N83447.AR.000097
NAS FORT WORTH
5090.3a

RESULTS OF CONTAMINATION INVESTIGATIONS AT SPOT 35 NAS FORT WORTH TX
11/1/1992
ARMY CORP OF ENGINEERS

File: 17G
A.F.

NAVAL AIR STATION
FORT WORTH JRB
CARSWELL FIELD
TEXAS

ADMINISTRATIVE RECORD
COVER SHEET

AR File Number 121

SPOT 35, CALSWEL AIR FORCE BASE
RESULTS OF CONTAMINATION INVESTIGATIONS

US ARMY CORPS OF ENGINEERS
FORT NORTH DISTRICT

NOVEMBER 1992

SPOT 35, CARSWELL AIR FORCE BASE
RESULTS OF CONTAMINATION INVESTIGATIONS
US ARMY CORPS OF ENGINEERS, FORT WORTH DISTRICT

TABLE OF CONTENTS

1.0 INTRODUCTION

2.0 INVESTIGATIONS
- 2.1 Previous Investigations
- 2.2 Current Investigations

3.0 SITE CONDITIONS
- 3.1 Site Geology
- 3.2 Ground Water

4.0 CONTAMINATION
- 4.1 Soils
- 4.2 Ground Water
  - 4.2.1 Total BTEX
  - 4.2.2 Total Recoverable Petroleum Hydrocarbons
  - 4.2.3 Trichloroethene

5.0 CONCLUSIONS AND RECOMMENDATIONS
- 5.1 Conclusions
- 5.2 Recommendations

FIGURE 1 SITE MAP
FIGURE 2 MONITORING WELL PLAN
FIGURE 3 GROUND WATER CONTOUR MAP

TABLE 1 SURFACE AND GROUND WATER ELEVATIONS
TABLE 2 RESULTS OF CHEMICAL ANALYSES - SOIL
TABLE 3 RESULTS OF CHEMICAL ANALYSES - GROUND WATER

APPENDIX I - EXCERPTS FROM PREVIOUS INVESTIGATION BY MAXIM ENGINEERING, INC.
APPENDIX II - FIELD LOGS OF BORINGS AND INSTALLATION OF MONITORING WELLS

SPOT 35, CARSWELL AIR FORCE BASE
RESULTS OF CONTAMINATION INVESTIGATIONS
US ARMY CORPS OF ENGINEERS, FORT WORTH DISTRICT

1.0 INTRODUCTION

At the request of Carswell Air Force Base (CAFB), and under directive from the Texas Water Commission (TWC) (letter dated 15 April 1991), the US Army Corps of Engineers, Fort Worth District (CESWF) has conducted site investigations to determine the extent of contamination of soil and ground water as a result of leakage of JP-4 at the Spot 35 parking area. Location of the study area is shown on Figure 1, Site Map.

2.0 INVESTIGATIONS

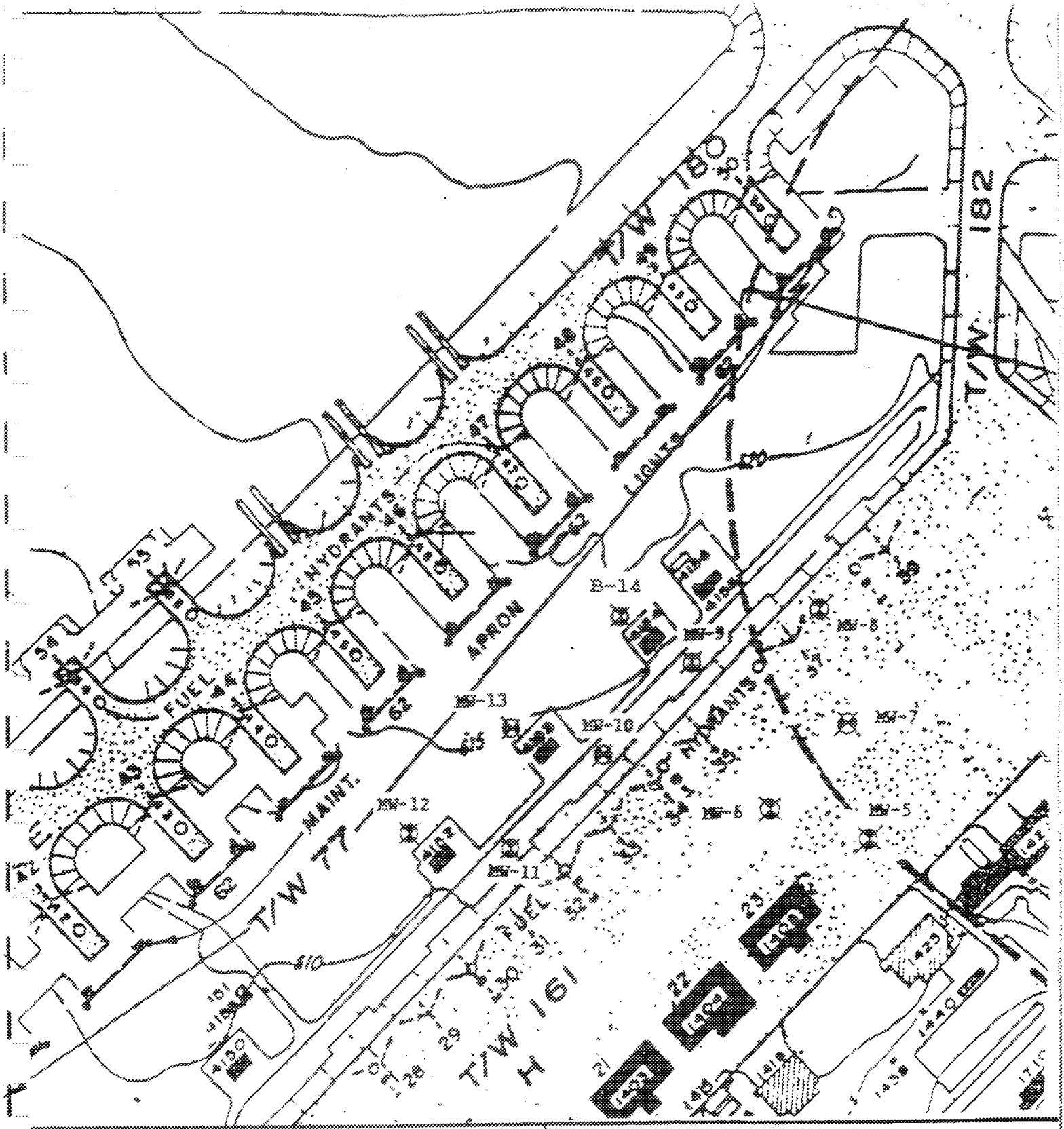
2.1 Previous Investigations

Previous investigations of the site had been conducted by MAXIM Engineers, INC. under contract with CAFB. Results of the investigations were published in a report dated October 26, 1990 and entitled, "Limited Subsurface Investigation, Hydrant Fueling System Spot 35". This investigation consisted of drilling and sampling 9 soil borings and installing 3 monitoring wells. The three monitoring wells, labeled MW-1, MW-2, and MW-3, were also observed and sampled during this investigation.

2.2 Current Investigations

CESWF investigations consisted of drilling 11 soil borings and installing 10 monitoring wells in the vicinity of Spot 35. Locations of the borings and monitoring wells are shown on Figure 1. Soil samples from each boring were analyzed in the Corps of Engineers Southwestern Division Laboratory, Dallas Texas for concentrations of benzene, toluene, ethylbenzene, and xylene (BTEX), total recoverable petroleum hydrocarbons (TRPH), and for trichloroethene (TCE).

In addition to the three existing monitoring wells at the site, CESWF installed 10 additional monitoring wells in order to determine the hydraulic gradient at the site and to determine the extent of contaminant migration from the site. The locations of all borings and monitoring wells installed by the CWSWF are shown on Figure 2. A letter report of findings was given to CAFB in October 1992 detailing the results of monitoring well installation and initial sampling. At that time CAFB requested that CESWF perform required sampling and analyses of the monitoring wells during FY 1992 and furnish a report at the end of FY 92. Concentrations of BTEX and TRPH in the ground water were monitored



NORTH

SCALE: 1" = 300'

U S ARMY CORPS OF ENGINEERS
FORT WORTH DISTRICT

CARSWELL AIR FORCE BASE, TEXAS

SPOT 35

FIGURE 1 SITE MAP

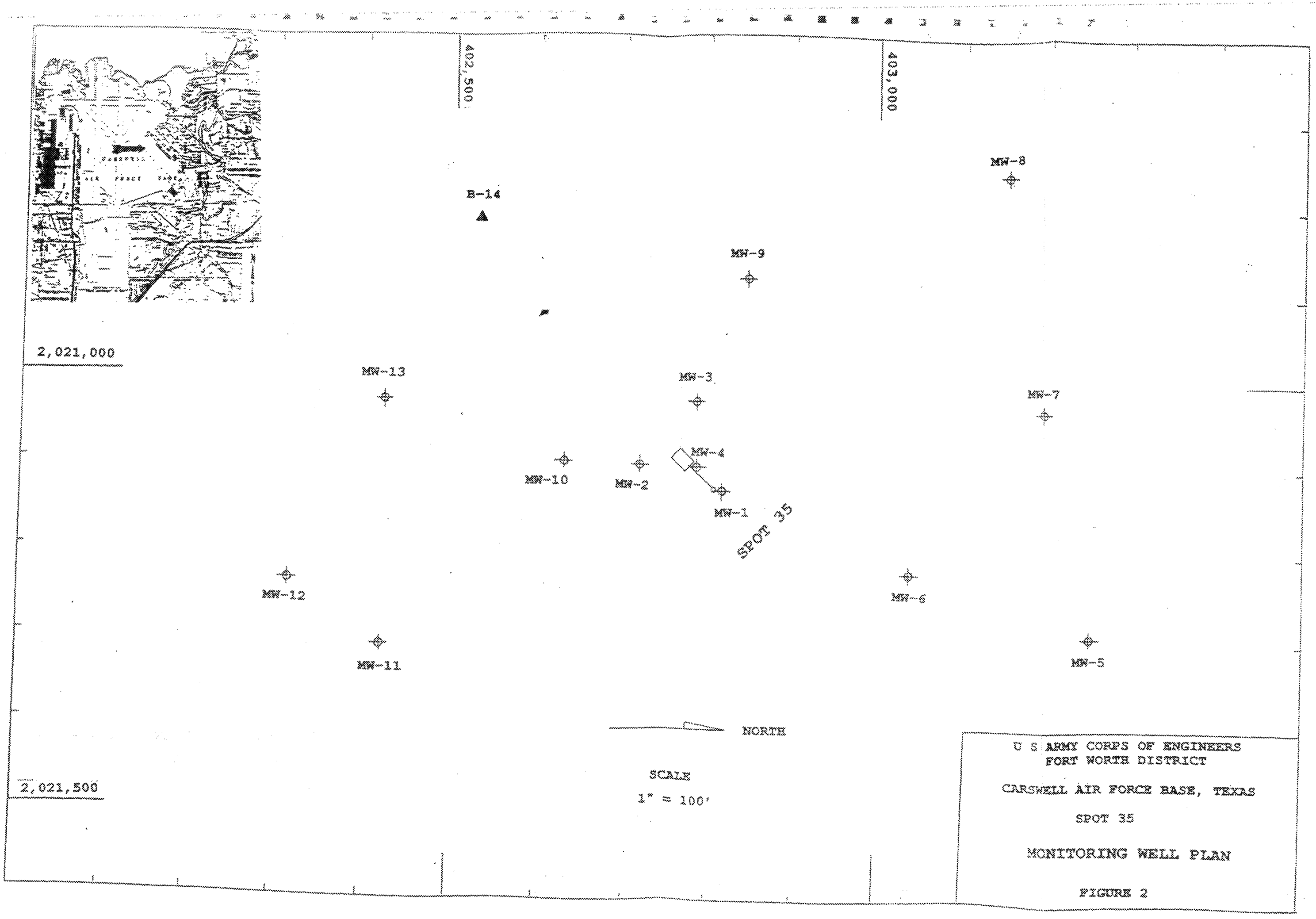
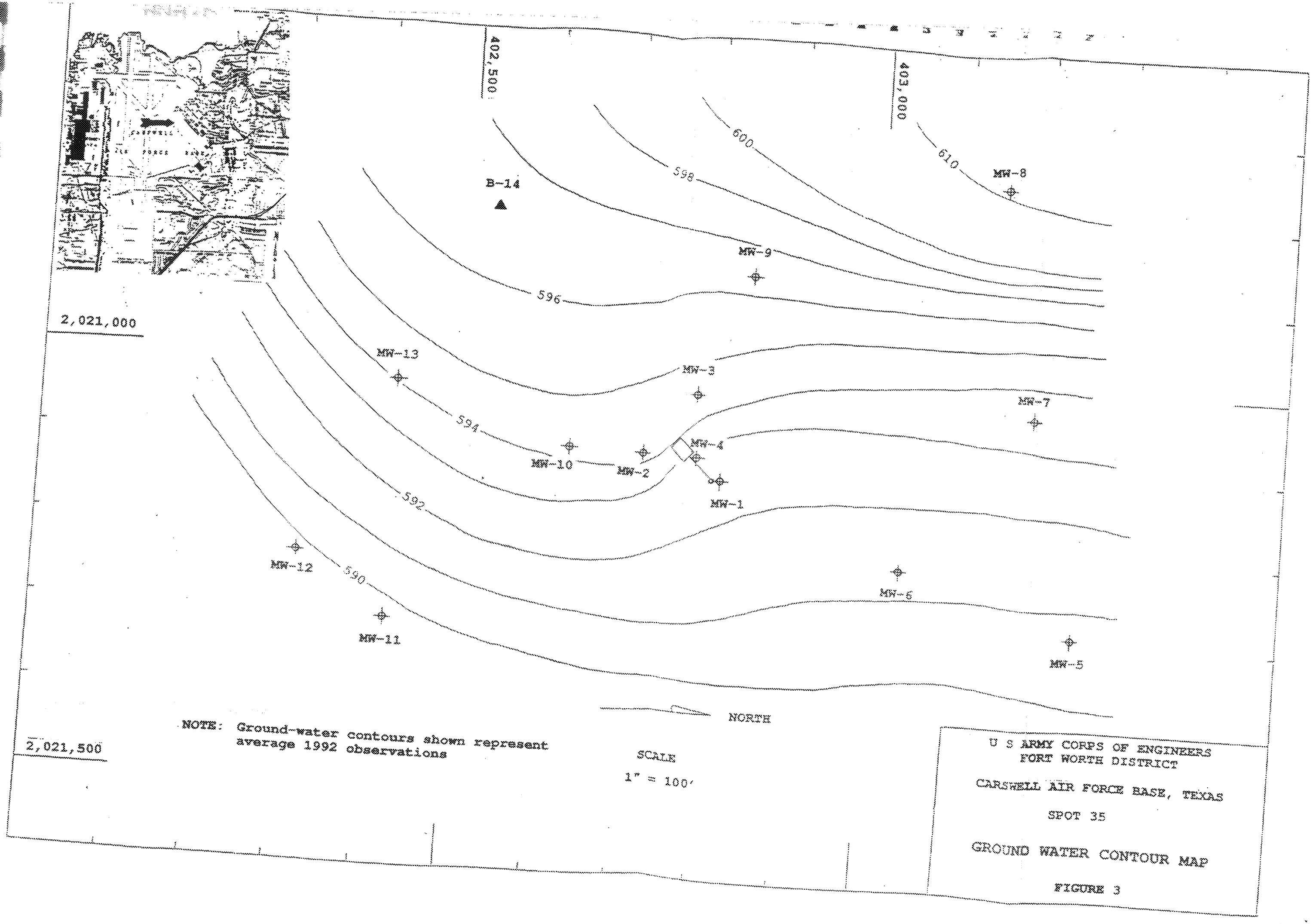

402,500
403,000
2,021,000
2,021,500
B-14
MW-8
MW-9
MW-13
MW-3
MW-7
MW-4
MW-10
MW-2
MW-1
SPOT 35
MW-12
MW-6
MW-11
MW-5
NORTH
SCALE
1" = 100'
U S ARMY CORPS OF ENGINEERS
FORT WORTH DISTRICT
CARSWELL AIR FORCE BASE, TEXAS
SPOT 35
MONITORING WELL PLAN
FIGURE 2

TABLE 1
SURFACE AND GROUND-WATER ELEVATIONS
MONITORING WELLS - CARSWELL AFB, SPOT 35

LOCATION	SURFACE ELEV	GROUND-WATER ELEVATION					AVERAGE 1992
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	**	**	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	**	**	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	**	**	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	**	**	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	**	**	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	**	**	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	**	**	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	**	**	[illegible]	[illegible]	[illegible]	589.94
[illegible]	[illegible]	**	**	[illegible]	[illegible]	[illegible]	589.97
[illegible]	[illegible]	**	**	[illegible]	[illegible]	[illegible]	593.01

* Monitoring Well MW-4 installed July 1991
** Monitoring Wells MW-5 through MW-13 installed September 1991


402,500
403,000
2,021,000
2,021,500
B-14
MW-8
MW-9
MW-13
MW-3
MW-7
MW-4
MW-10
MW-2
MW-1
MW-12
MW-6
MW-11
MW-5
600
598
596
594
592
590
NORTH
NOTE: Ground-water contours shown represent average 1992 observations
SCALE
1" = 100'
U S ARMY CORPS OF ENGINEERS
FORT WORTH DISTRICT
CARSWELL AIR FORCE BASE, TEXAS
SPOT 35
GROUND WATER CONTOUR MAP
FIGURE 3

beginning in July 1991.

