

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

CLIENT: Kennecott

DATE INSTALLED: 1-7-88 by Luisier Drilling Inc.

PROJECT: Geotechnical

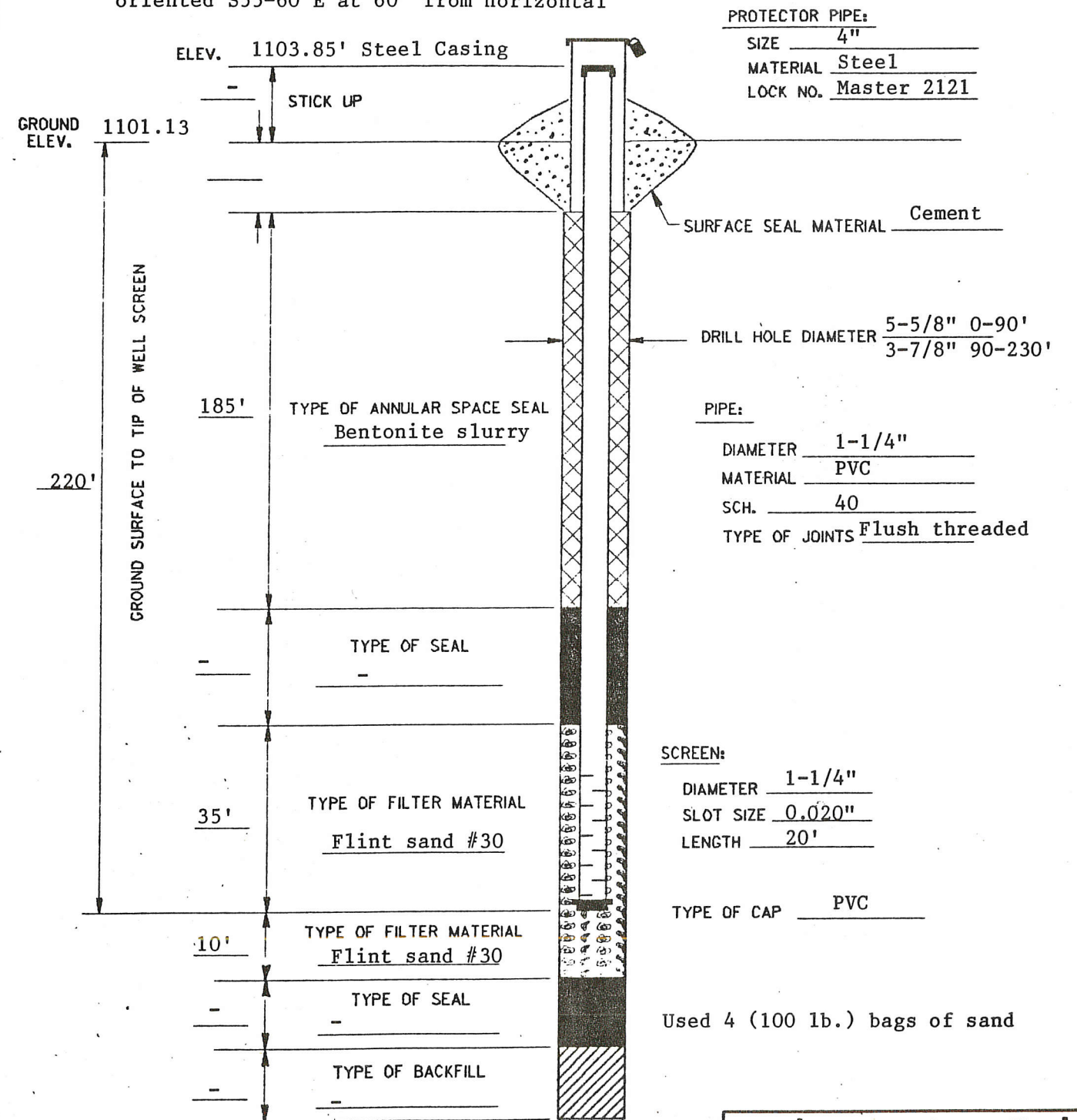
DRILLER: Longyear Company

SCOPE I.D.: 87K10

DRILLING METHOD: Mud rotary

BY: P.G. (Kennecott)

Angle Hole No. 22-137A
oriented S55-60° E at 60° from horizontal



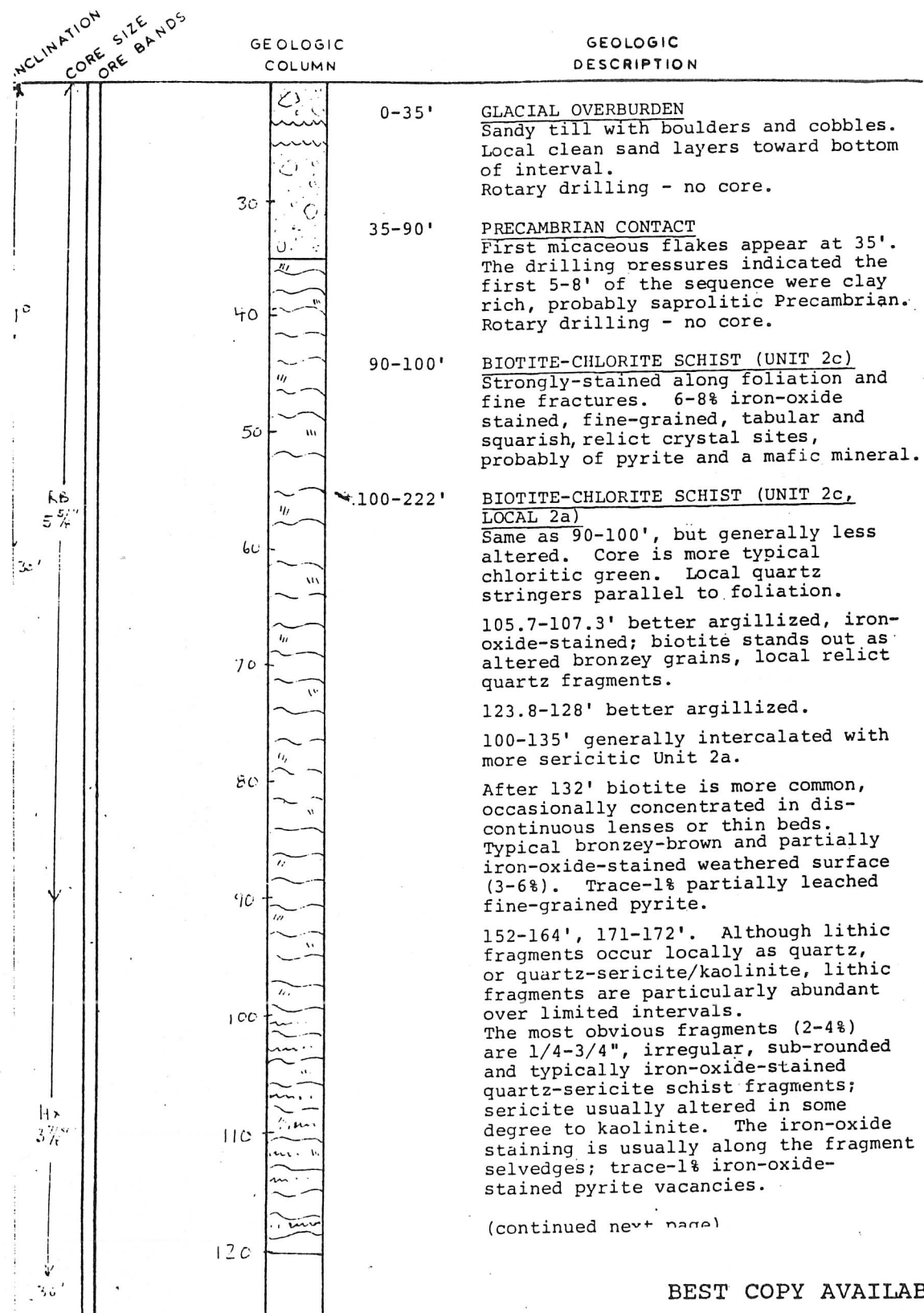
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Geosciences & Environmental
Management Division
Revised 3/88 By BJS
Drawn By MRS

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



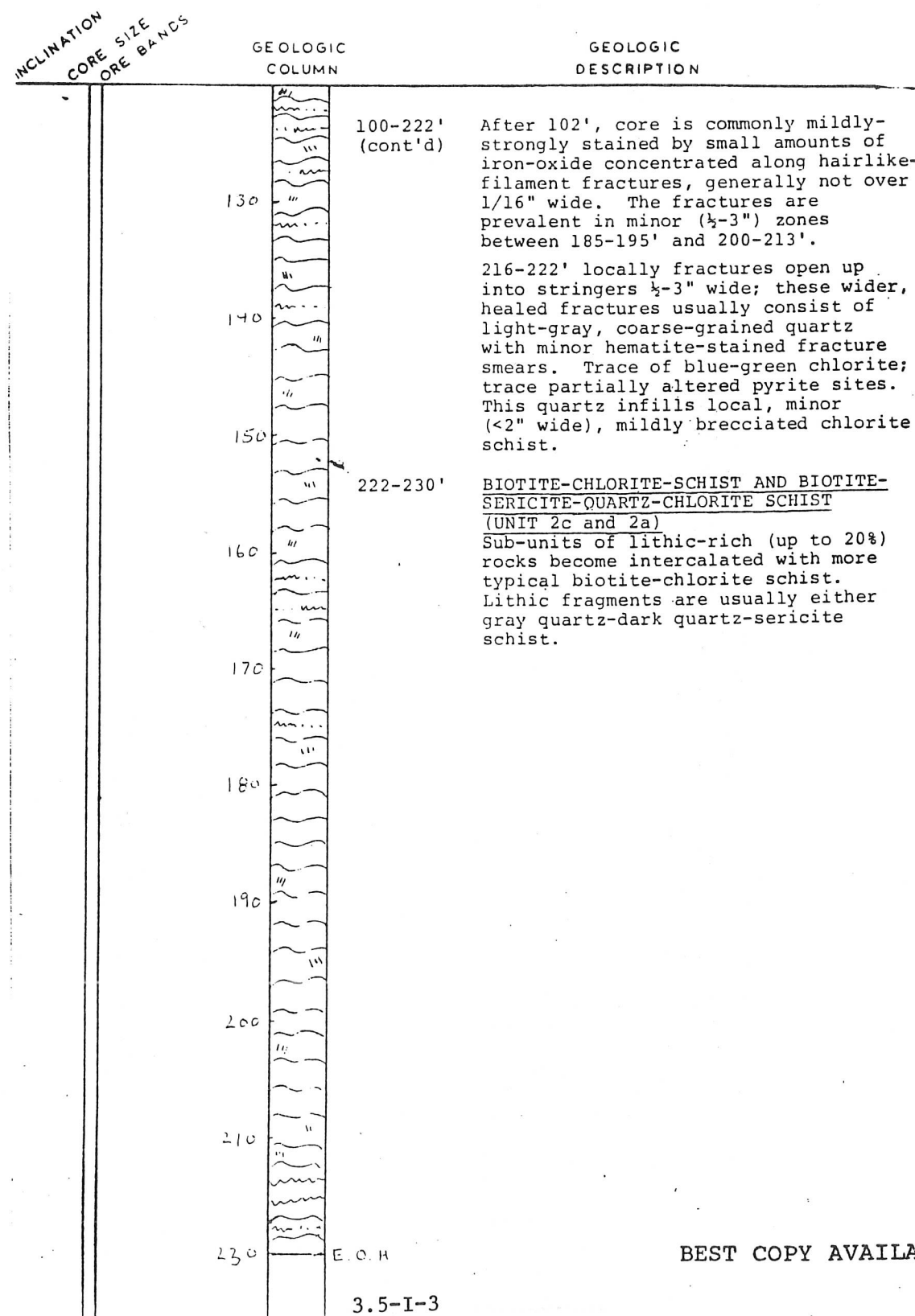
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Hole 22-137-A

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

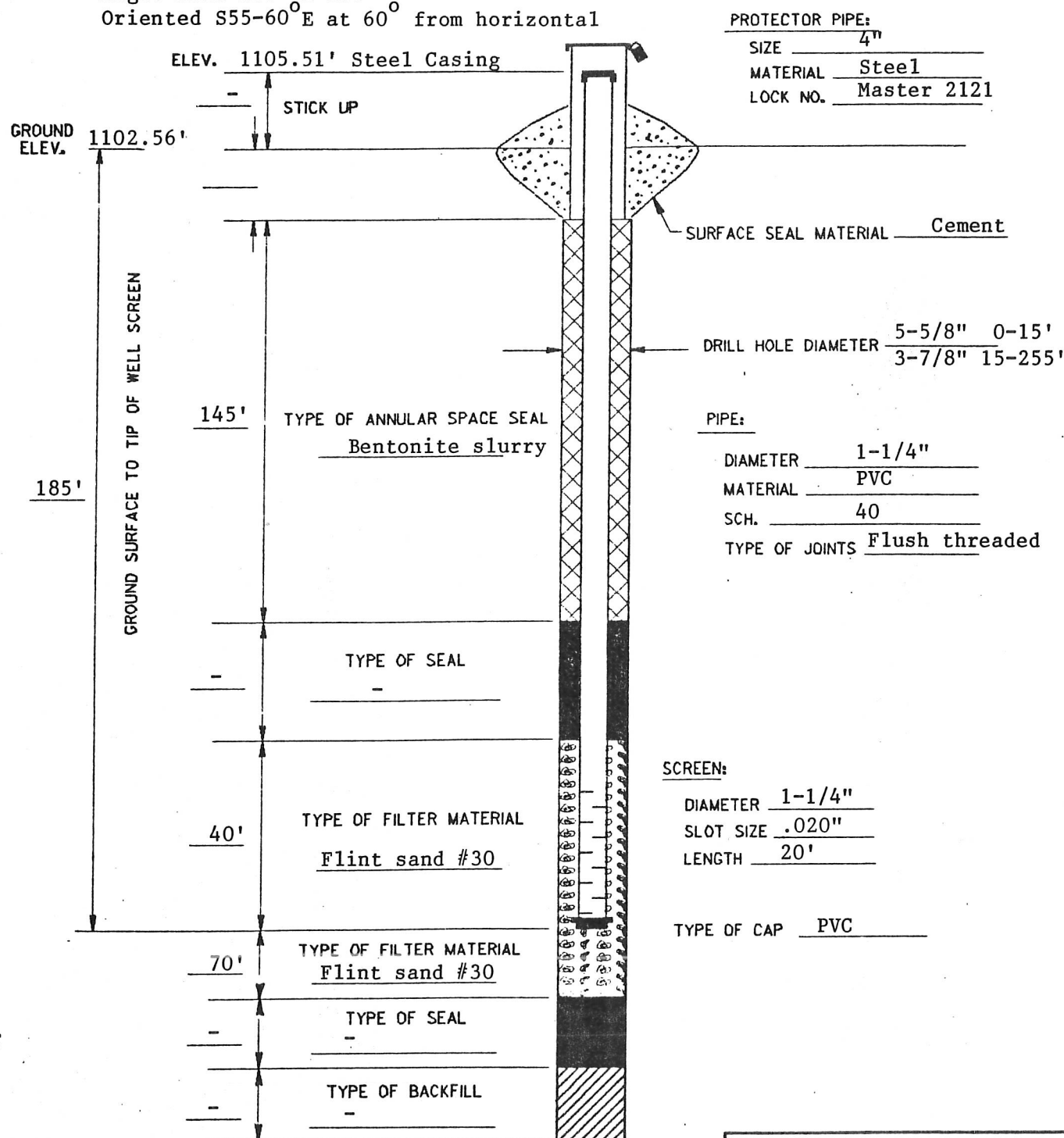


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MONITORING WELL CONSTRUCTION DIAGRAM

WELL NO: PZ-R2 CLIENT: Kennecott
 DATE INSTALLED: 1-8-88 by Luisier Drilling Inc. PROJECT: Geotechnical
 DRILLER: Longyear Company SCOPE I.D.: 87K10
 DRILLING METHOD: Mud rotary BY: P.G. (Kennecott)

Angle Hole No. 22-138
 Oriented S55-60° E at 60° from horizontal



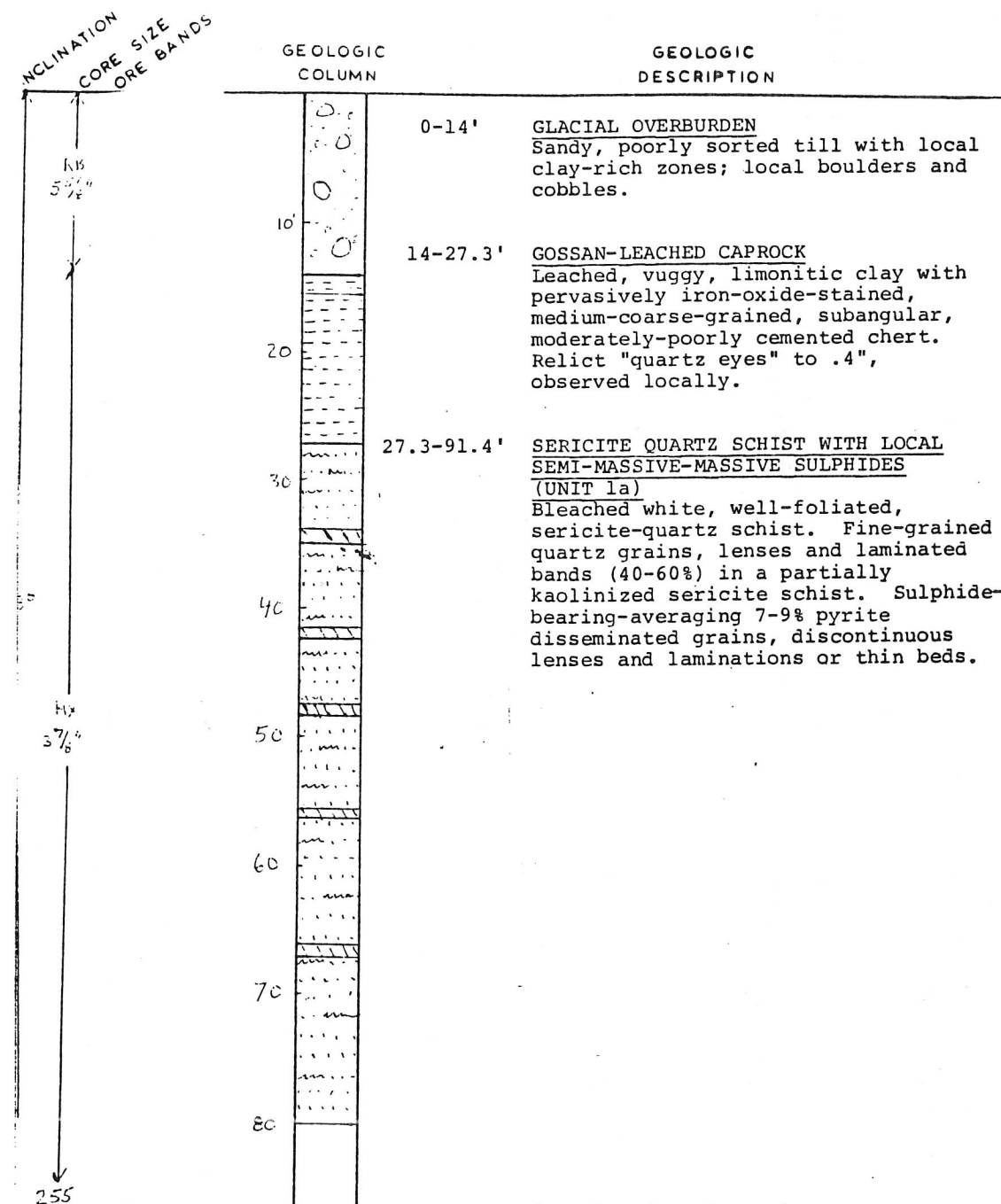
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 Drawn By MRS

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'



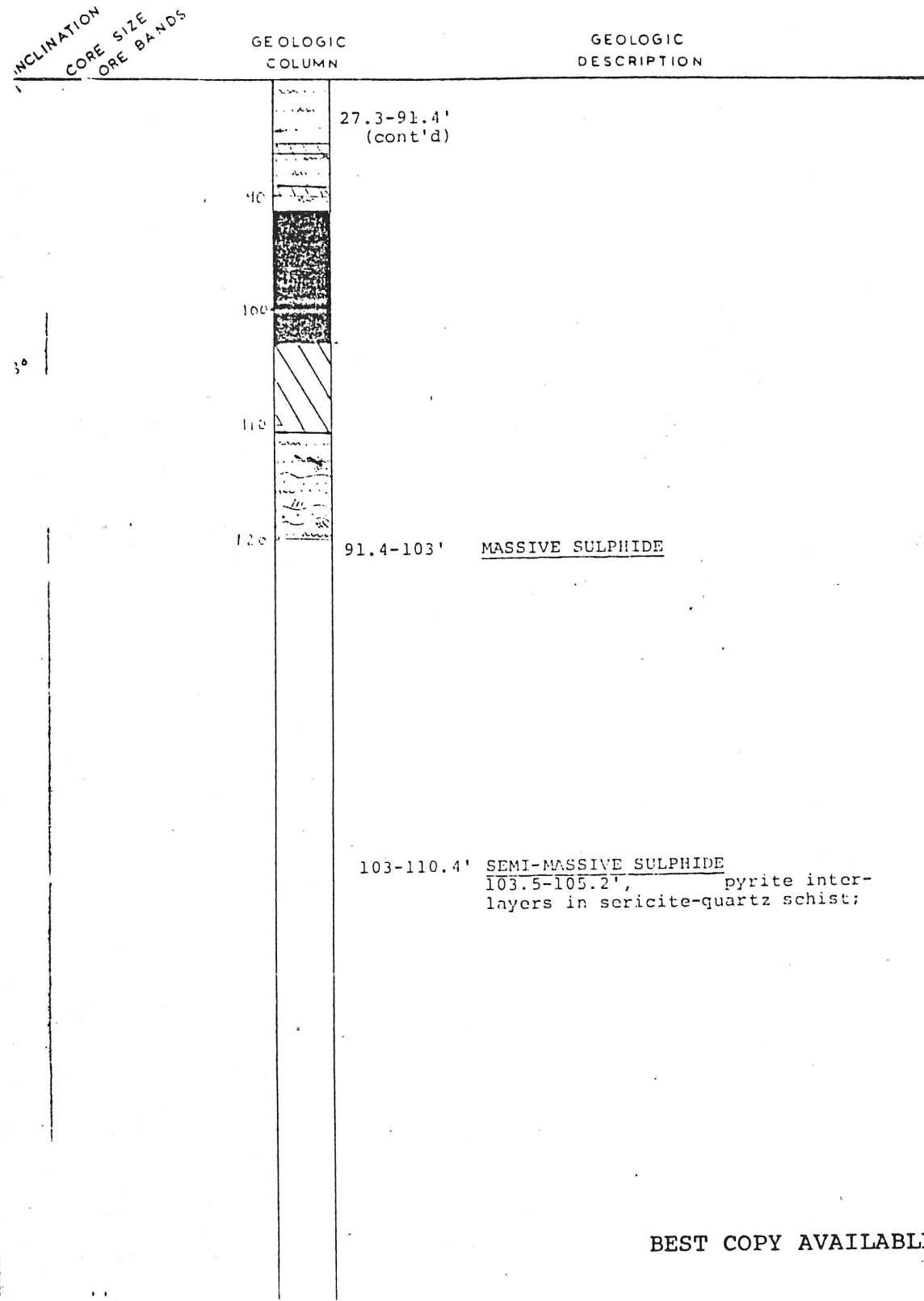
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Hole 22-138

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'



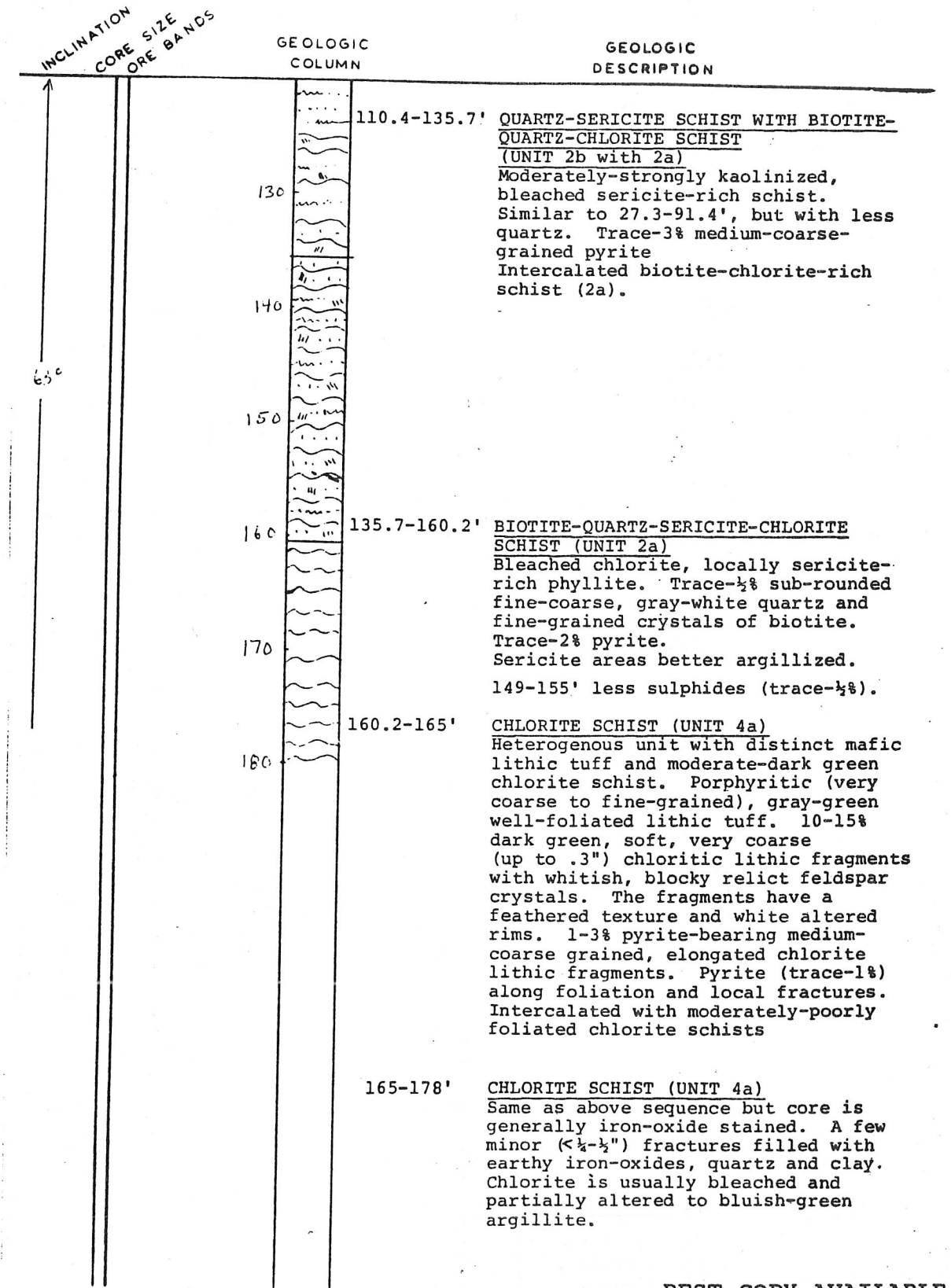
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Hole 22-138

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'



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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
65°			190	178-190' <u>BIOTITE-QUARTZ-SERICITE-CHLORITE SCHIST (UNIT 2a)</u> Light-dark green, moderately-poorly foliated, chloritic phyllite with isolated grains or lenses of biotite-sericite.
			200	Local, < 1/16-1/4" argillite-filled fractures with iron-oxide staining selvages, especially 181.3-185'.
			210	190-193.4' <u>ANDALUSITE-BIOTITE-QUARTZ-CHLORITE-SERICITE SCHIST (UNIT 2a)</u> Bleached chlorite, local greasy yellow-white sericite. 3-4% biotite; trace-1/2% blocky, fine-grained, red-brown andalusite. A few local slickenside surfaces and iron-oxide-clay-filled fractures.
			220	193.4-202' <u>QUARTZ AUGEN SCHIST (UNIT 3a WITH LOCAL 2a)</u> 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.
			230	202-220' <u>ANDALUSITE-BIOTITE-QUARTZ-CHLORITE (UNIT 2a)</u> As 178-190'. Local iron-oxide-stained, clay-filled filament fractures.
64°			240	220-255' <u>QUARTZ AUGEN SCHIST (UNIT 3a)</u> 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.
			250	

