ATLAS MISSILE SITE NO. 7
WILBARGER COUNTY, TEXAS

REMEDIAL INVESTIGATION REPORT

Draft Report

US Army Corps
of Engineers ®
Tulsa District

September 2002

REMEDIAL INVESTIGATION REPORT
FORMER ATLAS MISSILE SITE NO. 7
VERNON, TEXAS

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EXECUTIVE SUMMARY

This report presents the results of the Remedial Investigation (RI) activities conducted at the former Atlas Missile Site Number 7 (AMS No. 7) located approximately 13 miles north-northwest of Vernon, Texas. Along with the results of the RI activities, this report contains site background information, a description of the remedial investigative activities, an assessment of the human health risks associated with the identified contaminants, and a recommendation for any future actions.

The site was acquired by the Department of Defense in March 1960 for the construction of a missile silo. In 1967, the site was later identified as excess and the property was conveyed by deed to the Northside Independent School District No. 905, Vernon, Texas.
Of the original 8 acres given to the Northside Independent School District by the U.S. Government, the Future Farmers of America chapter occasionally uses 5 acres for displaying animals and storing supplies. This area is encircled with a 6-foot high chain-link fence topped with three strands of barbed wire. Entrance is gained through a locked steel gate. Within the fenced area is the corrugated-metal Quonset building and the pump house both constructed by the U.S. Air Force.

Several investigations have been conducted at AMS No. 7 since 1995: Preliminary Assessment and Site Inspection conducted in 1995, Demolition and closure of various DOD structures in 1999, Expanded Site Investigation Phase I in 2000, ESI Phase II performed in September 2001, and ESI Phase III performed in May/June 2002. Site investigations have identified three areas suspected to have had the greatest potential for contaminant release(s) based on historical or former site activities. These areas are the incinerator area, cooling tower area, and underground diesel fuel storage tank area.

To evaluate if site conditions warrant remediation, data collected from all the previous investigations were compiled and evaluated using the Risk Reduction Standards (RRS2) and Compliance Memorandum, dated July 23, 1998. The data included surface soil, subsurface soil and groundwater samples. A list of contaminants of potential concern (COPCs) was generated by comparing sampling results to the RRS2 Medium-Specific Concentration (MSC) for an industrial scenario. Any constituent detected above MSCs or may impact the groundwater quality was listed as a COPC. Potential exposure pathways for COPC would then be evaluated for those constituents.

An industrial exposure scenario was selected as the most reasonable exposure scenario for the current and future land use. Since exposure assumptions in the industrial scenario are more frequent and of longer duration than the reasonably anticipated exposure to the occasional FFA member, the industrial scenario was selected as a very conservative approach to assessing exposures at AMS No. 7.

The highest detected concentration of each constituent was compared to the appropriate MSCs. No constituents in the soil at AMS No. 7 were detected above the Soil Medium-Specific Concentration for industrial use based on inhalation, ingestion, and dermal contact (SAI-Ind). Therefore, no COPCs were generated for soil exposure pathways for an industrial worker.

However, several constituents were detected above the soil MSC for industrial use based on groundwater protection (GWP-Ind). These constituents included: aluminum, Aroclor 1254,

Aroclor 1260, arsenic, barium, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, chromium, and lead. Based on subsurface soil data, groundwater data, Synthetic Precipitation Leaching Procedure data and other factors discussed in this report, none of these constituents appear to have impacted the subsurface soils or ground water at AMS No.7. Therefore none of these chemicals were identified to be contaminant of potential concern (COPC).

Evaluation of the groundwater data indicated trichloroethene (TCE) and dichloroethene (DCE) concentrations above the groundwater MSC for industrial use (GW-Ind) therefore, are listed as COPCs. TCE and DCE are the only COPCs identified for AMS No. 7. Currently, the groundwater at AMS No. 7 is not being used as a drinking water source for human consumption or bathing; occasionally, it is used as a water source for livestock during FFA events. The AMS No. 7 water well that is used for the livestock has been sampled and DCE and TCE have not been detected. The well is not located downgradient of the area of contamination and should not be affected in the future. Therefore, AMS No. 7 has no completed pathways for the COPCs in the ground water.
Although TCE levels are above the MSC GW-Ind, it poses no immediate risk to human health or the environment.

Data collected from all the previous investigations does not indicate site conditions warrant remediation: the surface soils do not indicate levels of constituents above the SAI-Ind and the constituents detected in the soil above the GWP-Ind do not appear to have affected the groundwater. The constituents detected in the groundwater above the GW-Ind do not have a completed exposure pathway. In addition, using the industrial exposure scenario has added an additional factor of conservatism. The industrial scenario exposures are much longer and more frequent than the reasonable maximum exposure anticipated by occasional use of the site for livestock shows. Based on the compiled data, all of the anticipated risk to an industrial worker fall within an acceptable risk range. Therefore health risks to an FFA member would be far less than an industrial worker and would be within an acceptable risk range. No further action is recommended for this site based on its reasonably anticipated future use.

LIST OF ACRONYMS

AMS	Atlas Missile Site
bgs	below ground surface
COPC	Contaminant of Potential Concern
CPT	Cone Penetrometer
DCE	Dichloroethene
DEMS	Deerinwater Environmental Management Services
DOD	Department of Defense
DSITMS	Direct Sampling Ion Trap Mass Spectrometer
ESI	Expanded Site Investigation
ft	feet
ft/ft	feet per feet
FUDS	Formerly Used Defense Site
gpm	gallons per minute
GW	Ground Water
GWP	Ground Water Protection
LCC	Lauch Control Center
LNAPL	Light Non-Aqueous Phase Liquid
mg/kg	milligram per kilogram
mg/l	milligram per liter
MK	Morrison Knudsen Corporation
mph	miles per hour
MSCs	Medium Specific Concentrations
msl	Mean Sea Level
NR	Not reported
NS	Not sampled
PA/SI	Preliminary Assessment and Site Inspection
PCB	Polychlorinated Biphenyl

PVC	Polyvinyl Chloride
QA	Quality Assurance
RCRA	Resource Conservation and Recovery Act
RRS-II	Risk Reduction Standards No. 2
SCAPS	Site Characterization and Analysis Penetrometer System
SI	Site Inspection
SPLP	Synthetic Precipitation Leaching Procedure
SVOC	Semi-volatile Organic Compound
TCE	Trichloroethene
TCEQ	Texas Commission on Environmental Quality
TIC	Tentatively Identified Compounds
TNRCC	Texas Natural Resource Conservation Commission
TPH	Total Petroleum Hydrocarbons
TRPH	Total Recoverable Petroleum Hydrocarbons
UCL	Upper Confidence Level
ug/kg	microgram per kilogram
ug/l	microgram per liter
USACE	U.S. Army Corps of Engineers
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
VOC	Volatile Organic Compound

REMEDIAL INVESTIGATION REPORT
FORMER ATLAS MISSILE SITE NO. 7
VERNON, TEXAS

Section 1. INTRODUCTION

1.1. Purpose of this Report

This report presents the results of the remedial investigation (RI) activities conducted at the former Atlas Missile Site Number 7, (AMS No. 7) located approximately 13 miles north-northwest of Vernon, Texas in Wilbarger County. Along with the results of the RI activities, this report contains site background information, a description of the remedial investigative activities, an assessment of the human health risks associated with the identified contaminants, and a recommendation for any future actions.

1.2. Site Background/Description

The AMS No. 7 is located approximately five miles south of the Texas-Oklahoma border and 13 miles north-northwest of Vernon, Texas in Wilbarger County. The entire Formerly Used Defense Site (FUDS) property covers approximately 8 acres in an area of farmland; however, the missile silo and its support buildings were located in a secured and fenced area comprising less than 5 acres. The site is accessed by State Highway 91, and the nearest residential community is Odell, Texas, located approximately 6 miles west of the project site. Prior to construction of the missile launch facility, the site was used primarily for cattle grazing and cattle operations. The site was acquired in March 1960 and selected by the Department of Defense (DOD) because of its isolation in an unpopulated rural area of the state. Construction of the facility was completed shortly thereafter and assigned to the Altus Air Force Base. Site improvements made by the DOD included a Quonset hut, an underground Launch Control Center (LCC), an underground missile silo, septic systems, an underground storage tank (UST), water supply well with pump house, helicopter pad, and various utility vaults/manholes. The perimeter of the site is fenced and access to the site is through a gate which is kept locked when the site is not in use. Figure 1-1, Atlas Missile Site No. 7 Site Features, illustrates the locations of these structures.

The missile site was active for only a short period of time while housing liquid rocket propelled missiles with single nuclear warheads before being taken out of service in 1964. The site was later identified as excess, and the property was conveyed by deed in 1967 to the Northside Independent School District No. 905, Vernon, Texas. The DOD removed all USTs prior to conveyance of the property to the school district

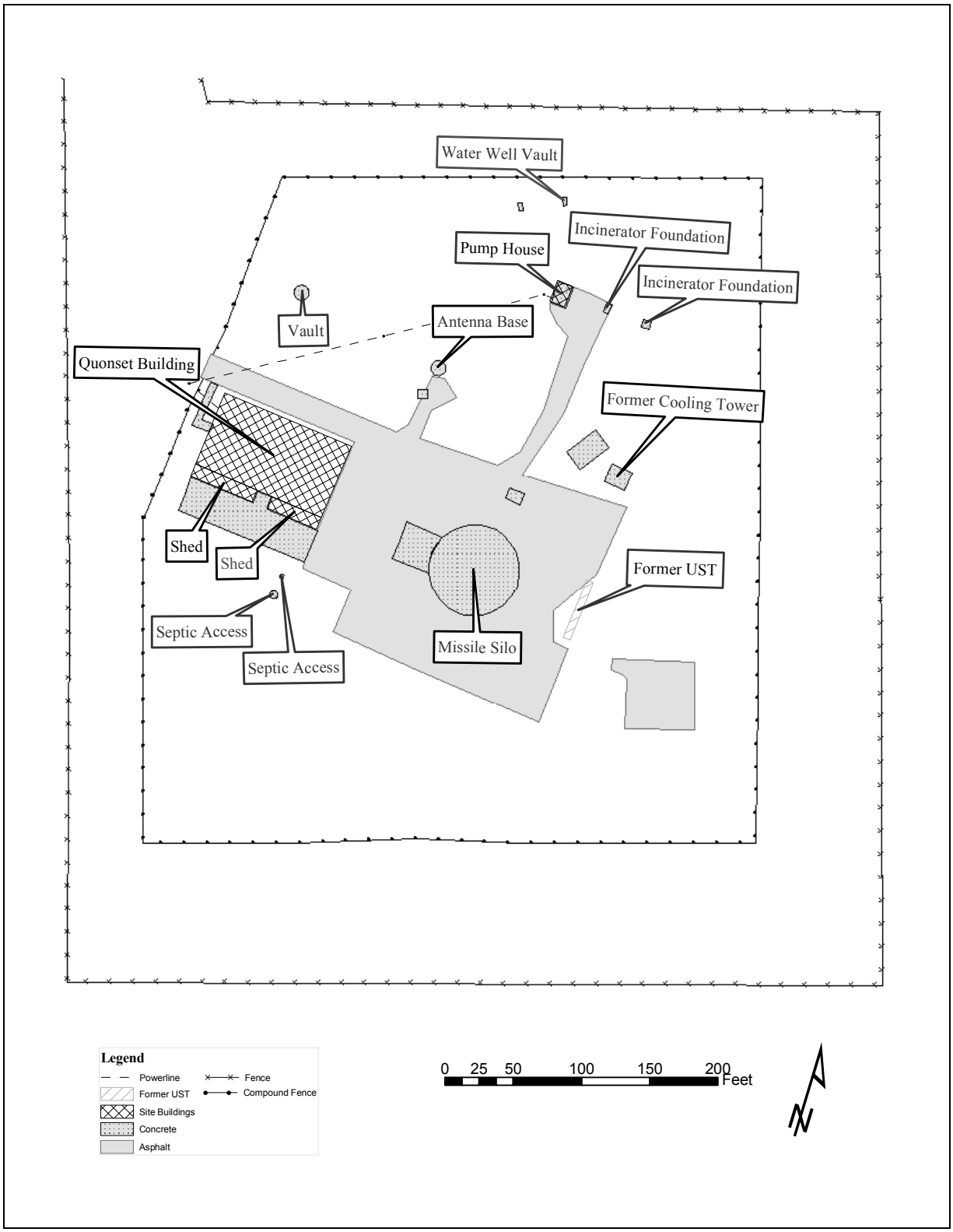


Figure 1-1 Atlas Missile Site No. 7 Site Features

1.3. Previous/Current Investigations

Several investigations have been conducted at AMS No. 7 since 1995. Discussed in more detail in Section 3, investigative efforts performed at the site consist of:

- Preliminary Assessment and Site Inspection (PA/SI) conducted in 1995,
- Demolition and closure of various DOD structures in 1999,
- Expanded Site Investigation (ESI) Phase I in 2000,
- ESI Phase II performed in September 2001,
- ESI Phase III performed in May/June 2002.

Analytical results for all investigations are included in Appendix A.