3.0 SITE CONDITIONS

3.1 Site Geology

The Spot 35 site is situated on an alluvial terrace deposit within the Trinity River flood plain. Borings for the monitoring wells encountered, in descending order, clay, sand, gravel, and shale or limestone bedrock. Clay was described as stiff, medium to high plasticity, and dark brown, becoming sandy and yellow-brown to gray with depth. The sand interval is generally silty, fine grained with occasional limy gravel nodules, becoming more gravelly with depth. Gravels encountered in borings for MW-5, MW-6, MW-9, MW-12, and MW-14, were described as sandy, limy, and coarse to fine with occasional cobble size. All borings were terminated at the top of bedrock which consisted of either shale or limestone. Logs of borings and records of monitoring well installation are included in Appendix I.

The thickness of the alluvial materials overlying bedrock generally ranged from 26 to 29 feet. The lone exception is boring B-14 where shale was encountered at 10 feet, an indication of the rise in the underlying bedrock to the west and southwest of parking spot 35.

3.2 Ground Water

Observations of static water levels measured immediately prior to sampling each monitoring well are shown on Table 1. The observations indicate an east-southeasterly direction of ground water movement across the site. A ground-water contour map is shown on Figure 3. The map was prepared using the average ground water table measurements taken in 1992. The gradients are very subtle, and could be subject to fluctuation during heavy rainfall periods. The ground water is migrating through the sand and gravel zones which lie just above the lower shale/limestone bedrock. The static level of the ground water generally occurs within the sand zone indicating the aquifer is under water table conditions, that is, it doesn't appear that it is confined by the overlying clay layer. The alluvial aquifer in which the ground water occurs is continuous across the study site; however, the aquifer is heterogeneous when considering its physical makeup and ground water flow characteristics.

4.0 CONTAMINATION

4.1 Soils

Soil samples taken from the monitoring well borings were

preserved and transported to the Corps of Engineers Southwestern Division Laboratory. Soil samples were analyzed for BTEX and TRPH using analytical methods 8020 and 418.1 respectively. Table 2 presents the results of the laboratory analyses. Table 2 shows that soils containing elevated concentrations of BTEX were found in the MW-4 boring only, located immediately adjacent to the spill site. Soil containing elevated levels (greater than 100 mg/kg) of TRPH were found in five of the monitoring well borings: MW-4, MW-9, MW-10, MW-11, and MW-13. The heaviest concentrations of TRPH were found within the sand and gravel zones in the borings, probably deposited there by TRPH contaminated ground water flowing through. With the exception of MW-4, none of the above wells are in a downgradient direction of ground water flow from the Spot 35 spill site, leading to the conclusion that the TRPH contamination in the soil at these locations is from a source other than Spot 35.

4.2 Ground Water

Samples of the ground water were collected from wells MW-1, MW-2, and MW-3 in October 1990 by Maxim Engineers, Inc., and analyzed for BTEX and TPH. Additional samples were collected and analyzed by the Corps of Engineers in July 1991, at the time well MW-4 was constructed. In October 1991, wells MW-5 through MW-13 were constructed and all wells were sampled in October 1991, June 1992, and September 1992. All samples of the ground water taken from the monitoring wells have been analyzed in the Corps of Engineers Southwestern Division Laboratory for BTEX and TRPH using EPA approved methods 8020 and 418.1 respectively. In addition, at the request of Carswell Air Force Base, samples collected in September 1992 were analyzed for Volatile Organics using Method 8240 for the primary purpose of testing for the contaminant trichloroethene (TCE).

Results of analysis of ground water performed by Maxim Engineers, Inc. are presented in Appendix 1. Results of all analyses performed by Maxim the Corps of Engineers are presented in Table 3.

4.2.1 Total BTEX

Table 3 shows that the amount of total BTEX contaminant in ground water was never detected in significant concentrations. The highest amounts detected were in MW-4 and MW-2 with concentrations of 2.55 mg/L and 2.024 mg/L. As expected, the highest concentrations of BTEX in ground water were found in MW-4, located immediately adjacent to the Spot 35 spill site. Low concentrations of total BTEX were found in MW-13, located 370 feet south of Spot 35. Neither MW-2 or MW-13 are located in a downgradient direction of ground water flow from the spill site, indicating another source of contamination may be present.

TABLE 2
RESULTS OF CHEMICAL ANALYSIS - SOIL
MONITORING WELLS - CARSWELL AFB, SPOT 35

LOCATION	DEPTH (ft)	PARAMETER					
		BENZENE (ug/kg)	TOLUENE (ug/kg)	ETHYLBENZENE (ug/kg)	XYLENE (ug/kg)	TOTAL BTEX (ug/kg)	TRPH (mg/kg)
MW-4	RINSATE	480	<10	490	990	1960	23
	0.5-1.0	<10	12.0	35	100	147	690
	2.5-3.0	15	<10	14	14	43	57
	3.5-4.0	1300	<1000	14000	61000	76300	3600
	6.0-7.0	<100	<100	920	2200	3120	2000
	9.0-10.0	<10	<10	16	80	96	66
	14.0-15.0	170	160	2200	1100	3630	630
	19.0-20.0	<200	<200	1700	7600	9300	890
	19.0-20.0 QC	<200	<200	1100	3800	4900	750
	19.0-20.0 QA	97	1400	9600	11000	22097	-
	19.0-20.0 QA	<200	2600	4600	15000	22200	860
	25.0-26.0	<1000	<1000	4600	14000	18600	1100
MW-5	2.0-3.0	<2	<2	<2	<2	ND	<10
	21.0-22.0	<2	<2	<2	<2	ND	<10
MW-6	2.3-3.0	<6200	<6200	<6200	<6200	ND	15
	23.0-24.0	<1200	<1200	<1200	<1200	ND	<4.8
MW-7	2.0-3.0	<12	<12	<12	<12	ND	99
	23.5-24.5	<12	<12	<12	<12	ND	<5.5
MW-8	2.1-3.1	<11	<11	<11	<11	ND	<5.7
	18.0-19.0	<12	<12	<12	<12	ND	24
	RINSATE	<2	<2	<2	<2	ND	2.1
MW-9	1.0-2.0	<11	<11	<11	<11	ND	120
	19.0-20.0	<120	<120	<120	<120	ND	130
MW-10	1.0-2.0	<11	<11	<11	<11	ND	<4.9
	9.5-10.4	<12	<12	<12	<12	ND	<4.1
	21.0-22.0	<48	<48	<48	<48	ND	250
	21.0-22.0 QC	<48	<48	<48	<48	ND	270
	21.0-22.0 QA	<200	<200	260	290	550	260
MW-11	1.0-2.0	<12	<12	<12	<12	ND	<5.4
	22.0-23.0	<12	<12	<12	<12	ND	110
MW-12	1.0-2.0	<12	<12	<12	<12	ND	<5.4
	22.0-23.0	<11	<11	<11	<11	ND	<4.2
MW-13	1.0-2.0	<12	<12	<12	<12	ND	<4.8
	21.0-22.0	<1200	<1200	<1200	<1200	ND	300
	21.0-22.0 QC	<240	<240	<240	<240	ND	430
	21.0-22.0 QA	<200	<200	1300	4200	5500	1900
B-14	1.0-2.0	<11	<11	<11	<11	ND	6.8
	6.0-7.0	<11	<11	<11	<11	ND	<5.6
	9.0-10.0	<11	<11	<11	<11	ND	3.9

TABLE 3
RESULTS OF CHEMICAL ANALYSIS - WATER
MONITORING WELLS - CARSWELL AFB, SPOT 35

PARAMETERS	DATE	UNITS	MW-1	MW-2	MW-3	MW-4	MW-4 (QC)	MW-4 RINSATE
BENZENE	OCT 90	PPM	[illegible]	0.55	0.16	*	*	*
	JUL 91	mg/L	[illegible]	0.14	<.001	0.71	0.0006	<.001
	OCT 91	mg/L	[illegible]	0.083	<.001	0.85	-	-
	JUN 92	mg/L	[illegible]	0.695	<0.5	0.0054	-	-
	SEP 92	mg/L	[illegible]	0.051	<0.005	0.767	-	-
TOLUENE	OCT 90	PPM	[illegible]	0.01	0.01	*	*	*
	JUL 91	mg/L	[illegible]	<.05	<.001	<.05	<.0001	<.001
	OCT 91	mg/L	[illegible]	<.0002	<.001	<.004	-	-
	JUN 92	mg/L	[illegible]	0.072	0.0054	0.0034	-	-
	SEP 92	mg/L	[illegible]	<0.005	<0.005	<0.005	-	-
ETHYLBENZENE	OCT 90	PPM	[illegible]	0.05	0.06	*	*	*
	JUL 91	mg/L	[illegible]	0.150	0.0063	0.44	0.00036	<.001
	OCT 91	mg/L	[illegible]	0.011	<.001	0.36	-	-
	JUN 92	mg/L	[illegible]	0.273	0.0051	0.0039	-	-
	SEP 92	mg/L	[illegible]	<0.005	<0.005	0.223	-	-
XYLENE	OCT 90	PPM	[illegible]	0.03	0.01	*	*	*
	JUL 91	mg/L	[illegible]	1.50	0.024	1.40	0.0013	<.001
	OCT 91	mg/L	[illegible]	0.012	<.001	0.75	-	-
	JUN 92	mg/L	[illegible]	0.984	0.0035	0.0054	-	-
	SEP 92	mg/L	[illegible]	<0.005	<0.005	0.462	-	-
TOTAL BTEX DETECTED	OCT 90	PPM	[illegible]	0.64	0.25	*	*	*
	JUL 91	mg/L	[illegible]	1.79	0.0303	2.55	0.00226	ND
	OCT 91	mg/L	[illegible]	0.106	ND	1.96	-	-
	JUN 92	mg/L	[illegible]	2.024	0.014	0.0181	-	-
	SEP 92	mg/L	[illegible]	0.051	ND	1.452	-	-
TRPH	OCT 90	PPM	[illegible]	93.3	28.3	*	*	*
	JUL 91	mg/L	[illegible]	11.0	2.9	110	210	<0.5
	OCT 91	mg/L	[illegible]	8.3	1.7	120	-	-
	JUN 92	mg/L	[illegible]	9.0	2.0	16	-	-
	SEP 92	mg/L	[illegible]	2.8	1.6	1.9	-	-
TRICHLOROETHENE	SEP 92	mg/L	[illegible]	<0.005	<0.005	<0.005	-	-

* Monitoring Well MW-4 installed July 1991
** Monitoring Wells MW-5 through MW-13 installed September 1991

TABLE 3 (CONT'D)
RESULTS OF CHEMICAL ANALYSIS - WATER
MONITORING WELLS - CARSWELL AFB, SPOT 35

PARAMETERS	DATE	UNITS	MW-5	MW-6	MW-6 (QA)	MW-6 (QC)	MW-6 RINSATE	MW-7
BENZENE	OCT 90	PPM	**	**	**	**	**	**
	JUL 91	mg/L	**	**	**	**	**	**
	OCT 91	mg/L	<.0002	<.0002	<.001	<.0002	<.0002	<.0002
	JUN 92	mg/L	DRY	0.0028	-	-	-	<0.5
	SEP 92	mg/L	DRY	<0.005	<0.005	<0.005	-	<0.005
TOLUENE	OCT 90	PPM	**	**	**	**	**	**
	JUL 91	mg/L	**	**	**	**	**	**
	OCT 91	mg/L	<.0002	0.0018	0.0014	<.0002	<.0002	<.0002
	JUN 92	mg/L	DRY	<0.5	-	-	-	<0.5
	SEP 92	mg/L	DRY	<0.005	<0.005	<0.005	-	<0.005
ETHYLBENZENE	OCT 90	PPM	**	**	**	**	**	**
	JUL 91	mg/L	**	**	**	**	**	**
	OCT 91	mg/L	<.0002	<.0002	<.001	<.0002	<.0002	<.0002
	JUN 92	mg/L	DRY	<0.5	-	-	-	<0.5
	SEP 92	mg/L	DRY	<0.005	<0.005	<0.005	-	<0.005
XYLENE	OCT 90	PPM	**	**	**	**	**	**
	JUL 91	mg/L	**	**	**	**	**	**
	OCT 91	mg/L	<.0002	<.0002	0.0025	<.0002	<.0002	<.0002
	JUN 92	mg/L	DRY	<0.5	-	-	-	<0.5
	SEP 92	mg/L	DRY	<0.005	<0.005	<0.005	-	0.009
TOTAL BTEX DETECTED	OCT 90	PPM	**	**	**	**	**	**
	JUL 91	mg/L	**	**	**	**	**	**
	OCT 91	mg/L	ND	0.0018	0.0039	ND	ND	ND
	JUN 92	mg/L	DRY	0.0028	-	-	-	ND
	SEP 92	mg/L	DRY	ND	ND	ND	-	0.101
TRPH	OCT 90	PPM	**	**	**	**	**	**
	JUL 91	mg/L	**	**	**	**	**	**
	OCT 91	mg/L	<.10	0.80	<0.5	<.10	-	<.10
	JUN 92	mg/L	DRY	<0.5	-	-	-	<0.5
	SEP 92	mg/L	DRY	<0.1	1.6	0.3	-	<0.1
TRICHLOROETHENE	SEP 92	mg/L	DRY	0.016	<0.005	0.015	-	0.092

* Monitoring Well MW-4 installed July 1991
** Monitoring Wells MW-5 through MW-13 installed September 1991

TABLE 3 (CONT'D)
RESULTS OF CHEMICAL ANALYSIS - WATER
MONITORING WELLS - CARSWELL AFB, SPOT 35

PARAMETERS	DATE	UNITS	MW-8	MW-9	MW-10	MW-11	MW-12	MW-13
BENZENE	OCT 90	PPM	**	**	**	**	**	**
	JUL 91	mg/L	**	**	**	**	**	**
	OCT 91	mg/L	<.0002	0.0043	0.0015	<.05	<.001	0.340
	JUN 92	mg/L	<0.5	0.0778	0.0018	<.05	<.0005	0.010
	SEP 92	mg/L	<0.005	0.120	<0.005	<0.005	<0.005	0.106
TOLUENE	OCT 90	PPM	**	**	**	**	**	**
	JUL 91	mg/L	**	**	**	**	**	**
	OCT 91	mg/L	<.0002	0.0052	<.001	<.05	<.001	<.05
	JUN 92	mg/L	<0.5	0.0070	0.0031	0.0063	<.0005	0.0016
	SEP 92	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
ETHYLBENZENE	OCT 90	PPM	**	**	**	**	**	**
	JUL 91	mg/L	**	**	**	**	**	**
	OCT 91	mg/L	<.0002	0.0059	0.0012	0.23	<.001	0.340
	JUN 92	mg/L	<0.5	<.0025	0.0012	0.0139	<.0005	0.0378
	SEP 92	mg/L	<0.005	<0.005	<0.005	0.007	<0.005	0.169
XYLENE	OCT 90	PPM	**	**	**	**	**	**
	JUL 91	mg/L	**	**	**	**	**	**
	OCT 91	mg/L	<.0002	0.0049	0.0098	0.023	<.001	1.10
	JUN 92	mg/L	<0.5	<.0025	0.0033	0.0041	<.0005	0.179
	SEP 92	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	0.971
TOTAL BTEX DETECTED	OCT 90	PPM	**	**	**	**	**	**
	JUL 91	mg/L	**	**	**	**	**	**
	OCT 91	mg/L	ND	0.0203	0.0125	0.253	ND	1.78
	JUN 92	mg/L	ND	0.0848	0.0094	0.0243	ND	0.2284
	SEP 92	mg/L	ND	0.120	ND	0.007	ND	1.246
TRPH	OCT 90	PPM	**	**	**	**	**	**
	JUL 91	mg/L	**	**	**	**	**	**
	OCT 91	mg/L	<.10	3.0	3.0	4.0	<0.5	140
	JUN 92	mg/L	<0.5	2.0	3.0	3.0	<0.5	32275
	SEP 92	mg/L	<0.1	1.2	0.3	1.2	<0.1	3100
TRICHLOROETHENE	SEP 92	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005

* Monitoring Well MW-4 installed July 1991
** Monitoring Wells MW-5 through MW-13 installed September 1991

4.2.2 Total Recoverable Petroleum Hydrocarbons

As shown in Table 3, elevated concentrations of TRPH were detected in all four monitoring wells near the Spot 35 spill site. The initial sample collected from MW-1 in October 1990 contained 174 PPM TRPH. MW-4, installed by the Corps of Engineers, produced ground water containing 110 mg/L and 120 mg/L in July 1991 and October 1991, respectively. However, in the last two sampling rounds collected in June 1992 and September 1992, the levels of TRPH in the four wells has declined significantly to the 1-2 mg/L range, indicating a purging of the TRPH from the ground water in the immediate vicinity of Spot 35.

