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FEDERAL FACILITY COMPLIANCE AGREEMENT (FFCA) - FEED MATERIALS PRODUCTION CENTER - RI/FS PROGRESS REPORT FOR MAY 1989

06/28/89

DOE-1199-89
DOE-FN USEPA
200
REPORT

Department of Energy
Oak Ridge Operations
P.O. Box 2001
Oak Ridge, Tennessee 37831—

6496

June 28, 1989
DOE-1199-89

Chief, Environmental Review Branch
U. S. Environmental Protection Agency
John C. Kluezynski, Federal Building, 5HE-14
230 South Dearborn Street
Chicago, Illinois 60604

Dear Sir:

FEDERAL FACILITY COMPLIANCE AGREEMENT (FFCA) - FEED MATERIALS PRODUCTION CENTER - RI/FS PROGRESS REPORT FOR MAY 1989

Enclosed please find the monthly RI/FS Progress Report for the period ending May 31, 1989. The report updates DOE activities in the RI/FS.

Please contact Mary Stone at FTS 774-6656, if you have any questions concerning the report provided herein.

Sincerely,

James A. Reafsnyder
FMPC Site Manager

DP-84:Stone

Enclosure: As stated

cc w/o encl:

Ben Wilmouth, ODH
Tom Winston, OEPA-Dayton
Graham Mitchell, OEPA-Dayton
Catherine McCord, USEPA-5

bcc w/o encl:

William R. Bibb, DP-80, ORO
James L. Foutch, CC-10, ORO
Larry Sparks, SE-31, ORO
Ray P. Berube, EH-24, FORS
Thomas B. Hindman, DP-12, GTN
Charles G. Halsted, DP-13, GTN
Alan Van Norman, CRA
Bob Conner, WMCO

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6496

REMEDIAL INVESTIGATION

AND

FEASIBILITY STUDY

MONTHLY TECHNICAL PROGRESS REPORT

MAY 1989

FEED MATERIALS PRODUCTION CENTER
FERNALD, OHIO

000003

Attachment to:

FMPC SITEWIDE RI/FS
May 1989
MONTHLY TECHNICAL PROGRESS REPORT

STATUS

General

Progressive actions continued on the FMPC sitewide RI/FS during May 1989. The installation of 10 off-site wells is on hold pending site access. Three auger rigs are currently in operation. Two auger rigs are being used for the Facility Testing program and one was used to complete borings in Paddy's Run for geochemical testing.

The quarterly groundwater sampling program continued during the month of May. For this quarterly sampling period, a total of 48 wells are scheduled for sampling. This includes the 19 off-site wells, the 24 well-program, three of the ten well program and two facility testing wells. Wells where quarterly samples have been collected four consecutive times are no longer being sampled.

Of the 48 wells scheduled for sampling this quarter, 16 were sampled in April and 25 in May. The seven remaining wells will be sampled in June.

Task 1 - Description of Current Situation

Task 1 Percent Complete: 100%

Task 2 - Remedial Investigation Work Plan Requirements

Reponses to the Facility Testing Work Plan comments were developed in May. At the May TIE Meeting, June 8, 1989 was agreed to as the date to review the responses with U.S. EPA and OEPA.

Task 2 Percent Complete: 95%

Task 3 - Site Investigation

Transit Survey - Surveying activities continued on establishing the horizontal and vertical coordinates of the completed wells, piezometers, and borings.

Facility Testing - During May, 32 soil borings were completed in Sectors 1 and 2. Piezometers were installed within the 28 borings where groundwater was encountered. Water yielding zones were not observed within the remaining four borings, 1132, 1168, 1170 and 1238; consequently, these four borings were plugged and abandoned.

As part of the drilling and logging operation, instrumentation was used to obtain chemical and radiological field measurements on all soils removed from each boring. In general, HNu measurements did not exceed background values (0 to 0.2 ppm) with the exception of boring 1132. At this boring, a value of 5 ppm was recorded for the 5 to 6 foot depth interval.

Radiological field measurements were generally 0 cpm for Alpha and 60 to 200 cpm for Beta-Gamma at most boring locations. Notable exceptions include an Alpha value of 10 cpm at 4 to 5 feet in boring 1237 and maximum values of 1500 to 1800 cpm at 0 to 1 feet in boring 1220; 8000 cpm at 0 to 1 feet in boring 1199; 1000 cpm at 0 to 1 feet in boring 1238 and 1000 to 1400 cpm at 0 to 1 feet in boring 1244.

Table 3-3 provides physical data in the borings and piezometers installed during the month of May.

Plant 6 borings were originally scheduled to commence on April 25, 1989. The revised anticipated start date for these borings is June 5, 1989.

Biological Resources - The Acute and Chronic Toxicity and Benthos studies of the FMPC are continuing. The biological resources studies will be correlated to comply with NEPA requirements. Public meeting comments will also be addressed in this correlation.

The Miami University study is presently undergoing peer review by the Advisory Committee with release anticipated in July. The issue involving uranium uptake in cattle is also deferred until July when the results of the May 15 meeting will be presented at the July 18 TIE meeting.

Task 3 Percent Complete: 97%* through Rev 3
62%* post Rev 3

*does not include Facilities Testing

Well Installation

One cable tool rig was in operation in early May to complete Well 2006. No wells were developed in May. Table 3-1 lists the well that was completed.

Table 3-1

Well Drilling Progress

Well No.	Date	Well Depth
2006	5/3/89	69.7

Ground Water Sampling

The fifth quarterly round of ground water sampling continued with the sampling of 25 of the 48 wells. They are listed in Table 3-2. Sample collection for wells included in round five is expected to be completed by June 8, 1989.

Table 3-2

Wells Sampled During May 1989

Well #	Date Sampled
4014	5/1
4016	5/1
3049	5/1
2045	5/1
2047	5/2
2048	5/2
2107	5/3
3107	5/3
4067	5/3
2097	5/8
3097	5/8
4097	5/8
2046	5/10
2049	5/10
4064	5/24
1064	5/24 and 5/25
3127	5/24
2127	5/24
2098	5/25
3098	5/25
3065	5/31
2108	5/31

Table 3-3

Facility Testing Borings and
Piezometer Installations

May 1989

Boring #	Comp. Date	Piezometer Installed Y/N	Boring Depth/Ft.	Well Depth/Ft.
1130	5/1	Y	10.0	10.0
1131	5/15	Y	7.5	7.5
1132	5/1	N	20.0	NA/Dry
1134	5/4	Y	16.5	15.8
1167	5/3	Y	12.0	10.0
1168	5/2	N	20.0	NA/Dry
1170	5/11	N	20.0	NA/Dry
1176	5/8	Y	12.0	12.0
1199	5/25	Y	18.0	18.0
1200	5/16	Y	16.5	16.5
1201	5/24	Y	13.5	13.5
1202	5/22	Y	16.5	16.0
1203	5/24	Y	16.5	16.5
1207	5/15	Y	9.0	9.0
1210	5/3	Y	10.5	10.5
1211	5/16	Y	10.5	10.5
1218	5/2	Y	10.5	10.5
1219	5/14	Y	12.0	11.5
1220	5/25	Y	20.0	19.6
1224	5/22	Y	20.0	20.0
1227	5/14	Y	12.0	12.0
1228	5/25	Y	15.0	15.0
1229	5/1	Y	12.5	12.5
1230	5/12	Y	20.0	18.0
1236	5/14	Y	13.5	13.3
1237	5/12	Y	15.0	15.0
1238	5/15	N	20.0	NA/Dry
1240	5/11	Y	13.5	13.4
1241	5/11	Y	15.5	15.5
1242	5/10	Y	15.0	15.0
1243	5/10	Y	13.5	13.0
1244	5/8	Y	15.0	15.0

Geochemical Sampling Program

The Geochemical sampling program was initiated in May. Five of the six proposed borings in Paddy's Run and the Storm Water Outfall Ditch were completed. Table 3-4 provides data on these borings. Surface water sampling for the Geochemical Program was also completed during May.

Table 3-4

Geochemical Program Borings

Completed May 1989

Boring #	Comp. Date	Boring Depth
S-2	5/16	17.0
S-3	5/16	9.0
P-3	5/16	6.0
P-3 (Redrill)	5/22	20.0
S-1	5/24	34.0
P-1	5/31	20.0

Preliminary geochemical species modeling is underway.

Work planned for June includes: U^{+4}/U^{+6} (Uranium Ionic State) ground water sampling, completing the final boring in Paddy's Run, selection of air deposition boring sites and preliminary estimates of aquifer Kd values.

Task 4 - Site Investigation Analysis

Accomplishments:

Database - Emphasis continued on level 1 verification of sampling data. Data from round 4 were added to the ongoing effort on rounds 1-3. Programming was finalized to ensure that users receive consistent reporting units for all parameters, and this part of the effort is closed.

Database set-up was completed for the Facilities Testing Program field data. Arrangements were made to receive and upload laboratory results to the master system.

Data entry for new borings and wells and their survey information continued.

Groundwater sampling data for rounds 1 through 4, both radiological and chemical, will be supplied to USEPA and OEPA (GeoTrans) on June 30, 1989.

Groundwater Modeling - The 3D flow model construction quality assurance checks are almost complete. The 3D transport model has also been constructed and the quality assurance checks are almost complete. Calibration of the flow model is nearly complete using sitewide data.

During June the 3D flow model calibration will continue using sitewide data. The 3D transport model calibration will be initiated and the QA for the models will be finished. Preliminary flow model runs for the FS will begin. The lack of south plume wells will limit the model to regional data which will decrease the accuracy of the model prediction in the south plume study area.

Risk Assessment - The Risk Assessment (RA) for the FMPC RI is proceeding on operable units 4 and 6 for both radiological and chemical contaminants.

For Operable Unit 6, preliminary modeling of radiological exposure pathways from wells to receptor(s) has been developed. The modeling approach will enable expedited calculations using radionuclide concentrations obtained from additional well monitoring data and calculated concentrations for the ground water model, following its calibration.

Tasks 5 - Laboratory & Benchscale Studies,

With the exceptions of WMCO work on the K-65 silos, no additional activity since the last report has occurred. WMCO input is unavailable at this time.

Task 6 - RI Reports

The RI report is underway for Operable Unit 6 with the initiation of a compilation of the existing data (excluding the seven off-site wells that have not been drilled), transferring the data to maps and development of a report outline.

Task 7 - Program Management and Reports

7.1 Program Management

Section 6.0 of the Workplan, Management Plan, is in process of being revised with submittal to USEPA in July.

7.2 Quality Assurance

The quality assurance activities for the month of May 1989 were categorized into general areas.

- Continued effort for closing of open audits, surveillances and nonconformances.
- Maintain field Quality Assurance on field activities through monitoring and surveillances.
- Audit/Surveillance schedule issued.

7.3 Health and Safety

- All workers continue to be monitored for exposures to chemicals and radioactive materials during RI/FS operations. All monitoring results continue to remain well below recommended action guides and applicable limits.
- The new urine sampling schedule showing urine samples collected from every field employee at the end of each 10-day work period continues to show results less than 5 ug/l (WMCO's detection level). No positive results were obtained during April. Over 100 samples were analyzed.

- Health and Safety support has been ongoing for water sampling operations and the Facilities Testing Phase of the RI/FS.

- Extensive planning for drilling operations in Plant 6 have been conducted with WMCO to ensure worker safety and health. Review of underground piping, conduits, and lines have been completed. Radiological, industrial hygiene, and general safety surveys will be completed prior to the initiation of work. Electrical power as well as process lines will be locked out during drilling. Also to minimize damage to underground lines, a WMCO subcontractor surveyed proposed areas to pinpoint drilling locations.

- Work is being done on 2nd shift to permit electrical power to the building to shut down thus ensuring electrical safety.

Task 8 - Community Relations Support

Accomplishments

1. A Public Meeting to inform the community of the progress of the FMPC RI/FS was held May 15, 1989 at the Ross Middle School.

2. Coordinated technical input for and wrote responses to questions written on comment cards received at the meeting.

3. Prepared for review a draft of questions and answers recorded on the flip chart during the meeting.

4. Began preparing the final report of the meeting.

5. Began transcribing the videotape of the meeting.

Planning commenced on the community assessment interview form.

Task 10 - Feasibility Study Work Plan

The Feasibility Study Work Plan was submitted to the USEPA and OEPA on August 15, 1988. Comments have not been received from either OEPA or USEPA.

Task 10 Percent Complete: 100%

Task 11 - Remedial Technology Alternatives

The Remedial Technology Alternatives Report was submitted to USEPA on December 16, 1988. Comments have not been received from either OEPA or USEPA.

Task 11 Percent Complete: 100%

Task 12 - Initial Screening of Alternatives

Operable Unit 1 - Schedule and manpower loading by sub-task have been established.

Operable Unit 4 - Two meetings were held at the Fernald location with technical personnel of WMCO, to exchange information and ideas on the most likely alternatives for the remediation of the K-65 silos. A briefing will be held for both OEPA and USEPA on July 18, 1989.

Operable Unit 6 - The initial screening of alternative was concluded during this period. A briefing will be held for both OEPA and USEPA on July 18, 1989.

The lack of the south plume wells limit plume definition and reliability of the ground water model predictions.

PLANNED ACTIVITIES FOR NEXT MONTH

- Conduct seep sampling,
- Continue sampling to support geochemical study,
- Continue Facilities Testing Program, and
- Complete Initial Screening of Alternatives on K-65.
- Continue the South Plume FS.

ATTACHMENT 1

FERNALD RI/FS

6498

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602-3.7.1	PROJECT NAME: Facilities Testing Program	
BORING NUMBER: 1134	COORDINATES:	DATE: 5-3-87
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5-3-87
ENGINEER/GEOLOGIST: L. Sinfield	Depth Date/Time	DATE COMPLETED: 5-4-87
DRILLING METHODS: B-53 Hollow Stem Auger with Split Spoon Auger		PAGE 1 OF 5

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
							Start = 1520
0.5	15627 WMCO	7	12in	Dark Yellowish Brown (10YR, 4/4) Lean clay, CL - Hard, abundant roots ~~at top~~ 5-3-89. Dry @ 1525	CL	4.5 TSF	HNU = ø ppm; α = ø cpm; Bγ = 160-200 cpm
1.0	15628	5					
1.5	15629 NR	6					
2.0	15630	7	6in	Very Stiff Light Brownish Gray (10YR, 6/2) Clay, CL - Dry, massive, mottled, rare roots, lean with some silt. @ 1530	CL	2.1 to 2.5 TSF	HNU = ø ppm; α = ø cpm; Bγ = 120-160 cpm
2.5	15631 NR WMCO	5					
3.0	15632 NR	10					
3.5	15633 NR	7	5in	Very Stiff to Hard, Dark Grayish Brown (10YR, 4/2) Clay, CL - Dry, mottled, massive medium plastic @ 1535	CL	2.6 to 4.5 TSF	HNU = ø ppm; α = ø cpm; Bγ = 120-140 cpm
4.0	15634 NR	9					
4.5	15635	10					
5.0	15636	4	3in	Stiff, Same as above 3.0-4.5ft @ 1540	CL	1.4 to 1.6 TSF	HNU = ø ppm; α = ø cpm; Bγ = 140-160 cpm
5.5	15637 NR WMCO	7					
6.0	15638 NR	3					
6.5	15639 NR	3	6in	Stiff, Dark yellowish Brown (10YR, 3/4), Medium Plastic Lean Clay, - Dry, massive, rare gravel. @ 1605	CL	1.2 TSF	HNU = ø ppm; α = ø cpm; Bγ = 140-180 cpm
7.0	15640 NR	6					
7.5	15641	7					

NOTES: Contractor: PennDrill
Driller: J. Saccani
Helper: G. Oye
Sample Tech: C. Melroy
Weather: Clear & Warm
HNU #: HH18

NR = No Recovery, No Sample Taken

Background @ 1500
HNU = ø ppm
α = ø cpm
Bγ = 200-240 cpm

4C2-11-86

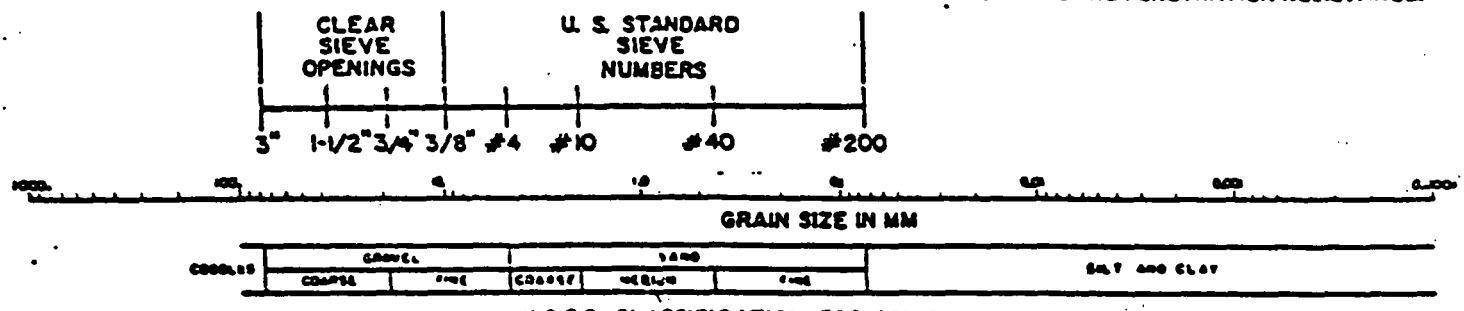
CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE(1)
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

(1) STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 18 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANCE.



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

FINE-GRAINED/HIGHLY ORGANIC SOILS

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENT

FERNALD RI/FS

6496

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602-3.2.1	PROJECT NAME: Facilities Testing Program	
BORING NUMBER: 1134	COORDINATES:	DATE: 5-3-87
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5-3-89
ENGINEER/GEOLOGIST: L. Sinfield	Depth Date/Time	DATE COMPLETED: 5-3-87
DRILLING METHODS: B-53-Hollow Stem Auger with Split Spoon Sampler		PAGE 2 OF 5

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
7.5	15642	5	15 IN	SOFT AT TOP TO HARD AT BASE, MOTTLED GRAY (10YR 6/1) to Brownish yellow (10YR 6/6) clay, med plastic, dry, massive @ 1610	CL	>4.5 TSF	Start= HNU= Ø ppm; α= Ø cpm; Bγ= 180-220 cpm
8.0	15643	10					
8.5	15644	15					
9.0	15645	10	6 IN	VERY STIFF, SAME AS ABOVE	CL	2.5 to 3.7 TSF	HNU= Ø ppm; α= Ø cpm; Bγ= 180-120 cpm
9.5	15646 NR	9		water developed in the borehole 10.25 ft			
10.0	15647 NR WMCO	9		5/3/89 @ 1615			
10.5	15648	4	18 IN	SATURATED, SAND, LOOSE BROWNISH YELLOW (10YR 6/6), MASSIVE Fine Sand 5/3/89 @ 1640	~~SW~~ SS Sm	5-3-89 Loose TSF	HNU= Ø ppm; α= Ø cpm; Bγ= 160-200 cpm
11.0	~~50649~~	6					
11.5	~~15644~~ 50649	9					
12.0	~~15650~~ 50650	9					
12.5	50651	4	18 IN	Same as above 12.0-13.5 ft 5/3/89 @ 1700	~~SW~~ SS Sm	5-3-89 Loose TSF	HNU= Ø ppm; α= Ø cpm; Bγ= 160-200 cpm
13.0	50652	6					
13.5	50653	6					
14.0	50654	5	18 IN	Same as Above 13.5-15.0 ft 5/4/89 @ 0930	~~SW~~ SS Sm	5-4-89 Loose TSF	HNU= Ø ppm; α= Ø cpm; Bγ= 160-200 cpm
14.5	50655	10					
15.0	50656	10					

NOTES: Contractor: Driller: Helper: Sample Tech: Weather: HNU#: See Page 1 of 5

5-4-89 Background @ 0930
HNU= Ø ppm
α= Ø cpm
Bγ= 160-200 cpm

Water Bearing Zone

4C2-11-86

FERNALD RI/FS

6496

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602-3.7.1	PROJECT NAME: Facilities Testing Program	
BORING NUMBER: 1134	COORDINATES:	DATE: 5/3/89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5/3/89
ENGINEER/GEOLOGIST: L. Sinfield	Depth Date/Time	DATE COMPLETED: 5/4/89
DRILLING METHODS: See Page 1 of 5		PAGE 3 OF 5

Water Bearing Zone

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
15.0	50657	6		Same As Above Fine Sand	~~SW~~ Sm	5-3-89 loose	Start= HNU= ∅ ppm α= ∅ cpm Bγ= 120-160 cpm
15.5	50658	a	18in				
16.0	50659	10		16.25 Clay, Gray (0YR/4/1) Lean Dry, Mr. Plastic, Massive @0945	CL	3.5 TSF	
16.5				TD=16.5ft Well Installed 5/4/89			HNU= ppm α= cpm Bγ= cpm
17.0							
17.5							
18.0				@		TSF	
18.5							HNU= ppm α= cpm Bγ= cpm
19.0							
19.5				@		TSF	
20.0				@		TSF	HNU= ppm α= cpm Bγ= cpm

NOTES: Contractor:
Driller:
Helper:
Sample Tech:
Weather:
HNU#:
} See page 1 of 5

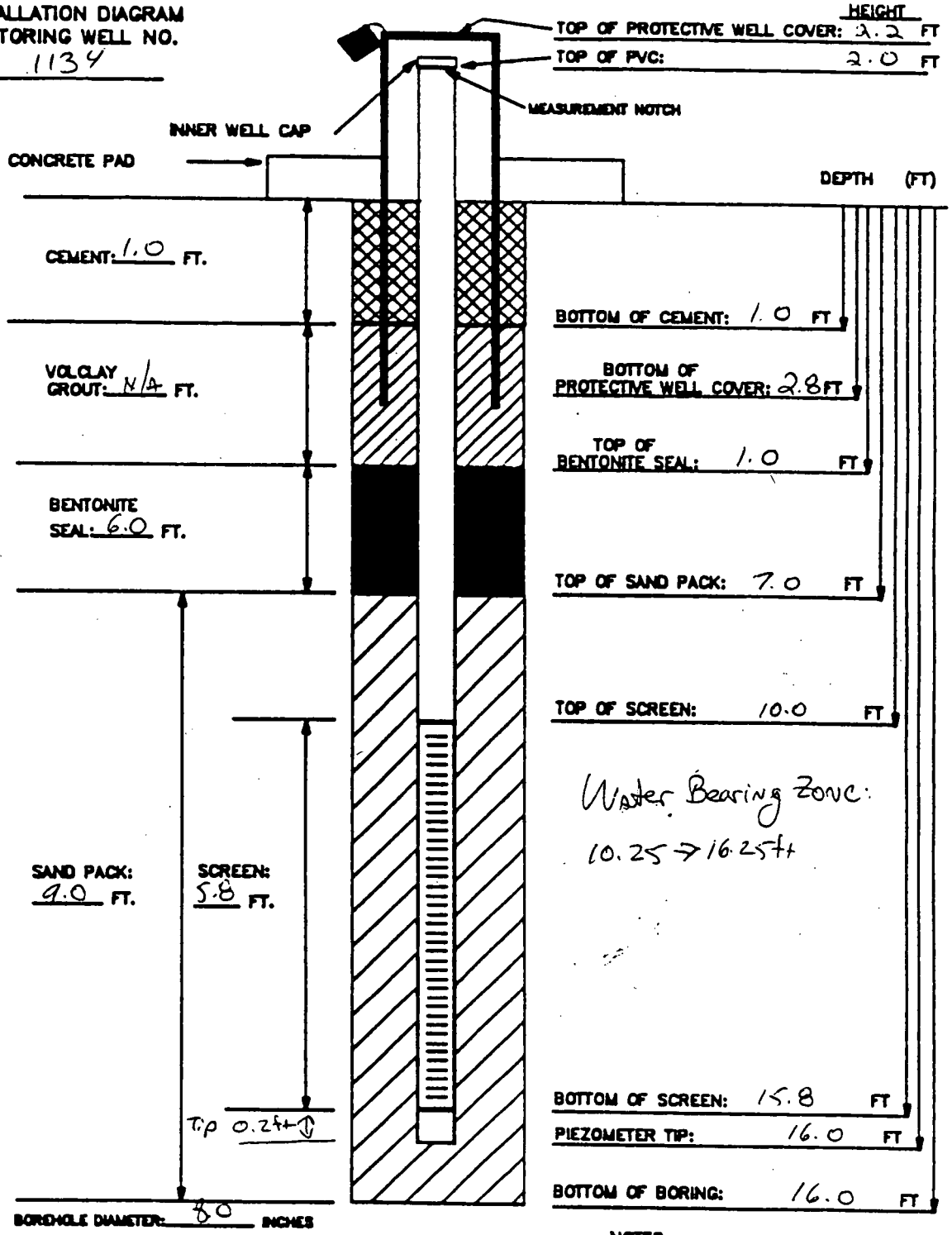
Background @ 0930
HNU= ∅ ppm
α= ∅ cpm
Bγ= 160-200 cpm

4C2-11-86

FERNALD RI/FS

INSTALLATION DIAGRAM
MONITORING WELL NO. 1134

INSTALLATION DATE: 5-4-1989



BOREHOLE DIAMETER: 8.0 INCHES

MATERIALS USED:
SAND TYPE AND QUANTITY: 1 Bag 10/20
BENTONITE PELLETS (5-GALLON BUCKETS): 3 1/2
BAGS OF VOLCLAY GROUT: N/A
AMOUNT OF CEMENT: 1/2 Bag
AMOUNT OF WATER USED: 10 gallons
OTHER: Protective Cover.

NOTES:
1) RISER PIPE IS 2-INCH SCHEDULE 40 PVC PIPE, FLUSH-THREADED JOINTS.
2) SCREEN IS 2-INCH I.D. SCHEDULE 40 PVC PIPE WITH 0.020-INCH SLOTS.
3) LOWER END OF SCREEN IS CAPPED WITH AN END CAP OR THREADED SUMP.
4) WATER DEPTH/DATE:

TASK: 602 3.7.1 GEOLOGIST/ENGINEER: C. Sinfield

FERNALD RI/FS

PIEZOMETER INSTALLATION SHEET

PROJECT NAME Facilities Testing FMPC RI/FS FIELD ENG./GEO. L. Sintfield DATE 5-5-84
PROJECT NO. 602-3.7.1 CHECKED BY [illegible] DATE [illegible]
BORING NO. 1134
PIEZOMETER NO. 1134 DATE OF INSTALLATION 5-4-84

BOREHOLE DRILLING

DRILLING METHOD Hollow-Stem Auger
DRILLING FLUID (S) USED: N/A
FLUID N/A FROM N/A TO N/A
FLUID N/A FROM N/A TO

TYPE OF BIT Auger Bit
CASING SIZE (S) USED: N/A
SIZE N/A FROM N/A TO N/A
SIZE N/A FROM N/A TO N/A

PIEZOMETER DESCRIPTION

TYPE Schedule 40 PVC
DIAMETER OF PERFORATED SECTION 2 inch ID
PERFORATION TYPE:
SLOTS ☒ HOLES ☐ SCREEN ☐
AVERAGE SIZE OF PERFORATIONS 0.020 inch
TOTAL PERFORATED AREA 5.8 ft

RISER PIPE MATERIAL Schedule 40 PVC
RISER PIPE DIAMETERS: 2 5/16 80 [illegible]
O.D. ~~2 1/4 inch~~ I.D. 2 inch
LENGTH OF PIPE SECTIONS 13.0 ft 85 5-5-84
JOINING METHOD Flush-Threaded

PROTECTION SYSTEM

RISER PROTECTIVE PIPE LENGTH 5.0 ft
PROTECTIVE PIPE O.D. 4 1/4 inch

OTHER PROTECTION Locking Cap

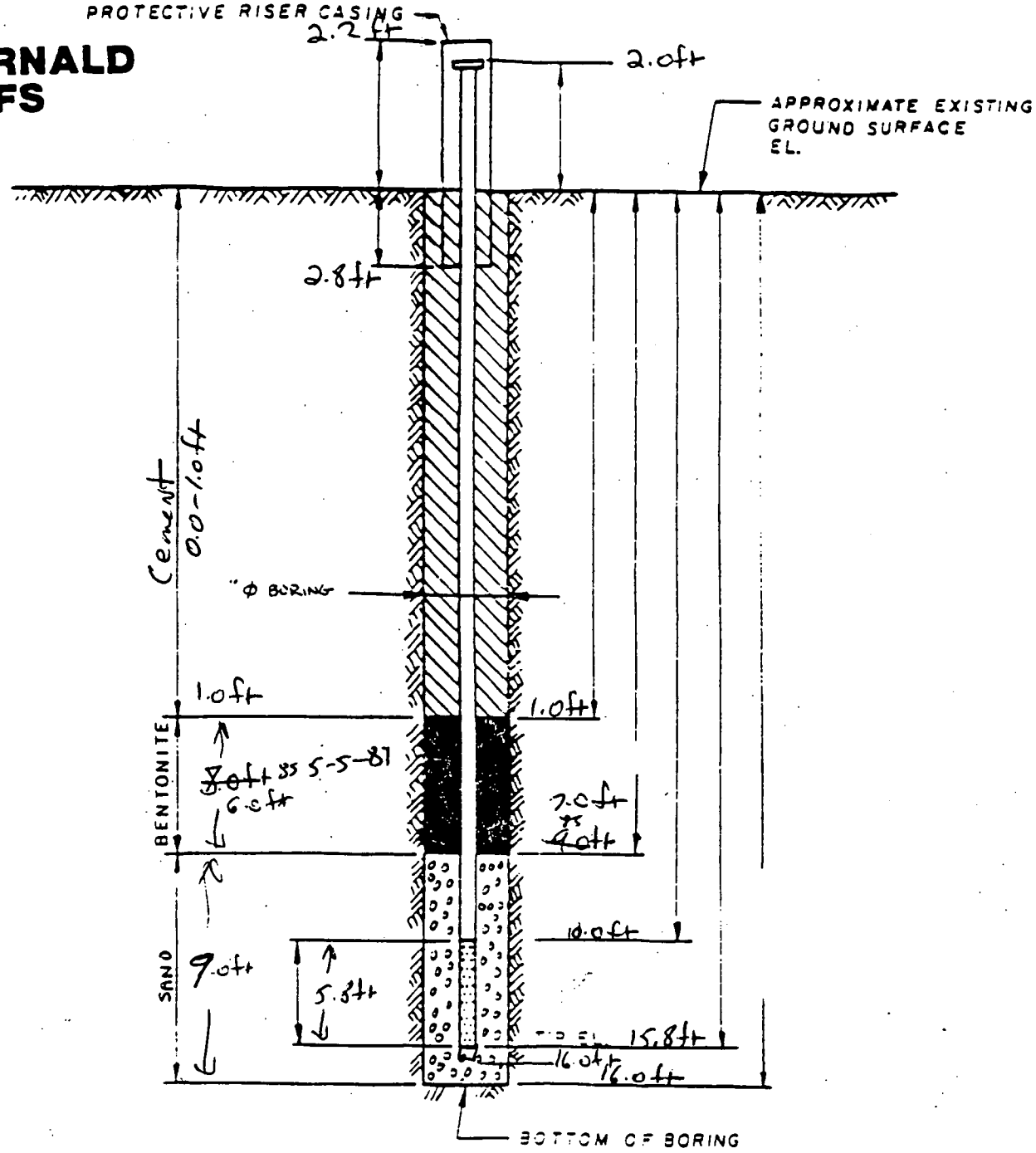
ITEM	DISTANCE ABOVE/BELOW GROUND SURFACE (ft)		ELEVATION (ft)	
TOP OF RISER PIPE	2.0 ft			
GROUND SURFACE	0.0 ft			
BOTTOM OF PROTECTIVE PIPE	2.8 ft			
BOREHOLE FILL MATERIALS:				
GROUT/SLURRY	TOP N/A	BOTTOM N/A	TOP	BOTTOM
BENTONITE	TOP 1.0 ft	BOTTOM 7.0 ft	TOP	BOTTOM
SAND	TOP 7.0 ft	BOTTOM 16.0 ft	TOP	BOTTOM
GRAVEL	TOP N/A	BOTTOM N/A	TOP	BOTTOM
PERFORATED SECTION	TOP 10.0 ft	BOTTOM 15.8 ft	TOP	BOTTOM
PIEZOMETER TIP	16.0 ft			
BOTTOM OF BOREHOLE	16.0 ft			
GWL AFTER INSTALLATION				

WAS THE PIEZOMETER FLUSHED AFTER INSTALLATION? YES ☐ NO ☑
WAS A SENSITIVITY TEST PERFORMED ON THE PIEZOMETER? YES ☐ NO ☑

REMARKS 1 bag of Sand (10x20) used - Sand from Aquifer flowed into well during construction and formed Sand pack to 7.0 ft.
Water Bearing Zone: 10.25 → 16.25 ft

409-11-86

FERNALD RI/FS



DRAWING NUMBER

CHECKED BY

APPROVED BY

DRAWN BY

NOTES:

1. RISER PIPE IS 2 IN I.D. SCHEDULE PIPE, THREADED, FLUSH-JOINTED.
2. SCREEN IS 2 IN I.D. PVC PIPE CONTINUOUS SLOT SCREEN (0.020 IN SLOT SIZE).
3. LOWER END OF SCREEN IS CAPPED.
4. ELEVATION OF WATER LEVEL
5. WATER LEVEL READING ON

materials Used:

1- Protective Cover 4 1/4 inch x 5.0 ft

ONE ~~3 1/2~~ - 50 lb bags of 10 x 20 SAND JS 5-5-87

3 1/2 ~~bg~~ - 5 gallon buckets of Bentonite Pellets.

1/2 bag of Cement

10 gallons of Water Used

INSTALLATION DETAILS
MONITORING WELL
1134
PREPARED FOR

2 endcaps - PVC

5.8 ft of 0.020 inch slotted Schedule PVC Flush-Threaded - 2 inch ID

10.0 ft of Schedule 40 PVC Blank - 2 inch ID.

Rig Geologist: C. Sin[illegible]

6496

Field Copy

FERNALD RI/FS

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602-3.2.1	PROJECT NAME: Facilities Testing Program	
BORING NUMBER: 1134	COORDINATES:	DATE: 5-3-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5-3-89
ENGINEER/GEOLOGIST: C. Sinfield	Depth Date/Time	DATE COMPLETED:
DRILLING METHODS: B-53 Hollow-Stem Auger with Split Spoon		PAGE 1 OF

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
0.5 1.0 1.5	15627 WMCO 15628 15629 NR	7 5 6	12 in	Dark yellowish brown (10YR, 4/4) grass at top, dry, massive lean clay, CL Hard Abundant roots @ ~~1430~~ 1525	CL	4.5 TSF	Start = ~~1430~~ 1520 HNU = Ø ppm α = Ø cpm Bγ = 160-200 cpm
2.0 2.5 3.0	15630 15631 NR WMCO 15632 NR	7 5 10	6 in	V. Stiff, light Brownish gray (10YR, 6/2) clay, dry, massive mottled, rare roots, lean with some silt, hard @ ~~1435~~ 1530	CL	2.1 to 2.5 TSF	HNU = Ø ppm α = Ø cpm Bγ = 120-160 cpm
3.5 4.0 4.5	15633 NR 15634 NR 15635	7 9 10	5 in	V. Stiff to Dark grayish brown, (10YR 4/2) clay, dry, mottled massive, med. plastic @ 1535	CL	2.6 to 4.5 TSF	HNU = Ø ppm α = Ø cpm Bγ = 120-140 cpm
5.0 5.5 6.0	15636 15637 NR WMCO 15638 NR	4 7 3	3 in	Stiff, Same as Above 3.0-4.5 ft @ 1540	CL	1.9 to 1.6 TSF	HNU = Ø ppm α = Ø cpm Bγ = 140-160 cpm
6.5 7.0 7.5	15639 NR 15640 NR 15641	3 6 7	6 in	Stiff - dark yellowish brown (10yr, 3/4) med plastic dry, clay, massive rare gravel @ 1605	CL	1.2 TSF	HNU = Ø ppm α = Ø cpm Bγ = 140-180 cpm

NOTES: Contractor: Penn Drill
Driller: Jim Saccani
Helper: G. Dye
Sample Tech: C. Melany
Weather: clear & warm
HNU #: HH18

Background @ 1500
HNU = Ø ppm
α = Ø cpm
Bγ = 200-240 cpm

4C2-11-86

6496

Date	5/15/89			
Initial	[illegible]			
	Field Check	1st Key In	2nd Key In	Hard Copy Verification

FERNALD RI/FS

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1208	COORDINATES:	DATE: 5-31-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5-31-89
ENGINEER/GEOLOGIST: C. Grube	Depth Date/Time	DATE COMPLETED: ~~5-1-89~~ 5-31-89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 1 OF 5

DEPTH (FT.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN.)	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	17145 1008 5-31	10	6	Medium Dense clayey gravel (surface) trace sand (10yr 5/3) Brown dry	GC	NA	HNU = 0 ppm α = 0 cpm Bγ = 500 cpm
1	17146 1008 5-31	9	6	HARD (10yr, 5/4) yellowish brown sandy clay, trace fine gravel, low plasticity, dry	CL	4.5	
	17147 1008 5-31	8	3	SAA 5-31-89	CL	4.5	
2	17148 1020 5-31	4	6	~~Medium~~ Very Stiff SAA Slightly moist	CL	3.25	HNU = 0 ppm α = 0 cpm Bγ = 120-140 cpm
	17149 1020 5-31	8	5	Medium stiff (5y 4/4) OLIVE SANDY CLAY, low plasticity, slightly moist	CL	.5	
3	17150 1020 NR	11	0	NR	NA	NA	
	17151 1022 5-31	11	6	Very stiff (2.5y, 5/4) light olive brown SANDY CLAY, TRACE FINE GRAVEL, low plasticity, slightly moist	CL	2.75	HNU = 0 ppm α = 0 cpm Bγ = 120->150 cpm
4	17152 1022 5-31	14	6	STIFF (10yr 3/3) Dark Brown silty clay, low plasticity, slightly moist	CL	1.75	
	17153 1022 5-31	13	4	STIFF (10yr 3/2) very dark greyish brown sandy clay, low plasticity, moist	CL	1.0	
5	17154 1041 5-31	4	6	medium stiff (10 YR 4/2) dark grayish Brown, sandy clay, medium plasticity, moist	CL	.5	HNU = 0 ppm α = 0 cpm Bγ = 140-160 cpm
	17155 1041 5-31	4	5	Stiff (2.5Y 4/4) dark grayish brown, silty clay, trace of sand, medium plasticity, moist	CL	1.0	
6	17156 1041 NR	4	0	NR	N/A	N/A	
	17157 1044 5-31	6	6	SOFT (2.5y, 4/4) olive brown sandy clay, trace fine gravel, medium plasticity, moist	CL	.25	HNU = 0 ppm α = 0 cpm Bγ = 100-120 cpm
7	17158 1044 5-31	6	4	SOFT (2.5y 4/2) dark greyish brown sandy clay, trace fine gravel, medium plasticity, moist	CL	.25	
	17159 1044 NR	7	0	NR	NA	NA	

NOTES: CONTRACTOR: PENN DRILL
RIG: Model 80
DRILLER: Craig Coulter
ASSISTANT: Chris Coulter
Geo. Assistant: Cindy Melroy

SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST
COLORS IDENTIFIED USING MUNSELL COLOR CHART
BACKGROUND LEVELS: HNU = 0 PPM
α = 0 CPM
Bγ = 100-140 CPM
LEL O2: LEL = 0% ~~PPM~~ @ 5/31/89
O2 = 20.6 %

SAA = Same As Above
NR = No Recovery

HNU # 00221

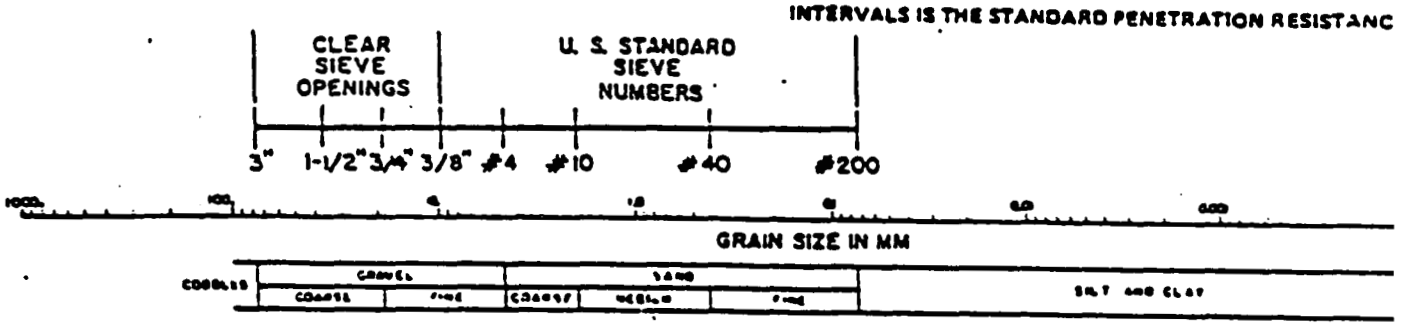
CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE(1)
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

(1) STANDARD PENETRATION RESISTANCE IS THE NUMBER O BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLIN FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 1 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EA 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANC



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

FINE-GRAINED/HIGHLY ORGANIC SO

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANC OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICI GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEO FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTIC ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CON

FERNALD RI/FS

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1208	COORDINATES:	DATE: 05/31/89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 05/31/89
ENGINEER/GEOLOGIST: C. Grube	Depth Date/Time	DATE COMPLETED: ~~9-1-88~~ 5/31/89 RB
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 2 OF 5

DEPTH (FT.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN.)	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
8	17160 1049 5-31	2	6	Very loose (10yr, 5/4) yellowish brown poorly graded gravelly sand, very wet	SP	NA	HNU = 0 ppm ⇐ VERY WET; α = 0 cpm; Bγ = 200-240 cpm
	17161 1049 5-31	2	6	Very loose (10yr, 5/4.) yellowish brown clayey sand, trace fine gravel, wet	SC	NA	⇐ WET
9	17162 1049 NR	1	0	NR	NA	NA	
10	17163 1125 5-31	1	6	SAA (8.0-78.5ft)	SC	NA	HNU = 0 ppm ⇐ WET; α = 0 cpm; Bγ = 120-140 cpm
	17164 1125 5-31	1	4	SAA ~~(8.0-78.5ft)~~ 78-78.0 ft (8) 5/31/89 poorly graded gravelly sand. CAM 5-31-89	SP	NA	⇐ WET
	17165 1125 NR	1	0	NR	NA	NA	
11	17166 1130 5-31	8	6	Medium Dense (2.5y 4/2 dark grayish brown, well graded, gravelly sand, wet.	SW	NA	HNU = 0 ppm ⇐ WET; α = 0 cpm; Bγ = 100-120 cpm
	52195 1130 5-31	8	6	SAA (10.5-11.0ft)	SW	NA	⇐ WET
12	52196 1130 5-31	7	6	Medium Dense (10yr, 5/4) yellowish brown well graded sand, trace fine gravel, trace clay, wet	SW	NA	⇐ WET
13	52197 1320 5-31	6	6	SAA (11.5-12.0ft)	SW	NA	HNU = 0 ppm ⇐ WET; α = 0 cpm; Bγ = 60-80 cpm
	52198 1320 5-31	3	6	SAA "	SW	NA	⇐ WET
	52199 1320 5-31	10	6	SAA "	SW	NA	⇐ WET
14	52200 1325 5-31	6	6	SAA "	SW	NA	HNU = 0 ppm ⇐ WET; α = 0 cpm; Bγ = 100-120 cpm
	52201 1325 5-31	8	6	SAA "	SW	NA	⇐ WET
	52202 1325 5-31	10	6	Med. Dense (10yr 4/6) dark yellowish brown poorly graded sand, wet	SP	NA	⇐ WET
				Med. Dense (10yr, 4/6.) dark yellowish brown silty sand, wet	SM	NA	⇐ WET

NOTES:

SAA = Same As Above
NR = No Recovery

FERNALD RI/FS

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1208	COORDINATES:	DATE: 5/31/89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5/31/89
ENGINEER/GEOLOGIST: C. Grube	Depth Date/Time	DATE COMPLETED: 5-7-89 ~~5/31/89~~
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 3 OF 5

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER 6"	RECOVERY (")	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	50203 1340 5-31	12	6	Med Dense (10yr, 5/4) yellowish brown clayey sand, trace fine gravel, wet	SC	NA	HNU = 0 ppm; α = 0 cpm ⇐ WET; BG = 120-140 cpm
16	50204 1340 5-31	14	6	Med Dense (2.5y, 4/2) dark grayish brown poorly graded sand, WET	SP	NA	⇐ WET
of water at approx 16.5 ft	50205 1340 5-31	15	6	SAA (15.5→16.0 ft)	SP	NA	⇐ WET
17	50206 1345 5-31	7	6	SAA (15.5→16.0 ft) VERY MOIST	SP	NA	HNU = 0 ppm; α = 0 cpm; BG = 80-100 cpm
	50207 1345 5-31	13	6	SAA (15.5→16.0 ft) VERY MOIST	SP	NA	
	50208 1345 5-31	12	6	SAA (15.5→16.0 ft) VERY MOIST	SP	NA	
18	50209 1520 5-31	8	6	SAA	SP	N/A	HNU = 0 ppm; α = 0 cpm; BG = 80-100 cpm
	50210 1520 5-31	10	6	SAA	SP	N/A	
19	50211 1520 5-31	10	6	SAA	SP	N/A	
	50212 1520 5-31	10	6	SAA	SP	N/A	HNU = 0 ppm; α = 0 cpm; BG = 80-~~100~~ 100 cpm
20				Bottom of Boring and sampling at 20.0 FT			

NOTES:

SAA = Same As Above
NR = No Recovery

Note: It is believed that Alphameter was not registering properly

FERNALD RI/FS

PIEZOMETER INSTALLATION SHEET

PROJECT NAME FMPC RI/FS
FIELD ENG./GEO. C. Grube
DATE ~~6-31-89~~ 6/1/89
PROJECT NO. 6023.7
CHECKED BY [illegible]
DATE 6/5/89
BORING NO. 1208
PIEZOMETER NO. 1208
DATE OF INSTALLATION 5-31-89

BOREHOLE DRILLING

DRILLING METHOD 8 in Hollow Stem Auger	TYPE OF BIT 8 in Hollow Auger
DRILLING FLUID (S) USED:	CASING SIZE (S) USED:
FLUID N/A FROM — TO —	SIZE N/A FROM — TO —
FLUID N/A FROM — TO —	SIZE N/A FROM — TO —

PIEZOMETER DESCRIPTION

TYPE Monitoring Piezometer	RISER PIPE MATERIAL Schedule 40 PVC
DIAMETER OF PERFORATED SECTION 2.0 in ID	RISER PIPE DIAMETERS:
PERFORATION TYPE:	O.D. 2 5/16 in I.D. 2.0 in
SLOTS [X] HOLES [ ] SCREEN [ ]	LENGTH OF PIPE SECTIONS 10.0 FT
AVERAGE SIZE OF PERFORATIONS 0.020	JOINING METHOD Screw type - flush joint threaded.
TOTAL PERFORATED AREA 10.0 FT	

PROTECTION SYSTEM

RISER PROTECTIVE PIPE LENGTH 5.0 FT	OTHER PROTECTION Hinged protective cover with installed padlock
PROTECTIVE PIPE O.D. 4 3/8 in	

ITEM	DISTANCE ABOVE/BELOW GROUND SURFACE (FT)		ELEVATION ( )	
TOP OF RISER PIPE	~~2.0~~ 2.2 6/1/89			
GROUND SURFACE	0.0			
BOTTOM OF PROTECTIVE PIPE	2.5			
BOREHOLE FILL MATERIALS:				
~~GROUT/SLURRY~~ Cement	TOP 0.0	BOTTOM 2.0	TOP	BOTTOM
BENTONITE	TOP 2.0	BOTTOM 6.0	TOP	BOTTOM
SAND	TOP 6.0	BOTTOM 20.0	TOP	BOTTOM
~~GRAVEL~~ N/A	TOP —	BOTTOM —	TOP	BOTTOM
PERFORATED SECTION	TOP 8.0	BOTTOM 18.0	TOP	BOTTOM
PIEZOMETER TIP	18.0 FT			
BOTTOM OF BOREHOLE	20.0 FT			
GWL AFTER INSTALLATION	— Approx. - 7 ft.			

[illegible] 6/5/89

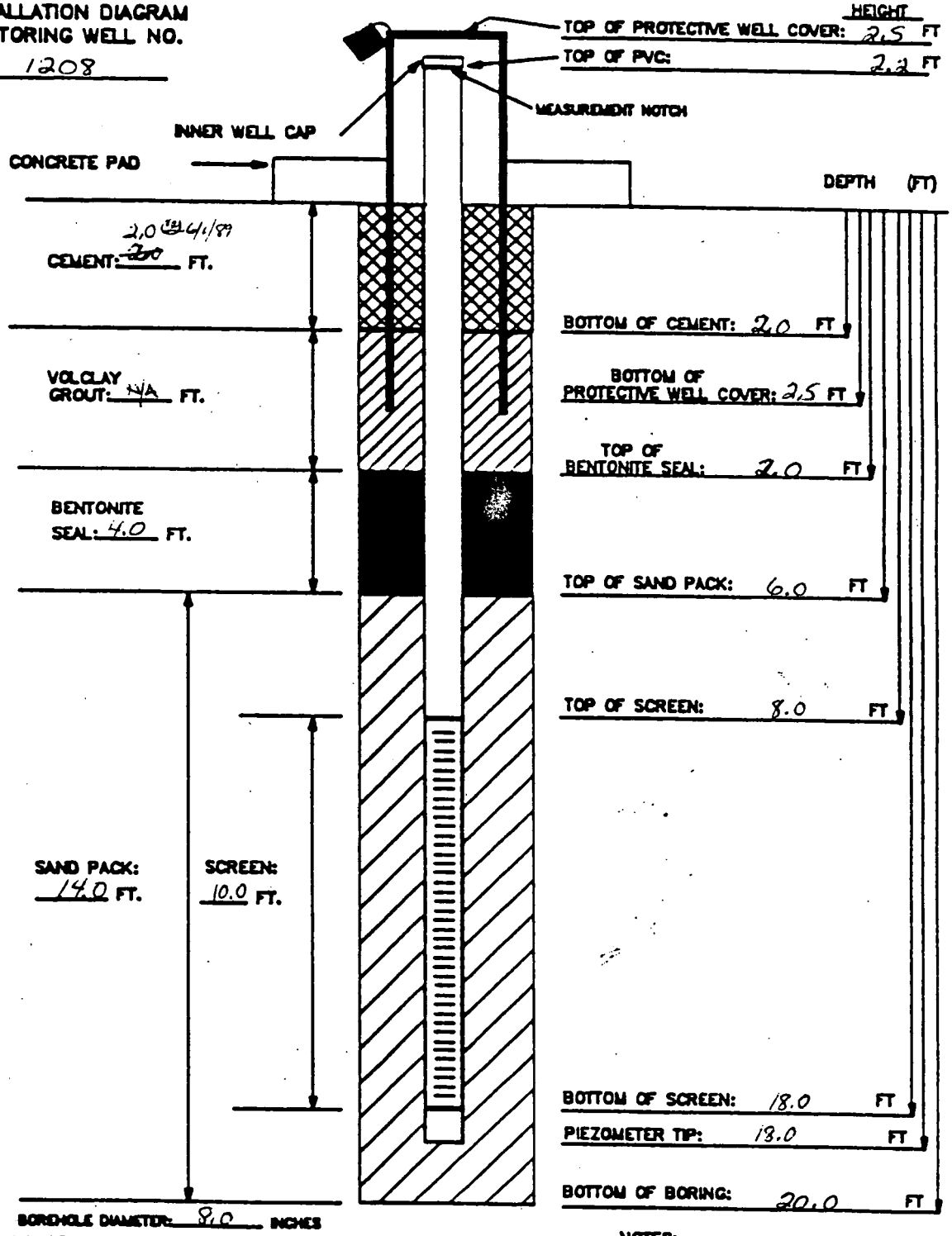
WAS THE PIEZOMETER FLUSHED AFTER INSTALLATION? YES [ ] NO [X]
WAS A SENSITIVITY TEST PERFORMED ON THE PIEZOMETER? YES [ ] NO [X]

REMARKS Top of water bearing zone - 7.5 FT
Bottom of water bearing zone - 16.5 FT

FERNALD RI/FS

INSTALLATION DIAGRAM
MONITORING WELL NO. 1208

INSTALLATION DATE: ~~2-21-87~~ 6/1/89



MATERIALS USED:

SAND TYPE AND QUANTITY: 5.0 80# sacks 10/20 sand
BENTONITE PELLETS (5-GALLON BUCKETS): 2 buckets.
BAGS OF VOLCLAY GROUT: N/A
AMOUNT OF CEMENT: 1/2 sack (94 lb)
AMOUNT OF WATER USED: 10 gal
OTHER: 5.0 FT Protective casing

NOTES:

1) RISER PIPE IS 2-INCH SCHEDULE 40 PVC PIPE, FLUSH-THREADED JOINTS.
2) SCREEN IS 2-INCH I.D. SCHEDULE 40 PVC PIPE WITH 0.020-INCH SLOTS.
3) LOWER END OF SCREEN IS CAPPED WITH AN END CAP OR THREADED SUMP.
4) WATER DEPTH/DATE:

TASK: 6023.7

GEOLOGIST/ENGINEER: C. Grabe

6496

FERNALD RI/FS

Date	6/5/89			
Initial	BW			
	Field Check	1st Key In	2nd Key In	Hard Copy Verification

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7.1	PROJECT NAME: Facilities Testing Program FMPC RI/FS	
BORING NUMBER: 1228	COORDINATES:	DATE: 5-24-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5-24-89
ENGINEER/GEOLOGIST: L. Sinfield	Depth Date/Time	DATE COMPLETED: 5-24-89
DRILLING METHODS: B-45, Hollow Stem Auger with Split Spoon Sampler		PAGE 1 OF ~~#~~ 6

BW. 6/5/89

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION Surface = Concrete Coreing started = @ 1120 to 1200	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
0.5	17585 WMCO	N/A	N/A	Concrete 0.7 ft	N/A	N/A	HNU = ∅ ppm α = ∅ Bγ = 400-440
1.0	17586 NR	N/A	N/A	Loose, gravel, massive, class II Base. Grab Sample 5/24/89 @ 1200	GW	Loose	Base of Concrete Bγ = 800-1000 cpm α = 10 cpm
1.5	17587	N/A	N/A				
2.0	17588	9	18 in	Very Stiff, Dark grayish Brown (2.5Y, 4/2) to Dark Gray (2.5Y, N4), Lean Clay, dry, medium plastic, massive, wood fragments @ 1340	CL	2.2 ↓ 3.2	HNU = ∅ ppm α = 10 cpm Bγ = 100-200 cpm
2.5	17589 WMCO	9					
3.0	17590	9					
3.5	17591	5	12 in	Very Stiff, very dark grayish brown, (2.5Y, 3/2) to Olive Brown (2.5Y, 4/4) mottled, dry, massive, medium plastic. Lean Clay. @ 1350	CL	2.7 ↓ 3.0	HNU = ∅ ppm α = ∅ cpm Bγ = 100-120 cpm
4.0	17592	7					
4.5	17593 NR	10					
5.0	17594	5	12 in	Stiff, Light Olive Brown (2.5Y, 5/6) to light Brownish Gray, (2.5Y, 6/2) Lean Clay, dry, massive, medium plastic, mottled @ 1400	CL	1.5 ↓ 1.6	HNU = ∅ ppm α = ∅ cpm Bγ = 80-100 cpm
5.5	17595	11					
6.0	17596 NR	16					
6.5	17597	4	18 in	Very Stiff to Hard, Brownish Yellow (10YR, 6/8) to Gray (2.5Y, N5) Dry, Lean Clay, massive, medium plastic @ 1420	CL	2.5 ↓ 4.5	HNU = ∅ ppm α = ∅ cpm Bγ = 100-120 cpm
7.0	17598	6					
7.5	17599	9					

NOTES:
Contractor: Penn Drill
Driller: D. Newman
Helper: W. Anderson
Weather: Warm/clear
HNU = B00221

Background @ 1100
HNU = ∅ ppm
gnd α = 100-120 cpm
gnd Bγ = 600-1800 cpm
Air α = ∅ cpm
Air Bγ = 180-240 cpm

NR = No Recovery, No Sample Taken

402-11-86

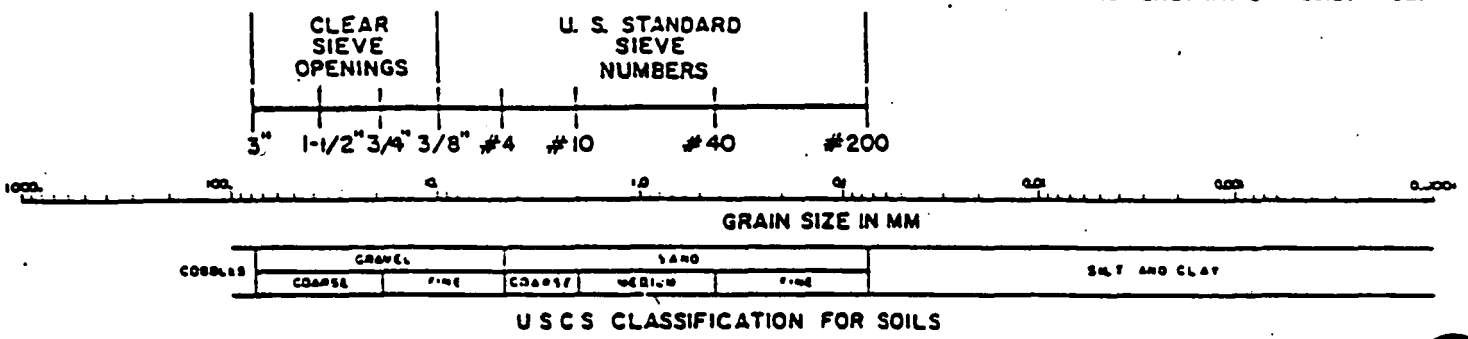
CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE(1)
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

(1) STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 18 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANCE.



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

FINE-GRAINED/HIGHLY ORGANIC SOILS

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENT

FERNALD RI/FS

6496

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602-3.2.1	PROJECT NAME: Facilities Testing Program	
BORING NUMBER: 1228	COORDINATES:	DATE: 5-25-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5-24-89
ENGINEER/GEOLOGIST: L. Sinfield	Depth Date/Time	DATE COMPLETED: 5-24-89
DRILLING METHODS: See Page 1 of 4		PAGE 2 OF 4

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER 6 IN	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
7.5	17600	11	18 IN	Very Stiff to Hard, Brownish Yellow (10YR, 6/8) to light gray (10YR, 7/1) Silty Clay, dry, medium plastic, 1/4 in moist silt layers @ 1430	CL	3.3 ↓ 4.3 TSF	Start = HNU = ∅ ppm; α = ∅ cpm; Bγ = 100-120 cpm
8.0	17601	14					
8.5	17602	17					
9.0	17603	17	18 IN	Very Stiff, Yellowish Brown (10YR, 5/4), Silty Clay, Very slightly moist, massive, medium plastic, 1/4 in silt layers - moist 10.25 ft	CL	2.6 ↓ 3.2	HNU = ∅ ppm; α = ∅ cpm; Bγ = 80-120 cpm
9.5	17604	24					
10.0	17605 MMCO	24		SAND - WET @ 1440	SM	TSF	
10.5	17606	5	12 IN	Loose, Gray (10YR, 6/1) Silt, massive, WET @ 1500	ML	N/A TSF	HNU = ∅ ppm; α = ∅ cpm; Bγ = 80-120 cpm
11.0	52475	8					
11.5	52476 NR	10					
12.0	52477	5	12 IN	Loose to medium Dense, Gray (10YR, 6/1), SILT, massive, WET, grades to Silty Sand at Base, massive WET. @ 1505	ML ↓ SM	N/A TSF	HNU = ∅ ppm; α = ∅ cpm; Bγ = 80-100 cpm
12.5	52478	10					
13.0	52479 NR	18					
13.5	52480	14	18 IN	Medium Dense, Coarse Sand, with silt, WET, massive, Gray (10YR, 6/1) 14.5 ft	SM	N/A	HNU = ∅ ppm; α = ∅ cpm; Bγ = 80-120 cpm
14.0	52481	16					
14.5	52482	18		Stiff, gray (10YR, 6/1) Lean Clay with Silt, dry with gravel massive @ 1515	CL	1.2 TSF	
15.0							

NOTES: Contractor: Driller: Helper: Sample Tech: Weather: HNU #: } See Page 1 of 4

TD = 15.0 ft @ 1515 5/24/89

Background @ HNU = See Page 1 of 4 ppm; α = cpm; Bγ = cpm

NR = No Recovery, No Sample Taken

0.25 ft

14.5 ft

FIELD COPY 6496

1130

FERNALD RI/FS

Cellosa Sewer Drains

1167
1244
1241

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602-3.7.1	PROJECT NAME: Facilities Testing Program	
BORING NUMBER: 1228	COORDINATES:	DATE: 5-24-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5-24-89
ENGINEER/GEOLOGIST: L. Sinfield	Depth Date/Time	DATE COMPLETED: 5/ /89
DRILLING METHODS: B-53, Hollow Stem Auger with Split Spoon Sampler		PAGE 1 OF

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION Surface = Concrete Coring at 1120 to 0 ft to 0.7 ft	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
0.0 / 7.5	17585 WMCO	N/A	N/A	Concrete	N/A		Start = 1120 HNU = Ø ppm α = Ø cpm Bγ = 400-440 cpm
0.5 / 8.0	17586 NR	N/A	N/A				
1.0 / 8.5	17587	N/A	N/A	Loose, gravel, massive, - Class II Base - Grab 5/24/89 @1200	GW	Loose TSF	Base of Concrete Bγ = 800-1000 cpm α = 10 cpm
2.0 / 9.5	17588	9	18 in	Very stiff, Dark grayish brown (2.5Y, 4/2) to dark Gray (2.5Y, N4), Lean clay, dry, medium plastic, massive Wood fragments 5/24/89 @1340	CL	2.2 ↓ 3.2 TSF	HNU = Ø ppm α = 10 cpm Bγ = 160-200 cpm
2.5 / 10.0	17589 WMCO	9					
10.5	17590	9					
3.5 / 11.0	17591	5	12 in	Very stiff, very dark grayish brown (2.5Y, 3/2) mottled to Olive Brown (2.5Y, 4/4), dry, massive, medium plastic, dry clay @1350	CL	2.7 ↓ 3.0 TSF	HNU = Ø ppm α = Ø cpm Bγ = 100-120 cpm
4.0 / 11.5	17592	7					
4.5 / 12.0	17593 NR	10					
5.0 / 12.5	17594	5	12 in	Stiff, light Olive Brown (2.5Y, 5/6) to light Brownish Gray (2.5Y, 6/2), Lean Clay, dry, massive, medium plastic, Mottled @1400	CL	1.5 ↓ 1.6 TSF	HNU = Ø ppm α = Ø cpm Bγ = 80-100 cpm
5.5 / 13.0	17595 WMCO	11					
6.0 / 13.5	17596 NR	16					
6.5 / 14.0	17597	4	18 in	Very Stiff to Hard, Brownish Yellow (10YR 6/8) to Gray (2.5Y, N5), dry, Lean Clay, massive, medium plastic @1420	CL	2.5 ↓ 4.5 TSF	HNU = Ø ppm α = Ø cpm Bγ = 100-120 cpm
7.0 / 14.5	17598	6					
7.5 / 15.0	17599	9					

NOTES: Contractor: Penn Drill
Driller: D. Newman
Helper: W. Anderson
Sample Tech: N/A
Weather: warm/clear
HNU#: B00221

Background @ 1100
HNU = Ø ppm
gnd α = 100-120 cpm
gnd Bγ = 600-1800 cpm
Air α = Ø cpm
Air Bγ = 180-240 cpm

NR = No Recovery No Sample Taken

000031

FERNALD RI/FS

FIELD COPY

6496

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602-3.7.1	PROJECT NAME: Facilities Testing Program	
BORING NUMBER: 1228	COORDINATES:	DATE: 5-24-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5-24-89
ENGINEER/GEOLOGIST: C. Sinfield	Depth Date/Time	DATE COMPLETED:
DRILLING METHODS: B-53, See page 1 of 5		PAGE 2 OF 5

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER 6 IN	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
7.5							Start =
8.0	17600	11	18in	Very Stiff to Hard Brownish yellow (10YR, 6/8) to light Gray (10YR, 7/1) Silty Clay, dry, medium plastic, massive, 1/4in silt layers wet. @ 1430	CL	3.3 ↓ 4.3 TSF	HNU = Ø ppm; α = Ø cpm; Bγ = 100-120 cpm
	17601	14					
8.5							
	17602	17					
9.0							
	17603	17		Very Stiff Yellowish Brown (10YR 5/4) silty Clay, very slightly moist, massive, medium plastic, 1/4in silt layers wet.	CL	2.6 ↓ 3.2 TSF	HNU = Ø ppm; α = Ø cpm; Bγ = 80-120 cpm
9.5							
	17604	24	18in				
10.0							
10.25	17605	24		10.25 ft WET SAND @ 1440	SM	TSF	
10.5	NMCO						
	17606	5		Loose, Gray (10YR, 6/1) SILT, massive, WET	ML	N/A	HNU = Ø ppm; α = Ø cpm; Bγ = 80-120 cpm
11.0							
	52475	8	12in				
11.5							
	52476 NR	10		@ 1500		TSF	
12.0							
	52477	5		Loose to Medium Dense Gray (10YR, 6/1) SILT, massive, WET grades to Silty Sand at Base, massive WET	ML ↓ SM	N/A TSF	HNU = Ø ppm; α = Ø cpm; Bγ = 80-100 cpm
12.5							
	52478	10	12in				
13.0							
	52479 NR	18		@ 1505			
13.5							
	52480	14		Medium Dense, Coarse Sand with Silt, WET, massive. Gray (10YR, 6/1) 14.5 ft	SM	N/A	HNU = Ø ppm; α = Ø cpm; Bγ = 80-120 cpm
14.0							
	52481	16	18in				
14.5							
14.75	52482	18		Stiff, Gray (10YR, 6/1) Clay with silt, dry, with gravel, massive, low plastic. @ 1515	CL	TSF	
15.0							

NOTES: Contractor: Driller: Helper: Sample Tech: Weather: HNU #: } See page 1 of 5

Background @
HNU = ppm
α = See cpm
Bγ = Page 1 of cpm

000032

407-11-86

6496

FERNALD RI/FS

PIEZOMETER INSTALLATION SHEET

PROJECT NAME Facilities Testing FMPC RI/FS
FIELD ENG./GEO. L. Sinfield DATE 5-24-89
PROJECT NO. 602 3.7.1
CHECKED BY DL DATE 6/5/89
BORING NO. 1228
PIEZOMETER NO. 1228
DATE OF INSTALLATION 5-29-89

BOREHOLE DRILLING

DRILLING METHOD Hollow Stem Auger - 8 inch OD
DRILLING FLUID (S) USED: N/A
FLUID N/A FROM N/A TO N/A
FLUID N/A FROM N/A TO N/A

TYPE OF BIT Auger Bit
CASING SIZE (S) USED: N/A
SIZE N/A FROM N/A TO N/A
SIZE N/A FROM N/A TO N/A

PIEZOMETER DESCRIPTION

TYPE Schedule 40 PVC - Monitering Well
DIAMETER OF PERFORATED SECTION 2 inch OD
PERFORATION TYPE:
SLOTS ☒ HOLES ☐ SCREEN ☐
AVERAGE SIZE OF PERFORATIONS 0.020 inch
TOTAL PERFORATED AREA 4.8 ft

RISER PIPE MATERIAL Schedule 40 PVC
RISER PIPE DIAMETERS:
O.D. 2 1/4 inch I.D. 2 inch
LENGTH OF PIPE SECTIONS 9.8 ft
JOINING METHOD Flush-Threaded Joints

PROTECTION SYSTEM

RISER PROTECTIVE PIPE LENGTH 1.0 ft
PROTECTIVE PIPE O.D. 4 3/8 inch

OTHER PROTECTION T-type locking top with Rubber Cap (Locking)

ITEM	DISTANCE ABOVE/BELOW GROUND SURFACE (ft)		ELEVATION ( )	
TOP OF RISER PIPE	- 0.2 ft			
GROUND SURFACE	0.0 ft			
BOTTOM OF PROTECTIVE PIPE	1.0 ft			
BOREHOLE FILL MATERIALS:				
GROUT/SLURRY	TOP 1.0 ft	BOTTOM 5.0 ft	TOP	BOTTOM
BENTONITE	TOP 5.0 ft	BOTTOM 4.5 ft	TOP	BOTTOM
SAND	TOP 4.5 ft	BOTTOM 15.0 ft	TOP	BOTTOM
GRAVEL	TOP N/A	BOTTOM N/A	TOP	BOTTOM
PERFORATED SECTION	TOP 9.8 ft	BOTTOM 14.6 ft	TOP	BOTTOM
PIEZOMETER TIP	15.0 ft			
BOTTOM OF BOREHOLE	15.0 ft			
GWL AFTER INSTALLATION	~~10.2~~ 5.35 5-24-89			

WAS THE PIEZOMETER FLUSHED AFTER INSTALLATION? YES ☐ NO ☒
WAS A SENSITIVITY TEST PERFORMED ON THE PIEZOMETER? YES ☐ NO ☒

REMARKS Water Bearing Zone: 10.25 — 14.5 ft

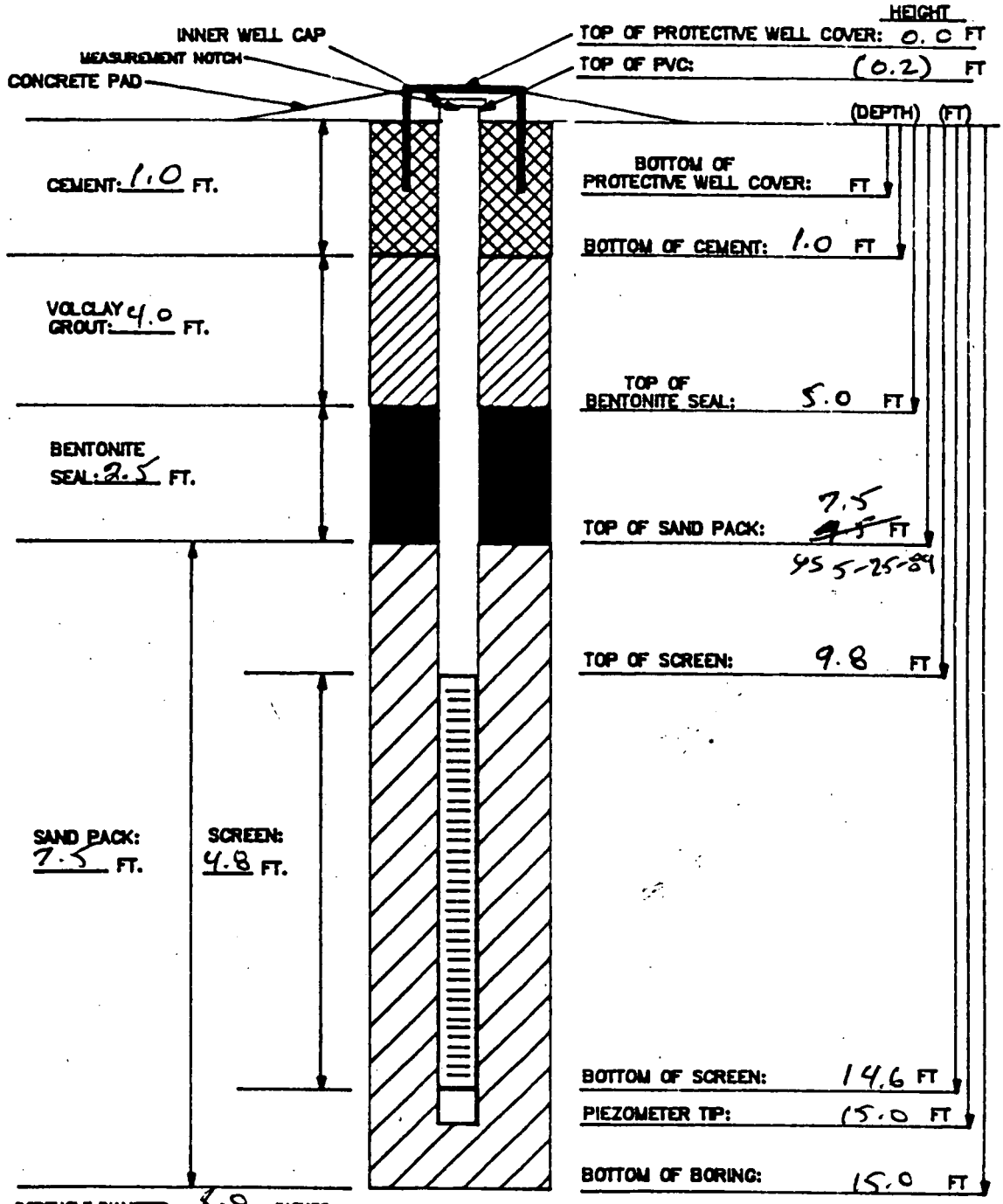
000033

409-11-86

FERNALD RI/FS

INSTALLATION DIAGRAM
MONITORING WELL NO.
1228

INSTALLATION DATE: 5-25-89



BOREHOLE DIAMETER: 8.0 INCHES

MATERIALS USED:
SAND TYPE AND QUANITITY: 2 Bags 10/20 (#016)
BENTONITE PELLETS (5-GALLON BUCKETS): 1
BAGS OF VOLCLAY GROUT: 1/2 Bag
AMOUNT OF CEMENT: 1 Bag
AMOUNT OF WATER USED: 20 gallons
OTHER:

NOTES:
1) RISER PIPE IS 2-INCH SCHEDULE 40 PVC PIPE, FLUSH-THREADED JOINTS.
2) SCREEN IS 2-INCH I.D. SCHEDULE 40 PVC PIPE WITH 0.020-INCH SLOTS.
3) LOWER END OF SCREEN IS CAPPED WITH AN END CAP OR THREADED SUMP.
4) WATER DEPTH/DATE:
5) TOP OF PVC IS SECURED WITH EXPANDABLE RUBBER PLUG AND PADLOCK.
6) PARENTHESIS INDICATE DEPTH BELOW GROUND LEVEL.

TASK: 602 3.7.1 GEOLOGIST/ENGINEER: L. Sinfield

6496

Date				
Initial				
	Field Check	1st Ker In	2nd Ker In	Hold Copy Verification

FERNALD RI/FS

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FMPC RI/FS		
BORING NUMBER: 1176	COORDINATES:	DATE: 5/3/39	
ELEVATION:	GWL: Depth	Date/Time	DATE STARTED: 5/3/39
ENGINEER/GEOLOGIST: C. Grube / L. Adams	Depth	Date/Time	DATE COMPLETED: 5/3/39
DRILLING METHODS: MOBILE DRILL HSA			PAGE 1 OF 4

(Field Copies Enclosed.)

DEPTH (FT.)	SAMPLE TYPE & NO	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
1	16441 1049 5-8	2	6	Medium stiff, dark yellowish brown (10YR 4/4) clay, some grass and roots, medium plasticity, moist	CL	1.75	HNU = 0 ppm, α = 0 cpm, βγ = 80-100 cpm
	16442 1049 5-8	5	5	SAA			
	16443 1049 5-8	7	None	No Recovery	N/A	N/A	
2	16444 1053 5-8	5	6	Stiff, yellowish brown (10YR 4/6) silty clay, some coarse sand, trace fine gravel, moist	CL	1.75	HNU = 0 ppm, α = 0 cpm, βγ = 60-80 cpm
	16445 1053 5-8	22	6	Very stiff, dark yellowish brown (10YR 4/4) silty clay, trace coarse sand, low plasticity, moist		3.25	
3	16446 1053 5-8	16	None	No Recovery	N/A	N/A	
4	16447 1100 5-8	16	6	Very stiff, yellowish brown (10YR 5/4) silty clay, trace fine gravel and sand, low plasticity, moist; very stiff, dark brown (10YR 3/3) clay, low to medium plasticity, moist	CL	3.5	HNU = 0 ppm, α = 0 cpm, βγ = 60-70 cpm
	16448 1100 5-8	17	6	SAA		2.0	
	16449 1100 5-8	21	None	No Recovery	N/A	N/A	
5	16450 1310 5-8	17	6	Stiff, dark brown (10YR 3/3) clay, low to medium plasticity, moist	CL	1.25	HNU = 0 ppm, α = 0 cpm, βγ = 80-100 cpm
	16451 1310 5-8	16	6	Stiff, yellowish brown (10YR 5/4) silty clay, trace sand, medium plasticity, moist		1.75	
6	16452 1310 5-8	15	5	SAA		2.0	
7	16453 1317 5-8	12	6	Stiff, yellowish brown (10YR 5/4) silty clay, trace sand, medium plasticity, very moist to wet	CL	1.0	HNU = 0 ppm, α = 0 cpm, βγ = 50-60 cpm
	16454 1317 5-8	7	4	SAA		1.5	
	16455 1317 5-8	6	None	No Recovery	N/A	N/A	

NOTES: DRILLING CO.: Penn Drill
DRILLER: (Model 80)
HELPER: Craig Coulter, Chris Coulter

MATERIALS USED:
2 sks 10-20 80# sand sks.
2 buckets (5 gal) bentonite pellets
½ sk. of cement

SAA = Same As Above

SAMPLING IN ACCORDANCE WITH ASTM STANDARDS, DESCRIPTION OF SOIL COLOR BY MUNSELL COLOR CHART. SAMPLES TAKEN FOR WMCO AT INTERVALS 0.0-.5 FT., 2-2.5 FT., 5-5.5 FT, 10-10.5 FT., 15-15.5 FT.