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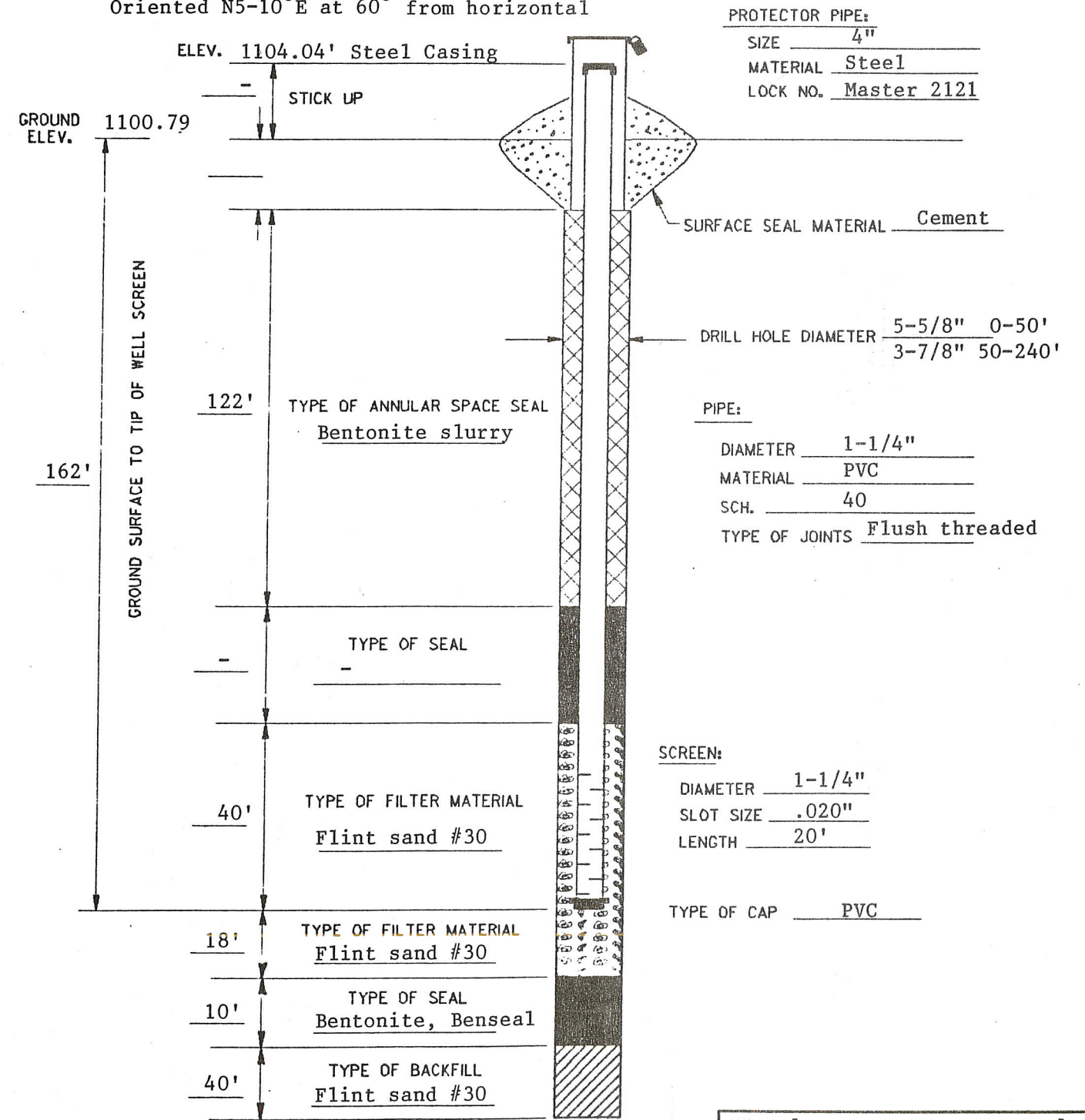
3.5-I-8

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



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 Management Division
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 Drawn By MRS

3.5-I-9

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'

INCLINATION	CORE SIZE	ORE BANDS	GEOLOGIC COLUMN	GEOLOGIC DESCRIPTION
50°	Rb 5 5/8"		0-37'	<u>GLACIAL OVERBURDEN</u> Sandy, poorly-sorted till with frequent cobbles and boulders. First sericite or bleached chlorite in cuttings at 37'.
			37-58'	<u>CHLORITE SCHIST</u> 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'	<u>HEMATITE-RICH METASEDIMENT</u> 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 argillaceous matrix. Trace of carbonate along vugs. Trace-1/2% rectangular, leached pyrite vacancies. Local hematite/epidote veinlets.
			60.3-68'	<u>WEATHERED SERICITE-QUARTZ-CHLORITE SCHIST (UNIT 2a)</u> As 37-58'.
			68-77'	<u>SERICITE-QUARTZ-CHLORITE SCHIST (UNIT 2a)</u> Similar to above, but less weathered. Chlorite bleached, but only weakly argillized. Partially-leached, squarish, fine-medium-grained pyrite vacancies (trace-1/2%). Local quartz-sericite laminations, better altered; more frequent toward bottom of interval. Gradational contact.
240°	Hx 3 7/8"		77-98'	<u>QUARTZ-SERICITE SCHIST WITH SERICITE-QUARTZ SCHIST (UNIT 2b with 1a)</u> White, bleached, well-foliated Local gray, cherty laminations.

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3.5-I-10

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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'

INCLINATION	CORE SIZE	ORE BANDS	GEOLOGIC COLUMN	GEOLOGIC DESCRIPTION
50°	Rb 5 5/8"		98-109'	<u>SERICITE-QUARTZ SCHIST (UNIT 1a)</u> 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-1/2%).
			109-136.8'	<u>SERICITE-QUARTZ SCHIST (UNIT 1a)</u> Similar to above, but with a continued increase of cherty interlayers and lenses.
	Hx 3 7/8"			Local zones (1/2-1 1/2") of white, very coarse-grained (up to 2cm) kaolinized fragments Foliation/bedding forms convoluted laminations wrapping the fragments

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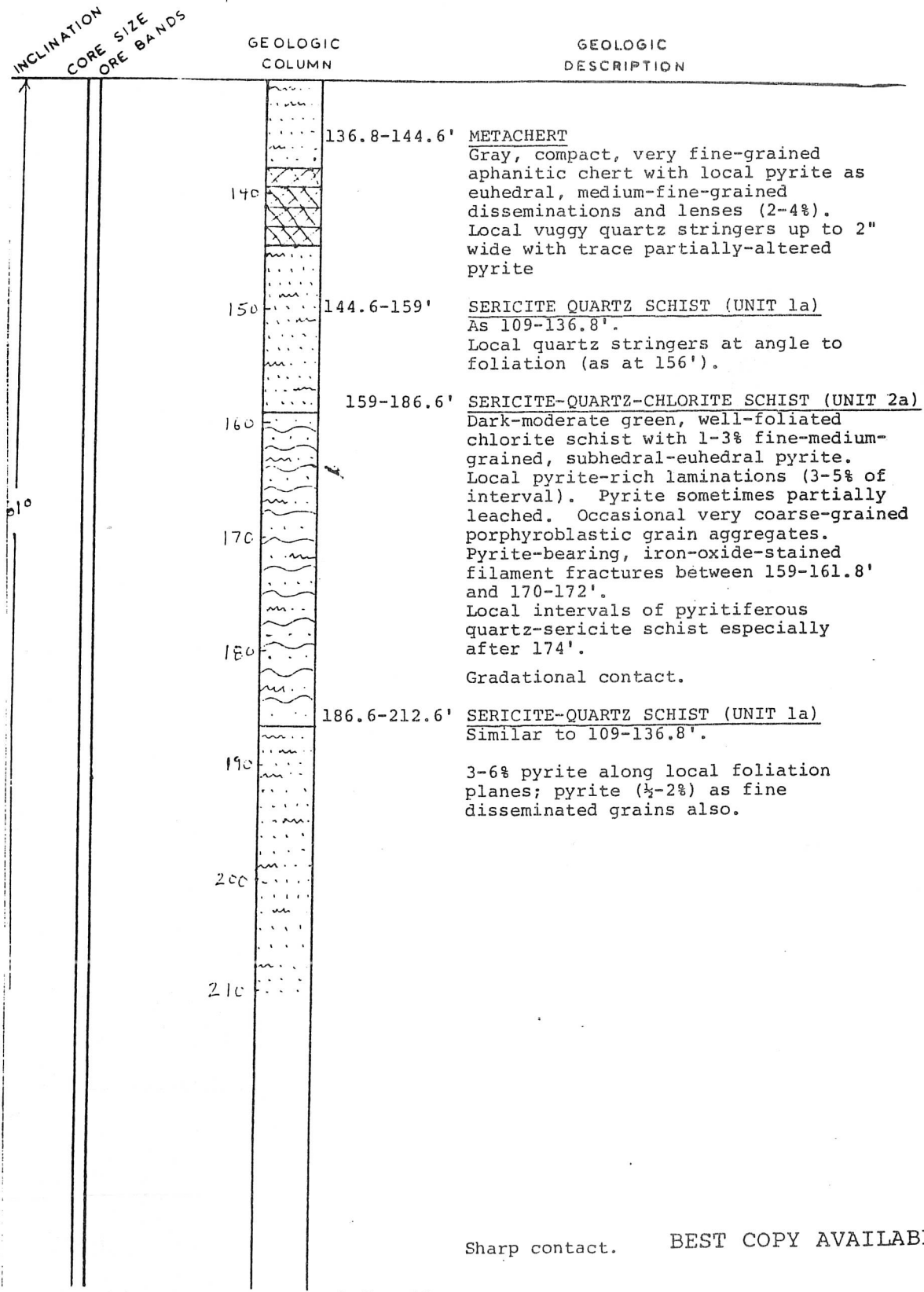
3.5-I-11

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'



Sharp contact.

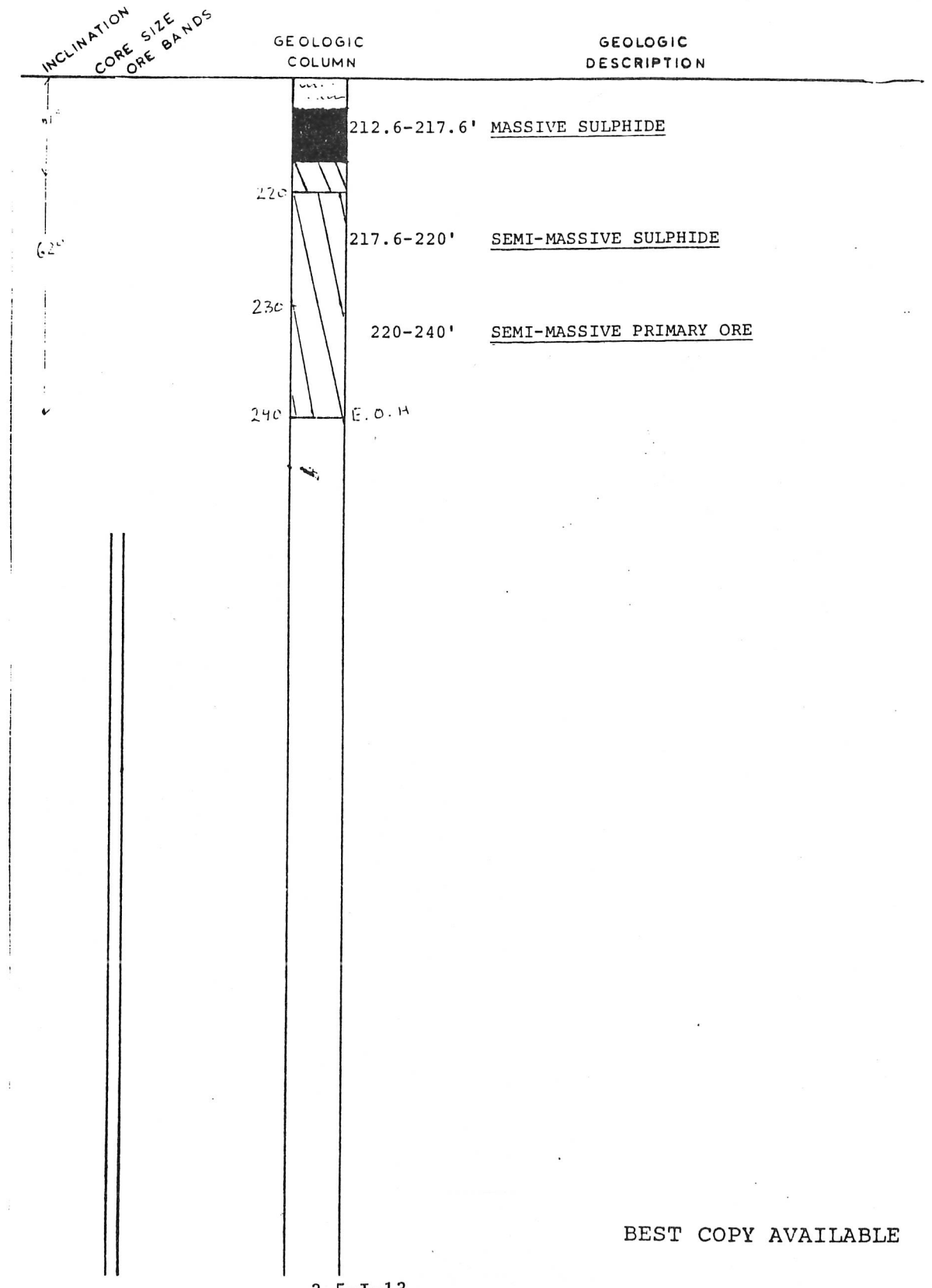
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Hole 22-139

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%

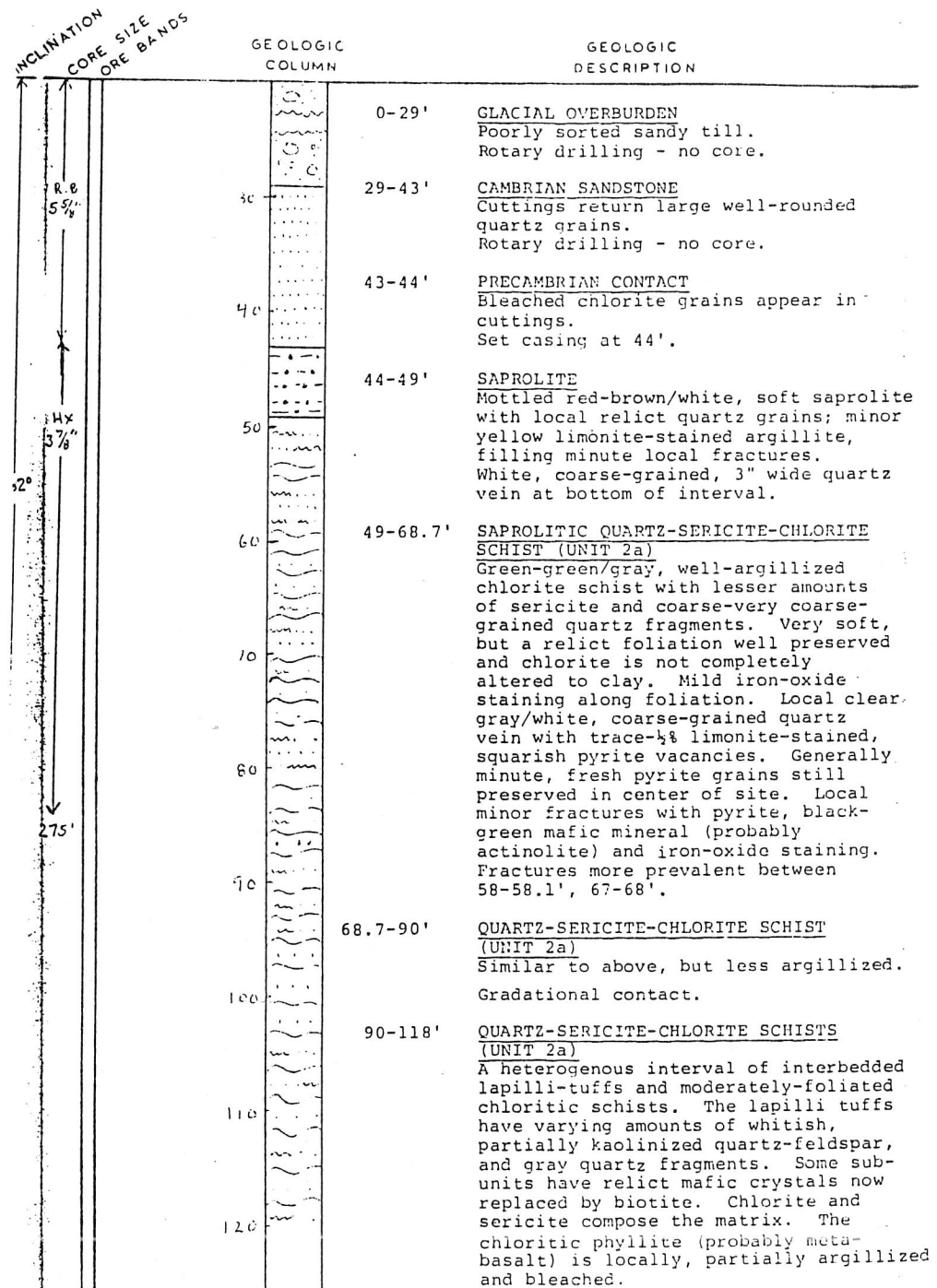


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Hole 22-140 (B-R4)

SECTION 406
 COORDINATES 40418.3442N, 39086.3310E
 AZIMUTH 135°
 ELEVATION 1117.35

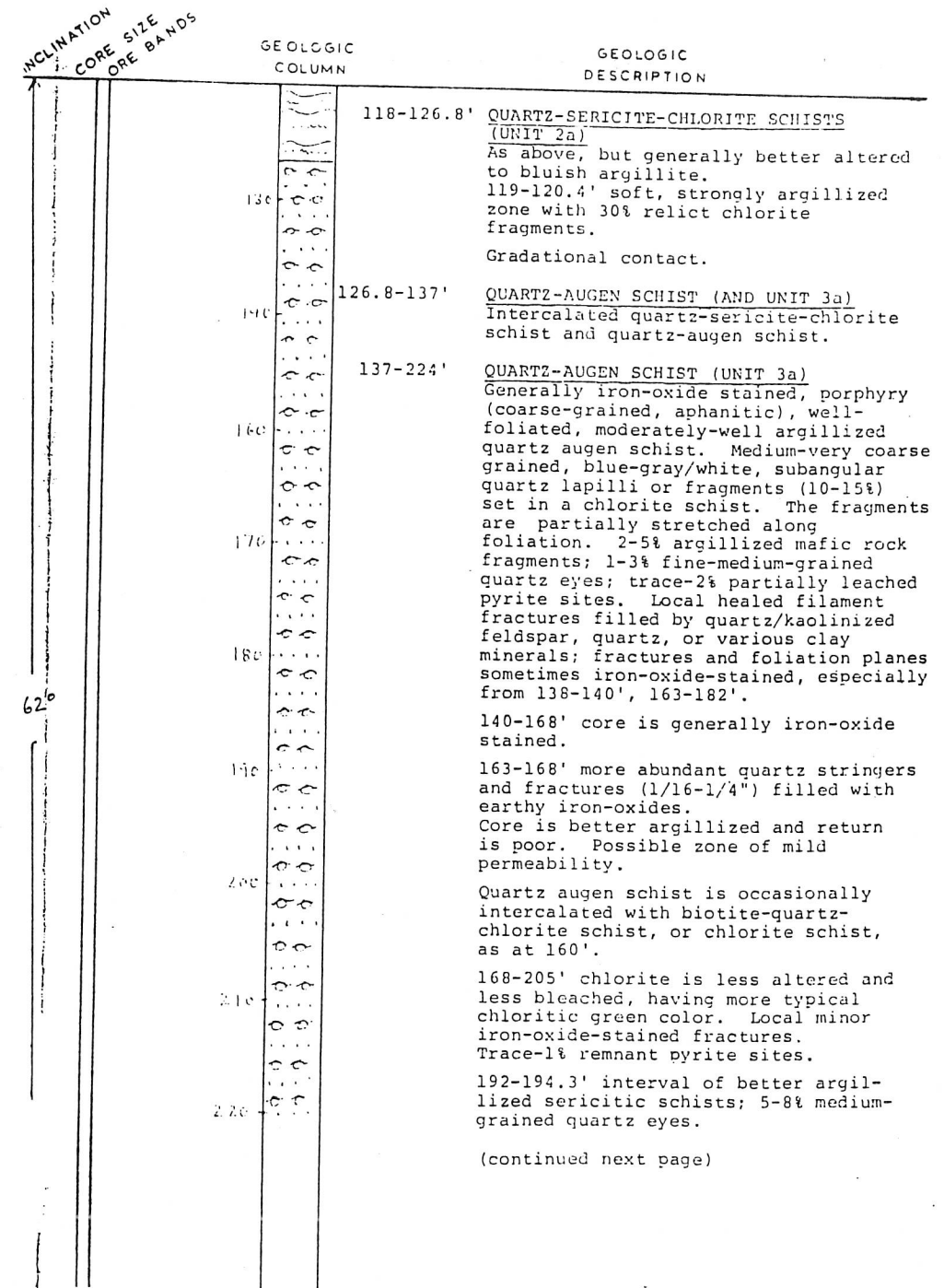
DATE STARTED 11-23-87
 COMPLETED 12-3-87
 LENGTH OF HOLE 275'



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'



(continued next page)

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 CORE BANDS	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' <u>BIOTITE-SERICITE-QUARTZ-CHLORITE SCHIST (UNIT 2a)</u> 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' <u>SERICITE-QUARTZ-BIOTITE-CHLORITE SCHIST (UNIT 2a)</u> Similar to 243-244', but with little or no quartz eyes. Local intervals rich in irregular kaolinized patches (up to 1/2") that contain fine-grained quartz (probably altered lithic fragments). Local iron-oxide-smear hairline fractures sometimes with white, argillized selvages, especially between 252-255', 256.7-256.9'. 256-258' biotite clots sometimes develop an alignment perpendicular to foliation.
		263.8-275' <u>SERICITE-BIOTITE-QUARTZ-CHLORITE SCHIST (UNIT 2a)</u> 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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Hole 22-140

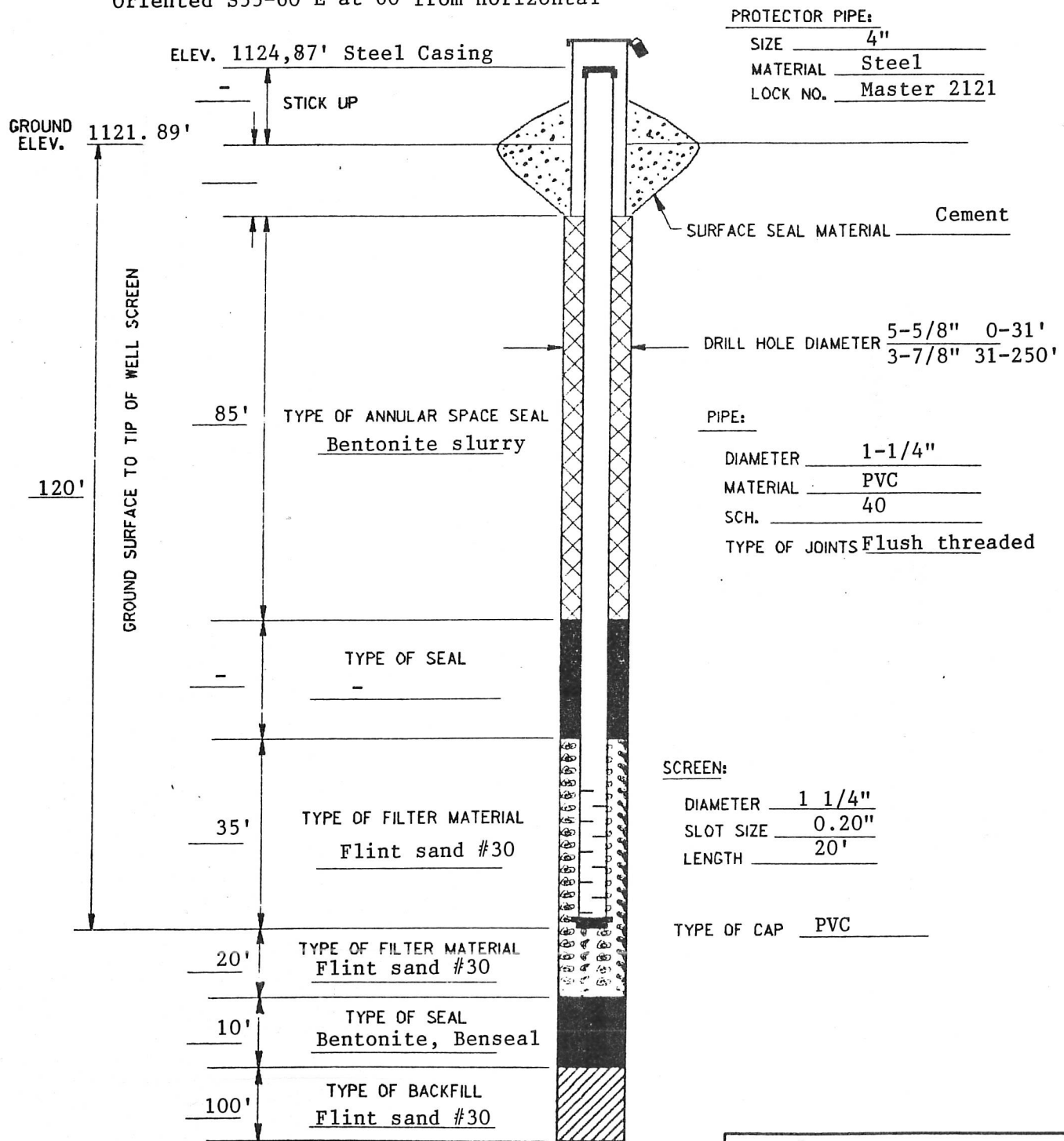
SECTION 406
 COORDINATES 40418.3442N, 39086.3310E
 AZIMUTH 135°
 ELEVATION 1117.35

DATE STARTED 11-23-87
 COMPLETED 12-3-87
 LENGTH OF HOLE 275'
 % ORE RECOVERY ---

INCLINATION CORE SIZE CORE 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. 1/2-1% leached, squarish pyrite vacancies. Trace fresh pyrite throughout interval. 261-263' pyrite sites coarser grained. 262-269' local fractures up to 1/2" wide, coated with earthy iron-oxide, argillized yellow-green chlorite.

MONITORING WELL CONSTRUCTION DIAGRAM

WELL NO: PZ-R5 CLIENT: Kennecott
 DATE INSTALLED: 1-6-88 by Luisier Drilling Inc. PROJECT: Geotechnical
 DRILLER: Longyear Company SCOPE I.D.: 87K10
 DRILLING METHOD: Mud rotary BY: P.G. (Kennecott)
 Angle Hole No. 22-136
 Oriented S55-60° E at 60° from horizontal



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 Geosciences & Environmental
 Management Division
 Revised 3/88 By BJS
 Drawn By MRS

BEAR CREEK MINING CO.

