

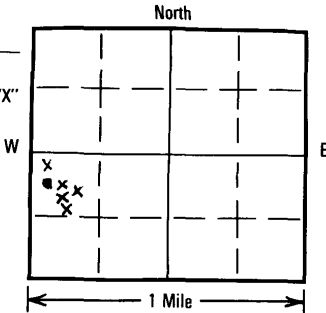
SOUTH DAKOTA WATER WELL COMPLETION REPORT

07-92

Location NW 1/4 SW 1/4 Sec 13 Twp 2N Rg 8E

County PENNINGTON

Please mark well location with an "X"



Well Completion Date See attached forms

LOCATION:

Distance from nearest potential pollution source (septic tank, abandoned well, feed lot, etc.)? _____ ft. from _____ (identify source).

PROPOSED USE:

- Domestic/Stock
- Municipal
- Business
- Test Holes
- Irrigation
- Industrial
- Institutional
- Monitoring well

METHOD OF DRILLING: OD = 10.25"
ID = 6.25"
HSA

CASING DATA:

- Steel
- Plastic(PVC)
- Other

If other describe _____

PIPEWEIGHT	DIAMETER	FROM	TO	HOLE DIAMETER
_____ LB/FT	<u>2</u> IN	_____ FT	_____ FT	_____ IN
_____ LB/FT	_____ IN	_____ FT	_____ FT	_____ IN
_____ LB/FT	_____ IN	_____ FT	_____ FT	_____ IN

GROUTING DATA: See attached forms

Grout Type	No. of Sacks	Grout Weight	From	To
<u>Cement/Bentonite</u>	_____	_____ lb./gal	_____ ft	_____ ft
_____	_____	_____ lb./gal	_____ ft	_____ ft

Describe grouting procedure Grout pump & tremied

SCREEN: Perforated pipe Manufactured

Diameter 2 IN Length See attached FEET

Material See attached forms

Slot Size 0.010 Set From _____ Feet to _____ Feet

Other information _____

WAS A PACKER OR SEAL USED? YES NO

If so, what material? Bentonite

Describe packer(s) and location? See attached forms

DISINFECTION:

Was well disinfected upon completion? _____ YES, How: _____

NO, Why Not?

Monitoring use only

Laboratory sent to for water quality analysis _____

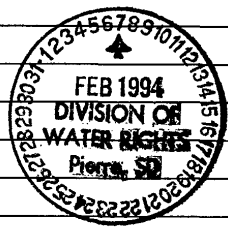
Well Owner: U.S. Air Force

Business Name: Ellsworth Air Force Base

Address: Ellsworth, S.D. 57706

WELL LOG: See attached forms

FORMATION	DEPTH	
	FROM	TO



STATIC WATER LEVEL: See attached forms Feet

If flowing: closed in pressure N/A PSI

GPM flow N/A through N/A inch pipe

Controlled by Valve Reducers Other N/A

Reduced Flowrate N/A GPM

Can well be completely shut in? N/A

WELL TEST DATA: N/A

- Pumped Describe: _____
- Bailed _____
- Other _____

Pumping Level Below Land Surface

_____ ft. After _____ Hrs. pumped _____ GPM

_____ ft. After _____ Hrs. pumped _____ GPM

If pump installed, pump rate _____ GPM

REMARKS: Well Numbers:

MW 930415
0417
0421
0425
0426

This well was drilled under license # 565

And this report is true and accurate.

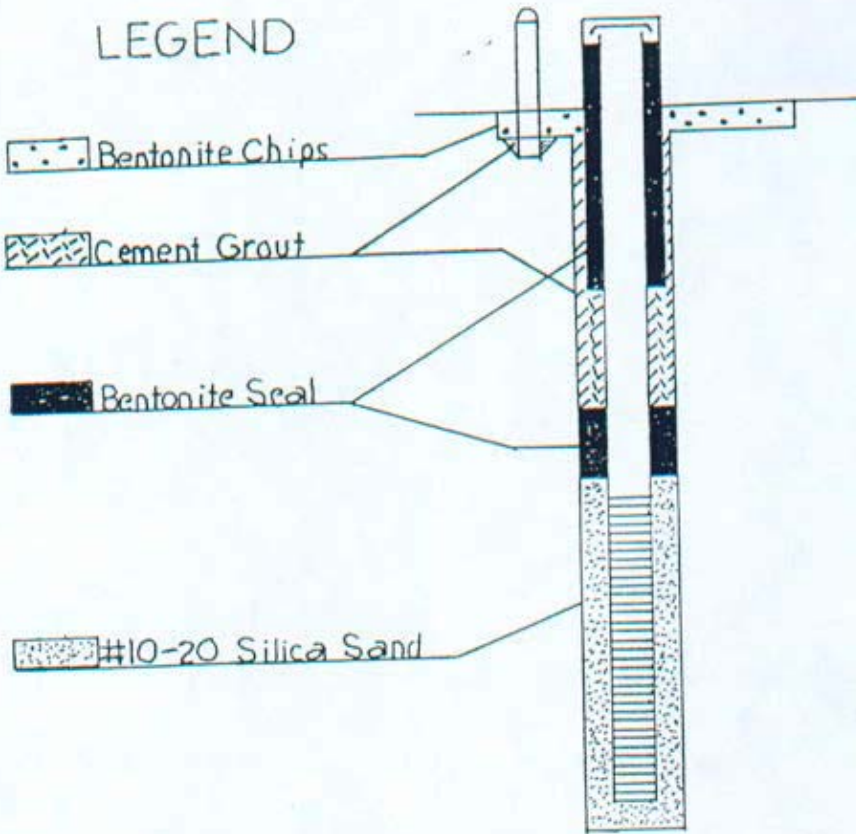
Drilling firm Twin City Testing Corp

Signature of License Representative: [Signature]