INSTRUMENT BACKGROUND
HNU = 0 ppm
α = 0 cpm
βγ = 180-200 cpm
LEL = 0%
O_2 = 20.6%

HNU Serial # 965513

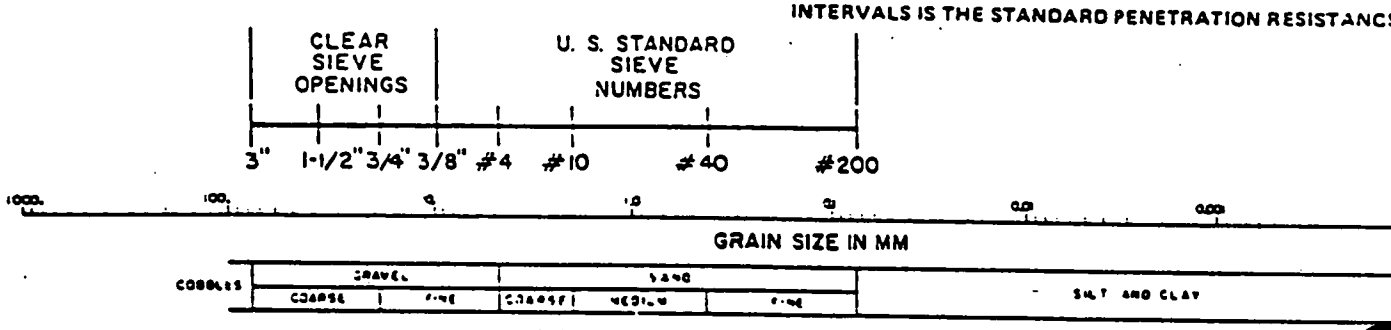
CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE[1]
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

(1) STANDARD PENETRATION RESISTANCE IS THE NUMBER O BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLIN FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 1 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EAC 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANC



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

FINE-GRAINED/HIGHLY ORGANIC SOILS

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONT

FERNALD RI/FS

6496

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FMPC RI/FS	
BORING NUMBER: 1176	COORDINATES:	DATE: 05-08-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 05-08-89
ENGINEER/GEOLOGIST: C. Grube / L. Adams	Depth Date/Time	DATE COMPLETED: 05-08-89
DRILLING METHODS: MOBILE DRILL HSA		PAGE 2 OF 4

DEPTH (FT.)	SAMPLE TYPE & NO	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
▽ Top of water bearing zone at 7.5 FT							
8	16456 1330 5-8	4	6	Very soft, yellowish brown (10 YR 5/6), silty clay, trace sand, wet	CL	.25	HNU = 0 ppm, α = 0 cpm, βγ = 60-80 cpm
	16457 1330 5-8	3	6	Soft, olive gray (5 Y 4/2) clay, trace sand and silt, medium plasticity, very moist	CL	.25	
9	16458 1330 5-8	4	2	Loose, yellowish brown (10 YR 5/6) silty sand, trace gravel (1.0-1.5 in), moist	SM	N/A	
	16459 1445 5-8	5	6	Medium stiff, dark brown (10 YR 3/3) silty clay, low plasticity, moist	CL	.75	HNU = 0 ppm, α = 0 cpm, βγ = 60-80 cpm
10	16460 1445 5-8	3	6	Loose, yellowish brown (10 YR 5/6) silty ~~clay~~ sand, trace fine gravel, poorly graded, wet	SM	N/A	
	16461 1445 5-8	4	None	No Recovery	N/A	N/A	
11	16462 1455 5-8	12	6	Medium Dense, yellowish brown (10 YR 5/6) poorly graded sand, wet	SP	N/A	HNU = 0 ppm, α = 0 cpm, βγ = 60-80 cpm
	50659 1455 5-8	10	6	Medium Dense, yellowish brown (10 YR 5/6) well graded sand, wet	SW	N/A	
Bottom of water bearing zone 11.5 FT				Medium Dense, yellowish brown (10 YR 5/6) silt, trace sand, very moist	ML		
12	50660 1455 5-8	13	6	Stiff, grey (5 Y 5/1) silty clay, trace fine gravel, moist	CL	1.5	
13				Bottom of boring and sampling at 12.0 FT			
14							

NOTES:

DRILLER:
HELPER:

INSTRUMENT BACKGROUND
Hnu =
α =
βγ =

FERNALD RI/FS

Field Copy 1

6496

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1176	COORDINATES:	DATE: 5/08/89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5/08/89
ENGINEER/GEOLOGIST: C. Grube / L. Adams	Depth Date/Time	DATE COMPLETED: 5/8/89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 1 OF 4

DEPTH (FT.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN.)	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	16441 1049 05-08	2	6	Med. dense, 10yr 4/4, dark yellowish brown moist clay. Some grass + root fragments. Med. plasticity.	CL	1.75	HNU: 0 ppm α: 0 cpm Bγ: 80-100 cpm
1	16442 1049 05-08	5	5				
	16443 1049 05-08	7	none	no recovery last 6 in.			
2	16444 1053 05-08	5	6	~~Dense~~, Stiff to very stiff. coarse sand ~~peg gravel~~ present 10yr 4/6		3.25	HNU: 0 ppm α: ~~60-80~~ 0 cpm Bγ: 60-80 cpm
	16445 1053 5-8-89	22	6	Silty clay trace fine gravel present.	CL	1.75	
3	16446 1053 5-8-89	16	none	10yr 4/4 very stiff dark yellowish brown low plasticity silty clay, trace coarse sand moist. no recovery last 5½ inches		3.25	
	16447 1100 5-8-89	16	6	3in. 10yr 5/4 silty clay trace fine gravel + sand, low plasticity moist very stiff		3.5	HNU: 0 ppm α: 0 cpm Bγ: 60-70 cpm
4	16448 1100 5-8-89	17	6	10yr 3/3 med. to low plasticity clay moist Dark brown, very stiff.	CL	2.0	
	16449 1100 5-8-89	21	none	No Recovery last 6 in.			
5	16450 1310 5-8-89	17	6	Stiff, 10yr 3/3 dark brown, med. to low plasticity clay, moist		1.25	HNU: 0 ppm α: 0 cpm Bγ: 80-100 cpm
	16451 1310 5-8-89	16	6	Stiff, 10yr 5/4 yellowish brown silty clay moist, med. plasticity, trace sand	CL	1.75	
6	16452 1310 5-8-89	15	5			2.0	
	16453 1317	12	6	Stiff, yellowish brown (10yr 5/4) ~~moist~~ clay, silty, trace sand, med. plasticity wet		1.0	HNU: 0 ppm α: 0 cpm Bγ: 50-60 cpm
7	16454 1317	7	4		CL	1.5	
	16455 1317	6	none	no recovery			

NOTES: CONTRACTOR: PENNDRILL
RIG: Model 80
DRILLER: Craig Coulter
ASSISTANT: Chris Coulter
Tech. Assistant: Laurie Adams

HNU Serial # 905513 29

SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TES
COLORS IDENTIFIED USING MUNSELL COLOR CHART
BACKGROUND LEVELS: HNU = 0 PPM
α = 0 CPM
Bγ = 130-200 CPM

LEL O2: LEL = 0 ~~ppm~~ %
O2 = 20.6 %

FERNALD RI/FS

Field Copy

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VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1176	COORDINATES:	DATE: 5/8/89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5/8/89
ENGINEER/GEOLOGIST: C. Grube/L. Adams	Depth Date/Time	DATE COMPLETED: 5/8/89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 2 OF 4

Top of water bearing zone at 7.5 ft.

DEPTH (FT.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN.)	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
8	16456 1330 5-8	4	6	very soft, yellowish brown (10 yr 5/6) silty clay trace sand, wet	CL	.25	HNU = 0ppm α = 0cpm Bγ = 60-80
	16457 1330 5-8	3	6	soft, olive gray (5Y 4/2) clay, trace sand and silt, very moist, med. plasticity	CL	.25	
9	16458 1330 5-8	4	2	loose, 10 yr 5/4 (yellowish brown silty sand trace gravel (1.0-1.5 in.) moist	SM		
	16459 1445 5-8	5 6	6	med stiff - Dark brown, 10 yr 3/3 silty clay, low plasticity moist	CL	.75	HNU = 0ppm α = 0cpm Bγ = 60-80 cpm
10	16460 1445 5-8	3 6	6	yellowish brown (10yr 5/6) silty sand trace fine gravel, wet poorly graded	SM	N/A	
	16461 1445 5-8	4	none	no recovery			
11	16462 1455 5-8	12	6	med. dense, yellowish brown (10yr 5/6) poorly graded ~~silty~~ sand, wet	SP		HNU = 0ppm α = 0cpm Bγ = 60-80 cpm
	50659 1455 5-8	10	6	med dense yellowish brown (10yr 5/6) well graded sand, wet; med dense yellowish brown (10yr 5/6) silt, trace sand, very moist			
12	50660 1455 5-8	13	6	Stiff (5y 5/1) gray silty clay, trace fine gravel moist.	CL	1.5	
13				Bottom of boring and sampling @ 12.0 ft.			HNU = α = Bγ =
14							HNU = α = Bγ =

NOTES:

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FERNALD RI/FS

PIEZOMETER INSTALLATION SHEET

PROJECT NAME FMPC RI/FS
PROJECT NO. 602 3.7
BORING NO. 1176
PIEZOMETER NO. 1176

FIELD ENG./GEO. C. Grube/L. Adams DATE 5/2/89
CHECKED BY [illegible] DATE 6/6/89
DATE OF INSTALLATION 5/3/89

BOREHOLE DRILLING

DRILLING METHOD 8 in. Hollow Stem Auger
DRILLING FLUID (S) USED:
FLUID N/A FROM — TO —
FLUID N/A FROM — TO —

TYPE OF BIT 8 in Hollow Auger
CASING SIZE (S) USED:
SIZE N/A FROM — TO —
SIZE N/A FROM — TO —

PIEZOMETER DESCRIPTION

TYPE Monitoring Piezometer
DIAMETER OF PERFORATED SECTION 2.0 in ID
PERFORATION TYPE:
SLOTS [X] HOLES [ ] SCREEN [ ]
AVERAGE SIZE OF PERFORATIONS 0.020 in
TOTAL PERFORATED AREA 5.0 FT

RISER PIPE MATERIAL Schedule 40 PVC
RISER PIPE DIAMETERS:
O.D. 2 5/16 in I.D. 2.0 in
LENGTH OF PIPE SECTIONS 9.0 FT
JOINING METHOD Screw type, flush joint threaded

PROTECTION SYSTEM

RISER PROTECTIVE PIPE LENGTH 5.0 FT
PROTECTIVE PIPE O.D. 4 3/8 in

OTHER PROTECTION Hinged cover with installed padlock.

ITEM	DISTANCE ABOVE/BELOW GROUND SURFACE (FT)		ELEVATION ( )	
TOP OF RISER PIPE	2.0			
GROUND SURFACE	0.0			
BOTTOM OF PROTECTIVE PIPE	2.6			
BOREHOLE FILL MATERIALS:				
~~GROUT/SLURRY~~ cement	TOP 0.0	BOTTOM 1.0	TOP	BOTTOM
BENTONITE	TOP 1.0	BOTTOM 4.0	TOP	BOTTOM
SAND	TOP 4.0	BOTTOM 12.0	TOP	BOTTOM
~~GRAVEL~~ N/A	TOP —	BOTTOM —	TOP	BOTTOM
PERFORATED SECTION	TOP 7.0	BOTTOM 12.0	TOP	BOTTOM
PIEZOMETER TIP	12.0			
BOTTOM OF BOREHOLE	12.0			
GWL AFTER INSTALLATION	—			

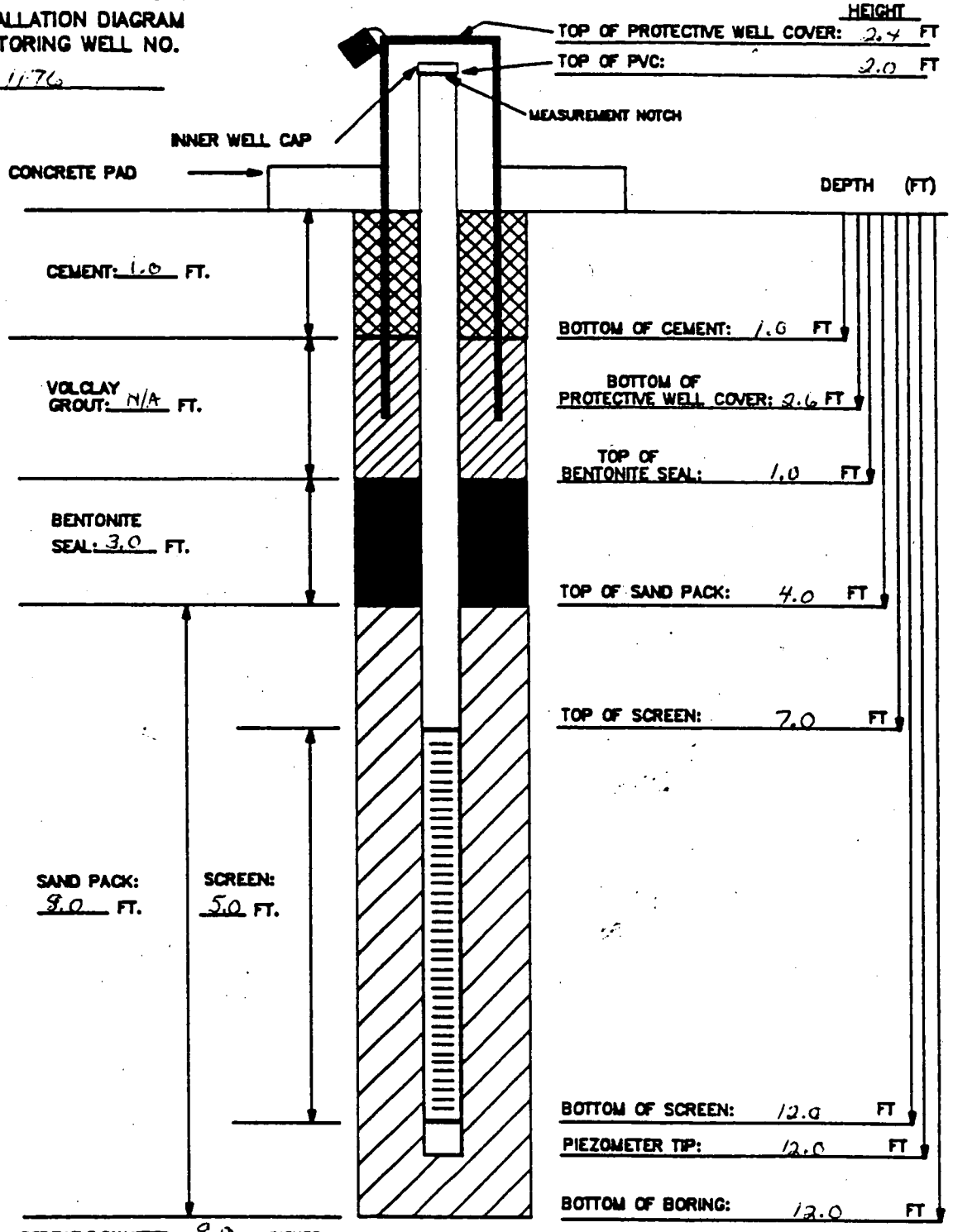
WAS THE PIEZOMETER FLUSHED AFTER INSTALLATION? YES [ ] NO [X]
WAS A SENSITIVITY TEST PERFORMED ON THE PIEZOMETER? YES [ ] NO [X]

REMARKS Top of water bearing zone at 7.5 FT
Bottom " " " " " 11.5 FT

INSTALLATION DATE: 5-9-89

FERNALD RI/FS

INSTALLATION DIAGRAM
MONITORING WELL NO.
1176



BOREHOLE DIAMETER: 9.0 INCHES

MATERIALS USED:
SAND TYPE AND QUANITITY: 10/20 sand 2 sacks (80 lb)
BENTONITE PELLETS (5-GALLON BUCKETS): 2 buckets
BAGS OF VOLCLAY GROUT: N/A
AMOUNT OF CEMENT: 1/2 sack (50 lb)
AMOUNT OF WATER USED: 20 gal
OTHER: 5.0 FT Protective casing

NOTES:
1) RISER PIPE IS 2-INCH SCHEDULE 40 PVC PIPE, FLUSH-THREADED JOINTS.
2) SCREEN IS 2-INCH I.D. SCHEDULE 40 PVC PIPE WITH 0.020-INCH SLOTS.
3) LOWER END OF SCREEN IS CAPPED WITH AN END CAP OR THREADED SUMP.
4) WATER DEPTH/DATE:

TASK: 602 3.7

GEOLOGIST/ENGINEER: C. Grube

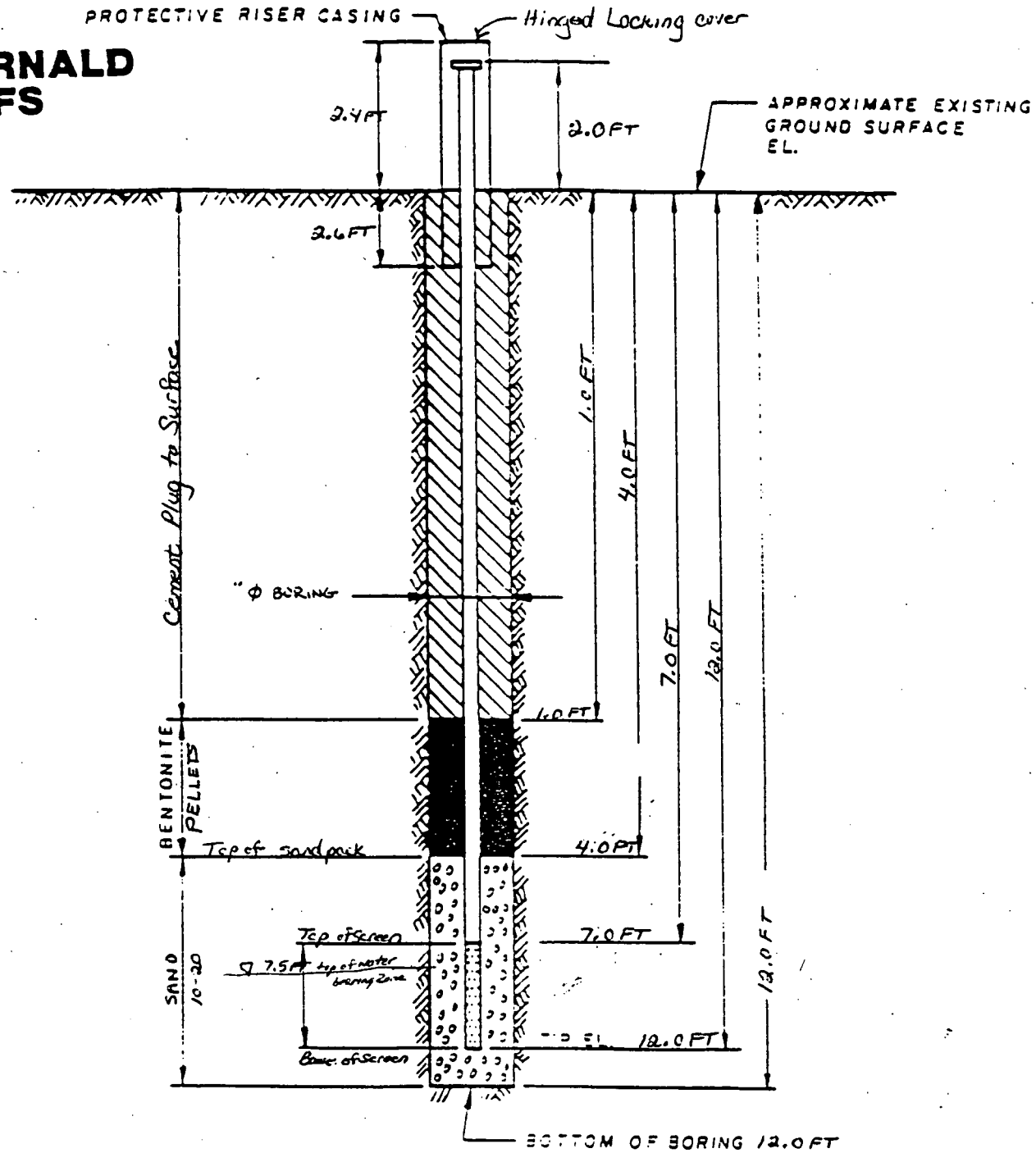
DRAWING NUMBER Boring # 1176

CHECKED BY
APPROVED BY

C.G.

DRAWN BY

FERNALD RI/FS



NOTES:

1. RISER PIPE IS 2.0 IN I D SCHEDULE PIPE, THREADED, FLUSH-JOINTED.
2. SCREEN IS 2.0 IN I.D SCH 40 PVC PIPE CONTINUOUS SLOT SCREEN (0.0 0 IN SLOT SIZE).
3. LOWER END OF SCREEN IS CAPPED.
4. ELEVATION OF WATER LEVEL
5. WATER LEVEL READING ON

Materials used:
2 sks 80# 10-20 sand
2 buckets (5gal) bentonite pellets
1/3 sk. cement (50#)
20 gal

INSTALLATION DETAILS
MONITORING WELL #1176

PREPARED FOR FMPC RI/FS

PVC Well Screen and Riser Pipe:
1 - 5.0 FT Screened section
1 - 9.0 FT Sch. 40 Riser PVC

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FERNALD RI/FS

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602-3.7.1	PROJECT NAME: Facilities Testing Program		
BORING NUMBER: 1244	COORDINATES:	DATE: 5-8-89	
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5-8-89	
ENGINEER/GEOLOGIST: L. Sintfield	Depth Date/Time	DATE COMPLETED: 5-8-89	
DRILLING METHODS: B-53, Hollow Stem Auger with Split Spoon Sampler		PAGE 1 OF 4	

6 Total pages with field copies enclosed. BY 6/5/89

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
							Start = 1445
0.5	17937 WMCO	7	8 in	Hard, Yellowish Brown (10YR, 5/6) Lean Clay with Gravel, CL - Dry, medium plastic, massive @ 1355	GM ↓ CL	>4.5 TSF	HNU = Ø ppm; α = 5-10 cpm; Bγ = 80-120 cpm at top of sample; ↳ = surface; Bγ = 1,000-1,400 cpm
1.0	17938	10					
1.5	17939 NR	27					
2.0	17940	32	12 in	Hard, same as above @ 1400	CL	4.2 to 4.5 TSF	HNU = Ø ppm; α = Ø cpm; Bγ = 80-120 cpm
2.5	17941 WMCO	14					
3.0	17942 NR	8					
3.5	17943 NR	8	6 in	medium Stiff to Stiff, Dark grayish Brown (2.5Y, 4/2) Lean Clay with Gravel, CL - dry medium plastic, massive. Silt at top, ML - Loose, yellowish brown (10YR, 6/6) massive @ 1405	ML/CL	0.5 to 1.2 TSF	HNU = Ø ppm; α = Ø cpm; Bγ = 180-220 cpm silt; Bγ = 100-1200 cpm clay
4.0	17944	8					
4.5	17945 NR	12					
5.0	17946	11	9 in	Stiff to Very Stiff, Dark grayish brown (2.5Y, 4/2) Lean Clay with Gravel, CL - dry massive, medium plastic, Slightly mottled. @ 1410	CL	1.1 to 2.6 TSF	HNU = Ø ppm; α = Ø cpm; Bγ = 100-140 cpm
5.5	17947 WMCO	10					
6.0	17948 NR	10					
6.5	17949 NR	5	4 in	Stiff, mottled Yellowish brown (10YR, 5/4) to (10YR, 5/5) Lean Clay with Gravel, CL - Dry, massive, medium plastic @ 1421	CL	1.2(?) TSF	HNU = Ø ppm; α = Ø cpm; Bγ = 140-200 cpm
7.0	17950 NR	8					
7.5	17951	9					

NOTES: Contractor: Penn Drill
Driller: J. Saccani
Helper: G. Dye
Sample Tech: C. Melroy
Weather: Clear & warm
HNU #: HH18

Using Lead shield to SCAN samples for Bγ.

NR = No Recovery, No Sample Taken

Background @ 1340
HNU = Ø ppm
Air α = Ø cpm
Air Bγ = 200-300 cpm
gnd α = ~~200~~ 20-700 cpm
gnd Bγ = 1,200-1,500 cpm

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4C2-11-86

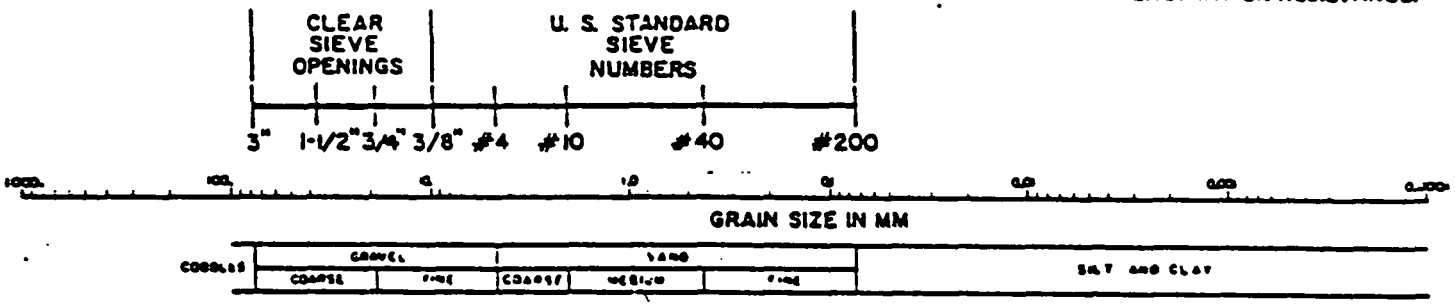
CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE (1)
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

(1) STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 18 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANCE.



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

FINE-GRAINED/HIGHLY ORGANIC SOILS

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

FERNALD RI/FS

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VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602-3.7.1	PROJECT NAME: Facilities Testing Program	
BORING NUMBER: 1244	COORDINATES:	DATE: 5-8-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5-8-89
ENGINEER/GEOLOGIST: L. Sintfield	Depth Date/Time	DATE COMPLETED: 5-8-89
DRILLING METHODS: B-53, Hollow Stem Auger with Split Spoon Sampler		PAGE 2 OF 4

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
7.5	17952	9	18 in	Very Stiff, mottled Gray (10YR, 6/4) to Brownish yellow (10YR, 6/6) Lean Clay with Sand, CL-Dry, massive, medium plastic with occasional Gravel @ 1450	CL	3.1 to 3.2 TSF	Start= HNU=0.5-1.0 ppm α= 0 cpm Bγ=230-260 cpm
8.0	17953	12					
8.5	17954	14					
9.0	17955	10	8 in	Stiff, same as above 7.5 to 9.0 ft, but more gravel @ 1455	CL	1.1 to 1.3 TSF	HNU= 0.5 ppm α= 1 cpm Bγ=200-240 cpm
9.5	17956	8					
10.0	NR 17957	10					
10.5	NR 17958	10	12 in	Very Stiff, Dark Grayish Brown (2.5Y, 4/2) to Olive Brown (2.5Y, 4/4) Lean Clay, CL-Dry, massive. 11.5	CL	2.2	HNU= 0 ppm α= 0 cpm Bγ=80-100 cpm
11.0	50651	12					
11.5	50652	10		Loose, silty sand, Brownish Yellow (10YR, 5/6), WET, massive @ 1505	SM	Loose TSF	
12.0	50653	5	18 in	Loose, Brownish Yellow (10YR, 5/6) SILTY SAND, SM-WET, massive grades to silt at Base @ 1530	SM ↓ ML	Loose TSF	HNU= 0 ppm α= 0 cpm Bγ= 80-120 cpm
12.5	50654	10					
13.0	50655	12					
13.5	50656	10	18 in	Loose, Brownish yellow (10YR, 5/6) Silty Sand, SM-WET, massive. 14.75 ft	SM	Loose	HNU= 0 ppm α= 0 cpm Bγ= 80-100 cpm
14.0	50657	12					
14.5	50658	5		Loose, Laminated silt and Clay, DRY- @ 1540	ML/CL	TSF	
15.0							

▽ 11.5 ft

Water Bearing Zone

14.75 ft

NOTES: Contractor: Penn Drill

Driller:
Helper:
Sample Tech:
Weather:
HNU#:
} See page 1 of 4

Water Bearing Zone = 11.5 to 14.75 ft depth

Background @ 1340
HNU= See ppm
α= cpm
Bγ= Page 1 of 4 cpm

NR = No Recovery, No Sample Taken

402-11-86

6496

Field Copy

FERNALD RI/FS

VISUAL CLASSIFICATION OF SOILS

FMPC-RI/FS

PROJECT NUMBER: 602-3.7.1	PROJECT NAME: Facilities Testing Program	602-3.7.1
BORING NUMBER: 244	COORDINATES:	DATE: 5-8-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5-8-89
ENGINEER/GEOLOGIST: C. Sinfield	Depth Date/Time	DATE COMPLETED: 5-8-89
DRILLING METHODS: B-53, Hollow Stem Auger with Split Spoon Sampler		PAGE 1 OF 4

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
							Start = 1330
0.5	17937 WMCO	7	8 in	Hard yellowish brown (10YR, 5/6) Lean Clay with Gravel, dry; med. plastic, massive. @1355	GM ↓ CL	74.5 TSF	HNU = Ø ppm; α = 5-10 cpm at; Bγ = 80-120 cpm at 1½ ft; Bγ = 1,000-1,400 cpm at surface
1.0	17938	10					
1.5	17939 NR	27					
2.0	17940	32	12 in	Hard, Lean clay Same as above 0.0-1.5 ft @1400	CL	4.2 - 4.5 TSF	HNU = Ø ppm; α = Ø cpm; Bγ = 80-120 cpm
2.5	17941 WMCO	14					
3.0	17942 NR	8					
3.5	17943 NR	8	6 in	medium stiff to stiff Dark grayish brown (2.5Y, 4/2) Lean clay with Gravel, dry med. plastic massive. with Silt at top - Loose, dry (10YR 6/6) massive, yellowish Brown @1405	ML CL	0.5 - 1.2 TSF	HNU = Ø ppm; α = Ø cpm; Bγ = 180-220 cpm silt; Bγ = 100-120 cpm clay
4.0	17944	8					
4.5	17945 NR	12					
5.0	17946	11	9 in	Same as above Clay occasional Gravel. Dry, Stiff to very Stiff, massive, medium plastic Slightly mottled @1410	CL	1.1 - 2.6 TSF	HNU = Ø ppm; α = Ø cpm; Bγ = 100-140 cpm
5.5	17947 WMCO	10					
6.0	17948 NR	10					
6.5	17949 NR	5	4 in	Stiff, mottled ~~Brown~~ yellowish Brown (10YR 5/4) to (10YR 5/5) Lean clay with gravel, dry massive, medium plastic @1427	CL	1.2(?) TSF	HNU = Ø ppm; α = Ø cpm; Bγ = 140-200 cpm
7.0	17950 NR	8					
7.5	17951	9					

NOTES: Contractor: Penn Drill
Driller: J. Saccani
Helper: G. Dye
Sample Tech: C. Melroy
Weather: clear & warm
HNU #: HH18

Using lead shield to screen samples for Bγ.

NR = No Recovery, No Sample Taken

Background @1340
HNU = Ø ppm
Air α = Ø cpm
Air Bγ = 200-300 cpm
gnd α = 20-100 cpm
gnd Bγ = 1,200-1,500

6496

Field Copy

FERNALD RI/FS

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602-3.7.1	PROJECT NAME: Facilities Testing Program FMPC RI/FS	
BORING NUMBER: 1244	COORDINATES:	DATE: 5-8-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5-8-89
ENGINEER/GEOLOGIST: L. Sinfield	Depth Date/Time	DATE COMPLETED: 5-8-89
DRILLING METHODS: B-53, Hollow Stem Auger with Split Spoon Sampler.		PAGE 2 OF 4

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
7.5	17952	9	18 in	Very Stiff, Mottled Gray (10YR, 6/1) to Brownish yellow (10YR, 6/6) Lean clay with Sand, dry, massive medium plastic isolate gravel. @ 1450	CL	3.1 to 3.2 TSF	Start = HNU = 0.5-1.0 ppm α = Ø cpm Bγ = 230-260 cpm
8.0	17953	12					
8.5	17954	14					
9.0	17955	10	8 in	Same as above, but stiff but more gravel Dry, massive @ 1455	CL	~~3.1~~ ~~3.2~~ 1.1 to 1.3 TSF	S 5-8-89 HNU = 0.5 ppm α = 1 cpm Bγ = 200-240 cpm
9.5	17956	8					
10.0	NR 17957 MMCO	10					
10.5	17958 NR	10	12 in	Very Stiff, Dark grayish Brown (2.5Y, 4/2) to Olive Brown (2.5Y, 4/4) Lean clay, dry, massive 11.5 ft.	pure gravel CL	22	HNU = Ø ppm α = Ø cpm Bγ = 80-100 cpm
11.0	50651	12		Loose, Silty Sand, Brownish yellow (10YR, 5/6), WET, massive. @ 1505	SM	Loose TSF	
11.5	50652	10					
12.0	50653	8	18 in	Loose, Silty Sand - same as above 11.5-12.0 ft Grades to Silt, brownish yellow (10YR, 6/6) saturated, massive. @ 1530	SM	Loose TSF	HNU = 0 ppm α = Ø cpm Bγ = 80-120 cpm
12.5	50654	10					
13.0	50655	12			ML		
13.5	50656	10	18 in	Loose Silty Sand, Brownish yellow (10YR, 6/6), massive, ~~Satu~~ 5-8-89 wet	SM	Loose TSF	HNU = Ø ppm α = Ø cpm Bγ = 60-80 cpm
14.0	50657	12					
14.5	50658	5		brownish yellow (10Y 14.75			
15.0				Loose Silt - well laminated, dry with clay @ 1540	ML		

NOTES: Contractor: Penn Drill
Driller: J. Saccani
Helper: G. Dye
Sample Tech: C. Melroy
Weather: clear and warm
HNU #: HH18

Water Bearing Zone: CL
11.5 → 14.75 ft depth

Background @ 1340
HNU = ppm
α = see page 1 of 4 cpm
Bγ = cpm

NR = No Recovery, No Sample Taken

4C2-11-86

FERNALD RI/FS

PIEZOMETER INSTALLATION SHEET

PROJECT NAME Facilities Testing FMPC RI/FS
FIELD ENG./GEO. L. Sinfield
DATE 5-8-89
PROJECT NO. 602-3.7.1
CHECKED BY RJ
DATE 6/6/89
BORING NO. 1244
PIEZOMETER NO. 1244
DATE OF INSTALLATION 5-8-89

BOREHOLE DRILLING

DRILLING METHOD Hollow Stem Auger
DRILLING FLUID (S) USED: N/A
FLUID N/A FROM N/A TO N/A
FLUID N/A FROM N/A TO N/A

TYPE OF BIT Auger Bit
CASING SIZE (S) USED: N/A
SIZE N/A FROM N/A TO N/A
SIZE N/A FROM N/A TO N/A

PIEZOMETER DESCRIPTION

TYPE Schedule 40 PVC
DIAMETER OF PERFORATED SECTION 2 inch ID
PERFORATION TYPE:
SLOTS ☑ HOLES ☐ SCREEN ☐
AVERAGE SIZE OF PERFORATIONS 0.020 inch
TOTAL PERFORATED AREA 4.8 feet

RISER PIPE MATERIAL Schedule 40 PVC
RISER PIPE DIAMETERS: 2 5/16 inch
O.D. ~~2 1/8 inch~~ I.D. 2 inch
LENGTH OF PIPE SECTIONS 11.7 ft
JOINING METHOD Flush-Threaded

PROTECTION SYSTEM

RISER PROTECTIVE PIPE LENGTH 5.0 ft
PROTECTIVE PIPE O.D. 4 1/4 inch

OTHER PROTECTION Locking protective cover Hinged lid

ITEM	DISTANCE ABOVE/BELOW GROUND SURFACE (ft)		ELEVATION (ft)	
TOP OF RISER PIPE	2.0 ft			
GROUND SURFACE	0.0 ft			
BOTTOM OF PROTECTIVE PIPE	2.8 ft			
BOREHOLE FILL MATERIALS:				
GROUT/SLURRY	TOP N/A	BOTTOM N/A	TOP	BOTTOM
BENTONITE	TOP 1.0 ft	BOTTOM 8.0 ft	TOP	BOTTOM
SAND	TOP 8.0 ft	BOTTOM 15.0 ft	TOP	BOTTOM
GRAVEL	TOP N/A	BOTTOM N/A	TOP	BOTTOM
PERFORATED SECTION	TOP 9.7 ft	BOTTOM 14.6 ft	TOP	BOTTOM
PIEZOMETER TIP	15.0 ft			
BOTTOM OF BOREHOLE	15.0 ft			
GWL AFTER INSTALLATION				

WAS THE PIEZOMETER FLUSHED AFTER INSTALLATION? YES ☐ NO ☑
WAS A SENSITIVITY TEST PERFORMED ON THE PIEZOMETER? YES ☐ NO ☑

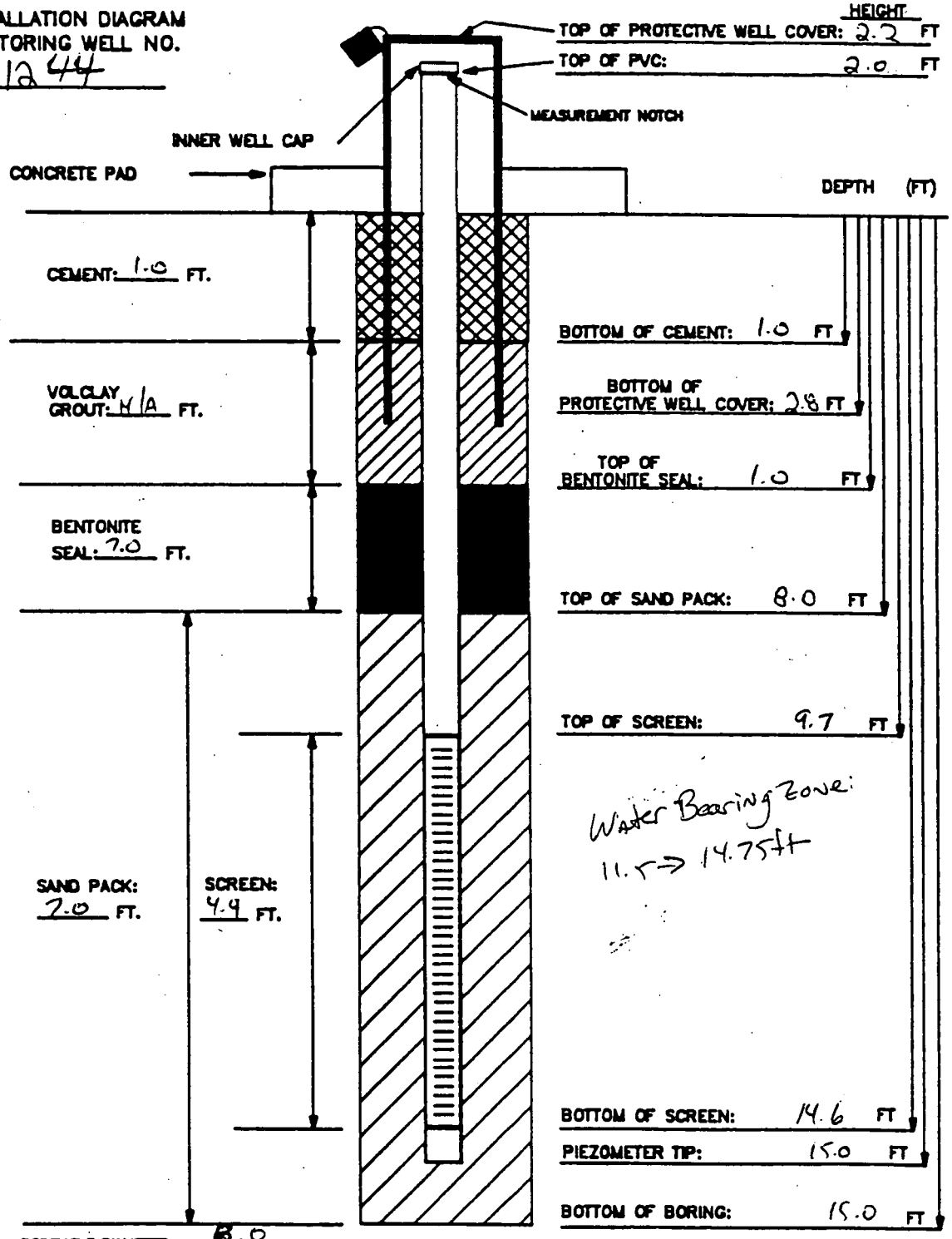
REMARKS Water Bearing Zone B from 11.5 ft to 14.7 ft below ground surface in a Silty Sand - SM.

409-11-55

INSTALLATION DATE: 5-8-89

FERNALD RI/FS

INSTALLATION DIAGRAM
MONITORING WELL NO.
1244



BOREHOLE DIAMETER: 8.0 INCHES

MATERIALS USED:
SAND TYPE AND QUANITITY: 3 Bags 10/20 8016
BENTONITE PELLETS (5-GALLON BUCKETS): 3
BAGS OF VOLCLAY GROUT: N/A
AMOUNT OF CEMENT: 1 Bag 50lb
AMOUNT OF WATER USED: 15 gallons
OTHER: 5.0ft x 4 3/8 inch Protective Cover.

NOTES:
1) RISER PIPE IS 2-INCH SCHEDULE 40 PVC PIPE, FLUSH-THREADED JOINTS.
2) SCREEN IS 2-INCH I.D. SCHEDULE 40 PVC PIPE WITH 0.020-INCH SLOTS.
3) LOWER END OF SCREEN IS CAPPED WITH AN END CAP OR THREADED SUMP.
4) WATER DEPTH/DATE:

TASK: 602 3.7.1 GEOLOGIST/ENGINEER: L. Sinfield

FERNALD RI/FS

6496

	Field Check	1st Key In	2nd Key In	Hard Copy Verification

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602-3.7.1	PROJECT NAME: Facilities Testing Program	
BORING NUMBER: 1224	COORDINATES:	DATE: 5-16-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5-15-89
ENGINEER/GEOLOGIST: L. Sinfield	Depth Date/Time	DATE COMPLETED: 5-16-89
DRILLING METHODS: B-45, Hollow Stem Auger with Split spoon Sampler		PAGE 1 OF 5

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
							Start = 1515 5/15/89
0.5	17497 WMCO	5		Loose, gravel, Wet, Massive.	GW		HNU = Ø ppm
1.0	17498	6	10in	Very Stiff, Brownish Yellow (10YR, 6/6) Lean Clay, CL - Dry, massive, medium plastic, with Silt, mottled 5/15/89 @ 1515	CL	3.9	α = Ø cpm BG = 700 cpm
1.5	17499 NR	10				TSF	
2.0	17500	6		Very Stiff, Brownish Yellow (10YR, 6/6), Lean clay, CL - Dry, massive, medium plastic with Silt, mottled to grayish Brown (2.5Y, 5/2) 5/15/89 @ 1530	CL	2.7	HNU = Ø ppm α = Ø cpm BG = 750-800 cpm
2.5	17501 NR WMCO	8	6in				
3.0	17502 NR	9				TSF	
3.5	17503	7		Very Stiff, Grayish Brown (2.5Y, 5/2) mottled, Lean Clay, CL - Dry, massive, medium plastic to Olive Gray (5Y, 4/2 5/15/89 @ 1640	CL	2.0 ↓ 2.4	HNU = Ø ppm α = Ø cpm BG = 320-380 cpm
4.0	17504	9	8in				
4.5	17505 NR	10				TSF	
5.0	17506	7		Stiff to Very Stiff, Olive Gray (5Y, 4/2) to Brownish yellow (10YR, 6/8) Lean Clay, Dry massive, medium plastic. 5/15/89 @ 1545	CL	1.2 ↓ 2.4	HNU = Ø ppm α = Ø cpm BG = 320-380 cpm
5.5	17507 NR WMCO	8	6in				
6.0	17508 NR	9				TSF	
6.5	17509	2		Stiff, dry, Same as above 4.5→6.0ft 5/15/89 @ 1610	CL	1.5 ↓ 1.7	HNU = Ø ppm α = 5 cpm BG = 280-320 cpm
7.0	17510	3	12in				
7.5	17511 NR	5				TSF	

NOTES: Contractor: Penn Drill
Driller: D. Newman
Helper: W. Anderson
Sample Tech: N/A
Weather: Cloudy-cool
HNU #: HH18

5/15/89 Background @ 1400
HNU = Ø ppm
α = Ø cpm
BG = 320-380 cpm

NR = No Recovery, No Sample Taken

4C2-11-86

000050

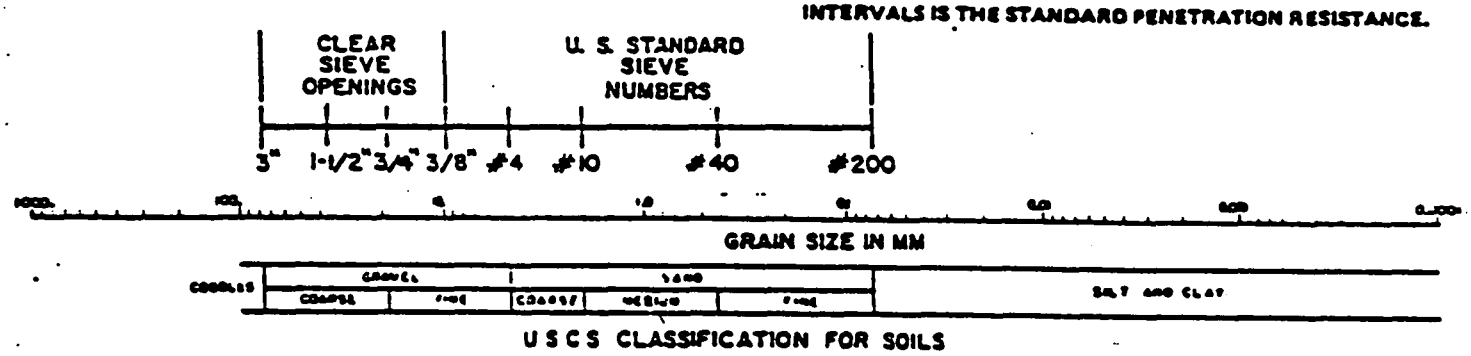
CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE (1)
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

(1) STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 18 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANCE.



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

FINE-GRAINED/HIGHLY ORGANIC SOILS

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

FERNALD RI/FS

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VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602-3.7.1	PROJECT NAME: Facilities Testing Program		
BORING NUMBER: 1224	COORDINATES:	DATE: 5/17/89	
ELEVATION:	GWL: Depth / Date/Time	DATE STARTED: 5/15/89	
ENGINEER/GEOLOGIST: L. Sinfield	Depth / Date/Time	DATE COMPLETED: 5/16/89	
DRILLING METHODS: See Page 1 of 5		PAGE 2 OF 5	

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER 6 IN	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
7.5							Start=
8.0	17512	4	12in	Stiff, olive Gray (5Y, 4/2) to Brownish Yellow (10YR, 6/8) Lean Clay, Dry, massive, medium plastic @ 1615	CL	1.1 ↓ 1.7 TSF	HNU= ø ppm; α= ø cpm; Bγ= 300-340 cpm
8.5	17513	7					
9.0	17514 NR	7					
9.5	17515	8	18in	Same as above 7.5-9.0 ft	CL	1.1 ↓ 1.8 TSF	HNU= ø ppm; α= ø cpm; Bγ= 300-340 cpm
10.0	17516	12					
10.5	17517 NRCO	14		10.0 ft Medium Dense, Silty, WET, massive 5/15/89 @ 1630	ML		
11.0	17518	6	18in	Very Stiff, Brownish yellow (10YR, 6/8) to Gray (10YR, 4/1) Lean Clay, dry, with thin (1/4 in) Silt layers - moist 5/16/89 @ 0830	CL/ML	2.6 ↓ 3.3 TSF	HNU= ø ppm; α= ø cpm; Bγ= 300-400 cpm
11.5	50792	11					
12.0	50793	11					
12.5	50794	10	18in	Very Stiff, Gray (10YR, 4/1) Lean Clay, dry, massive, medium plastic	CL	2.6 ↓ 3.0 TSF	HNU= ø ppm; α= ø cpm; Bγ= 300-400 cpm
13.0	50795	14					
13.5	50796	16		Medium Dense, Silty Sand, WET, massive 5/16/89 @ 0840	SM		
14.0	50797	6	12in	Loose, Coarse Sand, WET, massive with Silt.	SM	N/A TSF	HNU= ø ppm; α= ø cpm; Bγ= 300-400 cpm
14.5	50798	7					
15.0	50799	11		5/16/89 @ 0850			

NOTES: Contractor: Driller: Helper: Sample Tech: Weather: HNU #: } See Page 1 of 5

5/16/89 Background @ 0800
HNU= ø ppm
α= ø cpm
Bγ= 320-380 cpm

602-11-86

FERNALD RI/FS

6496

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602-3.7.1	PROJECT NAME: Facilities Testing Program	
BORING NUMBER: 1224	COORDINATES:	DATE: 5-17-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5-15-89
ENGINEER/GEOLOGIST: L. Sinfield	Depth Date/Time	DATE COMPLETED: 5-16-89
DRILLING METHODS: See Page 1 of 5		PAGE 3 OF 5

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
15.0							Start =
	50800 WMCO	10		Very Stiff, Brownish Yellow (10YR,6/8) 15.5ft	CL	3.7	HNU = ø ppm
15.5				Medium Dense, Silty Coarse Sand, WET, massive.	SM		α = ø cpm
	50801	14	18in			N/A	BG = 320-380 cpm
16.0							
	50802	17		@ 0915		TSF	
16.5							
	50803	14		Medium Dense, Silty Coarse Sand, Massive, WET, grading to Medium Dense, Silt, massive, gray (10YR, 4/1)	SM		HNU = ø ppm
17.0						N/A	α = ø cpm
	50804	14	18in				BG = 320-380 cpm
17.5							
	50805	15		@ 0925	ML	TSF	
18.0							
	50806	14		Medium Dense to Dense, Silty Coarse Sand, massive, WET.	SM		HNU = ø ppm
18.5						N/A	α = ø cpm
	50807	32	18in				BG = 320-380 cpm
19.0							
	50808	35		@ 1008		TSF	
19.5							
	50809	50	6in	Same as above 18.0-19.5ft @ 1008	SM	N/A	HNU = ø ppm
20.0						TSF	α = ø cpm
				TD = 20.0 ft.			BG = 320-380 cpm

NOTES: Contractor:
Driller:
Helper:
Sample Tech:
Weather:
HNU #:
} See page 1 of 5

5/16/89

Background @ 0800
HNU = ø ppm
α = ø cpm
BG = 320-380 cpm

4C2-11-86

FERNALD RI/FS

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PIEZOMETER INSTALLATION SHEET

PROJECT NAME Facilities Testing FMPC RI/FS FIELD ENG./GEO. L. Sinfield DATE 5-23-89
PROJECT NO. 602 3.7.1 CHECKED BY [illegible] DATE 6/5/89
BORING NO. 1224
PIEZOMETER NO. 1224 DATE OF INSTALLATION 5-24-89

BOREHOLE DRILLING

DRILLING METHOD Hollow Stem Auger	TYPE OF BIT Auger Bit
DRILLING FLUID (S) USED: N/A	CASING SIZE (S) USED: N/A
FLUID N/A FROM N/A TO N/A	SIZE N/A FROM N/A TO N/A
FLUID N/A FROM N/A TO N/A	SIZE N/A FROM N/A TO N/A

PIEZOMETER DESCRIPTION

TYPE Schedule 40 PVC - Monitoring Well	RISER PIPE MATERIAL Schedule 40 PVC
DIAMETER OF PERFORATED SECTION 2 inch ID	RISER PIPE DIAMETERS:
PERFORATION TYPE:	O.D. 2 1/4 inch I.D. 2 inch
SLOTS ☑ HOLES ☐ SCREEN ☐	LENGTH OF PIPE SECTIONS 10.0 ft
AVERAGE SIZE OF PERFORATIONS 0.020 inch	JOINING METHOD Flush - Threaded Joints
TOTAL PERFORATED AREA 10.0 ft.	

PROTECTION SYSTEM

RISER PROTECTIVE PIPE LENGTH 5 feet	OTHER PROTECTION Locking - Hinged Cover.
PROTECTIVE PIPE O.D. 4 3/8 inch	

ITEM	DISTANCE ABOVE/BELOW GROUND SURFACE (ft)		ELEVATION (ft)	
TOP OF RISER PIPE	2.0 ft			
GROUND SURFACE	0.0 ft			
BOTTOM OF PROTECTIVE PIPE	2.8 ft			
BOREHOLE FILL MATERIALS:	Cement 0.0 ft	1.0 ft		
GROUT/SLURRY	TOP 1.0 ft	BOTTOM 5.0 ft	TOP	BOTTOM
BENTONITE	TOP 5.0 ft	BOTTOM 8.0 ft	TOP	BOTTOM
SAND	TOP 8.0 ft	BOTTOM 20.0 ft	TOP	BOTTOM
GRAVEL	TOP N/A	BOTTOM N/A	TOP	BOTTOM
PERFORATED SECTION	TOP 9.6 ft	BOTTOM 19.6 ft	TOP	BOTTOM
PIEZOMETER TIP	20.0 ft			
BOTTOM OF BOREHOLE	20.0 ft			
GWL AFTER INSTALLATION	8.22 ft from TOC 5/24/89 @ 1000			

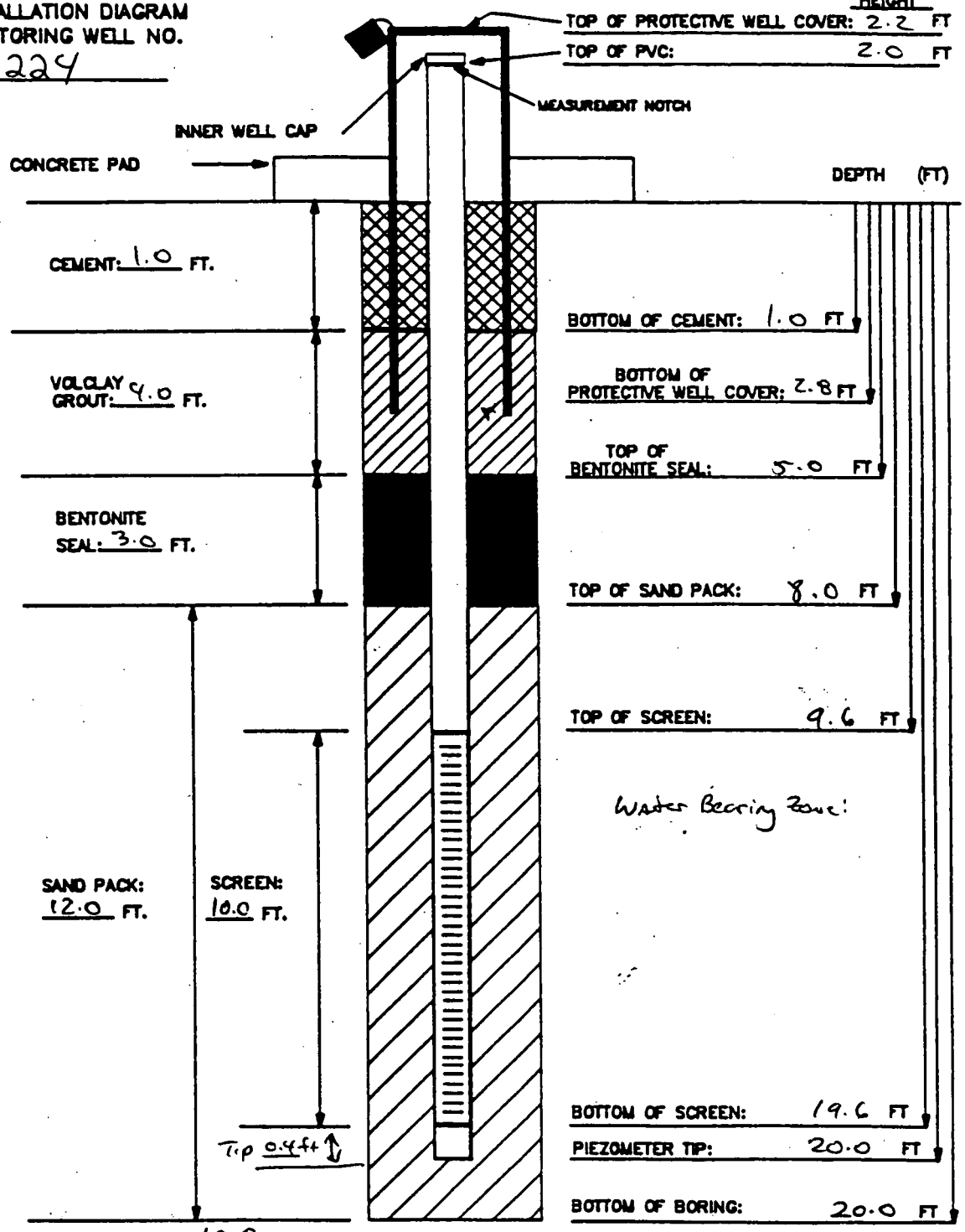
WAS THE PIEZOMETER FLUSHED AFTER INSTALLATION? YES ☐ NO ☑
WAS A SENSITIVITY TEST PERFORMED ON THE PIEZOMETER? YES ☐ NO ☑
REMARKS Water Bearing Zone:

Water level taken by Hold & Cut method with inoperable water level indicator.

INSTALLATION DATE: 5-24-89

FERNALD RI/FS

INSTALLATION DIAGRAM
MONITORING WELL NO. 1224



BOREHOLE DIAMETER: 10.0 INCHES

MATERIALS USED:
SAND TYPE AND QUANITITY: 8 Bags 10/20 80lb
BENTONITE PELLETS (5-GALLON BUCKETS): 2
BAGS OF VOLCLAY GROUT: 1 Bag (50lb)
AMOUNT OF CEMENT: 1 Bag (50lb)
AMOUNT OF WATER USED: 40 gallons
OTHER: Protector Cover 5' x 4 3/8"

NOTES:
1) RISER PIPE IS 2-INCH SCHEDULE 40 PVC PIPE, FLUSH-THREADED JOINTS.
2) SCREEN IS 2-INCH I.D. SCHEDULE 40 PVC PIPE WITH 0.020-INCH SLOTS.
3) LOWER END OF SCREEN IS CAPPED WITH AN END CAP OR THREADED SUMP.
4) WATER DEPTH/DATE: 8.22 TOC 5/24/89 @1000 (6.22 gwl)

Hold 15.00
Cut 6.78
8.22

TASK: 602 3.7.1

GEOLOGIST/ENGINEER: L. Sinfield

FERNALD RI/FS

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Field Copy

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602-371	PROJECT NAME: Facilities Testing Program	
BORING NUMBER: 1224	COORDINATES:	DATE: 5-15-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5-15-89
ENGINEER/GEOLOGIST: L. Dintrich	Depth Date/Time	DATE COMPLETED:
DRILLING METHODS: B-45, Hollow Stem Auger with Split Spoon Sampler		PAGE 1 OF 5

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER 6 IN	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
							Start = 1515
0.5	17497 wmco	5	10in	Loose, gravel, wet, massive	GW		HNU = Ø ppm α = Ø cpm BG = 700 cpm
1.0	17498	6		Very Stiff, Brownish yellow (10YR, 6/6) Lean Clay, dry, massive, med. plastic with silt, mottled		3.9	
1.5	17499 NR	10		5/15/89 @ 1515		TSF	
2.0	17500	6	6in	Very Stiff, Brownish yellow (10YR, 6/6) Lean Clay, dry massive, medium plastic with silt, mottled to grayish Brown (2.5Y, 5/2)		2.7	HNU = Ø ppm α = Ø cpm BG = 750-800 cpm
2.5	17501 NR wmco	8			CL		
3.0	17502 NR	9		5/15/89 @ 1530		TSF	
3.5	17503	7	8in	Very Stiff, Grayish Brown (2.5Y 5/2) mottled, Lean Clay, dry, massive, medium plastic, olive gray (5Y, 4/2)	CL	2.4 ↓ 2.0	HNU = ppm α = Ø cpm BG = 320-380 cpm
4.0	17504	9					
4.5	17505 NR	10		5/15/89 @ 1540		TSF	
5.0	17506	7	6in	Stiff to Very Stiff, Olive Gray (5Y, 4/2) to Brownish yellow (10YR, 6/8) Lean Clay, dry, massive, medium plastic	CL	2.4 ↓ 1.2	HNU = Ø ppm α = Ø cpm BG = 320-380 cpm
5.5	17507 NR wmco	8					
6.0	17508 NR	9		5/15/89 @ 1545		TSF	
6.5	17509	2	12in	Same as above, dry Stiff.	CL	1.5 ↓ 1.7	HNU = Ø ppm α = Ø cpm BG = 280-320 cpm
7.0	17510	3					
7.5	17511 NR	5		5/15/89 @ ~~1640~~ 1610		TSF	

NOTES: Contractor: Penn Drill
Driller: D. Newman
Helper: W. Anderson
Sample Tech: N/a
Weather: cloudy-cool
HNU #: HH118

5/15/89 Background @ 1400
HNU = Ø ppm
α = Ø cpm
BG = 320-380 cpm

4C2-11-86

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Field Copy

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602-37.1	PROJECT NAME: Facilities Testing Program	
BORING NUMBER: 1224	COORDINATES:	DATE: 5-16-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5-15-89
ENGINEER/GEOLOGIST: C. Sinfield	Depth Date/Time	DATE COMPLETED: 5-16-89
DRILLING METHODS: B-45 Hollow Stem Auger		PAGE 2 OF 5

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
7.5	17512		45	Stiff Same as above	CL	3.9	Start = 1515 HNU = ∅ ppm
8.0	17513	8	76			1.1 ↓ 1.7	α = ∅ cpm
8.5	17514 NR	12 in	70	5/15/89 @ 1615		TSF	Bγ = 300-340 cpm
9.0	17515	8		Stiff Same as above	CL	1.1 ↓ 1.8	HNU = ∅ ppm
9.5	17516	12	18 in				α = ∅ cpm
10.0	17517	14		WET 10.0 ft			Bγ = 300-340 cpm
10.5	WMCO			Silt, medium Dense @ 1630 5/15/89	ML	TSF	
	17518	6		Very Stiff, Brownish yellow (10YR 6/8) to Gray [illegible] Lean clay [illegible] thin (1/4 in) Silt layers - moist.	CL/ML	2.6 ↓ 3.3	HNU = ∅ ppm
11.0	50757	11	18 in				α = ∅ cpm
11.5	50758	11		5/16/89 @ 0830		TSF	Bγ = 300-400 cpm
12.0	50759	10		Very Stiff, Gray (10YR 4/1) Lean Clay, dry, massive, medium plastic	CL	2.6 ↓ 3.0	HNU = ∅ ppm
12.5	50760	14	18 in				α = ∅ cpm
13.0	50761	16		medium Dense, Silty Sand, WET, massive @ 0840	SM	TSF	Bγ = 300-400 cpm
13.5	50762	6		Loose, Coarse Sand, WET, massive		N/A	HNU = ∅ ppm
14.0	50763	7	18 in	with Silt			α = ∅ cpm
14.5	50764 NR	11		0850 @ 0850	SM	TSF	Bγ = 300-400 cpm
15.0							

NOTES: Contractor: Penn Drill
Driller: D. Newman
Helper: W. Anderson
Sample Tech: N/A
Weather: Cloudy
HNU #: HH18

5/16/89 Background @ 0800
HNU = ∅ ppm
α = ∅ cpm
Bγ = 320-380 cpm

NR = No Recovery, No Sample Taken

402-11-86

FERNALD RI/FS

6496
Field Copy

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602-3.7.1	PROJECT NAME: Facilities Testing Program	
BORING NUMBER: 1224	COORDINATES:	DATE: 5-16-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5-15-89
ENGINEER/GEOLOGIST: L. Sintrel	Depth Date/Time	DATE COMPLETED: 5-16-89
DRILLING METHODS: See page 1 of 5		PAGE 3 OF 5

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
15.0	50765	00		Medium Dense, Silty Coarse Sand, massive with 6 in clay at top, very stiff medium plastic gray [illegible] yellow (10YR, 6/8) @ 0915	CC / SM	3-7 TSF	Start= HNU= 0 ppm α= 0 cpm Bγ= 320-380 cpm
15.5	50766	14	18 in				
16.0	50767	17					
16.5	50768	14		Medium Dense, Silty Coarse Sand, massive, WET, grading to medium Dense, Silt, massive gray (10YR, 4/1). @ 0925	SM ↓ MC	N/A TSF	HNU= 0 ppm α= 0 cpm Bγ= 320-350 cpm
17.0	50769	14	18 in				
17.5	50770	15					
18.0	50771	14		Medium Dense to Dense, Silty Coarse Sand, massive WET @ 1008 ~~0930~~	SM	N/A TSF	HNU= 0 ppm α= 0 cpm Bγ= 320-380 cpm
18.5	50772	32	18 in				
19.0	50773	35					
19.5	50774	50	6 in	Same as above @ 1008	SM	N/A TSF	HNU= 0 ppm α= 0 cpm Bγ= 320-380 cpm
20.0				TD = 20.0 ft			

NOTES: Contractor:
Driller:
Helper:
Sample Tech:
Weather:
HNU#:
} See page 1 of 5

Background @
HNU= ppm
α= See page cpm
Bγ= 2 of 5 cpm

4C2-11-86

FERNALD RI/FS

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VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1211	COORDINATES:	DATE: 5-16-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5-16-89
ENGINEER/GEOLOGIST: C. Grube	Depth Date/Time	DATE COMPLETED: 5-16-89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 1 OF 4

TOTAL: 6 Pages with field Copies enclosed.

DEPTH (FT.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN.)	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	17211 0909 5-16	8	6	Stiff, dark yellowish brown (10YR 4/4) gravelly clay, trace of sand and silt, low plasticity, moist	CL	1.25	HNU = 0ppm α = 0cpm Bγ = 60-80cpm
1	17212 0909 5-16	3	6	SAA	CL	1.25	
	17213 0909 5-16	3	3	Medium Stiff, dark yellowish brown (10YR 4/4) silty clay, low plasticity, moist	CL	.75	
2	17214 0913 5-16	4	6	Medium Stiff, yellowish brown (10YR 5/4) sandy clay, trace fine gravel, low plasticity, very moist	CL	.75	HNU = 0 ppm α = 0cpm Bγ = 100-110 cpm
	17215 0913 5-16	3	3	Loose, yellowish brown (10YR 5/4) clayey sand, trace fine to medium gravel, trace silt, very moist	SC	N/A	
3	17216 0913 5-16	2	0	NR	N/A	N/A	
	17217 0915 5-16	4	6	SAA	SC	N/A	HNU = 0ppm α = 0cpm Bγ = 90-100cpm
4	17218 0915 5-16	4	6	Medium Stiff, olive gray (5Y 4/2) clay, trace medium to fine gravel, medium plasticity, moist	CL	.75	
	17219 0915 5-16	5	2	Medium Stiff, olive gray (5Y 5/2) silty clay, low plasticity, moist	CL	.75	
5	17220 0917 5-16	7	6	Medium Dense olive gray (5Y 5/2) Clayey sand, trace fine gravel, very moist	SC	N/A	HNU = 0 ppm α = 0cpm Bγ = 70-90 cpm
	17221 0917 5-16	8	6	Medium Dense, olive (5Y 5/3) clayey silt, moist	ML	N/A	
6	17222 0917 5-16	7	6	Medium Stiff, olive gray (5Y 4/2) silty clay, trace sand, low plasticity, moist	CL	.75	
	17223 0920 5-16	8	6	Medium Dense, olive (5Y 4/4) Clayey silt, trace sand, moist	ML	N/A	HNU = 0 ppm α = 0 cpm Bγ = 60-80 cpm
7	17224 0920 5-16	7	6	Soft, olive (5Y 5/3) silty clay, trace sand, low plasticity, very moist	CL	.5	
	17225 0920 5-16	9	0	NR	N/A	N/A	

NOTES: CONTRACTOR: PENN DRILL
RIG: Model 80
DRILLER: Craig Coulter
ASSISTANT: Chris Coulter
SAA = SAME AS ABOVE
NR = No Recovery
HNU serial # 1201 10

SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST
COLORS IDENTIFIED USING MUNSELL COLOR CHART
BACKGROUND LEVELS: HNU = 0 PPM
α = 0 CPM
Bγ = 80-100 CPM
LEL O_2: LEL = 0% ~~PPM~~ 5/17/89
O_2 = 20.6 %

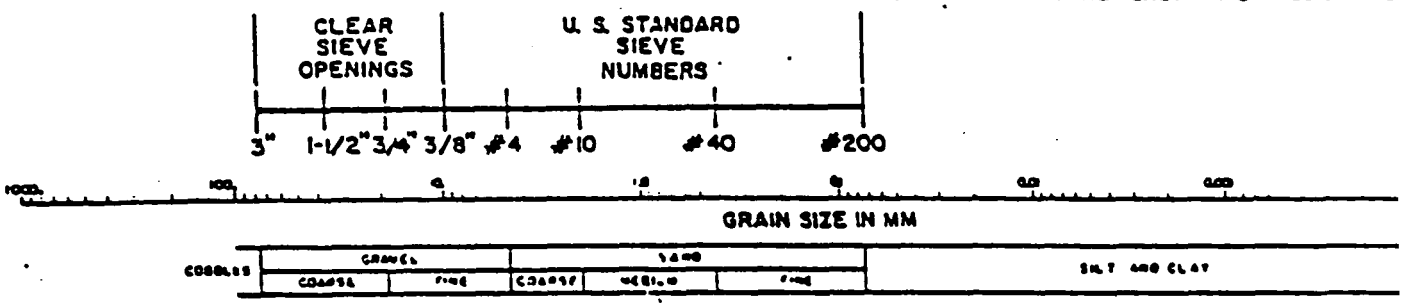
CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE (1)
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

(1) STANDARD PENETRATION RESISTANCE IS THE NUMBER O BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLIN FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 1 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EA 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANC



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

FINE-GRAINED/HIGHLY ORGANIC SOI

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SAN ROCK FLOUR, SILTY OR CLAYEY FINE SANC OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICI GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEO FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTIC ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTE

FERNALD RI/FS

6496

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1211	COORDINATES:	DATE: 5-16-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5-16-89
ENGINEER/GEOLOGIST: C. Grube	Depth Date/Time	DATE COMPLETED: 5-16-89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 2 OF 4

DEPTH (FT.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN.)	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
8	17226 0945 5-16	8	6	Soft, olive (5Y 5/3) silty clay, trace sand, low plasticity, very moist 7.7 FT	CL	.5	Hnu = 0 ppm
				medium Dense olive gray (5Y 5/2) clayey silt, trace sand, wet	ML	N/A	α = 0 cpm
	17227 0945 5-16	10	6	SAA	ML ~~SC~~ (5Y 5/1)	N/A	Bγ = 60-80 cpm
9	17228 0945 5-16	15	4	medium Dense olive gray (5Y 5/2) clayey sand, some gravel, well graded, wet	SC	N/A	
				medium Dense, yellowish brown (10 YR 5/6) silt, trace sand, very moist	ML	N/A	
	17229 1006 5-16	8	6	SAA	ML	N/A	Hnu = 0 ppm
							α = 0 cpm
10	17230 1006 5-16	9	2	Stiff, gray (5Y 5/1) silty clay, low plasticity, moist	CL	1.5	Bγ = 80-100 cpm
	17231 1006 5-16	7	0	NR	N/A	N/A	
11			*	Bottom of Boring and Sampling at 10.5 FT			Hnu =
							α =
							Bγ =
12							Hnu =
							α =
							Bγ =
13							
14							Hnu =
							α =
							Bγ =

NOTES:

SAA = Same As Above
NR = No Recovery

FERNALD RI/FS

Field Copy

6496

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1211	COORDINATES:	DATE: 5-16-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5-16-89
ENGINEER/GEOLOGIST: C. [illegible]	Depth Date/Time	DATE COMPLETED: 5-16-89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 1 OF 4

DEPTH (FT.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN.)	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	17211 0909 5-16	8	6	(10 YR 4/4) gravelly clay, trace sand & silt, low plasticity, moist	CL	1.25	HNU: 0 α: 0 Bγ: 60-80
	17212 0909 5-16	3	6	SAA	CL	1.25	
1	17213 0909	3	3	10 YR 4/4 silty clay, low plasticity moist	CL	.75	
	17214 0913	4	6	(10 YR 5/4) sandy clay, trace fine gravel, very moist, low plasticity	CL	.75	HNU: 0 α: 0 Bγ: 100-110
2	17215	3	3	(10 YR 5/4) ~~st~~ clayey silt, trace fine to med. gravel, trace silt, very moist		N/A	
	17216	2	0	No Recovery			
3	17217 0915	4	6	SAA			HNU: 0 α: 0 Bγ: 90-100
	17218	4	6	(5Y 4/2) clay, med plasticity, trace med. to fine gravel, moist		.75	
4	17219	5	2	(5Y 5/2) silty clay, low plasticity moist		.75	
	17220 0917	7	6	(5Y 5/2) Clayey sand, trace fine gravel, very moist		N/A	HNU: 0 α: 0 Bγ: 70-90
5	17221	8	6	(5Y 5/3), Clayey silt, moist		N/A	
	17222	7	6	(5Y 4/2) silty clay, trace sand low plasticity moist		.75	
6	17223 0936	8	6	(5Y 4/4) Clayey silt, trace sand, moist		N/A	HNU: 0 α: 0 Bγ: 60-80
	17224	7	6	(3Y 5/3) silty clay, trace sand, low plasticity, very moist	CL	.5	
7	17225	9	0	No Rec			

NOTES: CONTRACTOR: PENNDRILL
RIG: Model 80
DRILLER: Craig Coulter
ASSISTANT: Chris Coulter

SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST
COLORS IDENTIFIED USING MUNSELL COLOR CHART
BACKGROUND LEVELS: HNU = 0 PPM
α = 0 CPM
Bγ = 80-100 CPM
LEL/O2: LEL = 0 % ~~PPM~~
O2 = 20.6 %

FERNALD RI/FS

Field copy

6496

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1211	COORDINATES:	DATE:
ELEVATION:	GWL: Depth Date/Time	DATE STARTED:
ENGINEER/GEOLOGIST:	Depth Date/Time	DATE COMPLETED:
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 2 OF 4

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN.)	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	17226 0945	8	6	SAA 7.7			HNU = 0
8				(5Y 5/2) Clayey silt trace sand, wet 8.0			α = 0
	17227	10	6	SAA			Bγ = 60-800pm
	17228	5	4	5Y 5/2 Clayey sand, some gravel well graded, wet			
9				(10YR 5/6) silt trace sand very moist			
	17229 1006	8	6	SAA			HNU = 0
	17230	9	2				α = 0
10	17231	7	0	(5Y 5/1) silty clay, low plasticity moist No Recovery	CL	1.5	Bγ = 80-100
11				Bottom of Boring + sampling 10.5 FT			HNU = α = Bγ =
12							HNU = α = Bγ =
13							
14							HNU = α = Bγ =

NOTES:

FERNALD RI/FS

PIEZOMETER INSTALLATION SHEET

PROJECT NAME FMPC RI/FS FIELD ENG./GEO. C. Grube/M. Sluszinski DATE 5/16/89
PROJECT NO. 6023.7 CHECKED BY _____ DATE _____
BORING NO. 1211 ~~[illegible]~~ 24 5/16/89
PIEZOMETER NO. 1211 DATE OF INSTALLATION 5/16/89

BOREHOLE DRILLING

DRILLING METHOD Hollow stem auger - 8 in.	TYPE OF BIT 8 in Hollow Auger
DRILLING FLUID (S) USED:	CASING SIZE (S) USED:
FLUID N/A FROM — TO —	SIZE N/A FROM — TO —
FLUID N/A FROM — TO —	SIZE N/A FROM — TO —

PIEZOMETER DESCRIPTION

TYPE 1 in. Porous Piezometer	RISER PIPE MATERIAL Schedule 40 PVC
DIAMETER OF PERFORATED SECTION 2.0 in ID	RISER PIPE DIAMETERS:
PERFORATION TYPE:	O.D. 2 3/8 in I.D. 2.0 in
SLOTS ☒ HOLES ☐ SCREEN ☐	LENGTH OF PIPE SECTIONS 7.5 FT
AVERAGE SIZE OF PERFORATIONS 0.020 in	JOINING METHOD Screw type, flush joint threaded
TOTAL PERFORATED AREA 5.0 FT	

PROTECTION SYSTEM

RISER PROTECTIVE PIPE LENGTH 5.0 FT	OTHER PROTECTION Hinged cover with installed padlock
PROTECTIVE PIPE O.D. 4 3/8 in	

ITEM	DISTANCE ABOVE/BELOW GROUND SURFACE (FT)		ELEVATION ( )	
TOP OF RISER PIPE	2.0			
GROUND SURFACE	0.0			
BOTTOM OF PROTECTIVE PIPE	2.6			
BOREHOLE FILL MATERIALS:				
~~GROUT/SLURRY~~ Cement	TOP 0.0	BOTTOM 1.0	TOP	BOTTOM
BENTONITE	TOP 1.0	BOTTOM 4.0	TOP	BOTTOM
SAND	TOP 4.5	BOTTOM 5.5	TOP	BOTTOM
GRAVEL	TOP —	BOTTOM —	TOP	BOTTOM
PERFORATED SECTION	TOP 5.5	BOTTOM 10.5	TOP	BOTTOM
PIEZOMETER TIP	12.5			
BOTTOM OF BOREHOLE	10.5			
GWL AFTER INSTALLATION	—			

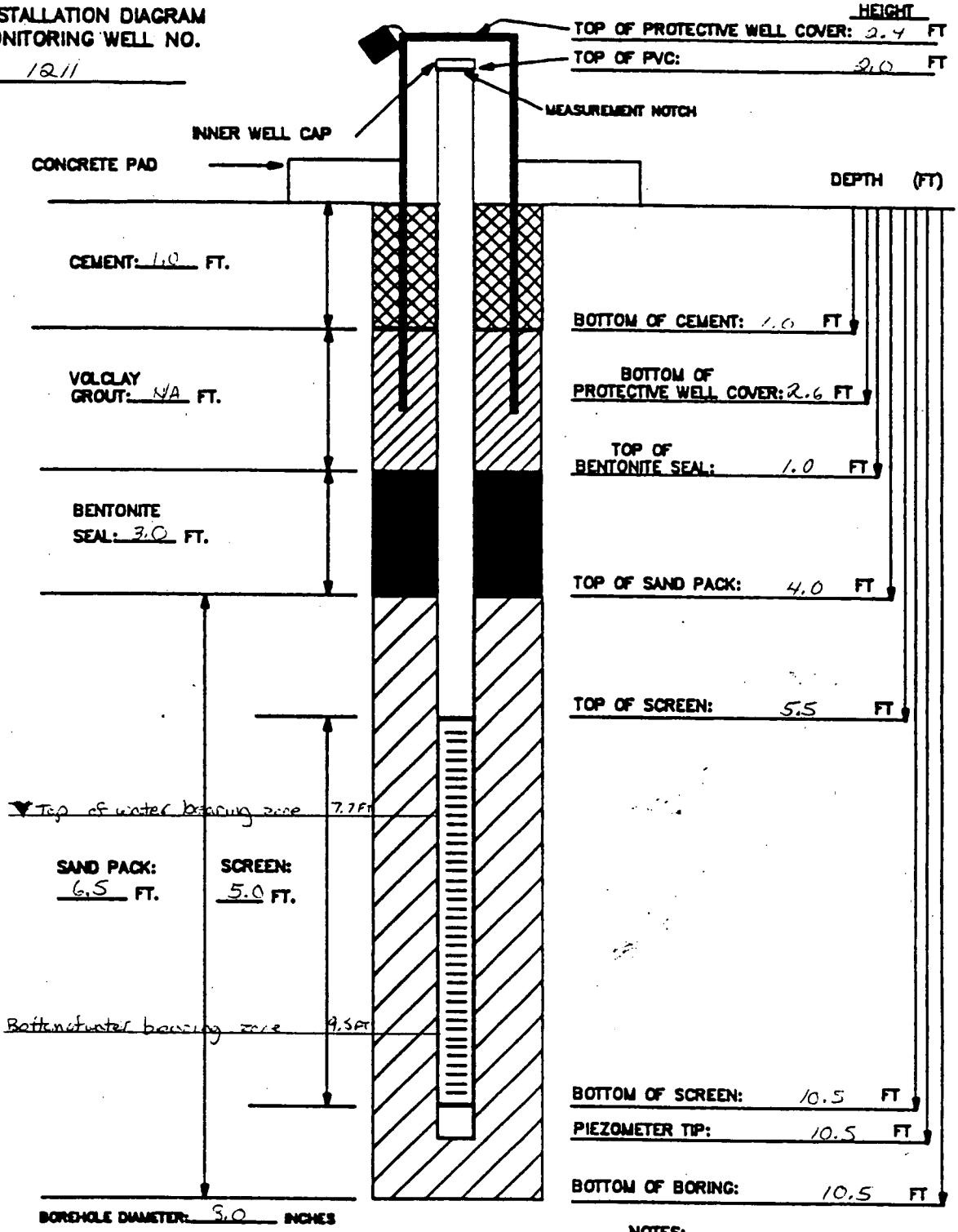
WAS THE PIEZOMETER FLUSHED AFTER INSTALLATION? YES ☐ NO ☒
WAS A SENSITIVITY TEST PERFORMED ON THE PIEZOMETER? YES ☐ NO ☒

REMARKS Top of Water Bearing Zone at 7.7 FT
Bottom " " " " " 9.5 FT

FERNALD RI/FS

INSTALLATION DIAGRAM
MONITORING WELL NO. 1211

INSTALLATION DATE: 5-16-89



BOREHOLE DIAMETER: 8.0 INCHES

MATERIALS USED:

SAND TYPE AND QUANITITY: 10/20 sand - 2 (50#) sacks
BENTONITE PELLETS (5-GALLON BUCKETS): 1 1/2 buckets
BAGS OF VOLCLAY GROUT: N/A
AMOUNT OF CEMENT: 1/2 sack (50#)
AMOUNT OF WATER USED: 20 gal
OTHER: 50FT Protective riser casing

NOTES:

1) RISER PIPE IS 2-INCH SCHEDULE 40 PVC PIPE, FLUSH-THREADED JOINTS.
2) SCREEN IS 2-INCH I.D. SCHEDULE 40 PVC PIPE WITH 0.020-INCH SLOTS.
3) LOWER END OF SCREEN IS CAPPED WITH AN END CAP OR THREADED SUMP.
4) WATER DEPTH/DATE:

TASK: 607 3.7

GEOLOGIST/ENGINEER: Cate Grube

FERNALD RI/FS

6496

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1200	COORDINATES:	DATE: 5-16-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5-16-89
ENGINEER/GEOLOGIST: C. Grube	Depth Date/Time	DATE COMPLETED: 5-16-89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 1 OF 5

Note: 8 Total Pages in packet with Field Copies Enclosed.