SECTION 410 Hole 22-136
 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
59°	RB 5 7/8"		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 siliceous 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 (1/4-1/2 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
			250'	

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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
54°			60	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.
			70	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.
			90	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
			110	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 -

INCLINATION	CORE SIZE	ORE BANDS	GEOLOGIC COLUMN	GEOLOGIC DESCRIPTION
54°			120	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.
			130	
			140	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'	<p>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.</p> <p>Minor fracture zones (1/2-2" 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</p> <p>In several areas (as between 111-112') a set of filament fractures are perpendicular to foliation and exhibit left-lateral displacement.</p> <p>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'.</p>
	136.5-151.4'	<p><u>PORPHYRITIC METADACITE (UNIT 5)</u> As 49.6-103.8'. Trace-3% fine-grained, euhedral pyrite and subhedral-anhedral fracture smears; less pyrite after 140'.</p>

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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 —

INCLINATION CORE SIZE ORE BANDS	GEOLOGIC COLUMN	GEOLOGIC DESCRIPTION
	151.4-161'	<p><u>ANDALUSITE-BIOTITE-QUARTZ-SERICITE-CHLORITE SCHIST (UNIT 2a)</u> 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</p> <p>Quartz also occurs as large gray-white lithic fragments, stretched along foliation (trace-1/2%). 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.</p> <p>Gradational contact.</p>
	161-174.3'	<p><u>PORPHYRITIC METADACITE (UNIT 5)</u> 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'.</p>
	174.3-180'	<p><u>ANDALUSITE-BIOTITE-QUARTZ-SERICITE-CHLORITE SCHIST (UNIT 2a)</u> 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 (1/2-1%).</p> <p>Gradual contact with porphyritic metadacite after 178'.</p>

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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 —

INCLINATION	CORE SIZE	ORE BANDS	GEOLOGIC COLUMN	GEOLOGIC DESCRIPTION
60"			180-184'	<u>PORPHYRITIC METADACITE (UNIT 5)</u> Crystal and crystal-lithic tuffs. Locally biotite-rich (6-8% coarse-grained, subhedral); local quartz stringers. Trace-1% pyrite.
			184-185.3'	<u>QUARTZ VEIN</u> Gray-white, medium-coarse-grained, translucent, chlorite-bearing fractures. Trace-½% fine-coarse-grained, subhedral pyrite.
			185.3-205'	<u>ANDALUSITE-BIOTITE-QUARTZ-CHLORITE SCHIST (UNIT 2c)</u> 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'	<u>INTERCALATED ANDALUSITE-BIOTITE-QUARTZ-CHLORITE and ANDALUSITE-BIOTITE-QUARTZ-SERICITE UNITS (CHLORITE AND SERICITE SCHISTS)</u> 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'	<u>ANDALUSITE-BIOTITE-QUARTZ-CHLORITE SCHIST (UNIT 2c)</u> 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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(continued next page)

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 —

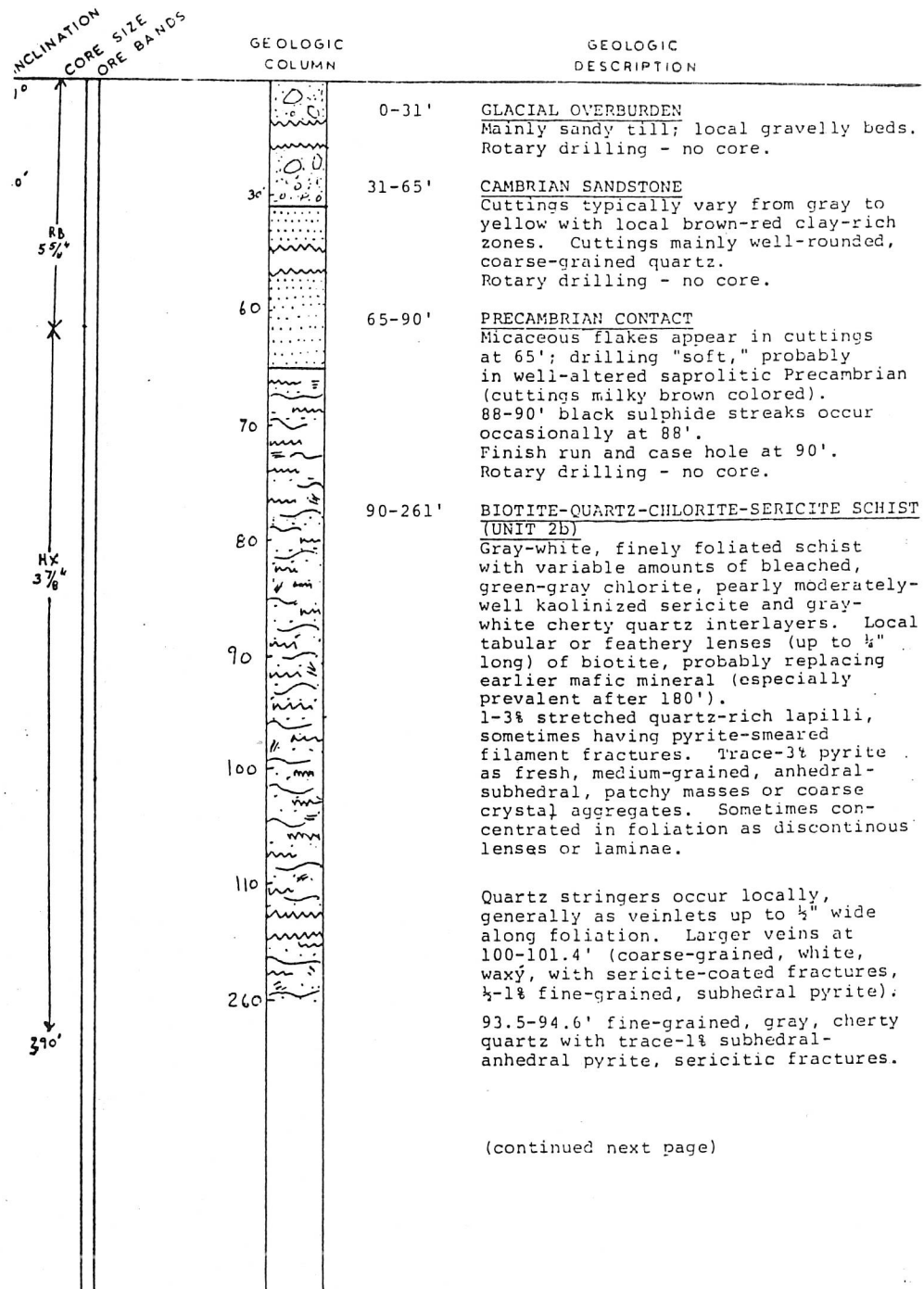
INCLINATION	CORE SIZE	ORE BANDS	GEOLOGIC COLUMN	GEOLOGIC DESCRIPTION
61°			216-231' (cont'd)	Local minor fractures (1/8-1/2") 45° to foliation, exhibiting right lateral displacement; more prevalent from 224-229'. Chlorite is almost completely bleached over this interval.
			231-250'	<u>ANDALUSITE-BIOTITE-QUARTZ-CHLORITE SCHISTS (UNIT 2c)</u> 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'

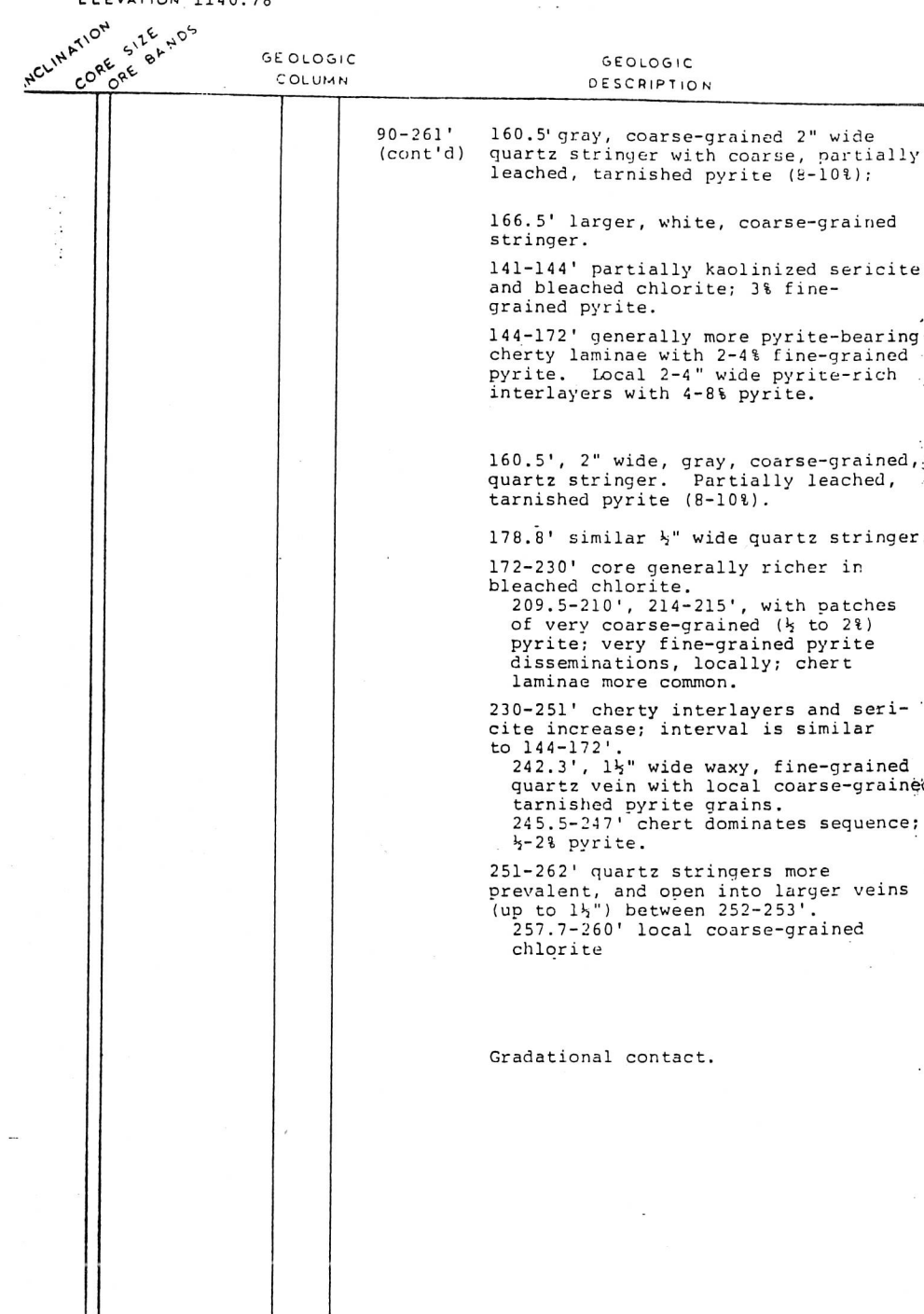


(continued next page)

Hole 22-141

SECTION 421
 COORDINATES 41361.3841N, 40267.2862E
 AZIMUTH 135°
 ELEVATION 1140.78

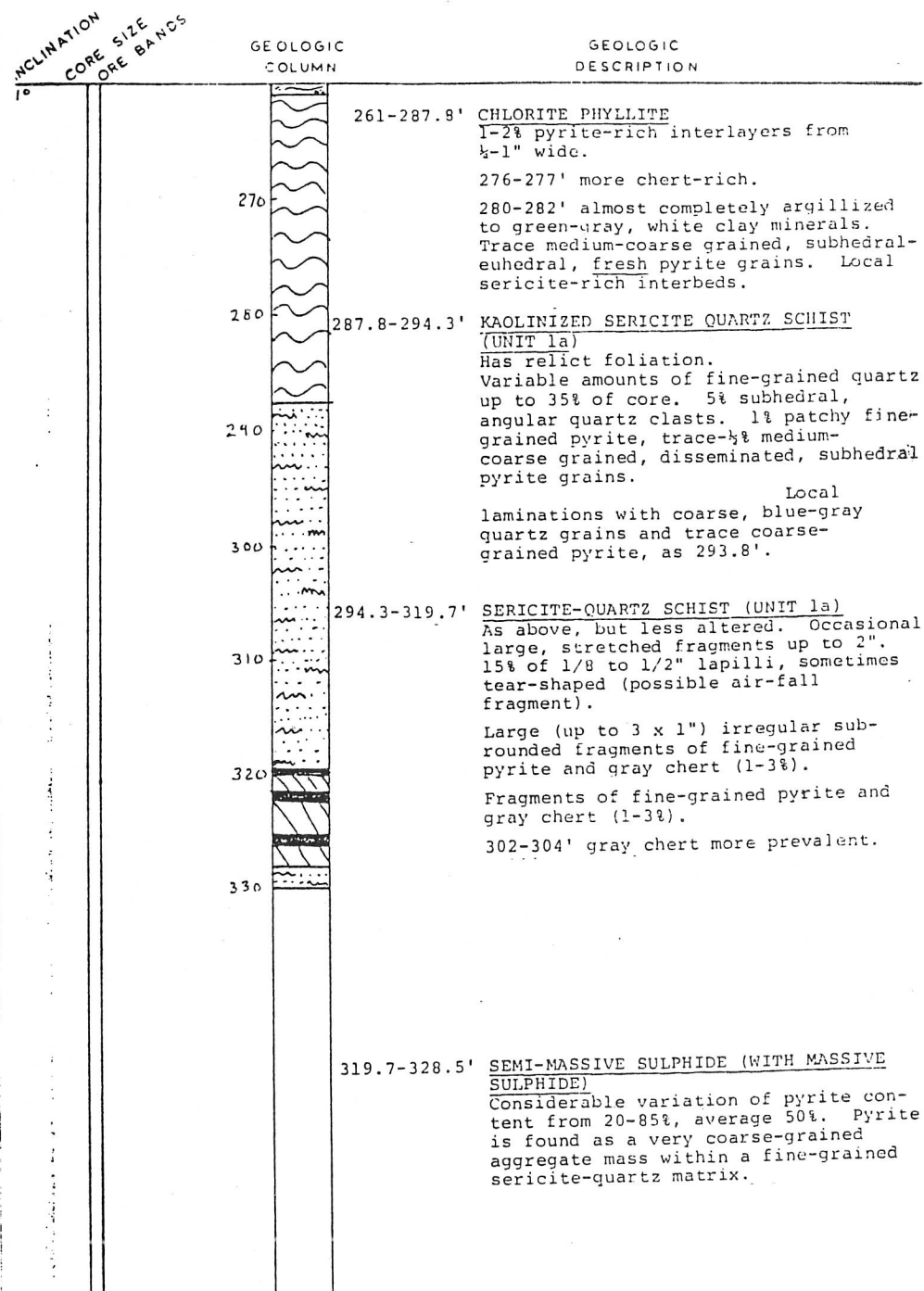
DATE STARTED 12-4-87
 COMPLETED 12-6-87
 LENGTH OF HOLE 390'



Hole 22-141

SECTION 421
 COORDINATES 41361.3841N, 40267.2862E
 AZIMUTH 135°
 ELEVATION 1140.78

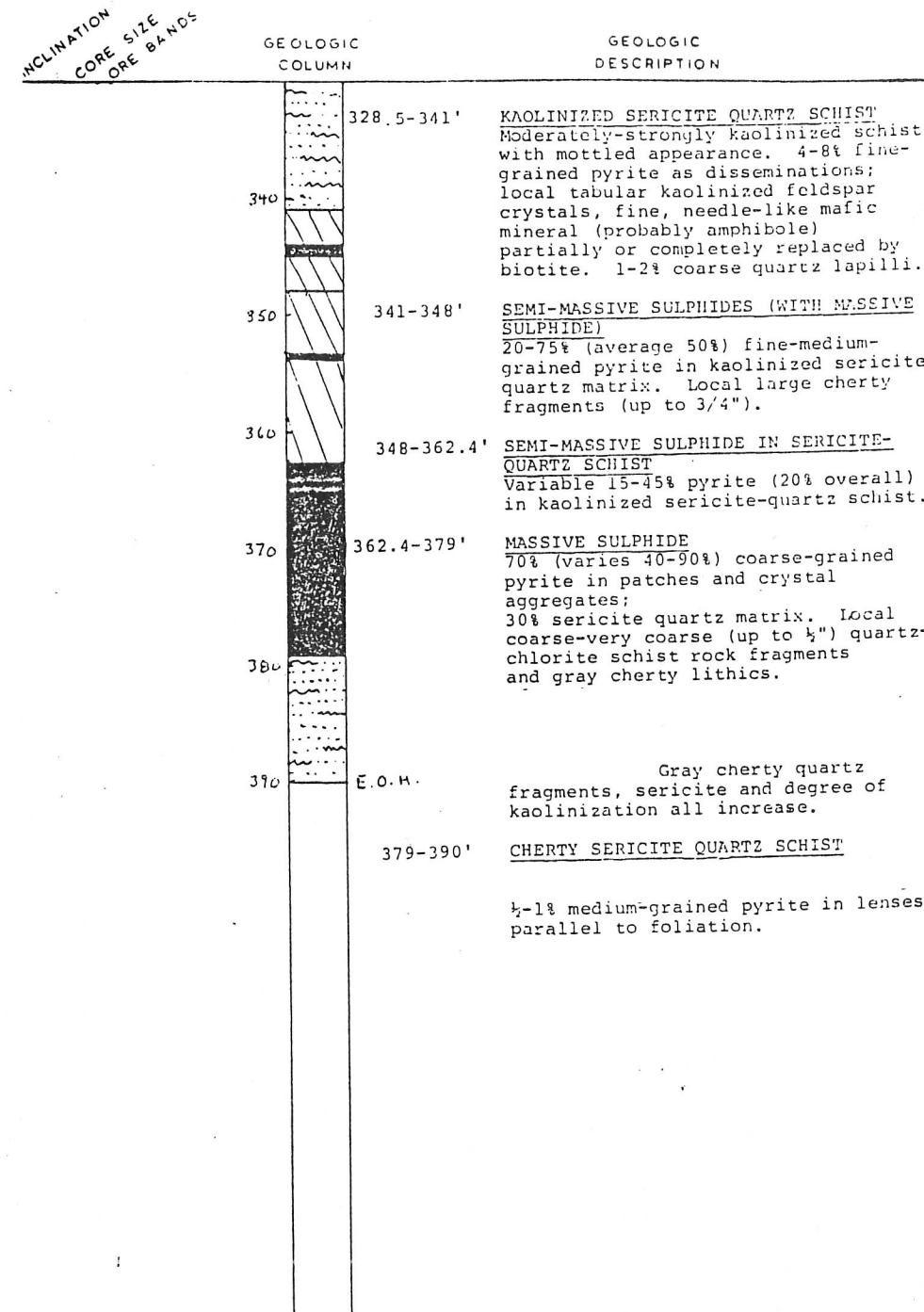
DATE STARTED 12-4-87
 DATE COMPLETED 12-6-87
 LENGTH OF HOLE 390'



Hole 22-141

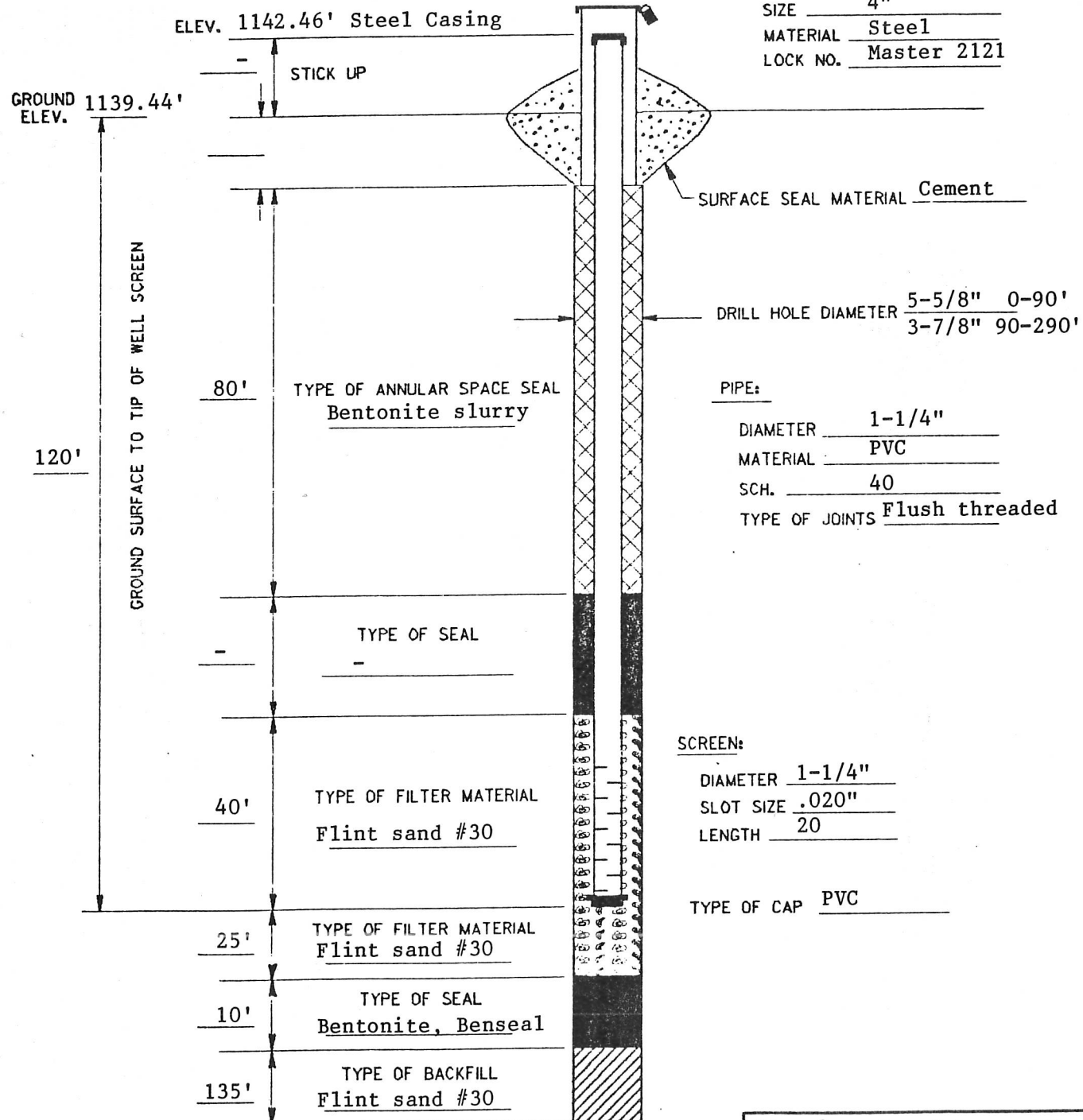
SECTION 421
 COORDINATES 41361.3841N, 40267.2862E
 AZIMUTH 135°
 ELEVATION 1140.78

DATE STARTED 12-4-87
 DATE COMPLETED 12-6-87
 LENGTH OF HOLE 390'



MONITORING WELL CONSTRUCTION DIAGRAM

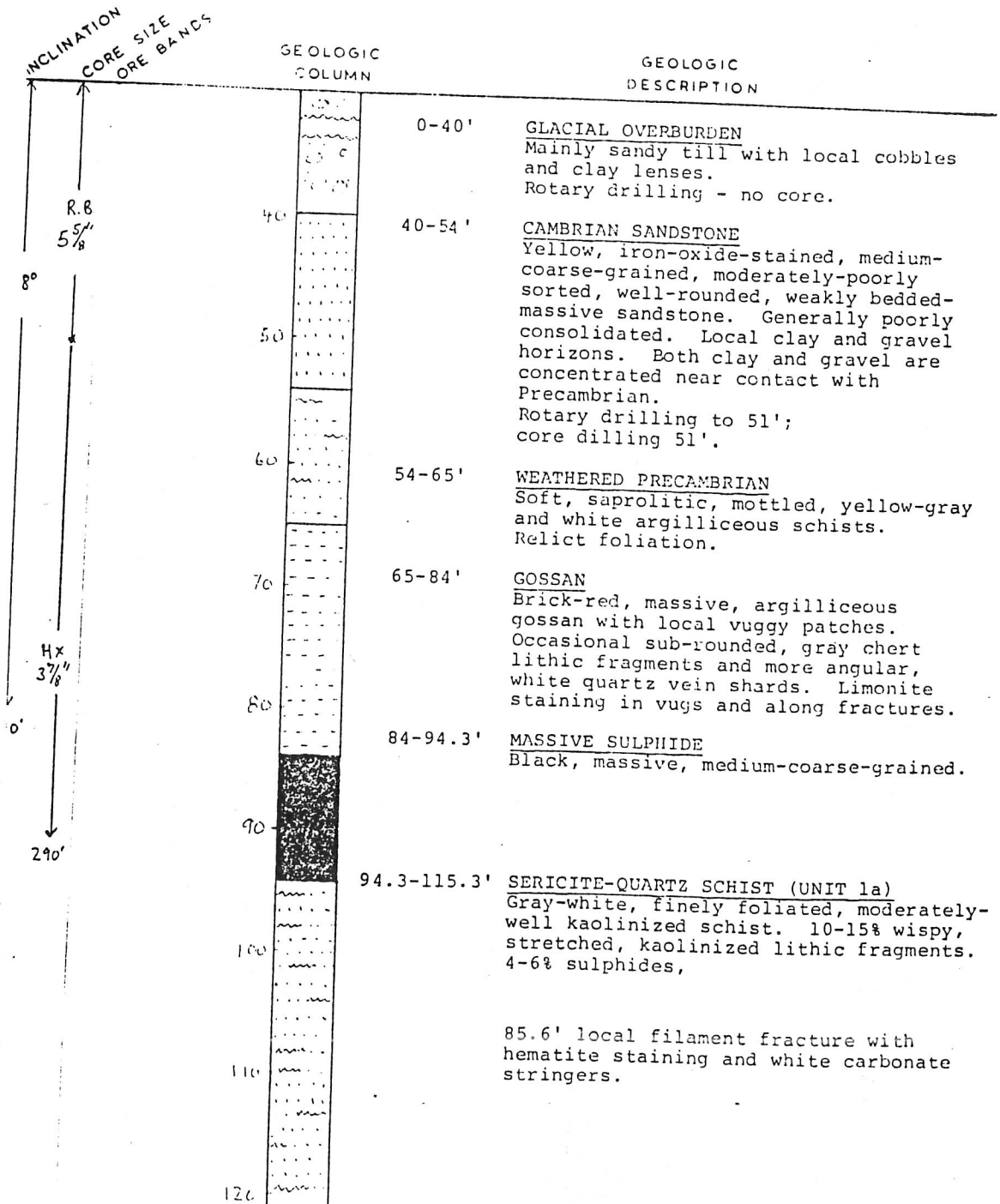
WELL NO: PZ-R7 CLIENT: Kennecott
 DATE INSTALLED: 1-12-88 by Luisier Drilling Inc. PROJECT: Geotechnical
 DRILLER: Longyear Company SCOPE I.D.: 87K10
 DRILLING METHOD: Mud rotary BY: P.G. (Kennecott)
 Angle Hole No. 22-142
 Oriented S55-60° E at 55° from horizontal



Foth & Van Dyke
 Geosciences & Environmental
 Management Division
 Revised 3/88 By BJS
 Drawn By MRS

BEAR CREEK MINING CO.

SECTION 422 Hole 22-142
 COORDINATES 41290.2697N, 40476.3052E
 AZIMUTH 135°
 ELEVATION 1139.80
 DATE STARTED 12-7-87
 COMPLETED 12-16-87
 LENGTH OF HOLE 290'



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'

INCLINATION
 CORE SIZE
 CORE BANDS

INCLINATION	CORE SIZE	CORE BANDS	GEOLOGIC COLUMN	GEOLOGIC DESCRIPTION
			115.3-136.6'	<u>SERICITE-QUARTZ SCHIST (UNIT 1a)</u> Similar to above, but more sericite-rich and better argillized. Trace-2% leached iron-oxide-stained pyrite sites. Local intercalated with lapilli-rich tuff.
130				125-129' rare, coarse (up to 1/4"), brown-white, tabular-square andalusite crystals. Iron-oxide is more abundant (lenses or Unit 2b).
			136.6-188.8'	<u>QUARTZ-CHLORITE AND AMPHIBOLE-CHLORITE SCHISTS (UNITS 4a and 4c)</u> Dark green, moderately-poorly foliated, chlorite phyllite intercalated with amphibole-bearing chlorite schist. Amphibole as fine, prismatic crystals (1/2-2%). Local fragments or lapilli of dark green, wispy chlorite, quartz, with carbonate-filled filament fractures.
140				136.6-139.2' lighter-colored, better-argillized bleached chlorite.
150				139.2', 149', 155-156', 162-162.4', chlorite generally argillized to blue-green clays. Mild iron-oxide staining as smears along minute fractures.
160				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-1/2% 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.
170				The coarser, mafic minerals give core a "grainy" appearance. Gradational contact.
180			188.8-221'	<u>AMPHIBOLE CHLORITE SCHIST (UNIT 4c)</u> As described above. After 200' biotite-quartz-chlorite schist (Unit 2c) becomes intercalated with Unit 4c. Gradational contact.
190				
200				
210				
220				

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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
 COMPLETED 12-16-87
 LENGTH OF HOLE 290'

INCLINATION
 CORE SIZE
 CORE BANDS

INCLINATION	CORE SIZE	CORE BANDS	GEOLOGIC COLUMN	GEOLOGIC DESCRIPTION
			221-264'	<u>BIOTITE-QUARTZ-CHLORITE SCHIST, PORPHYRITIC META-ANDESITE/DACITE, AND AMPHIBOLE CHLORITE SCHIST</u> 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.
220				
230				
240				
250				
260			264-290'	<u>PORPHYRITIC METADACITE/ANDESITE (UNIT 5)</u> 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.
270				
280				
290				E.O.H.