A particular point to note is that in June 1992, a water sample collected from MW-13 contained in access of 32,000 mg/L TRPH, almost pure product. In September 1992, the concentration was 3,100 mg/L, declining, but still excessively high. As noted above, MW-13 is not in a downgradient direction of ground water flow from Spot 35; therefore, a separate source of contamination is suspected.

4.2.3 Trichloroethene

Water samples collected in September 1992 were analyzed for volatile organics, particularly to see if Trichloroethene (TCE) has migrated onto the site. Low levels of TCE were detected in wells MW-6 (0.016 mg/L) and MW-7 (0.092 mg/L). Levels of TCE in samples from all other wells were below the detection limit of 0.005 mg/L.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

5.1.1 The study area is underlain by an unconfined alluvial aquifer, approximately 26 to 29 feet in thickness, and primarily consisting of clays underlain by impure sands and gravels, all overlying shale and limestone bedrock.

5.1.2 The principle direction of ground water movement at the study site is toward the east-southeast. Minor fluctuations in the water table occur during rainy periods.

5.1.3 Levels of total BTEX found in the soils were high only in MW-4, located immediately adjacent to Spot 35; amounts in all other borings were either low or not detected.

5.1.4 No significant concentrations of BTEX were found in ground water. Highest concentrations were found in wells immediately adjacent to Spot 35.

5.1.5 Significant levels of TRPH were initially found in soils and ground water adjacent to Spot 35; but have declined significantly in the ground water indicating a purging of contaminants from the area. However, it is possible a concentrated plume of TRPH contaminant may be moving with the ground water in a downgradient (easterly) direction.

5.1.6 Elevated levels (greater than 100 mg/kg) of TRPH were found in soils at five of the monitoring well sites.

5.1.7 Significant levels of BTEX and TRPH were found in well MW-13. Since MW-13 is not located in a down-gradient direction of ground water flow from Spot 35, it is suspected that a separate source of contamination is present, somewhere to the west-northwest of this well.

5.1.8 Significant levels of trichloroethene (TCE) were not detected in any of the monitoring wells sampled in September 1992.

5.2 Recommendations

5.2.1 Remedial effort will be required to clean up the contaminated soils in the immediate vicnity of Spot 35 where high concentrations of BTEX and TRPH were found. Remediation should consist of excavation and removal of the Spot 35 pump pit and immediately adjacent contaminated soils.

5.2.2 Remedial effort may be required to clean up the contaminated soils found at the five monitor well sites. Bioremediation is recommended due to the low concentrations detected, the unknown extent of the contamination, and the fact that much of the area is under concrete aprons or taxiways.

5.2.3 A risk assessment should be conducted to determine if there exists a mobile plume of TRPH in the ground water moving in a downgradient direction from Spot 35. As part of the risk assessment, additional monitor wells should be constructed in the area downgradient from Spot 35 between MW-11 and MW-6 to locate and predict the possible affects of migrating contaminant.

5.2.4 Additional investigations should be undertaken to determine the source of contamination present in MW-13.

APPENDIX I

EXCERPTS FROM HYDRANT FUELING SYSTEM SPOT 35

MAXIM ENGINEERS, INC

1.0 INTRODUCTION

The following is a report of activities performed by Maxim Engineers, Inc. (Maxim) as part of a limited subsurface soil investigation at Spot 35 of the hydrant fueling system, Carswell AFB, Fort Worth, Texas. The Spot 35 project was spawned from annual maintenance operations of the entire fueling system at Carswell Air Force Base. It was discovered during an annual line test that the thirty (30) foot section of pipe failed a line pressure test. At that time the line was shut down, disconnected and the hydrant was diverted to a new location to maintain operation, leaving the thirty (30) foot section inoperable.

The pipeline penetrated the wall of a pump pit approximately four (4) feet below finished grade. Maintenance crews also observed seepage of JP-4 jet fuel into the pump pit through this penetration. Maxim's scope of work called for chemical analysis of soil samples from borings at selected locations along the thirty (30) foot section of pipeline to determine the horizontal and vertical extent of the impacted soil.

2.0 SITE DESCRIPTION

The project site is located just south of the main taxi-way at hydrant fueling Spot 35 on the main apron. The vicinity surrounding the project location consists of open areas of taxi-ways and run-ways to the west, bomber row to the south, tanker row to the north, and the control tower along with hanger buildings to the east.

The hydrant fueling system is comprised of pump stations with large underground storage tanks which feed smaller subpump stations at each hydrant refueling spot located on the

main apron. An area location map is presented in Section II.

3.0 GEOLOGY/HYDROGEOLOGY

The geology of the project area consists of alluvial deposits of clays and sand from the west fork of the Trinity River flood plains. These clays are generally dark brown to brown in color with some grayish variances and range from medium plasticity to highly plastic soils with brown sand lenses interbedded. These alluvial soils over lie the Fredricksburg Group which consists of a series of shales, limestones and marls.

The shallow water table was encountered between twenty (20) and twenty-five (25) feet. Thickness of the shallow water bearing sand was not determined at the project site. The shallowest potable water aquifer is the Paluxy sand which lies approximately one hundred and fifty (150) to two hundred (200) feet below the surface.

4.0 FIELD ACTIVITIES

On September 24, 1990 Maxim began a subsurface investigation which consisted of nine (9) soil borings, three of which were converted to two (2) inch monitor wells. The soil borings ranged in depth from ten (10) feet to twenty-seven and one half (27.5) feet. The three monitor wells were set to depths ranging from twenty-five (25) feet to twenty-seven and one half (27.5) feet. Boring locations are indicated on the site map presented in Section II, Figure II. The borings were advanced with a rotary drilling rig and sampled with a continuous sampling device and logged by a geologist. Boring logs are presented in Section III. Augers and samplers were decontaminated to prevent cross contamination

between samplings. Samples were collected in three (3) foot composite intervals, placed in glass jars with teflon lined lids, labeled, packed on ice and transported to a local laboratory at the end of each day. Chain of Custody records are presented in Section III.

Upon completion, the borings were backfilled with the auger cuttings to the bottom of the concrete slab, then grouted to the finished grade with rapid set, high strength (8100 psi in 28 days) non-shrink grout. Remaining drill cuttings were containerized in 55-gallon soil drums and removed from the project site by Maxim personnel for disposal at a later date.

Borings B-2, B-8 and B-9 were converted to groundwater monitoring wells using two inch (2") schedule 40 PVC pipe and slotted screen. The monitor wells were then developed by removing at least three (3) well volumes of fluid, then sampled using proper EPA protocol. Each well was bailed with a dedicated bailer to prevent cross contamination of wells. Water samples were placed in 40 milliter glass VOA vials and 1 liter amber bottles, labeled, packed on ice, and delivered to a local laboratory for analyses. Copies of the State of Texas Water Well Reports are included in Section III. A groundwater gradient map was developed using relative elevations. Groundwater gradient is in a north-northwest direction. A groundwater gradient map is presented in Section II.

5.0 LABORATORY RESULTS

A total of seventeen (17) composite soil samples and three (3) groundwater samples were submitted to be analyzed for total petroleum hydrocarbons (TPH) using EPA approved method 418.1. Three of the seventeen (17) soil samples were also analyzed for benzene,

toluene, ethylbenzene, and xylenes (BTEX) using EPA approved method 8020. BTEX levels were below detection limits in two of the three samples analyzed (B-1, 25'-27.5' and B-3, 3'-6'). B-7, 0'-5' penetrated the trench in which the line is located and revealed levels of BTEX totaling 177 parts per million (ppm). It should be noted that the trench line was saturated with JP-4 jet fuel. TPH results revealed levels of 4,047 ppm in the trench line soil, boring B-7, 0'-5'.

Boring B-8, 0'-10' and 20'-25' revealed TPH levels of 623 and 134 ppm, respectively. Boring B-9, 20'-25' revealed TPH levels of 141 ppm. The remainder of the soil samples revealed TPH levels below the Texas Water Commission action levels of 100 ppm.

Groundwater samples were collected from monitor wells MW-1, MW-2, and MW-3 and analyzed for BTEX and TPH. Test results reveal TPH concentrations in MW-1, MW-2 and MW-3 of 174, 93, and 83 ppm, respectively. These concentrations are over the Texas Water Commission action levels for petroleum hydrocarbon impacted groundwater of 1 ppm.

6.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the results of our limited subsurface investigation, it appears that the JP-4 leak has had minimal impact on the native soil at the project site.

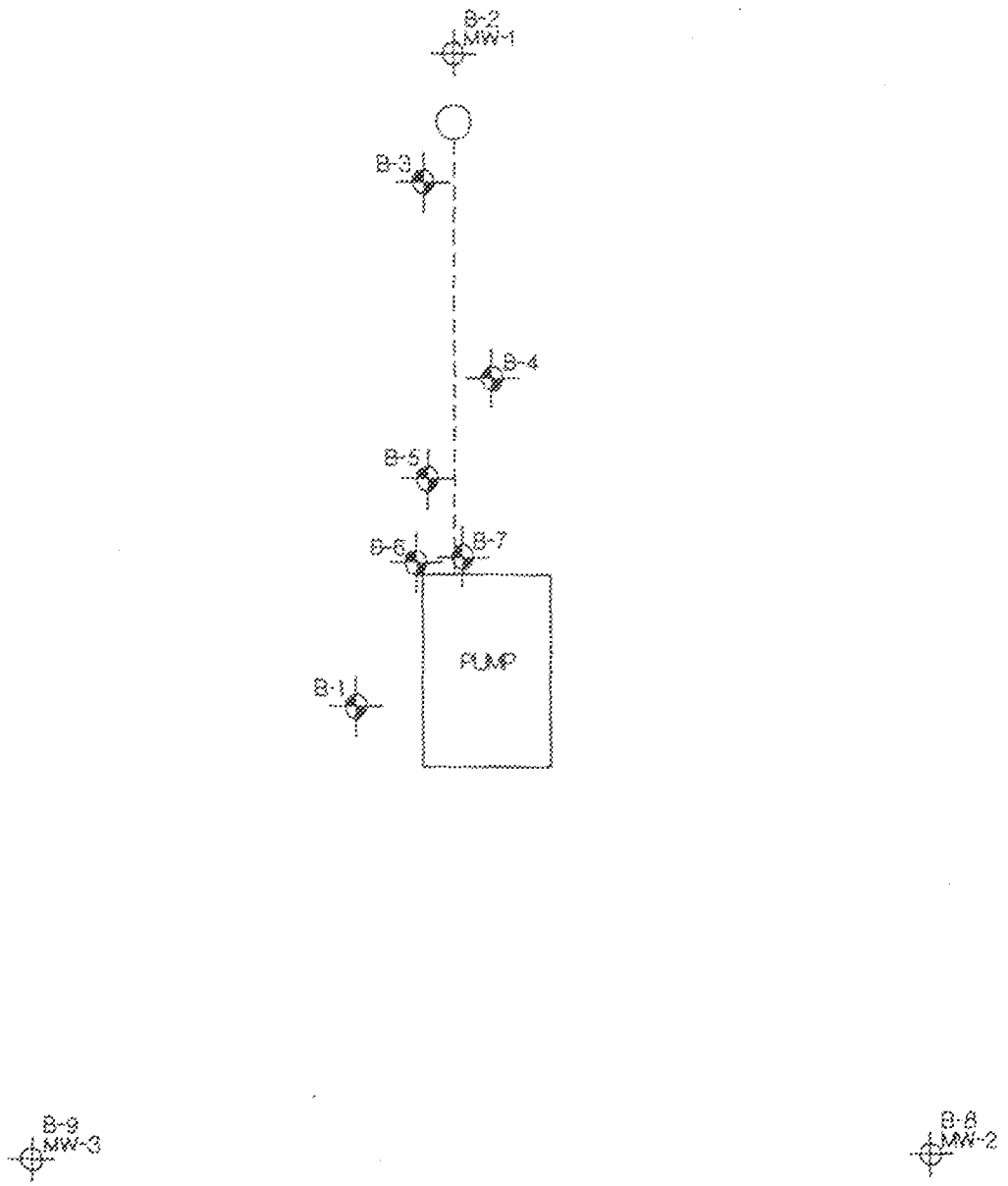
The close proximity of the borings to the trench line clearly indicated the JP-4 jet fuel impact has been confined to the porous sand of the trench line. A clay layer varying in

thickness from thirteen (13) to twenty-two (22) feet lies between the pipeline and the groundwater and represents a confining layer. Laboratory analyses of soil samples from borings B-1 through B-6, including soil samples from the water bearing strata, display TPH values below the Texas Water commission action levels of 100 ppm. Therefore, it appears that the JP-4 release has not migrated vertically into the water bearing strata. Excavation of the thirty (30) foot section of pipe to a depth of three (3) to four (4) feet, disposal of the impacted soil, and repair of the pipeline are recommended in order to remediate the situation.

TPH concentrations in the soil from borings B-8 and B-9 and the groundwater from monitor wells MW-1, MW-2 and MW-3 do not appear to be related to the release encountered from the thirty (30) foot section of pipe at Spot 35. It is recommended that a copy of this report be submitted to the Texas Water Commission and subsequent investigation(s) be performed to further identify the source of the release into the shallow groundwater and define the vertical and horizontal extent of the impact.

Summary of Analytical Test Results
Concentrations are Reported in ppm.

Sample ID	Benzene	Toluene	Ethyl-benzene	Xylenes	Total BTEX	TPH	TCLP
B-1, 3'-9' (3-6, 6-9)						17.7	
B-2, 3'-9' (3-6, 6-9)						12.8	
B-2, 25'-27.5'	<0.62	<0.62	<0.62	<0.62	<0.62	78.1	<0.03
B-3, 3'-6'	<0.62	<0.62	<0.62	<0.62	<0.62	34.0	<0.03
B-3, 6'-9'						20.9	
B-3, 20'-25'						12.4	
B-4, 3'-9' (3-6, 6-9)						11.5	
B-4, 12'-15'						11.4	
B-5, 3'-9' (3-6, 6-9)						11.0	
B-5, 9'-12'						13.3	
B-5, 20'-25'						65.0	
B-6, 0'-5'						39.5	
B-7, 0'-5'	35.7	2.6	37.6	101.1	177	4047.3	<0.03
B-8, 0'-10'						623.0	
B-8, 20'-25'						134.8	
B-9, 0'-10' (0-5, 5-10)						59.5	
B-9, 20'-25'						141.5	
MW-1	0.35	0.02	0.19	0.26	0.82	174.2	
MW-2	0.55	0.01	0.05	0.03	0.64	93.3	
MW-3	0.16	0.01	0.06	0.01	0.25	28.3	



LEGEND

- BORING LOCATIONS
- MONITOR WELL LOCATIONS

SITE PLAN - HYDRANT FUELING SYSTEM SPOT 35

FOR: CARSWELL AFB

SCALE:	PROJECT NO.	DRAWING NO.	DATE:	DRAWN BY:	IB:
1"=15'	DK32	1	10/2/90	FEC	\TNKS

MAXIM ENGINEERS, INC.
2342 FABENS
DALLAS, TEXAS 75229

APPENDIX II

FIELD LOGS OF BORINGS

AND

INSTALLATION OF MONITORING WELLS

MW-4

Hole No. B-10

DRILLING LOG	DIVISION SWD	INSTALLATION Ft. Worth	SHEET 1 OF 1 SHEETS
1. PROJECT SPOT 35, Carswell AFB		10. SIZE AND TYPE OF BIT X	
2. LOCATION (Coordinates or Station)		11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
3. DRILLING AGENCY USCE		12. MANUFACTURER'S DESIGNATION OF DRILL Failing 1500	
4. HOLE NO. (As shown on drawing title and file number) B-10 (MW-4)		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 10	UNDISTURBED —
5. NAME OF DRILLER Brewer		14. TOTAL NUMBER CORE BOXES —	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ___ DEG. FROM VERT.		15. ELEVATION GROUND WATER X X X	
		16. DATE HOLE STARTED 10 July 91 COMPLETED 10 July 91	
7. THICKNESS OF OVERBURDEN —			
8. DEPTH DRILLED INTO ROCK —		18. TOTAL CORE RECOVERY FOR BORING %	
9. TOTAL DEPTH OF HOLE 27.6'		19. SIGNATURE OF INSPECTOR Lucia	

			0 – 0.5 – Asphalt.	1	* Drilling
			0.5 – 1.5 – Gravel, base, course to fine, light gray, some dark gray, very clayey, chemical odor.	2	0 to 8' – 10" auger. 8' to 27.6' – 8¼" auger. Install MW-4.
			1.5' – 3.3' CLAY – fill, medium plast, stiff, slightly moist, dark brown, some gray, sandy, sl. gravelly, sl. odor.	3	Water at 23.3' after completion of drilling and installation of monitoring well.
	10'		3.3 to 4.5 Sand, fill, fine/medium, moist, brown, strong odor.	4	
			4.5 to 7.5 CLAY – low plast, fill, med stiff/stiff, moist, dark gray – sandy, chemical odor.	5	See diagram for MW-4 details.
	20'		7.5 to 17.6 CLAY – high plast, medium stiff/stiff, moist, yellow brown with green/gray, lime nodules.	6	Samples .5 Liter
	25'		17.6 – 19 SAND – fine, dry, yellowish brown, very silty, odor.	7, DA, QC	1. 0.5 – 1.0' 2. 2.5 – 3.0' 3. 3.3 – 4.0' 4. 6.0 – 7.0' 5. 9 – 10 6. 14 – 15
			19 to 25 CLAY – medium plast, medium stiff/stiff, yellowish brn, some gray, silty, odor.	8	7. 19 – 20' DA – 19 – 20 QC. 19 – 20 8. 25 – 26
			25 – 27.6 SAND – fine, wet, gravelly after 27'		Note: MW-4 purged and sampled as prescribed in Table 1.