DEPTH (FT.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN.)	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	16969 1419 5-16	10	6	Surface gravel with brown (10YR 5/3) clay traces, slightly moist	GW	N/A	HNU = 0 ppm α = 0 cpm Bγ = 100-120 cpm
1	16970 1419 5-16	11	6	Very Stiff to hard, yellowish brown (10YR 5/4) silty clay, trace of sand and medium gravel, low plasticity, slightly moist	CL	4.5 to 2.75	
	16971 1419 5-16	8	0	NR	N/A	N/A	
2	16972 1421 5-16	11	4	SAA	CL	2.25	HNU = 0 ppm α = 0 cpm Bγ = 80-100 cpm
	16973 1421 5-16	9	0	NR	N/A	N/A	
	16974 1421 5-16	8	0	NR	N/A	N/A	
3	16975 1423 5-16	15	6	Medium Stiff, yellowish brown (10YR 5/4) silty clay, trace of sand, medium plasticity, moist	CL	.5	HNU = 0 ppm α = 0 cpm Bγ = 60-80 cpm
4	16976 1423 5-16	13	6	Very Stiff, very dark gray (5Y 3/1) clay, trace of clay, medium plasticity, moist	CL	3.0	
	16977 1423 5-16	15	6	Stiff, dark gray (5Y 4/1) clay, trace fine gravel, low plasticity, moist	CL	1.5	
5	16978 1427 5-16	20	6	Soft, olive brown (2.5Y 4/4) sandy clay, medium plasticity, moist	CL	.25	HNU = 0 ppm α = 0 cpm Bγ = 80-100 cpm
				Gravel with sand and clay - (does not look natural), moist	GC	N/A	
	16979 1427 5-16	30	6	Stiff, dark grayish brown (2.5Y 4/2) clay, trace of silt, medium plasticity, moist	CL	1.5	
6	16980 1427 5-16	28	3	SAA	CL	1.5	
	16981 1444 5-16	7	6	Medium Dense yellowish brown (10YR 5/4) gravel, some sand and clay, slightly moist	GC	N/A	HNU = 0 ppm α = 0 cpm Bγ = 80-90 cpm
				Stiff, olive gray (5Y 4/2) clay, trace of sand and silt, medium plasticity, moist	CL	1.0	
7	16982 1444 5-16	9	6	Very Stiff, yellowish brown (10YR 5/4) silty clay, mottled, medium plasticity, moist	CL	2.5	
	16983 1444 5-16	11	6	SAA	CL	3.75	

NOTES: CONTRACTOR: PENN DRILL
RIG: Model 80
DRILLER: Craig Coulter
ASSISTANT: Chris Coulter

SAA = Same As Above
NR = No Recovery HNU Serial # 1201 10

SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TES
COLORS IDENTIFIED USING MUNSELL COLOR CHART
BACKGROUND LEVELS: HNU = 0 PPM
α = 0 CPM
Bγ = 60-70 CPM
LEL O2: LEL = 0% ~~PPM~~ CH 5/17/89
O2 = 20.6%

000066

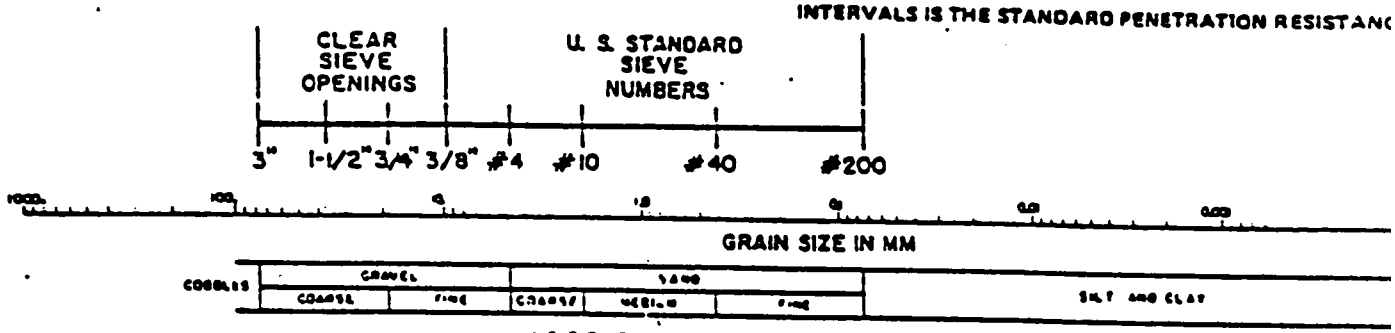
CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE(1)
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

(1) STANDARD PENETRATION RESISTANCE IS THE NUMBER O
BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL
SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLI
FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN
INCHES AND THE NUMBER OF BLOWS RECORDED FOR EA
6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO
INTERVALS IS THE STANDARD PENETRATION RESISTANC



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
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GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
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FINE-GRAINED/HIGHLY ORGANIC SOI

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SAN ROCK FLOUR, SILTY OR CLAYEY FINE SAN OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTIC GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEO FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTIC ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTE

FERNALD RI/FS

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1200	COORDINATES:	DATE: 5-16-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5-16-89
ENGINEER/GEOLOGIST: C. Grube	Depth Date/Time	DATE COMPLETED: 5-16-89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 2 OF 5

DEPTH (FT.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN.)	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
8	16984 1450 05-16	12	3	Medium stiff, yellowish brown (10YR5/4) clay, trace fine gravel, medium plasticity, moist	CL	.75	HNU = 0 ppm α = 0 cpm Bγ = 110-120 cpm
	16985 1450 05-16	13	0	NR	N/A	N/A	
9	16986 1450 05-16	10	0	NR	N/A	N/A	
	16987 1525 05-16	8	6	Medium stiff, yellowish brown (10YR5/4) silty clay, trace of fine gravel, medium plasticity, very moist	CL	.75	HNU = 0 ppm α = 0 cpm Bγ = 90-100 cpm
10	16988 1525 05-16	6	0	NR	N/A	N/A	
	16989 1525 05-16	2	0	NR	N/A	N/A	
11	16990 1533 05-16	7	6	Medium stiff, yellowish brown (10YR5/4), silty clay, trace fine gravel medium plasticity, very moist	CL	.75	HNU = 0 ppm α = 0 cpm Bγ = 60-70 cpm
	50780 1533 05-16	8	6	Very stiff, yellowish brown (10YR5/6) silty clay, low plasticity, very moist	CL	2.5	
12	50781 1533 05-16	10	6	Stiff, SAA	CL	1.5	
	50782 1536 05-16	9	6	Soft, dark grayish brown (2.5Y 4/2) sandy clay, trace fine gravel, medium plasticity, moist	CL	.5	HNU = 0 ppm α = 0 cpm Bγ = 50-60 cpm
13	50783 1536 05-16	9	2	Soft, light olive brown (2.5Y 5/4) silty clay, trace of gravel, medium plasticity, moist	CL	.25	
fluctuating zone	50784 1536 05-16	8	0	NR	N/A	N/A	
14	50785 1540 05-16	6	6	Soft, light olive brown (2.5Y 5/4) silty clay, medium plasticity, wet; Loose, yellowish brown (10YR 5/6) silt, wet	CL / ML	.25 / N/A	HNU = 0 ppm α = 0 cpm Bγ = 70-80 cpm
	50786 1540 05-16	5	6	Loose, grayish brown (2.5Y 5/2) clayey silt, trace sand, wet	ML	N/A	
fluctuating zone	50787 1540 05-16	3	6	SAA	ML	N/A	

NOTES:

SAA = Same As Above
NR = No Recovery

FERNALD RI/FS

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1200	COORDINATES:	DATE: 5-16-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5-16-89
ENGINEER/GEOLOGIST: C. Grube	Depth Date/Time	DATE COMPLETED: 5-16-89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 3 OF 5

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 in.)	RECOVERY (in.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	50788 1554 05-16	2	6	Stiff, yellowish brown (10YR5/4) silty clay, trace sand, trace gravel, low plasticity, moist	CL	1.5	HNU = 0ppm α = 0cpm Bq = 50-60cpm
	50789 1554 05-16	9	6	Stiff, yellowish brown (10YR5/4) silty clay, moist to Medium Dense, yellowish brown (10YR5/6) silt, moist	CL to ML	1.5 N/A	
16	50790 1554 05-16			Medium Dense, yellowish brown (10YR5/6) silt, moist	ML	N/A	
		12	6	Stiff, olive gray (5Y5/2) silty clay, low plasticity, moist	CL	1.0	
17				Bottom of Boring and Sampling at 16.5 FT			HNU = α = Bq =
18							HNU = α = Bq =
19							
20							HNU = α = Bq =

NOTES:

FERNALD RI/FS

Field Copy

6496

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1200	COORDINATES:	DATE: 5-16-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED:
ENGINEER/GEOLOGIST: C Gaube	Depth Date/Time	DATE COMPLETED: 5-16-89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 1 OF 5

DEPTH (FT.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN.)	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	16969 1419 5-16	10	6	Surface gravel with clay (10YR 5/3) traces slightly moist			HNU = 0 α = 0 Bγ = 100-120
1	16970	11	6	(10YR 5/4) silty clay, trace sand, trace med. gravel low plasticity, slightly moist			
	16971	8	0	N R	CL	4.5 to 2.75	
	16972 1421	11	4	SAA	CL	2.25	HNU = 0 α = 0 Bγ = 80-100
2	16973	9	0	N R			
	16974	8	0	N R			
3	16975 1423	15	6	(10YR 5/4) silty clay - trace sand, moist, med plasticity	CL	.5	HNU = 0 α = 0 Bγ = 60-80
	16976	13	6	(5Y 3/1) clay, low plasticity, trace fine to med. gravel, moist	CL	3.0	
4	16977	15	6	(5Y 4/1) clay, low plasticity, trace fine gravel, moist	CL	1.5	
	16978 1427	20	6	(2.5Y 4/4) sandy clay, med plast. moist	CL	.25	HNU = 0 α = 0 Bγ = 80-100
5	16979	30	6	Note: 2nd 3 in. - gravel with sandy clay Does not look Natural	GC	1.5	
	16980	28	3	(2.5Y 4/2) clay trace silt, med plasticity, moist SAA		1.5	
6	16981 1444	7	6	Gravel with clay and sand ~~[illegible]~~ (10YR 5/4) slightly moist			HNU = 0 α = 0 Bγ = 80-90
	16982	9	6	(5Y 4/2) clay, med plasticity, trace sand and silt, moist		1.0	
7	16983	11	6	10YR 5/4 silty clay, mottled, moist med plast. SAA		2.5	
						3.75	

NOTES: CONTRACTOR: PENN DRILL
RIG: Model 80
DRILLER: Craig
ASSISTANT: Chris

SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST
COLORS IDENTIFIED USING MUNSELL COLOR CHART
BACKGROUND LEVELS: HNU = 0 PPM
α = 0 CPM
Bγ = 60-70 CPM
LEL O2: LEL = PPM
O2 = %

402-11

FERNALD RI/FS

Field Copy

6496

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1200	COORDINATES:	DATE: 5-16-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5-16-89
ENGINEER/GEOLOGIST: C Grube	Depth Date/Time	DATE COMPLETED: 5-16-89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 2 OF 5

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN.)	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
8	16984 1450	12	3	(10YR 5/4) clay, med plasticity, trace fine gravel, moist	CL	.75	HNU = 0 α = 0 Bγ = 110-120
	16985	13	0	NR			
	16986	10	0	NR			
9	16987 1525	8	6	(10YR 5/4) silty clay, trace fine gravel, very moist, med plastic	CL	.75	HNU = 0 α = 0 Bγ = 90-100
	16988	6	0	NR			
10	16989	2	0	NR			
11	16990 1533	7	6	(10YR 5/4) silty clay, trace gravel, very moist, med plasticity	CL	.75	HNU = 0 α = 0 Bγ = 60-70
	50780	8	6	(10YR 5/6) silty clay, low plasticity very moist		2.5	
	50781	10	6	SAA		1.5	
12	50782 1536	9	6	(2.5Y 4/2) sandy clay, trace fine gravel, med plasticity, moist	CL	.5	HNU = 0 α = 0 Bγ = 50-60
	50783	9	2	(2.5Y 5/4) silty clay trace gravel, med plasticity, moist		.25	
13	50784	8	0	NR			
14	50785 1540	6	6	(2.5Y 5/4) silty clay, wet ~~very~~ ~~moist~~ med plasticity to 10YR 5/6 silt ~~very moist~~ wet	CL ML	.25	HNU = 0 α = 0 Bγ = 70-80
	50786	5	0	2.5Y 5/2 clayey silt, trace sand, wet			
	50787	3	6	SAA			

NOTES:

FERNALD RI/FS

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VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER:	COORDINATES:	DATE:
ELEVATION:	GWL: Depth Date/Time	DATE STARTED:
ENGINEER/GEOLOGIST:	Depth Date/Time	DATE COMPLETED:
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE OF

DEPTH	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER	RECOVERY	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	50788 TSST	2	6	(10 YR 5/4) silty clay, trace sand, trace gravel, low plasticity, moist		1.5	HNU = 0
	50789	9	6	(10 YR 5/6) silty clay to silt, moist	CL to ML	1.5	α = 0 Bδ = 50-60
16	50790	12	6	(10 YR 5/6) silt, moist	ML		
				(5Y 5/2) silty clay, low plasticity	CL	1.0	
				Bottom of Boring & Sampling 16.5 FT			HNU = α = Bδ =
17							
18							HNU = α = Bδ =
19							
20							HNU = α = Bδ =

NOTES:

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FERNALD RI/FS

PIEZOMETER INSTALLATION SHEET

PROJECT NAME FMPC RI/FS FIELD ENG./GEO. Cate Grabe DATE 5/16/89
PROJECT NO. 002 3.7 CHECKED BY RW DATE 6/5/89
BORING NO. 1200
PIEZOMETER NO. 1200 DATE OF INSTALLATION 5/16/89

BOREHOLE DRILLING

DRILLING METHOD 8 in. Hollow Stem Auger	TYPE OF BIT Hollow Auger - 8 in.
DRILLING FLUID (S) USED:	CASING SIZE (S) USED:
FLUID N/A FROM — TO —	SIZE N/A FROM — TO —
FLUID N/A FROM — TO —	SIZE N/A FROM — TO —

PIEZOMETER DESCRIPTION

TYPE Monitoring Piezometer	RISER PIPE MATERIAL Schedule 40 PVC
DIAMETER OF PERFORATED SECTION 2.0 in ID	RISER PIPE DIAMETERS:
PERFORATION TYPE:	O.D. 2 5/16 in I.D. 2.0 in
SLOTS ☒ HOLES ☐ SCREEN ☐	LENGTH OF PIPE SECTIONS 8.5 FT
AVERAGE SIZE OF PERFORATIONS 0.020 in	JOINING METHOD screw type, flush joint threaded
TOTAL PERFORATED AREA 10.0 FT	

PROTECTION SYSTEM

RISER PROTECTIVE PIPE LENGTH 5.0 FT	OTHER PROTECTION Hinged cover with installed padlock
PROTECTIVE PIPE O.D. 4 3/8 in	

ITEM	DISTANCE ABOVE/BELOW GROUND SURFACE (FT)		ELEVATION ( )	
TOP OF RISER PIPE	2.0			
GROUND SURFACE	0.0			
BOTTOM OF PROTECTIVE PIPE	2.7			
BOREHOLE FILL MATERIALS:				
~~GROUT/SLURRY~~ cement	TOP 0.0	BOTTOM 1.0	TOP	BOTTOM
BENTONITE	TOP 1.0	BOTTOM 3.5	TOP	BOTTOM
SAND	TOP 3.5	BOTTOM 16.5	TOP	BOTTOM
~~GRAVEL~~ N/A	TOP —	BOTTOM —	TOP	BOTTOM
PERFORATED SECTION	TOP 6.5 FT	BOTTOM 16.5	TOP	BOTTOM
PIEZOMETER TIP	16.5			
BOTTOM OF BOREHOLE	16.5			
GWL AFTER INSTALLATION	—			

WAS THE PIEZOMETER FLUSHED AFTER INSTALLATION? YES ☐ NO ☒
WAS A SENSITIVITY TEST PERFORMED ON THE PIEZOMETER? YES ☐ NO ☒

REMARKS Top of water bearing zone at 13.5 FT
Bottom " " " " " 15.0 FT

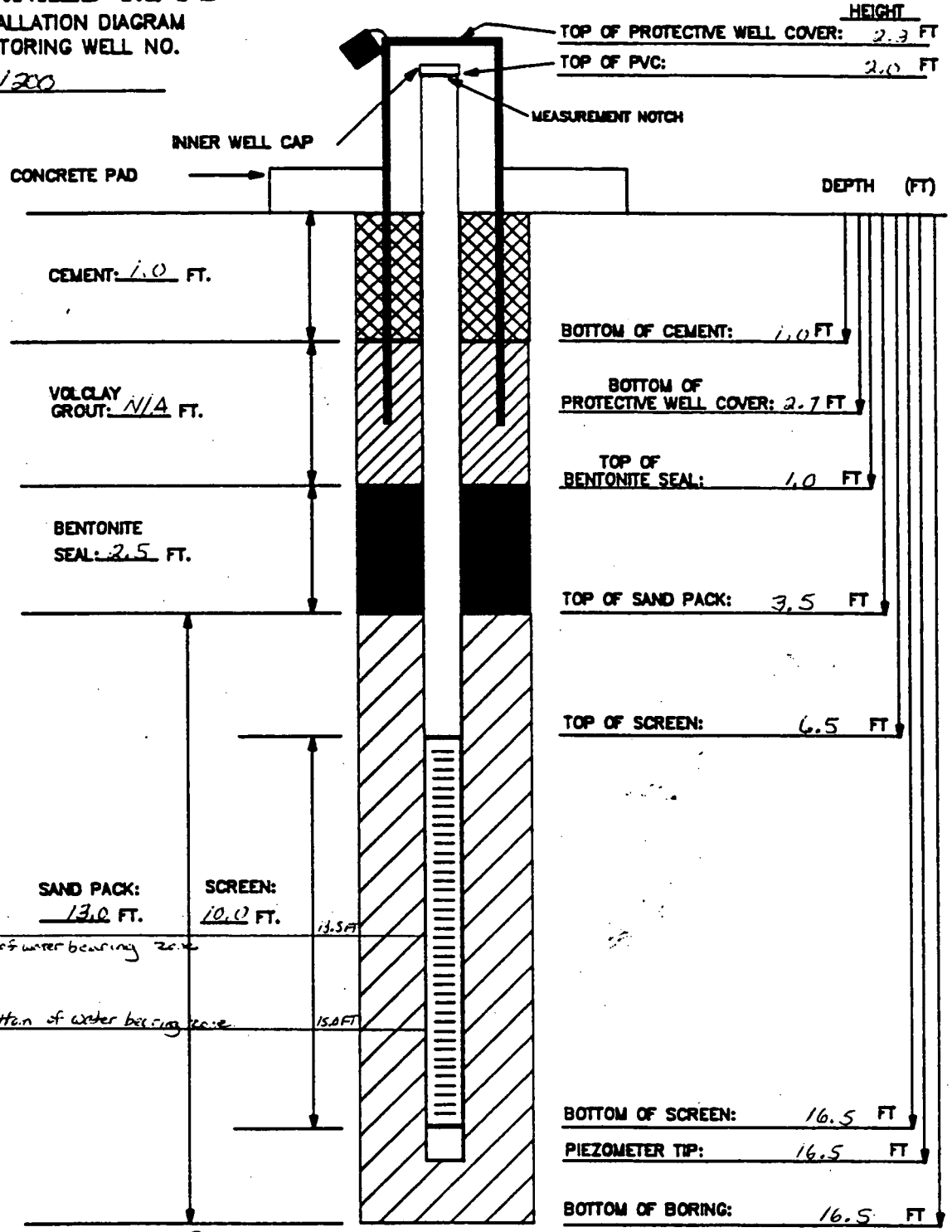
409-11-86

6496

FERNALD RI/FS

INSTALLATION DIAGRAM
MONITORING WELL NO.
1200

INSTALLATION DATE: 5-16-89



BOREHOLE DIAMETER: 8.0 INCHES

MATERIALS USED:
SAND TYPE AND QUANTITY: 10/20 4 (80#) Sacks
BENTONITE PELLETS (5-GALLON BUCKETS): 1 1/2 buckets
BAGS OF VOLCLAY GROUT: N/A
AMOUNT OF CEMENT: 1/2 sack (50#)
AMOUNT OF WATER USED: 20 gal.
OTHER: ~~[illegible]~~ 5.0 FT Protective riser casing
CB 5/17/89

NOTES:
1) RISER PIPE IS 2-INCH SCHEDULE 40 PVC PIPE, FLUSH-THREADED JOINTS.
2) SCREEN IS 2-INCH I.D. SCHEDULE 40 PVC PIPE WITH 0.020-INCH SLOTS.
3) LOWER END OF SCREEN IS CAPPED WITH AN END CAP OR THREADED SUMP.
4) WATER DEPTH/DATE:

TASK: 602 3.7

GEOLOGIST/ENGINEER: Cate Grube

FERNALD RI/FS

6496

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1007	COORDINATES:	DATE: 5-15-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5-15-89
ENGINEER/GEOLOGIST: C. Gates	Depth Date/Time	DATE COMPLETED: 5-15-89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 1 OF 4

Note: 6 Total pages with Field copies enclosed.

DEPTH (FT.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN.)	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	17123 1350 5-15	5	6	Dense, grayish brown (2.5Y 5/2) clayey gravel, slightly moist	GC	N/A	HNU = 0 ppm α = 0 cpm Bγ = 160-180 cpm
	17124 1350 5-15	12	4	Dense, yellowish brown (10YR 5/6) clayey gravel trace of silt and sand, slightly moist	GC	N/A	
1	17125 1350 5-15	26	0	NR	N/A	N/A	
	17126 1355 5-15	8	6	Stiff, Dark yellowish brown (10YR 4/4) sandy clay trace fine gravel, low plasticity, moist	CL	1.0	HNU = 0 ppm α = 0 cpm Bγ = 140-160 cpm
2	17127 1355 5-15	17	6	Hard, Dark olive (5Y 4/2) to very dark gray (5Y 3/1) clay, trace gravel, medium plasticity, moist	CL	4.5	
	17128 1355 5-15	13	0	NR	N/A	N/A	
3	17129 1400 5-15	8	6	Medium stiff to very stiff, brown (10YR 4/3) clay, trace silt, low to medium plasticity, moist	CL	.75 to 3.5	HNU = 0 ppm α = 0 cpm Bγ = 180-200 cpm
	17130 1400 5-15	12	6	Very stiff, dark gray (10YR 4/1) clay, trace sand and fine gravel, medium plasticity, moist	CL	2.5	
4	17131 1400 5-15	11	6	Stiff, brown (10YR 5/3) clay, low to medium plasticity, moist	CL	1.5	
	17132 1404 5-15	12	6	Medium Stiff, dark grayish brown (2.5Y 4/2) clay, medium plasticity, trace sand, moist	CL	.5	HNU = 0 ppm α = 0 cpm Bγ = 160-180 cpm
5	17133 1404 5-15	13	6	SAA	CL	1.5	
	17134 1404 5-15	11	4	SAA	CL	.75	
6	17135 1407 5-15	12	6	Soft, dark grayish brown (10YR 4/2) clay, medium plasticity, very moist	CL	.5	HNU = 0 ppm α = 0 cpm Bγ = 160-180 cpm
	17136 1407 5-15	3	6	Soft, brown (10YR 5/3) clay, trace sand, very moist	CL	.25	
Top of water bearing zone 7.0 FT	17137 1407 5-15	6	4	Medium Dense, brown (10YR 5/3) clayey gravel, trace sand, wet	GC	N/A	
				Stiff, yellowish brown (10YR 5/4) clay, medium plasticity, very moist	CL	1.5	

NOTES: CONTRACTOR: PENNDRILL
RIG: Model 80
DRILLER: Craig Coulter
ASSISTANT: Chris Coulter
SAA = Same As Above
NR = No Recovery
HNU serial # 1201 10

SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST
COLORS IDENTIFIED USING MUNSELL COLOR CHART
BACKGROUND LEVELS: HNU = 0 PPM
α = 0 CPM
Bγ = 1200 CPM
LEL/O2: LEL = 0% ~~PPM~~ @ 5/17/89
O2 = 20.6 %

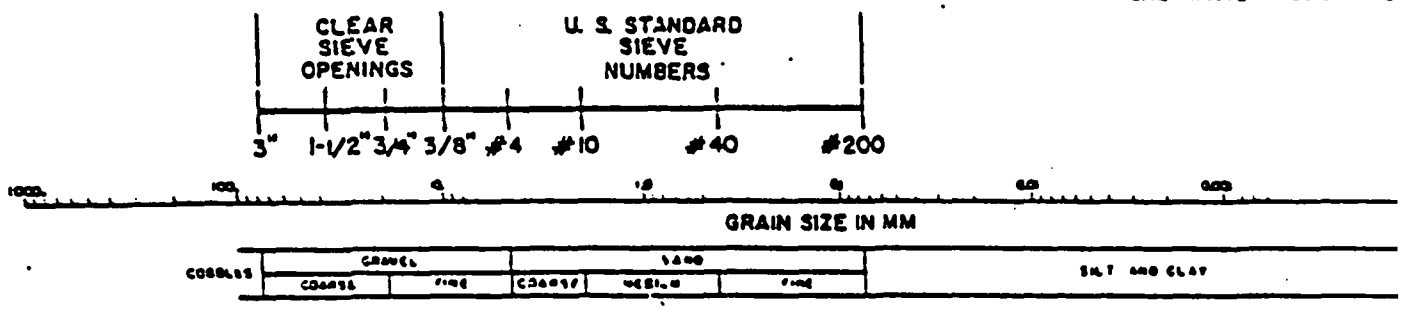
CONSISTENCY OF CO SIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE(1)
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

(1) STANDARD PENETRATION RESISTANCE IS THE NUMBER O BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLI FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 1 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EA 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANC



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

FINE-GRAINED/HIGHLY ORGANIC SO

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANC OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICI GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEO FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTIC ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTE

FERNALD
RI/FS

6496

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 °3.7	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1207	COORDINATES:	DATE: 5-15-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5-15-89
ENGINEER/GEOLOGIST: C. Grube	Depth Date/Time	DATE COMPLETED: 5-15-89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 2 OF 4

DEPTH (FT.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN.)	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
8	17138	4	6	Loose, brown (10YR 5/3) clayey gravel, trace sand, wet	GC	N/A	HNU = 0 ppm α = 0 cpm Bγ = 160-180 cpm
	17139	3	6	Loose, yellowish brown (10YR 5/4) sandy silt, wet	ML	N/A	
9	17140	3	3	Stiff, yellowish brown (10YR 5/6) silty clay, medium plasticity, moist	CL	1.25	
			*	Bottom of Boring and sampling - 9.0 FT			HNU = α = Bγ =
10							
11							HNU = α = Bγ =
12							
13							HNU = α = Bγ =
14							HNU = α = Bγ =

NOTES:

FERNALD RI/FS

Field Copy

6496

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1207	COORDINATES:	DATE: 5-15-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED:
ENGINEER/GEOLOGIST: R. Grube	Depth Date/Time	DATE COMPLETED: 5-15-89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE OF

DEPTH (FT.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN.)	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	1350	5	6	Dense, Grayish Brown (2.5Y 5/2) Clayey gravel slightly moist	GC		HNU: 0
		12	4	Dark yellowish Brown (10YR 3/6) clayey gravel trace silt and sand slightly moist	GC		α: 0
1		26	0	N R			BG: 160-180
	1355	8	6	DK. yellowish Brown (10YR 4/4) sandy clay trace fine gravel low plasticity moist	CL	1.0	HNU: 0
2		17	6	DK Olive (5Y 4/2) to very dark gray (5Y 3/1) clay trace gravel, med. plasticity, moist	CL	4.5	α: 0
		13	0	N R			BG: 140-160
3	1400	8	6	(10 YR 4/3) clay, trace silt, moist low to med plast.	CL	.75 3.5	HNU: 0
		12 11	6	10YR 4/1 clay, trace sand & fine gravel. med. plasticity, moist	CL	2.5	α: 0
4			6	10 YR 5/3 clay, low to med plast moist	CL	1.5	BG: 180-200
	1404	12	6	(2.5Y 4/2) clay, med plastic trace sand. moist	CL	.5	HNU: 0
5		13	6	SAA	CL	1.5	α: 0
		11	4	SAA	CL	.75	BG: 160-180
6	1407	12	6	DK gray Brown (10YR 4/2) clay, med plast very moist	CL	.5	HNU: 0
		8	6	10YR 5/3 clay trace sand very moist	CL	.25	α: 0
7		6	4	sand. same color wet Clayey gravel gray	GC	1.5	BG: 160-180
				(10 YR 5/4) clay med plat. very moist	CL		

NOTES: CONTRACTOR: PENNDRILL
RIG:
DRILLER:
ASSISTANT:

SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST
COLORS IDENTIFIED USING MUNSELL COLOR CHART
BACKGROUND LEVELS: HNU = PPM
α = CPM
BG = ~~140-160~~ CPM
LEL/O2: LEL = ~~400 SPM~~ PPM
O2 = %

At hole 1800

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FERNALD RI/FS

Field Copy

6496

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER:	COORDINATES:	DATE:
ELEVATION:	GWL: Depth Date/Time	DATE STARTED:
ENGINEER/GEOLOGIST:	Depth Date/Time	DATE COMPLETED:
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE OF

DEPTH (FT.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN.)	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
8	1450	4	6	trace sand, wet (10YR5/3) Clayey Gravel,	GC		HNU = 0 α = 0 Bδ = 160-180
	1450	3	6	wet (10YR5/4) sandy silt			
9	1450	3	3	med. plasticity moist (10YR5/6) silty clay		1.25	
10							HNU = α = Bδ =
11							HNU = α = Bδ =
12							
13							HNU = α = Bδ =
14							HNU = α = Bδ =

NOTES:

FERNALD RI/FS

PIEZOMETER INSTALLATION SHEET

PROJECT NAME FMPC RI/FS FIELD ENG./GEO. C. Grube DATE 5/15/89
PROJECT NO. [illegible] CHECKED BY B.N. DATE 6/5/89
BORING NO. [illegible]
PIEZOMETER NO. [illegible] DATE OF INSTALLATION 5/15/89

BOREHOLE DRILLING

DRILLING METHOD Hollow Stem Auger - 8 in	TYPE OF BIT 8 in Hollow Auger
DRILLING FLUID (S) USED:	CASING SIZE (S) USED:
FLUID N/A FROM — TO —	SIZE N/A FROM — TO —
FLUID N/A FROM — TO —	SIZE N/A FROM — TO —

PIEZOMETER DESCRIPTION

TYPE Monitoring piezometer	RISER PIPE MATERIAL Schedule 40 PVC
DIAMETER OF PERFORATED SECTION 2.0 in ID	RISER PIPE DIAMETERS:
PERFORATION TYPE:	O.D. 2 5/16 in I.D. 2.0 in
SLOTS [X] HOLES [ ] SCREEN [ ]	LENGTH OF PIPE SECTIONS 10.0 FT
AVERAGE SIZE OF PERFORATIONS 0.030 in	JOINING METHOD Screw type, joint threaded - flush
TOTAL PERFORATED AREA 5.0 FT	

PROTECTION SYSTEM

RISER PROTECTIVE PIPE LENGTH 5.0 FT	OTHER PROTECTION Hinged cover with Installed padlock
PROTECTIVE PIPE O.D. 4 3/8 in	

ITEM	DISTANCE ABOVE/BELOW GROUND SURFACE (FT)		ELEVATION ( )	
TOP OF RISER PIPE	2.0			
GROUND SURFACE	0.0			
BOTTOM OF PROTECTIVE PIPE	2.7			
BOREHOLE FILL MATERIALS:				
~~GROUT/SLURRY~~ Cement	TOP 0.0	BOTTOM 1.0	TOP	BOTTOM
BENTONITE	TOP 1.0	BOTTOM 3.0	TOP	BOTTOM
SAND	TOP 3.0	BOTTOM 9.0	TOP	BOTTOM
~~GRAVEL~~ N/A	TOP —	BOTTOM —	TOP	BOTTOM
PERFORATED SECTION	TOP 4.0	BOTTOM 9.0	TOP	BOTTOM
PIEZOMETER TIP	9.0			
BOTTOM OF BOREHOLE	9.0			
GWL AFTER INSTALLATION	—			

WAS THE PIEZOMETER FLUSHED AFTER INSTALLATION? YES [ ] NO [X]
WAS A SENSITIVITY TEST PERFORMED ON THE PIEZOMETER? YES [ ] NO [X]

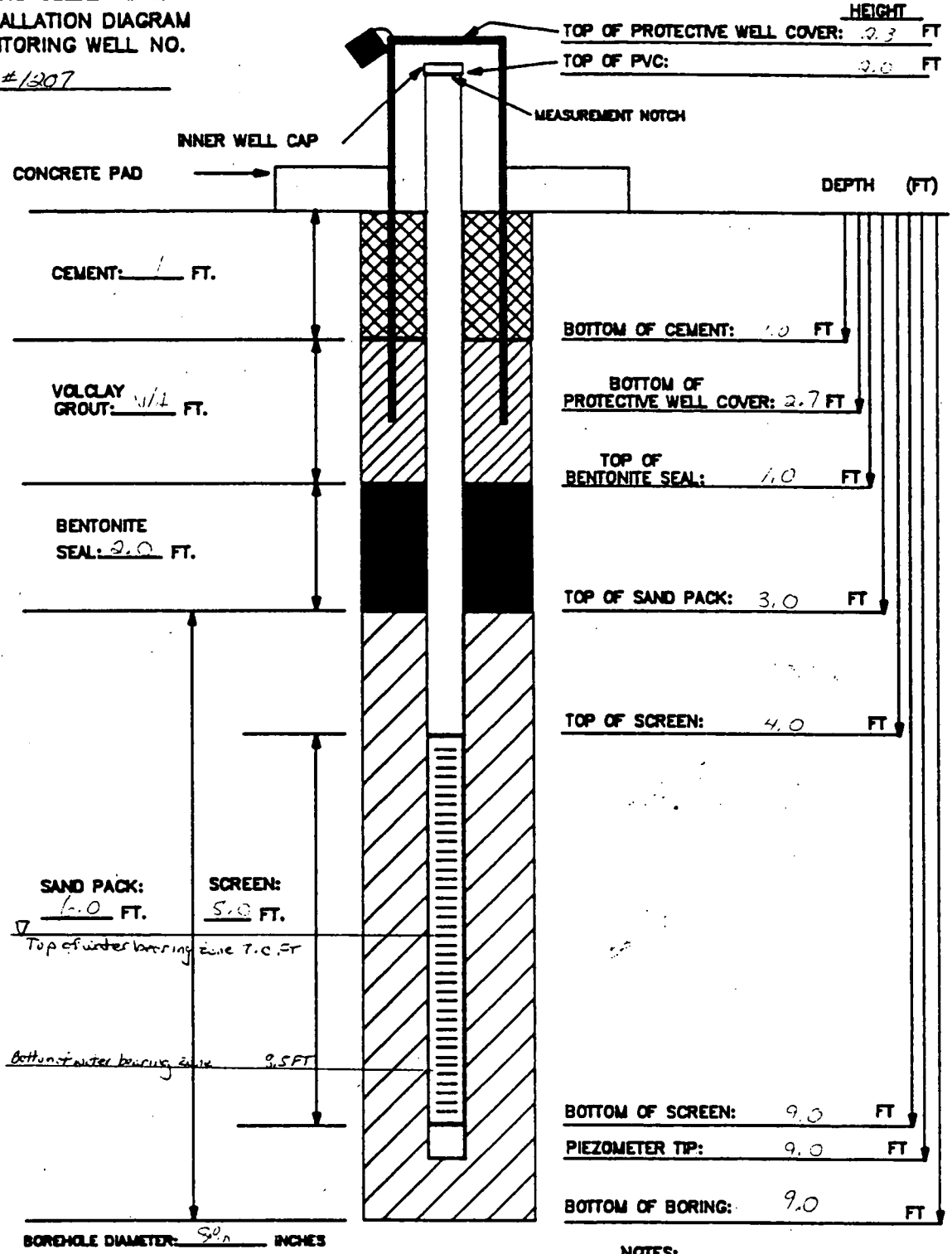
REMARKS Top of water bearing zone at 7.0 FT
Bottom " " " " " 8.5 FT

4C9-···86

FERNALD RI/FS

INSTALLATION DIAGRAM
MONITORING WELL NO.
#1207

INSTALLATION DATE: 5-15-89



BOREHOLE DIAMETER: 8" INCHES

MATERIALS USED:
SAND TYPE AND QUANITITY: 10/20 sand – 2½ sks (80 lb)
BENTONITE PELLETS (5-GALLON BUCKETS): 1 5gal bucket
BAGS OF VOLCLAY GROUT: N/A
AMOUNT OF CEMENT: ½ bag (50 lb)
AMOUNT OF WATER USED: 20 gal
OTHER: 5 FT protective riser pipe

NOTES:
1) RISER PIPE IS 2-INCH SCHEDULE 40 PVC PIPE, FLUSH-THREADED JOINTS.
2) SCREEN IS 2-INCH I.D. SCHEDULE 40 PVC PIPE WITH 0.020-INCH SLOTS.
3) LOWER END OF SCREEN IS CAPPED WITH AN END CAP OR THREADED SUMP.
4) WATER DEPTH/DATE:

TASK: 602 3.7

GEOLOGIST/ENGINEER: Cate Grube

FERNALD RI/FS

6496

Date				
Indel				
	Field Check	1st Key In	2nd Key In	Hard Copy Verification

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602- 3.7.1	PROJECT NAME: Facilities Testing Program	
BORING NUMBER: 1236	COORDINATES:	DATE: 5-14-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5-14-89
ENGINEER/GEOLOGIST: L. Sinfield	Depth Date/Time	DATE COMPLETED: 5-14-89
DRILLING METHODS: B-53, Hollow Stem Auger with Split Spoon Sampler		PAGE 1 OF 4

Note: 6 Total pages with field copies enclosed.

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
							Start = 1030
0.5	17761 WMCO	3	6in	Loose, Gravel, dry, massive, angular, with Base of Stiff, Lean Clay, Brownish Yellow (10YR, 6/8), dry, medium plastic, mottled. @ 1040	GM ↓ CL	1.5 TSF	HNU = Ø ppm; α = Ø cpm; Bγ = 600-700 cpm; α = Ø cpm; Bγ = 600-700 @ 1.0-1.5 ft
1.0	17762 NR	3	NR				
1.5	17763 NR	2	NR				
2.0	17764	1	6in	Poor Recovery due to large Amounts of Gravel, wet, massive, rounded @ 1042	CL ↓ GP	0.2 TSF	HNU = Ø ppm; α = Ø cpm; Bγ = 600-700 cpm
2.5	17765 NR WMCO	↑ 1 for 1.0 ft ↓	NR				
3.0	17766		NR				
3.5	17767	3	6in	Loose, Gravel, clean, wet, massive @ 1045	GP	Loose TSF	HNU = Ø ppm; α = Ø cpm; Bγ = 200 cpm
4.0	17768	↑ 1 for 1.0 ft ↓	HR				
4.5	17769		NR				
5.0	17770	5	6in	Loose, Gravel, Clean, wet, massive, little to no fines @ 1050	GP	Loose TSF	HNU = Ø ppm; α = Ø cpm; Bγ = 200-240 cpm
5.5	17771 WMCO	5	HR				
6.0	17772	2	NR				
6.5	17773	2	6in	Loose, Sand and Gravel, Wet, massive, with clay, CL-Brown yellow (10YR, 6/8) @ 1105	SM ↓ GM	Loose TSF	HNU = Ø ppm; α = Ø cpm; Bγ = 600 cpm
7.0	17774	5	6in				
7.5	17775	10	NR				

Top of water Bearing Zone

NOTES: Contractor: Penn Drill
Driller: J. Saccavi
Helper: G. Dye
Sample Tech: DO/A
Weather: cloudy-cool
HNU #: HH18

Water Bearing Zone: 7.0 - 12.5 ft

Background @ 0930
HNU = Ø ppm
Air α = Ø cpm
Air Bγ = 200-260 cpm
gnd α = Ø cpm
gnd Bγ = 1000-1200 cpm

NR* = No Recovery, No Sample Taken

4C2-11-86

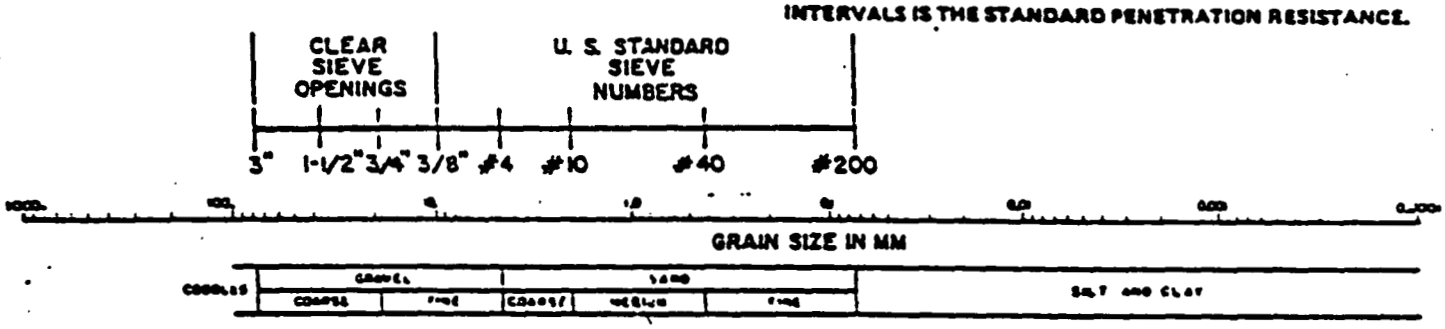
CONSISTENCY OF COHE: E SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE (1)
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

(1) STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 18 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANCE.



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

FINE-GRAINED/HIGHLY ORGANIC SOIL

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

FERNALD RI/FS

6496

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602-3.7.1	PROJECT NAME: Facilities Testing Program	
BORING NUMBER: 1236	COORDINATES:	DATE: 5-14-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5-14-89
ENGINEER/GEOLOGIST: L. Sinfield	Depth Date/Time	DATE COMPLETED: 5-14-89
DRILLING METHODS: B-53, Hollow Stem Auger with Split Spoon Sampler		PAGE 2 OF 4

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
7.5							Start=
8.0	17776	4	6in	Loose, gravel with silt, massive, wet	GM	N/A	HNU= ø ppm; α= ø cpm; Bγ= 300-500 cpm
8.5	17777	4	6in	Loose, Silty Sand, wet massive with Clay.	SM	Loose	
9.0	NR 17778	4	NRI	@ 1110		TSF	
9.5	17779	5	6in	Loose, Silty Sand, wet massive, some laminations Brownish Yellow (10YR 6/8)	SM	Loose	HNU= ø ppm; α= ø cpm; Bγ= 300-500 cpm
10.0	17780	5	6in				
10.5	17781	7	NR	@ 1115		TSF	
11.0	17782 N	10	6in	Loose to Medium Dense, Same as above	SM	Loose	HNU= ø ppm; α= ø cpm; Bγ= 300-500 cpm
11.5	50775	12	6in				
12.0	50776 NR	14	NR	@ 1120		TSF	
12.5	50777	3	6in	Same as above 12.5ft	SM		HNU= ø ppm; α= ø cpm; Bγ= 300-500 cpm
13.0	50778	5	6in	Stiff, Gray (10YR, 4/1), Lean Clay, Dry, massive, medium plastic	CL	1.2	
13.5	50779 NR	9	NR	@ 1150		TSF	
14.0				TD= 13.5 ft on 5/14/89 @ 1150			HNU= ppm; α= cpm; Bγ= cpm
14.5							
15.0				@		TSF	

NOTES: Contractor: Driller: Helper: Sample Tech: Weather: HNU #: } See page 1 of 4

Water Bearing Zone: 7.0 - 12.5 ft.

Background @ 0930
HNU= ppm
α= See page 1 of 4 cpm
Bγ= cpm

4C2-11-86

FERNALD RI/FS

Field Copy 6496

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602-37.1	PROJECT NAME: Facilities Testing Program	
BORING NUMBER: 1236	COORDINATES:	DATE: 5-14-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5-14-89
ENGINEER/GEOLOGIST: C. Sinfield	Depth Date/Time	DATE COMPLETED: 5-14-89
DRILLING METHODS: B-53, Hollow Stem Auger with Split Spoon Sampler		PAGE 1 OF 4

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
							Start = 1030
0.5	17761 WMCO	3	6 in	Loose, Gravel, dry, massive, angular with base of ~~medium~~ vs stiff, clean clay, Brownish yellow (10YR, 6/8) dry, medium plastic, massive mottled. @1040	GM	1.5	HNU = ∅ ppm; α = ∅ cpm; Bγ = 600-700 cpm } surface; α = ∅ cpm; Bγ = 600-700 cpm } @ 1.0 ft
1.0	17762 NR	3	∅ NR				
1.5	17763 NR	2	∅ NR		CC	TSF	
2.0	17764	1		Poor Recovery due to large amounts of gravel, wet, massive @1042	CC	0.2	HNU = ∅ ppm; α = ∅ cpm; Bγ = 600-700 cpm
2.5	17765 NR WMCO	↑ 1 for 100 ft	NR		~~GM~~ GP		
3.0	17766 NR		NR			TSF	
3.5	17767	3	6 in	Loose Same as Above Gravel, loose clean, wet massive @1045	~~GM~~ GP	N/A	HNU = ∅ ppm; α = ∅ cpm; Bγ = ~~600~~ 200-85-5-14-89 cpm
4.0	17768 NR	6↑	NR				
4.5	17769 NR	∅	NR			TSF	
5.0	17770	5	6 in	Loose Same as Above Loose Gravel, clean wet, massive, little to no fines @1050	~~GM~~ GP	N/A	HNU = ∅ ppm; α = ∅ cpm; Bγ = 200-240 cpm
5.5	NR 17771 WMCO	5	NR				
6.0	NR 17772	2	NR			TSF	
6.5	17773	2	6 in	Loose, Sand & Gravel WET, massive with clay. Brownish yellow (10-1, 6/8) @1105	SM ↓ GM		HNU = ∅ ppm; α = ∅ cpm; Bγ = 600 cpm
7.0	17774	5	6 in				
7.5	17775	10	N2			TSF	

NOTES: Contractor: Penn Drill
Driller: J. Saccani
Helper: G. Daye
Sample Tech: N/A
Weather: Cloudy + Cool
HNU #: HH 18

Background @ 0930
HNU = ∅ ppm
Air α = ∅ cpm #4
Air Bγ = 200-260 cpm #3
gnd α = ∅ cpm
gnd Bγ = 1000-1200 cpm

My Geologist: C. Sinfield

4C2-11-86

FERNALD RI/FS

Field Copy 6496

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602-3.7.1	PROJECT NAME: Facilities Testing Program	
BORING NUMBER: 1236	COORDINATES:	DATE: 5-14-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5-14-89
ENGINEER/GEOLOGIST: C. Sinfield	Depth Date/Time	DATE COMPLETED: 5-14-89
DRILLING METHODS: See page 1 of 4		PAGE 2 OF 4

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
7.5							Start=
8.0	177 76	4	6in	Loose, gravel, with silt massive, wet 8.2 ft	~~GP~~ GM	N/A	HNU= Ø ppm α= Ø cpm Bγ=300-500 cpm
8.5	177 77	4	6in	Loose, silty sand, wet. massive, with clay @ 1110	SM	Loose	
	NR 177 78	4	NR			TSF	
9.0	177 79	5	6in	Loose, silty sand, wet massive, some laminations Brownish yellow (10YR 6/8)	SM	Loose	HNU= Ø ppm α= Ø cpm Bγ=300-500 cpm
9.5	177 80	4	6in				
10.0	177 81 unused	7 NR	NR Ø	@ 1115		TSF	
10.5	177 82	10	6in	Same as above	SM	Loose	HNU= Ø ppm α= Ø cpm Bγ= 300-500 cpm
11.0	~~57900~~ ~~57990~~	13	6in				
11.5	57909 NR	14	NR	@ 1120		TSF	
12.0	57910	3	6in	Same as above	SM	Loose	HNU= Ø ppm α= Ø cpm Bγ= 300-500 cpm
12.5	57911	5	6in	Stiff, Clay, Yellowish Brown (10YR 6/8), Dry, massive, med. plastic	CL	1.2	
13.0	57912 NR	9	NR	@ 1130		TSF	
13.5							HNU= ppm α= cpm Bγ= cpm
14.0							
14.5							
15.0				@		TSF	

NOTES: Contractor: Driller: Helper: Sample Tech: Weather: HNU#: } See page 1 of 4

Background @ 1130
HNU= Ø ppm
Air α= Ø cpm
Air Bγ= 200-260 cpm
Grnd α = Ø cpm
Grnd Bγ= 600-1200 cpm

4G2-11-86

FERNALD RI/FS

6496

PIEZOMETER INSTALLATION SHEET

PROJECT NAME Facilities Testing FMPC RI/FS FIELD ENG./GEO. L. Sinfield DATE 5-14-89
PROJECT NO. 602 3.7.1 CHECKED BY RD DATE 6/5/89
BORING NO. 1236
PIEZOMETER NO. 1236 DATE OF INSTALLATION 5-14-89

BOREHOLE DRILLING

DRILLING METHOD Hollow Stem Auger
DRILLING FLUID (S) USED: N/A
FLUID N/A FROM N/A TO N/A
FLUID N/A FROM N/A TO N/A

TYPE OF BIT Auger Bit
CASING SIZE (S) USED: N/A
SIZE N/A FROM N/A TO N/A
SIZE N/A FROM N/A TO N/A

PIEZOMETER DESCRIPTION

TYPE Schedule 40 PVC
DIAMETER OF PERFORATED SECTION 2 inch I.D.
PERFORATION TYPE:
SLOTS ☒ HOLES ☐ SCREEN ☐
AVERAGE SIZE OF PERFORATIONS 0.020 inch
TOTAL PERFORATED AREA 6.5 ft.

RISER PIPE MATERIAL Schedule 40 PVC
RISER PIPE DIAMETERS: 6/15/89
O.D. ~~2 1/4 inch~~ 2 5/16 inch I.D. 2 inch
LENGTH OF PIPE SECTIONS 8.4 ft
JOINING METHOD Flush-Threaded Joints

PROTECTION SYSTEM

RISER PROTECTIVE PIPE LENGTH 5.0 ft
PROTECTIVE PIPE O.D. 4 3/8 inch

OTHER PROTECTION Locking Hinged Cap

ITEM	DISTANCE ABOVE/BELOW GROUND SURFACE (ft)		ELEVATION ( )	
TOP OF RISER PIPE	2.0 ft			
GROUND SURFACE	0.0			
BOTTOM OF PROTECTIVE PIPE	2.8 ft			
BOREHOLE FILL MATERIALS:	Cement Ø ft	1.0 ft		
GROUT/SLURRY	TOP N/A	BOTTOM N/A	TOP	BOTTOM
BENTONITE	TOP 1.0 ft	BOTTOM 5.5 ft	TOP	BOTTOM
SAND	TOP 5.5 ft	BOTTOM 13.3 ft	TOP	BOTTOM
GRAVEL	TOP N/A	BOTTOM N/A	TOP	BOTTOM
PERFORATED SECTION	TOP 6.4 ft	BOTTOM 13.1 ft	TOP	BOTTOM
PIEZOMETER TIP	13.3 ft			
BOTTOM OF BOREHOLE	5-14-89 ~~13.5 ft~~ 13.5 ft			
GWL AFTER INSTALLATION				

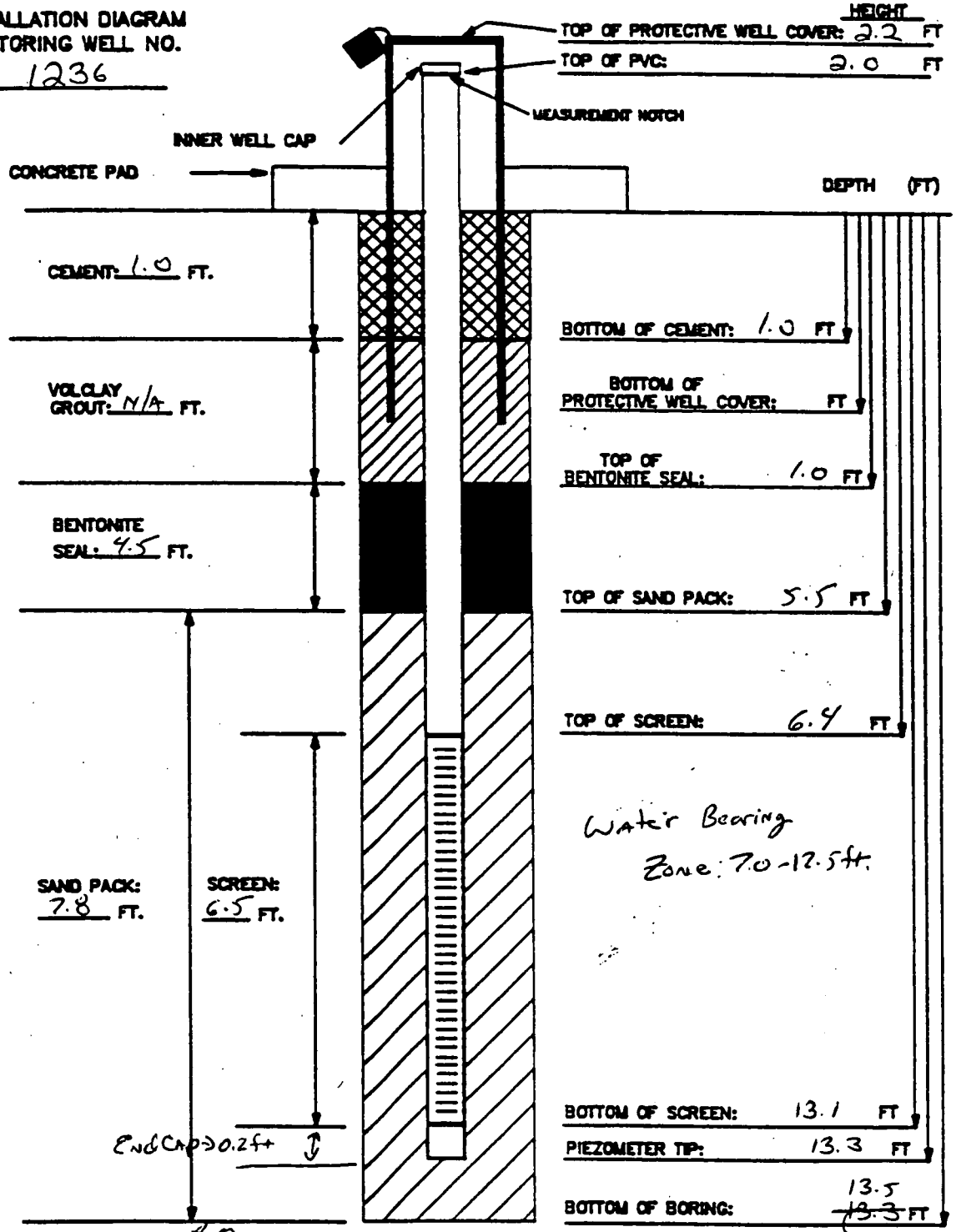
WAS THE PIEZOMETER FLUSHED AFTER INSTALLATION? YES ☐ NO ☒
WAS A SENSITIVITY TEST PERFORMED ON THE PIEZOMETER? YES ☐ NO ☒
REMARKS Water Bearing Zone: 7.0-12.5 ft

409-11-86

INSTALLATION DATE: 5-14-89

FERNALD RI/FS

INSTALLATION DIAGRAM
MONITORING WELL NO.
1236



MATERIALS USED:
SAND TYPE AND QUANTITY: 3 Bags 10/20 - 80lb
BENTONITE PELLETS (5-GALLON BUCKETS): 4 Buckets
BAGS OF VOLCLAY GROUT: N/A
AMOUNT OF CEMENT: 1 Bag - 50lb
AMOUNT OF WATER USED: 50 gallons
OTHER: Protective Cover

NOTES:
1) RISER PIPE IS 2-INCH SCHEDULE 40 PVC PIPE, FLUSH-THREADED JOINTS.
2) SCREEN IS 2-INCH I.D. SCHEDULE 40 PVC PIPE WITH 0.020-INCH SLOTS.
3) LOWER END OF SCREEN IS CAPPED WITH AN END CAP OR THREADED SUMP.
4) WATER DEPTH/DATE:

TASK: 60 L 3 7.1 GEOLOGIST/ENGINEER: L. Sinfield

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FERNALD RI/FS

6496

Date	6/5/89			
Initial	BB			
	Field Check	1st Key In	2nd Key In	Hard Copy Verification

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1131	COORDINATES:	DATE: 5/14/89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5/14/89
ENGINEER/GEOLOGIST: C. Grube	Depth Date/Time	DATE COMPLETED: 5/15/89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 1 OF 3

DEPTH (FT.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN.)	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	15583 1505 5-14	19	6	med Dense, lt. yellowish brown (10 YR 6/3) well graded gravelly sand, moist to very moist	SP	N/A	HNU = 0 ppm α = 0 cpm Bγ = 80-90 cpm
1	15584 1505 5-14	15	6	SAA	SP	N/A	
	15585 1505 5-14	12	0	No Recovery	N/A	N/A	
2	15586 1510 5-14	9	6	Stiff Yellowish Brown (10 YR 5/4) sandy clay trace fine gravel and silt, moist	CL	1.75	HNU = 0 ppm α = 0 cpm Bγ = 90-100 cpm
	15587 1510 5-14	11	0	No Recovery	N/A	N/A	
water 3.0 ft 3	15588 1510 5-14	7	0	No Recovery	N/A	N/A	
	15589 1520 5-14	19	2	Second try w/ catcher in spoon - 2 inches Dense, (Brown (10 YR 5/3), Clayey sand, some gravel, very moist	SC	N/A	HNU = 0 ppm α = 0 cpm Bγ = 100-110 cpm
4	15590 1520 5-14	17	0	No Recovery	N/A	N/A	
	15591 1520 5-14	23	0	No Recovery	N/A	N/A	
5	15592 1525 5-14	17	5	Dense, Dk grayish Brown (2.5Y 4/2) Clayey sand trace gravel & silt, wet	SC	N/A	HNU = 0 ppm α = 0 cpm Bγ = 100-110 cpm
	15593 1525 5-14	13	0	No Recovery	N/A	N/A	
water 6.0 ft 6	15594 1525 5-14	19	0	No Recovery	N/A	N/A	
	15595 1550 5-14	9	6	Very stiff Grayish Brown (2.5Y 5/2) silty clay trace of sand and fine to med. gravel, moist Low plasticity	CL	3.5	HNU = 0 ppm α = 0 cpm Bγ = 90-100 cpm
7	15596 1550 5-14	6	6	Very stiff, Dark gray (5Y 4/1), silty clay, trace fine gravel, low plasticity, moist	CL	3.5	
	15597 1550 05-14	3	2	SAA Bottom of Boring and sampling at 7.5 FT	CL	1.75	

NOTES: CONTRACTOR: PENN DRILL
RIG: Model 80
DRILLER: Craig Coulter
ASSISTANT: Chris Coulter

SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST
COLORS IDENTIFIED USING MUNSELL COLOR CHART
BACKGROUND LEVELS: HNU = 0 PPM
α = 0 CPM
Bγ = 80-100 CPM

LEL O_2: LEL = 0% ~~PPM~~ CB 5/14/89
O_2 = 20.6 %

HNU serial # 1201 10 SAA = Same As Above

000089

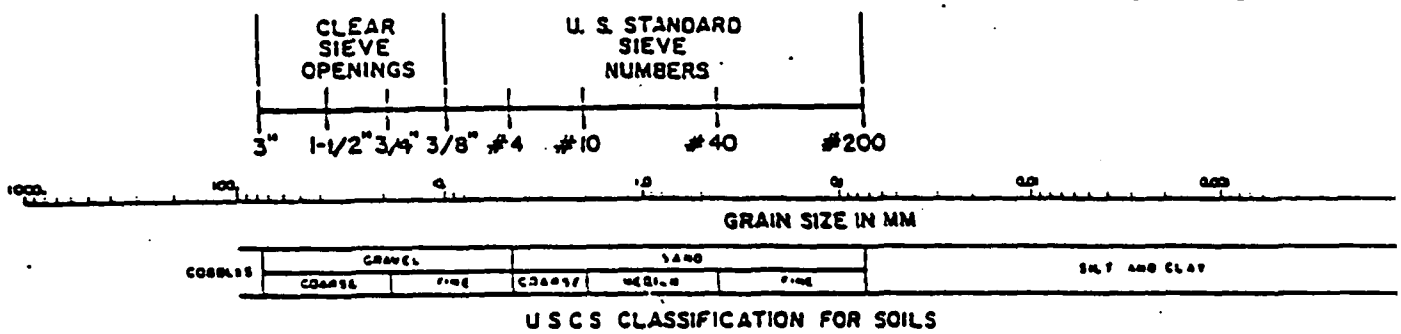
CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE (1)
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

(1) STANDARD PENETRATION RESISTANCE IS THE NUMBER O BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLIN FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 1 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EAC 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANC



U S C S CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

FINE-GRAINED/HIGHLY ORGANIC SOI

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SAND ROCK FLOUR, SILTY OR CLAYEY FINE SAND OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICIT GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOU FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTIC ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTEN

FERNALD RI/FS

6496

PIEZOMETER INSTALLATION SHEET

PROJECT NAME FMPC RI/FS
FIELD ENG./GEO. C. Gruber
DATE 5/15/89
PROJECT NO. 002 3.7
CHECKED BY DL
DATE 6/5/89
BORING NO. 1131
PIEZOMETER NO. 1131
DATE OF INSTALLATION 5/15/89

BOREHOLE DRILLING

DRILLING METHOD Hollow Stem Auger - 8 in
DRILLING FLUID (S) USED:
FLUID N/A FROM — TO —
FLUID N/A FROM — TO —

TYPE OF BIT 8 in Hollow auger
CASING SIZE (S) USED:
SIZE N/A FROM — TO —
SIZE N/A FROM — TO —

PIEZOMETER DESCRIPTION

TYPE Monitoring piezometer
DIAMETER OF PERFORATED SECTION 2.0 in ID.
PERFORATION TYPE:
SLOTS [X] HOLES [ ] SCREEN [ ]
AVERAGE SIZE OF PERFORATIONS ~~0.02~~ 0.020 in
TOTAL PERFORATED AREA 5.0 FT

RISER PIPE MATERIAL Schedule 40 PVC
RISER PIPE DIAMETERS:
O.D. 2 5/16 in I.D. 2.0 in
LENGTH OF PIPE SECTIONS 4.5 FT
JOINING METHOD screw type, flush joint threaded

PROTECTION SYSTEM

RISER PROTECTIVE PIPE LENGTH 5.0 FT
PROTECTIVE PIPE O.D. 4 3/8 in

OTHER PROTECTION Hinged cover with installed padlock

ITEM	DISTANCE ABOVE/BELOW GROUND SURFACE (FT)		ELEVATION ( )	
TOP OF RISER PIPE	2.0			
GROUND SURFACE	0.0			
BOTTOM OF PROTECTIVE PIPE	2.5			
BOREHOLE FILL MATERIALS:				
~~GROUT/SLURRY~~ cement	TOP 0.0	BOTTOM 1.0	TOP	BOTTOM
BENTONITE	TOP 1.0	BOTTOM 2.0	TOP	BOTTOM
SAND	TOP 2.0	BOTTOM 7.5	TOP	BOTTOM
~~GRAVEL~~ N/A	TOP —	BOTTOM —	TOP	BOTTOM
PERFORATED SECTION	TOP 2.5	BOTTOM 7.5	TOP	BOTTOM
PIEZOMETER TIP	7.5			
BOTTOM OF BOREHOLE	7.5			
GWL AFTER INSTALLATION	—			

WAS THE PIEZOMETER FLUSHED AFTER INSTALLATION? YES [ ] NO [X]
WAS A SENSITIVITY TEST PERFORMED ON THE PIEZOMETER? YES [ ] NO [X]

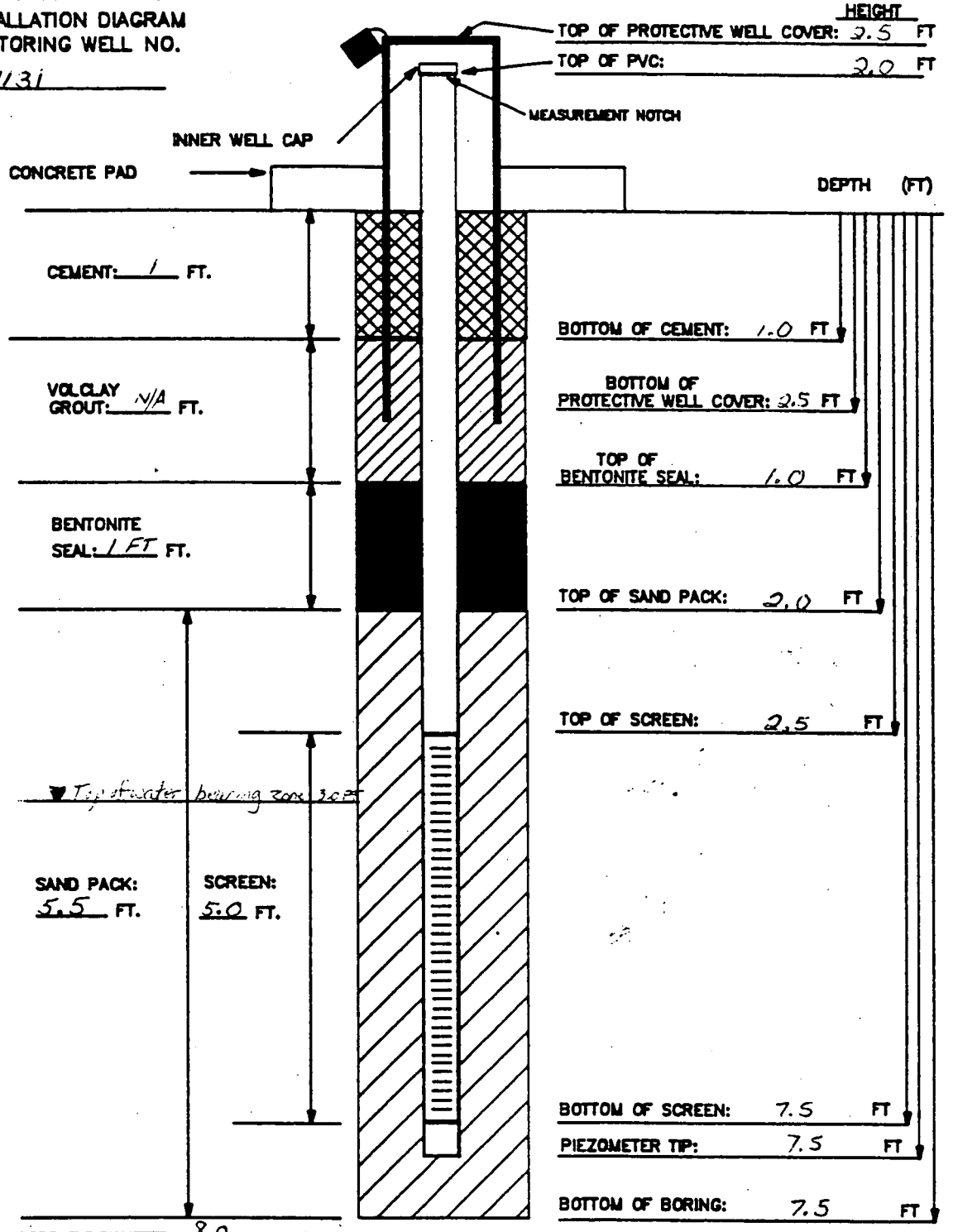
REMARKS Top of water bearing zone at 3.0 FT
Bottom " " " " " 6.0 FT

6496

FERNALD RI/FS

INSTALLATION DIAGRAM
MONITORING WELL NO.
1131

INSTALLATION DATE: 5-15-89



BOREHOLE DIAMETER: 8.0 INCHES

MATERIALS USED:
SAND TYPE AND QUANITITY: 2 sks (10/30) 80#
BENTONITE PELLETS (5-GALLON BUCKETS): ½ bucket
BAGS OF VOLCLAY GROUT: N/A
AMOUNT OF CEMENT: ½ sk. (50 lb)
AMOUNT OF WATER USED: 20 gal
OTHER: 5.0 FT Protective casing

NOTES:
1) RISER PIPE IS 2-INCH SCHEDULE 40 PVC PIPE, FLUSH-THREADED JOINTS.
2) SCREEN IS 2-INCH I.D. SCHEDULE 40 PVC PIPE WITH 0.020-INCH SLOTS.
3) LOWER END OF SCREEN IS CAPPED WITH AN END CAP OR THREADED SUMP.
4) WATER DEPTH/DATE:

TASK: 602 3.7

GEOLOGIST/ENGINEER: Cate Grube

FERNALD RI/FS

6496			
Initial			
Field Check	1st Key In	2nd Key In	Hard Copy Verification

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602-3.7.1	PROJECT NAME: Facilities Testing Program	
BORING NUMBER: 1237	COORDINATES:	DATE: 5-12-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5-12-89
ENGINEER/GEOLOGIST: L. Sinfield	Depth Date/Time	DATE COMPLETED: 5-12-89
DRILLING METHODS: B-53, Hollow Stem Auger with Split Spoon Sampler		PAGE 1 OF 4

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS (Note: Total of 5 pages with Field Copies.) Start = 0945
0.5	17783 WMCO	2		Loose, Gravel, dry, massive 0.5ft	GM	Loose	HNU = Ø ppm; α = Ø cpm; BG = 100-120 cpm clay; BG = 1000-2000 gravel
1.0	17784	7	12in.	Hard, Brownish Yellow (10YR, 6/8) Lean Clay, dry, massive, medium plastic.	CL	>4.5	
1.5	17785 NR	2		@ 0945		TSF	
2.0	17786	10		Stiff to Very Stiff, Brownish Yellow (10YR, 6/8) Lean clay, CL - Dry, massive, medium plastic, with some sand, rare gravel.	CL	1.7 to 2.6	HNU = Ø ppm; α = 5-10 cpm; BG = 100-140 cpm
2.5	17787 WMCO	7	10in				
3.0	17788 NR	4		@ 0950		TSF	
3.5	17789	3		Medium Stiff to Stiff, Brownish Yellow (10YR, 6/6) to Grayish Brown (2.5Y, 5/2) Dry, medium plastic, massive	CL	0.5 to 1.5	HNU = Ø ppm; α = 5 cpm; BG = 80-100 cpm
4.0	17790	5	16in.				
4.5	17791	7		@ 0955		TSF	
5.0	17792	2		Loose, Silty Sand with Gravel WET Brownish Yellow (10YR, 6/8) 5.0ft	SM	Loose	HNU = Ø ppm; α = 10 cpm; BG = 100-140 cpm
5.5	17793 NR WMCO	2	12in.	Soft, Dark Grayish Brown (2.5Y, 4/2), MOIST clay massive.	CL	<0.5	
6.0	17794 NR	4		@ 1000		TSF	
6.5	17795	1 for 1ft		Very Stiff, Brownish Yellow (10YR, 6/6) to grayish Brown (2.5Y, 4/2) Lean Clay, CL - Dry, massive, medium plastic, mottled, with silt	CL	2.7 to 3.5	HNU = Ø ppm; α = Ø cpm; BG = 100-120 cpm
7.0	17796		12in.				
7.5	17797	8		@ 1020		TSF	

NOTES: Contractor: Penn Drill
Driller: Wm. Saccani
Helper: G. Dye
Sample Tech: C. Melroy
Weather: Cover-cast) Cloudy - cold
HNU #: HH118

Water Bearing Zone: 12.0 → 14.0 ft.

Background @ 0900
HNU = Ø ppm
α = Ø cpm
BG = 100-120 cpm

NR = No Recovery, No Samples Taken

4C2-11-86

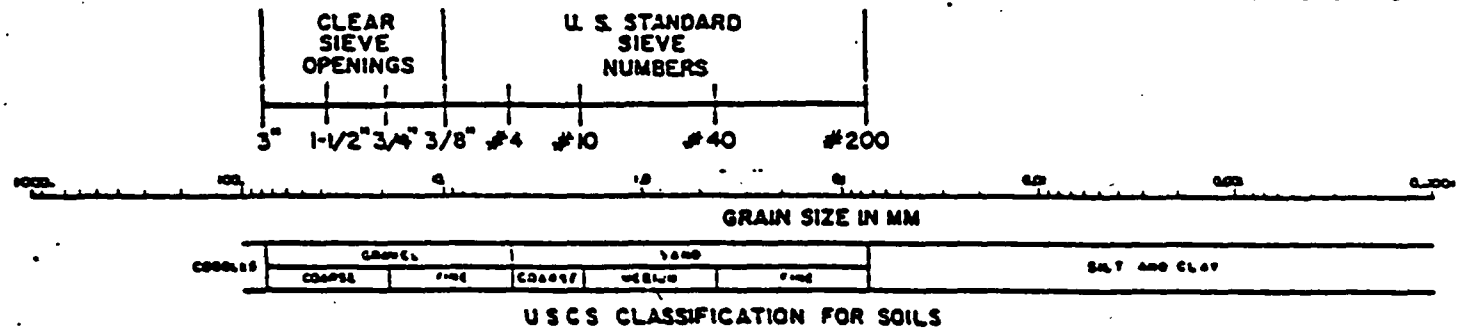
CONSISTENCY OF COHESI SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE[1]
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

(1) STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 18 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANCE.