Section 2. PHYSICAL CHARACTERISTICS OF THE STUDY AREA

2.1. Surface Features

AMS No. 7 is located in the gently rolling topography of northwestern Wilbarger County, Texas known as the Odell Sand Hills. Due to the sandy soils of the area, the surface drainage system in the Odell Sand Hills is poorly developed. The relief is dominantly nearly level to gently sloping upland. The terrain within a mile radius of the site is flat and gently sloping to the northeast. The 8-acre site is slightly elevated above the surrounding land. The highest point is at the center of the site where the former opening to the missile silo exists. The land gently slopes equally on all sides in a conical fashion until it intercepts the elevation of the surrounding land. This site has as an average elevation of 1365 ft above mean sea level (msl).

Of the original 8 acres given to the Northside Independent School District by the U.S. Government, the Future Farmers of America chapter occasionally uses 5 acres for displaying animals and storing supplies. This area is encircled with a 6-foot high chain-link fence topped with three strands of barbed wire. Entrance is gained through a locked steel gate. Within the fenced area is the corrugated-metal Quonset building and the pump house both constructed by the U.S. Air Force. The concrete pad under which the missile silo was located is also still present, although the silo has since been filled and the doors to the silo have been permanently closed.

2.2. Climatology/Meteorology

The climate of the area is classified as subhumid, temperate and continental. Average annual precipitation is about 24 inches. The months of March and April are the wettest and account for approximately 35% of the annual precipitation. The months of December through February are the driest with 15% of the annual precipitation occurring during this time. The average annual wind speed is about 12 miles per hour (mph). March and April are generally the windiest months of the year with an average speed of 14 mph. The prevailing wind direction is southerly from May through October and northerly for the remainder of the year.

2.3. Regional Geology/Hydrogeology

Wilbarger County, Texas, is located within the stratigraphic units consisting of Quaternary age surficial deposits and underlying Permian age redbeds. The surficial deposits at the site consist of a thin mantle of recent age wind-blown sands and silt, that overly the Pleistocene age Seymour formation (Willis and Knowles, 1953). The Seymour formation is fluvial in origin

and is comprised of fine to medium grained sands with interbedded silts and clays. Previous investigations at AMS No. 7 reported a thickness of Quaternary age surficial deposits ranging from 42 to 80 ft thick. The Seymour formation rests directly on the Permian age San Angelo formation of the Peace River Group.

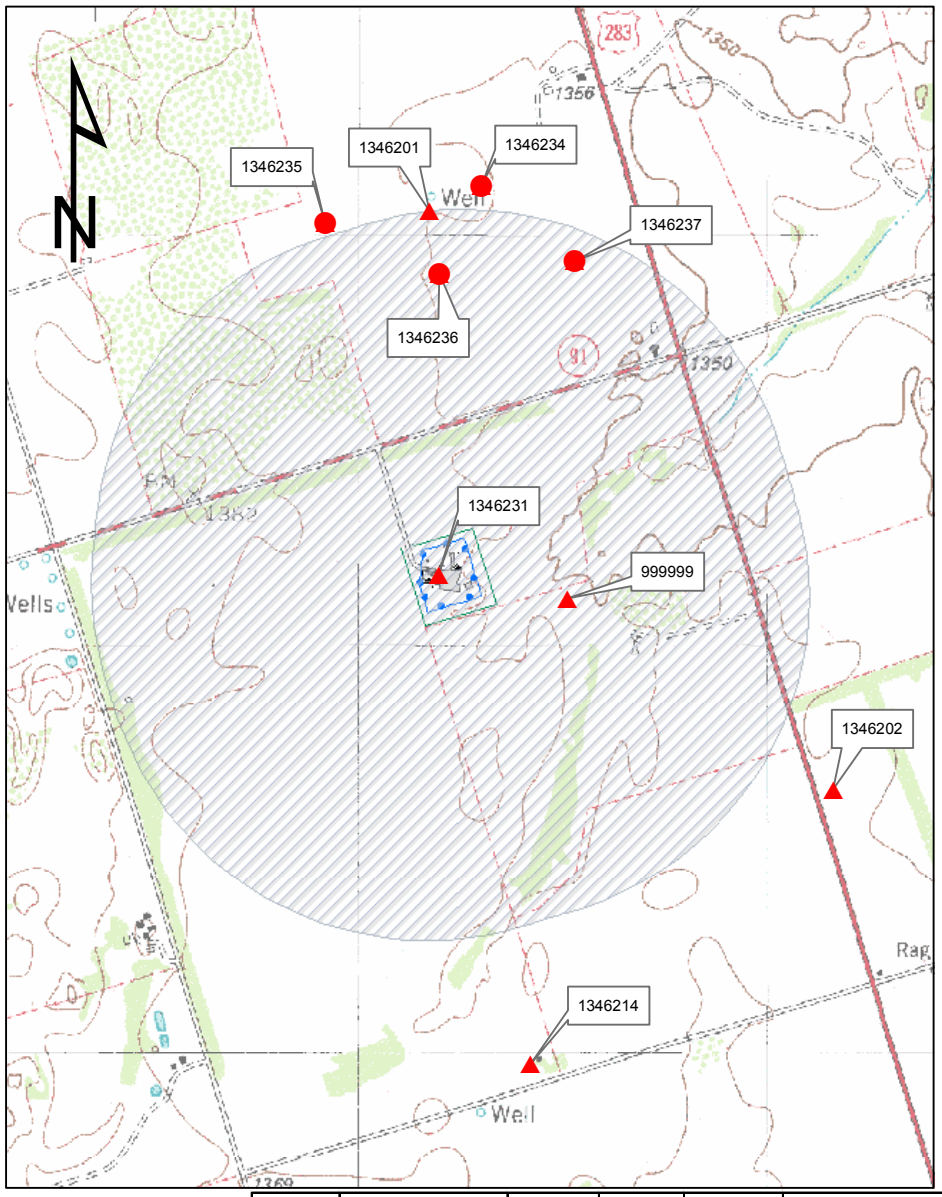
2.4. Site-Specific Geology

During construction of the missile silo, the site lithology was disturbed along the perimeter of the silo to a depth of 180 ft below the original ground surface. To construct the silo, a massive excavation was made into the earth around the silo to a depth of 34 ft below the original ground surface. At the completion of construction, the excavation was filled with random fill. Up to 5 ft of fill was added on top of the original ground surface elevation giving the site a mounded appearance. Consequently, the top 40 ft of the subsurface lithology near the silo is random fill material. Outside the disturbed soils between ground surface and 40 to 50 ft below ground surface (bgs), silty sands and sandy clays were recorded in the boring logs. Below the sandy clays to approximately 90 ft bgs flowing sands were encountered. Below the flowing sands to the bottom of the hole was shale with interbedded sandstone. Lithologic logs developed during the previous investigations are included in Appendix B.

2.5. Regional Hydrogeology

The Seymour Formation is the major groundwater aquifer in Wilbarger County. The aquifer is unconfined (i.e., under water-table conditions). The quality of water ranges from fresh to slightly saline and well yields range from 30 to 400 gallons per minute (gpm) (Price, 1979). One hundred one (101) wells and test wells are registered with the state of Texas in a three-mile radius of AMS No. 7 with only one well and two test wells within a one-half mile radius of the site. The one well that is present within the one-half mile radius is the well drilled at the missile site. Texas records indicate the well was drilled to a depth of 100 ft in 1958. All wells produce from the Seymour aquifer. Figure 2-1 illustrates the locations of the wells and test wells that are within a one-half mile radius of the missile site. Information from the Texas Water Development Board regarding these wells is presented in a table at the bottom of Figure 2-1. Based on water-table elevation maps from 1951 through 1971 for the Odell Sand Hills (Price 1979), groundwater flow directions in the vicinity of the site may vary from slightly east of north to eastward. No hydraulic conductivity measurements for the Seymour Aquifer were gathered during this investigation.

The redbeds beneath the Seymour Formation belong to the Permian age San Angelo Formation of the Peace River Group. The San Angelo Formation consists of red medium-grained deltaic sandstone (near the top of the formation) underlain by interbedded sandstone and shale (Price, 1979). The formation obtains a maximum thickness of 210 ft in Wilbarger County. The San Angelo Formation is a minor aquifer in Wilbarger County. Water quality ranges from fresh to slightly saline and yields are generally less than 50 gpm. Hydraulic connection between the San Angelo Aquifer and the overlying Seymour aquifer is unknown. Within a three-mile radius of AMS No.7, no wells are registered in this aquifer.



Legend

- Fence
- Compound Fence
- One-half Mile Buffer
- TWDB Database Wells
- TWDB Database Test Wells

State Well Number	Owner	Date Drilled	Well Depth	Aquifer Code	Remarks
1346201	W.S. Fitzgerald	1957	100	112SYMR	Yield reported 350 gpm.
1346202	Cleve Hamilton		25	112SYMR	Abandoned stock well. Well 40 of Bull. 5301. Well B-40 of Bull.5614
1346214	C.M. Clarkson	1965	64	112SYMR	Water reported from sand and gravel at 43 to 63 feet. Red beds reported at 63 feet.
1346231	North Side High School	1958	100	112SYMR	Formerly an industrial well used at the now abandoned missile base.
1346234	William S. Fitzgerald	1957	93	112SYMR	Test hole.
1346235	William S. Fitzgerald	1957	105	112SYMR	Test hole.
1346236	William S. Fitzgerald	1957	103	112SYMR	Test hole.
1346237	William S.Fitzgerald	1957	100	112SYMR	Test hole.

Figure 2-1 Groundwater Wells in the Atlas Missile Site No. 7 Vicinity

2.6. Site-Specific Hydrogeology

With the construction of the missile silo, the groundwater in the upper 200 ft of the strata in the vicinity of the silo should be considered to be hydraulically connected. Borings drilled at the site indicate the stratigraphy of the site to be composed of interbedded sands and clays from the ground surface to depths of 65 ft to 80 ft . Below the unconsolidated sands and clays to a depth of 200 ft are alternating beds of sandstones and shales ranging in color from red to tan.

From regional groundwater information, the groundwater flow direction was expected to be to the east-northeast. With the initial two wells (BH01 and BH03 shown on Figure 3-1) installed in 1995 being in close proximity to one another and at differing depths, a groundwater flow direction was not able to be determined from those wells. Plugged in 1998, wells BH01 and BH03 were replaced in the summer of 2000 by 3 shallow wells and 1 deeper well as shown on Figure 3-2. Using the groundwater elevations from the three shallow wells, the groundwater flow direction was determined to be to the northwest as shown in Figure 3-2 of the Morrison Knudsen Expanded Site Investigation (January 2001). The anomalous flow direction resulted in the conclusion that none of the four installed monitoring wells (MW06, MW07, MW08 and MW09) were positioned to sample water downgradient of the silo or launch control area.

To more fully characterize groundwater conditions at the site, the US Army Corps of Engineers (USACE) utilized its Site Characterization and Analysis Penetrometer System (SCAPS) in June 2002. Using the direct push technology of the SCAPS, soil classification and discreet water sampling were performed to a depth of 60 ft across the site. Additionally, small diameter wells (microwells) were installed to allow repeat sampling of specific intervals as well as the measurement of groundwater elevations at those specific intervals and locations. A more detailed description of the SCAPS operation is presented in Section 3 of this report. Using groundwater elevations from a selection of microwells and the existing monitoring wells, a groundwater contour map was generated and is presented as Figure 2-2. The information used to generate the resulting groundwater elevations are provided in Table 2-1.

As shown in Figure 2-2, the resulting groundwater elevation map indicates the groundwater to be mounded in the immediate vicinity of the silo with near radial flow away from the silo area with the apparent regional flow direction to the east-northeast. The horizontal hydraulic gradient of the mapped potentiometric surface ranges from 0.22 ft/ft around the silo near MW07 to approximately 0.002 ft/ft further away from the silo, both to the north and south.

At four locations (P-03, P-04, P-05 and P-06), screens were installed in two zones at each location with the water level measured to evaluate the difference in the vertical gradient at each location. At location P-03, the upper zone has a groundwater elevation of approximately 0.8 ft higher than the lower zone thus indicating either a barrier to vertical flow between the upper and lower zones or local recharge of the upper zone. The other three locations have groundwater elevations in the two zones that are virtually identical. These locations are in closer proximity and more downgradient to the silo than location P-03 and thus would be more influenced by the silo excavation. Concentrations of trichloroethene (TCE) detected in some of the push locations to the northeast of the silo provide another indication of the presence of a barrier between the upper and lower zone. As discussed in Section 3 and illustrated in Figures 3-5, 3-6 and 3-7, samples taken from screened intervals wholly within the lower zone were free of TCE or other volatile constituents whereas samples from the upper zone at the same locations had volatile organic compounds detected.

