APPENDIX 3.5-G

Geologic Logs, Well Construction Diagrams, and Well Development Forms for Permeability Test Wells, 1988

LOG OF TEST BORING NO.: TW - K1

CLIENT: Kennecott
PROJECT: Rock Permeability
PROJECT NUMBER: 87K10 - W066
LOCATION: River pillar, about 80′ E. of PZ - S1
COORDINATES: N40043.59, E38784.33

SURFACE ELEVATION: 1102.5 Feet
BORING DEPTH: 193.0 Feet
DATE: 03-07-88

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLING NOTES
1102.5	--0						Drilled wo/sampling 0 - 28′ Bldrs 0 - 8′;10 - 15′ Cuttings redbrown SILTY SAND	SM		
1082.5	--20						At 20′, lt. yel brn SILT, soft, altered shist. Rock soft to about 44 ft.	ML		
		33′-43′	*g							
1062.5	--40	43′-63′	g				Cuttings predominantly powder with few chips, dry.			
		53′-63′	g							
1042.5	--60	63′-73′	g				Gray, red, green biotite schist.			
		73′-83′	g							
1022.5	--80	83′-93′	g				Biotite-quartz-chlonite schist and biotite-chlorite-quartz-sericite schist	PC (2c), (2a)		
		93′-103′	g							
1002.5	--100	103′-113′	g							
		113′-123′	g							
982.5	--120	123′-133′	g							
		133′-143′	g							
962.5	--140	143′-153′	g							
		153′-163′	g							
942.5	--160	163′-173′	g							
		173′-183′	g							
922.5	--180	183′-193′	g							
902.5	--200						EOB at 193′ in biotite schist.			*g=grab samples of cuttings.
882.5	--220									

DRILLING DATA

START DATE: 03/07/88
COMPLETION DATE: 03/07/88
LOGGED BY: BJS
DRILLING METHOD: Mud rotary 0-28′; air 28-193′
DRILLING CONTRACTOR: Luisier Drilling, Inc.

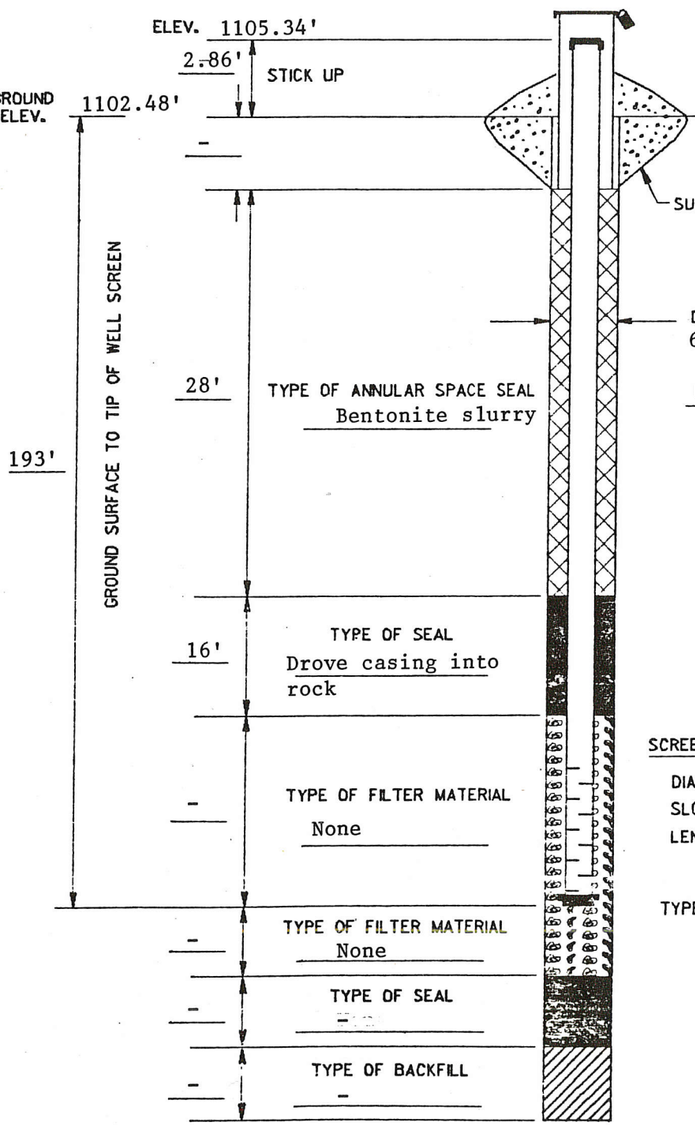
WATER LEVEL INFORMATION

DEPTH AT COMPLETION: DRY
LATER TIME/DEPTH: 03-08-88
LATER TIME/DEPTH: 7:55 AM/117′
CAVE IN DEPTH: 185′
DRILLING LOSSES:

MONITORING WELL CONSTRUCTION DIAGRAM

WELL NO: TW-K1
DATE INSTALLED: 3-7-88
DRILLER: Luisier Drilling, Inc.
DRILLING METHOD: Mud rotary, air

CLIENT: Kennecott
PROJECT: Rock permeability
SCOPE I.D.: 87K10-W.O. 66
BY: BJS



PROTECTOR PIPE:
SIZE 6"
MATERIAL Steel
LOCK NO. Master 3377

SURFACE SEAL MATERIAL -

DRILL HOLE DIAMETER 9" tricone 0-28'
6" downhole air hammer 28-193'

TYPE OF ANNULAR SPACE SEAL
Bentonite slurry

PIPE:
DIAMETER 6"
MATERIAL Steel
SCH. -
TYPE OF JOINTS Welded

TYPE OF SEAL
Drove casing into rock

TYPE OF FILTER MATERIAL
None

SCREEN: Open hole
DIAMETER 6"
SLOT SIZE -
LENGTH 157'

TYPE OF CAP -

TYPE OF FILTER MATERIAL
None

TYPE OF SEAL
-

TYPE OF BACKFILL
-

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

MONITORING WELL DEVELOPMENT

WELL NUMBER TW-K1
WELL DIAMETER 6"
TOTAL DEPTH OF WELL 193'
DEPTH TO WATER — TIME OF MEASUREMENT
BEFORE 23.85' — 1:35 p.m.
AFTER Dry — 2:08 p.m.

CLIENT Kennecott
PROJECT Rock permeability
SCOPE I.D. 87K10-W.O. 66
BY BJS
DATE 3-9-88

DESCRIPTION OF DEVELOPMENT METHOD

Well was dry on completion on 3-7-88.
On 3-9-88, well was surged with cable tool rock bailer (13' x 4.5" OD) for 8 min., then bailed dry.

VOLUME OF WATER REMOVED FROM WELL Approx. 250 gals.
CLARITY OF WATER IN WELL BEFORE DEVELOPMENT Red brn. silty
CLARITY OF WATER IN WELL AFTER DEVELOPMENT Red brn. silty
PRESENCE OF SEDIMENT AT THE BOTTOM OF THE WELL Silt
VOLUME OF WATER ADDED TO WELL None
SOURCE OF WATER ADDED TO WELL -
TIME SPENT FOR DEVELOPMENT 0.8 hrs.

STABILIZATION READINGS

GAL. REMOVED	TIME	FIELD TEMPERATURE	FIELD SPEC. COND.	FIELD pH

FOTH AND VAN DYKE

LOG OF TEST BORING NO.: TW - K2 (PZ - K2P, PZ - K2PP)

CLIENT: Kennecott
PROJECT: Rock Permeability
PROJECT NUMBER: 87K10 - W066
LOCATION: River pillar, about 40' SW of baseline.
COORDINATES: N39750.05, E39015.57

SURFACE ELEVATION: 1102.3 Feet
BORING DEPTH: 193.0 Feet
DATE: 03-08-88

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLING NOTES
1102.3	--0						Drilled wo/sampling to 30' Red brn silty SAND w/grl.	SM		
1082.3	--20						Bright red, soft, gossan.	PC(6)		
		30'-32'	*g				Dk gray massive sulfide, w/chert band at 30', hard, 0.5-1 gpm water.	(1c)		
1062.3	--40						White metachert, w/copper oxides coatings, v. hard, 10-15 gpm water @ 63'.	(1b)		
1042.3	--60	63'-73'	g				Biotite-sericite-quartz-chlorite-schist.			
		73'-83'	g							
1022.3	--80	83'-93'	g							
		93'-103'	g							
1002.3	--100	103'-113'	g							
		113'-123'	g							
982.3	--120	123'-133'	g					(2a)		
		133'-143'	g							
962.3	--140	143'-153'	g							
		153'-163'	g							
942.3	--160	163'-173'	g							
		173'-183'	g							
922.3	--180	183'-193'	g							
902.3	--200						EOB at 193' in biotite schist.			*g=grab samples of cuttings.
882.3	--220									

DRILLING DATA

START DATE: 03/08/88
COMPLETION DATE: 03/08/88
LOGGED BY: BJS
DRILLING METHOD: Mud rotary 0-30'; air 30-193'
DRILLING CONTRACTOR: Luisier Drilling, Inc.

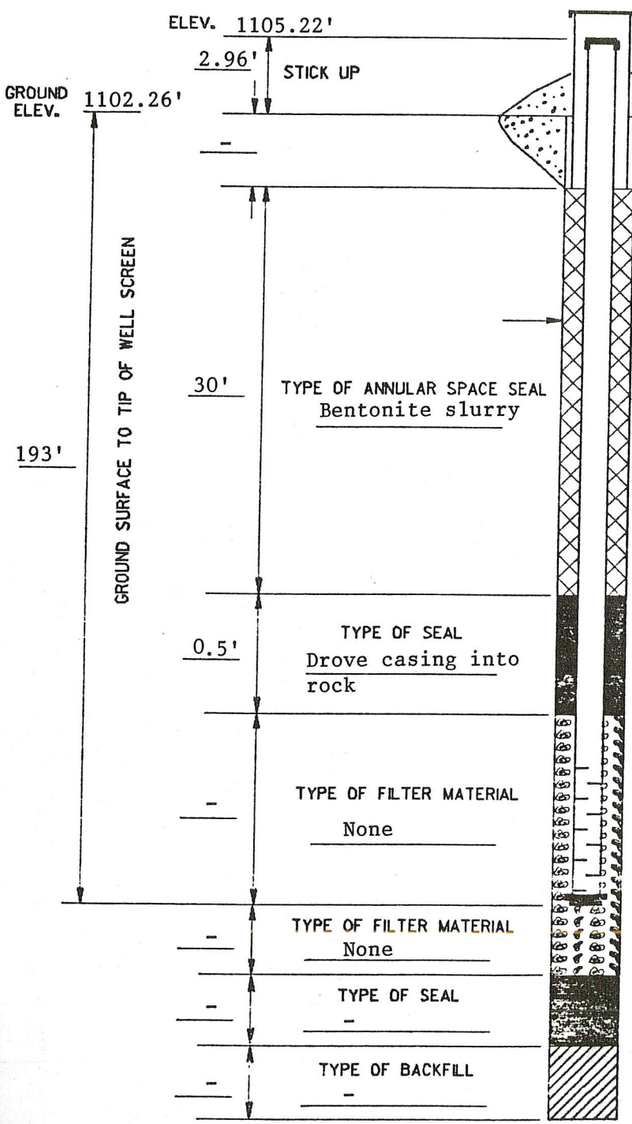
WATER LEVEL INFORMATION

DEPTH AT COMPLETION: 17.25 Feet
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:
DRILLING LOSSES:

MONITORING WELL CONSTRUCTION DIAGRAM

WELL NO: TW-K2
DATE INSTALLED: 3-8-88
DRILLER: Luisier Drilling, Inc.
DRILLING METHOD: Mud rotary, air

CLIENT: Kennecott
PROJECT: Rock permeability
SCOPE I.D.: 87K10-W.O. 66
BY: BJS



PROTECTOR PIPE:
SIZE 6"
MATERIAL Steel
LOCK NO. Master 3377

SURFACE SEAL MATERIAL -

DRILL HOLE DIAMETER 9" tricone 0-30'
6" down hole hammer 30-193'

TYPE OF ANNULAR SPACE SEAL
Bentonite slurry

PIPE:
DIAMETER 6"
MATERIAL Steel
SCH. -
TYPE OF JOINTS Welded

TYPE OF SEAL
Drove casing into rock

TYPE OF FILTER MATERIAL
None

SCREEN: Open hole
DIAMETER 6"
SLOT SIZE -
LENGTH 163'

TYPE OF FILTER MATERIAL
None

TYPE OF CAP -

TYPE OF SEAL
-

TYPE OF BACKFILL
-

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

MONITORING WELL DEVELOPMENT

WELL NUMBER TW-K2 — CLIENT Kennecott

WELL DIAMETER 6" — PROJECT Rock permeability

TOTAL DEPTH OF WELL 193' — SCOPE I.D. 87K10-W.O. 66

DEPTH TO WATER — TIME OF MEASUREMENT — BY BJS

BEFORE 13.4' — 3:25 p.m. — DATE 3-9-88

AFTER 26.4' — 3:40 p.m.