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

FINE-GRAINED/HIGHLY ORGANIC SOILS

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

FERNALD RI/FS

Field Copy 6496

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602-3.7.1	PROJECT NAME: Facilities Testing Program	
BORING NUMBER: 1237	COORDINATES:	DATE: 5-12-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5-12-89
ENGINEER/GEOLOGIST: L. Sintzel	Depth Date/Time	DATE COMPLETED: 5-12-89
DRILLING METHODS: D-53, Hollow Stem Auger with Split Spoon Sample		PAGE 1 OF

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
							Start = 0945
0.5	17783 WMCO	2		Loose, Gravel, dry, massive. 0.5 ft	GM	Loose	HNU = Ø ppm α = Ø cpm Bγ = 100-120 cpm clay Bγ = 1000-2000 Gravel
1.0	17784	7	12 in	Hard, clay, Brownish yellow (10YR, 6/8), dry, massive medium plastic. @ 0945	CL	>4.5	
1.5	17785 NR	2				TSF	
2.0	17786	10		Stiff to very stiff clay. Brownish yellow (10yr, 6/8) Lean clay, dry, massive med plastic, some sand rare gravel @ 0950	CL	1.7 to 2.6	HNU = Ø ppm α = 5-10 cpm Bγ = 100-140 cpm
2.5	17787 WMCO	7	10 in				
3.0	17788 NR	4				TSF	
3.5	17789	3		Med stiff to stiff, Brownish yellow (10yr, 6/6) to grayish brown (2.5y 5/2) dry, med plastic, massive. @ 0955	CL	0.5 to 1.5	HNU = Ø ppm α = 5 cpm Bγ = 80-100 cpm
4.0	17790	5	16 in				
4.5	17791	7				TSF	
5.0	17792	2		LOOSE, SILTY SAND w/ gravel brownish yellow 10yr 6/8 wet 5.0	SM	[illegible]	HNU = Ø ppm α = 10 cpm Bγ = 100-140 cpm
5.5	17793 WMCO	2	12 in				
6.0	17794 NR	4		Stiff, dark grayish brown 2.5y 4/2, moist CLAY @ 1000	CL	<.5 TSF	
6.5	17795 NR	1		Very Stiff, Brownish yellow (10YR 6/6) to Grayish Brown (2.5Y 4/2) Clay. Dry, massive, med. plastic mottled, with silt @ 1020	CL	2.7 to 3.5	HNU = Ø ppm α = Ø cpm Bγ = 100-120 cpm
7.0	17796	0	12 in				
7.5	17797	8				TSF	

NOTES: Contractor: Penn Drill
Driller: WM SACCANI
Helper: GARY DYE
Sample Tech: Cindy Melroy
Weather: Overcast, cold
HNU #: HH19

Background @ 0900
HNU = Ø ppm
α = Ø cpm
Bγ = 100-120 cpm

4C2-11-86

FERNALD RI/FS

6496

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602-37	PROJECT NAME: Facilities Testing Program	
BORING NUMBER: 1237	COORDINATES:	DATE: 5-12-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5-12-89
ENGINEER/GEOLOGIST: L. SINFIELD	Depth Date/Time	DATE COMPLETED: 5-12-89
DRILLING METHODS: B53 Hollow Stem Augers w/ Split Spoon		PAGE 2 OF 2

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
7.5							Start=
8.0	17798	2	18 IN	SOFT TO HARD AT BASE Dry, massive, med plastic (SAME AS ABOVE) LEAN CLAY TO SANDY CLAY Brownish yellow (10yr/6/6) to Grayish brown (2.5y 4/2) @ 1045	CL	0.0 to 4.5 TSF	HNU= Ø ppm α= Ø cpm Bγ= 100-120 cpm
8.5	17799	4					
9.0	17800	4					
9.5	17801	2	15 IN	Soft to Very Stiff. clay color-same as above mottled. very slightly moist med. plastic, massive. @ 1050	CL	0.2 to 2.1 TSF	HNU= Ø ppm α= Ø cpm Bγ= 100-120 cpm
10.0	17802	3					
10.5	17803 NMC 0	5					
11.0	17804	2	12 IN	Clay with some sand, colors, etc SAME AS above. SOFT TO HARD very slightly moist small sand seams @ 1055	CL	0.0 to 4.5 TSF	HNU= Ø ppm α= Ø cpm Bγ= 80-120 cpm
11.5	50745	2					
12.0	50746 NR	2					
12.5	50747	3	12 IN	~~Sand~~, LOOSE SILT GRADING TO SAND AT BASE, WET MASSIVE, GRAYSH BROWN (2.5y, 5/2) @ 1105	ML ↓ SM	Loose TSF	HNU= 0 ppm α= 0 cpm Bγ= 80-120 cpm
13.0	50748	5					
13.5	50749 NR	7					
14.0	50750	1.1	15 IN	~~LOOSE~~ SILT SAME AS ABOVE 14.0	~~SM~~ ML		HNU= 0 ppm α= 0 cpm Bγ= 80-120 cpm
14.5	50751	12		HARD, Light brownish Gray (2.5y, 6/2) clay massive, dry med. plastic @ 1110	CL	4.2 ↓ 3.6 TSF	
15.0	50752	14					

Water Bearing Zone

NOTES: Contractor: Driller: Helper: Sample Tech: Weather: HNU #: } See page 1 of 4

TD = 15.0 ft

Water Bearing Zone: 12.0 → 14.0 ft

Background @ 0900
HNU = Ø ppm
α = Ø cpm
Bγ = 100-140

FERNALD RI/FS

PIEZOMETER INSTALLATION SHEET

PROJECT NAME Facilities Testing FMPC RI/FS FIELD ENG./GEO. C. Sinfield DATE 5-12-89
PROJECT NO. 6023.7.1 CHECKED BY RN. DATE 6/5/89
BORING NO. 1237
PIEZOMETER NO. 1237 DATE OF INSTALLATION 5-12-89

BOREHOLE DRILLING

DRILLING METHOD Hollow Stem Auger
DRILLING FLUID (S) USED: N/A
FLUID N/A FROM N/A TO N/A
FLUID N/A FROM N/A TO N/A

TYPE OF BIT Auger Bit
CASING SIZE (S) USED: N/A
SIZE N/A FROM N/A TO N/A
SIZE N/A FROM N/A TO N/A

PIEZOMETER DESCRIPTION

TYPE Schedule 40 PVC
DIAMETER OF PERFORATED SECTION 2 inch I.D.
PERFORATION TYPE:
SLOTS [X] HOLES [ ] SCREEN [ ]
AVERAGE SIZE OF PERFORATIONS 0.020 inch
TOTAL PERFORATED AREA 4.8 ft

RISER PIPE MATERIAL Schedule 40 PVC
RISER PIPE DIAMETERS:
O.D. 2 1/4 inch I.D. 2 inch
LENGTH OF PIPE SECTIONS 10.8 ft
JOINING METHOD Flush-Threaded Joints

PROTECTION SYSTEM

RISER PROTECTIVE PIPE LENGTH 5.0 ft
PROTECTIVE PIPE O.D. 4 3/8 inch

OTHER PROTECTION Locking Hinged Cover

ITEM	DISTANCE ABOVE/BELOW GROUND SURFACE (ft)		ELEVATION ( )	
TOP OF RISER PIPE	2.0 ft			
GROUND SURFACE	0.0			
BOTTOM OF PROTECTIVE PIPE	2.8 ft			
BOREHOLE FILL MATERIALS:	Cement 0.0 ft	1.0 ft		
GROUT/SLURRY	TOP N/A	BOTTOM N/A	TOP	BOTTOM
BENTONITE	TOP 1.0 ft	BOTTOM 7.0 ft	TOP	BOTTOM
SAND	TOP 7.0 ft	BOTTOM 15.0 ft	TOP	BOTTOM
GRAVEL	TOP N/A	BOTTOM N/A	TOP	BOTTOM
PERFORATED SECTION	TOP 9.8 ft	BOTTOM 14.6 ft	TOP	BOTTOM
PIEZOMETER TIP	15.0 ft			
BOTTOM OF BOREHOLE	15.0 ft			
GWL AFTER INSTALLATION				

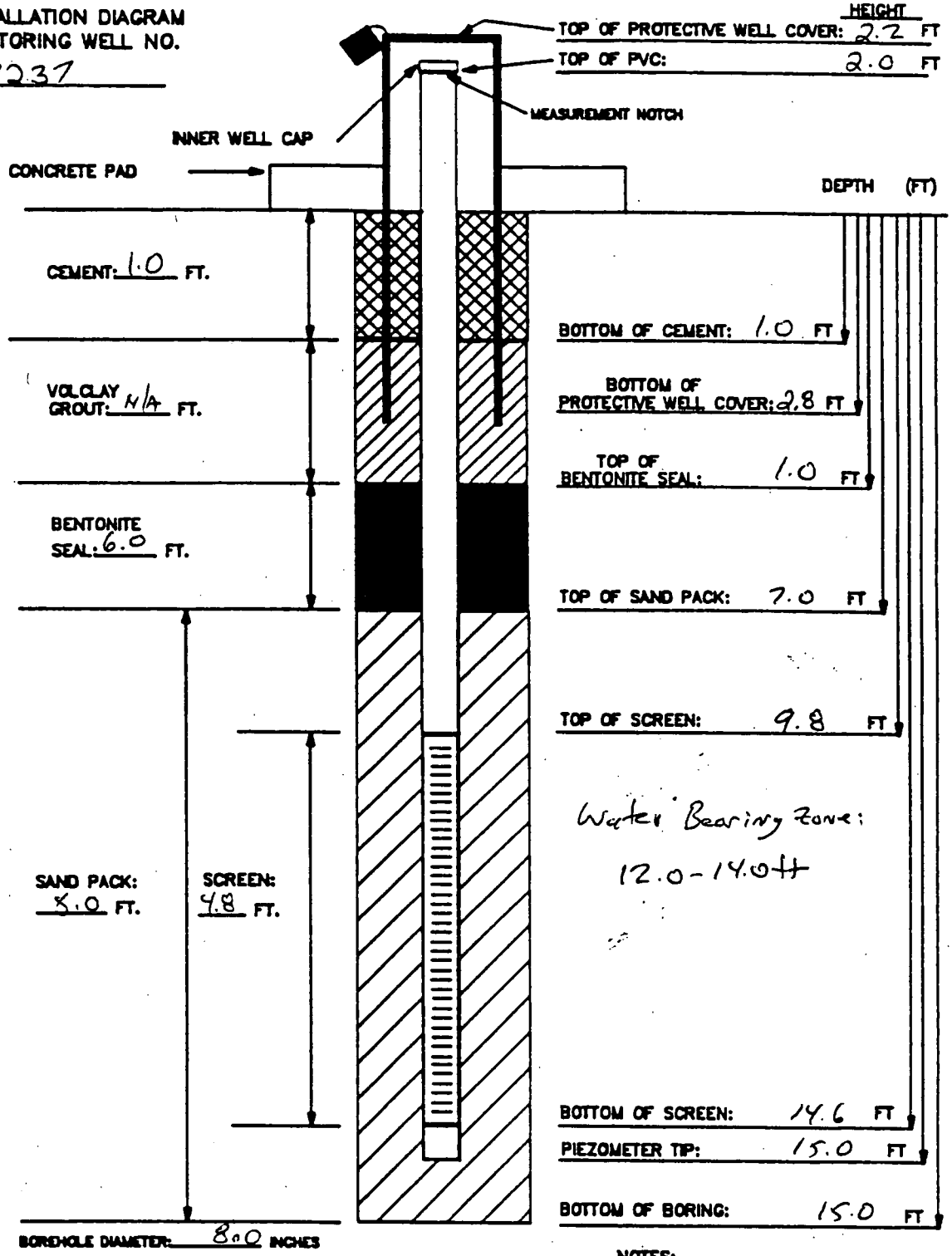
WAS THE PIEZOMETER FLUSHED AFTER INSTALLATION? YES [ ] NO [X]
WAS A SENSITIVITY TEST PERFORMED ON THE PIEZOMETER? YES [ ] NO [X]

REMARKS Water Bearing Zone: 12.0-14.0 ft

FERNALD RI/FS

INSTALLATION DIAGRAM
MONITORING WELL NO. 1237

INSTALLATION DATE: 5-12-89



BOREHOLE DIAMETER: 8.0 INCHES

MATERIALS USED:
SAND TYPE AND QUANITITY: 3 Bags 10/20 - 80lb bags
BENTONITE PELLETS (5-GALLON BUCKETS): 4 Buckets
BAGS OF VOLCLAY GROUT: N/A
AMOUNT OF CEMENT: 1 Bag - 50lb
AMOUNT OF WATER USED: 10 gallons
OTHER:

NOTES:
1) RISER PIPE IS 2-INCH SCHEDULE 40 PVC PIPE, FLUSH-THREADED JOINTS.
2) SCREEN IS 2-INCH I.D. SCHEDULE 40 PVC PIPE WITH 0.020-INCH SLOTS.
3) LOWER END OF SCREEN IS CAPPED WITH AN END CAP OR THREADED SUMP.
4) WATER DEPTH/DATE:

TASK: 602 3.7.1

GEOLOGIST/ENGINEER: C. Sinfield

FERNALD RI/FS

6496

Date				
Initial				
Field Check	1st Key In	2nd Key In	Hard Copy Verification	

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1219	COORDINATES:	DATE: 5-12-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5-12-89
ENGINEER/GEOLOGIST: C Grube/L. Adams	Depth Date/Time	DATE COMPLETED: 5-14-89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 1 OF 4

DEPTH (FT.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN.)	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	17387 1438 5-12	6	6	Dense, yellowish brown (10yr 5/4) sand. well graded. Trace silt + clay Dry. Some gravel	SW	N/A	HNU = 0 ppm α = 0 cpm Bγ = 100-120 cpm
1	17388 1438 5-12	22	6	SAA	SW	N/A	
	17389 1438 5-12	19	4	SAA	SW	N/A	
2	17390 1442 5-12	6	6	Loose SAA slightly moist	SW	N/A	HNU = 0 ppm α = 0 cpm Bγ = 60-80 cpm
	17391 1442 5-12	6	6	Loose, SAA	SW	N/A	
3	17392 1442 5-12	4	0	Loose ~~SAA~~ LAA 5/12/89 no recovery	N/A	N/A	
	17393 1445 5-12	2	6	very Loose, SAA very moist	SW	N/A	HNU = 0 ppm α = 0 cpm Bγ = 60-80 cpm
4	17394 1445 5-12	1/2	6	med. stiff, yellowish brown (10yr 5/4) clay Trace sand + silt. Med. plasticity, very moist	CL	~~N/A~~ .75 LA 5/12/89	
	17395 1445 5-12	1/2	2	SAA	CL	~~N/A~~ .75 LA 5/12/89	
5	17396 1452 5-12	1/2	6	med. stiff, yellowish brown (10yr 5/6) to dk brown (10yr 3/3) silty clay trace sand very moist	CL	.75	HNU = 0ppm α = 0 cpm Bγ = 60-80 cpm
	17397 1452 5-12	2	0	no recovery	N/A	N/A	
6	17398 1452 5-12	4	0	no recovery	N/A	N/A	
	17399 1456 5-12	3	6	SAA from 4.5 FT to 5.0 FT 6.2 FT Loose, yellowish brown (10yr 5/6) silt (clayey) wet. Trace sand	CL ML	.75 N/A	HNU = 0 ppm α = 0 cpm Bγ = 80-90 cpm
7	17400 1456 5-12	3	~~5~~ 4 LA	Loose, SAA	ML	N/A	
	17401 1456 5-12	4	0	no recovery	N/A	N/A	

NOTES: CONTRACTOR: PENN DRILL
RIG: Model 80
DRILLER: Craig Coulter
ASSISTANT: Chris Coulter

SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST
COLORS IDENTIFIED USING MUNSELL COLOR CHART
BACKGROUND LEVELS: HNU = 0 PPM
α = 0 CPM
Bγ = 80-100 CPM
LEL O2: LEL = 0 ~~PPM~~ % LA 5/12/89
O2 = 20.6 %

HNU serial # 1201 10

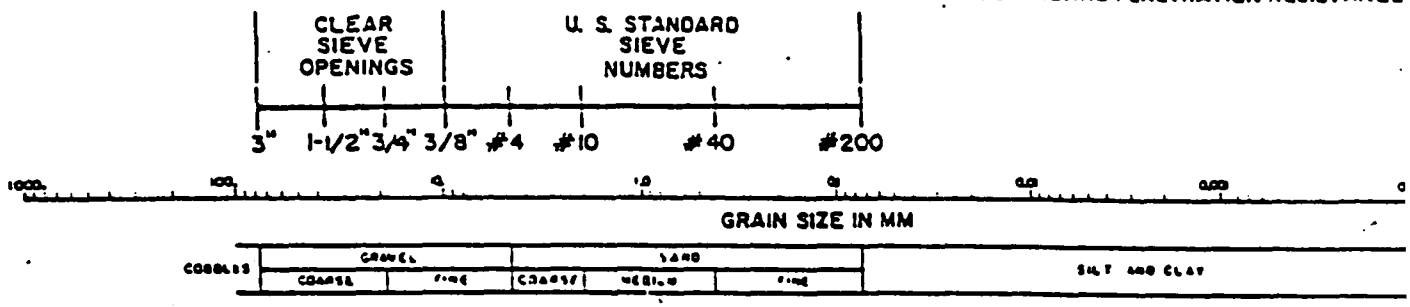
CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE(1)
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

(1) STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 18 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANCE



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

FINE-GRAINED/HIGHLY ORGANIC SOILS

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENT

FERNALD RI/FS

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VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1219	COORDINATES:	DATE: 5-12-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5-12-89
ENGINEER/GEOLOGIST: C. Grube/L. Adams	Depth Date/Time	DATE COMPLETED: 5-14-89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 2 OF 4

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN.)	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
8	17402 1500 5-12	8	6	~~Loose~~ yellowish brown (10yr 5/6) clayey silt. Trace fine gravel, trace sand. Very moist. (ed 5/13/89 Med. Dense)	ML	N/A	Hnu = 0ppm α = 0cpm Bγ = 60-80 cpm
	17403 1500 5-12	9	6	~~Loose~~ Med Dense, yellowish brown (10yr 5/6) silty sand. Wet. (ed 5/13/89)	SM	N/A	
9	17404 1500 5-12	8	6	~~Loose~~ (10yr 5/4) yellowish brown silt. Med Dense (ed 5/13/89)	ML	N/A	
	17405 1503 5-12	10	6	med dense (yellowish brown (10yr 5/6) silty sand, trace fine gravel. ~~Moist~~ wet (ed 5/12/89)	SM	N/A	Hnu = 0ppm α = 0cpm Bγ = 60-80 cpm
10	17406 1503 5-12	11	6	Med dense, yellowish brown (10yr 5/4) silty sand wet.	SM	N/A	
10.3 FT	17407 1503 5-12	9	6	Med. dense, yellowish brown (10yr 5/6) silt. Some sand. Wet	ML	N/A	
				med. dense, grayish brown (2.5y 5/2) clayey silt. moist (Last 3 in)	ML	N/A	
11	17408 08-55 5-14	8	6	SAA	ML	N/A	Hnu = 0 ppm α = 0 cpm Bγ = 60-80 cpm
	50755 0855 5-14	10	6	Stiff, gray (5y 5/1), silty clay, low to med. plasticity, very moist	CL	1.5	
12	50756 0855 5-14	13	6	medium stiff, gray (5y 5/1), silty clay, medium plasticity, moist	CL	.75	
				Bottom of Boring and sampling at 12.0 FT			Hnu = α = Bγ =
13							
14							Hnu = α = Bγ =

NOTES:

FERNALD RI/FS

PIEZOMETER INSTALLATION SHEET

PROJECT NAME FMPC RI/FS FIELD ENG./GEO. C. Grube DATE 5/14/89
PROJECT NO. 602 3.7 CHECKED BY _____ DATE _____
BORING NO. 1219
PIEZOMETER NO. 1219 DATE OF INSTALLATION 5/14/89

BOREHOLE DRILLING

DRILLING METHOD Hollow Stem Auger - 8 in	TYPE OF BIT 8 in. Hollow Auger
DRILLING FLUID (S) USED:	CASING SIZE (S) USED:
FLUID N/A FROM — TO —	SIZE N/A FROM — TO —
FLUID N/A FROM — TO —	SIZE N/A FROM — TO —

PIEZOMETER DESCRIPTION

TYPE Monitoring piezometer	RISER PIPE MATERIAL Schedule 40 PVC
DIAMETER OF PERFORATED SECTION 2.0 in ID	RISER PIPE DIAMETERS:
PERFORATION TYPE:	O.D. 2 5/16 in I.D. 2.0 in
SLOTS ☑ HOLES ☐ SCREEN ☐	LENGTH OF PIPE SECTIONS 8.5 FT
AVERAGE SIZE OF PERFORATIONS 0.020 in.	JOINING METHOD screw type, flush joint threaded
TOTAL PERFORATED AREA 5.0 FT	

PROTECTION SYSTEM

RISER PROTECTIVE PIPE LENGTH 5.0 FT	OTHER PROTECTION Hinged cover with installed padlock
PROTECTIVE PIPE O.D. 4 3/8 in	

ITEM	DISTANCE ABOVE/BELOW GROUND SURFACE (FT)		ELEVATION ( )	
TOP OF RISER PIPE	2.0			
GROUND SURFACE	0.0			
BOTTOM OF PROTECTIVE PIPE	2.5			
BOREHOLE FILL MATERIALS:				
GROUT/SLURRY	TOP 0.0	BOTTOM 1.0	TOP	BOTTOM
BENTONITE	TOP 1.0	BOTTOM 3.5	TOP	BOTTOM
SAND	TOP 3.5	BOTTOM 12.0	TOP	BOTTOM
~~GRAVEL~~ N/A	TOP —	BOTTOM —	TOP	BOTTOM
PERFORATED SECTION	TOP 6.5	BOTTOM 11.5	TOP	BOTTOM
PIEZOMETER TIP	11.5			
BOTTOM OF BOREHOLE	12.0			
GWL AFTER INSTALLATION	—			

WAS THE PIEZOMETER FLUSHED AFTER INSTALLATION? YES ☐ NO ☑
WAS A SENSITIVITY TEST PERFORMED ON THE PIEZOMETER? YES ☐ NO ☑

REMARKS Top of Water bearing Zone at 6.2 FT
Bottom of Water bearing Zone at 10.3 FT

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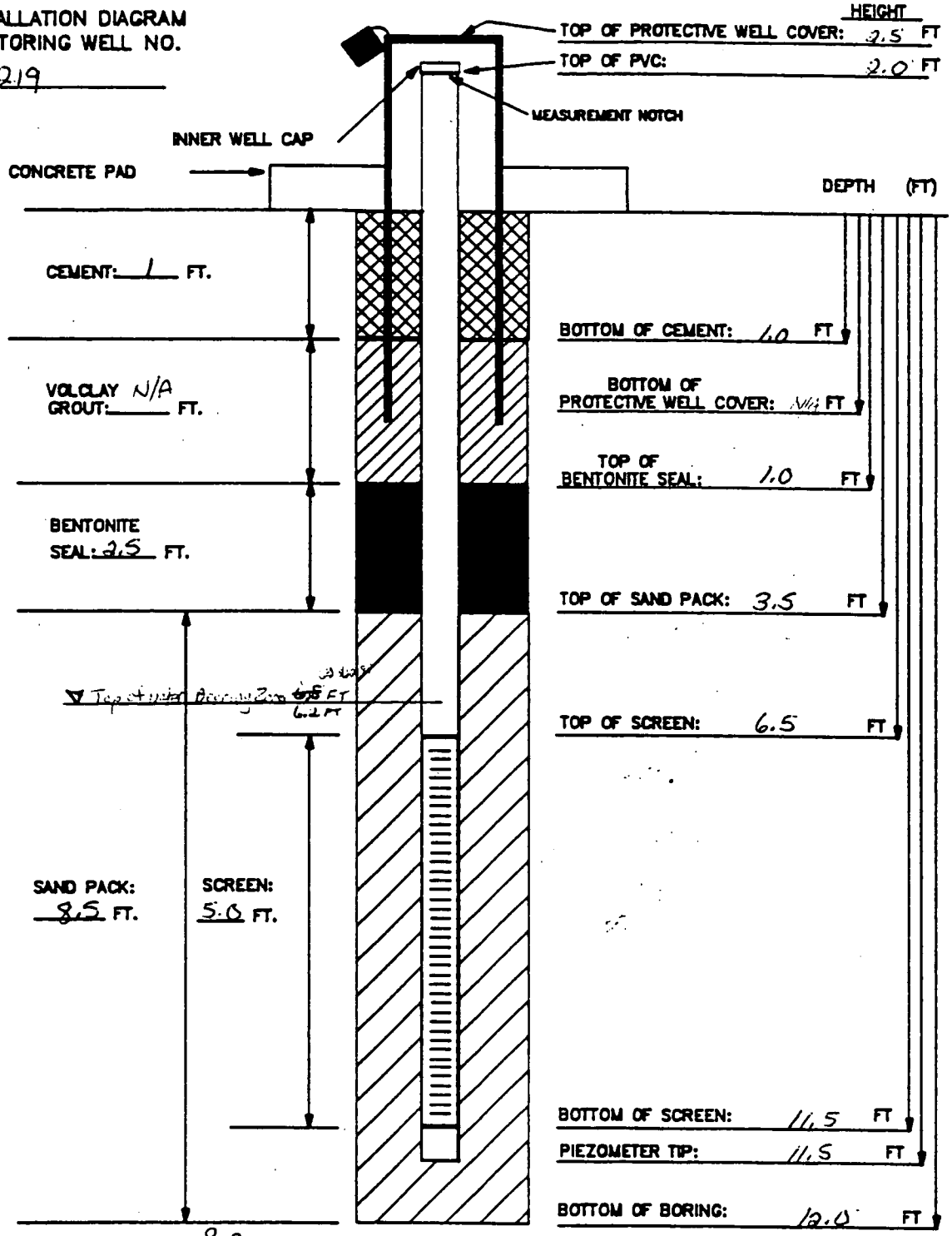
FERNALD RI/FS

INSTALLATION DIAGRAM
MONITORING WELL NO. 1219

INSTALLATION DATE: 05/14/89



BOREHOLE DIAMETER: 8.0 INCHES

MATERIALS USED:

SAND TYPE AND QUANITITY: 10/20 - 2 50lb sks
BENTONITE PELLETS (5-GALLON BUCKETS): 2 buckets
BAGS OF VOLCLAY GROUT: N/A
AMOUNT OF CEMENT: 1/2 sack (50lb)
AMOUNT OF WATER USED: ~20gal
OTHER: 5.0 ft Protective casing

NOTES:

1) RISER PIPE IS 2-INCH SCHEDULE 40 PVC PIPE, FLUSH-THREADED JOINTS.
2) SCREEN IS 2-INCH I.D. SCHEDULE 40 PVC PIPE WITH 0.020-INCH SLOTS.
3) LOWER END OF SCREEN IS CAPPED WITH AN END CAP OR THREADED SUMP.
4) WATER DEPTH/DATE:

TASK: 602 3.7

GEOLOGIST/ENGINEER: Cate Grube

FERNALD RI/FS

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Date	5/15			
Initial	[illegible]			
	Field Check	1st Rev'n	2nd Rev'n	Hydro Data Validation

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602-3.7.1	PROJECT NAME: Facilities Testing Program	
BORING NUMBER: 1227	COORDINATES:	DATE: 5-12-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5-12-89
ENGINEER/GEOLOGIST: L. Sinfield	Depth Date/Time	DATE COMPLETED: 5-14-89
DRILLING METHODS: B-53 Rig: Hollow Stem Augers with Split Spoon Sampler		PAGE 1 OF 4

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER 6 IN	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS (Note: 6 Total pages with field copies enclosed) Start = 1600
0.5	17563 wmco	@1500 N/a	N/a	Asphalt 0.0 → 0.25 ft	N/a		HNU = ∅ ppm
1.0	17564	N/a	N/a	Concrete 0.25 → 1.0 ft	N/a		α = 10-15 cpm
							Bγ = 200-250 cpm
1.5	17565	4	2in	Loose, gravel with Silt and Sand, massive, ~~wet~~ 5-14-89 moist @ 1600	GM	TSF	Bγ = 80-120 cpm @ 1.0 → 1.5 ft
2.0	17566 NR	4		Loose, Sand with gravel, micaceous, massive, moist	SM		HNU = ∅ ppm
2.5	17567 wmco	4	12in				α = ∅ cpm
							Bγ = 80-120 cpm
3.0	17568	5		Stiff to Very Stiff, Dark greyish brown (2.5Y, 4/2) clay, dry, massive @ 1605	CL	1.1 → 2.7 TSF	
3.5	17569 NR	4		Very Stiff, Dark Greyish Brown (2.5Y, 4/2) Lean Clay, dry massive, medium plastic	CL	2.3	HNU = ∅ ppm
4.0	17570	5	6in				α = ∅ cpm
							Bγ = 120-140 cpm
4.5	17571 NR	6		@ 1607		TSF	
5.0	17572	5		Loose, Silty Sand, ~~with~~ clay ~~dry~~, massive, moist. 5-14-89	SM	Soft 0.2	HNU = ∅ ppm
5.5	17573 wmco	7	12in		↓		α = ∅ cpm
							Bγ = 80-120 cpm
6.0	17574 NR	9		Grades to Soft, Brownish yellow (10YR, 6/6) clay, moist, massive medium plastic. @ 1612	CL	TSF	
6.5	17575	5		Soft, Brownish Yellow (10YR, 6/6) clay, moist, massive, medium plastic	CL	0.2 soft	HNU = ∅ ppm
7.0	17576	7	12in				α = ∅ cpm
							Bγ = 80-120 cpm
7.5	17577 NR	5		@ 1645		TSF	

NOTES: Contractor: Penn Drill
Driller: J. Saccani
Helper: G. Dye
Sample Tech: C. Melroy
Weather: Cloudy
HNU #: HH18

Water Bearing Zone: 8.0 → 11.0 ft.

Background @ 1600
HNU = ∅ ppm
Air α = ∅ cpm
Air Bγ = 80-120 cpm
gnd α = ∅ cpm
gnd Bγ = 300-500 cpm

NR* = No Recovery, No Sample Taken

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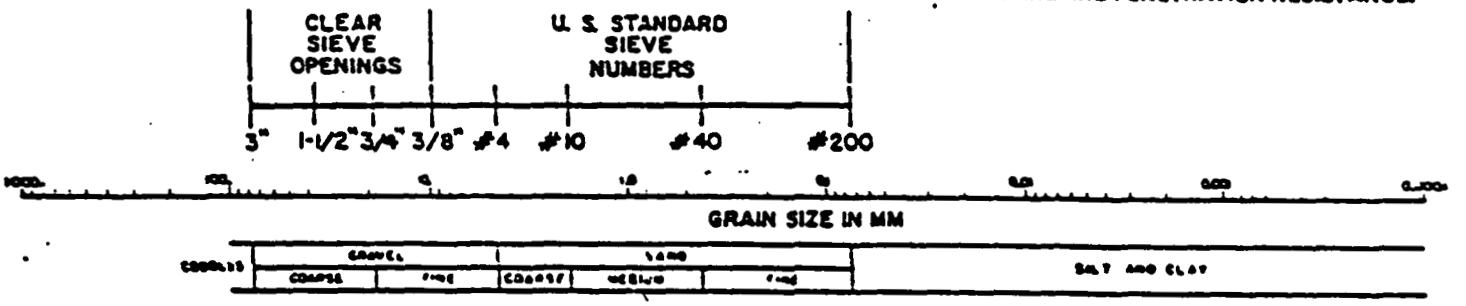
CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE (1)
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

(1) STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 18 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANCE.



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

FINE-GRAINED/HIGHLY ORGANIC SOILS

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENT

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VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602-3.7.1	PROJECT NAME: Facilities Testing Program	
BORING NUMBER: 1227	COORDINATES:	DATE: 5-12-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5-12-89
ENGINEER/GEOLOGIST: L. Sintzel	Depth Date/Time	DATE COMPLETED: 5-14-89
DRILLING METHODS: See Page 1 of 4		PAGE 2 OF 4

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
7.5							Start=
8.0	17578	5		Soft, Brownish Yellow (10YR/6/6), Clay, moist, massive, medium plastic. 3.0ft	CL		HNU= ø ppm α= ø cpm Bγ= 100-120 cpm
8.5	17579	7	12in	Loose, Silty Sand, Brownish Yellow (10YR, 6/8), Wet, massive,	SM		
9.0	17580 NR	8		@ 1649		TSF	
9.5	17581	6		Same as above 8.0-9.0ft			HNU= ø ppm α= ø cpm Bγ= 100-110 cpm
10.0	17582	7	18in	Laminated in places	SM		
10.5	17583 NRC0	9		@ 1655		TSF	
11.0	17584	5		Same as above 8.0-10.5ft	SM		HNU= ø ppm α= ø cpm Bγ= 80-100 cpm
11.5	50753	5	18in	Soft to very Stiff, Gray (10YR, 4/1) Lean clay - dry, massive medium plastic	CL	0.2 ↓ 3.2	
12.0	50754	6		@ 1700		TSF	
12.5				TD= 12.0ft on 9/12/89 @ 1700			HNU= ppm α= cpm Bγ= cpm
13.0							
13.5				@		TSF	
14.0							HNU= ppm α= cpm Bγ= cpm
14.5							
15.0				@		TSF	

NOTES: Contractor: Driller: Helper: Sample Tech: Weather: HNU #: } See page 1 of 4

Water Bearing Zone: 8.0 → 11.0 ft

See Page 1 of 4 → Background @ HNU= ppm α= cpm Bγ= cpm

NR = No Recovery, No Sample Taken

Zone

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Field Copy

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602-371	PROJECT NAME: Facilities Testing Program	
BORING NUMBER: 227	COORDINATES:	DATE: 5-12-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5-12-89
ENGINEER/GEOLOGIST: C. Sinfield	Depth Date/Time	DATE COMPLETED: 5-12-89
DRILLING METHODS: B-53, Hollow stem Auger with Split Spoon Sampler		PAGE 1 OF

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	1500 17563 WMCO	N/A	N/A	Asphalt → 0.25ft @ 1500 Concrete 0.25ft →	N/A N/A	N/A N/A	Start = HNU = Ø ppm α = 10-15 cpm Bγ = 200-250 cpm
0.5	17564	N/A	N/A				
1.0	17565	d	2in	Loose - probably gravel with silt, gravel and sand @ 1600	GM	TSF	← 80-120 cpm = Bγ
1.5	17566 NR	4		Sand with gravel, sm mica, loose, massive, moist. 2.5ft	SM	Loose	HNU = Ø ppm α = Ø cpm Bγ = 80-120 cpm
2.0	17567 WMCO	4	12in				
2.5	17568	5		Stiff to very stiff, Dark grayish brown (2.5Y, 4/2) dry, clay, massive @ 1605	CL	1.7-2.7 TSF	
3.0	17569 NR	4		Very Stiff, SAM as above 1.5-3.0ft (2.5Y, 4/2)	CL	2.3	HNU = Ø ppm α = Ø cpm Bγ = 120-140 cpm
3.5	17570	5	6in				
4.0	17571 NR	6		@ 1607		TSF	
4.5	17572	5		Silty Sand with Clay moist, SAME as above	SM ↓ CL	Soft	HNU = Ø ppm α = Ø cpm Bγ = 80-120 cpm
5.0	17573 WMCO	7	12in				
5.5	17574 NR	9		@ 1612		TSF	
6.0	17575	5		Soft Brownish Yellow (10YR, 6/6) clay, moist, massive medium plastic	CL	Soft	HNU = Ø ppm α = Ø cpm Bγ = 80-120 cpm
6.5	17576	7	12in				
7.0	17577 NR	5		@ 164[illegible]		TSF	
7.5							

NOTES: Contractor: Penn Drill
Driller: Jim Sacconi
Helper: G. Page
Sample Tech: C. Metzger
Weather: Cloudy
HNU #: HH19

Background @
HNU = ppm
Air α = cpm
Air Bγ = 80-120 cpm
gnd α = cpm
gnd Bγ = cpm

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FERNALD RI/FS

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Field Copy

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602–	PROJECT NAME: Facilities Testing Program	
BORING NUMBER:	COORDINATES:	DATE:
ELEVATION:	GWL: Depth Date/Time	DATE STARTED:
ENGINEER/GEOLOGIST:	Depth Date/Time	DATE COMPLETED:
DRILLING METHODS:		PAGE 2 OF

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
7.5	17578	5		Same as above soft 8.0	CC		Start= HNU= ∅ ppm α= ∅ cpm Bγ= 100-120 cpm
8.0	17579	7	12 IN	Silty Sand, loose, Brownish yellow (10YR, 6/8) WET @1649	Sm	Low	
8.5	17580 NR	8				TSF	
9.0	17581	6		Loose Brownish yellow (10YR, 6/6) Silty Sand WET massive, @1655	Sm		HNU= ∅ ppm α= ∅ cpm Bγ= 100-140 cpm
9.5	17582	7	18 in				
10.0	17583 WMCO	9				TSF	
10.5	17584	5		Loose Same as above wet 11.0	Sm		HNU= ∅ ppm α= ∅ cpm Bγ= 80-100 cpm
11.0	50753	5	18 in	~~Loose~~ Soft to very stiff Gray (10YR 4/1) clay med plastic, dry massive @1700	CC	0.2	
11.5	50754	6				3.2	
12.0						TSF	
12.5				TD < 12.0 ft @			HNU= ppm α= cpm Bγ= cpm
13.0							
13.5						TSF	
14.0				@			HNU= ppm α= cpm Bγ= cpm
14.5							
15.0						TSF	

NOTES: Contractor:
Driller:
Helper:
Sample Tech:
Weather:
HNU#:

Background @
HNU= ppm
α= cpm
Bγ= cpm

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FERNALD RI/FS

PIEZOMETER INSTALLATION SHEET

PROJECT NAME Facilities Testing
PROJECT NO. 602 3.2.1
BORING NO. 1227
PIEZOMETER NO. 1227

FIELD ENG./GEO. L. Sinfield DATE 5-14-89
CHECKED BY [illegible] DATE 6/5/89
DATE OF INSTALLATION 5-14-89

BOREHOLE DRILLING

DRILLING METHOD Hollow Stem Auger
DRILLING FLUID (S) USED: N/a
FLUID N/a FROM N/a TO N/a
FLUID N/a FROM N/a TO N/a

TYPE OF BIT Auger Bit
CASING SIZE (S) USED: N/a
SIZE N/a FROM N/a TO N/a
SIZE N/a FROM N/a TO N/a

PIEZOMETER DESCRIPTION

TYPE Schedule 40 PVC
DIAMETER OF PERFORATED SECTION 2 inch ID
PERFORATION TYPE:
SLOTS [X] HOLES [ ] SCREEN [ ]
AVERAGE SIZE OF PERFORATIONS 0.020 inch
TOTAL PERFORATED AREA 4.8 ft

RISER PIPE MATERIAL Schedule 40 PVC
RISER PIPE DIAMETERS:
O.D. ~~2 1/4 inch~~ 2 5/16 inch I.D. 2 inch
LENGTH OF PIPE SECTIONS 6.8 ft
JOINING METHOD Flush-Threaded

PROTECTION SYSTEM

RISER PROTECTIVE PIPE LENGTH 0.5 ft
PROTECTIVE PIPE O.D. 4 3/8 inch

OTHER PROTECTION Locking T-type Top Flush-Mount

ITEM	DISTANCE ABOVE/BELOW GROUND SURFACE (ft)		ELEVATION ( )	
TOP OF RISER PIPE	0.0			
GROUND SURFACE	0.0			
BOTTOM OF PROTECTIVE PIPE	0.5 ft			
BOREHOLE FILL MATERIALS:				
GROUT/SLURRY	TOP N/a	BOTTOM N/a	TOP	BOTTOM
BENTONITE	TOP 1.0 ft	BOTTOM 5.5 ft	TOP	BOTTOM
SAND	TOP 5.5 ft	BOTTOM 12.0 ft	TOP	BOTTOM
GRAVEL	TOP N/a	BOTTOM N/a	TOP	BOTTOM
PERFORATED SECTION	TOP 6.8 ft	BOTTOM 11.6 ft	TOP	BOTTOM
PIEZOMETER TIP	12.0 ft			
BOTTOM OF BOREHOLE	12.0 ft			
GWL AFTER INSTALLATION				

WAS THE PIEZOMETER FLUSHED AFTER INSTALLATION? YES [ ] NO [✓]
WAS A SENSITIVITY TEST PERFORMED ON THE PIEZOMETER? YES [ ] NO [✓]

REMARKS Flush-mount
Water Bearing Zone: 8.0 to 11.0 ft → Silty Sand

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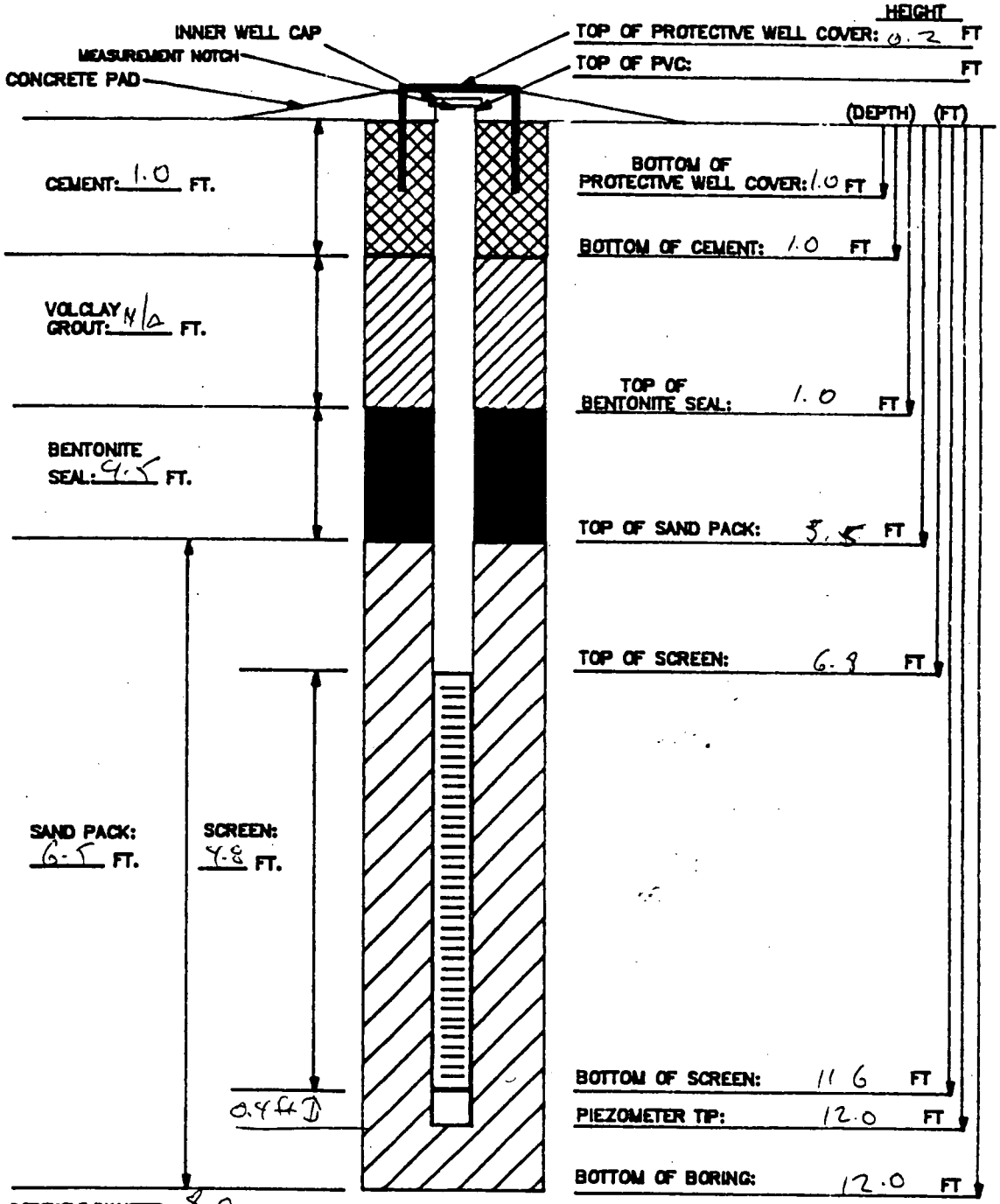
FERNALD RI/FS

INSTALLATION DIAGRAM
MONITORING WELL NO. 1227

INSTALLATION DATE: 5-14-89



BOREHOLE DIAMETER: 8.0 INCHES

MATERIALS USED:
SAND TYPE AND QUANITITY: 3 Bags 10/20-sand
BENTONITE PELLETS (5-GALLON BUCKETS): 2
BAGS OF VOLCLAY GROUT: N/a
AMOUNT OF CEMENT: 1 Bag (50 lb)
AMOUNT OF WATER USED: 10 gallons
OTHER:

NOTES:
1) RISER PIPE IS 2-INCH SCHEDULE 40 PVC PIPE, FLUSH-THREADED JOINTS.
2) SCREEN IS 2-INCH I.D. SCHEDULE 40 PVC PIPE WITH 0.020-INCH SLOTS.
3) LOWER END OF SCREEN IS CAPPED WITH AN END CAP OR THREADED SUMP.
4) WATER DEPTH/DATE:
5) TOP OF PVC IS SECURED WITH EXPANDABLE RUBBER PLUG AND PADLOCK.
6) PARENTHESIS INDICATE DEPTH BELOW GROUND LEVEL.

TASK: 60 2 3.7.1 GEOLOGIST/ENGINEER: C. Sinfield

FERNALD RI/FS

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VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1230	COORDINATES:	DATE: 5/11/89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5/11/89
ENGINEER/GEOLOGIST: C Grubb/L. Adams	Depth Date/Time	DATE COMPLETED: 5/12/89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 1 OF 5

DEPTH (FT.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN.)	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	17629 1406 5-11-89	12	6	Surface gravel 100% dark yellowish brown (10yr 3/6) silty sand, some clay, trace fine gravel, dry	SM	N/A	HNU = 0ppm α = 0cpm Bγ = 90-100 cpm
	17630 1406 5-11	13	6	Very stiff, yellowish brown (10yr 5/6) silty clay moist, low plasticity	CL	3.0	
1	17631 1406 5-11	8	0	no recovery	N/A	N/A	
	17632 1424 5-11-89	10	6	Stiff, yellowish brown, (10yr 5/4) sandy clay, low plasticity, slightly moist.	CL	1.5	HNU = 0ppm α = 0cpm Bγ = 60-80 cpm
2	17633 1424 5-11-89	12	0	no recovery	N/A	N/A	
	17634 1424 5-11-89	15	0	no recovery	N/A	N/A	
3	17635 1429 5-11-89	15	1	Dark yellowish brown (10yr 4/4) silty clay, moist, med. plasticity	CL	*	HNU = 0 ppm α = 0 cpm Bγ = 60-70 cpm *unable to measure due to small amount of recover.
	17636 1429 5-11-89	25	0	no recovery	N/A	N/A	
4	17637 1429 5-11-89	25	0	no recovery	N/A	N/A	
	17638 1435 5-11-89	24	6	Very stiff, dark gray, (5Y 4/1) to yellowish brown (10yr 5/6) silty clay. Med. plasticity. 1 in. surface gravel-like section moist	CL	2.25	HNU = 0 ppm α = ~~60~~ NA 5-11-89 0 cpm Bγ = 60-80 cpm
5	17639 1435 5-11-89	26	6	Very stiff, yellowish brown (10yr 5/6) silty clay, low plasticity moist	CL	2.5	
	17640 1435 5-11-89	23	2	Stiff, Same as above	CL	1.0	
6	17641 1522 5-11-89	2	6	Very stiff, yellowish brown (10yr 5/6) med. plasticity clay. Moist	CL	2.75	HNU = 0ppm α = ~~40~~ NA 5-11-89 0 cpm Bγ = 40-60 cpm
	17642 1522 5-11-89	6	5	Very stiff Same as above	CL	2.5	
7	17643 1522 5-11-89	6	0	no recovery	N/A	N/A	

NOTES: CONTRACTOR: PENN DRILL
RIG: Model 80
DRILLER: Craig Coulter
ASSISTANT: Chris Coulter

SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST
COLORS IDENTIFIED USING MUNSELL COLOR CHART
BACKGROUND LEVELS: HNU = 0 PPM
α = 0 CPM
Bγ = 80-90 CPM
LEL/O_2: LEL = 0 ~~PPM~~ %
O_2 = 20.6%

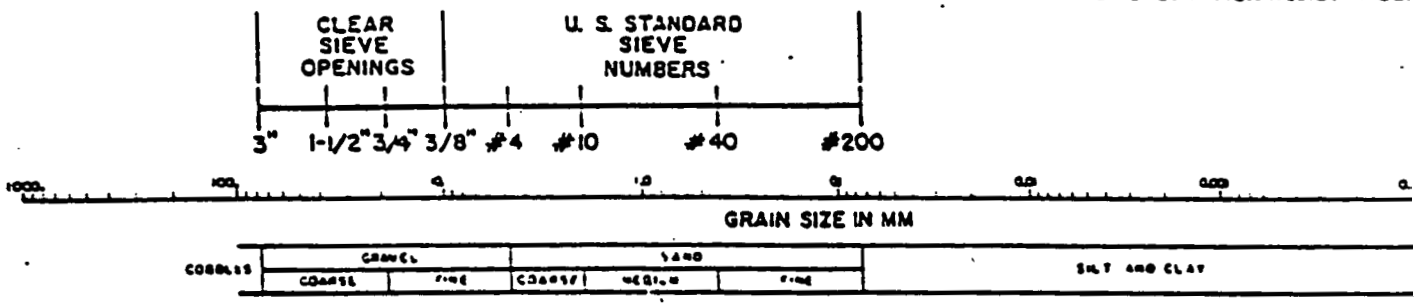
CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE (1)
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

(1) STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 18 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANCE.



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

FINE-GRAINED/HIGHLY ORGANIC SOILS

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENT

FERNALD RI/FS

6496

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1230	COORDINATES:	DATE: 5/11/89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5/11/89
ENGINEER/GEOLOGIST: C.Grube/L.Adams	Depth Date/Time	DATE COMPLETED: 5/12/89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 2 OF 5

DEPTH (FT.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN.)	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
8	17644 1526 5-11-89	9	6	Mod. Stiff, yellowish brown (10yr 5/6) Silty Clay. Low plasticity, moist.	CL	.75	HNU = 0 ppm α = 0 cpm Bγ = 60-80 cpm
	17645 1526 5-11-89	8	6	Very Stiff Same as above	CL	3.5	
9.0 FT 9	17646 1526 5-11-89	11	3	Very Stiff, yellowish brown (10yr 5/6) Silty Clay (very silty) low plasticity very moist.	CL	2.25	
Top of water bearing zone	17647 ~~1531~~ 1552 5-11-89	15	6	Yellowish brown (10yr 5/6) silt wet.	ML	N/A	HNU = 0 ppm α = 0 cpm Bγ = 60-80 cpm
10	17648 ~~1531~~ 1552 5-11-89	11	4	* SAA	ML	N/A	
	17649 ~~1531~~ 1552 5-11-89	14	0	No recovery	N/A	N/A	
11	17650 1555 5-11-89	3	6	Yellowish brown (10yr 5/6) silt. Very wet.	ML	N/A	HNU = 0 ppm α = 0 cpm Bγ = 80-100 cpm
	50724 1555 5-11-89	4	6	SAA	ML	N/A	
12	50725 1555 5-11-89	7	5	Brown (10yr 5/3) Silt. Trace sand. wet.	ML	N/A	
	50726 1604 5-11-89	11	6	Grayish Brown (2.5Y 5/2) Silt wet.	ML	N/A	HNU = 0 ppm α = 0 cpm Bγ = 60-80 cpm
13	50727 1604 5-11-89	8	6	Same as above	ML	N/A	
	50728 1604 5-11-89	12	2	Grayish brown (2.5Y 5/2) Sandy silt. wet.	ML	N/A	
14	50729 1614 5-11-89	10	6	Grayish brown (2.5Y 5/2) silty sand. Poorly graded. Very moist	ML	N/A	HNU = 0 ppm α = 0 cpm Bγ = 60-70 cpm
	50730 1614 5-11-89	17	6	SAA	ML	N/A	
	50731 1614 5-11-89	24	6	SAA very moist to wet	ML	N/A	

NOTES:

* SAA = Same as above

FERNALD RI/FS

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VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1230	COORDINATES:	DATE: 5/11/89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5/11/89
ENGINEER/GEOLOGIST: C. Grube/L. Adams	Depth Date/Time	DATE COMPLETED: 5/12/89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 3 OF 5

DEPTH (Ft.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 in.)	RECOVERY (in.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	50732 1630 5-11	3	~~12~~ 6	med. dense, grayish brown (2.5y 5/2) silt Trace coarse sand. moist	ML	N/A	HNU = 0 α = 0 Bγ = 60-80
16	50733 1630 5-11	5	~~12~~ 6	* SAA	ML	N/A	
	50734 1630 5-11	8	4	med. dense, grayish brown clayey silt (2.5y-5/2) Trace coarse sand. wet.	ML	N/A	
17	50735 1640 5-11	8	6	med. dense, Grayish brown (2.5y 5/2) very silty sand, well graded, some gravel wet.	ML	N/A	HNU = 0 α = 0 Bγ = 60-80
	50736 1640 5-11	12	6	med. dense, Grayish brown (2.5y 5/2) sandy silt. very moist.	ML	N/A	
18	50737 1640 5-11	15	6	SAA wet	ML	N/A	
	50738 1652 5-11	8	6	SAA w/ trace fine gravel	ML	N/A	HNU = 0 α = 0 Bγ = 60-80
19	50739 1652 5-11	8	6	SAA	ML	N/A	
bottom of water bearing zone 19.5 FT	50740 1652 5-11	12	6	SAA	ML	N/A	
20	50741 1652 5-11	13	6	Stiff, grayish brown (2.5y 5/2) silty clay trace sand + gravel (to .25-1.5 in.) very moist	CL	3.25	HNU = 0 α = 0 Bγ = 60-80
				Bottom of boring + sampling at 20.0 Ft.			

NOTES:

* SAA = Same as above.

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FERNALD RI/FS

PIEZOMETER INSTALLATION SHEET

PROJECT NAME FMPC RI/FS
FIELD ENG./GEO. C. Grube/L. Adams DATE 5/12/89
PROJECT NO. 602.3.7
CHECKED BY RL DATE 6/5/89
BORING NO. 1230
PIEZOMETER NO. 1230
DATE OF INSTALLATION 5/12/89

BOREHOLE DRILLING

DRILLING METHOD 8 in. Hollow Auger
DRILLING FLUID (S) USED:
FLUID N/A FROM — TO —
FLUID N/A FROM — TO —

TYPE OF BIT 8 in. Hollow Auger
CASING SIZE (S) USED:
SIZE N/A FROM — TO —
SIZE N/A FROM — TO —

PIEZOMETER DESCRIPTION

TYPE Monitoring piezometer
DIAMETER OF PERFORATED SECTION 2.0 in ID
PERFORATION TYPE:
SLOTS ☒ HOLES ☐ SCREEN ☐
AVERAGE SIZE OF PERFORATIONS 0.020
TOTAL PERFORATED AREA 10.0 FT

RISER PIPE MATERIAL Schedule 40 PVC
RISER PIPE DIAMETERS:
O.D. 2 5/16 in I.D. 2.0 in
LENGTH OF PIPE SECTIONS 10.0 FT
JOINING METHOD Screw type, flush joint threaded

PROTECTION SYSTEM

RISER PROTECTIVE PIPE LENGTH 5.0 FT
PROTECTIVE PIPE O.D. 4 3/8 in.

OTHER PROTECTION Hinged cover with installed padlock

ITEM	DISTANCE ABOVE/BELOW GROUND SURFACE (FT)		ELEVATION ( )	
TOP OF RISER PIPE	2.0			
GROUND SURFACE	0.0			
BOTTOM OF PROTECTIVE PIPE	2.5			
BOREHOLE FILL MATERIALS:				
~~GROUT/SLURRY~~ Cement	TOP 0.0	BOTTOM 1.0	TOP	BOTTOM
BENTONITE	TOP 1.0	BOTTOM 5.0	TOP	BOTTOM
SAND	TOP 5.0	BOTTOM 20.0	TOP	BOTTOM
~~GRAVEL~~	TOP —	BOTTOM —	TOP	BOTTOM
PERFORATED SECTION	TOP 8.0	BOTTOM 18.0	TOP	BOTTOM
PIEZOMETER TIP	18.0			
BOTTOM OF BOREHOLE	20.0			
GWL AFTER INSTALLATION				

WAS THE PIEZOMETER FLUSHED AFTER INSTALLATION? YES ☐ NO ☒
WAS A SENSITIVITY TEST PERFORMED ON THE PIEZOMETER? YES ☐ NO ☒

REMARKS Top of water bearing zone at 9.0 FT
Bottom " " " " 12.5 FT

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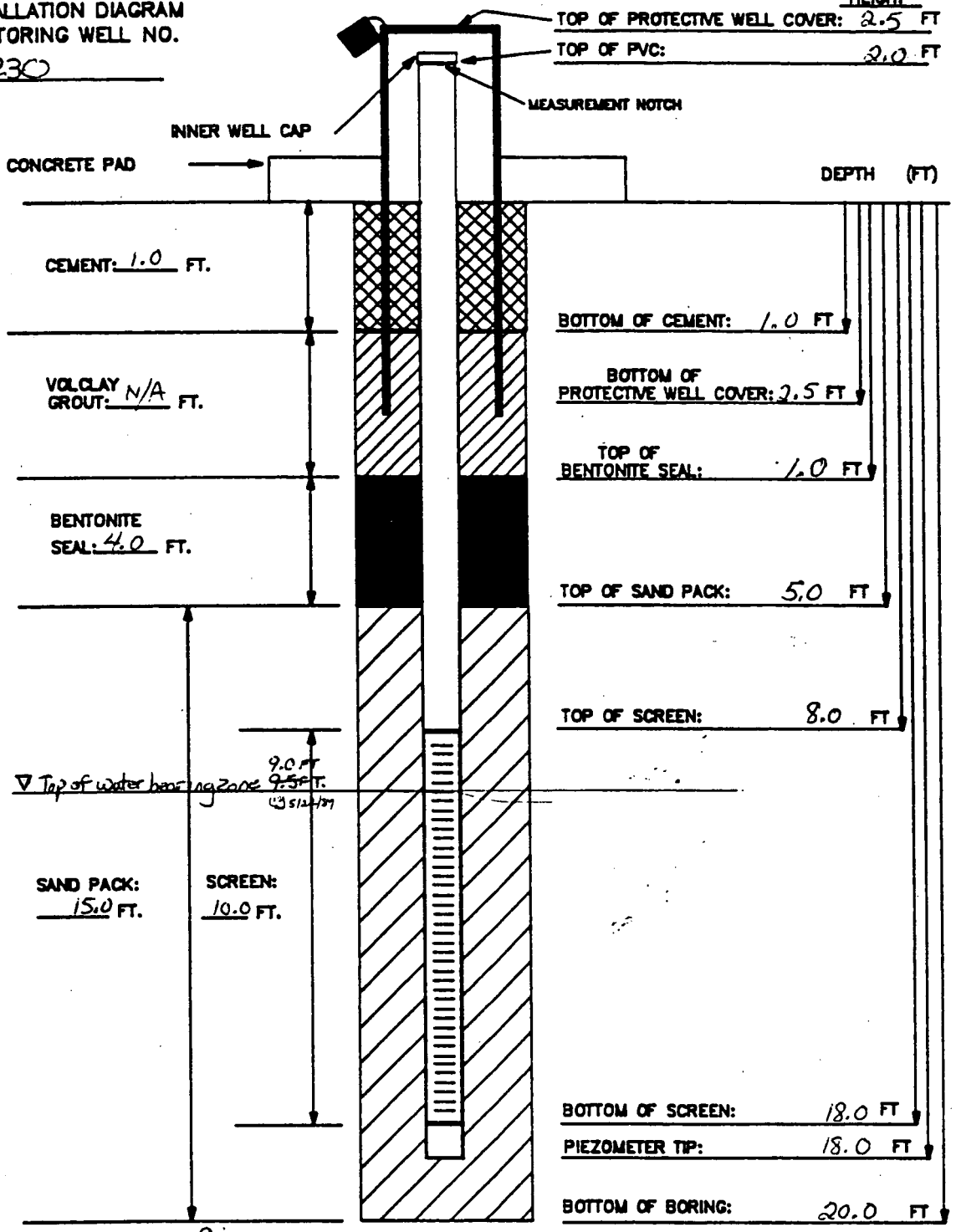
6496

INSTALLATION DATE: 5-12-89

FERNALD RI/FS

INSTALLATION DIAGRAM
MONITORING WELL NO.
12230



BOREHOLE DIAMETER: 8 in INCHES

MATERIALS USED:
SAND TYPE AND QUANITITY: 10/20 sand - 6 sks (80#)
BENTONITE PELLETS (5-GALLON BUCKETS): 2 buckets
BAGS OF VOLCLAY GROUT: N/A
AMOUNT OF CEMENT: ½ sack (50# bag)
AMOUNT OF WATER USED: 70 gal.
OTHER: 5.0 FT protective casing

NOTES:
1) RISER PIPE IS 2-INCH SCHEDULE 40 PVC PIPE, FLUSH-THREADED JOINTS.
2) SCREEN IS 2-INCH I.D. SCHEDULE 40 PVC PIPE WITH 0.020-INCH SLOTS.
3) LOWER END OF SCREEN IS CAPPED WITH AN END CAP OR THREADED SUMP.
4) WATER DEPTH/DATE:

TASK: 602 3.7

GEOLOGIST/ENGINEER: C. Grube / L. Adams

FERNALD RI/FS

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VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FMPC RI/FS		
BORING NUMBER: 1170	COORDINATES:	DATE: 5-10-89	
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5-10-89	
ENGINEER/GEOLOGIST: E. TROLLINGER	Depth Date/Time	DATE COMPLETED: 5-11-89	
DRILLING METHODS: MOBILE DRILL HSA (8 in.)		PAGE 1 OF 5	

DEPTH (FT.)	SAMPLE TYPE & NO	BLOWS ON SAMPLER PER (6 in)	RECOVERY (in)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
1	16419 1020 5-10	16	6	DENSE, DARK BROWN (10YR 4/4), GRAVELLY SILT, SOME GRAVEL FROM NATURAL FILL MATERIAL (.5 IN - 1.0 IN) MOIST	ML	N/A	H_{NU} = 0.4 ppm α = 0 CPM $\beta\gamma$ = 60-80 CPM
	16420 1020 5-10	21	6				
	16421 1020 5-10	20	—	NO RECOVERY			
2	16422 1026 5-10	9	6	MEDIUM DENSE, YELLOWISH BROWN, (10YR 5/4) CLAYEY SILT, TRACE OF COARSE SAND, LOW PLASTICITY, MOIST.	ML	N/A	H_{NU} = 0.4 ppm α = 0 CPM $\beta\gamma$ = 60 CPM
	16423 1026 5-10	9	6				
3	16424 1026 5-10	11	3				
3	16425 1035 5-10	10	6	STIFF, YELLOWISH BROWN, (10YR 5/4), SILTY CLAY, TRACE OF COARSE SAND, LOW PLASTICITY, MOIST.	CL	1.5	H_{NU} = 0.4 ppm α = 0 CPM $\beta\gamma$ = 60 CPM
	16426 1035 5-10	12	6				
4	16427 1035 5-10	15	6	STIFF, DARK YELLOWISH BROWN, (10YR 4/4) CLAY, LOW PLASTICITY, VERY MOIST.	CL	1.5	
5	16428 1037 5-10	13	6	VERY STIFF, YELLOWISH BROWN, (10YR 5/4) SILTY CLAY, TRACE OF GRAVEL (.5-1.0 IN) AND TRACE OF COARSE SAND, LOW PLASTICITY, MOIST.	CL	2.0	H_{NU} = 0.4 ppm α = 0 CPM $\beta\gamma$ = 60 CPM
	16429 1037 5-10	16	6				
6	16430 1037 5-10	18	6				
7	16431 1117 5-10	8	6	VERY STIFF, DARK YELLOWISH BROWN, (10YR 4/4) SANDY CLAY, TRACE OF FINE GRAVEL (.5-1.0 IN), LOW PLASTICITY, MOIST.	CL	3.5	H_{NU} = 0.2 ppm α = 0 CPM $\beta\gamma$ = 60-80 CPM
	16432 1117 5-10	10	6				
	16433 1117 5-10	11	6				

NOTES: DRILLING CO.:
DRILLER: Dave Newman
HELPER: Bill Anderson

MATERIALS USED:
CEMENT: 1/2 BAG 90 lb.
VOLCLAY GROUT: 2 (50 lb) bags
WATER: 45 GALS

SAMPLING IN ACCORDANCE WITH ASTM STANDARDS, DESCRIPTION OF SOIL COLOR BY MUNSELL COLOR CHART. SAMPLES TAKEN FOR WMCO AT INTERVALS 0.0-.5 FT., 2-2.5 FT., 5-5.5 FT, 10-10.5 FT., 15-15.5 FT.

INSTRUMENT BACKGROUND
H_{NU} = 0.4 ppm
α = 0 CPM
$\beta\gamma$ = 60-80 CPM
LEL = 0
O_2 = 21.6%

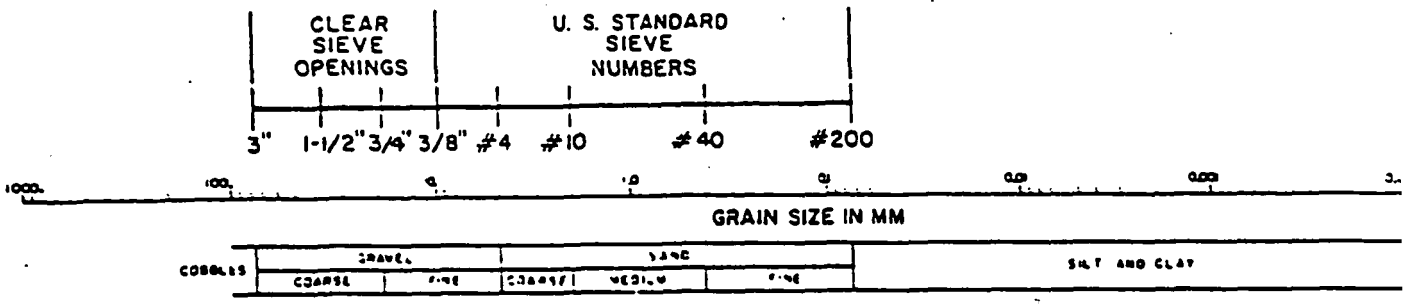
CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE(1)
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

(1) STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 18 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANCE.



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

FINE-GRAINED/HIGHLY ORGANIC SOIL

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONT

FERNALD RI/FS

6496

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FMPC RI/FS		
BORING NUMBER: 1170	COORDINATES:		DATE: 5-10-89
ELEVATION:	GWL: Depth	Date/Time	DATE STARTED: 5-10-89
ENGINEER/GEOLOGIST: E. TROLLINGER	Depth	Date/Time	DATE COMPLETED: 5-11-89
DRILLING METHODS: MOBILE DRILL HSA			PAGE 2 OF 5

DEPTH (FT.)	SAMPLE TYPE & NO	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
8	16434 1130 5-10	9	6	STIFF, GRAYISH BROWN, (10YR 4/2) SILTY CLAY, SOME SAND & FINE GRAVEL (.5 IN), MOIST. LOW PLASTICITY.	CL	2.0	Hnu = 0.4 ppm
	16435 1130 5-10	15	4	STIFF, GRAY (10YR 4/1) CLAY, LOW-MEDIUM PLASTICITY, MOIST.	CL	1.5	α = 0 CPM
9	16436 1130 5-10	15	—	NO RECOVERY			βγ = 60-80 CPM
10	16437 1135 5-10	15	6	STIFF, DARK GRAYISH BROWN, (2.5Y 4/2) SILTY CLAY, LOW TO MEDIUM PLASTICITY, MOIST.	CL	1.25	Hnu = 0.4 ppm
	16438 1135 5-10	18	6				α = 0 CPM
	16439 1135 5-10	19	5				βγ = 60 CPM
11	16446 1140 5-10	3	6	STIFF, BROWN, (10YR 4/4) SILTY CLAY LOW PLASTICITY, TRACE OF FINE GRAVEL (.25-.5 IN), MOIST.	CL	1.0	Hnu = 0.4 ppm
	501666 1140 5-10	5	6	STIFF,	CL	1.5	α = 0 CPM
12	501667 1140 5-10	7	—	NO RECOVERY			βγ = 60 CPM
13	501668 1316 5-10	5	6	STIFF, DARK GRAY (2.5Y 4/0) CLAY, TRACE OF COARSE SAND, LOW PLASTICITY, MOIST.	CL	2.0	Hnu = 0.4 ppm
	501669 1316 5-10	6	5				α = 0 CPM
	501670 1316 5-10	13	—	NO RECOVERY			βγ = 40-60 CPM
14	501671 1330 5-10	8	6	STIFF, DARK OLIVE GRAY, (5Y 3/2) CLAY, TRACE OF FINE GRAVEL, LOW PLASTICITY, MOIST.	CL	1.5	Hnu = 0.4 ppm
	501672 1330 5-10	9	6				α = 0 CPM
	501673 1330 5-10	13	—	NO RECOVERY			βγ = 60 CPM

NOTES:

DRILLER: DAVE NEWMAN
HELPER: BILL ANDERSON

INSTRUMENT BACKGROUND
Hnu = 0.4 ppm
α = 0 CPM
βγ = 60-80 CPM

FERNALD RI/FS

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FMPC RI/FS		
BORING NUMBER: 1170	COORDINATES:	DATE: 5-10-89	
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5-10-89	
ENGINEER/GEOLOGIST: E. TROLLINGER	Depth Date/Time	DATE COMPLETED: 5-11-89	
DRILLING METHODS: MOBILE DRILL HSA		PAGE 3 OF 5	

DEPTH (FT.)	SAMPLE TYPE & NO	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
15	50674 1335 5-10	9	6	VERY STIFF, DARK GRAY (5Y 4/1) SILTY CLAY, TRACE OF ~~MEDIUM~~ FINE GRAVEL (.5 IN) LOW PLASTICITY, MOIST.	CL	2.5	H_{mu} = 0.4 ppm
	50675 1335 5-10	30		NO RECOVERY			α = 0 cpm
16	50676 1335 5-10	27					$\beta\gamma$ = 60 cpm
17	50677 1400 5-10	14	6	VERY STIFF, DARK GRAY (5Y 4/1) GRAVELLY CLAY, LOW PLASTICITY, MOIST.	CL	3.25	H_{mu} = 0.4 ppm
	50678 1400 5-10	19	6	VERY STIFF, DARK OLIVE GRAY (5Y 3/2) SANDY CLAY, TRACE OF COARSE SAND AND GRAVEL (.5-1.0 IN), MOIST.	CL	4.0	α = 0 cpm
18	50679 1400 5-10	21	6				$\beta\gamma$ = 60-80 cpm
	50680 1436 5-10	25	6	VERY STIFF, DARK GRAY (5Y 4/1) GRAVELLY CLAY, TRACE OF COARSE SAND, LOW PLASTICITY, MOIST.	CL	2.75	H_{mu} = 0.4 ppm
	50681 1436 5-10	26	6				α = 0 cpm
19	50682 1436 5-10	37	6	HARD, DARK GRAY (5Y 4/2), SANDY CLAY, LOW PLASTICITY, MOIST	CL	>4.0	$\beta\gamma$ = 60 cpm
20	50683 1436 5-10	40/6 IN	4	HARD, DARK GRAY (5Y/4/2) GRAVELLY CLAY, TRACE OF COARSE SAND, LOW PLASTICITY, MOIST.	CL	>4.0	H_{mu} = 0.4 ppm, α = 0 cpm, $\beta\gamma$ = 60 cpm
				BOTTOM OF BORING. NOT TO EXCEED 20.0 FT FROM GROUND SURFACE * AUGER STOPPED AT 20.0 FT. SAMPLING STOPPED AT 20.0 FT.			

NOTES:

DRILLER: DAVE NEWMAN
HELPER: BILL ANDERSON

INSTRUMENT BACKGROUND

H_{mu} = 0.4 ppm
α = 0 cpm
$\beta\gamma$ = 60-80 cpm

FERNALD RI/FS

BORING #1170 (DRY)

6496 4/5

PIEZOMETER INSTALLATION SHEET

PROJECT NAME FMPC RI/FS FIELD ENG./GEO. E. TRECUNGER DATE 5-11-89
PROJECT NO. 602 3.7 CHECKED BY [illegible] DATE [illegible]89
BORING NO. 1170
PIEZOMETER NO. N/A DATE OF INSTALLATION BORING FILLED 5-11-89

BOREHOLE DRILLING

DRILLING METHOD CME 45 (8 IN HSA) TYPE OF BIT AUGER
DRILLING FLUID (S) USED: N/A CASING SIZE (S) USED: N/A
FLUID — FROM — TO — SIZE — FROM — TO —
FLUID — FROM — TO — SIZE — FROM — TO —

PIEZOMETER DESCRIPTION

TYPE N/A RISER PIPE MATERIAL N/A
DIAMETER OF PERFORATED SECTION N/A RISER PIPE DIAMETERS:
PERFORATION TYPE: O.D. — I.D. —
SLOTS ☐ HOLES ☐ SCREEN ☐ LENGTH OF PIPE SECTIONS N/A
AVERAGE SIZE OF PERFORATIONS N/A JOINING METHOD N/A
TOTAL PERFORATED AREA N/A

PROTECTION SYSTEM

RISER PROTECTIVE PIPE LENGTH N/A OTHER PROTECTION N/A
PROTECTIVE PIPE O.D. N/A

ITEM	DISTANCE ABOVE/BELOW GROUND SURFACE (FT.)		ELEVATION ( )	
TOP OF RISER PIPE	N/A			
GROUND SURFACE	0.0			
BOTTOM OF PROTECTIVE PIPE	N/A			
BOREHOLE FILL MATERIALS:	CEMENT 0.0	1.0		
VOLCLAY GROUT / ~~SLURRY~~	TOP 1.0	BOTTOM 20.0	TOP	BOTTOM
~~BENTONITE~~ NONE USED	TOP N/A	BOTTOM N/A	TOP	BOTTOM
~~SAND~~ NONE USED	TOP N/A	BOTTOM N/A	TOP	BOTTOM
~~GRAVEL~~ NONE USED	TOP N/A	BOTTOM N/A	TOP	BOTTOM
PERFORATED SECTION	TOP N/A	BOTTOM N/A	TOP	BOTTOM
PIEZOMETER TIP	N/A			
BOTTOM OF BOREHOLE	20.0 FT.			
GWL AFTER INSTALLATION	N/A			

WAS THE PIEZOMETER FLUSHED AFTER INSTALLATION? YES ☐ NO ☐
WAS A SENSITIVITY TEST PERFORMED ON THE PIEZOMETER? YES ☐ NO ☐

REMARKS

000121

409-11-86

DRAWING NUMBER Boring 1170

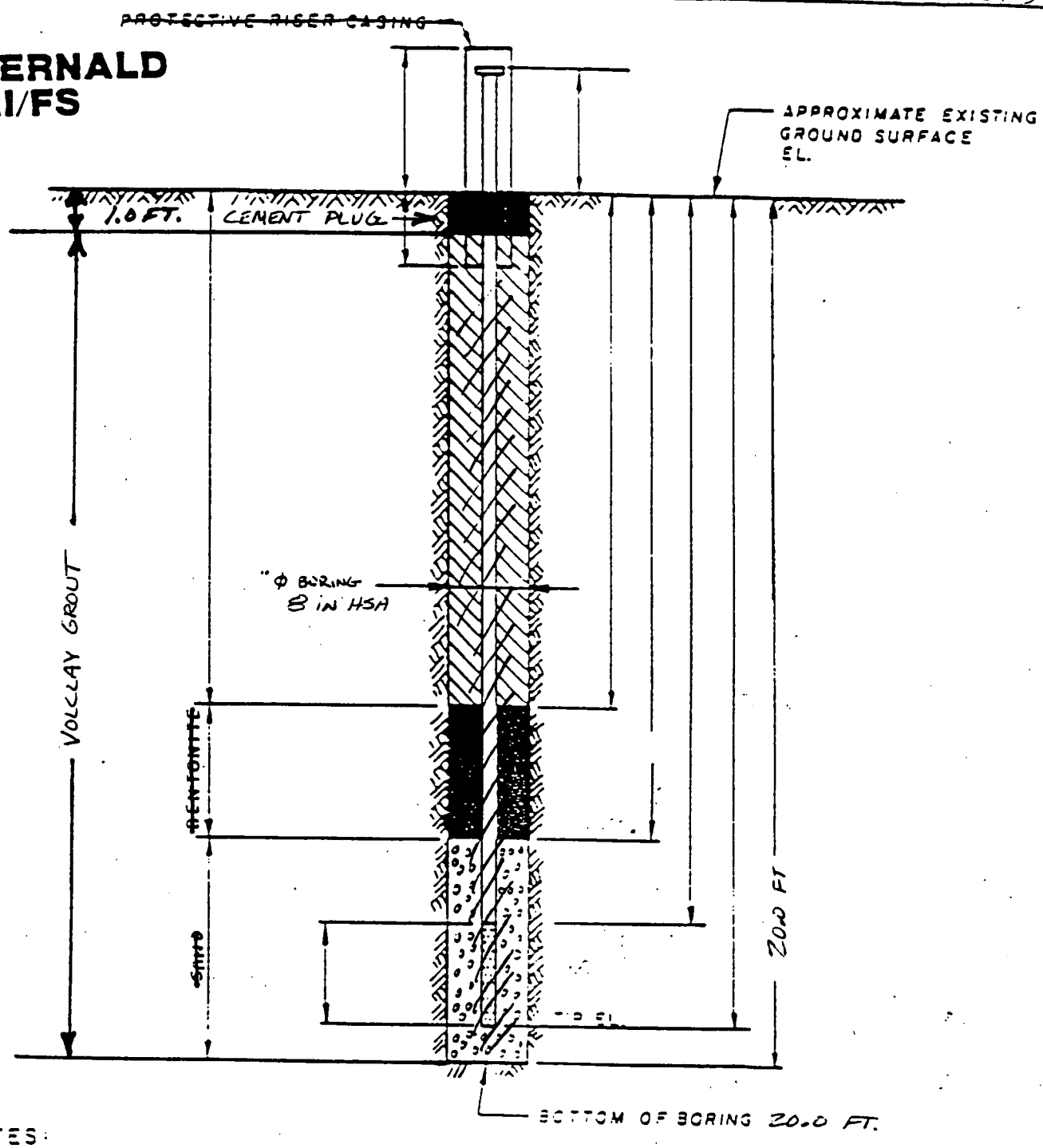
CHECKED BY

APPROVED BY

E.T.

DRAWN BY

FERNALD RI/FS



NOTES:

1. RISER PIPE IS / IN I.D. SCHEDULE PIPE, THREADED, FLUSH-JOINTED.
2. SCREEN IS / IN I.D PIPE CONTINUOUS SLOT SCREEN (0.0 0 IN SLOT SIZE).
3. LOWER END OF SCREEN IS CAPPED.
4. ELEVATION OF WATER LEVEL
5. WATER LEVEL READING ON

N/A

INSTALLATION DETAILS
MONITORING WELL
BORING #1170
PREPARED FOR FMPC RI/FS

* NOTE: BORING 1170 WAS DEEMED "DRY HOLE"
VOLCLAY GROUT TO 1.0 FT. FROM SURFACE,
CEMENT PLUG TO SURFACE.