Table 2-1 Groundwater Elevation Information from SCAPS Investigation

Location	Screened Interval Below Ground Surface (ft)		Reference Elevation (ft)	Depth-to-water (ft)	Date Measured	Groundwater Elevation
	Top	Base				
MW-6	16	31	1367.73	26.33	5/27/02	1341.40
MW-7	8	23	1370.07	15.93	5/27/02	1354.14
MW-9	186	211	1366.22	26	5/27/02	1340.22
P-2	25	35	1367.31	25.47	5/27/02	1341.84
P-3	25	35	1365.64	24.42	5/27/02	1341.22
P-3	40	50	1365.24	24.84	5/27/02	1340.40
P-4	20	30	1364.85	24.22	5/27/02	1340.63
P-4	37	47	1365.19	24.61	5/27/02	1340.58
P-5	21	31	1363.53	23.23	5/27/02	1340.30
P-5	58	68	1363.67	23.44	5/27/02	1340.23
P-6	18	28	1364.67	23.89	5/27/02	1340.78
P-6	50	60	1364.63	23.86	5/27/02	1340.77
P-7	20	30	1363.41	22.2	5/27/02	1341.21
P-11	20	30	1362.18	21.99	5/27/02	1340.19
P-15	22	32	1362.22	21.85	5/27/02	1340.37
P-16	25	35	1361.1	21.06	5/27/02	1340.04
P-17	20	30	1360.44	20.32	5/27/02	1340.12
P-18	20	30	1362.44	22.4	5/27/02	1340.04
P-19	20	30	1365.46	24.8	5/27/02	1340.66
P-20	22	32	1368.23	27.4	5/27/02	1340.83

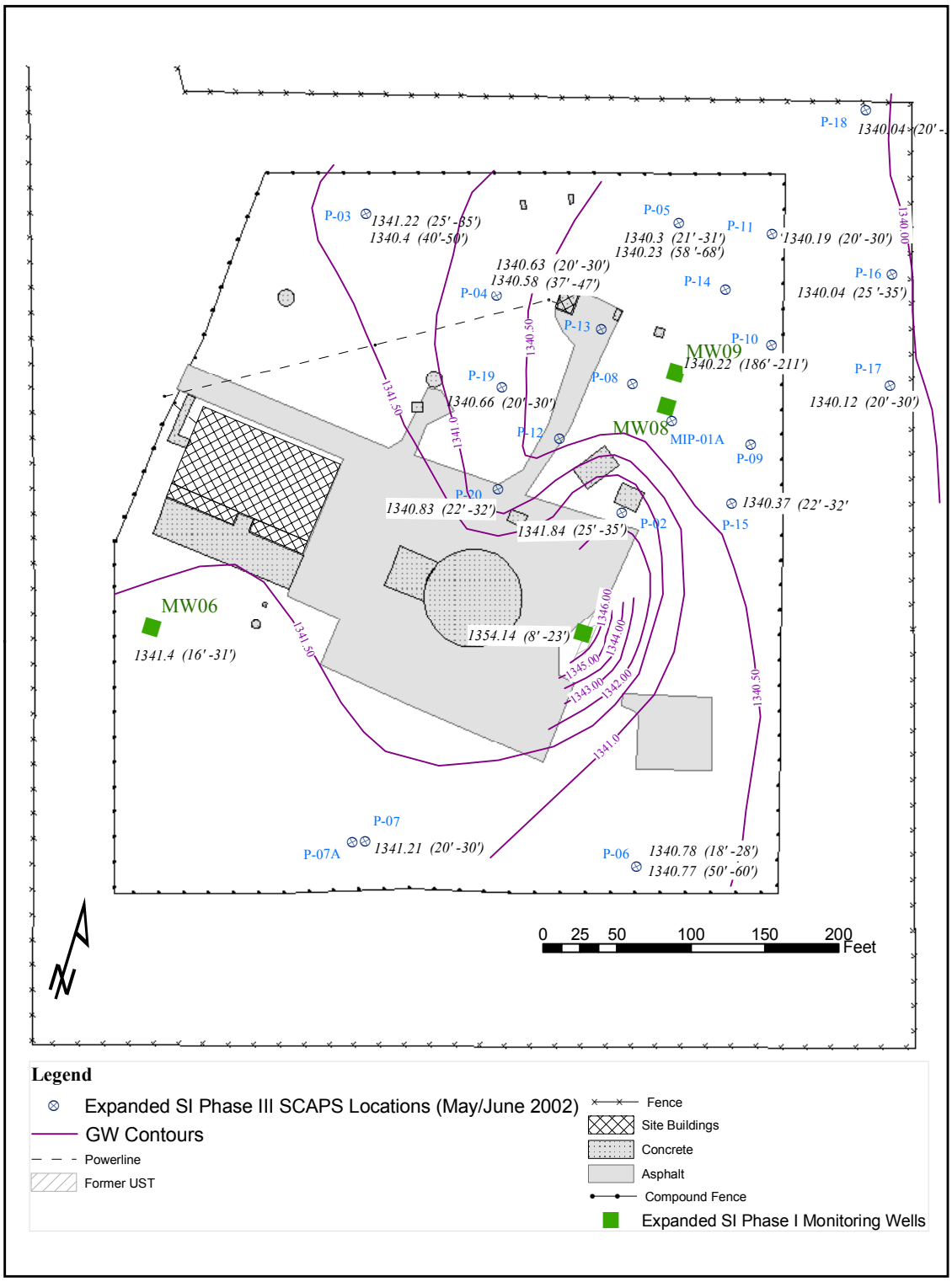


Figure 2-2 Groundwater Elevation Map from SCAPS Investigation

Section 3. STUDY AREA INVESTIGATION

3.1. Field Activities Associated with Site Characterization

3.1.1. PA/SI; USACE, Tulsa District (1995)

The USACE, as part of the DOD Environmental Restoration Program, conducted the Preliminary Assessment/Site Inspection (PA/SI) in 1995. The primary objective of the PA/SI was to determine if there was a release or potential release of hazardous substances due to past DOD usage of the site. The PA included:

- Gathering and reviewing existing site information,
- Interviews of former site personnel,
- Review of DOD files, published geological/hydro-geological reports, and aerial photography.

The completed PA identified the following sources for potential releases as:

- On-site storage tanks used to provide fuel for an incinerator and electrical generators.
- Fuels and oils used for equipment maintenance, and
- The hydraulic system used to operate the silo launch bay doors.

The SI was performed following the PA to determine if site soils or groundwater contamination had occurred as a result of past DOD activities. SI activities consisted of performing the following, sampling locations performed during the SI are shown in Figure 3-1:

- Collection of surface soil samples,
- Installation of three shallow boreholes for surface and subsurface soils data collection.
- Installation of one shallow groundwater monitoring well and one deep groundwater-monitoring well to assess groundwater quality,
- Collection of water samples from the missile silo and on-site domestic water well.

The PA/SI reported that no volatile organic compounds (VOCs) were detected in the soil or groundwater and all metals detected were within the acceptable background ranges. However, total recoverable petroleum hydrocarbons (TRPH) and several semi-volatile organic compounds (SVOCs) were detected in soil and groundwater samples. Bis(2-ethylhexyl) phthalate was the only SVOC detected in the soil. This contaminant was detected in all three boreholes and at various depths ranging from the surface to 25 ft bgs. SVOCs detected in groundwater samples included bis(2-ethlhexyl) phthalate, benzoic acid, di-n-octylphthalate, and phenol.

It was concluded in the SI report that bis(2-ethlhexyl) phthalate is commonly added to plastics to enhance flexibility and the presence of this compound in soil samples and groundwater was probably due to leaching from sampling equipment and rubber gloves used in sampling, rather than a result of DOD activities. The USACE report also concluded that the SVOCs detected in groundwater are known laboratory contaminants and thought to be introduced during the laboratory analysis procedures. USACE recommended no further action was required at this site. In May of 1998, USACE plugged and abandoned the two monitoring wells installed during the investigation.

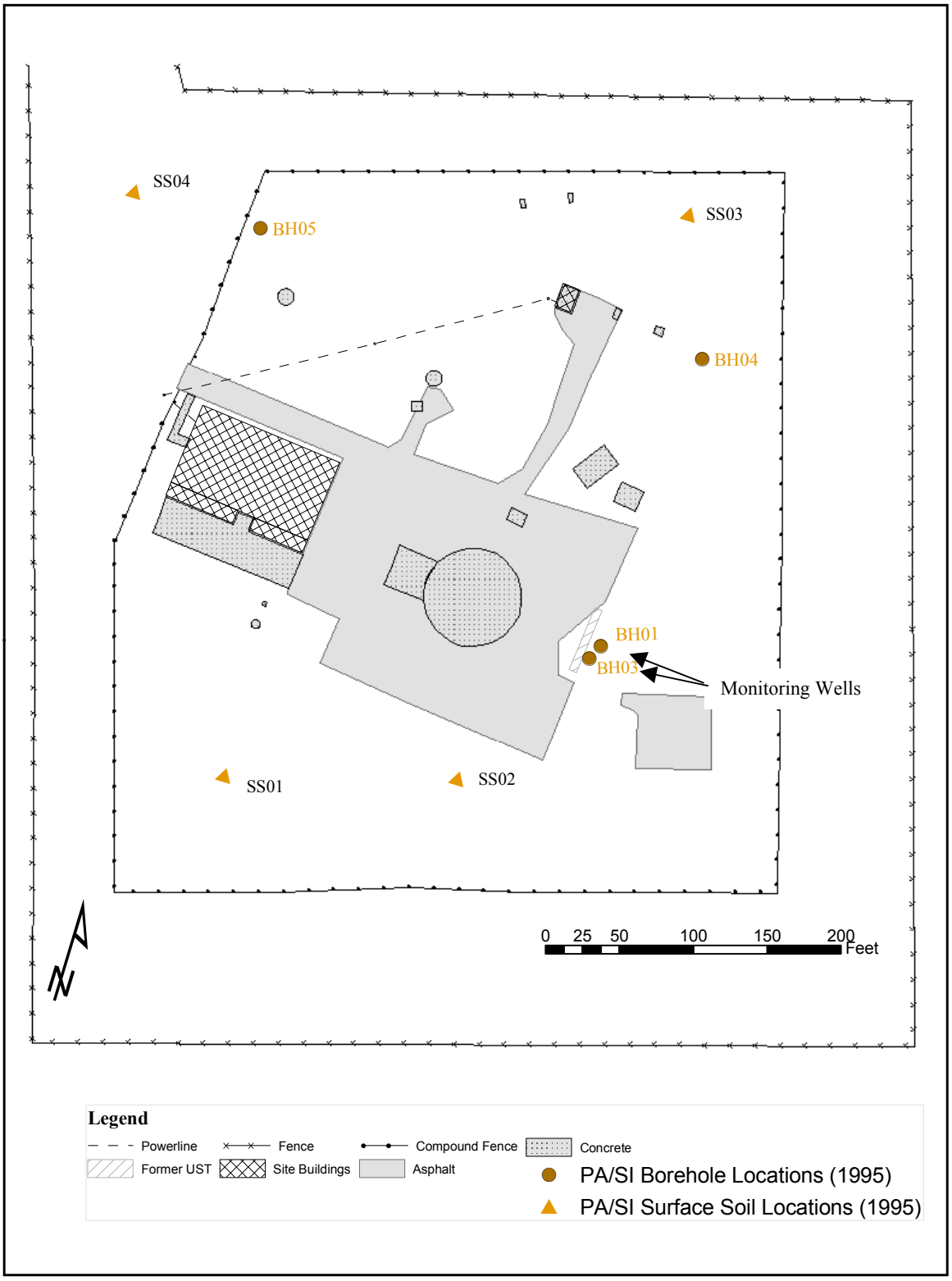


Figure 3-1 PA/SI Sampling Locations (1995)

3.1.2. Demolition And Closure Of Various DOD Structures; Morrison Knudsen Corporation (1999)

In late 1999, Morrison Knudsen Corporation (MK), under contract to the USACE (Tulsa District), performed the following site closure activities:

- The underground silo and LCC were backfilled with flowable fill (a low strength concrete mixture),
- The above ground portion of the LCC stairwell entrance and other utility risers and vents were demolished below grade and then covered with clean fill to prohibit future access,
- The silo launch bay doors were welded shut, and
- The site was graded and reseeded.

3.1.3. Expanded Site Investigation, Phase I; Morrison Knudsen Corporation (2000)

In March 1999, the Texas Natural Resource Conservation Commission (TNRCC) completed its review of the 1995 PA/SI report and responded with a Notice of Deficiency. The TNRCC concluded that the presences of SVOCs were not field sampling or laboratory contamination and that potential impacts to the upper and lower aquifers had not been properly evaluated. In response to the TNRCC Notice of Deficiency, the USACE, Tulsa District entered into contract with MK to perform an Expanded Site Investigation (ESI). The following is a brief description of field activities performed during the 2000 ESI. Figure 3-2 illustrates the sampling locations described below.

- Collection of ten (10) surface soil samples, samples SS05 to SS14, (seven on-site and three off-site) for chemical analysis. On-site surface soil locations were located near three former site structures or operations that may have had a potential for contaminant release. These included the incinerator, cooling tower, and underground diesel storage tank.
- Drilling and continuous coring of three shallow boreholes, BH06, BH07 and BH08. Boreholes were drilled to the top of the alluvial/bedrock (Seymour/San Angelo) contact. Soil samples were collected for chemical analysis at 5-foot intervals within the vadose zone at each borehole and at the underlying alluvial/bedrock, contact.
- Soils were lithologically described.
- Drilling and continuous coring of one deep borehole to 210 ft bgs. The deep borehole, BH09, was converted into the deep monitoring well MW09.
- Subsequent installation of monitoring wells at each borehole location. Shallow wells were screened across the water table within the Seymour Aquifer to test for dissolved phase contaminants and light non-aqueous phase liquid (LNAPL). The deep bedrock well was screened at the bottom of the borehole to test for dissolved phase contaminants in the San Angelo Aquifer below the missile silo base.
- Well development and groundwater sampling at each well followed well installation.
- Surveying of all sampling locations and monitoring wells.

In the MK ESI Final Report, submitted to the TNRCC in January 2001, all analytical results, except detected metal concentrations in soils, were compared to the TNRCC RRS2 Medium Specific Concentrations (MSCs) applicable to industrial activities. All analytical results for

detected metals in soils were compared to the Texas Specific Background Concentrations (TNRCC Interoffice Memorandum dated June 28, 2000).