Signature of Well Owner or Equitable Property Holder: _____

Date: 2/3/94

LEGEND

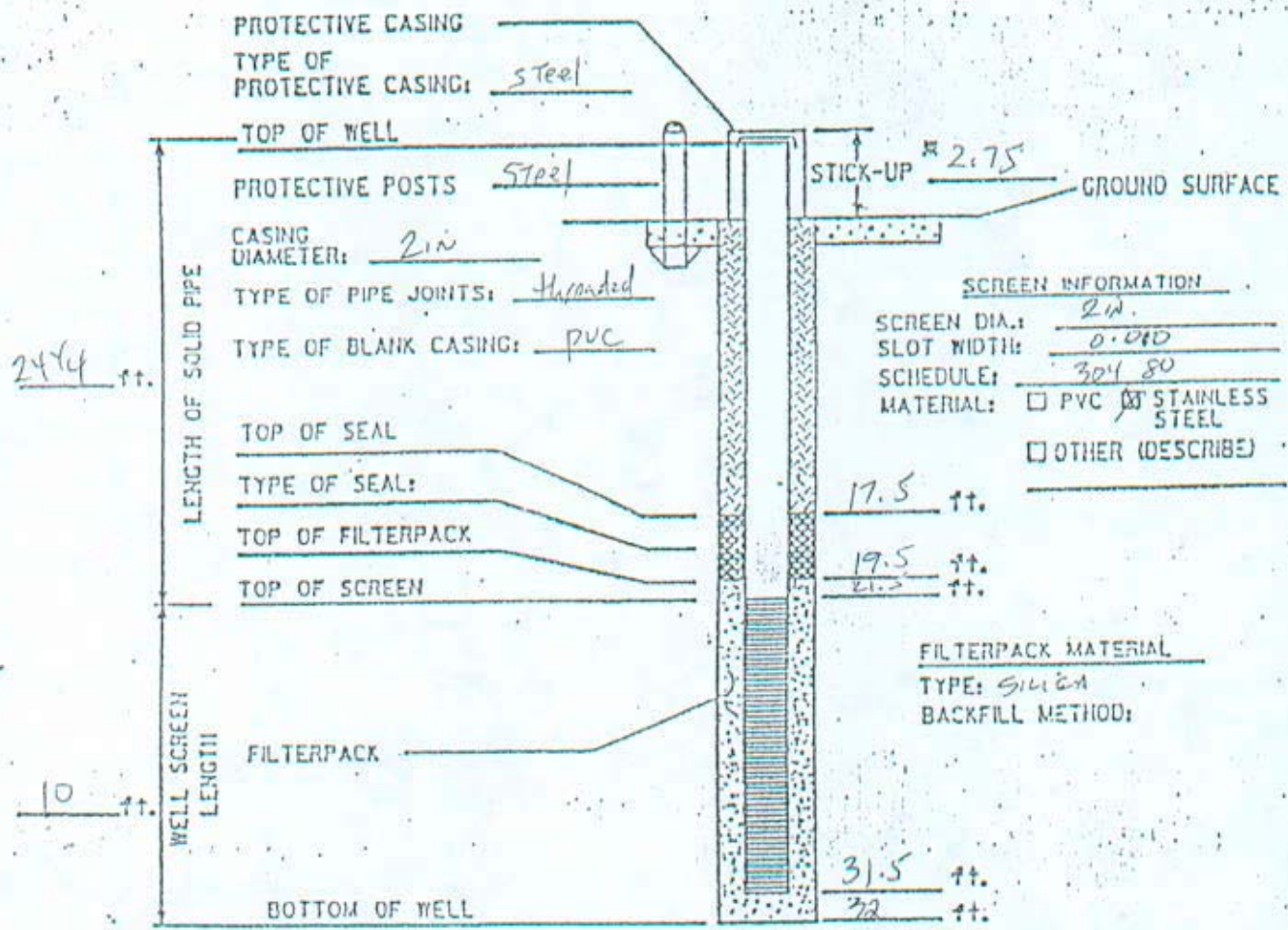


TITLE: MONITORING WELL MATERIALS DIAGRAM EA ENGINEERING ELLSWORTH AIR FORCE BASE	
PROJECT #: TCT NO. 6100-93-0130	
DATE: 1-28-94	SCALE: NONE
DRAWN BY: TSO	CHECKED BY: SDS

ELEVATION GROUND WATER			PROJECT: <u>EAPB</u>
DATE INSTALLED <u>17 OCT 1993</u>	STARTED <u>1500</u>	COMPLETED	LOCATION (Coordinates or Station) <u>OFFSITE 0u4</u>
ELEVATION TOP OF HOLE			SIGNATURE OF INSPECTOR <u>Bredenkamp</u>
TOTAL DEPTH OF HOLE <u>32 FT.</u>			HOLE NO. (as shown on drawing title and file number) <u>MW930415</u>

MONITORING WELL CONSTRUCTION DIAGRAM SB930455

(ALL MEASUREMENTS FROM GROUND SURFACE)



WELL DEVELOPMENT

METHOD: _____

TIME SPENT DEVELOPMENT: _____

VOLUME OF WATER REMOVED: _____

VOLUME OF WATER ADDED: _____

DESCRIPTION OF PREDEVELOPMENT WATER: _____

DESCRIPTION OF POST DEVELOPMENT WATER: _____

WATER LEVEL SUMMARY

WATER LEVEL MEASUREMENTS

DATE/TIME/LEVEL 10/26/93 (1310) 25.94'

DEPTH FROM TOP CASING AFTER DEVELOPMENT: 34.33

HTW DRILLING LOG

Boring No.
58930455
MW930415

Sheet 1 of 4

1. Company Name: EA Engineering		7. Drilling Sub: TCT	
3. Project: Ellsworth AFB		4. Location: off site - South of OU 4	
5. Name of Driller: Mark Madlock		6. Drill Rig Designation: CME 75	
7. Sizes and Types of Drilling and Sampling Equipment	8. Hole Location: 140' W/SW of 58930449		9. Surface Elevation:
	6 1/4" HSA		
	6" x 5' Continuous Samples		
12. Surface Composition: Grass		10. Date Started: 17 Oct 93	
13. Depth to Top Shale: 25'		11. Date Completed: 17 Oct 93	
14. Total Depth of Hole: 32'		15. Depth Groundwater Encountered (from samples): 22.5'	
18. Geotechnical smpls		16. Depth to Water & Time After Drilling Completed: Dry	
Disturbed		17. Other Water Level Measurements/Times: 23' @ 0945 on 18 Oct	
Undisturbed		19. Number & type of Cores Taken:	
20. Samples for Chemical Analyses: Direct Push		VOC	
		Metals	
		Other	
		Other	
		Other	
		Chlorinated Solvents	

22. Disposition of Soil Boring	Backfilled	Monitoring Well	Other	23. Signature of Inspector

Depth (a)	Analyt. Sample (b)	Hends pace (c)	Lith Column (d)	Lithologic Description (e)	Remarks (h)
1		Oppm 0-1'	OL	Very Dk. Brown (10YR/2/2) Silt w/organic matter. Dense root structure. Moist, Weak cementation. Sl. plastic	Start Boring @ 0845.
2				Brown (10YR/5/3) Clayey silt w/calcite nodules (30-35%). Dry, firm to crumbly. Sl. plastic w/mod. cementation. Trace roots visible	
3		Oppm 1-5'	ML	Very Dk. ^{gray} Brown (2.5Y/3/2) Calcareous Clayey silt with calcite nodules (15%). Firm w/mod cementation & dry. Trace root hairs visible and sl. plastic.	
4					
5					

ITW DRILLING LOG

Drilling No: 58930433

MW930415

Project: Rileworth AFB

Inspector: T. B. ...

Sheet 2 of 5

Depth (a)	Analyt. Sample (b)	Holds pace (c)	Lith Column (d)	Lithologic Description (e)	Remarks (h)
6				Same as above	
7		Oppm 5-7.5'	ML	Yellowish Brown (10YR 15/6) Silt, very fine, loose, sl. moist. Weak cementation w/ low to no plasticity. Calcite is absent	
9		Oppm 7.5-10'	Gm	Yellowish Brown (10YR 15/4) Silty gravel, F to C w/mod cementation. Moist to dry w/No plasticity. Trace coarse sand also found in matrix.	
12		Oppm 10-12.5'	3P	Yellowish Brown (10YR 15/4) Silty sand, Med in size, well sorted. Moist, sl plastic & loose	
13			ML	Yellowish Brown (10YR 15/4) Sandy silt w/ trace clay, moist, mod. cementation.	
14		Oppm 12.5-15'			

IT'W DRILLING LOG

Boring No: 58930455

MW 930415

Project: Ellsworth AFB

Inspector: *J. Brubaker*

Sheet 3 of 5

Depth (a)	Analyt. Sample (b)	Holds pace (c)	Lith Column (d)	Lithologic Description (e)	Remarks (h)
14				<i>Same as above</i>	
15					
16		<i>Oppm 15-17.5'</i>	<i>GW</i>	<i>Brown (10YR/5/3) Coarse Sand w/ Trace fines. Fine gravel (5-10%) also present. No plasticity, moist to dry, loose, low cementation. The coarse gravel is poorly sorted and sub-angular in nature. Trace cobbles also present</i>	<i>Augers quit on cobbles @ 17'</i>
19		<i>Oppm ?</i>	<i>?</i>		<i>No Recovery 17.5-20'</i>
20					
21		<i>0.6 ppm 20-22.5'</i>	<i>CL</i>	<i>Brown (10YR/5/3) Clay w/sand, f+tc poorly sorted sand. Moist w/mod plasticity. Trace gravel (f+tc), and trace cobbles also present.</i>	
22			<i>SP</i>	<i>Light Yellowish Brown (10YR/6/4) Fine sand, well sorted, loose and moist. Sl. trace of fines present.</i>	
23			<i>SW</i>	<i>Yellowish Brown (10YR/5/6) Sand w/clay, (f to C). Poorly sorted gravel also present (10%). Sand and gravel is sub-angular to sub-rounded. Moist.</i>	