DESCRIPTION OF DEVELOPMENT METHOD

At completion on 3-6-88, blew out about 10 gpm for 10 min.
On 3-9-88, well was surged with cable tool rock bailer (13' x 4.5" OD) for 11 min., then bailed down to static water level.

VOLUME OF WATER REMOVED FROM WELL Approx. 170 gal. (total)

CLARITY OF WATER IN WELL BEFORE DEVELOPMENT Red brn. silty

CLARITY OF WATER IN WELL AFTER DEVELOPMENT Lt. red brn., slightly silty

PRESENCE OF SEDIMENT AT THE BOTTOM OF THE WELL Silt

VOLUME OF WATER ADDED TO WELL None

SOURCE OF WATER ADDED TO WELL -

TIME SPENT FOR DEVELOPMENT 1 hr.

STABILIZATION READINGS

GAL. REMOVED	TIME	FIELD TEMPERATURE	FIELD SPEC. COND.	FIELD pH

FOTH AND VAN DYKE

LOG OF TEST BORING NO.: TW - K3, TW - K3R

CLIENT: Kennecott
PROJECT: Rock Permeability
PROJECT NUMBER: 87K10 - W066
LOCATION: Sec. 410, about 150' SW.
COORDINATES: N40,350.49 E39,746.34

SURFACE ELEVATION: 1124.6 Feet
BORING DEPTH: 163.0 Feet
DATE: 03-06-88

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLING NOTES
1124.6	--0						Drilled wo/sampling to 38'			
	-						Red brn silty SAND w/grl.	SM		
1104.6	--20						Lt. brn sandstone.	SP		
	-	38'-43'	*g				Lt. yel. brn SILT, altered biotite schist,moist			
1084.6	--40						Cuttings mostly powder.			
	-	43'-53'	g					ML		
	-	53'-63'	g							
1064.6	--60						Biotite schist, interbedded biotite-quartz-chlorite schist and biotite-sericite quartz-chlorite schist.			
	-	63'-73'	g							
	-	73'-83'	g							
1044.6	--80									
	-	83'-93'	g					PC		
	-							(2a)		
	-	93'-103'	g				At about 100', cuttings			
1024.6	--100						hematitic, moist, sticky.	(2c)		
	-	103'-113'	g							
	-	113'-123'	g						Drilled with air and water from 113'.	
1004.6	--120									
	-	123'-133'	g							
	-	133'-143'	g							
984.6	--140									
	-	143'-153'	g							
	-	153'-163'	g				==========	=====		
964.6	--160		g				EOB at 163' in biotite schist.			
	-		g							
944.6	--180		g							
	-									
924.6	--200									*g=grab samples of cuttings.
	-									
904.6	--220									

DRILLING DATA

START DATE: 03/06/88
COMPLETION DATE: 03/06/88
LOGGED BY: BJS
DRILLING METHOD: Mud rotary 0-38'; air 38-163'
DRILLING CONTRACTOR: Luisier Drilling, Inc.

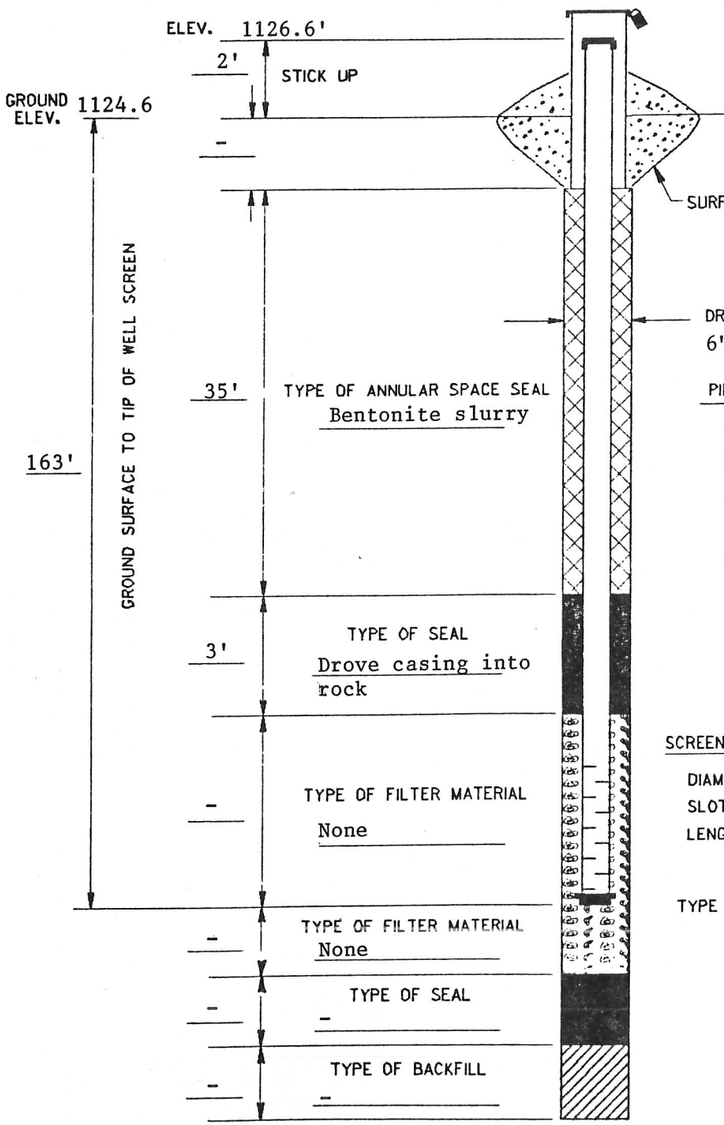
WATER LEVEL INFORMATION

DEPTH AT COMPLETION:
LATER TIME/DEPTH: 03-07-88
LATER TIME/DEPTH: 7:30AM/14.2'
CAVE IN DEPTH: 123'
DRILLING LOSSES:

MONITORING WELL CONSTRUCTION DIAGRAM

WELL NO: TW-K3
DATE INSTALLED: 3-6-88
DRILLER: Luisier Drilling, Inc.
DRILLING METHOD: Mud rotary, air

CLIENT: Kennecott
PROJECT: Rock permeability
SCOPE I.D.: 87K10-W.O. 66
BY: BJS



PROTECTOR PIPE:
SIZE 6"
MATERIAL Steel
LOCK NO. Master 3377

PIPE:
DIAMETER 6"
MATERIAL Steel
SCH. -
TYPE OF JOINTS Welded

SCREEN: Open hole
DIAMETER 6"
SLOT SIZE -
LENGTH 125'

TYPE OF CAP -

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

MONITORING WELL DEVELOPMENT

WELL NUMBER TW-K3
WELL DIAMETER 6"
TOTAL DEPTH OF WELL 163'

DEPTH TO WATER	TIME OF MEASUREMENT
BEFORE 12.5'	8:33 a.m.
AFTER 114'	9:12 a.m.

CLIENT Kennecott
PROJECT Rock permeability
SCOPE I.D. 87K10-W.O. 66
BY BJS
DATE 3-9-88

DESCRIPTION OF DEVELOPMENT METHOD

At completion on 3-6-88, blew out 0.5-1 gpm for 25 min.
On 3-9-88, well was surged with cable tool rock bailer (13' x 4.5" OD) for 5 min., then bailed down to 114 ft.

At 10:12 to 10:20 a.m. bailed out an additional 80 gals.
At 10:12 a.m. DTW = 14 ft.
At 10:20 a.m. DTW = 90 ft.

VOLUME OF WATER REMOVED FROM WELL Approx. 350 gals. (total)
CLARITY OF WATER IN WELL BEFORE DEVELOPMENT Red brn., silty
CLARITY OF WATER IN WELL AFTER DEVELOPMENT Lt. red brn., slightly silty
PRESENCE OF SEDIMENT AT THE BOTTOM OF THE WELL Silt
VOLUME OF WATER ADDED TO WELL None
SOURCE OF WATER ADDED TO WELL -
TIME SPENT FOR DEVELOPMENT 1 hr.

STABILIZATION READINGS

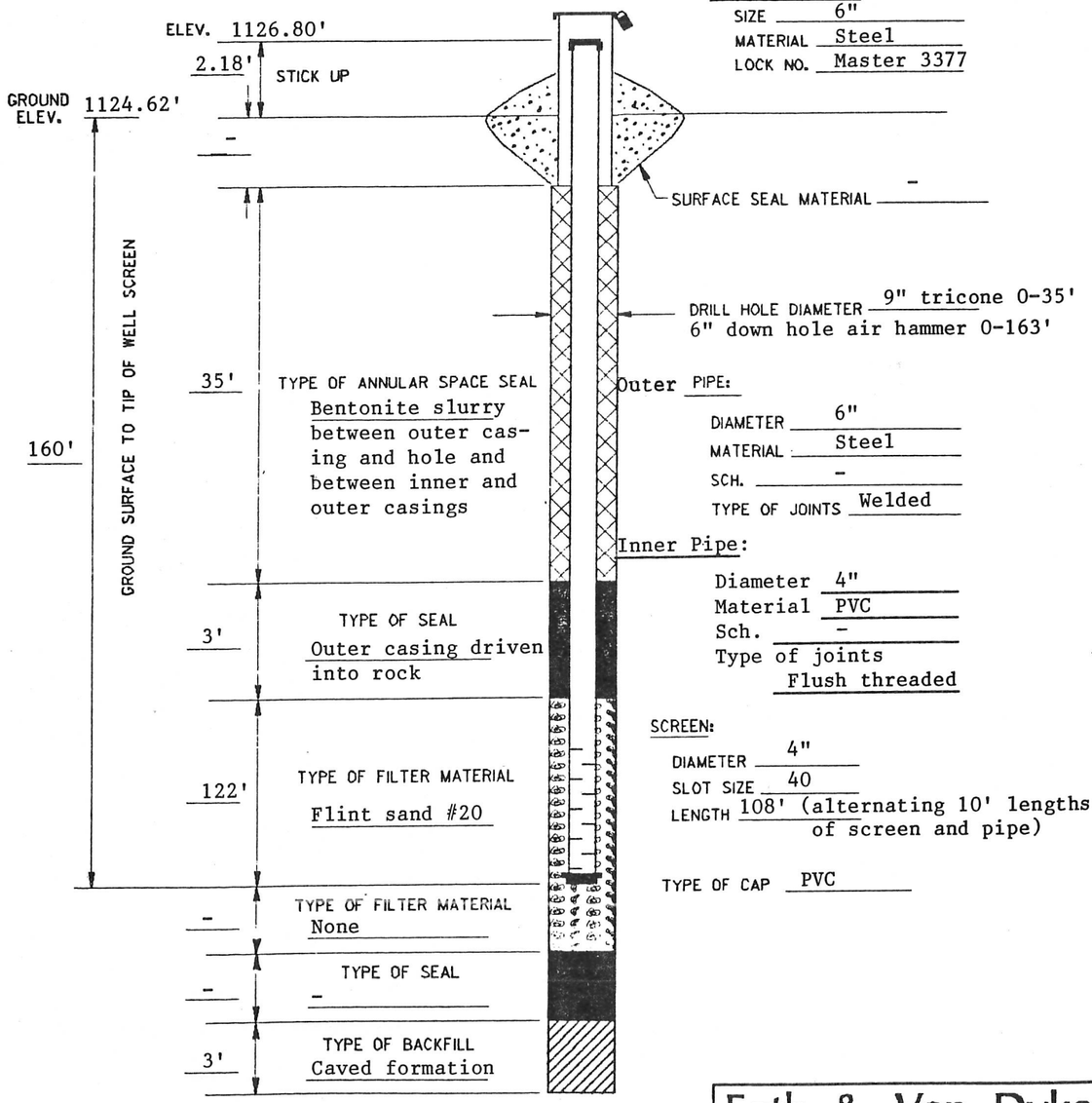
GAL. REMOVED	TIME	FIELD TEMPERATURE	FIELD SPEC. COND.	FIELD pH