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LOG OF TEST BORING NO.: PZ-S1										SURFACE ELEVATION: 1101.6		
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										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			
1084.1	--17.5	17.0-18.5	sb	4		1.5	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	sb4 (SP) 3% cse sand 36% med sand 58% fn sand 3% si & cl 14.4% moist		
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.			
1079.1	--22.5	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		
1076.6	--25.0	23.0-25.0	st	7		2.0	Slightly moist, brittle, altered schist					
1074.1	--27.5	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							WATER LEVEL INFORMATION					
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.							DEPTH AT COMPLETION: LATER TIME/DEPTH: 24 hr/6' LATER TIME/DEPTH: CAVE IN DEPTH: DRILLING LOSSES:					

LOG OF TEST BORING NO.: PZ-S1										SURFACE ELEVATION: 1101.6		
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										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							WATER LEVEL INFORMATION					
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.							DEPTH AT COMPLETION: LATER TIME/DEPTH: 24 hr/6' LATER TIME/DEPTH: CAVE IN DEPTH: DRILLING LOSSES:					

PROJECT NO.: _____
 JOB NO.: 87K10
 DATE: December 16-22, 1987
 REPORT NO.: 1

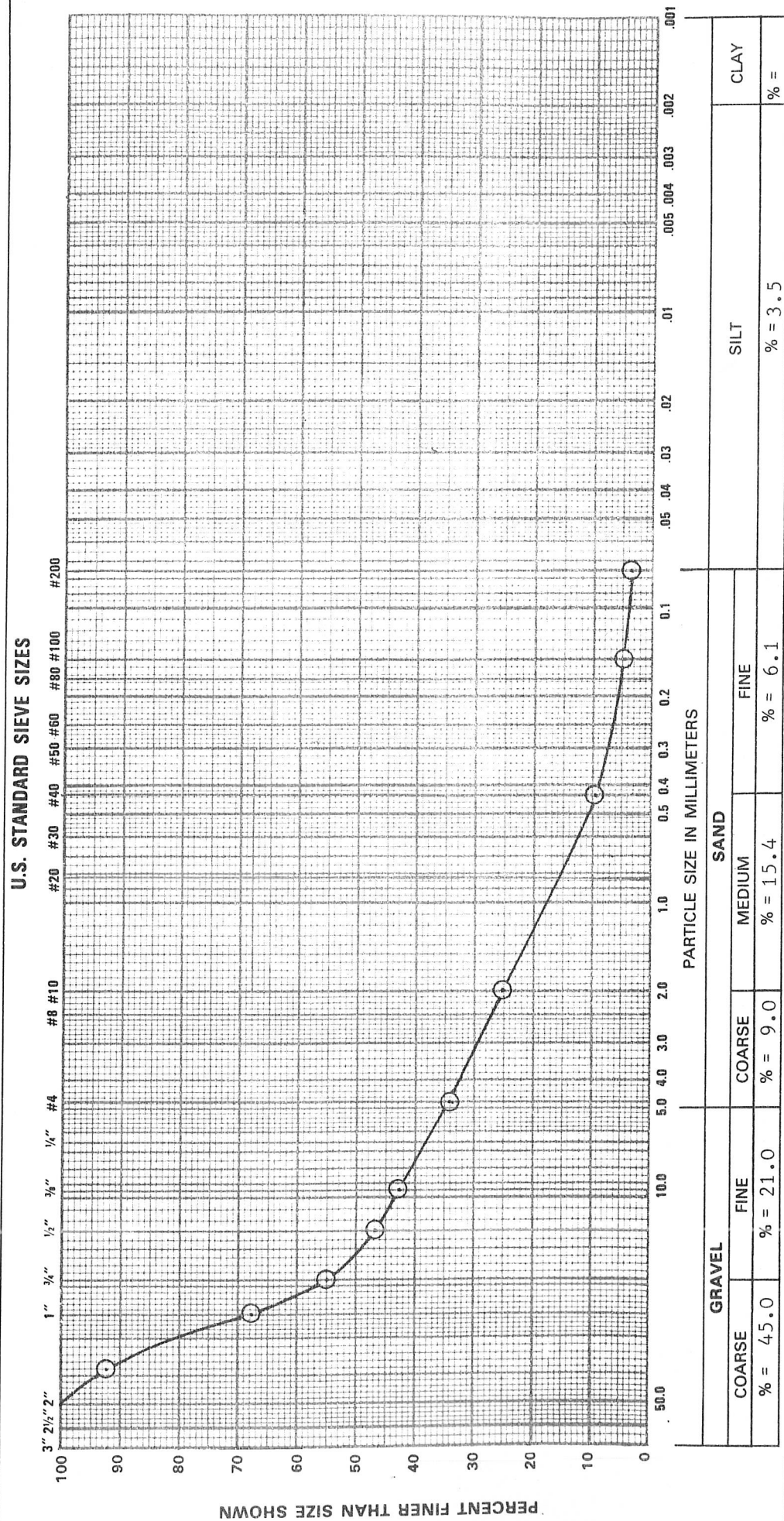
REPORT OF ANALYSIS OF AGGREGATES

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	Specifi-cations
3-Inch				
2-Inch	0	0	100	
1½-Inch	87.9	7.8	92.2	
1-Inch	276.3	24.4	67.8	
144.9	12.8	55.0		
½-Inch	91.9	8.1	46.9	
⅜-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)

Foth & Van Dyke and Associates Inc.
GRAIN SIZE DISTRIBUTION CURVE



CHECKED BY: RRR

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)

PROJECT NO.: _____
 JOB NO.: 87K10
 DATE: December 16-22, 1987
 REPORT NO.: 2

REPORT OF ANALYSIS OF AGGREGATES

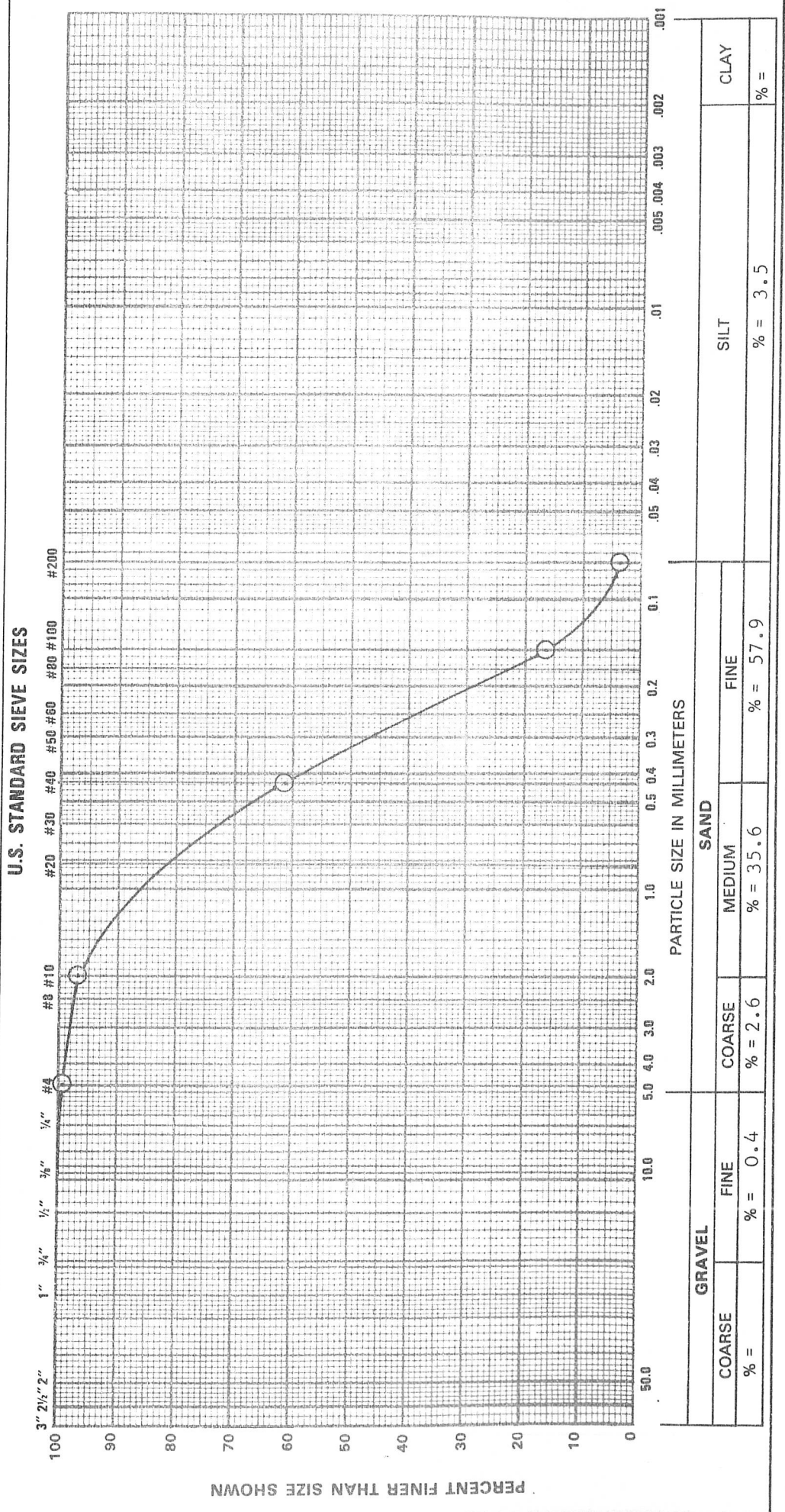
ARCHITECT/ENGINEER: Foth & Van Dyke CONTRACTOR: _____
 PROJECT: Kennecott Geotechnical SOURCE: _____
 REPORT OF TESTS OF: Verification of Subsurface Samples

Sieve Size or No.	Weight Retained	% Retained	% Passing	Specifications
3-Inch				
2-Inch				
1½-Inch				
1-Inch				
¾-Inch				
½-Inch				
⅜-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)

Foth & Van Dyke and Associates Inc.

GRAIN SIZE DISTRIBUTION CURVE



CHECKED BY: RRR

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 PI SAMPLED MOISTURE CONTENT (%): 14.4 COEFFICIENTS: Cc = 0.9 Cu = 3.5
 SAMPLE SOURCE: _____ MUNSSELL COLOR CODE: 10YR. 6/3 DATE SAMPLED: Nov. - Dec. 1987
 SOIL CLASSIFICATION (ASTM: D2487) SAND, fine to medium grained, pale brown (SP)

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: _____

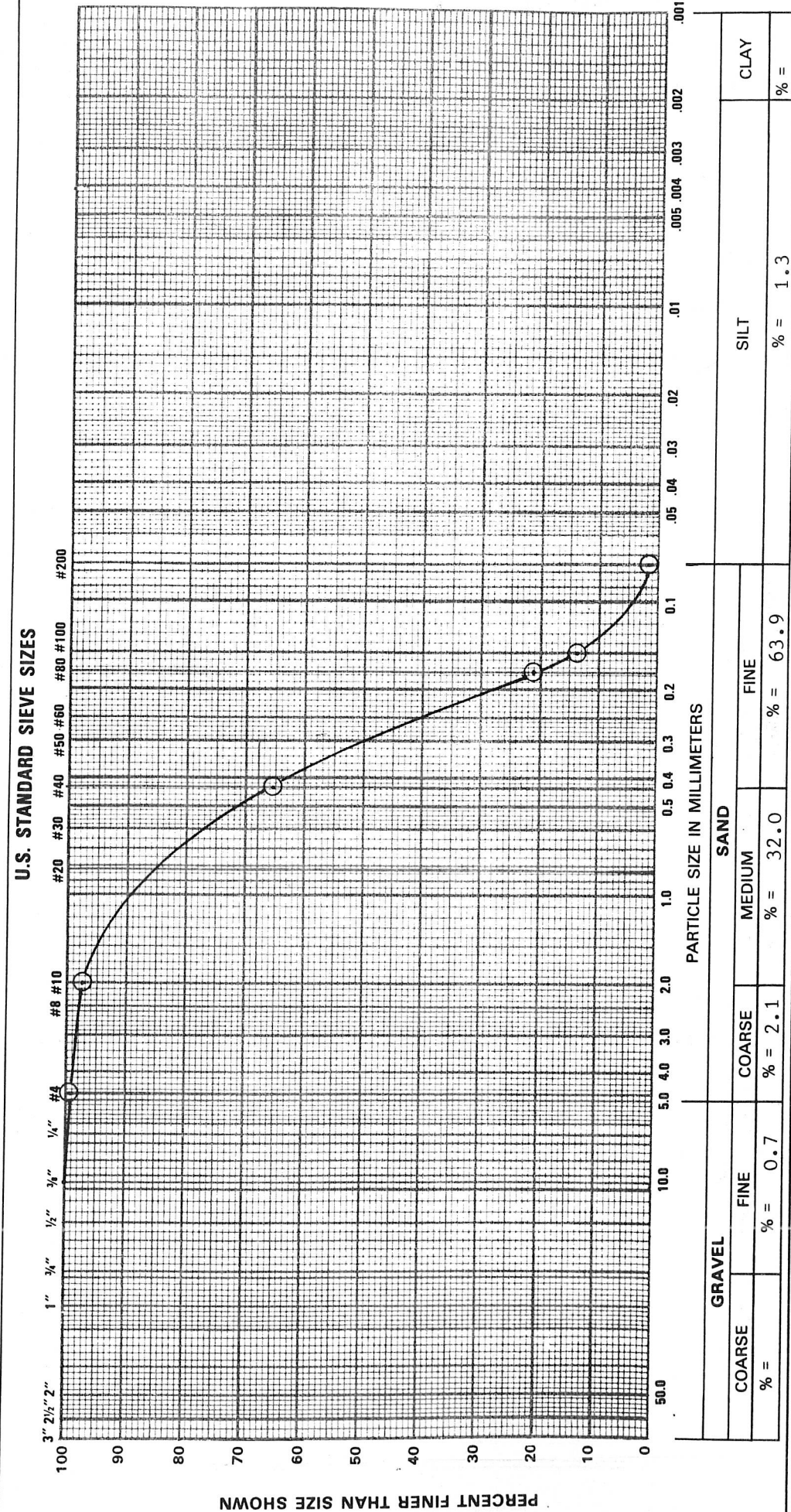
REPORT OF TESTS OF: Verification of Proposed Granular Blanket Material

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

Foth & Van Dyke and Associates Inc.

GRAIN SIZE DISTRIBUTION CURVE



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: _____ MUNSSELL COLOR CODE: 10 YR. 7/2 DATE SAMPLED: December 1987
 SOIL CLASSIFICATION (ASTM: D2487) SAND, fine to medium grained, light gray (SP)

CHECKED BY: RRR

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: Kenneocott

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

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
 Soil Classification: SILT W/SAND, a little gravel, yellowish brown (ML)
 Permeant Used: Distilled Water
 Technician: R. Rouse
 Coefficient of Permeability: 3.3×10^{-8}
 (cm/sec)

PROJECT SPECIFICATIONS

ASTM D1557 - Method "A"

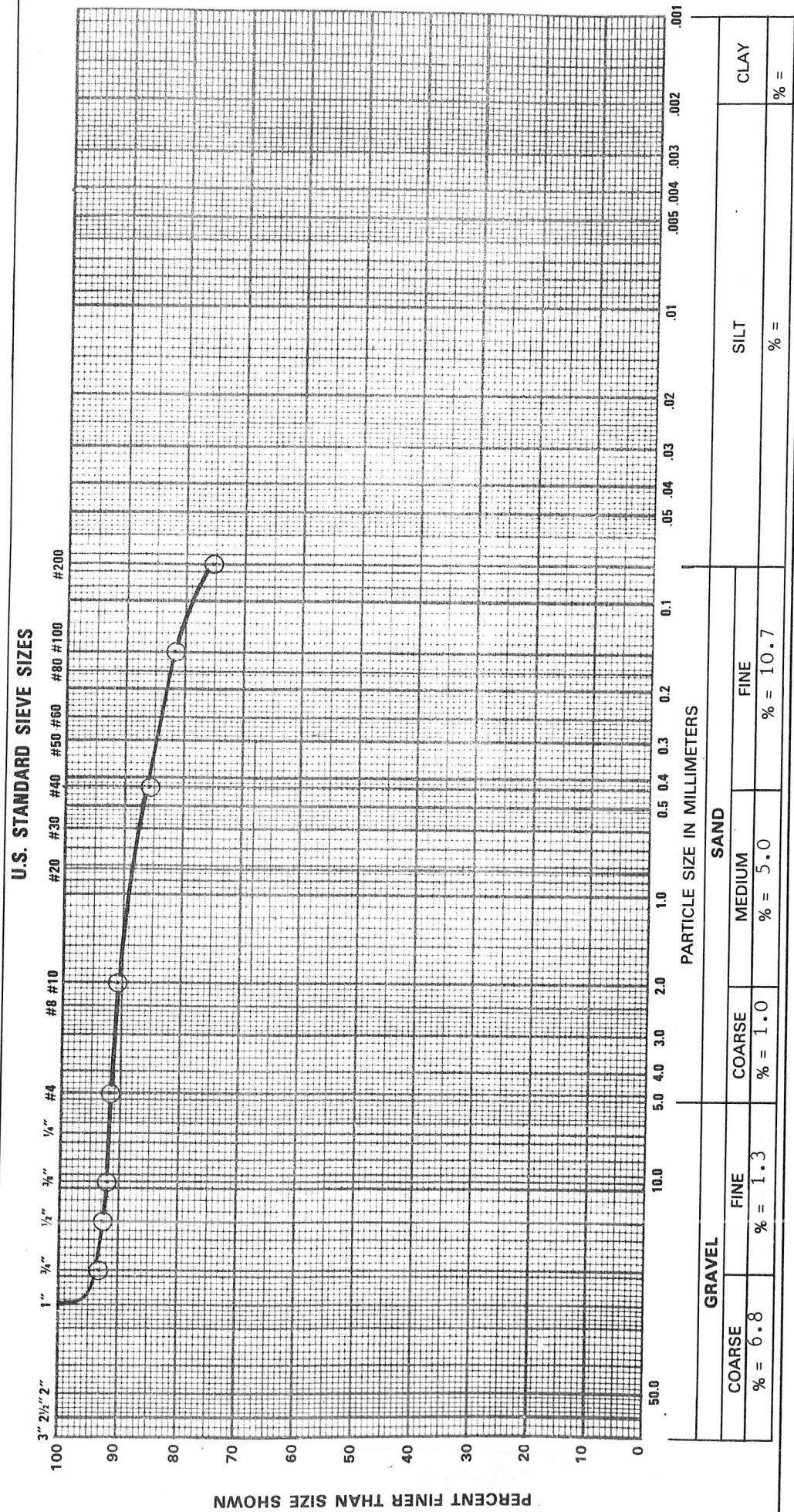
ATTERBERG LIMITS

Liquid Limit (%):
 Plastic Limit (%):
 Plasticity Index:

REMARKS:

Foth & Van Dyke and Associates Inc.

GRAIN SIZE DISTRIBUTION CURVE



By: Robert R. Rouse
 3.5-I-42

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: MUNSSELL COLOR CODE: 10 YR. 5/8 DATE SAMPLED: Dec. 8, 1987
 SOIL CLASSIFICATION (ASTM: D2487) SILT W/SAND, a little gravel, yellowish brown (ML)

PROJECT NO.: _____
 JOB NO.: 87K10
 DATE: February 1 to March 3, 1988
 REPORT NO.: 1

COMPACTION CONTROL REPORT

DATE: 2-18-88 JOB NAME: Kennecott Geotechnical SCOPE I.D. #: 87K10

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	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)

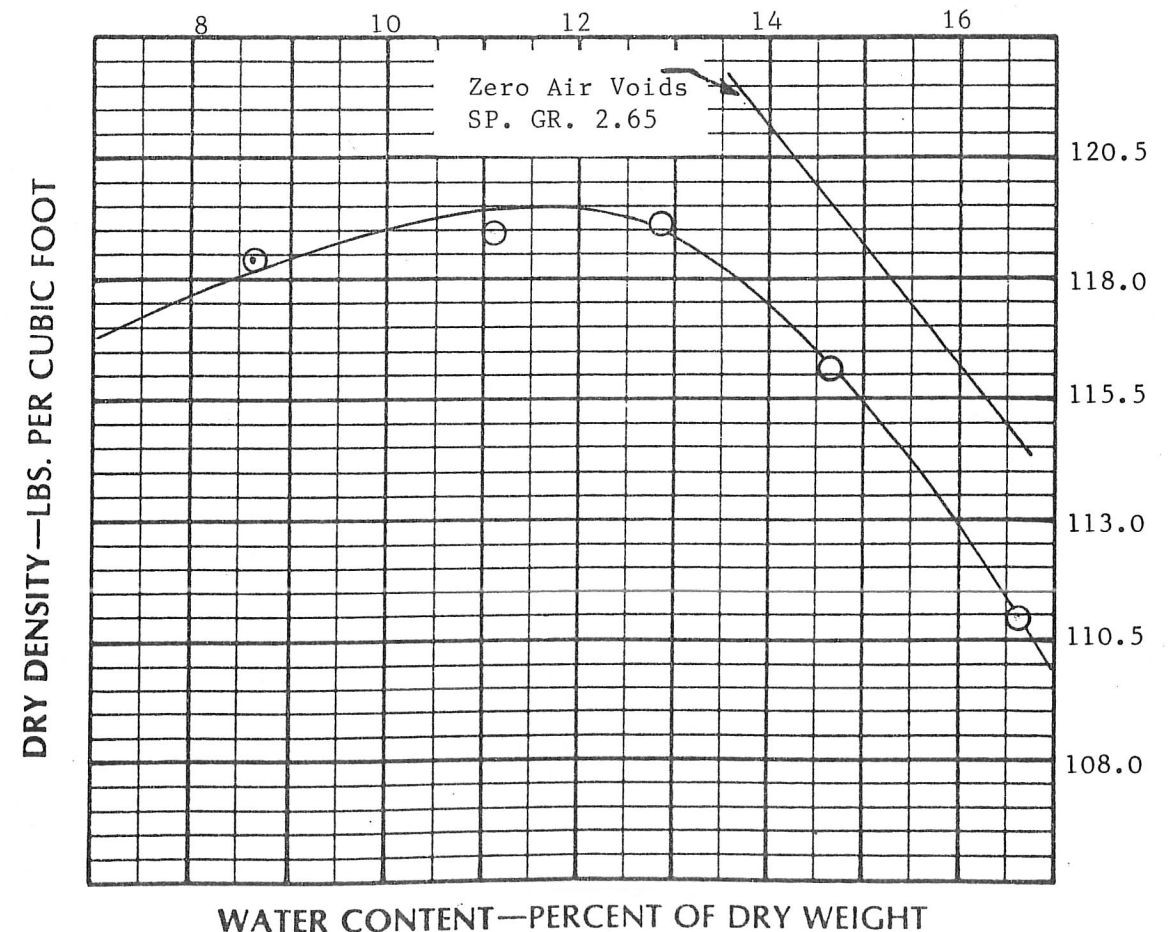
1. LABORATORY COMPACTION TEST DATA

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)



CHECKED BY: RRR

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

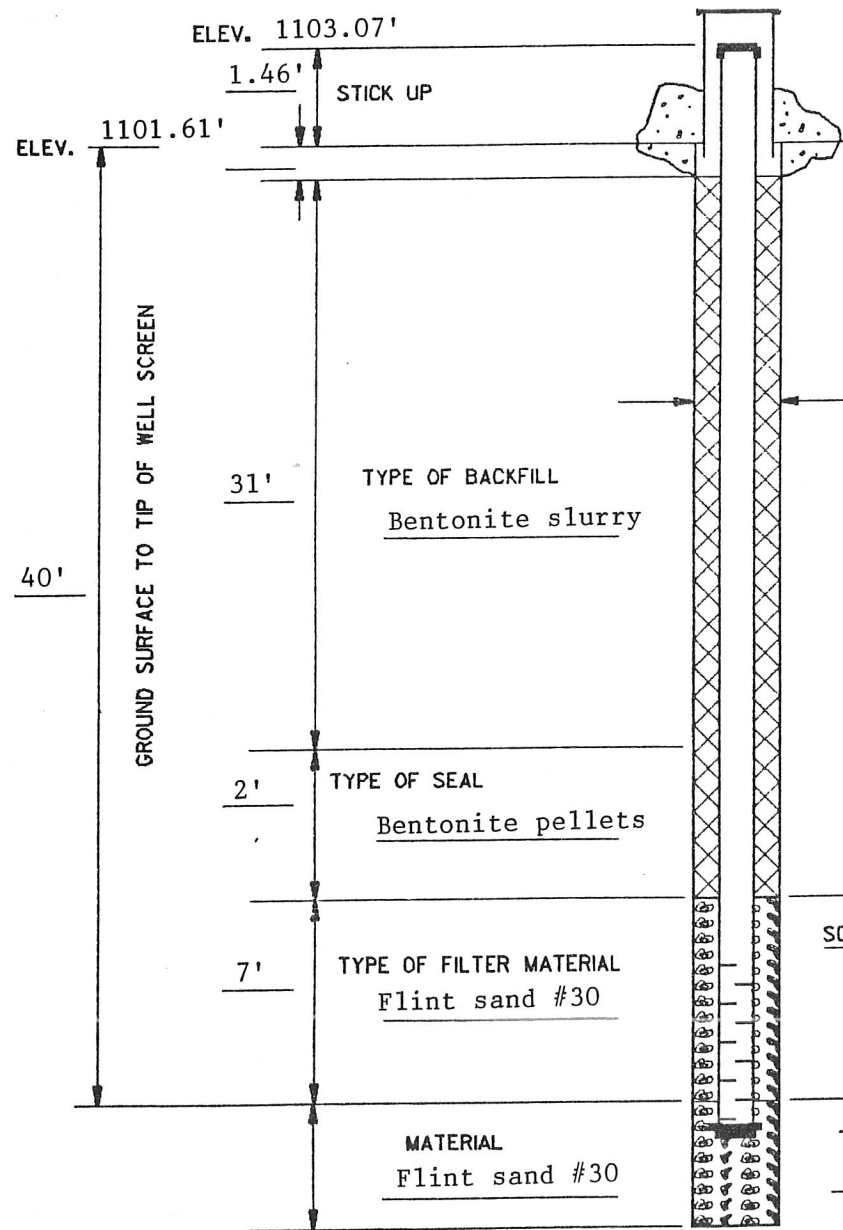
CLIENT: Kennecott
 PROJECT: Geotechnical
 SCOPE I.D.: 87K10-BL22
 BY: BJS

PROTECTOR PIPE:
 SIZE 6"
 MATERIAL Steel
 LOCK Master 2121

PIPE:
 DIAMETER 2"
 MATERIAL PVC
 SCH. 40
 TYPE OF JOINTS Threaded couplings and glue

SCREEN:
 DIAMETER 2"
 SLOT SIZE .006"

TYPE OF CAP
PVC



MONITORING WELL DEVELOPMENT

WELL NUMBER PZ-S1 CLIENT Kennecott
 WELL DIAMETER 2" PROJECT Geotechnical Investigation
 TOTAL DEPTH OF WELL 42.60' SCOPE I.D. 87K10-BL 22
 DEPTH TO WATER BEFORE 8.30' TIME OF MEASUREMENT BY MJH
 AFTER 36.55' 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	TEMPERATURE	FIELD	
			SPEC. COND.	pH
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

Foth & Van Dyke

Geosciences & Environmental Management Division

FOTH AND VAN DYKE

LOG OF TEST BORING NO.: PZ-S2										SURFACE ELEVATION: 1103.4		
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										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 schistosity (saprolite)	"GM"		sb4 (GM) 36% cse gvl 24% fn gvl 23% sand 16% silt 1% clay 11.9% moist		
1085.9	--17.5	17.0-18.5	st	5		1.5	Yel brn (oxidized) altered sericite schist w/distict foliation, hard	"ML"		st5 (SM) K= 3.3E - 07 cm/sec		
1083.4	--20.0	20.0-21.5	st	6		1.5	Same except crumbly, soft to hard					
1080.9	--22.5	22.0-23.0 @ 23.0	st c	7 8		1.0 0.0	Same except harder Cored 23-26', One piece 2x3" oxidized sericite schist w/secondary Fe cement along foliation & fractures		P.P. - 4.5+ RQD = 0%	st6 (SM) 22% gvl 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						WATER LEVEL INFORMATION						
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.						DEPTH AT COMPLETION: LATER TIME/DEPTH: 24 hr/12' LATER TIME/DEPTH: CAVE IN DEPTH: DRILLING LOSSES:						

LOG OF TEST BORING NO.: PZ-S2										SURFACE ELEVATION: 1103.4		
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										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 31.5'-End of Boring in altered schist PZ-S2 installed in boring at 31 ft	"ML"				
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						WATER LEVEL INFORMATION						
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.						DEPTH AT COMPLETION: LATER TIME/DEPTH: 24 hr/12' 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

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'	
1069.0	--35						30.0'-End of Boring in altered schist Refusal	=====		
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:

REPORT OF ANALYSIS OF AGGREGATES

ARCHITECT/ENGINEER: Foth & Van Dyke CONTRACTOR: _____
PROJECT: Kennecott Geotechnical SOURCE: _____
REPORT OF TESTS OF: Verification of Subsurface Samples