HTW DRILLING LOG

Boring No: 58930455

MW930415

Project: Ellsworth AFB

Inspector: J. Brubaker

Sheet 4 of 4

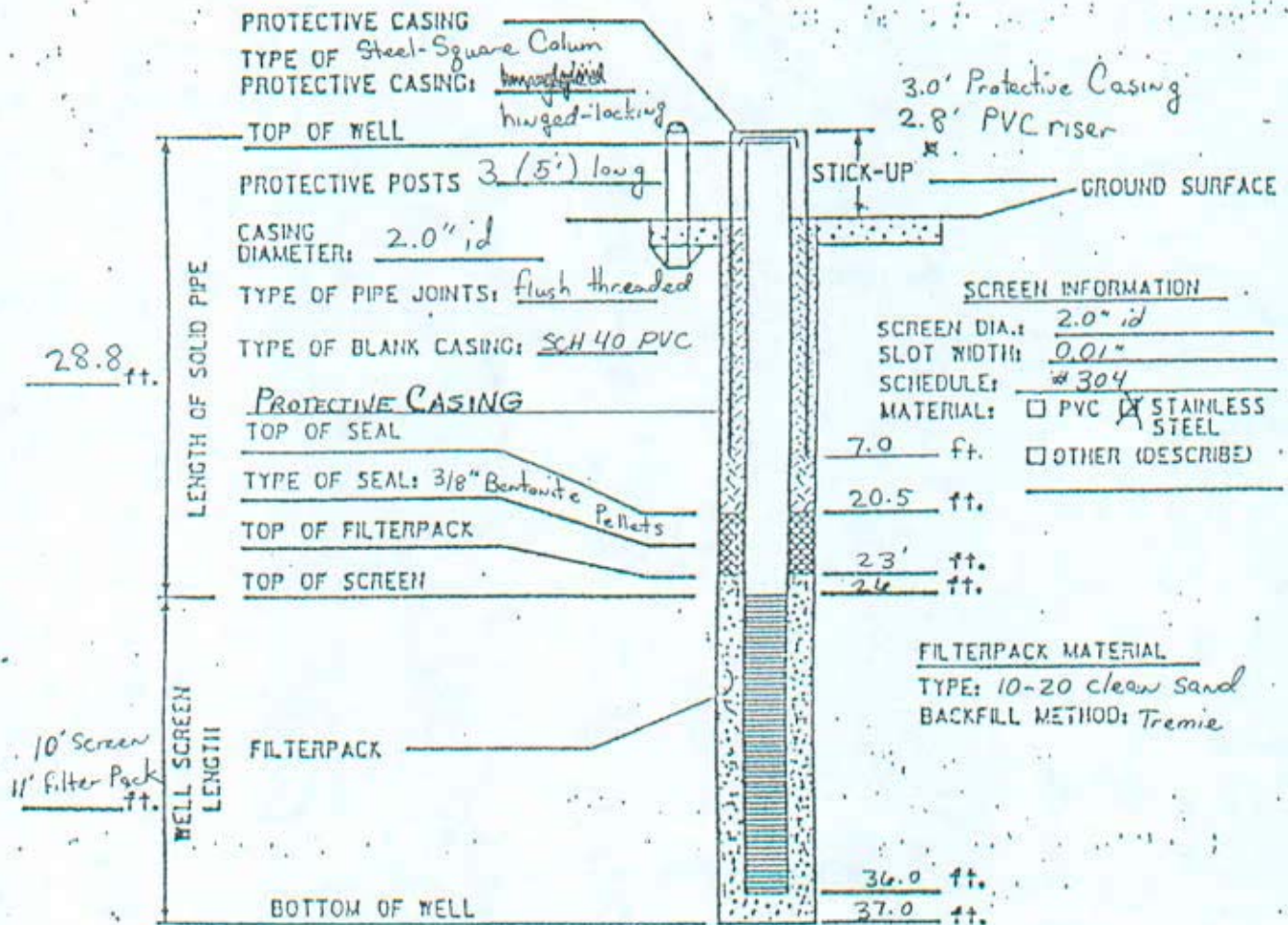
Depth (a)	Analyt. Sample (b)	Hands pace (c)	Lith Column (d)	Lithologic Description (a)	Remarks (b)
23				Large iron nodule found @ 23.5. The size is 2.5" thick and is the diameter of the spoon. The iron nodule is wet.	▽
24		Oppm 22.5-25'	GL	Yellowish Brown (10YR/5/4) Gravel (FtoC) w/ clay. Moist to wet w/mod plasticity. Some fines to coarse sands also present.	
25			CL	Brown (10YR/5/3) Clay w/ fine sand (5-10%) moderately dense & moist. Mod to high plasticity.	
26		Oppm 25-27.5'	WSH/FSH	Light Olive Brown (2.5Y/5/3) Highly weathered, fractured shale. Wet @ 25-26'. Trace iron staining	
27					
28		Oppm 27.5-30'	FSH	Very Dk gray (2.5Y/3/1) Fractured shale. Trace iron staining. More competent than above. Mica flakes appear on surface of fractures.	
29					
30					
31		Oppm 30-32'			
32					

BDH @ 32'
Drilling complete

ELEVATION GROUND WATER			PROJECT
DATE INSTALLED	STARTED	COMPLETED	LOCATION (Coordinates or Station)
	9-20-93	9-20-93	Off site on-4 SB930437
ELEVATION TOP OF HOLE			SIGNATURE OF INSPECTOR
TOTAL DEPTH OF HOLE			HOLE NO. (as shown on drawing title and file number)
37.0'			D.C. Metello mw930417

MONITORING WELL CONSTRUCTION DIAGRAM SB37

(ALL MEASUREMENTS FROM GROUND SURFACE)



WELL DEVELOPMENT

METHOD: _____

TIME SPENT DEVELOPMENT: _____

VOLUME OF WATER REMOVED: _____

VOLUME OF WATER ADDED: _____

DESCRIPTION OF PREDEVELOPMENT WATER: _____

DESCRIPTION OF POST DEVELOPMENT WATER: _____

WATER LEVEL SUMMARY

WATER LEVEL MEASUREMENTS

DATE/TIME/LEVEL 9-20-93 (1650) 18.40' (grade)

10-15-95 (1220) 20.63

T. PVC

DEPTH FROM TOP CASING AFTER DEVELOPMENT: 38.77

HTW DRILLING LOG

Boring No. DP930424
SB9304137
MW930417

Sheet 1 of 5

1. Company Name: EA Engineering		7. Drilling Sub: <u>Twin City Testing inc</u>	
3. Project: Ellsworth AFB <u>60378.83</u>		4. Location: <u>OU-4</u>	
5. Name of Driller: <u>Hugh Jacobson</u>		6. Drill Rig Designation:	
7. Sizes and Types of Drilling and Sampling Equipment	10.25" od 6.25" id		8. Hole Location: <u>offsite OU-4 200'(W) + 100'(S) of SB930428</u>
	5' X 6" od Cont.		9. Surface Elevation:
	SAMPLER		10. Date Started: <u>9.20.93</u> 11. Date Completed: <u>9.20.93</u>
12. Surface Composition: <u>Sloping Grassy Field</u>		15. Depth Groundwater Encountered (from samples): <u>30'</u> wet zone	
13. Depth to Top Shale: <u>10'</u>		16. Depth to Water & Time After Drilling Completed: <u>18.40</u> after well installation	
14. Total Depth of Hole: <u>37'</u>		17. Other Water Level Measurements/Times:	
18. Geotechnical smpls	Disturbed	Undisturbed	19. Number & type of Cores Taken:
<u>NONE</u>			
20. Samples for Chemical Analyses (3) <u>Description Only</u>	VOC	Metals	Other

22. Disposition of Soil Boring	Backfilled	Monitoring Well	Other	23. Signature of Inspector <u>D.C. Metallo</u>
		<u>MW930417</u>		