MATERIALS USED: - 1/2 SACK CEMENT (90 lbs/sk)
2 bags VOLCLAY GROUT (50 lb.) 45 gals water

FERNALD RI/FS

6496

Date	5/11/89			
Initials	[illegible]			
	Field Check	1st Rev'n	2nd Rev'n	Hard Copy Verification

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602-3.7.1	PROJECT NAME: Facilities Testing Program	
BORING NUMBER: 1241	COORDINATES:	DATE: 5-11-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5-11-89
ENGINEER/GEOLOGIST: L. SINFIELD	Depth Date/Time	DATE COMPLETED: 5-11-89
DRILLING METHODS: B-53 Hollow Stem Auger w/ Split Spoon Sampler		PAGE 1 OF 4

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS (Note: Total of 6 pages with Field copies enclosed.) Start = 0915
0.5	17871 wmco	7	10 IN	Loose gravel, massive, moist 0.75	GM		HNU = Ø ppm; α = Ø cpm; Bγ = 400-450 cpm
1.0	17872	8		Hard, mottled, brownish yellow (10yr, 6/6) to gray (10yr, 6/1) clay dry, massive @ 0920	CL	>4.5 TSF	
1.5	17873 NR	9					
2.0	17874	6	6 IN	very stiff, brownish yellow (10yr 6/6) to gray (10yr, 6/1) dry, massive, lean clay with occasional gravel medium plastic @ 0922	CL	2.7 to 3.5 TSF	HNU = Ø ppm; α = Ø cpm; Bγ = ~~100-120~~ cpm 5-11-89 80-100
2.5	17875 NR wmco	7					
3.0	17876 NR	7					
3.5	17877	9	10 IN	Very Stiff, same as above (1.5 to 3.0 ft) @ 0927	CL	2.6 TSF	HNU = Ø ppm; α = Ø cpm; Bγ = 100-120 cpm
4.0	17878	11					
4.5	17879 NR	11					
5.0	17880	9	11 IN	Very Stiff, mottled brownish yellow (10yr, 6/8) to pale brown (10yr, 6/3) Lean clay, CL = dry, massive, medium plastic @ 0935	CL	1.5 to 2.6 TSF	HNU = Ø ppm; α = Ø cpm; Bγ = 80-120 cpm
5.5	17881 wmco	10					
6.0	17882 NR	10					
6.5	17883	3	18 IN	Very Stiff, mottled brownish yellow (10yr, 6/8) LEAN clay - dry massive, medium plastic with 1/4 to 1 inch silt and sand seams - (moist) @ 0945	CL / ML / SM	3.4 TSF	HNU = Ø ppm; α = Ø cpm; Bγ = 100-120 cpm
7.0	17884	6					
7.5	17885	8					

NOTES: Contractor: PENN DRILL
Driller: WILLIAM SAGGAN
Helper: GARY DYE
Sample Tech: CINDY MELROY
Weather: CLEAR/WARM
HNU #: HH18

Water Bearing Zone: 9.0 - 14.5 ft.

Background @ 0930
HNU = Ø ppm
AIR α = 0 cpm
AIR Bγ = 80-100 cpm
GRD α = Ø cpm
GRD Bγ = 80-100 cpm

NR = No Recovery; No Sample Taken.

4C2-11-86

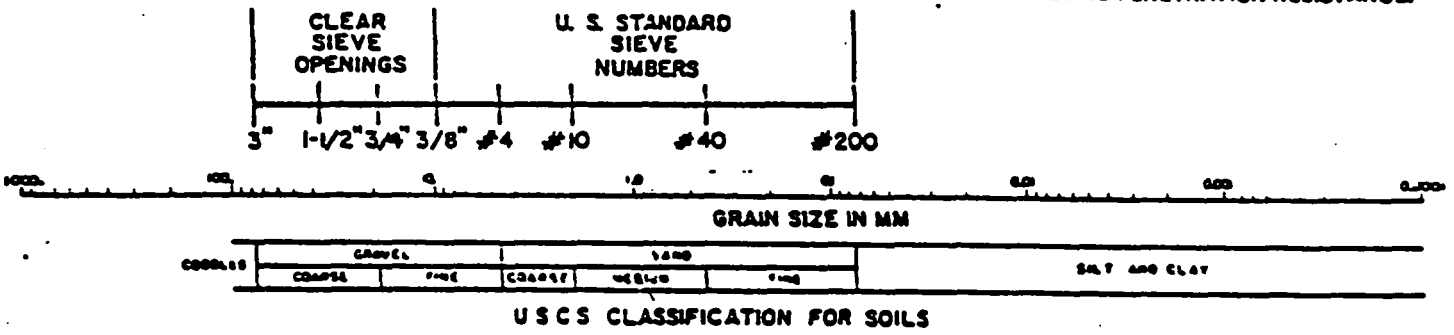
CONSISTENCY OF COHESI SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH(TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE[1]
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

(1) STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 18 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANCE.



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

FINE-GRAINED/HIGHLY ORGANIC SOILS

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

FERNALD RI/FS

6496

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602-3.7.1	PROJECT NAME: Facilities Testing Program	
BORING NUMBER: 1241	COORDINATES:	DATE: 5-11-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5-11-89
ENGINEER/GEOLOGIST: L. SINFIELD	Depth Date/Time	DATE COMPLETED: 5-11-89
DRILLING METHODS: B-53 Hollow Stem Auger w/ Split Spoon Sampler		PAGE 2 OF 4

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
7.5	17886	6	12 IN	Interbedded small silt and sand seams in clay - very stiff, brownish yellow (10yr, 6/8) dry to slightly moist, massive - silty sand, moist to wet 1/4 to 1/2 inch thick @ 0950	CL	3.5	Start = HNU = Ø ppm; α = Ø cpm; Bγ = 100-120 cpm
8.0	17887	9					
8.5	17888	11			SM / CL / SM		
9.0	NR					TSF	
9.5	17889	6	18 IN	Loose, silty sand, brownish yellow (10yr, 6/8) wet, massive @ 0955	SM	LOOSE	HNU = Ø ppm; α = Ø cpm; Bγ = 100-120 cpm
10.0	17890	6					
10.5	17891	8				TSF	
11.0	17892	5	12 IN	Loose, silty sand - same as above (9.0 → 10.5 ft) grades to silt at base @ 1000	SM ↓	LOOSE	HNU = Ø ppm; α = Ø cpm; Bγ = 100-140 cpm
11.5	50716	6					
12.0	50717 NR	18			ML	TSF	
12.5	50718	5	18 IN	Loose, silty sand, same as above with clay seam 6 inches thick - very stiff, massive, gray. Silt at base @ 1008	SM	3.7	HNU = Ø ppm; α = Ø cpm; Bγ = 100-120 cpm
13.0	50719	6			CL		
13.5	50720	18			ML	TSF	
14.0	50721	12	18 IN	Same as above 14.0 ft	SM	2.3 to 2.7	HNU = Ø ppm; α = Ø cpm; Bγ = 80-100 cpm
14.5	50722	5		Very stiff, lean clay - gray (10yr, 4/1) dry, masive, med plastic @ 1010	CL		
15.0	50723	6				TSF	

Top of Water Bearing Zone

Bottom of Water Bearing Zone

NOTES: Contractor: Penn Drill
Driller: William Saccani
Helper: Gary Dye
Sample Tech: Cindy Melroy
Weather: clear/warm
HNU#: HH18

TD = 15.0 ft

Water Bearing Zone 9.0 - 14.5 ft.

Background @
HNU = ppm
α = See cpm
Bγ = Page 1 of 4 cpm

NR = No Recovery, No Sample Taken

402-11-86

FERNALD RI/FS

Field Copy

6496

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602-3.7.1	PROJECT NAME: Facilities Testing Program	
BORING NUMBER: 1241	COORDINATES:	DATE: 9-11-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 9-11-89
ENGINEER/GEOLOGIST: L. Sintfeld	Depth Date/Time	DATE COMPLETED:
DRILLING METHODS: B-53 Hollow Stem Auger with Split Spoon Sampler		PAGE 1 OF 4

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER 6 IN	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
							Start = 915
0.5	17871 wmco	7	10in	Loose, gravel, massive, moist 0.75	GM		HNU = Ø ppm α = Ø cpm Bγ = 400-450 cpm
1.0	17872	8		Hard, mottled, Brownish yellow (10YR, 6/6) to gray (10YR, 6/1) dry, massive clay, @0920	CL	74.5 TSF	
1.5	17873 NR	9					
2.0	17874	6	6in	Very Stiff, Brownish yellow (10YR, 6/6) to Gray (10YR, 6/1) Dry, massive, lean clay with occasional gravel medium plastic @0922	CL	2.7 ~ 3.5 TSF	HNU = Ø ppm α = Ø cpm Bγ = 60-100 cpm
2.5	17875 wmco	7					
3.0	17876 NR	7					
3.5	17877	9	10in	Very stiff, same as above 1.2 to 3.0 ft @0927	CL	2.6 TSF	HNU = Ø ppm α = Ø cpm Bγ = 100-120 cpm
4.0	17878	11					
4.5	NR	11					
5.0	17880	9	11in	Very Stiff, mottled Brownish yellow (10YR 6/8) to pale brown (10YR, 6/3) Lean Clay, CL- dry, massive medium plastic @0931	CL	1.5 ↓ 2.6 TSF	HNU = Ø ppm α = Ø cpm Bγ = 80-120 cpm
5.5	17881 wmco	10					
6.0	17882 NR	10					
6.5	17883	3	18in	Very Stiff, mottled Brownish yellow (10YR, 6/8) lean clay - dry, massive, medium plastic with ½ to 1 inch silt and sand seams (moist) @0945	CL mc/sm	3.4 TSF	HNU = Ø ppm α = Ø cpm Bγ = 100-120 cpm
7.0	17884	6					
7.5	17885	9					

NOTES: Contractor:
Driller:
Helper:
Sample Tech:
Weather:
HNU #:

Background @0930
HNU = ppm
gnd α = cpm
Air Bγ = 80-100 cpm
Air α = 0 cpm
gnd Bγ

4C2-11-86

FERNALD RI/FS

6496 Field Copy

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602-	PROJECT NAME: Facilities Testing Program	
BORING NUMBER: 1241	COORDINATES:	DATE: 5-11-87
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5-11-84
ENGINEER/GEOLOGIST: C. Sintrel	Depth Date/Time	DATE COMPLETED:
DRILLING METHODS: B-53		PAGE 2 OF 4

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
7.5	17886	6		~~Top~~ Interbedded	CL	3.5	Start= HNU= Ø ppm
8.0	17887	9	12in	Small silt & sand seams in clay - very stiff, Brownish yellow (10YR, 6/8), dry to v. sl. moist, massive - silty sand, moist to wet 1/4 to 1/2 in thick @ 0950	SM / CL / SM	TSF	α= Ø cpm; Bγ= 100 120 cpm
8.5	17888 NR	11					
9.0	~~50716~~ 17889	6		Loose, Silty Sand, Brownish yellow (10YR 6/8) Wet, massive, @ 0955	SM	Loose	HNU= Ø ppm; α= Ø cpm; Bγ= 100-120 cpm
9.5	~~50717~~ 17890	6	18in				
10.0	~~50718~~ 17891	8				TSF	
10.5	17892 ~~50719~~	5		Loose, Silty Sand - same as above 9.0-10.5 ft Grades to silt at Base @ 1000	SM	Loose	HNU= Ø ppm; α= Ø cpm; Bγ= 100-140 cpm
11.0	50716 ~~50720~~	6	12in				
11.5	~~50721~~ 50717 NR	18			ML	TSF	
12.0	~~50722~~ 50718	5		Loose, Silty Sand - same as above with clay seam given thick - very stiff massive, gray Silt at Base @ 1005	SM		HNU= Ø ppm; α= Ø cpm; Bγ= 100-120 cpm
12.5	~~50723~~ 50719	6	18in		CL		
13.0	~~50724~~ 50720	10			ML	3.0 TSF	
13.5	~~50725~~ 50721	12		Same as above	SM	2.3	HNU= Ø ppm; α= Ø cpm; Bγ= 80-100 cpm
14.0	50722 ~~50726~~	5	18in	Very stiff Cum Clay - Gray (10YR 4/1) dry, massive, med plastic @ 1015	CL	2.0	
14.5	50723 ~~50727~~	6				TSF	
15.0							

NOTES: Contractor:
Driller:
Helper:
Sample Tech:
Weather:
HNU#:

Background @
HNU= ppm
α= cpm
Bγ= cpm

4C2-11-86

FERNALD RI/FS

6496

PIEZOMETER INSTALLATION SHEET

PROJECT NAME Facilities Testing FMPC RI/FS
FIELD ENG./GEO. L. Sinfield DATE 5-11-89
PROJECT NO. 602 3.2.1
CHECKED BY RLV DATE 6/6/89
BORING NO. 1241
PIEZOMETER NO. 1241
DATE OF INSTALLATION 5-11-89

BOREHOLE DRILLING

DRILLING METHOD Hollow Stem Auger
TYPE OF BIT Auger
DRILLING FLUID (S) USED: N/A
FLUID N/A FROM N/A TO N/A
FLUID N/A FROM N/A TO N/A
CASING SIZE (S) USED:
SIZE N/A FROM N/A TO N/A
SIZE N/A FROM N/A TO N/A

PIEZOMETER DESCRIPTION

TYPE Schedule 40 PVC
DIAMETER OF PERFORATED SECTION 2 inch ID
PERFORATION TYPE:
SLOTS ☒ HOLES ☐ SCREEN ☐
AVERAGE SIZE OF PERFORATIONS 0.020 inch
TOTAL PERFORATED AREA 4.8 ft
RISER PIPE MATERIAL Schedule 40 PVC
RISER PIPE DIAMETERS:
O.D. 2¼ inch I.D. 2 inch
LENGTH OF PIPE SECTIONS 12.3 ft
JOINING METHOD Flush-Threaded

PROTECTION SYSTEM

RISER PROTECTIVE PIPE LENGTH 5.0 ft
PROTECTIVE PIPE O.D. 4 3/8 inch
OTHER PROTECTION Locking Hinged Cover

ITEM	DISTANCE ABOVE/BELOW GROUND SURFACE (ft)		ELEVATION ( )	
TOP OF RISER PIPE	2.0 ft			
GROUND SURFACE	0.0			
BOTTOM OF PROTECTIVE PIPE	2.8 ft			
BOREHOLE FILL MATERIALS:				
GROUT/SLURRY	TOP N/A	BOTTOM N/A	TOP	BOTTOM
BENTONITE	TOP 1.0 ft	BOTTOM 7.5 ft	TOP	BOTTOM
SAND	TOP 7.5 ft	BOTTOM 15.5 ft	TOP	BOTTOM
GRAVEL	TOP N/A	BOTTOM N/A	TOP	BOTTOM
PERFORATED SECTION	TOP 10.3 ft	BOTTOM 15.1 ft	TOP	BOTTOM
PIEZOMETER TIP	15.5 ft			
BOTTOM OF BOREHOLE	15.5 ft			
GWL AFTER INSTALLATION				

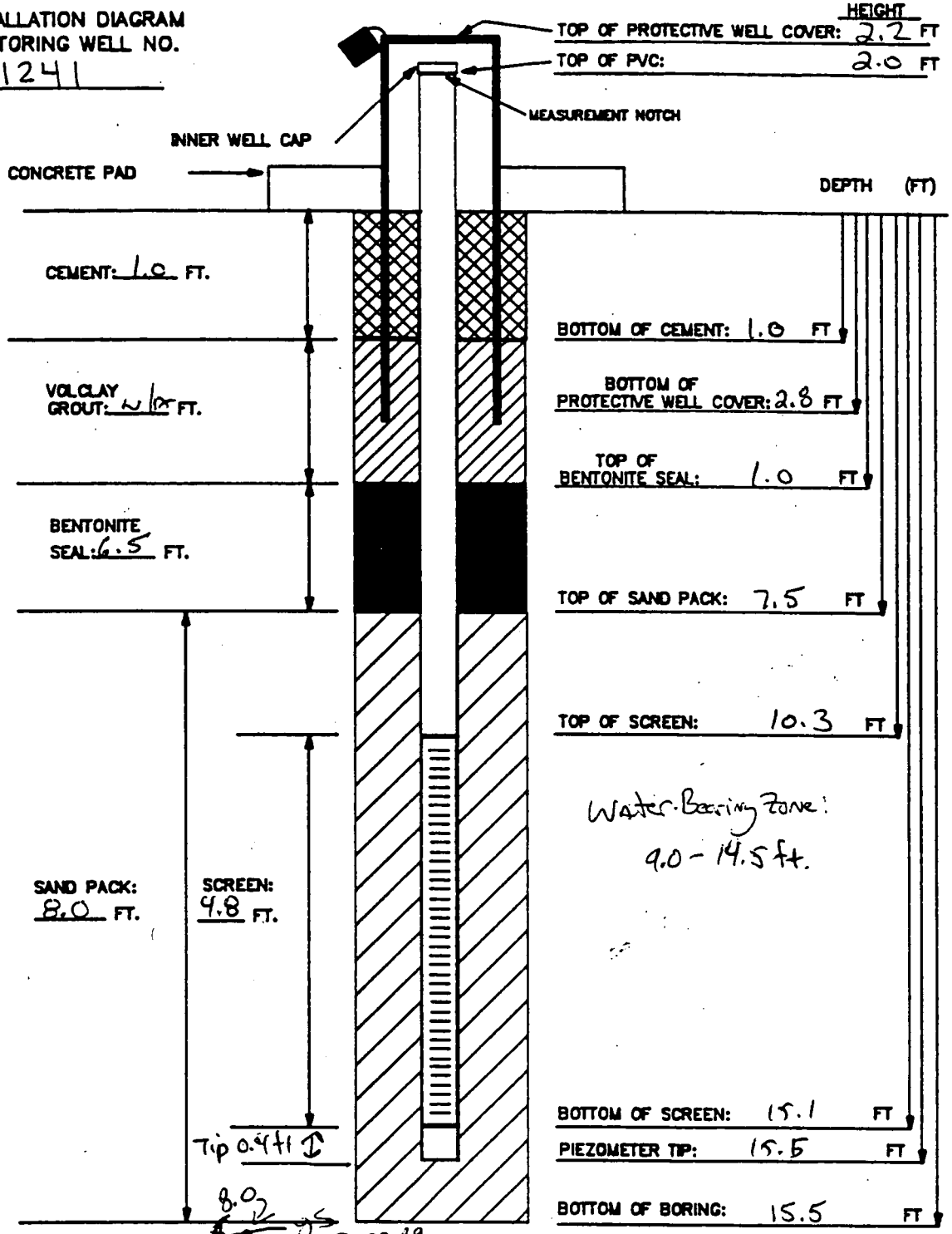
WAS THE PIEZOMETER FLUSHED AFTER INSTALLATION? YES ☐ NO ☑
WAS A SENSITIVITY TEST PERFORMED ON THE PIEZOMETER? YES ☐ NO ☑
REMARKS Water Bearing Zone: 9.0-14.5 ft

6496

FERNALD RI/FS

INSTALLATION DIAGRAM
MONITORING WELL NO. 1241

INSTALLATION DATE: 5-11-89



BOREHOLE DIAMETER: ~~10.0~~ 8.0 INCHES 5-23-89

MATERIALS USED:
SAND TYPE AND QUANTITY: 3 Bags 10/20 - 90 lb
BENTONITE PELLETS (5-GALLON BUCKETS): 4
BAGS OF VOLCLAY GROUT: N/A
AMOUNT OF CEMENT: 1 Bag - 50 lb
AMOUNT OF WATER USED: 10 gallons
OTHER: Protective Cover

NOTES:
1) RISER PIPE IS 2-INCH SCHEDULE 40 PVC PIPE, FLUSH-THREADED JOINTS.
2) SCREEN IS 2-INCH I.D. SCHEDULE 40 PVC PIPE WITH 0.020-INCH SLOTS.
3) LOWER END OF SCREEN IS CAPPED WITH AN END CAP OR THREADED SUMP.
4) WATER DEPTH/DATE:

TASK: 602.03.07

GEOLOGIST/ENGINEER: L. SINFIELD

FERNALD RI/FS

6496

Date				
Initial				
Field Check	1st Key In	2nd Key In	Hard Copy Verification	

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602-3.7.1	PROJECT NAME: Facilities Testing Program	
BORING NUMBER: 1243	COORDINATES:	DATE: 5-10-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5-10-89
ENGINEER/GEOLOGIST: L. Sinfield	Depth Date/Time	DATE COMPLETED:
DRILLING METHODS: B-53 Hollow Stem Auger with Split Spoon Sampler		PAGE 1 OF 4

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
							Start = 0900
0.5	17915 WMCO	5	8 IN	Loose, gravel, massive, wet, Angular 0.5 ft	GM	Loose	HNU = 0 ppm α = 0 cpm Bγ = 260-300 cpm
1.0	17916	8		Hard, Brownish Yellow (10YR, 6/6) Lean clay, rare gravel, medium plastic, dry. @ 0900	CL	>4.5	
1.5	17917 NR	7				TSF	
2.0	17918 NR	3	3 IN	Same as above 0.5-1.5 ft	CL	>4.5	HNU = 0 ppm α = 0 cpm Bγ = 260-300 cpm
2.5	17919 NR WMCO	4					
3.0	17920	6		@ 0905		TSF	
3.5	17921	3	4 IN	Stiff, Gray (2.5Y, N5) Lean clay, rare gravel, dry, medium plastic, massive	CL	1.2 ↓ 1.4	HNU = 0 ppm α = 0 cpm Bγ = N/A cpm Background too High
4.0	17922	2					
4.5	17923 NR	2		@ 0910		TSF	
5.0	17924	1	8 IN	Soft to Stiff, Gray (2.5Y, N5) Lean clay, rare gravel, dry medium plastic, massive	CL	0.1 ↓ 1.1	HNU = 0 ppm α = 0 cpm Bγ = N/A cpm Background too High
5.5	17925 WMCO	1					
6.0	17926 NR	2		@ 0915		TSF	
6.5	17927	2	14 IN	Soft to Stiff, Dark grayish Brown (2.5Y, 4/2) clay, massive, dry, medium plastic.	CL	0.1 ↓ 1.6	HNU = 0 ppm α = 0 cpm Bγ = 80-100 cpm
7.0	17928	3					
7.5	17929	5		@ 0945		TSF	

NOTES: Contractor: Penn Drill
Driller: J. Saccani
Helper: C. Oye
Sample Tech: C. Mercy
Weather: Cloudy
HNU #: HH18

Background @ 0900
HNU = 0 ppm
air & gnd α = 0 cpm
Air Bγ = 180-220 cpm
gnd Bγ = 320-360 cpm

NR = No Recovery, No Sample Taken

4C2-11-86

000130

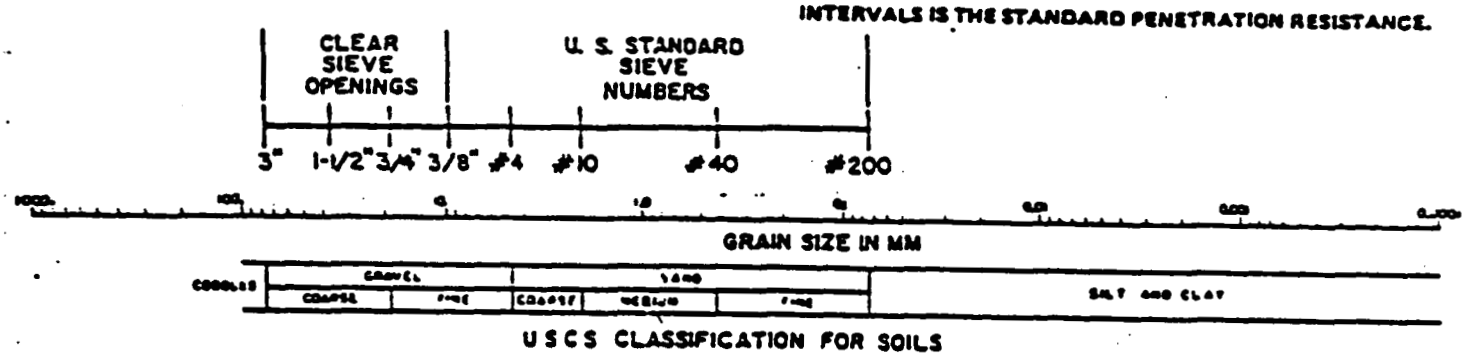
CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE (1)
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

(1) STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 18 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANCE.



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

FINE-GRAINED/HIGHLY ORGANIC SOILS

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

FERNALD RI/FS

6496

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602-3.7.1	PROJECT NAME: Facilities Testing Program	
BORING NUMBER: 1243	COORDINATES:	DATE: 5-10-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5-10-89
ENGINEER/GEOLOGIST: L. Sinfield	Depth Date/Time	DATE COMPLETED:
DRILLING METHODS: See Page 1 of 4		PAGE 2 OF 7

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
7.5							Start=
8.0	17930	1	18in	Soft, Dark grayish Brown, (2.5Y, 4/2) clay, massive, dry, medium plastic @ 0950	CL	0.0 ↓ 0.5 TSF	HNU= ø ppm; α= ø cpm; Bγ= 80-100 cpm
8.5	17931	5					
	17932	5					
9.0							
9.5	17933	5	18in	Soft, Mottled Brownish Yellow (10YR, 6/6) to Gray (10YR, 4/1) Clay, massive, dry, medium plastic @ 1000	CL	0.0 ↓ 0.5 TSF	HNU= ø ppm; α= ø cpm; Bγ= 80-100 cpm
	17934	5					
10.0	17935	5					
10.5							
11.0	17936	3	18in	Same As Above 9.0 ⇒ 10.5ft	CL	0.2	HNU= ø ppm; α= ø cpm; Bγ= 80-100 cpm
	50661	13		11.5ft			
11.5	50662	8		↑ ↑ @ 1005	Sm	TSF	
12.0							
12.5	50663	4	18in	Loose, Brownish Yellow (10YR, 6/6) wet, Silty Sand, massive ↓ ↓ 12.75ft	Sm		HNU= ø ppm; α= ø cpm; Bγ= 80-100 cpm
	50664	4					
13.0	50665	9		Very stiff, Gray (10YR, 4/1) Clay, dry, massive, medium plastic @ 1030	CL	2.5 ↓ 3.0 TSF	
13.5							
14.0	~~50666~~	~~5~~	~~18in~~	~~05~~ 5-23-87 TD= 73.5ft			HNU= ppm; α= cpm; Bγ= cpm
	~~50667~~	~~6~~		~~05~~ 5-23-87 Screen 13.0-8.0ft			
14.5							
15.0	~~50668~~	~~7~~		~~05~~ 5-23-87 @		TSF	

NOTES: Contractor: Driller: Helper: Sample Tech: Weather: HNU #: } See page 1 of 4

N/R = No Recovery No Sample Taken

Background @ HNU= See ppm; α= cpm; Bγ= Page 1 of 4 cpm

000132

4G7-11-86

FERNALD RI/FS

Field Copy 6496

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602-3.7.1	PROJECT NAME: Facilities Testing Program	
BORING NUMBER: 1243	COORDINATES:	DATE: 5-10-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5-10-89
ENGINEER/GEOLOGIST: L. Sintfield	Depth Date/Time	DATE COMPLETED:
DRILLING METHODS: B-53, Hollow Stem Auger with Split Spoon Sampler		PAGE 1 OF 4

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER 6 IN	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
							Start = 0900
0.5	17915 WMCO	5	8 IN	Loose, gravel, massive, wet Angular 0.5 ft	GM	Loose	HNU = 0 ppm α = 0 cpm Bγ = 260-300 cpm
1.0	17916	8		Hard, Brownish yellow (10YR, 6/6) Lean Clay, rare gravel, med. plastic dry @ 0900	CL	>4.5 TSF	
1.5	17917 NR	7					
2.0	17918 NR	3	3 in	Same as 0.5 to 1.5 ft @ 0905	CL	>4.5 TSF	HNU = 0 ppm α = 0 cpm Bγ = 260-300 cpm
2.5	17919 NR WMCO	4					
3.0	17920	6					
3.5	17921	3	4 in	Stiff, Gray (2.5Y, N5) Lean Clay, rare gravel, Dry, med. plastic, massive @ 0910	CL	1.2 to 1.4 TSF	HNU = 0 ppm α = 0 cpm Bγ = N/A cpm ↳ Background too High
4.0	17922 NR	2					
4.5	17923 NR	2					
5.0	17924	3 1	8 IN	Soft to Stiff, Gray (2.5Y, N5) Lean Clay Same as Above 3.0-4.5 ft @ 0915	CL	0.1 to 1.1 TSF	HNU = 0 ppm α = 0 cpm Bγ = N/A cpm ↳ Background too high ↳ 80-100 cpm
5.5	17925 WMCO	5 1					
6.0	17926 NR	2					
6.5	17927	2	14 in	Soft to Stiff, Dark grayish Brown (2.5Y, 4/2) Clay, massive, dry, med. plastic @ 0945	CL	0.1 to 1.6 TSF	HNU = 0 ppm α = 0 cpm Bγ = 80-100 cpm
7.0	17928	3					
7.5	17929	5					

NOTES: Contractor: Penn Drill
Driller: J. Sacconi
Helper: G. Dye
Sample Tech: C. Melroy
Weather:
HNU #: HH18

Background @
HNU = 0 ppm
Air & gnd α = 0 cpm
Air Bγ = 180-220 cpm
gnd Bγ = 320-360 cpm

NR = No Recovery, No Sample Taken

4C2-11-86

FERNALD RI/FS

Field Copy 6496

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602-3.7.1	PROJECT NAME: Facilities Testing Program	
BORING NUMBER: 1243	COORDINATES:	DATE: 5-10-89
ELEVATION:	GWL: Depth. Date/Time	DATE STARTED: 5-10-89
ENGINEER/GEOLOGIST: L. Sinclair	Depth Date/Time	DATE COMPLETED:
DRILLING METHODS: B-53, Hollow Stem Auger with Split Spoon Sampler		PAGE 2 OF 4

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER 6 IN	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
7.5							Start=
8.0	17930	1		Soft Same as above	CL	0.0 to 0.5	HNU= Ø ppm α= Ø cpm
	17931	5	18in	6.0 to 7.5 ft			Bγ= 80-100 cpm
8.5	17932	5		@ 0950		TSF	
9.0	17933	5		Soft Same as above	CL	0.0 to 0.5	HNU= Ø ppm α= Ø cpm
9.5	17934	5	18in	7.5 to 9.0 ft mottled Brownish yellow (10YR 6/6)			Bγ= 80-100 cpm
10.0	17935	5		to gray (10YR 4/1) @ 1000		TSF	
10.5	17936	3		Same as above 9.0-10.5 ft	CL	0.2	HNU= Ø ppm α= Ø cpm
11.0	50661	5	18in	10.5 ft			Bγ= 80-100 cpm
11.5	50662	8		Loose, brownish yellow (10YR 6/6) wet, silty SAND 5-10-89, @ 1005	SM	TSF	
12.0	50663	4		Loose, Brownish yellow (10YR 6/6) WET, SILTY SAND	SM	2.5 to 3.0	HNU= Ø ppm α= Ø cpm
12.5	50664	4	18in	moist 12.75 ft			Bγ= 80-100 cpm
13.0	50665	9		Very stiff, Gray (10YR 4/1) clay, dry, moist; red plastic @ 1030	CL	TSF	
13.5	50666			TD=13.5 ft			HNU= ppm
14.0	50667			Screen 13.0 - 8.0 ft			α= cpm
14.5	50668						Bγ= cpm
15.0				@		TSF	

NOTES: Contractor: Driller: Helper: Sample Tech: Weather: HNU #: See page 1 of 4

Background @
HNU= ppm
α= See cpm
Bγ= page 1 of 4 cpm

NRC= No Recovery, No Sample Taken

402-11-88

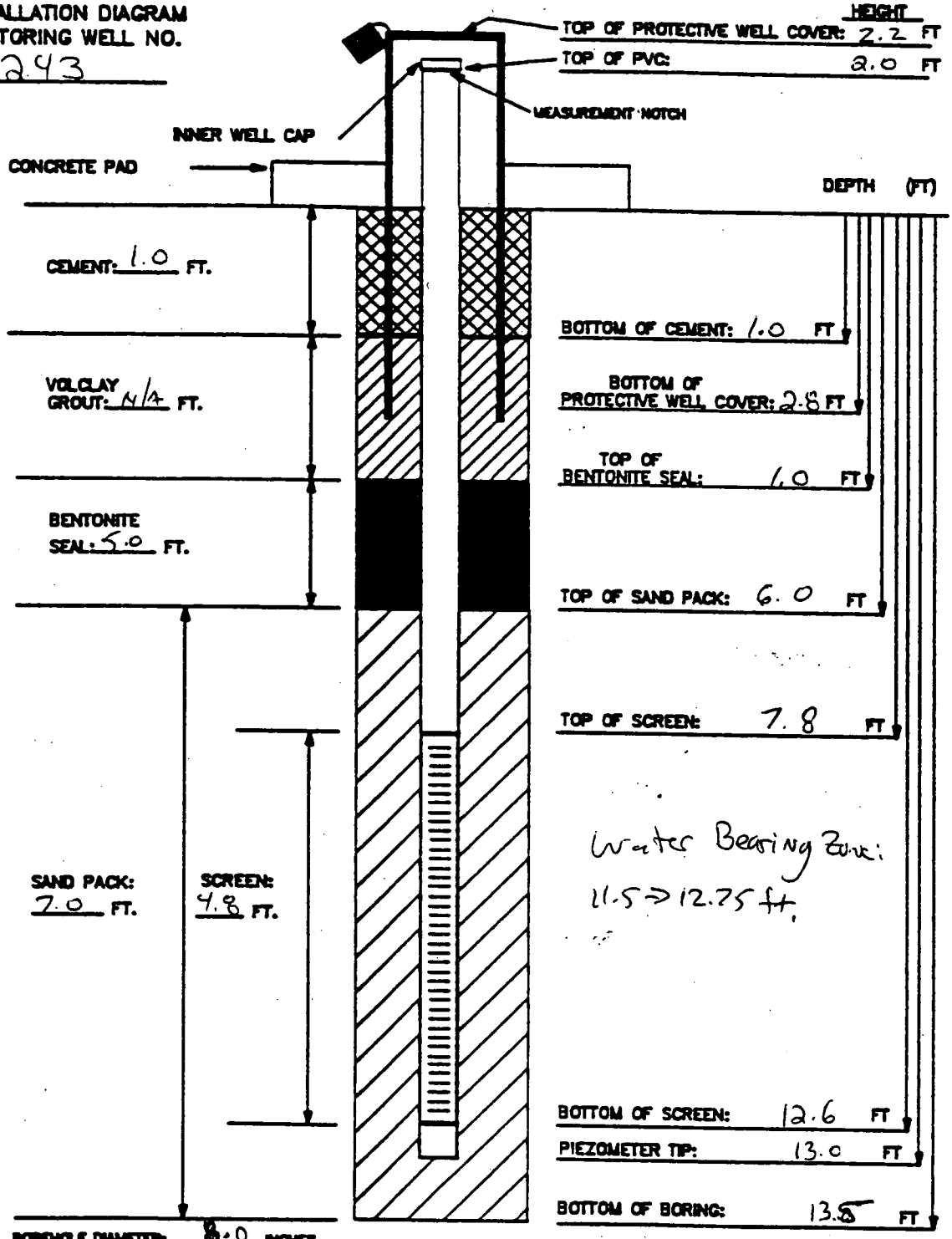
000134

6496 BS 5-10-89
See page 3 of 4

FERNALD RI/FS

INSTALLATION DIAGRAM
MONITORING WELL NO. 1243

INSTALLATION DATE: 5-10-89



BOREHOLE DIAMETER: 8.0 INCHES

MATERIALS USED:
SAND TYPE AND QUANTITY: 3 Bags 10/20 - 80 lb
BENTONITE PELLETS (5-GALLON BUCKETS): 2
BAGS OF VOLCLAY GROUT: N/A
AMOUNT OF CEMENT: 1 Bag - 50 lb
AMOUNT OF WATER USED: 10 gallons
OTHER: 5.0 ft x 4 3/8 in Protective cover

NOTES:
1) RISER PIPE IS 2-INCH SCHEDULE 40 PVC PIPE, FLUSH-THREADED JOINTS.
2) SCREEN IS 2-INCH I.D. SCHEDULE 40 PVC PIPE WITH 0.020-INCH SLOTS.
3) LOWER END OF SCREEN IS CAPPED WITH AN END CAP OR THREADED SUMP.
4) WATER DEPTH/DATE:

TASK: 60 2 3.7.1

GEOLOGIST/ENGINEER: L. Sinfield

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Page 4 of 4

FERNALD RI/FS

PIEZOMETER INSTALLATION SHEET

PROJECT NAME Facilities Testing FMPC RI/FS
FIELD ENG./GEO. L. Sinfield DATE 5-10-89
PROJECT NO. 6023.7.1
CHECKED BY RL DATE 6/1/89
BORING NO. 1243
PIEZOMETER NO. 1243
DATE OF INSTALLATION 5-10-89

BOREHOLE DRILLING

DRILLING METHOD Hollow Stem Auger
DRILLING FLUID (S) USED: N/a
FLUID N/a FROM N/a TO N/a
FLUID N/a FROM N/a TO N/A

TYPE OF BIT Auger Bit
CASING SIZE (S) USED: N/a
SIZE N/a FROM N/a TO N/a
SIZE N/a FROM N/a TO N/a

PIEZOMETER DESCRIPTION

TYPE Schedule 40 PVC
DIAMETER OF PERFORATED SECTION 2 inch I.D.
PERFORATION TYPE:
SLOTS [X] HOLES [ ] SCREEN [ ]
AVERAGE SIZE OF PERFORATIONS 0.020 inch
TOTAL PERFORATED AREA 4.8 ft

RISER PIPE MATERIAL Schedule 40 PVC
RISER PIPE DIAMETERS:
O.D. 2 1/4 inch I.D. 2 inch
LENGTH OF PIPE SECTIONS 9.8 ft
JOINING METHOD Flush-Threaded Joints

PROTECTION SYSTEM

RISER PROTECTIVE PIPE LENGTH 5.0 ft
PROTECTIVE PIPE O.D. 4 3/8 inch

OTHER PROTECTION Locking Hinged Cover

ITEM	DISTANCE ABOVE/BELOW GROUND SURFACE (ft)		ELEVATION ( )	
TOP OF RISER PIPE	2.0 ft			
GROUND SURFACE	0.0			
BOTTOM OF PROTECTIVE PIPE	2.8 ft			
BOREHOLE FILL MATERIALS:				
GROUT/SLURRY	TOP N/a	BOTTOM N/a	TOP	BOTTOM
BENTONITE	TOP 1.0 ft	BOTTOM 6.0 ft	TOP	BOTTOM
SAND	TOP 6.0 ft	BOTTOM 13.0 ft	TOP	BOTTOM
GRAVEL	TOP N/a	BOTTOM N/a	TOP	BOTTOM
PERFORATED SECTION	TOP 7.8 ft	BOTTOM 12.6 ft	TOP	BOTTOM
PIEZOMETER TIP	13.0 ft			
BOTTOM OF BOREHOLE	13.5 ft			
GWL AFTER INSTALLATION				

WAS THE PIEZOMETER FLUSHED AFTER INSTALLATION? YES [ ] NO [✓]
WAS A SENSITIVITY TEST PERFORMED ON THE PIEZOMETER? YES [ ] NO [✓]
REMARKS Water Bearing Zone: 11.5 → 12.75 ft

000136

ICD-11-86

FERNALD RI/FS

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	Field Check	1st Key In	2nd Key In	Hard Copy Verification

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602-3.7.1	PROJECT NAME: Facilities Testing Program	
BORING NUMBER: 1242	COORDINATES:	DATE: 5-10-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5-10-89
ENGINEER/GEOLOGIST: L. Sinfield	Depth Date/Time	DATE COMPLETED: 5-10-89
DRILLING METHODS: B-53, Hollow Stem Auger with Split Spoon Sampler		PAGE 1 OF 4

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION 5/10/89	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS Total of 6 pages with field copies enclosed. AD. 6/6/89 Start = 1330
0.5	17893 wmco	5	9 IN.	Hard, Yellowish Brown (10YR, 6/6) Clay with silt and gravel, Dry, massive, low plasticity. Top 6 IN. is loose gravel @ 1345	GIN	74.5 TSF	HNU = Ø ppm; α = Ø cpm; Bγ = 200-240 cpm; C Gravel
1.0	17894	15			CL		
1.5	17895 NR	7					Bγ = 100-140 cpm; C Clay
2.0	17896	9	12 IN.	Hard, Mottled light Olive Brown (2.5Y, 5/4) to gray (2.5Y, N5) Lean clay with silt and gravel, Dry, massive, medium plastic @ 1348	CL	74.5 TSF	HNU = Ø ppm; α = Ø cpm; Bγ = 100-140 cpm
2.5	17897 wmco	10					
3.0	17898 NR	10					
3.5	17899	14	9 IN.	Stiff to Very Stiff, Slightly Mottled Grayish Brown (2.5Y, 5/2) Lean clay, Dry, massive, medium plastic, rare gravel @ 1400	CL	1.7 ↓ 3.1 TSF	HNU = Ø ppm; α = Ø cpm; Bγ = 100-140 cpm
4.0	17900	15					
4.5	17901 NR	9					
5.0	17902	11	8 IN.	Stiff to Very Stiff, Mottled Gray (2.5Y, N6) to (2.5Y, N5) Lean Clay with Wood Fragments, Dry, massive, medium plastic @ 1415	CL	1.5 ↓ 3.6 TSF	HNU = Ø ppm; α = Ø cpm; Bγ = 100-140 cpm
5.5	17903 wmco	10					
6.0	17904 NR	11					
6.5	17905	3	18 IN.	Very Stiff, Mottled, Gray (2.5Y, N6) Lean Clay, Dry massive, medium plastic @ 1515	CL	2.2 ↓ 3.1 TSF	HNU = Ø ppm; α = Ø cpm; Bγ = 100-140 cpm
7.0	17906	6					
7.5	17906	8					

NOTES: Contractor: Penn Drill
Driller: J. Saccani
Helper: G. Dye
Sample Tech: C. Ihelroy
Weather: Cloudy - cool
HNU #: HH18

Background @ 1400
Air & gnd HNU = Ø ppm; α = Ø cpm
Air & air Bγ = 100-140 cpm

NR = No Recovery, No Sample Taken

4C2-11-86

000137

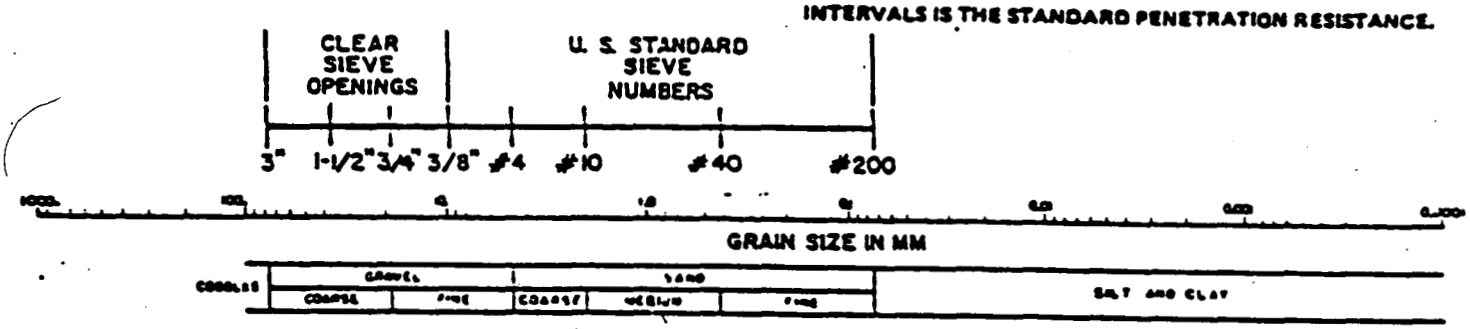
CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE (1)
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

(1) STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 18 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANCE.



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

FINE-GRAINED/HIGHLY ORGANIC SOILS

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

FERNALD RI/FS

6496

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602-3.7.1	PROJECT NAME: Facilities Testing Program	
BORING NUMBER: 1242	COORDINATES:	DATE: 5-10-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5-10-89
ENGINEER/GEOLOGIST: L. Sinfield	Depth Date/Time	DATE COMPLETED: 5-10-89
DRILLING METHODS: See Page 1 of 4		PAGE 2 OF 4

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
7.5							Start=
8.0	17908	7	12in	Very Stiff, Yellowish Brown, mottled, (10YR, 6/6) to Gray (2.5Y, N5) Lean clay, dry, massive, medium plastic. @ 1520	CL	1.2 ↓ 3.2 TSF	HNU= ø ppm; α= ø cpm; Bγ= 120→140 cpm
8.5	17909	8					
9.0	17910 NR	11					
9.5	17911	9	18in	Very Stiff, mottled Yellowish Brown (10YR, 6/6) to gray (2.5Y, N5) Lean clay, massive, dry, with 1 inch Silt layer - moist, massive, Yellowish Brown (10YR, 6/6) @ 1525	CL	2.7 TSF	HNU= ø ppm; α= ø cpm; Bγ= 120→140 cpm
10.0	17912	11			ML		
10.5	17913 WMCO	10			CL		
11.0	17914	5	18in	Same as Above 9.0→10.5ft	CL	1.7	HNU= ø ppm; α= ø cpm; Bγ= 100-140 cpm
11.5	50687	7		11.5ft			
12.0	50688	11		Loose, Brownish Yellow (10YR, 6/6) Silty Sand, Wet @ 1535	SM	Loose TSF	
12.5	50689	5	18in	Same as above 11.5-12.0ft Grades to Silt at Base @ 1540	SM ↓ ML	Loose TSF	HNU= ø ppm; α= ø cpm; Bγ= 100-120 cpm
13.0	50690	7					
13.5	50691	6					
14.0	50692	26	↑ 18in	Same as above 12.0→13.5ft	SM ↓ ML		HNU= ø ppm; α= ø cpm; Bγ= 100-120 cpm
14.5	50693	38		14.5ft			
15.0	50694	40	↓	Clay, dry, massive, medium plastic @ 1545	CL	TSF	

NOTES: Contractor: Driller: Helper: Sample Tech: Weather: HNU #: } See Page 1 of 4

Background @ 1400
HNU= ø ppm
Air & Gnd α= ø cpm
Air & Gnd Bγ= 100-140 cpm

NR= No Recovery, No Sample Taken

402-11-86

FERNALD RI/FS

6496

Field Copy

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602-3.7.1	PROJECT NAME: Facilities Testing Program	
BORING NUMBER: 1242	COORDINATES:	DATE: 5-10-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5-10-89
ENGINEER/GEOLOGIST: L. Sintield	Depth Date/Time	DATE COMPLETED:
DRILLING METHODS: B-53 Hollow Stem Auger with Split-spoon Sampler		PAGE 1 OF 4

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
							Start=1330
0.5	17893 WMCO	5		Hard, Yellowish Brown (10YR, 6/6) Clay with Silt and Gravel, Dry, massive, low plasticity. Top 6 in is gravel, loose, dry @1345	GM	74.5	HNU= Ø ppm α= Ø cpm Bγ=200-240 cpm GRAVEL Bγ=100-140 cpm clay
1.0	17894	15	9 in		CL		
1.5	17895 NR	7				TSF	
2.0	17896	9		Hard, ~~Yellowish Brown (10YR, 6/6)~~ mottled, Lean Clay with Silt and Gravel, massive, med. plastic DRY. Light Olive Brown (2.5Y, 5/4) to gray (2.5Y, N5) @1348	CL	74.5	HNU= Ø ppm α= Ø cpm Bγ=100-140 cpm
2.5	17899 WMCO	10	12 in				
3.0	17898 NR	10				TSF	
3.5	17899	14		Stiff to very stiff Grayish Brown (2.5Y, 5/2) Lean Clay, slightly mottled, Dry, massive, medium plastic rare gravel @1400 ~~1355~~ 5-10-87	CL	1.7 to 3.1	HNU= Ø ppm α= Ø cpm Bγ=100-140 cpm
4.0	17900	15	9 in				
4.5	17901 NR	9				TSF	
5.0	17902	11		Stiff to very stiff Mottled Gray (2.5Y, N6) to (2.5Y, N5) Lean Clay with Wood Fragments, mottled, Dry, massive, medium plastic @1415	CL	1.5 to 3.0	HNU= Ø ppm α= Ø cpm Bγ=100-140 cpm
5.5	17903 WMCO	10	8 in				
6.0	17904 NR	11				TSF	
6.5	17905	3		Very Stiff mottled Gray (2.5Y, N6) Lean clay, Dry, massive, medium plastic @1515	CL	2.2 to 3.1	HNU= Ø ppm α= Ø cpm Bγ=100-140 cpm
7.0	17906	6	18 in				
7.5	17907	8				TSF	

NOTES: Contractor: Penn Drill
Driller: J. Saccani
Helper: G. Dye
Sample Tech: C. Melroy
Weather: cloudy
HNU #: HH18

Background @1400
HNU= Ø ppm
at gnd α= Ø cpm
air Bγ=100-140 cpm
gnd Bγ=100-140 cpm

130
12
260
1300
1560

000140

4C2-11-86

FERNALD RI/FS

Field Copy

6496

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602-3.7.1	PROJECT NAME: Facilities Testing Program	
BORING NUMBER: 1242	COORDINATES:	DATE:
ELEVATION:	GWL: Depth Date/Time	DATE STARTED:
ENGINEER/GEOLOGIST:	Depth Date/Time	DATE COMPLETED:
DRILLING METHODS:		PAGE 2 OF 4

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
7.5	17908	~~7~~		Very stiff, Yellowish Brown (10YR, 6/6) to Gray (2.5Y, N5) mottled, Lean Clay, dry, massive, med. plastic. @1520	CL	3.2 to 1.2 TSF	Start= HNU= 0 ppm α= 0 cpm Bγ=120-140 cpm
8.0	17909	8	12 in				
8.5	17910 NR	11					
9.0	17911	9	18 in	Very Stiff, mottled Yellowish Brown (10YR, 6/6) to gray (2.5Y, N5) Lean clay, dry, massive with 1 inch Silt layer - moist, massive Yellowish Brown (10YR, 6/6) @1525	CL / ML / CL	2.7 TSF	HNU= 0 ppm α= 0 cpm Bγ=120-140 cpm
9.5	17912	11					
10.0	17913 WMCO	10					
10.5	17914	~~9~~ 5	5-10-8	Very Stiff, Same as above 9.0-10.5 ft 11-5 ft	CL	1.7	HNU= 0 ppm α= 0 cpm Bγ= 100-140 cpm
11.0	50687	~~11~~ 5	18 in	Brownish yellow (10YR, 6/6) Silty Sand, Loose, WET @1535	SM	Loose TSF	
11.5	50688	11					
12.0	50689	5	18 in	Same as 11.5 to 12.0 ft grades to Silt @1540	SM ↓ ML	Loose TSF	HNU= 0 ppm α= 0 cpm Bγ= 100-120 cpm
12.5	50690	7					
13.0	50691	6					
13.5	50692	6	18 in	Same as above 12.0-13.5 ft 14.5 ft	SM ↓ ML	Loose	HNU= 0 ppm α= 0 cpm Bγ= 100-120 cpm
14.0	50693	8					
14.5	50694	10		clay, dry, @1545	CL	TSF	
15.0							

NOTES: Contractor:
Driller:
Helper:
Sample Tech:
Weather:
HNU#:

Background @
HNU= ppm
α= cpm
Bγ= cpm

6496
Seepage 3 of 4

FERNALD RI/FS

PIEZOMETER INSTALLATION SHEET

PROJECT NAME Facilities Testing FMPC RI/FS 602371 FIELD ENG./GEO. C. Sinfield DATE 5-17-89
PROJECT NO. 602 3.7.1 CHECKED BY [illegible] DATE 6/6/89
BORING NO. 1242
PIEZOMETER NO. 1242 DATE OF INSTALLATION 5-10-89

BOREHOLE DRILLING

DRILLING METHOD Hollow Stem Auger
DRILLING FLUID (S) USED: N/A
FLUID N/A FROM N/A TO N/A
FLUID N/A FROM N/A TO N/A

TYPE OF BIT Auger Bit
CASING SIZE (S) USED: N/A
SIZE N/A FROM N/A TO N/A
SIZE N/A FROM N/A TO N/A

PIEZOMETER DESCRIPTION

TYPE Schedule 40 PVC
DIAMETER OF PERFORATED SECTION 2 inch I.D.
PERFORATION TYPE:
SLOTS ☒ HOLES ☐ SCREEN ☐
AVERAGE SIZE OF PERFORATIONS 0.020 inch
TOTAL PERFORATED AREA 9.8 ft

RISER PIPE MATERIAL Schedule 40 PVC
RISER PIPE DIAMETERS:
O.D. 2 1/4 inch I.D. 2-inch
LENGTH OF PIPE SECTIONS 11.8 ft
JOINING METHOD Flush-Threaded Joints

PROTECTION SYSTEM

RISER PROTECTIVE PIPE LENGTH 5.0 ft
PROTECTIVE PIPE O.D. 4 3/8 inch

OTHER PROTECTION Locking Hinged Cover

ITEM	DISTANCE ABOVE/BELOW GROUND SURFACE (ft)		ELEVATION ( )	
TOP OF RISER PIPE	2.0 ft			
GROUND SURFACE	0.0			
BOTTOM OF PROTECTIVE PIPE	2.8 ft			
BOREHOLE FILL MATERIALS:	Cement 0.0 ft	1.0 ft		
GROUT/SLURRY	TOP N/A	BOTTOM N/A	TOP	BOTTOM
BENTONITE	TOP 1.0 ft	BOTTOM 7.0 ft	TOP	BOTTOM
SAND	TOP 7.0 ft	BOTTOM 15.0 ft	TOP	BOTTOM
GRAVEL	TOP N/A	BOTTOM N/A	TOP	BOTTOM
PERFORATED SECTION	TOP 9.8 ft	BOTTOM 14.6 ft	TOP	BOTTOM
PIEZOMETER TIP	5-17-89 ~~14.6 ft~~ 15.0 ft			
BOTTOM OF BOREHOLE	15.0 ft			
GWL AFTER INSTALLATION				

WAS THE PIEZOMETER FLUSHED AFTER INSTALLATION? YES ☐ NO ☑
WAS A SENSITIVITY TEST PERFORMED ON THE PIEZOMETER? YES ☐ NO ☑
REMARKS Water Bearing Zone: 11.5 → 14.5 ft depth

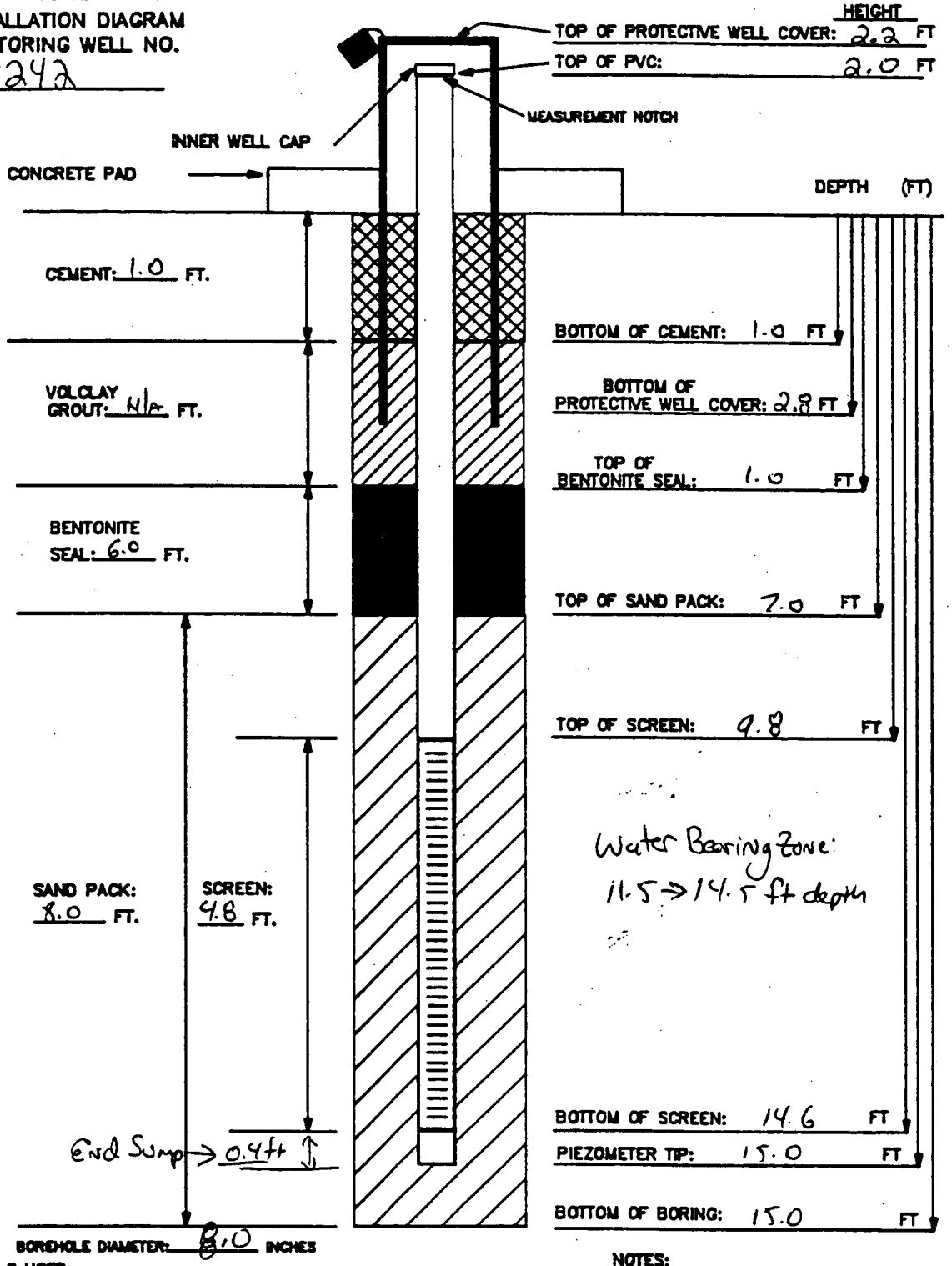
000142

409-11-86

FERNALD RI/FS

INSTALLATION DIAGRAM
MONITORING WELL NO. 1242

INSTALLATION DATE: 5-10-89



MATERIALS USED:
SAND TYPE AND QUANITITY: 3 Bags 10/20 (80lb Bag)
BENTONITE PELLETS (5-GALLON BUCKETS): 3
BAGS OF VOLCLAY GROUT: N/A
AMOUNT OF CEMENT: 1 Bag - 50lb
AMOUNT OF WATER USED: 10 gallons
OTHER: Protective Cover 5.0ft x 4 3/8 inch

NOTES:
1) RISER PIPE IS 2-INCH SCHEDULE 40 PVC PIPE, FLUSH-THREADED JOINTS.
2) SCREEN IS 2-INCH I.D. SCHEDULE 40 PVC PIPE WITH 0.020-INCH SLOTS.
3) LOWER END OF SCREEN IS CAPPED WITH AN END CAP OR THREADED SUMP.
4) WATER DEPTH/DATE:

TASK: 60 2 3 7 1

GEOLOGIST/ENGINEER: L. Sintred

FERNALD RI/FS

6496

Date				
Initial				
Field Check	1st Key In	2nd Key In	Hard Copy Verification	

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1240	COORDINATES:	DATE: 5/10/89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5/10/89
ENGINEER/GEOLOGIST: C. Grube/L. Adams	Depth Date/Time	DATE COMPLETED: 5/11/89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 1 OF 4

NOTE: Total of 7 pages with field copies enclosed.

DEPTH (FT.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN.)	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	17849 1533 5-10-89	1	6	Very stiff, yellowish brown (10yr 5/4) silty clay. Trace surface gravel + asphalt, trace sand. Med. plasticity, very moist	CL	3.0	HNU = 0 ppm α = 0 cpm Bγ = 60-80 cpm
1	17850 1533 5-10-89	3	6	Very stiff, yellowish brown (10yr 5/4) silty clay. Trace coarse sand. Low plasticity, moist.	CL	4.0	
	17851 1533 5-10-89	5	1	SAA	CL	2.5	
2	17852 1535 5-10-89	3	6	Stiff, yellowish brown (10yr 5/4) silty clay. Trace sand. Med. Plasticity, moist.	CL	1.25	HNU = 0 ppm α = 0 cpm Bγ = 100-110 cpm
	17853 1535 5-10-89	3	2	Soft, yellowish brown (10yr 5/4) silty clay, trace sand. Med. Plasticity, very moist.	CL	.25	
3	17854 1535 5-10-89	7	0	no recovery			
	17855 1540 5-10-89	5	6	Med. stiff, yellowish brown (10yr 5/4) silty clay. Trace sand + fine gravel (gravel to .25in) med. Plasticity, moist	CL	.5	HNU = 0 ppm α = 0 cpm Bγ = 60-80 cpm
4	17856 1540 5-10-89	7	6	Stiff, yellowish brown (10yr 5/4) silty clay. Trace sand + fine gravel (gravel to .25in) med. plasticity, moist.		1.75	
	17857 1540 5-10-89	8	6	Very stiff, dark gray (5Y 4/1) silty clay. low plasticity, slighty moist.	CL	3.75	
5	17858 1544 5-10-89	12	6	Stiff, Olive gray (5Y 4/2) silty clay. Med. plasticity, moist.	CL	1.5	HNU = 0 ppm α = 0 cpm Bγ = 70-90 cpm
	17859 1544 5-10-89	11	6	Very stiff, dark yellow brown (10yr 4/6) silty clay. Med. to low plasticity. Moist	CL	2.25	
6	17860 1544 5-10-89	15	6	Stiff, yellowish brown (10yr 5/4) silty clay. Low plasticity, moist.	CL	1.0	
	17861 1615 5-10-89	4	6	Soft, yellowish brown (10yr 5/6) silty clay, low plasticity. Very moist.	CL	.25	HNU = 0 ppm α = 0 cpm Bγ = 90-110 cpm
7	17862 1615 5-10-89	4	6	Med. stiff SAA	CL	.5	
	17863 1615 5-10-89	5	3	Loose, yellowish brown (10yr 5/4) clayey silt. Moist.	ML	N/A	

NOTES: CONTRACTOR: PENN DRILL
RIG: Model 80
DRILLER: Craig Coulter
ASSISTANT: Chris Coulter

SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST
COLORS IDENTIFIED USING MUNSELL COLOR CHART
BACKGROUND LEVELS: HNU = 0 PPM
α = 0 CPM
Bγ = 80-100 CPM
LEL O2: LEL = 0% ~~PPM~~ LAA 5/12/89
O2 = 20.6%

SAA = Same as above

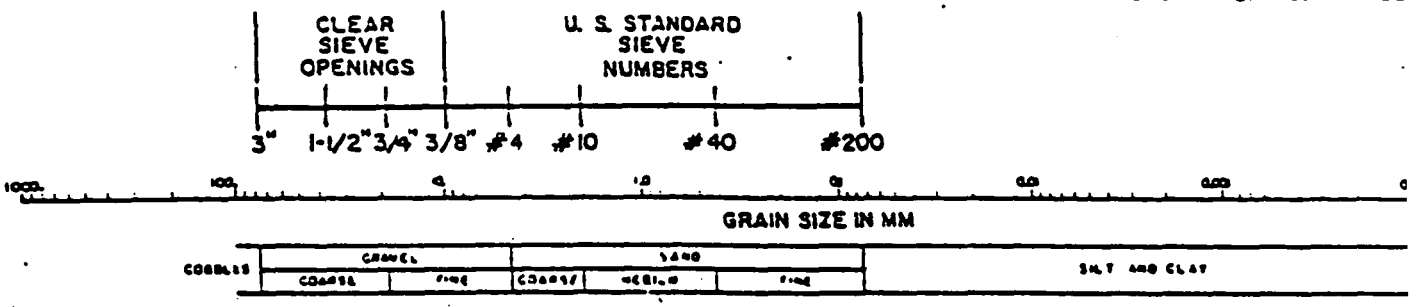
CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE (1)
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

(1) STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 18 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANCE



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

FINE-GRAINED/HIGHLY ORGANIC SOILS

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENT

FERNALD RI/FS

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1240	COORDINATES:	DATE: 5/10/89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5/10/89
ENGINEER/GEOLOGIST: C. Grube / L. Adams	Depth Date/Time	DATE COMPLETED: 5/11/89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 2 OF 4

DEPTH (FT.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN.)	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
8	17864 1621 5-10	8	6	Very stiff, very dk gray (5y 3/1) clay, some gravel. Low plasticity, moist. / Very stiff, yellowish brown (10yr 5/4) silty clay. Trace sand. Low plasticity. Very moist.	CL	2.5 / 2.25	HNU = 0 ppm, α = 0 cpm, Bγ = 80-90 cpm
	17865 1621 5-10	7	6	Med. Dense, brownish yellow (10yr 6/6) silt. Moist.	ML	N/A	
9	17866 1621 5-10	9	6	Med. Dense, Dark yellowish brown (10yr 5/4) to (10yr 4/6) silt. Trace sand. Moist.	ML	N/A	
	17867 1635 5-10	5	6	Loose, yellowish brown (10yr 5/4) silty clay. Trace sand + fine gravel. Moist, low plasticity	CL	.75	HNU = 0 ppm, α = 0 cpm, Bγ = 60-80 cpm
10	17868 1635 5-10	3	5	Loose, dark gray to yellowish brown (5y 4/1 to 10yr 5/6) silty clay. Low plasticity, moist.	CL	.75	
10.5FT	17869 1635 5-10	9	0	No recovery	N/A	N/A	
11	17870 1646 5-10	9	6	Med. dense, yellowish brown (10yr 5/4) silty sand. Poorly graded. Very fine grained. Very moist.	SM	N/A	HNU = 0 ppm, α = 0 cpm, Bγ = 60-80 cpm
	1646 5-10	9	6	*SAA wet.	SM	N/A	
12	1646 5-10	12	6	Med. dense, gray (5y 5/1) silt. Very moist.	ML	N/A	
	1654 5-10	4	6	Loose, yellowish brown (10yr 5/4) silty sand. Poorly graded. wet.	SM	N/A	HNU = 0 ppm, α = 0 cpm, Bγ = 60-80 cpm
13.5FT	1654 5-10	6	6	SAA	SM	N/A	
	1654 5-10	3	6	Med. stiff, gray (5y 5/1) silt to silty clay grading to clay in last 3 inches. Moist.	CL	.5	
14				Bottom of sampling and borehole at 13.5 ft.			HNU = α = Bγ =

T.T. sampling zone

(@ 5/23/89 ~~Tripod water~~ ~~sampling zone~~ 12.5 FT

bottom of water sampling zone

NOTES:

* SAA = Same as above.

FERNALD RI/FS

Field Copy

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VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1240	COORDINATES:	DATE: 05/10/89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED:
ENGINEER/GEOLOGIST: C. Grube/L. Adams	Depth Date/Time	DATE COMPLETED:
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 1 OF

DEPTH (FT.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN.)	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	17849 1533 5-10	1	6	very stiff 10yr 5/4 yellowish brown silty clay trace gravel (surface gravel) + asphalt trace sand med plasticity, very moist.	~~30~~	3.0	HNU = 0 ppm α = 0 cpm Bγ = 60-80 cpm
1	17850 1533 5-10	3	~~13~~ 6	very stiff 10yr 5/4 yellowish brown, silty clay low plasticity trace coarse sand moist	CL	4.0	
	17851 1533 5-10	5	1	same as above	~~[illegible]~~	2.5	
2	17852 1535 5-10	3	6	stiff, 10yr 5/4 yellowish brown, silty clay, trace sand med. plasticity, moist		1.25	HNU = 0 ppm α = 0 cpm Bγ = 100-110 cpm
	17853 1535 5-10	3	2	soft same as above very moist	CL	.25	
3	17854 1535 5-10	7	0	no recovery			
	17855 1540 5-10	5	6	med. stiff 10yr 5/4 yellowish brown, silty clay, trace sand + fine gravel (gravel to .25) med. plasticity, moist	~~5~~	.5	HNU = 0 ppm α = 0 cpm Bγ = 60-80 cpm
4	17856 1540 5-10	7	6	stiff same as above	CL	1.75	
	17857 1540 5-10	8	6	5y 4-1 dk gray silty clay, low plasticity slightly moist.		3.75	
5	17858 1544 5-10	12	6	stiff (5y 4/2) olive gray silty clay, med. plasticity, moist.	CL	1.5	HNU = 0 ppm α = 0 cpm Bγ = 70-90 cpm
	17859 1544 5-10	11	6	very stiff (10yr 4/6) dark yellow brown silty clay, med-low plasticity, moist	CL	2.25	
6	17860 1544 5-10	15	6	stiff (10yr 5-4) yellowish brown silty clay, low plasticity, moist.	CL	1.0	
	17861 1615 5-10	4	6	soft 10yr 5/6 yellowish brown silty clay very moist, low plasticity	CL	.25	HNU = 0 ppm α = 0 cpm Bγ = 90-110 cpm
7	17862 1615 5-10	4	6	med. stiff same as above	CL	.5	
	17863 1615 5-10	5	3	10yr 5/4 yellowish brown clayey silt moist	ML	N/A	

NOTES: CONTRACTOR: PENN DRILL
RIG: Model 80
DRILLER: Craig Coulter
ASSISTANT: Chris Coulter
~~50695 - 50715~~ A

HNU serial # B00199

SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TES
COLORS IDENTIFIED USING MUNSELL COLOR CHART
BACKGROUND LEVELS: HNU = 0 PPM
α = 0 CPM
Bγ = 80 - 100 CPM
LEL O_2: LEL = 0 ~~PPM~~ % CB 5/10/89
O_2 = 20.6 %

FERNALD RI/FS

Field Copy

6496

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER:	COORDINATES:	DATE:
ELEVATION:	GWL: Depth Date/Time	DATE STARTED:
ENGINEER/GEOLOGIST: C. Grube/L Adams	Depth Date/Time	DATE COMPLETED:
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 2 OF

DEPTH (FT.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN.)	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
8	17864 1621 5-10	8	6	very stiff (5Y 5/1) very dk. gray clay, some gravel moist, low plasticity moist; very stiff (10yr 5/4) yellowish brown silty clay trace sand, low plas. very moist	CL	2.5	HNU = 0ppm
	17865 1621 5-10	7	6	10yr 6/6 brownish yellow silt moist.	ML	>.25 N/A	α = 0cpm BG = 80-90 cpm
9	17866 1621 5-10	9	6	10yr 4/6 Dk. yellowish brown silt trace sand to 10yr 5/4	ML	N/A	
	17867 1635 5-10	5	6	10yr 5/4 yellowish brown silty clay trace sand, fine gravel, moist, low plasticity	CL	.75	HNU = 0ppm α = 0cpm BG = 60-80cpm
10	17868 1635 5-10	3	5	5Y 4/1 dk gray to 10yr 5/6 yellowish brown silty clay, low plasticity moist	CL	.75	
	17869 1635 5-10	6	6	no recovery		.75	
Contact 11	17870 1646 5-10	9	6	med. Dense, 10yr 5/4 yellowish brown silty sand. Poorly graded, moist (very) very fine grained	SM	N/A	HNU = 0ppm α = 0cpm BG = 60-80cpm
	1646 5-10	9	6	same as above wet	SM		
12	1646 5-10	12	6	5Y 5/1 gray silt, moist (very)	ML		
	1654 5-10	4	6	10yr 5/4 yellowish brown silty sand. Poorly graded, wet loose	SM	N/A	HNU = 0ppm α = 0cpm BG = 60-80cpm
13	1654 5-10	6	6	same as above	SM		
	1654 5-10	3	6	med. stiff. 5Y 5/1 gray silt to silty clay grading to clay last 3in. moist no gravel		.5	
14				Bottom of sampling and boring 13 ft			HNU = α = BG =

NOTES:

000148

FERNALD RI/FS

PIEZOMETER INSTALLATION SHEET

PROJECT NAME FMPC RI/FS
PROJECT NO. 6112 3.7
BORING NO. 1240
PIEZOMETER NO. 1240

FIELD ENG./GEO. C. Grube/L. Adams DATE 5/11/89
CHECKED BY BV. DATE 6/6/89
DATE OF INSTALLATION 5/11/89

BOREHOLE DRILLING

DRILLING METHOD Hollow Auger - 8 in
DRILLING FLUID (S) USED:
FLUID N/A FROM — TO —
FLUID N/A FROM — TO —

TYPE OF BIT 8 in. Hollow Auger
CASING SIZE (S) USED:
SIZE N/A FROM — TO —
SIZE N/A FROM — TO —

PIEZOMETER DESCRIPTION

TYPE Monitoring Piezometer
DIAMETER OF PERFORATED SECTION 2.0 in ID
PERFORATION TYPE:
SLOTS ☒ HOLES ☐ SCREEN ☐
AVERAGE SIZE OF PERFORATIONS 0.020
TOTAL PERFORATED AREA 5.0 FT

RISER PIPE MATERIAL Schedule 40 PVC
RISER PIPE DIAMETERS:
O.D. 2 5/16 in I.D. 2.0 in
LENGTH OF PIPE SECTIONS 10 FT
JOINING METHOD screwtype, flush joint threaded

PROTECTION SYSTEM

RISER PROTECTIVE PIPE LENGTH 5.0 FT
PROTECTIVE PIPE O.D. 4 3/8 in

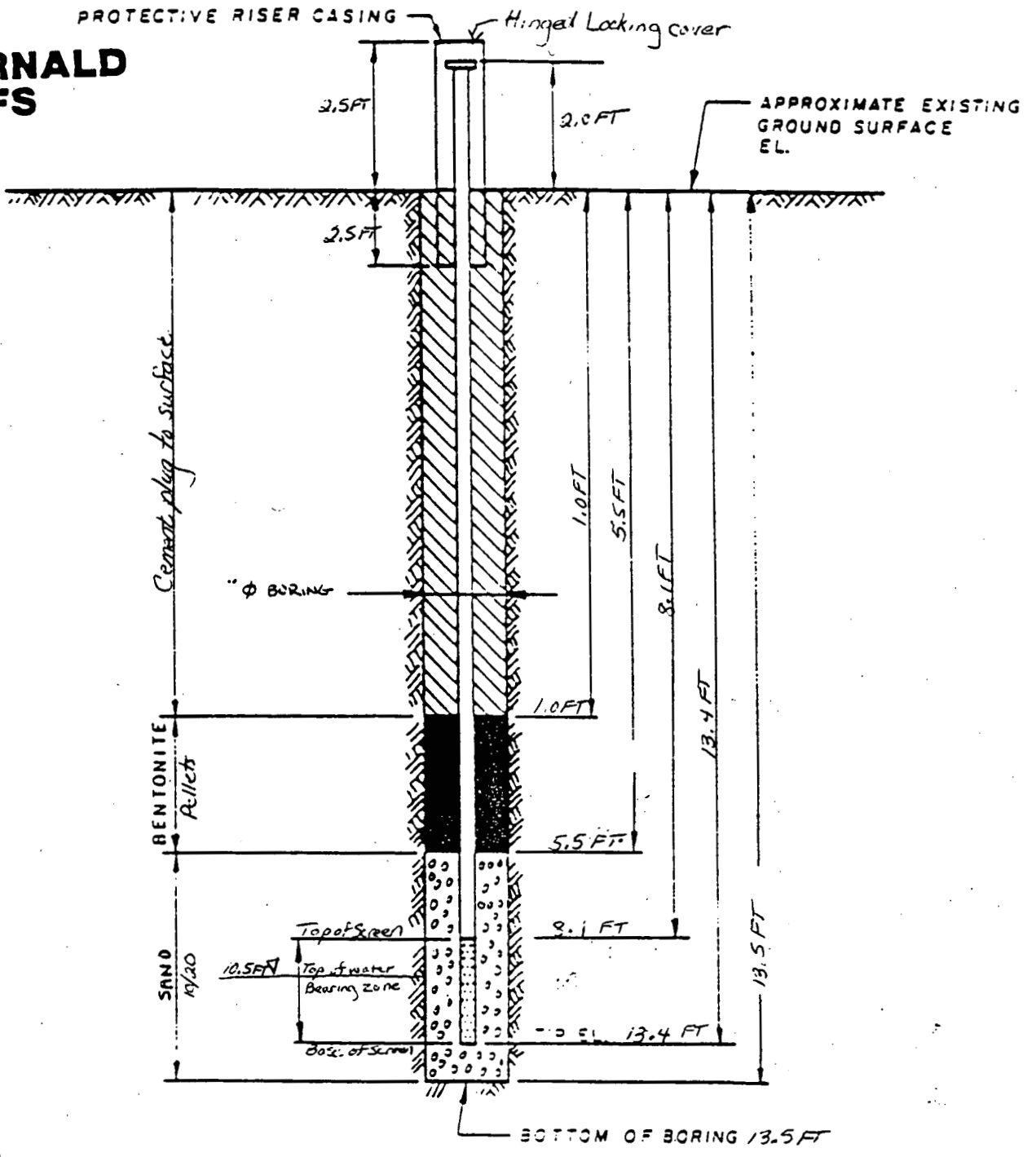
OTHER PROTECTION Hinged Cover with installed padlock

ITEM	DISTANCE ABOVE/BELOW GROUND SURFACE (FT)		ELEVATION ( )	
TOP OF RISER PIPE	2.0			
GROUND SURFACE	0.0			
BOTTOM OF PROTECTIVE PIPE	2.5			
BOREHOLE FILL MATERIALS:				
GROUT/SLURRY	TOP 0.0	BOTTOM 1.0	TOP	BOTTOM
BENTONITE	TOP 1.0	BOTTOM 5.5	TOP	BOTTOM
SAND	TOP 5.5	BOTTOM 13.5	TOP	BOTTOM
~~GRAVEL~~ N/A	TOP —	BOTTOM —	TOP	BOTTOM
PERFORATED SECTION	TOP 8.1	BOTTOM 13.4	TOP	BOTTOM
PIEZOMETER TIP	13.4			
BOTTOM OF BOREHOLE	13.5			
GWL AFTER INSTALLATION	—			

WAS THE PIEZOMETER FLUSHED AFTER INSTALLATION? YES ☐ NO ☒
WAS A SENSITIVITY TEST PERFORMED ON THE PIEZOMETER? YES ☐ NO ☒

REMARKS Top of water bearing zone at ~~12.0 FT~~ 10.5 FT (4/23/89
Bottom " " " " " 13.0 FT

FERNALD RI/FS



NOTES:

1. RISER PIPE IS 2.0 IN ID SCHEDULE PIPE, THREADED, FLUSH-JOINTED.
2. SCREEN IS 2.0 IN ID SCH. 40 PVC PIPE CONTINUOUS SLOT SCREEN (0.020 IN SLOT SIZE).
3. LOWER END OF SCREEN IS CAPPED with sediment sump
4. ELEVATION OF WATER LEVEL
5. WATER LEVEL READING ON

Materials used:
2 1/2 sks 80# 10/20 sand
2 buckets (sgal) bentonite pellets
1/2 sk cement (50#)
20 gal water