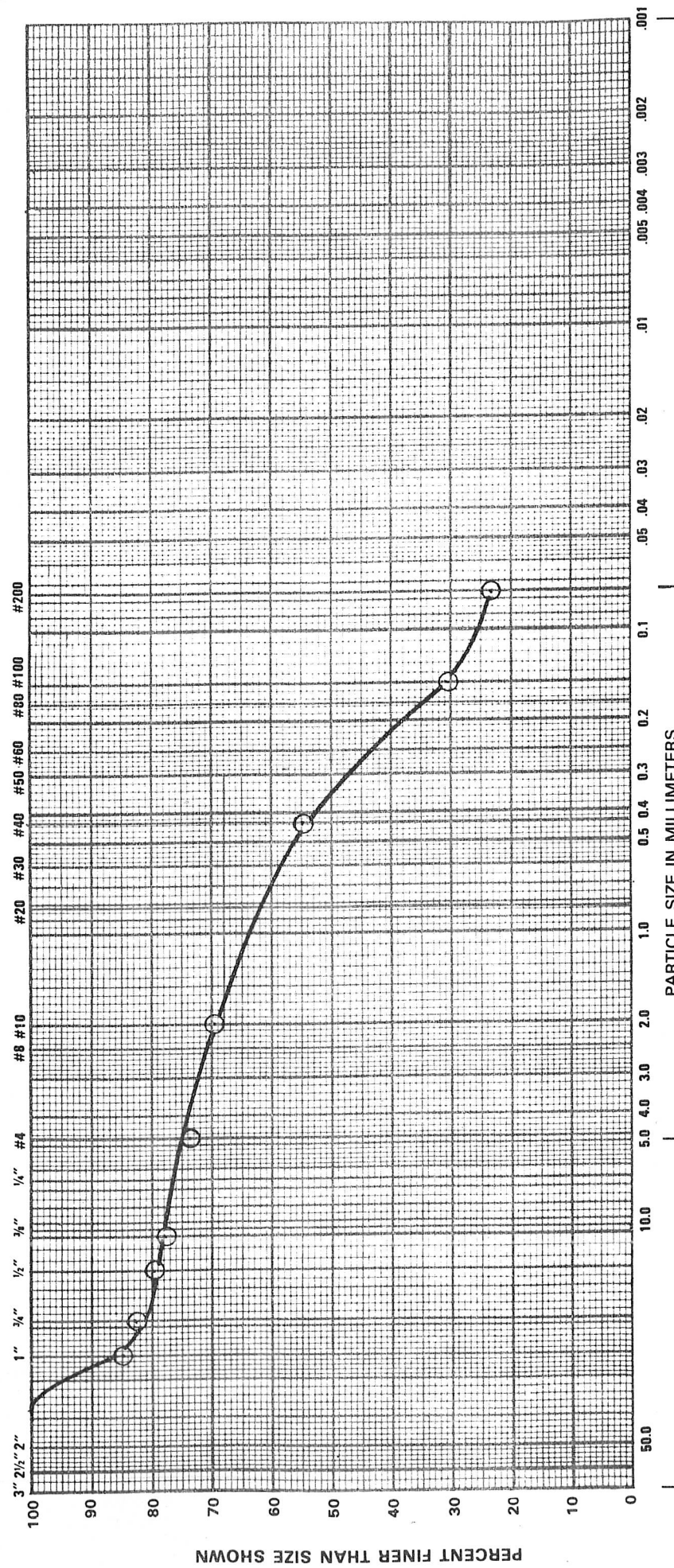
Sieve Size or No.	Weight Retained	% Retained	% Passing	Specifications
3-Inch				
2-Inch				
1 1/2-Inch	0	0	100	
1-Inch	74.2	15.2	84.8	
3/4-Inch	9.8	2.0	82.8	
1/2-Inch	13.9	2.9	79.9	
3/8-Inch	9.7	2.0	77.9	
No. 4	20.4	4.2	73.7	
No. 8				
No. 10	21.2	4.3	69.4	
No. 16				
No. 20				
No. 30				
No. 40	70.6	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 Pant+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

GRAIN SIZE DISTRIBUTION CURVE

U.S. STANDARD SIEVE SIZES



GRAVEL		SAND		SILT		CLAY							
COARSE	% = 17.2	FINE	% = 9.1	COARSE	% = 4.3	MEDIUM	% = 14.5	FINE	% = 31.8	SILT	% =	CLAY	% =

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 =
 MUNSSELL 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

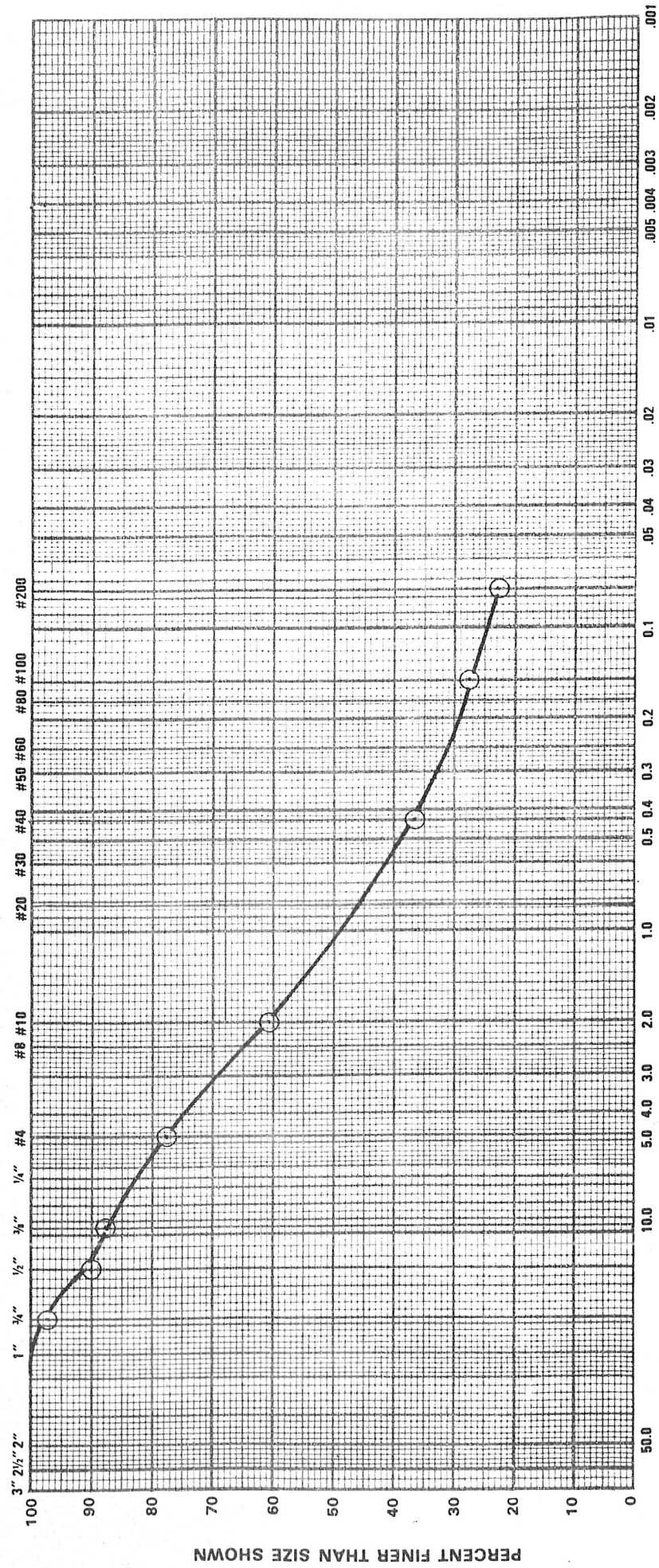
Sieve Size or No.	Weight Retained	% Retained	% Passing	Specifi-cations
3-Inch				
2-Inch				
1 1/2-Inch				
1-Inch	0	0	100	
3/4-Inch	67.6	36.2	63.8	
1/2-Inch	20.9	11.2	52.6	
3/8-Inch	14.2	7.6	45.0	
No. 4	8.8	4.8	40.2	
No. 8				
No. 10	10.6	5.7	34.5	
No. 16				
No. 20				
No. 30				
No. 40	16.5	8.8	25.6	
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

GRAIN SIZE DISTRIBUTION CURVE

U.S. STANDARD SIEVE SIZES

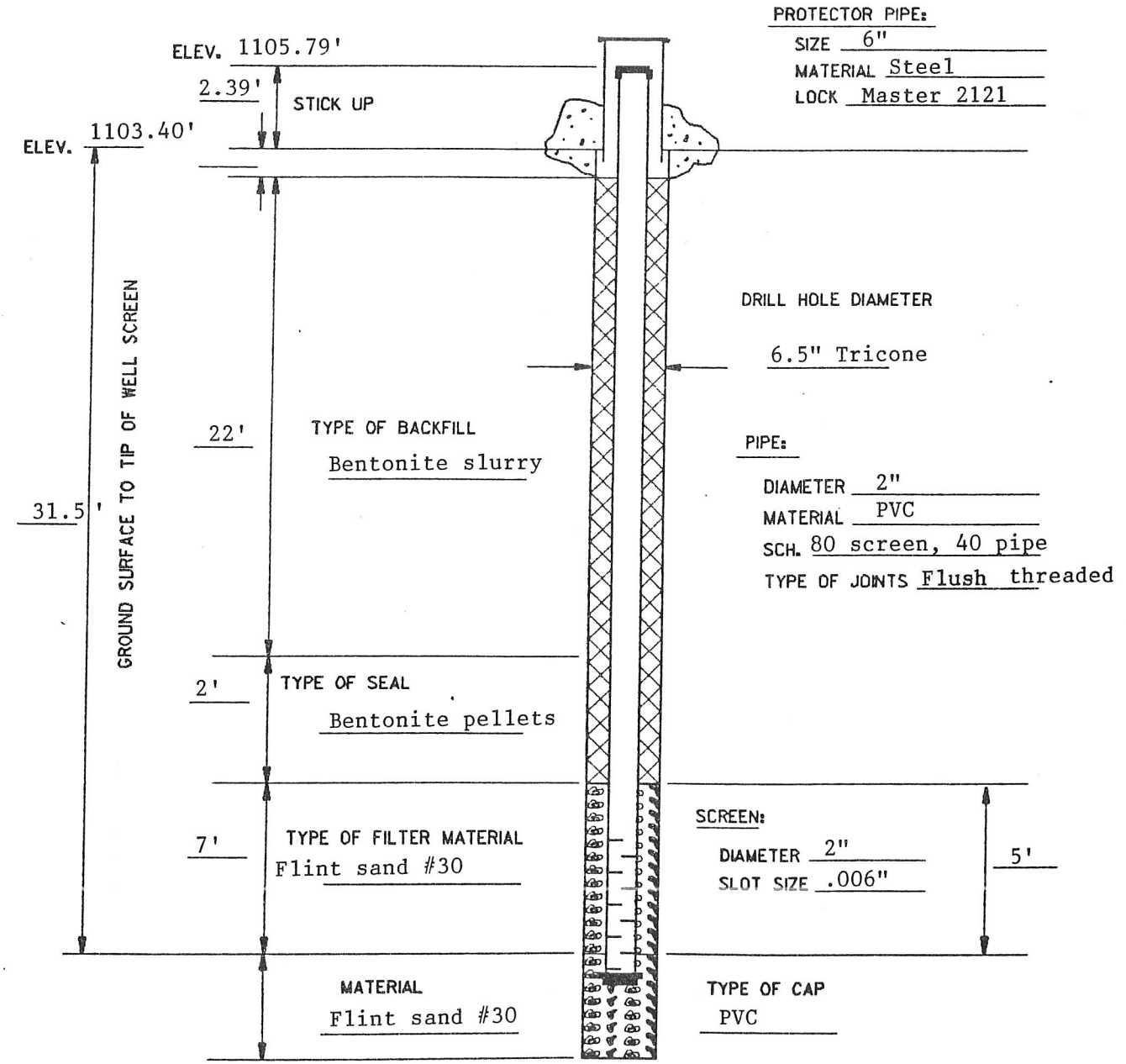


GRAVEL		SAND		SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	% =
% = 2.6	% = 19.5	% = 17.0	% = 24.2	% = 13.8	% =

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: _____ MUNSSELL 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)

MONITORING WELL INSTALLATION DIAGRAM

WELL NO: PZ-S2 CLIENT: Kennecott
 DATE INSTALLED: 12-07-87 PROJECT: Geotechnical
 DRILLER: Luisier Drilling Inc. SCOPE I.D.: 87K10-BL22
 DRILLING METHOD: Mud rotary BY: BJS
 COORDINATES: 39,703.68N 39,076.85E



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	SPEC. COND.	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 Many cobbles 14.5-16'	SW-SM	P.P. - 2.5	
		@ 16.0	sb	5	100	0.0	Boulder from 16.5-18.0', cuttings white, sericite schist			
1111.5	--17.5									
		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									
		25.0-26.0	sb	8	86	1.0	As above		P.P. - 3.0	
1104.0	--25.0									
		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

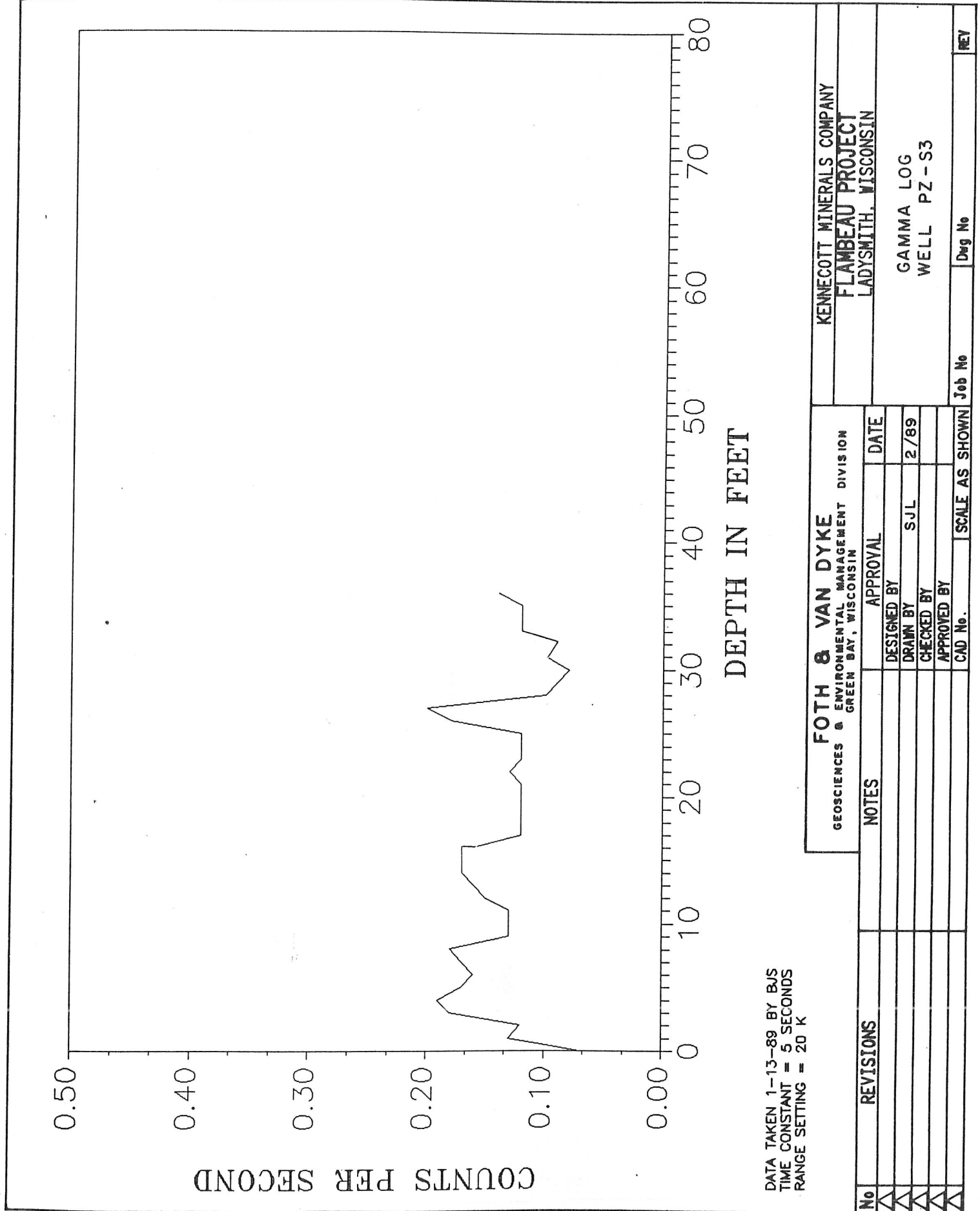
DEPTH AT COMPLETION:
 LATER TIME/DEPTH:
 LATER TIME/DEPTH:
 CAVE IN DEPTH:
 DRILLING LOSSES:

LOG OF TEST BORING NO.: PZ-S3										SURFACE ELEVATION: 1129.0	
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										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		
1099.0	--30.0	29.0-30.0	sb	11	100	0.2	Brn yel (10YR 6/8) poorly graded SAND w/silt, fn, unconsol., soft (ss)		Noncohesive		
1096.5	--32.5	32.0-33.0	pl	12	100	0.0	(Lt gray clayey SAND on bit) (Sandstone & incorp. saprolite)				
1094.0	--35.0	35.0-36.0	sb	13		0.2	Gray green & tan silty CLAY, soft, irreg laminated w/chips lt brn & yel brn ss (Cuttings cse brn qtz sand w/mica to 35' then yel brn soft micaceous saprolite)	CL-ML			
1091.5	--37.5	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	
		37.0-38.0	st	15	100	0.9	Drove 37-38'-Yel brn & gray altered schist as above		N - 50/0.2 P.P. - 4.5+	26% sand	
		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+	73% si & cl 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 schistosity apparent		N - 100/0.8' P.P. - 2.5		
1086.5	--42.5	41.0-42.0	st	18	300	0.0	41'-Tube crumpled (altered schist as above)		N - 300/0.2'		
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, schistosity apparent		P.P. - 2.0		
1081.5	--47.5										
1079.0	--50.0	50.0-51.0	sb	20	100	1.2	Dk grn gray w/white "SILT", soft, appar. schistosity (altered chlorite schist)			sb20 (ML) 7% sand 86% silt 7% clay LL=35.9 PI=4.2	
1076.5	--52.5	51.0-53.0	pl	21	500	1.9	Altered schist as above 52'-End of Boring in altered schist PZ-S3 installed in boring at 33.5'	=====	N - 500/1.0'	22.7% moist	
1074.0	--55.0										

WATER LEVEL INFORMATION

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

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.



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

KENNECOTT MINERALS COMPANY		FLAMBEAU PROJECT		GAMMA LOG	
LADYSMITH, WISCONSIN		LADYSMITH, WISCONSIN		WELL PZ-S3	
FOTH & VAN DYKE		APPROVAL		DATE	
GEOSCIENCES & ENVIRONMENTAL MANAGEMENT DIVISION		DESIGNED BY		2/89	
NOTES		DRAWN BY		S.J.L.	
REVISIONS		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

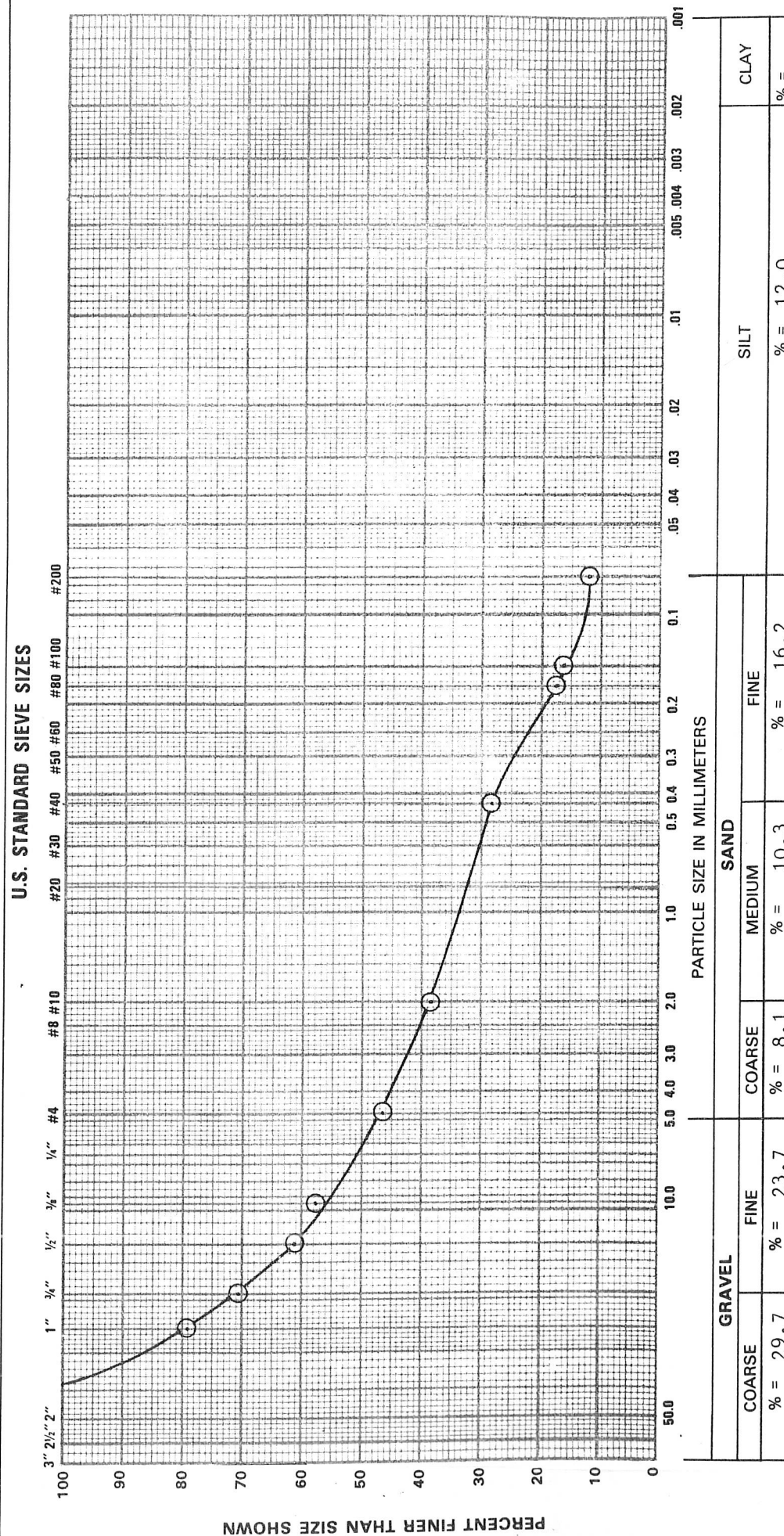
ARCHITECT/ENGINEER: Foth & Van Dyke CONTRACTOR: _____
PROJECT: Kennecott Geotechnical - Granular Blanket SOURCE: _____
REPORT OF TESTS OF: Verification of Proposed Granular Blanket Material

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

Foth & Van Dyke and Associates Inc.

GRAIN SIZE DISTRIBUTION CURVE



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: _____ MUNSSELL COLOR CODE: 10 YR. 3/3 DATE SAMPLED: December 1987
SOIL CLASSIFICATION (ASTM: D2487) GRAVEL W/SILT and SAND, dark brown (GM-GP)

CHECKED BY: RRR

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

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 %

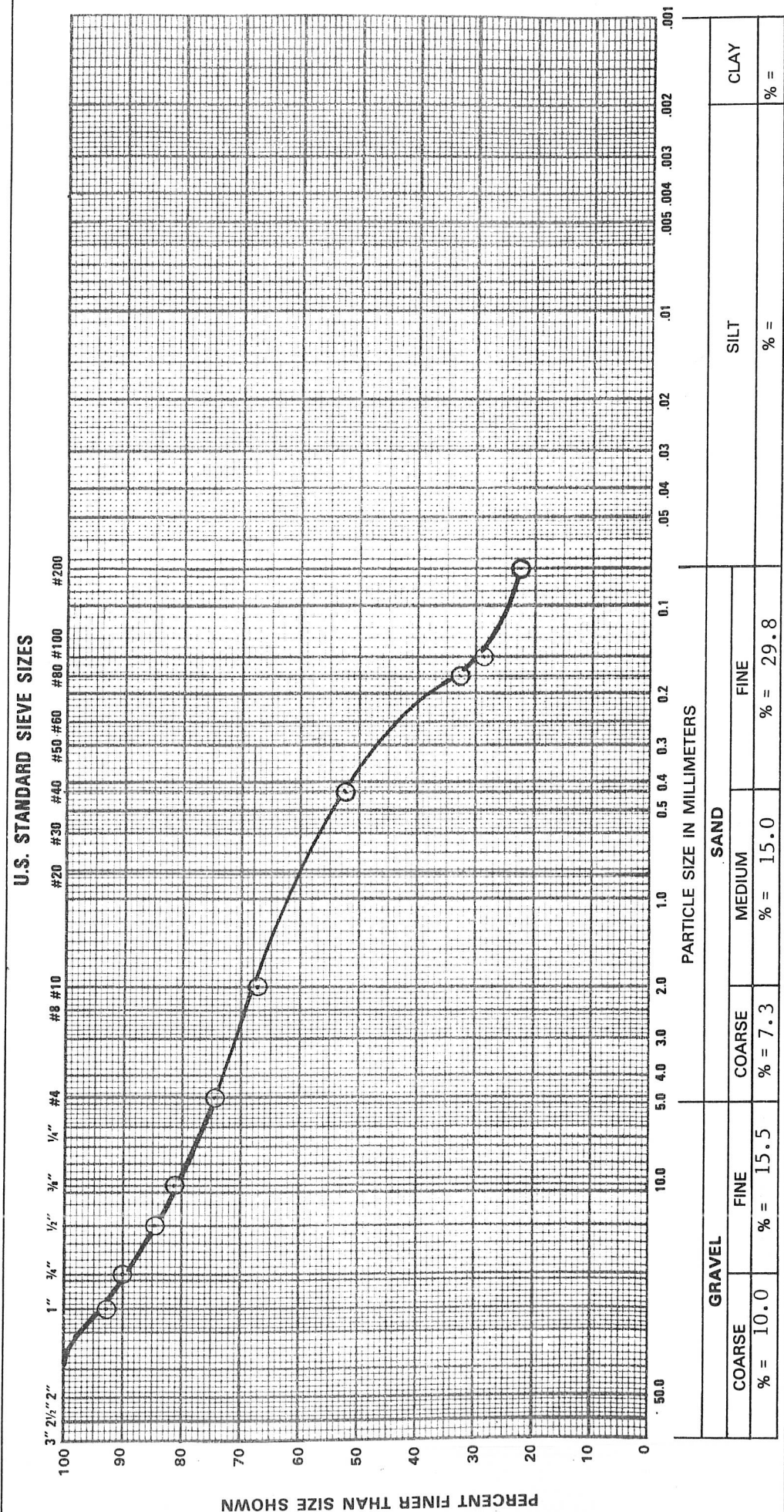
COLOR: 5 YR. 3/4 - dark reddish brown

Moisture Content = 14.8%
(As received)

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		

Foth & Van Dyke and Associates Inc.