Depth (a)	Analyt. Sample (b)	Heads pace (c)	Lith Column (d)	Lithologic Description (e)	Remarks (h)
		ppm	xxxxxx		
1		3.8	GM	0-2' Light Olive Brown (2.5Y 5/3), dry, silty Gravel (GM), small to large pebble + cobble sized gravel, calcitic material in distinct bands, loose structure, low competence, 0-8" organic root material	Difficult drilling
2		3.8	GM		
3				2-5' Light Olive Brown (2.5Y 5/3), dry, silty Gravel, small-to-large pebble + cobble sized gravel, loose structure, low competence, rounded-to sub rounded	
4		6.5	GM		Difficult drilling
5					

HTW DRILLING LOG

Boring No: 38A30437
MW930417

Project: Ellsworth AFB 60378.83

Inspector: D.C. Metello

Sheet 2 of 5

Depth (a)	Analyt. Sample (b)	Heads pace (c)	Lith Column (d)	Lithologic Description (e)	Remarks (h)
		ppm			
6		7.6	SW	5-8' Brown (104R 413), slightly moist - moist, coarsening downwards sequence from f-vc Sand (sw) to silty Gravel, small-large pebble + cobble sized gravel (Gm) rounded to sub-rounded, loose structure.	
7					
8		7.6	Gm		
9		N/A	NR (Gm)	8-10' NO RECOVERY, CUTTINGS: silty Gravel, dry - slightly moist	
10		N/A	NR (Gm)		
11		8.2	SHLE (w)	10-15' Light Olive Brown (2.54513), moist, weathered Shale (SHLE), blocky structure, layered, developed secondary fracture system, at 19': 2" thick concretion zone, med. Competence	
12					
13		8.2	SHLE (w)		

HTW DRILLING LOG

Boring No: S8930437

MW930417

Project: Ellsworth AFB

60378.83

Inspector:

D.C. Metello

Sheet 3 of 5

Depth (a)	Analyt. Sample (b)	Heads pace (c)	Lith Column (d)	Lithologic Description (e)	Remarks (h)
		PPM			
14		8.2	SHLE (w)	10-15' See Description Previous Page	
15					
		8.3	SHLE (w)		
16				15-20' Olive Brown (2.54 4/3), slightly moist, moist, weathered shale (SHLE), blocky structure, bedding planes horizontal to grade, moderate amt. of secondary fractures,	
17					
		8.3	SHLE (w)		
18					
19					
		8.3	SHLE (w)		
20				20-25' See Description Next Page	
21		8.0	SHLE (w)		

HTW DRILLING LOG

Boring No: 58930437
MW930417

Project: Ellsworth AFB

6037883

Inspector: *D.C. Metello*

Sheet 4 of 5

Depth (a)	Analyt. Sample (b)	Heads pace (c)	Lith Column (d)	Lithologic Description (e)	Remarks (h)
		ppm			
22		8.0	SHLE (w)	20-25' Very Dark Grayish Brown (2.5V 3/2), moist, weathered Shale (SHLE), layered, blocky structure, Fe staining, several concretion units, med. competence	
23		8.0	SHLE (w)		
24					
25		8.0	SHLE (w)		
26		7.5	SHLE (w)	25-30' Dark Grey (5Y 4/1), moist, weathered Shale (SHLE), layered, blocky structure, water bearing concretion zone (~29'), med-high competence	
27					
28		7.5	SHLE (w)		
29		7.5	SHLE (w)		

HTW DRILLING LOG

Boring No: SB930437
MW930417

Project: Ellsworth AFB

60378-83

Inspector: D.C. Matello

Sheet 5 of 5

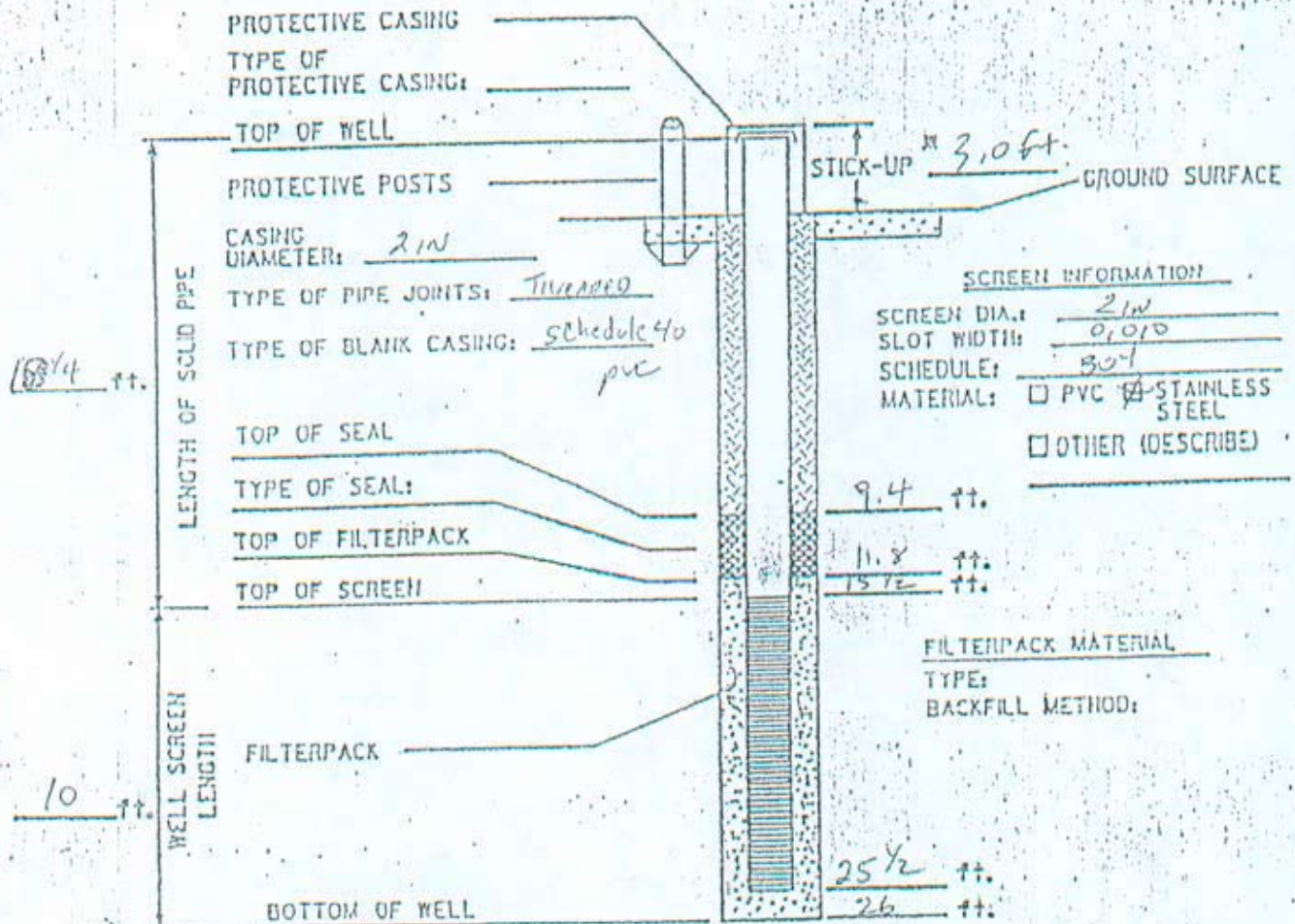
Depth (a)	Analyt. Sample (b)	Heads pace (c)	Lith Column (d)	Lithologic Description (e)	Remarks (h)
		ppm			
30'		7.5	SHLE (w)	25-30 See Description Previous Page	
31		7.2	SHLE (w)	30-35' Dark Grey (2.54 4/1) mottled olive brown (2.54 4/3), wet, slightly weathered Shale (w-SHLE) grading sharply into pre-Pierre phase Shale (SHLE v. competent), blocky, and random layering, Fe staining throughout, bottom of spoon contains aragonite (calcite) crystals	
32		7.2	SHLE (w)		
33		7.2	SHLE (w)		
34		7.2	SHLE v. comp (Pierre)		
35				Boring Terminated 35'	
36		3.0	SHLE (Pierre)	Well Construction Info 35-37' Dark Grey (N4), slightly moist, Pierre Shale (SHLE), layered in a blocky-concordial fashion, no-few secondary fractures, gaps b/w horizontal fracture/jointsets (some as wide as 1/4") filled w/ fibrous Aragonite crystals, very competent	
37				Boring Terminated 37' MW930417 TD: 37' SCREEN: 36-26' 0.01" slot SS Filter Pack: 37-23' Bentonite Seal: 23-20.5'	