FOTH AND VAN DYKE

MONITORING WELL CONSTRUCTION DIAGRAM

WELL NO: TW-K3R
DATE INSTALLED: 3-23-88
DRILLER: Luisier Drilling, Inc.
DRILLING METHOD: Mud rotary, air

CLIENT: Kennecott
PROJECT: Rock permeability
SCOPE I.D.: 87K10-W.O. 66
BY: BJS



PROTECTOR PIPE:
SIZE 6"
MATERIAL Steel
LOCK NO. Master 3377

SURFACE SEAL MATERIAL -

DRILL HOLE DIAMETER 9" tricone 0-35'
6" down hole air hammer 0-163'

TYPE OF ANNULAR SPACE SEAL
Bentonite slurry between outer casing and hole and between inner and outer casings

TYPE OF SEAL
Outer casing driven into rock

TYPE OF FILTER MATERIAL
Flint sand #20

TYPE OF FILTER MATERIAL
None

TYPE OF SEAL
-

TYPE OF BACKFILL
Caved formation

Outer PIPE:
DIAMETER 6"
MATERIAL Steel
SCH. -
TYPE OF JOINTS Welded

Inner Pipe:
Diameter 4"
Material PVC
Sch. -
Type of joints Flush threaded

SCREEN:
DIAMETER 4"
SLOT SIZE 40
LENGTH 108' (alternating 10' lengths of screen and pipe)

TYPE OF CAP PVC

Note: TW-K3R was installed in open hole well TW-K3. Hole had caved to 120 feet and was redrilled to 163 feet.

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

MONITORING WELL DEVELOPMENT

WELL NUMBER TW-K3R
WELL DIAMETER 4"
TOTAL DEPTH OF WELL 160'
DEPTH TO WATER — TIME OF MEASUREMENT
BEFORE - -
AFTER - -

CLIENT Kennecott
PROJECT Rock permeability
SCOPE I.D. 87K10-W.O. 66
BY BJS
DATE 3-23-88

DESCRIPTION OF DEVELOPMENT METHOD

At completion of drilling, blew out 1 to 1.5 gpm from open hole from 12:45 p.m. to 1:15 p.m.
Set 40 ft. of A-rod in 4" PVC well and surged with air for 5 min.
Blew out about 1 gpm from 5:00 p.m. to 5:20 p.m.

VOLUME OF WATER REMOVED FROM WELL Approx. 60 gals. (total)
CLARITY OF WATER IN WELL BEFORE DEVELOPMENT Red brn., silty
CLARITY OF WATER IN WELL AFTER DEVELOPMENT Lt. red brn., slightly silty
PRESENCE OF SEDIMENT AT THE BOTTOM OF THE WELL Silt
VOLUME OF WATER ADDED TO WELL None
SOURCE OF WATER ADDED TO WELL -
TIME SPENT FOR DEVELOPMENT 0.8 hrs.

STABILIZATION READINGS

GAL. REMOVED	TIME	FIELD TEMPERATURE	FIELD SPEC. COND.	FIELD pH

FOTH AND VAN DYKE

LOG OF TEST BORING NO.: TW - K4 (PZ - K4P, PZ - K4PP)

CLIENT: Kennecott
PROJECT: Rock Permeability
PROJECT NUMBER: 87K10 - W066
LOCATION: NE end of pit, near PZ - S4
COORDINATES: N41,204.15, E40,662.92

SURFACE ELEVATION: 1140.1 Feet
BORING DEPTH: 193.0 Feet
DATE: 03-06-88

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLING NOTES
1140.1	--0						Drilled wo/sampling to 52' Cuttings brn sand and grl, to 15' red brn SILTY SAND (till) to about 30'.	SP, GP,		
1120.1	--20						At about 30' v.fn. silty sandstone w/shale layers to 47', then yel. brn., SILT, soft.	SM		
1100.1	--40							SM (ss)		
		52'-63'	*g					ML		
1080.1	--60	63'-73'	g				Cuttings to 103', red brn., hematitic, moist. Interbedded biotite schist and metadacite			
		73'-83'	g					PC (2c)		
1060.1	--80	83'-93'	g					(5)		
		93'-103'	g							
1040.1	--100	103'-113'	g				At 113' red brn, hematitic, w/fn grl. size chips, wet, clayey.			
		113'-123'	g							
1020.1	--120	123'-133'	g				Water at about 123', 2-3gpm metadacite.			
		133'-143'	g					(5)		
1000.1	--140	143'-153'	g							
		153'-163'	g							
980.1	--160	163'-173'	g							
		173'-183'	g							
960.1	--180	183'-193'					EOB at 193' in metadacite.			
940.1	--200									*g=grab samples of cuttings.
920.1	--220									

DRILLING DATA

START DATE: 03/06/88 7:30AM
COMPLETION DATE: 03/06/88 12:30PM
LOGGED BY: BJS
DRILLING METHOD: Mud rotary to 50'; air 193'.
DRILLING CONTRACTOR: Luisier Drilling, Inc.

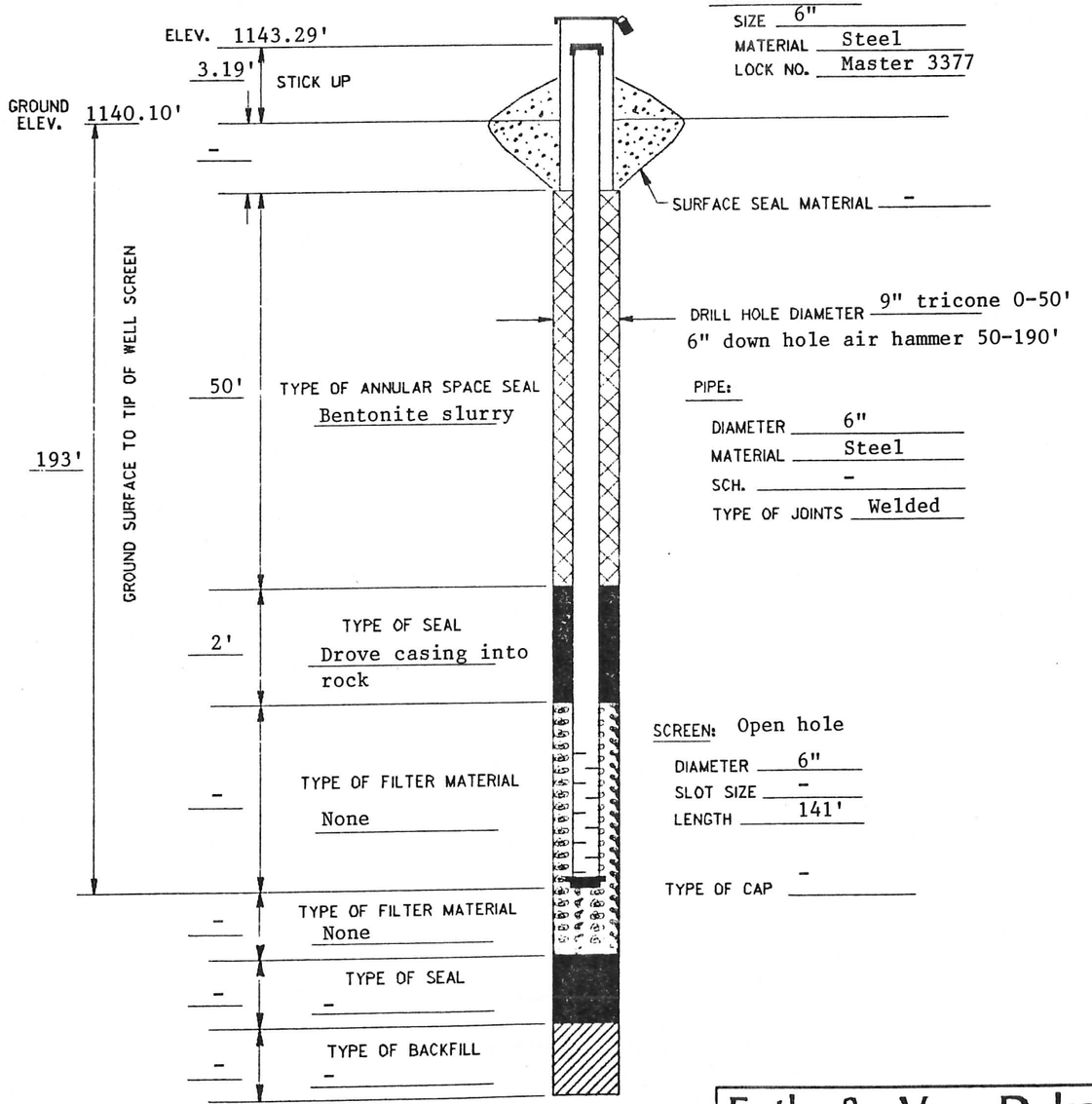
WATER LEVEL INFORMATION

DEPTH AT COMPLETION: 110 Feet
LATER TIME/DEPTH: 1:45PM/35'
LATER TIME/DEPTH: 5:15PM/27.4'
CAVE IN DEPTH:
DRILLING LOSSES:

MONITORING WELL CONSTRUCTION DIAGRAM

WELL NO: TW-K4
DATE INSTALLED: 3-6-88
DRILLER: Luisier Drilling, Inc.
DRILLING METHOD: Mud rotary, air

CLIENT: Kennecott
PROJECT: Rock permeability
SCOPE I.D.: 87K10-W.O. 66
BY: BJS



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

MONITORING WELL DEVELOPMENT

WELL NUMBER TW-K4 — CLIENT Kennecott

WELL DIAMETER 6" — PROJECT Rock permeability

TOTAL DEPTH OF WELL 193' — SCOPE I.D. 87K10-W.O. 66

DEPTH TO WATER — TIME OF MEASUREMENT — BY BJS

BEFORE - — 11:50 a.m. — DATE 3-6-88

AFTER 110' — 12:45 p.m.

DESCRIPTION OF DEVELOPMENT METHOD

Well completed at 11:50 a.m. on 3-6-88; blew out 3-4 gpm for 30 min.

VOLUME OF WATER REMOVED FROM WELL Approx. 110 gals.