GRAIN SIZE DISTRIBUTION CURVE



PROJECT: Kennocott Geotechnical

DATE: 3/9/88 SAMPLE NO.: 5

LOCATION SAMPLED: Boring No.: PZ-S3

DRAWN BY: RRR

APPROVED BY: POK

ATTERBERG LIMITS: LL _____ PL _____ PI _____

COEFFICIENTS: Cc = _____ Cu = _____

SAMPLE SOURCE: _____

DATE SAMPLED: 10/29/87

SOIL CLASSIFICATION (ASTM: D2487) SILTY SAND W/GRAVEL, fine to medium grained, dark reddish brown (SM)

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

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: 8.8×10^{-5} (cm/sec)

PROJECT SPECIFICATIONS

ATTERBERG LIMITS

Liquid Limit (%):
 Plastic Limit (%):
 Plasticity Index:

REMARKS:

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	
1.3 Pan 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 %

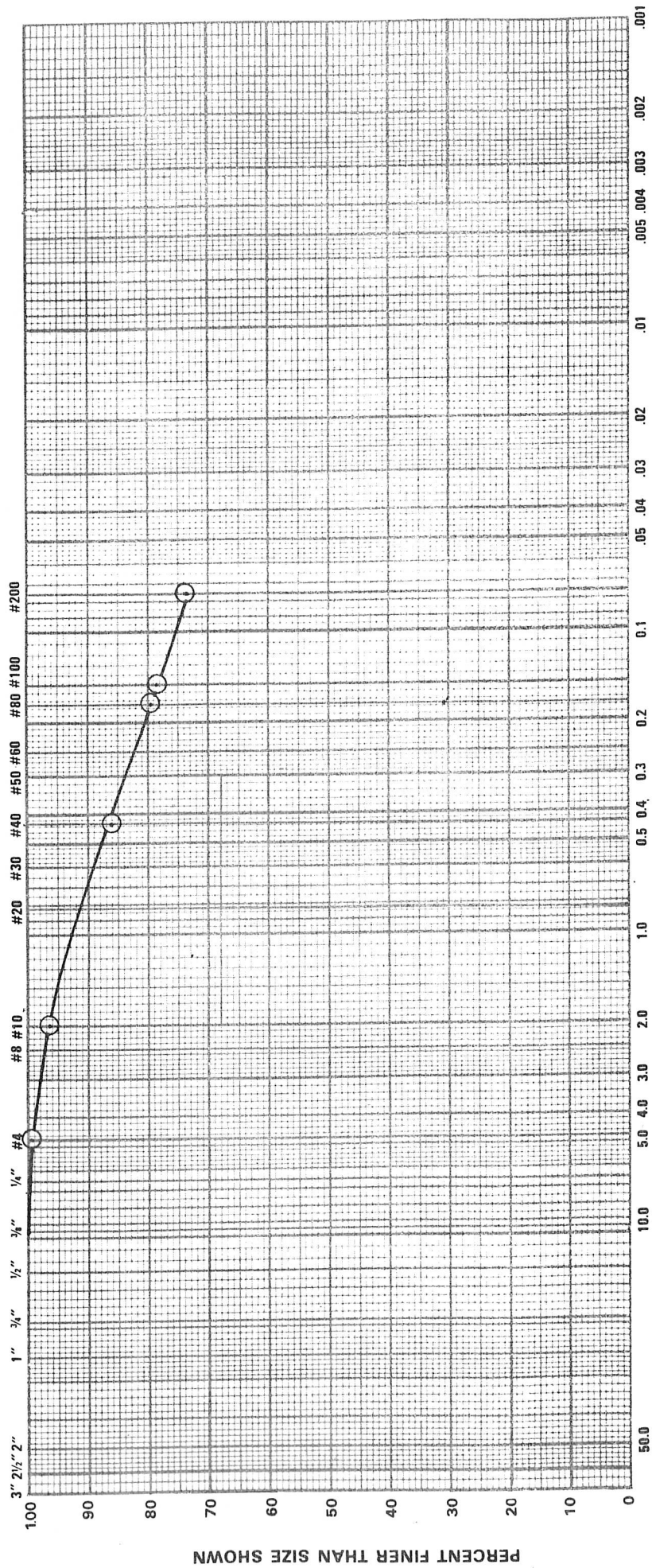
COLOR: 2.5 Y. 5/4 - light olive brown

Moisture Content = 15.3%
 (As Received)

CHECKED BY: RRR

GRAIN SIZE DISTRIBUTION CURVE

U.S. STANDARD SIEVE SIZES



GRAVEL		SAND		SILT		CLAY	
COARSE	% = 0.6	FINE	% = 12.4		% =		% =
		COARSE	% = 10.6				
		MEDIUM	% = 2.8				

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: MUNSSELL 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)

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

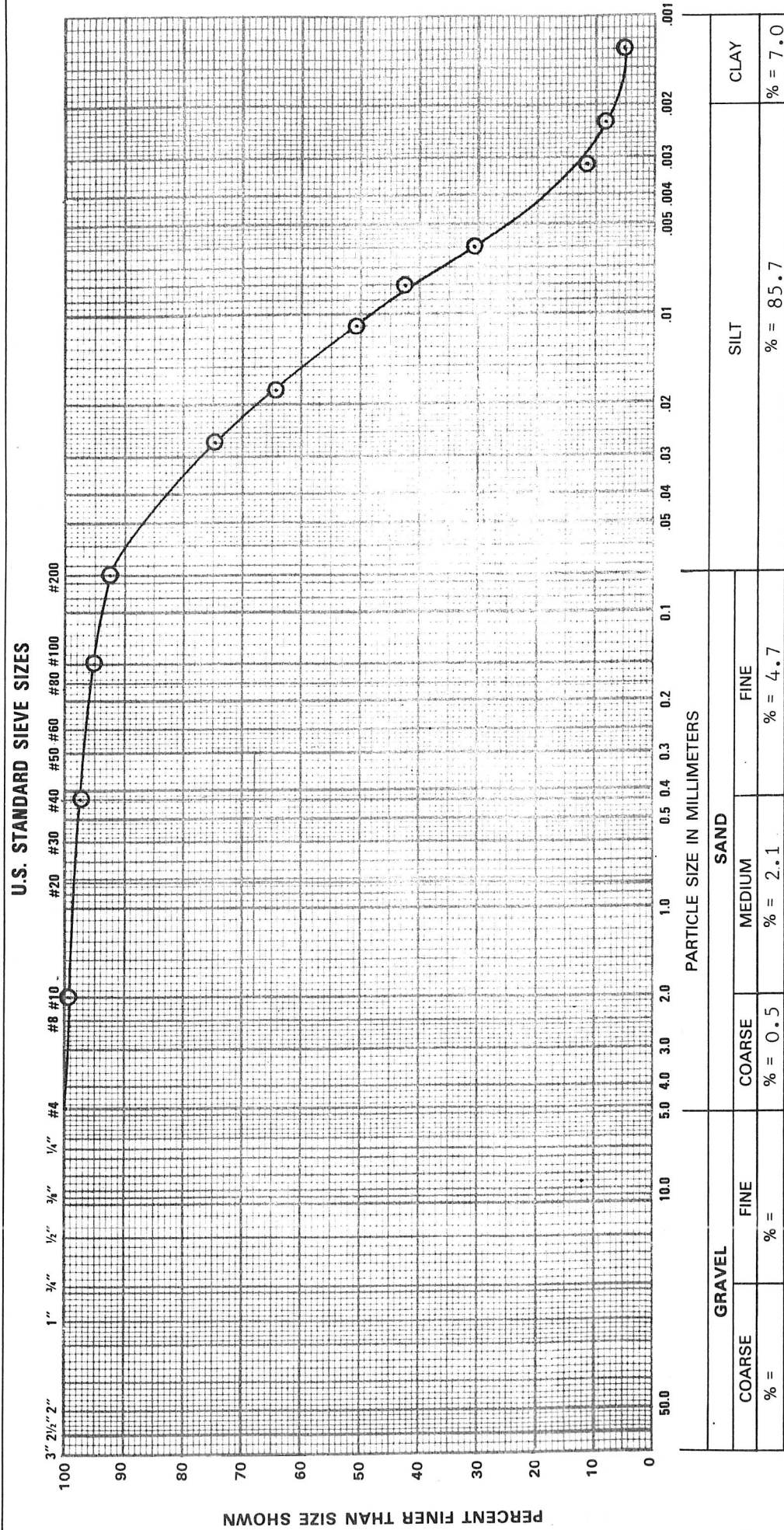
ARCHITECT/ENGINEER: Foth & Van Dyke CONTRACTOR:
 PROJECT: Kennecott - Geotechnical SOURCE:
 REPORT OF TESTS OF: Verification of Subgrade Sample

Sieve Size or No.	Weight Retained	% Retained	% Passing	Specifications
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

GRAIN SIZE DISTRIBUTION CURVE



3.5-I-70

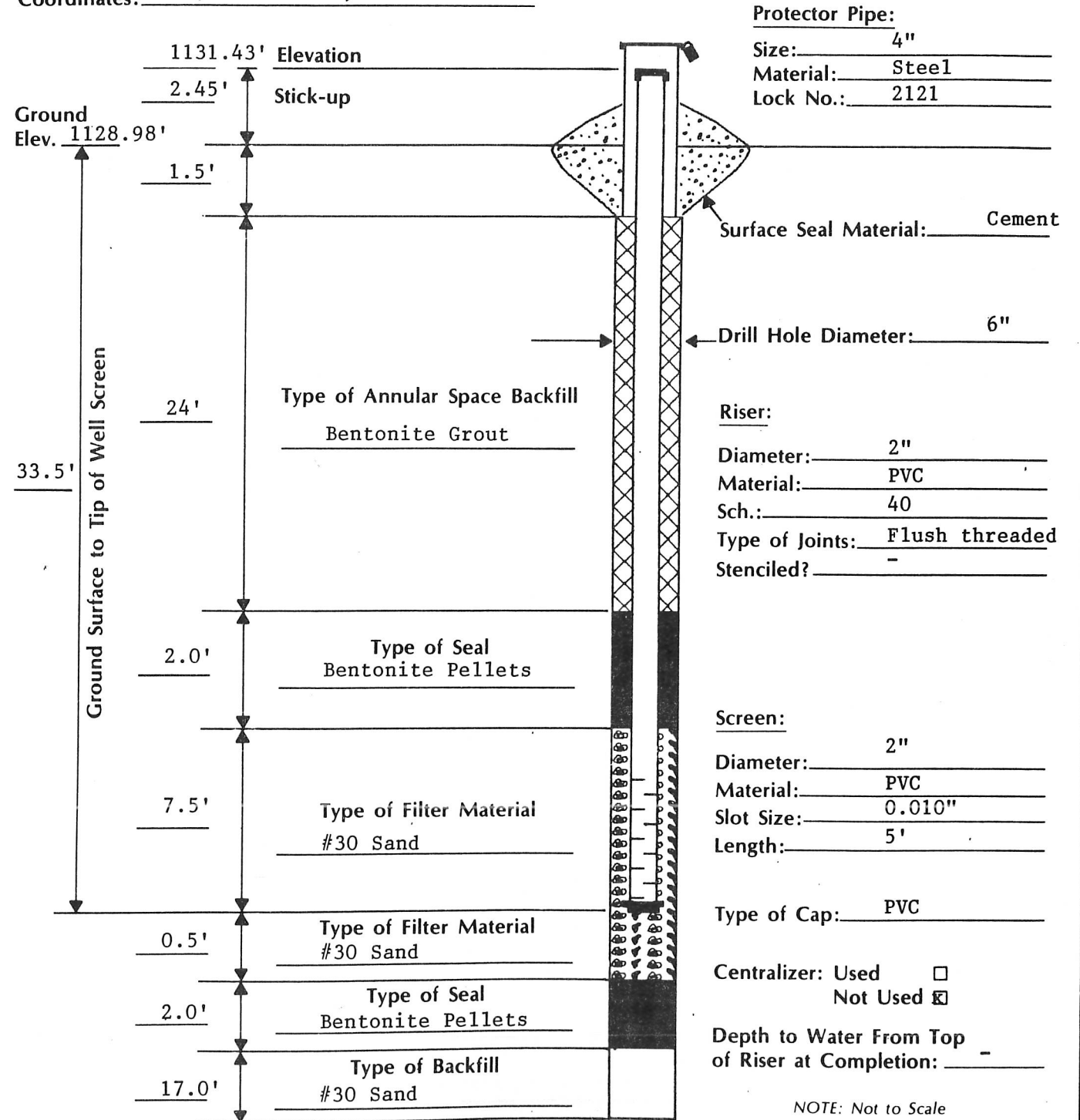
PROJECT: Kennecott Geotechnical DATE: 11/6/87 SAMPLE NO.: 1
 LOCATION SAMPLED: Boring: PZ-S3 Sample: 20 ELEV. OR DEPTH: 49.5'-50.5' DRAWN BY: POK APPROVED BY: RRR
 ATTERBERG LIMITS: LL 35.9 PL 31.7 PI 4.2 SAMPLED MOISTURE CONTENT (%): 22.7 COEFFICIENTS: Cc = Cu =
 SAMPLE SOURCE: Munsell Color Code: 5Y.5/1 DATE SAMPLED: October 1987
 SOIL CLASSIFICATION (ASTM: D2487) SILT, gray, (ML) FORM #411 SL (2/87)

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



MONITORING WELL DEVELOPMENT

WELL NUMBER PZ-S3 CLIENT Kennecott
 WELL DIAMETER 2" PROJECT Geotechnical Invest.
 TOTAL DEPTH OF WELL 34' SCOPE I.D. 87K10-BL22
 DEPTH TO WATER _____ TIME OF MEASUREMENT _____ BY FJD (Foth & Van Dyke)
 BEFORE 17.57' DATE 12-02-87
 AFTER _____

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	SPEC. COND.	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 @ 26.0 @ 26.0	st st st	7 8 9		0.0 0.0 0.0	Tube crumbled when pushed Tube crumbled when pushed Tube folded when driven w/air hammer, drove 9"		Noncohesive	
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	
								SM/ML (SS)	P.P. = 3.4	
1108.7	--32.5	31.5-32.5	pl	12		1.0	Lt brn gray silty SAND/SILT, cohesive, brittle, oxidized along bedding			
		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 2% si & cl
		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	sb15 (SP) 2% gvl 96% sand 2% silt K= 3.6E - 03 cm/sec
1103.7	--37.5	37.0-39.0	st	16		0.2	Sandstone, as above.			
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)		Noncohesive	sb18 (SP) 3% cse sand 65% med sand 30% fn sand 2% si & cl 13% moist
1098.7	--42.5	41.0-43.0	sb	18		2.2	As above w/vy dk red brn staining at 41.8', pods, laminae w/coating			
		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	
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 14.5% moist
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	sb23 (ML/CL-ML) 6% gvl 43% sand 46% silt 5% clay LL= 24.7 PI= 3.8 20.1% moist
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, schistosity apparent		P.P. - 4.5+	
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	
		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:

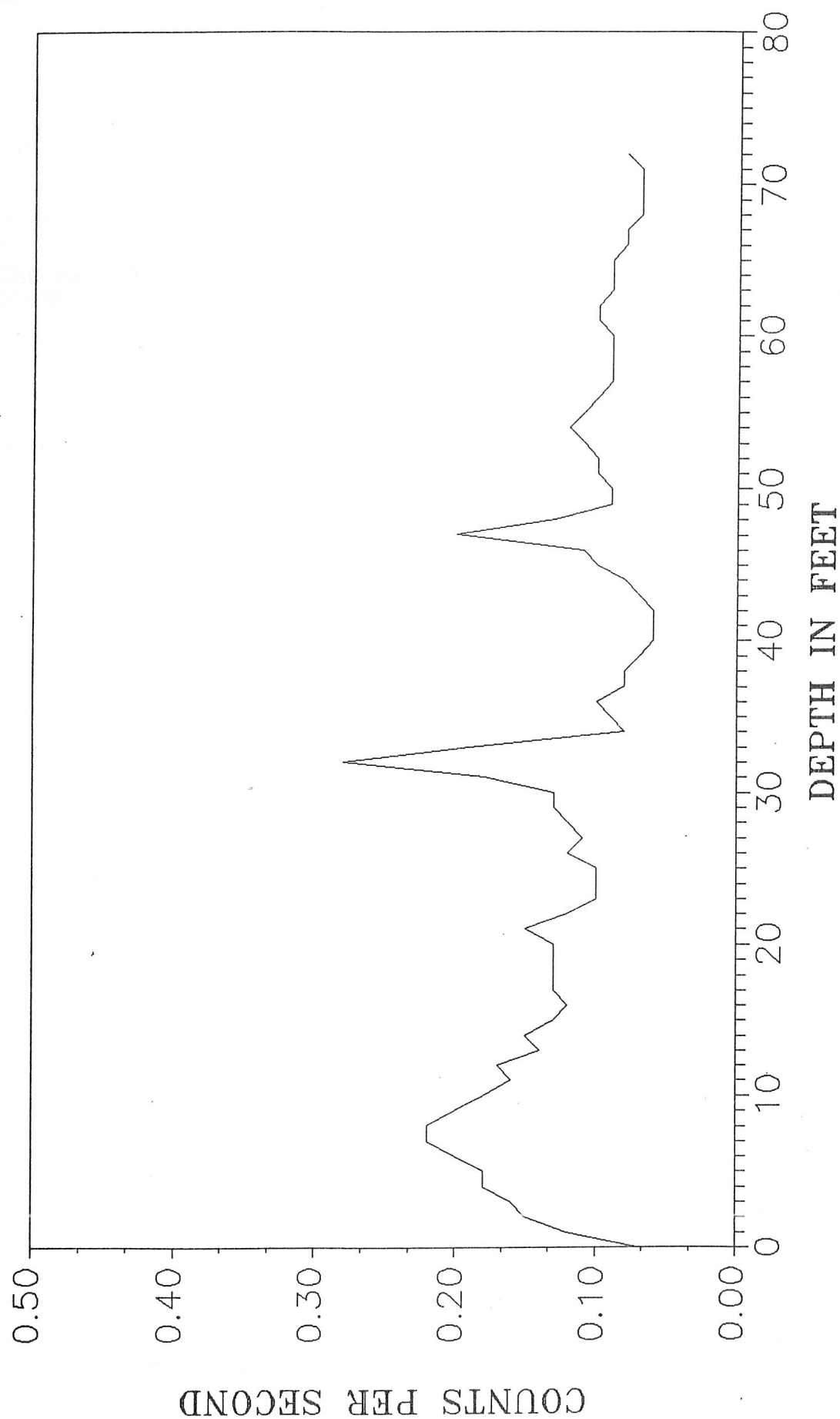
LOG OF TEST BORING NO.: PZ-S4
 CLIENT: Kennecott
 PROJECT: Geotechnical Investigation-Flambeau
 PROJECT NUMBER: 87K10-22
 LOCATION: East pit south slope; Section 472, 215 ft. S. baseline
 COORDINATES: 41138.73 N 40630.94 E

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	
1083.7	--57.5	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	
1081.2	--60.0	60.0-63.0	c	26		2.3	Length of pieces from 60': 0.5', 1.1', 0.5', 0.2'. Altered schist, dk red & blue green, schistosity apparent, clayey w/soft yel green laminae (chlorite?)		RQD = 70% Fract freq = 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	
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: Luisier 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

DEPTH IN FEET

KenneCott Minerals Company		FOTH & VAN DYKE	
FLAMBEAU PROJECT		GEO SCIENCES & ENVIRONMENTAL MANAGEMENT DIVISION	
LADYSMITH, WISCONSIN		GREEN BAY, WISCONSIN	
GAMMA LOG		NOTES	
WELL PZ-S4		DESIGNED BY	
		DRAWN BY SJL	
		CHECKED BY	
		APPROVED BY	
		CAD No.	
		APPROVAL	
		DATE	
		2/89	
Dwg No		SCALE AS SHOWN	
Job No			
REV			

Foth & Van Dyke & Associates, Inc.

LOG OF TEST BORING NO.: B-S4A							APPROXIMATE SURFACE ELEVATION: 1140.0			
CLIENT: Kennecott							BORING DEPTH: 31.0			
PROJECT: Geotechnical Investigation-Flambeau							DATE: 12/1/87			
PROJECT NUMBER: 87K10-22										
LOCATION: East pit, south slope; Section 422, 215 ft. S. baseline										
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, saturated	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	WATER LEVEL INFORMATION
START DATE: 12/01/87	DEPTH AT COMPLETION: 27.6
COMPLETION DATE: 12/01/87	LATER TIME/DEPTH:
LOGGED BY: BJS	LATER TIME/DEPTH:
DRILLING METHOD: Hollow stem augers, mud rotary	CAVE IN DEPTH:
DRILLING CONTRACTOR: Wisconsin Test Drilling, Inc.	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

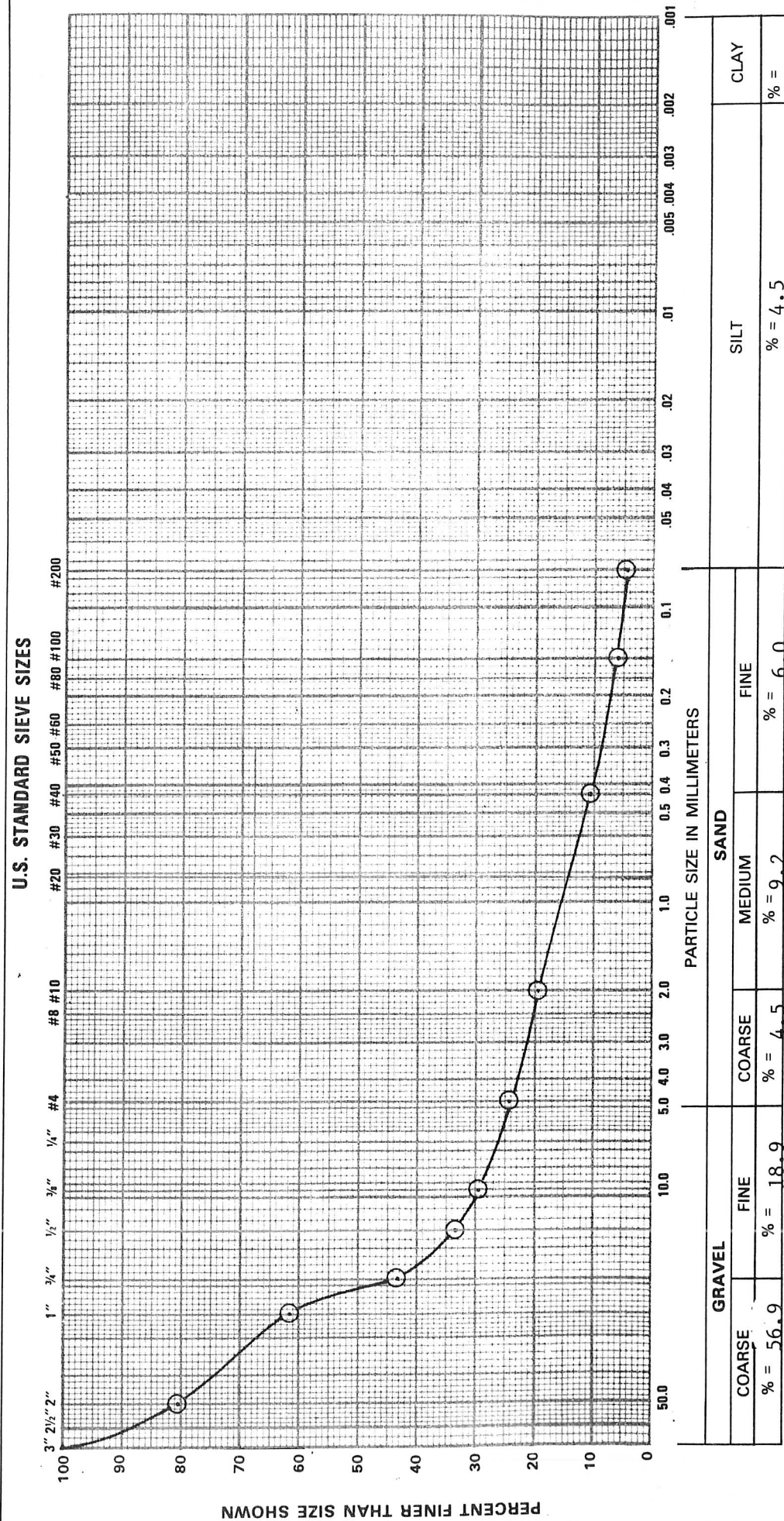
Sieve Size or No.	Weight Retained	% Retained	% Passing	Specifi-cations
3-Inch	0	0	100	
2-Inch	225.4	19.7	80.3	
1 1/2-Inch				
1-Inch	215.0	18.8	61.5	
3/4-Inch	210.7	18.4	43.1	
1/2-Inch	111.3	9.7	33.4	
3/8-Inch	46.2	4.0	29.4	
No. 4	60.0	5.2	24.2	
No. 8				
No. 10	52.0	4.5	19.7	
No. 16				
No. 20				
No. 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)

Foth & Van Dyke and Associates Inc.

GRAIN SIZE DISTRIBUTION CURVE



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: 10YR. 3/2 to 2/1 MUNSSELL COLOR CODE: _____ DATE SAMPLED: Nov.-Dec. 1987
SOIL CLASSIFICATION (ASTM: D2487) GRAVEL w/SAND, very dark grayish brown to black, (GP)

CHECKED BY: RRR

PROJECT NO.: _____
 JOB NO.: 87K10
 DATE: February 10 to 16, 1988
 REPORT NO.: 4

REPORT OF ANALYSIS OF AGGREGATES

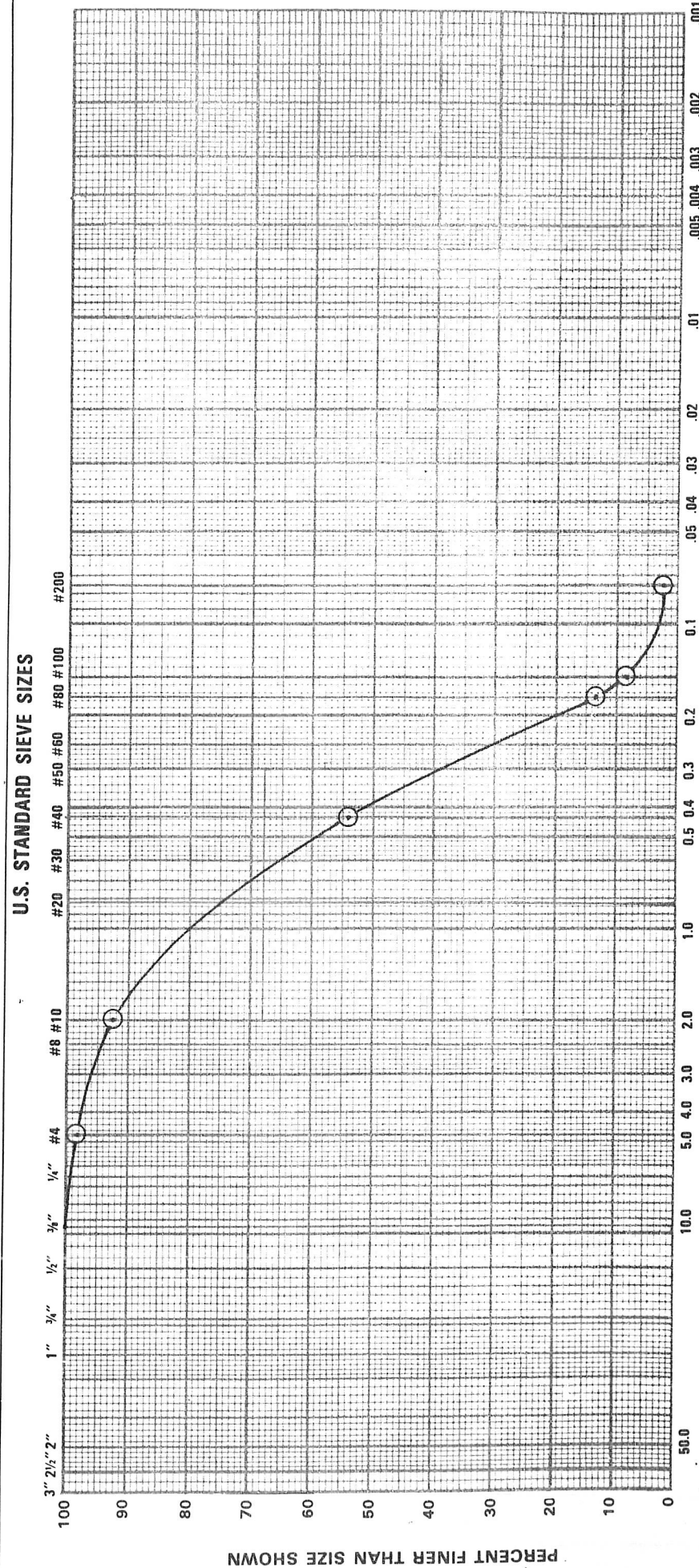
ARCHITECT/ENGINEER: Foth & Van Dyke CONTRACTOR: _____
 PROJECT: Kennecott Geotechnical SOURCE: _____
 REPORT OF TESTS OF: Verification of Subsurface Sample

Sieve Size or No.	Weight Retained	% Retained	% Passing	Specifications
3-Inch				
2-Inch				
1½-Inch				
1-Inch	0	0	100	
¾-Inch	16.6	2.6	97.4	
½-Inch	46.7	7.4	90.0	
⅜-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)

Foth & Van Dyke and Associates Inc.