ELEVATION GROUND WATER			PROJECT: <u>ERFB</u>
DATE INSTALLED <u>30 Sept 1993</u>	STARTED <u>29 SEPT 1993</u>	COMPLETED <u>30 SEPT 1993</u>	LOCATION (Coordinates or Station) <u>On 4 OFFSITE ~100 Ft from fence between 8634</u>
ELEVATION TOP OF HOLE			SIGNATURE OF INSPECTOR <u>[Signature]</u> TCT
TOTAL DEPTH OF HOLE <u>25 Feet.</u>			HOLE NO. (as shown on drawing, title and file number) <u>MW930421</u>

MONITORING WELL CONSTRUCTION DIAGRAM

SB41

(ALL MEASUREMENTS FROM GROUND SURFACE)



HTW DRILLING LOG

SB930441

DP930427/MW21

Boring No.
SB930441
DP930427/MW21
Sheet 1 of 4

1. Company Name: EA Engineering		7. Drilling Sub: TCT	
3. Project: Ellsworth AFB		4. Location: OFFSITE ON 4 - SOUTH SIDE	
5. Name of Driller: CART HOULE		6. Drill Rig Designation: CME 75	
7. Sizes and Types of Drilling and Sampling Equipment	6 1/4 ID HSA	8. Hole Location: ~100 ft from FACE & Between N 58 33 & S 83 4	
	6 IN x 5 FT	9. Surface Elevation:	
	CONTINUOUS SPRT SPOOR	10. Date Started: 29 SEPT 1993	
12. Surface Composition: GRASS		11. Date Completed: 30 SEPT 1993	
13. Depth to Top Shale: ~15 FT.		15. Depth Groundwater Encountered (from samples): N 11.0 FT	
14. Total Depth of Hole: 25 Feet.		16. Depth to Water & Time After Drilling Completed: BOH - FEW INCHES	
18. Geotechnical smpls		17. Other Water Level Measurements/Times: 30 SEPT @ 14.1 FT @ 800 MES.	
20. Samples for Chemical Analyses 1 Sample @ 10-12.5 Feet.		Disturbed	Undisturbed
20. Samples for Chemical Analyses		VOC	Metals
		TCL VOA	TAL METS. TOT
		Other	Other
		TCL BNA TCL PEST/PCB	TPH JP4 CN-

22. Disposition of Soil Boring	Backfilled	Monitoring Well	Other	23. Signature of Inspector <i>af</i>
		MW930421		

Depth (a)	Analyt. Sample (b)	Heads pace (c)	Lith Column (d)	Lithologic Description (e)	Remarks (h)
1		0.6	OL	DIL BROWN (10YR 4/3.2), ORGANIC MATTER & SILT, trace c-gravels-sub s, DRY. Grass roots.	BEGIN @ 1430
			ML/CL	Brown (10YR 4/2), SILT & CLAY, HARD, DRY, consolidated, Mod toughness - lumpy, sh. plastic. (50% SILT - 50% CL) SAME AS ABOVE - COLOUR CHANGE TO TANN (10YR 5/4).	
2		0.6	ML	TANN/WHITE (10YR 5/4), SILT, trace c-gravel fragments, fractured, weak cementation, STRONG REACTION TO ACID - PNEUMOUS, DRY. Trace CLAY (5% GULS, 10% CL, 85% SILT).	Pulled out Sample @ 3' - Panned through Rock.
3			ML	GRAY (10YR 4/3.2), CLAYEY SILT with little c-sub SAND & GRAVEL, FRACTURED, FIRM, DRY.	
4			?		
5					No Recovery 3.5-5'

HTW DRILLING LOG

Boring No: 58930441

DP: 27

Project: Ellsworth AFB

OFFSITE ONLY

Inspector:

E. JACKSON

Sheet 2 of 4

Depth (a)	Analyt. Sample (b)	Heads pace (c)	Lith Column (d)	Lithologic Description (e)	Remarks (h)
5			CL	TAN/WHITE (10YR/5/4), SILTY CLAY with little c-gravel; sub rounded & +, DRY, HARD, CONSOLIDATED.	
6		0.6	SM	TAN/WHITE (10YR/5/4), SILTY SAND, f-c SAND-SILT-CLAY with some f-sub & gravel. POORLY SORTED. DRY.	
7			SM	TAN (10YR/5/4), SILTY SAND; f-m SAND IN A SILT MATRIX, well SORTED. DRY to SL. MOIST. WEAK CEMENTATION.	
7			SM/GM	< LAYER of gravelly SAND ~ 2 in thick >	
8		0.6	SM	BROWN (10YR/4/3), SILTY SAND - same as f-m SAND IN SILT MATRIX, well SORTED, SL. MOIST. WEAK CEMENTATION.	
9			GM	BROWN (10YR/4/3), CLAYEY GRAVELS, SILT-SAND CLAY MATRIX surrounding f-c-sub & gravels & sub rounded.	
9			?	(No Recovery 9.5-10'
10			?		
11		0.5	GM	GRAY (10YR/4/4), SANDY GRAVELS, f-c SAND & SILT MATRIX. f-c sub & sub rounded gravels, SL. MOIST, POORLY SORTED, Cohesive - SL. LOOSE.	
12			SM/ML	BROWN (10YR/5/4), SILTY SAND - VERY FINE SAND & SILT, well sorted, WEAK CEMENTATION, MLT.	Took analytical sample @ 11 ft.
12			GM	TAN (10YR/4/4), SILTY GRAVELS, silt & CLAY MATRIX, f-c sub rounded gravels. MOIST to wet.	
12 1/2			?		No Recovery 12 1/2 - 15'

HTW DRILLING LOG

Boring No: SB930441

Project: Ellsworth AFB

offsite out

Inspector: E JACKSON

Sheet 3 of 4

Depth (a)	Analyt. Sample (b)	Heads pace (c)	Lith Column (d)	Lithologic Description (e)	Remarks (h)
			GM		
3			1.		
14			1.		
15			1.		
16		0.5	FSH	Brown (10/12/14/16 ?), FRACTURED SHALE, MOIST to WET, HIGHLY FRACTURED & WEATHERED.	
18			?		
20			?		NO Recovery 18-20' Collected DP @ 1700 HRS. Water @ Bottom of hole.

HTW DRILLING LOG

Boring No: SB930441
MW21

Project: Ellsworth AFB

osite on 4.

