socha, Foth & Van Dyke

SAMPLED FROM: Boring No.: B-S5

IDENTIFICATION: Depth: 62'-67'

DATE SAMPLED: November - December 1987

INTENDED USE: _____

WASHED GRADATION: yes

PERCENT PASSING NO. 200 SIEVE 59.9 %

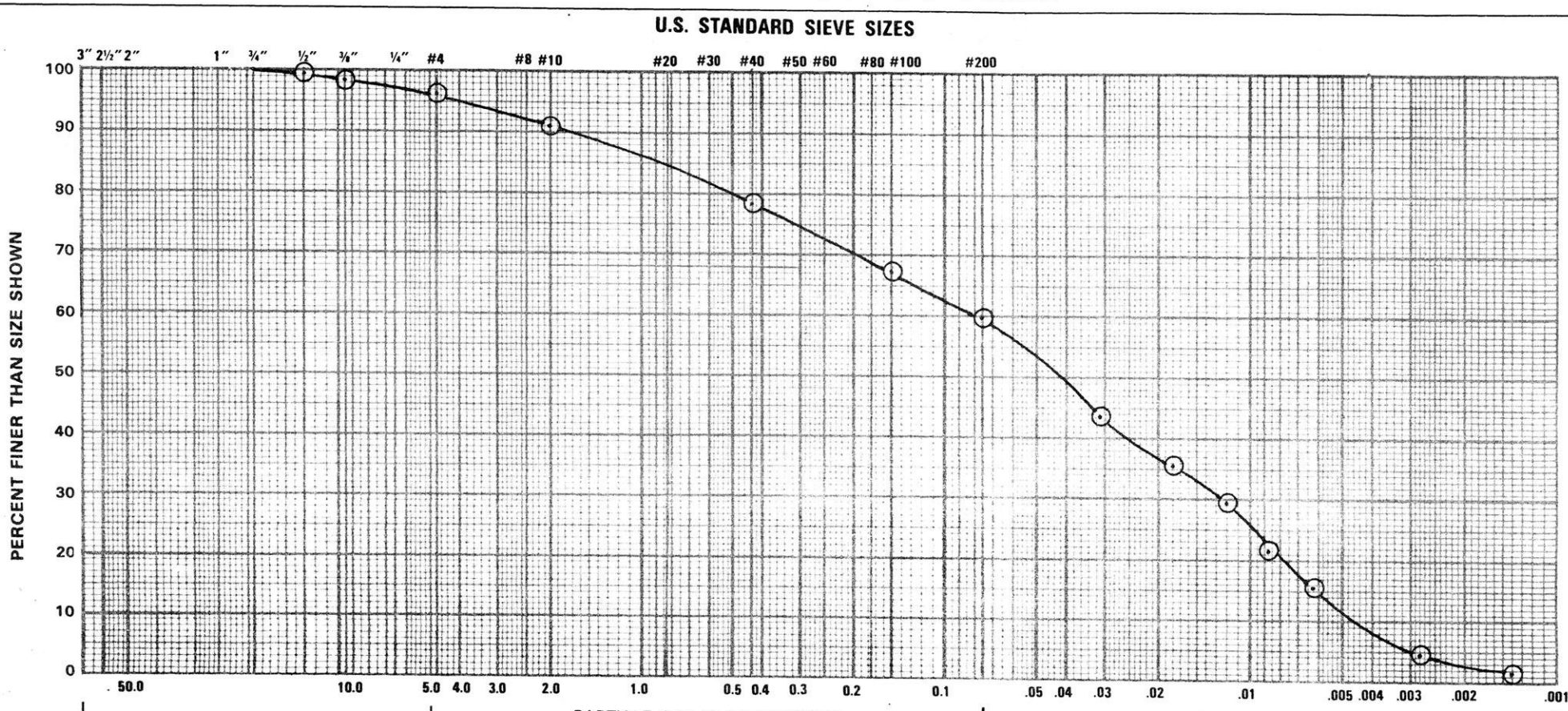
COLOR: 2.5YR.5/6-red

Moisture Content = 13.9%
(as received)

CHECKED BY: RFR

Foth & Van Dyke and Associates Inc.

GRAIN SIZE DISTRIBUTION CURVE



GRAVEL		SAND			SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE		
% =	% = 3.8	% = 5.2	% = 12.8	% = 18.3	% = 57.4	% = 2.5

PROJECT: Kennecott Geotechnical DATE: 12/22/87 SAMPLE NO.: 11

LOCATION SAMPLED: Boring: B-S5 ELEV. OR DEPTH: 62'-67' DRAWN BY: POK APPROVED BY: RRR

ATTERBERG LIMITS: LL 26.2 PL 23.5 PI 2.7 SAMPLED MOISTURE CONTENT (%): 13.9 COEFFICIENTS: Cc = Cu =

SAMPLE SOURCE: MUNSELL COLOR CODE: 2.5YR. 5/6 DATE SAMPLED: Nov.-Dec. 1987

SOIL CLASSIFICATION (ASTM: D2487) SANDY SILT, a little gravel, red (ML)

FORM #411 SL (2/87)

3.5-I-111

Foth & Van Dyke

Engineers/Architects

2737 S. Ridge Road P. O. Box 19012 Green Bay, Wisconsin 54307-9012 414/497-2500

COMPACTION CONTROL REPORT

DATE: 2/11/88 JOB NAME: Kennecott Geotechnical-Granular Blanket SCOPE I.D. #: 87K10

1. LABORATORY COMPACTION TEST DATA

A. DESCRIPTION OF SOIL: SAND, fine to medium grained, pale brown (SP)

MATERIAL MARK Sample #8 CLASSIFICATION _____ AASHO BPR

SOURCE OF MATERIAL Borings: PZ-S1, PZ-S3, PZ-S4, B-S5, B-WC2A, B-WC3 - All combined for 1 tested sample.

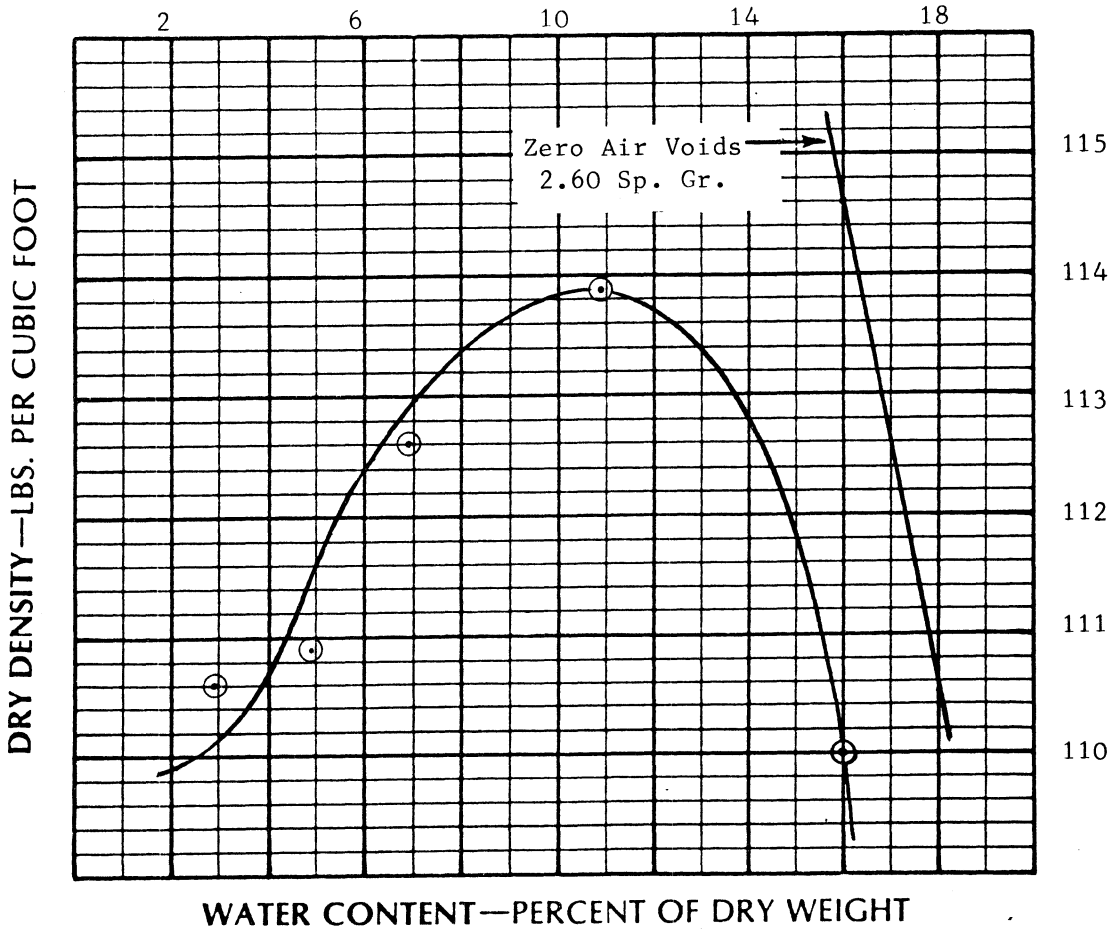
NATURAL WATER CONTENT _____ % NATURAL DRY DENSITY _____ PCF SPECIFIC GRAVITY _____

LIQUID LIMIT _____ % PLASTIC LIMIT _____ % PLASTICITY INDEX _____

B. TEST PROCEDURE USED: ASTM D1557 - Method "A"

C. TEST RESULTS: OPTIMUM WATER CONTENT 10.9 %

MAXIMUM DRY DENSITY 113.9 PCF (AT A WET DENSITY OF 126.3 PCF)



FORM #332 SL (6/85)

Report of: Density and Moisture Content of Submitted Samples

Project: Kennecott Geotechnical
Ladysmith, WI

Date: March 14, 1988
Scope I.D.: 87K10

Report Number	Boring Number	Sample Depth	Wet Density	Moisture Content	Dry Density
1	S1	25'-27'	137.2	13.2	121.2
2	S2	5'-7'	142.1	8.0	131.5
4	S2	22'-23'	140.3	8.4	129.4
5	S3	21'-22'	136.8	14.8	119.1
7	S3	36'-37'	144.1	11.4	129.4
8	S3	50'-51.5'	137.2	14.2	120.2
9	S4	31.5'-32.5'	Not Enough Sample Left		
10	S4	50'-51.5'	132.2	14.5	115.5
11	S5	18'-20'	142.9	10.4	129.4
12	S5	35'-36'	128.4	19.1	107.8
13	S5	40'-41'	133.4	15.7	115.3
14	S5	45'-46'	129.8	15.2	112.7
15	S5	47'-47.5'	140.6	10.0	127.8

APPENDIX 3.5-J

Geologic Logs, Soil Test Data, Well Construction Diagrams, and Well Development Forms for the Type II Waste Rock Storage Area, 1988

LOG OF TEST BORING NO.: B-SP1

CLIENT: Kennecott
PROJECT: Stockpile Borings
PROJECT NUMBER: 87K10
LOCATION: Ladysmith, Wisconsin
COORDINATES: 40812 N 40889 E

SURFACE ELEVATION: 1142.50
BORING DEPTH: 71.0
DATE: 11/10/88

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLING NOTES
1142.5	--0.0	0.0-1.5	ss	1	5	1.4	Top 3" is blk fgr sandy SILT w/ org, moist, loose - humus rest is lt br to red br to yel br banded silty fgr SAND, moist, firm mottled	OL/SM		
1137.5	--5.0	4.5-6.0	ss	2	16	1.3	Lt br silty fgr-mgr SAND w/ 6" layer of fgr SAND w/ grvl at 4.5 to 5', moist, dense			
1132.5	--10.0	9.5-11.0	ss	3	46	1.0	Red br silty SAND to clayey SAND w/ fgr-cgr grvl, moist, dense, w/ layers of lt br mgr-cgr SAND, drilled boulder 8.5-9.0, drove rock end of SS#3, hard drilling	SM, SP		
1127.5	--15.0	14.5-16.0	ss	4	17	1.5	due to cobbles and coarse grvl			
1122.5	--20.0	19.5-21.0	ss	5	48	1.7	1.3' layer of water bearing mgr-cgr SAND(20-20.3'), silty SAND w/ clay (Till) becoming v dense, drove rock in SS#6			
1117.5	--25.0	24.5-26.0	ss	6	59	0.4		SM		
1112.5	--30.0	29.5-31.0	ss	7	46	1.4	Red br silty SAND w/ fgr-cgr ang to subang grvl, tr clay, moist to wet, v dense - (Till)			
1107.5	--35.0	34.5-36.0	ss	8	25	1.2	Same.			
1102.5	--40.0	39.5-41.0	ss	9	56	1.1	Same.			
1097.5	--45.0	44.5-46.0	ss	10	43	1.2	Same except more clay.			
1092.5	--50.0	49.5-51.0	ss	11	28	1.5	Same except dk red brn clayey/ silty SAND (5YR 3/4)	SC/SM	%g-s-si-cl 6-56-22-16 LL=20 PI=8	
1087.5	--55.0									

DRILLING DATA

START DATE: 11/10/88 @ 12:00 pm
COMPLETION DATE: 11/11/88 @ 9:10 am
LOGGED BY: REM
DRILLING METHOD: Tricone and mud RIG: CME 850 - All Terrain
DRILLING CONTRACTOR: Twin City Testing

WATER LEVEL INFORMATION

DEPTH AT COMPLETION: NA
LATER TIME/DEPTH: NA
LATER TIME/DEPTH: NA
CAVE IN DEPTH: NA
DRILLING LOSSES: NA

LOG OF TEST BORING NO.: B-SP1

CLIENT: Kennecott
PROJECT: Stockpile Borings
PROJECT NUMBER: 87K10
LOCATION: Ladysmith, Wisconsin
COORDINATES: 40812 N 40889 E

SURFACE ELEVATION: 1142.50
BORING DEPTH: 71.0
DATE: 11/10/88

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLING NOTES
1087.5	--55.0	54.5-56.0	ss	12	30	1.5	Same.	SC/SM		
1082.5	--60.0	59.5-61.0	ss	13	54	1.1	Same except more clay. Cobbles and bldrs.	SC	%g-s-si-cl 6-48-27-19 LL=34 PI=16	
1077.5	--65.0	65.0-65.5	ss	14	55 /.5	0.4	Brown poorly graded SAND, med to cse w/fn and cse gvl, and dense, saturated. Cobbles and bldrs at 67 and 68.5 ft	SP (SS)		
1142.5	--	65.5-65.8	ss	15	100 1.3	NR	Trace white sand, fn, in tips of barrel, (sandstone).			
1072.5	--70.0	69.5-71.0	ss	16	78	1.2	Gray green SILT, fn grained, massive w/chert gravel, moist, v. dense, greasy feel. Weathered, altered, precambrian schist.	ML		
1067.5	--75.0						End of Boring at 71.0 feet			
1062.5	--80.0									
1057.5	--85.0									
1052.5	--90.0									
1047.5	--95.0									
1042.5	--100.0									
1037.5	--105.0									

DRILLING DATA

START DATE: 11/10/88 @ 12.00 pm
COMPLETION DATE: 11/11/88 @ 9:10 am
LOGGED BY: REM
DRILLING METHOD: Tricone and mud RIG: CME 850 - All Terrain
DRILLING CONTRACTOR: Twin City Testing

WATER LEVEL INFORMATION

DEPTH AT COMPLETION: NA
LATER TIME/DEPTH: NA
LATER TIME/DEPTH: NA
CAVE IN DEPTH: NA
DRILLING LOSSES: NA

Foth & Van Dyke and Associates Inc.

2737 S. Ridge Road P. O. Box 19012 Green Bay, WI 54307-9012 414/497-2500

REPORT OF:

SIEVE ANALYSIS OF COARSE TO FINE AGGREGATES

PROJECT: Proposed Waste Rock Storage

SCOPE I.D. #: 87K10

DATE TYPED: 12-27-88

REPORTED TO: Kennecott Explorations

REPORT NUMBER: 1

TEST PERFORMED IN GENERAL ACCORDANCE OF ASTM: D1140

GENERAL DATA:

SAMPLE LOCATION:

SAMPLE NUMBER: B-SP1

DEPTH OF SAMPLE: 49.5' - 51.0'

SAMPLED BY: BJ Socha at F&VD

DATE SAMPLED: 11/10/88

DATED RECEIVED: 12/6/88

SOURCE OF SAMPLE:

MUNSELL COLOR CODE: 5 YR. 3/4

LABORATORY DATA:

DATE TESTED: December 6-8, 1988

TESTED PERFORMED BY: KAS

REVIEWED BY: (POK 12-12-88)

24 HRS. TURN AROUND ____YES __x__NO

WASHED GRADATION __x__YES ____NO

WEIGHT OF TEST SAMPLE 154.4 GRAMS

SIEVE SIZE	WEIGHT RETAINED (gms)	% RETAINED	% PASSING	PROJECT SPECIFICATION % PASSING BY WEIGHT	SOURCE OF SPECIFICATION
3"					
1½					
1					
3/4					
1/2	0	0	100		
3/8	6.2	4.0	96.0		
#4	3.9	2.5	93.5		
10	7.3	4.7	88.8		
40	22.5	14.6	74.2		
100	40.6	26.3	47.9		
200	15.0	9.7	38.2		
PAN	58.8	38.1			

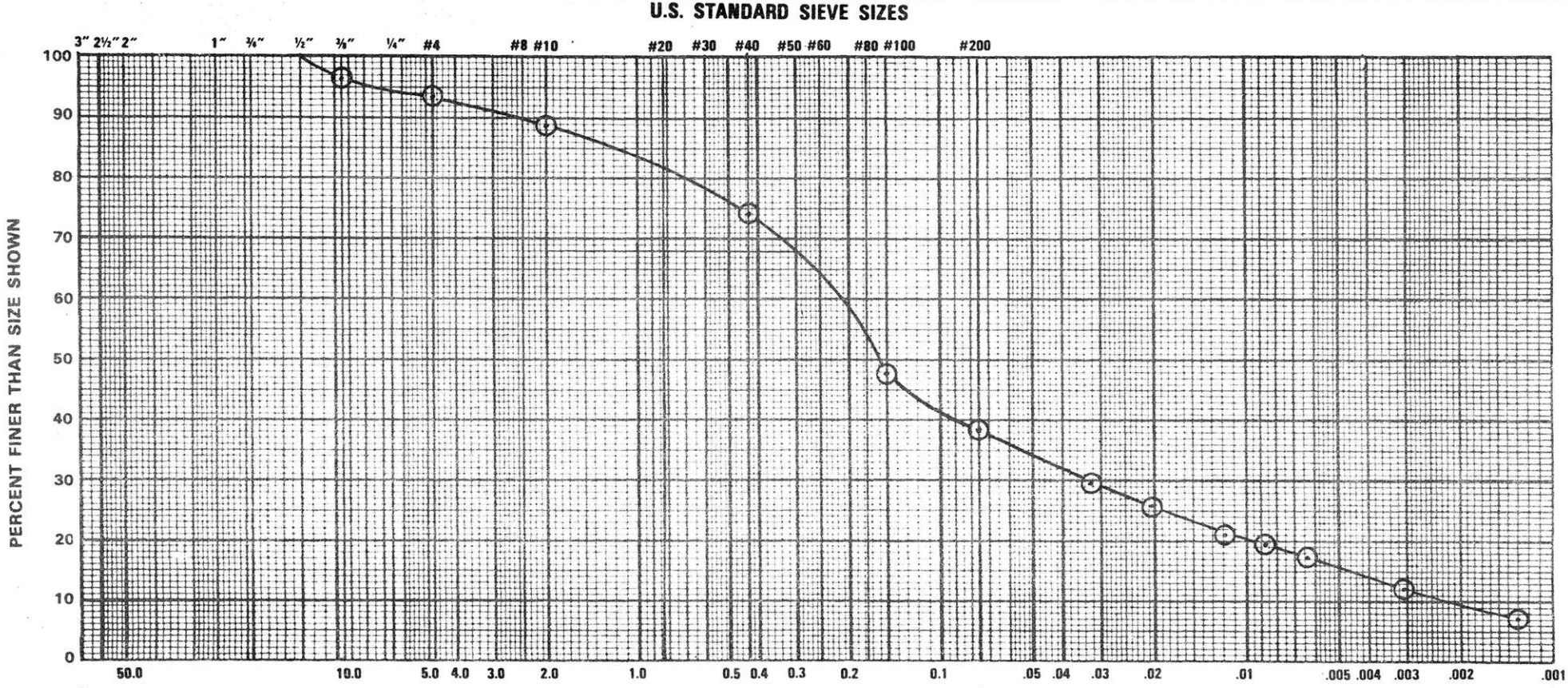
REMARKS:

FORM #329 SLB (Rev. 4/88)

BY: Robert R. Rouse

Foth & Van Dyke and Associates Inc.

GRAIN SIZE DISTRIBUTION CURVE



GRAVEL		SAND			SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE		
% =	% = 6.5	% = 4.7	% = 14.6	% = 36.1	% = 22.3	% = 15.3

PROJECT: Kennecott - Proposed Waste Rock Storage DATE: 12-12-88 SAMPLE NO.: 1

LOCATION SAMPLED: Boring: SP1 ELEV. OR DEPTH: 49.5'-51.0 DRAWN BY: POK APPROVED BY: RRR

ATTERBERG LIMITS: LL 20.4 PL 12.3 PI 8.1 SAMPLED MOISTURE CONTENT (%): 11.8 COEFFICIENTS: Cc = Cu =

SAMPLE SOURCE: MUNSELL COLOR CODE: 5 YR. 3/4 DATE SAMPLED: 11-10-88

SOIL CLASSIFICATION (ASTM: D2487) CLAYEY SAND, fine to medium grained, a little gravel, dark reddish brown, (SC/SM)

FORM #411 SL (2/87)

3.5-J-4

Foth & Van Dyke and Associates Inc.

2737 S. Ridge Road P. O. Box 19012 Green Bay, WI 54307-9012 414/497-2500

REPORT OF:

SIEVE ANALYSIS OF COARSE TO FINE AGGREGATES

PROJECT: Proposed Waste Rock Storage

SCOPE I.D. #: 87K10

DATE TYPED: 12-27-88

REPORTED TO: Kennecott Explorations

REPORT NUMBER: 2

TEST PERFORMED IN GENERAL ACCORDANCE OF ASTM: D1140

GENERAL DATA:

SAMPLE LOCATION:

SAMPLE NUMBER: B-SP1

DEPTH OF SAMPLE: 59.5'-61.0'

SAMPLED BY: B.J. Socha of F&VD

DATE SAMPLED: 11/10/88

DATED RECEIVED: 12/6/88

SOURCE OF SAMPLE:

MUNSELL COLOR CODE: 5 YR. 3/4

LABORATORY DATA:

DATE TESTED: December 6-8, 1988

TESTED PERFORMED BY: KAS

REVIEWED BY: POK (12-12-88)

24 HRS. TURN AROUND ____YES __x__NO

WASHED GRADATION __x__YES ____NO

WEIGHT OF TEST SAMPLE 162.7 **GRAMS**

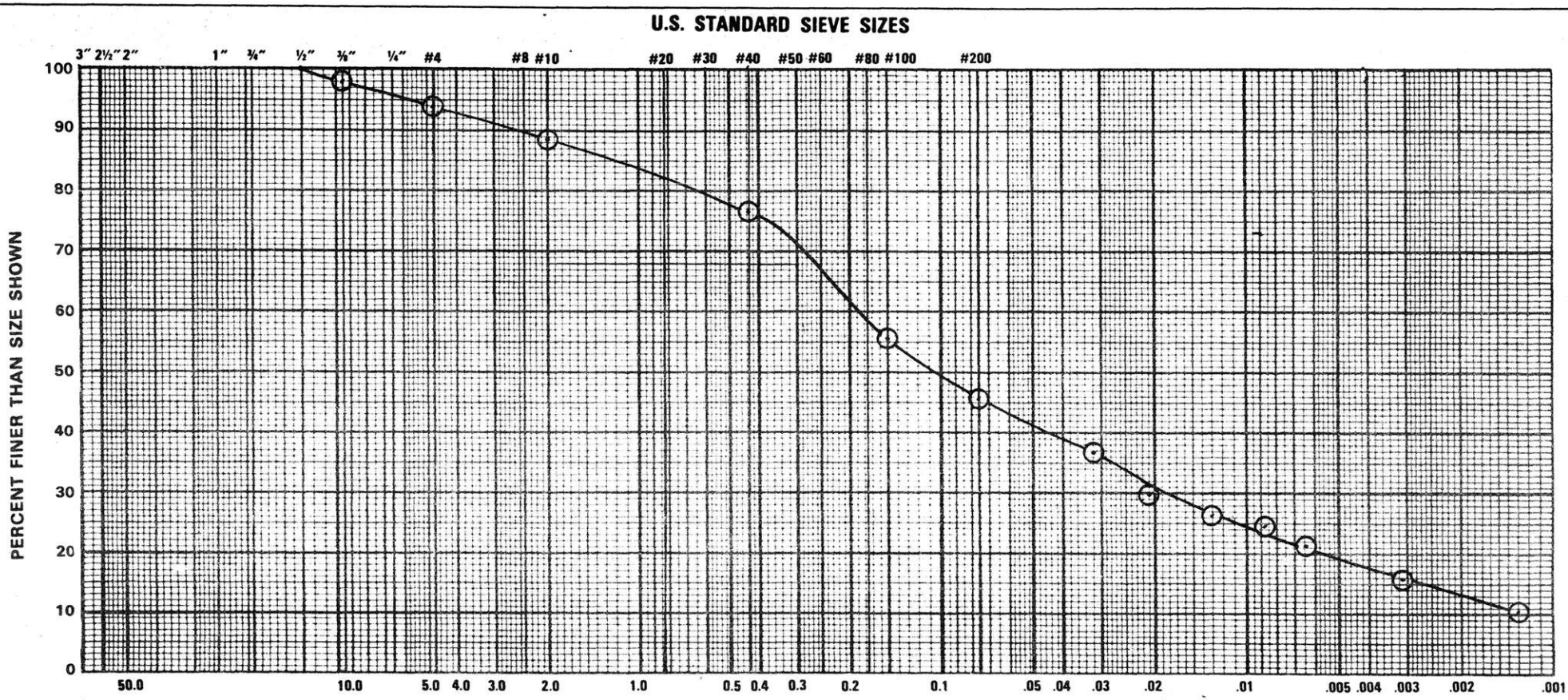
SIEVE SIZE	WEIGHT RETAINED *(gms)*	% RETAINED	% PASSING	PROJECT SPECIFICATION % PASSING BY WEIGHT	SOURCE OF SPECIFICATION
3"					
1½					
1					
3/4					
1/2	0	0	100		
3/8	3.2	2.0	98.0		
#4	6.7	4.1	93.9		
10	8.5	5.2	88.7		
40	19.6	12.0	76.7		
100	34.5	21.2	55.5		
200	16.0	9.8	45.7		
PAN	74.4	45.7			

REMARKS:

BY: Robert R. Rouse

Foth & Van Dyke and Associates Inc.

GRAIN SIZE DISTRIBUTION CURVE



GRAVEL		SAND			SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE		
% =	% = 6.1	% = 5.2	% = 12.0	% = 31.0	% = 26.7	% = 19.0

PROJECT: Kennecott - Proposed Waste Rock Storage DATE: 12-12-88 SAMPLE NO.: 2

LOCATION SAMPLED: Boring: SP1 ELEV. OR DEPTH: 59.5'-61.0' DRAWN BY: POK APPROVED BY: RRR

ATTERBERG LIMITS: LL 34.0 PL 17.6 PI 16.4 SAMPLED MOISTURE CONTENT (%): 12.5 COEFFICIENTS: Cc = Cu =

SAMPLE SOURCE: MUNSELL COLOR CODE: 5 YR. 3/4 DATE SAMPLED: 11-10-88

SOIL CLASSIFICATION (ASTM: D2487) CLAYEY SAND, fine to medium grained, a little gravel, dark reddish brown (SC)

FORM #411 SL (2/87)

3.5-J-6

LOG OF TEST BORING NO.: B-SP2

CLIENT: Kennecott
PROJECT: Stockpile Borings
PROJECT NUMBER: 87K10
LOCATION: Ladysmith, Wisconsin
COORDINATES: 40005 N 40005 E

SURFACE ELEVATION: 1155.31
BORING DEPTH: 60.0
DATE: 11/07/88

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLING NOTES
1155.3	--0.0	0.0-1.5	ss	1	4	1.5	Dk br org SILT w/ fgr sand, tr clay (top 4"?); rest is red br SILT w/ fgr sand, tr fgr-cgr grvl	ML		
1150.3	--5.0	4.5-6.0	ss	2	21	1.5	Red br silty fgr-cgr SAND, tr fgr-cgr grvl, med dense, firm	SM		
1145.3	--10.0	9.5-11.0	ss	3	51	1.5	Red br SILT w/ fgr sand, tr fgr grv., dense, non-plastic			
1140.3	--15.0	14.5-16.0	ss	4	64	1.4	Same as above	ML		
1135.3	--20.0	19.5-21.0	ss	5	32	1.5	Red br SILT w/ clay, tr fgr-mgr sand, cohesive, firm to hard			
1130.3	--25.0	24.5-26.0	ss	6	82	0.5	Red br silty fgr-cgr SAND, tr fgr grvl, dense			
1125.3	--30.0	29.5-31.0	ss	7	113	1.5	Same as above	SM		
1120.3	--35.0	34.5-36.0	ss	8	86	1.4	Same as above			
1115.3	--40.0	39.5-41.0	ss	9	101	1.4	Top of sample is same as above, rest is br tan fgr SANDSTONE, poorly cemented, sugary texture to grains, dense	SP		
1110.3	--45.0	44.5-46.0	ss	10	100/.4	0.7	Br tan fgr SANDSTONE, poorly cemented to uncemented, slightly sugary texture to grains, dense	(SS)		
1105.3	--50.0	49.5-51.0	ss	11	200/.3	0.0	No recovery (Sandstone?)			
1100.3	--55.0									

DRILLING DATA

START DATE: 11/07/88
COMPLETION DATE: 11/08/88
LOGGED BY: KAD
DRILLING METHOD: RIG: CME 850 - All Terrain HSA to 29', Mud to 60'
DRILLING CONTRACTOR: Twin City Testing

WATER LEVEL INFORMATION

DEPTH AT COMPLETION: NA
LATER TIME/DEPTH: NA
LATER TIME/DEPTH: NA
CAVE IN DEPTH: NA
DRILLING LOSSES: NA

LOG OF TEST BORING NO.: B-SP2

CLIENT: Kennecott
PROJECT: Stockpile Borings
PROJECT NUMBER: 87K10
LOCATION: Ladysmith, Wisconsin
COORDINATES: 40005 N 40005 E

SURFACE ELEVATION: 1155.31
BORING DEPTH: 60.0
DATE: 11/07/88

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLING NOTES
1100.3	--55	54.5-56.0	ss	11	200 /.7	0.1	Tan br fgr-cgr SANDSTONE, partly cemented to uncemented, well rounded grains, dense	SS		
		59.5-60.0	ss	12	150 /.5	0.1	Blue, pink, tan schistose bedrock, soft, "greasy", some qtz phenocrysts, schistosity perpend. to ground surface	ML		
1095.3	--60						End of Boring at 60.0 feet			
1090.3	--65									
1085.3	--70									
1080.3	--75									
1075.3	--80									
1070.3	--85									
1065.3	--90									
1060.3	--95									
1055.3	--100									
1050.3	--105									
1045.3	--110									

DRILLING DATA

START DATE: 11/07/88
COMPLETION DATE: 11/08/88
LOGGED BY: KAD
DRILLING METHOD: RIG: CME 850 - All Terrain
DRILLING CONTRACTOR: Twin City Testing

WATER LEVEL INFORMATION

DEPTH AT COMPLETION: NA
LATER TIME/DEPTH: NA
LATER TIME/DEPTH: NA
CAVE IN DEPTH: NA
DRILLING LOSSES: NA

LOG OF TEST BORING NO.: B-SP3

CLIENT: Kennecott
PROJECT: Stockpile Borings
PROJECT NUMBER: 87K10
LOCATION: Ladysmith, Wisconsin
COORDINATES: 40255 N 40396 E

SURFACE ELEVATION: 1148.96
BORING DEPTH: 36.0
DATE: 11/08/88

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLING NOTES
1149.0	--0.0	0.0-1.5	ss	1	5	1.0	Top 5" is topsoil - br blk org SILT, tr fgr sand, next 7" is red br grey mottled SILT, tr fgr sand, non organic, loose, soft	ML		
1144.0	--5.0	4.5-6.0	ss	2	18	1.3	Red br silty fgr SAND, tr fgr grvl med dense, dry, non cohesive, non plastic			
1139.0	--10.0	9.5-11.0	ss	3	23	1.2	Same as above w/ more grvl, dry, non cohesive, non plastic			
1134.0	--15.0	14.5-16.0	ss	4	30	1.1	Same as above w/ less grvl, 1" thick sand			
1129.0	--20.0	19.5-21.0	ss	5	42	1.2	Red br silty fgr-cgr SAND, tr fgr grvl and clay, dense, slightly cohesive, damp	SM		
1124.0	--25.0	24.5-26.0	ss	6	62	1.2	Red br fgr-mgr SAND w/ silt, tr fgr grvl, dense, damp			
1119.0	--30.0	29.5-31.0	ss	7	73 /.5	0.7	Same as above exc. w/ fgr-cgr grvl, damp to v damp			
1114.0	--35.0	34.5-36.0	ss	8	78	1.1	Same as above, damp to v damp			
							End of Boring at 36.0 feet			
1109.0	--40.0									
1104.0	--45.0									
1099.0	--50.0									
1094.0	--55.0									

DRILLING DATA

START DATE: 11/08/88
COMPLETION DATE: 11/09/88
LOGGED BY: KAD
DRILLING METHOD: RIG: CME 850 - All Terrain HSA to 15', Mud to 36'
DRILLING CONTRACTOR: Twin City Testing

WATER LEVEL INFORMATION

DEPTH AT COMPLETION: NA
LATER TIME/DEPTH: NA
LATER TIME/DEPTH: NA
CAVE IN DEPTH: NA
DRILLING LOSSES: NA

LOG OF TEST BORING NO.: B-SP4

CLIENT: Kennecott
PROJECT: Stockpile Borings
PROJECT NUMBER: 87K10
LOCATION: Ladysmith, Wisconsin
COORDINATES: 40362 N 40895 E

SURFACE ELEVATION: 1142.15
BORING DEPTH: 36.0
DATE: 11/10/88

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLING NOTES
1142.2	--0.0	0.0-1.5	ss	1	8	1.5	Blk fgr sandy SILT w/ org, moist, very loose	OL		
							Greyish br silty fgr SAND, tr clay moist, loose	SM		
1137.2	--5.0	4.5-6.0	ss	2	23	1.25	Br yellowish to reddish br fgr sandy SILT/ silty fgr SAND, tr clay, moist to wet, mottled, firm	SM/ML		
1132.2	--10.0	9.5-11.0	ss	3	113	0.25	Reddish br silty SAND w/ fgr-cgr grvl, tr clay, moist to saturated, dense to v dense, drove rock w/ sampler			
1127.2	--15.0	14.5-16.0	ss	4	49	1.25	Same.			
1122.2	--20.0	19.5-21.0	ss	5	45	1.25	Seams of water bearing mgr-cgr SAND at 19-21'	SM		
1117.2	--25.0	24.5-26.0	ss	6	55	1.2	Lt reddish br silty SAND w/ fgr-cgr grvl, water bearing, dense			
1112.2	--30.0	29.5-31.0	ss	7	46	1.3	Lt reddish br silty SAND w/ fgr-mgr grvl, tr clay, moist to wet, dense			
							Multicolored br, red, green, blue, silty mgr-cgr SAND w/ fgr-mgr grvl - mainly qtz and weathered	____ SM	%g-s-si-cl 10-72-10-8	
1107.2	--35.0	34.5-36.0	ss	8	92	1.3	ig/meta lithologics.			
							End of Boring @ 36.0 feet			
1102.2	--40.0									
1097.2	--45.0									
1092.2	--50.0									
1087.2	--55.0									

DRILLING DATA

START DATE: 11/10/88 @ 7:00 am
COMPLETION DATE: 11/10/88 @ 11:30 am
LOGGED BY: REM
DRILLING METHOD: Tricone bit and mud RIG: CME 850 - All Terrain
DRILLING CONTRACTOR: Twin City Testing

WATER LEVEL INFORMATION

DEPTH AT COMPLETION: NA
LATER TIME/DEPTH: NA
LATER TIME/DEPTH: NA
CAVE IN DEPTH: NA
DRILLING LOSSES: NA

Foth & Van Dyke and Associates Inc.

2737 S. Ridge Road P. O. Box 19012 Green Bay, WI 54307-9012 414/497-2500

REPORT OF:

SIEVE ANALYSIS OF COARSE TO FINE AGGREGATES

PROJECT: Proposed Waste Rock Storage

SCOPE I.D. #: 87K10

DATE TYPED: 12-27-88

REPORTED TO: Kennecott Explorations

REPORT NUMBER: 3

TEST PERFORMED IN GENERAL ACCORDANCE OF ASTM: D1140

GENERAL DATA:

SAMPLE LOCATION:

SAMPLE NUMBER: B-SP4

DEPTH OF SAMPLE: 34.5'-36.0'

SAMPLED BY: B.J. Socha of F&VD

DATE SAMPLED: 11/10/88

DATED RECEIVED: 12/6/88

SOURCE OF SAMPLE:

MUNSELL COLOR CODE: 7.5 YR. 3/4

LABORATORY DATA:

DATE TESTED: December 6-8, 1988

TESTED PERFORMED BY: KAS

REVIEWED BY: POK (12-12-88)

24 HRS. TURN AROUND ____YES __x__NO

WASHED GRADATION __x__YES ____NO

WEIGHT OF TEST SAMPLE 2522 **GRAMS**

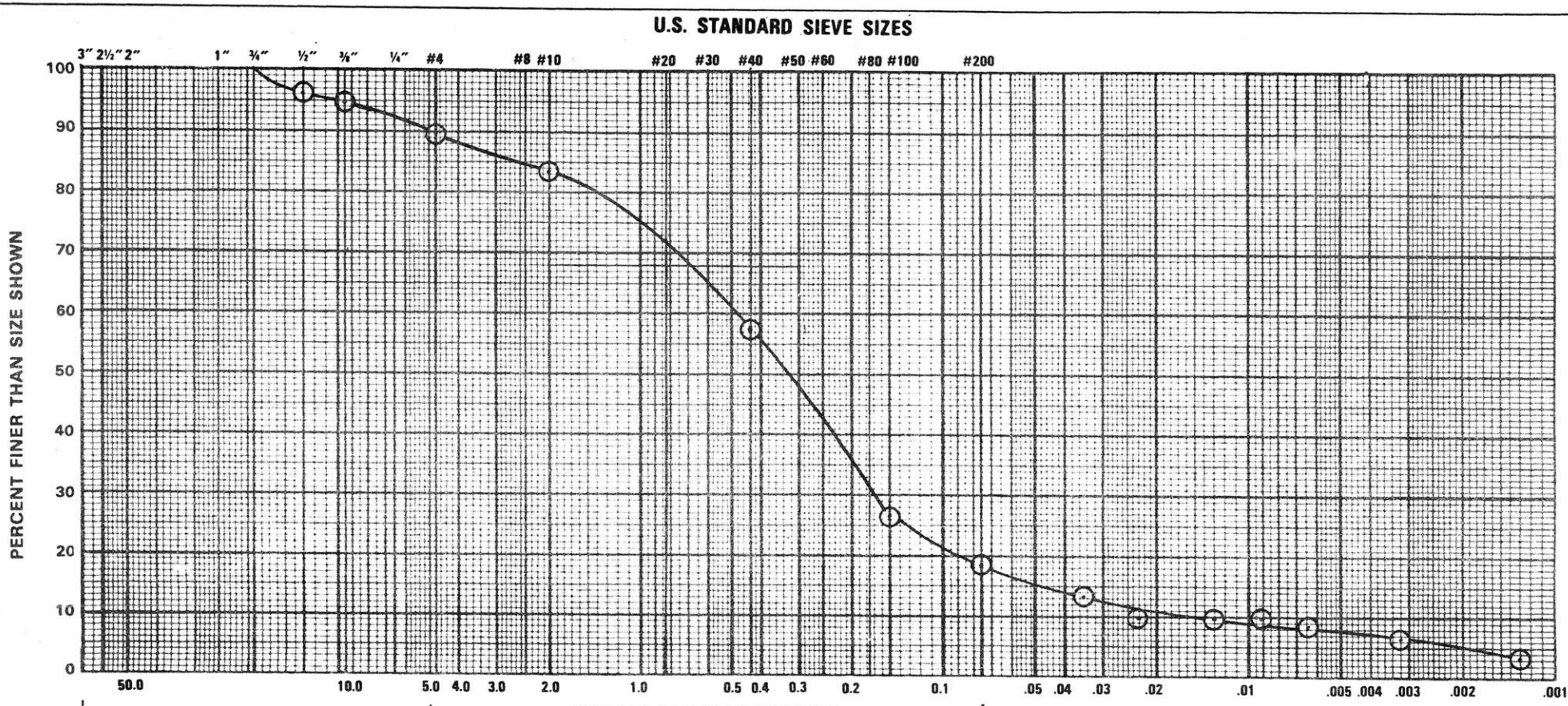
SIEVE SIZE	WEIGHT RETAINED *(gms)*	% RETAINED	% PASSING	PROJECT SPECIFICATION % PASSING BY WEIGHT	SOURCE OF SPECIFICATION
3"					
1½					
1					
3/4	0	0	100		
1/2	9.5	3.8	96.2		
3/8	3.2	1.3	94.9		
#4	12.9	5.1	89.8		
10	16.7	6.6	83.2		
40	64.8	25.7	57.5		
100	78.3	31.0	26.5		
200	20.6	8.2	18.3		
PAN	46.0	18.2			

REMARKS:

BY: Robert R. Rouse

Foth & Van Dyke and Associates Inc.

GRAIN SIZE DISTRIBUTION CURVE



GRAVEL		SAND			SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE		
% =	% = 10.2	% = 6.6	% = 25.7	% = 39.3	% = 10.4	% = 7.8

PROJECT: Kennecott - Proposed Waste Rock Storage DATE: 12-12-88 SAMPLE NO.: 3

LOCATION SAMPLED: Boring: SP4 ELEV. OR DEPTH: 34.5-36.0' DRAWN BY: POK APPROVED BY: RRR

ATTERBERG LIMITS: LL _____ PL _____ PI _____ SAMPLED MOISTURE CONTENT (%): 12.7 COEFFICIENTS: Cc = _____ Cu = _____

SAMPLE SOURCE: _____ MUNSELL COLOR CODE: 7.5 YR. 3.4 DATE SAMPLED: 11-10-88

SOIL CLASSIFICATION (ASTM: D2487) SILTY SAND, fine to medium grained, a little gravel, dark brown (SM)

FORM #411 SL (2/87)

3.5-J-12

LOG OF TEST BORING NO.: B-SP5

CLIENT: Kennecott
PROJECT: Stockpile Borings
PROJECT NUMBER: 87K10
LOCATION: Ladysmith, Wisconsin
COORDINATES: 39957 N 40501 E

SURFACE ELEVATION: 1148.77
BORING DEPTH: 36.0
DATE: 11/09/88

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLING NOTES
1148.8	--0.0	0.0-1.5	ss	1	6	0.8	Blk br org SILT, tr cl[illegible] and fgr sand, loose, dry - topsoil(4") rest is red br Fe-stained SILT	ML		
1143.8	--5.0	4.5-6.0	ss	2	24	1.5	Red br fgr-cgr gravelly fgr-mgr SAND, loose, dry	SP		
1138.8	--10.0	9.5-11.0	ss	3	62	1.4	Same as above w/ less grvl plus silt, v damp to wet	SM		
1133.8	--15.0	14.5-16.0	ss	4	37	0.8	Red br clayey fgr-mgr SAND, tr fgr grvl, dense, wet	SC		
1128.8	--20.0	19.5-21.0	ss	5	33	1.0	Red br silty fgr-cgr SAND, tr fgr grvl, wet, dense			
1123.8	--25.0	24.5-26.0	ss	6	15	0.0	No recovery			
1118.8	--30.0	29.5-31.0	ss	7	15	1.5	Red br silty fgr-mgr SAND, tr fgr grvl, soft, wet, med loose	SM		
1113.8	--35.0	34.5-36.0	ss	8	36	1.5	Same as above			
							End of Boring at 36.0 feet			
1108.8	--40.0									
1103.8	--45.0									
1098.8	--50.0									
1093.8	--55.0									

DRILLING DATA

START DATE: 11/09/88
COMPLETION DATE: 11/09/88
LOGGED BY: KAD
DRILLING METHOD: RIG: CME 850 - All Terrain Mud rotary
DRILLING CONTRACTOR: Twin City Testing

WATER LEVEL INFORMATION

DEPTH AT COMPLETION: NA
LATER TIME/DEPTH: NA
LATER TIME/DEPTH: NA
CAVE IN DEPTH: NA
DRILLING LOSSES: NA

LOG OF TEST BORING NO.: PZ-SP6

CLIENT: Kennecott
PROJECT: Stockpile Borings
PROJECT NUMBER: 87K10
LOCATION: Ladysmith, Wisconsin
COORDINATES: 39652 N 40205 E

SURFACE ELEVATION: 1154.81
BORING DEPTH: 36.0
DATE: 11/08/88

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLING NOTES
1154.8	--0.0	0.0-1.5	ss	1	6	1.4	Br org SILT, tr fgr sand, topsoil, loose, dry (top 4"?), rest is br fgr sandy SILT, dry, loose, non-plastic, non cohesive, very soft	ML		
1149.8	--5.0	4.5-6.0	ss	2	22	1.2	Br silty fgr-mgr SAND, loose, dry, subang to ang, some Fe-stained sand grains			
1144.8	--10.0	9.5-11.0	ss	3	53	1.3	Same as above only tending to be more fgr, dense, dry	SM		
1139.8	--15.0	14.5-16.0	ss	4	99	1.2	Same as above, dense, damp			
1134.8	--20.0	19.5-21.0	ss	5	51	1.3	Br fgr sandy SILT, non plastic, saturated(wet), dense, becoming more plastic and cohesive w/ depth			
1129.8	--25.0	24.5-26.0	ss	6	58	1.0	Dk red brn (5YR 3/8) fgr sandy SILT, tr clay, slightly plastic, cohesive, wet, dense, firm, more grvl and sand w/ depth	ML	%g-s-si-cl 5-32-46-17 LL=14 PI=0.6	
1124.8	--30.0	29.5-31.0	ss	7	30	1.5	Br fgr sandy SILT w/ fgr grvl and mgr-cgr sand, wet, dense, firm			
1119.8	--35.0	34.5-36.0	ss	8	74	1.4	Br red silty fgr-mgr SAND w/ fgr grvl and cgr sand, damp, firm, dense	SM		
							End of Boring at 36.0 feet			
1114.8	--40.0									
1109.8	--45.0									
1104.8	--50.0									
1099.8	--55.0									

DRILLING DATA

START DATE: 11/08/88
COMPLETION DATE: 11/08/88
LOGGED BY: KAD
DRILLING METHOD: RIG: CME 850 - All Terrain Mud rotary
DRILLING CONTRACTOR: Twin City Testing

WATER LEVEL INFORMATION

DEPTH AT COMPLETION:
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:
DRILLING LOSSES:

Foth & Van Dyke and Associates Inc.

2737 S. Ridge Road P. O. Box 19012 Green Bay, WI 54307-9012 414/497-2500

REPORT OF:

SIEVE ANALYSIS OF COARSE TO FINE AGGREGATES

PROJECT: Proposed Waste Rock Storage

SCOPE I.D. #: 87K10

DATE TYPED: 12-27-88

REPORTED TO: Kennecott Explorations

REPORT NUMBER: 4

TEST PERFORMED IN GENERAL ACCORDANCE OF ASTM: D1140

GENERAL DATA:

SAMPLE LOCATION:

SAMPLE NUMBER: B-SP6

DEPTH OF SAMPLE: 24.5'-26.0'

SAMPLED BY: B.J. Socha at F&VD

DATE SAMPLED: 11/8/88

DATED RECEIVED: 12/6/88

SOURCE OF SAMPLE:

MUNSELL COLOR CODE: 5 YR. 3/3

LABORATORY DATA:

DATE TESTED: December 6-8, 1988

TESTED PERFORMED BY: KAS

REVIEWED BY: POK (12-12-88)

24 HRS. TURN AROUND ____YES __xx__NO

WASHED GRADATION __x__YES ____NO

WEIGHT OF TEST SAMPLE 201.8 **GRAMS**

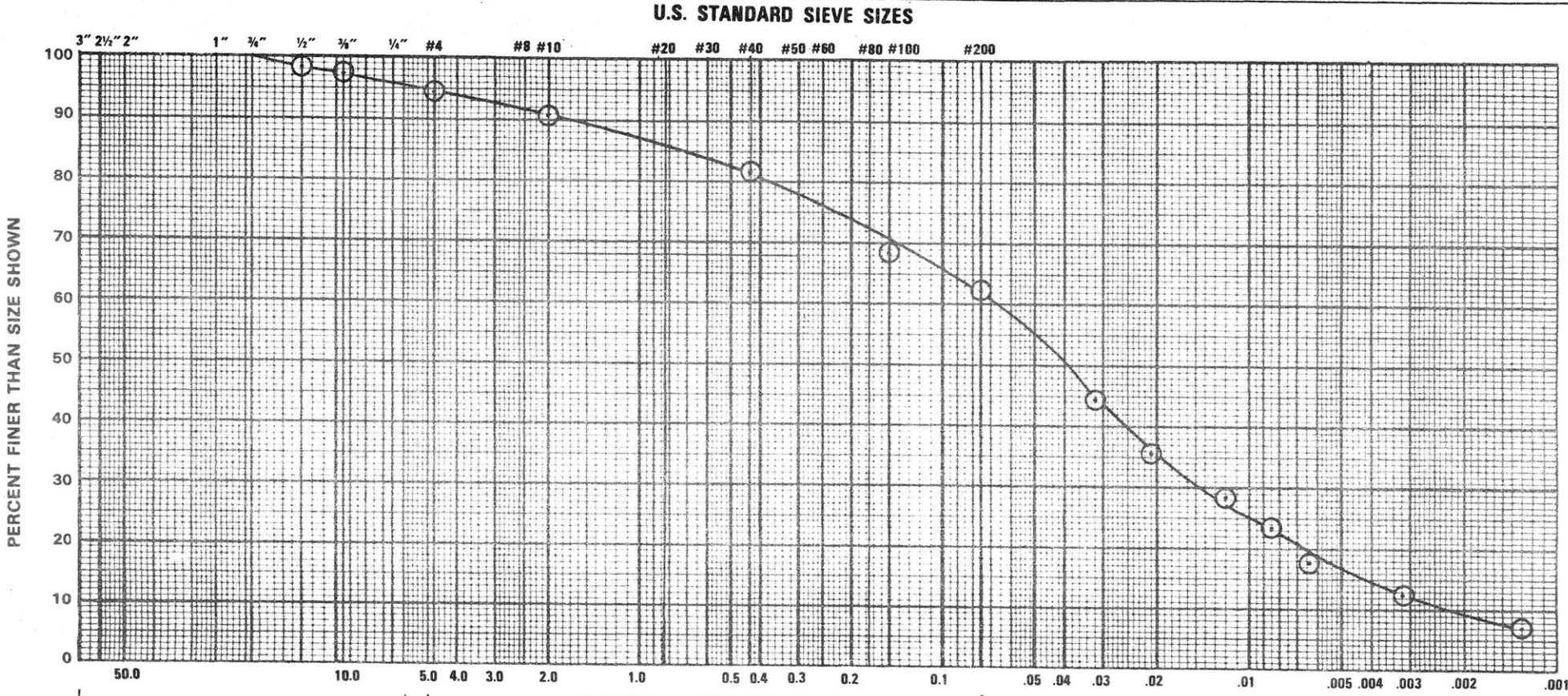
SIEVE SIZE	WEIGHT RETAINED (gms)	% RETAINED	% PASSING	PROJECT SPECIFICATION % PASSING BY WEIGHT	SOURCE OF SPECIFICATION
3"					
1½					
1					
3/4	0	0	100		
1/2	3.5	1.7	98.3		
3/8	2.1	1.0	97.3		
#4	5.5	2.7	94.6		
10	7.4	3.7	90.9		
40	19.1	9.5	81.4		
100	26.6	13.2	68.2		
200	11.9	5.9	62.3		
PAN	125.9	62.4			

REMARKS:

3.5-J-15 BY: Robert R. Rouse

Foth & Van Dyke and Associates Inc.