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE PROJECT HOLE NO.

Hole No. MW-5

DRILLING LOG	DIVISION SWD	INSTALLATION Ft. Worth	SHEET 1 OF 1 SHEETS

1. PROJECT: SPOT 35, Carswell AFB
2. LOCATION (Coordinates or Station)
3. DRILLING AGENCY: USCE
4. HOLE NO. (As shown on drawing title and file number): MW-5
5. NAME OF DRILLER: Brown/Williams
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED ___ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 28.3
8. DEPTH DRILLED INTO ROCK: 0.3
9. TOTAL DEPTH OF HOLE: 28.6
10. SIZE AND TYPE OF BIT: —
11. DATUM FOR ELEVATION SHOWN (TBM or MSL):
12. MANUFACTURER'S DESIGNATION OF DRILL: Failing 1500
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 2; UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: 0
15. ELEVATION GROUND WATER: 18 hr. ck @ 22.8'
16. DATE HOLE: STARTED 25 Sept. 91; COMPLETED 25 Sept. 91
17. ELEVATION TOP OF HOLE: [redacted]
18. TOTAL CORE RECOVERY FOR BORING: %
19. SIGNATURE OF INSPECTOR: R. McVey

ELEVATION (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (Description) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)
			0 to 1.8' – Concrete.			* Drilling 0 to 3' – 10" rockbit, 3' to 5' – 8" auger, Refusal – ~~Limestone~~ 5' to 6' – 10" rockbit, 6' to 28.6' – 8" auger, Set monitor well – see diagram Refusal @ 28.6'.
			1.8' to 5.5' – CLAY Fill, high plast., medium stiff, moist, reddish brown/dark brown, sandy/silty, thin sand seams – ~~limestone~~ Fill 5.1' to 5.5'.			
			5.5' to 19' CLAY 5.5' to 9.0' – low plast., stiff, dry, black, silty.			Soil sample 1. 2' to 3' 2. 21' to 22'
	10		9.0' to 19' – high plast., very stiff/hard, sl. moist, brown to light gray/yellow brown, lime nodules, increasing sand after 16'.			HNU readings 3' – 3.5 6 – 3 8 – 3 10 – Less than 2 12 – as above 14 – ⊖ 16 – ⊖ 18 – L.T. 1.5 20 – ⊖ 22 – ⊖
			19' to 24.5' SAND – Fine, moist, light olive/brown/light gray, silty, scatt. gravels.			
	20		24.5' to 28.3 GRAVEL – coarse to fine, wet, dark olive, very sandy, thin clay seams, cobbles.			
			28.3' to 28.6' LIMESTONE – ? Driller call – no recovery.			
	30					

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT | HOLE NO.

Hole No. MW-6

DRILLING LOG	DIVISION SWD	INSTALLATION Ft. Worth	SHEET OF SHEETS

1. PROJECT: SPOT 35, Carswell AFB
2. LOCATION (Coordinates or Station):
3. HOLE NO. (As shown on drawing title and file number): MW-6
4. NAME OF DRILLER: Brewer
5. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.
6. THICKNESS OF OVERBURDEN: —
7. DEPTH DRILLED INTO ROCK: —
8. TOTAL DEPTH OF HOLE: 28.5'
9. SIZE AND TYPE OF BIT: X
10. DATUM FOR ELEVATION SHOWN (TBM or MSL):
11. MANUFACTURER'S DESIGNATION OF DRILL: Failing 1500
12. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 2; UNDISTURBED 0
13. TOTAL NUMBER CORE BOXES: 0
14. ELEVATION GROUND WATER: 23.6'
15. DATE HOLE: STARTED 23 Sept. 91; COMPLETED 28 Sept 91
16. ELEVATION TOP OF HOLE: [redacted]
17. TOTAL CORE RECOVERY FOR BORING: %
18. SIGNATURE OF INSPECTOR: R. McKey

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			0 to 2.3 – Concrete.			X Drilling
			2.3 to 3' – Gravel/Sand-base – dark brown.		1	0 to 2.3' – 10" rockbit, 2.5' to 28.5' – 8" auger. Refusal @ 28.5'. set MW-6 - see diagram
			3' to 21' CLAY			Soil samples
			3' to 4.5' – Fill? medium to high plast, stiff, dry, very dark brown + dark gray brown, sandy/silty.			1. 2.3' to 3.0' 2. 23' to 24'
	10'		4.5' to 10' – high plast, stiff to very stiff, slightly moist to moist, very dark brown + gray brown, sl. silty, odor?			HNU readings 3' to 7' – 4 to 6 8', 9', 10' – peak @ 4.5, stable @ 4. 15' – 4 20 – peak-7.5 stable-5 21' – 2-3 24 – 2-3.5
			10' to 21' – high plast, hard, sl. moist, yellowish brown, lt gray, brown, and some strong brown, sandy/silty, bedding noted			Note: a constant background reading of 2 to 3.
	20'		21' to 27' SAND – Fine/medium, moist to wet by 25', lt. gray w/ brown, silty + clayey.		2	
			27' to 28.5' GRAVEL – coarse to fine, wet, poor recovery.			
	30'		Refusal @ 28.5'.			

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE | PROJECT | HOLE NO.

Hole No. MW-7

DRILLING LOG	DIVISION SWD	INSTALLATION Ft. Worth	SHEET 1 OF 1 SHEETS

1. PROJECT: SPOT 35, Carswell AFB
2. LOCATION (Coordinates or Station):
3. DRILLING AGENCY: USCE
4. HOLE NO. (As shown on drawing title and file number): MW-7
5. NAME OF DRILLER: William - 10
6. [illegible]
7. THICKNESS OF OVERBURDEN: 29'
8. DEPTH DRILLED INTO ROCK: 1'
9. TOTAL DEPTH OF HOLE:

10. SIZE AND TYPE OF BIT: *
11. DATUM FOR ELEVATION SHOWN (TBM or MSL):
12. MANUFACTURER'S DESIGNATION OF DRILL: Failing 1500
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 2; UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: 0
15. ELEVATION TOP OF HOLE: 1120 Sept. 11 1120 Sept. 7
16. TOTAL CORE RECOVERY FOR BORING: %
17. SIGNATURE OF INSPECTOR: [illegible]

a	b	c	d (Description)	e RECOVERY	f SAMPLE NO.	g REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
			0 to 1.8. Concrete.			* Drilling
			1.8' to 25.8' CLAY		1	0 to 2' — 10" rockbit, 2' to 30' — 8" auger. Set monitor well - see diagram for details.
			1.8 to 5.5' - Fill?, high plasticity, medium stiff, moist, brown to gray, silty.			Soil Samples
			5.5' to 8.0' - low plast., stiff/v. stiff, sl. moist, brown, very sandy/silty.			1. 2' to 3'
	10'		8.0' to 11' - high plast., very stiff, sl. moist, gray-brown + yellow brn, sandy/silty, gravelly.			2. 23.5' to 24.5'
			11' to 15' - high plast., hard, sl. moist, red-yellow, sl. sandy/silty.			HNU readings
			15' to 21' - high plast., hard, few thin soft seams, sl. moist, light olive with light gray, silty/sand.			Every foot 2' to 10', every five feet to 25' - all zero.
	20'		21' to 23.5' - high plast., hard, sl. moist, strong brown + light gray, silty.		2	
			23.5' to 25.8' - medium/low plast., v. moist, brown, very silty/sandy.			
			25.8' to 29 SAND - Fine/medium, wet, red-brown, silty gravelly.			
	30'		29' to 30' SHALE + LIMESTONE Driller call - poor recovery.			

HOLE NO.

Hole No. MW-8

DRILLING LOG	DIVISION SWD	INSTALLATION Ft Worth	SHEET 1 OF 1 SHEETS

1. PROJECT Spot 35, Carswell AFB	10. SIZE AND TYPE OF BIT *
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
3. DRILLING AGENCY USCE	12. MANUFACTURER'S DESIGNATION OF DRILL tailing 1500
4. HOLE NO. (As shown on drawing title and file number) MW-8	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN — DISTURBED 2 — UNDISTURBED 0
5. NAME OF DRILLER Brewer	14. TOTAL NUMBER CORE BOXES 0
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
	16. DATE HOLE — STARTED 11 Sept. 91 — COMPLETED 12 Sept. 91
7. THICKNESS OF OVERBURDEN 28.2'	17. ELEVATION TOP OF HOLE [redacted]
8. DEPTH DRILLED INTO ROCK 2.8	18. TOTAL CORE RECOVERY FOR BORING %
9. TOTAL DEPTH OF HOLE 31.0'	19. SIGNATURE OF INSPECTOR R. McVey

			0 to 1.9 – Concrete.			* Drilling
			1.9 to 2.1 – GRAVEL, base		1	0 to 2' – 10" rockbit, 2' to 31' – 8" auger, set monitor well (see diagram).
			2.1 to 6.0 CLAY – medium plasticity, very stiff, sl. moist, strong brown, sandy/silty			Note: natural sand caved to 15' after drilling. Driller pushed monitor well pipe with hydraulic system and hammered with 300lb hammer
			6.0 to 28.2' SAND			
	10'		6' to 14' – Fine/medium, dense, very moist to wet by 8', strong brn, silty, gravel sized sand stone clasts.			
			14' to 28.2' – Fine, dense, wet, yellow brown w/ some gray + light brown by 26, limy (nodules)		2	Samples - soil 1. 21' – 3.1 2. 18' – 19'
	20'		28.2 to 31' SHALE – weathered white (limy) till 30' (reworked?) then av unweathered dark gray.			water samples on 12 Sept. 91
						Grouted 12 Sept. 91
	30'					

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT HOLE NO.

Hole No. MW-9

DRILLING LOG	DIVISION: Sw D	INSTALLATION: Ft Worth	SHEET 1 OF 1 SHEETS

1. PROJECT: SPOT 35, Carswell AFB	10. SIZE AND TYPE OF BIT: 8" auger
2. LOCATION (Coordinates or Station):	11. DATUM FOR ELEVATION SHOWN (TBM or MSL):
3. DRILLING AGENCY: USCE	12. MANUFACTURER'S DESIGNATION OF DRILL: Failing 1500
4. HOLE NO. (As shown on drawing title and file number): MW-9	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 2; UNDISTURBED 0
5. NAME OF DRILLER: Brewer	14. TOTAL NUMBER CORE BOXES: 0
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER: 21.7'
7. THICKNESS OF OVERBURDEN: 29.1'	16. DATE HOLE: STARTED 14 Sept 91; COMPLETED 14 Sept 91
8. DEPTH DRILLED INTO ROCK: 0.9'	17. ELEVATION TOP OF HOLE: [redacted]
9. TOTAL DEPTH OF HOLE: 30.0'	18. TOTAL CORE RECOVERY FOR BORING: %
	19. SIGNATURE OF INSPECTOR: R. McVey

ELEVATION (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (Description) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)
			0 - 0.2 - Asphalt.			Set monitor well after drilling - see diagram for details.
			0.2 - 0.8 GRAVEL - base		1	
			0.8 to 28.7' CLAY			
			0.8' to 2' - low plasticity, very soft, dry, very dark brown to dk. brn, sandy/silty.			Hole grouted 18 + 19 Sept 91.
	10'		2' to 8' - high plast, hard, dry, vi dk brn to dk. brn, sl. sandy.			Soil Samples 1. 1' to 2' 2. 19' to 20'
			8' to 18.5' - medium/high plast, stiff/very stiff, sl. moist to moist (10-11'), Red yellow, limy/v. limy, sand + gravel nodules.			
			18.5' to 22' - high plast, soft, moist, yellowish brn. to light brown, scatt. lime nodules, chemical odor.		2	Water samples taken 18 Sept. 91 after hole bailed 17 Sept 91.
	20		22 to 28.7 - interbedded with SAND - high plast, very soft, v. moist to wet, light yellow brn.			
			28.7' to 29.1' GRAVEL - coarse to fine, yellow brn, wet.			
	30		29.1 to 30' SHALE - weathered strong brown + yellow brown, blocky structure.			

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE | PROJECT | HOLE NO.

Hole No. MW-10

DRILLING LOG	DIVISION SWD	INSTALLATION Ft Worth	SHEET 1 OF 1 SHEETS

1. PROJECT: SPOT 35, Carswell AFB
2. LOCATION (Coordinates or Station):
3. DRILLING AGENCY: USCE
4. HOLE NO. (As shown on drawing title and file number): MW-10
5. NAME OF DRILLER: Brewer
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 26.9'
8. DEPTH DRILLED INTO ROCK: 1.7
9. TOTAL DEPTH OF HOLE: 28.5'
10. SIZE AND TYPE OF BIT: 8" auger
11. DATUM FOR ELEVATION SHOWN (TBM or MSL):
12. MANUFACTURER'S DESIGNATION OF DRILL: Failing 1500
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 5; UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: 0
15. ELEVATION GROUND WATER: 20.5'
16. DATE HOLE: STARTED 14 Sept 91; COMPLETED 14 Sept 91
17. ELEVATION TOP OF HOLE: [redacted]
18. TOTAL CORE RECOVERY FOR BORING: %
19. SIGNATURE OF INSPECTOR: R. McVey

ELEVATION (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (Description) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)
			0 - 0.2 - asphalt.			Set monitor well - see diagram for details.
			0.2 - 0.7 GRAVEL - base		1	
			0.7 to 9.3'			
			CLAY			
			0.7 - 2.0' - high plasticity, stiff, dry, dark brown, sandy/silty - plasticity changes with sand %.			Soil Samples
						1. 1' to 2'
			2.0 to 9.3 - high plasticity, very stiff, sl. moist, dark red brown to dark gray to gray by 4.5', light gray by 8', sandy-silty, limy after 8'. Some green after 9.			2. 9.3' to 10.4'
	10'				2	3. 21' to 22'
						QA. 21' to 22'
						QC. 21' to 22'
			9.3' to 10.4			
			SAND - fine, dry, light gray with green, very silty + clayey - odor?			Hole backfilled 17 Sept. Sampled 18 Sept.
	20'					
			10.4 to 24.5			
			CLAY		3 QA. QC.	
			10.4 - 13' - high plasticity, very stiff, moist, yellow brown + light gray, silty + limy.			
			13' to 21 - medium flow, stiff to medium stiff, moist, Red yellow to yellow brown, sandy/silty			
	30'		21' to 24.5' - low, soft, very moist, yellow brown w/ some light gray, very sandy/silty, chemical odor.			
			24.5' to 26.8			
			SAND - fine/med, wet, yellow brown, v. silty/clayey, gravelly			
			26.8 - 28.5			
			SHALE - weathered gray to unweathered dark green, limy.			

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT | HOLE NO.