Inspector: EJ

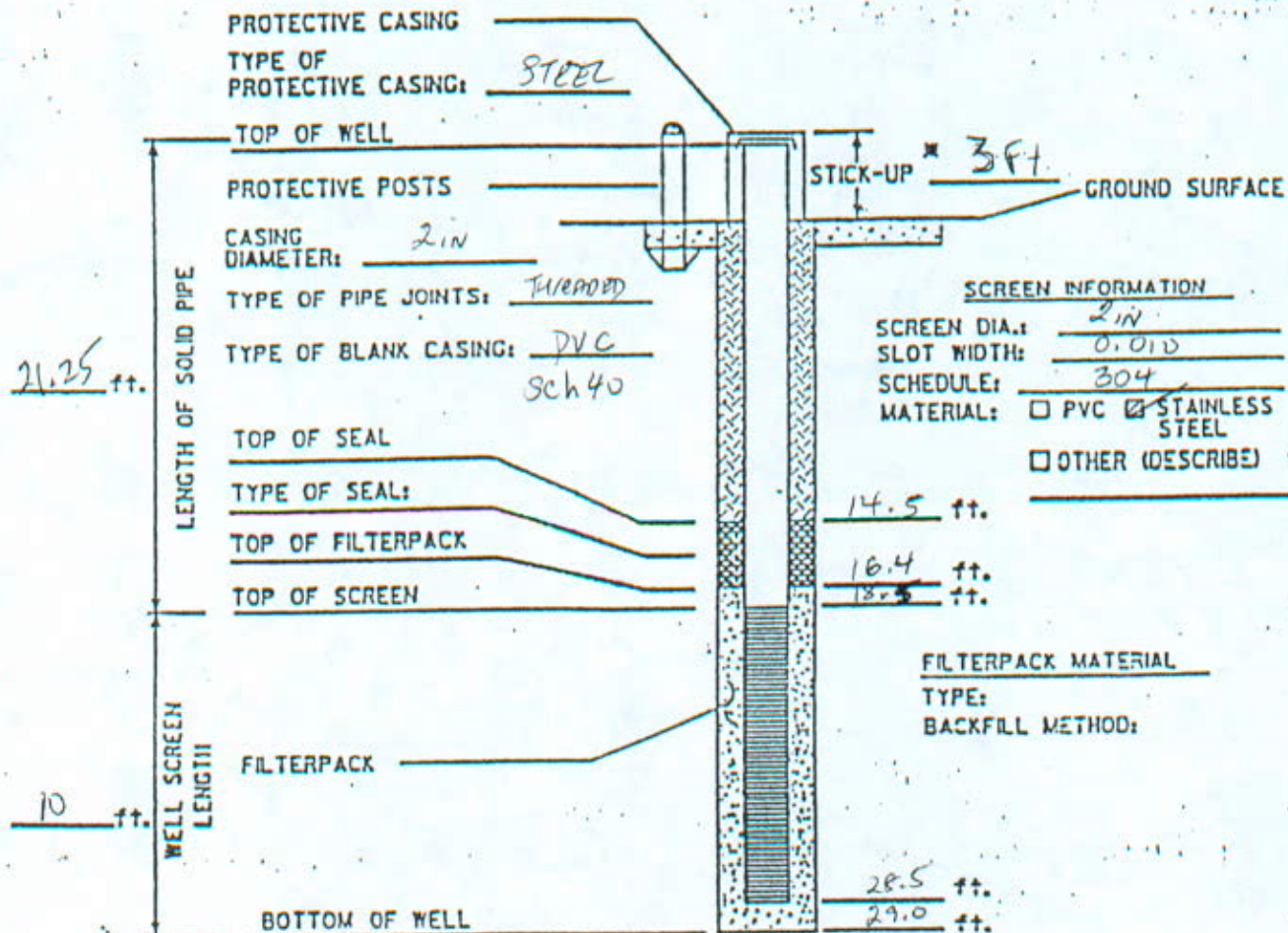
Sheet 4 of 4

Depth (a)	Analyt. Sample (b)	Heads pace (c)	Lith Column (d)	Lithologic Description (e)	Remarks (h)
20					
22		0.3	FSH	Brown (2.54/4/3), FRACTURED SHALE, WET. HIGHLY FRACTURED.	
24		0.3			
25					EDH @ 25'; 1730 HRS.
26		0.8	WSH	OLIVE (2.54/4/3), W SHALE, DENSE CONSOLIDATED, NO FRACTURES, CLAY/ SHALE, MOIST.	up up to 15 feet.
					30 Sept 1993 Water @ 14.1 ft 500 HRS. Dene to 26 ft. INSTAR well. Screen - 2 1/2" - 1 1/2" Sno! 20626-13.8'
				BENT. 13 1/2" - 11 1/2" 11.8 - 9.4'	

ELEVATION GROUND WATER			PROJECT
DATE INSTALLED	STARTED	COMPLETED	LOCATION (Coordinates or Station)
16 OCT 1993	16 OCT 1993	16 OCT 1993	014 OFFSITE - SOUTH
ELEVATION TOP OF HOLE			SIGNATURE OF INSPECTOR
TOTAL DEPTH OF HOLE			HOLE NO. (as shown on drawing title and file number)
29 Feet.			MW930425

MONITORING WELL CONSTRUCTION DIAGRAM

(ALL MEASUREMENTS FROM GROUND SURFACE)



WELL DEVELOPMENT

METHOD: _____
 TIME SPENT DEVELOPMENT: _____
 VOLUME OF WATER REMOVED: _____
 VOLUME OF WATER ADDED: _____
 DESCRIPTION OF PREDEVELOPMENT WATER:

 DESCRIPTION OF POST DEVELOPMENT WATER:

WATER LEVEL SUMMARY

WATER LEVEL MEASUREMENTS

DATE/TIME/LEVEL _____

DEPTH FROM TOP CASING
 AFTER DEVELOPMENT: _____

HTW DRILLING LOG

MW930425

DP930440
Sheet 1 of 5

1. Company Name: EA Engineering		7. Drilling Sub: TCT	
3. Project: Ellsworth AFB		4. Location: OFFSITE on 4 - SOUTH	
5. Name of Driller:		6. Drill Rig Designation: CME 75.	
7. Sizes and Types of Drilling and Sampling Equipment	6Y10 HSA	8. Hole Location: N300 F NW of MW 17	
	6 in x 5 ft	9. Surface Elevation:	
	CONTINUOUS	10. Date Started: 15 OCT 1993	
	SPIN SPOON	11. Date Completed: 16 OCT 1993	
12. Surface Composition: GRASS		15. Depth Groundwater Encountered (from samples):	
13. Depth to Top Shale: 115 feet		16. Depth to Water & Time After Drilling Completed: N18.0 FT @	
14. Total Depth of Hole: 29 ft.		17. Other Water Level Measurements/Times: 16 OCT / 800 HAS.	
18. Geotechnical smpls	Disturbed	Undisturbed	19. Number & type of Cores Taken:
20. Samples for Chemical Analyses	VOC	Metals	Other
Direct Push		Other	Other

SB930425

22. Disposition of Soil Boring	Backfilled	Monitoring Well	Other	23. Signature of Inspector
		MW930425		[Signature]

Depth (a)	Analyt. Sample (b)	Heads pace (c)	Lith Column (d)	Lithologic Description (e)	Remarks (h)
			OL	DK Brown 10YR/2/2, ORGANIC MATTER - GRASS RTS & SILT, SL. MOIST, SL. PLASTIC.	BEGIN @ 1015. COBBLES - SURFACE
1		Ø	SM/GM	GRAY C 10YR/6/3, GRAVELLY-SAND; f-c subk GRAVELS/COBLES in a SILTY SAND (f) MATAIN, DRY, LOOSE - (30% GULS). POORLY SORTED.	DIFFICULT PULLING - COBBLES.
2			SM	BROWN (10YR/4/3), f-sub rounded gravelly SAND - SAND f-c, LOOSE, (20% GULS). DRY.	
3		Ø	GM	DRILL CUTTINGS - Brown (10YR/4/4), SANDY GRAVELS & COBBLES, SUB. DRY.	
4					
5					

Depth (a)	Analyt. Sample (b)	Holds pace (c)	Lith Column (d)	Lithologic Description (e)	Remarks (f)
5					
6		0.6	GM GM	Brown (1042/3/3), DRY, SANDY Gravels, & COBBLES, SUBK, 3-5 in, (~60%) F-C SILTY SAND, LOOSE.	
7					
8					
9					
10					
11		0.6	GM GM	SAME AS ABOVE - Brown (1042/3/3), F-C SANDY Gravel, f-c subk & rounded GULS (~50%) in a FINE-SILTY SAND Matrix, LOOSE, DRY.	
12			WST	GRAY & ORANGE (2154/4/2), Weathered shale, HIGHLY FRACTURED - WEATHERED, CLAY, E. HOIST, FIRM.	