No pesticides, herbicides or TRPH were detected in the surface soil samples collected.

Bis(2-ethlhexyl) phthalate was not detected in surface or subsurface soils during the ESI performed by MK. The absence of detectable levels of this compound suggests that the presence of this SVOC detected in the 1995 PA/SI samples were a result of laboratory cross contamination and not from previous DOD usage.

All laboratory results for metals in the soil were found to be less than TNRCC Texas Specific Background Concentrations, with the exception of lead and zinc in the areas associated with the old incinerator, cooling tower, and UST locations.

Polychlorinated biphenyls (PCBs) were detected in soil samples collected from areas near the incinerator, cooling tower, and UST locations. Detected PCB concentrations did not exceed the MSCs for inhalation, ingestion, and dermal contact, but do exceed the MSCs for groundwater protection. It was concluded in the MK ESI Phase I final report that because subsurface soil sample concentrations were non-detect for PCBs that the TNRCC groundwater protection criteria was met.

Subsurface soil samples were collected from three separate borehole locations. All laboratory results for metals were reported less than the TNRCC Texas specific background concentrations. Several VOC and SVOC compounds were detected in the subsurface soil samples, with all results below the MSC values for inhalation, ingestion, dermal contact, and groundwater protection. VOC and SVOCs were detected in the groundwater samples. Concentrations detected were below the MSC groundwater values with the exception of TCE. TCE was detected at a concentration of 0.140 mg/l from monitoring well MW08, which exceeds the MSC of 0.005 mg/l established by the TNRCC administrative code for public drinking water.

ESI Phase I Conclusions and Recommendations

MK concluded that based on the data, findings, and regulatory compliance review AMS No. 7 could not be closed in accordance with RRS1 or RRS2 cleanup levels without additional data or possibly remediation of soils and groundwater.

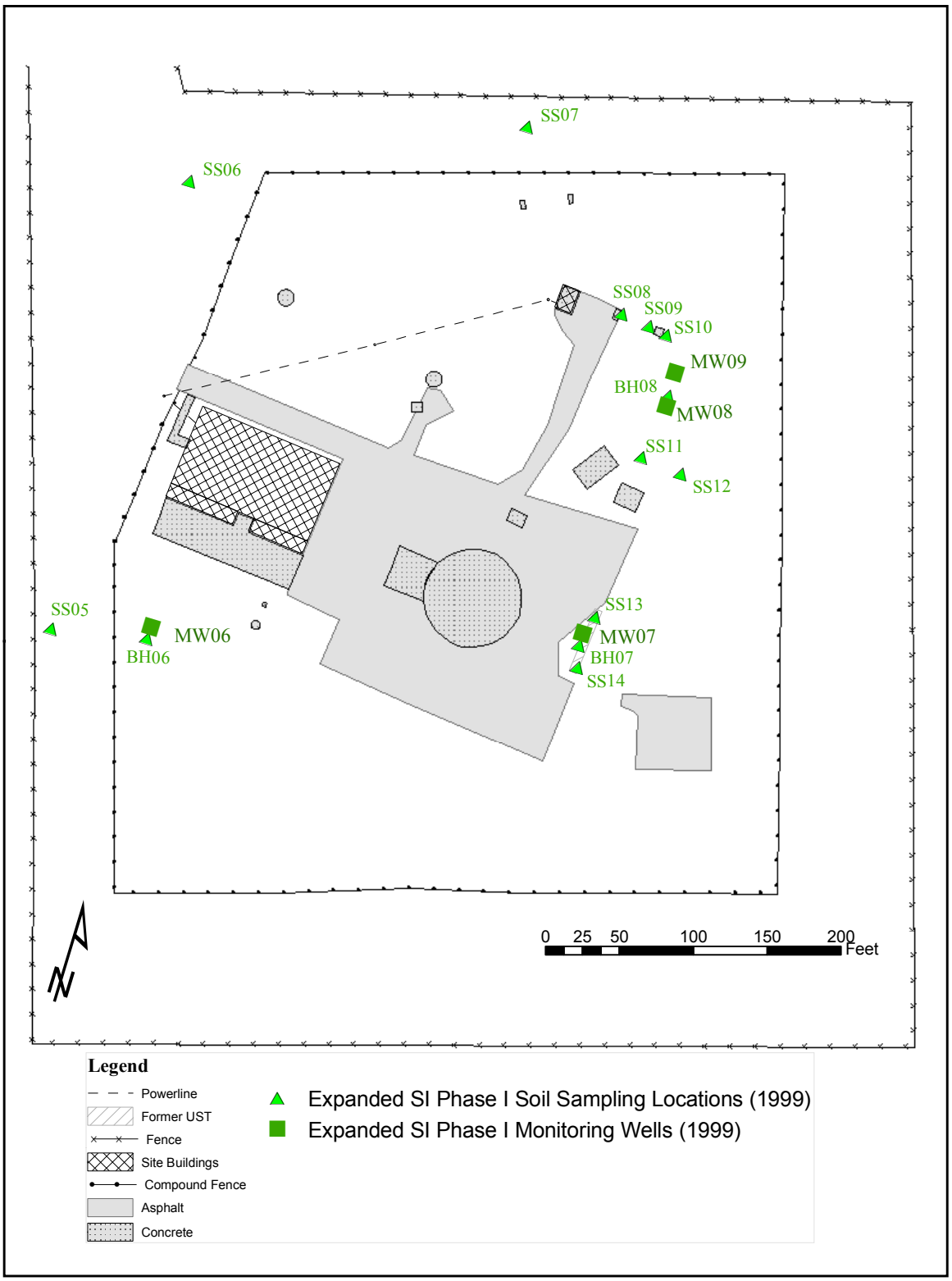


Figure 3-2 ESI Phase I Sampling Locations (1999)

3.1.4. Expanded Site Investigation, Phase II; Deerinwater Environmental Management Services, Inc (2002)

To confirm the nature and extent of contaminants encountered during previously performed site investigations an ESI Phase II was performed in September of 2001 by Deerinwater Environmental Management Services, Inc. (DEMS) for the U.S. Army Corps of Engineers. The ESI Phase II was designed to identify potential data gaps and provide recommendations to achieve site closure under the TNRCC RRS2 Residential. The locations of samples collected during the Phase II investigation are shown on Figure 3-3.

The ESI Phase II activities included:

- The collection and chemical analysis of 65 surface soil samples to further define the lateral extent of identified soil contamination and to establish soil background concentrations.
- Four existing groundwater monitoring wells installed during the ESI Phase I were redeveloped and groundwater samples collected. The collected groundwater samples were analyzed for the 8 Resource Conservation and Recovery Act (RCRA) metals, zinc, VOAs, SVOAs, Pesticides/PCBs, Herbicides, and TRPH.

Soil

Analytical results from surface soil sampling conducted during the ESI Phase II confirmed elevated levels of lead, zinc, and some PCBs surrounding the incinerator, cooling tower, and UST. All three Contaminant of Potential Concern (COPC) maximum concentrations were below the MSCs RRS2 soil screening levels for residential use of 500 mg/kg for lead, 59000 mg/kg for zinc and 10 mg/kg for PCBs. Analytical results for all metals tested were below the soil RRS2 MSC levels for residential. However, all lead and several sample locations for PCBs detected concentrations exceeding the RRS2 MSC Ground Water Protection (GWP) values for residential soil.

Groundwater

Water samples were collected from the three shallow monitoring wells and one deep well. Groundwater samples were analyzed for the 8 RCRA metals, zinc, VOCs, SVOCs, Pesticides/PCBs, Herbicides, and TPH. Four VOC's were detected in water samples collected during the ESI Phase II. Cis-1,2-dichloroethene, trans-1,2-dichloroethene, toluene, and trichloroethene were detected in MW08. Toluene alone was detected in MW09. Trichloroethene was the only compound detected above the MSC action level for residential groundwater. Five VOC compounds, 1,1-dichloreoethylene, acetone, chloroform, 4-isopropyltoluene, and vinyl chloride previously identified in the MK ESI 2001 final report were not detected in this ESI Phase II. No SVOCs, including bis (2-ethylhexyl) phthalate, were detected in the samples collected and analyzed during this ESI Phase II. Site specific background results were all lower than the Texas Specific Background Concentrations.

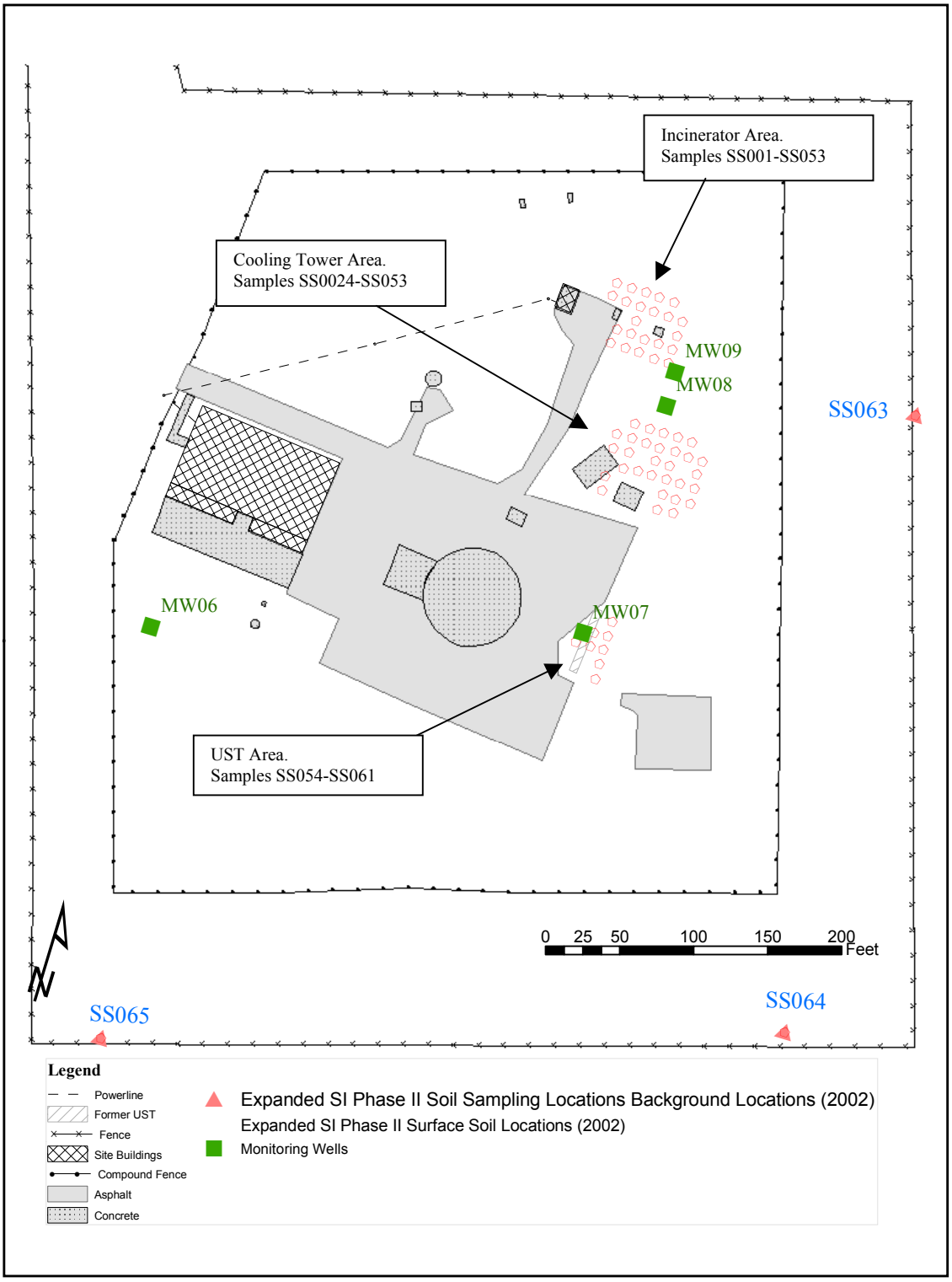


Figure 3-3 ESI Phase II Sampling Locations (2002)

Of all detected compounds only TCE was detected above the TNRCC RRS2 MSC screening value of .005 mg/l for residential. No SVOCs, Pesticides/PCBs, Herbicides, or TRPH were detected in any of the monitoring wells sampled during the ESI Phase II.

ESI Phase II Conclusions and Recommendations

While fieldwork for the ESI Phase II was in progress the TNRCC completed its review of the 2001 MK Phase I report and responded to the USACE, Tulsa District by letter dated September 24, 2001. Based on the data gathered during the ESI Phase II, a regulatory compliance review, and the comments and suggested/requested actions by the TNRCC, DEMS made the following conclusions/recommendations for AMS No. 7.

- Contamination was identified and confirmed surrounding the incinerator, cooling tower, and UST site. COPCs are lead, zinc, and PCBs, however none of the COPCs exceed the RRS2 soil screening levels for residential use. Many of the soil sample results exceed the values established for RRS2 GWP. Further investigations were recommended to establish GWP values.

- In the September 24, 2001 letter, TNRCC suggested leachate tests be conducted to determine site-specific soil to GWP values, in accordance with Texas Administrative Code Title 30, Part 1, Chapter 335, Subchapter S, Rule 335.559, subsection (g). The reference to Subsection (g) was based upon the original MK report that this site be closed as industrial. DEMS recommended in this report that the site closure be based upon residential standards, so subsection (f) of the above referenced Texas Administrative Code should be applied. In particular subsection (f) (2) which defines the procedures required to meet GWP as "a concentration in soil that does not produce a leachate in excess of MCLs or MSCs for groundwater when subjected to the Synthetic Precipitation Leaching Procedure, Method 1312 of SW 846".