Hole No. MW-11

DRILLING LOG

1. PROJECT: SPOT 35 Carswell AFB	10. SIZE AND TYPE OF BIT: 8" auger
2. LOCATION (Coordinates or Station):	11. DATUM FOR ELEVATION SHOWN (TBM or MSL):
3. DRILLING AGENCY: USAE	12. MANUFACTURER'S DESIGNATION OF DRILL: Failing 1500
4. HOLE NO. (As shown on drawing title and file number): MW-11	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 2; UNDISTURBED 0
5. NAME OF DRILLER: Brewer	14. TOTAL NUMBER CORE BOXES: 0
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER: 22.9'
7. THICKNESS OF OVERBURDEN: 26.5	16. DATE HOLE: STARTED 13 Sept. 91; COMPLETED 13 Sept 91
8. DEPTH DRILLED INTO ROCK: —	17. ELEVATION TOP OF HOLE: —
9. TOTAL DEPTH OF HOLE: 26.5	18. TOTAL CORE RECOVERY FOR BORING: %
	19. SIGNATURE OF INSPECTOR: R McVey

ELEVATION (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (Description) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)
			0 to 0.1 - asphalt. 0.1' to 0.7' - GRAVEL base. 0.7' to 15.8' CLAY 0.7 - 2.5' Fill, high plasticity, stiff, slightly moist, red, sandy lime. 2.5' to 15.8' - high plast., stiff, moist, black, sl. sandy, some dark olive gray which grades to yellow brn by 8', lime nodules.		1	Refusal @ 26.5' Set monitor well after drilling - See diagram. Soil Samples 1. 1' to 2' 2. 22' to 23' Water samples taken 18 Sept. 91 after bailing well on the 17th + 18th. Grouted 17 Sept. 91.
	10'					
	20'		15.8' to 26.5 SAND - Fine/medium, very slightly moist at top to wet by 24', clayey + silty, coarse to fine after 25' w/ gravels.		2	
			Refusal @ 26.5' LIMESTONE?			

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE

PROJECT | HOLE NO.

Hole No. MW-12

SHEET 2

1. PROJECT: SPOT 35, Carswell AFB	10. SIZE AND TYPE OF BIT: 8" auger
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
3. DRILLING AGENCY: USCE	12. MANUFACTURER'S DESIGNATION OF DRILL: Failing 1500
4. HOLE NO. (As shown on drawing title and file number): MW-12	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 2; UNDISTURBED 0
5. NAME OF DRILLER: Greenar	14. TOTAL NUMBER CORE BOXES: 0
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER: water at 24 after 1 hr.
7. THICKNESS OF OVERBURDEN: 23'	16. DATE HOLE: STARTED 13 Sept 91; COMPLETED 13 Sept 91
8. DEPTH DRILLED INTO ROCK: 0.5	17. ELEVATION TOP OF HOLE: [redacted]
9. TOTAL DEPTH OF HOLE: 28.5'	18. TOTAL CORE RECOVERY FOR BORING: %
	19. SIGNATURE OF INSPECTOR: P. McVey

ELEVATION	DEPTH	LEGEND	20. CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	23. REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
			0 to 17.1'			Soil Samples
			CLAY			1. 1'-2'
			0 to 6' - high plasticity, stiff, moist, dark brown to dark gray; some white, sandy/silty.			2. 22'-23'
			6' to 14' - medium plast, v. stiff, moist, dark red brn to red yellow, sl. sandy/silty, lime nodules after 9'.			water samples taken after bailing (13 Sept) on 16 Sept 91.
	10'		14' to 17.1' - low plast, stiff, sl moist, reddish yellow, very silty/sandy.			Set monitor well after drilling - See diagram.
			17.1' to 27.2			Note: natural sand caved to 22'.
			SAND			
	20'		17.1' to 23 - Fine/medium, dry, yellow brn, silty to sl. silty white seams.			
			23' to 27.2 - Coarse to Fine, very moist, brown, silty, gravelly.			
			27.2 to 28'			
			GRAVEL - wet, clayey sandy.			
	30'		Refusal at 28.5'			
			28' to 28.5 - limestone			
			note: Driller call - no clear visual - poor recovery.			

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE PROJECT HOLE NO.

Hole No. MW-13

DRILLING LOG	DIVISION SWD	INSTALLATION Ft. Worth	SHEET 1 OF 1 SHEETS

1. PROJECT: SPOT 3S, Carswell AFB
2. LOCATION (Coordinates or Station): MW-13
3. NAME OF DRILLER: Brewer
4. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.
5. THICKNESS OF OVERBURDEN: 28.7'
6. DEPTH DRILLED INTO ROCK: 0
7. TOTAL DEPTH OF HOLE: 28.7'
10. SIZE AND TYPE OF BIT: 8" auger
11. DATUM FOR ELEVATION SHOWN (TBM or MSL):
12. MANUFACTURER'S DESIGNATION OF DRILL: Failing 1500
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 4; UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: 0
15. DATE HOLE: 12 Sept 91 / 12 Sept 91
17. ELEVATION TOP OF HOLE: [redacted]
18. TOTAL CORE RECOVERY FOR BORING: %
19. SIGNATURE OF INSPECTOR: R. McVey

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			0 to 23.9'			Refusal @ 28.7'
			CLAY		1	LIMESTONE ?
			0 to 4' – high plast, stiff, sl. moist, dark red brown to yellow red, sl. sandy/silty, sl. limy.			Soil Samples 1. 1' to 2' 2. 21' to 22' QA – 21'-22' QC – 21'-22'
	10'		4' to 9' – high plast, very stiff, moist, very dark gray/dk gray.			
			9' to 15.2 – high plast, v stiff/hard, sl. moist, light brown to lt. gray + red brn, sandy/silty, limy to very limy.			Water samples after bailing (13 sept.) taken 16 Sept. 91.
	20		15.2 to 17' – low plast, medium stiff, moist, yellow brn – some light gray, very sandy/silty.		2, QA QC	Set monitor well after drilling – see diagram
			17 to 23.9' – medium/low, med. stiff/soft, moist, yellow brn/gray, very sandy/silty, sl. limy, chemical odor.			
			23.9 to 28.7'			
	30		SAND – Fine to coarse, wet, yellow brn, clayey + silty, gravelly, odor.			
			Refusal @ 28.7'.			

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT HOLE NO.

Hole No. MW-14

DRILLING LOG	DIVISION: SWD	INSTALLATION: Ft Worth	SHEET 1 OF 1 SHEETS

1. PROJECT: SPOT 39, Carswell AFB
2. LOCATION (Coordinates or Station)
3. DRILLING AGENCY: USCE
4. HOLE NO. (As shown on drawing title and file number): MW-14 (B-14)
5. NAME OF DRILLER: Brewer
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 10'
8. DEPTH DRILLED INTO ROCK: 3
9. TOTAL DEPTH OF HOLE: 13'
10. SIZE AND TYPE OF BIT: 8" auger.
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
12. MANUFACTURER'S DESIGNATION OF DRILL: Failing 1500
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 3; UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: 0
15. ELEVATION GROUND WATER: Dry hole
16. DATE HOLE: STARTED 12 Sept 91; COMPLETED 12 Sept 91
17. ELEVATION TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING: %
19. SIGNATURE OF INSPECTOR: R. McVay

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			0 to 8'			Samples
			CLAY		1	1. 1' to 2'
			0 to 2' – high plast, hard, dry, dark red brn, Sl. gravelly + sandy.			2. 6' to 7'
						3. 9' to 10'
			2' to 6' – low plast, hard, dry, dk. red brn silty/sandy, white lime seams.		2	
						Day – No Mon
	10'				3	Well installed
			6' to 8' – low plast, hard, dry, red yellow, some white.			
			8' to 10'			
			GRAVEL – coarse to fine, dry, white, very sandy + clayey.			
			10' to 13'			
			SHALE – weathered, Sl. moist, light yellow brown + gray with strong brown, hard, massive, blocky structure, weathered?			

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE | PROJECT | HOLE NO.

Send original copy by certified mail to: Texas Water Commission, P.O. Box 13087, Austin, Texas 78711

Please use black ink

ATTENTION OWNER: Confidentially
Privilege Notice on Reverse Side

State of Texas WELL REPORT

MW-1

Texas Water Well Drillers Board
P.O. Box 13087
Austin, Texas 78711

1) OWNER Carswell Air Force Base (Name) ADDRESS PO Box 52 Carswell AFB (Street or RFD) Texas (City) 76127- (State) 5926

2) LOCATION OF WELL: County Tarrant 2 miles in West (NE, SW, etc.) direction from Fort Worth (Town)

Driller must complete the legal description below with distance and direction from two intersecting section or survey lines, or he must locate and identify the well on an official Quarter- or Half-Scale Texas County General Highway Map and attach the map to this form.

☐ LEGAL DESCRIPTION:

Section No. ..... Block No. ..... Township ..... Abstract No. ..... Survey Name .....

Distance and direction from two intersecting section or survey lines .....

☑ SEE ATTACHED MAP

3) TYPE OF WORK (Check): ☑ New Well ☐ Deepening ☐ Reconditioning ☐ Plugging

4) PROPOSED USE (Check): ☐ Domestic ☐ Industrial ☑ Monitor ☐ Public Supply ☐ Irrigation ☐ Test Well ☐ Injection ☐ De-Watering

5) DRILLING METHOD (Check): ☐ Drive ☐ Mud Rotary ☐ Air Hammer ☐ Jetted ☑ Auger ☐ Air Rotary ☐ Cable Tool ☐ Other .....

6) WELL LOG:

Date Drilling: Started 9/24 1990 Completed 9/24 1990

DIAMETER OF HOLE		
Dia. (in.)	From (ft.)	To (ft.)
10	Surface	27.5

7) BOREHOLE COMPLETION: ☐ Open Hole ☐ Straight Wall ☐ Underreamed ☐ Gravel Packed ☑ Other SAND PACKED

If Gravel Packed give interval ... from 10 ft. to 27.5 ft.

From (ft.)	To (ft.)	Description and color of formation material
0	2'	Concrete Paving
2'	16'	Brown Sandy Clay

(Use reverse side if necessary)

8) CASING, BLANK PIPE, AND WELL SCREEN DATA:

Dia. (in.)	New or Used	Steel, Plastic, etc. Perf., Slotted, etc. Screen Mfg., if commercial	Setting (ft.) From	Setting (ft.) To	Gage Casing Screen

9) CEMENTING DATA (Rule 287.44(1))

Cemented from 0 ft. to 2 ft. No. of Sacks Used 4

..... ft. to ..... ft. No. of Sacks Used .....

Method used Hand Placed

Cemented by Driller

10) SURFACE COMPLETION

☐ Specified Surface Slab Installed (Rule 287.44(2)(A))

☐ Pitless Adapter Used (Rule 287.44(3)(B))

☑ Approved Alternative Procedure Used (Rule 287.71)

11) WATER LEVEL:

Static level 25 ft. below land surface Date 9/24/90

Artesian flow ..... gpm. Date .....

12) PACKERS: NA Type Depth

13) TYPE PUMP: ☐ Turbine ☐ Jet ☐ Submersible ☐ Cylinder ☐ Other NA

Depth to pump bowls, cylinder, jet, etc. ..... ft.

14) WELL TESTS: NA

Type Test: ☐ Pump ☐ Bailer ☐ Jetted ☐ Estimated

Yield: ..... gpm with ..... ft. drawdown after ..... hrs.

15) WATER QUALITY:

Did the drilling penetrate any strata which contained undesirable constituents?

☐ Yes ☐ No If yes, submit "REPORT OF UNDESIRABLE WATER"

Type of water? Fresh Depth of strata 16'

Was a chemical analysis made? ☑ Yes ☐ No

I hereby certify that this well was drilled by me (or under my supervision) and that each and all of the statements herein are true to the best of my knowledge and belief. I understand that failure to complete items 1 thru 15 will result in the log(s) being returned for completion and resubmittal.

COMPANY NAME Maxim Engineers Inc. (Type or print) WELL DRILLER'S LICENSE NO. 2952-M

ADDRESS 2342 Fabens (Street or RFD) Dallas (City) Texas (State) 75229 (Zip)

(Signed) John Vincent (Licensed Well Driller) (Signed) ..... (Registered Driller Trainee)

Please attach electric log, chemical analysis, and other pertinent information, if available

For TWC use only: Well No. ..... Located on map .....

...d original copy by certified mail to: Texas Water Commission, P.O. Box 13087, Austin, Texas 78711 — Please use black ink

ATTENTION OWNER: *Confidentiality Privilege Notice on Reverse Side*

State of Texas WELL REPORT

MW-2

Texas Water Well Drillers Board
P.O. Box 13087
Austin, Texas 78711

1) OWNER Carswell Air Force Base (Name) ADDRESS Bo Box 550 Carswell AFB (Street or RFD) Texas (City) 76127 (State) (Zip) 5326

2) LOCATION OF WELL: County Tarrant 2 miles in West (NE, SW, etc.) direction from Fort Worth (Town)

Driller must complete the legal description below with distance and direction from two intersecting section or survey lines, or he must locate and identify the well on an official Quarter- or Half-Scale Texas County General Highway Map and attach the map to this form.

☐ LEGAL DESCRIPTION:
Section No. _____ Block No. _____ Township _____ Abstract No. _____ Survey Name _____
Distance and direction from two intersecting section or survey lines _____

☑ SEE ATTACHED MAP

3) TYPE OF WORK (Check): ☑ New Well ☐ Deepening ☐ Reconditioning ☐ Plugging

4) PROPOSED USE (Check): ☐ Domestic ☐ Industrial ☑ Monitor ☐ Public Supply ☐ Irrigation ☐ Test Well ☐ Injection ☐ De-Watering

5) DRILLING METHOD (Check): ☐ Driven ☐ Mud Rotary ☐ Air Hammer ☐ Jetted ☑ Bored ☐ Air Rotary ☐ Cable Tool ☐ Other _____

6) WELL LOG:
Date Drilling: Started 9/24 1980 Completed 9/24 1980

DIAMETER OF HOLE

Dia. (in.)	From (ft.)	To (ft.)
[illegible]	[illegible]	[illegible]

7) BOREHOLE COMPLETION: ☐ Open Hole ☐ Straight Wall ☐ Underreamed ☐ Gravel Packed ☐ Other [illegible]
If Gravel Packed give interval . . . from 7 ft. to 25 ft.

From (ft.)	To (ft.)	Description and color of formation material
0'	5'	Brown + Gray CLAY
5'	15'	Brown Silty CLAY
15'	25'	Red + Brown SAND

(Use reverse side if necessary)

8) CASING, BLANK PIPE, AND WELL SCREEN DATA:

Dia. (in.)	New or Used	Steel, Plastic, etc. Perf., Slotted, etc. Screen Mfg., if commercial	Setting (ft.) From	Setting (ft.) To	Gage Casing Screen
2	N	Sch. 40 PVC	0	7	Blank
2	N	Sch. 40 PVC	7	25	Screen

9) CEMENTING DATA [Rule 287.44(1)]
Cemented from 0 ft. to 5 ft. No. of Sacks Used 2.5
_____ ft. to _____ ft. No. of Sacks Used _____
Method used Hand Placed
Cemented by Driller

10) SURFACE COMPLETION
☐ Specified Surface Slab Installed [Rule 287.44(2)(A)]
☐ Pitless Adapter Used [Rule 287.44(3)(B)]
☑ Approved Alternative Procedure Used [Rule 287.71]

11) WATER LEVEL:
Static level 20' ft. below land surface Date 9/24/80
Artesian flow _____ gpm. Date _____

12) PACKERS: NA Type Depth

13) TYPE PUMP: ☐ Turbine ☐ Jet ☐ Submersible ☐ Cylinder ☐ Other NA
Depth to pump bowls, cylinder, jet, etc., _____ ft.

14) WELL TESTS: NA
Type Test: ☐ Pump ☐ Bailer ☐ Jetted ☐ Estimated
Yield: _____ gpm with _____ ft. drawdown after _____ hrs.

15) WATER QUALITY:
Did the drilling penetrate any strata which contained undesirable constituents?
☑ Yes ☐ No If yes, submit "REPORT OF UNDESIRABLE WATER"
Type of water? Fresh Depth of strata 15
Was a chemical analysis made? ☑ Yes ☐ No

I hereby certify that this well was drilled by me (or under my supervision) and that each and all of the statements herein are true to the best of my knowledge and belief. I understand that failure to complete items 1 thru 15 will result in the log(s) being returned for completion and resubmittal.

COMPANY NAME Maxim Engineers, Inc (Type or print) WELL DRILLER'S LICENSE NO. 2952-M

ADDRESS 2312 [illegible] Dallas Texas 75229
(Street or RFD) (State) (Zip)

(Signed) [illegible] (Licensed Well Driller) (Signed) _____ (Registered Driller Trainee)

Please attach electric log, chemical analysis, and other pertinent information, if available

[illegible]

...-012 (Rev. 09/21/88)

TEXAS WATER COMMISSION COPY

Send original copy by certified mail to: Texas Water Commission, P.O. Box 13087, Austin, Texas 78711

Please use black ink.

ATTENTION OWNER: *Confidentially Privilege Notice on Reverse Side*

State of Texas WELL REPORT

MW-3

Texas Water Well Drillers Board
P.O. Box 13087
Austin, Texas 78711

1) OWNER Carswell Air Force Base (Name) ADDRESS PO Box 940 Carswell AFB (Street or RFD) Texas 76127 (City) (State) (Zip) 0320

2) LOCATION OF WELL: County Tarrant 2 miles in West (NE, SW, etc.) direction from Fort Worth (Town)

Driller must complete the legal description below with distance and direction from two intersecting section or survey lines, or he must locate and identify the well on an official Quarter- or Half-Scale Texas County General Highway Map and attach the map to this form.