HTW DRILLING LOG

MW 25

DA930440

Project: Ellsworth AFB

OFFSITE on 4

Inspector:

EJ

Sheet 3 of 3

Depth (a)	Analyt. Sample (b)	Hole size (c)	Lith Column (d)	Lithologic Description (e)	Remarks (h)
13		Ø	WSH		
14					
15				(2.54 1/2)	
16		Ø	FSH / WSH	GRAY & ORANGE LAYERED, WSH & HIGHLY FRACTURED SHALE. - WEATHERING ALONG FRACTURES, MOISTURE ALONG FRACTURES, SOFT TO FIRM, FRAGILE.	
17					
18		Ø			
19					
20					

Depth (a)	Analyt. Sample (b)	Hole size (c)	Lith Column (d)	Lithologic Description (e)	Remarks (h)
20					
21		∅	FSH	OLIVE (2.5Y/4/2), HIGHLY FRACTURED SHALE, SOFT TO FIRM; MOISTURE, MOIST.	
22					
23		∅			
24					
25					
26			FSH	OLIVE (2.5Y/4/2), HIGHLY FRACTURED SHALE, WET.	
27					

HTW DRILLING LOG

MW25

DP930440

Project: Ellsworth AFB

OFFSITE DU4

Inspector:

EJ

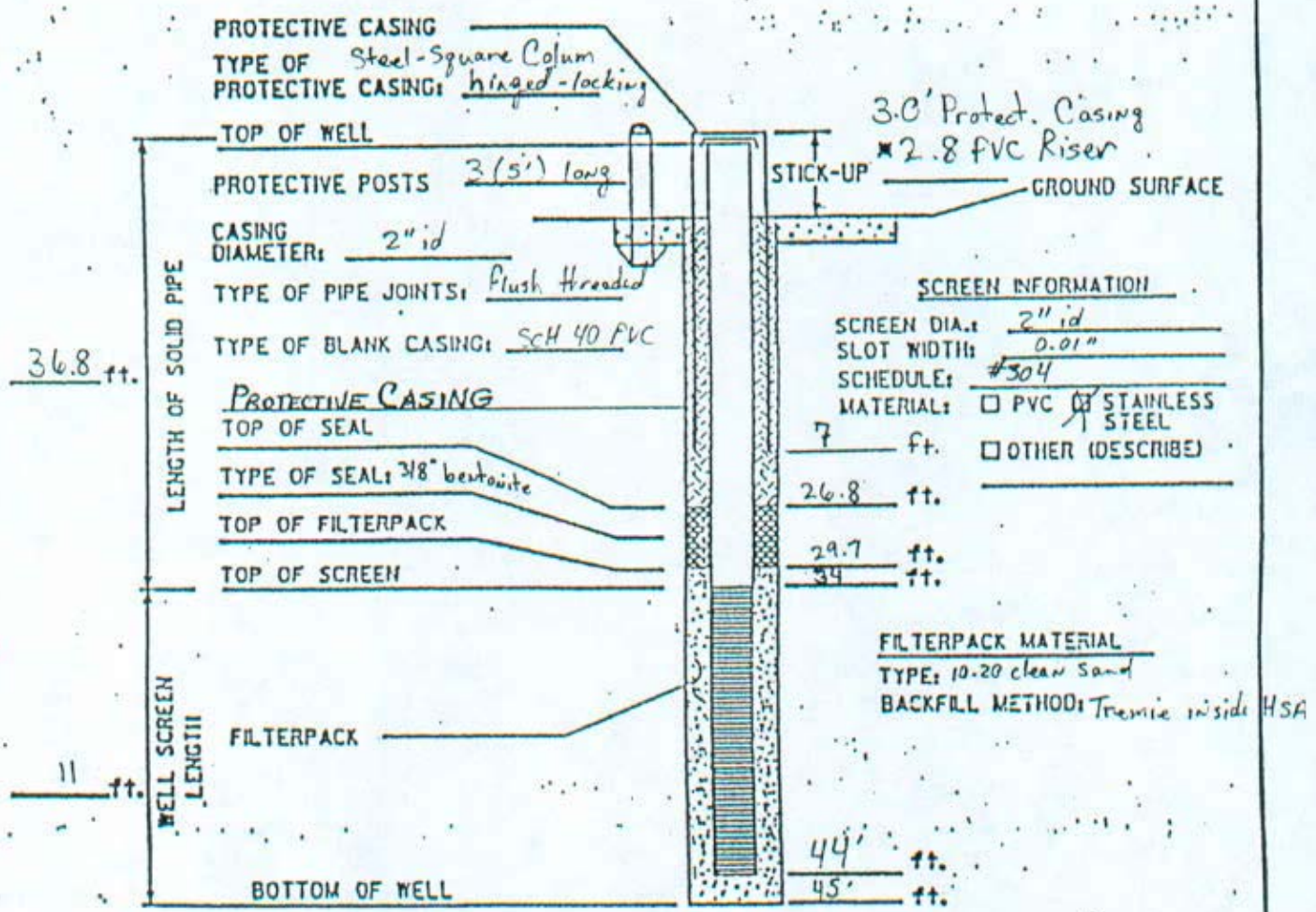
Sheet 3 of 5

Depth (a)	Analyt. Sample (b)	Hends pace (c)	Lith Column (d)	Lithologic Description (e)	Remarks (h)
28		φ	FSH		16 OCT 1993 Collected DP water @ 18' STD HAS.
29					30H @ 29' SET well. SAND 29-16.5' SCREEN 28.5-18.5' BENT 16.5-14.5'
30					

ELEVATION GROUND WATER			PROJECT: 60378.83
DATE INSTALLED	STARTED: 11-18-93	COMPLETED: 11-18-93	LOCATION (Coordinates or Station): OU-4 offsite
ELEVATION TOP OF HOLE			SIGNATURE OF INSPECTOR: D.C. Mettall
TOTAL DEPTH OF HOLE: 45'			HOLE NO. (as shown on drawing title and file number): SB930456 MW930426

MONITORING WELL CONSTRUCTION DIAGRAM

(ALL MEASUREMENTS FROM GROUND SURFACE)



WELL DEVELOPMENT

METHOD: _____
 TIME SPENT DEVELOPMENT: _____
 VOLUME OF WATER REMOVED: _____
 VOLUME OF WATER ADDED: _____
 DESCRIPTION OF PREDEVELOPMENT WATER: _____

 DESCRIPTION OF POST DEVELOPMENT WATER: _____

WATER LEVEL SUMMARY

WATER LEVEL MEASUREMENTS
 DATE/TIME/LEVEL: 35.30 (11-18-93) 0800
 25.20 (11-18-93) after well installation
~~11-30-93 (1200) 25.1~~
 11-19-93 (0846) 21.68
 T.P.V.C.
 DEPTH FROM TOP CASING AFTER DEVELOPMENT: 45.98

Filter Pack Placement Measurements: 100 lbs. bags

BAG #1: 39.2' (6" augers), pulled augers: 42' w/ sand	BAG #5: 37.7-36.1'	BAG #9: 30.4-29.7'
BAG #2: 42' - 39.1' (3" augers) pulled augers: 41' w/ sand	BAG #6: 36.1 - 34.4	2-5gal. buckets of
BAG #3: 41 - 39' (augers were pulled to 39')	BAG #7: 34.4 - 32.8	3/8" bent. pellets
BAG #4: 40' - 39' (augers were pulled to 39')	BAG #8: 32.8 - 30.4	