GRAIN SIZE DISTRIBUTION CURVE



GRAVEL		SAND			SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE		
% =	% = 5.4	% = 3.7	% = 9.5	% = 19.0	% = 45.6	% = 16.8

PROJECT: Kennecott - Proposed Waste Rock Storage DATE: 12-12-88 SAMPLE NO.: 4

LOCATION SAMPLED: Boring: SP-6 ELEV. OR DEPTH: 24.5'-26.0' DRAWN BY: POK APPROVED BY: RRR

ATTERBERG LIMITS: LL 14.0 PL 13.4 PI 0.6 SAMPLED MOISTURE CONTENT (%): 12.8 COEFFICIENTS: Cc = Cu =

SAMPLE SOURCE: MUNSELL COLOR CODE: 5 YR. 3/3 DATE SAMPLED: 11-8-88

SOIL CLASSIFICATION (ASTM: D2487) SANDY SILT, a little gravel, dark reddish brown, (ML)

FORM #411 SL (2/87)

3.5-J-16

LOG OF TEST BORING NO.: B-SP7

CLIENT: Kennecott
PROJECT: Stockpile Borings
PROJECT NUMBER: 87K10
LOCATION: Ladysmith, Wisconsin
COORDINATES: 40111 N 40799 E

SURFACE ELEVATION: 1142.32
BORING DEPTH: 36.0
DATE: 11/09/88

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLING NOTES
1142.3	--0.0	0.0-1.5	ss	1	5	1.4	Top 3" is org rich blk SILT, rest is red br (Fe-stained) SILT, tr clay and fgr sand	ML		
1137.3	--5.0	4.5-6.0	ss	2	16	1.3	Red br (Fe-stained) SILT, tr clay, fgr sand, med loose, damp			
1132.3	--10.0	9.5-11.0	ss	3	35	1.2	Red br fgr-mgr SAND w/ silt, faint laminations, very damp to wet, med dense	SM		
1127.3	--15.0	14.5-16.0	ss	4	21	1.2	Red br clayey fgr-cgr SAND, tr fgr grvl, wet, dense			
1122.3	--20.0	19.5-21.0	ss	5	11	1.5	Red br mottled SILT, tr clay, fgr sand, damp, dense	ML		
1117.3	--25.0	24.5-26.0	ss	6	14	1.4	Red br silty fgr-cgr SAND, tr clay damp	SM		
1112.3	--30.0	29.5-31.0	ss	7	39	0.5	Same as above			
1107.3	--35.0	34.5-36.0	ss	8	29	1.4	Same as above			
							End of Boring at 36.0 feet			
1102.3	--40.0									
1097.3	--45.0									
1092.3	--50.0									
1087.3	--55.0									

DRILLING DATA

START DATE: 11/09/88
COMPLETION DATE: 11/10/88
LOGGED BY: KAD
DRILLING METHOD: RIG: CME 850 - All Terrain Mud rotary
DRILLING CONTRACTOR: Twin City Testing

WATER LEVEL INFORMATION

DEPTH AT COMPLETION: NA
LATER TIME/DEPTH: NA
LATER TIME/DEPTH: NA
CAVE IN DEPTH: NA
DRILLING LOSSES: NA

LOG OF TEST BORING NO.: PZ-SP8

CLIENT: Kennecott
PROJECT: Stockpile Borings
PROJECT NUMBER: 87K10
LOCATION: Ladysmith, Wisconsin
COORDINATES: 39662 N 40905 E

SURFACE ELEVATION: 1142.79
BORING DEPTH: 36.0
DATE: 11/11/88

MSL ELEV	DEPTH FR LND SURF	SAMPLE INTERVAL	TYPE	#	N	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLING NOTES
1142.8	--0.0	0.0-1.5	ss	1	10	1.5	Top .9' is blk fgr sandy SILT w/ org, moist to wet, very soft, next .6' is lt grey to red br mottled fgr sandy SILT, tr fgr-cgr grvl, moist, loose, 2.5-4.5 is red br	OL ML ML/CL		
1137.8	--5.0	4.5-6.0	ss	2	42	1.3	sandy, silty CLAY w/ fgr-cgr grvl, moist, v stiff Reddish br to lt br to grey silty SAND w/ fgr-cgr grvl, tr clay, moist, firm to dense, mottled,	SM		
1132.8	--10.0	9.5-11.0	ss	3	17	1.2	cgr grvl/cobbles @ 6' Reddish br clayey SAND w/ silt and fgr-cgr grvl, moist, dense	SC		
1127.8	--15.0	14.5-16.0	ss	4	12	1.5	Reddish br layered silty SAND and clayey SAND w/ fgr-cgr grvl and 1-2" seams of mgr-cgr SAND @ 11.8' & 14.5', saturated, firm to loose, cgr grvl and cobbles @ 10.0-11.5	SC/SM SP		
1122.8	--20.0	19.5-21.0	ss	5	15	1.5	Same.			
1117.8	--25.0	24.5-26.0	ss	6	9	1.1	Red br clayey fgr-cgr SAND, tr silt, firm, dense, plastic, cohesive	SC		
1112.8	--30.0	29.5-31.0	ss	7	7	0.8	Red br fgr-cgr SAND w/ clay and silt, plastic, soft, cohesive			
1107.8	--35.0	34.5-36.0	ss	8	7	0.5	Grey lean CLAY w/ fgr-cgr sand, tr fgr grvl, cohesive, soft, plastic	CL		
							End of Boring at 36.0 feet			
1102.8	--40.0									
1097.8	--45.0									
1092.8	--50.0									
1087.8	--55.0									

DRILLING DATA

START DATE: 11/11/88 @ 10:10 am
COMPLETION DATE: 11/11/88 @ 2:10 pm
LOGGED BY: REM/KAD
DRILLING METHOD: RIG: CME 850 - All Terrain HSA to 19', Mud to 36'
DRILLING CONTRACTOR: Twin City Testing

WATER LEVEL INFORMATION

DEPTH AT COMPLETION: 14.4' @ 16.0'
LATER TIME/DEPTH: 19.3' @ 21.0'
LATER TIME/DEPTH: NA
CAVE IN DEPTH: NA
DRILLING LOSSES: NA

APPENDIX 3.5-K

Geologic Logs and Soil Test Data for the Railroad Spur Borings, 1988

LOG OF TEST BORING NO.: B-RS1

CLIENT: Kennecott
PROJECT: Railroad Spur Borings
PROJECT NUMBER: 87K10
LOCATION: Ladysmith, Wisconsin
COORDINATES: 39537 N 40141 E

SURFACE ELEVATION: 1153.96
BORING DEPTH: 21.0
DATE: 11/14/88

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (in)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLING NOTES
1154.0	--0.0	0.0-1.5	ss	1	4	15.0	Dk br org SILT, abrupt change to red br SILT, loose, dry	ML		
1151.5	--2.5	2.0-3.5	ss	2	10	16.0	Red br silty fgr-mgr SAND, loose, dry, subang grains, abrupt change to red br and grey mottled SILT w/ fgr sand, loose, dry	SM/ML		
1149.0	--5.0	4.5-6.0	ss	3	24	13.0	Red br silty fgr SAND w/ lenses of fgr-mgr sand, tr grv., med loose, dry			
1146.5	--7.5	7.0-8.5	ss	4	22	14.0	Br fgr-cgr SAND w/ silt, med loose dry, subang grains			
1144.0	--10.0	9.5-11.0	ss	5	50	14.0	Top 6" - Same as above, bottom 4" is red br silty fgr SAND, tr fgr grvl, dense, damp	SM		
1141.5	--12.5									
1139.0	--15.0	14.5-16.0	ss	6	58	13.0	Top 8" - br silty fgr-cgr SAND w/ 2 2" red br SILT layers @ 8" and 11", dense, damp			
1136.5	--17.5						Top 3" red br silty fgr-cgr SAND, wet, hard, dense; next 8" red br SILT w/ fgr sand, hard, dense, damp; next 4" red br fgr sandy	SM/ML		
1134.0	--20.0	19.5-21.0	ss	7	68	15.0	SILT, tr cgr grvl, dense, damp			
							End of Boring at 21.0 feet			
1131.5	--22.5									
1129.0	--25.0									
1126.5	--27.5									

DRILLING DATA

START DATE: 11/14/88
COMPLETION DATE: 11/14/88
LOGGED BY: KAD
DRILLING METHOD: HSA - ID 3 1/4", OD 5" RIG: CME 850 - All Terrain
DRILLING CONTRACTOR: Twin City Testing

WATER LEVEL INFORMATION

DEPTH AT COMPLETION: NA
LATER TIME/DEPTH: NA
LATER TIME/DEPTH: NA
CAVE IN DEPTH: NA
DRILLING LOSSES: NA

LOG OF TEST BORING NO.: B-RS2

CLIENT: Kennecott
PROJECT: Railroad Spur Borings
PROJECT NUMBER: 87K10
LOCATION: Ladysmith, Wisconsin
COORDINATES: 39543 N 40641 E

SURFACE ELEVATION: 1142.94
BORING DEPTH: 21.0
DATE: 11/14/88

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (in)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLING NOTES
1142.9	--0.0	0.0-1.5	ss	1	5	20.0	Dk br org SILT w/ fgr sand, abrupt change to red br SILT w/ fgr sand, soft, dry to slightly damp	ML		
1140.4	--2.5	2.0-3.5	ss	2	10	18.0	Red br and grey mottled SILT, w/ fgr-mgr sand, soft, damp @ 3.0'; .5' of red br CLAY w/ silt and fgr sand, firm to med firm, damp	CL		
1137.9	--5.0	4.5-6.0	ss	3	22	15.0	Red br SILT, w/ fgr sand, tr cgr sand, dense, damp, slightly mottled	ML		
1135.4	--7.5	7.0-8.5	ss	4	39	14.0	Red br silty fgr-cgr SAND, subang, dense, damp			
1132.9	--10.0	9.5-11.0	ss	5	17	18.0	Red br silty fgr-cgr SAND, tr fgr-cgr grvl, med dense, damp, subang grains	SM		
1130.4	--12.5									
1127.9	--15.0	14.5-16.0	ss	6	9	22.0	Red and br mottled SILT w/ fgr sand, tr clay, soft, damp	ML		
1125.4	--17.5									
1122.9	--20.0	19.5-21.0	ss	7	26		Rock beneath sampler - no sample recovered, prob sand w/ grvl(sand on outside of sampler)	SM		
							End of Boring at 21.0 feet			
1120.4	--22.5									
1117.9	--25.0									
1115.4	--27.5									

DRILLING DATA

START DATE: 11/14/88
COMPLETION DATE: 11/14/88
LOGGED BY: KAD
DRILLING METHOD: HSA - ID 3 1/4", OD 5" RIG: CME 850 - All Terrain
DRILLING CONTRACTOR: Twin City Testing

WATER LEVEL INFORMATION

DEPTH AT COMPLETION: NA
LATER TIME/DEPTH: NA
LATER TIME/DEPTH: NA
CAVE IN DEPTH: NA
DRILLING LOSSES: NA

LOG OF TEST BORING NO.: B-RS3

CLIENT: Kennecott
PROJECT: Railroad Spur Borings
PROJECT NUMBER: 87K10
LOCATION: Ladysmith, Wisconsin
COORDINATES: 39550 N 41141 E

SURFACE ELEVATION: 1139.53
BORING DEPTH: 21.0
DATE: 11/15/88

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (in)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLING NOTES
1139.5	--0.0	0.0-1.5	ss	1	1	14.0	Org rich bl br SILT, tr clay, soft			
1137.0	--2.5	2.0-3.5	ss	2	10	16.0	Red br SILT w/ fgr sand, tr clay and fgr grvl, damp, soft	ML		
1134.5	--5.0	4.5-6.0	ss	3	14		Red br silty fgr-cgr SAND, loose, wet, saturated, subang grains			
1132.0	--7.5	7.0-8.5	ss	4	21	14.0	Red br silty fgr-cgr SAND grading to silty fgr-mgr SAND @ bottom, loose, saturated(wet)			
1129.5	--10.0	9.5-11.0	ss	5	18		Same as above only w/o cgr sand	SM		
1127.0	--12.5									
1124.5	--15.0	14.5-16.0	ss	6	70		Red br silty fgr SAND, tr fgr grvl wet, dense, high blow counts due to grvl			
1122.0	--17.5									
1119.5	--20.0	19.5-21.0	ss	7	7		Red br silty fgr-mgr SAND w/ lenses(1/8") of fgr-cgr silty SAND wet, soft, subang grains			
							End of Boring at 21.0 feet			
1117.0	--22.5									
1114.5	--25.0									
1112.0	--27.5									

DRILLING DATA

START DATE: 11/15/88
COMPLETION DATE: 11/15/88
LOGGED BY: KAD
DRILLING METHOD: HSA - ID 3 1/4", OD 5" RIG: CME 850 - All Terrain
DRILLING CONTRACTOR: Twin City Testing

WATER LEVEL INFORMATION

DEPTH AT COMPLETION: NA
LATER TIME/DEPTH: NA
LATER TIME/DEPTH: NA
CAVE IN DEPTH: NA
DRILLING LOSSES: NA

LOG OF TEST BORING NO.: B-RS4

CLIENT: Kennecott
PROJECT: Railroad Spur Borings
PROJECT NUMBER: 87K10
LOCATION: Ladysmith, Wisconsin
COORDINATES: 39557 N 41641 E

SURFACE ELEVATION: 1143.07
BORING DEPTH: 21.0
DATE: 11/16/88

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (in)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLING NOTES
1143.1	--0.0	0.0-1.5	ss	1	3	18.0	Top 2" dk br to bl org SILT, next 10" is red grey and br mottled SILT, tr clay, next 6" is red br silty fgr SAND w/ grey mottles, tr clay, damp	ML/SM		Moderate amount of boulders thruout soil
1140.6	--2.5	2.0-3.5	ss	2	6		Grey br mottled SILT, tr clay, soft, damp, some Fe-staining			
1138.1	--5.0	4.5-6.0	ss	3	10		Red br and grey mottles SILT w/ fgr-cgr sand, damp, soft	ML		
1135.6	--7.5	7.0-8.5	ss	4	18		Red br silty fgr-mgr SAND, tr fgr-cgr grvl(chert), med soft, damp			
1133.1	--10.0	9.5-11.0	ss	5	14	12.0	Red br silty fgr-cgr SAND, tr fgr grvl, soft, damp to v damp	SM		
1130.6	--12.5									
1128.1	--15.0	14.5-16.0	ss	6	7	15.0	Red br silty fgr-cgr SAND w/ fgr-cgr grvl, tr clay, wet, soft			
1125.6	--17.5									
1123.1	--20.0	19.5-21.0	ss	7	8	10.0	Red br silty fgr-cgr SAND, w/ fgr-cgr grvl, tr clay, wet, soft			
							End of Boring at 21.0 feet			
1120.6	--22.5									
1118.1	--25.0									
1115.6	--27.5									

DRILLING DATA

START DATE: 11/16/88 @ 8:00 am
COMPLETION DATE: 11/16/88 @ 9:00 am
LOGGED BY: KAD
DRILLING METHOD: HSA - ID 3 1/4", OD 5" RIG: CME 850 - All Terrain
DRILLING CONTRACTOR: Twin City Testing

WATER LEVEL INFORMATION

DEPTH AT COMPLETION: 16.0 feet
LATER TIME/DEPTH: NA
LATER TIME/DEPTH: NA
CAVE IN DEPTH: NA
DRILLING LOSSES: NA

LOG OF TEST BORING NO.: B-RS5

CLIENT: Kennecott
PROJECT: Railroad Spur Borings
PROJECT NUMBER: 87K10
LOCATION: Ladysmith, Wisconsin
COORDINATES: 39683 N 42137 E

SURFACE ELEVATION: 1147.57
BORING DEPTH: 21.0
DATE: 11/16/88

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (in)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLING NOTES
1147.6	--0.0	0.0-1.5	ss	1	6	12.0	Top 3" bl br SILT w/ organics, tr fgr sand, dry, soft, next 9" is grey Fe-stained (mottled) SILT w/ fgr sand, tr clay, dry to damp, soft			
1145.1	--2.5	2.0-3.5	ss	2	10	18.0	Same as above w/ fgr grvl (chert)	ML		
1142.6	--5.0	4.5-6.0	ss	3	30	10.0	Same as above except bottom 6" is fgr-cgr SAND w/ silt and fgr-cgr grvl, tr clay	ML/SM		
1140.1	--7.5	7.0-8.5	ss	4	23	6.0	Red br silty fgr-cgr SAND w/ fgr-cgr grvl, med dense, damp to v damp, subang grains			
1137.6	--10.0	9.5-11.0	ss	5	13	10.0	Same as above exc bottom 2" is silty cgr sand, med loose, damp to v damp	SM		
1135.1	--12.5									
1132.6	--15.0	14.5-16.0	ss	6	3	18.0	Red br silty fgr-cgr SAND w/ fgr-cgr grvl and clay, wet, soft			
1130.1	--17.5									
1127.6	--20.0	19.5-21.0	ss	7	10	9.0	Same as above, wet, soft			
							End of Boring at 21.0 feet			
1125.1	--22.5									
1122.6	--25.0									
1120.1	--27.5									

DRILLING DATA

START DATE: 11/16/88 @ 9:40 am
COMPLETION DATE: 11/16/88 @ 10:35 am
LOGGED BY: KAD
DRILLING METHOD: HSA - ID 3 1/4", OD 5" RIG: CME 850 - All Terrain
DRILLING CONTRACTOR: Twin City Testing

WATER LEVEL INFORMATION

DEPTH AT COMPLETION: 16.5'@ 10:30 am
LATER TIME/DEPTH: NA
LATER TIME/DEPTH: NA
CAVE IN DEPTH: NA
DRILLING LOSSES: NA

LOG OF TEST BORING NO.: B-RS6

CLIENT: Kennecott
PROJECT: Railroad Spur Borings
PROJECT NUMBER: 87K10
LOCATION: Ladysmith, Wisconsin
COORDINATES: 39999 N 42530 E

SURFACE ELEVATION: 1150.19
BORING DEPTH: 21.0
DATE: 11/16/88

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (in)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLING NOTES
1150.2	--0.0	0.0-1.5	SS	1	1.5	12.0	Top 3" is bl br org rich SILT, rest is grey br(Fe-stained) mottled SILT, tr fgr sand and clay dry, loose	ML		
1147.7	--2.5	2.0-3.5	SS	2	20	10.0	top 6" is grey br(Fe-stained) SILT tr clay, fgr sand and fgr grvl, bottom 4" is red br silty fgr-cgr SAND w/ fgr-cgr grvl, loose, damp	ML/SM		
1145.2	--5.0	4.5-6.0	SS	3	26	14.0	Same as above, med loose, damp			
1142.7	--7.5	7.0-8.5	SS	4	33	16.0	Red br silty fgr-cgr SAND w/ fgr-cgr grvl, dense, damp			
1140.2	--10.0	9.5-11.0	SS	5	34	14.0	Same as above	SM		
1137.7	--12.5									
1135.2	--15.0	14.5-16.0	SS	6	69	4.0	Red br silty mgr-cgr SAND, w/ fgr-cgr grvl, wet, loose, hard due to size of gravel			Water at 14 feet at 12:15 pm
1132.7	--17.5									
1130.2	--20.0	19.5-21.0	SS	7	33	18.0	Red br silty fgr-mgr SAND w/ fgr-cgr grvl, v damp to wet, med dense non-cohesive to slightly cohesive			
							End of Boring at 21.0 feet			
1127.7	--22.5									
1125.2	--25.0									
1122.7	--27.5									

DRILLING DATA

START DATE: 11/16/88 @ 11:30 am
COMPLETION DATE: 11/16/88/@ 12:45 pm
LOGGED BY: KAD
DRILLING METHOD: HSA - ID 3 1/4", OD 5" RIG: CME 850 - All Terrain
DRILLING CONTRACTOR: Twin City Testing

WATER LEVEL INFORMATION

DEPTH AT COMPLETION: NA
LATER TIME/DEPTH: NA
LATER TIME/DEPTH: NA
CAVE IN DEPTH: NA
DRILLING LOSSES: NA

LOG OF TEST BORING NO.: B-RS7

CLIENT: Kennecott
PROJECT: Railroad Spur Borings
PROJECT NUMBER: 87K10
LOCATION: Ladysmith, Wisconsin
COORDINATES: 40353 N 42890 E

SURFACE ELEVATION: 1156.77
BORING DEPTH: 21.0
DATE: 11/16/88

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (in)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLING NOTES
1156.8	--0.0	0.0-1.5	ss	1	2	6.0	Top 3" is dk br blk org SILT, next 3" is br Fe-stained mottled SILT, dry, soft			
1154.3	--2.5	2.0-3.5	ss	2	20	18.0	Red br SILT w/ fgr sand, tr clay grading to red br silty fgr SAND w/ mgr-cgr sand, tr grvl and clay, dry, med loose	ML		
1151.8	--5.0	4.5-6.0	ss	3	25	14.0	Red br silty fgr-cgr SAND, tr grvl med loose, dry			
1149.3	--7.5	7.0-8.5	ss	4	38	12.0	Red br silty fgr-cgr SAND w/ silt, some 1/2" fgr-cgr SAND lenses, all w/ tr fgr-mgr grvl, damp, dense			
1146.8	--10.0	9.5-11.0	ss	5	29	13.0	Same as above, v damp	SM		
1144.3	--12.5									
1141.8	--15.0	14.5-16.0	ss	6	171/6	4.0	Same as above - rock impeding sampler			
1139.3	--17.5									
1136.8	--20.0	19.5-21.0	ss	7	30	14.0	Same as above, v damp			
							End of Boring at 21.0 feet			
1134.3	--22.5									
1131.8	--25.0									
1129.3	--27.5									

DRILLING DATA

START DATE: 11/16/88 @ 2:00 pm
COMPLETION DATE: 11/16/88 @ 3:45 pm
LOGGED BY: KAD
DRILLING METHOD: HSA - ID 3 1/4", OD 5" RIG: CME 850 - All Terrain
DRILLING CONTRACTOR: Twin City Testing

WATER LEVEL INFORMATION

DEPTH AT COMPLETION: DRY
LATER TIME/DEPTH: NA
LATER TIME/DEPTH: NA
CAVE IN DEPTH: NA
DRILLING LOSSES: NA

LOG OF TEST BORING NO.: B-RS8

CLIENT: Kennecott
PROJECT: Railroad Spur Borings
PROJECT NUMBER: 87K10
LOCATION: Ladysmith, Wisconsin
COORDINATES: 40647 N 43306 E

SURFACE ELEVATION: 1156.89
BORING DEPTH: 21.0
DATE: 11/17/88

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (in)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLING NOTES
1156.9	--0.0	0.0-1.5	ss	1	4	12.0	Top 4" blk br org SILT, tr fgr sand; bottom 8" is red tan mottled SILT w/ fgr sand, tr fgr-mgr grvl, dry, soft			
1154.4	--2.5	2.0-3.5	ss	2	13	12.0	Tan red and br(Fe-stained) mottled SILT, tr clay, dry, loose, slightly cohesive when saturated	ML		
1151.9	--5.0	4.5-6.0	ss	3	21	14.0	Red br silty fgr SAND, tr clay grading to silty fgr-mgr SAND, damp, med loose			
1149.4	--7.5	7.0-8.5	ss	4	12	9.0	Top 3" Same as above, next 3" br fgr-cgr SAND w/ silt, tr fgr-cgr grvl, next 3" fgr-cgr SAND w/ silt loose, dry			
1146.9	--10.0	9.5-11.0	ss	5	35	7.0	Red br silty fgr-mgr SAND, tr cgr grvl, damp, dense	SM		
1144.4	--12.5									
1141.9	--15.0	14.5-16.0	ss	6	47	11.0	Red br silty fgr-cgr SAND, tr cgr grvl, v dense, damp, hard			
1139.4	--17.5									
1136.9	--20.0	19.5-21.0	ss	7	47	12.0	Same as above w/ top 4" tr clay, wet			
							End of Boring at 21.0 feet			
1134.4	--22.5									
1131.9	--25.0									
1129.4	--27.5									

DRILLING DATA

START DATE: 11/16/88 @ 4:15 pm
COMPLETION DATE: 11/17/88 @ 8:00 am
LOGGED BY: KAD
DRILLING METHOD: HSA - ID 3 1/4", OD 5" RIG: CME 850 - All Terrain
DRILLING CONTRACTOR: Twin City Testing

WATER LEVEL INFORMATION

DEPTH AT COMPLETION: DRY
LATER TIME/DEPTH: NA
LATER TIME/DEPTH: NA
CAVE IN DEPTH: NA
DRILLING LOSSES: NA

LOG OF TEST BORING NO.: B-RS9

CLIENT: Kennecott
PROJECT: Railroad Spur Borings
PROJECT NUMBER: 87K10
LOCATION: Ladysmith, Wisconsin
COORDINATES: 40871 N 43748 E

SURFACE ELEVATION: 1160.75
BORING DEPTH: 21.0
DATE: 11/17/88

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (in)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLING NOTES
1160.8	--0.0	0.0-1.5	ss	1	3	10.0	Top 3" dk br org SILT, wet, soft next 7" br Fe-stained mottled SILT tr clay, dry to slightly damp, soft			
1158.3	--2.5	2.0-3.5	ss	2	9	12.0	Br SILT, w/ fgr sand, tr clay, v slightly cohesive, damp, soft	ML		
1155.8	--5.0	4.5-6.0	ss	3	33	12.0	Red br silty fgr-cgr SAND, tr fgr grvl, hard, damp, subang grains			
1153.3	--7.5	7.0-8.5	ss	4	34	12.0	Same as above			
1150.8	--10.0	9.5-11.0	ss	5	46	11.0	Br fgr-cgr SAND w/ silt, tr fgr grvl, dry, dense, subang grains	SM		
1148.3	--12.5									
1145.8	--15.0	14.5-16.0	ss	6	38	13.0	Red br silty fgr-cgr SAND w/ fgr-cgr grvl, dense, hard, dry			
1143.3	--17.5									
1140.8	--20.0	19.5-21.0	ss	7	50	18.0	Same as above w/ 1" fgr-cgr SAND seam @ 20.5' BGS, sand lense wet, rest of sample damp			
							End of Boring at 21.0 feet			
1138.3	--22.5									
1135.8	--25.0									
1133.3	--27.5									

DRILLING DATA

START DATE: 11/17/88 @ 8:10 am
COMPLETION DATE: 11/17/88 @ 10:00 am
LOGGED BY: KAD
DRILLING METHOD: HSA - ID 3 1/4", OD 5" RIG: CME 850 - All Terrain
DRILLING CONTRACTOR: Twin City Testing

WATER LEVEL INFORMATION

DEPTH AT COMPLETION: DRY
LATER TIME/DEPTH: NA
LATER TIME/DEPTH: NA
CAVE IN DEPTH: NA
DRILLING LOSSES: NA

LOG OF TEST BORING NO.: B-RS10

CLIENT: Kennecott
PROJECT: Railroad Spur Borings
PROJECT NUMBER: 87K10
LOCATION: Ladysmith, Wisconsin
COORDINATES: 41087 N 44206 E

SURFACE ELEVATION: 1166.17
BORING DEPTH: 16.0
DATE: 11/17/88

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (in)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLING NOTES
1166.2	--0.0	0.0-1.5	ss	1	7	12.0	Top 6" is dk blk br org SILT, tr fgr sand, dry, soft, next 6" is tan grey nottled SILT w/ fgr sand, dry, soft, slightly cohesive	ML		
1163.7	--2.5	2.0-3.5	ss	2	16	14.0	Top 6" same as above, next 8" is red br silty fgr-cgr SAND w/ fgr-cgr grvl, dry to damp, med loose	ML/SM		
1161.2	--5.0	4.5-6.0	ss	3	37	16.0	Same as above only dense rather than med loose			
1158.7	--7.5	7.0-8.5	ss	4	31	14.0	Same as above, dry, dense			
1156.2	--10.0	9.5-11.0	ss	5	99	6.0	Same as above, high blow count due to rock in sampler tip	SM		
1153.7	--12.5									
1151.2	--15.0	14.5-16.0	ss	6			Same as above, sampler destroyed (flattened), small amount recovered			
							End of Boring at 16.0 feet			
1148.7	--17.5									
1146.2	--20.0									
1143.7	--22.5									
1141.2	--25.0									
1138.7	--27.5									

DRILLING DATA

START DATE: 11/17/88 @ 10:30 am
COMPLETION DATE: 11/17/88 @ 12:00 pm
LOGGED BY: KAD
DRILLING METHOD: HSA - ID 3 1/4", OD 5" RIG: CME 850 - All Terrain
DRILLING CONTRACTOR: Twin City Testing

WATER LEVEL INFORMATION

DEPTH AT COMPLETION: DRY
LATER TIME/DEPTH: NA
LATER TIME/DEPTH: NA
CAVE IN DEPTH: NA
DRILLING LOSSES: NA

LOG OF TEST BORING NO.: B-RS11

CLIENT: Kennecott
PROJECT: Railroad Spur Borings
PROJECT NUMBER: 87K10
LOCATION: Ladysmith, Wisconsin
COORDINATES: 41368 N 44622 E

SURFACE ELEVATION: 1159.53
BORING DEPTH: 21.0
DATE: 11/17/88

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (in)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLING NOTES
1159.5	--0.0	0.0-1.5	ss	1	3	14.0	Top 7" is blk br org SILT, soft, damp, next 7" is tan reddish br mottled SILT w/ fgr sand, soft, damp to dry	ML		
1157.0	--2.5	2.0-3.5	ss	2	17	14.0	Red br to tan br silty fgr-cgr SAND, tr fgr-cgr grvl, damp to dry loose, soft			
1154.5	--5.0	4.5-6.0	ss	3	33	12.0	Red br silty fgr-cgr SAND w/ fgr-cgr grvl, damp to dry, dense, grains are subang	SM		
1152.0	--7.5	7.0-8.5	ss	4	20	15.0	Br fgr-cgr SAND w/ sitl and fgr-cgr grvl, loose, dry, grains are subang to ang			
1149.5	--10.0	9.5-11.0	ss	5	28	18.0	Top 3" Same as above, next 3" br SILT w/ fgr sand, soft, damp, non-cohesive, next 6" red br silty fgr-cgr SAND, tr fgr-cgr grvl, dense, dry to damp	SM/ML		
1147.0	--12.5									
1144.5	--15.0	14.5-16.0	ss	6	24	16.0	Same as above(last 6" from above)	SM		
1142.0	--17.5									
1139.5	--20.0	19.5-21.0	ss	7	19	18.0	Top 12" is br silty fgr-mgr SAND, soft, loose, wet, subang to ang grains, bottom 6" is br to red br SILT w/ fgr sand, dense, damp			
							End of Boring at 21.0 feet			
1137.0	--22.5									
1134.5	--25.0									
1132.0	--27.5									

DRILLING DATA

START DATE: 11/17/88 @ 12:30 pm
COMPLETION DATE: 11/17/88 @ 1:45 pm
LOGGED BY: KAD
DRILLING METHOD: HSA - ID 3 1/4", OD 5" RIG: CME 850 - All Terrain
DRILLING CONTRACTOR: Twin City Testing

WATER LEVEL INFORMATION

DEPTH AT COMPLETION: 19.7' @ 1:45 pm
LATER TIME/DEPTH: NA
LATER TIME/DEPTH: NA
CAVE IN DEPTH: NA
DRILLING LOSSES: NA

LOG OF TEST BORING NO.: B-RS12

CLIENT: Kennecott
PROJECT: Railroad Spur Borings
PROJECT NUMBER: 87K10
LOCATION: Ladysmith, Wisconsin
COORDINATES: 41826 N 44851 E

SURFACE ELEVATION: 1151.27
BORING DEPTH: 16.0
DATE: 11/17/88

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (in)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLING NOTES
1151.3	--0.0	0.0-1.5	ss	1	3	12.0	Top 3" is blk br org SILT, soft, v damp, next 9" is tan br mottled SILT w/ fgr sand, tr clay, soft, loose, v damp, slightly cohesive			
1148.8	--2.5	2.0-3.5	ss	2	25	14.0	Tan br mottled fgr sandy SILT, tr fgr-cgr grvl, dry, med dense	ML		
1146.3	--5.0	4.5-6.0	ss	3	46	14.0	Red br silty fgr-cgr SAND w/ fgr-cgr grvl, damp, dense			
1143.8	--7.5	7.0-8.5	ss	4	35	10.0	Same as above			
1141.3	--10.0	9.5-11.0	ss	5	54	12.0	Same as above only denser	SM		
1138.8	--12.5									Difficult drilling due to boulders
1136.3	--15.0	14.5-16.0	ss	6	70	7.0	Same as above w/ boulders mixed in			
							End of Boring at 16.0 feet			
1133.8	--17.5									
1131.3	--20.0	19.5-21.0	ss	7						
1128.8	--22.5									
1126.3	--25.0									
1123.8	--27.5									

DRILLING DATA

START DATE: 11/17/88 @ 2:15 pm
COMPLETION DATE: 11/17/88 @ 4:30 pm
LOGGED BY: KAD
DRILLING METHOD: HSA - ID 3 1/4", OD 5" RIG: CME 850 - All-Terrain
DRILLING CONTRACTOR: Twin City Testing

WATER LEVEL INFORMATION

DEPTH AT COMPLETION: NA
LATER TIME/DEPTH: NA
LATER TIME/DEPTH: NA
CAVE IN DEPTH: NA
DRILLING LOSSES: NA

APPENDIX 3.5-L

Results of Consolidated Undrained Triaxial Compression and Direct Shear Testing, STS Consultants Ltd., 1988

STS Consultants Ltd.
Consulting Engineers

Laboratory Testing

Kenicott Geotechnical Project

Foth & VanDyke

REPORT

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STS Consultants Ltd.
Consulting Engineers

111 Pfingsten Road
Northbrook, Illinois 60062
(312) 272-6520

March 15, 1988

Mr. Robert Rouse
Foth & VanDyke
2737 South Ridge Road
PO Box 19012
Green Bay, WI 54307-9012

RE: Laboratory Testing Pertaining to the Kenicott Geotechnical Project -- STS Project No. 25331

Dear Mr. Rouse:

Please find enclosed three (3) copies of laboratory test results pertaining to the above referenced testing program.

Included in our report is a discussion of the scope of services provided by STS Consultants, a description of the laboratory test equipment and testing procedures utilized throughout the testing program, a discussion of the laboratory testing results and a summarization of all laboratory testing data including graphs where applicable.

We are pleased to have been of service to you on this particular project. Should you have any questions or comments pertaining to the laboratory test data presented, the contents of this report, or if we may be of further assistance to you in any other way, please do not hesitate to contact us.

Respectfully,

STS CONSULTANTS, LTD.

/William P. Quinn/nt

William P. Quinn
Laboratory Manager

Charles W. Pfingsten, P.E.
Senior Principal Engineer

WPQ/nt
enc.

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Scope of Services

STS Consultants was to provide Foth & Van Dyke with laboratory test data obtained by the performance of consolidated undrained triaxial compression and direct shear tests. The tests were performed on samples delivered to our Northbrook testing facility on February 24, 1988. The samples were in the form of 3 inch Shelby tube samples that had been extruded prior to their delivery at the STS laboratory. All selected samples and testing pressures including consolidating stresses for triaxial tests and normal loads for direct shear tests were as instructed by Foth & Van Dyke.

Testing Procedures

The consolidated isotropically undrained triaxial tests were performed utilizing standard triaxial equipment. This equipment consists of a triaxial compression cell adapted to test 3 inch diameter shelby tube specimen, a pore pressure panel used to regulate both cell and back pressures and having a pressure transducer which monitors pore water pressures throughout the test, and a triaxial loader with load cell to provide vertical loads to shear the test specimens.

The initial phase of testing was to encase each of the specimens in a flexible rubber membrane and seal it into the triaxial chamber. Once sealed in the chamber, each specimen was backpressure saturated. This was accomplished by providing a pressure differential of 0.15 ksc (kilograms per square centimeter) between the cell pressure and the backpressure. The pressures were simultaneously and incrementally increased until saturating pressures of 4.15 ksc cell pressure and 4.00 ksc backpressure were attained. The specimen saturation was considered complete when a Skempton's pore pressure B parameter of 0.95 or greater was attained. This B parameter is the ratio of an increase in pore water pressure to a corresponding and simultaneous increase in cell confining pressure.

Once full saturation had been attained, the confining pressure was increased to a predetermined stress to provide a consolidating stress to the test specimen. The valves to the specimen were then opened and the pore fluids were allowed to collect in a calibrated burette. Volumetric measurements of the pore fluids were periodically made until full specimen consolidation had been completed. This was determined by the stabilization of the pore fluid volumetric measurements. Consolidating stresses of 0.70, 2.11 and 3.52 ksc (10, 30 and 50 psi, respectively) were utilized throughout the testing program.

Once full specimen consolidation had been attained, the final stage was to shear the test specimen in the triaxial loader. During the loading process, a strain rate of 0.100 millimeters per minute was utilized. For this phase of testing, deformation and

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pore water pressure measurements were recorded at regular time intervals. The procedures outlined previously were in general conformance with those procedures outlined in the Corps of Engineers Testing Manual EM110-2-1906, Appendix X.

The direct shear test was performed utilizing a Wykeham Farrance direct shear device. The test was performed as a consolidated drained direct shear test, utilizing one normal load per test as per instructions received from Foth & Van Dyke. A total of 3 tests were performed with normal loads of 0.7, 2.11 and 3.52 ksc (10, 30 and 50 psi). Strain rates of the tests were determined by determining the time of failure as 50 x T_{50} where T_{50} was the time required for specimen to achieve 50% of consolidation under the normal force. It is assumed that this rate of strain was sufficient to allow full drainage throughout the loading of the test specimen although the tests are normally performed utilizing 3 separate points, to eliminate assumptions.

During the setup of the direct shear specimens, a small section of the undisturbed sample was trimmed to approximately a 2 centimeter height. This was accomplished by trimming the specimen to fit into the direct shear shearing box. A normal force was then applied to the top of the test specimen and the consolidation of the specimen was recorded. During this time, water was used to fully inundate the test specimen in the shear box. When the consolidation of the test specimen had been completed, the top of the shear box was raised approximately 1/10 inch and a horizontal shearing force was applied to the shear box until the specimen was completely sheared. During this time, horizontal load, horizontal and vertical deformation readings were recorded. The test was performed in general conformance with those procedures outlined in ASTM D-3080, "Direct Shear Test of Soils Under Consolidated Drained Conditions".

Laboratory Test Results

The samples delivered to the STS laboratory for testing consisted of mostly silt material. Three of the four triaxial tests consisted of 3 separate points. The test utilizing specimens labeled S5, 45-47 feet consisted of two specimens. A third specimen originally scheduled for testing consisted mostly of sand. We were unable to obtain a suitable specimen for testing. The condition of all the specimens indicated some sample disturbance by the gouges on the specimen sides. Also moisture content and dry density test results varied from 1 to 2 percent, with samples used for the same triaxial test.

The direct shear test performed on S4, 31.5 to 32.5 feet indicates a very high shear stress. The sample initially was very dense and slightly dessicated. We recommend additional direct shear points be performed to determine a ϕ angle passing through the origin.

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A summarization of all laboratory testing including graphs where applicable is attached to this report.

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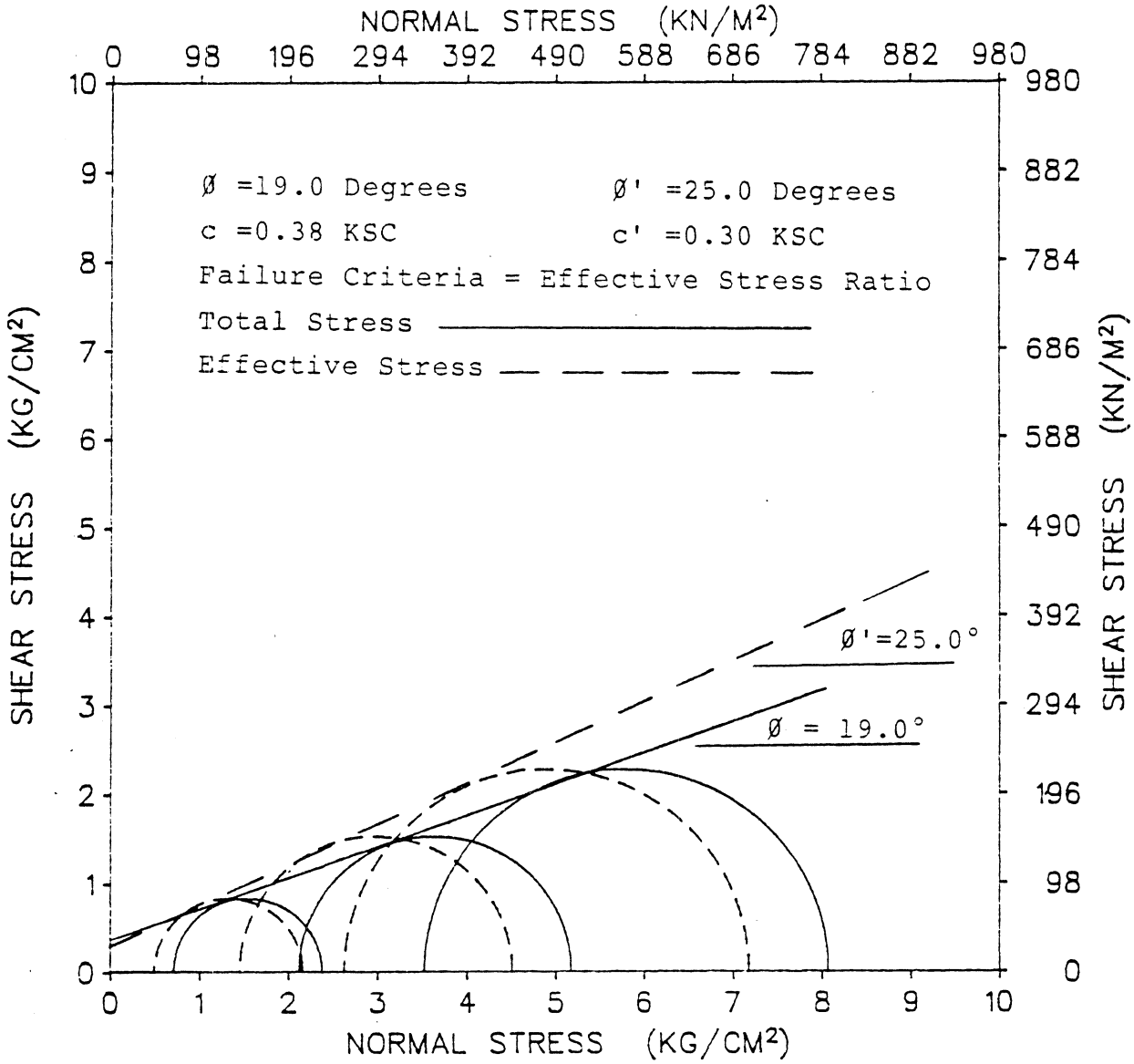
STS Consultants Ltd.