☐ LEGAL DESCRIPTION:

Section No. _____ Block No. _____ Township _____ Abstract No. _____ Survey Name _____

Distance and direction from two intersecting section or survey lines _____

☑ SEE ATTACHED MAP

3) TYPE OF WORK (Check): ☑ New Well ☐ Deepening ☐ Reconditioning ☐ Plugging

4) PROPOSED USE (Check): ☐ Domestic ☐ Industrial ☑ Monitor ☐ Public Supply ☐ Irrigation ☐ Test Well ☐ Injection ☐ De-Watering

5) DRILLING METHOD (Check): ☐ Drive ☐ Mud Rotary ☐ Air Hammer ☐ Jetted ☑ Auger ☐ Air Rotary ☐ Cable Tool ☐ Other _____

6) WELL LOG:

Date Drilling: Started 9/24 1990 Completed 9/24 1990

DIAMETER OF HOLE		
Dia. (in.)	From (ft.)	To (ft.)
10	Surface	25

7) BOREHOLE COMPLETION: ☐ Open Hole ☐ Straight Wall ☐ Underreamed ☐ Gravel Packed ☑ Other Sand Packed

If Gravel Packed give interval . . . from 7 ft. to 25 ft.

From (ft.)	To (ft.)	Description and color of formation material
0'	9'	Brown + Gray Silty CLAY
9'	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

(Use reverse side if necessary)

8) CASING, BLANK PIPE, AND WELL SCREEN DATA:

Dia.	New	Steel, Plastic, etc.	Setting (ft.) From	Setting (ft.) To	Gage
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

9) CEMENTING DATA [Rule 287.44(1)]

Cemented from 0 ft. to 25 ft. No. of Sacks Used 2.5

_____ ft. to _____ ft. No. of Sacks Used _____

Method used Hand Packed

Cemented by Driller

10) SURFACE COMPLETION

☐ Specified Surface Slab Installed [Rule 287.44(2)(A)]

☐ Pitless Adapter Used [Rule 287.44(3)(B)]

☑ Approved Alternative Procedure Used [Rule 287.71]

11) WATER LEVEL:

Static level 22 ft. below land surface Date 9/24/90

Artesian flow _____ gpm. Date _____

12) PACKERS: NA Type Depth

13) TYPE PUMP:

☐ Turbine ☐ Jet ☐ Submersible ☐ Cylinder

☐ Other _____

Depth to pump bowls, cylinder, jet, etc., _____ ft.

14) WELL TESTS:

Type Test: ☐ Pump ☐ Bailer ☐ Jetted ☐ Estimated

Yield: _____ gpm with _____ ft. drawdown after _____ hrs.

15) WATER QUALITY:

Did the drilling penetrate any strata which contained undesirable constituents?

☐ Yes ☐ No If yes, submit "REPORT OF UNDESIRABLE WATER"

Type of water? _____ Depth of strata _____

Was a chemical analysis made? ☐ Yes ☐ No

I hereby certify that this well was drilled by me (or under my supervision) and that each and all of the statements herein are true to the best of my knowledge and belief. I understand that failure to complete items 1 thru 15 will result in the log(s) being returned for completion and resubmittal.

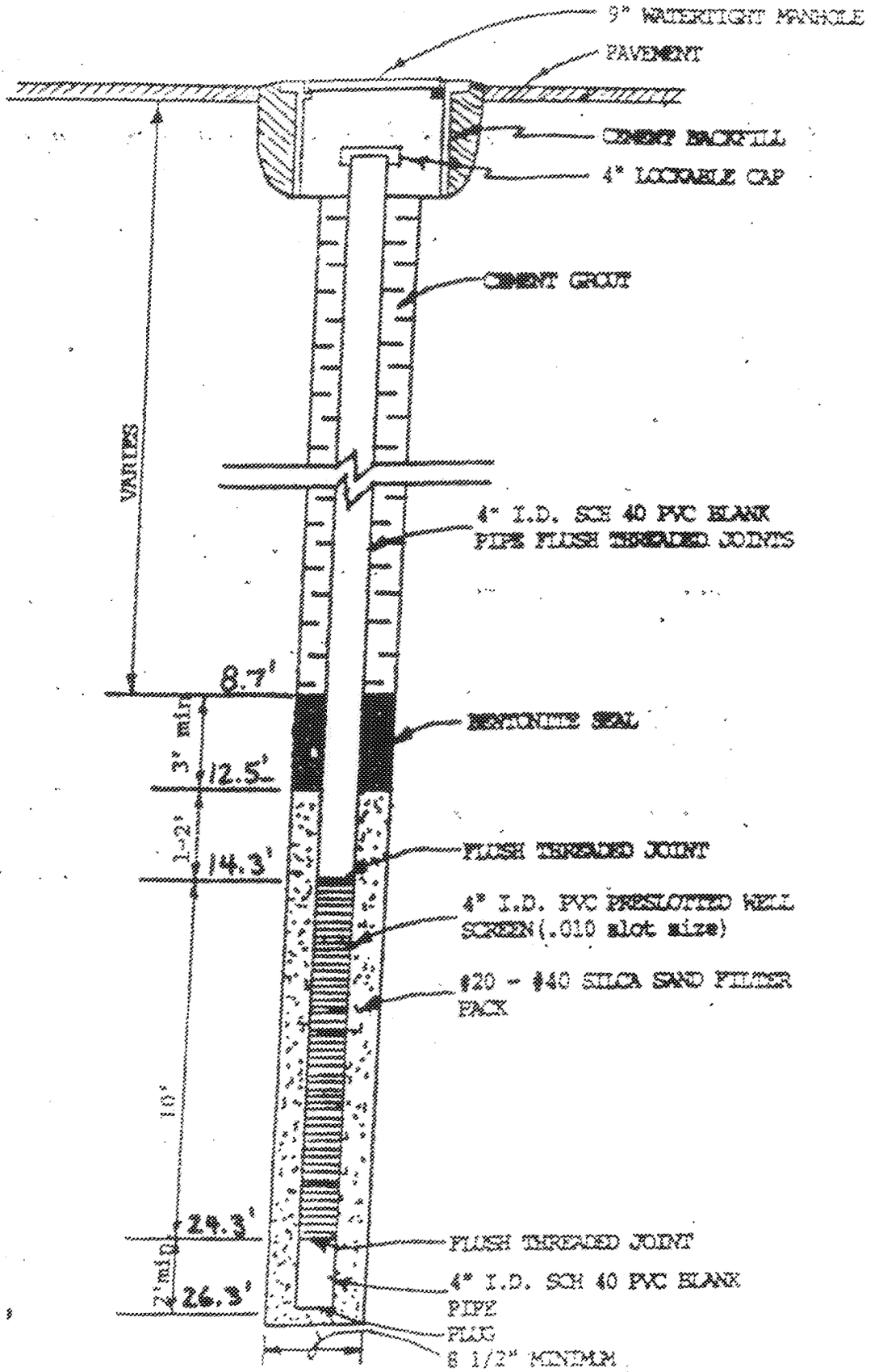
COMPANY NAME Maxim Engineers Inc (Type or print) WELL DRILLER'S LICENSE NO. 2952-M

ADDRESS 2342 Fabens (Street or RFD) Dallas (City) Texas (State) 75229 (Zip)

(Signed) John R. Harvey (Licensed Well Driller) (Signed) _____ (Registered Driller Trainee)

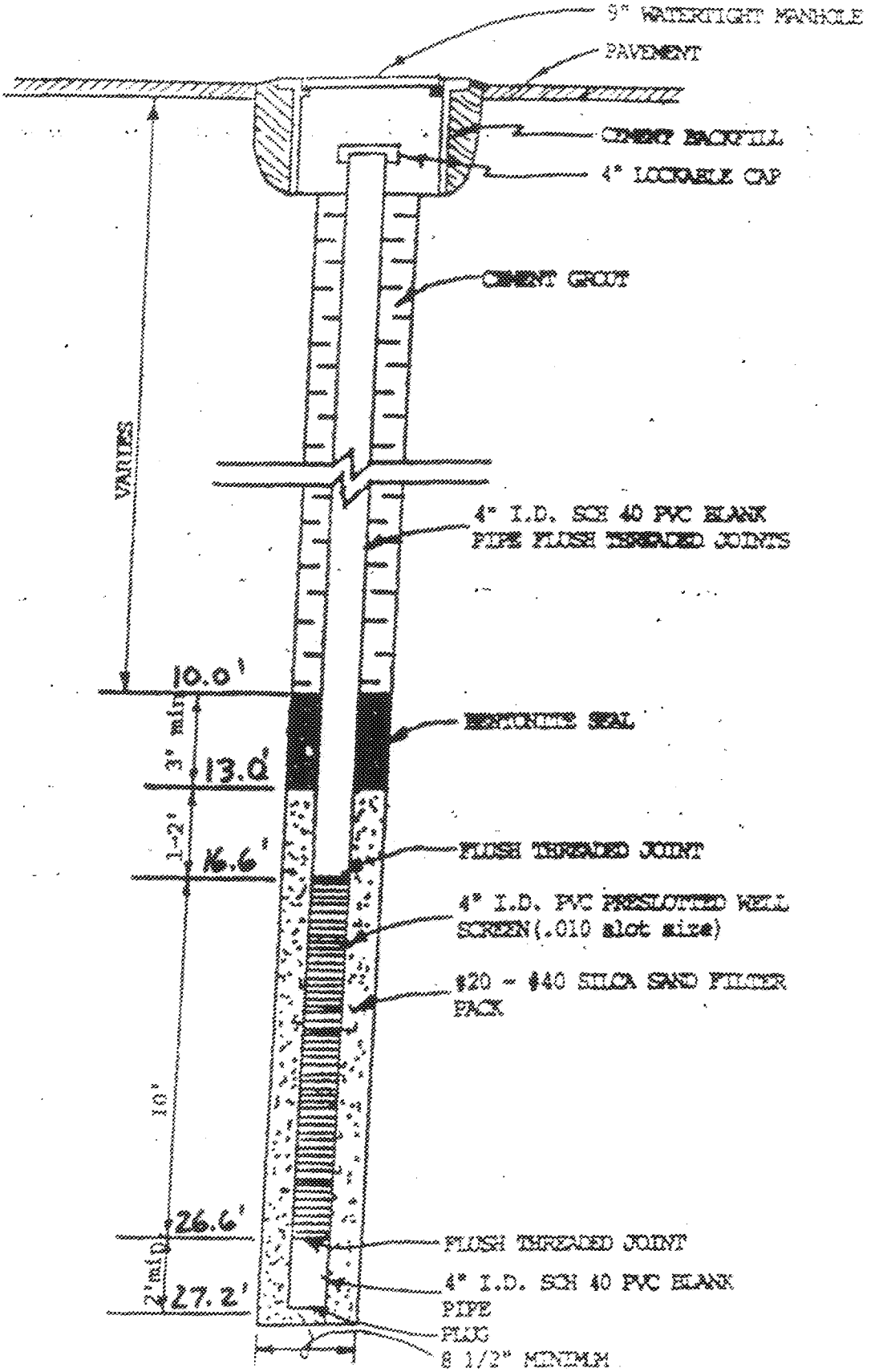
Please attach electric log, chemical analysis, and other pertinent information, if available.

For TWC use only: Well No. _____ Located on map _____



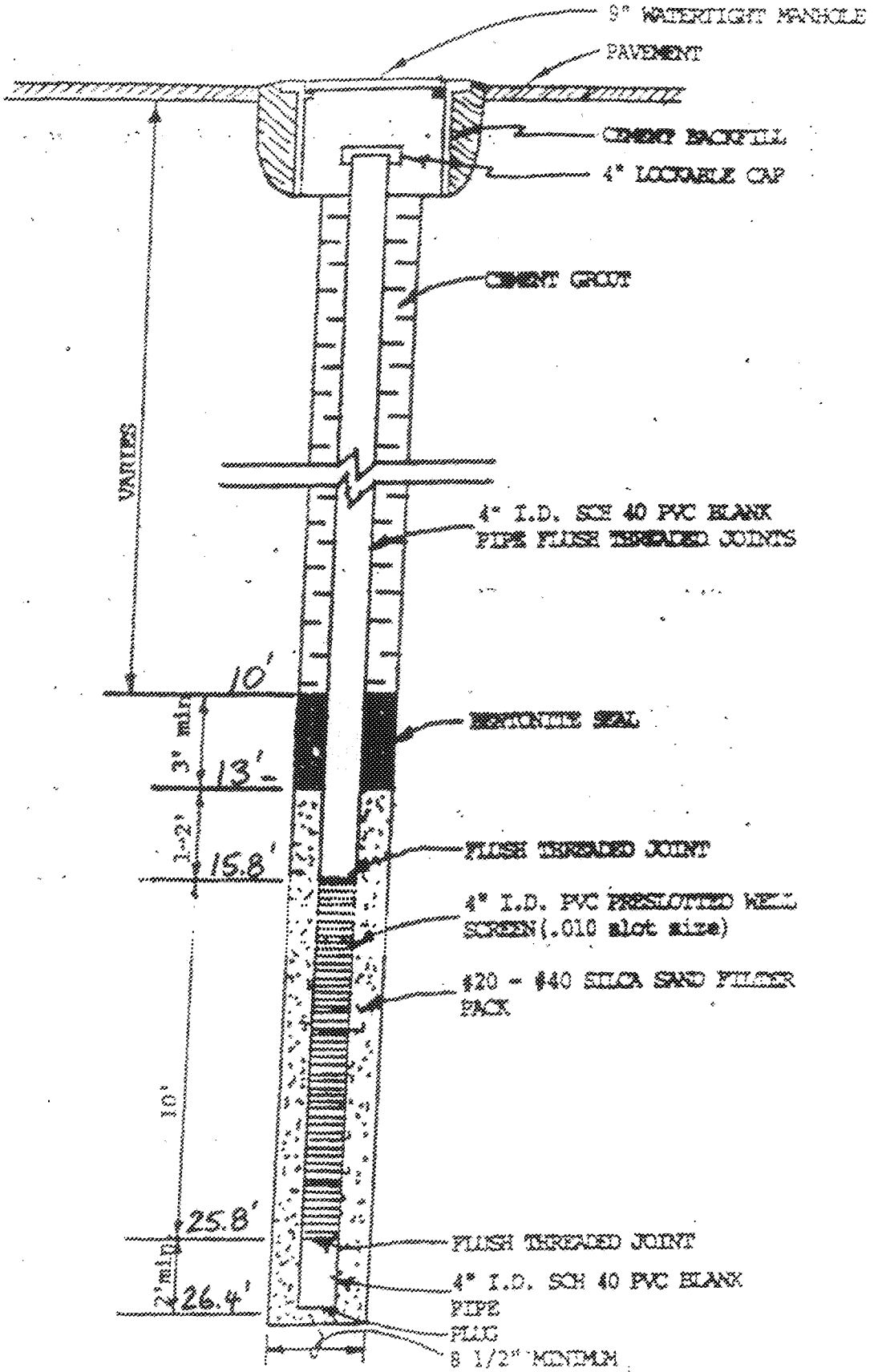
MONITORING WELL CONSTRUCTION DETAIL

MW- 4 10 JUL 91



MONITORING WELL CONSTRUCTION DETAIL

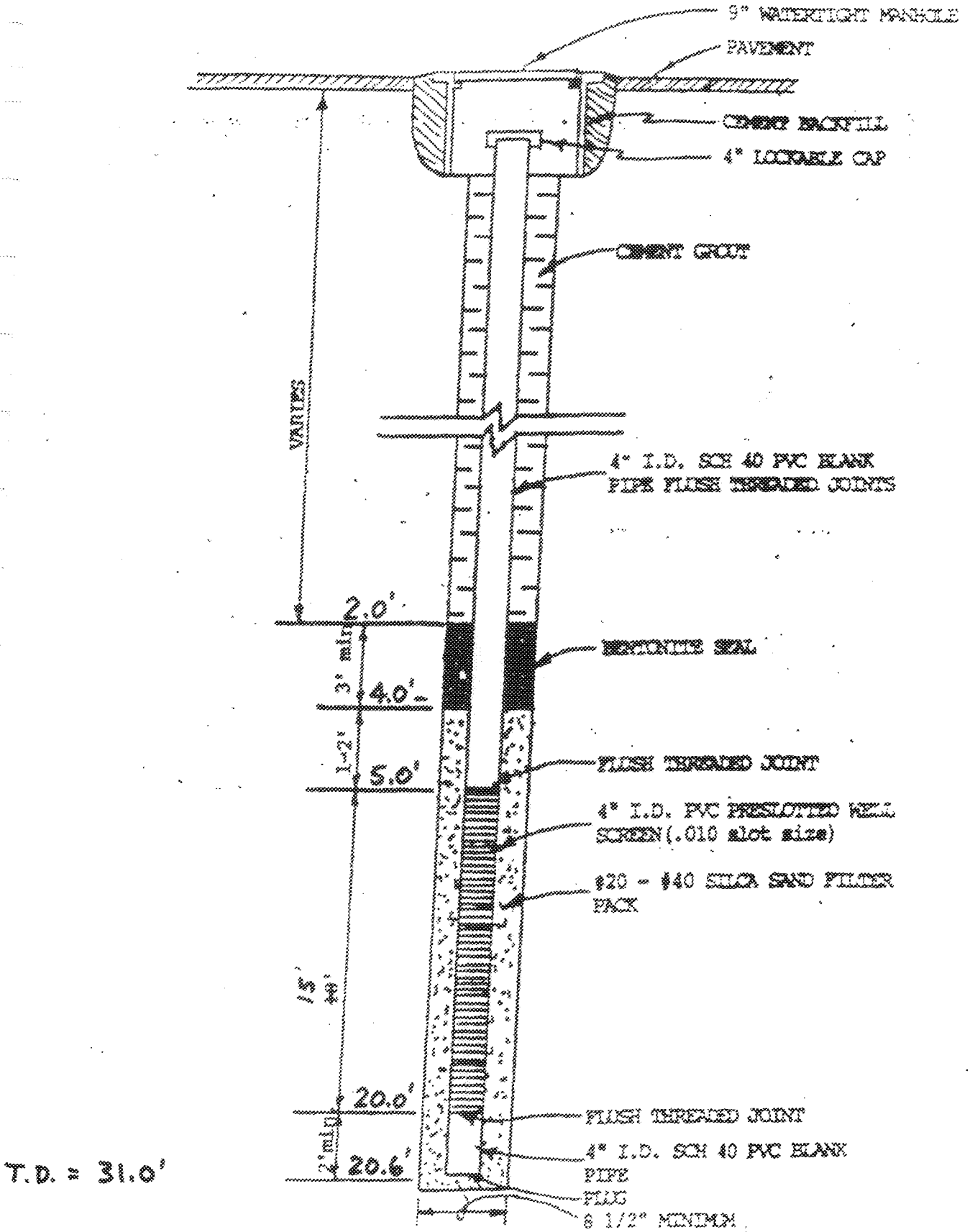
MW- 5 25 SEP 91



T.D. = 28.6'