CLARITY OF WATER IN WELL BEFORE DEVELOPMENT Red brn., silty

CLARITY OF WATER IN WELL AFTER DEVELOPMENT Lt. red brn., silty

PRESENCE OF SEDIMENT AT THE BOTTOM OF THE WELL Silt

VOLUME OF WATER ADDED TO WELL None

SOURCE OF WATER ADDED TO WELL -

TIME SPENT FOR DEVELOPMENT 0.7 hrs.

STABILIZATION READINGS

GAL. REMOVED	TIME	FIELD TEMPERATURE	FIELD SPEC. COND.	FIELD pH

FOTH AND VAN DYKE

LOG OF TEST BORING NO.: TW - K5, TW - K5R

CLIENT: Kennecott
PROJECT: Rock Permeability
PROJECT NUMBER: 87K10 - W066
LOCATION: River pillar, about 40' SW of baseline.
COORDINATES: N41490.04, E40444.96 (TW-KSR)

SURFACE ELEVATION: 1102.3 Feet
BORING DEPTH: 193.0 Feet
DATE: 03-05-88

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLING NOTES
1102.3	--0						Drilled wo/sampling to 55'			
	-						Silt to about 10', then silty			
	-						sand till to about 30'	ML		
	-									
	-									
1082.3	--20							SM		
	-									
	-						At about 30', cse & med. qtz			
	-						sand (sandstone).			
	-									
1062.3	--40							SP		
	-						At about 47' yel. brn. extremely	(ss)		
	-	55'-63'	*g				altered schist (silt).			
	-									
	-							"ML"		
1042.3	--60									
	-	63'-73'	g				Cuttings mostly lt. blue gray			
	-						powder (biotite, chlorite, quartz,			
	-						sericite schist.)			
	-	73'-83'	g							
1022.3	--80							PC		
	-	83'-93'	g				Cuttings from 80' to about 100'			
	-						w/grl size pieces, chert, hard	(2b)		
	-						w/pyrite in schist.			
	-	93'-103'	g							
1002.3	--100									
	-	103'-113'	g							
	-									
	-	113'-123'	g							
982.3	--120									
	-	123'-133'	g				Cuttings to bottom of hole,			
	-						mostly powder.			
	-									
	-	133'-143'	g							
962.3	--140									
	-	143'-153'	g							
	-									
	-									
	-	153'-163'	g							
942.3	--160									
	-	163'-173'	g							
	-									
	-									
	-	173'-183'	g							
922.3	--180									
	-	183'-193'	g							
	-									
	-									
	-									
	-						EOB at 193' in biotite schist.			*g=grab samples of cuttings.
902.3	--200									
	-									
	-									
	-									
882.3	--220									

DRILLING DATA

START DATE: 03/05/88 2:30PM
COMPLETION DATE: 03/05/88 5:30PM
LOGGED BY: BJS
DRILLING METHOD: Mud rotary to 55'; air to 193'.
DRILLING CONTRACTOR: Luisier Drilling, Inc.

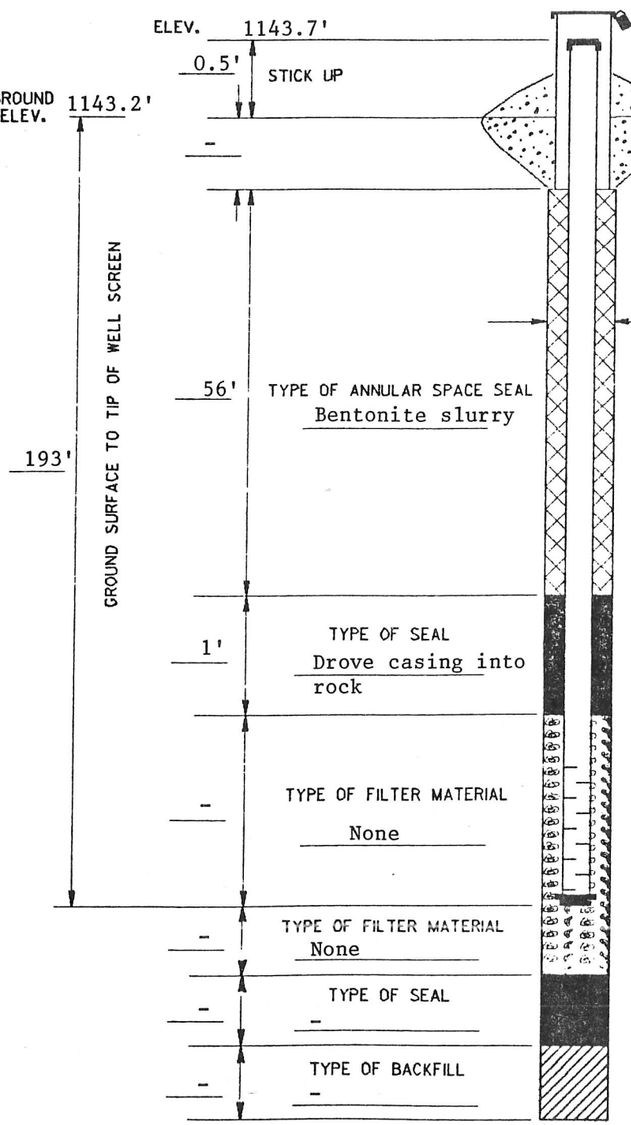
WATER LEVEL INFORMATION

DEPTH AT COMPLETION: DRY
LATER TIME/DEPTH: 7:30AM/3-6/90'
LATER TIME/DEPTH: 7:30AM/3-7/36'
CAVE IN DEPTH: 56'
DRILLING LOSSES:

MONITORING WELL CONSTRUCTION DIAGRAM

WELL NO: TW-K5
DATE INSTALLED: 3-5-88
DRILLER: Luisier Drilling, Inc.
DRILLING METHOD: Mud rotary, air

CLIENT: Kennecott
PROJECT: Rock permeability
SCOPE I.D.: 87K10-W.O. 66
BY: BJS



PROTECTOR PIPE:
SIZE 6"
MATERIAL Steel
LOCK NO. Master 3377

SURFACE SEAL MATERIAL -

DRILL HOLE DIAMETER 9" tricone 0-55'
6" down hole air hammer 55-193'

TYPE OF ANNULAR SPACE SEAL
Bentonite slurry

PIPE:
DIAMETER 6"
MATERIAL Steel
SCH. -
TYPE OF JOINTS Welded

TYPE OF SEAL
Drove casing into rock

TYPE OF FILTER MATERIAL
None

SCREEN: Open hole
DIAMETER 6"
SLOT SIZE -
LENGTH 136'

TYPE OF CAP -

TYPE OF FILTER MATERIAL
None

TYPE OF SEAL
-

TYPE OF BACKFILL
-

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

MONITORING WELL DEVELOPMENT

WELL NUMBER TW-K5
WELL DIAMETER 6"
TOTAL DEPTH OF WELL 193'

DEPTH TO WATER	TIME OF MEASUREMENT
BEFORE 90'	7:30 a.m.
AFTER Dry	8:00 a.m.

CLIENT Kennecott
PROJECT Rock permeability
SCOPE I.D. 87K10-W.O. 66
BY BJS
DATE 3-6-88

DESCRIPTION OF DEVELOPMENT METHOD

Well was dry on completion at 5:15 p.m. on 3-5-88.
Well was blown out with air on 3-6-88.
Well caved to bottom of steel casing before it could be developed with cable tool rock bailer on 3-9-88.

VOLUME OF WATER REMOVED FROM WELL Approx. 145 gals.
CLARITY OF WATER IN WELL BEFORE DEVELOPMENT Lt. gray silty
CLARITY OF WATER IN WELL AFTER DEVELOPMENT Lt. gray silty
PRESENCE OF SEDIMENT AT THE BOTTOM OF THE WELL Silt
VOLUME OF WATER ADDED TO WELL None
SOURCE OF WATER ADDED TO WELL -
TIME SPENT FOR DEVELOPMENT 0.5 hrs.

STABILIZATION READINGS

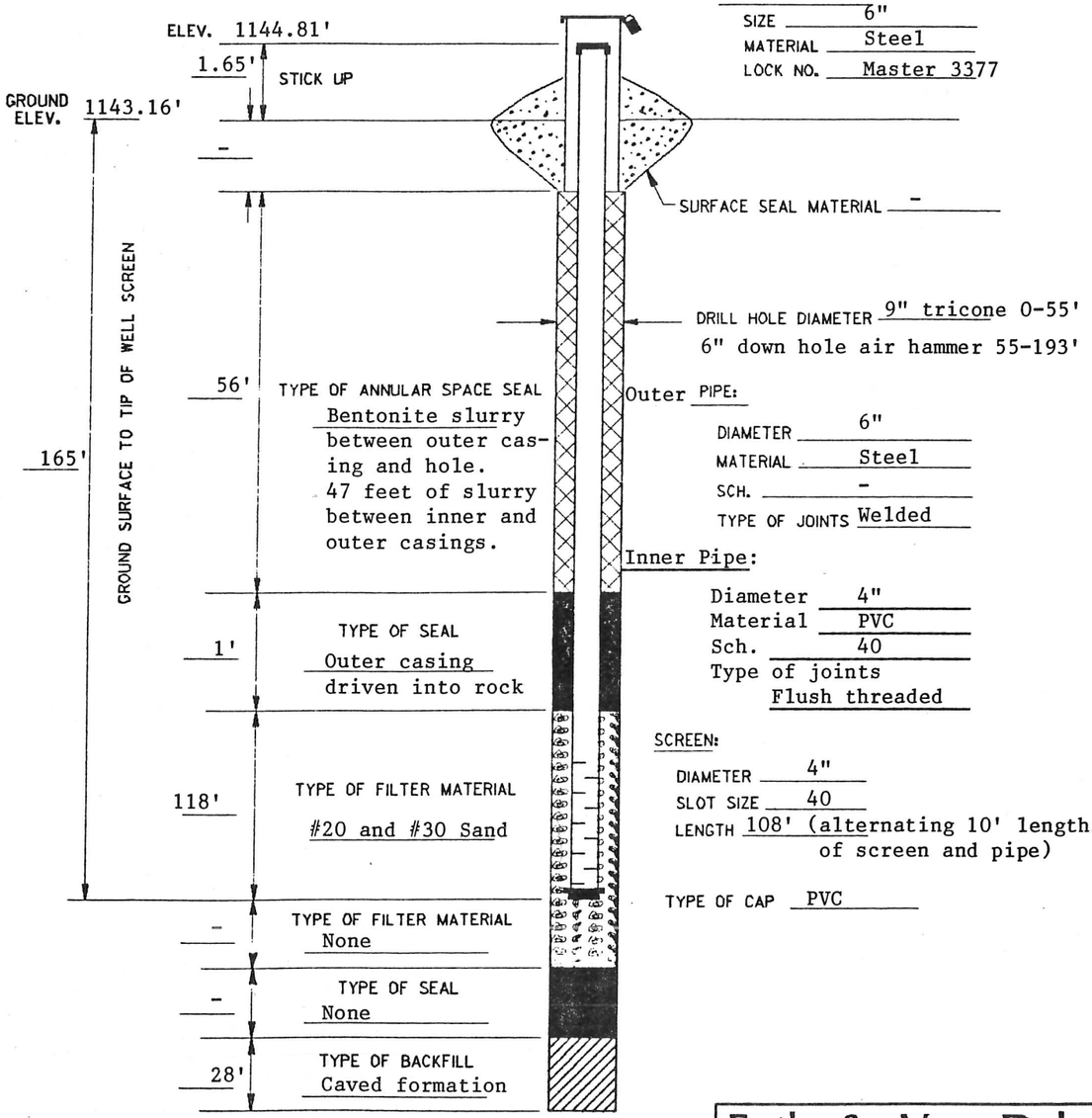
GAL. REMOVED	TIME	FIELD TEMPERATURE	FIELD SPEC. COND.	FIELD pH

FOTH AND VAN DYKE

MONITORING WELL CONSTRUCTION DIAGRAM

WELL NO: TW-K5R
DATE INSTALLED: 3-26-88
DRILLER: Luisier Drilling, Inc.
DRILLING METHOD: Mud rotary, air

CLIENT: Kennecott
PROJECT: Rock permeability
SCOPE I.D.: 87K10-W.O. 66
BY: BJS



PROTECTOR PIPE:
SIZE 6"
MATERIAL Steel
LOCK NO. Master 3377

SURFACE SEAL MATERIAL -

DRILL HOLE DIAMETER 9" tricone 0-55'
6" down hole air hammer 55-193'

TYPE OF ANNULAR SPACE SEAL
Bentonite slurry between outer casing and hole. 47 feet of slurry between inner and outer casings.