- Collect of additional surface and shallow subsurface soil samples to be analyzed for the total lead, zinc, and PCBs, along with leachate tests using the SPLP Method 1312. This report recommended soil borings be performed at each identified source of contamination: incinerator, cooling tower, and UST site.

- Install additional groundwater monitoring wells up gradient and down gradient of MW08 to determine the extent and potential source of the TCE contamination in the Seymour aquifer and to comply with the recommendations of the TNRCC.

- Perform a well survey of all wells located within one half mile of the site. The survey should include location, well owners, well construction details (if available), total depth of well and screened interval, producing aquifer, current status of the well, and usage or type of well.

- DEMS and TNRCC recommended that a new well be drilled in the deep aquifer (San Angelo Formation) to an approximate depth of 200 ft, down gradient to the silo.

Previous investigative surveys recommended that AMS No. 7 be classified as an industrial site. DEMS concluded based upon the concentrations and types of COPCs identified in the ESI Phase II, there was no advantage to classifying this site as industrial and closure could be met using the Residential RRS2 screening levels.

3.1.5. Expanded Site Investigation, Phase III, USACE, Tulsa District (2002)

SCAPS Investigation

The Tulsa District, Corps of Engineers SCAPS unit was deployed to the Former AMS No. 7 in April/May 2002 to delineate both the vertical and horizontal extent of chlorinated solvent contamination in the groundwater. Sixty-eight groundwater samples were collected from 20 temporary water sample collection wells (i.e. microwells). Locations sampled during this field effort are shown on Figure 3-4. Data collected from these efforts was used in the placement of three additional monitoring wells and the identification of potential source areas. This section is a summary of the SCAPS efforts. Field analytic techniques, sample analysis and other tasks completed during the SCAPS deployment can be found in Appendix C.

SCAPS Work

The Tulsa District's SCAPS unit uses cone penetrometer testing (CPT) sensors and a variety of other in-situ devices to provide real-time measurements of subsurface contamination. CPT is used to determine soil stratigraphy (soil strength and soil type). This is done using a probe that can measure tip resistance and sleeve friction. Tip resistance is measured using strain gauges and sleeve friction is measured using a floating cylindrical sleeve located behind the cone tip. The measurements are independent and can distinguish porous sands from silts and clays. This data was used to determine screening intervals for microwell installation and to identify any preferential pathways for contaminant migration. Two methods were used to collect water samples. The first method consisted of installing temporary microwells with Polyvinyl Chloride (PVC) pipe as the well casing. This method is similar to conventional monitoring wells with the exception of not having a sand pack to filter fine particles from the sample and the absence of above ground protective structures. The second method involved collecting groundwater samples through the push rods of the SCAPS unit. Once the depth of interest was achieved, the push rods were retracted in order to expose approximately ten feet of screen and enable groundwater infiltration. Balers were then lowered through the rods and into the screen for collection of samples.

Collection of Water Samples

Sixty-eight groundwater samples were collected from 20 locations and analyzed in real time using the Direct Sampling Ion Trap Mass Spectrometer (DSITMS). By providing immediate results, the SCAPS unit was able to setup in areas in which contaminant limits were not fully defined. On site chemical analysis was performed in accordance with EPA Method 8265. Refer to Figure 3-4 for the specific microwell locations. At most locations, shallow and deep groundwater samples were collected. On a few occasions where interpretation of the CPT proved to be more challenging, an intermediate sample was also collected. In general the shallow zone ranged from 15 to 30 ft below ground surface (bgs) and the deep zone averaged 40 to 60 ft bgs. The intermediate zone ranged between 25 to 40 ft bgs. A summary of the total number of samples collected and analyzed is presented in Table 3-1.

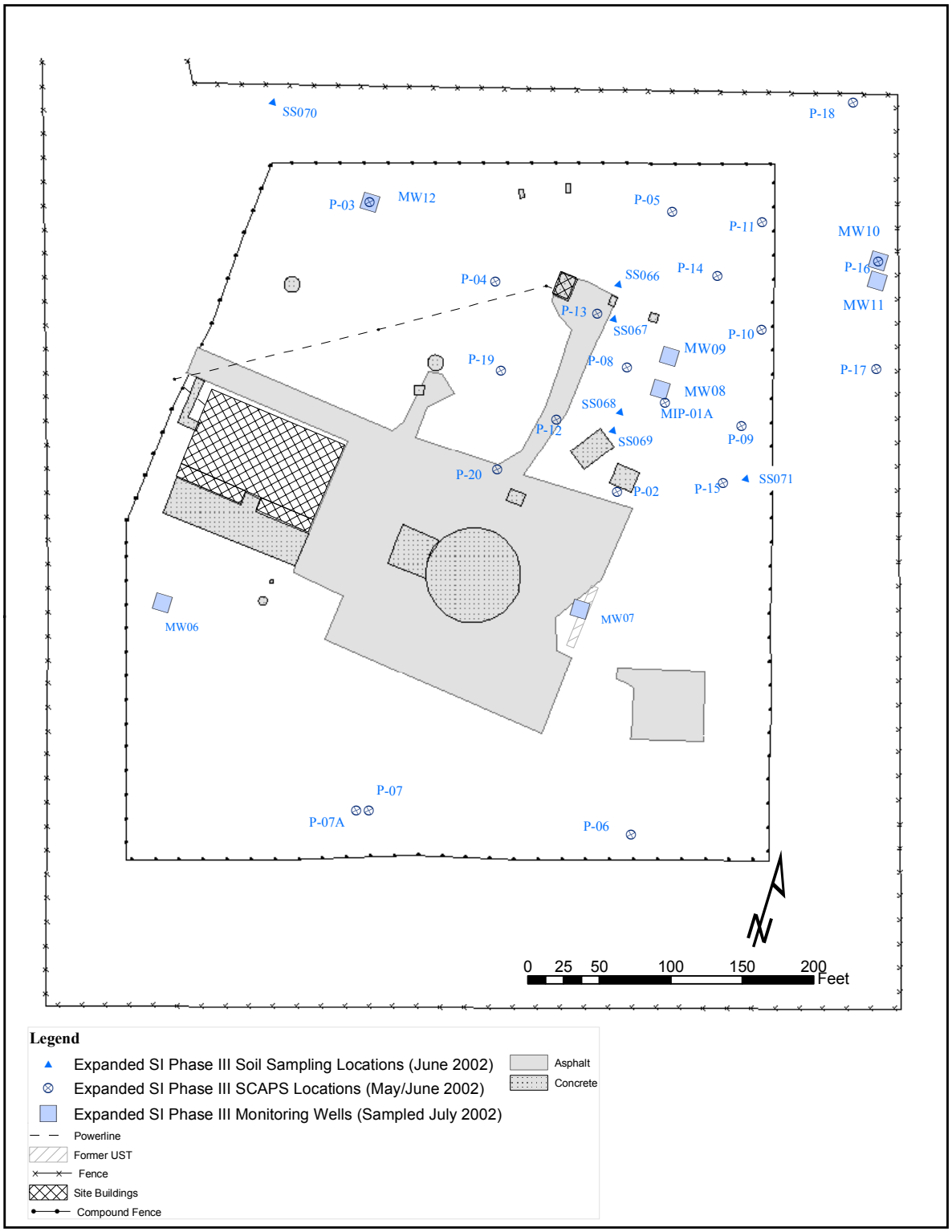


Figure 3-4 ESI Phase III Sampling Locations

Table 3-1 Synopsis of SCAPS Groundwater Samples

Installation Date	Location/Sample ID	Depth (ft bgs)	Date Sampled	Comments	Water Level (ft btoc)	Groundwater Zone	QA Sample	Analytical Date
04/05/02	MIP-01A	15-25	04/06/02		nr	S		4/6/02
		25-30	04/05/02		nr	I		4/5/02
		30-40	04/05/02		nr	I		4/5/02
		40-50	04/05/02		nr	D		4/5/02
05/25/02	P-2	25-35	05/25/02		nr	S		5/25/02
		25-35	05/27/02		25.47	S	Y	5/27/02
		35-45	05/25/02	Sampled through push rods	nr	D		5/25/02
05/22/02	P-3	25-35	05/23/02		24.36	S		5/23/02
		25-35	05/27/02		24.42	S		5/27/02
		40-50	05/23/02		24.78	D		5/23/02
05/22/02	P-4	20-30	05/23/02		24.20	S		5/23/02
		20-30	05/27/02		24.22	S		5/27/02
		37-47	05/23/02		24.52	D		5/23/02
05/23/02	P-5	21-31	05/23/02		23.21	S	Y	5/23/02
		21-31	05/27/02		23.23	S		5/27/02
		32-52	05/23/02	Sampled through push rods	nr	I		5/23/02
		58-68	05/23/02		23.28	D		5/23/02
05/23/02	P-6	18-28	05/24/02		23.90	S		5/24/02
		18-28	05/27/02		23.89	S		5/27/02
		36-46	05/23/02	Sampled through push rods	nr	I		5/23/02
		50-60	05/24/02		23.86	D		5/24/02
05/24/02	P-7	20-30	05/24/02		22.16	S		5/24/02
		20-30	05/27/02		22.20	S		5/27/02
		47-57	05/24/02	Sampled through push rods	nr	D		5/24/02
05/24/02	P-8	20-30	05/24/02		24.60	S	Y	5/24/02
		20-30	05/25/02		23.83	S		5/25/02
		20-30	05/27/02		23.85	S		5/27/02
		30-40	05/24/02	Sampled through push rods	nr	D	Y	5/24/02
05/24/02	P-9	20-30	dry		dry	S		5/25/02
		20-30	05/26/02		25.98	S		5/26/02
		20-30	05/27/02		24.53	S		5/27/02
		30-40	05/24/02	Sampled through push rods	26	I		5/24/02
05/24/02	P-10	20-30	05/25/02		21.70	S		5/25/02
		20-30	05/27/02		21.72	S		5/27/02
		30-40	05/24/02	Sampled through push rods	nr	I		5/24/02
		45-55	05/27/02	Sampled through push rods	nr	D		5/27/02
05/24/02	P-11	20-30	05/25/02		21.97	S		5/25/02
		20-30	05/27/02		21.99	S		5/27/02
		30-40	05/24/02	Sampled through push rods	nr	D		5/24/02
05/25/02	P-12	20-30	05/25/02		27.47	S		5/25/02
		20-30	5/26/02		27.43	S		5/26/02
		20-30	05/27/02		27.43	S		5/27/02
		25-35	05/25/02		27.16	I		5/25/02
		25-35	05/27/02		26.78	I		5/27/02
		25-35	05/26/02		26.87	I		5/26/02
		40-50	05/25/02	Sampled through push rods	nr	D		5/25/02
05/25/02	P-13	20-30	05/23/02		29.27	S		5/26/02
		20-30	05/27/02		28.58	S		5/27/02
		40-50	05/25/02	Sampled through push rods	nr	I		5/25/02
		48-58	05/27/02	Sampled through push rods	nr	D		5/27/02
05/25/02	P-14	20-30	05/26/02		22.34	S		5/26/02

Installation Date	Location/Sample ID	Depth (ft bgs)	Date Sampled	Comments	Water Level (ft btoc)	Groundwater Zone	QA Sample	Analytical Date
		20-30	05/27/02		22.34	S		5/27/02
		40-50	05/25/02	Sampled through push rods	nr	D		5/25/02
05/26/02	P-15	22-32	05/26/02		21.83	S		5/26/02
		22-32	05/27/02		21.85	S		5/27/02
05/26/02	P-16	25-35	05/25/02		21.06	S	Y	5/27/02
		37-47	05/26/02	Sampled through push rods	nr	I		5/26/02
		45-55	05/27/02	Sampled through push rods	nr	D		5/27/02
05/26/02	P-17	20-30	05/27/02		20.32	S	Y	5/27/02
		37-47	05/26/02	Sampled through push rods	nr	D		5/26/02
	P-18	20-30	05/27/02		22.41	S	Y	5/27/02
		40-50			nr	D		5/27/02
05/27/02	P-19	20-30	05/27/02		24.80	S	Y	5/27/02
05/27/02	P-20	22-32	05/27/02		27.40	S	Y	5/27/02
NA	AMS7-WW	0	05/25/02	On-site water well				5/25/02
5/27/02	SCAPS Decon	0	5/27/02	SCAPS decon water				5/27/02

nr – data not reported.
S – represents the shallowest zone sampled.
I – represents an intermediate zone sampled.
D – represents the deepest zone sampled

Nine quality assurance (QA) samples were sent to a USACE certified laboratory to confirm delineation of the contaminant plume and to aide in validating the results from the on site DSITMS.

Field Analytical DSITMS

Water

TCE was detected in eight push locations at concentrations ranging from 0.51 to 246.74 ug/l. Samples taken from screened intervals wholly within the lower zone were free of TCE or other volatile constituents whereas samples from the upper zone at the same locations had volatile organic compounds detected. A definitive source area for the TCE was not determined. The identified groundwater contours are consistent with the direction in which contamination appears to be migrating. TCE contamination appears to be limited to the northeast corner of the site as shown in Figure 3-5. Figure 3-5 shows the sample locations with the TCE results and sample interval in conjunction with the TCE distribution interpretation as indicated by the TCE iso-concentration contours. Table C-3 in Appendix C provides a complete listing of all DSITMS analytical results.