STS JOB NO. 25331

CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST

Boring:	Sample: S-1	Depth: 25-27
Boring:	Sample: S-1	Depth: 27-29
Boring:	Sample: S-1	Depth: 23-25

MOHR ENVELOPE



Sigma 3 = 0.7 ksc
Sigma 3 = 2.1 ksc
Sigma 3 = 3.5 ksc

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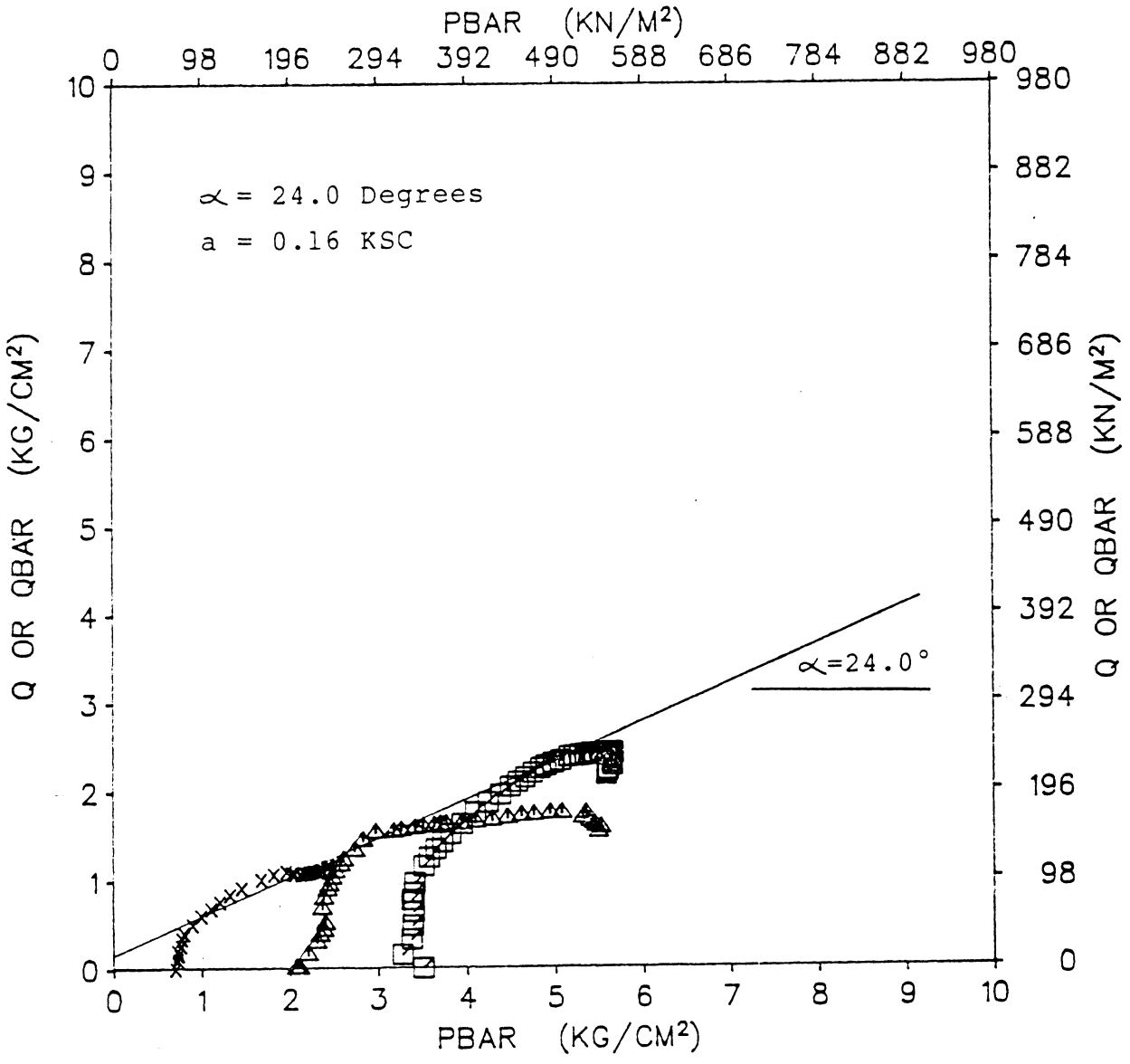
STS JOB NO. 25331

CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST

Boring:	Sample: S-1	Depth: 25-27
Boring:	Sample: S-1	Depth: 27-29
Boring:	Sample: S-1	Depth: 23-25

STRESS PATH PLOT



× Sigma 3 = 0.7 ksc
△ Sigma 3 = 2.1 ksc
☑ Sigma 3 = 3.5 ksc

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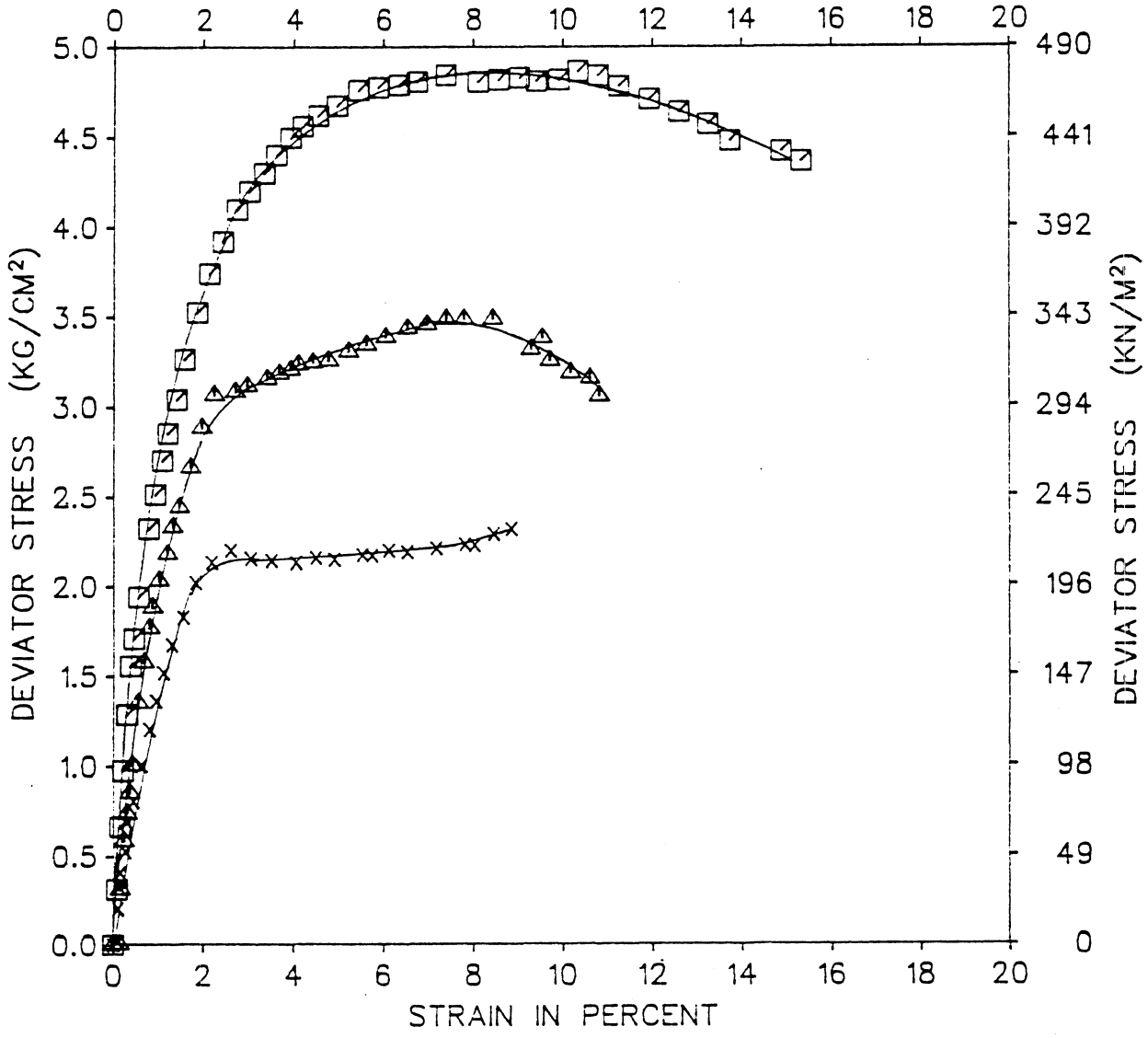
STS JOB NO. 25331

CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST

Boring: Sample: S-1 Depth: 25-27
Boring: Sample: S-1 Depth: 27-29
Boring: Sample: S-1 Depth: 23-25

DEVIATOR STRESS vs STRAIN



× Sigma 3 = 0.7 ksc
△ Sigma 3 = 2.1 ksc
☐ Sigma 3 = 3.5 ksc

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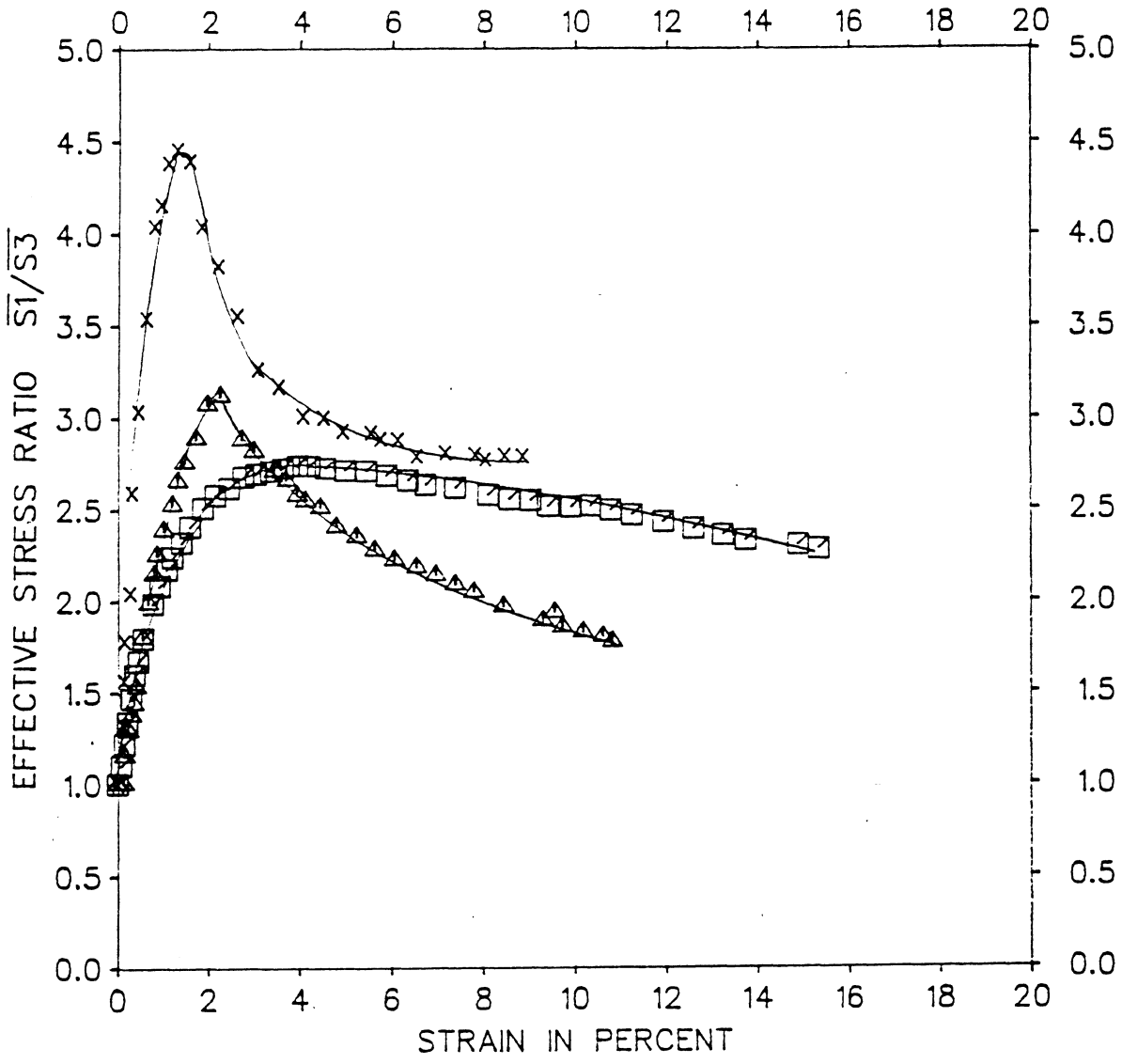
CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST

Boring:	Sample: S-1	Depth: 25-27
Boring:	Sample: S-1	Depth: 27-29
Boring:	Sample: S-1	Depth: 23-25

EFFECTIVE STRESS RATIO vs STRAIN



× Sigma 3 = 0.7 ksc

△ Sigma 3 = 2.1 ksc

□ Sigma 3 = 3.5 ksc

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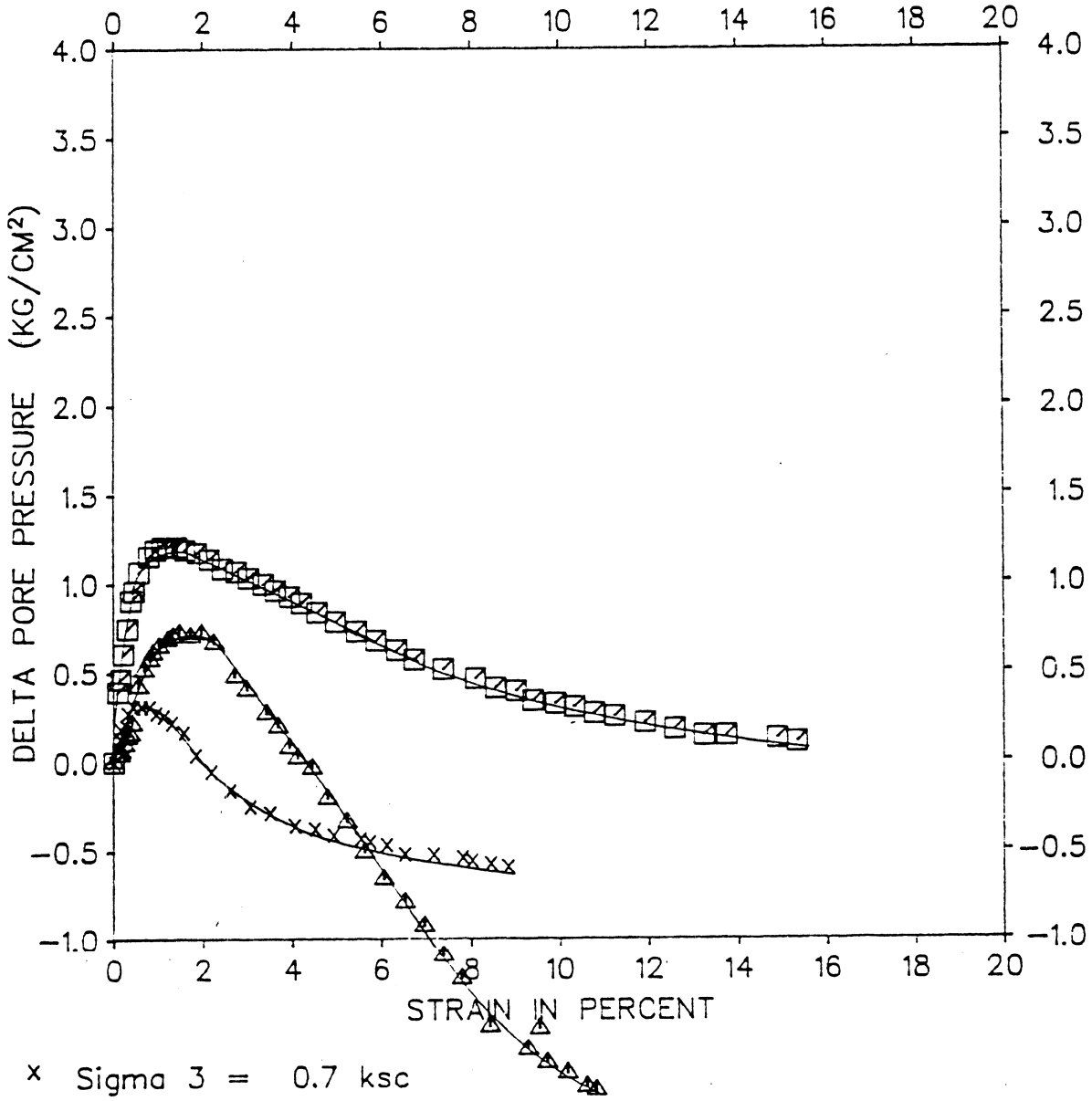
STS Consultants Ltd.

STS JOB NO. 25331

CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST

Boring:	Sample: S-1	Depth: 25-27
Boring:	Sample: S-1	Depth: 27-29
Boring:	Sample: S-1	Depth: 23-25

DELTA PORE PRESSURE vs STRAIN



× Sigma 3 = 0.7 ksc

△ Sigma 3 = 2.1 ksc

☐ Sigma 3 = 3.5 ksc

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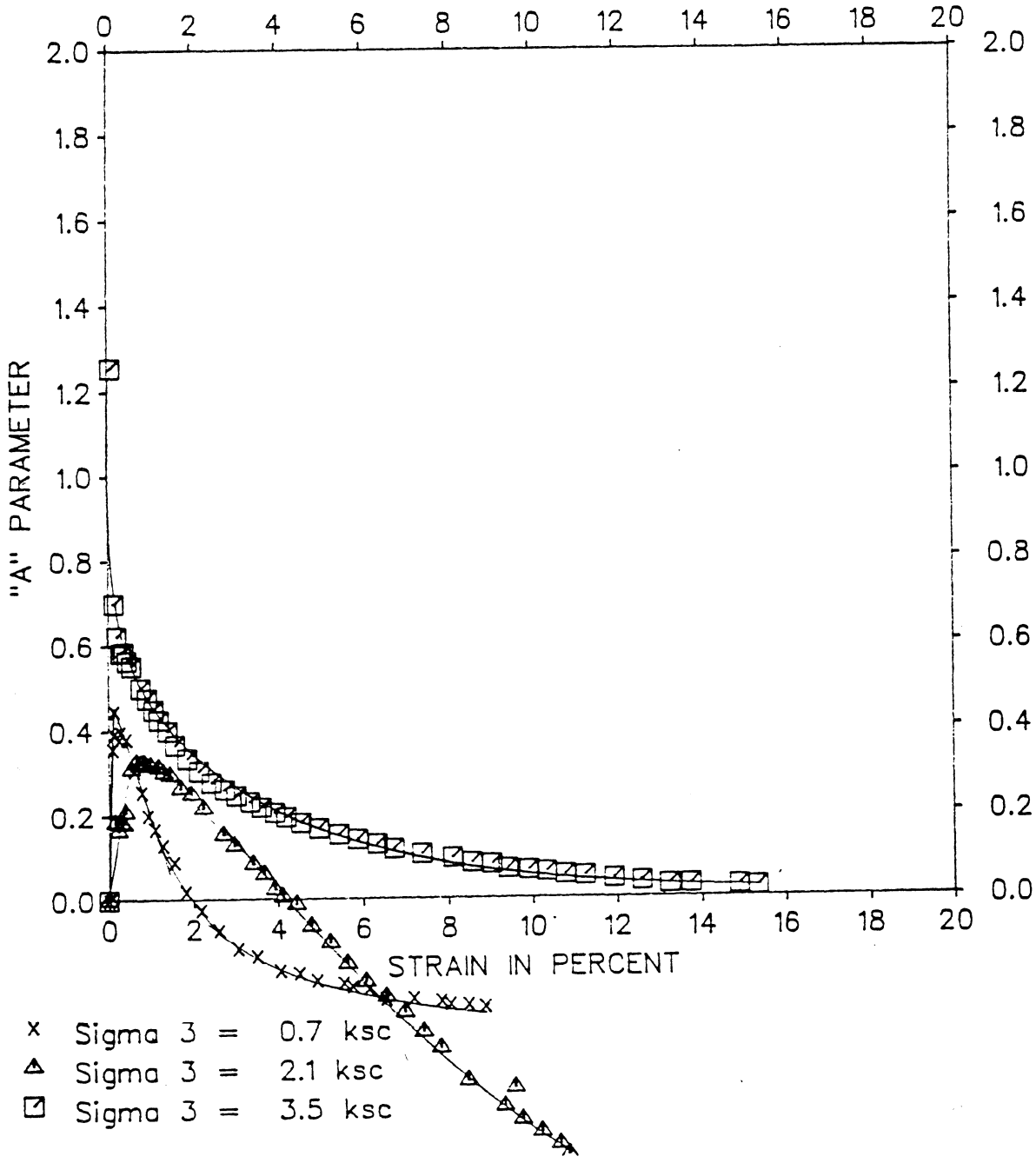
STS Consultants Ltd.

STS JOB NO. 25331

CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST

Boring:	Sample: S-1	Depth: 25-27
Boring:	Sample: S-1	Depth: 27-29
Boring:	Sample: S-1	Depth: 23-25

"A" PARAMETER vs STRAIN



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BORING:
SAMPLE: S-1
DEPTH : 25-27

STS JOB NO: 25331
EFF. SIGMA3: 0.700 KG/CM2

TEST RESULTS----------

LOAD KG	DEF MM	CORR AREA MM2	DELTA P.W.P. KG/CM2	SIGMA1 TOTAL KG/CM2	SIGMA3 TOTAL KG/CM2	SIGMA1 BAR KG/CM2	SIGMA3 BAR KG/CM2	STRAIN %	S1 - S3 KG/CM2	S1BAR/ S3BAR	P KG/CM2	PBAR KG/CM2	Q OR QBAR KG/CM2	A
0.0	0.00	3800.	0.00	0.70	0.70	0.70	0.70	0.0	0.00	1.00	0.70	0.70	0.00	0.00
7.7	0.16	3804.	0.07	0.90	0.70	0.83	0.63	0.1	0.20	1.32	0.80	0.73	0.10	0.36
12.3	0.20	3805.	0.13	1.02	0.70	0.90	0.57	0.1	0.32	1.56	0.86	0.74	0.16	0.39
15.4	0.22	3805.	0.18	1.10	0.70	0.92	0.52	0.1	0.40	1.78	0.90	0.72	0.20	0.44
20.0	0.40	3810.	0.20	1.22	0.70	1.03	0.50	0.3	0.52	2.04	0.96	0.76	0.26	0.38
26.1	0.44	3811.	0.27	1.38	0.70	1.11	0.43	0.3	0.68	2.59	1.04	0.77	0.34	0.39
30.7	0.66	3817.	0.30	1.50	0.70	1.20	0.39	0.4	0.80	3.04	1.10	0.80	0.40	0.38
38.3	0.92	3823.	0.30	1.70	0.70	1.40	0.39	0.6	1.00	3.54	1.20	0.90	0.50	0.30
46.0	1.19	3830.	0.30	1.90	0.70	1.60	0.39	0.8	1.20	4.04	1.30	1.00	0.60	0.25
52.1	1.41	3836.	0.27	2.06	0.70	1.79	0.43	0.9	1.36	4.16	1.38	1.11	0.68	0.20
58.3	1.65	3842.	0.25	2.22	0.70	1.96	0.45	1.1	1.52	4.38	1.46	1.21	0.76	0.17
64.4	1.93	3850.	0.22	2.37	0.70	2.16	0.48	1.3	1.67	4.46	1.54	1.32	0.84	0.13
70.5	2.33	3860.	0.16	2.53	0.70	2.36	0.54	1.6	1.83	4.39	1.61	1.45	0.91	0.09
78.2	2.73	3871.	0.04	2.72	0.70	2.68	0.66	1.8	2.02	4.04	1.71	1.67	1.01	0.02
82.8	3.27	3885.	-0.05	2.83	0.70	2.89	0.75	2.2	2.13	3.83	1.77	1.82	1.07	-0.03
85.8	3.90	3902.	-0.16	2.90	0.70	3.06	0.86	2.6	2.20	3.55	1.80	1.96	1.10	-0.07
84.3	4.56	3920.	-0.25	2.85	0.70	3.10	0.95	3.1	2.15	3.26	1.78	2.03	1.08	-0.12
84.3	5.24	3938.	-0.29	2.84	0.70	3.13	0.99	3.5	2.14	3.17	1.77	2.06	1.07	-0.13
84.3	6.05	3960.	-0.36	2.83	0.70	3.19	1.06	4.1	2.13	3.01	1.76	2.12	1.06	-0.17
85.8	6.71	3979.	-0.38	2.86	0.70	3.23	1.08	4.5	2.16	3.00	1.78	2.16	1.08	-0.17
85.8	7.33	3996.	-0.41	2.85	0.70	3.26	1.11	4.9	2.15	2.93	1.77	2.19	1.07	-0.19
87.4	8.25	4022.	-0.43	2.87	0.70	3.30	1.13	5.5	2.17	2.92	1.79	2.22	1.09	-0.20
87.4	8.56	4031.	-0.45	2.87	0.70	3.32	1.15	5.7	2.17	2.89	1.78	2.23	1.08	-0.21
88.9	9.12	4047.	-0.47	2.90	0.70	3.36	1.17	6.1	2.20	2.88	1.80	2.27	1.10	-0.21
88.9	9.72	4065.	-0.52	2.89	0.70	3.41	1.22	6.5	2.19	2.79	1.79	2.31	1.09	-0.24
90.4	10.68	4093.	-0.52	2.91	0.70	3.43	1.22	7.2	2.21	2.81	1.80	2.32	1.10	-0.24
91.9	11.65	4122.	-0.54	2.93	0.70	3.47	1.24	7.8	2.23	2.80	1.81	2.35	1.11	-0.24
91.9	11.97	4131.	-0.56	2.92	0.70	3.48	1.26	8.0	2.22	2.77	1.81	2.37	1.11	-0.25
95.0	12.61	4151.	-0.57	2.99	0.70	3.56	1.27	8.5	2.29	2.80	1.84	2.42	1.14	-0.25
96.5	13.19	4168.	-0.59	3.01	0.70	3.61	1.29	8.8	2.31	2.79	1.86	2.45	1.16	-0.26

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STS CONSULTANTS, LTD.

TRIAXIAL COMPRESSION TEST
CONSOLIDATED UNDRAINED - DATA

PROJECT: KENNICOTT GEOTECNICAL
BORING:
SAMPLE: S-1
DEPTH : 27-29
SOIL DESC: CLAYEY SILT TRACE FINE SAND --
LTR. YELLOW BROWN & WHITE (ML)

STS JOB NO: 25331
DATE: 3-1-88
TESTED BY: JJ
APPROVED BY: [illegible]

SPEC PREP: ENDS TRIMMED

SPECIMEN CHARACTERISTICS		INITIAL	CONSOLIDATED
DIAMETER-AVERAGE	MM	70.620	69.266
LENGTH---AVERAGE	MM	145.600	144.580
AREA	CM2	39.169	37.682
VOLUME	CM3	570.304	544.801
WET DENSITY	G/CM3	2.243	2.395
DRY DENSITY	G/CM3	2.012	2.106
WATER CONTENT	%	11.500	13.700

TEST PARAMETERS FOR CONSOLIDATION		
TOTAL SIGMA1 + BACK PRESSURE	KG/CM2	6.110
TOTAL SIGMA3 + BACK PRESSURE	KG/CM2	6.110
BACK PRESSURE	KG/CM2	4.000
EFFECTIVE SIGMA 1	KG/CM2	2.110
EFFECTIVE SIGMA 3	KG/CM2	2.110
CONSOLIDATION RATIO		1.000
STRAIN RATE	MM/MIN	0.100

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BORING:
SAMPLE: S-1
DEPTH : 27-29

STS JOB NO: 25331
EFF. SIGMA3: 2.110 KG/CM2

TEST RESULTS----------

LOAD KG	DEF MM	CORR AREA MM2	DELTA P.W.P. KG/CM2	SIGMA1 TOTAL KG/CM2	SIGMA3 TOTAL KG/CM2	SIGMA1 BAR KG/CM2	SIGMA3 BAR KG/CM2	STRAIN %	S1 - S3 KG/CM2	S1BAR/ S3BAR	P KG/CM2	PBAR KG/CM2	Q OR QBAR KG/CM2	A
0.0	0.00	3768.	0.00	2.11	2.11	2.11	2.11	0.0	0.00	1.00	2.11	2.11	0.00	0.00
11.8	0.22	3774.	0.06	2.42	2.11	2.36	2.05	0.2	0.31	1.15	2.27	2.21	0.16	0.18
22.0	0.34	3777.	0.10	2.69	2.11	2.60	2.01	0.2	0.58	1.29	2.40	2.31	0.29	0.16
27.8	0.44	3780.	0.13	2.85	2.11	2.71	1.98	0.3	0.74	1.37	2.48	2.34	0.37	0.18
32.2	0.52	3782.	0.15	2.96	2.11	2.81	1.96	0.4	0.85	1.43	2.54	2.38	0.43	0.18
38.0	0.59	3784.	0.21	3.11	2.11	2.91	1.90	0.4	1.00	1.53	2.61	2.40	0.50	0.21
51.1	0.79	3789.	0.42	3.46	2.11	3.04	1.69	0.5	1.35	1.80	2.78	2.37	0.67	0.31
59.8	0.97	3794.	0.51	3.69	2.11	3.18	1.60	0.7	1.58	1.99	2.90	2.39	0.79	0.32
67.1	1.15	3798.	0.57	3.88	2.11	3.31	1.54	0.8	1.77	2.15	2.99	2.43	0.88	0.32
71.5	1.25	3801.	0.61	3.99	2.11	3.39	1.50	0.9	1.88	2.25	3.05	2.44	0.94	0.32
77.3	1.45	3806.	0.64	4.14	2.11	3.50	1.47	1.0	2.03	2.39	3.13	2.48	1.02	0.32
83.1	1.73	3814.	0.68	4.29	2.11	3.61	1.43	1.2	2.18	2.52	3.20	2.52	1.09	0.31
89.0	1.89	3818.	0.70	4.44	2.11	3.74	1.41	1.3	2.33	2.65	3.28	2.58	1.17	0.30
93.3	2.12	3824.	0.72	4.55	2.11	3.83	1.39	1.5	2.44	2.75	3.33	2.61	1.22	0.29
102.1	2.48	3834.	0.70	4.77	2.11	4.07	1.41	1.7	2.66	2.89	3.44	2.74	1.33	0.26
110.8	2.84	3844.	0.72	4.99	2.11	4.27	1.39	2.0	2.88	3.07	3.55	2.83	1.44	0.25
118.1	3.24	3855.	0.66	5.17	2.11	4.51	1.45	2.2	3.06	3.12	3.64	2.98	1.53	0.22
119.4	3.93	3873.	0.47	5.19	2.11	4.72	1.64	2.7	3.08	2.88	3.65	3.18	1.54	0.15
120.9	4.31	3884.	0.40	5.22	2.11	4.82	1.71	3.0	3.11	2.82	3.67	3.27	1.56	0.13
123.0	4.94	3901.	0.27	5.26	2.11	5.00	1.84	3.4	3.15	2.71	3.69	3.42	1.58	0.08
124.5	5.32	3912.	0.19	5.29	2.11	5.10	1.92	3.7	3.18	2.66	3.70	3.51	1.59	0.06
125.6	5.68	3922.	0.08	5.31	2.11	5.24	2.03	3.9	3.20	2.57	3.71	3.64	1.60	0.02
127.0	5.94	3930.	0.02	5.34	2.11	5.32	2.09	4.1	3.23	2.55	3.73	3.71	1.62	0.01
127.9	6.41	3943.	-0.04	5.35	2.11	5.39	2.15	4.4	3.24	2.51	3.73	3.77	1.62	-0.01
128.7	6.91	3957.	-0.21	5.36	2.11	5.57	2.32	4.8	3.25	2.40	3.74	3.94	1.63	-0.06
131.3	7.55	3976.	-0.34	5.41	2.11	5.75	2.45	5.2	3.30	2.35	3.76	4.10	1.65	-0.10
133.4	8.12	3992.	-0.51	5.45	2.11	5.96	2.62	5.6	3.34	2.27	3.78	4.29	1.67	-0.15
135.7	8.74	4011.	-0.66	5.49	2.11	6.16	2.77	6.0	3.38	2.22	3.80	4.46	1.69	-0.20
138.3	9.43	4031.	-0.79	5.54	2.11	6.33	2.90	6.5	3.43	2.18	3.83	4.62	1.72	-0.23
139.8	10.05	4050.	-0.93	5.56	2.11	6.49	3.04	7.0	3.45	2.14	3.84	4.76	1.73	-0.27
141.7	10.67	4068.	-1.10	5.59	2.11	6.69	3.21	7.4	3.48	2.09	3.85	4.95	1.74	-0.31
142.3	11.26	4086.	-1.23	5.59	2.11	6.82	3.34	7.8	3.48	2.04	3.85	5.08	1.74	-0.35
143.3	12.19	4115.	-1.50	5.59	2.11	7.09	3.61	8.4	3.48	1.96	3.85	5.35	1.74	-0.43
140.7	13.79	4165.	-1.51	5.49	2.11	7.00	3.62	9.5	3.38	1.93	3.80	5.31	1.69	-0.45
137.6	13.42	4154.	-1.63	5.42	2.11	7.05	3.74	9.3	3.31	1.89	3.77	5.39	1.66	-0.49
135.7	14.04	4173.	-1.70	5.36	2.11	7.06	3.81	9.7	3.25	1.85	3.74	5.44	1.63	-0.52
133.5	14.70	4195.	-1.76	5.29	2.11	7.05	3.87	10.2	3.18	1.82	3.70	5.46	1.59	-0.55
132.9	15.33	4215.	-1.83	5.26	2.11	7.10	3.94	10.6	3.15	1.80	3.69	5.52	1.58	-0.58
129.0	15.63	4225.	-1.85	5.16	2.11	7.02	3.96	10.8	3.05	1.77	3.64	5.49	1.53	-0.61

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TRIAXIAL COMPRESSION TEST
CONSOLIDATED UNDRAINED - DATA

PROJECT: KENNICOTT GEOTECNICAL
BORING:
SAMPLE: S-1
DEPTH : 23-25
SOIL DESC: CLAYEY SILT TRACE FINE SAND -
LT. YELLOW BROWN & WHITE (ML)

STS JOB NO: 25331
DATE: 3-1-88
TESTED BY: JJ
APPROVED BY: [signature]

SPEC PREP: ENDS TRIMMED

SPECIMEN CHARACTERISTICS		INITIAL	CONSOLIDATED
DIAMETER-AVERAGE	MM	71.440	69.683
LENGTH---AVERAGE	MM	140.000	138.320
AREA	CM2	40.084	38.137
VOLUME	CM3	561.178	527.508
WET DENSITY	G/CM3	2.160	2.296
DRY DENSITY	G/CM3	1.913	2.035
WATER CONTENT	%	12.900	12.800

TEST PARAMETERS FOR CONSOLIDATION		
TOTAL SIGMA1 + BACK PRESSURE	KG/CM2	7.510
TOTAL SIGMA3 + BACK PRESSURE	KG/CM2	7.510
BACK PRESSURE	KG/CM2	4.000
EFFECTIVE SIGMA 1	KG/CM2	3.510
EFFECTIVE SIGMA 3	KG/CM2	3.510
CONSOLIDATION RATIO		1.000
STRAIN RATE	MM/MIN	0.100

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BORING:
SAMPLE: S-1
DEPTH : 23-25

STS JOB NO: 25331
EFF. SIGMA3: 3.510 KG/CM2

TEST RESULTS

LOAD KG	DEF MM	CORR AREA MM2	DELTA P.W.P. KG/CM2	SIGMA1 TOTAL KG/CM2	SIGMA3 TOTAL KG/CM2	SIGMA1 BAR KG/CM2	SIGMA3 BAR KG/CM2	STRAIN %	S1 - S3 KG/CM2	S1BAR/ S3BAR	P KG/CM2	PBAR KG/CM2	Q OR QBAR KG/CM2	A
0.0	0.00	3814.	0.00	3.51	3.51	3.51	3.51	0.0	0.00	1.00	3.51	3.51	0.00	0.00
11.9	0.11	3817.	0.39	3.82	3.51	3.43	3.12	0.1	0.31	1.10	3.67	3.27	0.16	1.25
25.3	0.20	3819.	0.46	4.17	3.51	3.71	3.05	0.1	0.66	1.22	3.84	3.38	0.33	0.70
37.2	0.29	3822.	0.60	4.48	3.51	3.88	2.91	0.2	0.97	1.33	4.00	3.39	0.49	0.62
49.1	0.42	3825.	0.75	4.79	3.51	4.05	2.76	0.3	1.28	1.46	4.15	3.41	0.64	0.58
59.5	0.52	3828.	0.91	5.06	3.51	4.16	2.60	0.4	1.55	1.60	4.29	3.38	0.78	0.58
65.4	0.62	3831.	0.96	5.22	3.51	4.26	2.55	0.4	1.71	1.67	4.36	3.40	0.85	0.56
74.4	0.77	3835.	1.07	5.45	3.51	4.38	2.44	0.6	1.94	1.79	4.48	3.41	0.97	0.55
89.2	1.08	3844.	1.16	5.83	3.51	4.68	2.36	0.8	2.32	1.99	4.67	3.52	1.16	0.50
96.7	1.28	3849.	1.19	6.02	3.51	4.83	2.32	0.9	2.51	2.08	4.77	3.58	1.26	0.47
104.1	1.49	3855.	1.21	6.21	3.51	5.00	2.30	1.1	2.70	2.17	4.86	3.65	1.35	0.45
110.1	1.66	3860.	1.21	6.36	3.51	5.15	2.30	1.2	2.85	2.24	4.94	3.73	1.43	0.42
117.5	1.94	3868.	1.21	6.55	3.51	5.34	2.30	1.4	3.04	2.32	5.03	3.82	1.52	0.40
126.4	2.19	3875.	1.19	6.77	3.51	5.58	2.32	1.6	3.26	2.41	5.14	3.95	1.63	0.36
136.9	2.58	3886.	1.17	7.03	3.51	5.86	2.34	1.9	3.52	2.51	5.27	4.10	1.76	0.33
145.8	2.96	3897.	1.14	7.25	3.51	6.11	2.37	2.1	3.74	2.58	5.38	4.24	1.87	0.30
153.2	3.37	3909.	1.08	7.43	3.51	6.35	2.43	2.4	3.92	2.62	5.47	4.39	1.96	0.28
160.7	3.80	3921.	1.07	7.61	3.51	6.54	2.44	2.7	4.10	2.68	5.56	4.49	2.05	0.26
165.1	4.18	3932.	1.03	7.71	3.51	6.68	2.48	3.0	4.20	2.69	5.61	4.58	2.10	0.25
169.6	4.63	3946.	1.00	7.81	3.51	6.81	2.51	3.3	4.30	2.71	5.66	4.66	2.15	0.23
174.1	5.00	3957.	0.96	7.91	3.51	6.95	2.55	3.6	4.40	2.72	5.71	4.75	2.20	0.22
178.5	5.44	3970.	0.92	8.01	3.51	7.08	2.59	3.9	4.50	2.74	5.76	4.83	2.25	0.21
181.5	5.81	3981.	0.89	8.07	3.51	7.18	2.62	4.2	4.56	2.74	5.79	4.90	2.28	0.19
184.5	6.28	3995.	0.84	8.13	3.51	7.29	2.68	4.5	4.62	2.73	5.82	4.98	2.31	0.18
187.5	6.86	4013.	0.78	8.18	3.51	7.40	2.73	5.0	4.67	2.71	5.85	5.06	2.34	0.17
191.9	7.52	4033.	0.73	8.27	3.51	7.54	2.78	5.4	4.76	2.71	5.89	5.16	2.38	0.15
193.4	8.12	4052.	0.68	8.28	3.51	7.61	2.84	5.9	4.77	2.68	5.90	5.22	2.39	0.14
194.9	8.76	4072.	0.62	8.30	3.51	7.67	2.89	6.3	4.79	2.66	5.90	5.28	2.39	0.13
196.4	9.30	4089.	0.57	8.31	3.51	7.75	2.94	6.7	4.80	2.63	5.91	5.34	2.40	0.12
199.3	10.20	4117.	0.52	8.35	3.51	7.84	2.99	7.4	4.84	2.62	5.93	5.42	2.42	0.11
199.3	11.20	4150.	0.46	8.31	3.51	7.85	3.05	8.1	4.80	2.58	5.91	5.45	2.40	0.10
200.8	11.84	4171.	0.41	8.32	3.51	7.92	3.10	8.6	4.81	2.55	5.92	5.51	2.41	0.08
202.3	12.48	4192.	0.39	8.34	3.51	7.94	3.12	9.0	4.83	2.55	5.92	5.53	2.41	0.08
202.3	13.00	4209.	0.34	8.32	3.51	7.98	3.17	9.4	4.81	2.51	5.91	5.58	2.40	0.07
203.8	13.70	4233.	0.32	8.32	3.51	8.00	3.19	9.9	4.81	2.51	5.92	5.60	2.41	0.07
206.8	14.28	4253.	0.30	8.37	3.51	8.07	3.21	10.3	4.86	2.52	5.94	5.64	2.43	0.06
206.8	14.90	4274.	0.27	8.35	3.51	8.08	3.24	10.8	4.84	2.49	5.93	5.66	2.42	0.05
205.3	15.54	4296.	0.25	8.29	3.51	8.04	3.26	11.2	4.78	2.47	5.90	5.65	2.39	0.05
203.8	16.49	4330.	0.21	8.22	3.51	8.00	3.30	11.9	4.71	2.43	5.86	5.65	2.35	0.05
202.3	17.40	4362.	0.18	8.15	3.51	7.97	3.33	12.6	4.64	2.39	5.83	5.65	2.32	0.04
200.8	18.30	4395.	0.14	8.08	3.51	7.94	3.37	13.2	4.57	2.36	5.79	5.65	2.28	0.03
197.9	19.00	4421.	0.14	7.99	3.51	7.84	3.37	13.7	4.48	2.33	5.75	5.61	2.24	0.03
197.9	20.58	4480.	0.12	7.93	3.51	7.80	3.39	14.9	4.42	2.30	5.72	5.59	2.21	0.03
196.4	21.20	4504.	0.11	7.87	3.51	7.76	3.40	15.3	4.36	2.28	5.69	5.58	2.18	0.02

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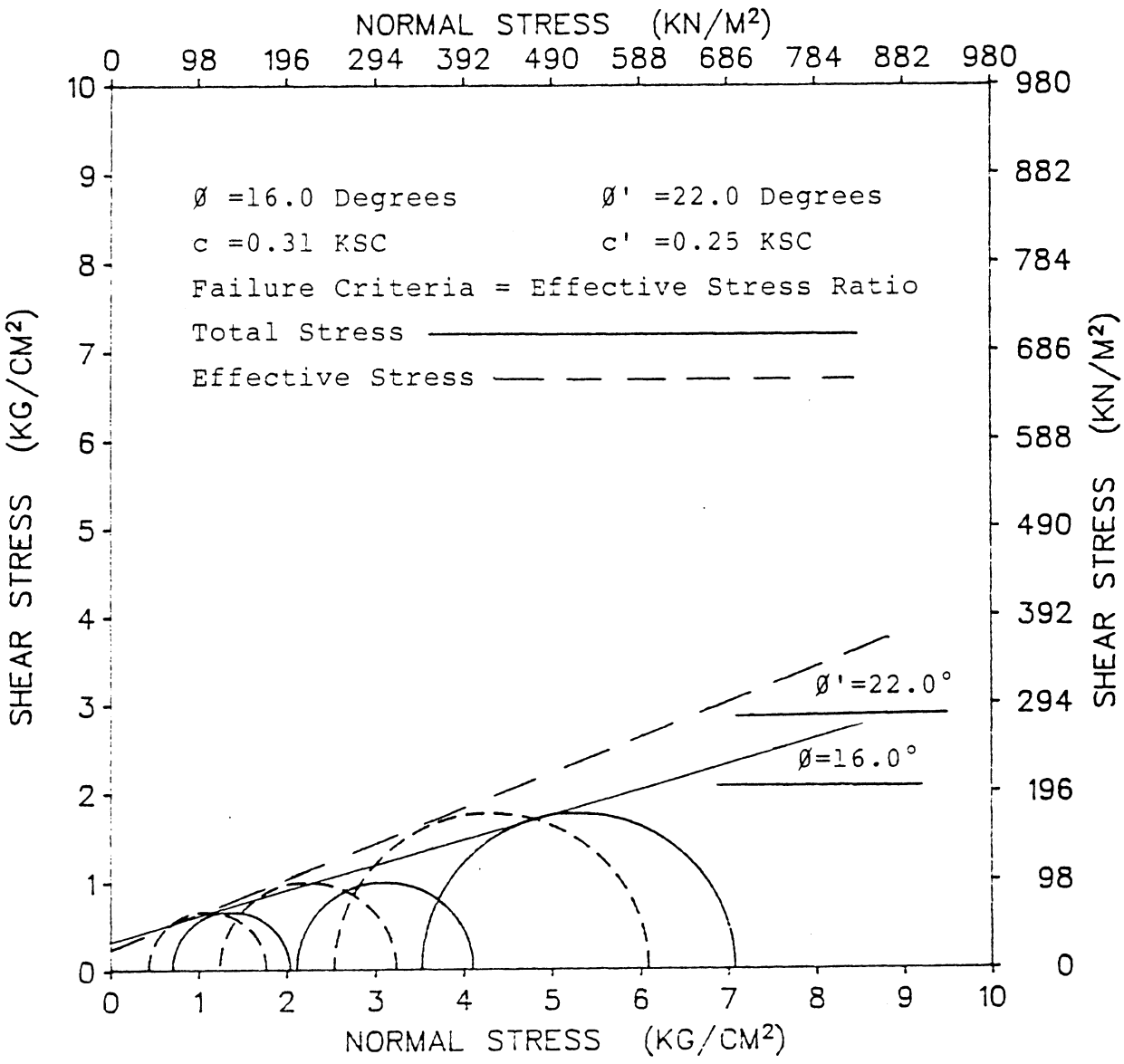
STS JOB NO. 25331

CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST

Boring: S-3	Sample: 3	Depth: 36-37
Boring: S3	Sample: S3	Depth: 37-38
Boring:	Sample: 3	Depth: 38-39

MOHR ENVELOPE



Sigma 3 = 0.7 ksc
Sigma 3 = 2.1 ksc
Sigma 3 = 3.5 ksc

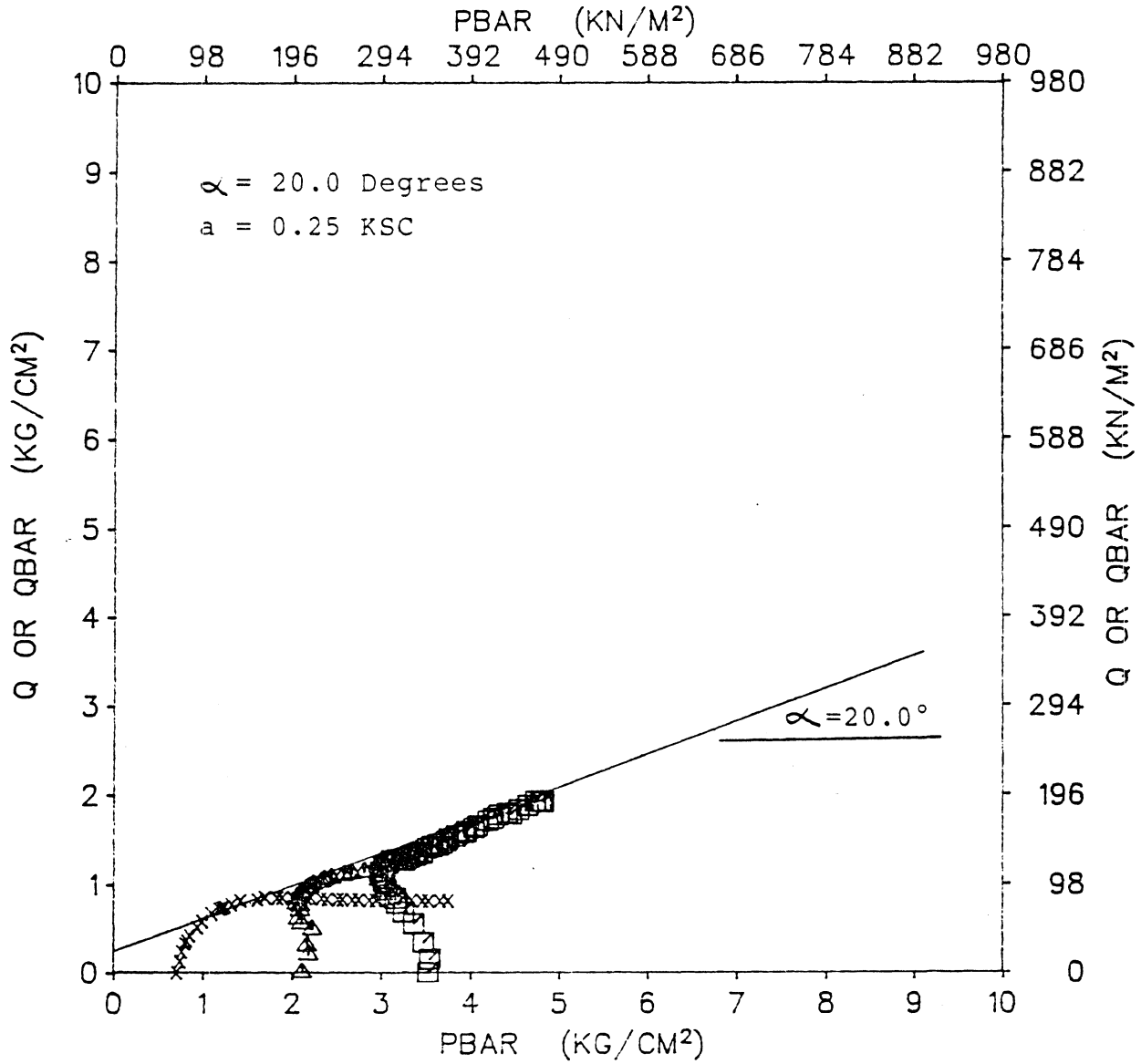
STS Consultants Ltd.

STS JOB NO. 25331

CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST

Boring: S-3	Sample: 3	Depth: 36-37
Boring: S3	Sample: S3	Depth: 37-38
Boring:	Sample: 3	Depth: 38-39

STRESS PATH PLOT



× Sigma 3 = 0.7 ksc

△ Sigma 3 = 2.1 ksc

☐ Sigma 3 = 3.5 ksc

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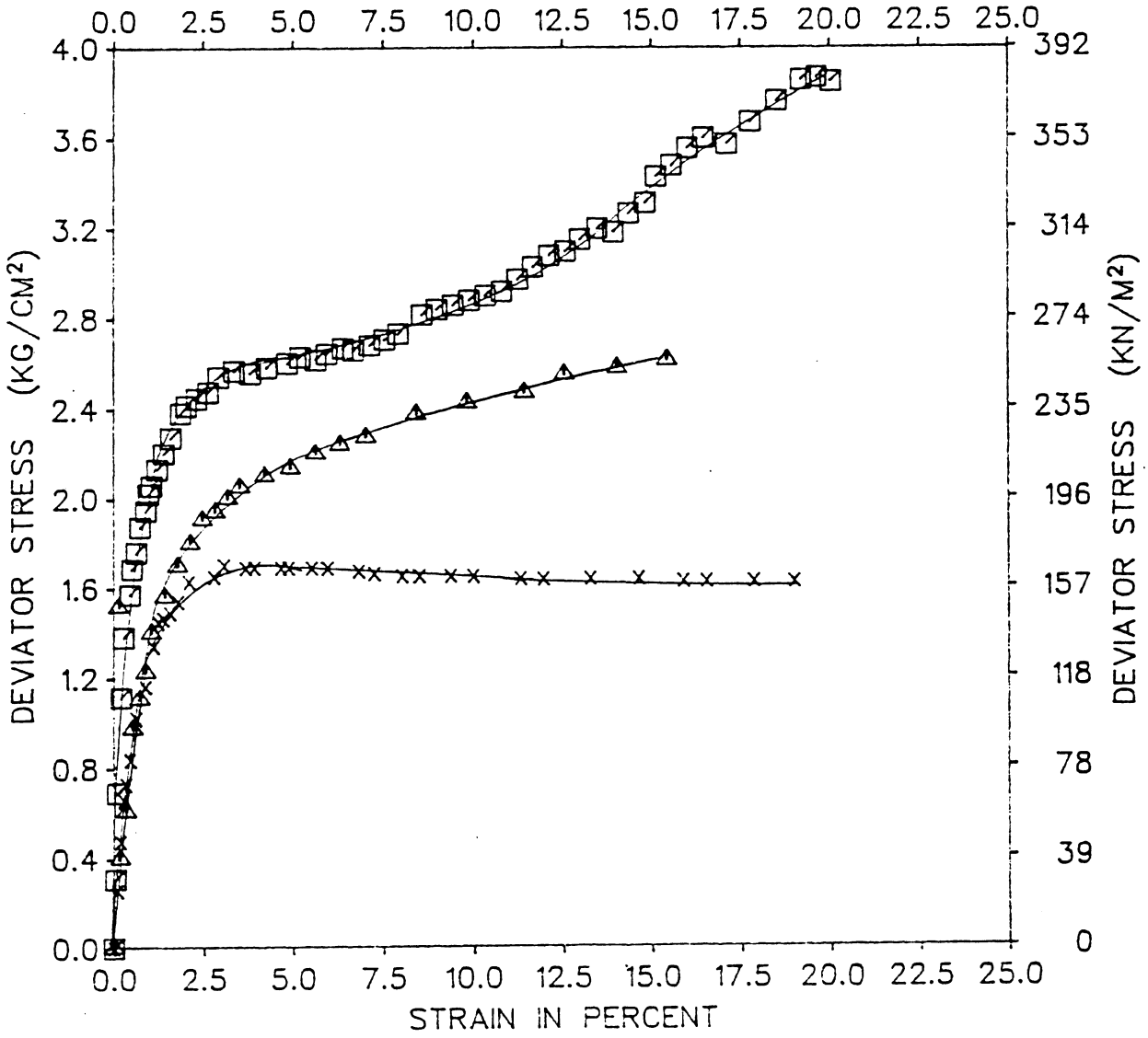
STS JOB NO. 25331

CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST

Boring: S-3	Sample: 3	Depth: 36-37
Boring: S3	Sample: S3	Depth: 37-38
Boring:	Sample: 3	Depth: 38-39

DEVIATOR STRESS vs STRAIN



× Sigma 3 = 0.7 ksc

△ Sigma 3 = 2.1 ksc

□ Sigma 3 = 3.5 ksc

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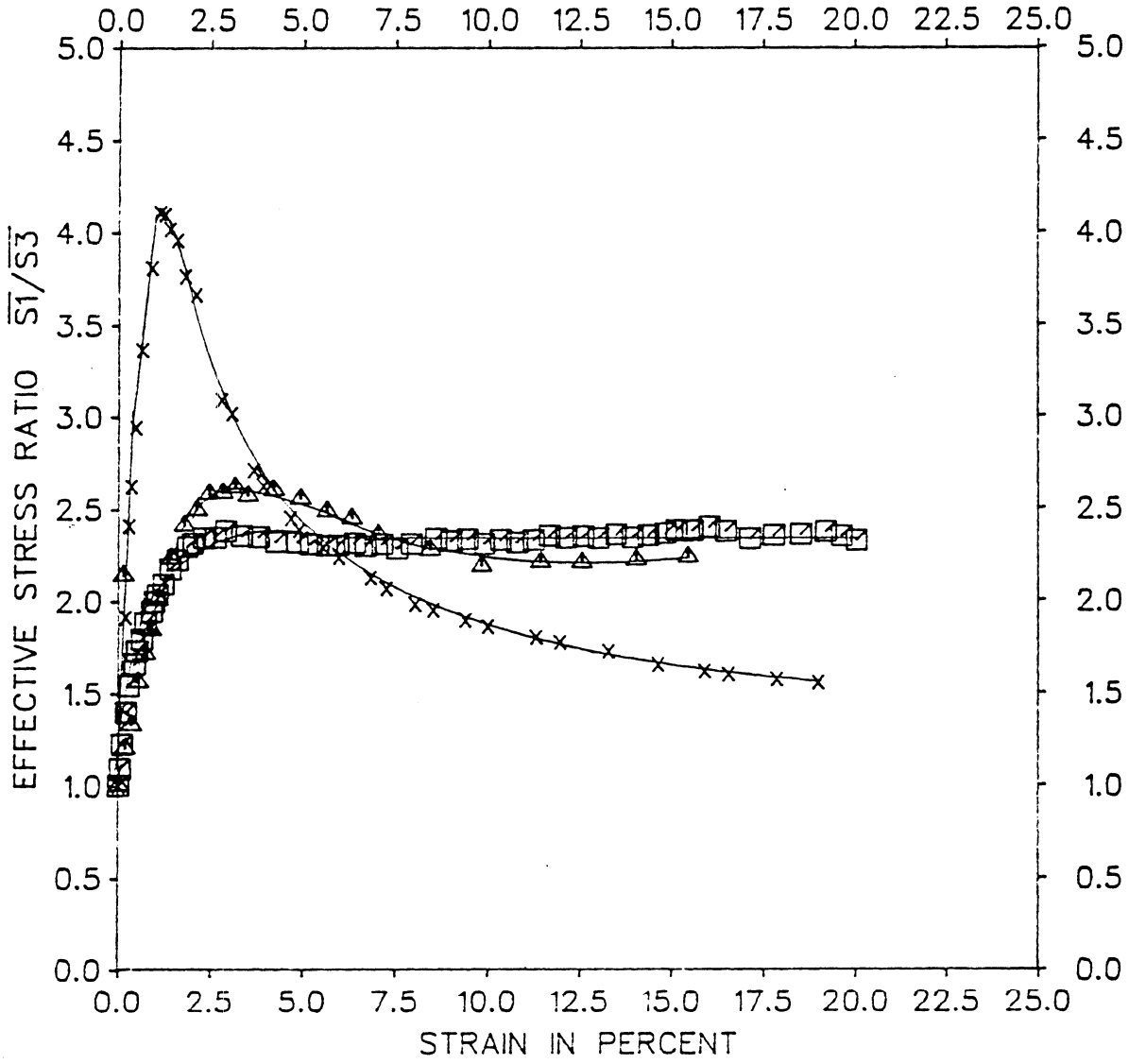
STS JOB NO. 25331

CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST

Boring: S-3	Sample: 3	Depth: 36-37
Boring: S3	Sample: S3	Depth: 37-38
Boring:	Sample: 3	Depth: 38-39