Outer PIPE:
DIAMETER 6"
MATERIAL Steel
SCH. -
TYPE OF JOINTS Welded

Inner Pipe:
Diameter 4"
Material PVC
Sch. 40
Type of joints Flush threaded

TYPE OF SEAL
Outer casing driven into rock

SCREEN:
DIAMETER 4"
SLOT SIZE 40
LENGTH 108' (alternating 10' lengths of screen and pipe)

TYPE OF FILTER MATERIAL
#20 and #30 Sand

TYPE OF CAP PVC

TYPE OF FILTER MATERIAL
None

TYPE OF SEAL
None

TYPE OF BACKFILL
Caved formation

Note: TW-K5R was installed in open hole well TW-K5. Hole had caved to 56 feet and was redrilled to 193 feet.

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

MONITORING WELL DEVELOPMENT

WELL NUMBER TW-K5R
WELL DIAMETER 4"
TOTAL DEPTH OF WELL 165'
DEPTH TO WATER — TIME OF MEASUREMENT
BEFORE - -
AFTER - -

CLIENT Kennecott
PROJECT Rock permeability
SCOPE I.D. 87K10-W.O. 66
BY BJS
DATE 3-26-88

DESCRIPTION OF DEVELOPMENT METHOD

At completion of drilling, blew out 2 to 3 gpm from open hole from 11:54 a.m. to 12:02 p.m.
Set A-rod in the 4" PVC well and surged with air for 5 min.
Blew out about 2 gpm from 4:24 to 4:29 p.m.

VOLUME OF WATER REMOVED FROM WELL Approx. 30 gals. (total)
CLARITY OF WATER IN WELL BEFORE DEVELOPMENT Lt. gray, silty
CLARITY OF WATER IN WELL AFTER DEVELOPMENT Lt. gray, silty
PRESENCE OF SEDIMENT AT THE BOTTOM OF THE WELL Silt
VOLUME OF WATER ADDED TO WELL None
SOURCE OF WATER ADDED TO WELL -
TIME SPENT FOR DEVELOPMENT 0.5 hrs.

STABILIZATION READINGS

GAL. REMOVED	TIME	FIELD TEMPERATURE	FIELD SPEC. COND.	FIELD pH

FOTH AND VAN DYKE

LOG OF TEST BORING NO.: TW - K6, TW - K6R

CLIENT: Kennecott
PROJECT: Rock Permeability
PROJECT NUMBER: 87K10 - W066
LOCATION: Center of pit, west side.
COORDINATES: N40,397.05, E39,248.53 (TW - K6R)

SURFACE ELEVATION: 1118.2 Feet
BORING DEPTH: 183.0 Feet
DATE: 03-07-88

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLING NOTES
1118.2	--0						Drilled w/o sampling to 43' Cuttings sand and grl, and silty sand (till).	SP, GP, SM		
1098.2	--20									
							Sandstone.	SS		
1078.2	--40	43'-53'	*g				Cuttings red brn and purple red, v. soft, sticky, drill w/foam.			
		53'-63'	g							
1058.2	--60	63'-73'	g				Altered schist. (Metadacite)			
		73'-83'	g							
1038.2	--80	83'-93'	g					PC		
		93'-103'	g					(5)		
1018.2	--100	103'-113'	g							
		113'-123'	g							
998.2	--120	123'-133'	g							
		133'-143'	g							
978.2	--140	143'-153'	g							
		153'-163'	g							
958.2	--160	163'-173'	g							
		173'-183'	g				EOB at 183' in altered schist. (Metadacite)			*g=grab samples of cuttings.
938.2	--180									
918.2	--200									
898.2	--220									

DRILLING DATA

START DATE: 03/07/88 7:00AM
COMPLETION DATE: 03/07/88 11:30AM
LOGGED BY: BJS
DRILLING METHOD: Mud rotary to 43'; air w/foam to 183'.
DRILLING CONTRACTOR: Luisier Drilling, Inc.

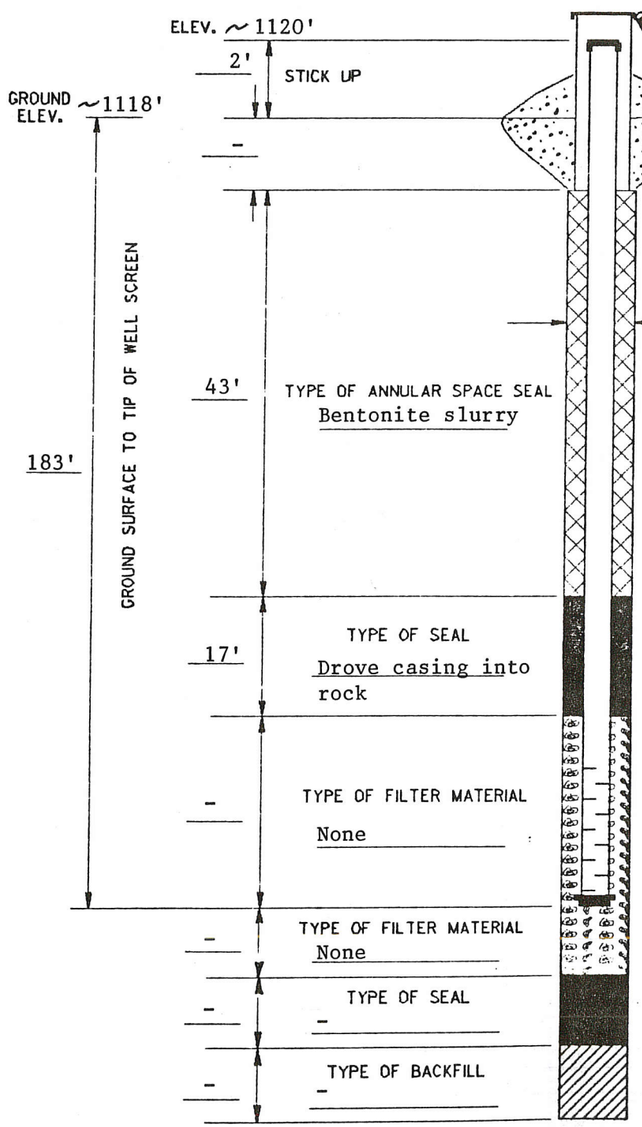
WATER LEVEL INFORMATION

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

MONITORING WELL CONSTRUCTION DIAGRAM

WELL NO: TW-K6 (Abandoned)
DATE INSTALLED: 3-7-88
DRILLER: Luisier Drilling, Inc.
DRILLING METHOD: Mud rotary, air

CLIENT: Kennecott
PROJECT: Rock permeability
SCOPE I.D.: 87K10-W.O. 66
BY: BJS



PROTECTOR PIPE:
SIZE 6"
MATERIAL Steel
LOCK NO. Master 3377

SURFACE SEAL MATERIAL -

DRILL HOLE DIAMETER 9" tricone 0-43'
6" down hole air hammer 43-183'

PIPE:
DIAMETER 6"
MATERIAL Steel
SCH. -
TYPE OF JOINTS Welded

SCREEN: Open hole
DIAMETER 6"
SLOT SIZE -
LENGTH 123'

TYPE OF CAP -

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

MONITORING WELL DEVELOPMENT

WELL NUMBER TW-K6
WELL DIAMETER 6"
TOTAL DEPTH OF WELL 183'
DEPTH TO WATER — TIME OF MEASUREMENT
BEFORE - 11:15 a.m.
AFTER 179.4' 12:45 p.m.

CLIENT Kennecott
PROJECT Rock permeability
SCOPE I.D. 87K10-W.O. 66
BY BJS
DATE 3-7-88

DESCRIPTION OF DEVELOPMENT METHOD

At 11:15 a.m. on completion, blew out well with air. Blew out approximately 0.3 gpm for 10 min.
Well caved to the bottom of the steel casing before it could be developed with cable tool rock bailer on 3-9-88.

VOLUME OF WATER REMOVED FROM WELL Approx. 3 gals.
CLARITY OF WATER IN WELL BEFORE DEVELOPMENT Red brn., silty
CLARITY OF WATER IN WELL AFTER DEVELOPMENT Red brn., silty
PRESENCE OF SEDIMENT AT THE BOTTOM OF THE WELL Silt
VOLUME OF WATER ADDED TO WELL None
SOURCE OF WATER ADDED TO WELL -
TIME SPENT FOR DEVELOPMENT 0.5 hrs.

STABILIZATION READINGS

GAL. REMOVED	TIME	FIELD TEMPERATURE	FIELD SPEC. COND.	FIELD pH

FOTH AND VAN DYKE

State of Wisconsin
Department of Natural Resources

WELL/DRILLHOLE ABANDONMENT

Form 3300-5 Rev. 6-87

(1) GENERAL INFORMATION

Well/Drillhole Location: County: Rusk

SW 1/4 of SE 1/4 of Sec. 9 ; T. 34 N; R. 6 [ ] E [X] W

(If applicable) - Gov't Lot - Grid Number

Civil Town Name: Grant

Street Address of Well: -

City, Village: Ladysmith

Date of Abandonment: 3-24-88

(2) FACILITY NAME

Original Well Owner (If Known): Kennecott

Present Well Owner: Same

Street or Route: 1515 Mineral Square

City, State, Zip Code: Salt Lake City, UT 84112

Well Number and/or Name (If Applicable): TW-K6

Reason For Abandonment: Well was caved from 183 to 60 feet

WELL/DRILLHOLE INFORMATION

(3) Original Well/Drillhole Construction Completed on (Date) 3-7-88

[X] Water Well [ ] Drillhole

Construction Report Available? [X] Yes [ ] No

Construction Type:
[X] Drilled [ ] Driven (Sandpoint) [ ] Dug
[ ] Other (Specify)

Well Type:
[ ] Unconsolidated Formation Well [XX] Bedrock Well

Total Well Depth (ft.) 183' Casing Diameter (ins.) 6"

Casing Depth (ft.) 60'

Was Well Annular Space Grouted? [X] Yes [ ] No [ ] Unknown
If Yes, To What Depth? 43 Feet

(4) Depth to Water (Feet) 9

Pump & Piping Removed?	[ ] Yes	[ ] No	[X] Not Applicable
Liner(s) Removed?	[ ] Yes	[ ] No	[X] Not Applicable
Screen Removed?	[ ] Yes	[ ] No	[X] Not Applicable
Casing Left in Place?	[X] Yes	[ ] No	

If No, Explain

Was Casing Cut Off Below Surface?	[X] Yes	[ ] No
Did Sealing Material Rise to Surface?	[X] Yes	[ ] No
Did Material Settle After 24 Hours?	[ ] Yes	[X] No
If Yes, Was Drillhole Retopped?	[ ] Yes	[ ] No

(5) Required Method of Placing Sealing Material
[X] Conductor Pipe-Gravity [ ] Conductor Pipe-Pumped
[ ] Dump Bailer [ ] Other (Explain)

(6) Acceptable Sealing Materials
Neat Cement Grout; Concrete Grout; Concrete; Clay Slurry; (Sodium Bentonite Slurry)

(7) Kind of Sealing Material	From (Ft.)	To (Ft.)	No. Yards or Sacks Sealant	Mix Ratio or Mud Weight
Clayey cuttings	Surface	2'	-	-
Bentonite slurry	2	60'	1 bag	Approx. 50 lbs./50 gals.