HTW DRILLING LOG

Boring No.
SB930456 MW930426
DP930442
Sheet 1 of 6

1. Company Name: EA Engineering		7. Drilling Sub: TWIN CITY TESTING	
3. Project: Ellsworth APB 60378.83		4. Location: 011-4 offsite	
5. Name of Driller: BRENT Thomas		6. Drill Rig Designation: CME-75	
7. Sizes and Types of Drilling and Sampling Equipment	10.25" od 6.25" id	8. Hole Location: (S) of MW930425	
	5' X 6" od Cowl.	9. Surface Elevation:	
	SAMPLER	10. Date Started: 11.16.93	
12. Surface Composition: sloping grassy hillside		11. Date Completed: 11.16.93	
13. Depth to Top Shale: 22.0		15. Depth Groundwater Encountered (from samples): Several v. small zones	
14. Total Depth of Hole: 45.0		16. Depth to Water & Time After Drilling Completed: 42.30' (5 hrs)	
18. Geotechnical smpls NONE		17. Other Water Level Measurements/Times: 35.30' (11.18.93) 0800	
20. Samples for Chemical Analyses NONE-Description Only		19. Number & type of Cores Taken:	
Disturbed		Undisturbed	Other
VOC		Metals	Other
		Other	Other

22. Disposition of Soil Boring	Backfilled	Monitoring Well	Other	23. Signature of Inspector D.C. Metello
		MW930426	DP930442 (1400) 11-17-93	

Depth (a)	Analyt. Sample (b)	Wellspace (c)	Lith Column (d)	Lithologic Description (e) DP930442(1650) B	Remarks (h)
1	0.1	PPM	CL	0-2' Grayish Brown (10YR5/2), dry - slightly moist, silty Clay (CL), massive structure, NO secondary fractures, low plasticity, med. competence,	- v. difficult drilling 0-3', retrieved sample had to remove sampler to finish drill run from 3-5' (setting on a quartzite boulder)
2	0.1		CL		
3	0.1		GM-GC	2-3' Grayish Brown (10YR5/2), dry, silty + clayey Gravel (GM-GC), w/ small - large pebble + cobble and small - med boulder size gravel, rounded - sub angular, loose conglomeritic structure, low competence, calcitic material throughout	
4	N/A		NR	3-5 No Recovery in Sampler:	
5	N/A		NR	Cuttings: no cuttings due to v. large cobble/small boulder caught in sampler throat	

ITW DRILLING LOG

Drilling No: 58930456
DP930442

Project: Ellsworth AFB

60378.83

Inspector: D.C. Metello

Sheet 2 of 6

Depth (a)	Analyt. Sample (b)	Heads pace (c)	Lith Column (d)	Lithologic Description (e)	Remarks (h)
		ppm			
6		0.1	GM-CH	5-8' Dark Greyish Brown (10YR 4/2), dry - slightly moist, silty + clayey Gravel and Clay (GM-CH), clay: med.-high plasticity, med competence, GM: no plasticity, med-high plasticity, small-large pebble + cobble size gravel, tight massive structure, calcitic material throughout	
7		0.1	GM-CH		
8		0.1	GM-CH		
			?		
9		N/A	NR	8-10' No Recovery in Sampler Cuttings: same as above	
10		N/A	NR		
11		0.4	GM-GC	10-13' Brown (10YR 4/3), slightly moist, silty - clayey Gravel, (GM-GC), small-large pebble + cobble and small boulder size gravel, round - sub angular, massive - conglumertic structure, no plasticity, low competence, some secondary fractures	
12		0.4	GM-GC		
13			?		
		N/A	NR (GM-GC)	13'-15' See Description Next Page	

ITW DRILLING LOG

Drilling No: SB930456
 PL930422 DP930442

Project: Hilsworth AFB

60378.83

Inspector:

D.C. Matello

Sheet 3 of 6

Depth (a)	Analyt. Sample (b)	Heads pace (c)	Lith Column (d)	Lithologic Description (e)	Remarks (h)
14		N/A	NR (GM-GC)	13-15' No Recovery in Sampler Cuttings: same as above (GM-GC)	-difficult drilling
15		N/A	NR (GM-GC)		
16		N/A	NR (GC)	15-18' No Recovery in Sampler. Cuttings: gravel/clayey gravel, slightly moist	
17					17' easier drilling, drilling cuttings indicate the gravel/clay interface
18		N/A	NR (GC)		
19		1.1	GC	18-20' Dark Yellowish Brown (10YR 4/4), slightly moist, clayey Gravel (GC), small-large pebble + cobble and small boulder size gravel, round-angular, loose conglomeritic structure, low competence	
20		1.1	GC		
21		N/A	NR (GC)	20-22' NO Recovery in Sampler Cuttings: clayey Gravel	
		N/A	NR (GC)		

HTW DRILLING LOG

Drilling No: SB930456

MW930426 DP930442

Project: Ellsworth AFB

60378.83

Inspector:

D.C. Medallo

Sheet 4 of 6

Depth (a)	Analyt. Sample (b)	Hends paco (c)	Lith Column (d)	Lithologic Description (e)	Remarks (f)
22		N/A	NR (GC) ?	20-22' NO recovery in Sampler Cuttings: clayey Gravel	
23		0.2	SHLE (hw)	22-25' Dark Greyish Brown (2.5V 4/2), slightly moist, highly weathered Shale (hw SHLE) tightly layered (convoluted), blocky structure, ~3% small-med pebble size gravel, high competence, developed secondary fractures, Fe staining throughout.	
24		0.2	SHLE (hw)		
26		0.2	SHLE (w)		
27		0.2	SHLE (w)	25-30' Olive Brown (2.5V 4/3), slightly moist, weathered Shale (w SHLE), tightly layered blocky structure, developed secondary fractures, high competence, Fe staining throughout, several bands (.25" thick) selenite crystals	
28		0.2	SHLE (w)		
29		0.2	SHLE (w)		

HTW DRILLING LOG

BOREHOLE NO: 56930456
DP930492

Project: Ellsworth AFD

60378.83

Inspector: D.C. Metello

Sheet 5 of 6

Depth (a)	Analyt. Sample (b)	Minds. Inco (c)	Lith Column (d)	Lithologic Description (e)	Remarks (f)
		FFm			
30		0.2	SHLE (w)	25-30' See Description Previous Page.	
31		0.1	SHLE (w)		
32				30-35' Very Dark Greyish Brown (2.5Y 3/2) slightly moist, - to wet in places, weathered Shale (w SHLE) layered blocky structure, developed secondary fractures, med-high competence, several developed concretion zones	
33		0.1	SHLE (w)		
34					
35		0.1	SHLE (w)		
36		0.2	SHLE (w)	35-40' Very Dark Greyish Brown (2.5Y 3/2) slightly moist, weathered Shale (w SHLE), massive - blocky structure, remnant layering, med-high competence, some secondary fractures, Fe staining throughout	
37		0.2	SHLE (w)		

HPW DRILLING LOG

Boring No: SB930436

MW 930426

DP930442

Project: Ellsworth AFB

Inspector:

Sheet 6 of 6

Depth (a)	Analyt. Sample (b)	Headspace (c)	Lith Column (d)	Lithologic Description (e)	Remarks (f)
38		0.2	SHLE (w)	35-40' See Description Previous Page	
39		0.2	SHLE (w)		
40		0.1	SHLE ~w Pierre Fm.	40-45' Very Dark Greyish Brown (2.5Y 3/2), slightly moist, Shale (slightly weathered) [Pierre Fm.], v. few secondary fractures, massive-blocky structure, some Fe staining, high competence, concoidal fracture patterns, selenite crystals in several places <u>WELL CONSTRUCTION INFO MW930426</u> TD: 45' SCREEN: 44-34' 10' of 0.01" slot S.S. FILTER PACK: 45-30' RISER: 34- (+) 2.8' SCH 40 PVC BENT. SEAL: 30-26.8	
41		0.1	SHLE ~w Pierre Fm.		
42		0.1	SHLE ~w Pierre Fm.		
43		0.1	SHLE ~w Pierre Fm.		
44		0.1	SHLE ~w Pierre Fm.		
45				Boring Terminated 45' Well Const. Info MW930426: TD: 45' SCREEN: 44-34' Bent. Seal: 29.7-26.8 Filter Pack: 45-29.7 Riser: 34- (+) 2.8' Screen: 2" id 0.01" slot S.S.	