Discrepancies in regional groundwater flow reported in earlier investigations were resolved which resulted in flow patterns similar to the direction in which contamination appears to be migrating.

Soil

Surface soil samples were collected and analyzed for total lead, zinc, and PCBs. Based upon the results of the total lead, zinc and PCBs, samples were selected to be analyzed using the Synthetic Precipitation Leaching Procedure (SPLP) Method 1312. The samples for metals were selected as representative of the high, median and low range of total metals results. The samples selected for SPLP analysis of PCBs were intended to represent the high and low range

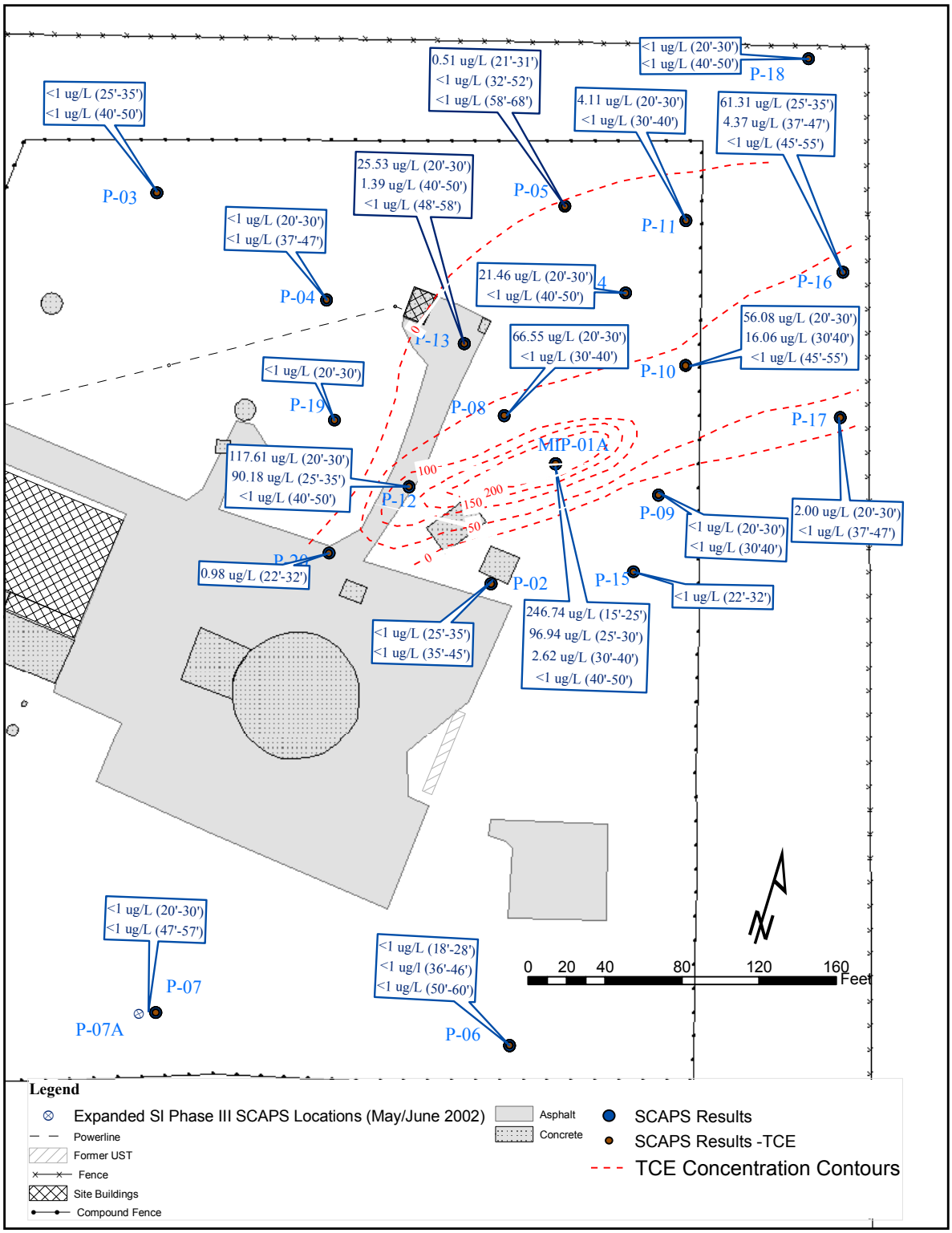


Figure 3-5 TCE Iso-concentration Map and SCAPS Results

of detected PCB concentrations. AMS7-SS066, AMS7-SS068 and AMS7-SS070 were analyzed using SPLP for lead and zinc. AMS7-SS067 and SMS7-SS071 were analyzed for Aroclor 1016, Aroclor 1221, Aroclor 1232, Aroclor 1242, Aroclor 1248, Aroclor 1254 and Aroclor 1260 using the SPLP procedures. The results for the SPLP analyses are listed in Table 3-2.

Table 3-2 ESI Phase III Surface Soil Analytical Results

Totals Analytical Results							
Parameter	Units	AMS7-SS066	AMS7-SS067	AMS7-SS068	AMS7-SS069	AMS7-SS070	AMS7-SS071
Metals		**SW846 3050B/6010B**	**SW846 3050B/6010B**	**SW846 3050B/6010B**	**SW846 3050B/6010B**	**SW846 3050B/6010B**	**SW846 3050B/6010B**
Lead	ug/Kg	148000	115000	12300	28000	7970	6850
Zinc	ug/Kg	94500	67900	58300	114000	28800	32700
PCBs		**SW846 8082**	**SW846 8082**	**SW846 8082**	**SW846 8082**	**SW846 8082**	**SW846 8082**
Aroclor-1016	ug/Kg	< 17.7	1.90 HJ	< 18.3	< 7.08	< 3.63	< 3.58
Aroclor-1221	ug/Kg	< 17.7	< 3.55 HU	< 18.3	< 7.08	< 3.63	< 3.58
Aroclor-1232	ug/Kg	< 17.7	< 3.55 HU	< 18.3	< 7.08	< 3.63	< 3.58
Aroclor-1242	ug/Kg	< 17.7	< 3.55 HU	63.5	< 7.08	< 3.63	< 3.58
Aroclor-1248	ug/Kg	< 17.7	< 3.55 HU	< 18.3	< 7.08	< 3.63	< 3.58
Aroclor-1254	ug/Kg	< 17.7	52.0 H	52.0	31.9	< 3.63	5.20
Aroclor-1260	ug/Kg	< 17.7	386 H	386	< 7.08	< 3.63	17.9
SPLP Analytical Results							
Metals							
Lead	ug/L	83.0		<26.6		<26.6	
Zinc	ug/L	61.5		47.6		<20.9	
PCBs							
Aroclor-1016	ug/L		<0.875				<0.875
Aroclor-1221	ug/L		<4.17				<4.17
Aroclor-1232	ug/L		<1.9				<1.9
Aroclor-1242	ug/L		<2.22				<2.22
Aroclor-1248	ug/L		<1.35				<1.35
Aroclor-1254	ug/L		<1.26				<1.26
Aroclor-1260	ug/L		<0.670				<0.670

The SPLP results for AMS7-SS067 and AMS7-SS071 did not indicate any leaching of Aroclor 1254 or Aroclor 1260. AMS7-SS067 contained 52.0 ug/kg Aroclor 1254 and 386 ug/kg Aroclor 1260. Therefore, any samples with concentrations below 52.0 ug/kg of Aroclor 1254 and 386 ug/kg of Aroclor 1260 should not have any impact to the ground water. It is possible that samples above these levels may have leaching, although data does not demonstrate this. Only five samples had concentrations above these levels: AMS7-SS001, SS006, SS036, SS047, and SS049. If these samples did leach, the impact to groundwater would be minimal since these sample locations are not concentrated in one area. Figure 3-2 shows the locations of these samples. In addition, groundwater data collected during the various phases of investigation have not indicated the presence of Aroclor 1254 or Aroclor 1260; demonstrating that no leaching has been detected at AMS #7.