EFFECTIVE STRESS RATIO vs STRAIN



× Sigma 3 = 0.7 ksc

△ Sigma 3 = 2.1 ksc

□ Sigma 3 = 3.5 ksc

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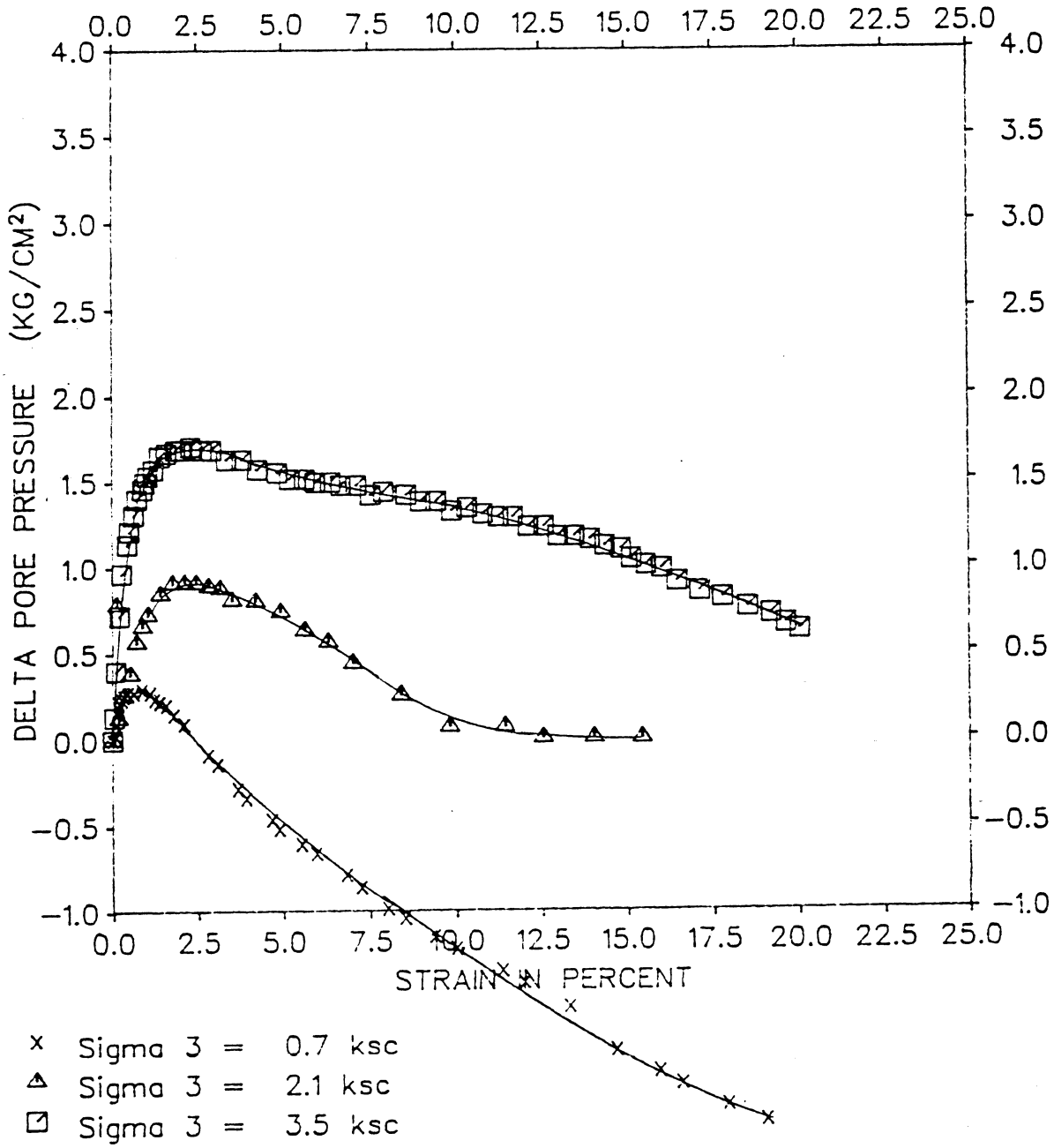
CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST

Boring: S-3	Sample: 3	Depth: 36-37
Boring: S3	Sample: S3	Depth: 37-38
Boring:	Sample: 3	Depth: 38-39

DELTA PORE PRESSURE vs STRAIN



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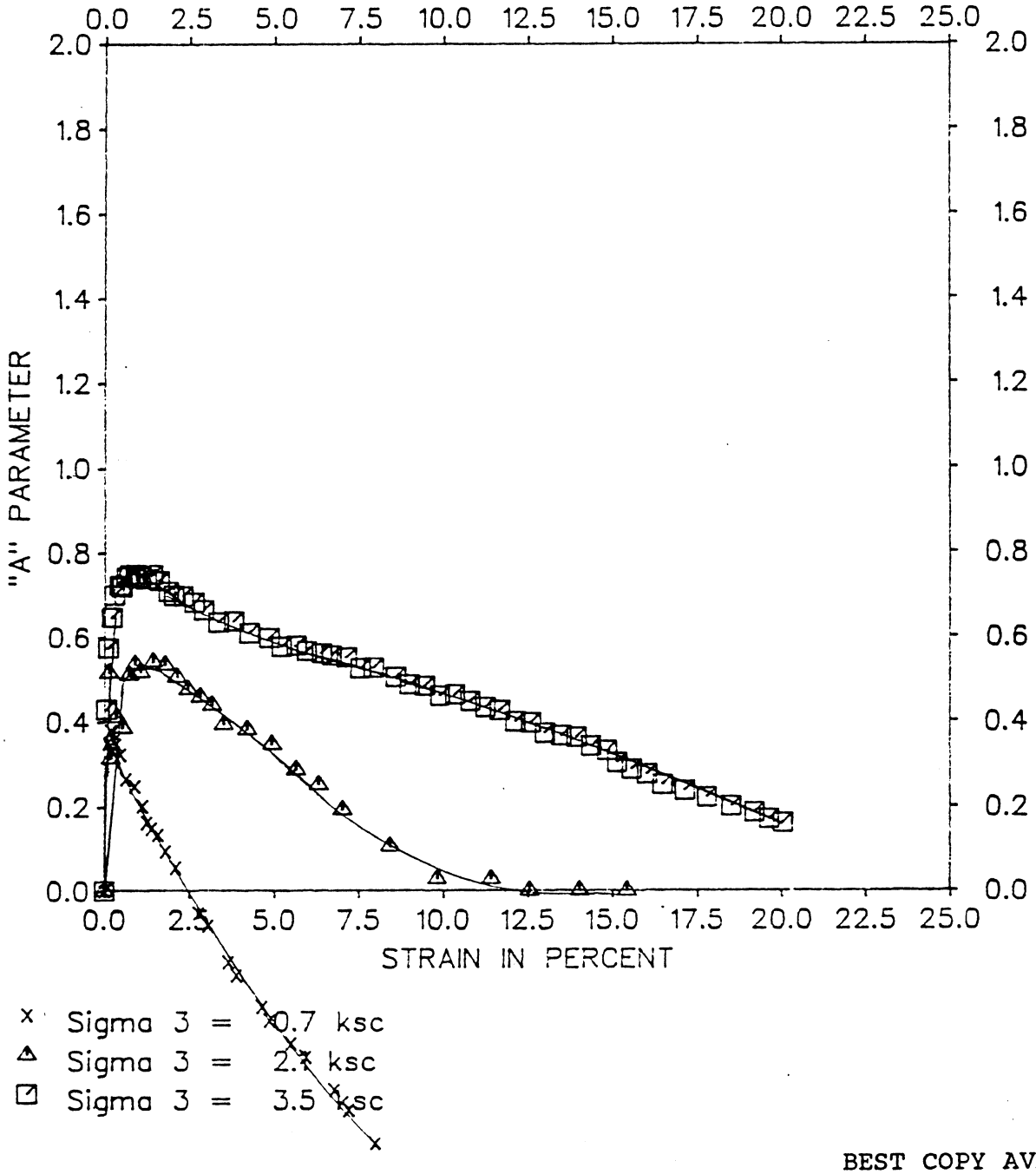
CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST

Boring: S-3	Sample: 3	Depth: 36-37
Boring: S3	Sample: S3	Depth: 37-38
Boring:	Sample: 3	Depth: 38-39

"A" PARAMETER vs STRAIN



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TRIAXIAL COMPRESSION TEST
CONSOLIDATED UNDRAINED - DATA

PROJECT: KENNICOTT GEOTECNICAL
BORING: B-3
SAMPLE: 3
DEPTH : 36-37
SOIL DESC: SILT TRACE CLAY TRACE FINE SAND &
FINE GRAVEL - BROWN (ML)

STS JOB NO: 25331
DATE: 3-7-88
TESTED BY: JJ
APPROVED BY: MG

SPEC PREP: ENDS TRIMMED

SPECIMEN CHARACTERISTICS		INITIAL	CONSOLIDATED
DIAMETER-AVERAGE	MM	73.250	73.046
LENGTH---AVERAGE	MM	144.000	143.900
AREA	CM2	42.141	41.907
VOLUME	CM3	606.831	603.039
WET DENSITY	G/CM3	2.193	2.247
DRY DENSITY	G/CM3	1.935	1.947
WATER CONTENT	%	13.300	15.400

TEST PARAMETERS FOR CONSOLIDATION		
TOTAL SIGMA1 + BACK PRESSURE	KG/CM2	4.700
TOTAL SIGMA3 + BACK PRESSURE	KG/CM2	4.700
BACK PRESSURE	KG/CM2	4.000
EFFECTIVE SIGMA 1	KG/CM2	0.700
EFFECTIVE SIGMA 3	KG/CM2	0.700
CONSOLIDATION RATIO		1.000
STRAIN RATE	MM/MIN	0.100

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BORING: S-3
SAMPLE: 3
DEPTH : 36-37

STS JOB NO: 25331
EFF. SIGMA3: 0.700 KG/CM2

TEST RESULTS----------

LOAD KG	DEF MM	CORR AREA MM2	DELTA P.W.P. KG/CM2	SIGMA1 TOTAL KG/CM2	SIGMA3 TOTAL KG/CM2	SIGMA1 EAR KG/CM2	SIGMA3 BAR KG/CM2	STRAIN %	S1 - S3 KG/CM2	S1BAR/ S3BAR	P KG/CM2	PBAR KG/CM2	Q OR QBAR KG/CM2	A
0.0	0.00	4191.	0.00	0.70	0.70	0.70	0.70	0.0	0.00	1.00	0.70	0.70	0.00	0.00
10.7	0.14	4195.	0.09	0.96	0.70	0.87	0.61	0.1	0.26	1.42	0.83	0.74	0.13	0.35
19.9	0.26	4198.	0.18	1.17	0.70	1.00	0.52	0.2	0.47	1.91	0.94	0.76	0.24	0.38
27.6	0.40	4202.	0.23	1.36	0.70	1.12	0.47	0.3	0.66	2.41	1.03	0.80	0.33	0.35
30.6	0.48	4205.	0.25	1.43	0.70	1.18	0.45	0.3	0.73	2.62	1.06	0.81	0.36	0.34
35.2	0.66	4210.	0.27	1.54	0.70	1.27	0.43	0.5	0.84	2.94	1.12	0.85	0.42	0.32
42.9	0.90	4217.	0.27	1.72	0.70	1.45	0.43	0.6	1.02	3.36	1.21	0.94	0.51	0.26
49.0	1.27	4228.	0.29	1.86	0.70	1.57	0.41	0.9	1.16	3.81	1.28	0.99	0.58	0.25
56.7	1.59	4238.	0.27	2.04	0.70	1.77	0.43	1.1	1.34	4.10	1.37	1.10	0.67	0.20
61.3	1.77	4243.	0.23	2.14	0.70	1.91	0.47	1.2	1.44	4.09	1.42	1.19	0.72	0.16
62.1	1.97	4249.	0.22	2.16	0.70	1.95	0.48	1.4	1.46	4.01	1.43	1.22	0.73	0.15
63.3	2.25	4257.	0.20	2.19	0.70	1.99	0.50	1.6	1.49	3.96	1.44	1.25	0.74	0.13
65.6	2.57	4267.	0.14	2.24	0.70	2.09	0.56	1.8	1.54	3.76	1.47	1.33	0.77	0.09
69.6	3.01	4280.	0.09	2.33	0.70	2.24	0.61	2.1	1.63	3.66	1.51	1.42	0.81	0.05
71.1	4.02	4311.	-0.09	2.35	0.70	2.44	0.79	2.8	1.65	3.09	1.52	1.61	0.82	-0.05
73.5	4.42	4323.	-0.14	2.40	0.70	2.54	0.84	3.1	1.70	3.01	1.55	1.69	0.85	-0.08
73.4	5.28	4350.	-0.29	2.39	0.70	2.68	0.99	3.7	1.69	2.71	1.54	1.83	0.84	-0.17
73.7	5.64	4362.	-0.34	2.39	0.70	2.73	1.04	3.9	1.69	2.62	1.54	1.89	0.84	-0.20
74.2	6.71	4396.	-0.47	2.39	0.70	2.86	1.17	4.7	1.69	2.45	1.54	2.01	0.84	-0.28
74.4	7.03	4406.	-0.52	2.39	0.70	2.91	1.22	4.9	1.69	2.38	1.54	2.07	0.84	-0.31
74.9	7.95	4436.	-0.61	2.39	0.70	3.00	1.31	5.5	1.69	2.29	1.54	2.16	0.84	-0.36
75.2	8.58	4456.	-0.66	2.39	0.70	3.05	1.36	6.0	1.69	2.24	1.54	2.21	0.84	-0.39
75.3	9.82	4498.	-0.79	2.37	0.70	3.16	1.49	6.8	1.67	2.12	1.54	2.33	0.84	-0.47
75.1	10.44	4518.	-0.86	2.36	0.70	3.22	1.56	7.3	1.66	2.06	1.53	2.39	0.83	-0.52
75.2	11.55	4556.	-0.99	2.35	0.70	3.34	1.69	8.0	1.65	1.98	1.53	2.51	0.83	-0.60
75.6	12.24	4580.	-1.04	2.35	0.70	3.39	1.74	8.5	1.65	1.95	1.53	2.57	0.83	-0.63
76.3	13.48	4624.	-1.15	2.35	0.70	3.50	1.85	9.4	1.65	1.89	1.53	2.67	0.83	-0.70
76.8	14.38	4656.	-1.22	2.35	0.70	3.57	1.92	10.0	1.65	1.86	1.52	2.75	0.82	-0.74
77.4	16.27	4725.	-1.35	2.34	0.70	3.69	2.05	11.3	1.64	1.80	1.52	2.87	0.82	-0.82
77.9	17.21	4760.	-1.42	2.34	0.70	3.76	2.12	12.0	1.64	1.77	1.52	2.94	0.82	-0.87
79.1	19.10	4832.	-1.56	2.34	0.70	3.90	2.26	13.3	1.64	1.72	1.52	3.08	0.82	-0.95
80.4	21.06	4909.	-1.81	2.34	0.70	4.15	2.51	14.6	1.64	1.65	1.52	3.33	0.82	-1.11
81.0	22.87	4983.	-1.94	2.33	0.70	4.26	2.64	15.9	1.63	1.62	1.51	3.45	0.81	-1.19
81.6	23.80	5021.	-2.01	2.33	0.70	4.34	2.71	16.5	1.63	1.60	1.51	3.52	0.81	-1.24
82.9	25.70	5102.	-2.14	2.32	0.70	4.46	2.84	17.9	1.62	1.57	1.51	3.65	0.81	-1.32
84.0	27.31	5172.	-2.23	2.32	0.70	4.55	2.93	19.0	1.62	1.56	1.51	3.74	0.81	-1.37

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TRIAXIAL COMPRESSION TEST
CONSOLIDATED UNDRAINED - DATA

PROJECT: KENNICOTT GEOTECNICAL
BORING: B3
SAMPLE: S3
DEPTH : 37-38
SOIL DESC: SILT TRACE CLAY TRACE F-M SAND & FINE GRAVEL - BROWN (ML)

STS JOB NO: 25331
DATE: 3-7-88
TESTED BY: JJ
APPROVED BY: MS

SPEC PREP: ENDS TRIMMED

SPECIMEN CHARACTERISTICS		INITIAL	CONSOLIDATED
DIAMETER-AVERAGE	MM	72.090	71.121
LENGTH---AVERAGE	MM	144.350	142.730
AREA	CM2	40.817	39.727
VOLUME	CM3	589.192	567.021
WET DENSITY	G/CM3	2.147	2.206
DRY DENSITY	G/CM3	1.882	1.956
WATER CONTENT	%	14.100	12.800

TEST PARAMETERS FOR CONSOLIDATION		
TOTAL SIGMA1 + BACK PRESSURE	KG/CM2	6.110
TOTAL SIGMA3 + BACK PRESSURE	KG/CM2	6.110
BACK PRESSURE	KG/CM2	4.000
EFFECTIVE SIGMA 1	KG/CM2	2.110
EFFECTIVE SIGMA 3	KG/CM2	2.110
CONSOLIDATION RATIO		1.000
STRAIN RATE	MM/MIN	0.100

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BORING: B3
SAMPLE: S3
DEPTH : 37-38

STS JOB NO: 25331
EFF. SIGMA3: 2.110 KG/CM2

TEST RESULTS----------

LOAD KG	DEF MM	CORR AREA MM2	DELTA P.W.P. KG/CM2	SIGMA1 TOTAL KG/CM2	SIGMA3 TOTAL KG/CM2	SIGMA1 BAR KG/CM2	SIGMA3 BAR KG/CM2	STRAIN %	S1 - S3 KG/CM2	S1BAR/ S3BAR	P KG/CM2	PBAR KG/CM2	Q OR QBAR KG/CM2	A
0.0	0.00	3973.	0.00	2.11	2.11	2.11	2.11	0.0	0.00	1.00	2.11	2.11	0.00	0.00
15.9	0.25	3980.	0.13	2.51	2.11	2.38	1.99	0.2	0.40	1.20	2.31	2.18	0.20	0.31
24.3	0.50	3987.	0.25	2.72	2.11	2.47	1.86	0.4	0.61	1.33	2.41	2.16	0.30	0.41
38.9	0.75	3994.	0.38	3.08	2.11	2.71	1.74	0.5	0.97	1.56	2.60	2.22	0.49	0.38
44.2	1.02	4001.	0.56	3.21	2.11	2.65	1.55	0.7	1.10	1.71	2.66	2.10	0.55	0.51
49.1	1.26	4008.	0.66	3.34	2.11	2.68	1.45	0.9	1.23	1.84	2.72	2.07	0.61	0.54
56.2	1.48	4014.	0.72	3.51	2.11	2.79	1.39	1.0	1.40	2.01	2.81	2.09	0.70	0.52
60.3	0.18	3978.	0.78	3.63	2.11	2.84	1.33	0.1	1.52	2.14	2.87	2.09	0.76	0.52
62.9	2.01	4029.	0.84	3.67	2.11	2.83	1.27	1.4	1.56	2.23	2.89	2.05	0.78	0.54
68.7	2.52	4044.	0.91	3.81	2.11	2.90	1.20	1.8	1.70	2.41	2.96	2.05	0.85	0.53
73.0	3.03	4059.	0.91	3.91	2.11	3.00	1.20	2.1	1.80	2.50	3.01	2.10	0.90	0.50
77.6	3.51	4073.	0.91	4.02	2.11	3.11	1.20	2.5	1.91	2.58	3.06	2.16	0.95	0.48
79.3	4.03	4088.	0.89	4.05	2.11	3.16	1.22	2.8	1.94	2.59	3.08	2.19	0.97	0.46
82.0	4.52	4103.	0.88	4.11	2.11	3.23	1.24	3.2	2.00	2.62	3.11	2.23	1.00	0.44
84.4	5.01	4117.	0.81	4.16	2.11	3.35	1.30	3.5	2.05	2.57	3.13	2.33	1.02	0.39
87.1	6.00	4147.	0.80	4.21	2.11	3.41	1.31	4.2	2.10	2.60	3.16	2.36	1.05	0.38
89.2	7.03	4178.	0.74	4.24	2.11	3.51	1.37	4.9	2.13	2.56	3.18	2.44	1.07	0.35
92.6	8.04	4210.	0.63	4.31	2.11	3.68	1.48	5.6	2.20	2.49	3.21	2.58	1.10	0.29
95.0	9.01	4240.	0.56	4.35	2.11	3.79	1.55	6.3	2.24	2.45	3.23	2.67	1.12	0.25
97.2	10.02	4273.	0.44	4.38	2.11	3.95	1.67	7.0	2.27	2.36	3.25	2.81	1.14	0.19
103.0	12.02	4338.	0.25	4.48	2.11	4.23	1.86	8.4	2.37	2.28	3.30	3.05	1.19	0.11
106.8	14.01	4405.	0.07	4.53	2.11	4.47	2.04	9.8	2.42	2.19	3.32	3.25	1.21	0.03
110.7	16.30	4485.	0.07	4.58	2.11	4.51	2.04	11.4	2.47	2.21	3.34	3.28	1.23	0.03
115.7	17.91	4543.	0.00	4.66	2.11	4.66	2.11	12.5	2.55	2.21	3.38	3.38	1.27	0.00
119.0	20.03	4621.	0.00	4.69	2.11	4.68	2.11	14.0	2.58	2.22	3.40	3.40	1.29	0.00
122.6	22.03	4698.	0.00	4.72	2.11	4.72	2.11	15.4	2.61	2.24	3.41	3.41	1.30	0.00

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TRIAXIAL COMPRESSION TEST
CONSOLIDATED UNDRAINED - DATA

PROJECT: KENNICOTT GEOTECNICAL
BORING:
SAMPLE: 3
DEPTH : 38-39
SOIL DESC: SILT TRACE CLAY TRACE F-M SAND & FINE GRAVEL - BROWN (ML)

STS JOB NO: 25331.
DATE: 3-7-88
TESTED BY: JJ
APPROVED BY: [signature]

SPEC PREP: ENDS TRIMMED

SPECIMEN CHARACTERISTICS		INITIAL	CONSOLIDATED
DIAMETER-AVERAGE	MM	71.520	69.434
LENGTH---AVERAGE	MM	142.600	138.970
AREA	CM2	40.174	37.864
VOLUME	CM3	572.881	526.199
WET DENSITY	G/CM3	2.145	2.309
DRY DENSITY	G/CM3	1.909	2.078
WATER CONTENT	%	12.400	11.100

TEST PARAMETERS FOR CONSOLIDATION		
TOTAL SIGMA1 + BACK PRESSURE	KG/CM2	7.520
TOTAL SIGMA3 + BACK PRESSURE	KG/CM2	7.520
BACK PRESSURE	KG/CM2	4.000
EFFECTIVE SIGMA 1	KG/CM2	3.520
EFFECTIVE SIGMA 3	KG/CM2	3.520
CONSOLIDATION RATIO		1.000
STRAIN RATE	MM/MIN	0.100

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BORING:
SAMPLE: 3
DEPTH : 38-39

STS JOB NO: 25331
EFF. SIGMA3: 3.520 KG/CM2

TEST RESULTS----------

LOAD KG	DEF MM	CORR AREA MM2	DELTA P.W.P. KG/CM2	SIGMA1 TOTAL KG/CM2	SIGMA3 TOTAL KG/CM2	SIGMA1 BAR KG/CM2	SIGMA3 BAR KG/CM2	STRAIN %	S1 - S3 KG/CM2	S1BAR/ S3BAR	P KG/CM2	PBAR KG/CM2	Q OR QBAR KG/CM2	A
0.0	0.00	3786.	0.00	3.52	3.52	3.52	3.52	0.0	0.00	1.00	3.52	3.52	0.00	0.00
11.7	0.06	3788.	0.13	3.83	3.52	3.70	3.39	0.0	0.31	1.09	3.67	3.54	0.15	0.43
26.2	0.14	3790.	0.40	4.21	3.52	3.81	3.12	0.1	0.69	1.22	3.87	3.47	0.35	0.57
42.2	0.28	3794.	0.72	4.63	3.52	3.91	2.80	0.2	1.11	1.40	4.08	3.36	0.56	0.65
52.4	0.38	3797.	0.97	4.90	3.52	3.94	2.55	0.3	1.38	1.54	4.21	3.25	0.69	0.70
59.7	0.61	3803.	1.14	5.09	3.52	3.95	2.38	0.4	1.57	1.66	4.30	3.17	0.78	0.72
64.1	0.69	3805.	1.21	5.20	3.52	3.99	2.31	0.5	1.68	1.73	4.36	3.15	0.84	0.72
67.0	0.87	3810.	1.31	5.28	3.52	3.97	2.21	0.6	1.76	1.79	4.40	3.09	0.88	0.74
71.4	1.01	3814.	1.40	5.39	3.52	3.99	2.12	0.7	1.87	1.88	4.46	3.06	0.94	0.75
74.3	1.23	3820.	1.46	5.46	3.52	4.01	2.06	0.9	1.94	1.94	4.49	3.04	0.97	0.75
77.2	1.33	3823.	1.50	5.54	3.52	4.04	2.02	1.0	2.02	2.00	4.53	3.03	1.01	0.74
78.7	1.45	3826.	1.53	5.58	3.52	4.04	1.99	1.0	2.06	2.03	4.55	3.02	1.03	0.75
81.6	1.67	3832.	1.57	5.65	3.52	4.08	1.95	1.2	2.13	2.09	4.58	3.01	1.06	0.74
84.5	1.93	3840.	1.65	5.72	3.52	4.07	1.87	1.4	2.20	2.17	4.62	2.97	1.10	0.75
87.4	2.20	3847.	1.67	5.79	3.52	4.13	1.85	1.6	2.27	2.22	4.66	2.99	1.14	0.73
91.8	2.58	3858.	1.68	5.90	3.52	4.22	1.84	1.9	2.38	2.30	4.71	3.03	1.19	0.71
93.2	2.80	3864.	1.68	5.93	3.52	4.25	1.84	2.0	2.41	2.31	4.73	3.04	1.21	0.70
94.7	3.20	3876.	1.70	5.96	3.52	4.26	1.82	2.3	2.44	2.34	4.74	3.04	1.22	0.70
96.1	3.65	3889.	1.68	5.99	3.52	4.31	1.84	2.6	2.47	2.35	4.76	3.07	1.24	0.68
99.0	4.05	3900.	1.68	6.06	3.52	4.37	1.84	2.9	2.54	2.38	4.79	3.11	1.27	0.66
100.5	4.65	3918.	1.63	6.09	3.52	4.46	1.89	3.3	2.57	2.36	4.80	3.18	1.28	0.63
100.5	5.28	3936.	1.63	6.07	3.52	4.45	1.89	3.8	2.55	2.35	4.80	3.17	1.28	0.64
102.0	5.92	3955.	1.57	6.10	3.52	4.53	1.95	4.3	2.58	2.32	4.81	3.24	1.29	0.61
103.4	6.73	3979.	1.55	6.12	3.52	4.57	1.97	4.8	2.60	2.32	4.82	3.27	1.30	0.60
104.9	7.23	3994.	1.51	6.15	3.52	4.63	2.01	5.2	2.63	2.31	4.83	3.32	1.31	0.58
104.9	7.84	4013.	1.51	6.13	3.52	4.62	2.01	5.6	2.61	2.30	4.83	3.31	1.31	0.58
106.3	8.26	4026.	1.50	6.16	3.52	4.67	2.02	5.9	2.64	2.30	4.84	3.35	1.32	0.57
107.8	8.88	4045.	1.50	6.19	3.52	4.69	2.02	6.4	2.67	2.32	4.85	3.36	1.33	0.56
107.8	9.29	4058.	1.48	6.18	3.52	4.70	2.04	6.7	2.66	2.30	4.85	3.37	1.33	0.56
109.2	9.91	4077.	1.48	6.20	3.52	4.72	2.04	7.1	2.68	2.31	4.86	3.38	1.34	0.55
110.7	10.47	4095.	1.42	6.22	3.52	4.80	2.10	7.5	2.70	2.29	4.87	3.45	1.35	0.52
112.2	11.00	4112.	1.44	6.25	3.52	4.81	2.08	7.9	2.73	2.31	4.88	3.45	1.36	0.53
116.5	11.92	4142.	1.42	6.33	3.52	4.91	2.10	8.6	2.81	2.34	4.93	3.51	1.41	0.50
118.0	12.49	4160.	1.38	6.36	3.52	4.98	2.14	9.0	2.84	2.33	4.94	3.56	1.42	0.49
119.4	13.11	4181.	1.38	6.38	3.52	4.99	2.14	9.4	2.86	2.34	4.95	3.57	1.43	0.48
120.9	13.74	4202.	1.32	6.40	3.52	5.07	2.20	9.9	2.88	2.31	4.96	3.63	1.44	0.46
122.4	14.36	4223.	1.34	6.42	3.52	5.08	2.18	10.3	2.90	2.33	4.97	3.63	1.45	0.46
123.8	14.99	4244.	1.31	6.44	3.52	5.13	2.21	10.8	2.92	2.32	4.98	3.67	1.46	0.45
126.7	15.61	4266.	1.29	6.49	3.52	5.20	2.23	11.2	2.97	2.33	5.01	3.72	1.49	0.43
129.6	16.21	4286.	1.29	6.54	3.52	5.26	2.23	11.7	3.02	2.35	5.03	3.74	1.51	0.43
132.5	16.84	4309.	1.23	6.60	3.52	5.37	2.29	12.1	3.08	2.34	5.06	3.83	1.54	0.40
134.0	17.48	4331.	1.23	6.61	3.52	5.38	2.29	12.6	3.09	2.35	5.07	3.84	1.55	0.40
136.9	18.05	4352.	1.17	6.67	3.52	5.49	2.35	13.0	3.15	2.34	5.09	3.92	1.57	0.37
139.8	18.73	4376.	1.17	6.71	3.52	5.54	2.35	13.5	3.19	2.36	5.12	3.94	1.60	0.37
139.8	19.36	4399.	1.15	6.70	3.52	5.54	2.37	13.9	3.18	2.34	5.11	3.96	1.59	0.36
144.2	19.96	4421.	1.12	6.78	3.52	5.67	2.40	14.4	3.26	2.36	5.15	4.03	1.63	0.34
147.1	20.61	4446.	1.10	6.83	3.52	5.73	2.42	14.8	3.31	2.37	5.17	4.08	1.65	0.33

TEST RESULTS----------CONTINUED FROM PREVIOUS PAGE----------

LOAD	DEF	CORR AREA	DELTA P.W.P.	SIGMA1 TOTAL	SIGMA3 TOTAL	SIGMA1 BAR	SIGMA3 BAR	STRAIN	S1 - S3	S1BAR/ S3BAR	P	PBAR	Q OR QBAR	A
KG	MM	MM2	KG/CM2	KG/CM2	KG/CM2	KG/CM2	KG/CM2	%	KG/CM2		KG/CM2	KG/CM2	KG/CM2	
160.2	22.26	4509.	0.98	7.07	3.52	6.09	2.54	16.0	3.55	2.40	5.30	4.31	1.78	0.28
163.1	22.88	4533.	0.91	7.12	3.52	6.21	2.61	16.5	3.60	2.38	5.32	4.41	1.80	0.25
163.1	23.79	4568.	0.85	7.09	3.52	6.24	2.67	17.1	3.57	2.34	5.31	4.45	1.79	0.24
169.0	24.71	4605.	0.81	7.19	3.52	6.38	2.71	17.8	3.67	2.36	5.35	4.54	1.83	0.22
174.8	25.72	4646.	0.76	7.28	3.52	6.53	2.76	18.5	3.76	2.36	5.40	4.64	1.88	0.20
180.6	26.67	4686.	0.72	7.37	3.52	6.66	2.80	19.2	3.85	2.38	5.45	4.73	1.93	0.19
182.1	27.27	4711.	0.66	7.39	3.52	6.72	2.86	19.6	3.87	2.35	5.45	4.79	1.93	0.17
182.1	27.84	4735.	0.62	7.37	3.52	6.74	2.90	20.0	3.85	2.33	5.44	4.82	1.92	0.16

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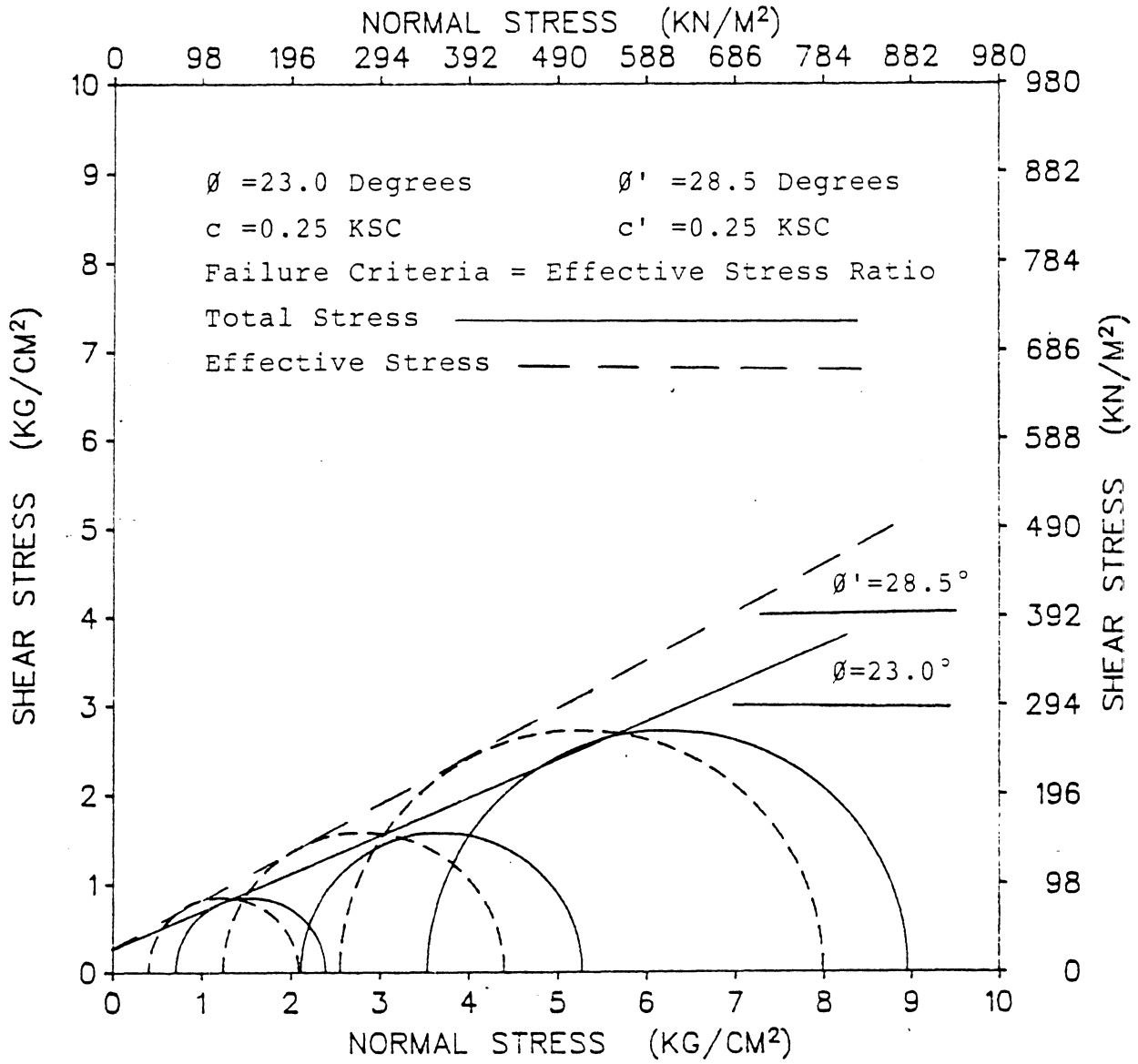
STS JOB NO. 25331

CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST

Boring: S-5	Sample: SS4	Depth: 18-20
Boring: S-5	Sample: SS6	Depth: 22-24
Boring: S-5	Sample: SS4	Depth: 25-27

MOHR ENVELOPE



Sigma 3 = 0.7 ksc
Sigma 3 = 2.1 ksc
Sigma 3 = 3.5 ksc

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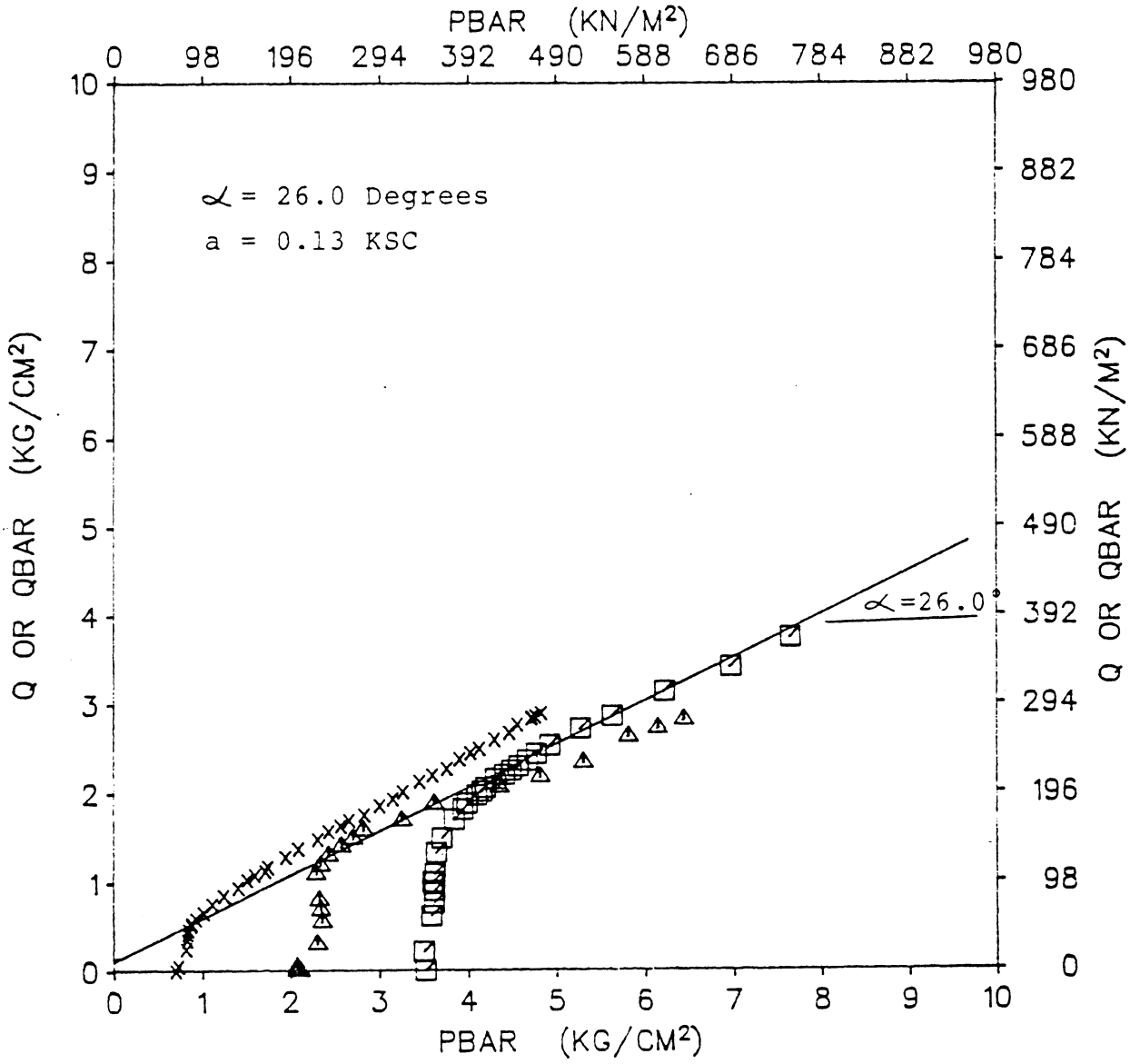
STS Consultants Ltd.

STS JOB NO. 25331

CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST

Boring: S-5	Sample: SS4	Depth: 18-20
Boring: S-5	Sample: SS6	Depth: 22-24
Boring: S-5	Sample: SS4	Depth: 25-27

STRESS PATH PLOT



× Sigma 3 = 0.7 ksc

△ Sigma 3 = 2.1 ksc

⊡ Sigma 3 = 3.5 ksc

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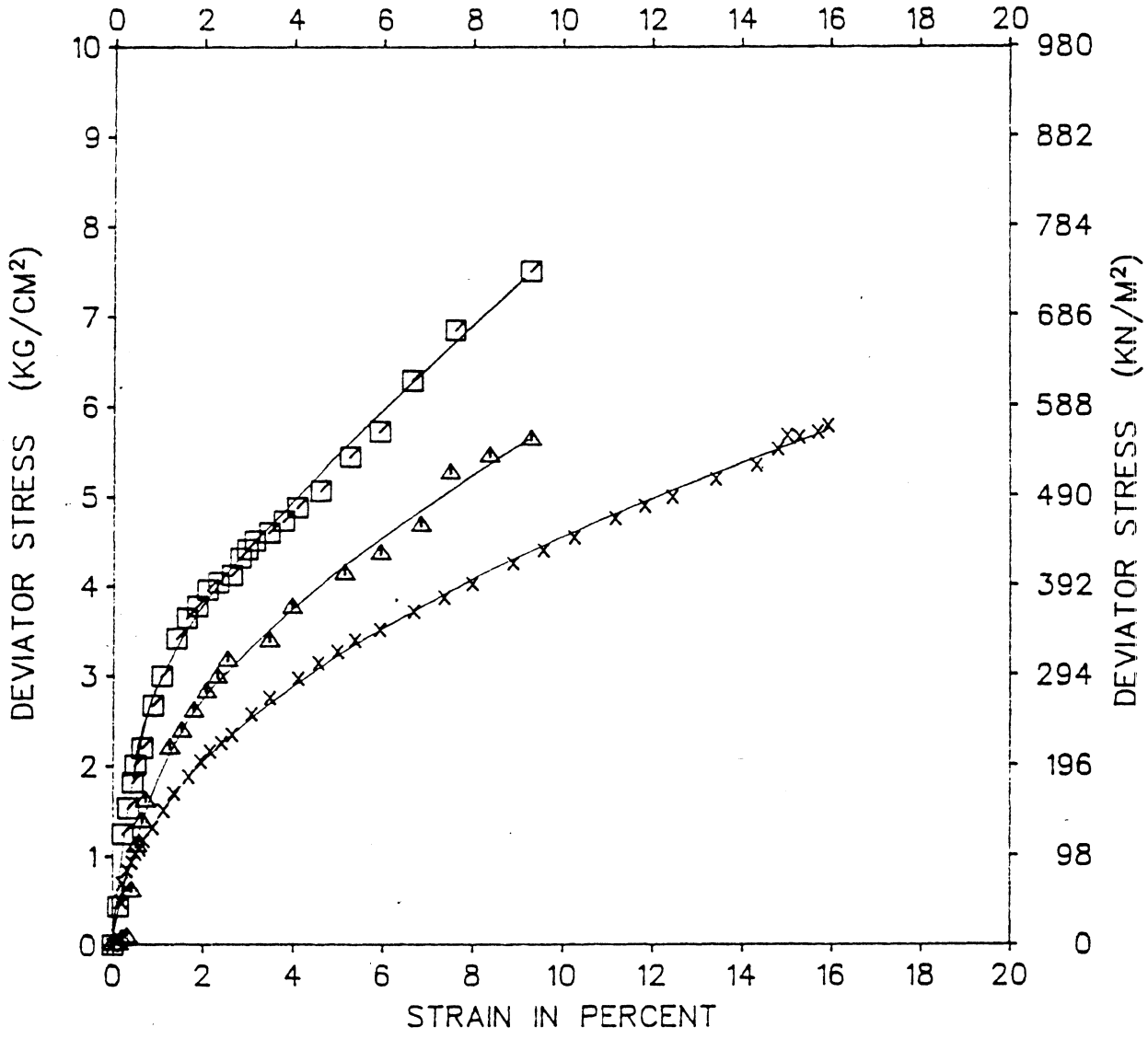
STS JOB NO. 25331

CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST

Boring: S-5 Sample: SS4 Depth: 18-20
Boring: S-5 Sample: SS6 Depth: 22-24
Boring: S-5 Sample: SS4 Depth: 25-27

DEVIATOR STRESS vs STRAIN



× Sigma 3 = 0.7 ksc
△ Sigma 3 = 2.1 ksc
□ Sigma 3 = 3.5 ksc

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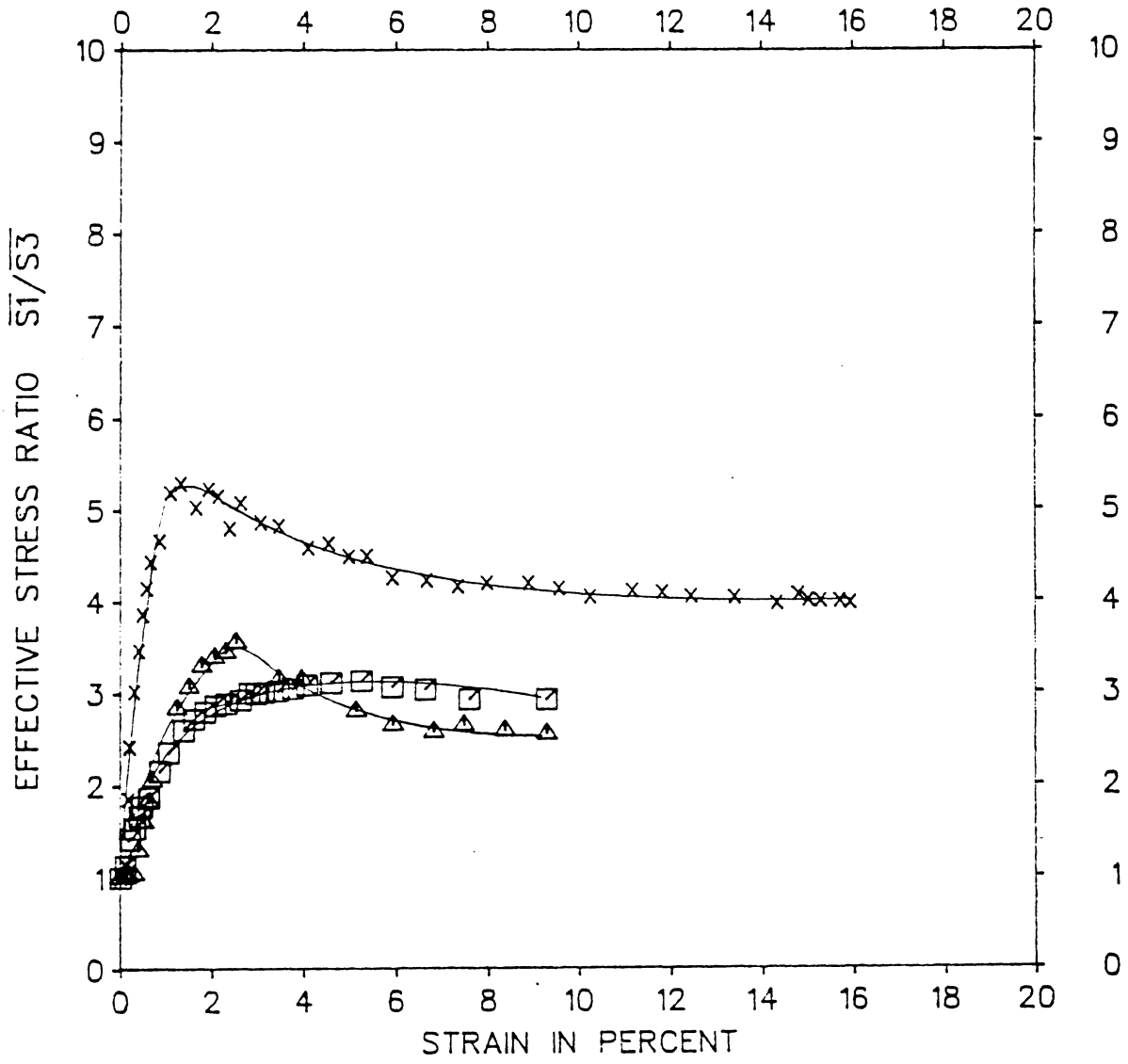
STS JOB NO. 25331

CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST

Boring: S-5	Sample: SS4	Depth: 18-20
Boring: S-5	Sample: SS6	Depth: 22-24
Boring: S-5	Sample: SS4	Depth: 25-27

EFFECTIVE STRESS RATIO vs STRAIN



× Sigma 3 = 0.7 ksc

△ Sigma 3 = 2.1 ksc

□ Sigma 3 = 3.5 ksc

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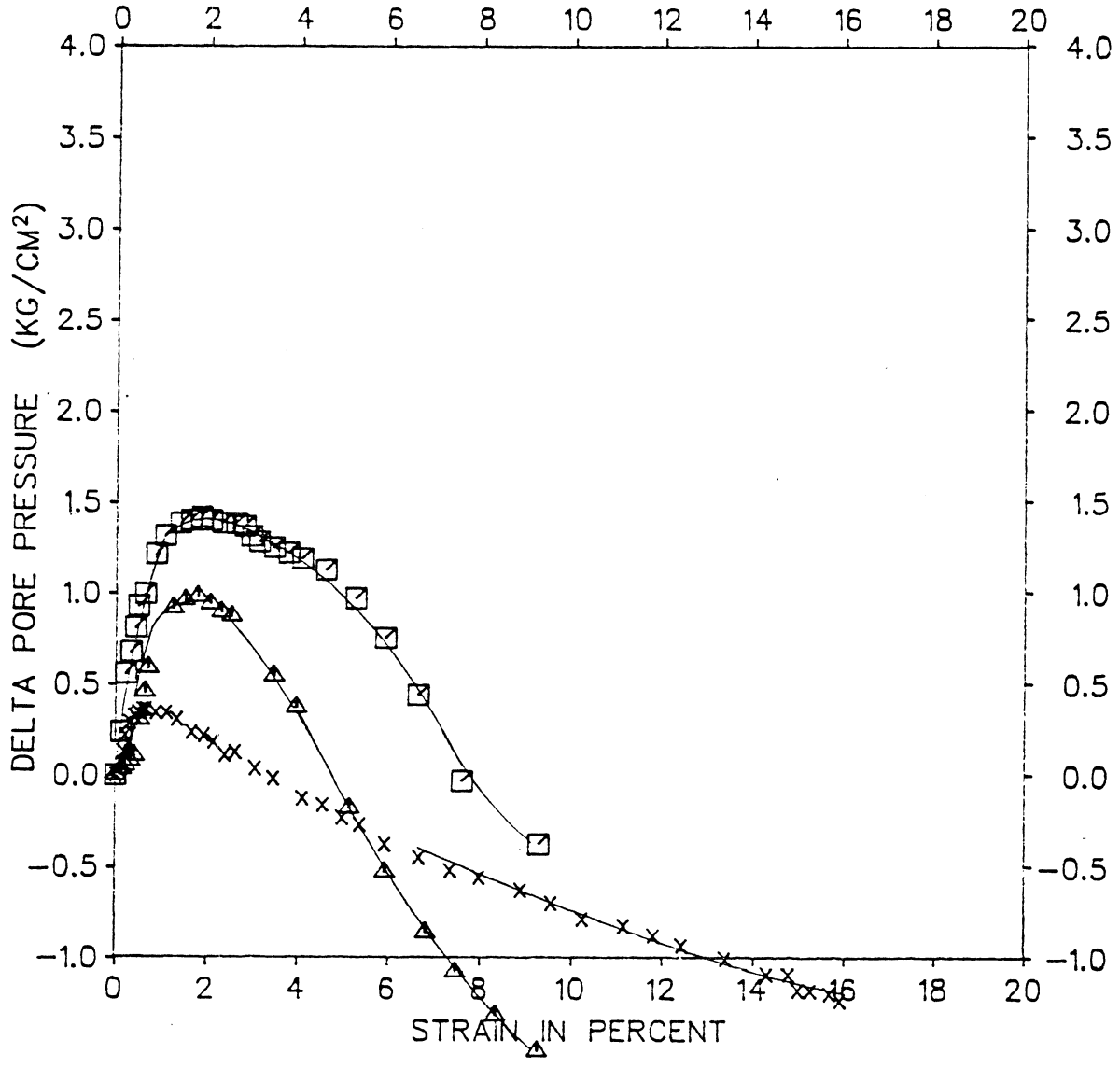
CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST

Boring: S-5 Sample: SS4 Depth: 18-20
Boring: S-5 Sample: SS6 Depth: 22-24
Boring: S-5 Sample: SS4 Depth: 25-27

DELTA PORE PRESSURE vs STRAIN



× Sigma 3 = 0.7 ksc
△ Sigma 3 = 2.1 ksc
☐ Sigma 3 = 3.5 ksc

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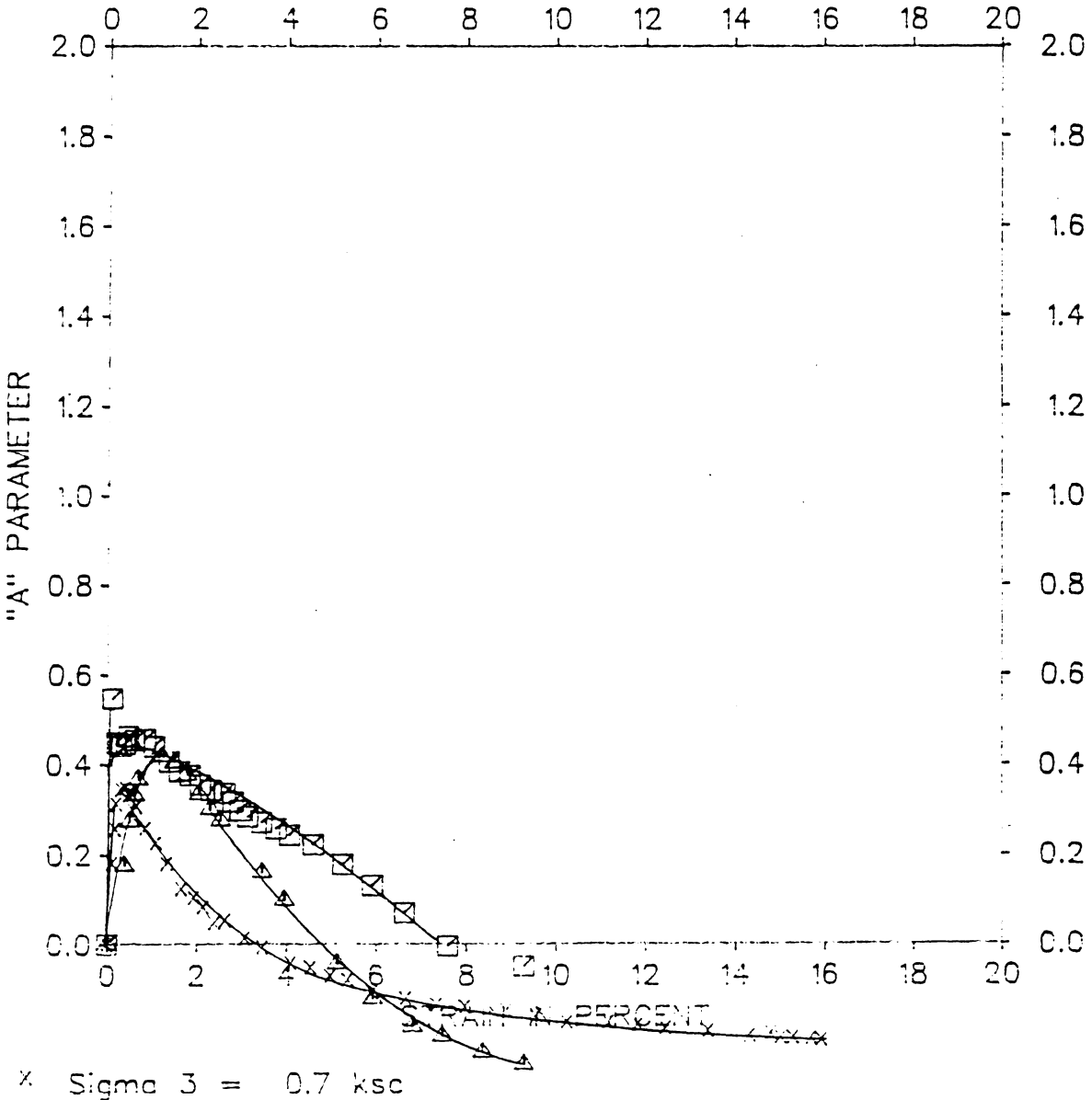
CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST

Boring: S-5	Sample: SS4	Depth: 18-20
Boring: S-5	Sample: SS6	Depth: 22-24
Boring: S-5	Sample: SS4	Depth: 25-27

"A" PARAMETER vs STRAIN



× Sigma 3 = 0.7 ksc

△ Sigma 3 = 2.1 ksc

☐ Sigma 3 = 3.5 ksc

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TRIAXIAL COMPRESSION TEST
CONSOLIDATED UNDRAINED - DATA

PROJECT: KENNICOTT GEOTECNICAL
BORING: B-5
SAMPLE: SS4
DEPTH : 18-20
SOIL DESC: Silty Sand trace Fine Gravel trace
Clay - Reddish Brown (SM)

STS JOB NO: 25331
DATE: 3-1-88
TESTED BY: JJ
APPROVED BY: WPO

SPEC PREP: ENDS TRIMMED

SPECIMEN CHARACTERISTICS		INITIAL	CONSOLIDATED
DIAMETER-AVERAGE	MM	63.210	63.035
LENGTH---AVERAGE	MM	139.080	138.960
AREA	CM2	31.381	31.207
VOLUME	CM3	436.442	433.652
WET DENSITY	G/CM3	2.285	2.308
DRY DENSITY	G/CM3	2.070	2.083
WATER CONTENT	%	10.400	10.800

TEST PARAMETERS FOR CONSOLIDATION		
TOTAL SIGMA1 + BACK PRESSURE	KG/CM2	4.700
TOTAL SIGMA3 + BACK PRESSURE	KG/CM2	4.700
BACK PRESSURE	KG/CM2	4.000
EFFECTIVE SIGMA 1	KG/CM2	0.700
EFFECTIVE SIGMA 3	KG/CM2	0.700
CONSOLIDATION RATIO		1.000
STRAIN RATE	MM/MIN	0.100

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BORING: S-5
SAMPLE: SS4
DEPTH : 18-20

STS JOB NO: 25331
EFF. SIGMA3: 0.700 KG/CM2

TEST RESULTS----------

LOAD KG	DEF MM	CORR AREA MM2	DELTA P.W.P. KG/CM2	SIGMA1 TOTAL KG/CM2	SIGMA3 TOTAL KG/CM2	SIGMA1 BAR KG/CM2	SIGMA3 BAR KG/CM2	STRAIN %	S1 - S3 KG/CM2	S1BAR/ S3BAR	P KG/CM2	PBAR KG/CM2	Q OR QBAR KG/CM2	A
0.0	0.00	3121.	0.00	0.70	0.70	0.70	0.70	0.0	0.00	1.00	0.70	0.70	0.00	0.00
3.1	0.14	3124.	0.02	0.80	0.70	0.78	0.68	0.1	0.10	1.15	0.75	0.73	0.05	0.18
15.3	0.24	3126.	0.13	1.19	0.70	1.06	0.57	0.2	0.49	1.85	0.94	0.82	0.24	0.26
21.5	0.28	3127.	0.22	1.39	0.70	1.17	0.48	0.2	0.69	2.42	1.04	0.83	0.34	0.31
26.1	0.42	3130.	0.29	1.53	0.70	1.25	0.41	0.3	0.83	3.02	1.12	0.83	0.42	0.34
29.1	0.56	3133.	0.32	1.63	0.70	1.31	0.38	0.4	0.93	3.46	1.16	0.84	0.46	0.35
32.2	0.68	3136.	0.34	1.73	0.70	1.39	0.36	0.5	1.03	3.86	1.21	0.87	0.51	0.33
33.7	0.80	3139.	0.36	1.77	0.70	1.41	0.34	0.6	1.07	4.15	1.24	0.88	0.54	0.33
36.8	0.92	3141.	0.36	1.87	0.70	1.51	0.34	0.7	1.17	4.44	1.29	0.93	0.59	0.31
41.4	1.20	3148.	0.34	2.02	0.70	1.67	0.36	0.9	1.32	4.66	1.36	1.02	0.66	0.26
47.5	1.53	3155.	0.34	2.21	0.70	1.86	0.36	1.1	1.51	5.19	1.45	1.11	0.75	0.23
53.6	1.85	3163.	0.30	2.39	0.70	2.09	0.39	1.3	1.69	5.29	1.55	1.24	0.85	0.18
59.7	2.31	3173.	0.23	2.58	0.70	2.35	0.47	1.7	1.88	5.03	1.64	1.41	0.94	0.12
65.3	2.69	3182.	0.22	2.75	0.70	2.54	0.48	1.9	2.05	5.23	1.73	1.51	1.03	0.10
68.9	2.99	3189.	0.18	2.86	0.70	2.68	0.52	2.2	2.16	5.15	1.78	1.60	1.08	0.08
72.0	3.33	3197.	0.11	2.95	0.70	2.84	0.59	2.4	2.25	4.80	1.83	1.72	1.13	0.05
75.1	3.66	3205.	0.13	3.04	0.70	2.92	0.57	2.6	2.34	5.08	1.87	1.75	1.17	0.05
82.7	4.26	3219.	0.04	3.27	0.70	3.23	0.66	3.1	2.57	4.87	1.98	1.95	1.28	0.01
88.9	4.82	3233.	-0.02	3.45	0.70	3.47	0.72	3.5	2.75	4.83	2.07	2.09	1.37	-0.01
96.5	5.70	3254.	-0.13	3.67	0.70	3.79	0.83	4.1	2.97	4.59	2.18	2.31	1.48	-0.04
102.6	6.33	3270.	-0.16	3.84	0.70	4.00	0.86	4.6	3.14	4.64	2.27	2.43	1.57	-0.05
107.2	6.93	3284.	-0.23	3.96	0.70	4.20	0.93	5.0	3.26	4.49	2.33	2.57	1.63	-0.07
111.8	7.47	3298.	-0.27	4.09	0.70	4.36	0.97	5.4	3.39	4.50	2.39	2.66	1.69	-0.08
116.4	8.23	3317.	-0.38	4.21	0.70	4.59	1.08	5.9	3.51	4.26	2.45	2.83	1.75	-0.11
124.1	9.26	3344.	-0.45	4.41	0.70	4.86	1.15	6.7	3.71	4.23	2.56	3.00	1.86	-0.12
130.2	10.20	3368.	-0.52	4.57	0.70	5.09	1.22	7.3	3.87	4.17	2.63	3.15	1.93	-0.13
136.3	11.09	3391.	-0.56	4.72	0.70	5.28	1.26	8.0	4.02	4.20	2.71	3.27	2.01	-0.14
145.5	12.35	3425.	-0.63	4.95	0.70	5.58	1.33	8.9	4.25	4.20	2.82	3.45	2.12	-0.15
151.7	13.29	3451.	-0.70	5.10	0.70	5.80	1.40	9.6	4.40	4.14	2.90	3.60	2.20	-0.16
157.8	14.24	3477.	-0.79	5.24	0.70	6.03	1.49	10.2	4.54	4.05	2.97	3.76	2.27	-0.17
167.0	15.52	3513.	-0.83	5.45	0.70	6.28	1.53	11.2	4.75	4.12	3.08	3.90	2.38	-0.17
173.1	16.43	3539.	-0.88	5.59	0.70	6.47	1.58	11.8	4.89	4.10	3.15	4.03	2.45	-0.18
177.7	17.29	3564.	-0.93	5.69	0.70	6.62	1.63	12.4	4.99	4.05	3.19	4.13	2.49	-0.19
186.9	18.62	3604.	-1.01	5.89	0.70	6.89	1.71	13.4	5.19	4.04	3.29	4.30	2.59	-0.19
194.5	19.90	3642.	-1.10	6.04	0.70	7.14	1.80	14.3	5.34	3.97	3.37	4.47	2.67	-0.21
202.2	20.56	3663.	-1.10	6.22	0.70	7.32	1.80	14.8	5.52	4.07	3.46	4.56	2.76	-0.20
208.3	20.85	3672.	-1.18	6.37	0.70	7.56	1.88	15.0	5.67	4.01	3.54	4.72	2.84	-0.21
208.3	21.23	3683.	-1.18	6.36	0.70	7.54	1.88	15.3	5.66	4.00	3.53	4.71	2.83	-0.21
211.4	21.81	3702.	-1.20	6.41	0.70	7.61	1.90	15.7	5.71	4.00	3.56	4.76	2.86	-0.21
214.5	22.13	3712.	-1.24	6.48	0.70	7.72	1.94	15.9	5.78	3.98	3.59	4.83	2.89	-0.21

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TRIAXIAL COMPRESSION TEST
CONSOLIDATED UNDRAINED - DATA

PROJECT: KENNICOTT GEOTECNICAL
BORING: S-5
SAMPLE: SS6
DEPTH : 22-24
SOIL DESC: Silty Sand trace Fine Gravel trace
Clay - Reddish Brown (SM)

STS JOB NO: 25331
DATE: 3-1-88
TESTED BY: JJ
APPROVED BY: [signature]

SPEC PREP: ENDS TRIMMED

SPECIMEN CHARACTERISTICS		INITIAL	CONSOLIDATED
DIAMETER-AVERAGE	MM	64.240	63.515
LENGTH---AVERAGE	MM	138.120	137.900
AREA	CM2	32.412	31.684
VOLUME	CM3	447.669	436.923
WET DENSITY	G/CM3	2.251	2.319
DRY DENSITY	G/CM3	2.065	2.116
WATER CONTENT	%	9.000	9.600

TEST PARAMETERS FOR CONSOLIDATION		
TOTAL SIGMA1 + BACK PRESSURE	KG/CM2	6.110
TOTAL SIGMA3 + BACK PRESSURE	KG/CM2	6.110
BACK PRESSURE	KG/CM2	4.000
EFFECTIVE SIGMA 1	KG/CM2	2.110
EFFECTIVE SIGMA 3	KG/CM2	2.110
CONSOLIDATION RATIO		1.000
STRAIN RATE	MM/MIN	0.100

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BORING: B-5
SAMPLE: SS6
DEPTH : 22-24

STS JOB NO: 25331
EFF. SIGMA3: 2.110 KG/CM2

TEST RESULTS

LOAD KG	DEF MM	CORR AREA MM2	DELTA P.W.P. KG/CM2	SIGMA1 TOTAL KG/CM2	SIGMA3 TOTAL KG/CM2	SIGMA1 BAR KG/CM2	SIGMA3 BAR KG/CM2	STRAIN %	S1 - S3 KG/CM2	S1BAR/ S3BAR	P KG/CM2	PBAR KG/CM2	Q OR QBAR KG/CM2	A
0.0	0.00	3168.	0.00	2.11	2.11	2.11	2.11	0.0	0.00	1.00	2.11	2.11	0.00	0.00
1.6	0.28	3175.	0.05	2.16	2.11	2.11	2.06	0.2	0.05	1.02	2.14	2.08	0.03	1.00
2.6	0.43	3178.	0.08	2.19	2.11	2.12	2.03	0.3	0.08	1.04	2.15	2.07	0.04	0.93
19.1	0.55	3181.	0.11	2.71	2.11	2.61	2.01	0.4	0.60	1.30	2.41	2.31	0.30	0.17
35.1	0.71	3185.	0.30	3.21	2.11	2.91	1.81	0.5	1.10	1.61	2.66	2.36	0.55	0.27
43.8	0.87	3189.	0.46	3.48	2.11	3.03	1.65	0.6	1.37	1.83	2.80	2.34	0.69	0.33
51.1	0.97	3191.	0.59	3.71	2.11	3.12	1.52	0.7	1.60	2.05	2.91	2.32	0.80	0.37
70.2	1.71	3208.	0.92	4.30	2.11	3.38	1.19	1.2	2.19	2.83	3.20	2.29	1.09	0.42
76.4	2.08	3217.	0.96	4.48	2.11	3.52	1.15	1.5	2.37	3.07	3.30	2.34	1.19	0.40
83.8	2.46	3226.	0.98	4.71	2.11	3.73	1.13	1.8	2.60	3.30	3.41	2.43	1.30	0.38
90.8	2.84	3235.	0.94	4.92	2.11	3.98	1.17	2.1	2.81	3.39	3.51	2.58	1.40	0.33
96.5	3.18	3243.	0.89	5.09	2.11	4.19	1.22	2.3	2.98	3.45	3.60	2.70	1.49	0.30
102.3	3.49	3251.	0.87	5.27	2.11	4.40	1.24	2.5	3.16	3.55	3.69	2.82	1.58	0.28
110.8	4.78	3282.	0.54	5.49	2.11	4.94	1.57	3.5	3.38	3.15	3.80	3.25	1.69	0.16
123.7	5.46	3299.	0.37	5.86	2.11	5.49	1.74	4.0	3.75	3.15	3.98	3.62	1.87	0.10
137.8	7.09	3340.	-0.18	6.24	2.11	6.42	2.29	5.1	4.13	2.80	4.17	4.35	2.06	-0.04
146.5	8.18	3368.	-0.53	6.46	2.11	6.99	2.64	5.9	4.35	2.65	4.28	4.82	2.17	-0.12
158.7	9.41	3400.	-0.86	6.78	2.11	7.64	2.97	6.8	4.67	2.57	4.44	5.30	2.33	-0.18
179.8	10.31	3424.	-1.08	7.36	2.11	8.44	3.19	7.5	5.25	2.65	4.74	5.32	2.63	-0.21
188.0	11.54	3458.	-1.32	7.55	2.11	8.87	3.43	8.4	5.44	2.58	4.83	6.15	2.72	-0.24
196.5	12.81	3493.	-1.52	7.74	2.11	9.25	3.63	9.3	5.63	2.55	4.92	6.44	2.81	-0.27

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STS CONSULTANTS, LTD.

TRIAXIAL COMPRESSION TEST
CONSOLIDATED UNDRAINED - DATA

PROJECT: KENNICOTT GEOTECNICAL
BORING: B-5
SAMPLE: SS4
DEPTH : 25-27

STS JOB NO: 25331
DATE: 3-1-88
TESTED BY: JJ
APPROVED BY: WG

SOIL DESC: Silty Sand trace Fine Gravel trace
CLAY -- REDDISH BROWN (SM)

SPEC PREP: ENDS TRIMMED

SPECIMEN CHARACTERISTICS		INITIAL	CONSOLIDATED
DIAMETER-AVERAGE	MM	63.470	62.795
LENGTH---AVERAGE	MM	129.950	129.400
AREA	CM2	31.639	30.970
VOLUME	CM3	411.153	400.755
WET DENSITY	G/CM3	2.299	2.335
DRY DENSITY	G/CM3	2.084	2.138
WATER CONTENT	%	10.300	9.200

TEST PARAMETERS FOR CONSOLIDATION		
TOTAL SIGMA1 + BACK PRESSURE	KG/CM2	7.520
TOTAL SIGMA3 + BACK PRESSURE	KG/CM2	7.520
BACK PRESSURE	KG/CM2	4.000
EFFECTIVE SIGMA 1	KG/CM2	3.520
EFFECTIVE SIGMA 3	KG/CM2	3.520
CONSOLIDATION RATIO		1.000
STRAIN RATE	MM/MIN	0.100

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BORING: S-5
SAMPLE: SS4
DEPTH : 25-27

STS JOB NO: 25331
EFF. SIGMA3: 3.520 KG/CM2

TEST RESULTS----------

LOAD KG	DEF MM	CORR AREA MM2	DELTA P.W.P. KG/CM2	SIGMA1 TOTAL KG/CM2	SIGMA3 TOTAL KG/CM2	SIGMA1 EAR KG/CM2	SIGMA3 EAR KG/CM2	STRAIN %	S1 - S3 KG/CM2	S1BAR/ S3BAR	P KG/CM2	PBAR KG/CM2	Q OR QBAR KG/CM2	A
0.0	0.00	3097.	0.00	3.52	3.52	3.52	3.52	0.0	0.00	1.00	3.52	3.52	0.00	0.00
13.4	0.15	3101.	0.24	3.95	3.52	3.72	3.28	0.1	0.43	1.13	3.74	3.50	0.22	0.55
38.6	0.27	3104.	0.56	4.76	3.52	4.21	2.96	0.2	1.24	1.42	4.14	3.58	0.62	0.45
47.6	0.42	3107.	0.68	5.05	3.52	4.38	2.84	0.3	1.53	1.54	4.29	3.61	0.77	0.44
56.5	0.54	3110.	0.81	5.34	3.52	4.53	2.71	0.4	1.82	1.67	4.43	3.62	0.91	0.45
62.5	0.62	3112.	0.93	5.53	3.52	4.60	2.59	0.5	2.01	1.77	4.52	3.60	1.00	0.46
68.4	0.81	3117.	0.99	5.71	3.52	4.72	2.53	0.6	2.19	1.87	4.62	3.62	1.10	0.45
83.3	1.12	3124.	1.22	6.19	3.52	4.97	2.30	0.9	2.67	2.16	4.85	3.64	1.33	0.46
93.7	1.37	3130.	1.32	6.51	3.52	5.20	2.20	1.1	2.99	2.36	5.02	3.70	1.50	0.44
107.1	1.80	3141.	1.38	6.93	3.52	5.55	2.14	1.4	3.41	2.60	5.23	3.84	1.71	0.41
114.5	2.09	3148.	1.40	7.16	3.52	5.76	2.12	1.6	3.64	2.72	5.34	3.94	1.82	0.38
119.0	2.40	3156.	1.42	7.29	3.52	5.87	2.10	1.9	3.77	2.79	5.41	3.99	1.89	0.38
125.0	2.69	3163.	1.40	7.47	3.52	6.07	2.12	2.1	3.95	2.86	5.50	4.10	1.98	0.35
127.9	3.00	3171.	1.38	7.55	3.52	6.17	2.14	2.3	4.03	2.89	5.54	4.15	2.02	0.34
130.9	3.39	3180.	1.38	7.64	3.52	6.25	2.14	2.6	4.12	2.93	5.58	4.19	2.06	0.34
137.4	3.64	3187.	1.37	7.83	3.52	6.46	2.15	2.8	4.31	3.00	5.68	4.31	2.16	0.32
140.6	3.83	3191.	1.31	7.93	3.52	6.61	2.21	3.0	4.41	3.00	5.72	4.41	2.20	0.30
143.9	4.05	3197.	1.28	8.02	3.52	6.74	2.24	3.1	4.50	3.01	5.77	4.49	2.25	0.28
147.4	4.47	3208.	1.25	8.11	3.52	6.86	2.27	3.5	4.59	3.02	5.82	4.57	2.30	0.27
152.1	4.88	3218.	1.22	8.25	3.52	7.03	2.30	3.8	4.73	3.05	5.88	4.66	2.36	0.26
157.4	5.27	3229.	1.19	8.40	3.52	7.21	2.33	4.1	4.88	3.09	5.96	4.77	2.44	0.24
164.3	5.95	3246.	1.13	8.58	3.52	7.46	2.39	4.6	5.06	3.11	6.05	4.93	2.53	0.22
177.3	6.80	3269.	0.97	8.96	3.52	7.99	2.55	5.3	5.44	3.13	6.24	5.27	2.72	0.18
188.3	7.65	3292.	0.75	9.24	3.52	8.49	2.77	5.9	5.72	3.07	6.38	5.63	2.86	0.13
208.3	8.58	3317.	0.44	9.80	3.52	9.36	3.08	6.6	6.28	3.04	6.66	6.22	3.14	0.07
229.3	9.82	3351.	-0.03	10.36	3.52	10.39	3.55	7.6	6.84	2.93	6.94	6.97	3.42	0.00
256.1	12.01	3414.	-0.38	11.02	3.52	11.40	3.89	9.3	7.50	2.93	7.27	7.65	3.75	-0.05

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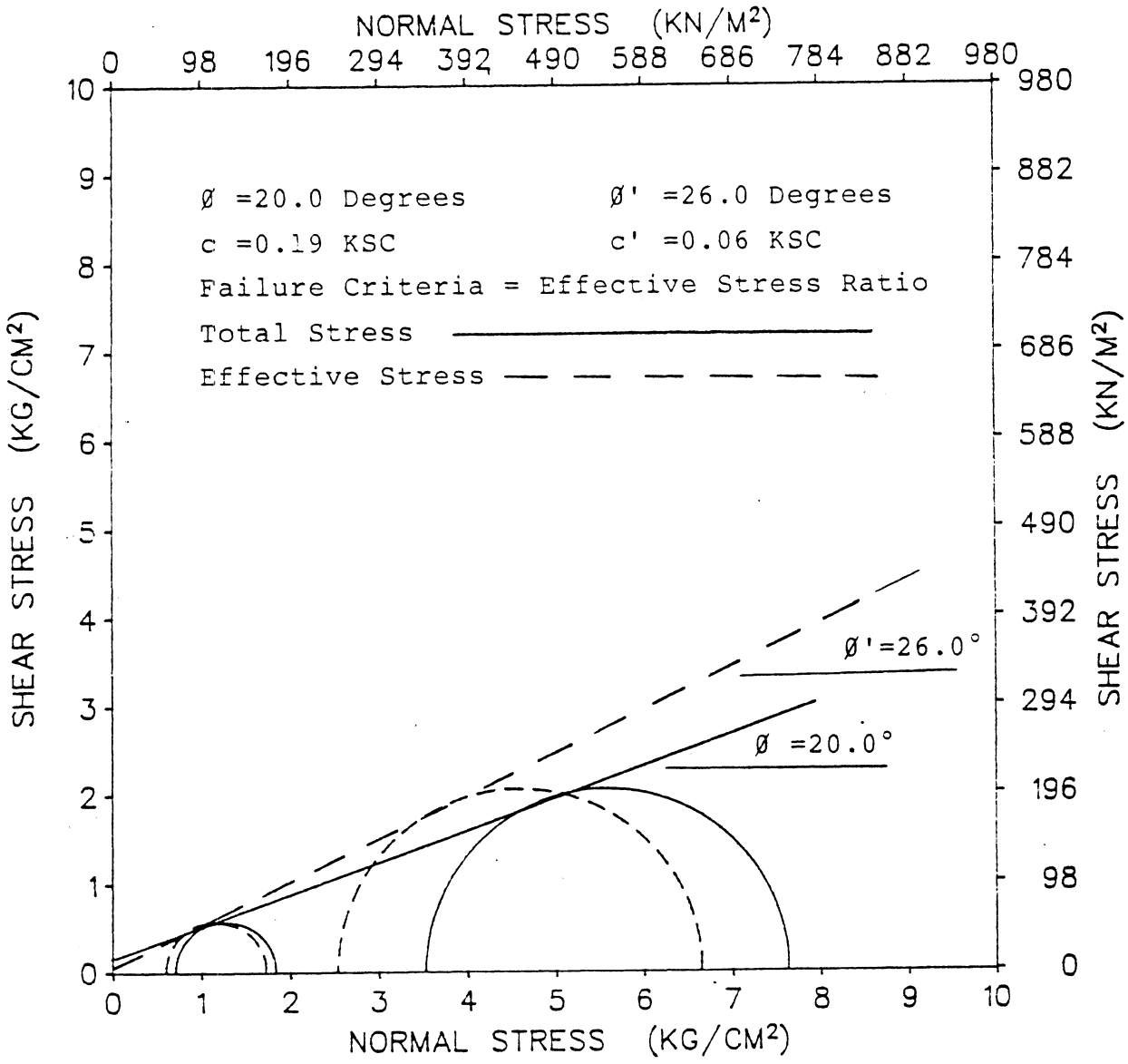
STS JOB NO. 25331

CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST

Boring: S5 Sample: Depth: 45–46

Boring: S5 Sample: Depth: 46–47

MOHR ENVELOPE



Sigma 3 = 0.7 ksc

Sigma 3 = 3.5 ksc

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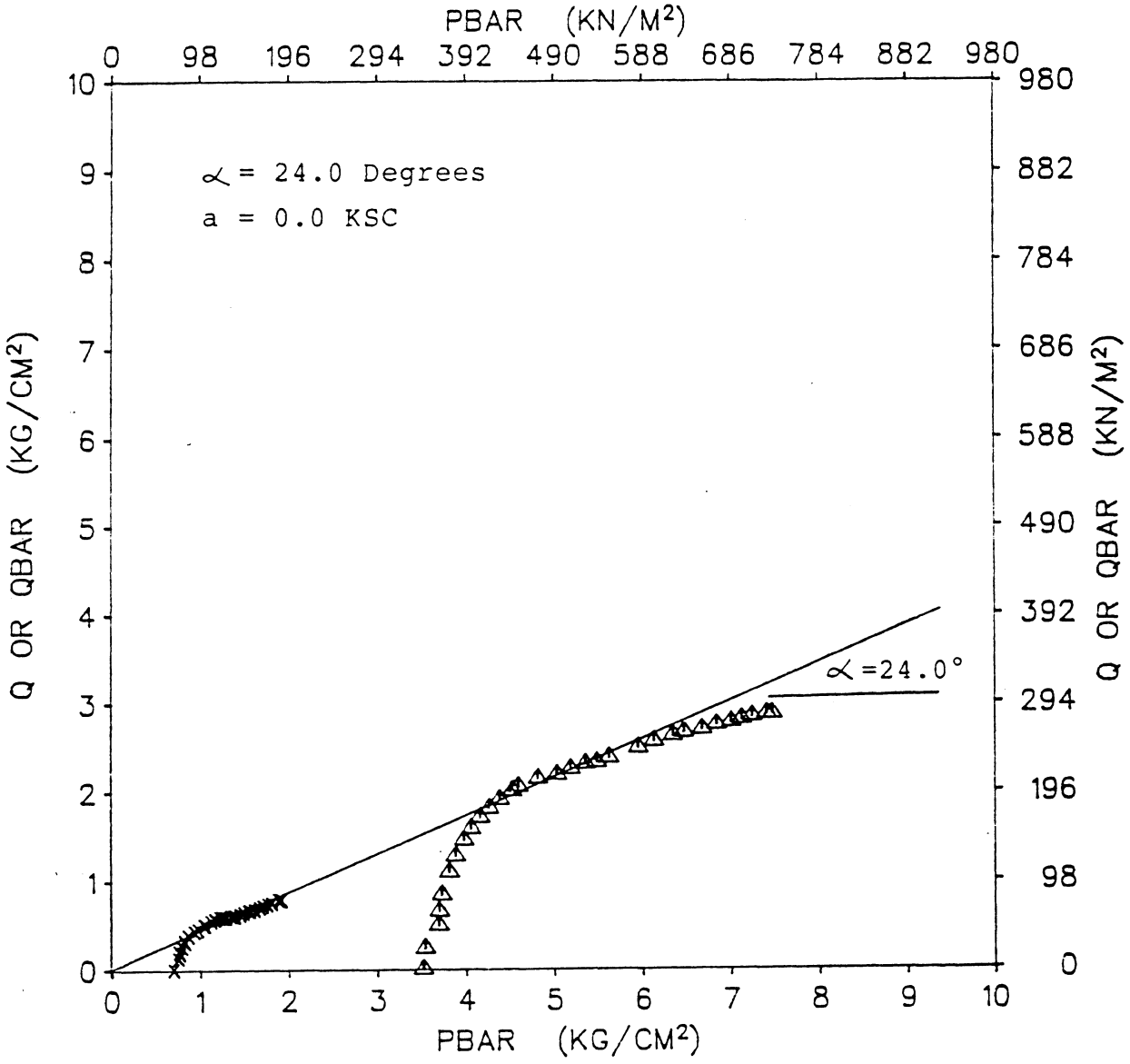
CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST

Boring: S5 Sample: Depth: 45–46

Boring: S5 Sample: Depth: 46–47

STRESS PATH PLOT



× Sigma 3 = 0.7 ksc

△ Sigma 3 = 3.5 ksc

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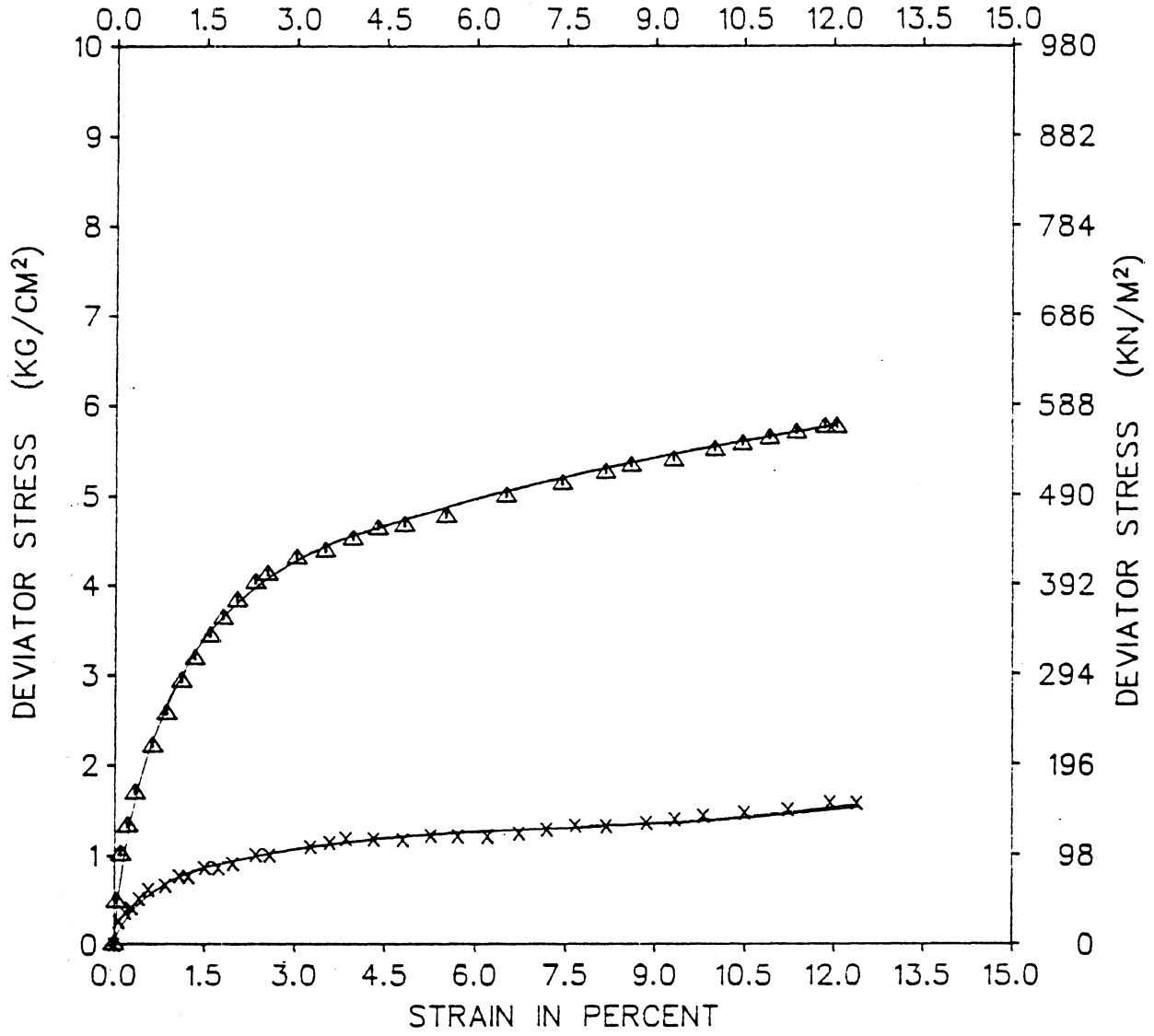
CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST

Boring: S5 Sample: Depth: 45–46

Boring: S5 Sample: Depth: 46–47

DEVIATOR STRESS vs STRAIN



× Sigma 3 = 0.7 ksc

△ Sigma 3 = 3.5 ksc

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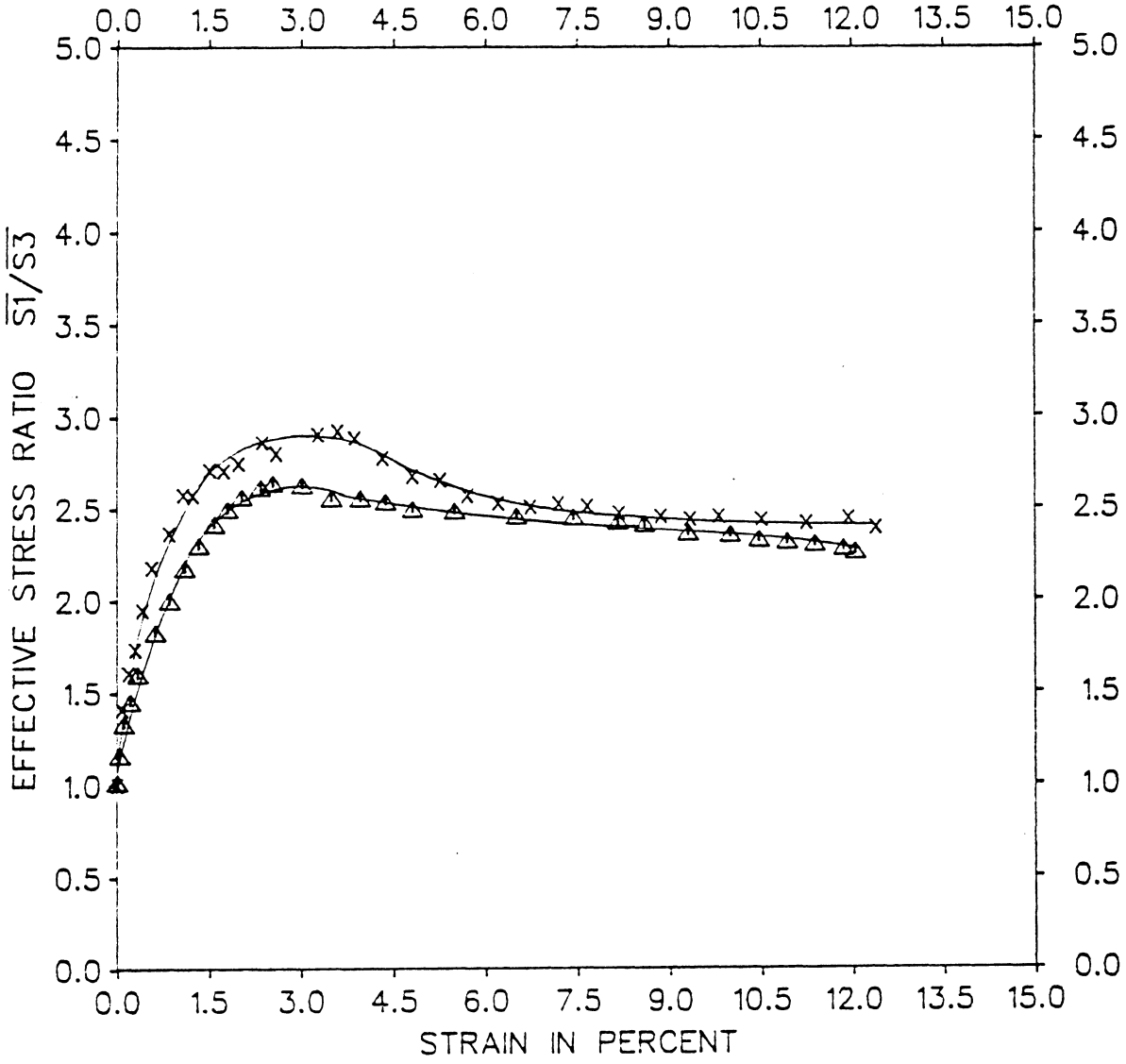
CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST

Boring: S5 Sample: Depth: 45–46

Boring: S5 Sample: Depth: 46–47

EFFECTIVE STRESS RATIO vs STRAIN



× Sigma 3 = 0.7 ksc

△ Sigma 3 = 3.5 ksc

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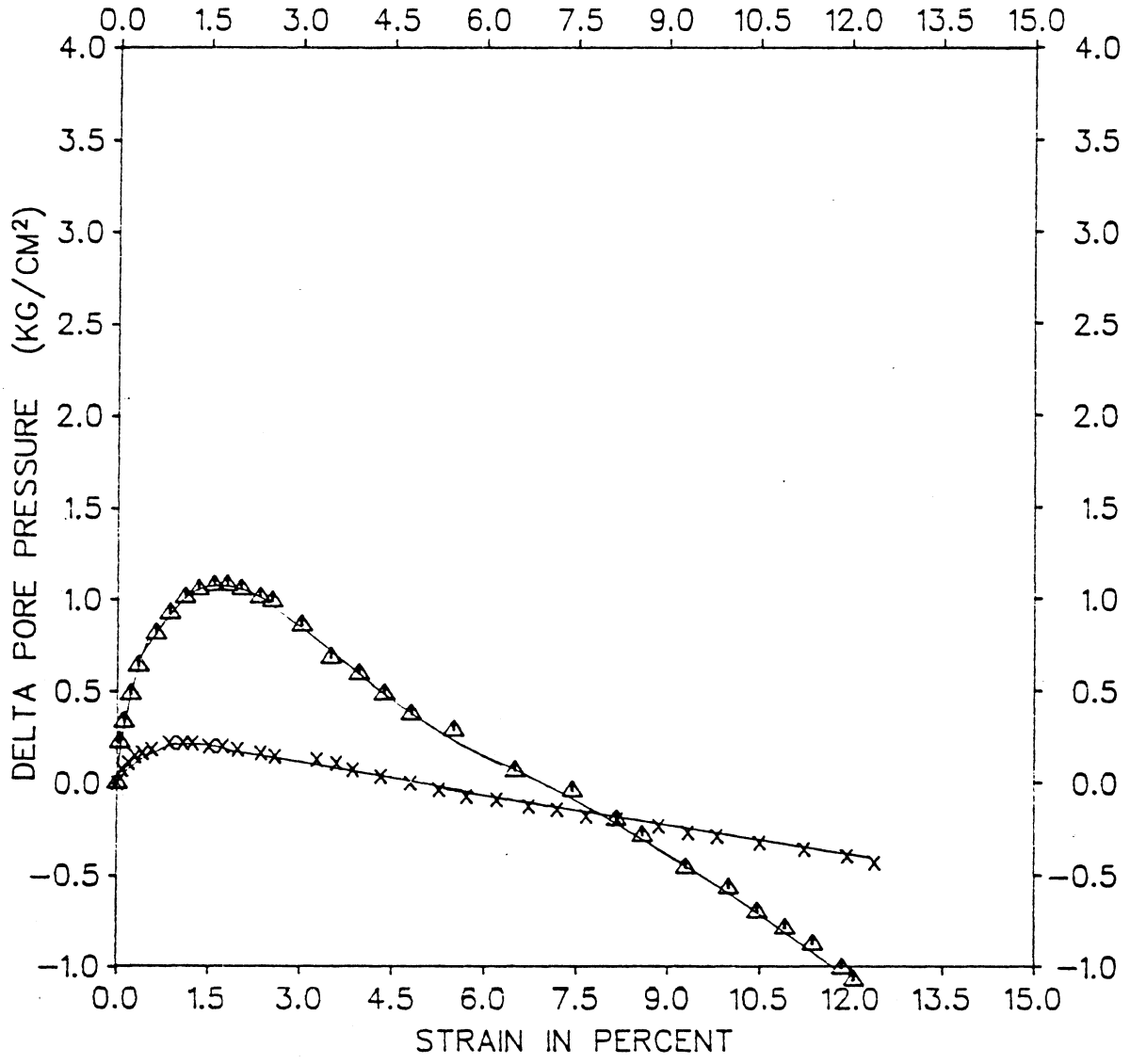
CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST

Boring: S5 Sample: Depth: 45–46

Boring: S5 Sample: Depth: 46–47

DELTA PORE PRESSURE vs STRAIN



× Sigma 3 = 0.7 ksc

△ Sigma 3 = 3.5 ksc

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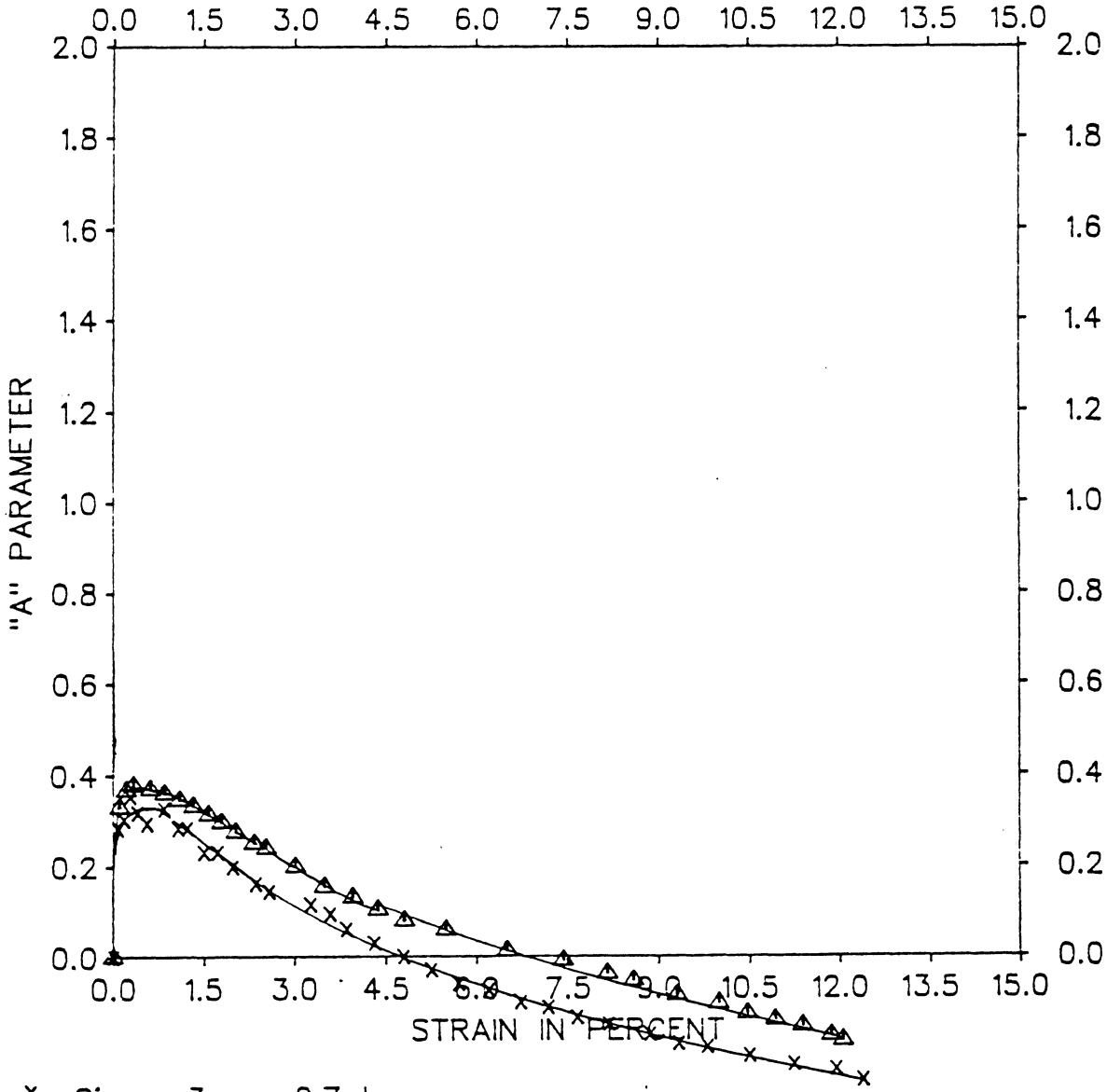
CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST

Boring: S5 Sample: Depth: 45–46

Boring: S5 Sample: Depth: 46–47

"A" PARAMETER vs STRAIN



× Sigma 3 = 0.7 ksc

△ Sigma 3 = 3.5 ksc

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TRIAXIAL COMPRESSION TEST
CONSOLIDATED UNDRAINED - DATA

PROJECT: KENNICOTT GEOTECNICAL
BORING: S5
SAMPLE:
DEPTH : 45-46
SOIL DESC: SILT TRACE CLAY TRACE FINE SAND
-- BROWN & VERY LT. REDDISH CREAM
(ML)
SPEC PREP: ENDS TRIMMED

STS JOB NO: 25331
DATE: 3-7-88
TESTED BY: JJ
APPROVED BY: [illegible]

SPECIMEN CHARACTERISTICS		INITIAL	CONSOLIDATED
DIAMETER-AVERAGE	MM	62.070	61.634
LENGTH---AVERAGE	MM	132.000	131.060
AREA	CM2	30.259	29.835
VOLUME	CM3	399.418	391.017
WET DENSITY	G/CM3	2.224	2.320
DRY DENSITY	G/CM3	1.958	2.000
WATER CONTENT	%	13.600	16.000

TEST PARAMETERS FOR CONSOLIDATION		
TOTAL SIGMA1 + BACK PRESSURE	KG/CM2	4.700
TOTAL SIGMA3 + BACK PRESSURE	KG/CM2	4.700
BACK PRESSURE	KG/CM2	4.000
EFFECTIVE SIGMA 1	KG/CM2	0.700
EFFECTIVE SIGMA 3	KG/CM2	0.700
CONSOLIDATION RATIO		1.000
STRAIN RATE	MM/MIN	0.100

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BORING: S5
SAMPLE:
DEPTH : 45-46