(8) Comments:

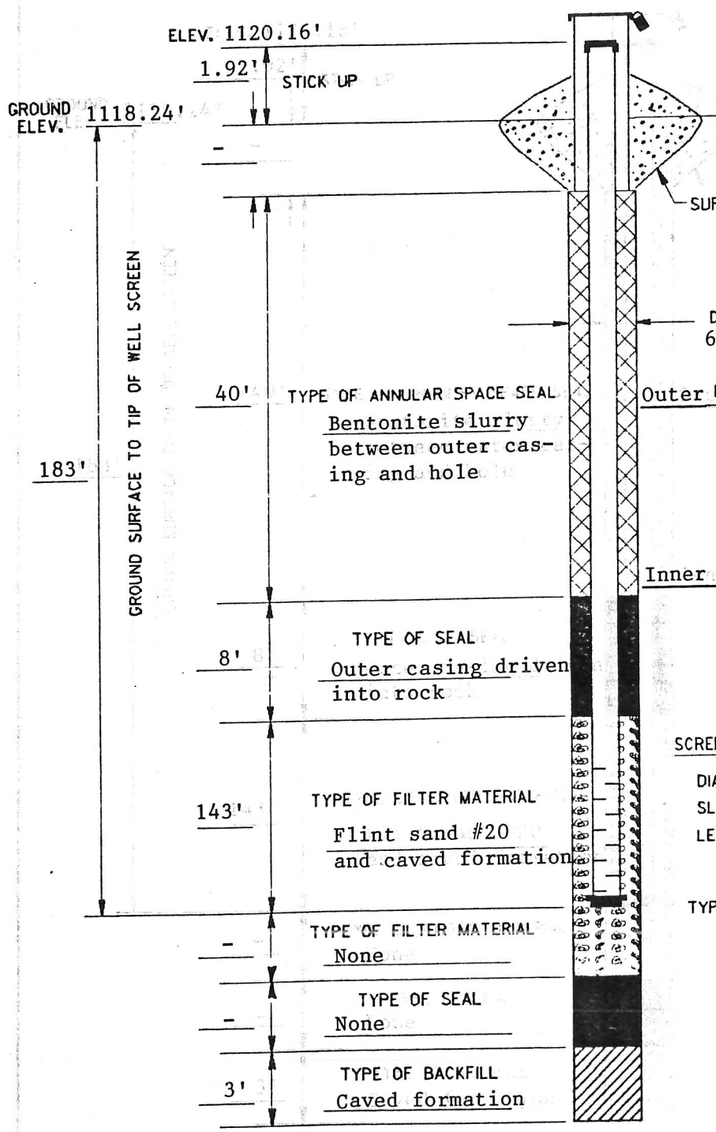
(9) Name of Person or Firm Doing Sealing Work: Luisier Drilling, Inc.
Signature of Person Doing Work: Keith Meyers
Date Signed:
Street or Route: 7391 Porcupine Lake Rd.
Telephone Number: (414) 829-5239
City, State, Zip Code: Lena, WI 54139

(10) FOR DNR OR COUNTY USE ONLY
Date Received/Inspected
District/County
Reviewer/Inspector
Follow-up Necessary

MONITORING WELL CONSTRUCTION DIAGRAM

WELL NO: TW-K6R
DATE INSTALLED: 3-24-88
DRILLER: Luisier Drilling, Inc.
DRILLING METHOD: Mud rotary, air

CLIENT: Kennecott
PROJECT: Rock permeability
SCOPE I.D.: 87K10-W.O. 66
BY: BJS



PROTECTOR PIPE:
SIZE 6"
MATERIAL Steel
LOCK NO. Master 3377

SURFACE SEAL MATERIAL -

DRILL HOLE DIAMETER 9" tricone 0-40'
6" down hole air hammer

TYPE OF ANNULAR SPACE SEAL
Bentonite slurry between outer casing and hole

TYPE OF SEAL
Outer casing driven into rock

TYPE OF FILTER MATERIAL
Flint sand #20 and caved formation

TYPE OF FILTER MATERIAL
None

TYPE OF SEAL
None

TYPE OF BACKFILL
Caved formation

Outer PIPE:
DIAMETER 6"
MATERIAL Steel
SCH. -
TYPE OF JOINTS Welded

Inner Pipe:
Diameter 4"
Material PVC
Sch. 40
Type of Joints Flush threaded

SCREEN:
DIAMETER 4"
SLOT SIZE 40
LENGTH 118' (alternating 10' lengths of screen and pipe)

TYPE OF CAP PVC

Note: TW-K6R was drilled about 15' south of TW-K6.
TW-K6 caved to 60 ft.

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

MONITORING WELL DEVELOPMENT

WELL NUMBER TW-K6R
WELL DIAMETER 4"
TOTAL DEPTH OF WELL 183'

DEPTH TO WATER	TIME OF MEASUREMENT
BEFORE 13.5'	8:30 a.m.
AFTER 175.7'	9:10 a.m.

CLIENT Kennecott
PROJECT Rock permeability
SCOPE I.D. 87K10-W.O. 66
BY BJS
DATE 3-25-88

DESCRIPTION OF DEVELOPMENT METHOD

Set 57 ft. of A-rod in the 4" PVC well and surged with air for 10 min.
Filled well with water twice.
Blew out dry.

VOLUME OF WATER REMOVED FROM WELL 250 gals.
CLARITY OF WATER IN WELL BEFORE DEVELOPMENT Red brn., silty
CLARITY OF WATER IN WELL AFTER DEVELOPMENT Red brn., silty
PRESENCE OF SEDIMENT AT THE BOTTOM OF THE WELL Silt
VOLUME OF WATER ADDED TO WELL 400 gals.
SOURCE OF WATER ADDED TO WELL On-site water supply well
TIME SPENT FOR DEVELOPMENT 1 hr.

STABILIZATION READINGS

GAL. REMOVED	TIME	FIELD TEMPERATURE	FIELD SPEC. COND.	FIELD pH

FOTH AND VAN DYKE

LOG OF TEST BORING NO.: TW-K7

CLIENT: Kennecott
PROJECT: Pit Inflow
PROJECT NUMBER: 87K10
LOCATION: River Pillar
COORDINATES: 39896.18 N 38813.28 E

SURFACE ELEVATION: 1098.18
BORING DEPTH: 31'
DATE: 09/20/88

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N Sec	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLING NOTES
1098.2	--0									
	-	1-3	SB	1	P	2.0	Brown poorly graded SAND, fine, loose w/ roots & organics, dry, (very fine aeolian sand), boulders at 3 feet	SP		
1093.2	--5	5-7	SB	2	P	1.5	5-5.5 Lt. brown poorly graded SAND fine with coarse gravel (cobble). 5.5-6 Red brown silty SAND, fine, diamict. 6-6.5 Red brown well graded gravel, fine to coarse w/red brown silty SAND	SP, SM, GW		
1088.2	--10									
	-	10-12	SB	3	P	0.5	Well graded GRAVEL, cored granite			
	-	11-13	SB	4	20	2.0	Red brown (5YR 4/3) silty GRAVEL, well graded, coarse w/fine w/fine to coarse sand, well rounded gravel. Few 1" thick SP layers, much gravel, boulders to 15'	GM		
1083.2	--15									
	-	16-18	SB	5	20	2.0	Red brown (5YR 4/3) poorly graded SAND, fine, laminated, saturated	SP		
1078.2	--20	20-22	SB	6	20	0.5	Black (10YR 2/1) well graded GRAVEL w/ silt, coarse with fine, stained with few brown yellow mottles (10YR 6/8), dense, little sand	GW-GM	Pump Test Permeability: K=5.4 x 10E-3 cm/sec K=4.3 x 10E-3 cm/sec (recovery)	Many cobbles, boulders, 20-30 feet.
1073.2	--25	25-27	SB	7	80	1.0	Same as above except yellow brown with little black mottling			
1068.2	--30	30-32	SB	8	85	1.3	Top 0.3' gravel as above, dark red brown (2.5YR 2.5/4) and yellow brown (10YR 5/6) SILT, color laminated, soft, brittle (altered schist) w/ broken very hard chert layers	ML (2a)		
1063.2	--35						31.0'-End of Boring			
1058.2	--40									
1053.2	--45									
1048.2	--50									
1043.2	--55									

DRILLING DATA

START DATE: 09/20/88
COMPLETION DATE: 09/20/88
LOGGED BY: BJS
DRILLING METHOD: Air to 10 feet, mud rotary to 31 feet, 6" bit
DRILLING CONTRACTOR: Luisier Well Drilling, Inc.

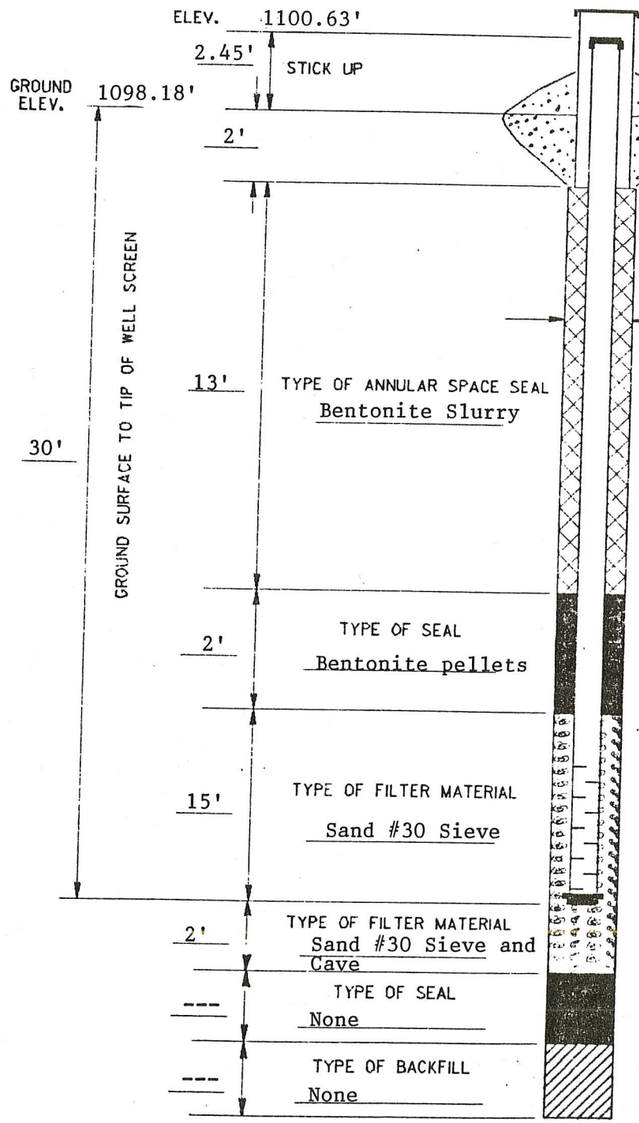
WATER LEVEL INFORMATION

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

MONITORING WELL CONSTRUCTION DIAGRAM

WELL NO: TW-K7
DATE INSTALLED: 9-21-88
DRILLER: Luisier Drilling, Inc.
DRILLING METHOD: Air/Mud Rotary
COORDINATES: 39912.28N 38, 811.98E

CLIENT: Kennecott
PROJECT: Pit Inflow
SCOPE I.D.: 87K10
BY: BJS



PROTECTOR PIPE:
SIZE 6"
MATERIAL steel
LOCK NO. 2121

SURFACE SEAL MATERIAL cement

DRILL HOLE DIAMETER 9"
reamed hole from 6 to 9 inches.