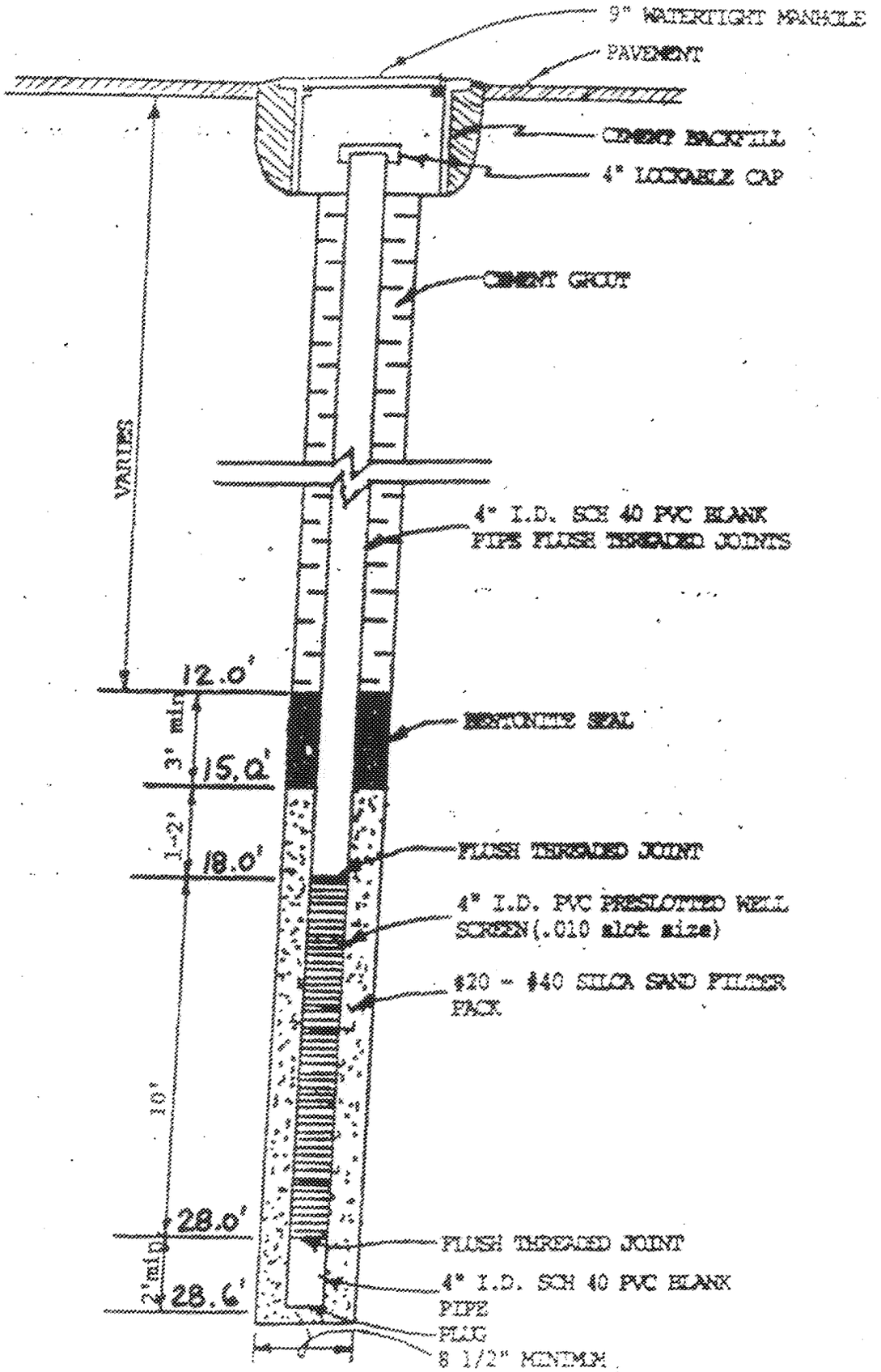
MONITORING WELL CONSTRUCTION DETAIL

MW- 6 23 Sep 91



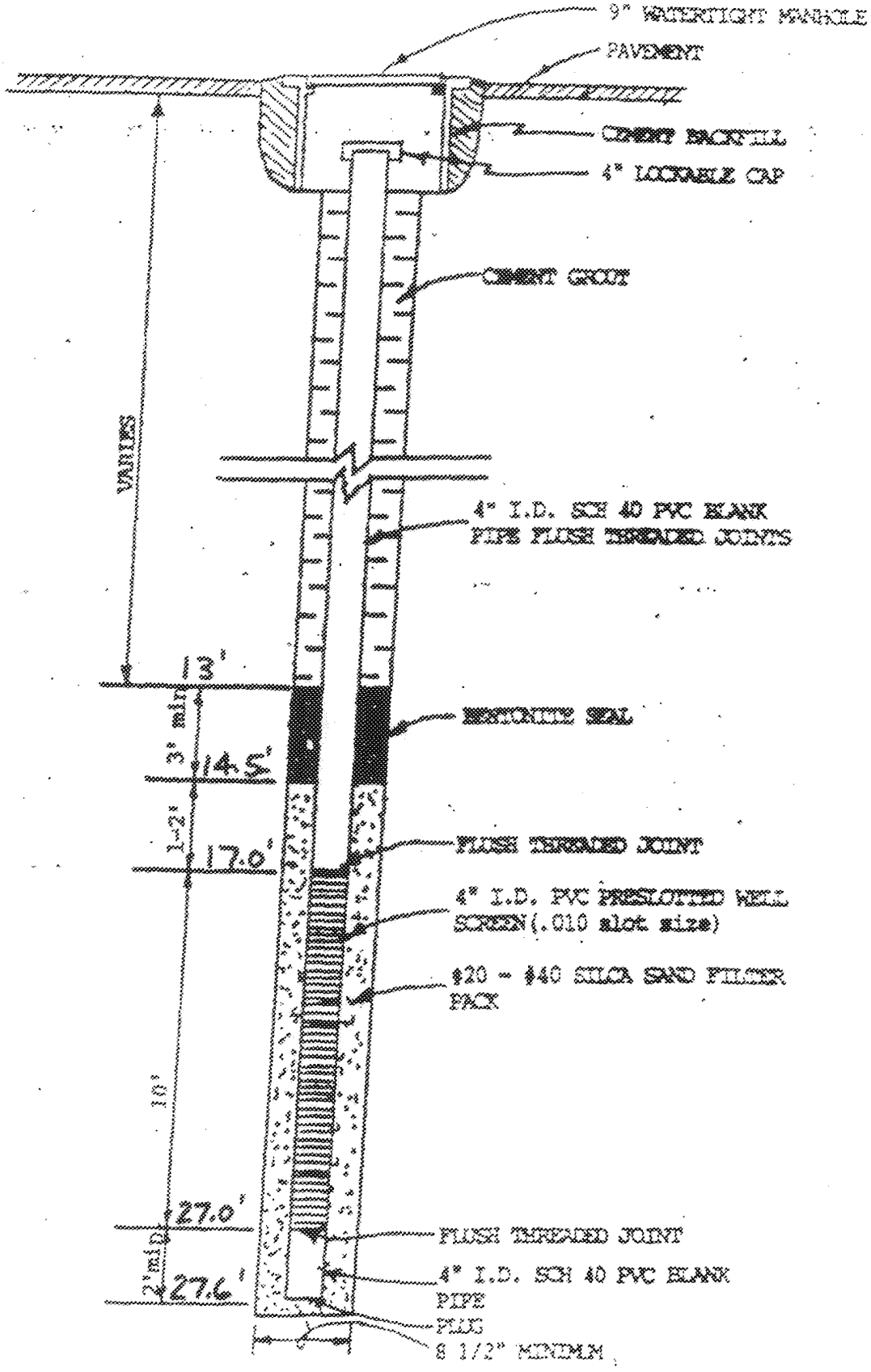
MONITORING WELL CONSTRUCTION DETAIL

MW- 8 12 SEP 91



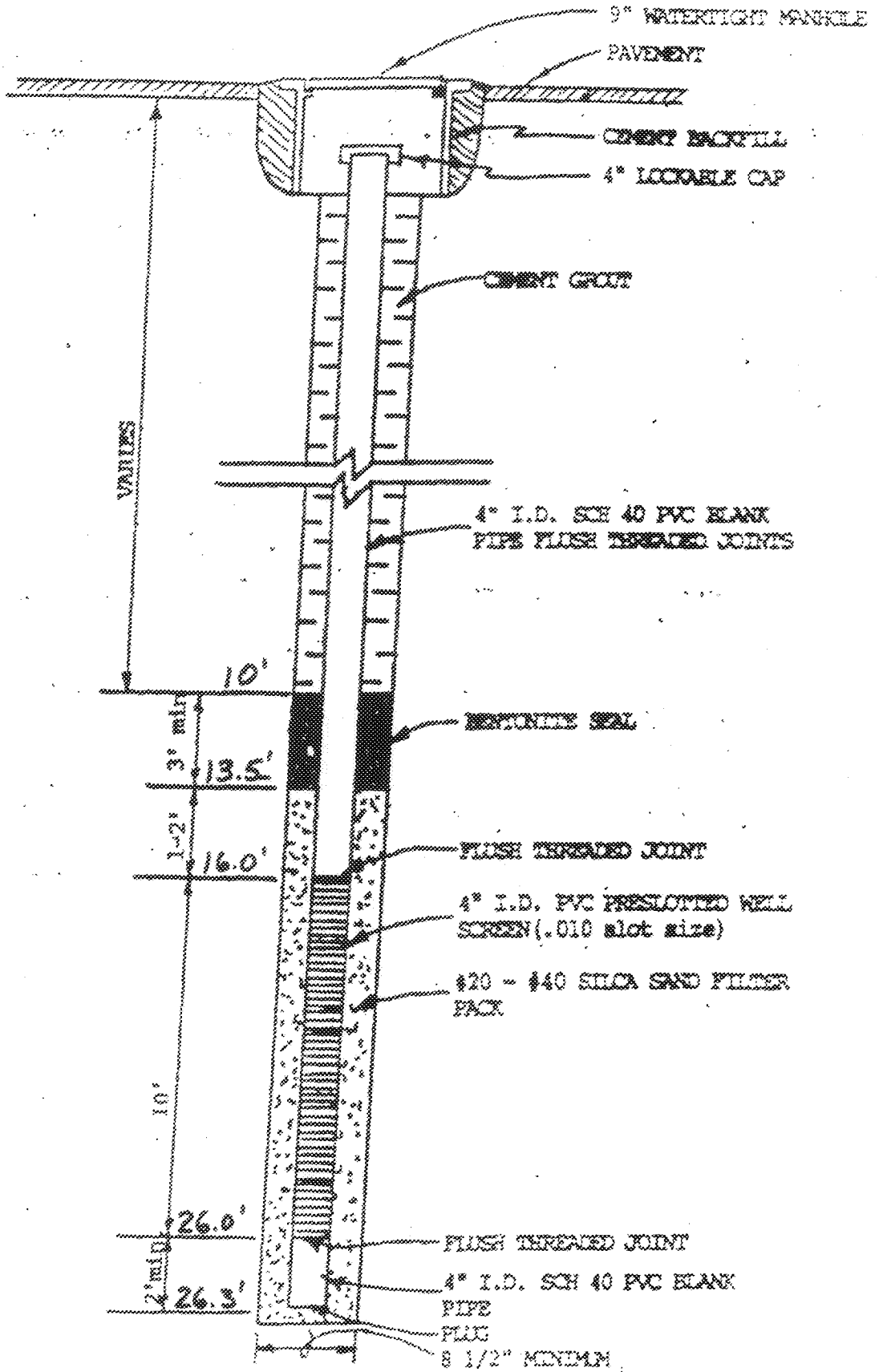
MONITORING WELL CONSTRUCTION DETAIL

MW- 9 14 SEP 91



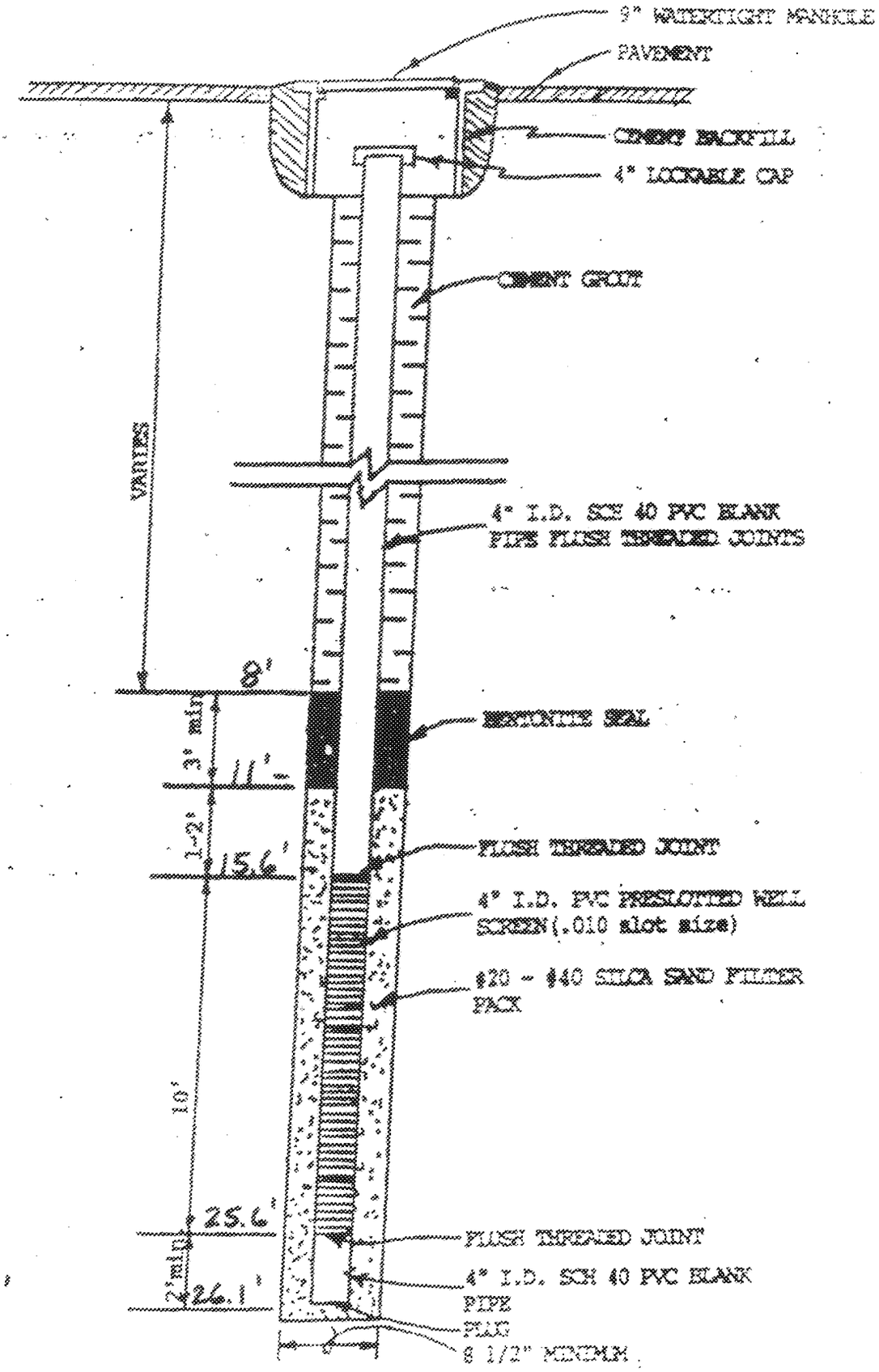
MONITORING WELL CONSTRUCTION DETAIL

MW- 10 14 SEP 91



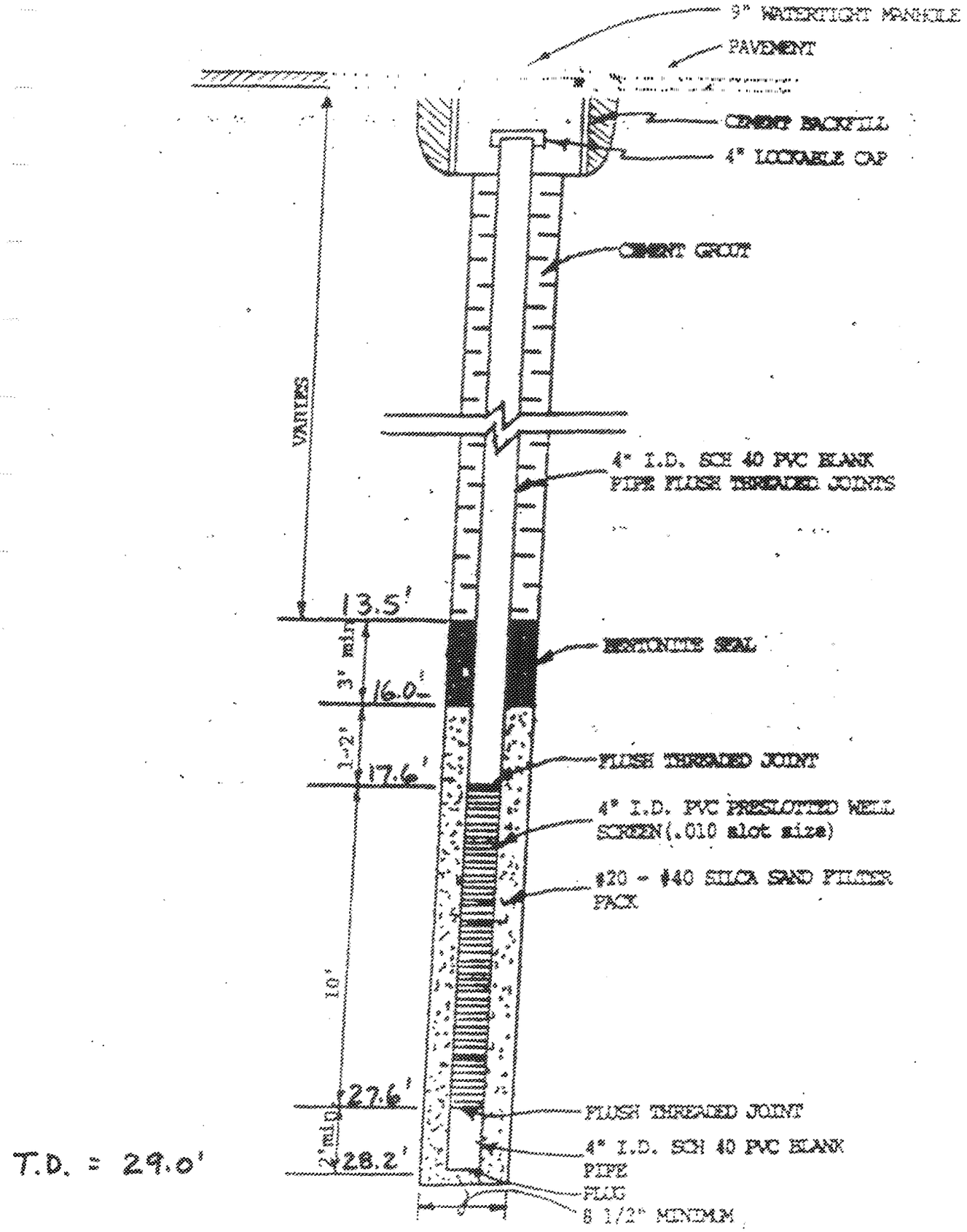
MONITORING WELL CONSTRUCTION DETAIL

MW- 11 13 SEP 91



MONITORING WELL CONSTRUCTION DETAIL

MW- 12 13 SEP 91



MONITORING WELL CONSTRUCTION DETAIL

MW- 13 12 SEP 91

Log of Boring

Number: B-2

Location: SEE SITE PLAN

Project: Spot 35 Carswell AFB, Fort Worth, Texas

Auger Type: Auger

Casing Elevation:

Drilled By: J. Hanna

Logged By: W. Crabb

Depth Feet	Samples	Symbol	STRATUM DESCRIPTION	Well Construction Details	Photo-Ionization Reading	Benzene (ppm)	Toluene (ppm)	Xylene (ppm)	Ethyl Benzene (ppm)	Total BTXE (ppm)	T.P.H. (ppm)
			CONCRETE paving								
			Tan road base with GRAVEL								
10											
15											
			Brown clayey SAND, fine grain								
20											
25											

Completion Depth: 27.5'

Date: 9/24/90

Water Observations: Water Encountered at 25'

Maxim Engineers

Log of Boring

Number B-2

Spot 35 [illegible]

Auger

J. Hanna | W. Crabb

Depth	Samples	Symbol	STRATUM DESCRIPTION	Well Construction Details	Photo-ionization Reading	Benzene (ppm)	Toluene (ppm)	Xylene (ppm)	Total Benzene (ppm)	Total BTXE (ppm)	T.H. (ppm)
			Thin gravel lense, black streaks, good odor								
			inches								

Completion Depth 27.5'

Date Water [illegible] 9/24/90

Water encountered at 25'

Maxim Engineers

Log of Boring

Number: B-3

Location: SEE SITE PLAN

Project: Spot 35 Carswell AFB, Fort Worth, Texas

Auger Type: Auger

Casing Elevation:

Drilled By: J. Hanna

Logged By: W. Crabb

Depth Feet	Samples	Symbol	STRATUM DESCRIPTION	Well Construction Details	Photo-ionization Reading	Benzene (ppm)	Toluene (ppm)	Xylene (ppm)	Ethyl Benzene (ppm)	Total BTXE (ppm)	T.P.H. (ppm)
			CONCRETE paving								
5			Dark brown to gray CLAY, thin sand lenses with slight odor (green and black)								
			9.0								
10			Brown sandy CLAY with calcareous nodules								
15			Some severely weathered limestone layers								
			Very fine sandy clay with few calcareous nodules								
20											
			24.0								
25			Brown SAND								

Completion Depth: 25.0'

Date: 9/25/90

Water Observations: Water Encountered at 25'

Maxim Engineers

Log of Boring

Number: B-3

Location: SEE SITE PLAN

Project: Spot 35 Carswell AFB, Fort Worth, Texas

Auger Type: Auger

Casing Elevation:

Drilled By: J. Hanna

Logged By: W. Crabb

Depth Feet	Samples	Symbol	STRATUM DESCRIPTION	Well Construction Details	Photo-Ionization Reading	Benzene (ppm)	Toluene (ppm)	Xylene (ppm)	Ethyl Benzene (ppm)	Total BTXE (ppm)	T.P.H. (ppm)
			25.0 Boring terminated at 25 feet								

Completion Depth: 25.0'

Date: 9/25/90

Water Observations: Water Encountered at 25'

Maxim Engineers

TABLE 1
SURFACE AND [illegible]
MONITORING [illegible] 13

LOCATION	SURFACE ELEV	GROUND-WATER ELEVATION					
		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	AVERAGE 1992
MW-1	[illegible]	[illegible]	591.14	[illegible]	590.[illegible]	594.24	592.58
MW-2	[illegible]	[illegible]	592.[illegible]	591.35	[illegible]	[illegible]	594.07
MW-3	612.91	[illegible]	591.[illegible]	592.[illegible]	594.[illegible]	594.65	594.37
MW-4	[illegible]	*	[illegible]	592.[illegible]	591.[illegible]	[illegible]	592.98
MW-5	[illegible]	**	**	[illegible]	DRY	DRY	DRY
MW-6	[illegible]	**	**	[illegible]	[illegible]	591.26	591.28
MW-7	[illegible]	**	**	[illegible]	[illegible]	593.76	593.69
MW-8	616.45	**	**	[illegible]	[illegible]	610.91	610.83
MW-9	[illegible]	**	**	[illegible]	[illegible]	597.13	596.20
MW-10	[illegible]	**	**	[illegible]	[illegible]	594.21	594.03
MW-11	612.20	**	**	589.69	589.89	590.27	589.94
MW-12	612.21	**	**	589.[illegible]	590.64	589.51	589.97
MW-13	615.51	**	**	[illegible]	593.8[illegible]	594.16	594.01

* Monitoring Well MW-4 installed July 1991
** Monitoring Wells MW-5 through MW-13 installed September 1991

7 Dec 92

LOCATION	WATER	PRODUCT
MW-4	7'-4 1/4"	None
MW-5	Dry	None
MW-6	4'-6 7/8"	None
MW-7	7'-5 3/8"	None
MW-8	14'-10"	None
MW-9	9'-8"	None
MW-10	7'-10"	None
MW-11	4'-0 1/4"	None
MW-12	3'-4 1/2"	None
MW-13 stuck bolt		

Log of Boring

Number: B-4

Location: SEE SITE PLAN

Project: Spot 35 Carswell AFB, Fort Worth, Texas

Auger Type: Auger

Casing Elevation:

Drilled By: J. Hanna

Logged By: W. Crabb

Depth Feet	Samples	Symbol	STRATUM DESCRIPTION	Well Construction Details	Photo-Ionization Reading	Benzene (ppm)	Toluene (ppm)	Xylene (ppm)	Ethyl Benzene (ppm)	Total BTXE (ppm)	T.P.H. (ppm)
			CONCRETE paving								
15			Light brown silty sandy CLAY with severely weathered limestone seams and fragments (15.0)								