INSTALLATION DETAILS
MONITORING WELL #1240

PREPARED FOR FMPC RI/FS

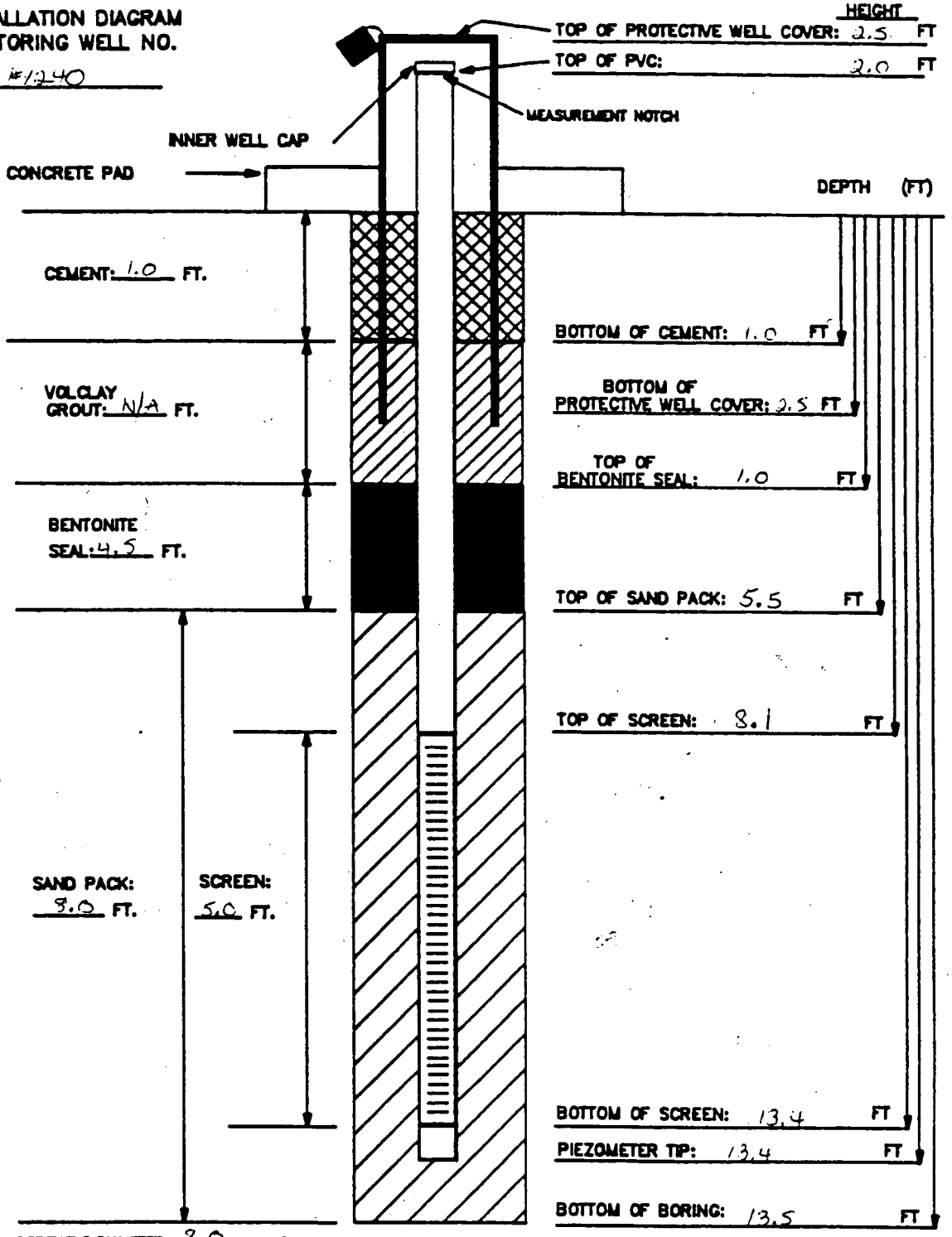
PVC well screen and Riser Pipe:
1 - .4 in long sediment sump cap
1 - 5.0 FT screened section
1 - 10.0 FT sch. 40 Riser PVC

DRAWING NUMBER Boring #1240
CHECKED BY
APPROVED BY
DRAWN BY

FERNALD RI/FS

INSTALLATION DIAGRAM
MONITORING WELL NO.
#1240

INSTALLATION DATE: 5-11-87



BOREHOLE DIAMETER: 8.0 INCHES

MATERIALS USED:

SAND TYPE AND QUANITITY: 10/20 sand 2½ sacks (80 lb)
BENTONITE PELLETS (5-GALLON BUCKETS): 2 buckets
BAGS OF VOLCLAY GROUT: N/A
AMOUNT OF CEMENT: ½ sack (50 lb)
AMOUNT OF WATER USED: 20 gal
OTHER: 5.0 FT Protective casing

NOTES:

1) RISER PIPE IS 2-INCH SCHEDULE 40 PVC PIPE, FLUSH-THREADED JOINTS.
2) SCREEN IS 2-INCH I.D. SCHEDULE 40 PVC PIPE WITH 0.020-INCH SLOTS.
3) LOWER END OF SCREEN IS CAPPED WITH AN END CAP OR THREADED SUMP.
4) WATER DEPTH/DATE:

TASK: 602 3.7

GEOLOGIST/ENGINEER: C. Grube

FERNALD RI/FS

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Date	6/6/89			
Initial	BJ			
	Field Geologist	Field Engineer	Data Review	Field Data Verification

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1199	COORDINATES:	DATE: 5-25-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5-25-89
ENGINEER/GEOLOGIST: C. Gruber	Depth Date/Time	DATE COMPLETED: 5-25-89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 1 OF 5

DEPTH (FT.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN.)	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	16947 1024 5-25	3	2	SURFACE GRAVEL WITH UNCONSOLIDATED SANDY CLAY (10yr 4/4) dark yellowish brown dry	GC	NA	HNU = 0 ppm α = 0 cpm Bγ = 8000 cpm
1	16948 1024 5-25	3	0	NR	NA	NA	
	16949 1024 5-25	4	0	NR	NA	NA	
2	16950 1028 5-25	5/1/89 6	6	SANDY CLAY w/ TRACE SILT (10yr 5/4) yellowish brown, low plasticity, moist, TRACE SURFACE GRAVEL	CL	.75	HNU = 0 ppm α = 0 cpm Bγ = 700 cpm
	16951 1028 5-25	7	6	SAA	CL	.75	
3	16952 1028 NR	9	0	NR	NA	NA	
	16953 1033 5-25	9	6	SOFT SAA (2.0 to 2.5 ft) 6/1/89	CL	.25	HNU = 0 ppm Alpha mete α = UK not functio Bγ = 900 cpm
4	16954 1033 5-25	6	6	Very Stiff (2.5y 4/2) Dark greyish brown, silty clay trace sand, low plasticity, moist	CL	2.25	
	16955 1033 5-25	8	6	Medium Stiff (2.5y, 4/2) Dark greyish brown, silty clay, trace sand. medium plastic, moist.	CL	1.0	
5	16956 1040 5-25	10	6	(2.5y 4/4) OLIVE BROWN SILTY CLAY w/ TRACE SAND. MED PLASTIC, MOIST, MED STIFF	CL	.75	HNU = 0 ppm α = UK Bγ = 160-200 cpm
	16957 1040 5-25	6	5	MED STIFF, SAA	CL	.75	
6	16958 1040 NR	7	0	NR	NA	NA	
	16959 1056 NR	4	0	NR	N/A	N/A	HNU = α = Bγ =
7	16960 1056 NR	3	0	NR	N/A	N/A	
	16961 1056 NR	4	0	NR	N/A	N/A	

NOTES: CONTRACTOR: PENNDRILL
RIG: Model 80
DRILLER: Dave Newman
ASSISTANT: Chris Coulter
Geo Assistant - Cindy Melray

SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TES
COLORS IDENTIFIED USING MUNSELL COLOR CHART
BACKGROUND LEVELS: HNU = 0 PPM
α = 0 CPM
Bγ = 100-140 CPM
LEL = 0% ~~PPM~~ 6/6/89
O_2 = 20.6 %

SAA = Same As Above
NR = No Recovery
UK = Unknown

HNU # 00002

Note: Alphameter stopped functioning after second sample because it peaked

UK = UNKNOWN

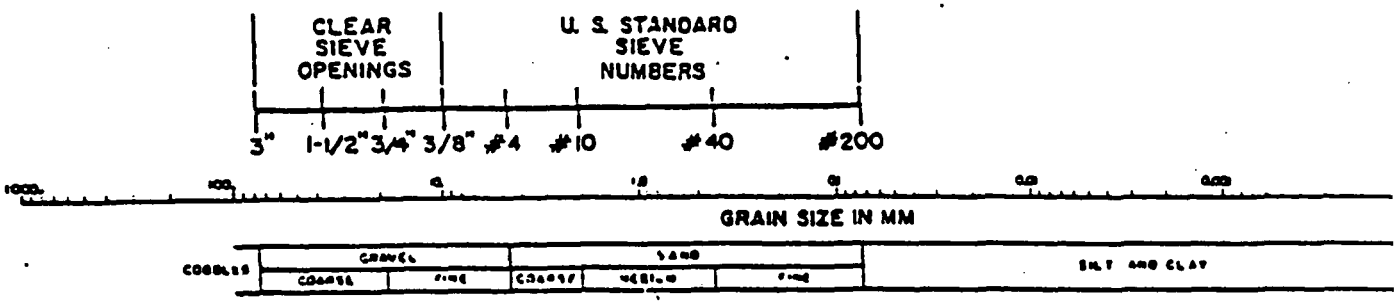
CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE (1)
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

(1) STANDARD PENETRATION RESISTANCE IS THE NUMBER C BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLI FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN INCHES AND THE NUMBER OF BLOWS RECORDED FOR SA 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANC



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

FINE-GRAINED/HIGHLY ORGANIC SO

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS ROCK FLOUR, SILTY OR CLAYEY FINE SAN OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTIC GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACE FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTI ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTE

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FERNALD RI/FS

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1199	COORDINATES:	DATE: 5/25/89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5/25/89
ENGINEER/GEOLOGIST: C Grube	Depth Date/Time	DATE COMPLETED: 5/25/89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 2 OF 5

DEPTH (FT.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN.)	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
8	16962 1059 5-25	5	6	medium stiff (5Y 5/2) olive gray to (10YR 5/6) yellowish brown silty mottled clay, trace sand, medium plastic, moist	CL	.75	Hnu = 0 ppm α = UK cpm Bγ = 300-320 cpm
	16963 1059 5-25	4	6	stiff, SAA	CL	1.75	
9	16964 1059 5-25	4	2	very stiff, (5Y 5/2) olive gray to (10YR 5/6) yellowish brown, mottled silty clay, some sand, low plasticity moist	CL	3.0	
	16965 1114 5-25	4	6	Loose, (10yr 5/4) yellowish brown clayey silt, moist	ML	N/A	Hnu = 0 ppm α = UK Bγ = 360-380 cpm
10	16966 1114 5-25	4	2	Loose (5y 4/2) Light olive grey, silt some sand, very moist	ML	N/A	
	16967 1114 5-25	4	0	NR	N/A	N/A	
11	16968 1125 5-25	4	6	(10yr 5/6) yellowish brown sandy silt very moist, medium dense	ML	NA	Hnu = 0 ppm α = UK Bγ = 170→200 cpm
	52055 1125 5-25	5	6	STIFF (10yr 5/4) yellowish brown to (5y 6/1) LIGHT GREY, VERY SILTY CLAY TRACE SAND & FINE GRAVEL MOIST	CL	1.5	
12.0 FT 12	52056 1125 5-25	7	5 24 89 CAM 3	(2.5y, 5/2) greyish brown sandy silt moist to very moist, medium dense	ML	NA	
	52057 1130 5-25	6	6	(2.5y, 5/2) greyish brown, clayey silt some SAND, very moist, medium dense	ML	NA	Hnu = 0 ppm α = UK Bγ = 100→140 cpm
13	52058 1130 5-25	4	6	(10yr 5/3) BROWN, clayey silt, medium dense, WET	ML	NA	⇐ WET
	52059 1130 5-25	9	5 24 89 CAM 6	(10yr 5/6) yellowish brown, silty sand, poorly graded very moist, medium dense (10yr 5/3) brown to (5y 5/1) gray clayey silt some SAND, WET, medium dense	SM ML	NA	⇐ WET
14	52060 1356 5-25	4	6	(10yr 5/3) Brown, clayey gravel, wet, medium dense	GC	NA	Hnu = 0 ppm α = UK ⇐ WET Bγ = 100-140 cpm
	52061 1356 5-25	5	6	(10yr, 5/6) yellowish brown, silty sand, wet, medium dense	SM	NA	⇐ WET
	52062 1356 5-25	8	6	(2.5y 5/2) greyish brown, wet, silt medium dense	ML	NA	⇐ WET

NOTES:

000154

FERNALD RI/FS

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1199	COORDINATES:	DATE: 5-25-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5-25-89
ENGINEER/GEOLOGIST: C. Grube	Depth Date/Time	DATE COMPLETED: 5-25-89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 3 OF 5

DEPTH ( )	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER ( )	RECOVERY ( )	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	52063 1410 5-25	10	6	(2.5y, 3/2) very dark greyish brown sandy clay, trace fine gravel, stiff, moist	CL	1.25	Hnu = 0 ppm α = uk Bγ = 500 cpm
16	52064 1410 5-25	13	6	(2.5y, 4/4) olive brown clayey gravel some sand, wet, medium dense	GC	NA	⇐ WET
	52065 1410 5-25	15	6	(5y, 4/3) olive sandy silt, wet, medium dense	ML	NA	⇐ WET
Water 17.0 FT 17	52066 1428 5-25	12	6	(2.5y, 4/4) olive brown clayey gravel wet, medium dense	GC	NA	Hnu = 0 ppm α = uk ⇐ WET
	52067 1428 5-25	15	6	(2.5y, 5/4) Light olive brown silty clay trace sand, low plasticity, moist, stiff	CL	1.0	Bγ = 100-140 cpm
18	52068 1428 5-25	15	6	(2.5y 5/2) grayish brown sandy silt WET, medium dense	ML	NA	⇐ WET
				Bottom of boring and sampling at 18.0 FT			Hnu = α = Bγ =
19							
20							Hnu = α = Bγ =

NOTES:

FERNALD RI/FS

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PIEZOMETER INSTALLATION SHEET

PROJECT NAME FMPC RI/FS FIELD ENG./GEO. C. Grube DATE 5-25-89
PROJECT NO. 602 3.7 CHECKED BY RN DATE 6/6/89
BORING NO. 1199
PIEZOMETER NO. 1199 DATE OF INSTALLATION

BOREHOLE DRILLING

DRILLING METHOD 8 in Hollow Stem Auger	TYPE OF BIT 8 in Hollow Auger
DRILLING FLUID (S) USED:	CASING SIZE (S) USED:
FLUID N/A FROM — TO —	SIZE N/A FROM — TO —
FLUID N/A FROM — TO —	SIZE N/A FROM — TO —

PIEZOMETER DESCRIPTION

TYPE Monitoring piezometer	RISER PIPE MATERIAL Schedule 40 pvc
DIAMETER OF PERFORATED SECTION 2.0 in ID	RISER PIPE DIAMETERS:
PERFORATION TYPE:	O.D. 2 5/16 in I.D. 2.0 in
SLOTS [X] HOLES [ ] SCREEN [ ]	LENGTH OF PIPE SECTIONS 10.0 FT
AVERAGE SIZE OF PERFORATIONS 0.020 in	JOINING METHOD Screw type, flush threaded joint
TOTAL PERFORATED AREA 10.0 FT	

PROTECTION SYSTEM

RISER PROTECTIVE PIPE LENGTH 5.0 FT	OTHER PROTECTION Hinged cover with installed padlock
PROTECTIVE PIPE O.D. 4 3/8 in	

ITEM	DISTANCE ABOVE/BELOW GROUND SURFACE (FT)		ELEVATION ( )	
TOP OF RISER PIPE	2.0			
GROUND SURFACE	0.0			
BOTTOM OF PROTECTIVE PIPE	2.7			
BOREHOLE FILL MATERIALS:				
~~GROUT/SLURRY~~ cement	TOP 0.0	BOTTOM 1.0	TOP	BOTTOM
BENTONITE	TOP 1.0	BOTTOM 4.0	TOP	BOTTOM
SAND	TOP 4.0	BOTTOM 18.0	TOP	BOTTOM
GRAVEL	TOP —	BOTTOM —	TOP	BOTTOM
PERFORATED SECTION	TOP 8.0	BOTTOM 18.0	TOP	BOTTOM
PIEZOMETER TIP	18.00			
BOTTOM OF BOREHOLE	18.0			
GWL AFTER INSTALLATION	—			

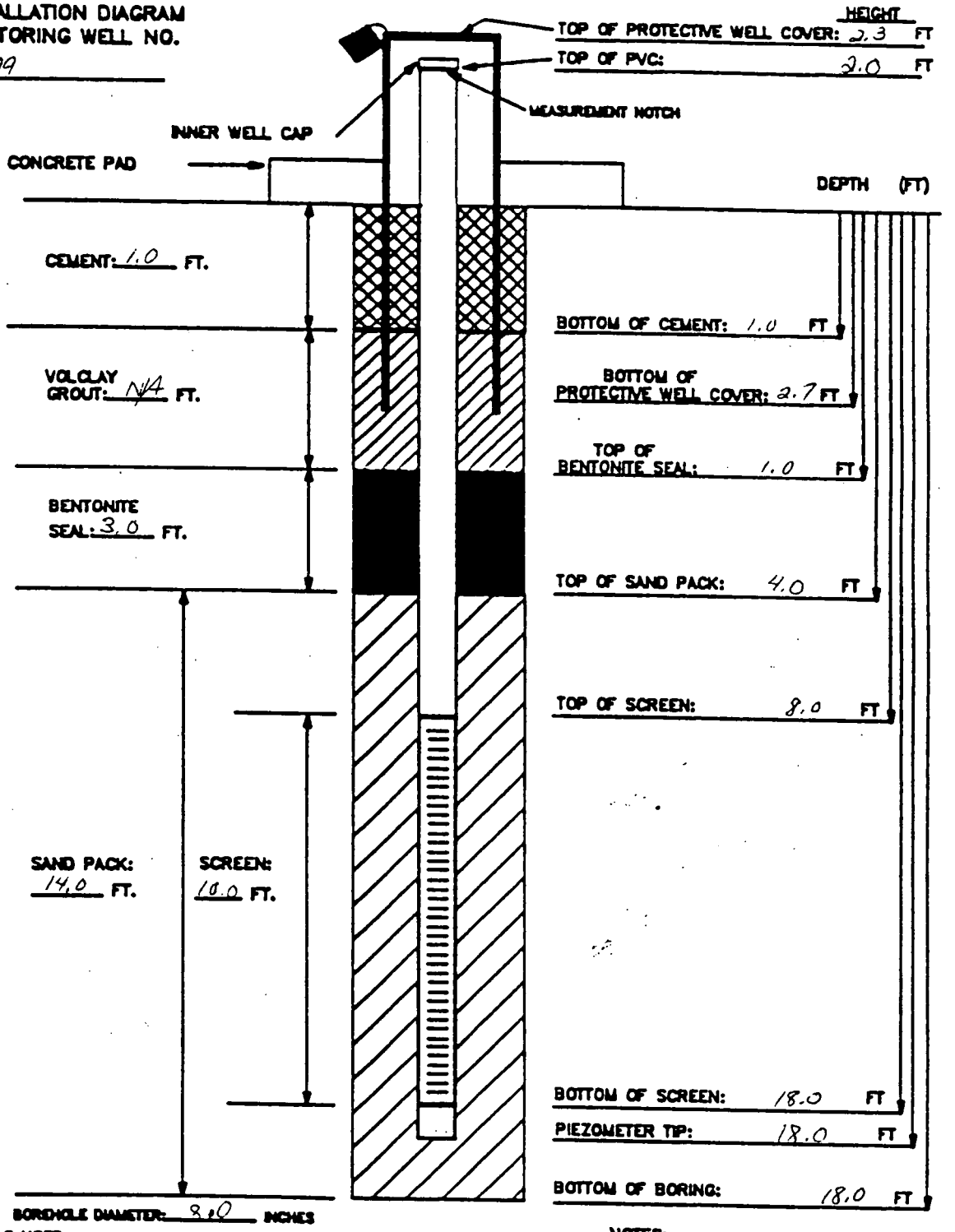
WAS THE PIEZOMETER FLUSHED AFTER INSTALLATION? YES [ ] NO [X]
WAS A SENSITIVITY TEST PERFORMED ON THE PIEZOMETER? YES [ ] NO [X]
REMARKS Top of water bearing zone at 12.0 FT
Bottom of water bearing zone at 17.0 FT

000156

FERNALD RI/FS

INSTALLATION DIAGRAM
MONITORING WELL NO.
#1199

INSTALLATION DATE: 5-25-89



BOREHOLE DIAMETER: 8.0 INCHES

MATERIALS USED:

SAND TYPE AND QUANTITY: 3 80lb sacks of 10/20 sand
BENTONITE PELLETS (5-GALLON BUCKETS): 1 1/2 buckets
BAGS OF VOLCLAY GROUT: N/A
AMOUNT OF CEMENT: 1/2 Sack (94lb)
AMOUNT OF WATER USED: 20 gal.
OTHER: 5.0 FT Protective casing

NOTES:

1) RISER PIPE IS 2-INCH SCHEDULE 40 PVC PIPE, FLUSH-THREADED JOINTS.
2) SCREEN IS 2-INCH I.D. SCHEDULE 40 PVC PIPE WITH 0.020-INCH SLOTS.
3) LOWER END OF SCREEN IS CAPPED WITH AN END CAP OR THREADED SUMP.
4) WATER DEPTH/DATE:

TASK: 6023.7

GEOLOGIST/ENGINEER: C. Grube

FERNALD RI/FS

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Date				
Initial				
	Field Check	1st Key In	2nd Key In	Hard Copy Verification

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1202	COORDINATES:	DATE: 5-22-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5-22-89
ENGINEER/GEOLOGIST: C. Grube/C. Melroy	Depth Date/Time	DATE COMPLETED: 5-22-89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 1 OF 5

DEPTH (FT.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN.)	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	17013 1227 5-22	9	6	Surface gravel, brown (10 YR 5/3), some sand, dry	GC	N/A	Total of 3 pages with field copies enclosed. CB 1/25/89 HNU = 0 ppm α = 0 cpm Bγ = 200-300 cpm
1	17014 1227 5-22	4	6	SAA	GC	N/A	
	17015 1227 5-22	5	2	Very stiff, dark grayish brown (2.5 Y 4/2) clay, trace fine gravel, low plasticity, moist	CL	2.5	
2	17016 1234 5-22	8	5	Very stiff, yellowish brown (10 YR 5/4) clay, trace fine gravel, trace sand, low plasticity, moist	CL	2.25	HNU = 0 ppm α = 0 cpm Bγ = 80-100 cpm
	17017 1234 5-22	5	0	NR	N/A	N/A	
3	17018 1234 5-22	3	0	NR	N/A	N/A	
	17019 1237 5-22	12	4	Medium stiff, dark gray (5 Y 4/1) silty clay, trace sand, low plasticity, moist	CL	1.0	HNU = 0 ppm α = 0 cpm Bγ = 80-100 cpm
4	17020 1237 5-22	11	0	NR	N/A	N/A	
	17021 1237 5-22	14	0	NR	N/A	N/A	
	17022 1255 5-22	12	6	Medium stiff, brown (10 YR 5/3) Gravelly Clay, trace sand, low plasticity, dry	CL	.75	HNU = 0 ppm α = 0 cpm Bγ = 60-80 cpm
5	17023 1255 5-22	11	6	Very stiff, dark gray (5 Y 4/1) clay, trace silt, medium plasticity, moist	CL	2.25	
6	17024 1255 5-22	11	2	SAA	CL	2.0	
	17025 1322 5-22	5	6	Stiff, olive gray, (5 Y 4/2) Clay, medium plasticity, moist			HNU = 0 ppm α = 0 cpm Bγ = 100-120 cpm
				Gravel with brown (10 YR 5/3) Clay	~~CL~~ GC	1.5	
7	17026 1322 5-22	4	6	SAA	CL	1.5	
	17027 1322 5-22	6	1	SAA	CL	1.0	

NOTES: CONTRACTOR: PENN DRILL
RIG: Model 80
DRILLER: Craig Coulter
ASSISTANT: Chris Coulter
SAA = Same As Above
NR = No Recovery
HNU Serial # 1201 10

SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST
COLORS IDENTIFIED USING MUNSELL COLOR CHART
BACKGROUND LEVELS: HNU = 0 PPM
α : 0 CPM
Bγ : 60-100 CPM
LEL/O2: LEL = 0% ~~PPM~~ CB 5/22/89
O2 = 20.6 %

* Sample numbers were changed from 11.0 FT to 16.5 FT due to numbering system update on 5-25-89

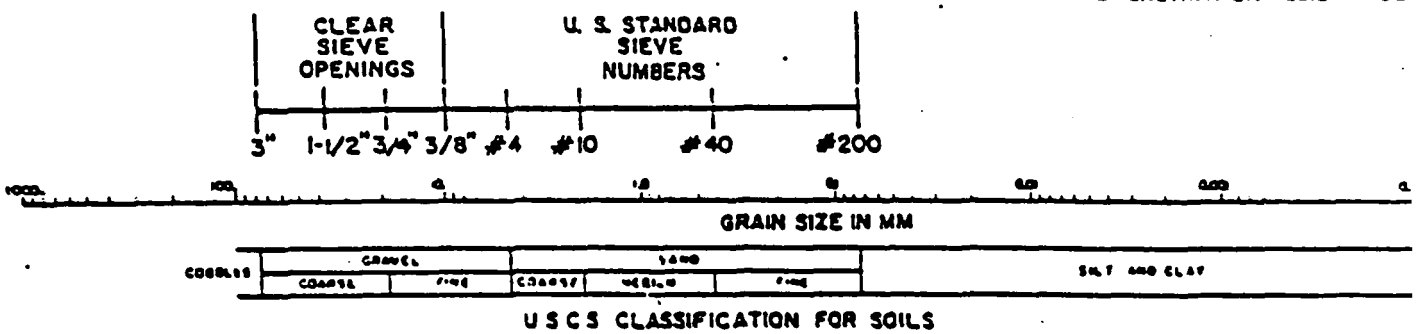
CONSISTENCY OF CO. .SIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE(1)
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

(1) STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 18 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANCE.



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

FINE-GRAINED/HIGHLY ORGANIC SO

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENT

FERNALD RI/FS

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1202	COORDINATES:	DATE: 5-22-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5-22-89
ENGINEER/GEOLOGIST: C. Grube/C. Melroy	Depth Date/Time	DATE COMPLETED:
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 2 OF 5

DEPTH (FT.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN.)	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
8	17028 1326 5-22	5	6	Loose clayey gravel, trace sand and silt, dry	GC	N/A	HNU = 0 ppm
				Stiff, dark gray, (5Y 4/1) clay, mottled, medium plasticity, moist	CL	1.0	α = 0 cpm
	17029 1326 5-22	6	6	SAA	CL	1.0	Bγ = 100-120 cpm
9	17030 1326 5-22	4	2	SAA	CL	1.0	
	17031 1330 5-22	6	6	Stiff, light olive brown (2.5Y 5/4) silty clay, medium plasticity, moist	CL	1.25	HNU = 0 ppm
				Gravel with clay (9.3 FT - 9.5 FT)	GC	N/A	α = 0 cpm
10	17032 1330 5-22	7	6	Stiff, grayish brown (2.5Y 5/2) silty clay, trace sand, medium plasticity, moist	CL	1.25	Bγ = 100-120 cpm
	17033 1330 5-22	4	0	NR	N/A	N/A	
11	17034 1351 5-22	5	6	Stiff, gray, (5Y 5/1) silty clay, trace sand, trace med. gravel, medium plasticity, moist	CL	1.0	HNU = 0 ppm
	~~50807~~ 1351 5-22	52095 5/25/89 2	6	SAA	CL	1.0	α = 0 cpm
				Stiff, yellowish brown (10YR 5/4) silty clay, low plasticity, moist	CL	1.0	Bγ = 110-130 cpm
12	~~50810~~ 1351 5-22	52096 5/25/89 3	3	SAA	CL	2.5	
	~~50811~~ 1355 5-22	52097 5/25/89 6	6	Medium stiff, dark gray (5Y 4/1) sandy clay, trace med. to fine gravel, medium plasticity, moist	CL	.75	HNU = 0 ppm
13	~~50812~~ 1355 5-22	52098 5/25/89 4	6	Very stiff, gray (5Y 5/2) silty clay, trace sand, low plasticity, moist	CL	3.5	α = 0 cpm
	~~50813~~ 1355 5-22	52099 5/25/89 3	6	SAA	CL	1.25	Bγ = 80-100 cpm
▽ Top of water				Loose, yellowish brown (10YR 5/4) silty sand, very moist	SM	N/A	
Bearing Zone 13.5 14	~~50814~~ 1403 5-22	52100 7	6	Medium Dense, olive gray (5Y 5/2), clayey silt, some sand, trace fine gravel, wet	ML	N/A	HNU = 0 ppm
	~~50815~~ 1403 5-22	52101 8	6	Medium Dense, yellowish brown (10YR 5/6) silty sand, wet	SM	N/A	α = 0 cpm
Bottom of water 15.0	~~50816~~ 1403 5-22	52102 11	6	medium Dense, olive (5Y 5/3) silt, very, very moist	ML	N/A	Bγ = 140-160 cpm

Bearing zone NOTES:

SAA = Same As Above
NR = No Recovery

FERNALD RI/FS

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1202	COORDINATES:	DATE: 5/22/89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5/22/89
ENGINEER/GEOLOGIST: C. Grube/C. Melroy	Depth Date/Time	DATE COMPLETED: 5/22/89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 3 OF 5

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN.)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	~~50917~~ 1423 05-22	52103 3	6	Stiff, dark grayish brown (2.5Y 4/2) Sandy Clay, trace silt, trace gravel, low plasticity, very moist	CL	1.5	HNU = 0 ppm α = 0 cpm Bγ = 100-140 cpm
	~~50915~~ 1423 5-22	52104 3	6	SAA	CL	1.75	
16	~~50919~~ 1423 5-22	52105 4	1	Very stiff, dk. grayish brown (2.5Y 4/2) silty clay, low plasticity, moist	CL	2.25	
				Bottom of Boring and Sampling at 16.5 FT			HNU = α = Bγ =
17							
18							HNU = α = Bγ =
19							
20							HNU = α = Bγ =

NOTES:

SAA = Same As Above
NR = No Recovery

FERNALD RI/FS

Field Copy

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VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1202	COORDINATES:	DATE: 5-22-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5-22-89
ENGINEER/GEOLOGIST: C. Grube / C. Melray	Depth Date/Time	DATE COMPLETED:
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 1 OF 5

DEPTH (FT.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN.)	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	17013 1227 5-22	9	6	Surface gravel, some clay, (10 YR 5/3), brown, some sand, dry	GC	N/A	HNU = 0 α = 0 Bγ = 200-300
1	17014 1227 5-22	4	6	SAA	GC	N/A	
	17015 1227 5-22	5	2	Very stiff (2.5 4/2), clay, trace fine gravel, low plasticity, moist	CL	2.5	
2	17016 1234 5-22	8	5	Very stiff yellowish brown (10 YR 5/4) clay, trace fine gravel & sand, low plasticity moist	CL	2.25	HNU = 0 α = 0 Bγ = 80-100
	17017 1234 5-22	5	0 NR	NR	N/A	N/A	
3	17018 1234 5-22	3	0 NR	NR	N/A	N/A	
	17019 1237 5-22	12	4	Medium stiff dk gray (5Y 4/1) silty clay, trace sand, low plasticity, moist	CL	1.0	HNU = 0 α = 0 Bγ = 80-100
4	17020 1237 5-22	11	0	NR	N/A	N/A	
	17021 1237 5-22	14	0	NR	N/A	N/A	
5	17022 1255 5-22	12	6	med stiff (brown 10 YR 5/3) Gravelly clay, trace sand, low plasticity dry	CL	.75	HNU = 0 α = 0 Bγ = 60-80
	17023 1255 5-22	11	6	Very stiff dk gray (5Y 4/1), Clay trace silt, medium plasticity, moist	CL	2.25	4.5-5.0 FT 300-400 cpm
6	17024 1255 5-22	11	2	SAA	CL	2.0	
	17025 1322 5-22	5	6	Olive gray (5Y 4/2) CLAY, med plasticity, moist / Gravel w/ clay	CL	1.5	HNU = 0 α = [illegible] Bγ = 100-120
7	17026 1322 5-22	4	6	SAA	CL	1.5	
	17027 1322 5-22	6	1	SAA	CL	1.0	

NOTES: CONTRACTOR: PENN DRILL
RIG: Model 80
DRILLER: Craig Coulter
ASSISTANT: Chris Coulter

SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST
COLORS IDENTIFIED USING MUNSELL COLOR CHART
BACKGROUND LEVELS: HNU = 0 PPM
α = 0 CPM
Bγ = 60-~~80~~ 100 CPM 5/22/89
LEL O2: LEL = 0% ~~PPM~~ 5/22/89
O2 = 20.6%

HNU serial # 1201 10

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FERNALD RI/FS

Field Copy

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1202	COORDINATES:	DATE: 5-22-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5-22-89
ENGINEER/GEOLOGIST: C. Grube/C. McIrou	Depth Date/Time	DATE COMPLETED:
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 2 ~~2~~ ~~3~~ OF 5

DEPTH (FT.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN.)	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
8	17028 1326 5-22	5	6	Clayey gravel, trace sand dry 5Y 4/1 med. plast. moist clay, mottled	~~CL~~ CL	1.0	HNU = 0 α = 0 Bγ = 100-120
	17029 1326 5-22	6	6	SAA	CL	1.0	
9	17030 1326 5-22	4	2	SAA	CL	1.0	
	17031 1330 5-22	6	6	plasticity moist 2.5Y 5/4, silty clay, med Gravel w/ clay 2.0 in.	CL	1.25	HNU = 0 α = 0 Bγ = 100-120
10	17032 1330 5-22	7	6	(2.5Y 5/2) silty clay, trace sand, med plasticity, moist	CL	1.25	
	17033 1330 5-22	4	0	NR	N/A	N/A	
11	17034 1351 5-22	5	6	15Y 5/1 silty clay trace sand, plast. moist trace med gravel	CL	1.0	HNU = 0 α = 0 Bγ = 110-130
	50809 1351 5-22	2	6	SAA (10YR 5/4) silty clay, moist low plasticity	CL	1.0	
12	50810 1351 5-22	3	3	SAA	CL	2.5	
	50811 1355 5-22	6	6	(5Y 4/1) sandy clay trace med to fine gravel, [illegible]	CL	.75	HNU = 0 α = 0 Bγ = 80-100
13	50812 1355 5-22	4	6	5Y 5/2 silty clay trace [illegible] plast moist	CL	.5	
13.5 FT	50813 1355 5-22	3	6	SAA 10YR 5/4 silty sand, very moist	CL	1.25	
14	50814 1403 5-22	7	6	(5Y 5/2) clay silt [illegible] sand trace fine gravel moist	ML	N/A	HNU = 0 α = 0 Bγ = 140-160
	50815 1403 5-22	8	6	10YR 5/6 silty sand	SM	N/A	
	50816 1403 5-22	11	6	5Y 5/3 silt very very moist	ML	N/A	

Top of water bearing zone

Bottom of water bearing zone 15.0 FT

NOTES:

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FERNALD RI/FS

Field Copy

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VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER:	COORDINATES:	DATE:
ELEVATION:	GWL: Depth Date/Time	DATE STARTED:
ENGINEER/GEOLOGIST: C. Grube	Depth Date/Time	DATE COMPLETED:
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 3 OF 5

DEPTH ( )	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER ( )	RECOVERY ( )	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	50817 1423	3	6	2.5 4/2 sandy clay ~~Trace~~ Silt & gravel very moist	CL	1.5	HNU = 0 α = 0 Bγ = 100-140
	50818 1423	3	6	SAA	CL	1.75	
16	50817 1423	4	1	SAME 6 br AA ~~SAA~~ silty clay moist low plast.	CL	2.25	
				Bottom of Boring & Sampling at 16.5 FT			HNU = α = Bγ =
17							
18							HNU = α = Bγ =
19							
20							HNU = α = Bγ =

NOTES:

FERNALD RI/FS

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PIEZOMETER INSTALLATION SHEET

PROJECT NAME FMPC RI/FS FIELD ENG./GEO. C. Gabe DATE 5-22-89
PROJECT NO. 6037 CHECKED BY DL DATE 6/5/89
BORING NO. 1202
PIEZOMETER NO. 1202 DATE OF INSTALLATION 5-22-89

BOREHOLE DRILLING

DRILLING METHOD Hollow Stem Auger - 8 in	TYPE OF BIT 8 in Hollow Stem Auger
DRILLING FLUID (S) USED:	CASING SIZE (S) USED:
FLUID N/A FROM — TO —	SIZE N/A FROM — TO —
FLUID N/A FROM — TO —	SIZE N/A FROM — TO —

PIEZOMETER DESCRIPTION

TYPE Monitoring piezometer	RISER PIPE MATERIAL Schedule 40 PVC
DIAMETER OF PERFORATED SECTION 2.0 in ID	RISER PIPE DIAMETERS:
PERFORATION TYPE:	O.D. 2 5/16 in I.D. 2.0 in
SLOTS ☒ HOLES ☐ SCREEN ☐	LENGTH OF PIPE SECTIONS 8.5 ~~10~~ FT (DL 5-22-89)
AVERAGE SIZE OF PERFORATIONS 0.020 in	JOINING METHOD Screw type, joint threaded - flush
TOTAL PERFORATED AREA 10.0 FT	

PROTECTION SYSTEM

RISER PROTECTIVE PIPE LENGTH 5.0 FT	OTHER PROTECTION Hinged cover with installed padlock
PROTECTIVE PIPE O.D. 4 3/8 in	

ITEM	DISTANCE ABOVE/BELOW GROUND SURFACE (FT)		ELEVATION ( )	
TOP OF RISER PIPE	2.0			
GROUND SURFACE	0.0			
BOTTOM OF PROTECTIVE PIPE	2.6			
BOREHOLE FILL MATERIALS:				
~~GROUT/SLURRY~~ Cement	TOP 0.0	BOTTOM 1.0	TOP	BOTTOM
BENTONITE	TOP 1.0	BOTTOM 4.0	TOP	BOTTOM
SAND	TOP 4.0	BOTTOM 16.5	TOP	BOTTOM
~~GRAVEL~~	TOP —	BOTTOM —	TOP	BOTTOM
PERFORATED SECTION	TOP 16.5	BOTTOM ~~16.5~~ 16.0 (DL 5/22/89)	TOP	BOTTOM
PIEZOMETER TIP	~~16.5 FT~~ 16.0 FT (DL 5/22/89)			
BOTTOM OF BOREHOLE	16.5 FT			
GWL AFTER INSTALLATION	—			

WAS THE PIEZOMETER FLUSHED AFTER INSTALLATION? YES ☐ NO ☒
WAS A SENSITIVITY TEST PERFORMED ON THE PIEZOMETER? YES ☐ NO ☒

REMARKS Top of water bearing zone at 13.5 FT
Bottom of water bearing zone at 15.0 FT

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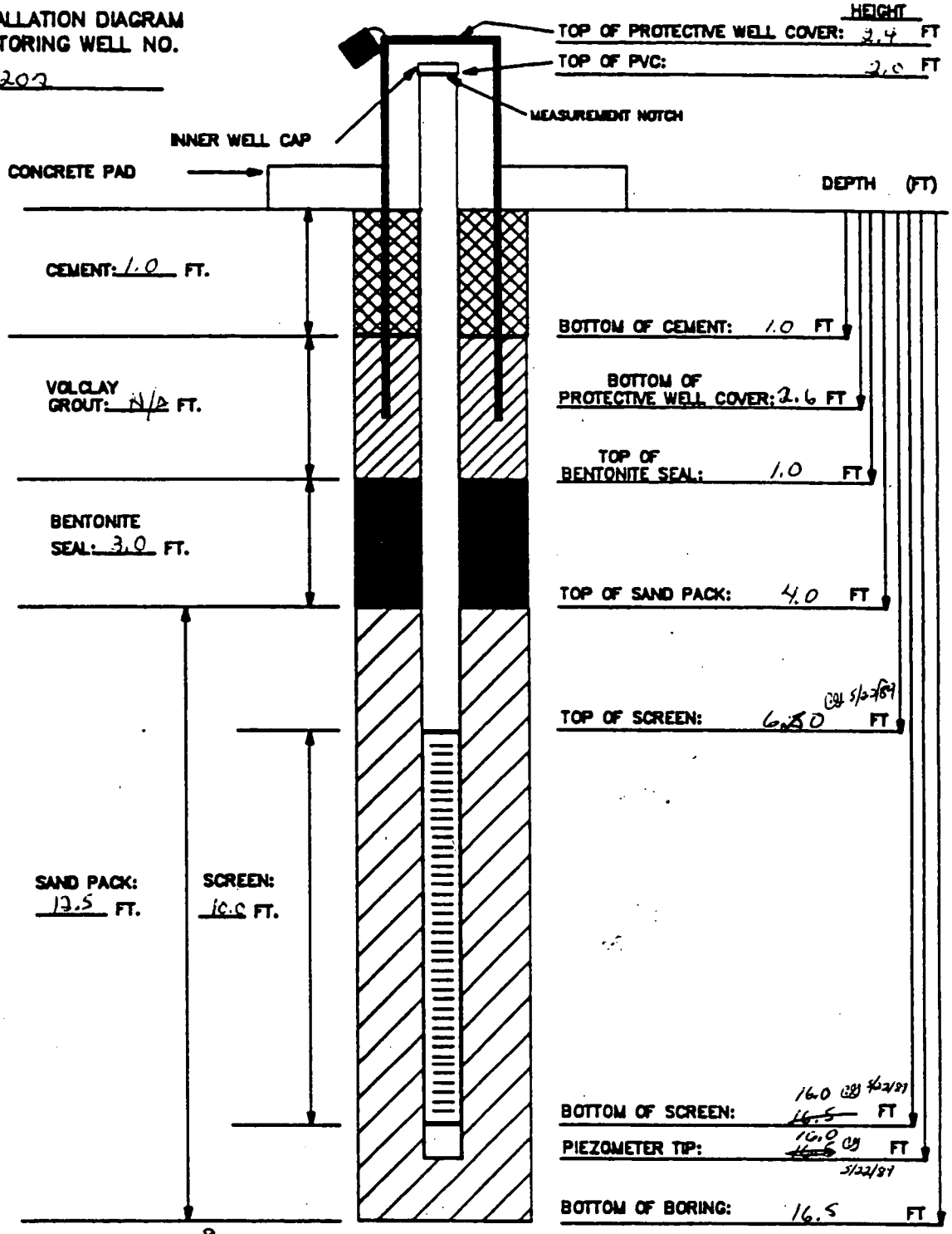
409-...36

INSTALLATION DATE: 05-22-89

FERNALD RI/FS

INSTALLATION DIAGRAM
MONITORING WELL NO.
1202



BOREHOLE DIAMETER: 8 INCHES

MATERIALS USED:
SAND TYPE AND QUANITITY: 10/20 sand - 2 sks (90#)
BENTONITE PELLETS (5-GALLON BUCKETS): 1 1/2 buckets
BAGS OF VOLCLAY GROUT: N/A
AMOUNT OF CEMENT: 1/2 sk (50#)
AMOUNT OF WATER USED: -
OTHER: 5FT Protect casing

NOTES:
1) RISER PIPE IS 2-INCH SCHEDULE 40 PVC PIPE, FLUSH-THREADED JOINTS.
2) SCREEN IS 2-INCH I.D. SCHEDULE 40 PVC PIPE WITH 0.020-INCH SLOTS.
3) LOWER END OF SCREEN IS CAPPED WITH AN END CAP OR THREADED SUMP.
4) WATER DEPTH/DATE:

TASK: 602 3.7

GEOLOGIST/ENGINEER: C. Grube

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Date				
Initial				
	Field Check	1st Key In	2nd Key In	Hard Copy Verification

FERNALD RI/FS

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7.1	PROJECT NAME: Facilities Testing	
BORING NUMBER: 1220	COORDINATES:	DATE: 5/25/89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5/25/89
ENGINEER/GEOLOGIST: L. Sixfield	Depth Date/Time	DATE COMPLETED:
DRILLING METHODS: B-45 Rig: Hollow Stem Auger with Split Spoon Sampler		PAGE 1 OF 5

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER 6 (IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
				Gravel at Surface			START = 1030
0.5	17409 WMCO	4	12in	Loose, to Medium Dense, Gravel, Massive, dry	GW	N/A	HNU = Ø ppm α = 60-80 cpm Bγ = 1,500-1,800 cpm
1.0	17410	16					
1.5	17411 NR	15		@ 1035			
2.0	17412	4	6in	Stiff to Very Stiff, Very Dark Grayish Brown (2.5Y, 3/2) Lean Clay with Gravel, dry massive, medium plastic	CL	1.7 ↓ 2.2	HNU = Ø ppm α = 140-200 cpm Bγ = 260-380 cpm
2.5	17413 NR	5					
3.0	17414 NR	8		@ 1040			
3.5	17415	6	12in	Soft, Very dark grayish Brown (2.5Y, 3/2) Lean Clay, dry, massive 3.5ft	CL	<0.5	HNU = Ø ppm α = 10 cpm Bγ = 380-460 cpm
4.0	17416	13		Medium Dense, Silty Gravelly Sand, dry, massive.	SM	N/A	
4.5	17417 NR	15		@ 1045			
5.0	17418	10	12in	Medium Dense, Silty Sandy Gravel, becomes wet at Base, massive	GM	N/A	HNU = Ø ppm α = 20-40 cpm Bγ = 400-460 cpm
5.5	17419	10					
6.0	17420 NR	9		@ 1050			
6.5	17421	7	12in	Medium Dense to Loose, Silty Sandy Gravel, wet, massive Grades to Sand at Base	GM	N/A	HNU = Ø ppm α = Ø cpm Bγ = 380-420 cpm
7.0	17422	7					
7.5	17423 NR	8		@ 1055			

NOTES:
Contractor: Penn Drill
Driller: D. Newman
Helper: B. Anderson
Weather: Cloudy-Humid
HNU = B00221
NR = No Recovery, No Sample Taken

Background @ 1030
air Bγ = 200-240 cpm
air α = Ø cpm
HNU = Ø ppm
gnd Bγ = 200-900 cpm
~~gnd α(gnd) 60 cpm~~ 5-25-89
α(gnd) 180-260 cpm

402-11-86

000167

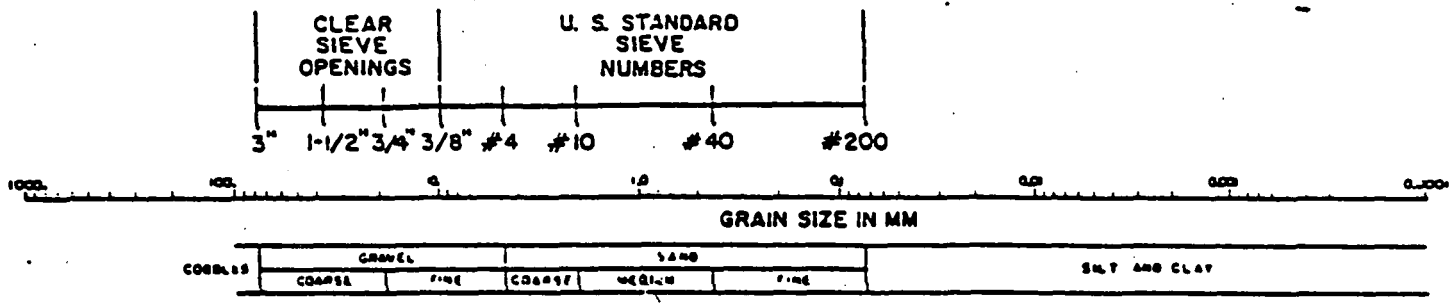
CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE (1)
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

(1) STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 18 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANCE.



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

FINE-GRAINED/HIGHLY ORGANIC SOILS

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

FERNALD RI/FS

6496

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602-371	PROJECT NAME: Facilities Testing Program	
BORING NUMBER: 1220	COORDINATES:	DATE: 5-25-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5-25-89
ENGINEER/GEOLOGIST: L Sinfield	Depth Date/Time	DATE COMPLETED:
DRILLING METHODS: See Page 1 of 5		PAGE 2 OF 5

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
7.5	17424	7	6 IN	Loose, Brownish Yellow (10YR, 6/8) Silty SAND, WET, massive	SM	N/A	Start= HNU= ∅ ppm α= ∅ cpm Bγ= 180-220 cpm
8.0	NR						
8.5	17425	10					
9.0	17426 NR	10		@ 1115		TSF	
9.5	17427	7	18 IN	Loose, Same as Above 7.5-9.0 ft	SM	N/A	HNU= ∅ ppm α= ∅ cpm Bγ= 100-140 cpm
10.0	17428	8					
10.5	17429 NR	10		@ 1135		TSF	
11.0	17430	10	18 IN	Medium Dense, Silty Gravelly SAND, WET, massive,	SM	N/A	HNU= ∅ ppm α= ∅ cpm Bγ= 100-140 cpm
11.5	52355	15					
12.0	52356	18		@ 1145		TSF	
12.5	52357	25	18 IN	Medium Dense to dense, Silty Gravelly SAND, WET, massive Coarse Sand	SM	N/A	HNU= ∅ ppm α= ∅ cpm Bγ= 100-140 cpm
13.0	52358	30					
13.5	52359	30		@ 1150		TSF	
14.0	52360	8	12 IN	Loose to Medium Dense Silty Sand, Coarse Sand, WET, massive	SM	N/A	HNU= ∅ ppm α= ∅ cpm Bγ= 100-120 cpm
14.5	52361	13					
15.0	52362 NR	16		@ 1400		TSF	

NOTES: Contractor:
Driller:
Helper:
Sample Tech:
Weather:
HNU#:

See page 1 of 5

NR = No Recovery, No Sample Taken

Background @ 1500
HNU= ∅ ppm
gnd α= 140-160 cpm
AM Bγ= 140-180 cpm
YS 5-25-89 ~~gnd~~
Air α= ∅ cpm
YS-5-25-89 Air GND Bγ= 700-800 cpm

402-11-86

000169

FERNALD RI/FS

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VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602-37.1	PROJECT NAME: Facilities Testing Program	
BORING NUMBER: 1220	COORDINATES:	DATE: 5-25-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5-25-89
ENGINEER/GEOLOGIST: C. Sinfield	Depth Date/Time	DATE COMPLETED: 5-25-89
DRILLING METHODS: See Page 1 of 5		PAGE 3 OF 5

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
15.0							Start=
15.5	52363	6	18in	Loose, Silty Coarse Sand, Brownish yellow (10YR, 6/6) WET, Massive.	SM	N/A	HNU= ∅ ppm α= ∅ cpm Bγ= 100-120 cpm
16.0	52364	8					
16.5	52365	10		@1410		TSF	
17.0	52366	7	18in	Loose, Silty Coarse to Silty Medium Sand, Brownish Yellow (10YR, 6/6) WET, Massive.	SM	N/A	HNU= ∅ ppm α= ∅ cpm Bγ= 100-120 cpm
17.5	52367	8					
18.0	52368	10		@1420		TSF	
18.5	52369	8	↑	Same as Above 16.5-18.0ft	SM	N/A	HNU= ∅ ppm α= ∅ cpm Bγ= 100-120 cpm
19.0	52370	8	18in				
19.5	52371	7	↓	@1430		TSF	
20.0	52372	6	NR	No Recovery @1430	SM	N/A TSF	HNU= N/A ppm α= N/A cpm Bγ= N/A cpm
				TD= 20.0ft @1430 on 5/25/89			

NOTES: Contractor:
Driller:
Helper:
Sample Tech:
Weather:
HNU#:
} See Page 1 of 5

NR= No Recovery, No Sample Taken

Background @
HNU= ∅ ppm
Air α= ∅ cpm
Air Bγ= 140-180 cpm
gnd α= 100-140 cpm
gnd Bγ= 100-80 cpm

4C2-11-8a

000170

6496

FERNALD RI/FS

PIEZOMETER INSTALLATION SHEET

PROJECT NAME Facilities Testing FMPC RI/FS FIELD ENG./GEO. C. Sinfield DATE 5-26-89
PROJECT NO. 602 3.7.1 CHECKED BY BV. DATE 6/6/89
BORING NO. 1220
PIEZOMETER NO. 1220 DATE OF INSTALLATION 5-25-89

BOREHOLE DRILLING

DRILLING METHOD Hollow Stem Auger
DRILLING FLUID (S) USED: N/a
FLUID N/a FROM N/a TO N/a
FLUID N/a FROM N/a TO N/a

TYPE OF BIT Auger Bit
CASING SIZE (S) USED: N/a
SIZE N/a FROM N/a TO N/a
SIZE N/a FROM N/a TO N/a

PIEZOMETER DESCRIPTION

TYPE Monitoring Well - Schedule 40 PVC
DIAMETER OF PERFORATED SECTION 2 inch ID
PERFORATION TYPE:
SLOTS ☒ HOLES ☐ SCREEN ☐
AVERAGE SIZE OF PERFORATIONS 0.020 inch
TOTAL PERFORATED AREA 14.8 ft

RISER PIPE MATERIAL Schedule 40 PVC
RISER PIPE DIAMETERS: 2 9/16 BD 6/6/89
O.D. ~~2 1/4 inch~~ I.D. 2 inch
LENGTH OF PIPE SECTIONS 6.8 ft
JOINING METHOD Flush - Threaded Joints

PROTECTION SYSTEM

RISER PROTECTIVE PIPE LENGTH 5.0 ft
PROTECTIVE PIPE O.D. 4 3/8 inch

OTHER PROTECTION Locking Hinged Cover.

ITEM	DISTANCE ABOVE/BELOW GROUND SURFACE (ft)		ELEVATION ( )	
TOP OF RISER PIPE	2.0 ft			
GROUND SURFACE	0.0 ft			
BOTTOM OF PROTECTIVE PIPE	2.8 ft			
BOREHOLE FILL MATERIALS:				
GROUT/SLURRY	TOP N/a	BOTTOM N/a	TOP	BOTTOM
BENTONITE	TOP 1.0 ft	BOTTOM 4.0 ft	TOP	BOTTOM
SAND	TOP 4.0 ft	BOTTOM 20.0 ft	TOP	BOTTOM
GRAVEL	TOP N/a	BOTTOM N/a	TOP	BOTTOM
PERFORATED SECTION	TOP 4.8 ft	BOTTOM 19.6 ft	TOP	BOTTOM
PIEZOMETER TIP	19.6 ft			
BOTTOM OF BOREHOLE	20.0 ft			
GWL AFTER INSTALLATION (Gnd)	8.5 ft			

WAS THE PIEZOMETER FLUSHED AFTER INSTALLATION? YES ☐ NO ☑
WAS A SENSITIVITY TEST PERFORMED ON THE PIEZOMETER? YES ☐ NO ☑
REMARKS Water Bearing Zone: 5.0 → >20.0 ft

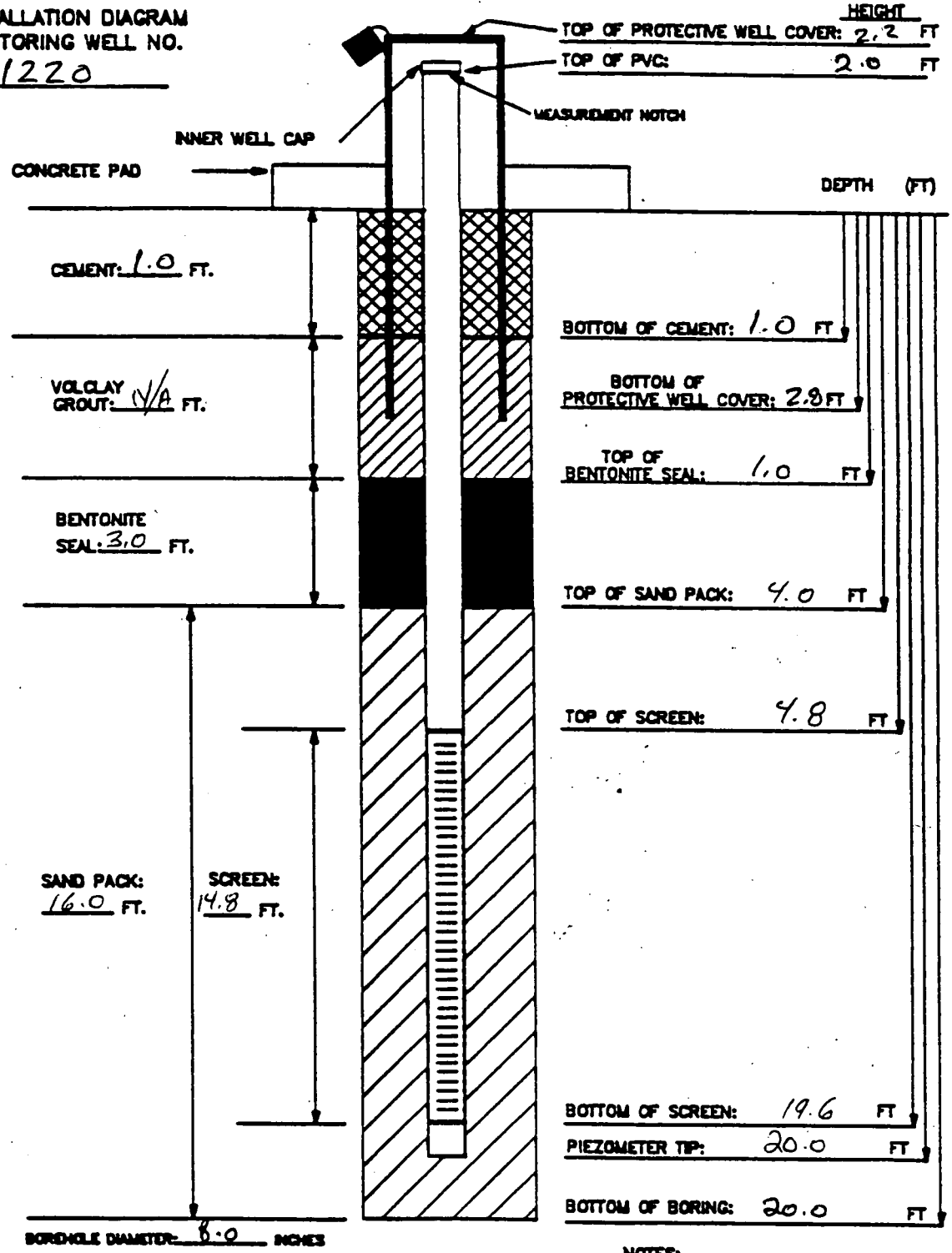
000171

409-11-86

INSTALLATION DATE: 5-25-89

FERNALD RI/FS

INSTALLATION DIAGRAM
MONITORING WELL NO.
1220



MATERIALS USED:
SAND TYPE AND QUANITITY: 3 Bags 10/20 (80lb)
BENTONITE PELLETS (5-GALLON BUCKETS): 1
BAGS OF VOLCLAY GROUT: N/A
AMOUNT OF CEMENT: 1 Bag
AMOUNT OF WATER USED: 10 gallons
OTHER:

NOTES:
1) RISER PIPE IS 2-INCH SCHEDULE 40 PVC PIPE, FLUSH-THREADED JOINTS.
2) SCREEN IS 2-INCH I.D. SCHEDULE 40 PVC PIPE WITH 0.020-INCH SLOTS.
3) LOWER END OF SCREEN IS CAPPED WITH AN END CAP OR THREADED SUMP.
4) WATER DEPTH/DATE: 8.5ft gwl

TASK: 602 3.7.1

GEOLOGIST/ENGINEER: L. Sinfield

FERNALD RI/FS

6496

Date				
Initial				
Field Check	1st Key In	2nd Key In	Hard Copy Verification	

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1203	COORDINATES:	DATE: 5-24-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5-24-89
ENGINEER/GEOLOGIST: C. Grube	Depth Date/Time	DATE COMPLETED:
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 1 OF 5

DEPTH (FT.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN.)	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	17035 0830	10	6	Surface gravel with clay (2.5y, 4/4) olive brown, trace sand, moist	GC		HNU = 0 α = 0 Bγ = 500
1	17036 0830	9	6	stiff silty clay (10yr, 5/4) yellowish brown, trace sand and fine gravel trace organics, med plastic, moist	CL	1.25	
	17037 0830 NR	7	0	NR	NA	NA	
2	17038 0835	9	6	(10yr 3/3) dark brown silty clay trace sand & fine gravel, very stiff moist	CL	2.5	HNU = 0 α = 0 Bγ = 100→120
	17039 0835 NR	7	0	NR	NA	NA	
3	17040 0835 NR	8	0	NR	NA	NA	
	17041 0838	8	6	STIFF (2.5y, 4/2) dark greyish brown silty clay, trace sand & fine→med gravel med plastic, moist	CL	1.25	HNU = 0 α = 0 Bγ = 80→90
4	17042 0838	19	6	VERY STIFF SAA	CL	2.75	
	17043 0838	14	6	VERY STIFF (5y, 5/1) grey silty clay, trace sand & fine gravel, low plasticity, moist	CL	2.5	
5	17044 0854	5	6	Stiff, (5Y 3/1) very dark gray, silty clay, trace sand, trace fine to medium gravel, low plasticity, moist	CL	1.25	HNU = 0 α = 0 Bγ = 100 - 120
	17045 0854	6	6	Stiff, (5Y 4/2) olive gray, silty clay, trace of sand low plasticity, moist	CL	1.25	
6	17046 0854	8	2	Stiff, SAA	CL	1.75	
	17047 0857	7	6	Stiff (5Y 4/2) to 5Y 3/2, olive gray to dark olive gray, mottled clay, medium plasticity, moist trace gravel	CL	1.5	HNU = 0 α = 0 Bγ = 60-80
7	17048 0857	10	6	Stiff, SAA	CL	1.25	
	17049 0857 NR	11	0	NR	NA	NA	

NOTES:
CONTRACTOR: PENN DRILL
RIG: Model 30
DRILLER: Craig Coulter
ASSISTANT: Chris Coulter
Geo-tech. Assistant: Cindy Melroy
SAA = Same As Above
NR = No Recovery

SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST
COLORS IDENTIFIED USING MUNSELL COLOR CHART
BACKGROUND LEVELS: HNU = 0 PPM
α = 0 CPM
Bγ = 80-100 CPM
LEL O2: LEL = 0% ~~PPM~~ 5/24/89
O2 = 20.6%

HNU serial # 00222

000173

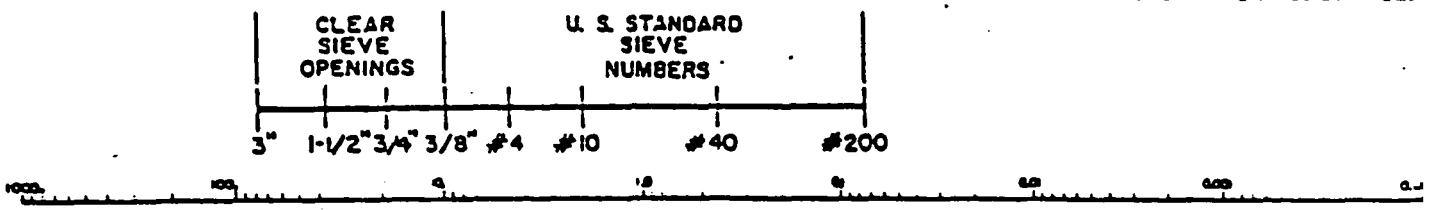
CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE (1)
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

(1) STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 18 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANCE.



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

FINE-GRAINED/HIGHLY ORGANIC SOILS

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

FERNALD RI/FS

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1203	COORDINATES:	DATE: 5/24/89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5/24/89
ENGINEER/GEOLOGIST: C. Grube	Depth Date/Time	DATE COMPLETED:
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 2 OF 5

DEPTH (FT.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN.)	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
8	17050 0900 NR	12	0	NR	NA	NA	HNU NA α NA Bγ NA
	17051 0900 NR	10	0	NR	NA	NA	
9	17052 0900 NR	13	0	NR	NA	NA	
	17053 0921	4	4	VERY STIFF (2.5y, 5/4) LIGHT OLIVE BROWN TO (10yr, 5/4) yellowish brown, mottled, silty clay, low plastic, moist	CL	2.0	HNU = 0 α = 0 Bγ = 80→90
10	17054 0921 NR	8	0	NR	NA	NA	
	17055 0921 NR	2	0	NR	NA	NA	
11	17056 0924	5	6	STIFF (2.5y, 5/2) to (10yr, 5/6) greyish brown to yellowish brown, silty clay, some sand, low plasticity, moist	CL	1.25	HNU = 0 α = 0 Bγ = 50→70
	52115 0924	5	6	SILT, (2.5y, 6/2) Light brownish grey moist	ML CAM	NA	
12	52116 0924	8	6	HARD (2.5y, 5/4) light olive brown very silty clay, moist, low plasticity	CL	4.5	
water table	52117 0930	12	6	(2.5y 5/2) greyish brown silt, moist	ML	NA	HNU = 0 α = 0 Bγ = 80→90
13	52118 0930	15	6	SAND (2.5y 5/4) light olive brown to (10yr, 5/6) yellowish brown, poorly graded, clean sand, wet	SP	NA	⟸ WET
	52119 0930	9	6	SILTY SAND (10yr, 4/6) Dark yellowish brown, wet.	SM	NA	⟸ WET
14	52120 1025	2	6	Clayey gravel (10yr, 5/3) Brown trace sand, wet	GC	NA	HNU = 0 α = 0 Bγ = 100→120 ⟸ WET
	52121 1025	2	6	Med. Stiff (10yr, 4/6) Dark yellowish brown silty clay, trace med gravel trace sand, very moist	CL	.75	
	52122 1025	11	3	(10yr, 5/4) yellowish brown, silt, trace sand, wet.	ML	NA	⟸ WET

NOTES:

FERNALD RI/FS

6496

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER:	COORDINATES:	DATE:
ELEVATION:	GWL: Depth Date/Time	DATE STARTED:
ENGINEER/GEOLOGIST:	Depth Date/Time	DATE COMPLETED:
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 3 OF 5

DEPTH	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER	RECOVERY	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	S2123 1030	2	6	SILTY SAND, (10yr 5/4) yellowish brown, poorly graded, wet.	SM	NA	HNU = 0 α = 0 ⇐ WET BS = 60-80
	S2124 1030	4	6	(10yr, 5/2) greyish brown · clayey silt some sand, trace fine gravel, wet	ML	NA	⇐ WET
16 Further Zone 3 FT	S2125 1030	12	6	SAA (except bottom 2 inches) (10yr 5/3) brown silty clay, trace sand trace ~~med~~ gravel, low plasticity, moist stiff	ML ↓ CL	1.25	
			~~6~~	CAM 5-24-89			HNU = α = BS =
17			~~6~~	CAM 5-24-89			
18							HNU = α = BS =
19							
20							HNU = α = BS =

NOTES:

6496S

FERNALD RI/FS

PIEZOMETER INSTALLATION SHEET

PROJECT NAME FMPC RI/FS
PROJECT NO. 602 3.1
BORING NO. 1203
PIEZOMETER NO. 1203
FIELD ENG./GEO. C. Grube DATE 5-24-89
CHECKED BY GV. DATE 6/6/89
DATE OF INSTALLATION 5-24-89.