STS JOB NO: 25331
EFF. SIGMA3: 0.700 KG/CM2

TEST RESULTS----------

LOAD KG	DEF MM	CORR AREA MM2	DELTA P.W.P. KG/CM2	SIGMA1 TOTAL KG/CM2	SIGMA3 TOTAL KG/CM2	SIGMA1 BAR KG/CM2	SIGMA3 BAR KG/CM2	STRAIN %	S1 - S3 KG/CM2	S1BAR/ S3BAR	P KG/CM2	PBAR KG/CM2	Q OR QBAR KG/CM2	A
0.0	0.00	2983.	0.00	0.70	0.70	0.70	0.70	0.0	0.00	1.00	0.70	0.70	0.00	0.00
7.6	0.10	2986.	0.07	0.95	0.70	0.88	0.63	0.1	0.25	1.41	0.83	0.76	0.13	0.28
10.7	0.24	2989.	0.11	1.06	0.70	0.95	0.59	0.2	0.36	1.60	0.88	0.77	0.18	0.30
12.2	0.38	2992.	0.14	1.11	0.70	0.96	0.56	0.3	0.41	1.73	0.90	0.76	0.20	0.35
15.3	0.54	2996.	0.16	1.21	0.70	1.05	0.54	0.4	0.51	1.95	0.96	0.79	0.26	0.32
18.4	0.74	3000.	0.18	1.31	0.70	1.13	0.52	0.6	0.61	2.18	1.01	0.83	0.31	0.29
19.9	1.11	3009.	0.22	1.36	0.70	1.15	0.48	0.8	0.66	2.37	1.03	0.81	0.33	0.33
23.0	1.41	3016.	0.22	1.46	0.70	1.25	0.48	1.1	0.76	2.58	1.08	0.87	0.38	0.28
23.0	1.61	3021.	0.22	1.46	0.70	1.24	0.48	1.2	0.76	2.57	1.08	0.86	0.38	0.28
26.0	1.97	3029.	0.20	1.56	0.70	1.36	0.50	1.5	0.86	2.71	1.13	0.93	0.43	0.23
26.0	2.27	3036.	0.20	1.56	0.70	1.36	0.50	1.7	0.86	2.71	1.13	0.93	0.43	0.23
27.6	2.59	3044.	0.18	1.61	0.70	1.43	0.52	2.0	0.91	2.74	1.15	0.97	0.45	0.20
30.6	3.09	3056.	0.16	1.70	0.70	1.54	0.54	2.4	1.00	2.86	1.20	1.04	0.50	0.16
30.6	3.39	3063.	0.14	1.70	0.70	1.56	0.56	2.6	1.00	2.80	1.20	1.06	0.50	0.14
33.7	4.28	3084.	0.13	1.79	0.70	1.67	0.57	3.3	1.09	2.90	1.25	1.12	0.55	0.12
35.2	4.70	3094.	0.11	1.84	0.70	1.73	0.59	3.6	1.14	2.92	1.27	1.16	0.57	0.09
36.7	5.06	3103.	0.07	1.88	0.70	1.81	0.63	3.9	1.18	2.88	1.29	1.22	0.59	0.06
36.7	5.66	3118.	0.04	1.88	0.70	1.84	0.66	4.3	1.18	2.77	1.29	1.25	0.59	0.03
36.7	6.29	3134.	0.00	1.87	0.70	1.87	0.70	4.8	1.17	2.67	1.29	1.29	0.59	0.00
38.3	6.89	3149.	-0.04	1.92	0.70	1.95	0.74	5.3	1.22	2.65	1.31	1.34	0.61	-0.03
38.3	7.47	3164.	-0.07	1.91	0.70	1.98	0.77	5.7	1.21	2.57	1.31	1.38	0.61	-0.06
38.3	8.13	3181.	-0.09	1.90	0.70	1.99	0.79	6.2	1.20	2.53	1.30	1.39	0.60	-0.07
39.8	8.82	3199.	-0.13	1.94	0.70	2.07	0.82	6.7	1.24	2.51	1.32	1.45	0.62	-0.10
41.3	9.42	3215.	-0.14	1.98	0.70	2.13	0.84	7.2	1.28	2.52	1.34	1.49	0.64	-0.11
42.9	10.04	3231.	-0.18	2.03	0.70	2.21	0.88	7.7	1.33	2.51	1.36	1.54	0.66	-0.13
42.9	10.72	3249.	-0.20	2.02	0.70	2.22	0.90	8.2	1.32	2.47	1.36	1.56	0.66	-0.15
44.4	11.61	3273.	-0.23	2.06	0.70	2.29	0.93	8.9	1.36	2.45	1.38	1.61	0.68	-0.17
45.9	12.23	3291.	-0.27	2.09	0.70	2.36	0.97	9.3	1.39	2.44	1.40	1.67	0.70	-0.19
47.5	12.85	3308.	-0.29	2.14	0.70	2.42	0.99	9.8	1.44	2.45	1.42	1.70	0.72	-0.20
49.0	13.76	3333.	-0.32	2.17	0.70	2.49	1.02	10.5	1.47	2.44	1.43	1.76	0.73	-0.22
50.5	14.72	3361.	-0.36	2.20	0.70	2.56	1.06	11.2	1.50	2.42	1.45	1.81	0.75	-0.24
53.6	15.64	3388.	-0.39	2.28	0.70	2.68	1.09	11.9	1.58	2.44	1.49	1.89	0.79	-0.25
53.6	16.23	3405.	-0.43	2.27	0.70	2.71	1.13	12.4	1.57	2.39	1.49	1.92	0.79	-0.27

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TRIAXIAL COMPRESSION TEST
CONSOLIDATED UNDRAINED - DATA

PROJECT: KENNICOTT GEOTECNICAL
BORING: S5
SAMPLE:
DEPTH : 46-47
SOIL DESC: SILT TRACE CLAY TRACE FINE SAND
BROWN AND VERY LT. REDDISH CREAM
(ML)
SPEC PREP: ENDS TRIMMED

STS JOB NO: 25331
DATE: 3-7-98
TESTED BY: JJ
APPROVED BY: MC

SPECIMEN CHARACTERISTICS		INITIAL	CONSOLIDATED
DIAMETER-AVERAGE	MM	62.070	59.274
LENGTH---AVERAGE	MM	132.650	130.410
AREA	CM2	30.259	27.594
VOLUME	CM3	401.384	359.857
WET DENSITY	G/CM3	2.248	2.521
DRY DENSITY	G/CM3	1.995	2.225
WATER CONTENT	%	12.700	13.300

TEST PARAMETERS FOR CONSOLIDATION		
TOTAL SIGMA1 + BACK PRESSURE	KG/CM2	7.520
TOTAL SIGMA3 + BACK PRESSURE	KG/CM2	7.520
BACK PRESSURE	KG/CM2	4.000
EFFECTIVE SIGMA 1	KG/CM2	3.520
EFFECTIVE SIGMA 3	KG/CM2	3.520
CONSOLIDATION RATIO		1.000
STRAIN RATE	MM/MIN	0.100

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BORING: S5
SAMPLE:
DEPTH : 46-47

STS JOB NO: 25331
EFF. SIGMA3: 3.520 KG/CM2

TEST RESULTS----------

LOAD KG	DEF MM	CORR AREA MM2	DELTA P.W.P. KG/CM2	SIGMA1 TOTAL KG/CM2	SIGMA3 TOTAL KG/CM2	SIGMA1 BAR KG/CM2	SIGMA3 BAR KG/CM2	STRAIN %	S1 - S3 KG/CM2	S1BAR/ S3BAR	P KG/CM2	PBAR KG/CM2	Q OR QBAR KG/CM2	A
0.0	0.00	2759.	0.00	3.52	3.52	3.52	3.52	0.0	0.00	1.00	3.52	3.52	0.00	0.00
13.1	0.05	2760.	0.22	3.99	3.52	3.78	3.30	0.0	0.47	1.14	3.76	3.54	0.24	0.46
27.6	0.14	2762.	0.33	4.52	3.52	4.19	3.19	0.1	1.00	1.31	4.02	3.69	0.50	0.33
36.4	0.28	2765.	0.48	4.84	3.52	4.35	3.04	0.2	1.32	1.43	4.18	3.70	0.66	0.37
46.6	0.44	2769.	0.64	5.20	3.52	4.57	2.88	0.3	1.68	1.58	4.36	3.73	0.84	0.38
61.1	0.81	2777.	0.81	5.72	3.52	4.91	2.71	0.6	2.20	1.81	4.62	3.81	1.10	0.37
71.3	1.11	2783.	0.92	6.08	3.52	5.16	2.60	0.9	2.56	1.99	4.80	3.88	1.28	0.36
81.5	1.43	2790.	1.01	6.44	3.52	5.43	2.51	1.1	2.92	2.16	4.98	3.97	1.46	0.35
88.8	1.73	2797.	1.05	6.70	3.52	5.64	2.47	1.3	3.18	2.29	5.11	4.06	1.59	0.33
96.1	2.06	2804.	1.07	6.95	3.52	5.87	2.45	1.6	3.43	2.40	5.23	4.16	1.71	0.31
101.3	2.34	2810.	1.07	7.15	3.52	6.07	2.45	1.8	3.63	2.48	5.33	4.26	1.81	0.30
107.7	2.64	2816.	1.05	7.34	3.52	6.29	2.47	2.0	3.82	2.55	5.43	4.38	1.91	0.28
113.6	3.04	2825.	1.01	7.54	3.52	6.53	2.51	2.3	4.02	2.60	5.53	4.52	2.01	0.25
116.5	3.30	2831.	0.99	7.64	3.52	6.65	2.53	2.5	4.12	2.62	5.58	4.59	2.06	0.24
122.3	3.93	2845.	0.86	7.82	3.52	6.96	2.66	3.0	4.30	2.61	5.67	4.81	2.15	0.20
125.2	4.55	2859.	0.68	7.90	3.52	7.22	2.84	3.5	4.38	2.54	5.71	5.03	2.19	0.16
129.6	5.16	2873.	0.59	8.03	3.52	7.44	2.93	4.0	4.51	2.54	5.78	5.18	2.26	0.13
133.5	5.70	2886.	0.48	8.15	3.52	7.66	3.04	4.4	4.63	2.52	5.83	5.35	2.31	0.10
135.2	6.27	2899.	0.37	8.18	3.52	7.81	3.15	4.8	4.66	2.48	5.85	5.48	2.33	0.08
139.1	7.16	2920.	0.29	8.28	3.52	8.00	3.23	5.5	4.76	2.47	5.90	5.62	2.38	0.06
147.2	8.48	2951.	0.07	8.51	3.52	8.44	3.45	6.5	4.99	2.44	6.01	5.95	2.49	0.01
152.8	9.69	2981.	-0.04	8.65	3.52	8.69	3.56	7.4	5.13	2.44	6.08	6.13	2.56	-0.01
157.8	10.64	3005.	-0.20	8.77	3.52	8.97	3.72	8.2	5.25	2.41	6.15	6.34	2.63	-0.04
160.8	11.20	3019.	-0.29	8.85	3.52	9.13	3.81	8.6	5.33	2.40	6.18	6.47	2.66	-0.05
163.9	12.13	3042.	-0.46	8.91	3.52	9.37	3.98	9.3	5.39	2.35	6.21	6.67	2.69	-0.09
168.6	13.03	3066.	-0.57	9.02	3.52	9.59	4.09	10.0	5.50	2.34	6.27	6.84	2.75	-0.10
171.4	13.64	3082.	-0.70	9.08	3.52	9.78	4.22	10.5	5.56	2.32	6.30	7.00	2.78	-0.13
174.3	14.24	3098.	-0.79	9.15	3.52	9.94	4.31	10.9	5.63	2.31	6.33	7.12	2.81	-0.14
177.1	14.83	3113.	-0.88	9.21	3.52	10.09	4.40	11.4	5.69	2.29	6.36	7.24	2.84	-0.15
180.0	15.45	3130.	-1.01	9.27	3.52	10.28	4.53	11.8	5.75	2.27	6.40	7.40	2.88	-0.18
180.4	15.71	3137.	-1.07	9.27	3.52	10.35	4.59	12.0	5.75	2.25	6.40	7.47	2.88	-0.19

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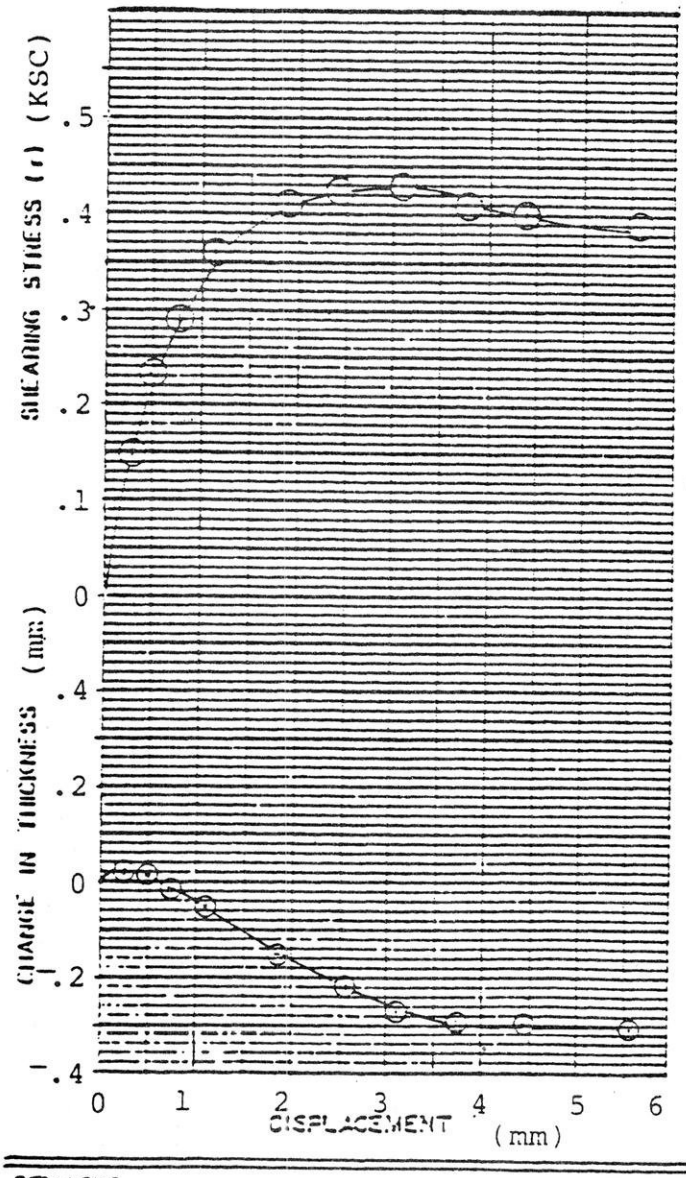
STS Consultants Ltd.

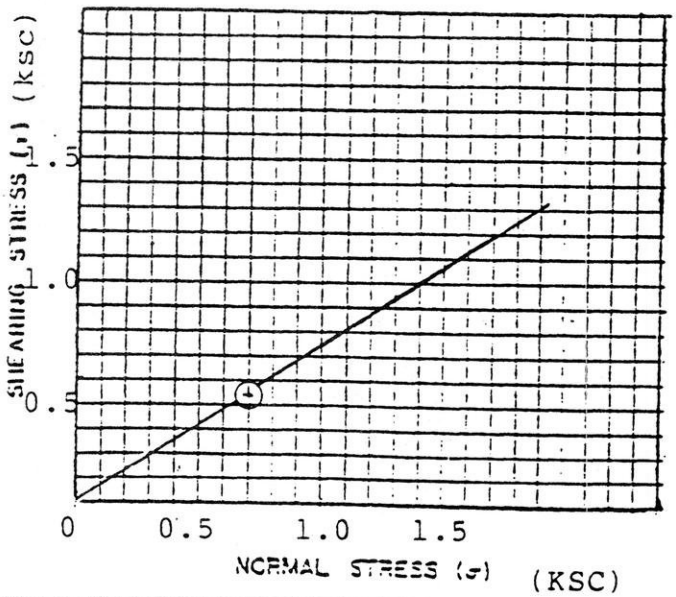
DIRECT SHEAR TEST

PROJECT: Kenicott Geotechnical		SAMPLE LOCATION: ---	
FIELD SAMPLE NO.: S-2	DEPTH: 5-7'	STS Project No. 25331	
TYPE OF SAMPLE: 3" Shelby Tube	TESTED BY: STS-Northbrook	APPROVED BY: W.P.Q.	DATE: 3/11/88
CLASSIFICATION: Silty sand, little fine gravel--reddish brown(sm)	LL -- PI --	SPECIFIC GRAVITY	
TYPE OF TEST: Drained	CONTROL: strain	$G_s(-)$ #4	--
RATE OF LOADING: 0.048mm/min	MOISTURE CONDITION: saturated	$G_s(-)$ #4	--
TYPE OF SPECIMEN: Round undisturbed	AREA: 28.27cm^2	THICKNESS: 2.00cm	



TEST NO.	1	2	3	4
INIT. MOISTURE, %	9.7			
DRY DENSITY, gm/cc	1.987			
INIT. VOID RATIO	.349			
TEST DURATION, (min)	125			
FINAL MOISTURE, %	11.4			
NORMAL STRESS KSC	0.70			
MAX. SHEAR STRESS KSC	0.41			

SHEAR VALUES	Ø	C
AT MAXIMUM STRESS	33°	0.0KSC



REMARKS

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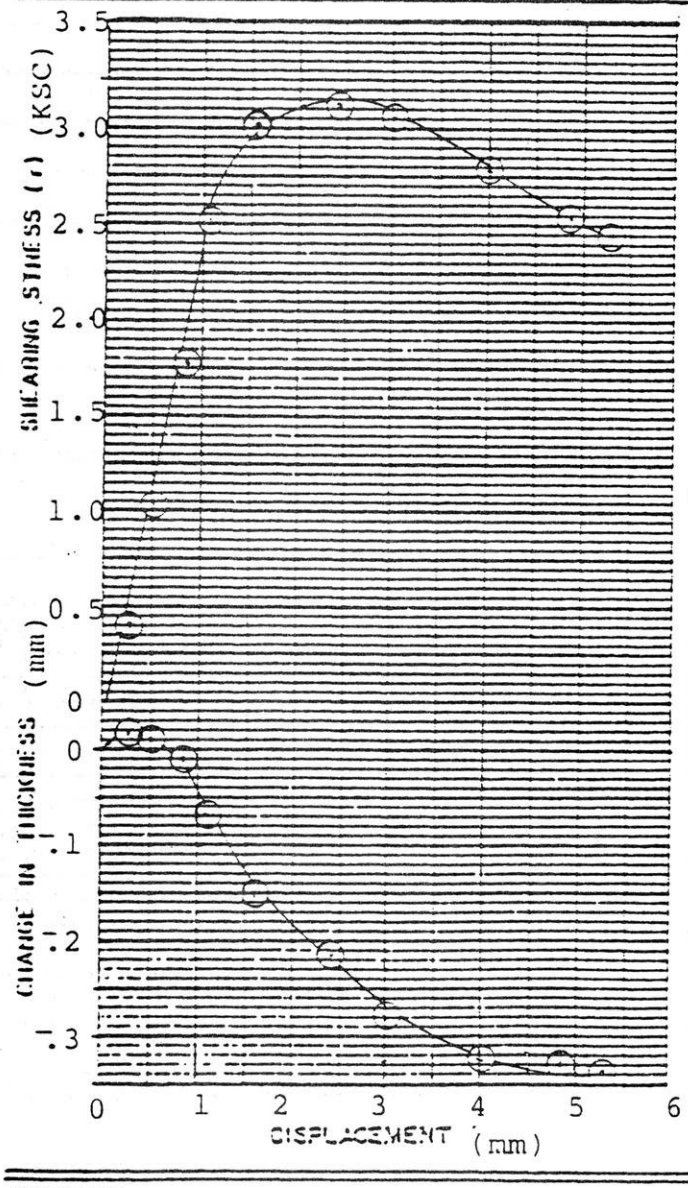
STS Consultants Ltd.

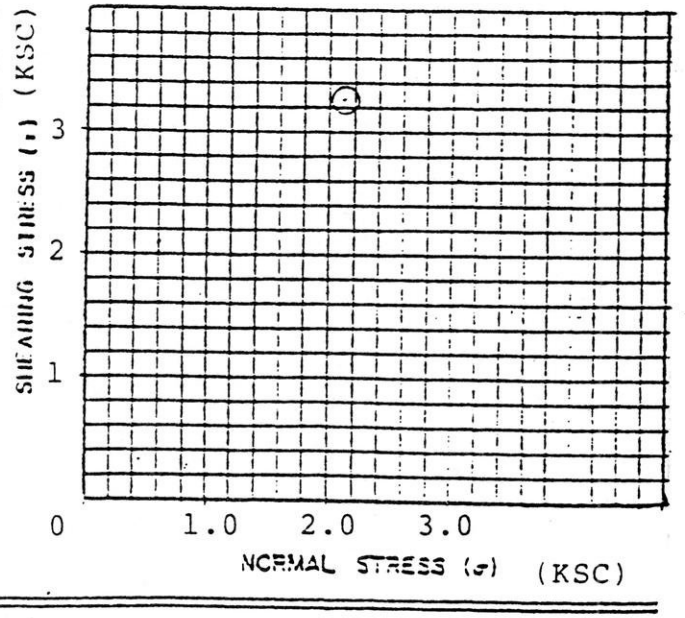
DIRECT SHEAR TEST

PROJECT: Kenicott Geotechnical		SAMPLE LOCATION: ---	
FIELD SAMPLE NO.: S-4	DEPTH: 31.5-32.5'	STS Project No.: 25331	
TYPE OF SAMPLE: 3" Shelby Tube	TESTED BY: STS-northbrook	APPROVED BY: W.P.Q.	DATE: 3/11/88
CLASSIFICATION: Fine sandy silt--tan (ML)	LL --	PI --	SPECIFIC GRAVITY
TYPE OF TEST: Drained	CONTROL: Strain	G_s (-) #4	--
RATE OF LOADING: 0.024mm/min	MOISTURE CONDITION: saturated	G_s (-) #4	--
TYPE OF SPECIMEN: round undisturbed	AREA: 28.27cm^2	THICKNESS: 2.00cm	



TEST NO.	1	2	3	4
INIT MOISTURE, %	13.0			
DRY DENSITY, gm/cc	1.939			
INIT VOID RATIO	.366			
TEST DURATION (hrs)	250			
FINAL MOISTURE, %	13.8			
NORMAL STRESS KSC	2.11			
MAX SHEAR STRESS KSC	3.29			

SHEAR VALUES	Ø	C
AT MAXIMUM STRESS		



REMARKS

Note: Sample extreamly hard. Require additional direct shear points to determine Ø angle.

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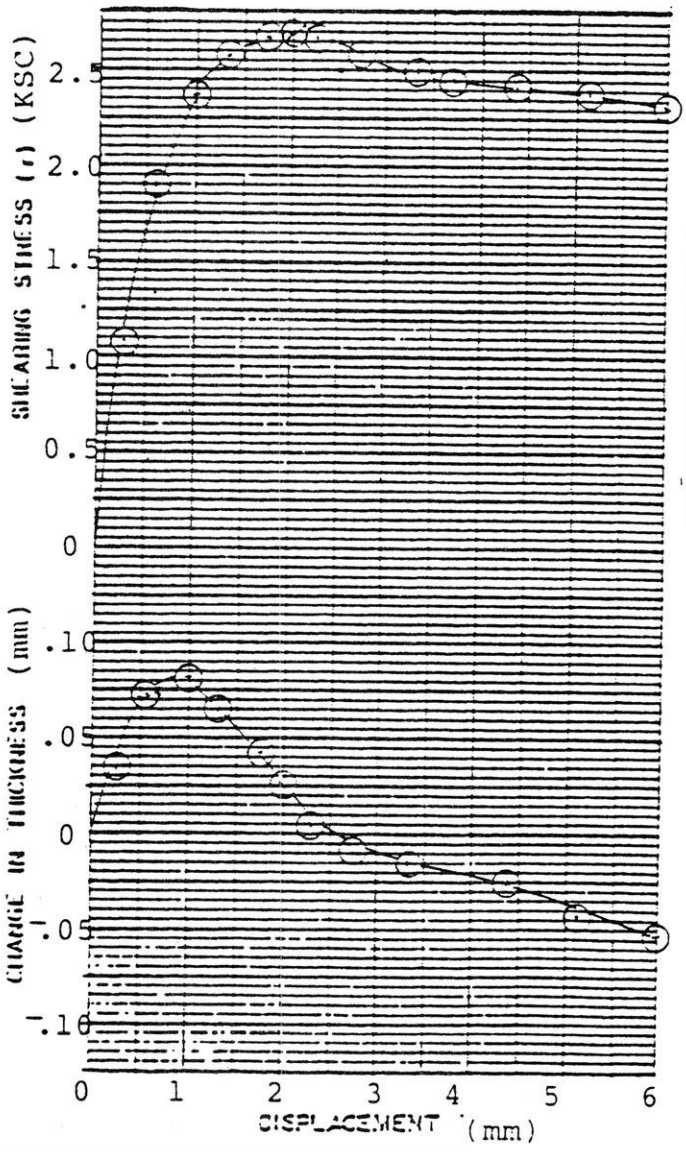
STS Consultants Ltd.

DIRECT SHEAR TEST

PROJECT: Kenicott Geotechnical		SAMPLE LOCATION: ---	
FIELD SAMPLE NO.: S-5	DEPTH: 35-36'	STS Project No.: 25331	
TYPE OF SAMPLE: 3" Shelby Tube	TESTED AT: STS-Northbrook	APPROVED BY: W.P.Q.	DATE: 3/11/88

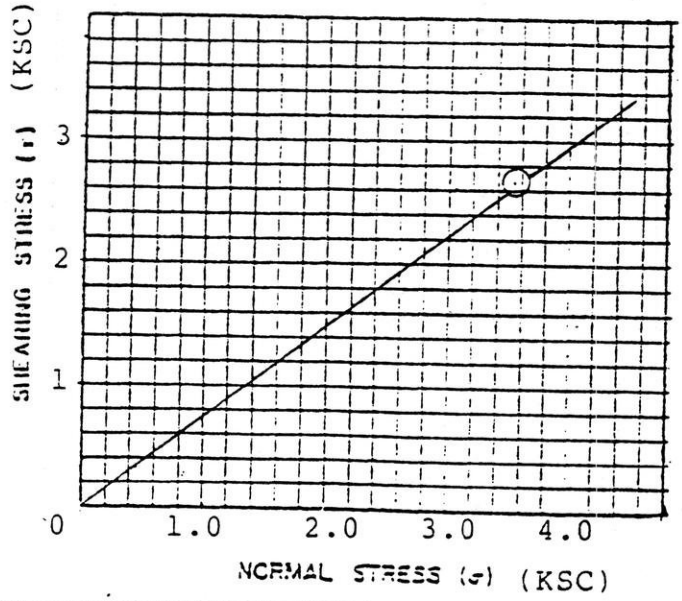
CLASSIFICATION: Fine sand -- cream (SP) LL -- PI -- SPECIFIC GRAVITY

TYPE OF TEST: Drained	CONTROL: Strain	$G_s(-)$ #4	--
RATE OF LOADING: 0.048mm/min	MOISTURE CONDITION: saturated	$G_s(-)$ #4	--
TYPE OF SPECIMEN: Round undisturbed	AREA: 28.27cm²	THICKNESS: 2.00cm	



TEST NO.	1	2	3	4
INIT MOISTURE, %	18.5			
DRY DENSITY, INIT gms/cc	1.823			
INIT VOID RATIO	.438			
TEST DURATION (min)	125			
FINAL MOISTURE, %	21.6			
NORMAL STRESS KSC	3.52			
MAX. SHEAR STRESS KSC	2.69			

SHEAR VALUES	Ø	C
AT MAXIMUM STRESS	36.5°	0.0



REMARKS

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APPENDIX 3.5-M

Detailed Soil Pit Descriptions
Flambeau Project, Ladysmith, WI

Description of Soil Pit KWC-1

Horizon	Description
1	0 to 6 inches, brown (7.5 YR 4/2) silt loam; dry; moderate medium platy breaking to moderate medium subangular blocky; few fine faint yellowish red (5 YR 5/6-5/8) interpedal mottles; common roots; abrupt smooth boundary.
2	6 to 10 inches, dark grayish brown (10 YR 4/2) heavy silt loam; dry; weak medium platy; few medium distinct yellowish red (5 YR 5/6-5/8) interpedal mottles; 10-20% gravel; abrupt wavy boundary.
3	10 to 20 inches, dark brown (10 YR 3/3) gritty sandy loam to silt loam; dry; weak medium platy; common coarse distinct dark reddish brown to yellowish red (5 YR 3/4-4/6) interpedal mottles; abrupt wavy boundary.
4	20 to 23 inches, dark reddish brown (5 YR 2.5/2) silt loam; dry; moderate medium platy; common fine prominent reddish yellow (7.5 YR 7/8) intrapedal mottles and common coarse distinct dark reddish brown (5 YR 3/4) interpedal mottles; common roots; trace of woody charcoal; appears to be a buried A1 horizon; abrupt wavy boundary.
5	23 to 26 inches, pinkish gray (7.5 YR 6/2) silt loam; dry; very weak medium platy breaking to very weak medium subangular blocky; common fine distinct brown (7.5 YR 4/4) intra- and interpedal mottles; appears to be a buried A21 horizon; abrupt wavy boundary.
6	26 to 44 inches, light gray (10 YR 7/2) silt loam; dry; weak medium platy breaking to very weak fine subangular blocky; common medium to coarse distinct dark brown (7.5 YR 3/4) and strong brown (7.5 YR 5/8) inter- and intrapedal mottles; appears to be a buried A22 horizon; abrupt wavy boundary.
7	44 to 66 inches, brown (7.5 YR 4/4) light sandy clay loam; dry; very weak medium platy breaking to weak fine subangular blocky; firm; dark reddish brown (2.5 YR 3/4) clay and iron oxide bridges between grains; 20-40% gravel; appears to be a buried B2 in horizon; abrupt smooth boundary.
8	66 to 74+ inches, dark brown (7.5 YR 3/4) light sandy clay loam to sandy loam; dry; weak medium subangular blocky; 15-30% gravel; appears to be a buried B horizon.

Described on 10/08/87 by John Thresher. Sample KWC-1 collected from horizons 1 and 2.

Description of Soil Pit KWC-2

Horizon	Description
1	0 to 11 inches, dark brown (7.5 YR 3/4) silt loam; dry; weak fine platy breaking to weak very fine subangular blocky; common roots; abrupt smooth boundary.
2	11 to 19 inches, brown (7.5 YR 4/4 - 5/4) fine sandy loam; dry; very weak fine platy breaking to very weak very fine subangular blocky; few roots; clear wavy boundary.
3	19 to 28 inches, brown (7.5 YR 4/4) fine sandy loam; dry; weak medium platy breaking to medium granular; friable; few roots; abrupt wavy boundary.
4	28 to 51 inches, brown (7.5 YR 4/4) medium loamy sandy; dry; very weak medium platy breaking to medium granular; few medium distinct strong brown (7.5 YR 5/8) intrapedal mottles; abrupt smooth boundary.
5	51 to 62 inches, dark yellowish brown (10 YR 4/4) light sandy clay loam; dry; weak medium platy breaking to weak medium platy breaking to weak fine subangular blocky; weak medium stratified; friable; few medium to coarse prominent dark reddish brown (5 YR 3/4) mottles; abrupt wavy boundary.
6	62 to 77+ inches, dark brown (7.5 YR 3/4) coarse sand and sandy gravel; dry; 40-50% gravel overall; weak coarse stratification; friable; weak medium to coarse granular.

Described on 10/08/87 by John Thresher. Sample KWC-2 collected from horizon 1.

Description of Soil Pit KWC-3

Horizon	Description
1	0 to 10 inches, dark reddish brown (5 YR 3/2) fine sandy loam; dry; weak fine platy breaking to weak fine granular; friable; common roots; abrupt wavy boundary.
2	10 to 19 inches, brown (7.5 YR 4/4) fine sandy loam; dry; weak fine stratified breaking to weak fine subangular blocky; clear smooth boundary.
3	19 to 52 inches, strong brown (7.5 YR 4/6) fine sandy loam; dry; friable to firm; weak medium platy breaking to fine subangular blocky; common medium distinct reddish yellow (5 YR 7/8) interpedal mottles; abrupt smooth boundary.
4	52 to 68 inches, reddish brown (5 YR 4/4) light sandy clay loam; dry; weak fine platy breaking to fine crumb; friable; many medium distinct yellowish red (5 YR 5/6-5/8) mottles; abrupt smooth boundary.
5	68 to 74+ inches, brown (7.5 YR 4/4) silty clay loam; dry; moderate medium platy; 25 to 30% gravel; many coarse prominent yellowish red (5 YR 5/6-5/8) interpedal mottles.

Described on 10/08/87 by John Thresher. Sample KWC-3 collected from horizon 1. The central till sample KWC-4 was collected from horizon 4.

Description of Soil Pit KWC-4

Horizon	Description
1	0 to 5 inches, dark reddish brown (5 YR 2.5/2) medium loamy sandy; dry; moderate medium platy; very friable; common roots; abrupt wavy boundary.
2	5 to 11 inches, dark reddish brown (5 YR 3/4) medium sandy loam; dry; friable; medium granular; clear smooth boundary.
3	11 to 23 inches, strong brown (7.5 YR 4/6) medium sandy loam; dry; friable; fine to medium granular; diffuse smooth boundary.
4	23 to 51 inches, brown (7.5 YR 5/4) medium loamy sand; dry; very friable; fine crumb; weak medium stratification; few medium to coarse faint reddish yellow (7.5 YR 6/8) mottles; abrupt smooth boundary.
5	51 to 55-71 inches, brown (7.5 YR 4/4) light fine sandy clay loam wedge; dry; weak medium platy breaking to weak fine subangular blocky; few fine to coarse distinct reddish yellow (7.5 YR 6/6-6/8) root mottles; 15-20% gravel; abrupt smooth boundary.
6	55-71 to 74+ inches, strong brown (7.5 YR 4/6) medium to coarse loamy sand wedge; dry; weak coarse cross-stratified; loose.

Described on 10/08/87 by John Thresher. Sample KWC-4 collected from horizons 1 and 2.

Description of Soil Pit KWC-5

Horizon	Description
1	0 to 6 inches, very dark brown (7.5 YR 2/2) gritty silt loam; dry; friable; weak medium platy breaking to weak fine subangular blocky; common roots; clear smooth boundary.
2	6 to 12 inches, dark brown (7.5 YR 3/2) gritty silt loam; dry; weak medium platy breaking to fine to medium subangular blocky; friable; clear smooth boundary.
3	12 to 17 inches, dark brown (7.5 YR 3/4) light sandy clay loam; moist; moderate medium platy breaking to weak fine subangular blocky; many very fine to fine distinct strong brown (7.5 YR 5/8) mottles; stiff; abrupt wavy boundary.
4	17 to 42 inches, brown (7.5 YR 4/2) fine gritty sandy clay loam; moist; weak medium platy breaking to fine crumb; stiff; 3-5% gravel; many coarse prominent red (2.5 YR 4/6-4/8) mottles; weak medium stratification; abrupt wavy boundary.
5	42 to 70+ inches, dark reddish brown (5 YR 3/4) gritty medium sandy clay loam; moist; massive breaking to weak fine to medium granular; stiff; 5-7% gravel; common coarse faint to distinct yellowish red (5 YR 4/6-5/8) mottles.

Described on 10/08/87 by John Thresher. Sample KWC-5 collected from horizons 1 and 2.

Description of Soil Pit KWC-6

Horizon	Description
1	0 to 6 inches, black (10 YR 2/1) firm sandy loam; moist; friable; medium crumb; common roots; few medium faint dark yellowish brown (10 YR 4/6) mottles; abrupt wavy boundary.
2	6 to 16 inches, dark brown (7.5 YR 3/4) fine sandy loam; wet; friable; non-sticky; medium crumb; common medium distinct reddish brown (5 YR 5/4) mottles; diffuse smooth (almost glossic) boundary.
3	16 to 32 inches, dark reddish brown (5 YR 3/4) medium loamy sand; wet; friable to firm; medium granular; weak fine stratification; common medium distinct dark red (2.7 YR 3/6) mottles; abrupt smooth boundary.
4	32 to 49+ inches, dark reddish brown (5 YR 3/4) gritty sandy clay loam; wet; massive breaking to fine to medium subangular blocky; 20-30% gravel; common coarse distinct reddish yellow (5 YR 6/8-7/8) mottles.

Described on 10/09/87 by John Thresher. Standing water at 44 inches. Sample KWC-6 collected from horizons 1 and 2.

APPENDIX 3.5-N

Sample Composite and Measurement Methods, Results, and Quality Control
Flambeau Project, Ladysmith, WI

TABLE NO. 1

TOPSOIL, TILL, SANDSTONE, AND SAPROLITE
COMPOSITING DATA

Topsoil Compositing Data

Sample Location	Wet Weight	Dry Weight
Topsoil - West (Composite)		
KWC-1	3,483.4	2,682.2
KWC-1	3,025.8	2,329.9
KWC-1	3,288.9	2,532.4
KWC-2	3,417.7	2,631.6
KWC-2	2,650.0	2,040.5
KWC-2	4,370.7	3,365.4
TOTAL	20,236.5 (gms)	15,582.0 (gms)
Topsoil - Central (Composite)		
KWC-3	3,553.0	2,735.8
KWC-3	3,225.8	2,483.9
KWC-3	4,351.7	3,350.8
KWC-4	4,266.7	3,285.4
KWC-4	3,919.5	3,018.0
KWC-4	4,241.8	3,266.2
TOTAL	23,558.5 (gms)	18,140.1 (gms)
Topsoil - East (Composite)		
KWC-5	4,652.0	4,000.7
KWC-5	3,524.8	3,031.3
KWC-5	3,219.8	2,769.0
KWC-6	3,847.2	3,308.6
KWC-6	4,008.0	3,446.9
KWC-6	3,333.3	2,866.6
TOTAL	22,585.1 (gms)	19,423.1 (gms)

TABLE NO. 1 (Cont.)

Type I Soil (KWR Soils) Compositing Data

Sample	Color	Texture (USDA)	Wet Weight	Dry Weight
KWR-1	5YR3/3	sil-sicl	1,068.7	958.6
KWR-2	*	sil-sicl	1,174.2	1,053.2
KWR-3	7.5YR4/4	sil	955.4	857.0
KWR-4	7.5YR4/6	l	906.1	812.8
KWR-5	5YR3/4	sl-l	1,031.8	925.5
KWR-6	7.5YR3/4	sl	1,074.5	963.8
KWR-7	5YR3/3	l	1,115.5	1,000.6
KWR-8	5YR4/6	sl	1,058.7	949.6
KWR-9	5YR3/4	sl	1,173.6	1,052.7
KWR-10	7.5YR3/4	sl	1,106.6	992.6
TOTALS			10,665.1 (gms)	9,566.4 (gms)

*Base color is 5YR4/4 but includes mff 5YR5/8 mottles.

TABLE NO. 1 (Cont.)

Till Compositing Data

Boring No.	Sample No.	Sample Depth (ft)	Wet Weight	Dry Weight
Till - West Compositing Data				
B-S1	SS1	5- 7	321.5	288.6
B-S1	SS2	10-11.5	646.2	580.1
B-S1	SS2	10-12	1,183.1	1,062.1
B-S1	SS3	15-17	714.2	641.1
B-S2	SS1	5- 7	1,607.8	1,443.3
B-S2	SS2	10-11	842.4	756.2
B-S2	SS3	12-13.4	1,544.9	1,386.8
B-WC1	SS2	2- 4	3,669.4	3,294.0
B-WC1	SS4	6- 8	3,780.1	3,393.4
B-WC1	SS5	8-10	2,318.8	2,081.6
B-WC1	SS5	10-12	3,104.6	2,787.0
B-WC1	SS6	12-14	4,330.0	3,887.0
B-WC1A	SS3	4- 6	4,465.6	4,008.8
TOTALS			28,528.6 (gms)	25,610.0 (gms)
Till - East Compositing Data				
B-S4	SS2	5- 7	1,908.9	1,727.2
B-S4	SS3	10	2,100.2	1,900.3
B-S4	SS5	15-17	616.5	557.8
B-S4	SS6	20-22	1,425.2	1,289.5
B-S5	SS2	10-12	203.3	184.0
B-S5	SS3	15-17	930.8	842.2
B-S5	SS5	20-21	600.5	543.3
B-S5	SS6	22-24	581.4	526.0
B-WC3	SS2	5- 6.5	1,763.5	1,595.6
B-WC3	SS5	20-21.5	2,058.2	1,862.3
B-WC3	SS6	25-26.5	3,250.4	2,941.0
B-WC3A	SS3	7- 9	2,555.6	2,312.3
B-WC3A	SS7	12-14	3,164.1	2,862.9
TOTALS			21,158.6 (gms)	19,144.4 (gms)

TABLE NO. 1 (Cont.)

Till - Central Compositing Data

Boring No.	Sample No.	Sample Depth (ft)	Wet Weight	Dry Weight
B-S3	SS2	5- 6.5	461.5	415.4
B-S3	SS3	10-11.5	407.0	366.3
B-S3 *	SS6	19.5-21	574.0	516.6
	ST	21-22		
B-S3	--	24.5-26	442.1	397.9
B-WC2	SS3	4- 6	3,150.7	2,835.6
B-WC2	SS9	17-19	3,509.4	3,158.5
B-WC2A	SS5	8-10	4,395.7	3,956.1
B-WC2A	SS8	14-16	3,519.1	3,167.2
B-WC2A	SS12	22-24	4,319.9	3,887.9
KWC-4	--	8-10	3,718.9	3,347.0
TOTALS			24,498.3 (gms)	22,048.5 (gms)

* B-S3 is a composite of SS6 and ST. Individual weights of these two samples were not recorded.

TABLE NO. 1 (cont.)

Sandstone Compositing Data

Boring No.	Sample No.	Sample Depth (ft)	Wet Weight	Dry Weight
Sandstone - West Compositing Data				
B-S1	SS4	17-18	883.2	776.8
B-S1	SS5	19-21	777.9	684.2
B-S1	SS6	21-23	1,514.3	1,331.8
TOTALS			3,175.4 (gms)	2,792.8 (gms)
Sandstone - Central Compositing Data				
B-S3	--	27	369.0	320.2
B-WC2	SS12	25-26	2,076.9	1,802.3
B-WC2	SS13	26-28	2,866.8	2,487.8
B-WC2	SS14	28-30	533.7	463.1
B-WC2	SS15	29.0-29.5	596.2	517.4
TOTALS			6,442.6 (gms)	5,590.8 (gms)
Sandstone - East Compositing Data				
B-S4	SS17	39-41	2,835.2	2,509.2
B-S4	SS18	41-43	2,523.8	2,233.6
B-S4	SS19	43-45	2,890.9	2,558.4
B-S5	SS10	40-42	1,166.8	1,032.6
B-WC3	SS7	10.0-11.5	2,299.6	2,035.2
B-WC3	SS9	34.0-35.5	2,342.7	2,073.3
B-WC3	SS10	35.5-38	3,449.6	3,052.9
B-WC3	SS11	38.5-39.5	1,737.5	1,537.7
TOTALS			19,246.1 (gms)	17,032.9 (gms)

TABLE NO. 1 (Cont.)

Saprolite Compositing Data

Boring No.	Sample No.	Sample Depth (ft)	Wet Weight	Dry Weight
B-S2	ST	30-31.5	3,298.7	2,896.6
B-S3	SS10	39.5-41	301.2	264.5
B-S3	--	44.5-46	305.5	268.3
B-S3	--	49.5-50.5	442.2	388.3
B-S3	--	50.5-51.5	392.0	344.2
B-S3	--	51-53	1,010.9	887.7
B-S4	SS20	45-47	1,725.9	1,515.5
B-S4	SS21	47-50	3,627.7	3,185.5
B-S4	--	47-50	512.2	449.8
B-S4	SS21	47-50	491.9	431.9
B-S4	SS22	50-51.5	268.1	235.4
B-S4	ST24	53-54.1	1,553.8	1,364.4
B-S4	ST24	54-56	1,290.8	1,133.4
B-S5	C1	58-62	1,705.3	1,497.4
B-S5	C1	58-62	2,035.5	1,787.4
B-S5	C1	62-67	2,232.3	1,960.2
B-S5	C1	62-67	2,093.1	1,838.0
B-WC1	SS7	14-16	4,603.7	4,042.5
B-WC1	SS8	16.5-18	2,605.2	2,287.6
B-WC1	SS9	18-19.5	1,296.8	1,138.7
B-WC1	SS9	18-19.5	2,172.0	1,907.2
B-WC1A	SS10	18.5-19.5	927.1	814.1
B-WC1A	SS10	18.5-19.5	1,149.1	1,009.0
B-WC1B	SS7	14-16	843.6	740.8
B-WC1B	SS10	17.5-18.5	1,685.6	1,480.1
B-WC3	C1	42-43	3,460.4	3,038.6
B-WC3	C1	43-44	2,360.3	2,072.6
TOTALS			44,390.9 (gms)	38,979.7 (gms)

METHODS USED IN CALCULATING DATA PRESENTED IN TABLE NO. 2

Waste Rock Chip Axial Lengths, Volumes and Surface Areas

1. The three principal orthogonal axes of each rock chip were measured to the nearest millimeter. These include the median (b), the long (c), and the short (a) axes.

2. The single chip maximum volume and surface area were calculated using the mean chip axial lengths. The maximum volume and surface area assume that the three measured orthogonal axes are the principal axes of a rectangular parallelopiped.

   a. Single chip maximum volume (in cm^3) = a x b x c.

   b. Single chip maximum surface area (in cm^2) = (a x b x 2) + (a x c x 2) + (b x c x 2).

   c. Maximum total chip volume and maximum total chip surface area = single chip maximum volume x number chips and single chip maximum surface area x number chips, respectively.

3. The corrected total volume of the chips was calculated by dividing the total mass of the chips (TABLE NO. 5 - APPENDIX 3.5-N) by the average specific gravity. (Bulk specific gravity (saturated-surface-dry) = 2.57).

4. The numerical mean single chip maximum surface area for all waste rock samples is 2.1 $\pm$ 0.4 (cm^2) (n=78) times the single chip maximum density. It is assumed that the actual chip surface area will also bear a similar relationship to the actual chip density. This demonstrated relationship was utilized in the calculation of the corrected total surface area.

   a. The corrected total surface area was calculated by multiplying the maximum total surface area by the quotient of the corrected total volume divided by the maximum total volume.

TABLE NO. 2

Rock Chip Axial Lengths, Volumes and Surface Areas

DDH	Sample Depth	Geologic Unit	Axial Lengths			Axial Ratio a:b:c	Number Chips	Maximum Volume		Corrected Total Volume	Maximum Surface Area		Corrected Total Surface Area
			Median	Long	Short			Single Chip	Total Chips		Single Chip	Total Chips	
							WR-1						
22-6	209-219	2a	3.2 ± 0.7	5.1 ± 1.5	1.7 ± 0.3	0.5:1.0:1.6	28	27.7	775.6	352.6	60.9	1,705	775.1
22-17	123-128	2a	2.9 ± 0.9	4.7 ± 0.9	1.8 ± 0.6	0.6:1.0:1.6	34	24.5	833.0	602.4	54.6	1,856	1,342
22-17	131-138	2a	2,9 ± 1.0	4.4 ± 1.0	1.9 ± 0.6	0.7:1.0:1.5	21	24.2	508.2	348.6	53.3	1,119	767.6
22-17	145-147	2a	3.9 ± 0.7	5.0 ± 0.9	2.2 ± 0.2	0.6:1.0:1.3	16	42.9	686.4	357.0	78.2	1,251	650.6
22-30	171-176	4c	3.7 ± 1.3	5.0 ± 1.8	2.2 ± 1.0	0.6:1.0:1.4	21	40.7	854.7	432.5	75.3	1,581	800.0
22-56	149-157	3a	3.5 ± 1.1	4.9 ± 1.7	2.1 ± 0.9	0.6:1.0:1.4	45	36.0	1,620	1,061.1	69.6	3,132	2,051
22-56	157-160	3a	3.3 ± 1.0	4.5 ± 1.0	1.9 ± 1.2	0.6:1.0:1.4	25	28.2	705.0	374.9	59.3	1,482	788.1
22-57	52-72	3a	4.2 ± 0.4	5.4 ± 0.9	1.6 ± 0.9	0.4:1.0:1.3	30	36.3	1,089	691.2	76.1	2,283	1,449
22-70	69-79	2c	3.2 ± 0.9	4.7 ± 1.4	2.2 ± 0.7	0.7:1.0:1.5	48	33.1	1,589	877.3	64.8	3,110	1,717
22-70	140-150	2c	3.5 ± 0.9	5.0 ± 1.5	2.2 ± 0.9	0.6:1.0:1.4	43	38.5	1,656	1,081	72.4	3,113	2,032
22-70	150-160	2c	4.1 ± 0.5	5.6 ± 1.5	2.9 ± 1.0	0.7:1.0:1.4	27	66.6	1,798	900.9	102.2	2,759	1,382
22-86	59-70	2c	2.5 ± 1.0	3.6 ± 1.4	1.4 ± 0.7	0.6:1.0:1.4	32	12.6	403.2	296.8	35.1	1,123	826.6
22-86	70-78	2c	3.3 ± 1.1	5.7 ± 2.4	1.3 ± 0.8	0.4:1.0:1.7	57	24.5	1,397	975.4	61.0	3,477	2,438
22-90	72-80	2b	3.8 ± 0.7	5.8 ± 1.7	2.1 ± 0.9	0.6:1.0:1.5	31	46.3	1,435	664.7	84.4	2,616	1,212
22-90	80-95	2b	3.4 ± 1.0	4.8 ± 1.8	2.0 ± 0.9	0.6:1.0:1.4	51	32.6	1,663	834.9	65.4	3,335	1,674
22-98	50-55	2b	3.1 ± 1.2	3.8 ± 1.2	1.5 ± 0.6	0.5:1.0:1.2	15	17.7	265.5	160.9	44.3	664.5	402.7
	(ft)		(cm)	(cm)	(cm)			(cm^3)	17,279 (cm^3)	10,012 (cm^3)	(cm^2)	34,606 (cm^2)	20,308 (cm^2)

TABLE NO. 2 (Cont.)

DDH	Sample Depth	Geologic Unit	Axial Lengths Median	Long	Short	Axial Ratio a:b:c	Number Chips	Maximum Volume Single Chip	Maximum Volume Total Chips	Corrected Total Volume	Maximum Surface Area Single Chip	Maximum Surface Area Total Chips	Corrected Total Surface Area
							WR-2						
22-1	129-174	2a	3.1 ± 0.6	5.0 ± 1.8	1.6 ± 1.2	0.5:1.0:1.6	59	24.8	1,463	898.9	56.9	3,357	2,063
22-32	92-96	2a	3.6 ± 0.9	4.9 ± 1.0	2.0 ± 0.4	0.6:1.0:1.4	35	35.3	1,236	846.7	69.3	2,426	1,662
22-32	96-100	2a	3.7 ± 0.9	5.8 ± 1.6	2.2 ± 0.3	0.6:1.0:1.6	23	47.2	1,086	440.7	84.7	1,948	790.5
22-38	58-63	2a	3.4 ± 0.8	5.8 ± 1.6	1.9 ± 1.0	0.6:1.0:1.7	31	37.5	1,163	811.8	74.4	2,306	1,610
22-56	140-149	3a	3.8 ± 0.9	5.4 ± 1.2	2.6 ± 1.4	0.7:1.0:1.4	33	53.4	1,762	887.5	88.9	2,934	1,478
22-62	52-62	4c	3.4 ± 0.9	4.7 ± 1.1	2.4 ± 1.0	0.7:1.0:1.4	38	38.4	1,459	840.4	70.8	2,690	1,549
22-62	62-72	4c	3.2 ± 1.0	5.2 ± 2.0	2.1 ± 1.2	0.7:1.0:1.6	38	34.9	1,326	1,055	68.6	2,607	2,074
22-62	72-80	4c	3.7 ± 1.0	4.8 ± 1.0	2.6 ± 1.0	0.7:1.0:1.3	36	46.2	1,663	993.8	79.7	2,869	1,714
22-68	130-135	1a	3.6 ± 0.9	5.4 ± 1.7	2.0 ± 1.1	0.6:1.0:1.5	28	38.9	1,089	546.6	74.9	2,097	1,053
22-68	162-175	4c	3.4 ± 1.1	4.9 ± 1.7	2.4 ± 1.1	0.7:1.0:1.4	52	40.0	2,080	988.0	73.2	3,806	1,808
22-94	115-120	2c	4.0 ± 0.7	5.7 ± 1.9	2.6 ± 1.3	0.7:1.0:1.4	22	59.3	1,305	915.6	96.0	2,112	1,482
	(ft)		(cm)	(cm)	(cm)			(cm^3)	15,632 (cm^3)	9,225 (cm^3)	(cm2)	29,152 (cm^2)	17,248 (cm^2)
							WR-3						
22-17	128-131	2a	3.0 ± 0.7	4.3 ± 0.5	1.8 ± 0.4	0.6:1.0:1.4	30	23.2	696.0	586.1	52.1	1,563	1,316
22-17	138-145	2a	3.8 ± 0.8	5.0 ± 0.6	2.2 ± 0.4	0.6:1.0:1.3	33	41.8	1,379	536.2	76.7	2,531	984.1
22-17	152-157	2a	3.6 ± 0.9	4.7 ± 0.3	2.0 ± 1.0	0.6:1.0:1.4	27	33.8	912.6	612.9	67.0	1,809	1,215
22-17	157-162	2a	3.6 ± 1.0	5.1 ± 0.8	2.0 ± 0.5	0.6:1.0:1.4	27	36.7	990.9	586.1	71.5	1,931	1,142
22-30	165-171	4c	3.7 ± 0.9	4.8 ± 0.9	2.2 ± 0.9	0.6:1.0:1.3	45	39.1	1,760	1,028	72.9	3,281	1,916
22-51	130-131	2c	2.8 ± 0.8	5.6 ± 1.5	1.4 ± 0.6	0.5:1.0:2.0	47	22.0	1,034	743.7	54.9	2,580	1,856
22-68	121-130	1a	3.8 ± 0.7	5.2 ± 0.9	2.2 ± 0.7	0.6:1.0:1.4	38	43.5	1,653	1,159	79.1	3,006	2,108
22-78	58-65	1a	3.1 ± 0.9	4.6 ± 1.3	1.9 ± 1.0	0.6:1.0:1.5	31	27.1	840.1	318.7	57.8	1,792	679.8
22-94	78-83	2c	3.4 ± 0.9	5.1 ± 1.3	2.4 ± 1.0	0.7:1.0:1.5	27	41.6	1,123	697.5	75.5	2,039	1,266
22-94	130-140	2c	4.0 ± 0.8	5.6 ± 1.3	3.0 ± 1.2	0.8:1.0:1.4	30	67.2	2,016	844.4	102.4	3,072	1,287
22-98	55-65	1a	2.6 ± 0.8	5.0 ± 1.8	1.4 ± 0.6	0.5:1.0:1.9	36	18.2	655.2	413.9	47.3	1,703	1,076
22-99	55-70	1a	2.9 ± 0.9	4.6 ± 1.5	1.6 ± 0.5	0.6:1.0:1.6	33	21.3	702.9	427.7	50.7	1,673	1,018
22-99	76-82	1a	3.7 ± 0.8	4.9 ± 1.4	2.2 ± 0.8	0.6:1.0:1.3	30	39.9	1,197	643.0	74.1	2,223	1,194
	(ft)		(cm)	(cm)	(cm)			(cm^3)	14,960 (cm^3)	8,597 (cm^3)	(cm^2)	29,203 (cm^2)	17,058 (cm^2)

TABLE NO. 2 (Cont.)