TYPE OF ANNULAR SPACE SEAL
Bentonite Slurry

PIPE:
DIAMETER 4"
MATERIAL PVC
SCH. 40
TYPE OF JOINTS Flush/threaded

TYPE OF SEAL
Bentonite pellets

TYPE OF FILTER MATERIAL
Sand #30 Sieve

SCREEN:
DIAMETER 4"
SLOT SIZE 0.04"
LENGTH 10

TYPE OF FILTER MATERIAL
Sand #30 Sieve and Cave

TYPE OF SEAL
None

TYPE OF BACKFILL
None

TYPE OF CAP PVC-flat

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

MONITORING WELL DEVELOPMENT

WELL NUMBER TW-K7 CLIENT Kennecott

WELL DIAMETER 4" PROJECT Pit Inflow

TOTAL DEPTH OF WELL 30' SCOPE I.D. 87K10

DEPTH TO WATER TIME OF MEASUREMENT BY BJS

BEFORE --- --- DATE 9-21-88

AFTER --- ---

DESCRIPTION OF DEVELOPMENT METHOD

Surged with air from 11:39 to 11:42 a.m. Blew out about 4 gpm from 11:42 to 11:52 a.m. Jetted moving drill rod up and down in well from 11:52 to 11:55 a.m. Produced v. dk red brn silty water. Blew out about 7 gpm from 11:55 to 12:06 p.m. Surged at 12:06 p.m. Continued to blow out to 12:25 p.m. Surged at 12:26 p.m. Water dk brn, v. silty. Continued to blow out about 7 gpm. Jetted at 12:40 p.m. Surged at 12:53 p.m. Blew out 1:22 p.m. Water clear, v. pale brn.

VOLUME OF WATER REMOVED FROM WELL 200 gallons

CLARITY OF WATER IN WELL BEFORE DEVELOPMENT V. dark red brn. silty

CLARITY OF WATER IN WELL AFTER DEVELOPMENT V. pale brown

PRESENCE OF SEDIMENT AT THE BOTTOM OF THE WELL slightly silty

VOLUME OF WATER ADDED TO WELL none

SOURCE OF WATER ADDED TO WELL ---

TIME SPENT FOR DEVELOPMENT 45 Minutes

STABILIZATION READINGS

GAL. REMOVED	TIME	FIELD TEMPERATURE	FIELD SPEC. COND.	FIELD pH

FOTH AND VAN DYKE

LOG OF TEST BORING NO.: PZ-K8

CLIENT: Kennecott
PROJECT: Pit Inflow
PROJECT NUMBER: 87K10
LOCATION: River Pillar
COORDINATES: 39840.93 N 38905.02 E

SURFACE ELEVATION: 1099.70
BORING DEPTH: 27'
DATE: 09/21/88

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N Sec	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLING NOTES
1099.7	--0	1-3	SB	1	P	2.0	Brown poorly graded SAND w/silt, fine, dense, loose, top 6" w/organics (topsoil). (Windblown sand)	SP-SM		Many boulders, cobbles from 3 to 6 feet.
1094.7	--5	6-8	SB	2	10	1.5	Red brown silty SAND, fine-coarse w/fine and coarse gravel, diamict. Top 6" cored cobble, well graded GRAVEL w/silt, fine-coarse gravel	SM, GW-GM		
1089.7	--10	10-12	SB	3	30	1.0	Red brown silty GRAVEL/SAND, coarse gravel w/fine to coarse, matrix supported gravel, cohesive, dense. Cuttings at 14', SILT, (Precambrian)	GM/SM		
1084.7	--15	15-17	SB	4	30	2.0	Light yellow, red brown SILT and silty SAND, very brittle, soft to hard, little moisture (Altered schist)		Bail Test Permeability: K=1.2 x 10E-5 cm/sec	
1079.7	--20	20-22	SB	5	70	2.0	As above	SM and ML		
1074.7	--25	25-27	SB	6	80	2.0	Dusky red w/ white SILT and silty SAND as above, last 8" mostly very pale green w/ bright green and white sugary (quartz?) laminae 27.0'-End of Boring			
1069.7	--30									
1064.7	--35									
1059.7	--40									
1054.7	--45									
1049.7	--50									
1044.7	--55									

DRILLING DATA

START DATE: 09/21/88
COMPLETION DATE: 09/21/88
LOGGED BY: BJS
DRILLING METHOD: Mud Rotary, 6" bit
DRILLING CONTRACTOR: Luisier Well Drilling, Inc.

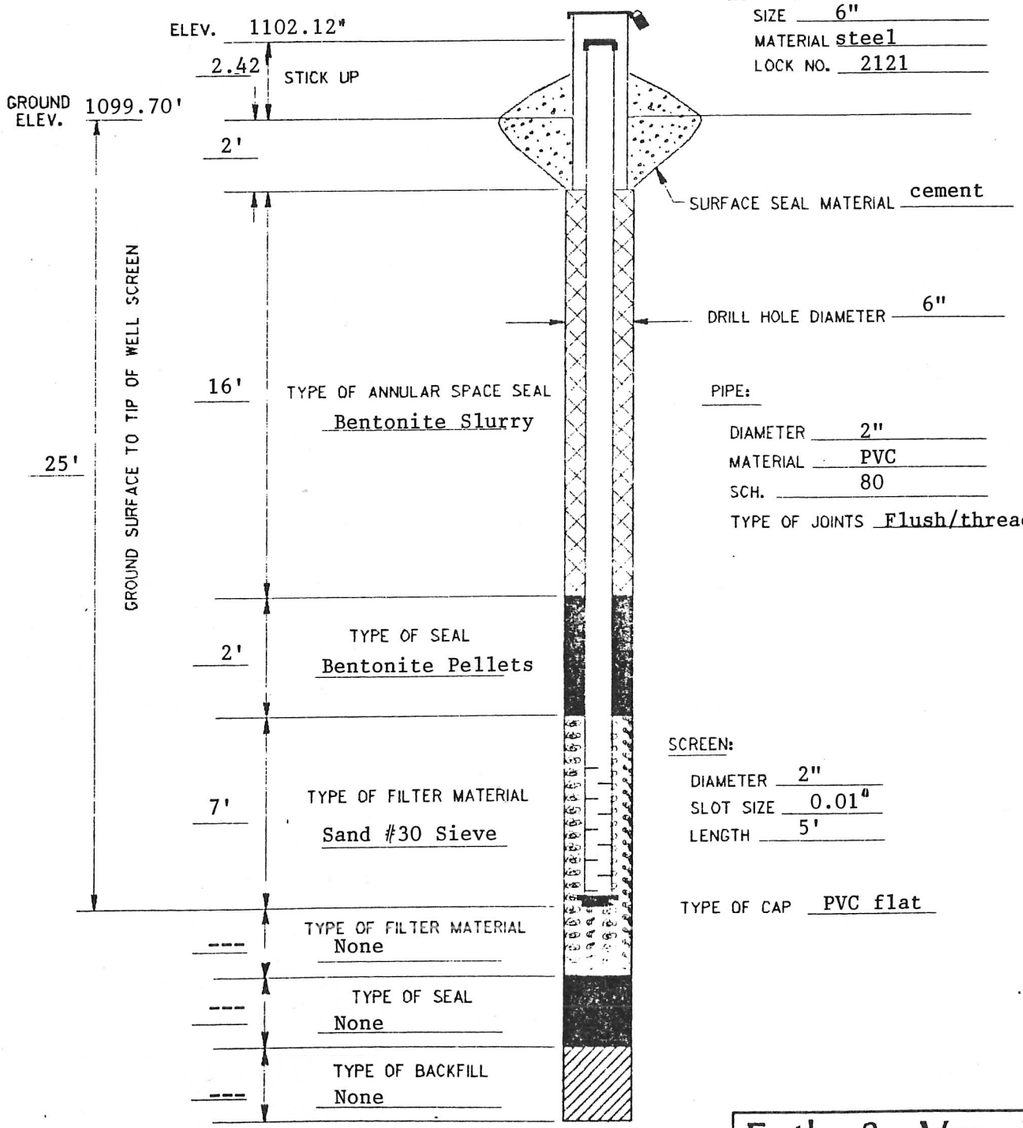
WATER LEVEL INFORMATION

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

MONITORING WELL CONSTRUCTION DIAGRAM

WELL NO: PZ-K8
DATE INSTALLED: 9-21-88
DRILLER: Luisier Drilling, Inc.
DRILLING METHOD: Mud Rotary
COORDINATES: 39,855.80N 38902.96E

CLIENT: Kennecott
PROJECT: Pit Inflow
SCOPE I.D.: 87K10
BY: BJS



PROTECTOR PIPE:
SIZE 6"
MATERIAL steel
LOCK NO. 2121

SURFACE SEAL MATERIAL cement

DRILL HOLE DIAMETER 6"

TYPE OF ANNULAR SPACE SEAL
Bentonite Slurry

PIPE:
DIAMETER 2"
MATERIAL PVC
SCH. 80
TYPE OF JOINTS Flush/threaded

TYPE OF SEAL
Bentonite Pellets

TYPE OF FILTER MATERIAL
Sand #30 Sieve

SCREEN:
DIAMETER 2"
SLOT SIZE 0.01"
LENGTH 5'

TYPE OF CAP PVC flat

TYPE OF FILTER MATERIAL
None

TYPE OF SEAL
None

TYPE OF BACKFILL
None

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

MONITORING WELL DEVELOPMENT

WELL NUMBER PZ-K8
WELL DIAMETER 2"
TOTAL DEPTH OF WELL 25'

DEPTH TO WATER	TIME OF MEASUREMENT
BEFORE 3.3'	6:45 p.m.
AFTER 11.5'	7:19 p.m.

CLIENT Kennecott
PROJECT Pit Inflow
SCOPE I.D. 87K10
BY BJS
DATE 9-21-88

DESCRIPTION OF DEVELOPMENT METHOD

Surged and bailed with PVC hand bailer.

VOLUME OF WATER REMOVED FROM WELL 23 gallons
CLARITY OF WATER IN WELL BEFORE DEVELOPMENT lt. red brn. slightly silty
CLARITY OF WATER IN WELL AFTER DEVELOPMENT lt. red brn.
PRESENCE OF SEDIMENT AT THE BOTTOM OF THE WELL slightly silty
VOLUME OF WATER ADDED TO WELL None
SOURCE OF WATER ADDED TO WELL ---
TIME SPENT FOR DEVELOPMENT 30 Minutes

STABILIZATION READINGS

GAL. REMOVED	TIME	FIELD TEMPERATURE	FIELD SPEC. COND.	FIELD pH

FOTH AND VAN DYKE

LOG OF TEST BORING NO.: TW-K17B

CLIENT: Kennecott
PROJECT: Pit Inflow
PROJECT NUMBER: 87K10
LOCATION: River Pillar at ST-9-17A
COORDINATES: 39943.30 N 38746.81 E