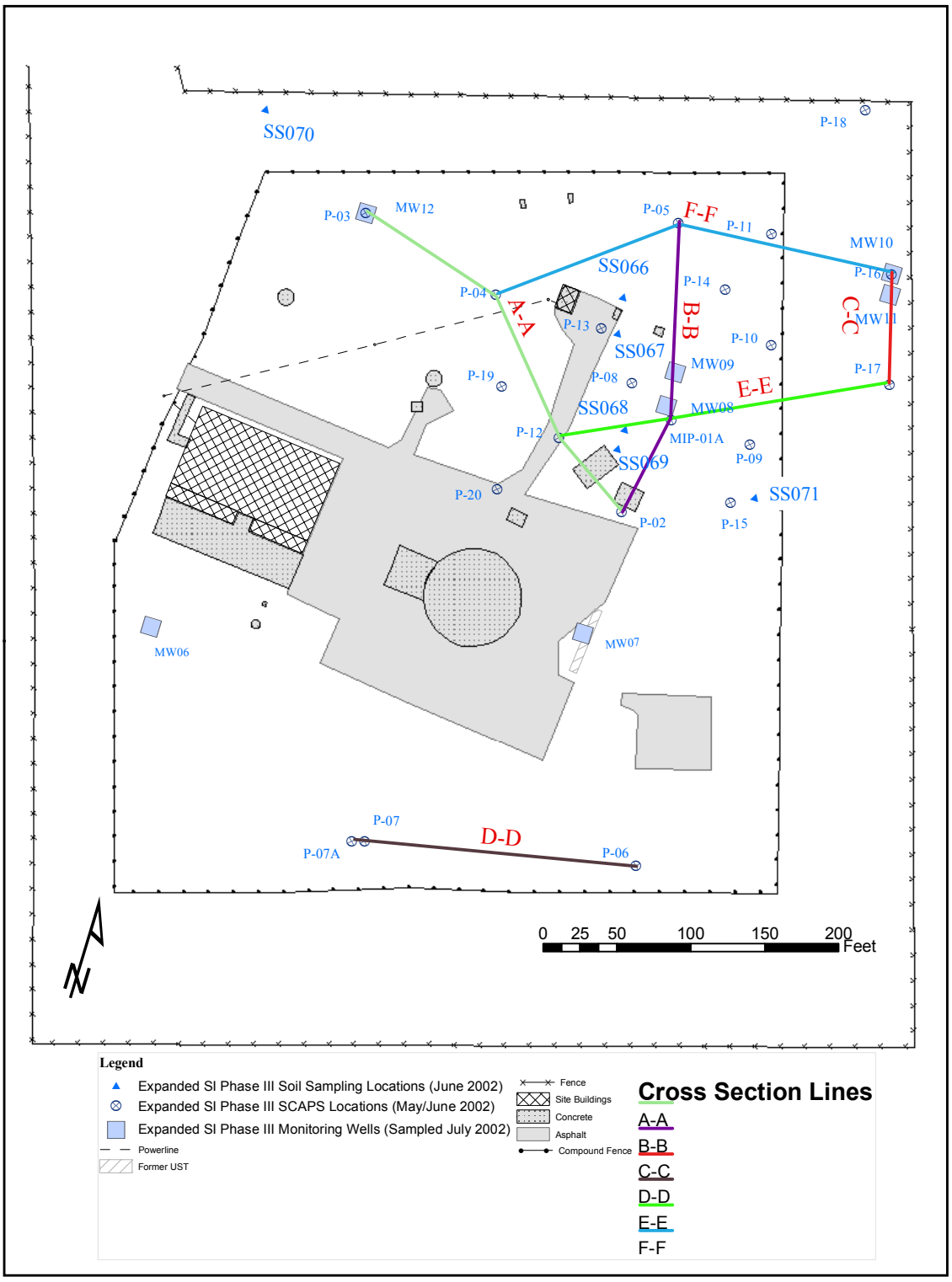
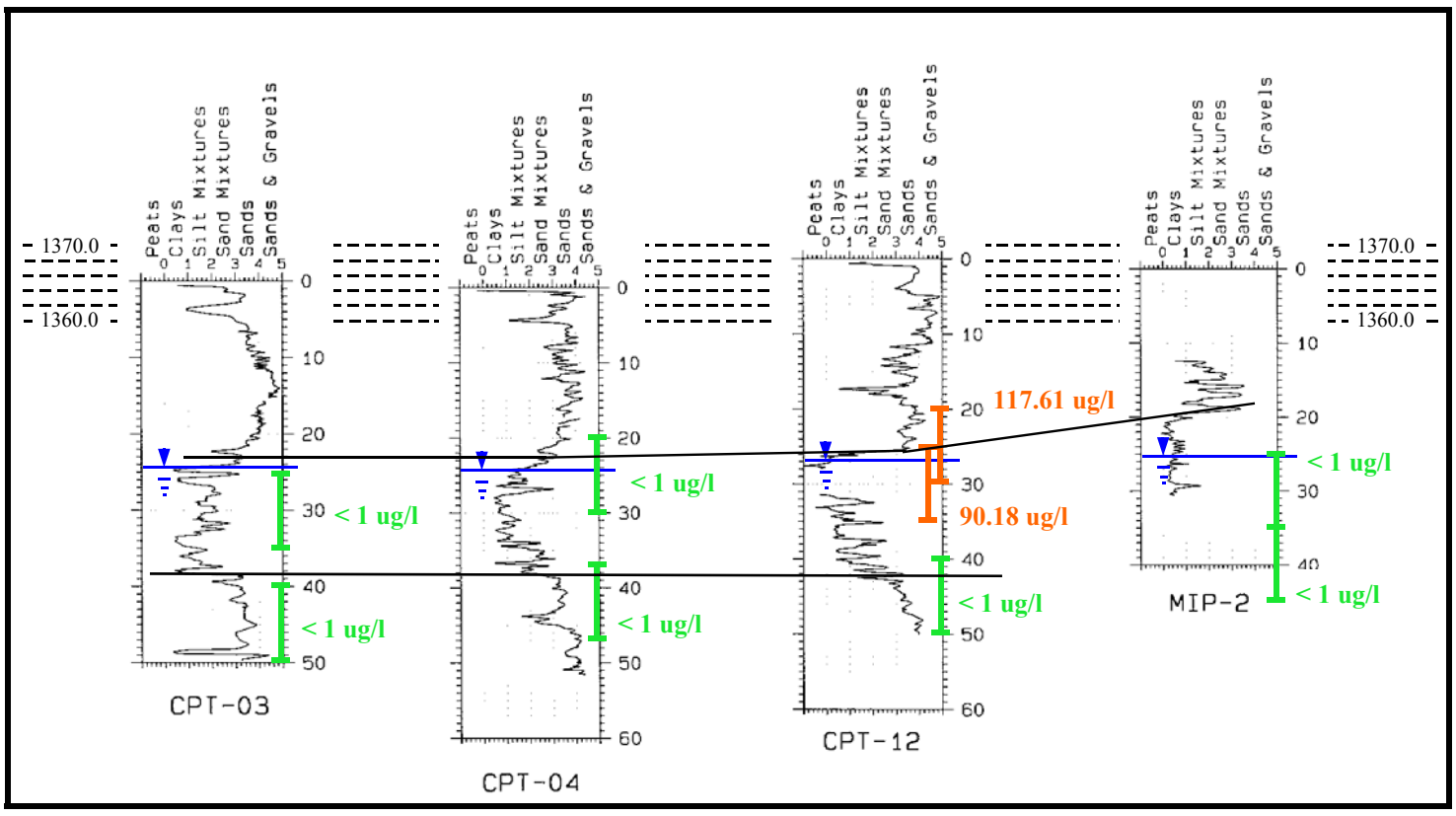
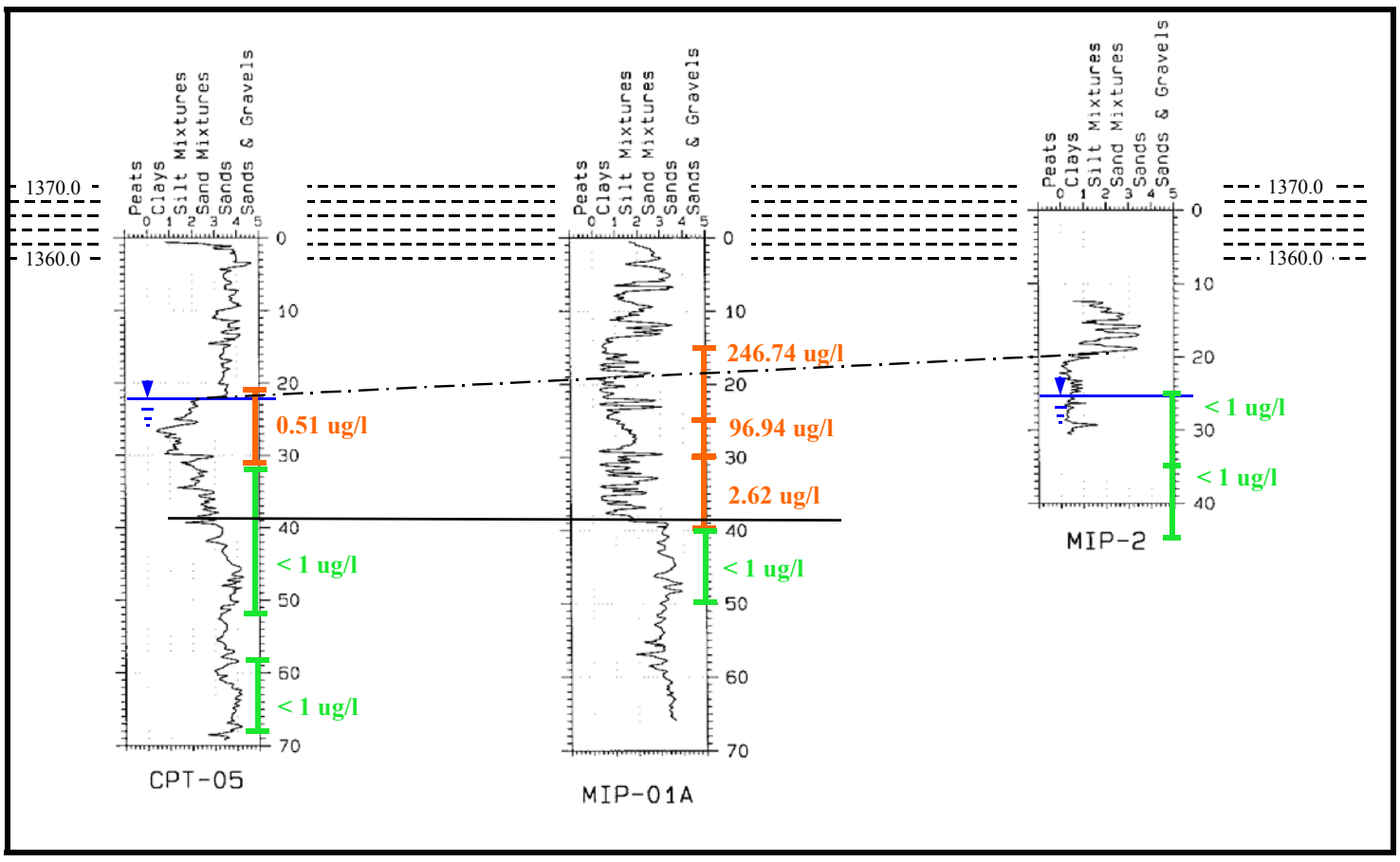


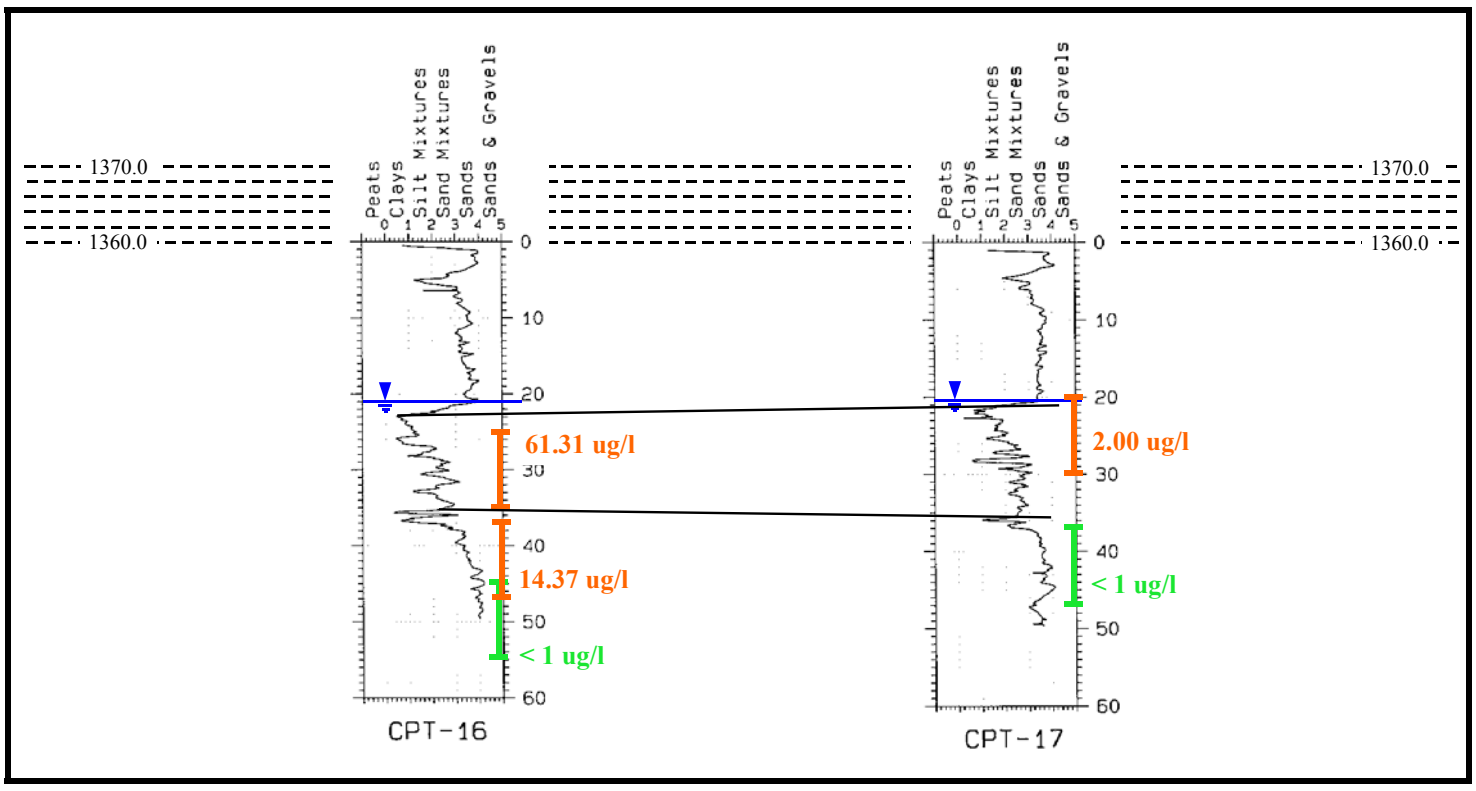
Figure 3-6 Lines of SCAPS CPT Cross Sections