BOREHOLE DRILLING

DRILLING METHOD 8 in Hollow Stem Auger	TYPE OF BIT 8 in. Hollow Auger
DRILLING FLUID (S) USED:	CASING SIZE (S) USED:
FLUID N/A FROM — TO —	SIZE N/A FROM — TO —
FLUID N/A FROM — TO —	SIZE N/A FROM — TO —

PIEZOMETER DESCRIPTION

TYPE Monitoring Piezometer	RISER PIPE MATERIAL Schedule 40 PVC
DIAMETER OF PERFORATED SECTION 2.0 in. ID	RISER PIPE DIAMETERS:
PERFORATION TYPE:	O.D. 2 3/16 in I.D. 2.0 in
SLOTS ☒ HOLES ☐ SCREEN ☐	LENGTH OF PIPE SECTIONS
AVERAGE SIZE OF PERFORATIONS 0.020 in	JOINING METHOD Screw type, Flush threaded joint
TOTAL PERFORATED AREA	

PROTECTION SYSTEM

RISER PROTECTIVE PIPE LENGTH 5.0 FT	OTHER PROTECTION Hinged cover with installed padlock
PROTECTIVE PIPE O.D. 4 3/8 in	

ITEM	DISTANCE ABOVE/BELOW GROUND SURFACE (FT)		ELEVATION ( )	
TOP OF RISER PIPE	2.0			
GROUND SURFACE	0.0			
BOTTOM OF PROTECTIVE PIPE	2.6.			
BOREHOLE FILL MATERIALS:				
~~GROUT/SLURRY~~ cement	TOP 0.0	BOTTOM 1.0	TOP	BOTTOM
BENTONITE	TOP 1.0	BOTTOM 4.0	TOP	BOTTOM
SAND	TOP 4.0	BOTTOM 16.5	TOP	BOTTOM
~~GRAVEL~~ N/A	TOP —	BOTTOM —	TOP	BOTTOM
PERFORATED SECTION	TOP 6.5	BOTTOM 16.5	TOP	BOTTOM
PIEZOMETER TIP	16.5			
BOTTOM OF BOREHOLE	16.5			
GWL AFTER INSTALLATION	—			

WAS THE PIEZOMETER FLUSHED AFTER INSTALLATION? YES ☐ NO ☒
WAS A SENSITIVITY TEST PERFORMED ON THE PIEZOMETER? YES ☐ NO ☒

REMARKS Top of water bearing zone at 12.5 FT
Bottom of water bearing zone at 16.3 FT

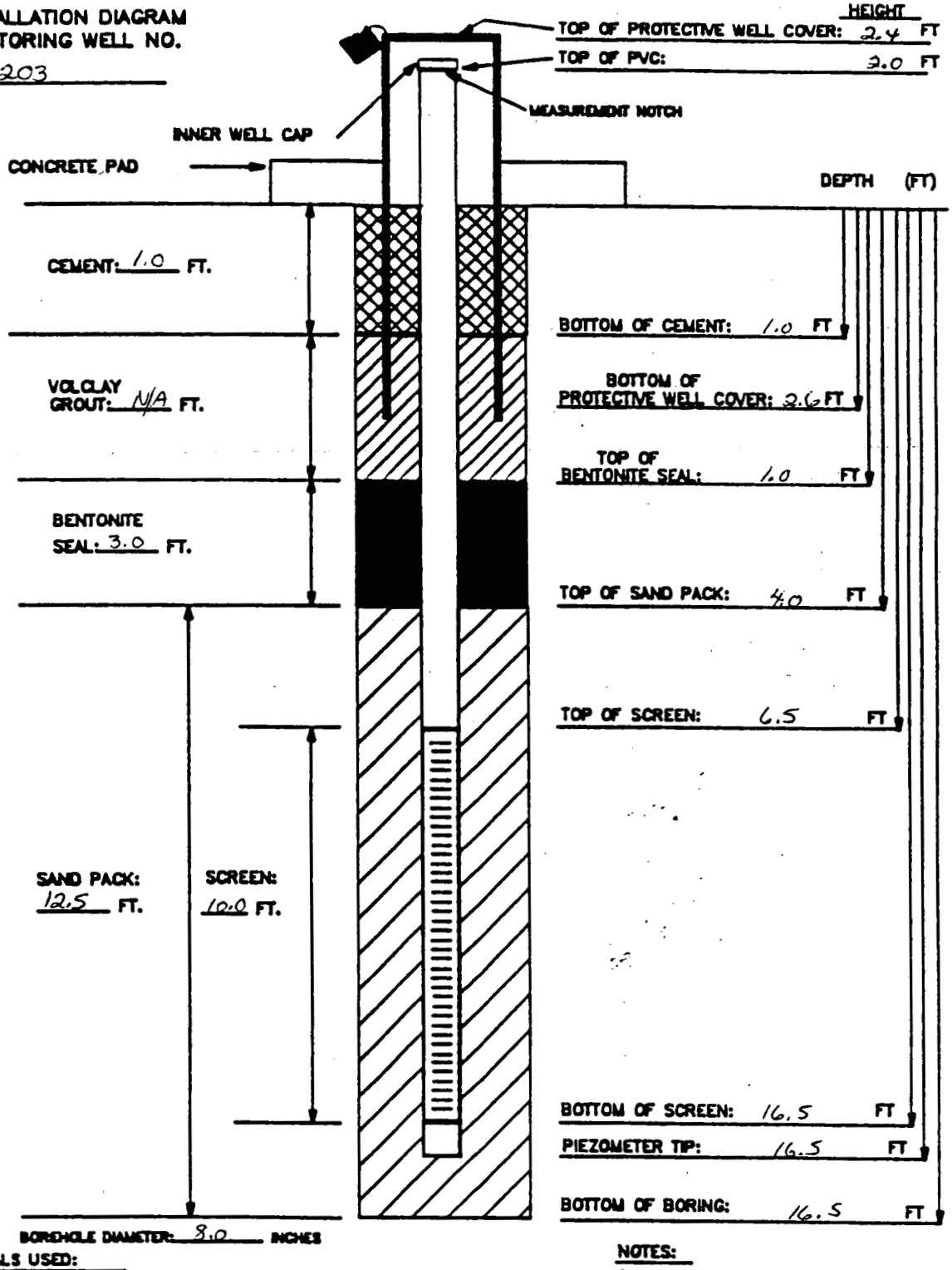
000177

4C9-···-86

FERNALD RI/FS

INSTALLATION DIAGRAM
MONITORING WELL NO.
1203

INSTALLATION DATE: 5-24-87



BOREHOLE DIAMETER: 8.0 INCHES

MATERIALS USED:
SAND TYPE AND QUANITITY: 10/20 sand 3½ sacks (80#)
BENTONITE PELLETS (5-GALLON BUCKETS): 1½ buckets
BAGS OF VOLCLAY GROUT: N/A
AMOUNT OF CEMENT: ½ sack (50#)
AMOUNT OF WATER USED: 20 gal
OTHER: 5.0 FT protective casing

NOTES:
1) RISER PIPE IS 2-INCH SCHEDULE 40 PVC PIPE, FLUSH-THREADED JOINTS.
2) SCREEN IS 2-INCH I.D. SCHEDULE 40 PVC PIPE WITH 0.020-INCH SLOTS.
3) LOWER END OF SCREEN IS CAPPED WITH AN END CAP OR THREADED SUMP.
4) WATER DEPTH/DATE:

TASK: 602 3.7

GEOLOGIST/ENGINEER: C. Grube

FERNALD RI/FS

6496

Date				
Initial				
Field Check	1st Key In	2nd Key In	Hard Copy Verification	

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FERNALD RI/FS	
BORING NUMBER: 1201	COORDINATES:	DATE: 5-24-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5-24-89
ENGINEER/GEOLOGIST: C. Grube	Depth Date/Time	DATE COMPLETED: 5-24-89
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 1 OF 4

DEPTH (FT.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN.)	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
	16991 1349 5-24	5	6	surface gravel with clay (2.5y, 4/4) olive brown trace sand, slightly moist	GC	NA	HNU = 0 ppm α = 0 cpm Bγ = 180-200 cpm
1	16992 1349 5-24	7	6	HARD (10yr 5/4) yellowish brown silty clay, trace sand & fine gravel moist, low plasticity	CL	4.5	
	16993 1349 5-24	4	5	STIFF (5y, 4/3) olive clay w/ trace sand & fine gravel, low plasticity, moist	CL	1.75	
2	16994 1354 5-24	7	6	STIFF ~~2.5y~~ CAM 5-24-89 SAA	CL	1.5	HNU = 0 ppm α = 0 cpm Bγ = 70-80 cpm
	16995 1354 5-24	10	4	STIFF SAA	CL	1.5	
3	16996 1354 NR	8	0	NR	NA	NA	
	16997 1358 5-24	9	6	SOFT (2.5y, 4/2) dark greyish brown SILTY CLAY, SOME SAND, MED PLASTIC MOIST	CL	.25	HNU = 0 ppm α = 0 cpm Bγ = 90 → 110 cpm
4	16998 1358 5-24	11	6	HARD (2.5y, 5/4) Light yellowish brown to (2.5y, 5/0) grey, mottled, sandy clay, trace silt & fine gravel, low plasticity, slightly moist	CL	4.25	
	16999 5-24 1358	8	6	VERY STIFF (5y, 4/1) Dark grey clay low plasticity, moist	CL	2.5	
5	17000 5-24 1403	16	6	SOFT (2.5y, 4/2) dark greyish brown SILTY CLAY, SOME SAND, MED PLASTIC MOIST	CL	.25	HNU = 0 ppm α = 0 cpm CAM 5-24-89 Bγ = 50 → 70 cpm
	17001 5-24 1403	9	6	STIFF (5y, 4/1) Dark grey, clay trace silt, medium plastic, moist	CL	1.75	
6	17002 1403 5-24	18	6	STIFF SAA	CL	1.25	
	17003 5-24 1428	15	6	Stiff (5Y 5/1) gray to (10YR 5/6) yellowish brown, silty clay, trace sand, medium plastic, moist	CL	1.5	HNU = 0 ppm α = 0 cpm Bγ = 70-80 cpm
7	17004 5-24 1428	10	6	Stiff (5y, 6/1) Grey to (10yr 5/6) yellowish brown, mottled, silty clay, med plastic, moist	CL	1.75	
	17005 1428 5-24	12	3	SAA	CL	1.75	

NOTES: CONTRACTOR: PENN DRILL
RIG: Model 80
DRILLER: Craig Coulter
ASSISTANT: Chris Coulter
SAA - Same As Above
NR - No Recovery
HNU # 00222

SAMPLES COLLECTED PER ASTM STANDARD PENETRATION TEST
COLORS IDENTIFIED USING MUNSELL COLOR CHART
BACKGROUND LEVELS: HNU = 0 PPM
α = 0 CPM
Bγ = 60-100 CPM
LEL O2: LEL = 0% ~~PPM~~ 5/24/89
O2 = 20.6%

Geotech Assistant - Cindy Melroy

000179

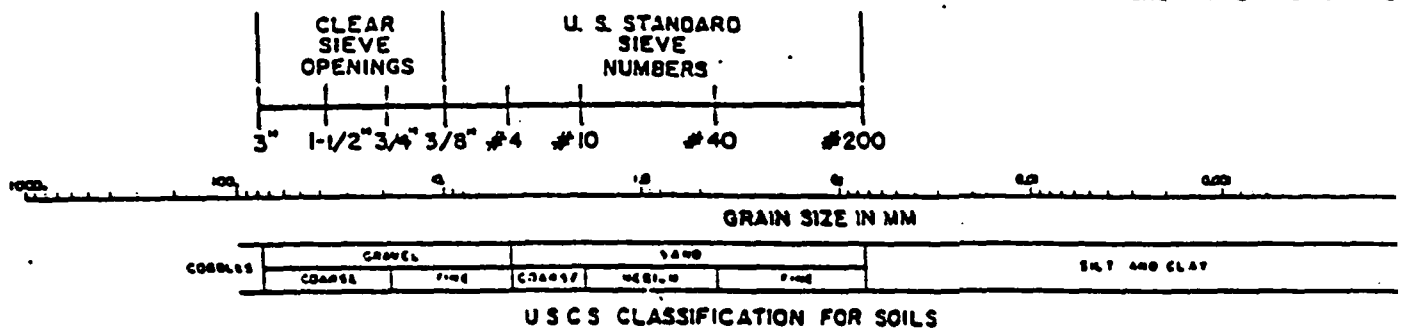
CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE(1)
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

(1) STANDARD PENETRATION RESISTANCE IS THE NUMBER C BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLI FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN INCHES AND THE NUMBER OF BLOWS RECORDED FOR SA 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANC



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

FINE-GRAINED/HIGHLY ORGANIC SOI

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS ROCK FLOUR, SILTY OR CLAYEY FINE SANC OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICI GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEO FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTIC ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTE

FERNALD RI/FS

6496

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FERNALD RI/FS		
BORING NUMBER: 1201	COORDINATES:	DATE: 5-24-89	
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5-24-89	
ENGINEER/GEOLOGIST: C. Grube	Depth Date/Time	DATE COMPLETED: 5-24-89	
DRILLING METHODS: AUGER (HOLLOW STEM)		PAGE 2 OF 4	

DEPTH (FT.)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN.)	RECOVERY (IN.)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
8	17006 1431 5-24	9	6	Very Stiff (2.5y, 4/2) Dark greyish brown clay w/ trace sand & fine gravel low plasticity, moist	CL	2.25	HNU = 0 ppm α = 0 cpm Bδ = 80-7100 cpm
	17007 1431 5-24	10	6	STIFF (10yr, 5/6) yellowish brown to (2.5y, 5/2) greyish brown, mottled, silty clay trace sand, med plastic, moist	CL	1.25	
9	17008 1431 5-24	8	6	STIFF SAA	CL	1.0	
	17009 1445 5-24	9	6	medium stiff (2.5Y 4/2) dark greyish brown, sandy clay, trace medium to fine gravel, medium plastic, moist	CL	.75	HNU = 0 ppm α = 0 cpm Bδ = 70-90 cpm
10	17010 1445 5-24	13	6	Very Stiff (10YR 5/6) yellowish brown to (2.5y 5/2) greyish brown, mottled silty clay, low plasticity, moist	CL	2.75	
	17011 1445 5-24	11	2	Medium Dense (10 YR 5/6) yellowish brown clayey silt, moist	ML	N/A	
11	17012 1459 5-24	4	6	STIFF (5y, 4/2) olive grey silty CLAY, Trace sand, med plastic moist	CL	1.25	HNU = 0 ppm α = 0 cpm Bδ = 80-7100 cpm
11.5FT	52075 1459 5-24	6	6	(2.5y, 5/4) light olive brown clayey silt, moist, Loose	ML	NA	
12	52076 1459 5-24	4	6	(10yr, 5/4) yellowish brown, silt some clay, very moist, Loose	ML	NA	
	52077 1502 5-24	4	6	SANDY SILT at bottom (2.5y, 5/6) light olive brown, clayey silt at top very moist to wet medium dense	ML	NA	HNU = 0 ppm α = 0 cpm ← WET Bδ = 60-70 cpm
13	52078 1502 5-24	5	6	(2.5y 5/2) grayish brown silt trace sand, very moist, medium dense	ML	NA	
13.3FT	52079 1502 5-24	6	5	SAA (5y, 5/2) olive grey SILTY CLAY, low plasticity, moist, med stiff	ML CL	NA 0.5	
14	52080			Bottom of boring and sampling at 13.5 FT			HNU = α = Bδ =
	52081						
	52082						

NOTES:

FERNALD RI/FS 287000

PIEZOMETER INSTALLATION SHEET

PROJECT NAME FMPC RI/FS FIELD ENG./GEO. C. Grube DATE 5/24/89
PROJECT NO. 6023.7 CHECKED BY RW DATE 6/15/89
BORING NO. 1201
PIEZOMETER NO. 1201 DATE OF INSTALLATION 5/24/89

BOREHOLE DRILLING

DRILLING METHOD 8 in Hollow Stem Auger
DRILLING FLUID (S) USED:
FLUID N/A FROM — TO —
FLUID N/A FROM — TO —

TYPE OF BIT 8 in. Hollow Auger
CASING SIZE (S) USED:
SIZE N/A FROM — TO —
SIZE N/A FROM — TO —

PIEZOMETER DESCRIPTION

TYPE Monitoring Piezometer
DIAMETER OF PERFORATED SECTION 2.0 in ID
PERFORATION TYPE:
SLOTS [X] HOLES [ ] SCREEN [ ]
AVERAGE SIZE OF PERFORATIONS 0.020 in
TOTAL PERFORATED AREA 5.5 FT

RISER PIPE MATERIAL Schedule 40 PVC
RISER PIPE DIAMETERS:
O.D. 2 5/16 in I.D. 2.0 in
LENGTH OF PIPE SECTIONS 10.0 FT
JOINING METHOD Screw type, flush joint threaded

PROTECTION SYSTEM

RISER PROTECTIVE PIPE LENGTH 5.0 FT
PROTECTIVE PIPE O.D. 4 3/8 in

OTHER PROTECTION Hinged cover with installed padlock

ITEM	DISTANCE ABOVE/BELOW GROUND SURFACE (FT)		ELEVATION ( )	
TOP OF RISER PIPE	2.1			
GROUND SURFACE	0.0			
BOTTOM OF PROTECTIVE PIPE	2.7			
BOREHOLE FILL MATERIALS:				
~~GROUT/SLURRY~~	TOP 0.0	BOTTOM ~~1.0~~ 1.5 CB 5/24/89	TOP	BOTTOM
BENTONITE	TOP ~~1.0~~ 1.5 CB 5/24/89	BOTTOM 7.0	TOP	BOTTOM
SAND	TOP 7.0	BOTTOM 13.5	TOP	BOTTOM
GRAVEL	TOP —	BOTTOM —	TOP	BOTTOM
PERFORATED SECTION	TOP 8.0	BOTTOM 13.5	TOP	BOTTOM
PIEZOMETER TIP	13.5			
BOTTOM OF BOREHOLE	13.5			
GWL AFTER INSTALLATION	—			

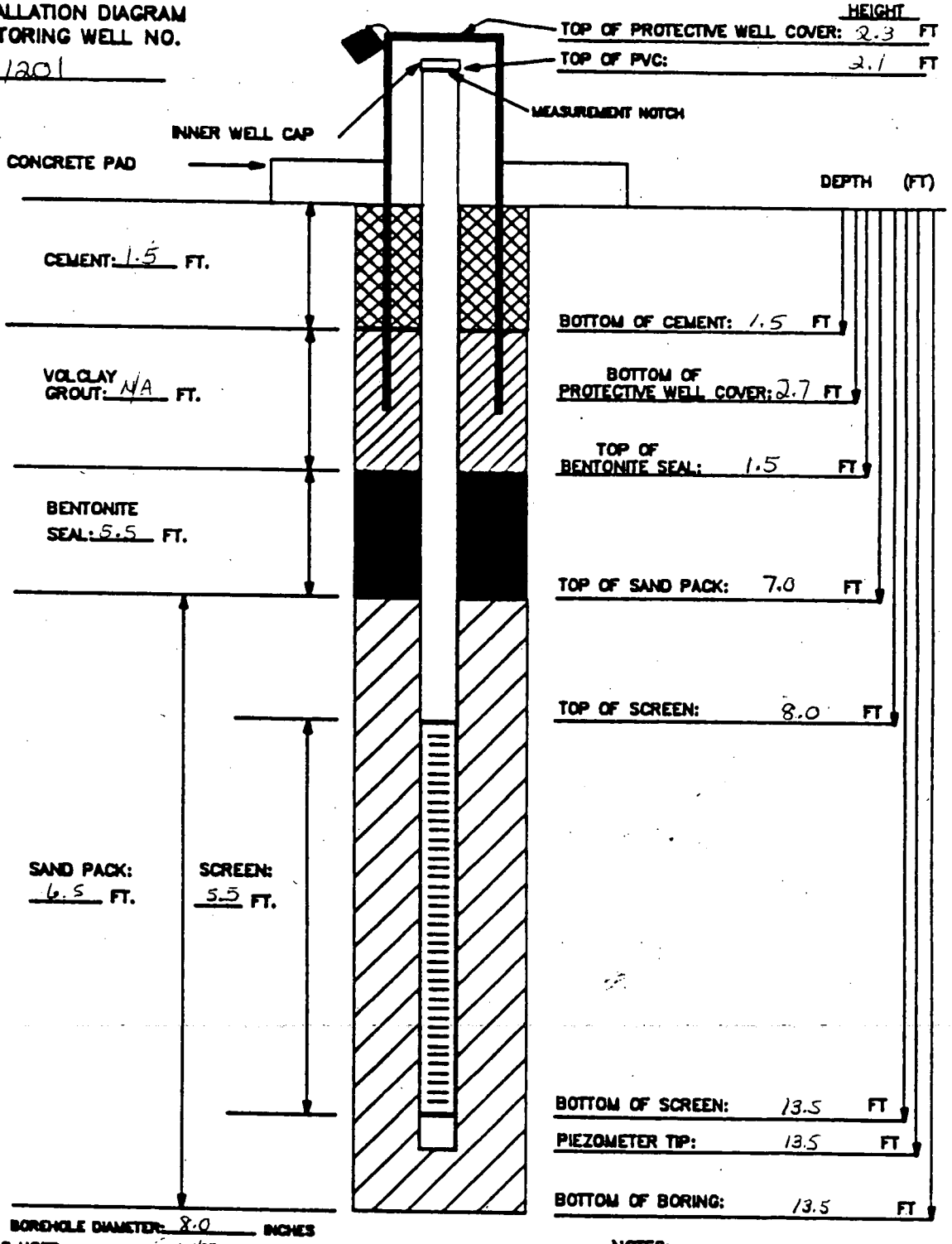
WAS THE PIEZOMETER FLUSHED AFTER INSTALLATION? YES [ ] NO [X]
WAS A SENSITIVITY TEST PERFORMED ON THE PIEZOMETER? YES [ ] NO [X]
REMARKS Top of water bearing zone at 11.5 FT
Bottom of water bearing zone at 13.3 FT

4C9

FERNALD RI/FS

INSTALLATION DIAGRAM
MONITORING WELL NO.
1201

INSTALLATION DATE: 5-24-89



BOREHOLE DIAMETER: 8.0 INCHES

MATERIALS USED:
SAND TYPE AND QUANITITY: ~~2gl~~ 5/24/89 10/20 sand - 2 (80#) sacks
BENTONITE PELLETS (5-GALLON BUCKETS): 2 buckets
BAGS OF VOLCLAY GROUT: N/A
AMOUNT OF CEMENT: 8/4 sk(50#)
AMOUNT OF WATER USED: 20gal
OTHER: 5 FT Protective Casing

NOTES:
1) RISER PIPE IS 2-INCH SCHEDULE 40 PVC PIPE, FLUSH-THREADED JOINTS.
2) SCREEN IS 2-INCH I.D. SCHEDULE 40 PVC PIPE WITH 0.020-INCH SLOTS.
3) LOWER END OF SCREEN IS CAPPED WITH AN END CAP OR THREADED SUMP.
4) WATER DEPTH/DATE:

TASK: 602 3.7

GEOLOGIST/ENGINEER: C. Grube

FERNALD RI/FS

6496

	Date	6/5/89			
	Initial	[illegible]			
		Field Check	1st Key In	2nd Key In	Hard Copy Verification

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FMPC RI/FS		
BORING NUMBER: 1210	COORDINATES:	DATE: 5-3-89	
ELEVATION:	GWL: Depth 8.0 FT Date/Time 5-3-89/1330	DATE STARTED: 5-3-89	
ENGINEER/GEOLOGIST: E. TROLLINGER C. CRUSE	Depth Date/Time	DATE COMPLETED: 5-3-89	
DRILLING METHODS: MOBILE DRILL 8 in HSA		PAGE 1 OF 4	

DEPTH (FT.)	SAMPLE TYPE & NO	BLOWS ON SAMPLER PER 6 IN	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
1	17189 1000 05-03-89	2	12	VERY STIFF, BROWN (10YR 3/3) SILTY CLAY, TRACE OF ORGANICS (GRASS, ROOTS), LOW PLASTICITY, MOIST.	CL	2.5	Hnu = 0.0 ppm - 0.2 ppm
	17190 1000 05-03-89	6		VERY STIFF, BROWN, (10YR 3/3) SILTY CLAY, TRACE OF FINE GRAVEL, LOW PLASTICITY MOIST	CL	3.5	α = 0 cpm
	17191 1000 05-03-89	15		NO RECOVERY	N/A	N/A	βγ = 80 cpm
2	17192 1007 05-03-89	7	12	VERY STIFF, BROWN, (10YR 4/4), SILTY CLAY, TRACE OF FINE GRAVEL, LOW PLASTICITY, MOIST.	CL	4.0	Hnu = 0.2 ppm
	17193 1007 05-03-89	11		VERY STIFF, BROWN (10YR 4/4), SILTY CLAY, TRACE OF SAND AND FINE GRAVEL, LOW PLASTICITY, MOIST.	CL	3.0	α = 0 cpm
	17194 1007 05-03-89	15		NO RECOVERY	N/A	N/A	βγ = 80 cpm
3	17195 1014 05-03-89	9	14	VERY STIFF, YELLOWISH BROWN, (10YR 5/6), SILTY CLAY TRACE OF FINE GRAVEL, LOW PLASTICITY, MOIST.	CL	4.0	Hnu = 0.2 ppm
4	17196 1014 05-03-89	18		VERY STIFF, YELLOWISH BROWN (10YR 5/6) & GRAY (10YR 5/1), CLAY, MEDIUM PLASTICITY, MOIST (2 in. RECOV. ON 17191)	CL	3.0	α = 0 cpm
	17197 1014 05-03-89	25				2.0	βγ = 80 cpm
5	17198 1023 05-03-89	19	15	STIFF, YELLOWISH BROWN, (10YR 5/4), CLAY, MEDIUM PLASTICITY, MOIST.	CL	1.75	Hnu = 0.2 ppm
	17199 1023 05-03-89	23		STIFF, YELLOWISH BROWN, (10YR 5/4), CLAY, TRACE OF COARSE SAND, MEDIUM PLASTICITY, MOIST. (2 in RECOV. on 17200)	CL	1.50	α = 0 cpm
6	17200 1023 05-03-89	26					βγ = 80 cpm
7	17201 1325 05-03-89	3	18	VERY STIFF, OLIVE GRAY (5Y 5/2) TO YELLOWISH BROWN, (10YR 4/6) SILTY CLAY, LOW TO MEDIUM PLASTICITY, MOIST.	ET. CL	3.25	Hnu = 0.2 ppm
	17202 1325 05-03-89	6			ET.	3.0	α = 0 cpm
	17203 1325 05-03-89	7		~~VERY STIFF~~ ET. MEDIUM DENSE, YELLOWISH BROWN, (10YR 5/6) SILT, WET-SATURATED	N/A	N/A	βγ = 80 cpm

NOTES: DRILLING CO.:
DRILLER: DAVE NEWMAN
HELPER: BILL ANDERSON

MATERIALS USED:
2 BAGS 10/20 SAND (80 lb) ea.
1 BUCKET BENTONITE PELLETS (5 gal.)
½ SACK CEMENT TYPE I
3 GAL. WATER

SAMPLING IN ACCORDANCE WITH ASTM STANDARDS, DESCRIPTION OF SOIL COLOR BY MUNSELL COLOR CHART. SAMPLES TAKEN FOR WMCO AT INTERVALS 0.0-.5 FT., 2-2.5 FT., 5-5.5 FT, 10-10.5 FT., 15-15.5 FT.

INSTRUMENT BACKGROUND
Hnu = 0.2 ppm
α = 0 cpm
βγ = 60-80 cpm
LEL = 0.0 ppm
O_2 = 20.6%

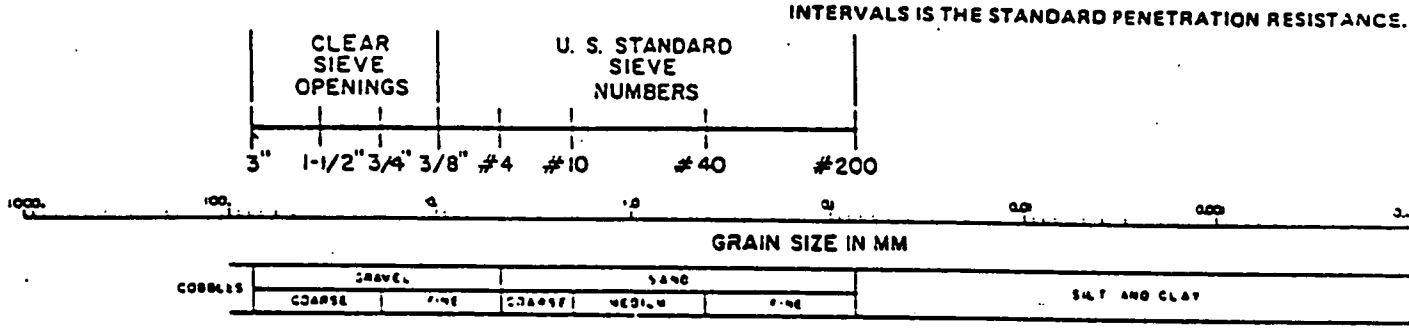
CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE(1)
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

(1) STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 18 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANCE.



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

FINE-GRAINED/HIGHLY ORGANIC SOILS

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONT

FERNALD RI/FS

6496

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FMPC RI/FS		
BORING NUMBER: 1210	COORDINATES:	DATE: 5-3-89	
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5-3-89	
ENGINEER/GEOLOGIST: E. TROLLINGER C. BRUSE	Depth Date/Time	DATE COMPLETED: 5-3-89	
DRILLING METHODS: MOBILE DRILL HSA		PAGE 2 OF 4	

DEPTH (FT.)	SAMPLE TYPE & NO	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
8	17204 1330 05-03-89	4		DENSE, BROWN (10 YR 5/3) CLAYEY SILT, SATURATED.	ML	N/A	H_{net} = 0.2 ppm
	17205 1330 05-03-89	14	17	DENSE, YELLOWISH BROWN (10YR 5/6) SILT, WET.	ML	N/A	α = 0 cpm
9	17206 1330 05-03-89	18					$\beta\gamma$ = 80 cpm
	17207 1335 05-03-89	10		MEDIUM DENSE, YELLOWISH BROWN, (10 YR 5/6), SILT, WET	ML	N/A	H_{net} = 0.2 ppm
10	17208 1335 05-03-89	16	18				α = 0 cpm
	17209 1335 05-03-89	19		VERY STIFF, YELLOWISH BROWN (10 YR 5/6) SILTY CLAY, MOIST.	CL	2.75	$\beta\gamma$ = 80 cpm
11				BOTTOM OF BORING AT 10.5 FT. SAMPLING ENDED AT 10.5 FT.			
12							
13							
14							

NOTES:

DRILLER: DAVE NEWMAN
HELPER: BILL ANDERSON

INSTRUMENT BACKGROUND
H_{net} = 0.2 ppm
α = 0 cpm
$\beta\gamma$ = 60-80 cpm

FERNALD RI/FS

6496 3/4

PIEZOMETER INSTALLATION SHEET

PROJECT NAME FMPC RI/FS
FIELD ENG./GEO. C. Gruber/E. Trollinger DATE 5/2/89
PROJECT NO. 602 3.7
CHECKED BY _____ DATE _____
BORING NO. 1210
PIEZOMETER NO. 1210
DATE OF INSTALLATION 5/2/89

BOREHOLE DRILLING

DRILLING METHOD 8 in Hollow Stem Auger	TYPE OF BIT 8 in. Hollow Stem Auger
DRILLING FLUID (S) USED:	CASING SIZE (S) USED:
FLUID N/A FROM — TO —	SIZE N/A FROM — TO —
FLUID N/A FROM — TO —	SIZE N/A FROM — TO —

PIEZOMETER DESCRIPTION

TYPE Monitoring Piezometer	RISER PIPE MATERIAL Schedule 40 PVC
DIAMETER OF PERFORATED SECTION 2.0 in ID	RISER PIPE DIAMETERS:
PERFORATION TYPE:	O.D. 2 5/16 in I.D. 2.0 in
SLOTS [X] HOLES [ ] SCREEN [ ]	LENGTH OF PIPE SECTIONS 7.5 FT
AVERAGE SIZE OF PERFORATIONS 0.020 in	JOINING METHOD Screw type, Flush joint threaded
TOTAL PERFORATED AREA 5.0 FT	

PROTECTION SYSTEM

RISER PROTECTIVE PIPE LENGTH 5 FT	OTHER PROTECTION Hinged cover with installed padlock.
PROTECTIVE PIPE O.D. 4 3/8 in	

ITEM	DISTANCE ABOVE/BELOW GROUND SURFACE (FT)		ELEVATION ( )	
TOP OF RISER PIPE	2.0			
GROUND SURFACE	0.0			
BOTTOM OF PROTECTIVE PIPE	2.5			
BOREHOLE FILL MATERIALS:				
~~GROUT/SLURRY~~ Cement	TOP 0.0	BOTTOM 1.0	TOP	BOTTOM
BENTONITE	TOP 1.0	BOTTOM 2.3	TOP	BOTTOM
SAND	TOP 2.3	BOTTOM 10.5	TOP	BOTTOM
~~GRAVEL~~ N/A	TOP —	BOTTOM —	TOP	BOTTOM
PERFORATED SECTION	TOP 5.5	BOTTOM 10.5	TOP	BOTTOM
PIEZOMETER TIP	10.5			
BOTTOM OF BOREHOLE	10.5			
GWL AFTER INSTALLATION	≃ 8.0 FT.			

WAS THE PIEZOMETER FLUSHED AFTER INSTALLATION? YES [ ] NO [X]
WAS A SENSITIVITY TEST PERFORMED ON THE PIEZOMETER? YES [ ] NO [X]
REMARKS WATER BEARING ZONE ENCOUNTERED FROM 8.0 FT. TO 10.0 FT. AS NOTED ON BORING LOG.

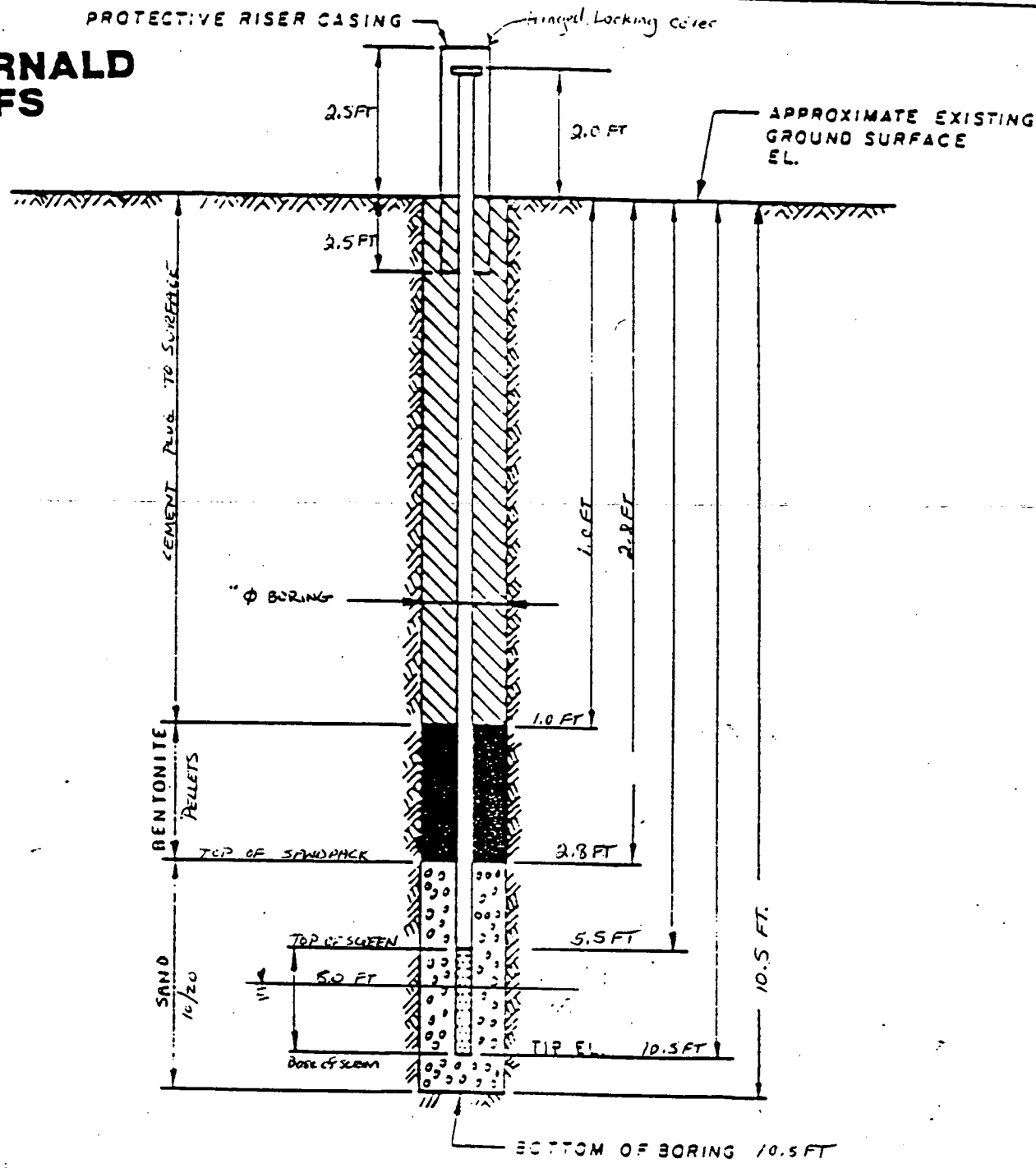
000187

409-11-86

FIELD COPY

6496 4/4

FERNALD RI/FS



DRAWING NUMBER Boring 1210

DRAWN BY ET

CHECKED BY

APPROVED BY

NOTES:

1. RISER PIPE IS 2 IN I.D. SCHEDULE PIPE, THREADED, FLUSH-JOINTED.
2. SCREEN IS 2 IN I.D. SCH 40 PVC PIPE CONTINUOUS SLOT SCREEN (0.020 IN SLOT SIZE).
3. LOWER END OF SCREEN IS CAPPED.
4. ELEVATION OF WATER LEVEL
5. WATER LEVEL READING ON

MATERIALS USED:

2 BAGS 10/20 SAND (80 lb) ea.
1 BUCKET BENTONITE PELLETS (5 gal)
½ SACK TYPE I CEMENT
3 gal. WATER

INSTALLATION DETAILS
MONITORING WELL #1210

PREPARED FOR FMPC RI/FS

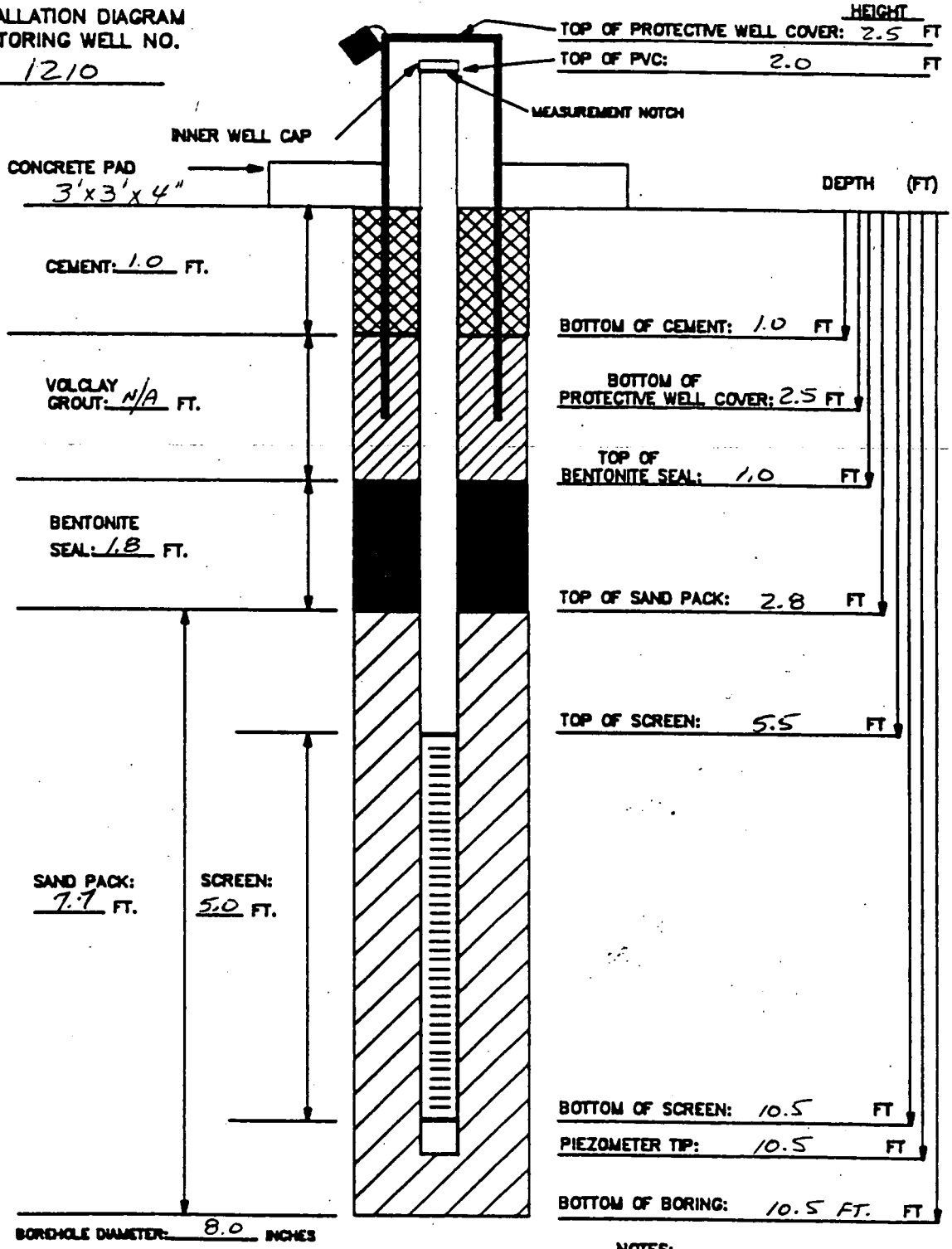
PVC WELL SCREEN AND RISER PIPE:

1 - 5.0 FT. SCREENED SECTION
1 - 7.5 FT. SCH. 40 RISER PVC.

FERNALD RI/FS

INSTALLATION DIAGRAM
MONITORING WELL NO. 1210

INSTALLATION DATE: 5/3/89



BOREHOLE DIAMETER: 8.0 INCHES

MATERIALS USED:

SAND TYPE AND QUANITITY: 10/20 2 BAGS (80 lb. ea)
BENTONITE PELLETS (5-GALLON BUCKETS): 1
BAGS OF VOLCLAY GROUT: N/A
AMOUNT OF CEMENT: 1/2 SACK
AMOUNT OF WATER USED: 3 GALS.
OTHER:

NOTES:

1) RISER PIPE IS 2-INCH SCHEDULE 40 PVC PIPE, FLUSH-THREADED JOINTS.
2) SCREEN IS 2-INCH I.D. SCHEDULE 40 PVC PIPE WITH 0.020-INCH SLOTS.
3) LOWER END OF SCREEN IS CAPPED WITH AN END CAP OR THREADED SUMP.
4) WATER DEPTH/DATE: 8.0 FT. 5/3/89

TASK: 3.7

GEOLOGIST/ENGINEER: E. TROLLINGER / C. Gerube

FERNALD RI/FS

6496

Date				
Initial				
	Field Check	1st Key In	2nd Key In	Hard Copy Verification

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602-371	PROJECT NAME: Facilities Testing Program	
BORING NUMBER: 1167	COORDINATES:	DATE: 5-3-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5-3-89
ENGINEER/GEOLOGIST: L. Sintfeld	Depth Date/Time	DATE COMPLETED: 5-3-89
DRILLING METHODS: B-53 Hollow Stem Auger with Split spoon Sampler		PAGE 1 OF 4

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
							Start = 0905
0.5	16353 wmco	7	8IN	Loose to Medium Dense, Gravel, GM with Silt and Sand.	GM	Loose	HNU = Ø ppm α = Ø cpm Bγ = 800 cpm
1.0	16354	12					
1.5	16355 NR	13		@ 0907		TSF	
2.0	16356	4	9IN	Very Stiff, Brownish Yellow (10YR, 6/6) Lean Clay, CL - Dry, mottled, medium plastic, massive with Sand and Silt	CL	2.1	HNU = Ø ppm α = Ø cpm Bγ = 80-100 cpm
2.5	16357 wmco	4					
3.0	16358 NR	6		@ 0910		TSF	
3.5	16359 NR	4	6IN	Same as above Dst moist at top 3 inches	CL	2.1	HNU = Ø ppm α = Ø cpm Bγ = 80-100 cpm
4.0	16360 NR	5					
4.5	16361	3		@ 0912		TSF	
5.0	16362	1 blow for 18IN	12IN	Very Soft, Lean Clay with Gray Sand and Gravel, ~~Saturated~~ with H_2O, Very plastic, massive.	CL	0.0	HNU = Ø ppm α = Ø cpm Bγ = 80-120 cpm
5.5	16363 wmco						
6.0	16364 NR			@ 0915		TSF	
6.5	16365	1	8IN	Same as above 4.5-6.0 ft	CL	0.0	HNU = 1 ppm α = Ø cpm Bγ = 100-120 cpm
7.0	16366	1					
7.5	16367	2		@ 1015		TSF	

NOTES: Contractor: Penn Drill
Driller: J. Sacconi
Helper: G. Dye
Sample Tech: C. Melton
Weather: Warm & Clear
HNU #: HH18

NR = No Recovery
No Sample Taken

Background @ 0900
HNU = Ø ppm
α = Ø cpm
Bγ = 80-120 cpm

4G2-11-86

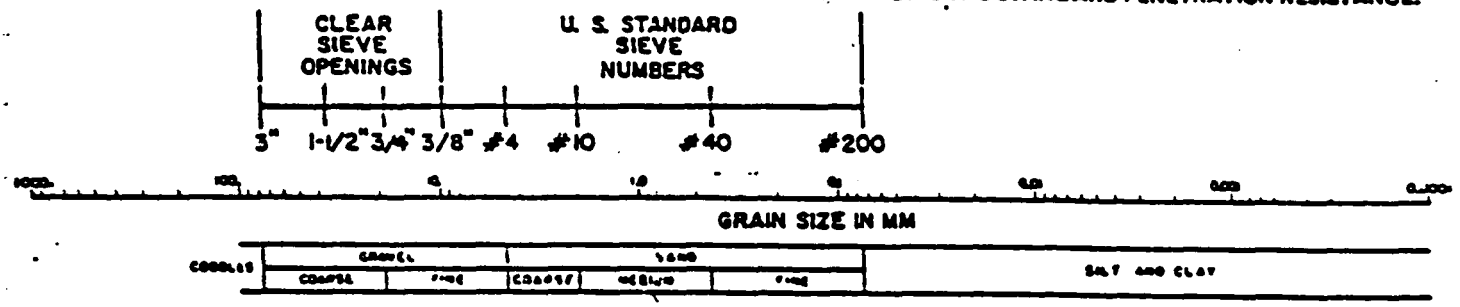
CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE(1)
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

(1) STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 18 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANCE.



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

FINE-GRAINED/HIGHLY ORGANIC SOILS

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

FERNALD RI/FS

6496

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602-3.7.1	PROJECT NAME: Facilities Testing Program	
BORING NUMBER: 1167	COORDINATES:	DATE: 5-3-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5-3-89
ENGINEER/GEOLOGIST: L. Sinfield	Depth Date/Time	DATE COMPLETED: 5-3-89
DRILLING METHODS: B-53, Hollow Stem Auger with Split Spoon Sampler		PAGE 2 OF 4

Bottom of Water Bearing Zone

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
7.5	16368	4		Slough - Gravel, moist, loose with soil			Start= HNU= ∅ ppm
8.0	16369	4	12 in	Stiff, Brownish yellow (10YR, 6/6) mottled Lean Clay, CL - Dry medium plastic, massive	CL	1.5	α= ∅ cpm; Bγ= 60-100 cpm
8.5	16370 NR	7		@ 1020		TSF	
9.0	16371	7	18 in	Soft, light Olive Brown (2.5Y, 5/4) Clay, CL - Moist, massive, very plastic 9.7 ft	CL	∅	HNU= ∅ ppm; α= ∅ cpm; Bγ= 80-120 cpm
9.5	16372	5					
10.0	16373 WMCO	4		Very Stiff, Brownish Yellow (10YR, 6/6) Lean Clay, CL - Some Silt, Dry Massive, medium Plastic @ 1030	CL	3.2 TSF	
10.5	16374	6	18 in	Hard, Brownish Yellow (10YR, 6/6) Lean Clay, CL - Dry, massive, medium plastic, rare gravel, Some silt @ 1040	CL	74.5 TSF	HNU= ∅ ppm; α= ∅ cpm; Bγ= 80-100 cpm
11.0	50647	9					
11.5	50648	12					
12.0	~~50644~~ JS 5-3-89			TD= 12.0 ft Piezometer Installed 5/3/89 To 10.0 ft @		TSF	HNU= ppm; α= cpm; Bγ= cpm
12.5	~~50650~~ JS 5-3-89						
13.0							
13.5							
14.0							HNU= ppm; α= cpm; Bγ= cpm
14.5							
15.0				@		TSF	

NOTES: Contractor:
Driller:
Helper:
Sample Tech:
Weather:
HNU#:

See Page 1 of 4

NR = No Recovery
No Sample Taken

Background @ 0900
HNU= ∅ ppm
α= ∅ cpm
Bγ= 80-120 cpm

4C2-11-86

FERNALD RI/FS

6496 Field Copy

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602-3.7.1	PROJECT NAME: Facilities Testing Program	
BORING NUMBER: 1167	COORDINATES:	DATE: 5-3-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5-3-89
ENGINEER/GEOLOGIST: C. Smithwell	Depth Date/Time	DATE COMPLETED: 5/3/89
DRILLING METHODS: B-53, Hollow Stem Auger with Split Spoon		PAGE 1 OF 2

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
							Start = 905
0.5	16355 wmco	7		Loose, gravel, dry with silt and sand	GW	Loose	HNU = Ø ppm α = Ø cpm Bγ = 800 cpm
1.0	16356	12	8in				
1.5	16357 NR	13		@ 0907		TSF	
2.0	16356	4		Very Stiff, Lean Clay Brownish yellow (10YR, 6/6) Dry, mottled, med plastic massive, with sand and silt	CL	2.1	HNU = Ø ppm α = Ø cpm Bγ = 80-100 cpm
2.5	16357 wmco	4	9in				
3.0	16358 NR	6		@ 0910		TSF	
3.5	16359 NR	4		Same as above but moist at tip		2.1	HNU = Ø ppm α = Ø cpm Bγ = 80-100 cpm
4.0	16360 NR	5	6in				
4.5	16361	3		@ 0912		TSF	
5.0	16362			Wet, clay, soft mottled, U. plastic, massive, rare gravel, with sand & gravel	CL	Ø	HNU = Ø ppm α = Ø cpm Bγ = 80-120 cpm
5.5	16363 wmco	18for 18in	12in				
6.0	16364 NR			@ 0915		TSF	
6.5	16365 NR	1	8in	Soft, clay, gray (10YR, 4/1) massive, moist with rare gravel	CL	Ø	HNU = 1 ppm α = Ø cpm Bγ = 100-120 cpm
7.0	16366	1					
7.5	16367	2		@ 1015		TSF	

NOTES: Contractor: Penn Drill
Driller: Jim Saccavi
Helper: G. Dyk
Sample Tech: C. Nilberg
Weather: warm & clear
HNU #: HH18

Background @ 0900
HNU = Ø ppm
α = Ø cpm
Bγ = 80-120 cpm

4C7-11-86

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Field Copy

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602-3.2.1	PROJECT NAME: Facilities Testing Program	
BORING NUMBER:	COORDINATES:	DATE: 5-3-89
ELEVATION: 167	GWL: Depth Date/Time	DATE STARTED: 5-3-89
ENGINEER/GEOLOGIST: L. S. [illegible]	Depth Date/Time	DATE COMPLETED:
DRILLING METHODS:		PAGE 2 OF 2

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
7.5							Start =
8.0	16368	4		Gravel - moist, loose with silt, sand, massive	CL	1.5	HNU = Ø ppm α = Ø cpm Bγ = 60-100 cpm
8.5	16369	4	12 in	Clay - lean, dry, mod. plastic, stiff, Brnish Yellow (10YR 6/6) mottled @ 1020		TSF	
9.0	16370 MR	7					
9.5	16371	7		moist olive brown (2.5Y, 5/4) Clay, soft, massive v. plastic,	CL	Ø	HNU = Ø ppm α = Ø cpm Bγ = 80-120 cpm
10.0	16372	5	18 in	v. stiff, brownish yellow (10YR 6/6) lean clay, some silt, massive dry, mod. plastic @ 1030		3.2 TSF	
10.5	16373 MMCO	4					
11.0	16374	6		HARD Brownish yellow (10yr, 6/6) Lean clay mottled, massive, dry rare gravel, some silt @ 1040	CL	>4.5 TSF	HNU = Ø ppm α = Ø cpm Bγ = 80-100 cpm
11.5	50647	9	18 in				
12.0	50648	12					
12.5	50649						HNU = ppm α = cpm Bγ = cpm
13.0	50650						
13.5	50651			@		TSF	
14.0	50652						HNU = ppm α = cpm Bγ = cpm
14.5	50653						
15.0	50654			@		TSF	

NOTES: Contractor:
Driller:
Helper:
Sample Tech:
Weather:
HNU #:

Background @
HNU = ppm
α = cpm
Bγ = cpm

4C2-11-86

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FERNALD RI/FS

6496

PIEZOMETER INSTALLATION SHEET

PROJECT NAME Facilities Testing FMPC RI/FS FIELD ENG./GEO. C. Sinfield DATE 5-3-89
PROJECT NO. 602 · 3.2 CHECKED BY RD. DATE 6/5/89
BORING NO. 1167
PIEZOMETER NO. 1167 DATE OF INSTALLATION 5-3-89

BOREHOLE DRILLING

DRILLING METHOD Hollow Stem Auger	TYPE OF BIT Auger Bit
DRILLING FLUID (S) USED: N/A	CASING SIZE (S) USED: N/A
FLUID N/A FROM N/A TO N/A	SIZE N/A FROM N/A TO N/A
FLUID N/A FROM N/A TO N/A	SIZE N/A FROM N/A TO N/A

PIEZOMETER DESCRIPTION

TYPE Schedule 40 PVC	RISER PIPE MATERIAL Schedule 40 PVC
DIAMETER OF PERFORATED SECTION 2 inch	RISER PIPE DIAMETERS: 2 5/16 RD 6/5/89
PERFORATION TYPE:	O.D. ~~2 1/4 inch~~ I.D. 2 inch
SLOTS ☑ HOLES ☐ SCREEN ☐	LENGTH OF PIPE SECTIONS 7.0 ft
AVERAGE SIZE OF PERFORATIONS 0.020 inch	JOINING METHOD Flush-Threaded
TOTAL PERFORATED AREA ~~4.8 ft~~ ~~5 ft~~ 4.8 ft. RD 6/5/89	

PROTECTION SYSTEM

RISER PROTECTIVE PIPE LENGTH 3.0 ft	OTHER PROTECTION Locking Cap
PROTECTIVE PIPE O.D. 4 1/4 inch	

ITEM	DISTANCE ABOVE/BELOW GROUND SURFACE (ft)		ELEVATION (ft)	
TOP OF RISER PIPE	2.0 ft			
GROUND SURFACE	0.0 ft			
BOTTOM OF PROTECTIVE PIPE	2.8 ft			
BOREHOLE FILL MATERIALS:				
GROUT/SLURRY	TOP N/A	BOTTOM N/A	TOP	BOTTOM
BENTONITE	TOP 1.0 ft	BOTTOM 4.0 ft	TOP	BOTTOM
SAND	TOP 4.0 ft	BOTTOM 10.0 ft	TOP	BOTTOM
GRAVEL	TOP N/A	BOTTOM N/A	TOP	BOTTOM
PERFORATED SECTION	TOP 5.0 ft	BOTTOM 9.8 ft	TOP	BOTTOM
PIEZOMETER TIP	10.0 ft			
BOTTOM OF BOREHOLE	12.0 ft ~~10.0 ft~~ JS 5-9-89			
GWL AFTER INSTALLATION				

WAS THE PIEZOMETER FLUSHED AFTER INSTALLATION? YES ☐ NO ☑
WAS A SENSITIVITY TEST PERFORMED ON THE PIEZOMETER? YES ☐ NO ☑
REMARKS Water Bearing Zone: 4.5 > 8.0 ft

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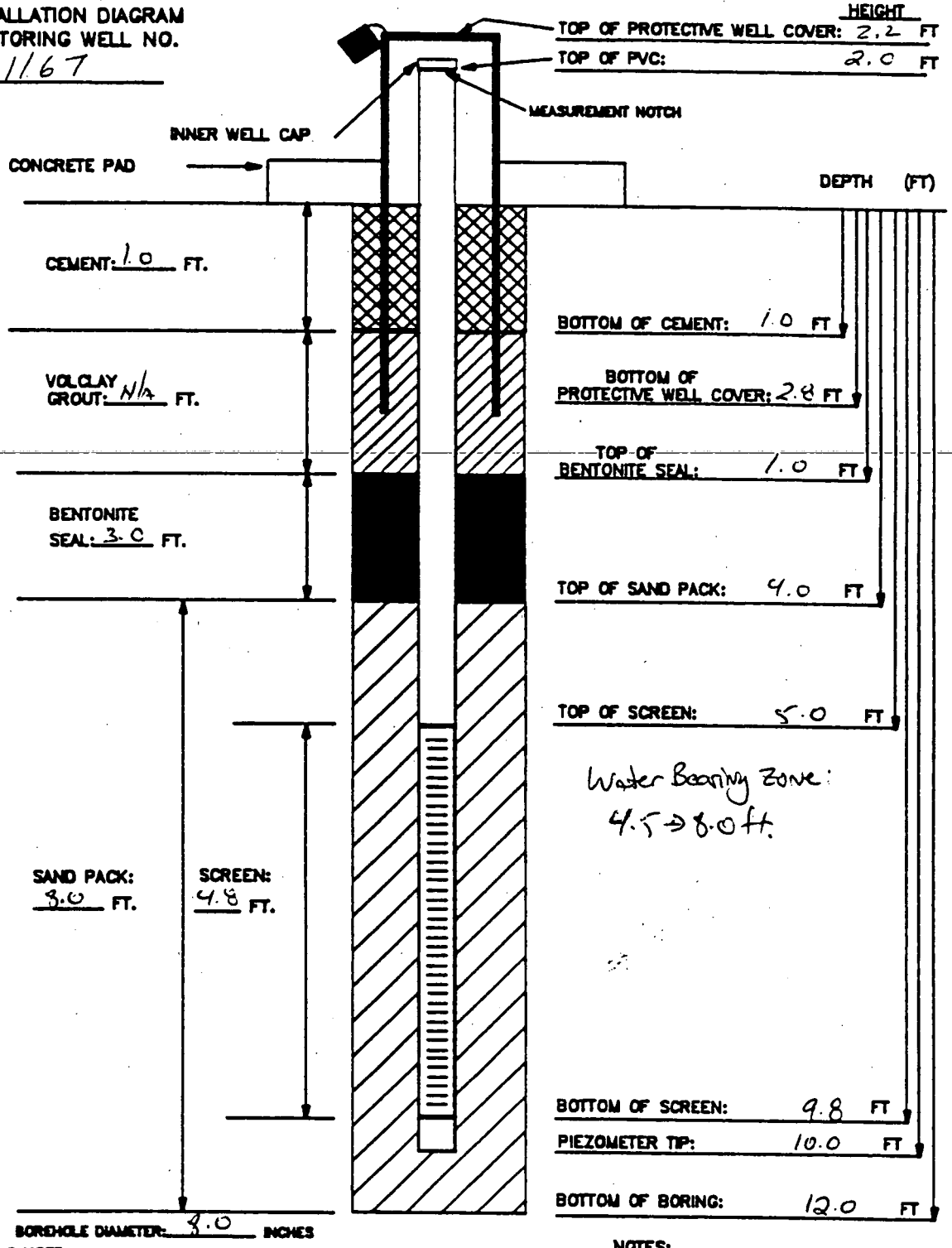
409-11-86

FERNALD RI/FS

INSTALLATION DIAGRAM
MONITORING WELL NO. 1167

INSTALLATION DATE: 5-3-89



BOREHOLE DIAMETER: 8.0 INCHES

MATERIALS USED:
SAND TYPE AND QUANTITY: 2½ Bags 10/20 80lb Bag
BENTONITE PELLETS (5-GALLON BUCKETS): 2
BAGS OF VOLCLAY GROUT: N/A
AMOUNT OF CEMENT: 1 Bag (94 lb)
AMOUNT OF WATER USED: 10 gallons
OTHER: Protective Cover.

NOTES:
1) RISER PIPE IS 2-INCH SCHEDULE 40 PVC PIPE, FLUSH-THREADED JOINTS.
2) SCREEN IS 2-INCH I.D. SCHEDULE 40 PVC PIPE WITH 0.020-INCH SLOTS.
3) LOWER END OF SCREEN IS CAPPED WITH AN END CAP OR THREADED SUMP.
4) WATER DEPTH/DATE:

TASK: 602 3.2.1

GEOLOGIST/ENGINEER: L. Sinfield

FERNALD RI/FS

6496

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602-	PROJECT NAME: Facilities Testing Program		
BORING NUMBER: 1168	COORDINATES:		DATE: 5-2-89
ELEVATION:	GWL: Depth	Date/Time	DATE STARTED: 5-2-89
ENGINEER/GEOLOGIST: L SINFIELD	Depth	Date/Time	DATE COMPLETED: 5-2-89
DRILLING METHODS: B-53 Hollow Stem Auger w/split spoon sampler			PAGE 1 OF 3-5

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS (Note (5 Total Sheets w/Field Copies Enclosed) 1/17/89)
							Start = 1046
0.5	16375 WMCO	10	8 in	GRAVEL, Dry, loose with clay and silt, Dark Grey (10yr, 4/1) @ 1050	GW	Loose TSF	HNU = Ø ppm; α = 10 cpm; Bγ = 200-240 cpm
1.0	16376	19					
1.5	16377 NR	10					
2.0	16378 NR	6	8 in	VERY STIFF, Lean Clay gray (2.5y, N5) mottled, med plastic, dry, massive @ 1100	CL	2.5 to 3.1 TSF	HNU = Ø ppm; α = 10 cpm; Bγ = 200-240 cpm
2.5	16379 WMCO	5					
3.0	16380	7					
3.5	16381	5	4 in	MEDIUM STIFF, LIGHT OLIVE BROWN, (2.5Y, 5/4) to gray (2.5Y, N5), clay, dry, massive, med plastic @ 1105	CL	1.5 TSF	HNU = Ø ppm; α = 10 cpm; Bγ = 100-140 cpm
4.0	16382 NR	6					
4.5	16383 NR	7					
5.0	16384	6	18 in	Stiff, becomes Very stiff towards base, Light Olive Brown (2.5Y, 5/4) Lean Clay, CL - Dry, massive medium plastic. @ 1110	CL	1.0 ↓ 3.3 TSF	HNU = Ø ppm; α = 10 cpm; Bγ = 80-100 cpm
5.5	16385 WMCO	8					
6.0	16386	16					
6.5	16389	2	18 in	Stiff Mottled Brownish Yellow (10YR, 6/6) Lean Clay, CL - Dry, massive, medium plastic	CL	1.5 ↓	HNU = 2 ppm; α = 10 cpm; Bγ = 100-140 cpm
7.0	16388 ~~16390~~ YS	5					
7.5	16389	7		Very Stiff, mottled Gray (10YR, 4/1) Lean Clay, CL - Dry, massive med. plastic @ 1115	CL	3.0 TSF	

NOTES: Contractor: Penn Drill
Driller: Jim Saccani
Helper: G. Dye
Sample Tech: C. Melroy
Weather: Cloudy
HNU #: HH18

Background @ 0900
HNU = Ø ppm
α = 10 cpm
Bγ = 100-120 cpm

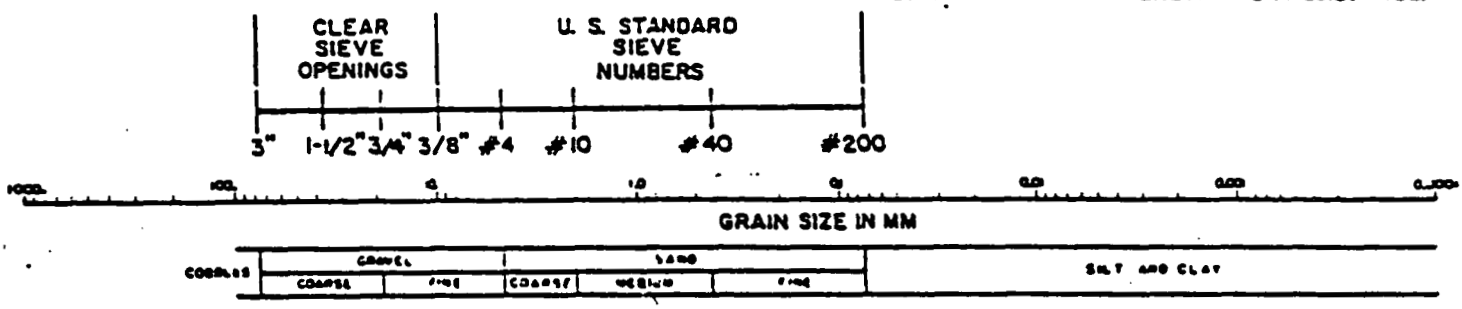
CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE[1]
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

(1) STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 18 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANCE.



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

FINE-GRAINED/HIGHLY ORGANIC SOILS

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

FERNALD RI/FS

6496

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602-3.7.1	PROJECT NAME: Facilities Testing Program	
BORING NUMBER: 1168	COORDINATES:	DATE: 5/2/89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5/2/89
ENGINEER/GEOLOGIST: L. Sintfield	Depth Date/Time	DATE COMPLETED: 5/8/89
DRILLING METHODS: B-53, Hollow Stem Auger with Split Spoon Sampler		PAGE 2 OF ~~75~~ 85

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER 1 6IN	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
7.5							Start=
8.0	16390	8		Stiff to Very Stiff, mottled Brownish yellow (10YR, 6/6)		1.5	HNU= Ø ppm
	16391	9	18in	to gray (10YR, 6/1) Lean Clay,	CL	to 4.0	α= 10 cpm
8.5				CL - Dry, medium Plastic			Bγ= 100-140 cpm
	16392	10		massive @ 1120		TSF	
9.0							
	16393	6		Very Stiff, Gray (10YR, 6/1)		2.1	HNU= Ø ppm
9.5				Lean Clay, CL - Dry, medium			α= 10 cpm
	16394	8	8in	plastic, massive	CL		Bγ= 80-100 cpm
10.0							
	16395	10		@ 1125		TSF	
10.5							
	16396	16		Hard, mottled Brownish		74.5	HNU= Ø ppm
11.0				yellow (10YR, 6/6) Lean Clay			α= 10 cpm
	50629	18	18in	with Sand, ~~CL~~ stringers, CL	CL/SM		Bγ= 100-140 cpm
11.5				Sand is 1/4in thick, clay & sand			
	50630	20		Sand is dry, clay = massive, medium plastic @ 1140		TSF	
12.0							
	50631	8		Hard, Same as above but		74.5	HNU= Ø ppm
12.5				Top 1inch is a moist			α= Ø cpm
	50632	17	14in	silt, massive, loose,	CL		Bγ= 80-100 cpm
13.0				brownish yellow.			
	50633	18		@ 1330		TSF	
13.5							
	50634	21		Very Stiff to Hard		1.5	HNU= Ø ppm
14.0				Gray (10YR, 5/1) Lean Clay, CL-		to	α= 10 cpm
	50635	22	18in	Medium plastic, dry, massive,	CL	4.5	Bγ= 100-120 cpm
14.5				rare gravel, isolated.			
	50636	24		@ 1335		TSF	
15.0							

NOTES: Contractor: Driller: Helper: Sample Tech: Weather: HNU #: } See page 1 of 5

Background @ 1300
HNU= Ø ppm
α= 10 cpm
Bγ= 80-140 cpm

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FERNALD RI/FS

6496

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602-3.7.1	PROJECT NAME: Facilities Testing Program	
BORING NUMBER: 1168	COORDINATES:	DATE: 5/2/89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5/2/89
ENGINEER/GEOLOGIST: L. Sinfield	Depth Date/Time	DATE COMPLETED: 5/8/89
DRILLING METHODS: B-53, Hollow Stem Auger with Split Spoon Sampler		PAGE 3 OF 5

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
15.0							Start=
15.5	50637	6		Stiff, Gray (10YR, 6/1) to Brownish yellow (10YR, 6/6) Lean Clay, CL, - dry to very slightly moist, medium plastic, massive, Rare gravel. @ 1340	CL	1.6 TSF	HNU= ∅ ppm α= 10 cpm Bγ= 80-100 cpm
16.0	50638	9	18in				
16.5	50639	13					
17.0	50640	10		Stiff to Very Stiff, Gray same as above 15.0-16.5ft with linch Silt layer - moist @ 1405	CL	1.0 to 2.1 TSF	HNU= ∅ ppm α= ∅ cpm Bγ= 80-100 cpm
17.5	50641	16	18in				
18.0	50642	14					
18.5	50643	21	↑	Hard - same as above but top 6inch is moist - slough? @ 1410	CL	? 4.5 TSF	HNU= ∅ ppm α= ∅ cpm Bγ= 80-100 cpm
19.0	50644	27	24in				
19.5	50645	27	↓				
20.0	50646	57	↓	@ 1410	CL	4.5 TSF	HNU= ∅ ppm α= ∅ cpm Bγ= 80-100 cpm
				TD = 20.0ft Borehole was backfilled with Volclay Grout to ~~the~~ 1.0ft below the ground surface on 5/1/89 by			

NOTES: Contractor:
Driller:
Helper:
Sample Tech:
Weather:
HNU#:
} See Page 1 of 5

Background @
HNU= ∅ ppm
α= 10 cpm
Bγ= 100-140 cpm

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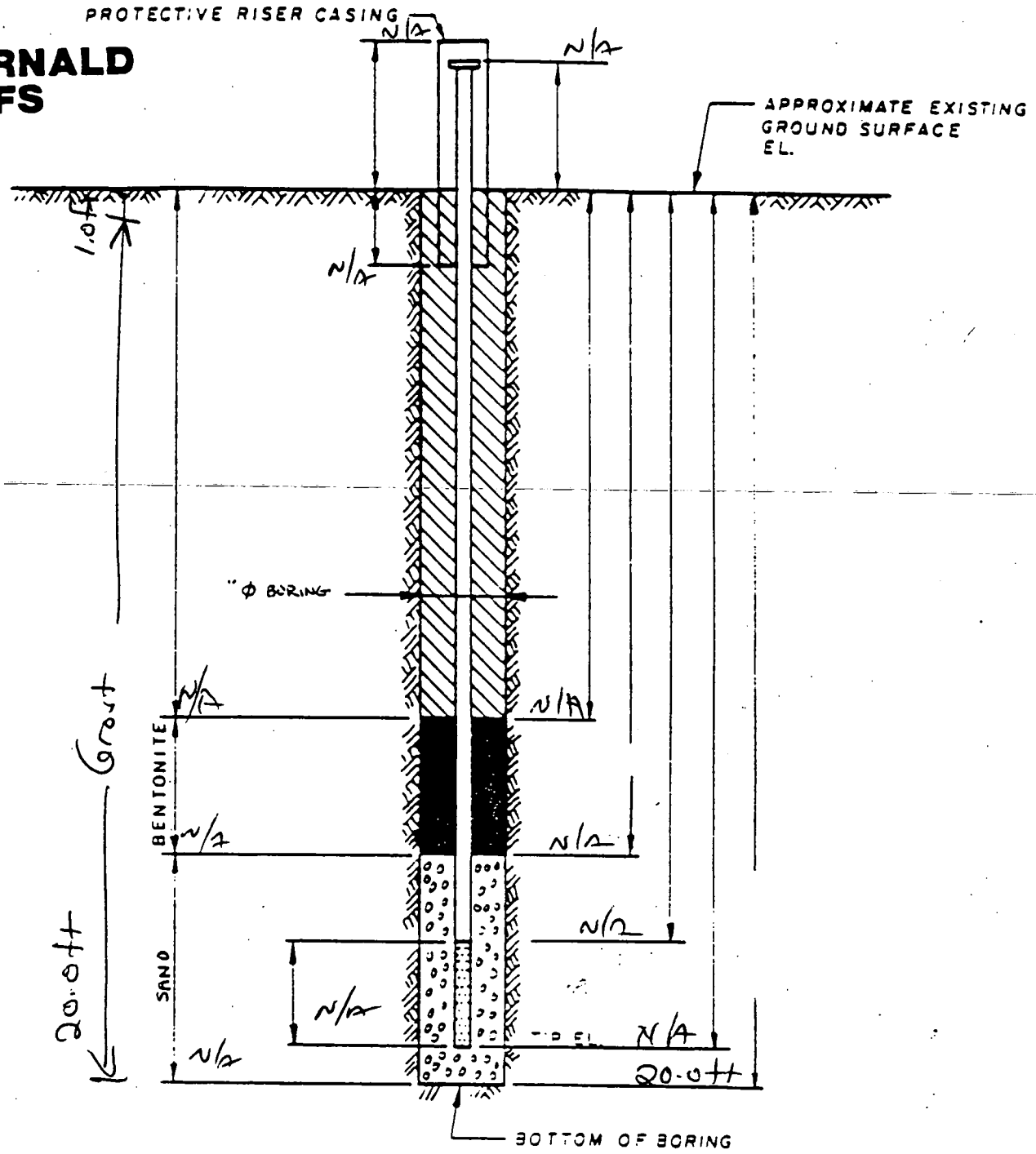
4C2-11-86

FERNALD RI/FS



NOTES:

1. RISER PIPE IS IN I.D. SCHEDULE N/A PIPE, THREADED, FLUSH-JOINTED.
2. SCREEN IS IN I.D. N/A PIPE CONTINUOUS SLOT SCREEN (0.0 0 IN SLOT SIZE).
3. LOWER END OF SCREEN IS CAPPED.
4. ELEVATION OF WATER LEVEL ~N/A
5. WATER LEVEL READING ON N/A

3 — 50 lb bags of dolomite grout

50 — ~~Buck~~ Gallons of Water.

INSTALLATION DETAILS
MONITORING WELL 1168

PREPARED FOR

DRAWING NUMBER

CHECKED BY

APPROVED BY

DRAWN BY

FERNALD RI/FS

PIEZOMETER INSTALLATION SHEET

PROJECT NAME Facilities Testing FMPC RI/FS FIELD ENG./GEO. C. Sinfield DATE 5-2-89
PROJECT NO. 602 371 CHECKED BY B.D. DATE 6/5/89
BORING NO. 1168
PIEZOMETER NO. None DATE OF INSTALLATION N/A 5-8-89

BOREHOLE DRILLING

DRILLING METHOD Hollow Stem Auger	TYPE OF BIT Auger ~~Rig~~ Bit
DRILLING FLUID (S) USED:	CASING SIZE (S) USED: None
FLUID N/A FROM N/A TO N/A	SIZE N/A FROM N/A TO N/A
FLUID N/A FROM N/A TO N/A	SIZE N/A FROM N/A TO N/A

PIEZOMETER DESCRIPTION

TYPE ~~Sch~~ N/A	RISER PIPE MATERIAL N/A
DIAMETER OF PERFORATED SECTION N/A	RISER PIPE DIAMETERS:
PERFORATION TYPE:	O.D. N/A I.D. N/A
SLOTS ☐ HOLES ☐ SCREEN ☐	LENGTH OF PIPE SECTIONS N/A
AVERAGE SIZE OF PERFORATIONS N/A	JOINING METHOD N/A
TOTAL PERFORATED AREA N/A	

PROTECTION SYSTEM

RISER PROTECTIVE PIPE LENGTH N/A	OTHER PROTECTION N/A
PROTECTIVE PIPE O.D. N/A	N/A

ITEM	DISTANCE ABOVE/BELOW GROUND SURFACE ( )		ELEVATION ( )	
TOP OF RISER PIPE	N/A			
GROUND SURFACE	0.0			
BOTTOM OF PROTECTIVE PIPE	N/A			
BOREHOLE FILL MATERIALS: GROUT/SLURRY	TOP ~~0.0 ft~~ 1.0 ft	BOTTOM ~~10 ft~~ 20.0 ft	TOP	BOTTOM
BENTONITE	TOP N/A	BOTTOM N/A	TOP	BOTTOM
SAND	TOP N/A	BOTTOM N/A	TOP	BOTTOM
GRAVEL	TOP N/A	BOTTOM N/A	TOP	BOTTOM
PERFORATED SECTION	TOP N/A	BOTTOM N/A	TOP	BOTTOM
PIEZOMETER TIP	N/A			
BOTTOM OF BOREHOLE	~~10 ft~~ 20.0 ft			
GWL AFTER INSTALLATION	Dry			

WAS THE PIEZOMETER FLUSHED AFTER INSTALLATION? YES ☐ NO ☑
WAS A SENSITIVITY TEST PERFORMED ON THE PIEZOMETER? YES ☐ NO ☑

REMARKS Grouted to Surface

ACG-11-86

FERNALD RI/FS

6496

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FMPC RI/FS		
BORING NUMBER: 1218	COORDINATES:	DATE: 5-2-89	
ELEVATION:	GWL: Depth 7.5 FT Date/Time 5-2-89 @ 1553	DATE STARTED: 5-2-89	
ENGINEER/GEOLOGIST: E. TROLLINGER C. GRUBE	Depth Date/Time	DATE COMPLETED: 5-2-89	
DRILLING METHODS: MOBILE DRILL 8" HSA		PAGE 1 OF 4	

DEPTH (FT.)	SAMPLE TYPE & NO	BLOWS ON SAMPLER PER 6 (IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
1	17365 1045 05-2	4	18	MEDIUM DENSE, BROWN (10YR5/3) SANDY SILT, TRACE OF ORGANICS (ROOTS, GRASS) MOIST.	ML	N/A	Hnu = 0.2 ppm
	17366 1045 05-2	9		VERY STIFF, BROWN, (10YR3/3), SILTY CLAY TRACE OF FINE GRAVEL, LOW PLASTICITY, MOIST.	CL	2.75	α = 0 cpm
	17367 1045 05-2	25		VERY STIFF, BROWN (10YR3/4), GRAVELLY CLAY, LOW PLASTICITY, MOIST.	CL	3.0	βγ = 60-80 cpm
2	17368 1055 05-2	25	12	VERY STIFF, GRAYISH BROWN, (2.5Y 4/4) CLAY, LOW PLASTICITY, TRACE OF GRAVEL, MOIST.	CL	4.0	Hnu = 0.2 ppm
	17369 1055 05-2	19					α = 0 cpm
							βγ = 60-80 cpm
3	17370 1055 05-2	16		NO RECOVERY	N/A	N/A	
4	17371 1100 05-2	10	17	VERY STIFF, GRAYISH BROWN (10YR4/3) SILTY CLAY, LOW-MEDIUM PLASTICITY, MOIST.	CL	2.5	Hnu = 0.2 ppm
	17372 1100 05-2	25					α = 0 cpm
							βγ = 60-80 cpm
	17373 1100 05-2	33		VERY STIFF, GRAYISH BROWN, (10YR4/3) CLAY, MEDIUM PLASTICITY, MOIST.	CL	4.0	
5	17374 1105 05-2	21	18	STIFF TO VERY STIFF, GRAYISH-BROWN (10YR4/3) SILTY CLAY, LOW TO MEDIUM PLASTICITY, MOIST.	CL	1.75	Hnu = 0.2 ppm
	17375 1105 05-2	25				1.75	α = 0 cpm
6	17376 1105 05-2	30				2.75	βγ = 60-80 cpm
7	17377 1505 05-2	7	12	VERY STIFF, DARK BROWN (10YR3/3) SILTY CLAY, TRACE OF FINE GRAVEL LOW PLASTICITY, MOIST.	CL	3.0	Hnu = 0.2 ppm
	17378 1545 05-2	7		MEDIUM DENSE, GRAYISH BROWN (10YR4/2) SANDY SILT, MOIST.	ML	N/A	α = 0 cpm
	17378 1545 05-2	10		NO RECOVERY	N/A	N/A	βγ = 60-80 cpm

NOTES: DRILLING CO.:
DRILLER: DAVE NEWMAN
HELPER: BILL ANDERSON

MATERIALS USED:
2 SACKS 10/20 SAND (50 lb.) ea
1½ BUCKETS BENTONITE PELLETS (5 gal)
½ SACK TYPE I CEMENT
5 GAL. WATER

SAMPLING IN ACCORDANCE WITH ASTM STANDARDS, DESCRIPTION OF SOIL COLOR BY MUNSELL COLOR CHART. SAMPLES TAKEN FOR WMCO AT INTERVALS 0.0-.5 FT., 2-2.5 FT., 5-5.5 FT, 10-10.5 FT., 15-15.5 FT.

INSTRUMENT BACKGROUND
Hnu = 0.2 ppm
α = 0 cpm
βγ = 60-80 cpm
LEL = 0 ppm
O_2 = 20.6 %

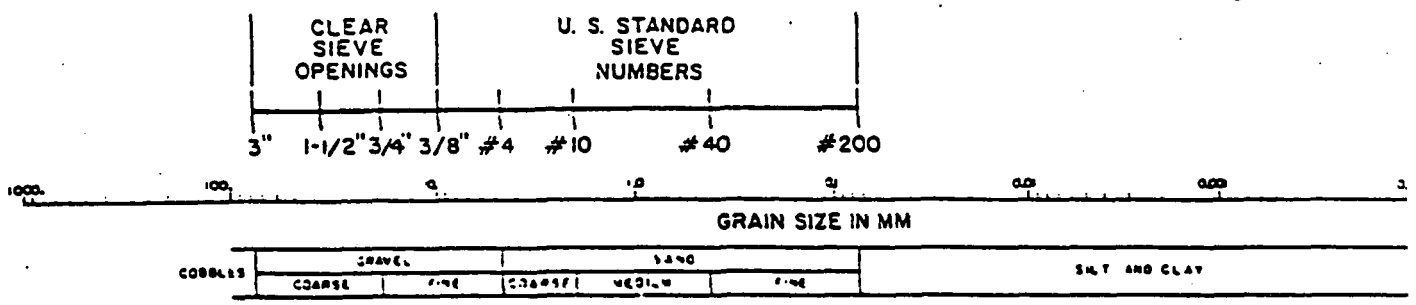
CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE(1)
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

(1) STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 18 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANCE.



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

FINE-GRAINED/HIGHLY ORGANIC SOIL

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONT

FERNALD RI/FS

6496

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FMPC RI/FS		
BORING NUMBER: 1218	COORDINATES:	DATE: 5-2-89	
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5-2-89	
ENGINEER/GEOLOGIST: E. TROWINGER, F. GRUBE	Depth Date/Time	DATE COMPLETED: 5-2-89	
DRILLING METHODS: MOBILE DRILL 8 IN HSA		PAGE 2 OF 4	

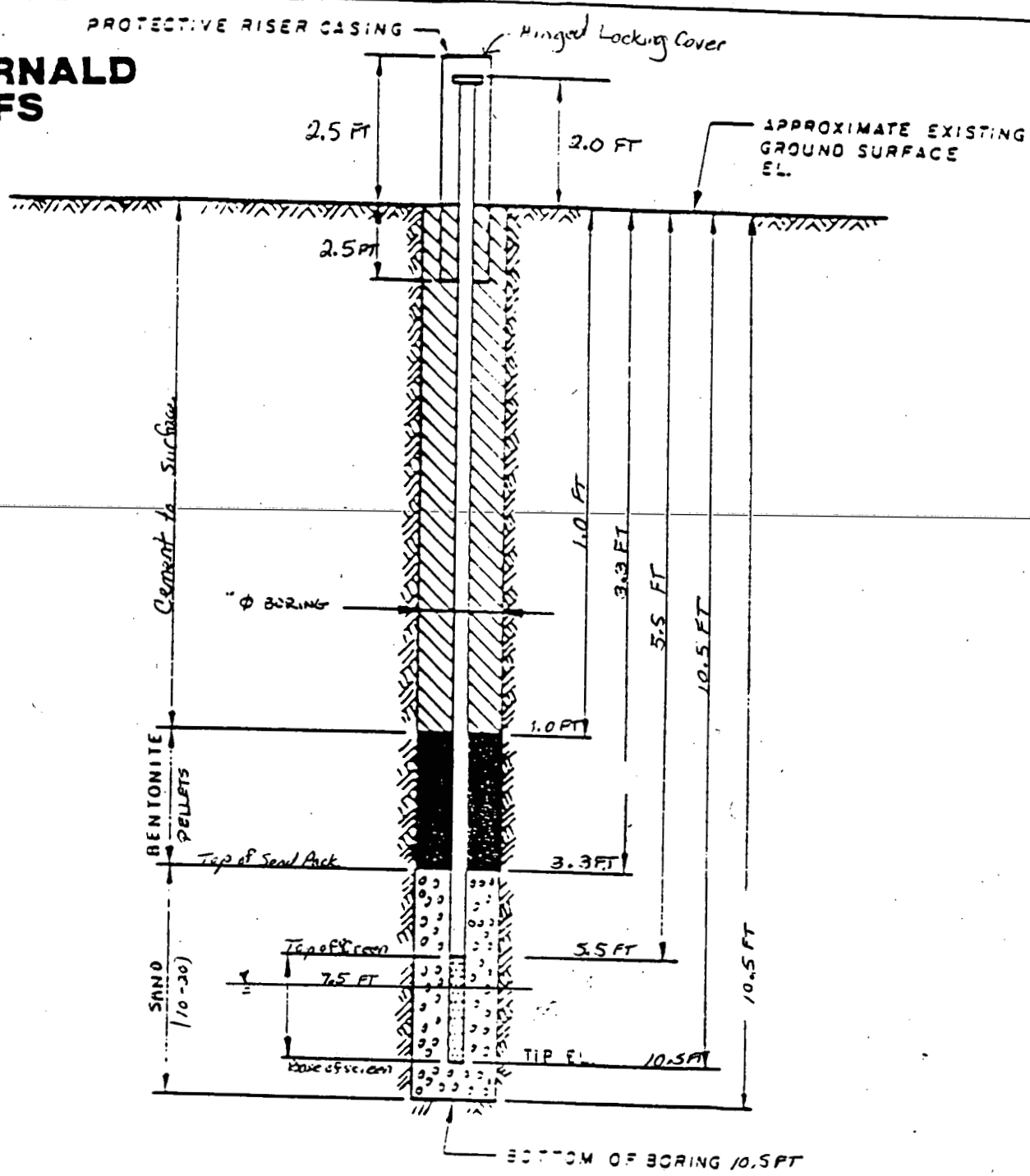
DEPTH (FT.)	SAMPLE TYPE & NO	BLOWS ON SAMPLER PER (6 IN.)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
8	17379 1553 05-2	7		MEDIUM DENSE, YELLOWISH BROWN, (10 YR 5/4) SANDY SILT, TRACE OF GRAVEL, WET.	ML	N/A	Hnu = 0.2 ppm
	17380 1553 05-2	17	16	VERY STIFF, YELLOWISH BROWN (10 YR 5/6) SILTY CLAY, VERY MOIST. (4 IN RECOV. ON 17381)			α = 0 CPM
	17381 1553 05-2	15			CL	2.75	βγ = 80 CPM
9	17382 1600 05-2	9		MEDIUM DENSE, YELLOWISH BROWN (10YR 5/6) SILT, WET	ML	N/A	Hnu = 0.2 ppm
	17383 1600 05-2	13	16				α = 0 CPM
10	17384 1600 05-2	20		VERY STIFF, GRAYISH BROWN (10YR 5/4) CLAY, LOW PLASTICITY, MOIST. (4 IN OF RECOVERY)	CL	4.0	βγ = 80 CPM
11				BOTTOM OF BORING AT 10.5 FT. SAMPLING ENDED AT 10.5 FT.			~~Hnu~~ = ~~α~~ = ~~βγ~~ =
12							
13							
14							

NOTES:

DRILLER: DAVE NEWMAN
HELPER: BILL ANDERSON

INSTRUMENT BACKGROUND
Hnu = 0.2 ppm
α = 0 CPM
βγ = 80-90 CPM

FERNALD RI/FS



DRAWING NUMBER Boring 1218

CHECKED BY / APPROVED BY

CG

DRAWN BY

NOTES:

1. RISER PIPE IS 2.0 IN ID SCHEDULE PIPE, THREADED, FLUSH-JOINTED.
2. SCREEN IS 2.0 IN 1.0 sch. 40 PIPE CONTINUOUS SLOT SCREEN (0.020 IN SLOT SIZE).
3. LOWER END OF SCREEN IS CAPPED.
4. ELEVATION OF WATER LEVEL
5. WATER LEVEL READING ON

Materials used in well installation:

10-20 sand - 2 80 lb sacks
Bentonite pellets - 1 ½ buckets - 5 gal
½ sack cement
5 gal water

INSTALLATION DETAILS
MONITORING WELL #1218

PREPARED FOR FMPC RI/FS
Boring #1218

PVC well screen and riser pipe:

1 - 5.0 FT screen section
1 - 7.5 FT Riser Section (cut to length)

FERNALD RI/FS

PIEZOMETER INSTALLATION SHEET

PROJECT NAME FMPC RI/FS
FIELD ENG./GEO. C. Grubb/E. Trollinger DATE 5/2/89
PROJECT NO. 602 3.7
CHECKED BY R.W. DATE 6/4/89
BORING NO. 1218
PIEZOMETER NO. 1218
DATE OF INSTALLATION 5/2/89

BOREHOLE DRILLING

DRILLING METHOD 8 in. Hollow Stem Auger
DRILLING FLUID (S) USED:
FLUID N/A FROM — TO —
FLUID N/A FROM — TO —

TYPE OF BIT 8 in Hollow Stem Auger
CASING SIZE (S) USED:
SIZE N/A FROM — TO —
SIZE N/A FROM — TO —

PIEZOMETER DESCRIPTION

TYPE Monitoring Piezometer
DIAMETER OF PERFORATED SECTION 2.0 in I.D.
PERFORATION TYPE:
SLOTS [X] HOLES [ ] SCREEN [ ]
AVERAGE SIZE OF PERFORATIONS 0.020 in
TOTAL PERFORATED AREA 5.0 FT

RISER PIPE MATERIAL Schedule 40 PVC
RISER PIPE DIAMETERS:
O.D. 2 5/16 in I.D. 2.0 in
LENGTH OF PIPE SECTIONS 7.5 FT
JOINING METHOD screw type, flush joint threaded

PROTECTION SYSTEM

RISER PROTECTIVE PIPE LENGTH 5.0 FT
PROTECTIVE PIPE O.D. 4 3/8 in.