SURFACE ELEVATION: 1099.99
BORING DEPTH: 46'
DATE: 09/19/88

MSL ELEV	DEPTH FR LND SURF	SAMP DEPTH INTERVAL	TYPE	#	N Sec	REC (ft)	DESCRIPTION OF MATERIAL	CLASS	LABORATORY TESTS	DRILLING AND SAMPLING NOTES
1100.0	--0									
		1-3	SB	1	P	2.0	Str. brown (7.5YR 4/6) poorly graded SAND w/silt, fine, very slightly moist, indistinctly laminated, boulders starting at 3'	SP-SM		
1095.0	--5	5-6.5	SB	2	P	1.5	Dk red brown (5YR 3/4) silty clayey SAND, fine-coarse w/fine coarse gravel, stiff, moist coarse gravel diamict, brittle to cohesive, very well rounded gravel at 10-12 feet	SC-SM		
1090.0	--10	10-12	SB	3	P	2.0	Str. brown well graded SAND, fine to coarse w/much coarse gravel. At 11.5' poorly graded SAND, fine laminated, saturated at tip of barrel	SW / SP		
1085.0	--15	15-17	SB	4	P	2.0	Red brown well graded SAND w/silt w/layers coarse (1" diam) rounded gravel, saturated, dense. At 16', str. brown silty clayey SAND, fine to coarse w/fine and coarse gravel, indistinctly stratified	SW-SM, SC-SM		
1080.0	--20						diamict, cohesive, dense			
		20-20.5	SB	5	P	0.5	Red brown diamict, as above			
		20-23	SB	5A	P	0.3	Same, stratified diamict			
		24-26	SB	6	30	2.0	Dark brown (7.5YR 4/4) silty GRAVEL/SAND, mottled, well graded, fine, coarse gravel, rounded and broken, fine-coarse sand, w/clay. At 25', dark brown (7.5YR 4/4) poorly graded SAND, fine, loose	GM/SM		
1075.0	--25									
1070.0	--30	30-32	SB	7	30	2.0	Silty GRAVEL/SAND, as above			
1065.0	--35	35-37	SB	8	85	1.0	35-35.5' red brn. silty SAND, fine well graded, diamict. 35.5-36' well graded GRAVEL, fine & coarse w/fine to coarse sand, w/much dark gray staining. Lt. pink granite cobble (2") coned in tip of barrel	GW	Pump Test Permeability: K=5.9 x 10E-3 cm/sec (drawdown) K=7.1 x 10E-3 cm/sec (recovery)	
1060.0	--40	40-42	SB	9	45	0.0	Cuttings, fine gravel, rounded	GW		
		43-46	SB	10	50	3.0	Dark yellow brown (10YR 4/6) well graded GRAVEL w/silt, fine and coarse gravel, fine to coarse sand w/clay, very dense w/black staining (10YR 2/1) in irregular layers At 45 ' weak red (2.5YR 4/2) and dusky red (2.5YR 2.5/2) silty GRAVEL (Altered schist, fractured) w/sand and fine gravel along fractures. Soft to cohesive, brittle, relict schistocity apparent	GM		
1055.0	--45									
1050.0	--50									
1045.0	--55						46.0'-End of Boring			

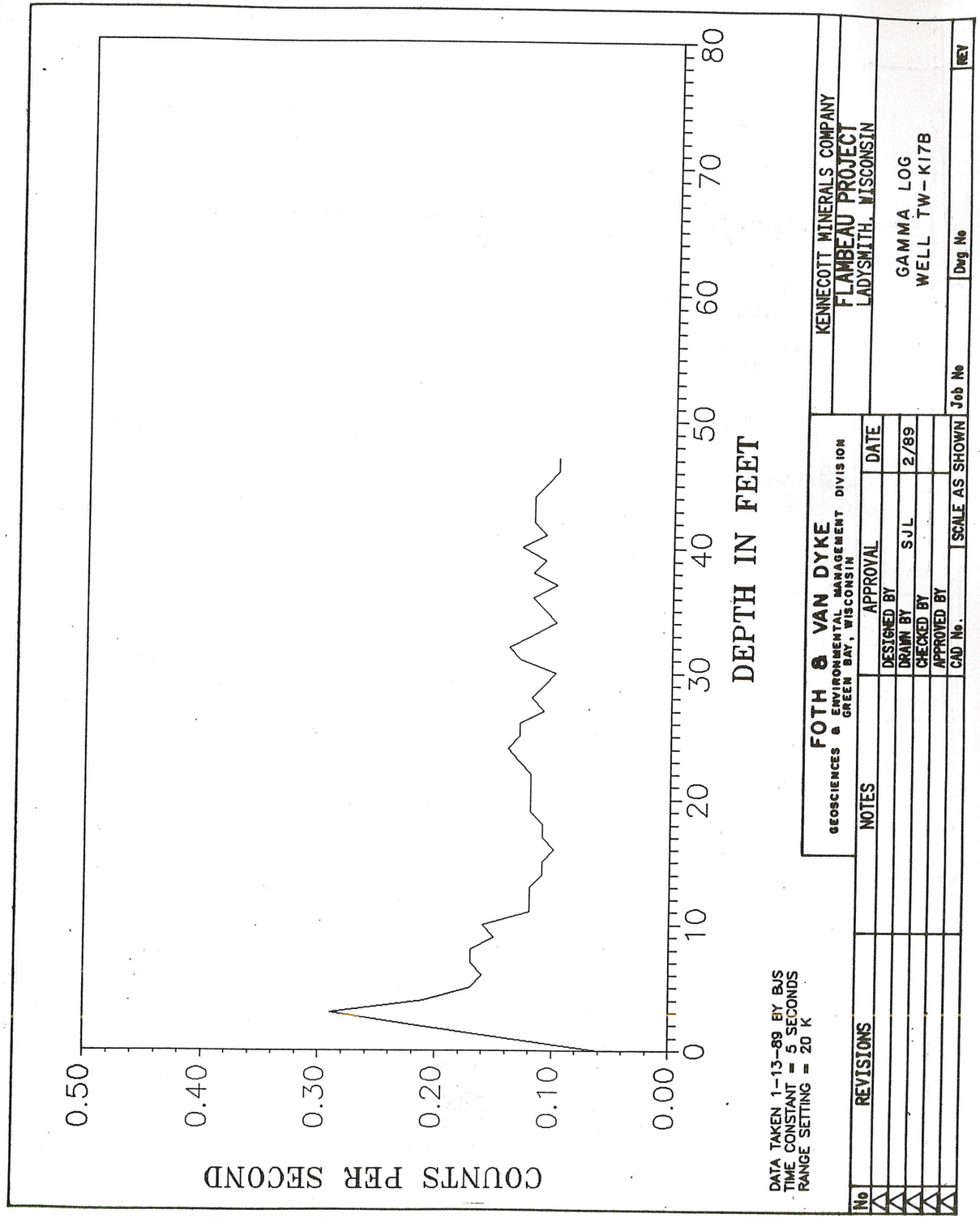
P - Split barrel sampler was pushed or sampler was driven with an air hammer for length of time as indicated.

DRILLING DATA

START DATE: 09/19/88
COMPLETION DATE: 09/19/88
LOGGED BY: BJS
DRILLING METHOD: Air to 15 feet, Mud Rotary to 46 feet, 6" bit
DRILLING CONTRACTOR: Luisier Well Drilling, Inc.

WATER LEVEL INFORMATION

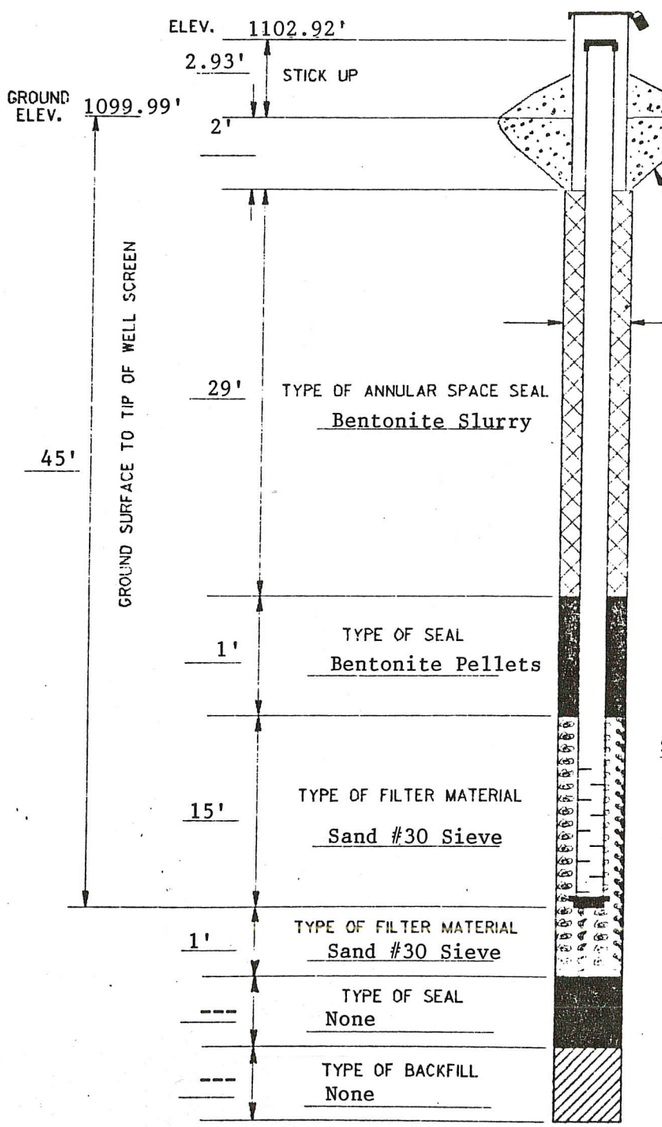
DEPTH AT COMPLETION:
LATER TIME/DEPTH:
LATER TIME/DEPTH:
CAVE IN DEPTH:
DRILLING LOSSES:



MONITORING WELL CONSTRUCTION DIAGRAM

WELL NO: TW-K17B
DATE INSTALLED: 9-20-88
DRILLER: Luisier Drilling, Inc.
DRILLING METHOD: Air/Mud Rotary
COORDINATES: 39,960.29N 38,746.15E

CLIENT: Kennecott
PROJECT: Pit Inflow
SCOPE I.D.: 87K10
BY: BJS



PROTECTOR PIPE:
SIZE 6"
MATERIAL steel
LOCK NO. 2121

SURFACE SEAL MATERIAL cement

DRILL HOLE DIAMETER 9"
Reamed hole from 6 to 9 inches.

TYPE OF ANNULAR SPACE SEAL
Bentonite Slurry

PIPE:
DIAMETER 4"
MATERIAL PVC
SCH. 40
TYPE OF JOINTS Flush/threaded

TYPE OF SEAL
Bentonite Pellets

SCREEN:
DIAMETER 4"
SLOT SIZE 0.04"
LENGTH 10'

TYPE OF FILTER MATERIAL
Sand #30 Sieve

TYPE OF CAP PVC flat

TYPE OF FILTER MATERIAL
Sand #30 Sieve

TYPE OF SEAL
None

TYPE OF BACKFILL
None

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MONITORING WELL DEVELOPMENT

WELL NUMBER TW-K17B
WELL DIAMETER 4"
TOTAL DEPTH OF WELL 45'

DEPTH TO WATER	TIME OF MEASUREMENT
BEFORE ---	---
AFTER ---	---

CLIENT Kennecott
PROJECT Pit Inflow
SCOPE I.D. 88K10
BY BJS
DATE 9-20-88

DESCRIPTION OF DEVELOPMENT METHOD

Surged with air starting at 4:55 p.m. to 5:00 p.m.
Blew out about 15 gpm from 5:00 to 5:08 p.m.
Jetted with air while pulling drill rod up and down in sand packed interval.
Jetted from 5:08 to 5:16 p.m. Blew out about 20 gpm from 5:16 to 5:23 p.m.
On 9-21-88 pumped out about 800 gallons at about 15 gpm.

VOLUME OF WATER REMOVED FROM WELL 400 gallons
CLARITY OF WATER IN WELL BEFORE DEVELOPMENT lt red brn, silty
CLARITY OF WATER IN WELL AFTER DEVELOPMENT clear
PRESENCE OF SEDIMENT AT THE BOTTOM OF THE WELL none
VOLUME OF WATER ADDED TO WELL none
SOURCE OF WATER ADDED TO WELL ---
TIME SPENT FOR DEVELOPMENT 30 Minutes

STABILIZATION READINGS

GAL. REMOVED	TIME	FIELD TEMPERATURE	FIELD SPEC. COND.	FIELD pH

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