DDH	Sample Depth	Geologic Unit	Axial Lengths			Axial Ratio	Number	Maximum Volume		Corrected	Maximum Surface Area		Corrected
			Median	Long	Short	a:b:c	Chips	Single Chip	Total Chips	Total Volume	Single Chip	Total Chips	Total Surface Area
							WR-4						
22-6	219-229	2a	3.3 ± 0.4	4.3 ± 0.4	2.0 ± 0.7	0.6:1.0:1.3	36	28.4	1,022	558.6	58.8	2,117	1,157
22-16	123-130	1a	3.0 ± 1.1	4.7 ± 1.3	1.3 ± 0.6	0.4:1.0:1.6	66	18.3	1,208	910.8	48.2	3,181	2,398
22-17	162-165	2a	3.4 ± 1.1	5.0 ± 0.8	1.9 ± 0.3	0.6:1.0:1.5	17	32.3	549.1	451.7	65.9	1,120	921.3
22-17	165-169	2a	3.1 ± 0.8	4.5 ± 0.7	1.8 ± 0.6	0.6:1.0:1.4	27	25.1	677.7	513.9	55.3	1,493	1,132
22-17	171-177	2a	3.3 ± 1.0	4.6 ± 0.5	1.8 ± 0.6	o.6:1.0:1.4	44	27.3	1,201	708.5	58.8	2,587	1,526
22-27	85-90	26	3.6 ± 1.1	6.0 ± 1.4	2.5 ± 1.1	0.7:1.0:1.7	31	54.0	1,674	1,128	91.2	2,827	1,905
22-27	100-105	2b	3.7 ± 0.8	6.1 ± 2.0	2.2 ± 0.6	0.6:1.0:1.7	24	49.7	1,193	464.1	88.3	2,119	824.3
22-49	180-190	2a	3.5 ± 0.8	5.1 ± 1.1	1.6 ± 0.7	0.5:1.0:1.5	56	28.6	1,602	1,014	63.2	3,539	2,240
22-68	145-149	1a	4.0 ± 0.8	5.3 ± 0.9	2.8 ± 0.9	0.7:1.0:1.3	21	59.4	1,247	720.5	94.5	1,984	1,146
22-68	154-162	4c	3.5 ± 1.1	4.5 ± 1.1	2.3 ± 1.0	0.7:1.0:1.3	37	36.2	1,339	1,008	68.3	2,527	1,902
22-69	37-40	1a	3.7 ± 0.9	4.9 ± 1.5	1.9 ± 0.8	0.5:1.0:1.3	18	34.4	619.2	146.7	68.9	1,240	293.8
22-69	42-46	1a	2.9 ± 0.8	4.1 ± 1.0	1.5 ± 0.7	0.5:1.0:1.4	45	17.8	801.0	496.3	44.8	2,016	1,249
22-69	46-50	1a	3.0 ± 0.9	4.8 ± 1.0	1.2 ± 0.5	0.4:1.0:1.6	40	17.3	692.0	534.9	47.5	1,900	1,469
22-70	160-170	2c	4.4 ± 0.2	7.4 ± 1.1	3.5 ± 1.2	0.8:1.0:1.7	19	114.0	2,166	941.0	147.7	2,806	1,219
22-70	170-180	2c	3.9 ± 0.8	5.6 ± 1.6	2.7 ± 1.2	0.7:1.0:1.4	29	59.0	1,711	1,082	95.0	2,755	1,742
22-94	62-72	1a	3.6 ± 1.0	5.5 ± 1.5	2.5 ± 1.2	0.7:1.0:1.5	31	49.5	1,534	975.6	85.1	2,638	1,678
22-94	110-115	2c	3.9 ± 0.9	4.7 ± 0.9	2.8 ± 1.3	0.7:1.0:1.2	37	51.3	1,898	969.3	84.8	3,138	1,603
22-99	70-76	1a	4.3 ± 0.4	5.8 ± 1.0	2.1 ± 0.2	0.5:1.0:1.4	18	52.4	943.2	500.5	92.3	1,661	881.4
	(ft)		(cm)	(cm)	(cm)			(cm^3)			(cm^2)		
									22,077 (cm^3)	13,124 (cm^3)		41,648 (cm^2)	25,287 (cm^2)

TABLE NO. 2 (Cont.)

DDH	Sample Depth	Geologic Unit	Axial Lengths			Axial Ratio a:b:c	Number Chips	Maximum Volume		Corrected Total Volume	Maximum Surface Area		Corrected Total Surface Area
			Median	Long	Short			Single Chip	Total Chips		Single Chip	Total Chips	
							WR-5						
22-6	229-239	2a	3.0 ± 0.7	4.6 ± 0.9	1.6 ± 0.6	0.5:1.0:1.5	22	22.1	486.2	252.0	51.9	1,142	591.9
22-15	60-66	2b	3.3 ± 1.3	4.7 ± 1.5	1.7 ± 0.6	0.5:1.0:1.4	39	26.4	1,030	880.1	58.2	2,270	1,940
22-16	105-115	1a	3.7 ± 1.0	5.3 ± 1.1	1.9 ± 0.3	0.5:1.0:1.4	34	37.3	1,268	883.6	73.4	2,496	1,739
22-18	65-73	2b	3.9 ± 0.8	5.1 ± 1.2	2.1 ± 1.0	0.5:1.0:1.3	41	41.8	1,714	1,149	77.6	3,182	2,133
22-32	115-120	2a	3.8 ± 0.9	5.1 ± 1.0	2.1 ± 0.5	0.6:1.0:1.3	43	40.7	1,750	1,037	76.1	3,272	1,939
22-35	39-49	1a	2.7 ± 0.9	6.7 ± 2.2	1.2 ± 0.6	0.4:1.0:2.5	59	21.7	1,280	886.8	58.7	3,463	2,399
22-35	50-55	1a	2.7 ± 0.9	6.9 ± 2.0	1.3 ± 0.5	0.5:1.0:2.6	46	24.2	1,113	794.6	62.2	2,861	2,042
22-35	61-66	1a	2.9 ± 1.0	5.1 ± 1.3	1.5 ± 0.6	0.5:2.0:1.8	53	22.2	1,177	819.5	53.6	2,841	1,978
22-38	66-73	2a	3.1 ± 1.0	5.5 ± 1.0	1.1 ± 0.6	0.4:1.0:1.8	61	18.8	1,147	781.9	53.0	3,233	2,204
22-38	73-80	2a	3.1 ± 1.0	5.2 ± 1.3	1.1 ± 0.7	0.3:1.0:1.7	68	17.7	1,204	1,056	50.5	3,434	3,311
22-38	92-99	2a	3.2 ± 1.1	4.8 ± 1.4	1.3 ± 0.8	0.4:1.0:1.5	68	20.0	1,360	963.4	51.5	3,502	2,481
22-49	65-81	2a	3.9 ± 0.8	5.4 ± 1.3	2.5 ± 1.4	0.6:1.0:1.4	31	52.7	1,634	1,054	88.6	2,747	1,772
22-66	60-70	2b	3.3 ± 0.8	5.8 ± 1.1	1.5 ± 0.5	0.4:1.0:1.8	54	28.7	1,550	961.4	65.6	3,542	2,197
22-66	70-78	2b	2.9 ± 0.9	6.0 ± 0.9	1.4 ± 0.7	0.5:1.0:2.1	52	24.4	1,269	856.4	59.7	3,104	2,095
22-75	47-50	1b	4.1 ± 0.6	5.1 ± 0.8	2.3 ± 0.7	0.6:1.0:1.2	17	48.1	817.7	518.1	84.1	1,430	906.1
22-90	95-100	2b	2.6 ± 0.7	3.8 ± 1.3	1.0 ± 0.5	0.4:1.0:1.5	34	9.88	335.9	270.2	32.6	1,108	891.3
22-90	100-110	2b	3.1 ± 1.0	4.6 ± 1.4	1.5 ± 0.6	0.5:1.0:1.5	27	21.4	577.8	482.3	51.6	1,393	1,163
22-90	72-78	2c	3.1 ± 1.0	4.3 ± 1.2	1.9 ± 1.3	0.6:1.0:1.4	41	25.3	1,037	692.5	54.8	2,247	1,500
22-98	65-70	1a	3.9 ± 0.8	5.7 ± 1.9	2.1 ± 0.4	0.5:1.0:1.5	14	46.7	653.8	353.3	84.8	1,187	641.4
22-98	70-80	1a	3.1 ± 0.9	5.7 ± 1.5	1.6 ± 0.5	0.5:1.0:1.8	10	28.3	283.0	161.3	63.5	635.0	361.9
	(ft)		(cm)	(cm)	(cm)			(cm^3)			(cm^2)		
									21,687 (cm^3)	14,853 (cm^3)		48,089 (cm^2)	34,286 (cm^2)

TABLE NO. 2 (Cont.)

DDH	Sample Depth	Geologic Unit	Axial Lengths Median	Long	Short	Axial Ratio a:b:c	Number Chips
			WW-1 Rock Chip Axial Lengths				
22-27	195-206	1c	3.9 ± 0.5	4.9 ± 1.1	2.1 ± 0.6	0.5:1.0:1.3	20
22-38	184-194	1c	3.2 ± 0.5	4.2 ± 0.8	1.5 ± 0.2	0.5:1.0:1.3	49
22-38	194-203	1c	3.1 ± 0.6	4.3 ± 0.9	1.5 ± 0.2	0.5:1.0:1.4	67
22-65	95-109	2a	3.6 ± 1.0	4.7 ± 1.0	2.1 ± 0.2	0.6:1.0:1.3	42
22-69	93-100	2a	2.6 ± 0.9	4.4 ± 1.1	1.1 ± 0.6	0.4:1.0:1.7	58
22-73	167-175	1c	3.1 ± 1.0	5.0 ± 1.3	1.8 ± 0.4	0.6:1.0:1.6	42
22-73	175-183	1c	3.8 ± 0.9	5.0 ± 1.1	1.7 ± 0.5	0.5:1.0:1.3	50
22-73	183-185	1c	2.6 ± 0.7	5.0 ± 1.2	1.4 ± 0.5	0.5:1.0:1.9	28
22-76	85-95	1c	3.9 ± 0.9	4.9 ± 1.1	2.2 ± 0.8	0.6:1.0:1.3	38
22-82	139-246	1c	3.9 ± 0.8	5.1 ± 1.0	2.0 ± 0.5	0.5:1.0:1.3	36
22-82	146-149	1c	3.6 ± 1.1	4.6 ± 1.2	1.7 ± 0.8	0.5:1.0:1.3	26
22-85	271-280	1c	3.7 ± 0.9	5.8 ± 1.1	1.0 ± 0.5	0.3:1.0:1.6	63
22-93	85-94	2b	3.7 ± 0.8	5.0 ± 1.0	1.4 ± 0.5	0.4:1.0:1.4	52
22-93	94-100	2b	3.6 ± 0.8	4.9 ± 1.0	1.6 ± 0.5	0.4:1.0:1.4	36
22-96	140-144	1a	3.8 ± 0.9	5.1 ± 1.1	1.7 ± 0.6	0.5:1.0:1.3	25
22-96	144-153	1a	3.7 ± 0.9	4.7 ± 1.0	1.4 ± 0.8	0.4:1.0:1.3	36
22-96	153-160	1c	3.4 ± 1.0	4.8 ± 0.9	1.8 ± 0.4	0.5:1.0:1.4	46
	(ft)		(cm)	(cm)	(cm)		

TABLE NO. 3

Boring No. and Depth Interval of Each Waste Rock Sample Composited for Specific Gravity Determination

Boring Number	Depth Interval (feet)	Boring Number	Depth Interval (feet)	Boring Number	Depth Interval (feet)
22-1	129-174	22-38	184-194	22-76	85-95
22-6	209-219	22-38	194-203	22-78	58-65
22-6	219-229	22-49	65-81	22-82	139-146
22-6	229-239	22-49	180-190	22-82	146-149
22-15	60-66	22-51	130-135	22-85	271-280
22-16	105-115	22-56	140-149	22-86	59-70
22-16	123-130	22-56	149-157	22-86	70-78
22-17	123-128	22-56	157-160	22-90	72-80
22-17	128-131	22-57	52-72	22-90	80-90
22-17	131-138	22-62	52-62	22-90	90-100
22-17	138-145	22-62	62-72	22-90	100-110
22-17	145-147	22-62	72-80	22-93	85-94
22-17	152-175	22-65	95-109	22-93	94-100
22-17	157-162	22-66	60-70	22-94	62-72
22-17	162-165	22-66	70-78	22-92	72-78
22-17	165-169	22-68	121-130	22-94	78-83
22-17	171-177	22-68	130-135	22-94	110-115
22-18	65-73	22-68	145-149	22-94	115-120
22-27	85-90	22-68	154-162	22-94	130-140
22-27	100-105	22-68	162-175	22-96	140-144
22-27	195-206	22-69	37-40	22-96	144-153
22-30	165-171	22-69	42-46	22-96	153-160
22-30	171-176	22-69	46-50	22-98	50-55
22-32	92-96	22-69	93-100	22-98	55-65
22-32	96-100	22-70	69-79	22-98	65-70
22-32	115-120	22-70	140-150	22-98	70-80
22-35	39-49	22-70	150-160	22-99	55-70
22-35	50-55	22-70	160-170	22-99	70-76
22-35	61-66	22-70	170-180	22-99	76-82
22-38	58-63	22-73	167-175	WC2	34.9-39.5
22-38	66-73	22-73	175-183		
22-38	73-80	22-73	183-185		
22-38	92-99	22-75	47-50		

Specific Gravity Results - Waste Rock*

A = Weight of oven-dry test sample in air (g)
A_1 = Weight of air-dry test sample in air (g)
B = Weight of saturated-surface dry sample in air (g)
C = Weight of saturated test sample in water (g)

A = 7104 g
A_1 = 7233 g
B = 7526 g
C = 4595 g

Bulk specific gravity (air-dry) = $A_1/B-C$ = 2.47
Bulk specific gravity (oven-dry) = $A/B-C$ = 2.42
Bulk specific gravity (saturated-surface-dry) = $B/B-C$ = 2.57
Apparent specific gravity (air dry) = A_1/A_1-C = 2.74
Apparent specific gravity (oven-dry) = $A/A-C$ = 2.83
Percent Absorption (air-dry) = $[B-A_1/A_1] \times 100$ = 4.1%
Percent Absorption (oven-dry) = $[B-A/A] \times 100$ = 5.9%
Approximate Effective Porosity (air-dry) = $(B-A_1)/(B-C)$ = 10.0%
Approximate Effective Porosity (oven-dry) = $(B-A)/(B-C)$ = 14.4%

* Test performed 2/18/88 - 2/22/88

Calculation of Estimated Error for Waste Rock Specific Gravity Determination

A. Direct Measurements

1. Weight Determinations

Accuracy of balance - ± 1 g

Values are presented as 4 significant digits (e.g., 7104 ± 1 g)

B. Calculations

1. Specific Gravity

Values are presented as 3 significant digits (e.g., 2.47 ± 0.01)

The least accurate of the values used in the specific gravity equations contains 4 significant digits. The specific gravity is presented with only 3 significant digits to account for error due to loss of sample during saturation. Assuming 1% moisture in the air-dried waste rock composite, the maximum loss of sample during saturation was 0.8% of the original air-dried weight.

Modifications to ASTM Test Designation: C127-84 for Specific Gravity Determination of Waste Rock Composite

1) The sample was not oven-dried prior to saturation with water.

2) The saturated-surface-dry weight was obtained after obtaining the weight of the saturated sample in water.

3) The temperature of the distilled water in which the sample was weighed was 20^{o} C.

Calculation of Estimated Error for Overburden Specific Gravity Determinations

A. Direct Measurements

1. Weight Determinations

Accuracy of balance - $\pm$0.1 g

Values are presented as 4 significant digits (e.g., 691.4 g $\pm$0.1)

2. Temperature

A calibrated laboratory thermometer (accurate to 1^{o} C) was utilized for the test. The temperature of the volumetric flask filled with water (Wa, observed) was used to compile values of Wa for the range of temperatures expected during the test (see paragraph 6.2 in ASTM Test Designation: D854-83). The value, Wa, varies by 0.1 g within the range of temperatures present during the tests.

Values of Wa are therefore presented as 4 significant digits (e.g., 691.0 $\pm$ 0.1).

B. Calculations

1. Sample Weight

Sample weights ranged from 38.7 to 64.2 grams. The sample weight values are presented with 3 significant digits. The sample weight value is the least accurate value in the specific gravity equation.

2. Specific Gravity

Carrying 3 significant digits, the least accurate of the parameters in the specific gravity equation results in specific gravity values being $\pm$ 0.01.

Modifications to ASTM Test Designation: D854-84 for Specific Gravity Determination of Overburden Samples

1. The scale used was sensitive to 0.1 grams.

Specific Gravity Results - Overburden*

Sample No./Description	Specific Gravity
Till East #1	2.67
Till East #2	2.67
Till Central #1	2.73
Till Central #2	2.69
Till West #1	2.71
Till West #2	2.74
Saprolite #1	2.65
Saprolite #2	2.69
Saprolite #3	2.65
Sandstone Composite	2.65

*Results are given for water @ 20° C.

Specific Gravity, Density, and Grain Size
Determinations of Topsoil, Overburden, and Waste Rock Materials
Flambeau Project, Ladysmith, WI

Foth & Van Dyke and Associates Inc.

2737 S. Ridge Road P. O. Box 19012 Green Bay, WI 54307-9012 414/497-2500

REPORT OF:

SIEVE ANALYSIS OF COARSE TO FINE AGGREGATES

PROJECT: Waste Characterization

SCOPE I.D. #: 87K10

DATE TYPED: 1-26-89

REPORTED TO: Kennecott Explorations

REPORT NUMBER: 1

TEST PERFORMED IN GENERAL ACCORDANCE OF ASTM: D1140

GENERAL DATA:

SAMPLE LOCATION:

SAMPLE NUMBER: Soil Composite - Type 1

DEPTH OF SAMPLE:

SAMPLED BY: John Thresher

DATE SAMPLED: 12/27/88

DATED RECEIVED: 12/28/88

SOURCE OF SAMPLE:

MUNSELL COLOR CODE: 7.5 YR. 3/4

LABORATORY DATA:

DATE TESTED: 12/30/88

TESTED PERFORMED BY: KAS

REVIEWED BY: P.O. Kepler 1-3-89

24 HRS. TURN AROUND ____ YES __x__ NO

WASHED GRADATION __x__ YES ____ NO

WEIGHT OF TEST SAMPLE 407.8 **GRAMS**

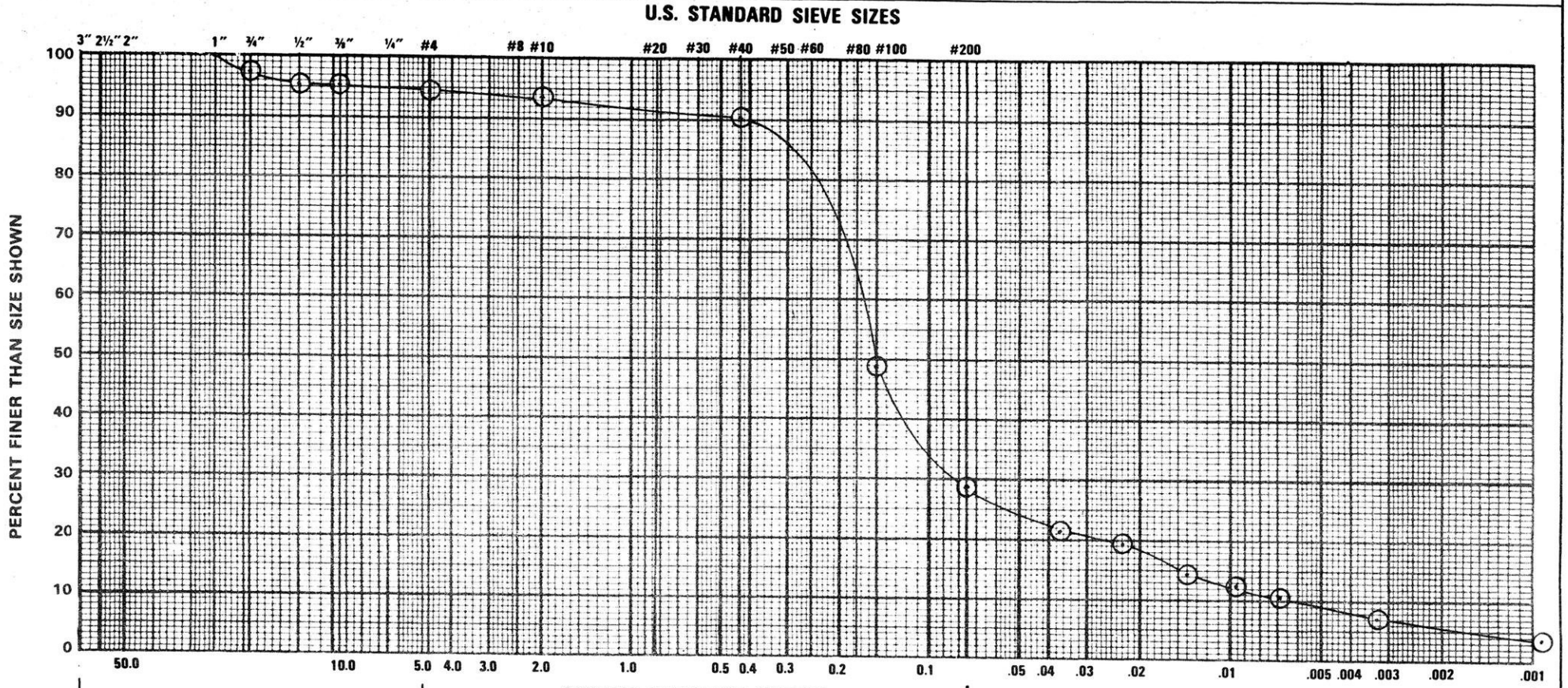
SIEVE SIZE	WEIGHT RETAINED *(gms)*	% RETAINED	% PASSING	PROJECT SPECIFICATION % PASSING BY WEIGHT	SOURCE OF SPECIFICATION
3"					
1½					
1	0	0	100		
3/4	10.8	2.6	97.4		
1/2	7.4	1.8	95.6		
3/8	0	0	95.6		
#4	3.9	1.0	94.6		
10	3.6	0.9	93.7		
40	14.3	3.5	90.2		
100	168.4	41.3	48.9		
200	81.9	20.1	28.8		
PAN	117.9	28.9			

REMARKS:

BY: Robert R. Rouse

Foth & Van Dyke and Associates Inc.

GRAIN SIZE DISTRIBUTION CURVE



GRAVEL		SAND			SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE		
% = 2.6	% = 2.8	% = 0.9	% = 3.5	% = 61.3	% = 23.4	% = 5.5

PROJECT: Waste Characterization - Kennecott Explorations DATE: 1-3-89 SAMPLE NO.: 1

LOCATION SAMPLED: Soil Composite - Type 1 ELEV. OR DEPTH: _____ DRAWN BY: POK APPROVED BY: RRR

ATTERBERG LIMITS: LL _____ PL _____ PI _____ SAMPLED MOISTURE CONTENT (%): 10.3 COEFFICIENTS: Cc = _____ Cu = _____

SAMPLE SOURCE: _____ MUNSELL COLOR CODE: 7.5 YR. 3/4 DATE SAMPLED: 12-27-88

SOIL CLASSIFICATION (ASTM: D2487) SILTY SAND, fine grained, a little gravel, dark brown. (SM)

FORM #411 SL (2/87)

3.5-N-20

Foth & Van Dyke

Engineers/Architects

2737 S. Ridge Road
P. O. Box 19012
Green Bay, Wisconsin 54307-9012
414/497-2500

PROJECT NO.: _____

JOB NO.: 87K10

DATE: February 29 to March 8, 1988

REPORT NO.: 1

REPORT OF ANALYSIS OF AGGREGATES

ARCHITECT/ENGINEER: Foth & Van Dyke CONTRACTOR: _____

PROJECT: Kennecott Geotechnical SOURCE: _____

REPORT OF TESTS OF: Verification of Sandstone Composite Sample

Sieve Size or No.	Weight Retained	% Retained	% Passing	Specifi-cations
3-Inch				
2-Inch				
1 1/2-Inch				
1-Inch	0	0	100	
3/4-Inch	34.3	0.8	99.2	
1/2-Inch	33.3	0.8	98.4	
3/8-Inch	34.7	0.8	97.6	
No. 4	70.5	1.7	95.9	
No. 8				
No. 10	113.7	2.7	93.2	
No. 16				
No. 20	566.3	13.6	79.6	
No. 30				
No. 40	1088.9	26.1	53.5	
No. 50	779.3	18.7	34.8	
No. 80	855.8	20.5	14.3	
No. 100	194.3	4.7	9.6	
No. 200	247.8	5.9	3.7	
Pan	147.6	3.5		

RECEIVED AT LABORATORY: February 22, 1988

QUANTITY REPRESENTED: 4167.0 Grams

SUBMITTED BY: John Thresher

SAMPLED FROM: Sandstone

IDENTIFICATION: East

DATE SAMPLED: Autumn 1987

INTENDED USE: _____

WASHED GRADATION: Yes

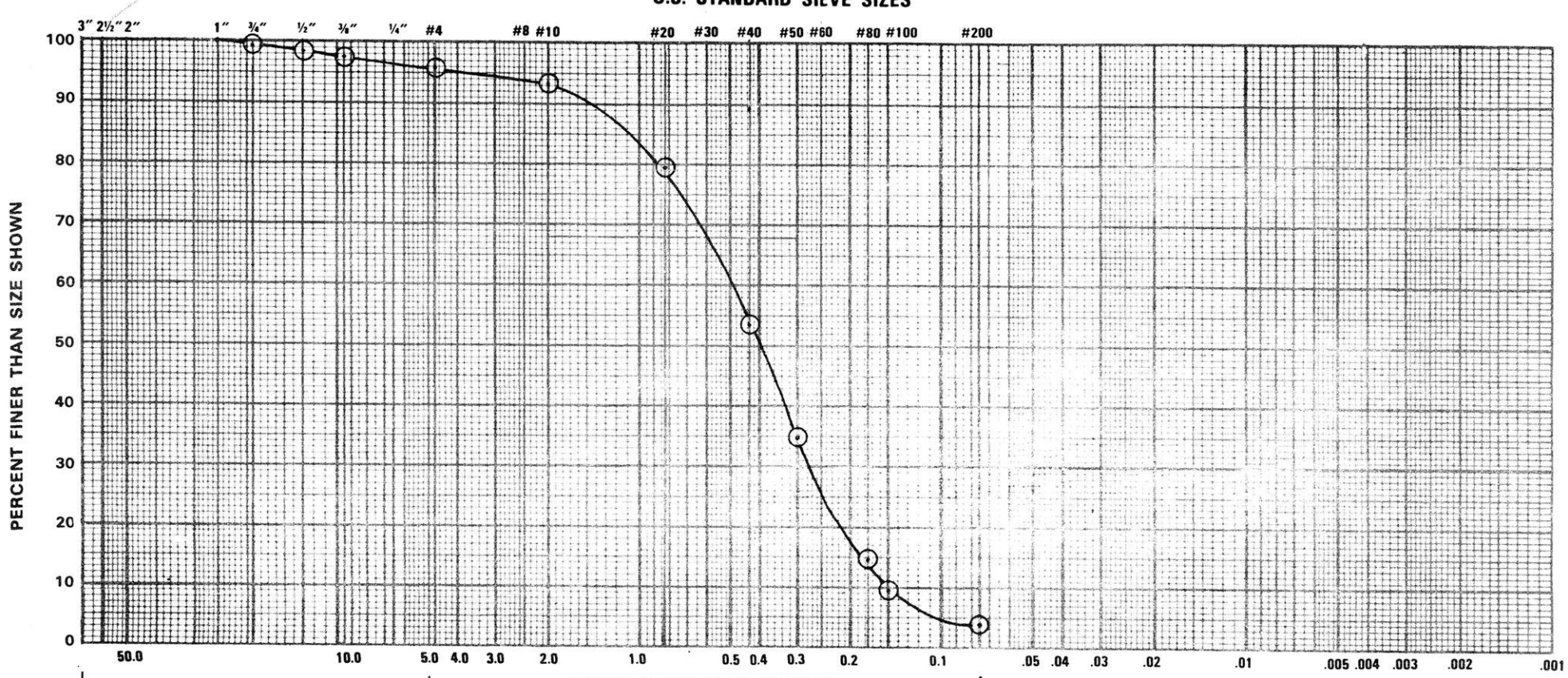
PERCENT PASSING NO. 200 SIEVE 3.5 %

COLOR: 10 Yr. 6/8 - brownish yellow

CHECKED BY: RRR

Foth & Van Dyke and Associates Inc.

GRAIN SIZE DISTRIBUTION CURVE



GRAVEL		SAND			SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE		
% = 0.8	% = 3.3	% = 2.7	% = 39.7	% = 50.0	% = 3.5	% =

PROJECT: Kennecott Geotechnical DATE: 3-10-88 SAMPLE NO.: 1

LOCATION SAMPLED: Sandstone - East ELEV. OR DEPTH: DRAWN BY: POK APPROVED BY: RRR

ATTERBERG LIMITS: LL PL PI SAMPLED MOISTURE CONTENT (%): COEFFICIENTS: Cc = 1.1 Cu = 3.2

SAMPLE SOURCE: MUNSELL COLOR CODE: 10 YR. 6/8 DATE SAMPLED: Autumn, 1987

SOIL CLASSIFICATION (ASTM: D2487) SAND, fine to medium grained, a little gravel, brownish yellow (SP)

FORM #411 SL (2/87)

3.5-N-22

Foth & Van Dyke
Engineers/Architects
2737 S. Ridge Road
P. O. Box 19012
Green Bay, Wisconsin 54307-9012
414/497-2500

PROJECT NO.: _____

JOB NO.: 87K10

DATE: February 29 to March 7, 1988

REPORT NO.: 2

REPORT OF ANALYSIS OF AGGREGATES

ARCHITECT/ENGINEER: Foth & Van Dyke CONTRACTOR: _____

PROJECT: Kennecott Geotechnical SOURCE: _____

REPORT OF TESTS OF: Verification of Composite Sandstone Sample

Sieve Size or No.	Weight Retained	% Retained	% Passing	Specifi-cations
3-Inch				
2-Inch				
1 1/2-Inch				
1-Inch				
3/4-Inch	0	0	100	
1/2-Inch	2.5	0.2	99.8	
3/8-Inch	1.1	0.1	99.7	
No. 4	5.5	0.5	99.2	
No. 8				
No. 10	15.4	1.4	97.8	
No. 16				
No. 20	85.9	7.6	90.2	
No. 30				
No. 40	229.6	20.2	70.0	
No. 50				
No. 80	541.2	47.7	22.3	
No. 100	113.5	10.0	12.3	
No. 200	95.9	8.4	3.9	
Pan +37.3 7.4	44.7	3.9		

RECEIVED AT LABORATORY: February 22, 1988

QUANTITY REPRESENTED: 1135.4 grams

SUBMITTED BY: John Thresher

SAMPLED FROM: Sandstone

IDENTIFICATION: Central

DATE SAMPLED: Autumn 1987

INTENDED USE: _____

WASHED GRADATION: Yes

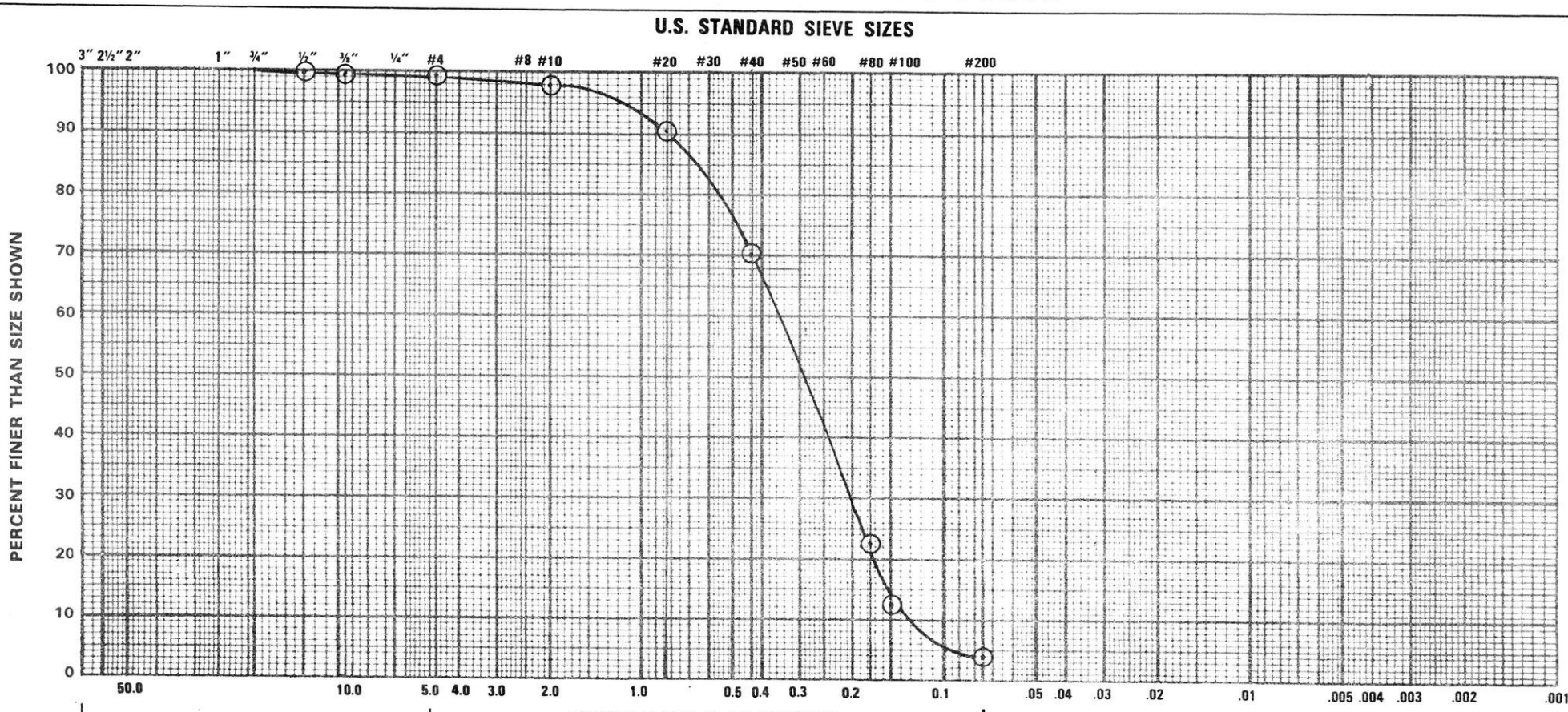
PERCENT PASSING NO. 200 SIEVE 3.9 %

COLOR: 10 YR. 6/6 - brownish yellow

CHECKED BY: RRR

Foth & Van Dyke and Associates Inc.

GRAIN SIZE DISTRIBUTION CURVE



GRAVEL		SAND			SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE		
% =	% = 0.8	% = 1.4	% = 27.8	% = 66.1	% = 3.9	% =

PROJECT: Kennecott Geotechnical DATE: 3-10-88 SAMPLE NO.: 2

LOCATION SAMPLED: Sandstone - Central ELEV. OR DEPTH: DRAWN BY: POK APPROVED BY: RRR

ATTERBERG LIMITS: LL PL PI SAMPLED MOISTURE CONTENT (%): COEFFICIENTS: Cc = 1.0 Cu = 2.7

SAMPLE SOURCE: MUNSELL COLOR CODE: 10 YR. 6/6 DATE SAMPLED: Autumn, 1987

SOIL CLASSIFICATION (ASTM: D2487) SAND, fine to medium grained, brownish yellow (SP)

FORM #411 SL (2/87)

3.5-N 24

Foth & Van Dyke

Engineers/Architects

2737 S. Ridge Road
P. O. Box 19012
Green Bay, Wisconsin 54307-9012
414/497-2500

PROJECT NO.: _____

JOB NO.: 87K10

DATE: February 29 to March 3, 1988

REPORT NO.: 3

REPORT OF ANALYSIS OF AGGREGATES

ARCHITECT/ENGINEER: Foth & Van Dyke CONTRACTOR: _____

PROJECT: Kennecott Geotechnical SOURCE: _____

REPORT OF TESTS OF: Verification of Composite Sandstone Sample

Sieve Size or No.	Weight Retained	% Retained	% Passing	Specifi-cations
3-Inch				
2-Inch				
1 1/2-Inch				
1-Inch				
3/4-Inch	0	0	100	
1/2-Inch	17.5	2.7	97.3	
3/8-Inch	6.8	1.0	96.3	
No. 4	9.3	1.4	94.9	
No. 8				
No. 10	23.2	3.5	91.4	
No. 16				
No. 20				
No. 30				
No. 40	222.6	33.7	57.7	
No. 50				
No. 80				
No. 100	310.4	47.0	10.7	
No. 200	46.4	7.0	3.7	
Pan	24.3	3.7		

RECEIVED AT LABORATORY: February 22, 1988

QUANTITY REPRESENTED: 660.5 grams

SUBMITTED BY: John Thresher

SAMPLED FROM: Sandstone

IDENTIFICATION: West

DATE SAMPLED: Autumn 1987

INTENDED USE: _____

WASHED GRADATION: Yes

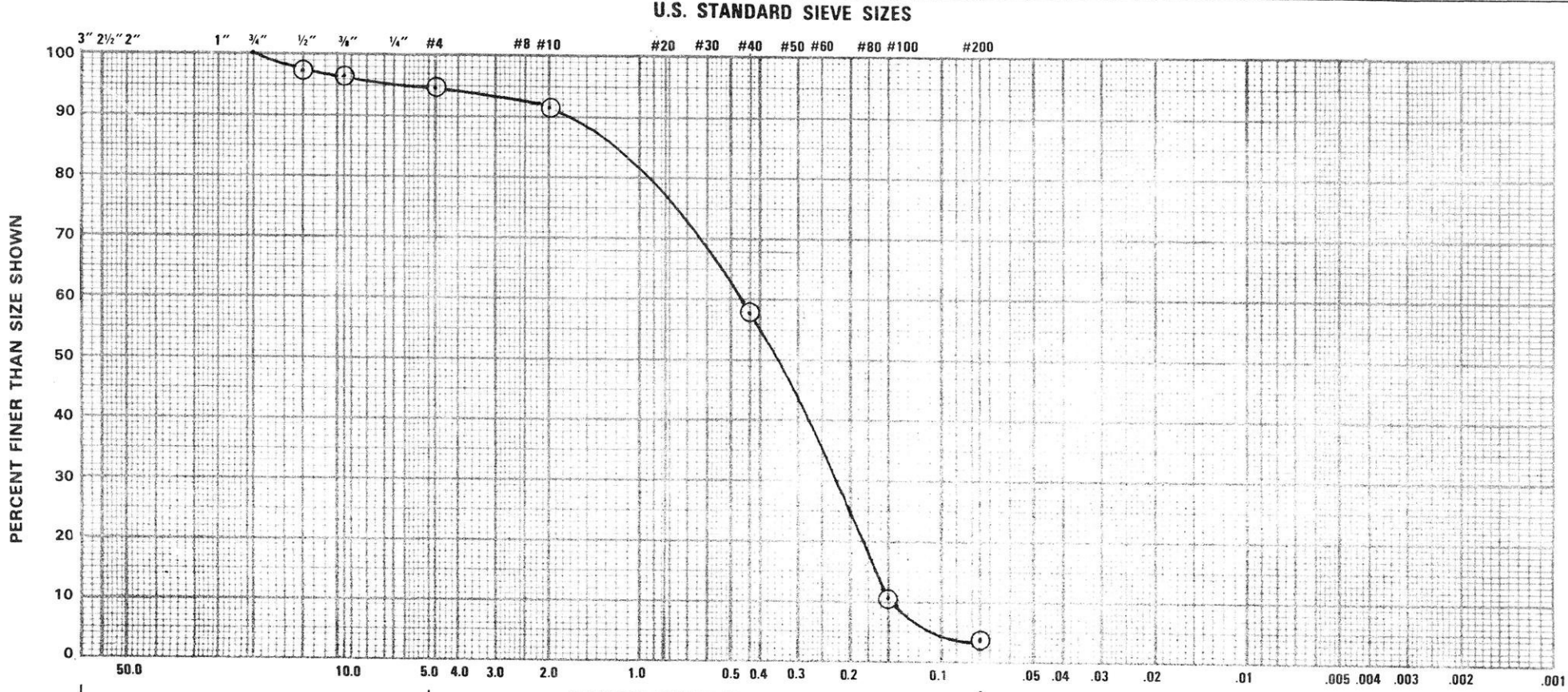
PERCENT PASSING NO. 200 SIEVE 3.7 %

COLOR: 10 YR. 6/6 - brownish yellow

CHECKED BY: RRR

Foth & Van Dyke and Associates Inc.

GRAIN SIZE DISTRIBUTION CURVE



GRAVEL		SAND			SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE		
% =	% = 5.1	% = 3.5	% = 33.7	% = 54.0	% = 3.7	% =

PROJECT: Kennecott Geotechnical DATE: 3/10/88 SAMPLE NO.: 3

LOCATION SAMPLED: Sandstone - West ELEV. OR DEPTH: DRAWN BY: POK APPROVED BY: RRR

ATTERBERG LIMITS: LL PL PI SAMPLED MOISTURE CONTENT (%): COEFFICIENTS: Cc = 0.8 Cu = 3.1

SAMPLE SOURCE: MUNSELL COLOR CODE: 10 YR. 6/6 DATE SAMPLED: Autumn, 1987

SOIL CLASSIFICATION (ASTM: D2487) SAND, fine to medium grained, a little gravel, brownish yellow (SP)

FORM #411 SL (2/87)

3.5-N-26

Foth & Van Dyke

Engineers/Architects

2737 S. Ridge Road
P. O. Box 19012
Green Bay, Wisconsin 54307-9012
414/497-2500

PROJECT NO.: _____

JOB NO.: 87K10

DATE: February 29 to March 7, 1988

REPORT NO.: 4

REPORT OF ANALYSIS OF AGGREGATES

ARCHITECT/ENGINEER: Foth & Van Dyke CONTRACTOR: _____

PROJECT: Kennecott Geotechnical SOURCE: _____

REPORT OF TESTS OF: Verification of Composite Till Sample

Sieve Size or No.	Weight Retained	% Retained	% Passing	Specifi-cations
3-Inch				
2-Inch				
1 1/2-Inch	0	0	100	
1-Inch	183.7	7.5	92.5	
3/4-Inch	44.5	1.8	90.7	
1/2-Inch	191.3	7.8	82.9	
3/8-Inch	93.4	3.8	79.1	
No. 4	155.3	6.3	72.8	
No. 8				
No. 10	190.6	7.7	65.1	
No. 16				
No. 20	234.6	9.5	55.6	
No. 30				
No. 40	351.2	14.2	41.4	
No. 50	261.8	10.6	30.8	
No. 80	232.1	9.4	21.4	
No. 100	58.2	2.4	19.0	
No. 200	108.1	4.4	14.6	
Pan	361.0	14.6		

RECEIVED AT LABORATORY: February 22, 1988

QUANTITY REPRESENTED: 2465.7 grams

SUBMITTED BY: John Thresher

SAMPLED FROM: Till

IDENTIFICATION: East

DATE SAMPLED: Autumn, 1987

INTENDED USE: _____

WASHED GRADATION: Yes

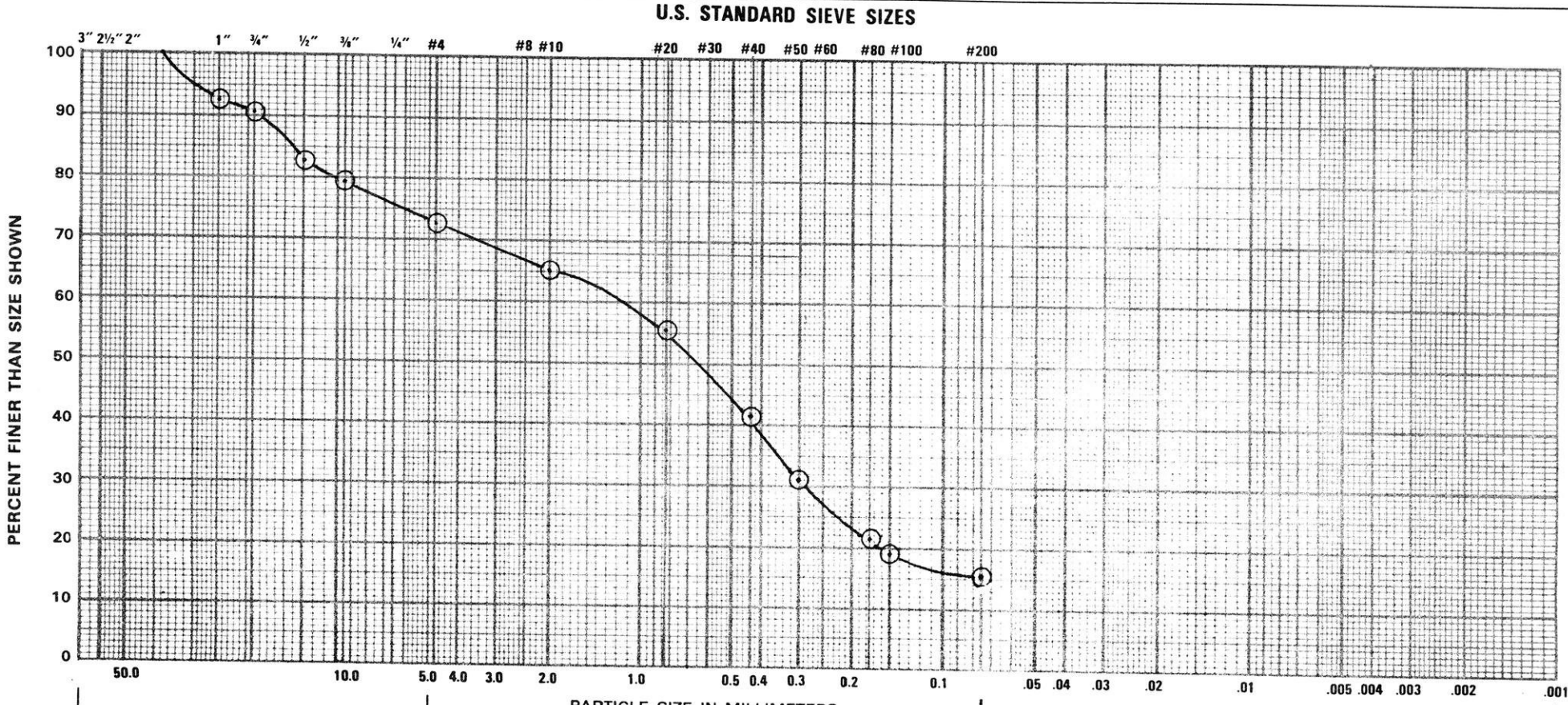
PERCENT PASSING NO. 200 SIEVE 14.6 %

COLOR: 7.5 YR. 3/4 - dark brown

CHECKED BY: RRR

Foth & Van Dyke and Associates Inc.