OTHER PROTECTION Hinged cover with installed padlock

ITEM	DISTANCE ABOVE/BELOW GROUND SURFACE (FT)		ELEVATION ( )	
TOP OF RISER PIPE	2.0			
GROUND SURFACE	0.0			
BOTTOM OF PROTECTIVE PIPE	2.5			
BOREHOLE FILL MATERIALS:				
~~GROUT/SLURRY~~ Cement	TOP 0.0	BOTTOM 1.0	TOP	BOTTOM
BENTONITE	TOP 1.0	BOTTOM 3.3	TOP	BOTTOM
SAND 10/20	TOP 3.0	BOTTOM 10.5	TOP	BOTTOM
~~GRAVEL~~ NONE USED	TOP —	BOTTOM —	TOP	BOTTOM
PERFORATED SECTION	TOP 5.5	BOTTOM 10.5	TOP	BOTTOM
PIEZOMETER TIP	10.5			
BOTTOM OF BOREHOLE	10.5			
GWL AFTER INSTALLATION	—			

WAS THE PIEZOMETER FLUSHED AFTER INSTALLATION? YES [ ] NO [X]
WAS A SENSITIVITY TEST PERFORMED ON THE PIEZOMETER? YES [ ] NO [X]

REMARKS WATER BEARING ZONE ENCOUNTERED FROM 7.5 FT. TO 10.0 FT. AS NOTED ON BORING LOG.

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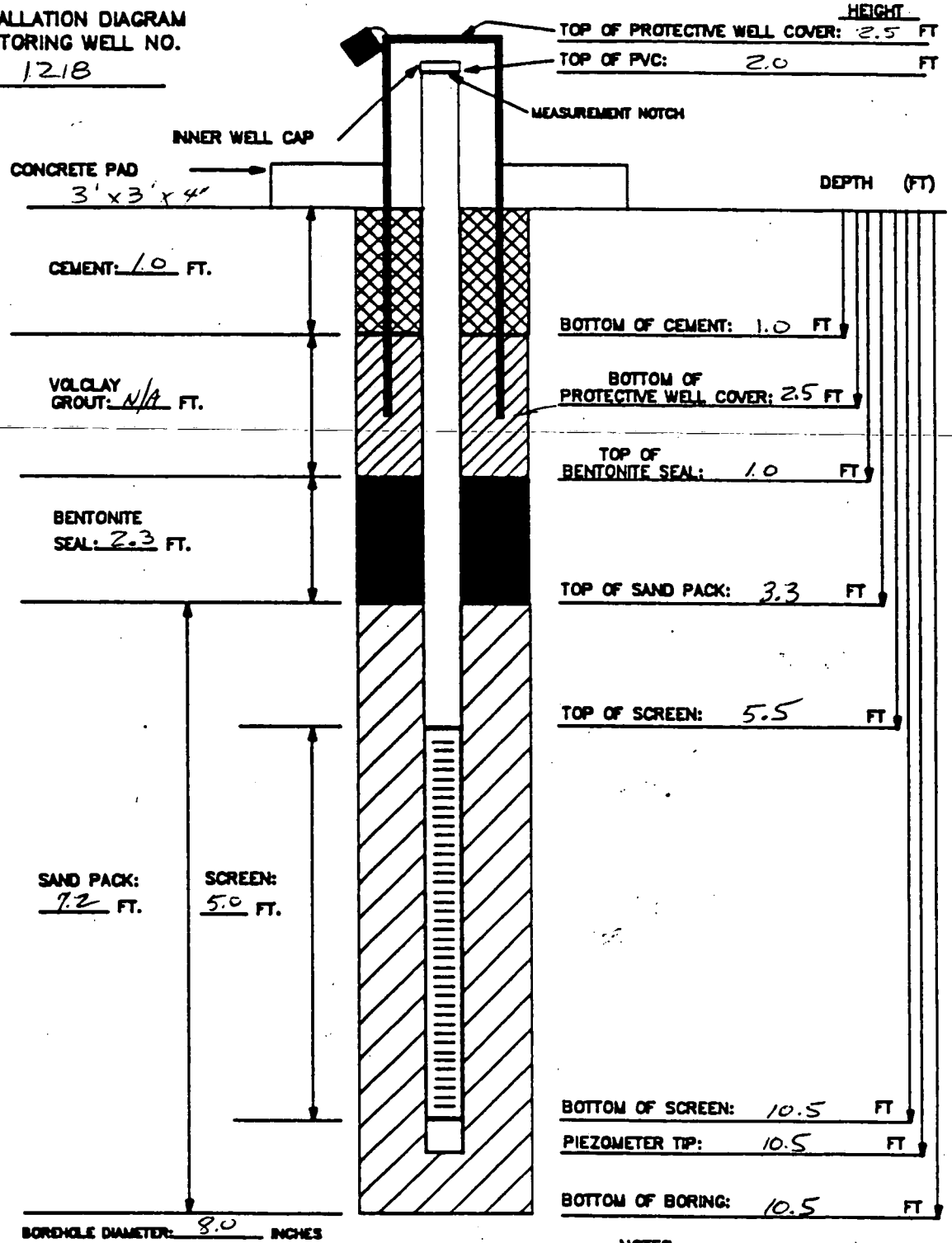
409-11-86

FERNALD RI/FS

INSTALLATION DIAGRAM
MONITORING WELL NO.
1218

INSTALLATION DATE: 5/2/89



BOREHOLE DIAMETER: 8.0 INCHES

MATERIALS USED:
SAND TYPE AND QUANITITY: 10/20, 2 80 lb. BAGS
BENTONITE PELLETS (5-GALLON BUCKETS): 1 1/2
BAGS OF VOLCLAY GROUT: NONE
AMOUNT OF CEMENT: 1/2 SACK
AMOUNT OF WATER USED: 5 GALS.
OTHER:

NOTES:
1) RISER PIPE IS 2-INCH SCHEDULE 40 PVC PIPE, FLUSH-THREADED JOINTS.
2) SCREEN IS 2-INCH I.D. SCHEDULE 40 PVC PIPE WITH 0.020-INCH SLOTS.
3) LOWER END OF SCREEN IS CAPPED WITH AN END CAP OR THREADED SUMP.
4) WATER DEPTH/DATE: 7.5 FT 5/2/89

TASK: 3.7

GEOLOGIST/ENGINEER: E. Trollinger, C. Grube

FERNALD RI/FS

6496

Date	6/5/89			
Initial				
	Field Check	1st Key In	2nd Key In	Hard Copy Verification

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602-3.7.1	PROJECT NAME: Facilities Testing Program	
BORING NUMBER: 1130	COORDINATES:	DATE: 5/1/89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5/1/89
ENGINEER/GEOLOGIST: L. Sinfield	Depth Date/Time	DATE COMPLETED: 5/2/89
DRILLING METHODS: B-53, Hollow Stem Auger with Split Spoon Sampler		PAGE 1 OF 7

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
0.5	15561 WMCO	8	12 in	Stiff to Very Stiff Gravel 0.5 ft Very dark grey (10YR, 3/1) Lean clay, cl - Dry, Some silt and Gravel, massive mottled. @ 1405	GM	2.5 to 3.5 TSF	Start = 1400 HNU = ∅ ppm α = ∅ cpm Bγ = 80-100 cpm
1.0	15562	7			CL		
1.5	15563 NR	6					
2.0	15564 NR	7	6 in	Stiff to Very Stiff Dark grayish brown (2.5YR, 4/2) Lean Clay, cl with gravel and silt - dry, massive, mottled. @ 1407	CL	1.5 to 2.5 TSF	HNU = ∅ ppm α = ∅ cpm Bγ = 80-120 cpm
2.5	15565 WMCO	5					
3.0	15566 NR	7					
3.5	15567 NR	8	6 in	Same as above 1.5 to 3.0 ft Dry - massive @ 1410	CL	1.0 to 2.5 TSF	HNU = ∅ ppm α = ∅ cpm Bγ = 80-120 cpm
4.0	15568	5					
4.5	15569 NR	6					
5.0	15570	4	18 in	Soft, Mottled light yellowish brown (10YR, 6/4) to Dark grayish brown (2.5YR, 4/2) Clay with Silt, CL - Moist, massive, medium plastic @ 1415	CL	0.5 TSF	HNU = ∅ ppm α = ∅ cpm Bγ = 80-120 cpm
5.5	15571 WMCO	3					
6.0	15572	4					
6.5	15573 NR	2	12 in	Soft, Same as above 4.5 to 6.0 ft but Very Slightly Moist @ 1430	CL	0.0 to 0.5 TSF	HNU = ∅ ppm α = ∅ cpm Bγ = 80-100 cpm
7.0	15574	4					
7.5	15575	4					

Water Bearing Zone ↑ 7.5 ft

NOTES: Contractor: Penn Drill
Driller: J. Saccani
Helper: G. Dye
Sample Tech: L. McCoy
Weather: Cloudy
HNU #: HH18

X/R = No Recovery
No Sample Taken

Background @ 1400
HNU = ∅ ppm
α = 0-10 cpm
Bγ = 80-120 cpm

4C2-11-86

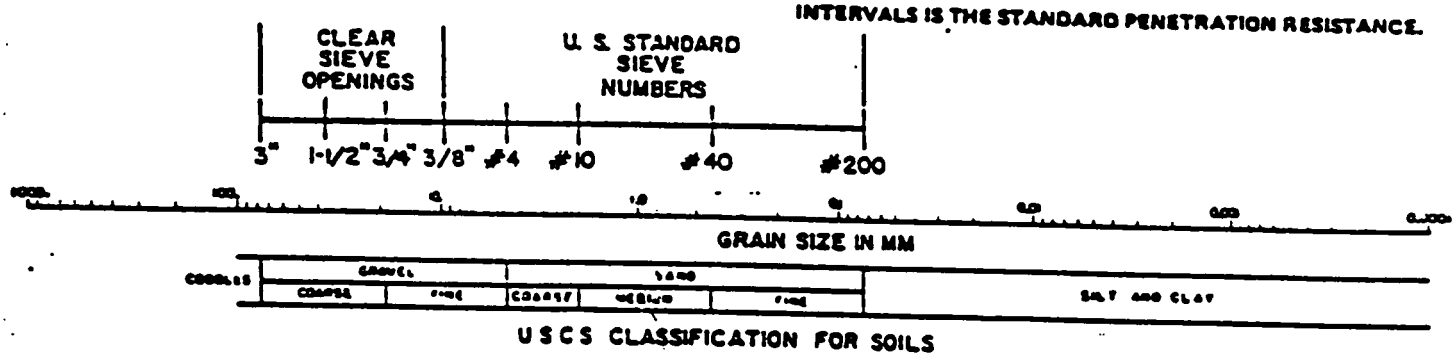
CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE (1)
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

(1) STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 18 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANCE.



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

FINE-GRAINED/HIGHLY ORGANIC SOILS

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

FERNALD RI/FS

6496 Field Copy

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602-37.1	PROJECT NAME: Facilities Testing Program	
BORING NUMBER: 1130	COORDINATES:	DATE: 5-1-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5-1-89
ENGINEER/GEOLOGIST: L Sinfield.	Depth Date/Time	DATE COMPLETED:
DRILLING METHODS: B-53 Hollow stem auger with split spoon sampler		PAGE 1 2 OF 7

BV 6/5/89

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
							Start = 1400
0.5	15561 WMCO	8		STIFF TO VERY STIFF Very dark grey (10yr 3/1) Lean clay, dry some silt & gravel, massive, mottled @ 1405	GW		HNU = ∅ ppm α = <1 cpm Bγ = 80-100 cpm
1.0	15562	7	12 IN		CL	2.5 to 3.5	
1.5	15563 NR	6				TSF	
2.0	15564 NR	7		Stiff to very stiff Dark grayish brown (2.5YR, 4/2) Lean clay with gravel and silt, dry, massive, mottled. @ 1407		1.5 to 2.5	HNU = ∅ ppm α = ∅ cpm Bγ = 80-120 cpm
2.5	15565 WMCO	5	6 in		CL		
3.0	15566 NR	7				TSF	
3.5	15567 NR	8		Stiff to very stiff Same as above 1.5 to 3.0 ft dry, massive @ 1410		1.0 to 2.5	HNU = ∅ ppm α = ∅ cpm Bγ = 80-120 cpm
4.0	15568	5	6 in		CL		
4.5	15569 NR	6				TSF	
5.0	15570	4		Soft, clay with silt, mottled light yellowish brown (10YR 6/4) to Dark grayish brown (2.5YR, 4/2) moist, massive, med. plastic @ 1415		0.5	HNU = ∅ ppm α = ∅ cpm Bγ = 80-120 cpm
5.5	15571 WMCO	3	18 IN		CL		
6.0	15572	4				TSF	
6.5	15573 NR	2		Soft, clay with silt Same as above but v. slight moist @ 1430		0.0 to 0.5	HNU = ∅ ppm α = ∅ cpm Bγ = 80-100 cpm
7.0	15574	4	12"		CL		
7.5	15575	4				TSF	

NOTES: Contractor: Penn Drill
Driller: Jim Saccani
Helper:
Sample Tech: Cindy Mahony
Weather: Cloudy
HNU #: HH18

Background @ 1400
HNU = ∅ ppm
α = 0 to 10 cpm
Bγ = 80-120 cpm

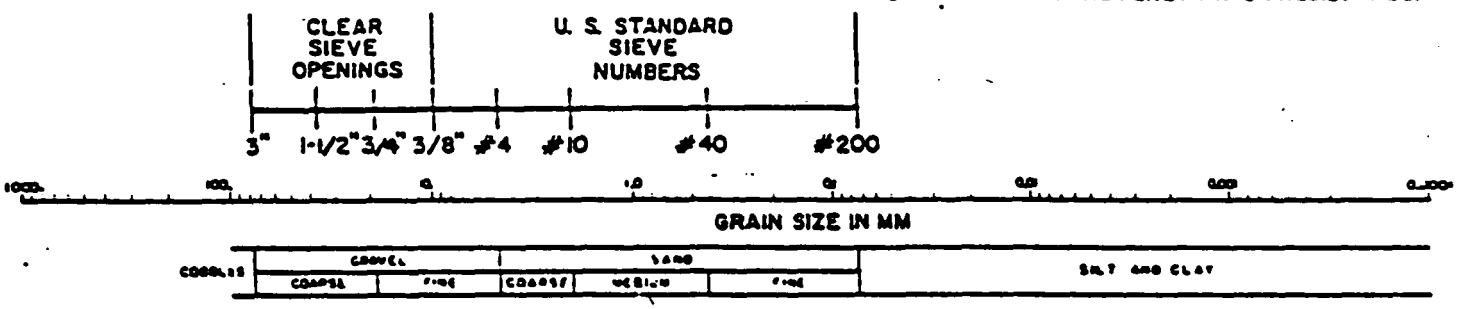
CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE(1)
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

(1) STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 18 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANCE.



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

FINE-GRAINED/HIGHLY ORGANIC SOILS

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

FERNALD RI/FS

6496

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602-3.7.1	PROJECT NAME: Facilities Testing Program	
BORING NUMBER: 1130	COORDINATES:	DATE: 5/1/89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5/1/89
ENGINEER/GEOLOGIST: L. Sinfield	Depth Date/Time	DATE COMPLETED: 5/2/89
DRILLING METHODS: B-53, Hollow Stem Auger with Split Spoon Sampler		PAGE ~~2~~ 3 OF ~~4~~ 7

BW. 6/5/89

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
7.5	15576	5		5 ft, Brownish yellow (10YR, 6/6) Clean clay, cl – moist with silt layers, mottled, massive medium plastic			Start =
8.0	15577	8	18 in		CL	70.5	HNU = ppm α = cpm Bγ = cpm
8.5	15578	13		@ 1500		TSF	
9.0	15579	2		Same as above but moist			HNU = ppm α = cpm Bγ = cpm
9.5	15580	8	18 in		CL	70.5	
10.0	15581	9		@ 1505		TSF	
10.5	WMCO			TD = 10.5 ft			HNU = ppm α = cpm Bγ = cpm
11.0							
11.5							
12.0				@		TSF	
12.5							HNU = ppm α = cpm Bγ = cpm
13.0							
13.5				@		TSF	
14.0							HNU = ppm α = cpm Bγ = cpm
14.5							
15.0				@		TSF	

NOTES: Contractor:
Driller:
Helper:
Sample Tech:
Weather:
HNU #:
} see page 1 of 1

Background @ 1400
HNU = 0 ppm
α = 0-10 cpm
Bγ = 80-120 cpm

402-11-86

000213

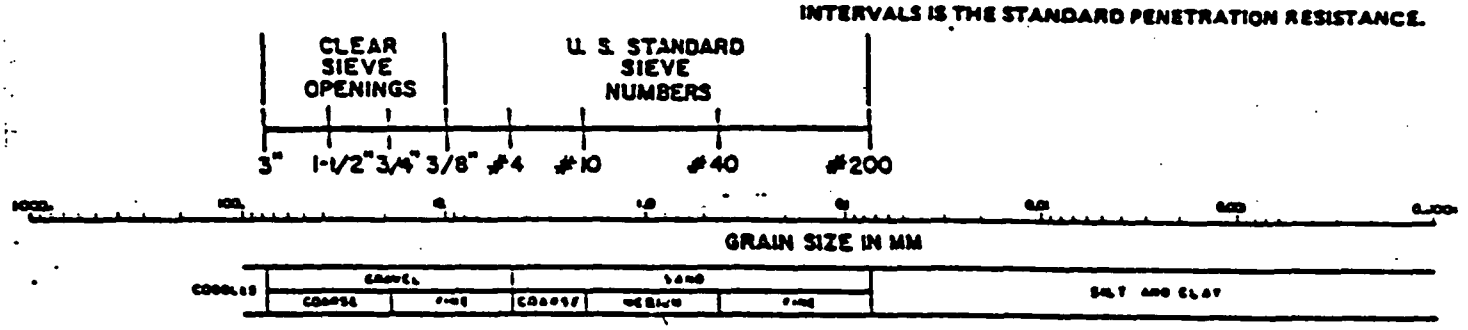
CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE (1)
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

(1) STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 18 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANCE.



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

FINE-GRAINED/HIGHLY ORGANIC SOILS

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

FERNALD RI/FS

6496

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602-	PROJECT NAME: Facilities Testing Program	
BORING NUMBER: 1130	COORDINATES:	DATE:
ELEVATION:	GWL: Depth Date/Time	DATE STARTED:
ENGINEER/GEOLOGIST: L. SINFIED	Depth Date/Time	DATE COMPLETED:
DRILLING METHODS: B-53 Hollow stem Auger w/ Split Spoon Sampler		PAGE ~~2~~ 4 OF ~~4~~ 7

6/5/89

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
7.5	15576	5		Soft Clay Brownish yellow			Start=
8.0	15577	8	18 in	(10YR, 6/6), massive, mottled	CC	70.5	HNU= 6 ppm α= ∅ cpm
8.5	15578	13		moist, Clean with moist Silt layers			Bγ= 80-120 cpm
9.0	15579	2		@ 1500		TSF	
9.5	15580	8	18 in	Same as above moist	CC	70.5	HNU= ∅ ppm α= ∅ cpm Bγ= 80-120 cpm
10.0	15581	9					
10.5	WMCO			@ 1505		TSF	
	~~15582~~ RS	5-4-87		TD=10.5 ft			HNU= ppm
11.0	~~50584~~ RS	5-4-87					α= cpm Bγ= cpm
11.5	50585						
12.0				@		TSF	
	50586						HNU= ppm
12.5	50587						α= cpm Bγ= cpm
13.0	50588						
13.5				@		TSF	
	50589						HNU= ppm
14.0	50590						α= cpm Bγ= cpm
14.5	50591						
15.0				@		TSF	

NOTES: Contractor:
Driller:
Helper:
Sample Tech:
Weather:
HNU#:

Background @
HNU= ppm
α= cpm
Bγ= cpm

000215

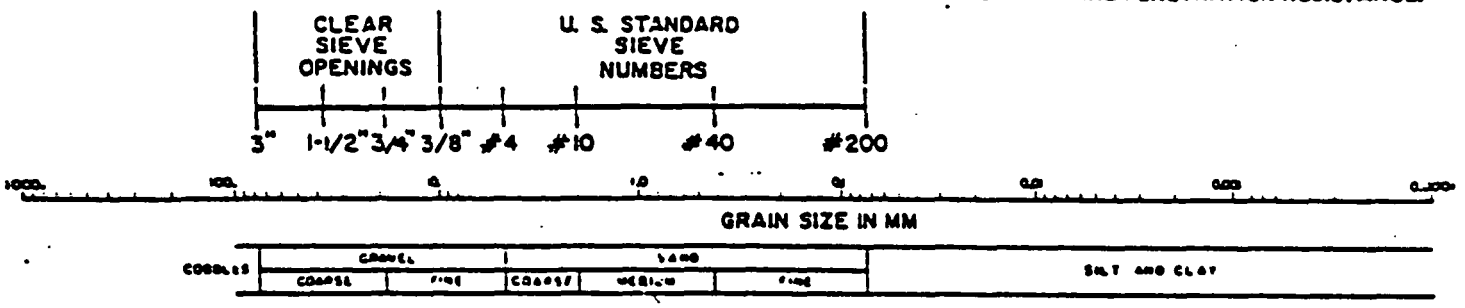
CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE (1)
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

(1) STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 18 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANCE.



USCS CLASSIFICATION FOR SOILS

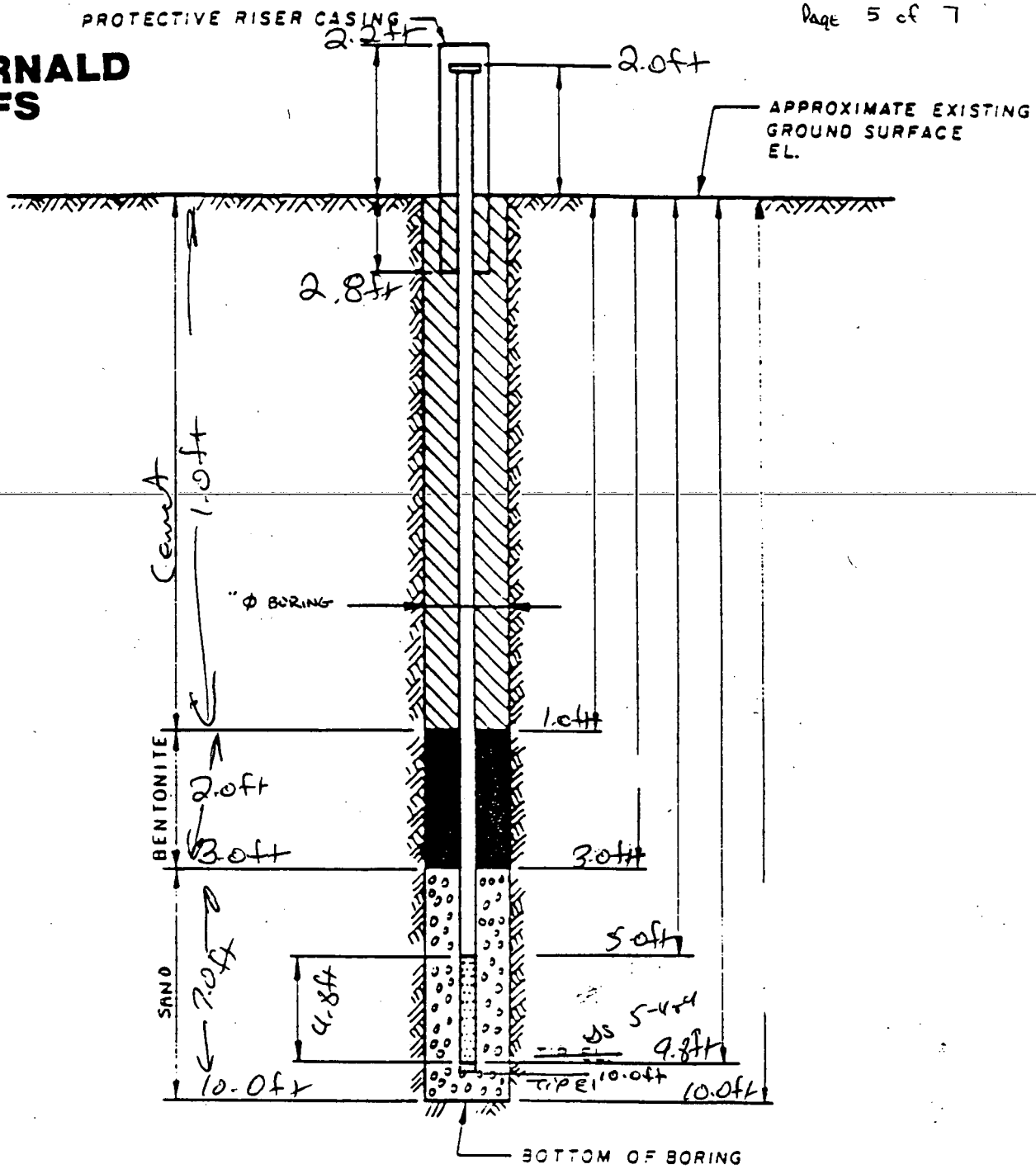
COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

FINE-GRAINED/HIGHLY ORGANIC SOILS

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

FERNALD RI/FS



DRAWING NUMBER

CHECKED BY

APPROVED BY

DRAWN BY

NOTES:

1. RISER PIPE IS 2 IN I.D. SCHEDULE PIPE, THREADED, FLUSH-JOINTED.
2. SCREEN IS 2 IN I.D. PVC PIPE CONTINUOUS SLOT SCREEN (0.020 IN SLOT SIZE).
3. LOWER END OF SCREEN IS CAPPED.
4. ELEVATION OF WATER LEVEL
5. WATER LEVEL READING ON

Materials Used:

3-50lb bags 10x20 Sand
1 1/2 buckets of Bentonite Pellets
10 gallons Water

INSTALLATION DETAILS
MONITORING WELL
1130

PREPARED FOR

5.0ft x 4 1/2 in Protective Casing
7.0ft of Schedule 40 PVC Black
4.8ft of Schedule 40 PVC 0.020 slotted Screen - Flush Threaded

Rig Geologist: J. Sintrell

6496

Dang BD. 6/5/89
~~3 of 5~~

FERNALD RI/FS

PIEZOMETER INSTALLATION SHEET

PROJECT NAME Facility Testing FMPC RI/FS FIELD ENG./GEO. C. Sintfield DATE 5-2-89
PROJECT NO. 60L 37.4 CHECKED BY BD. DATE 6/5/89
BORING NO. 1130
PIEZOMETER NO. 1130 DATE OF INSTALLATION 5/2/89 and 5/3/89

BOREHOLE DRILLING

DRILLING METHOD Hollow Stem Auger	TYPE OF BIT Auger Bit
DRILLING FLUID (S) USED:	CASING SIZE (S) USED:
FLUID N/A FROM N/A TO N/A	SIZE N/A FROM N/A TO N/A
FLUID N/A FROM N/A TO N/A	SIZE N/A FROM N/A TO N/A

PIEZOMETER DESCRIPTION

TYPE Schedule 40 PVC	RISER PIPE MATERIAL Schedule 40 PVC
DIAMETER OF PERFORATED SECTION 2 inch	RISER PIPE DIAMETERS: BD 6/5/89
PERFORATION TYPE:	O.D. ~~2 1/8 inch~~ 2 5/16 I.D. 2 inch
SLOTS ☒ HOLES ☐ SCREEN ☐	LENGTH OF PIPE SECTIONS 7.0 ft
AVERAGE SIZE OF PERFORATIONS 0.020 in	JOINING METHOD Flush Threaded
TOTAL PERFORATED AREA 4.8 ft	

PROTECTION SYSTEM

RISER PROTECTIVE PIPE LENGTH 5.0 ft	OTHER PROTECTION Locking Cap
PROTECTIVE PIPE O.D. 4 1/4 inch	

ITEM	DISTANCE ABOVE/BELOW GROUND SURFACE (ft)		ELEVATION (ft)	
TOP OF RISER PIPE	2.0 ft			
GROUND SURFACE	0.0			
BOTTOM OF PROTECTIVE PIPE	5.0 ft			
BOREHOLE FILL MATERIALS:				
GROUT/SLURRY	TOP N/A	BOTTOM N/A	TOP	BOTTOM
BENTONITE	TOP 1.0 ft	BOTTOM 3.0 ft	TOP	BOTTOM
SAND	TOP 3.0 ft	BOTTOM 10.0 ft	TOP	BOTTOM
GRAVEL	TOP N/A	BOTTOM N/A	TOP	BOTTOM
PERFORATED SECTION	TOP 5.0 ft	BOTTOM 9.8 ft	TOP	BOTTOM
PIEZOMETER TIP	~~9.8 ft~~ OS 10.0 ft			
BOTTOM OF BOREHOLE	10.0 ft			
GWL AFTER INSTALLATION				

WAS THE PIEZOMETER FLUSHED AFTER INSTALLATION? YES ☐ NO ☒
WAS A SENSITIVITY TEST PERFORMED ON THE PIEZOMETER? YES ☐ NO ☒
REMARKS Possible Water Bearing Zone: 5.0 → 9.0 ft.

000218

409-11-86

TEST EQUIPMENT LIST

TEST _____

EQUIPMENT NUMBER	EQUIPMENT NAME

NOTE:

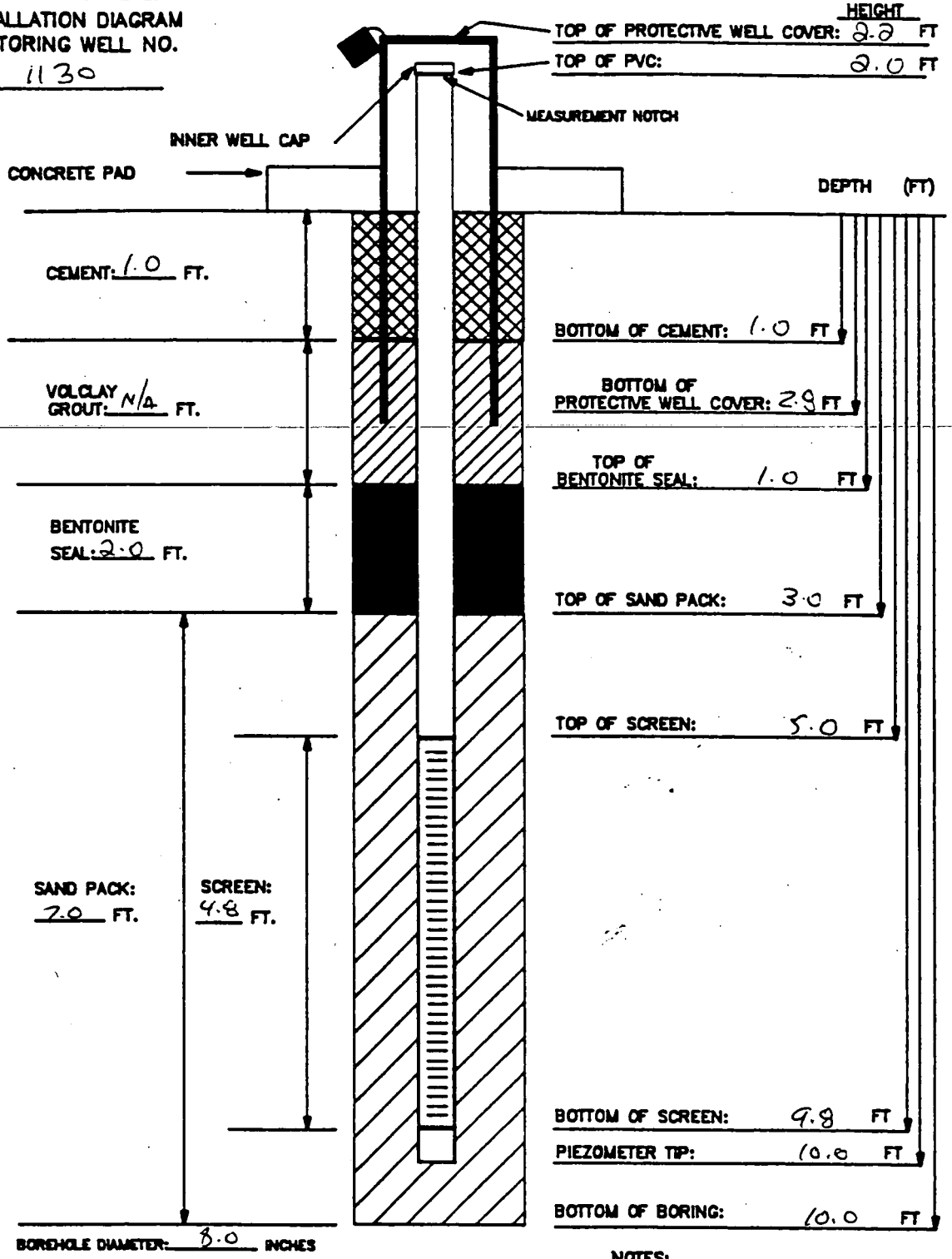
THIS LIST SHALL BE COMPLETED FOR ALL TESTS, ONLY EQUIPMENT SUBJECT TO CALIBRATION NEED BE LISTED.

6496

FERNALD RI/FS

INSTALLATION DIAGRAM
MONITORING WELL NO.
1130

INSTALLATION DATE: 5-2-90



BOREHOLE DIAMETER: 8.0 INCHES

MATERIALS USED:
SAND TYPE AND QUANTITY: 3 Bags 10/20 8016
BENTONITE PELLETS (5-GALLON BUCKETS): 1 1/2
BAGS OF VOLCLAY GROUT: N/A
AMOUNT OF CEMENT: 1 Bag
AMOUNT OF WATER USED: 10 gallons
OTHER:

NOTES:
1) RISER PIPE IS 2-INCH SCHEDULE 40 PVC PIPE, FLUSH-THREADED JOINTS.
2) SCREEN IS 2-INCH I.D. SCHEDULE 40 PVC PIPE WITH 0.020-INCH SLOTS.
3) LOWER END OF SCREEN IS CAPPED WITH AN END CAP OR THREADED SUMP.
4) WATER DEPTH/DATE:

TASK: 602 3.7.1

GEOLOGIST/ENGINEER: C. Sinfield

FERNALD RI/FS

6496

Date	5/5/89			
Initials				
	Field Check	1st Key In	2nd Key In	Hard Copy Verification

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FMPC RI/FS		
BORING NUMBER: 1229	COORDINATES:	DATE: 5-1-89	
ELEVATION:	GWL: Depth 10.7 FT. Date/Time 05-01-89 @ 1530	DATE STARTED: 5-1-89	
ENGINEER/GEOLOGIST: E. TRULLINGER C. GRUBE	Depth Date/Time	DATE COMPLETED: 5-1-89	
DRILLING METHODS: MOBILE DRILL HSA 8"		PAGE 1 OF 25	

DEPTH (FT.)	SAMPLE TYPE & NO	BLOWS ON SAMPLER PER 6 (IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
1	17607 1025 5-1	9	8	Natural Gravel Fill, medium size, wet from surface water	GP	N/A	HNU = 0 ppm α = 0 cpm βγ = 100-110 cpm
	17608 1025 5-1	19					
	17609 1025 5-1	27					
2	17610 1030 5-1	19	9	Medium Dense, yellowish brown (10YR 4/4) to gray (10YR 4/2) sandy gravel, wet from surface water	GW	N/A	HNU = 0 ppm α = 0 cpm βγ = 100-110 cpm
	17611 1030 5-1	12					
3	17612 1030 5-1	12		Stiff, gray (10YR 4/1) Clay, trace of fine gravel, medium plastic, wet from surface water	CL	1.75	
	17613 1035 5-1	6	10	Very Stiff, gray (5Y 4/2), clay, trace fine gravel, medium plastic, moist	CL	2.75	HNU = 0 ppm α = 0 cpm βγ = 100-120 cpm
4	17614 1035 5-1	7		Stiff, olive gray (5Y 4/3), clay, medium plastic, moist		1.75	
	17615 1035 5-1	14					
5	17616 1043 5-1	13	10	Stiff, yellowish brown (10YR 5/6) clay, trace sand, medium plastic, moist	CL	1.75	HNU = 0 ppm α = 0 cpm βγ = 80-100 cpm
	17617 1043 5-1	17					
6	17618 1043 5-1	26					
7	17619 1340 5-1	6	16	Very Stiff, light olive brown (5Y 5/4), clay, low to medium plastic, moist	CL	3.5	HNU = 0 ppm α = 0 cpm βγ = 80-110 cpm
	17620 1340 5-1	12					
	17621 1340 5-1	19					

NOTES: DRILLING CO.:
DRILLER: DAVE NEUMAN
HELPER: BILL ANDERSON

MATERIALS USED:
3½ BAGS 10/20 SAND.
2½ 5 gal. BUCKETS BENTONITE
½ BAG. CEMENT
5 GAL. WATER

SAMPLING IN ACCORDANCE WITH ASTM STANDARDS, DESCRIPTION OF SOIL COLOR BY MUNSELL COLOR CHART. SAMPLES TAKEN FOR WMCO AT INTERVALS 0.0-.5 FT., 2-2.5 FT., 5-5.5 FT, 10-10.5 FT., 15-15.5 FT.

INSTRUMENT BACKGROUND
HNU = 0.2 ppm
α = 0 cpm
βγ = 60-80 cpm
LEL = 0.0 ppm
O_2 = 20.6 %

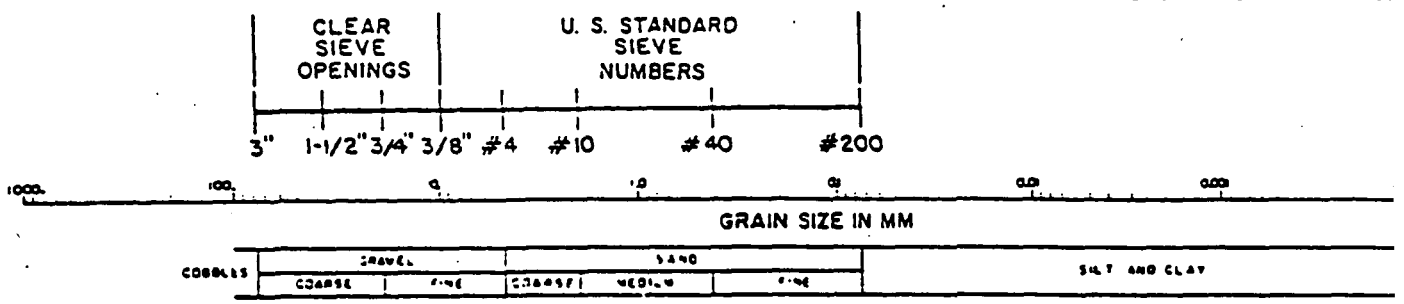
CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE(1)
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

(1) STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 18 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANCE.



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

FINE-GRAINED/HIGHLY ORGANIC SOILS

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENT

FERNALD RI/FS

6496

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602 3.7	PROJECT NAME: FMPC RI/FS	
BORING NUMBER: 1229	COORDINATES:	DATE: 5-1-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 5-1-89
ENGINEER/GEOLOGIST: E. Trollinger/C. Grube	Depth Date/Time	DATE COMPLETED: 5-1-89
DRILLING METHODS: MOBILE DRILL HSA		PAGE 2 OF 2 5

DEPTH (FT.)	SAMPLE TYPE & NO	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
8	17622 1345 5-1	14	7	Stiff, yellowish brown (10YR 5/6), silty clay, low plastic, moist	CL	1.5	HNU = 0 ppm; α = 0 cpm; βγ = 100-120 cpm
	17623 1345 5-1	16					
9	17624 1345 5-1	22					
10	17625 1415 5-1	18	NR	Attempted samples at this interval 3 times with catchers in spoon.	—	—	HNU = N/A; α = N/A; βγ = N/A
	17626 1415 5-1	20					
	17627 1415 5-1	32					
11	17628 1430 5-1	8	18	Stiff, yellowish brown (10YR 5/6), silty clay, trace sand, trace medium gravel, low plasticity, moist	CL	1.0	HNU = 0 ppm; α = 0 cpm; βγ = 80-100 cpm
	50627 1430 5-1	6		Medium Dense, clayey silts, yellowish brown (10YR 5/6), wet	ML	N/A	
12	50628 1430 5-1	10		Medium Stiff, gray (5Y 5/1) clay, trace coarse sand, trace medium gravel, wet GRAY-BROWN (10YR 5/2) CLAY IN END OF SPOON	CL	0.75	* Note: used 15 in long, 3 in. in diameter split spoon from 10.5 FT to 12.0 FT after 1st attempt at recovery of a sample failed
13				BOTTOM OF BORING @ 12.0 FT. SAMPLING ENDING @ 12.0 FT.			
14							

PERCHED WATER LEVEL @ 10.7 FT.

BOTTOM OF WATER BEARING ZONE @ 11.9 FT

NOTES:

DRILLER: DAVE NEWMAN
HELPER: BILL ANDERSON

INSTRUMENT BACKGROUND
HNU = 0.2 ppm
α = 0 cpm
βγ = 60-80 cpm

6496 3/4 5

BN 615149

FERNALD RI/FS

PIEZOMETER INSTALLATION SHEET

PROJECT NAME Fernald FMPC RI/FS
PROJECT NO. 602 3.7
BORING NO. 1229
PIEZOMETER NO. 1229

FIELD ENG./GEO. E. Trollinger/C. Grube DATE 05-01-89
CHECKED BY W.A. Hoehel DATE 05-02-89
DATE OF INSTALLATION 05-01-89

BOREHOLE DRILLING

DRILLING METHOD 8 in. Hollow Stem Auger
DRILLING FLUID (S) USED:
FLUID N/A FROM — TO —
FLUID N/A FROM — TO —

TYPE OF BIT 8 in. Hollow Stem Auger
CASING SIZE (S) USED:
SIZE N/A FROM — TO —
SIZE N/A FROM — TO —

PIEZOMETER DESCRIPTION

TYPE Monitoring Piezometer
DIAMETER OF PERFORATED SECTION 2.0 in. ID
PERFORATION TYPE:
SLOTS ☒ HOLES ☐ SCREEN ☐
AVERAGE SIZE OF PERFORATIONS 0.020 in.
TOTAL PERFORATED AREA 5.0 FT

RISER PIPE MATERIAL schedule 40 PVC
RISER PIPE DIAMETERS:
O.D. 2 5/16 in I.D. 2.0 in
LENGTH OF PIPE SECTIONS 9.0 FT
JOINING METHOD screw type, flush joint threaded

PROTECTION SYSTEM

RISER PROTECTIVE PIPE LENGTH 5.0 FT
PROTECTIVE PIPE O.D. 4 3/8 in.

OTHER PROTECTION Hinged cover with installed padlock

ITEM	DISTANCE ABOVE/BELOW GROUND SURFACE (FT)		ELEVATION ( )	
TOP OF RISER PIPE	2.0			
GROUND SURFACE	0.0			
BOTTOM OF PROTECTIVE PIPE	2.5			
BOREHOLE FILL MATERIALS:				
~~GROUT/SLURRY~~ Cement	TOP 0.0 FT	BOTTOM 1.0 FT	TOP	BOTTOM
BENTONITE	TOP 1.0 FT	BOTTOM 4.7 FT	TOP	BOTTOM
SAND	TOP 4.7 FT	BOTTOM 12.0 FT	TOP	BOTTOM
~~GRAVEL~~ N/A	TOP —	BOTTOM —	TOP	BOTTOM
PERFORATED SECTION	TOP 7.0 FT	BOTTOM 12.0 FT	TOP	BOTTOM
PIEZOMETER TIP	12.0 FT			
BOTTOM OF BOREHOLE	12.0 FT			
GWL AFTER INSTALLATION	—			

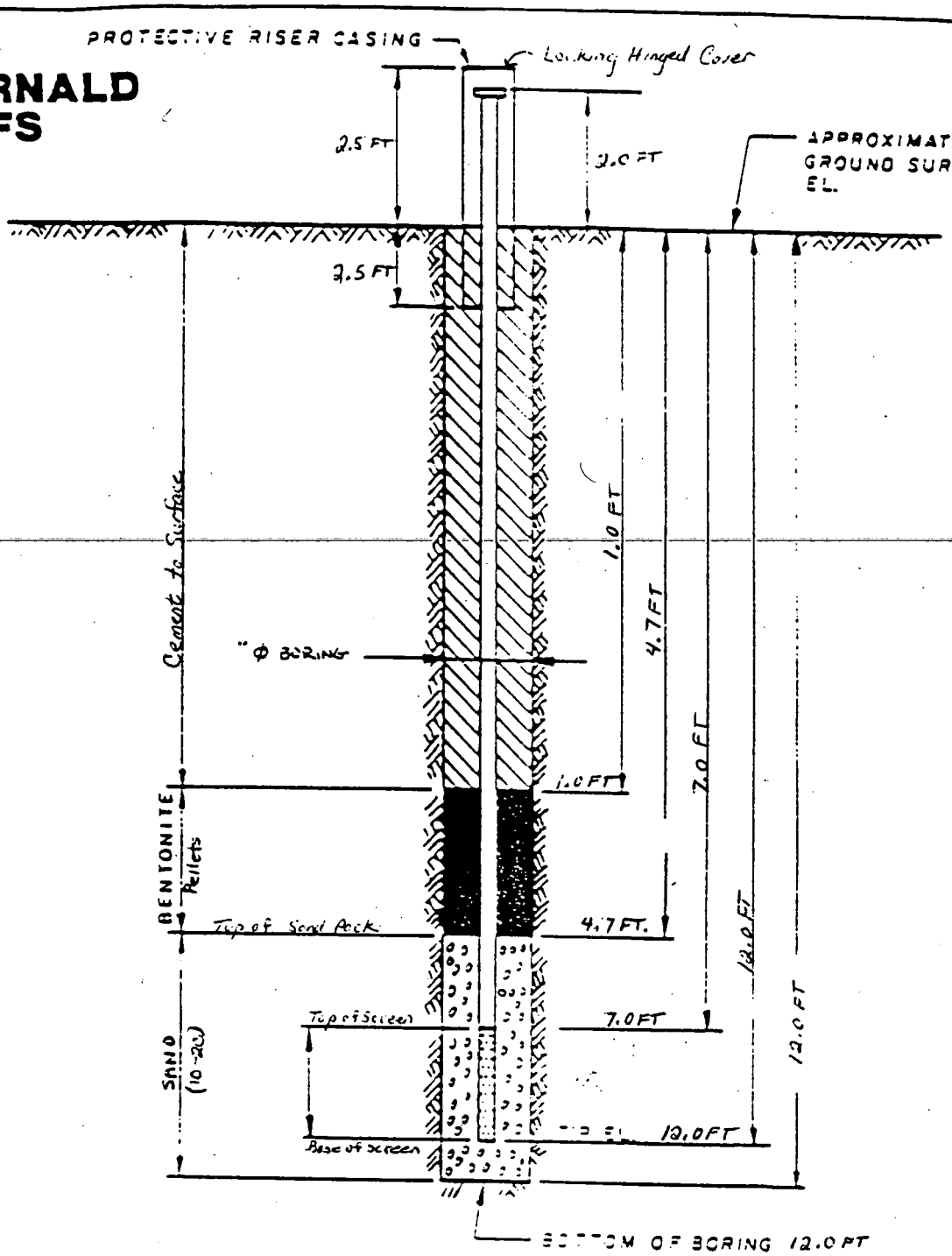
WAS THE PIEZOMETER FLUSHED AFTER INSTALLATION? YES ☐ NO ☒
WAS A SENSITIVITY TEST PERFORMED ON THE PIEZOMETER? YES ☐ NO ☒
REMARKS WATER BEARING ZONE ENCOUNTERED FROM 10.7 FT TO 11.9 FT AS NOTED ON BORING LOG.

NOTE: Sample Zone 9 to 10.5 had no recovery - Possible Wet Sand bearing zone
BN 6/5/89

000224

FERNALD RI/FS

DRAWING NUMBER	MW-1229
CHECKED BY	
APPROVED BY	
DRAWN BY	CG



NOTES:

1. RISER PIPE IS 2 IN I.D SCHEDULE 40 PVC PIPE, THREADED, FLUSH-JOINTED.
2. SCREEN IS 2 IN I.D SCH 40 PVC PIPE CONTINUOUS SLOT SCREEN (0.020 IN SLOT SIZE).
3. LOWER END OF SCREEN IS CAPPED.
4. ELEVATION OF WATER LEVEL
5. WATER LEVEL READING ON

Materials used in well installation:

10-20 sand — 3 ½ 80 lb. sacks
Bentonite Pellets — 2 ½ 5 gal. Buckets
Cement — ½ 50 lb. bag
WATER — 5 gals.

INSTALLATION DETAILS
MONITORING WELL # 1229

PREPARED FOR FMPC RI/FS
Boring # 1229

PVC well screen and riser pipe:

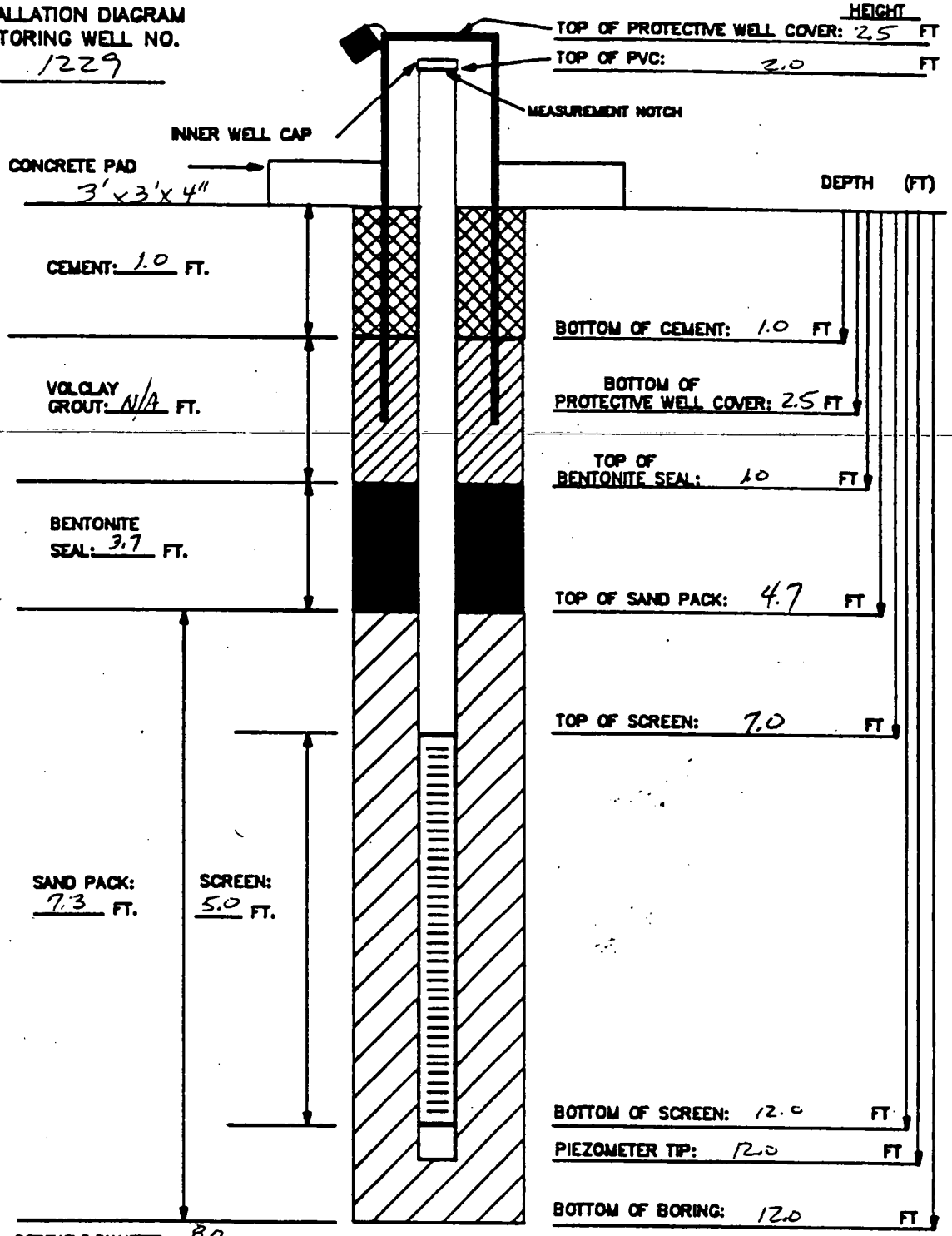
1 — 5 FT screen section
1 — 9 FT Riser Section (Cut to Length)

6496

FERNALD RI/FS

INSTALLATION DIAGRAM
MONITORING WELL NO.
1229

INSTALLATION DATE: 5/1/89



BOREHOLE DIAMETER: 8.0 INCHES

MATERIALS USED:
SAND TYPE AND QUANITITY: 10/20 3 1/2 SACKS
BENTONITE PELLETS (5-GALLON BUCKETS): 2 1/2
BAGS OF VOLCLAY GROUT: NONE
AMOUNT OF CEMENT: 1/2 50 lb. sack
AMOUNT OF WATER USED: 5 gals.
OTHER:

NOTES:
1) RISER PIPE IS 2-INCH SCHEDULE 40 PVC PIPE, FLUSH-THREADED JOINTS.
2) SCREEN IS 2-INCH I.D. SCHEDULE 40 PVC PIPE WITH 0.020-INCH SLOTS.
3) LOWER END OF SCREEN IS CAPPED WITH AN END CAP OR THREADED SUMP.
4) WATER DEPTH/DATE:

TASK: 3.7

GEOLOGIST/ENGINEER: E. Trollinger / C. Gruber

6496

FERNALD RI/FS

Date				
Initial				
	Field Check	1st Key In	2nd Key In	Hard Copy Verification

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602-3.7.1	PROJECT NAME: Facilities Testing Program	
BORING NUMBER: 1132	COORDINATES:	DATE: 4-30-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 4-30-89
ENGINEER/GEOLOGIST: L. Sinfield	Depth Date/Time	DATE COMPLETED: 5-1-89
DRILLING METHODS: B-53, Hollow Stem Auger with Split-spoon Sampler		PAGE 1 OF 8

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION Concrete Core Concrete Thickness 0.7 ft	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS Note: 8 Total Pages with field copies enclosed. JD 4/1/89 Start = 1110
0.5	15605 WMCO	3		Loose, Gravel, GW - Wet, Angular - Class II Base	GW	Loose	HNU = ø ppm α = 10 cpm Bγ = 100-120 cpm
1.0	15606 NR	5	4 in				
1.5	15607 NR	7		4/30/89 @ 1115		TSF	
2.0	15608 NR	4		Very Stiff Lean Clay, CL - Brownish Yellow (10YR, 6/6), mottled, Dry, medium plastic, isolated gravel, some silt, massive	CL	3.5	HNU = 2 ppm α = ø cpm Bγ = 80-100 cpm
2.5	15609 WMCO	16	12 in				
3.0	15610 NR	16		4/30/89 @ 1120		TSF	
3.5	15611 NR	12		Loose, Sand, SW - moist, silt and gravel, massive,	SW	Loose	HNU = 3.5 ppm α = ø cpm Bγ = 80-100 cpm
4.0	15612	75 for 0.3 ft	4 in				
4.5	15613 NR			Clay - Hard, Brownish yellow medium plastic @ 1125	CL	TSF	
5.0	15614	51		Very Stiff to Hard, Lean Clay, CL - Brownish Yellow (10YR, 6/6) to Dark Gray (10YR, 4/1) medium plastic, Dry, Rare gravel.	CL	4.5 to 3.0	HNU = ø ppm α = ø cpm Bγ = 80-100 cpm
5.5	15615 WMCO	14	18 in				
6.0	15616	16		@ 1135		TSF	
6.5	15617	16		Very Stiff, Lean Clay with Gravel, pale brown (10YR, 6/2) massive, rare silt, dry	CL	2.0 to 2.5	HNU = 5 ppm α = ø cpm Bγ = 100-120 cpm
7.0	15618	21	14 in				
7.5	15619 NR	15		@ 1405		TSF	

NOTES: Contractor: Penn Drill
Driller: Jim Saccani
Helper: Greg Dye
Sample Tech: ~~[illegible]~~ Randal Odell
Weather: Clear & warm
HNU #: HH 18

NR = No Recovery

Background @ 1110
HNU = 0.5 ppm
Air α = ø cpm
Air Bγ = 800-1100 cpm
gnd α = 1,000 cpm
gnd Bγ = 5,000-6,000 cpm

000227

402-11-86

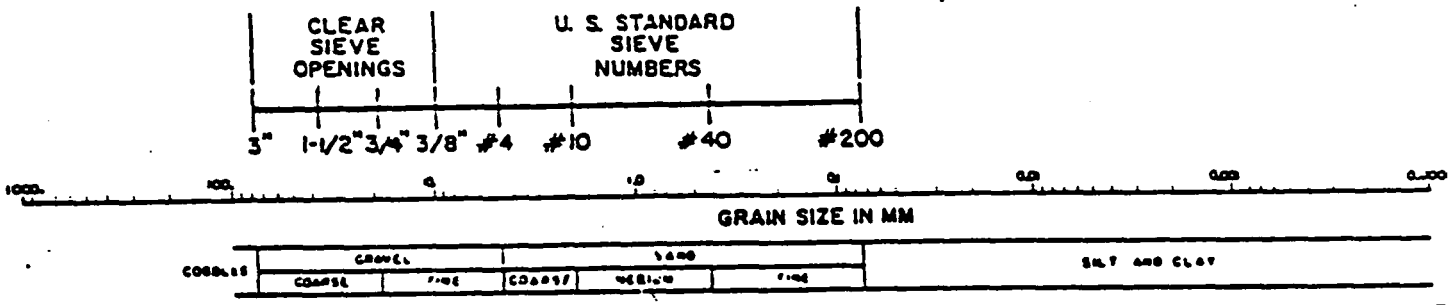
CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH (TONS PER SQUARE FOOT)
VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
MEDIUM STIFF	0.50 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	MORE THAN 4.0

DENSITY OF GRANULAR SOILS

DENSITY	STANDARD PENETRATION RESISTANCE[1]
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

[1] STANDARD PENETRATION RESISTANCE IS THE NUMBER OF BLOWS REQUIRED TO DRIVE A 2-INCH O.D. SPLIT BARREL SAMPLER 12 INCHES USING A 140-POUND HAMMER FALLING FREELY THROUGH 30 INCHES. THE SAMPLER IS DRIVEN 18 INCHES AND THE NUMBER OF BLOWS RECORDED FOR EACH 6-INCH INTERVAL. THE SUMMATION OF THE FINAL TWO INTERVALS IS THE STANDARD PENETRATION RESISTANCE.



USCS CLASSIFICATION FOR SOILS

COARSE-GRAINED SOILS

CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS GRAVEL-SAND-CLAY MIXTURES
CLEAN SANDS (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES

FINE-GRAINED/HIGHLY ORGANIC SOILS

SILTS AND CLAYS LIQUID LIMIT (LESS THAN 50)	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
SILTS AND CLAYS LIQUID LIMIT (GREATER THAN 50)	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY ORGANIC SILTS
HIGHLY ORGANIC SOILS	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CON

FERNALD
RI/FS

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VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602-3.7.1	PROJECT NAME: Facilities Testing Program	
BORING NUMBER: 1132	COORDINATES:	DATE: 4-30-87
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 4-30-87
ENGINEER/GEOLOGIST: C. Sintfield	Depth Date/Time	DATE COMPLETED: 5-1-87
DRILLING METHODS: B-53, Hollow-Stem Auger with Split-Spoon Sampler		PAGE 3 OF 8

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
7.5							Start = 1110
8.0	15620	11		Very Stiff, Gray (10YR, 6/1) Lean clay, with gravel & sand, Dry, Med. plastic, massive @ 1410		2.0	HNU = Ø ppm
	15621 NR	11	6in		CL	to	α = Ø cpm
8.5	15622 NR	12				2.5	BΓ = 100-120 cpm
9.0						TSF	
9.5	15623 NR	8	6in	Stiff, Gray (10YR, 6/1) Lean clay with gravel & sand, dry, med. plastic, massive @ 1415	CL	1.0 to 1.5 TSF	HNU = 1.0 ppm
	15624 NR	9					α = Ø cpm
10.0	15625	11					BΓ = 100-120 cpm
10.5	MMCO						
11.0	15626	7	6in	Stiff, SAME AS ABOVE (9.0→10.5 ft) Dry @ 1425	CL	1.0 to 1.5 TSF	HNU = Ø ppm
	50607 NR	8					α = Ø cpm
11.5	50608 NR	9					BΓ = 100-120 cpm
12.0							
12.5	50609	9	10in	SAME AS ABOVE STIFF, V. SL. MOIST Rare gravel @ 1435	CL	1.5 to 1.7 TSF	HNU = Ø ppm
	50610	15					α = Ø cpm
13.0	50611	17					BΓ = 100-120 cpm
13.5							
14.0	50612 NR	13	8in	Medium stiff, same as above, very slightly moist, rare gravel @ 1500	CL	0.5 to 0.75 TSF	HNU = 0.5 ppm
	50613	10					α = Ø cpm
14.5	50614	11					BΓ = 100-120 cpm
15.0							

NOTES: Contractor: Penn Drill
Driller: Jim Saccani
Helper: Gary Dye
Sample Tech: Randell O'dell
Weather: clear & warm
HNU #: HH18

Background @
HNU = Ø ppm
AIR α = Ø cpm
AIR BΓ = 1000 ~~100~~ cpm CAM 4-30-87
GROUND α = 1000 cpm
GROUND BΓ 5000→6000 cpm

4C2-11-86

FERNALD
RI/FS

6496

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602-3.7.1	PROJECT NAME: Facilities Testing Program	
BORING NUMBER: 1132	COORDINATES:	DATE: 4-30-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 4-30-89
ENGINEER/GEOLOGIST: L. SINFIELD	Depth Date/Time	DATE COMPLETED: 5/1/89
DRILLING METHODS: B-53 Hollow Stem Auger with Split Spoon Sampler		PAGE ~~3 of 5~~ 3 OF 8

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
15.0	50615 NR	4		SOFT TO MED STIFF GRAY (10YR, 6/1) LEAN CLAY, MASSIVE, SOME SILT, SOME Gravel, Med. plastic, very slightly moist @ 1530	CL	0.5 to 0.75 TSF	Start = HNU = Ø ppm; α = Ø cpm; Bγ = 100-120 cpm
15.5	50616	5	14 IN				
16.0	50617	7					
16.5	50618	4		SAME AS ABOVE @ 1540	CL	0.5 to 0.75 TSF	HNU = Ø ppm; α = Ø cpm; Bγ = 100-120 cpm
17.0	50619	6	18 IN				
17.5	50620	9					
18.0	50621	10	24 IN	Medium Stiff to Stiff SAME AS ABOVE. Very Slightly moist @ 1600	CL	0.5 to 1.2 TSF	HNU = Ø ppm; α = Ø cpm; Bγ = 100-120 cpm
18.5	50622	10					
19.0	50623	10					
19.5	~~50624~~ 9K	12		@ 1600	CL	TSF	HNU = Ø ppm; α = Ø cpm; Bγ = 100-120 cpm
20.0				TD = 20.0 ft @ 1600			

NOTES: Contractor: Penn Drill
Driller: Jim Saccani
Helper: Gary Dye
Sample Tech: Randell Odell
Weather: Clear & warm
HNU #: HH18

50623 B a
Composite Sample from 19.0 - 20.0 ft

Borehole was dry
Grouted to Surface

Background @ 1600
HNU = Ø ppm
AIR α = Ø cpm
AIR Bγ = 1000 cpm
ground α = 1000 cpm
ground Bγ = 5000-26000 cpm

000230

4C2-11-86

6496

FERNALD RI/FS

15605 – 15626

Field Copy

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602–	PROJECT NAME: Facilities Testing Program	
BORING NUMBER: 1132	COORDINATES:	DATE: 4-30-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 4-30-89
ENGINEER/GEOLOGIST: L. Sinfield	Depth Date/Time	DATE COMPLETED:
DRILLING METHODS: B-53, Hollow Stem Auger with Split Spoon		PAGE ~~2 of 8~~ 4 OF 8

BW 615159

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION Concrete Corer @ 1110 Concrete = 0.60 ft Thick	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS Start = 1110
0.5	15605 WMCO	3		Gravel, wet, loose Angular – Class II base	GW	Loose	HNU = 0 ppm α = 10 cpm Bγ = 100-120 cpm
1.0	15606 NR	5	4"				
1.5	15607 NR	7		4/30/89 @ 1115		TSF	
2.0	15608 NR	4		v. stiff Clay, dry, medium plastic massive, isolated gravel, some silt, Brownish yellow (10YR, 6/6), mottled	CL	3.5	HNU = 2 ppm α = 0 cpm Bγ = 80-100 cpm
2.5	15609 WMCO	16	12"				
3.0	15610 NR	16		4/30/89 @ 1120		TSF	
3.5	15611 NR	12	4"	Loose Sand with gravel moist, silt and gravel, massive	SW	Loose	HNU = 3½ ppm α = 0 cpm Bγ = 80-100 cpm
4.0	15612	75 for 0.3 ft	3/10 ft	Clay? – Hard Brownish yellow, medium plastic 4/30/89 @ 1125			
4.5	15613 NR					TSF	
5.0	15614	51		Very stiff to Hard, mottled Lean Clay, Brownish yellow (10YR, 6/6) to Dark gray (10YR, 4/1), med. plastic, large Dry. Gravel-Rare @ 1135	CL	4.5 to 3.0	HNU = 0 ppm α = 0 cpm Bγ = 80-100 cpm
5.5	15615 WMCO	14	18"				
6.0	15616	16				TSF	
6.5	15617	16		Very stiff, Lean clay with gravel, Pale brown (10YR, 6/2), massive, rare silt DRY,	CL	2.0 to 2.5	HNU = 5 ppm α = 0 cpm Bγ = 100-120 cpm
7.0	15618	21	14"				
7.5	15619 NR	15		4/30/89 @ 1405		TSF	

NOTES: Contractor: Penn Drill
Driller: Jim Saccani
Helper: Greg Dyer
Sample Tech:
Weather: Warm, clear
HNU #: 4H18

Background @ 1100
HNU = ½ ppm
Air α = 0 cpm
Air Bγ = 800-1100 cpm
ground Dγ = 5,000-6,000 cpm
ground α = 1000 cpm

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4G2-11-86

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FERNALD RI/FS

Field Copy

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602-3.7.1	PROJECT NAME: Facilities Testing Program	
BORING NUMBER: 1132	COORDINATES:	DATE: 4-30-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 4/30/89
ENGINEER/GEOLOGIST: L. Sinfield	Depth Date/Time	DATE COMPLETED:
DRILLING METHODS: B-53 Hollow Stem Auger with Splitspoon Sampler		PAGE ~~6~~ ~~2-4-7~~ OF 8

page 5 of 8

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
7.5	15620	11	6"	Very Stiff, Gray (10YR, 6/1) Clean Clay with Gravel & Sand, Dry, med. plastic massive @ 1410	CL	2.0 to 2.5 TSF	Start= HNU= Ø ppm α= Ø cpm Bγ= 100-120 cpm
8.0	15621	11					
8.5	15622	12					
9.0	15623	8	6in	Stiff, Gray (10YR, 6/1) Clean Clay with Gravel & Sand, Dry, med. plastic massive @ 1415	CL	1.0 to 1.5 TSF	HNU= 1.0 ppm α= Ø cpm Bγ= 100-120 cpm
9.5	15624	9					
10.0	15625 WMCO	15					
10.5	15626	7	6in	Stiff, Same as above 9.0 to 10.5 ft Dry @ 1425	CL	1.0 to 1.5 TSF	HNU= Ø ppm α= Ø cpm Bγ= 100-120 cpm
11.0	50607	8					
11.5	50608	9					
12.0	50609	9	18in	Same as above but stiff v. sl. moist Rare Gravel @ 1435	CL	1.5 to 1.7 TSF	HNU= Ø ppm α= Ø cpm Bγ= 100-120 cpm
12.5	50610	5					
13.0	50611	5					
13.5	50612	13	8in	medium stiff Same as above sl. moist Rare Gravel @ 1500	CL	0.5 to 0.75 TSF	HNU= Ø ppm α= Ø cpm Bγ= 100-120 cpm
14.0	50613	10					
14.5	50614	11					
15.0							

NOTES: Contractor: Penn Drill
Driller: Jim Saccani
Helper: Greg Dye
Sample Tech: Cindy Kelvey
Weather: Clear & warm
HNU#: HH18

Background @
HNU= Ø ppm
Air α= Ø cpm
Air Bγ= 1000 cpm
Ground α= 1000 cpm
Ground Bγ= 5000-6000 cpm

4C2-11-86

000232

6496

Field Copy

FERNALD RI/FS

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER: 602-3.2.1	PROJECT NAME: Facilities Testing Program	
BORING NUMBER: 1132	COORDINATES:	DATE: 4-30-89
ELEVATION:	GWL: Depth Date/Time	DATE STARTED: 4-30-89
ENGINEER/GEOLOGIST: C. Sinfue	Depth Date/Time	DATE COMPLETED:
DRILLING METHODS: B-53 Hollow Stem Auger with Split Spoon Sampler		PAGE ~~3~~ 6 OF 8

DEPTH (FT)	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER (6 IN)	RECOVERY (IN)	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS
15.0	~~50619~~ 50620	4		~~loose to~~ Soft to med. stiff			Start =
15.5	~~50620~~ 50616			gray (10YR, 6/1) Lean clay		0.5	HNU = Ø ppm
16.0	~~50621~~ 50617	5	17"	massive, some silt, some	CC	0.25	α = Ø cpm
16.5	~~50622~~ 50617	7		gravel, med. plastic, v. slight moist @ 1530		TSF	Bγ = 100-120 cpm
17.0	~~50623~~ 50618	4		Same As		0.5 to	HNU = Ø ppm
17.5	~~50624~~ 50619	6	18	Above	CC	0.75	α = Ø cpm
18.0	~~50625~~ 50620	9		@ 1540		TSF	Bγ = 100-120 cpm
18.5	~~50626~~ 50621	10		medium stiff to stiff	CC	0.5 to	HNU = Ø ppm
19.0	~~50627~~ 50622	10	24"	Same As Above		1.2	α = Ø cpm
19.5	~~50628~~ 50623	10		v. slightly moist @ 1600		TSF	Bγ = 100-120 cpm
20.0	~~50629~~ 50624	12		@ 1600		TSF	HNU = Ø ppm
				TD = 20.0 ft @ 1600			α = Ø cpm
				Borehole is dry - Abandoned			Bγ = 100-120 cpm

NK 50615

NOTES: Contractor: Penn Drill
Driller: Jim Saccari
Helper: Gary Dye
Sample Tech: R. Odell
Weather: Clear & warm
HNU#: HN18

Background @ 1600
HNU = Ø ppm
Air α = Ø cpm
Air Bγ = 1000 cpm
gnd Bγ = 5,000-6,000 cpm
gnd α = 1,000 cpm

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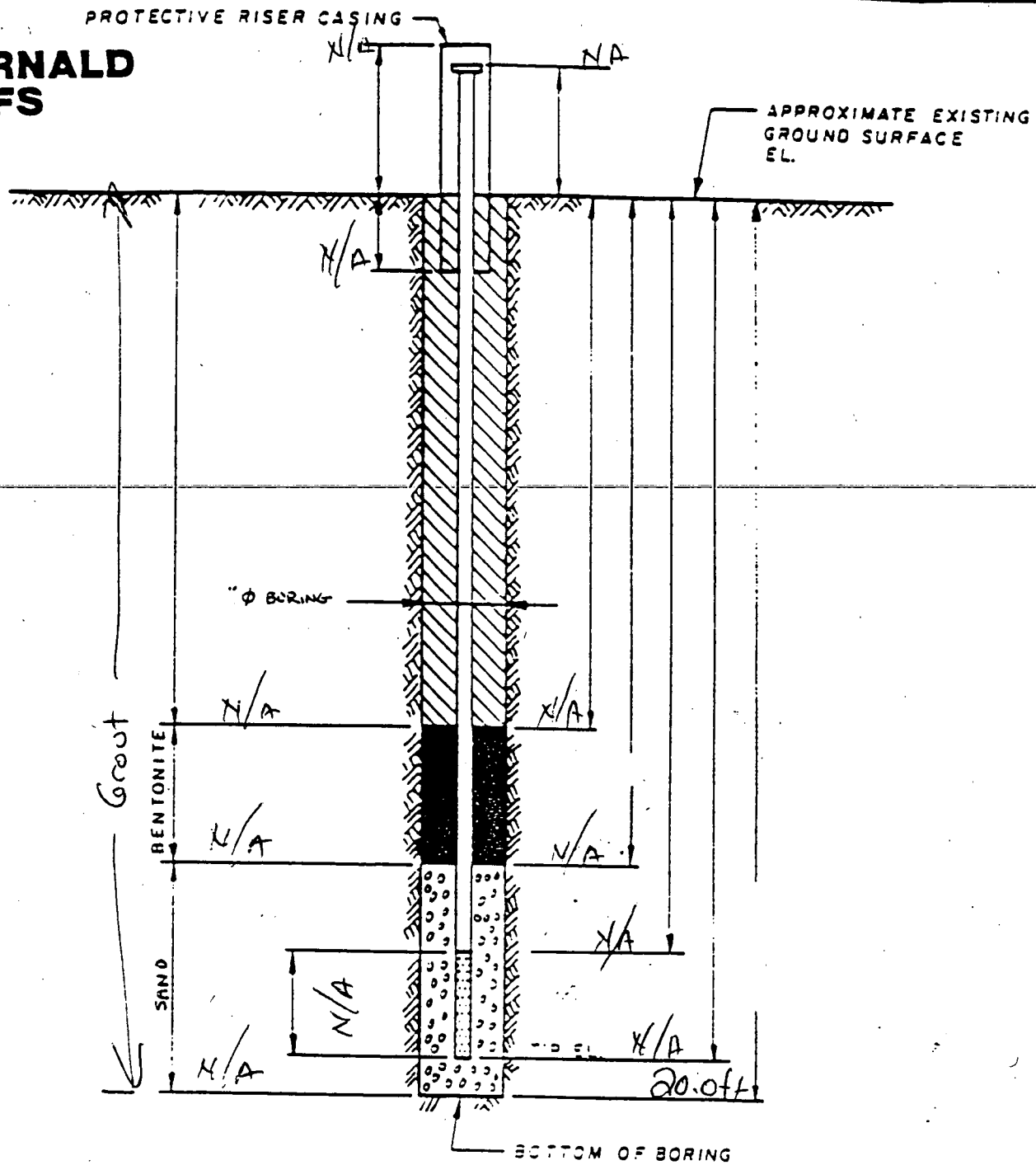
FERNALD RI/FS



DRAWING NUMBER

CHECKED BY

APPROVED BY

DRAWN BY

NOTES:

1. RISER PIPE IS IN I.D. SCHEDULE PIPE, THREADED, FLUSH-JOINTED.
2. SCREEN IS N/A IN I.D. N/A PIPE CONTINUOUS SLOT SCREEN (0.0 0 IN SLOT SIZE).
3. LOWER END OF SCREEN IS CAPPED.
4. ELEVATION OF WATER LEVEL
5. WATER LEVEL READING ON

Materials Used:
3-50lb bags of Volclay Grout
30 gallons of water

INSTALLATION DETAILS
MONITORING WELL 1132

PREPARED FOR

Rig Geologist: G. Sinfield

FERNALD RI/FS

6496

PIEZOMETER INSTALLATION SHEET

PROJECT NAME Facilities Testing FMPC RI/FS FIELD ENG./GEO. L. Sinfield DATE 5-1-89
PROJECT NO. 602 3.7.4 CHECKED BY B.V. DATE 6/5/89
BORING NO. 1132
PIEZOMETER NO. N/A DATE OF INSTALLATION N/A

BOREHOLE DRILLING

DRILLING METHOD Hollow Stem Auger	TYPE OF BIT Auger Bit
DRILLING FLUID (S) USED:	CASING SIZE (S) USED:
FLUID N/A FROM N/A TO N/A	SIZE N/A FROM N/A TO N/A
FLUID N/A FROM N/A TO N/A	SIZE N/A FROM N/A TO N/A

PIEZOMETER DESCRIPTION

TYPE N/A	RISER PIPE MATERIAL N/A
DIAMETER OF PERFORATED SECTION N/A	RISER PIPE DIAMETERS:
PERFORATION TYPE:	O.D. N/A I.D. N/A
SLOTS ☐ HOLES ☐ SCREEN ☐	LENGTH OF PIPE SECTIONS N/A
AVERAGE SIZE OF PERFORATIONS N/A	JOINING METHOD N/A
TOTAL PERFORATED AREA N/A	

PROTECTION SYSTEM

RISER PROTECTIVE PIPE LENGTH N/A	OTHER PROTECTION N/A
PROTECTIVE PIPE O.D. N/A	N/A

ITEM	DISTANCE ABOVE/BELOW GROUND SURFACE (ft)		ELEVATION (ft)	
TOP OF RISER PIPE	N/A		N/A	
GROUND SURFACE	0.0		N/A	
BOTTOM OF PROTECTIVE PIPE	N/A		N/A	
BOREHOLE FILL MATERIALS:				
GROUT/SLURRY	TOP 1.0 ft	BOTTOM 20.0 ft	TOP N/A	BOTTOM N/A
BENTONITE	TOP N/A	BOTTOM N/A	TOP N/A	BOTTOM N/A
SAND	TOP N/A	BOTTOM N/A	TOP N/A	BOTTOM N/A
GRAVEL	TOP N/A	BOTTOM N/A	TOP N/A	BOTTOM N/A
PERFORATED SECTION	TOP N/A	BOTTOM N/A	TOP N/A	BOTTOM N/A
PIEZOMETER TIP	N/A			
BOTTOM OF BOREHOLE	20.0 ft			
GWL AFTER INSTALLATION	N/A			

WAS THE PIEZOMETER FLUSHED AFTER INSTALLATION? YES ☐ NO ☐ N/A
WAS A SENSITIVITY TEST PERFORMED ON THE PIEZOMETER? YES ☐ NO ☐ N/A

REMARKS Bore hole grouted to the surface with Volclay Grout - 3-50lb bags with 30 gallons H2O

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