Boring terminated at 15 feet

Completion Depth: 15.0'

Date: 9/25/90

Water Observations: No Water Encountered

Maxim Engineers

Log of Boring

Number: B-5

Location: SEE SITE PLAN

Project: Spot 35 Carswell AFB, Fort Worth, Texas

Auger Type: Auger

Casing Elevation:

Drilled By: J. Hanna

Logged By: W. Crabb

Depth Feet	Samples	Symbol	STRATUM DESCRIPTION	Well Construction Details	Photo-Ionization Reading	Benzene (ppm)	Toluene (ppm)	Xylene (ppm)	Ethyl Benzene (ppm)	Total BTXE (ppm)	T.P.H. (ppm)
			CONCRETE pavement								
5			Dark brown to gray CLAY								
			9.0								
10											
15			Brown CLAY with calcareous nodules								
20											
			24.0 Brown fine SAND with clayey seams								
25											

Completion Depth: 25.0'

Date: 9/25/90

Water Observations: Water Encountered at 25'

Maxim Engineers

Log of Boring B-5 SEE SITE PLAN

Project

Spot 35 Carswell AFB, Fort Worth, Texas

Auger Type	Casing Elevation
Auger	
Drilled By	**Logged By**
J. Hanna	W. Crabb

Depth	Samples	Symbol	STRATUM DESCRIPTION	Well Construction Details	Photo-Ionization Reading	Benzene (ppm)	Toluene (ppm)	Xylene (ppm)	Ethyl Benzene (ppm)	Total BTXE (ppm)	T.P.H. (ppm)
			25.0 Boring terminated at 25 feet								

Completion Depth 25.0' Date 9/25/90 Water Observations Water Encountered at 25'

Maxim Engineers

Log of Boring

Number: B-6

Location: SEE SITE PLAN

Project: Spot 35 Carswell AFB, Fort Worth, Texas

Auger Type:

Casing Elevation:

Drilled By: J. Hanna

Logged By: W. Crabb

Depth Feet	Samples	Symbol	STRATUM DESCRIPTION	Well Construction Details	Photo-Ionization Reading	Benzene (ppm)	Toluene (ppm)	Xylene (ppm)	Ethyl Benzene (ppm)	Total BTXE (ppm)	T.P.H. (ppm)
			0.3 ASPHALT base								
			Base material								
			1.5								
5			Dark brown to gray CLAY and sand with calcareous nodules								
10			10.0 Boring terminated at 10 feet								

Completion Depth: 10.0'

Date: 9/25/90

Water Observations: No Water Encountered

Maxim Engineers

Log of Boring B-7

SEE SITE PLAN

Project: Spot 35 Carswell AFB, Fort Worth, Texas

Auger Type:

Casing Elevation:

Drilled By: J. Hanna

Logged By: W. Crabb

Depth feet	Sample Symbol	STRATUM DESCRIPTION	Well Construction Details	Photo-ionization Reading	Benzene (ppm)	Toluene (ppm)	Xylene (ppm)	Ethyl Benzene (ppm)	Total BTXE (ppm)	T.P.H. (ppm)
		Base material								
		3.8 Gray medium SAND, saturated with JP4, free product								
5		5.0 Dark brown to brown CLAY with calcareous nodules								
10		10.0 Boring terminated at 10 feet								

Completion Depth: 10.0'

Date: 9/25/90

Water Observations: No Water Encountered

Maxim Engineers

Log of Boring | B-8/MW2 | SEE SITE PLAN

Project

Spot 35 Carswell AFB, Fort Worth, Texas

Auger Type	Casing Elevation
Drilled By: J. Hanna	Logged By: W. Crabb

Depth Feet	Samples	Symbol	STRATUM DESCRIPTION	Well Construction Details	Photo-Ionization Reading	Benzene (ppm)	Toluene (ppm)	Xylene (ppm)	Ethyl Benzene (ppm)	Total BTXE (ppm)	T.P.H. (ppm)
			0.5 ASPHALT surface								
			Dark brown to gray CLAY with calcareous nodules								
5			5.0								
10			Brown silty CLAY with calcareous nodules								
			Severely weathered limestone seams								
15			15.0 Red brown fine SAND								
			Interbedded clay lenses								
			Slight odor at 20 feet								
20			20.0 Brown SAND								
			Intermittent gravel layers at 24 feet								
25											

Completion Depth	Date	Water Observations
25.0'	9/26/90	Water Encountered at 20'

Maxim Engineers

Log of Boring

Number: B-8/MW2

Location: SEE SITE PLAN

Project: Spot 35 Carswell AFB, Fort Worth, Texas

Auger Type:

Casing Elevation:

Drilled By: J. Hanna

Logged By: W. Crabb

Depth Feet	Samples Symbol	STRATUM DESCRIPTION	Well Construction Details	Photo-Ionization Reading	Benzene (ppm)	Toluene (ppm)	Xylene (ppm)	Ethyl Benzene (ppm)	Total BTXE (ppm)	T.P.H. (ppm)
		25.0 Boring terminated at 25 feet								

Completion Depth: 25.0'

Date: 9/26/90

Water Observations: Water Encountered at 20'

Maxim Engineers

Log of Boring B-9/MW3 SEE SITE PLAN

Project: Spot 35 Carswell AFB, Fort Worth, Texas

Auger Type	Casing Elevation
Drilled By: J. Hanna	Logged By: W. Crabb

Depth Feet	Samples	Symbol	STRATUM DESCRIPTION	Well Construction Details	Photo-Ionization Reading	Benzene (ppm)	Toluene (ppm)	Xylene (ppm)	Ethyl Benzene (ppm)	Total BTXE (ppm)	T.P.H. (ppm)
			0.3 ASPHALT base								
			Tan road base								
			2.0								
5			Dark brown to gray silty CLAY with calcareous nodules								
			9.0								
10			Red brown silty sandy CLAY								
15			Red brown silty clay								
20											
			23.0								
25			Brown silty CLAY, slight odor								

Completion Depth	Date	Water Observations
25.0'	9/26/90	Water Encountered at 22'

Maxim Engineers

FINAL PAGE

ADMINISTRATIVE RECORD

FINAL PAGE

FINAL PAGE

ADMINISTRATIVE RECORD

FINAL PAGE