GRAIN SIZE DISTRIBUTION CURVE



GRAVEL		SAND			SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE		
% = 9.3	% = 17.9	% = 7.7	% = 23.7	% = 26.8	% =	% =

PROJECT: Kennecott Geotechnical DATE: 3/10/88 SAMPLE NO.: 4

LOCATION SAMPLED: Till - East ELEV. OR DEPTH: DRAWN BY: POK APPROVED BY: RRR

ATTERBERG LIMITS: LL PL PI SAMPLED MOISTURE CONTENT (%): COEFFICIENTS: Cc = Cu =

SAMPLE SOURCE: MUNSELL COLOR CODE: 7.5 YR. 3/4 DATE SAMPLED: Autumn, 1987

SOIL CLASSIFICATION (ASTM: D2487) SILTY SAND W/GRAVEL, fine to medium grained, dark brown (SM)

FORM #411 SL (2/87)

3.5-N-28

Foth & Van Dyke

Engineers/Architects

2737 S. Ridge Road
P. O. Box 19012
Green Bay, Wisconsin 54307-9012
414/497-2500

PROJECT NO.:

JOB NO.: 87K10

DATE: February 29 to March 8, 1988

REPORT NO.: 5

REPORT OF ANALYSIS OF AGGREGATES

ARCHITECT/ENGINEER: Foth & Van Dyke CONTRACTOR:

PROJECT: Kennecott Geotechnical SOURCE:

REPORT OF TESTS OF: Verification of Composite Till Sample

Sieve Size or No.	Weight Retained	% Retained	% Passing	Specifications
3-Inch				
2-Inch				
1 1/2-Inch	0	0	100	
1-Inch	95.4	2.9	97.1	
3/4-Inch	63.8	1.9	95.2	
1/2-Inch	140.6	4.2	91.0	
3/8-Inch	26.8	0.8	90.2	
No. 4	110.6	3.3	86.9	
No. 8				
No. 10	157.8	4.8	82.1	
No. 16				
No. 20	227.1	6.8	75.3	
No. 30				
No. 40	287.0	8.6	66.7	
No. 50	249.1	7.5	59.2	
No. 80	590.9	17.8	41.4	
No. 100	134.1	4.0	37.4	
No. 200	305.7	9.2	28.2	
Pan	934.1	28.1		

RECEIVED AT LABORATORY: February 22, 1988

QUANTITY REPRESENTED: 3323 grams

SUBMITTED BY: John Thresher

SAMPLED FROM: Till

IDENTIFICATION: Central

DATE SAMPLED: Autumn, 1987

INTENDED USE:

WASHED GRADATION: Yes

PERCENT PASSING NO. 200 SIEVE 28.1 %

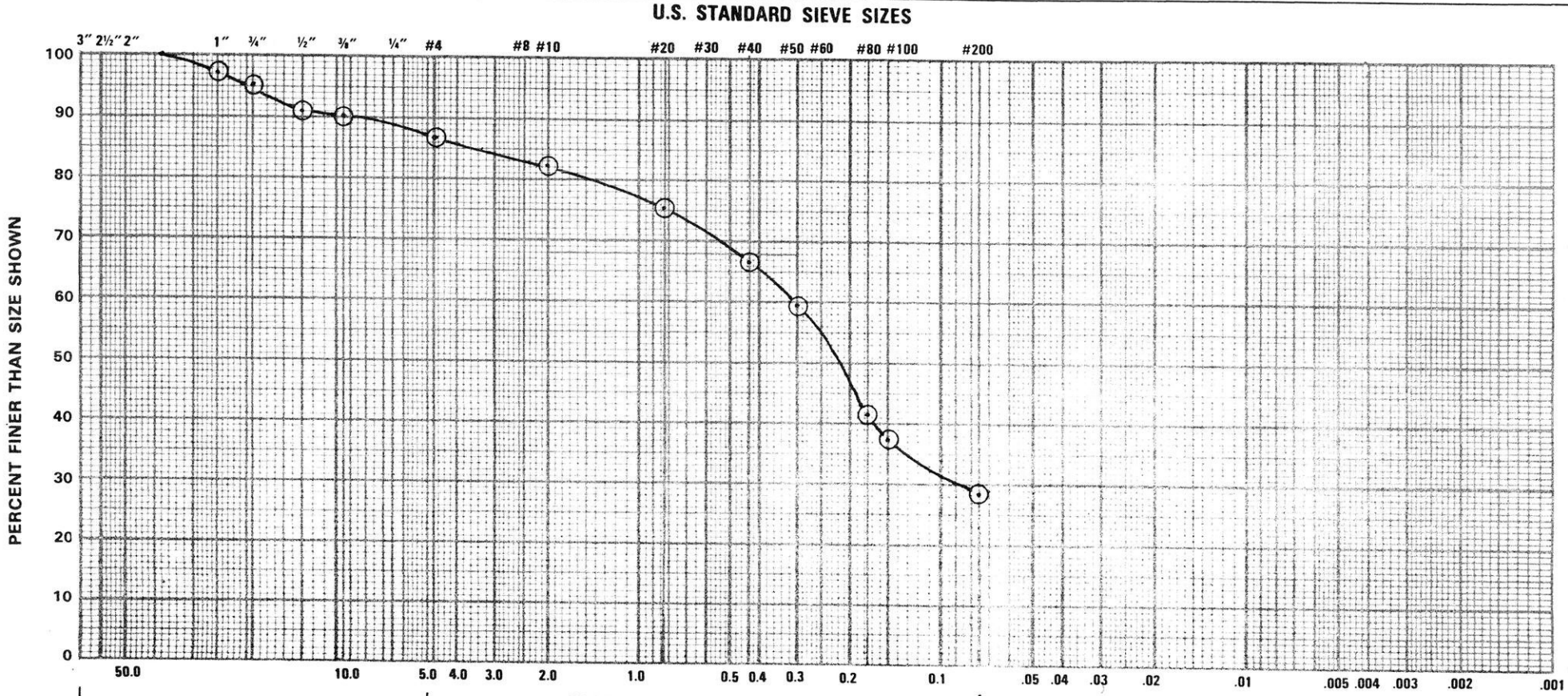
COLOR: 10 YR. 4/4 - dark yellowish brown

Moisture Content = 10.0%
(As received)

CHECKED BY: RRR

Foth & Van Dyke and Associates Inc.

GRAIN SIZE DISTRIBUTION CURVE



GRAVEL		SAND			SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE		
% = 4.8	% = 8.3	% = 4.8	% = 15.4	% = 38.6	% =	% =

PROJECT: Kennecott Geotechnical DATE: 3/10/88 SAMPLE NO.: 5

LOCATION SAMPLED: Till - Central ELEV. OR DEPTH: DRAWN BY: POK APPROVED BY: RRR

ATTERBERG LIMITS: LL PL PI SAMPLED MOISTURE CONTENT (%): COEFFICIENTS: Cc = Cu =

SAMPLE SOURCE: MUNSELL COLOR CODE: 10 YR. 4/4 DATE SAMPLED: Autumn, 1987

SOIL CLASSIFICATION (ASTM: D2487) SILTY SAND, fine to medium grained, a littel gravel, dark yellowish brown, (SM)

FORM #411 SL (2/87)

3.5-N-30

Foth & Van Dyke

Engineers/Architects

2737 S. Ridge Road
P. O. Box 19012
Green Bay, Wisconsin 54307-9012
414/497-2500

PROJECT NO.: _____

JOB NO.: 87K10

DATE: February 29 to March 7, 1988

REPORT NO.: 6

REPORT OF ANALYSIS OF AGGREGATES

ARCHITECT/ENGINEER: Foth & Van Dyke CONTRACTOR: _____

PROJECT: Kennecott Geotechnical SOURCE: _____

REPORT OF TESTS OF: Verification of Composite Till Sample

Sieve Size or No.	Weight Retained	% Retained	% Passing	Specifi-cations
3-Inch				
2-Inch	0	0	100	
1 1/2-Inch	141.3	5.1	94.9	
1-Inch	201.5	7.3	87.6	
3/4-Inch	40.5	1.5	86.1	
1/2-Inch	144.6	5.2	80.9	
3/8-Inch	119.9	4.3	76.6	
No. 4	224.2	8.1	68.5	
No. 8				
No. 10	285.6	10.3	58.2	
No. 16				
No. 20	319.1	11.6	46.6	
No. 30				
No. 40	291.3	10.5	36.1	
No. 50	183.4	6.6	29.5	
No. 80	241.9	8.8	20.7	
No. 100	75.5	2.7	18.0	
No. 200	118.9	4.3	13.7	
Pan 344.9 + 30.9	375.8	13.6		

RECEIVED AT LABORATORY: February 22, 1988

QUANTITY REPRESENTED: 2763.5 grams

SUBMITTED BY: John Thresher

SAMPLED FROM: Till

IDENTIFICATION: West

DATE SAMPLED: Autumn 1987

INTENDED USE: _____

WASHED GRADATION: Yes

PERCENT PASSING NO. 200 SIEVE 13.6 %

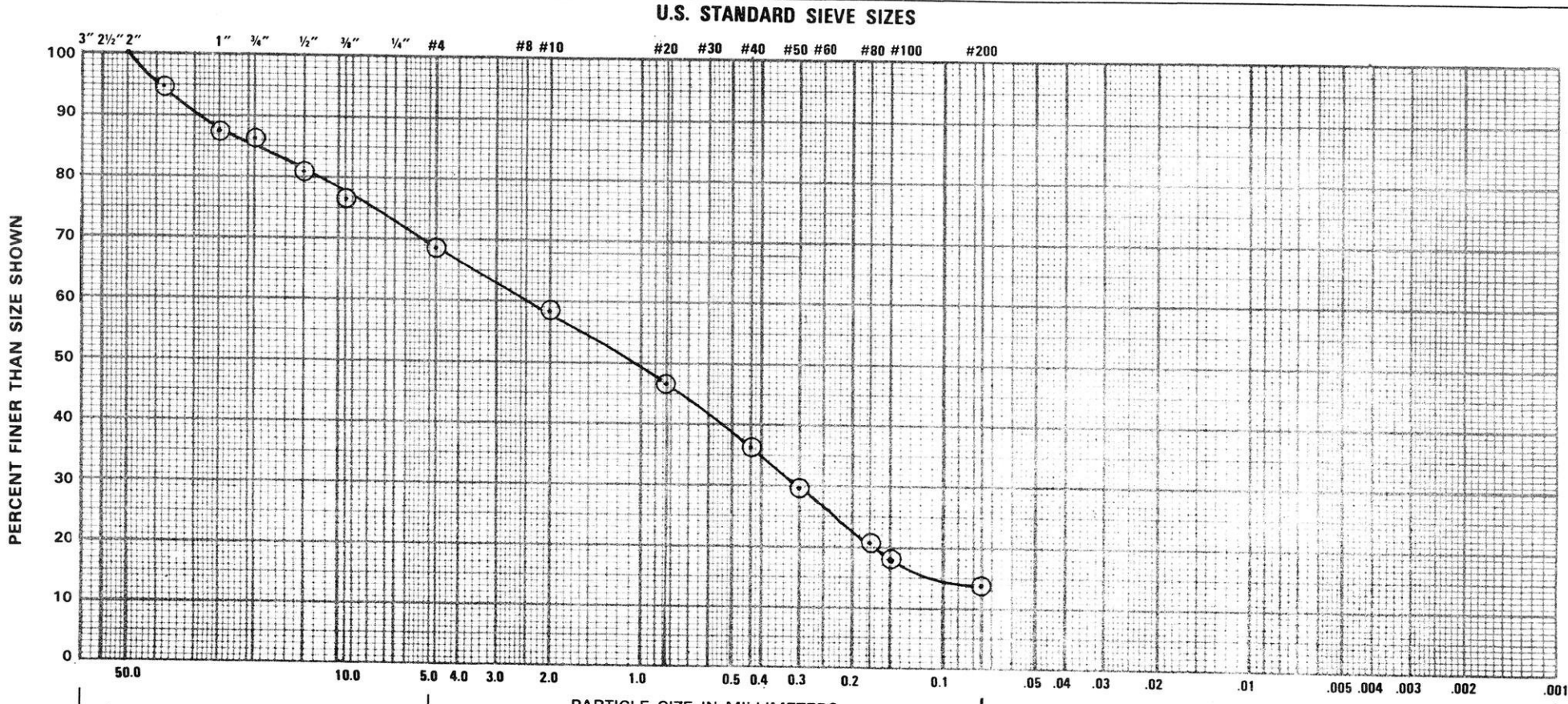
COLOR: 7.5 YR. 3/4 - dark brown

CHECKED BY: RRR

FORM #329 A-1 SL (Rev. 11/86)

Foth & Van Dyke and Associates Inc.

GRAIN SIZE DISTRIBUTION CURVE



GRAVEL		SAND			SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE		
% = 13.9	% = 17.6	% =10.3	% = 22.1	% = 22.5	% =	% =

PROJECT: Kennecott Geotechnical DATE: 3-10-88 SAMPLE NO.: 6

LOCATION SAMPLED: Till - West ELEV. OR DEPTH: DRAWN BY: POK APPROVED BY: RRR

ATTERBERG LIMITS: LL PL PI SAMPLED MOISTURE CONTENT (%): COEFFICIENTS: Cc = Cu =

SAMPLE SOURCE: MUNSELL COLOR CODE: 7.5 YR. 3/4 DATE SAMPLED: Autumn, 1987

SOIL CLASSIFICATION (ASTM: D2487) SILTY SAND W/GRAVEL, fine to medium grained, dark brown (SM)

FORM #411 SL (2/87)

3.5-N-32

Foth & Van Dyke

Engineers/Architects

2737 S. Ridge Road
P. O. Box 19012
Green Bay, Wisconsin 54307-9012
414/497-2500

PROJECT NO.: _____

JOB NO.: 87K10

DATE: February 29 to March 8, 1988

REPORT NO.: 7

REPORT OF ANALYSIS OF AGGREGATES

ARCHITECT/ENGINEER: Foth & Van Dyke CONTRACTOR: _____

PROJECT: Kennecott Geotechnical SOURCE: _____

REPORT OF TESTS OF: Verification of Composite Saprolite Sample

Sieve Size or No.	Weight Retained	% Retained	% Passing	Specifi-cations
3-Inch				
2-Inch	0	0	100	
1 1/2-Inch	348.3	12.5	87.5	
1-Inch	81.7	2.9	84.6	
3/4-Inch	94.7	3.4	81.2	
1/2-Inch	92.8	3.3	77.9	
3/8-Inch	65.1	2.3	75.6	
No. 4	142.4	5.1	70.5	
No. 8				
No. 10	205.4	7.4	63.1	
No. 16				
No. 20	207.9	7.5	55.6	
No. 30				
No. 40	174.7	6.3	49.3	
No. 50	98.4	3.5	45.8	
No. 80	144.5	5.2	40.6	
No. 100	49.9	1.8	38.8	
No. 200	142.2	5.1	33.7	
Pan	936.8	33.6		

RECEIVED AT LABORATORY: February 22, 1988

QUANTITY REPRESENTED: 2785 grams

SUBMITTED BY: John Thresher

SAMPLED FROM: _____

IDENTIFICATION: Saprolite

DATE SAMPLED: Autumn, 1987

INTENDED USE: _____

WASHED GRADATION: Yes

PERCENT PASSING NO. 200 SIEVE 33.6 %

COLOR: 10 YR. 6/2 - pinkish gray

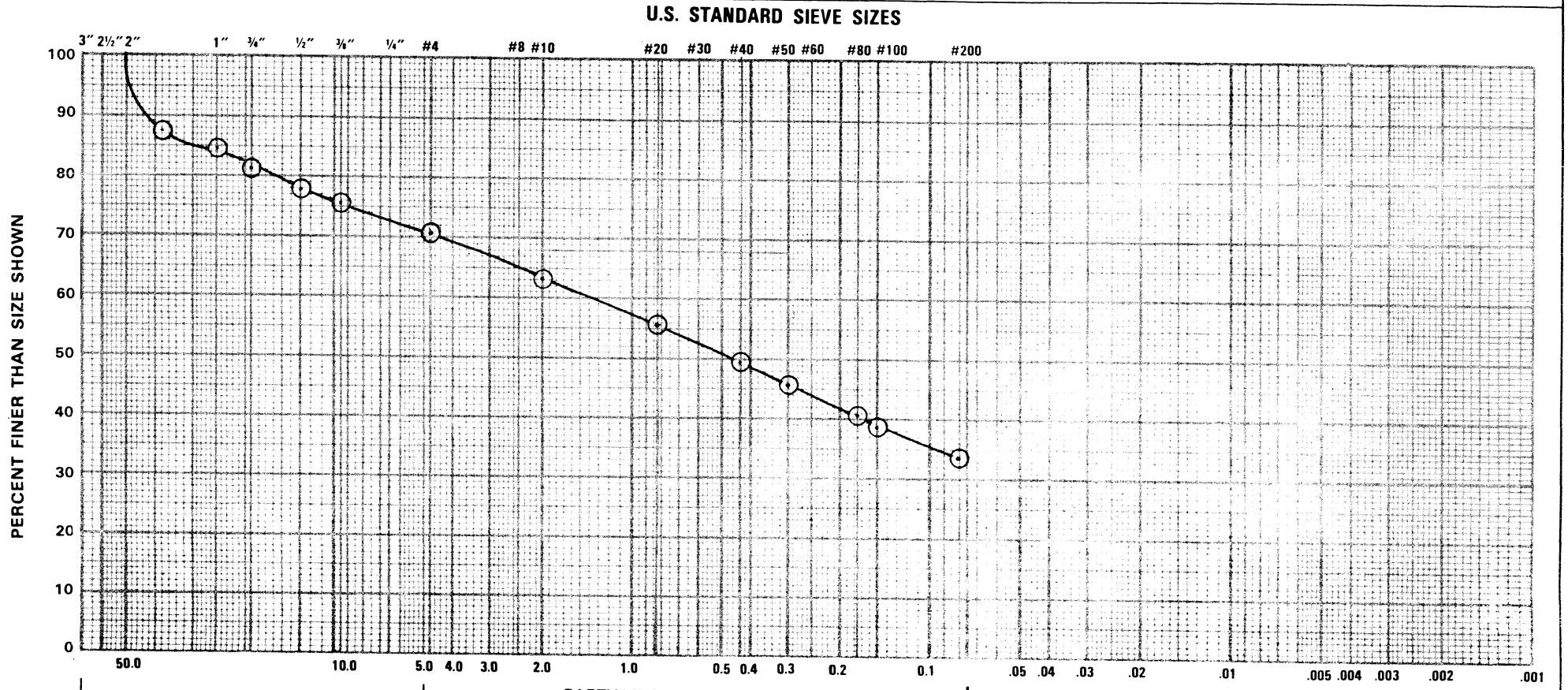
To 10 YR. 6/6 - reddish yellow

Moisture Content - 12.7%
(As received)

CHECKED BY: RRR

Foth & Van Dyke and Associates Inc.

GRAIN SIZE DISTRIBUTION CURVE



GRAVEL		SAND			SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE		
% = 18.8	% = 10.7	% = 7.4	% = 13.8	% = 15.7	% =	% =

PROJECT: Kennecott Geotechnical DATE: 3/10/88 SAMPLE NO.: 7

LOCATION SAMPLED: Saprolite ELEV. OR DEPTH: DRAWN BY: POK APPROVED BY: RRL

ATTERBERG LIMITS: LL PL PI SAMPLED MOISTURE CONTENT (%): COEFFICIENTS: Cc = Cu =

SAMPLE SOURCE: MUNSELL COLOR CODE: 10 YR. 6/2 to 6/6 DATE SAMPLED: Autumn, 1987

SOIL CLASSIFICATION (ASTM: D2487) SILTY SAND W/GRAVEL, fine to medium grained, pinkish gray to reddish yellow (SM)

FORM #411 SL (2/87)

3.5-N-34

Foth & Van Dyke

Engineers/Architects

2737 S. Ridge Road
P. O. Box 19012
Green Bay, Wisconsin 54307-9012
414/497-2500

PROJECT NO.: _____

JOB NO.: 87K10

DATE: March 7 to 9, 1988

REPORT NO.: 8

REPORT OF ANALYSIS OF AGGREGATES

ARCHITECT/ENGINEER: Foth & Van Dyke CONTRACTOR: _____

PROJECT: Kennecott Geotechnical SOURCE: _____

REPORT OF TESTS OF: Verification of Composite Topsoil Sample

Sieve Size or No.	Weight Retained	% Retained	% Passing	Specifications
3-Inch				
2-Inch				
1 1/2-Inch				
1-Inch				
3/4-Inch				
1/2-Inch				
3/8-Inch				
No. 4			100	
No. 8				
No. 10	7.1	1.4	98.6	
No. 16	3.8	0.8	97.8	
No. 20				
No. 30	14.2	2.8	95.0	
No. 40				
No. 50	73.7	14.8	80.2	
No. 140	130.0	26.0	54.2	
No. 200	32.0	6.4	47.8	
No. 270	28.3	5.7	42.1	
Pan	210.5	42.2		

16.7 grams

RECEIVED AT LABORATORY: February 22, 1988

QUANTITY REPRESENTED: 516.1 - 16.7 = 499.4 grams

SUBMITTED BY: John Thresher

SAMPLED FROM: Topsoil

IDENTIFICATION: East

DATE SAMPLED: Autumn, 1987

INTENDED USE: _____

WASHED GRADATION: Yes

PERCENT PASSING NO. 270 SIEVE 42.2 %

COLOR: 10 YR. 3/2 - very dark grayish brown

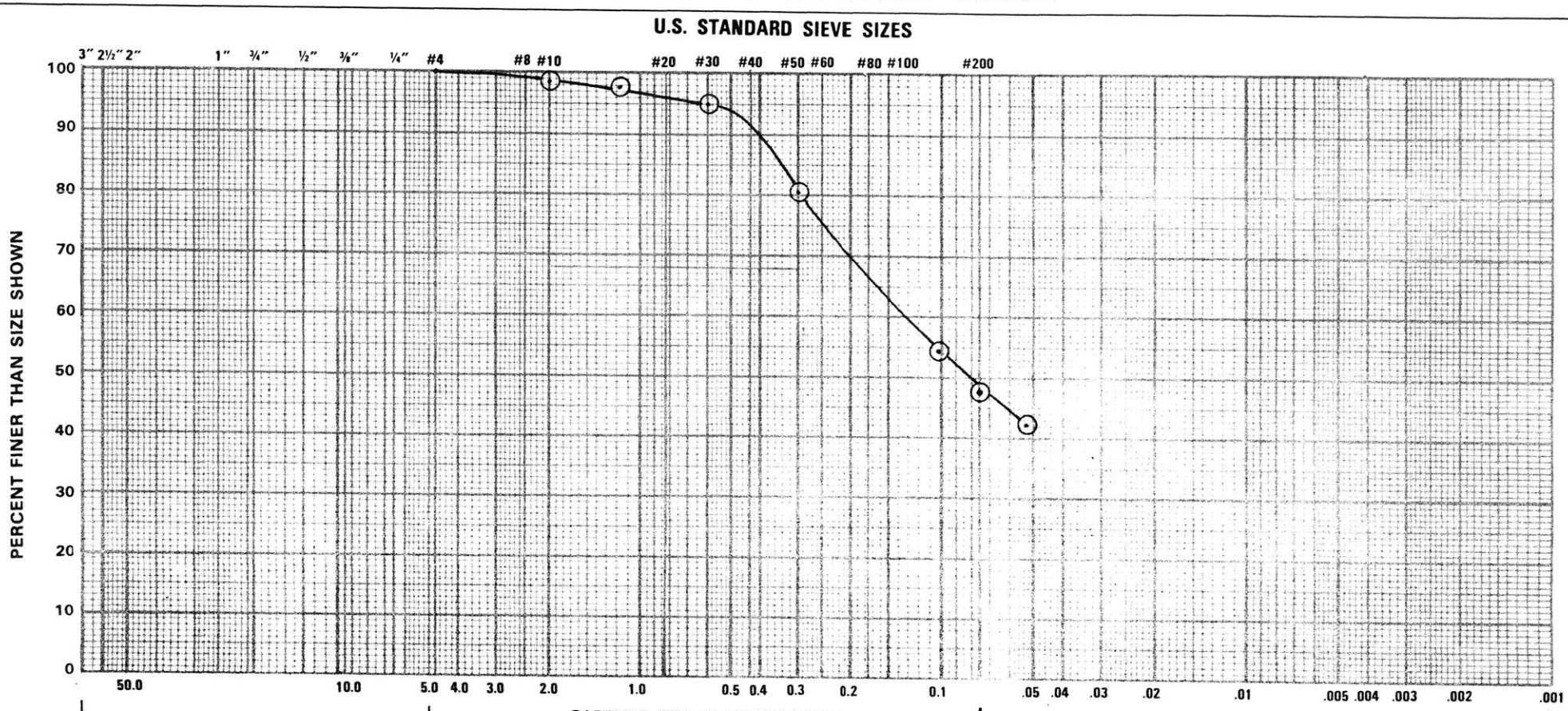
Gravel Content (+#4) = 3.2%

Wt. of +4 material = 16.7 grams

CHECKED BY: RRR

Foth & Van Dyke and Associates Inc.

GRAIN SIZE DISTRIBUTION CURVE



GRAVEL		SAND			SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE		
% =	% =	% = 1.4	% = 7.1	% = 43.7	% =	% =

PROJECT: Kennecott Geotechnical DATE: 3/10/88 SAMPLE NO.: 8

LOCATION SAMPLED: Topsoil - East ELEV. OR DEPTH: DRAWN BY: POK APPROVED BY: RRR

ATTERBERG LIMITS: LL PL PI SAMPLED MOISTURE CONTENT (%): COEFFICIENTS: Cc = Cu =

SAMPLE SOURCE: MUNSELL COLOR CODE: 10 YR. 3/2 DATE SAMPLED: Autumn, 1987

SOIL CLASSIFICATION (ASTM: D2487) SILTY SAND, fine grained, very dark grayish brown (SM)

USDA CLASSIFICATION: SANDY LOAM/LOAM, very dark grayish brown

FORM #411 SL (2/87)

3.5-N-36

Foth & Van Dyke

Engineers/Architects

2737 S. Ridge Road
P. O. Box 19012
Green Bay, Wisconsin 54307-9012
414/497-2500

PROJECT NO.: _____

JOB NO.: 87K10

DATE: March 3 to 8, 1988

REPORT NO.: 9

REPORT OF ANALYSIS OF AGGREGATES

ARCHITECT/ENGINEER: Foth & Van Dyke CONTRACTOR: _____

PROJECT: Kennecott Geotechnical SOURCE: _____

REPORT OF TESTS OF: Verification of Topsoil Sample

Sieve Size or No.	Weight Retained	% Retained	% Passing	Specifi-cations
3-Inch				
2-Inch				
1 1/2-Inch				
1-Inch				
3/4-Inch				
1/2-Inch				
3/8-Inch				
No. 4	0	0	100	
No. 8				
No. 10	0.7	0.1	99.9	
No. 16	0.8	0.1	99.8	
No. 20				
No. 30	2.7	0.3	99.5	
No. 40				
No. 50	23.4	2.5	97.0	
No. 140	425.5	45.8	51.2	
No. 200	103.5	11.1	40.1	
No. 270	61.7	6.6	33.5	
Pan	311.1	33.5		

RECEIVED AT LABORATORY: February 22, 1988

QUANTITY REPRESENTED: 929.3 grams

SUBMITTED BY: John Thresher

SAMPLED FROM: Topsoil

IDENTIFICATION: Central

DATE SAMPLED: Autumn, 1987

INTENDED USE: _____

WASHED GRADATION: Yes

PERCENT PASSING NO. 270 SIEVE 33.5 %

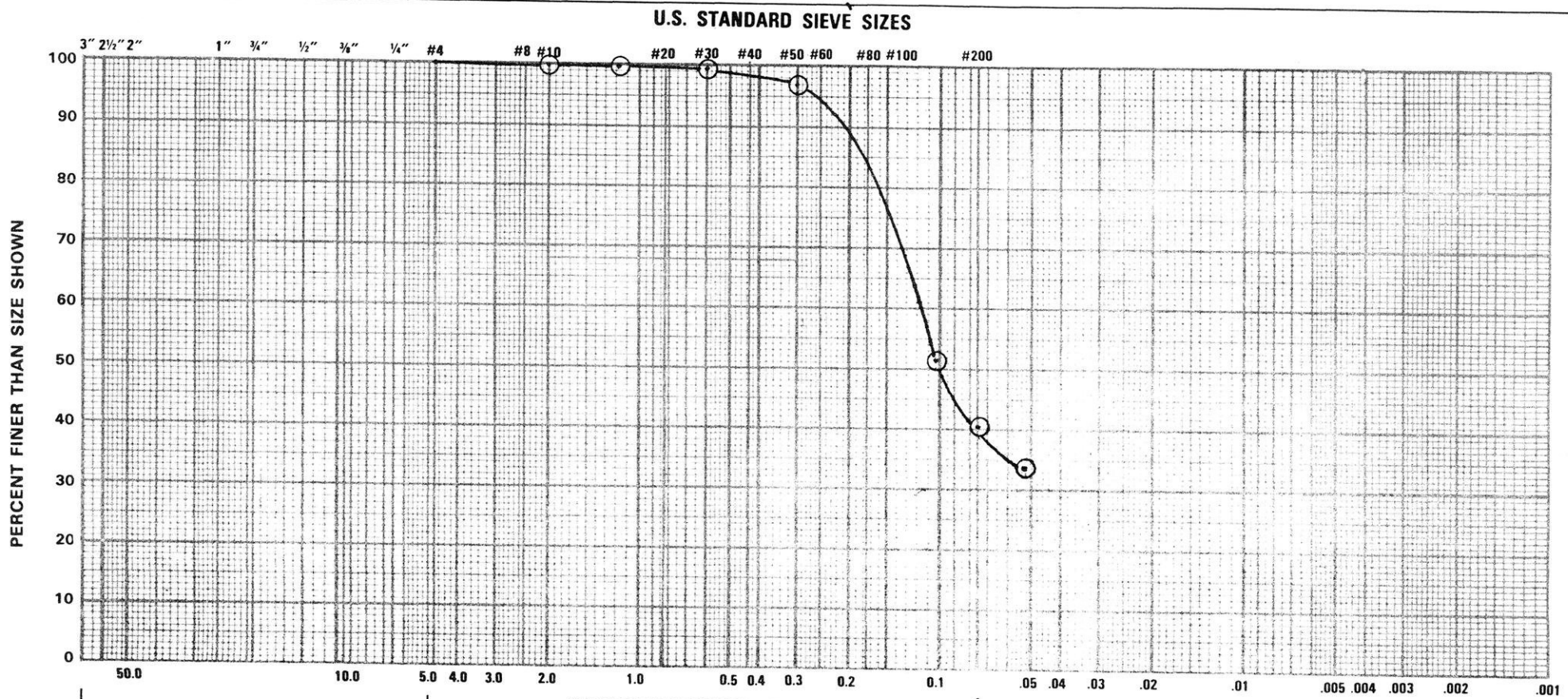
COLOR: 10 YR. 3/4 - dark yellowish brown

Gravel Content (+#4) = None

CHECKED BY: RRR

Foth & Van Dyke and Associates Inc.

GRAIN SIZE DISTRIBUTION CURVE



GRAVEL		SAND			SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE		
% =	% =	% = 0.1	% = 1.9	% = 57.9	% =	% =

PROJECT: Kennecott Geotechnical DATE: 3/10/88 SAMPLE NO.: 9

LOCATION SAMPLED: Topsoil - Central ELEV. OR DEPTH: DRAWN BY: POK APPROVED BY: RRR

ATTERBERG LIMITS: LL PL PI SAMPLED MOISTURE CONTENT (%): COEFFICIENTS: Cc = Cu =

SAMPLE SOURCE: MUNSELL COLOR CODE: 10 YR. 3/4 DATE SAMPLED: Autumn, 1987

SOIL CLASSIFICATION (ASTM: D2487) SILTY SAND, fine grained, dark yellowish brown (SM)

USDA CLASSIFICATION: SANDY LOAM, dark yellowish brown

FORM #411 SL (2/87)

3.5-N-38

Foth & Van Dyke

Engineers/Architects

2737 S. Ridge Road
P. O. Box 19012
Green Bay, Wisconsin 54307-9012
414/497-2500

PROJECT NO.: _____

JOB NO.: 87K10

DATE: March 7 to 9, 1988

REPORT NO.: 10

REPORT OF ANALYSIS OF AGGREGATES

ARCHITECT/ENGINEER: Foth & Van Dyke CONTRACTOR: _____

PROJECT: Kennecott Geotechnical SOURCE: _____

REPORT OF TESTS OF: Verification of Composite Topsoil Samples

Sieve Size or No.	Weight Retained	% Retained	% Passing	Specifi-cations
3-Inch				
2-Inch				
1 1/2-Inch				
1-Inch				
3/4-Inch				
1/2-Inch				
3/8-Inch				
No. 4			100	
No. 8				
No. 10	7.9	1.4	98.6	
No. 16	5.8	1.0	97.6	
No. 20				
No. 30	11.9	2.1	95.5	
No. 40				
No. 50	71.2	12.5	83.0	
No. 140	217.3	38.3	44.7	
No. 200	44.5	7.8	36.9	
No. 270	26.2	4.6	32.3	
Pan	183.2	32.3		

33.3 grams

RECEIVED AT LABORATORY: February 22, 1988

QUANTITY REPRESENTED: 601.2 - 33.3 = 567.9 grams

SUBMITTED BY: John Thresher

SAMPLED FROM: Topsoil

IDENTIFICATION: West

DATE SAMPLED: Autumn, 1987

INTENDED USE: _____

WASHED GRADATION: Yes

PERCENT PASSING NO. 270SIEVE 32.3 %

COLOR: 10 YR. 3/2 - very dark grayish brown

Gravel Content (+#4) = 5.5%

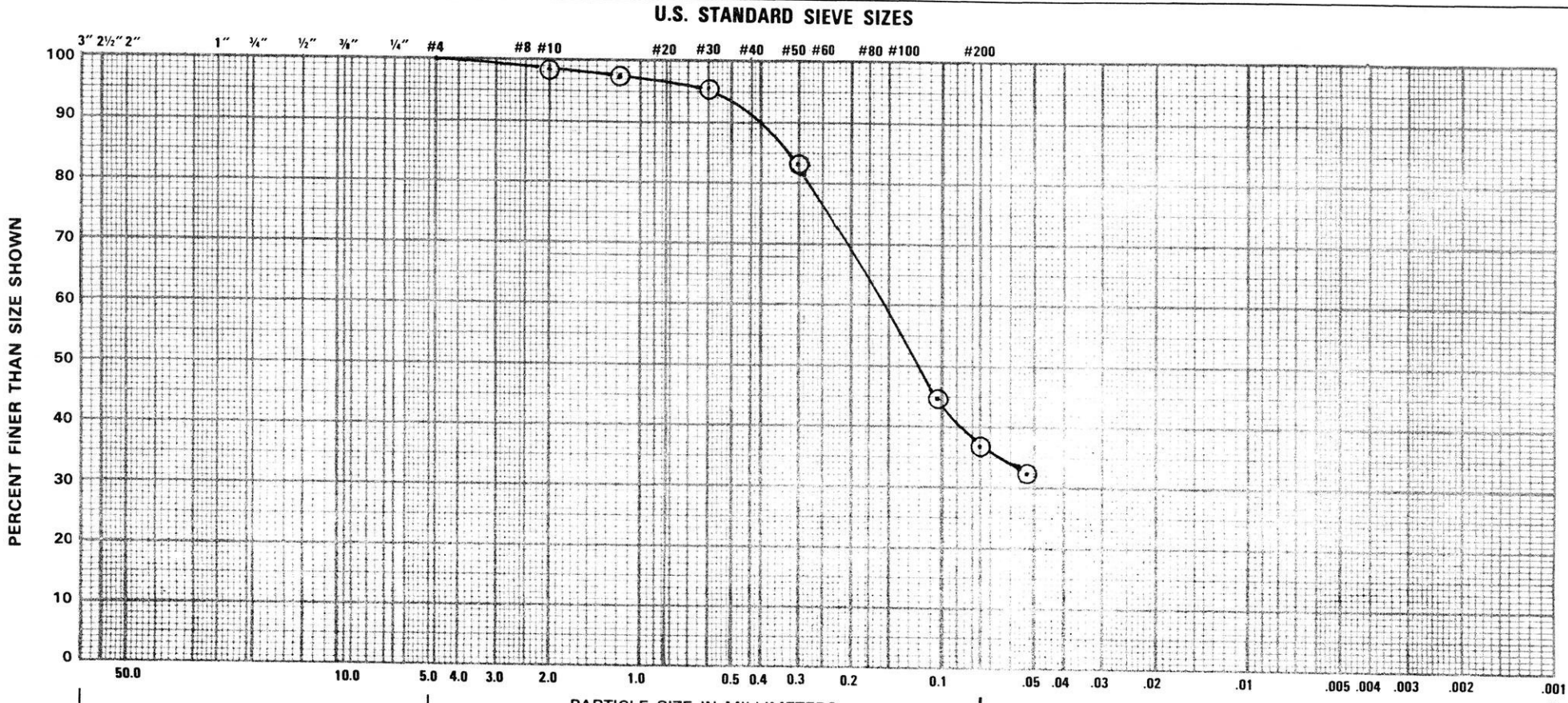
Wt. of +4 material = 33.3 grams

(includes a 3/4" stone)

CHECKED BY: RRR

Foth & Van Dyke and Associates Inc.

GRAIN SIZE DISTRIBUTION CURVE



GRAVEL		SAND			SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE		
% =	% =	% = 1.4	% = 8.6	% = 53.1	% =	% =

PROJECT: Kennecott Geotechnical DATE: 3/10/88 SAMPLE NO.: 10

LOCATION SAMPLED: Topsoil - West ELEV. OR DEPTH: DRAWN BY: POK APPROVED BY: RRR

ATTERBERG LIMITS: LL PL PI SAMPLED MOISTURE CONTENT (%): COEFFICIENTS: Cc = Cu =

SAMPLE SOURCE: MUNSELL COLOR CODE: 10 YR. 3/2 DATE SAMPLED: Autumn, 1987

SOIL CLASSIFICATION (ASTM: D2487) SILTY SAND, fine grained, very dark grayish brown (SM)
USDA CLASSIFICATION: SANDY LOAM, very dark grayish brown

FORM #411 SL (2/87)

3.5-N-40

Calculations of the Carryover of Iron and Sulfur During the Grinding Process of the Waste Rock Samples

1. The waste rock samples were ground in one of four milling jars made of Burundum (Norton Trademark) enhanced porcelain with Burundum pellets. Jars 1 - 3 were size #0 and Jar 4 was a size #00.

2. Samples were ground in order of increasing total sulfur content.

3. After the grinding of waste rock samples WR-1 through 3, approximately 100 g of silica sand was ground in each jar. It was observed that the grinding of the silica sand removed essentially all of the dark red, brown and black pigment which had been accumulating in the jars. The pigmenting agents had been scoured by and were entrained within the ground silica sand.

   a. Similarly, silica sand was ground in the jars upon completion of the grinding of the WR-4 samples and of the WR-5 and WW-1 samples.

4. Jar 4 was used only to grind two samples in the WR-1 through 3 group of samples.

5. The contaminated ground silica sand samples were digested in a microwave oven and analyzed for percent total sulfur and iron (ug/g).

6. The results of the analyses have been used to estimate the carryover of sulfur and iron from sample to sample during the milling process.

   a. The quantity of iron or sulfur in the silica powder (in ug/g) was calculated by multiplying the iron or sulfur concentration (in ug/g as %) by the weight of the silica sand (100 g).

   b. The concentration of iron or sulfur carryover within the waste rock samples (ug Fe or S/g sample) was calculated by dividing the quantity of each element in the silica sand by the weight of all of the waste rock samples ground in the jar prior to the grinding of the silica sand.

   c. It has been assumed that all of the carryover iron and sulfur had been scoured from the jars and was entrained within the powdered silica sand. Also, it had been assumed that each sample within group (A, B, or C) contributed an equal proportion of the material carried over.

7. The mean concentration of iron carryover for all jars and sample sets is 14.2 ug/g. Since the range of iron concentration in samples WR-1 through 5 varied between 30,000 and 40,000 ug/g, the calculated carryover is less than or equal to 0.05% of the iron in the samples.

8. The mean concentration of sulfur carryover for all jars used to grind samples WR-1 through 3 is 150.6 ug/g. These samples have a sulfur concentration of 7,000 ug/g, or less sulfur. The mean concentration of sulfur carryover for all jars used to grind the WR-4 samples is 175.4 ug/g. The sulfur concentration of WR-4 samples is 20,000 ug/g. Finally, the mean concentration of sulfur carryover for all jars used to grind the WR-5 and WW-1 samples is 34.5 ug/g. The concentration of sulfur in samples WR-4 and WW-1 varies from 48,000 to 340,000 ug/g.

9. The iron carryover appears to have varied randomly from jar to jar and sample set to sample set. This carryover is essentially insignificant.

10. The sulfur carryover was greatest for those samples with the lowest sulfur concentration and was lowest for those with the highest sulfur concentration.

ORTEK
Oneida Environmental Technology Center
2496 West Mason Street
P. O. Box 12435
Green Bay, WI 54307-2435
Telephone: (414) 498-2222

LABORATORY ANALYSIS RESULTS

W.D.N.R. LAB CERT. NO. 405099530

Client Kennecott
Address

Name of Rep.
Telephone No. (414) 497-2500

Sampled By J. Thresher
P.O. #
Job # 87K10
Report to: B. Burton
Invoice # 1553
Result Sheet No. 39106.01

Sample I.D.	WW-1	Jar 1-A	Jar 2-A	Jar 3-A	Jar 4-A
Date Collected	01/12/89	01/12/89	01/12/89	01/12/89	01/12/89
Date Received	01/12/89	01/12/89	01/12/89	01/12/89	01/12/89
Parameters, units	---------- Results ----------				
T. Sulfur, %	34	0.32	0.30	0.18	0.07
Iron, ug/g	450	220	360	410	110
Copper, ug/g	9600				
Manganese, ug/g	19				
T. Chromium, ug/g	31				

Comments:

Signed: David Turriff Date: February 25, 1987

Environmental Technology Center
West Mason Street
P. Box 12435
Green Bay, WI 54307-2435
Telephone: (414) 498-2222

LABORATORY ANALYSIS RESULTS

W.D.N.R. LAB CERT. NO. 405099530

Client	Kennecott	Sampled By	J. Thresher
Address		P.O. #	
		Job #	87K10
		Report to:	B. Burton
Name of Rep.		Invoice #	1553
Telephone No.	(414) 497-2500	Result Sheet No.	39106.02

Sample I.D.	Jar 1-B	Jar 2-B	Jar 3-B	Jar 1-C	Jar 2-C
Date Collected	01/12/89	01/12/89	01/12/89	01/12/89	01/12/89
Date Received	01/12/89	01/12/89	01/12/89	01/12/89	01/12/89
Parameters, units	Results				
T. Sulfur, %	0.33	0.28	0.32	0.15	0.31
Iron, ug/g	190	340	170	390	510

Comments:

Signed: David Turriff Date: February 15, 1989

. Environmental Technology Center
West Mason Street
J. Box 12435
een Bay, WI 54307-2435
.elephone: (414) 498-2222

LABORATORY ANALYSIS RESULTS

W.D.N.R. LAB CERT. NO. 405099530

Client	Kennecott	Sampled By	J. Thresher
Address		P.O. #	
		Job #	87K10
		Report to:	B. Burton
Name of Rep.		Invoice #	1553
Telephone No.	(414) 497-2500	Result Sheet No.	39106.03

Sample I.D.	Jar 3-C
Date Collected	01/12/89
Date Received	01/12/89

Parameters, units	Results
T. Sulfur, %	0.19
Iron, ug/g	150

Comments:

Signed: David Turriff Date: February 15, 19--

TABLE NO. 4

Calculations of the Carryover of Iron and Sulfur During the Grinding Process of Waste Rock Samples

	WR-1 through 3 Samples				WR-4 Samples			WR-5 and WW-1 Samples		
	Jar 1-A	Jar 2-A	Jar 3-A	Jar 4-A	Jar 1-B	Jar 2-B	Jar 3-B	Jar 1-C	Jar 2-C	Jar 3-C
Number Samples	12	13	13	2	6	6	5	11	12	12
Total Sample Weights (gms)	4,088	3,656	4,088	175.9	2,251	2,191	1,271	5,860	6,229	6,755
Concentration of Fe in Silica Powder (ug)	22,000	36,000	41,000	11,000	19,000	34,000	17,000	39,000	51,000	15,000
Fe Carryover - ug FE/g Sample	5.38	9.85	10.03	62.54	8.44	15.52	13.38	6.66	8.19	2.22
Concentration of S in Silica Powder (%)	0.32	0.30	0.18	0.07	0.33	0.28	0.32	0.15	0.31	0.19
Quantity of S in Silica Powder (g)	0.32	0.30	0.18	0.07	0.33	0.28	0.32	0.15	0.31	0.19
S Carryover - ug S/g Sample	78.3	82.1	44.0	398	147	128	252	25.6	49.8	28.1

TABLE NO. 5

Waste Rock Sampling and Compositing Data

DDH	Section	Sample Depth (ft)	Geologic Units	Rock Chips	Rock Powder	C/P
A. WR-1 (<0.10% S) Compositing Data						
22-6	410	209-219	2a	906.3	129.3	7.01
22-17	400	123-128	2a	1548.1	221.2	7.00
22-17	400	131-138	2a	895.9	128.0	7.00
22-17	400	145-147	2a	917.5	129.5	7.08
22-30	424	171-176	4c	1111.6	156.5	7.10
22-56	408	149-157	3a	2727.1	391.3	6.97
22-56	408	157-160	3a	963.4	137.6	7.00
22-57	408	52-72	3a	1776.3	253.8	7.00
22-70	418	69-79	2c	2254.6	322.1	7.00
22-70	418	140-150	2c	2777.5	392.4	7.08
22-70	418	150-160	2c	2315.2	331.7	6.98
22-86	402	59-70	2c	762.8	109.0	7.00
22-86	402	70-78	2c	2506.9	357.8	7.01
22-90	418	72-80	2b	1708.3	241.7	7.07
22-90	418	80-95	2b	2145.8	305.8	7.02
22-98	422	50-55	2b	413.6	59.1	7.00
TOTALS		(ft)		25,730.9 (gms)	3,666.8 (gms)	

TABLE NO. 5 (Cont.)

DDH	Section	Sample Depth (ft)	Geologic Units	Rock Chips	Rock Powder	C/P
B. WR-2 (0.49% S) Compositing Data						
22-1	402	129-174	2a	2310.3	328.7	7.03
22-32	400	92-96	2a	2175.9	310.8	7.00
22-32	400	96-100	2a	1132.5	161.8	7.00
22-38	408	58-63	2a	2086.3	298.0	7.00
22-56	408	140-149	3a	2280.9	325.4	7.01
22-62	420	52-62	4c	2159.7	308.5	7.00
22-62	420	62-72	4c	2711.2	387.3	7.00
22-62	420	72-80	4c	2554.1	364.9	7.00
22-68	422	130-135	1a	1404.8	200.1	7.02
22-68	422	162-175	4c	2539.2	361.7	7.02
22-94	412	115-120	2c	2353.0	339.3	6.93
TOTALS		(ft)		23,707.9 (gms)	3,386.5 (gms)	
C. WR-3 (0.70% S) Compositing Data						
22-17	400	128-131	2a	1506.2	231.7	6.50
22-17	400	138-145	2a	1378.0	211.1	6.53
22-17	400	152-157	2a	1575.1	242.3	6.50
22-17	400	157-162	2a	1506.4	231.1	6.52
22-30	424	165-171	4c	2642.3	405.1	6.52
22-51	404	130-131	2c	1911.2	294.0	6.50
22-68	422	121-130	1a	2978.2	458.2	6.50
22-78	406	58-65	1a	819.1	125.8	6.51
22-94	412	78-83	2c	1792.7	275.8	6.50
22-94	412	130-140	2c	2170.0	335.1	6.48
22-98	422	55-65	1a	1063.6	164.5	6.47
22-99	410	55-70	1a	1099.2	167.9	6.55
22-99	410	76-82	1a	1652.4	254.2	6.50
TOTALS		(ft)		22,094.4 (gms)	3,396.8 (gms)	

TABLE NO. 5 (Cont.)

DDH	Section	Sample Depth (ft)	Geologic Units	Rock Chips	Rock Powder	C/P
D. WR-4 (2.0% S) Composting Data						
22-6	410	219-229	2a	1435.5	179.4	8.00
22-16	416	123-130	1a	2340.7	292.0	8.02
22-17	400	162-165	2a	1160.9	145.1	8.00
22-17	400	165-169	2a	1320.6	165.8	7.97
22-17	400	171-177	2a	1820.9	228.3	7.98
22-27	424	85-90	2b	2899.7	362.5	8.00
22-27	424	100-105	2b	1192.8	148.3	8.04
22-49	404	180-190	2a	2604.7	325.6	8.00
22-68	422	145-149	1a	1851.8	231.5	8.00
22-68	422	154-162	4c	2591.3	323.9	8.00
22-69	402	37-40	1a	377.0	46.4	8.13
22-69	402	42-46	1a	1275.5	159.4	8.00
22-69	402	46-50	1a	1374.8	171.9	8.00
22-70	418	160-170	2c	2418.5	302.2	8.00
22-70	418	170-180	2c	2781.8	347.7	8.00
22-94	412	62-72	1a	2507.2	311.9	8.04
22-94	412	110-115	2c	2491.2	310.2	8.03
22-99	410	70-76	1a	1286.2	162.3	7.92
TOTALS		(ft)		33,731.1 (gms)	4,214.4 (gms)	

TABLE NO. 5 (Cont.)

DDH	Section	Sample Depth (ft)	Geologic Units	Rock Chips	Rock Powder	C/P
E. WR-5 (4.8% S) Compositing Data						
22-6	410	229-239	2a	647.7	104.7	6.19
22-15	416	60-66	2b	2261.9	368.5	6.14
22-16	416	105-115	1a	2270.8	368.8	6.16
22-18	416	65-73	2b	2954.0	480.0	6.15
22-32	400	115-120	2a	2665.4	430.5	6.19
22-35	400	39-49	1a	2279.1	370.6	6.15
22-35	400	50-55	1a	2042.0	332.0	6.15
22-35	400	61-66	1a	2106.1	342.5	6.15
22-38	408	66-73	2a	2009.4	326.7	6.15
22-38	408	73-80	2a	2714.7	441.4	6.15
22-38	408	92-99	2a	2476.0	402.6	6.15
22-49	404	65-81	2a	2707.9	441.1	6.14
22-66	422	60-70	2b	2470.8	401.8	6.15
22-66	422	70-78	2b	2201.0	357.9	6.15
22-75	406	47-50	1b	1331.5	216.5	6.15
22-90	418	95-100	2b	694.5	112.9	6.15
22-90	418	100-110	2b	1239.5	201.5	6.15
22-94	412	72-78	2c	1779.6	290.1	6.13
22-98	422	65-70	1a	907.9	148.0	6.13
22-98	422	70-80	1a	414.6	67.3	6.16
TOTALS		(ft)		38,174.4 (gms)	6,205.4 (gms)	

TABLE NO. 5 (Cont.)

DDH	Section	Sample Depth (ft)	Geologic Units	Rock Chips	Rock Powder	C/P
F. WW-1 (34% S) Compositing Data						
22-27	424	195-206	1c	847.2	209.6	4.04
22-38	408	184-194	1c	3187.2	796.8	4.00
22-38	408	194-203	1c	4357.6	1089.0	4.00
22-65	402	95-109	2a	2539.1	634.8	4.00
22-69	402	93-100	2a	1767.9	442.0	4.00
22-73	418	167-175	1c	2797.9	699.5	4.00
22-73	418	175-183	1c	3266.6	816.0	4.00
22-73	418	183-185	1c	1023.4	256.3	3.99
22-76	414	85-95	1c	3727.0	931.8	4.00
22-82	410	139-146	1c	3144.7	786.3	4.00
22-82	410	146-149	1c	1392.7	346.9	4.01
22-85	410	271-280	1c	2995.2	733.4	4.08
22-93	416	85-94	2b	2404.4	618.8	3.89
22-93	416	94-100	2b	1609.5	393.2	4.09
22-96	412	140-144	1a	1060.2	265.3	4.00
22-96	412	144-153	1a	2088.8	521.1	4.01
22-96	412	153-160	1c	3055.1	764.5	4.00
TOTALS				41,264.5 (gms)	10,305.3 (gms)	
G. WR-1A (<0.17% S) Compositing Data						
22-136	410	122-123	5		43.6	
22-137	401	82-83	2a		79.4	
22-140	406	140-141	3a		60.1	
22-142	422	135-136	1a		58.9	
22-142	422	142-143	4c		72.7	
22-147	415	98-99	1a		51.8	
22-147	415	109-110	2b		55.3	
TOTAL		(ft)			421.8 (gms)	

Engineers
Architects
Planners
Scientists
Economists

Foth & Van Dyke

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414/497-2500

February 3, 1989

Project: Waste Characterization — Scope I.D. 87K10

Reported to: Kennecott Explorations — Report No. 1

GENERAL DATA:

Sample Number:	Soil Composite - Type I
Date Sampled:	12/27/88
Date Received:	12/28/88
Sampled By:	John Thresher

LABORATORY DATA:

Height of Soil:	1 7/16"
Wet Density:	121.9 pcf
Moisture Content:	10.3 %
Dry Density:	110.5 pcf
Date of Test:	January 4, 1989
Tested By:	R. Rouse
Soil Classification:	SILTY SAND, fine grained, a little gravel dark brown (SM)

REMARKS:

The soil composite sample was delivered to the laboratory in a closed freezer bag. To obtain a density of the soil, we performed the following: (1) Placed the soil in a 4" diameter proctor mold. (2) Used a modified hammer and compacted the lift of soil with 25 blows from the hammer. (3) The height of the sample was measured and also the weight of soil in the mold. (4) Sample was placed in an oven for 24 hours at 110°C to obtain the moisture content. (5) Calculations were performed to provide the results noted above.

50 years

UW-STEVENS POINT
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