GRAIN SIZE DISTRIBUTION CURVE



GRAVEL		SAND		SILT		CLAY	
COARSE	% = 1.8	COARSE	% = 5.6	MEDIUM	% = 38.6	FINE	% = 51.9
FINE	% = 1.8	COARSE	% = 5.6	MEDIUM	% = 38.6	FINE	% = 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 PI SAMPLED MOISTURE CONTENT (%): 28.3 COEFFICIENTS: Cc = 0.8 Cu = 3.3
 SAMPLE SOURCE: _____ MUNSSELL COLOR CODE: 10 YR. 5/8 DATE SAMPLED: December 1987
 SOIL CLASSIFICATION (ASTM: D2487) SAND, fine to medium grained, light yellowish brown (SP)

CHECKED BY: RRR

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)

3.5-I-82

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

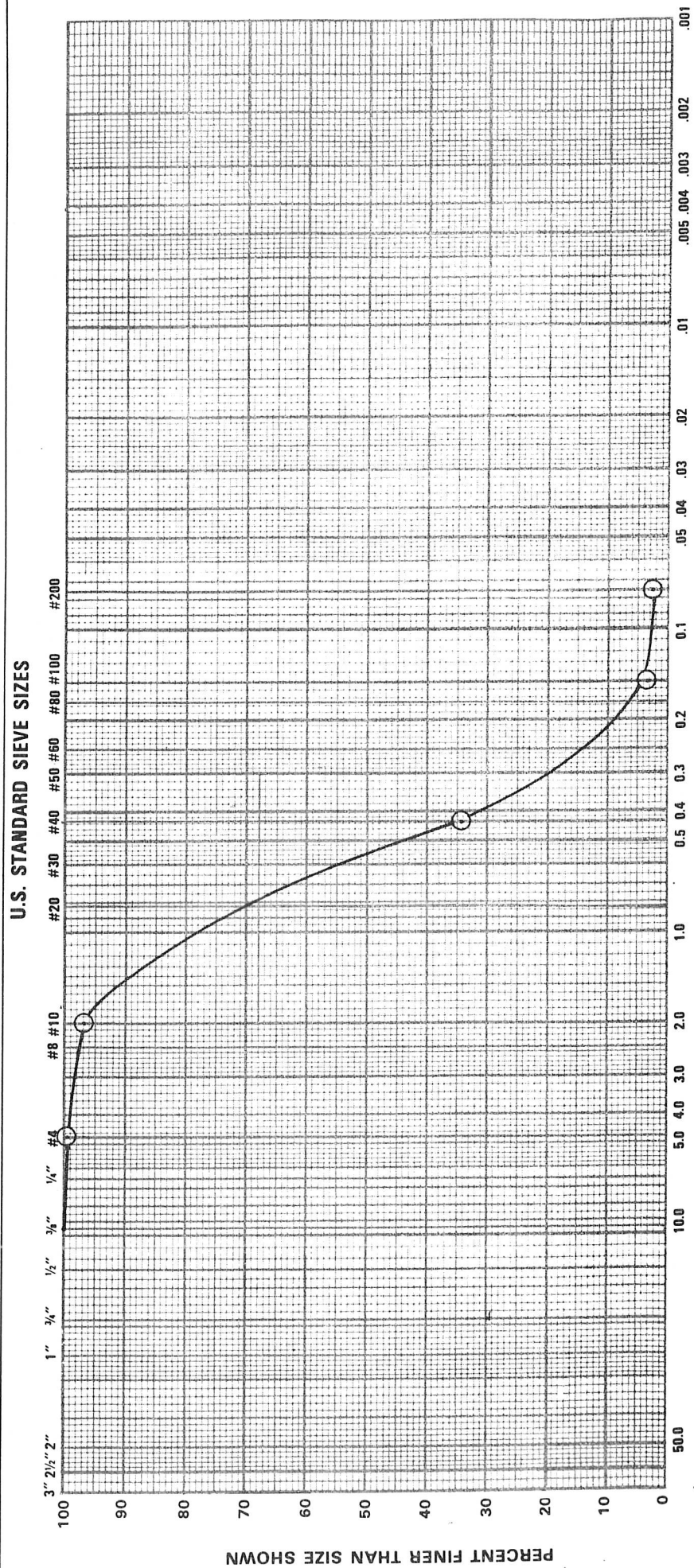
Moisture Content = 13.4%
(as received)

CHECKED BY: PRR

3.5-I-83

FORM #329 A-1 SL (Rev. 11/86)

GRAIN SIZE DISTRIBUTION CURVE



GRAVEL		SAND		SILT		CLAY	
COARSE	FINE	COARSE	MEDIUM	FINE			
% = 0.2	% = 2.8	% = 64.6	% = 2.8	% = 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)

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

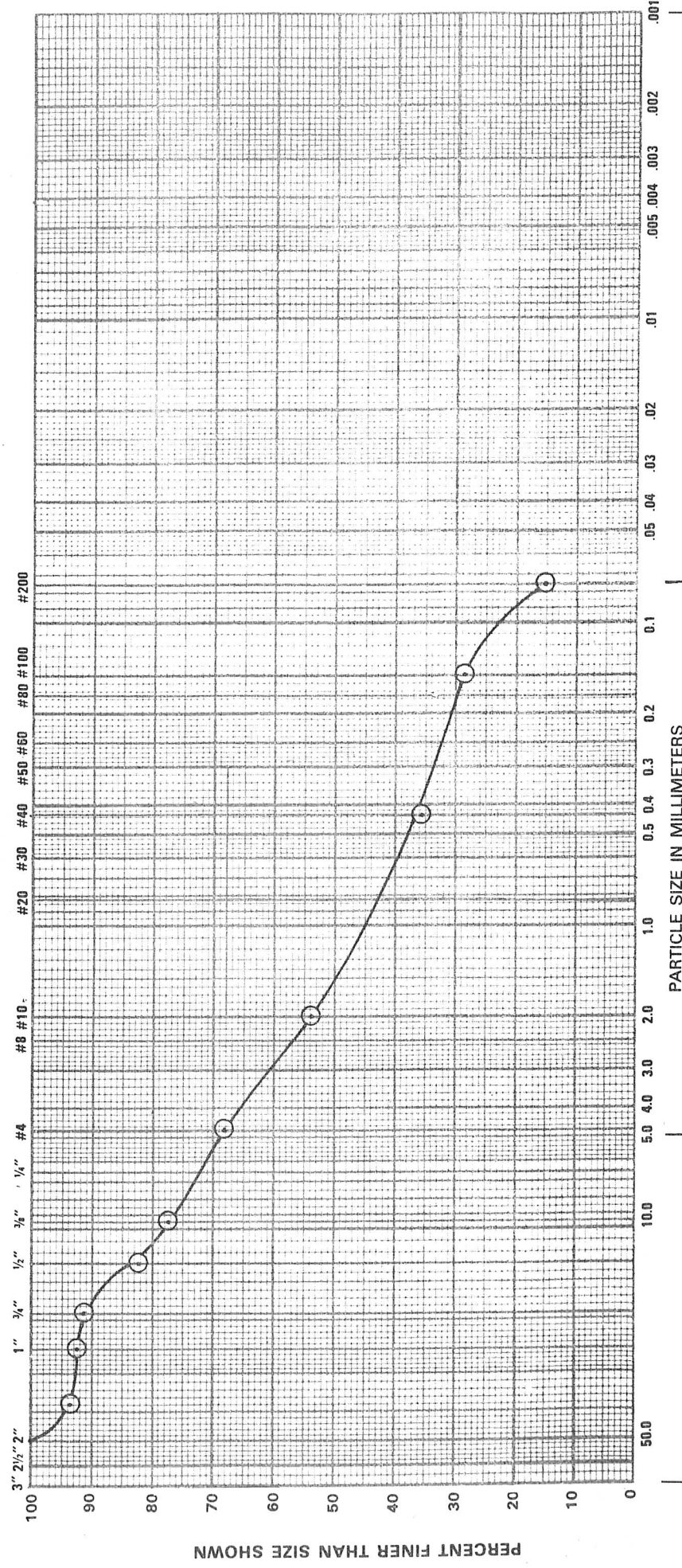
Sieve Size or No.	Weight Retained	% Retained	% Passing	Specifi-cations
3-Inch				
2-Inch	0	0	100	
1 1/2-Inch	104.2	6.3	93.7	
1-Inch	23.7	1.4	92.3	
3/4-Inch	16.1	1.0	91.3	
1/2-Inch	153.4	9.2	82.1	
3/8-Inch	80.5	4.8	77.3	
No. 4	153.5	9.2	68.1	
No. 8				
No. 10	235.7	14.2	53.9	
No. 16				
No. 20				
No. 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: RRR

GRAIN SIZE DISTRIBUTION CURVE

U.S. STANDARD SIEVE SIZES

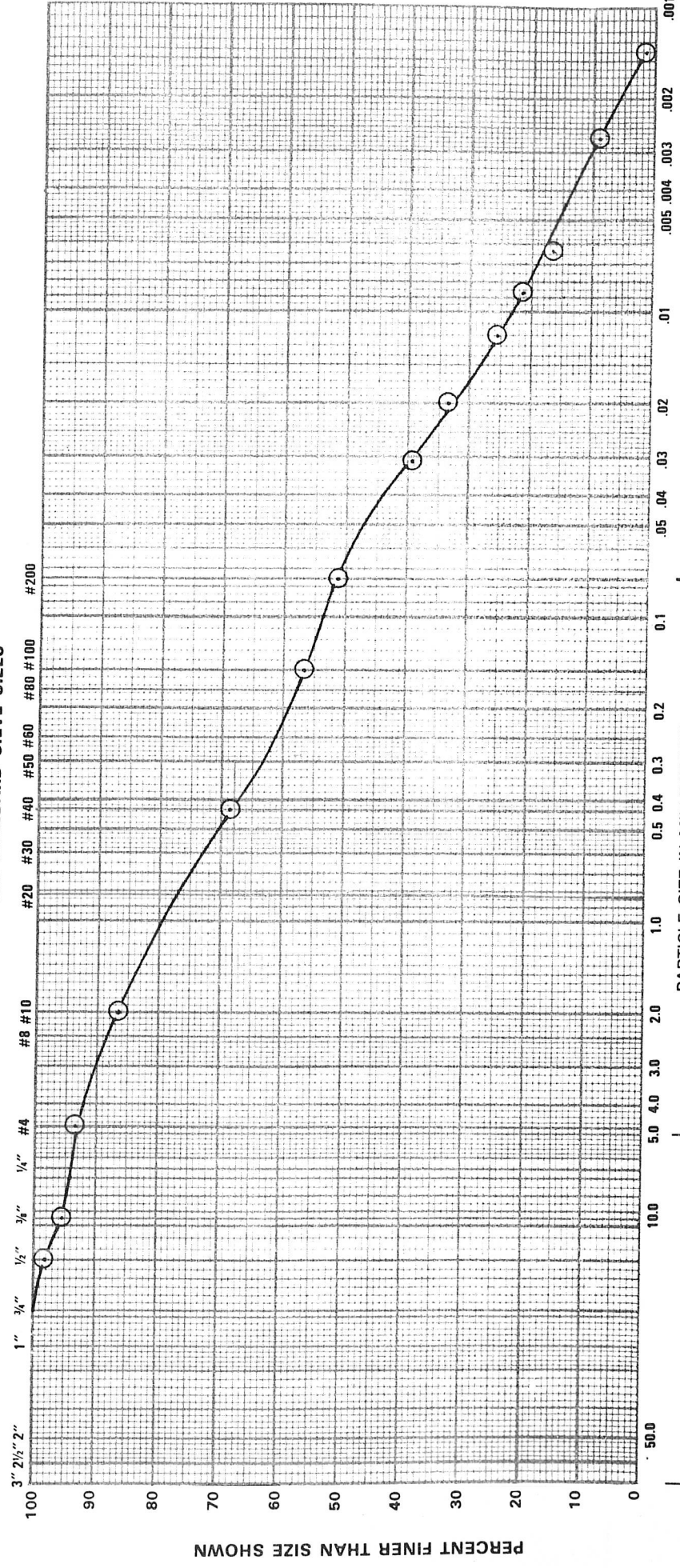


PROJECT: Kennecott Geotechnical DATE: 2/17/88 SAMPLE NO.: 10
 LOCATION SAMPLED: Boring No.: PZ-S4 ELEV. OR DEPTH: 50.0' - 51.5' DRAWN BY: POK APPROVED BY: RRR
 ATTERBERG LIMITS: LL _____ PL _____ PI _____ SAMPLED MOISTURE CONTENT (%): 14.5 COEFFICIENTS: Cc = _____ Cu = _____
 7.5 YR. 4/6 to 10 YR.
 SAMPLE SOURCE: _____ MUNSELL COLOR CODE: 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)

Foth & Van Dyke and Associates Inc.

GRAIN SIZE DISTRIBUTION CURVE

U.S. STANDARD SIEVE SIZES



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: _____
 SOIL CLASSIFICATION (ASTM: D2487) SANDY SILT, a little gravel, light gray to yellow with some red, (ML/CL-ML)
 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.: 7

REPORT OF ANALYSIS OF AGGREGATES

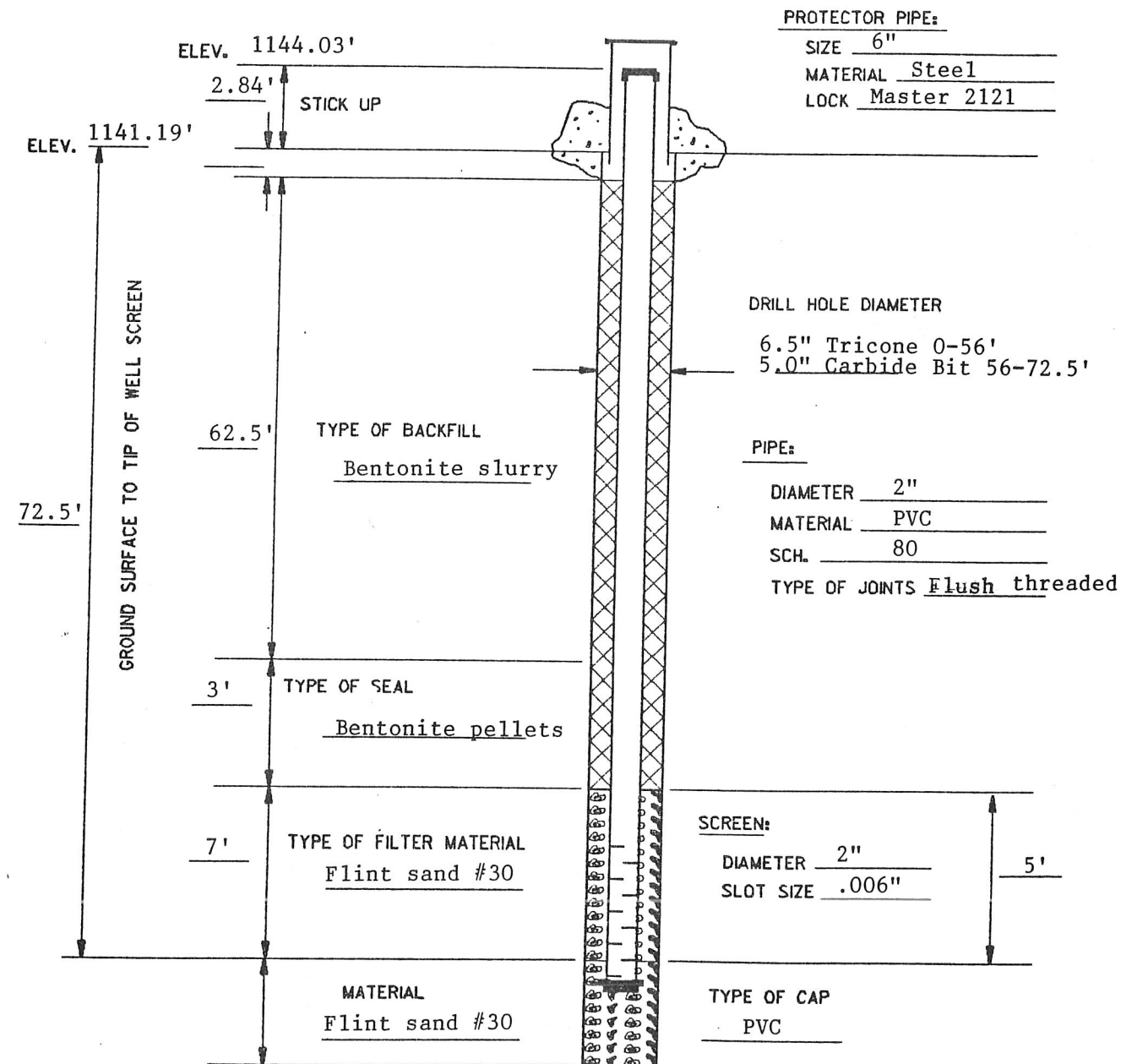
ARCHITECT/ENGINEER: Foth & Van Dyke CONTRACTOR: _____
PROJECT: Kennecott Geotechnical SOURCE: _____
REPORT OF TESTS OF: Verification of Subsurface Samples

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)

MONITORING WELL INSTALLATION DIAGRAM

WELL NO: PZ-S4 CLIENT: Kennecott
DATE INSTALLED: 12-01-87 PROJECT: Geotechnical
DRILLER: Luisier Drilling Inc. SCOPE I.D.: 87K10-BL22
DRILLING METHOD: Mud rotary BY: BJS
COORDINATES: 41,138.73N 40,630.94E



CHECKED BY: RRR

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

FIELD				
GAL. REMOVED	TIME	TEMPERATURE	SPEC. COND.	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)			
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		sb1 (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 58% sand 31% si & cl
1120.3	--20	20.0-22.0	sb	5		1.0	As above. Bldr @ 21'		P.P.-1.2	sb7 (SM) 10% gravel 60% sand 24% silt 6% clay LL=17.6 PI=2.5 9.9% moist
		22.0-24.0	sb	6		2.0	As above (till).		P.P.-1.3	
1115.3	--25	25.0-27.0	sb	7		2.0	As above (till).			
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 56% fn sand 3% si & cl 16.3% moist K= 3.5E - 03 cm/sec
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	
1100.3	--40	40.0-42.0	sb	10		2.0	Lt gray poorly graded SAND w/silt, fn, cohesive (vy fn ss w/kaolinite) 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 schistosity (Saprolite)	ML		sb11 (ML) 22% sand 78% si & cl LL= 28.7 PI= 2.9
		47.0-49.0	st	12		2.0	Yel (10YR 7/8) SILT, soft, cohesive, brittle, moist, w/apparent schistosity			
		49.0-50.0	st	13		1.0	Altered schist w/hrd crystalline laminae			
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"		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										SURFACE ELEVATION: 1140.3	
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										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" w/sand & fn gvl, brittle, talcy, as above except softer	"ML"		st15 (ML) K= 2.2E - 07 cm/sec	
		57.0-58.0	st	16		1.0	Same except harder		P.P. - 0.7 RQD = 75%	c18 (ML) 4% gravel	
1080.3	--60	58.0-61.0	c	17		3.0	Core 58-62', no breaks in core in barrel Red (10YR 4/8) "SILT", vy soft, brittle, w/apparent schistosity		Fract freq = 0/ft	5% cse sand 13% med sand 18% fn sand	
		62.0-67.0	c	18		5.0	Core 62-67', broken in barrel into 8-10" pieces. Red yel (5YR5/8) & red (10R 4/8) w/yel (2.5Y8/8) laminated "SILT", w/very distinct schistosity, soft, moist		P.P. - 1.1 RQD = 100%	57% silt 3% clay LL = 26.2 PI = 2.7	
1075.3	--65							=====	Fract freq = 1.3/ft	13.9% moist	
							67'-End of Boring in altered schist				
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						WATER LEVEL INFORMATION					
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.						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										APPROXIMATE SURFACE ELEVATION: 1140.0	
CLIENT: Kennecott PROJECT: Geotechnical Investigation-Flambeau PROJECT NUMBER: 87K10-22 LOCATION: East pit north slope; Section 422, 254 ft. N. baseline										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 schistosity 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						WATER LEVEL INFORMATION					
START DATE: 12/01/87 COMPLETION DATE: 12/01/87 LOGGED BY: BJS DRILLING METHOD: Hollow stem augers DRILLING CONTRACTOR: Wisconsin Test Drilling, Inc.						DEPTH AT COMPLETION: 28 LATER TIME/DEPTH: LATER TIME/DEPTH: CAVE IN DEPTH: DRILLING LOSSES:					

Foth & Van Dyke

Engineers/Architects

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414/497-2500

PROJECT NO.: _____
JOB NO.: 87K10
DATE: December 16-22, 1987
REPORT NO.: 8

REPORT OF ANALYSIS OF AGGREGATES

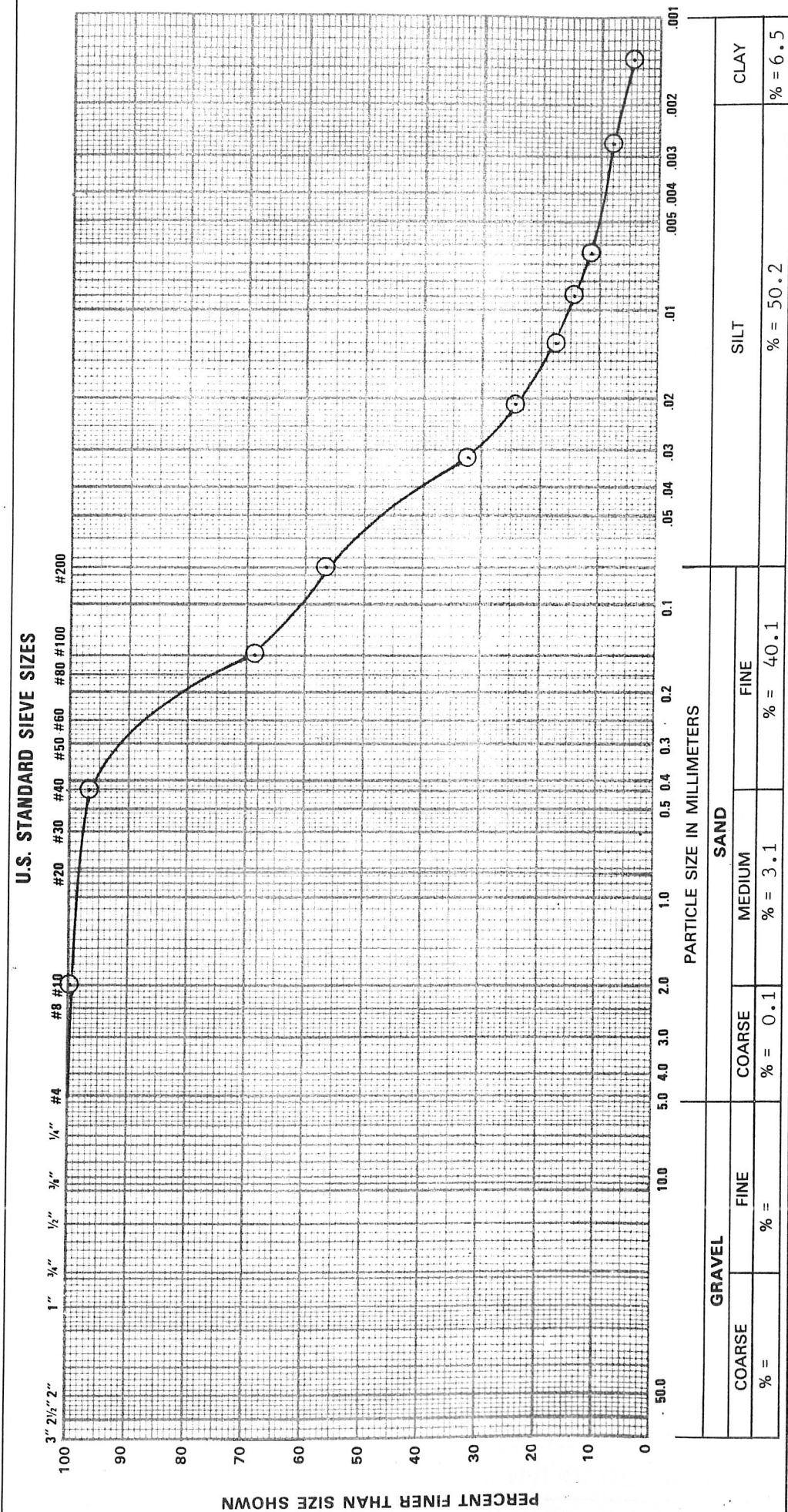
ARCHITECT/ENGINEER: Foth & Van Dyke CONTRACTOR: _____
PROJECT: Kennecott Geotechnical SOURCE: _____
REPORT OF TESTS OF: Verification of Subsurface Samples

Sieve Size or No.	Weight Retained	% Retained	% Passing	Specifications
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)

Foth & Van Dyke and Associates Inc.

GRAIN SIZE DISTRIBUTION CURVE



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: _____ MUNSSELL COLOR CODE: 7.5YR. 4/4
SOIL CLASSIFICATION (ASTM: D2487): SANDY SILT, strong brown, (ML) DATE SAMPLED: Nov.-Dec. 1987

CHECKED BY: RRR

Foth & Van Dyke
 Engineers/Architects
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 P. O. Box 19012
 Green Bay, Wisconsin 54307-9012
 414/497-2500

ATTERBERG LIMITS

Scope I.D. : 87K10
 TEST NO.: 11
 DATE: February 17 to 18, 1988
 TESTED BY: POK
 LOCATION:
 BORING NO.: B-S5 DEPTH: 15' - 16'

JOB NAME: Kennecott Geotechnical

SAMPLE NO.: SS3

BORING NO.: B-S5 DEPTH: 15' - 16'

DETERMINATION NO.	CONTAINER NO.	LIQUID LIMIT		PLASTIC LIMIT	PERCENT WATER
		37	29		
	H1		H2	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

FORM #342 SL (7/85)

Foth & Van Dyke

Engineers/Architects

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COMPACTION CONTROL REPORT

DATE: 3/14/88 JOB NAME: Kennecott Geotechnical SCOPE I.D. #: 87K10

1. LABORATORY COMPACTION TEST DATA

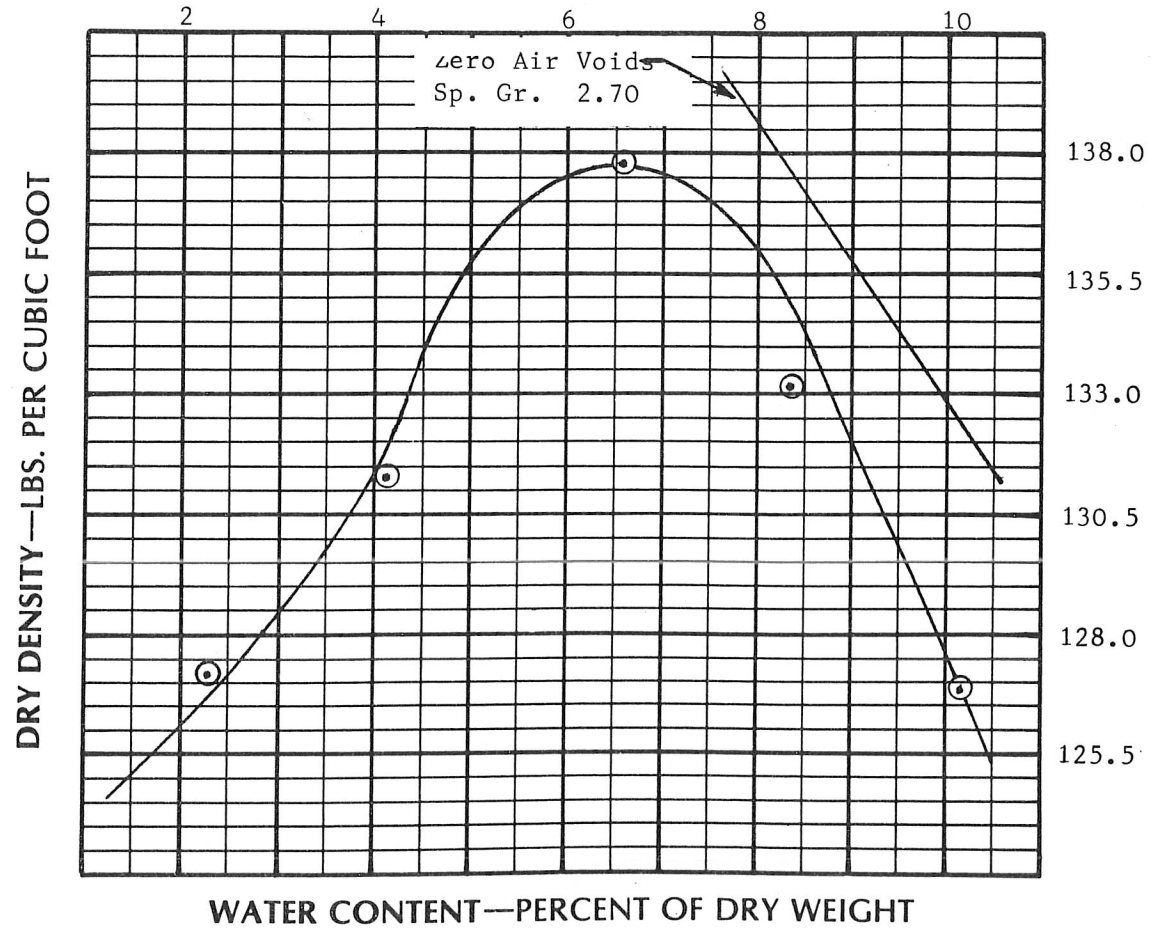
A. DESCRIPTION OF SOIL: SILTY SAND, fine to medium grained, a little gravel, dark reddish brown (SM)

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)



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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

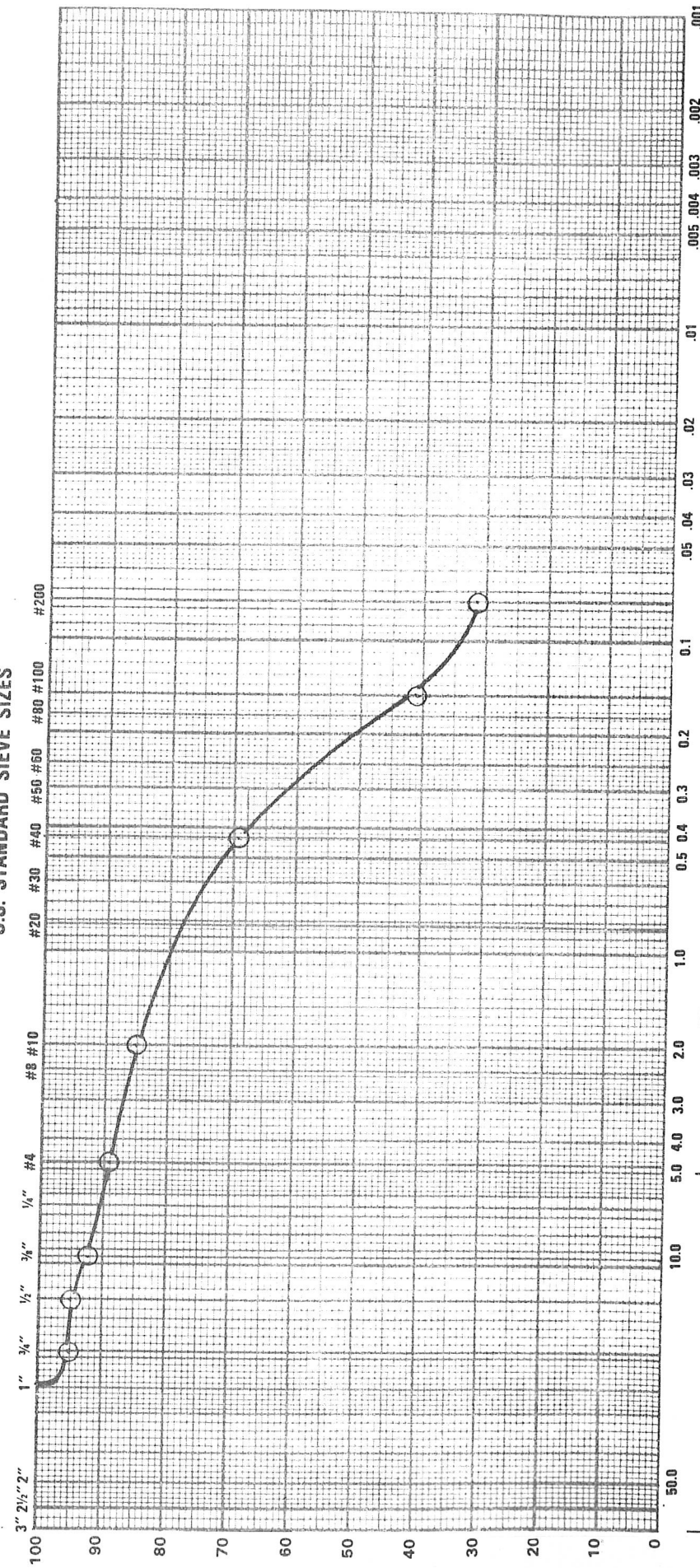
Sieve Size or No.	Weight Retained	% Retained	% Passing	Specifications
3-Inch				
2-Inch				
1 1/2-Inch				
1-Inch	0	0	100	
3/4-Inch	25.4	4.9	95.1	
1/2-Inch	0			
3/8-Inch	14.0	2.7	97.4	
No. 4	16.6	3.2	89.2	
No. 8				
No. 10	20.9	4.1	85.1	
No. 16				
No. 20				
No. 30				
No. 40	81.4	15.8	69.3	
No. 50				
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)

Foth & Van Dyke and Associates Inc.

GRAIN SIZE DISTRIBUTION CURVE

U.S. STANDARD SIEVE SIZES



PARTICLE SIZE IN MILLIMETERS

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 = _____
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)

CHECKED BY: RRR

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 Engineers/Architects
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 P. O. Box 19012
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 414/497-2500

PROJECT NO.: _____
 JOB NO.: 87K10
 DATE: December 16-22, 1987
 REPORT NO.: 9

REPORT OF ANALYSIS OF AGGREGATES

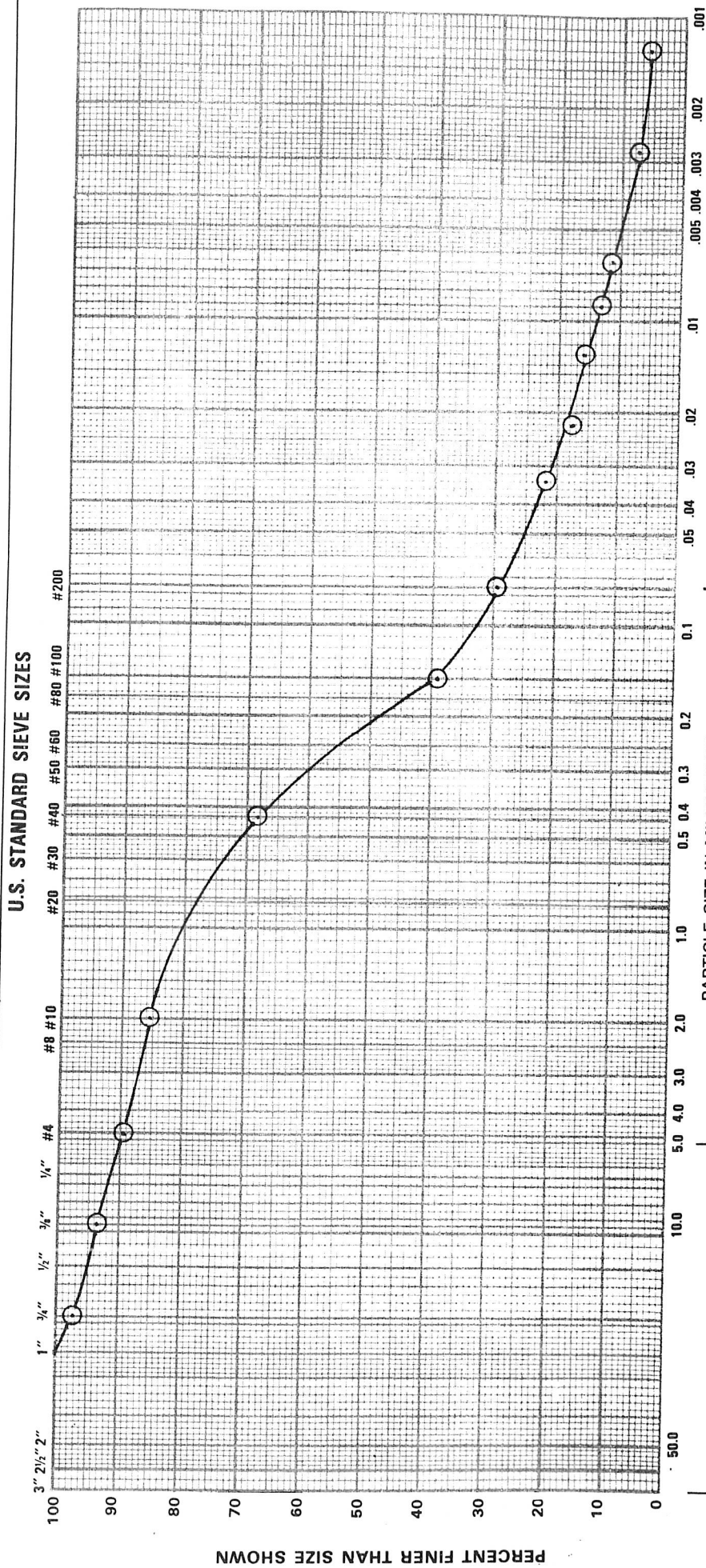
ARCHITECT/ENGINEER: Foth & Van Dyke CONTRACTOR: _____
 PROJECT: Kennecott Geotechnical SOURCE: _____
 REPORT OF TESTS OF: Verification of Subsurface Samples

Sieve Size or No.	Weight Retained	% Retained	% Passing	Specifi-cations
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)

Foth & Van Dyke and Associates Inc.

GRAIN SIZE DISTRIBUTION CURVE



GRAVEL	SAND		SILT	CLAY
	COARSE	FINE		
% = 2.8	% = 7.5	% = 17.4	% = 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)

CHECKED BY: RRR

Foth & Van Dyke

Engineers/Architects

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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

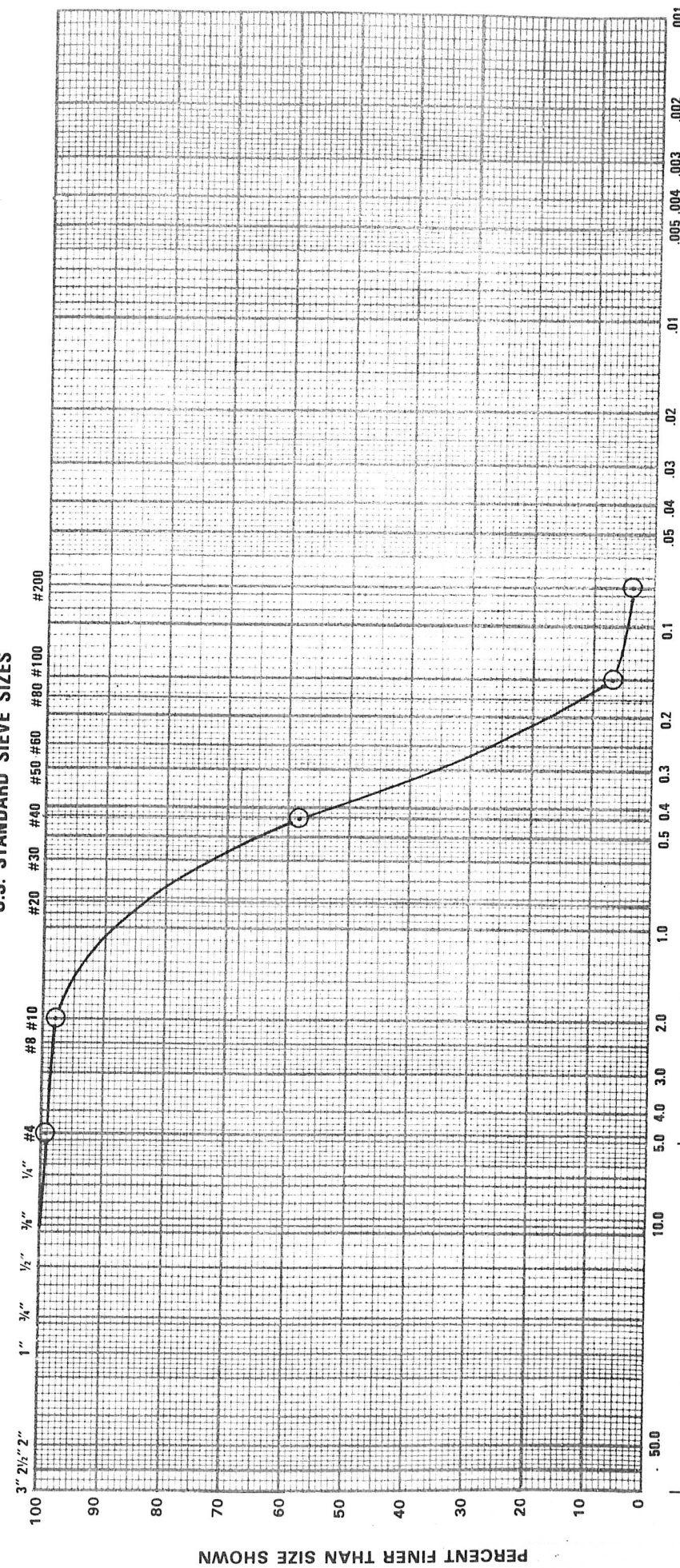
Sieve Size or No.	Weight Retained	% Retained	% Passing	Specifi-cations
3-Inch				
2-Inch				
1 1/2-Inch				
1-Inch				
3/4-Inch				
1/2-Inch				
3/8-Inch	0	0	100	
No. 4	6.5	0.8	99.2	
No. 8				
No. 10	9.9	1.2	98.0	
No. 16				
No. 20				
No. 30				
No. 40	320.8	40.0	58.0	
No. 50				
No. 80				
No. 100	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)

Foth & Van Dyke and Associates Inc.

GRAIN SIZE DISTRIBUTION CURVE

U.S. STANDARD SIEVE SIZES



GRAVEL		SAND		SILT		CLAY	
COARSE	% =	COARSE	% =				
	0.8	MEDIUM	40.0				
		FINE	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: _____ MUNSSELL COLOR CODE: 10YR. 6/3 DATE SAMPLED: Nov.-Dec. 1987
SOIL CLASSIFICATION (ASTM: D2487) SAND, fine to medium grained, pale brown (SP)

CHECKED BY: RRR

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

3.5-I-104

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

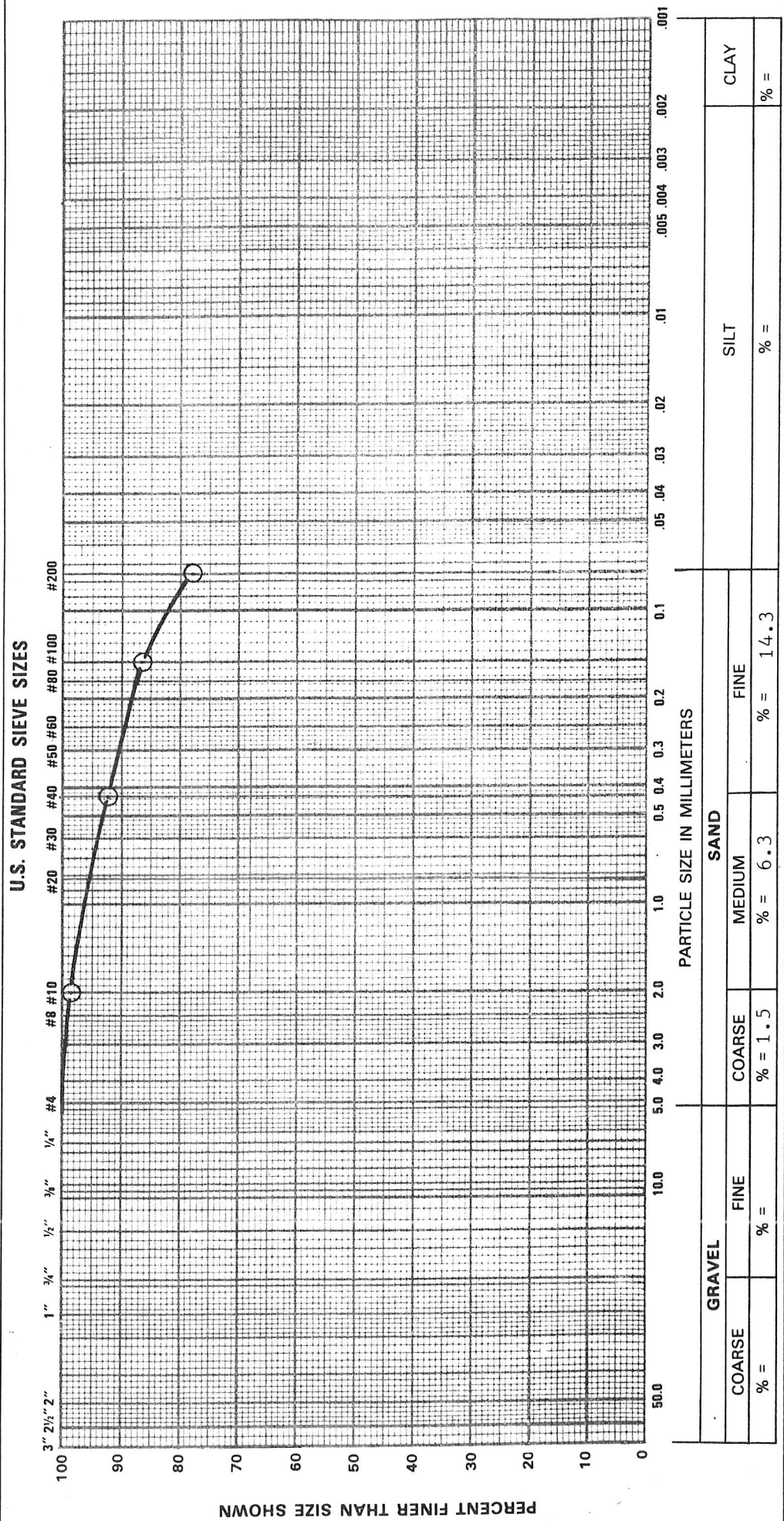
Moisture Content = 15.2%
(As received)

CHECKED BY: RRR

3.5-I-105

FORM #329 A-1 SL (Rev. 11/86)

GRAIN SIZE DISTRIBUTION CURVE



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)

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

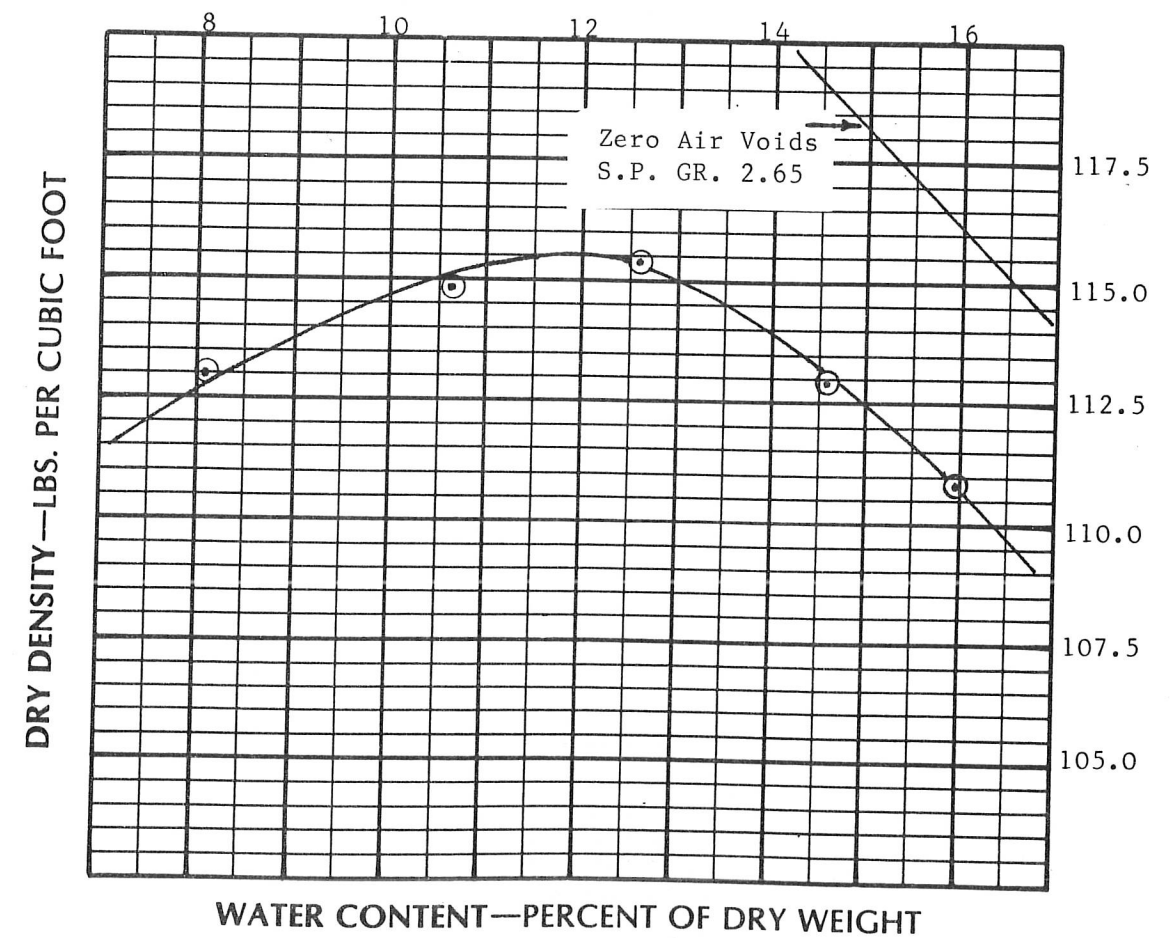
A. DESCRIPTION OF SOIL: SILT W/SAND, brownish yellow (ML)

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)



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'

DETERMINATION NO.	LIQUID LIMIT			PLASTIC LIMIT			PERCENT WATER
	31	18	15				
CONTAINER NO.	H 5	H 6	H 7		H 8		
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)

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

REPORTED TO: Kennecott

SCOPE I.D. #: 87K10

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

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
Soil Classification: SILT W/SAND, brownish yellow (ML)
Permeant Used: Distilled Water
Technician: R. Rouse
Coefficient of Permeability (cm/sec): 2.2×10^{-7}

PROJECT SPECIFICATIONS

ASTM D1557 - Method "A"

ATTERBERG LIMITS

Liquid Limit (%):
Plastic Limit (%):
Plasticity Index:

REMARKS:

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

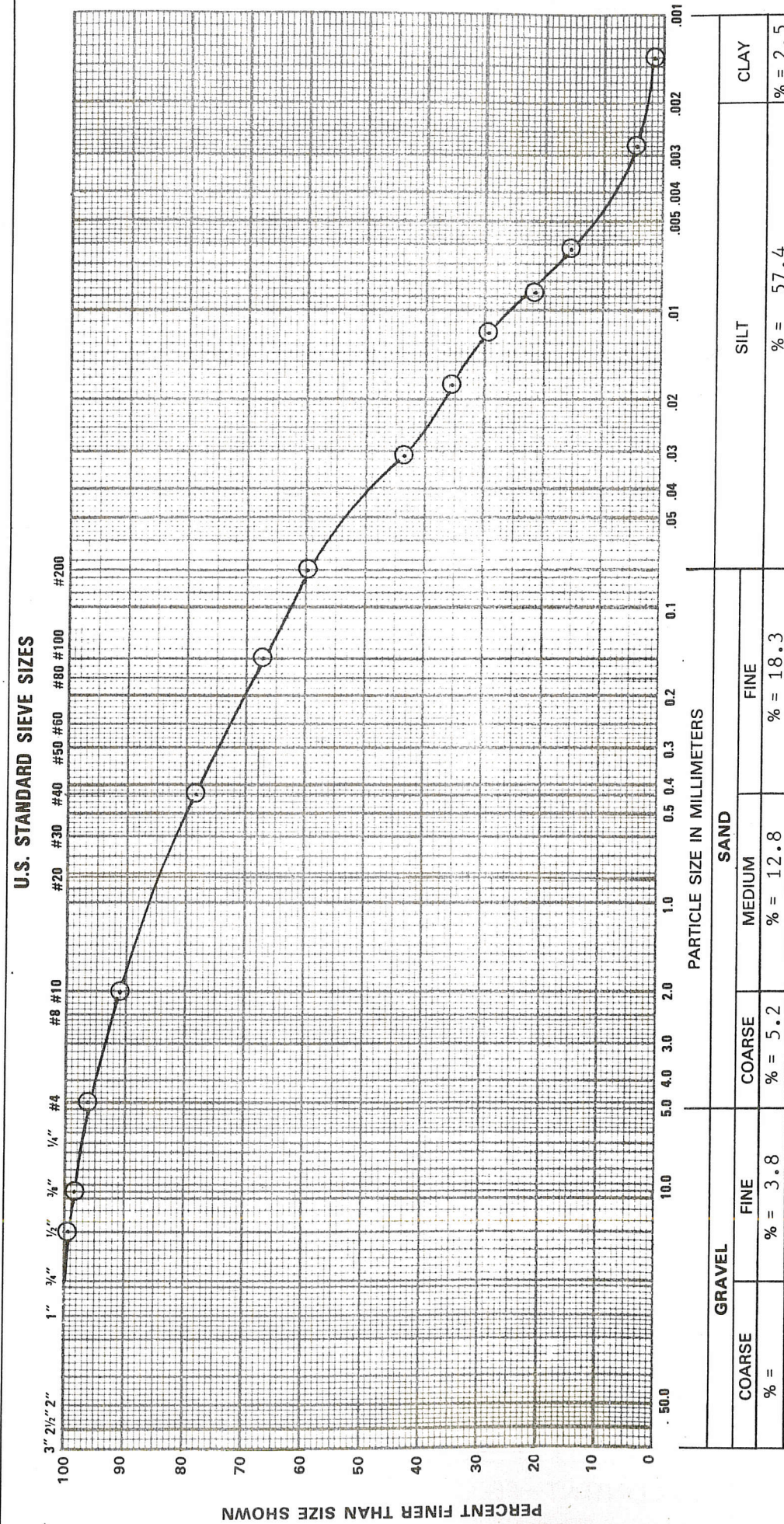
RECEIVED AT LABORATORY: December 14, 1987
 QUANTITY REPRESENTED: 564.9 grams
 SUBMITTED BY: Betty Socha, Foth & Van Dyke
 SAMPLED FROM: Boring No.: B-S5
 IDENTIFICATION: Depth: 62'-67'
 DATE SAMPLED: November - December 1987
 INTENDED USE: _____
 WASHED GRADATION: yes
 PERCENT PASSING NO. 200 SIEVE: 59.9 %
 COLOR: 2.5YR, 5/6-red

Moisture Content = 13.9%
(as received)

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		

Foth & Van Dyke and Associates Inc.

GRAIN SIZE DISTRIBUTION CURVE



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: 2.5YR. 5/6 MUNSSELL COLOR CODE: SANDY SILT, a little gravel, red (ML) DATE SAMPLED: Nov.-Dec. 1987
 SOIL CLASSIFICATION (ASTM: D2487) SANDY SILT, a little gravel, red (ML)

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.

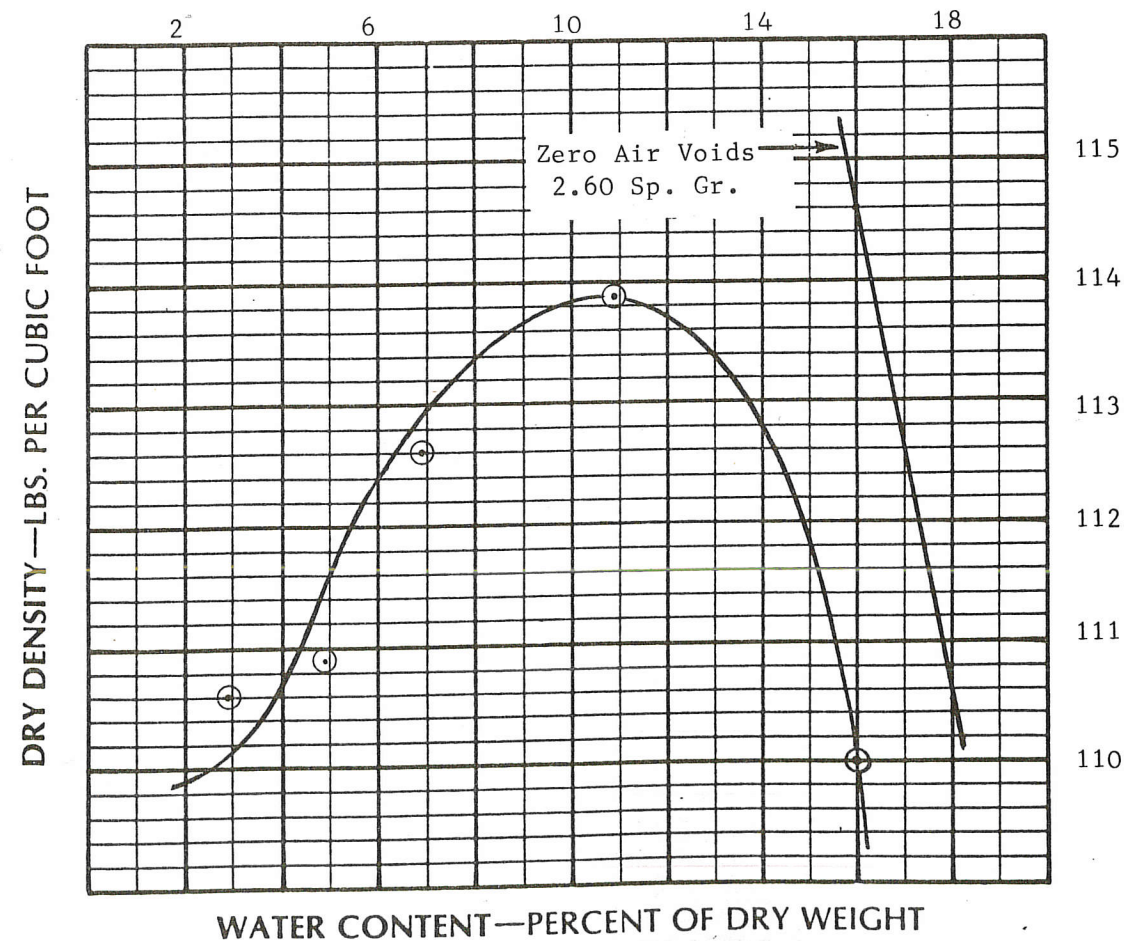
NATURAL WATER CONTENT _____ % NATURAL DRY DENSITY _____ PCF SPECIFIC GRAVITY _____

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)



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