A-A

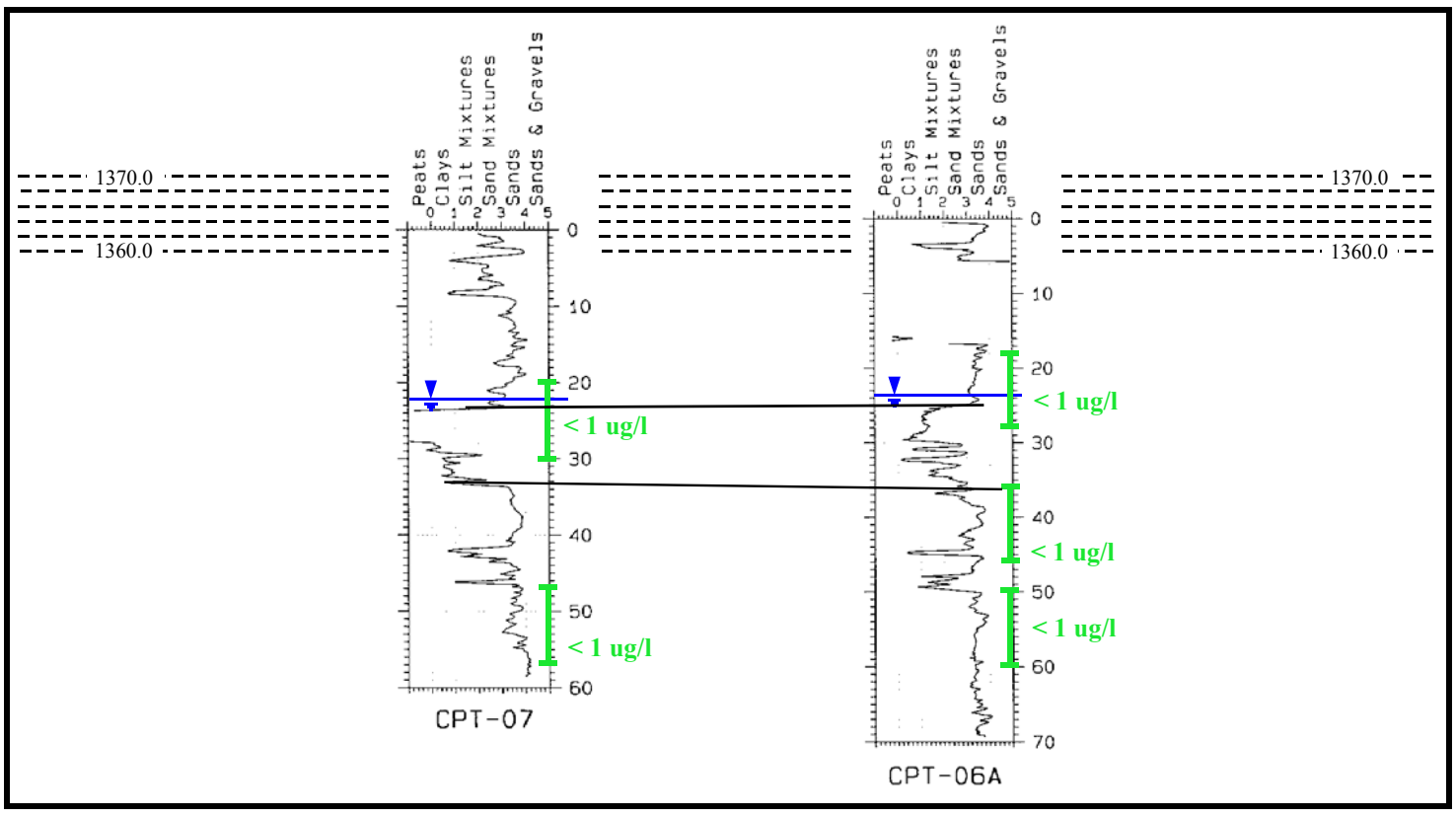


B-B

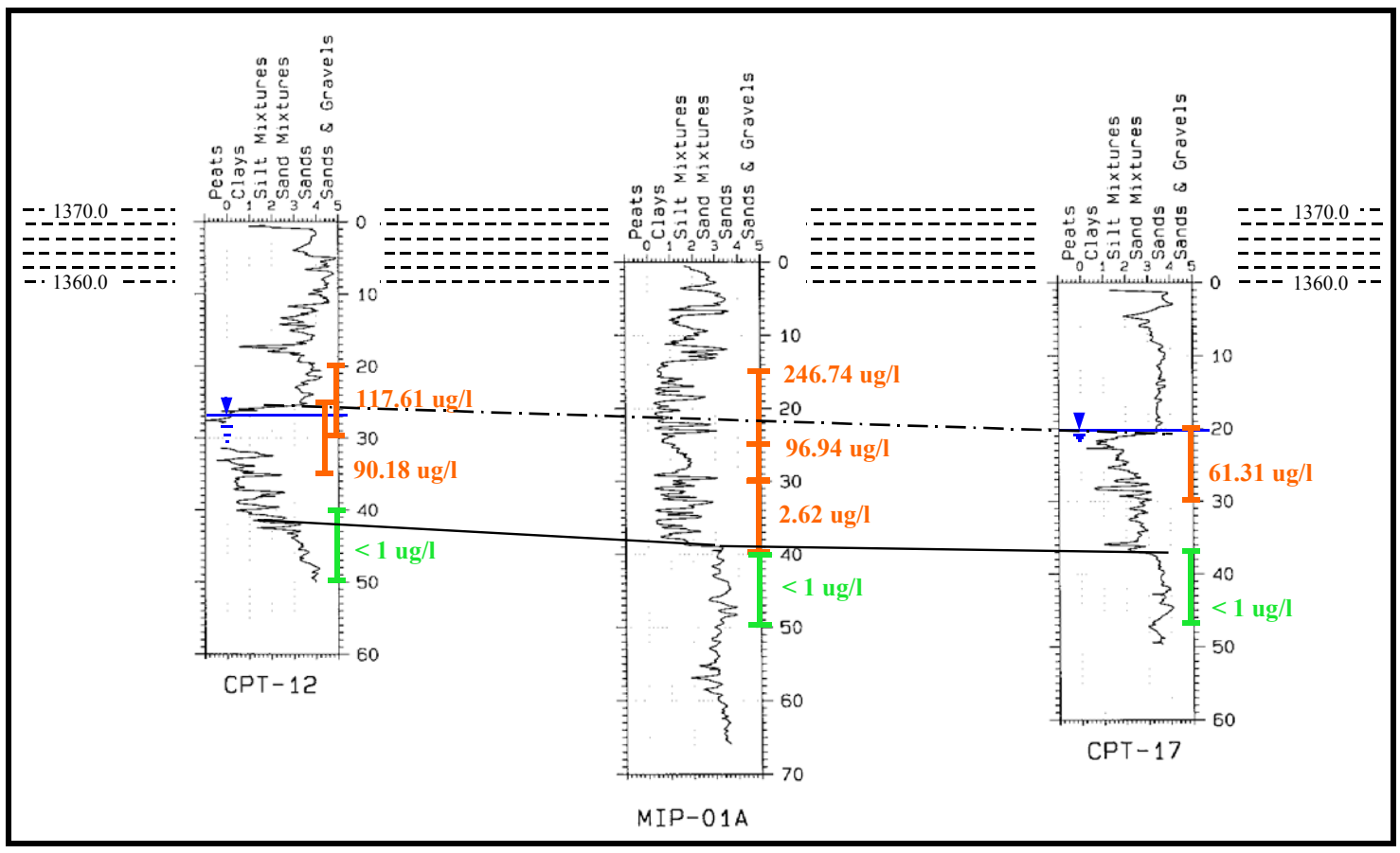


C-C

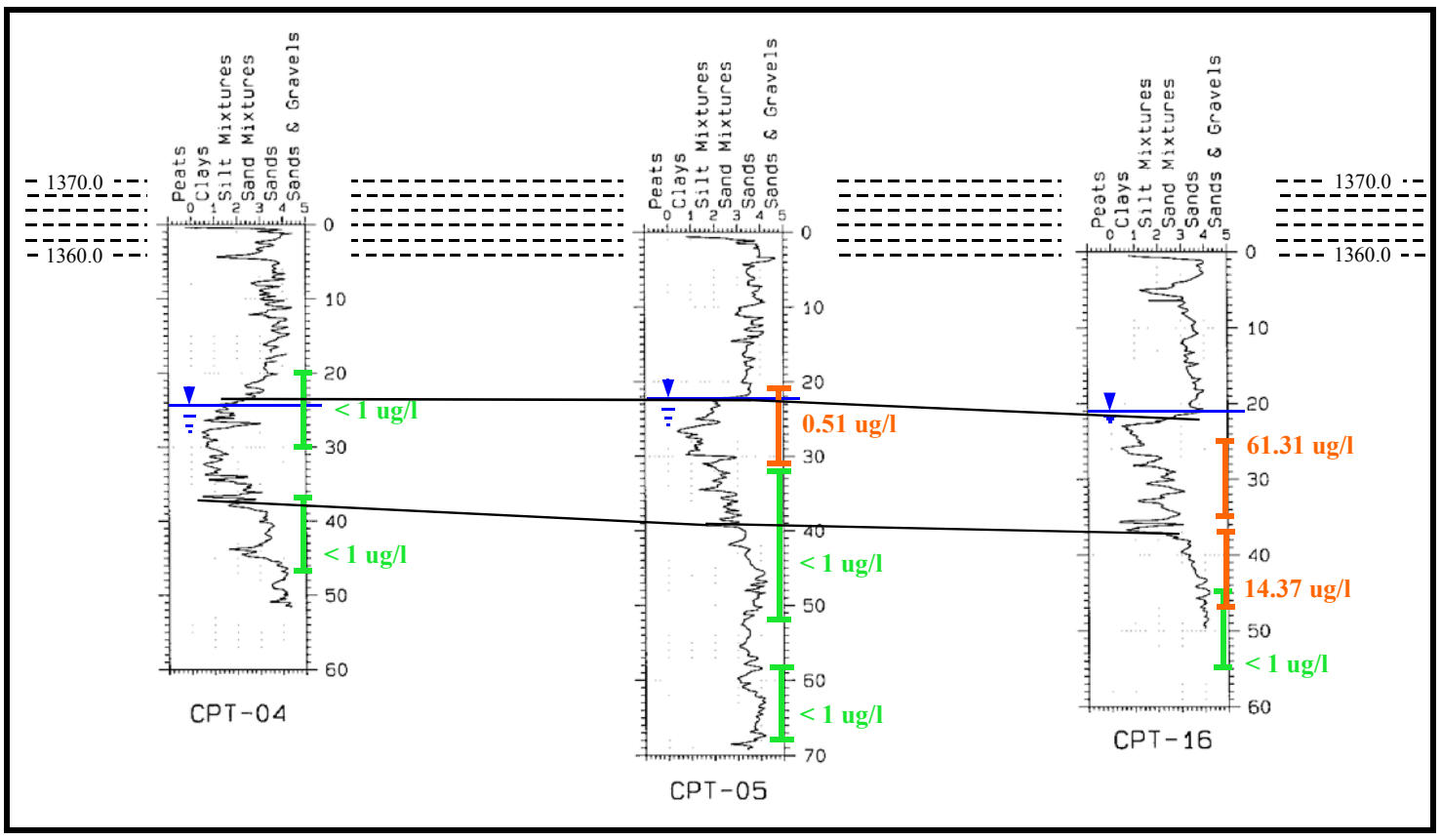
Figure 3-7: SCAP Logs and Cross Sections
Atlas Missile Silo No. 7
Vernon, Texas



D-D



E-E



F-F

Figure 3-8: SCAP Logs and Cross Sections
Atlas Missile Silo No. 7
Vernon, Texas

Monitor Well Installation

During the week of June 25, 2002, following the determination of the groundwater flow direction and groundwater plume orientation using the direct push technologies, three monitoring wells were installed at the site. The drilling and installation of these wells was subcontracted to Cherokee America Drilling in cooperation with Mohawk Drilling, Inc. The placement of these wells is shown in Figure 3-6 with a completion summary provided in the table below. MW10 was installed to a depth of 210 ft in the San Angelo Formation with a screened interval from a depth of 200 ft to 210 ft below ground surface with the intent to sample groundwater at a depth approximately equal to the total depth of penetration of the missile silo construction. MW11 was installed in the Seymour Formation to a total depth of 35 ft with a screened interval from 25 ft to 35 ft bgs with the intent of monitoring groundwater in the uppermost aquifer. MW12 was also installed as a shallow well in the Seymour Formation with its total depth being 37 ft and a screened interval of 27 ft to 37 ft bgs. MW12 was installed to monitor groundwater conditions upgradient to the affected silo area. State of Texas well reports, daily field notes and the Site Safety and Health Plan utilized for this effort are provided in Appendix D of this report.

Table 3-3 Expanded Site Investigation Phase II Well Completion Information

Well ID	Date Drilled	Screened Interval (Feet)	Total Depth (Feet)	Estimated Development Volume (Gallon)
MW10	26-28 June 2002	200-210	210	450
MW11	27 June 2002	25-35	35	250
MW12	27 June 2002	27-37	37	166

The shallow wells, MW11 and MW12, were installed using 8-inch diameter hollow stem augers to set the 4-inch PVC pipe and screen. Sand filter pack was installed to approximately 2 ft above the screened interval with a bentonite seal placed from 5 ft to 7 ft above the filter pack. The remaining annular space was filled with a cement/bentonite slurry.

For the installation of MW10, a rotary mud drilling unit was used to set an 8 5/8-inch diameter steel surface/isolation casing from ground surface into lithified materials at a depth of 140 ft. Pressure grounting equipment was used to circulate a bentonite/grout mixture around the outside of the casing to ground surface from the bottom of the drilled hole. After the cement/grout mixture had been allow to set more than 24 hours, the cement was drilled out using an air rotary drilling unit equipped with an 8-inch bit. After drilling out of the isolation casing, water began filling the borehole. The response of the bit and drill pipe while drilling indicated weathered and fractured strata. Upon reaching a total depth of 210 ft, schedule 80 PVC screen and casing were installed with the screened interval placed from 200 ft to 210 ft bgs. Sand filter pack was placed from 196 ft to 210 ft. Bentonite pellets were placed from 140 ft to 196 ft bgs. A cement/bentonite slurry was used to fill the remaining annular space from groundsurface to 140 ft bgs.

All wells were completed with a locking outer casing set into a concrete pad. Steel bollards were placed at the corner of each pad as additional protection for the well casing.

All wells were developed using a downhole electric pump with a capacity of approximately 15 gpm. While pumping water out the pump was periodically raised and lowered to produce a surge effect to remove fine materials from within the sand filter pack. The wells were purged until the produced water was free of particulate matter. Wells MW11 and MW12 were developed 1-2 July 2002 and MW10 was developed 9-11 July 2002. Estimated volumes of development water are included in the Table 3-3.

Monitor Well Sampling Results

During the week of 8 July 2002, following the installation of monitoring wells MW10, MW11 and MW12, all seven wells at AMS No. 7 were sampled by personnel from the Tulsa District Corps of Engineers. Wells MW06, MW07 and MW09 were sampled using low flow techniques with the remainder purged and sampled using conventional sampling techniques.

Samples from all wells were shipped to a Corps validated laboratory, General Engineering Laboratory (GEL) in Charleston, SC, and analyzed for anions (chloride and nitrate/nitrite), metals (arsenic, barium, cadmium, lead, mercury, selenium, silver, zinc), volatile organic compounds and semi-volatile organic compounds. One quality control sample was collected and sent to GEL for duplicate analysis. One quality assurance sample was collected and sent to Environmental Testing and Chemistry for analysis. Table 3-4 lists the results for anion and metals analyses. Detected concentrations for the volatile organic compounds and semi-volatile organic compounds are provided in Table 3-5. A complete listing of analytical results is provided in Appendix D.

Metals

Arsenic was detected in three of the seven wells with a reporting limit of 5 ug/l. The detections ranged from 2.33 to 8.09 ug/l.

Barium was detected in all seven wells with concentrations ranging from 51.1 to 660 ug/l. The two lowest concentrations, 51.1 and 71.6 ug/l, were from wells completed in the lower San Angelo formations. The remaining detections ranged from 193 to 660 ug/l and were from the shallower Seymour formation with the highest concentration found in well MW08.

Cadmium was detected in samples from one well, MW08, at a concentration of 0.671 ug/l, an estimated value below the reporting limit of 2 ug/l.

Chromium was detected in five of the seven wells with concentrations ranging from 0.793 to 28.9 ug/l. The highest concentration, 28.9 ug/l, was found in groundwater from well MW08.

Lead was in four of the seven wells at concentrations ranging from 3.48 to 14.8 ug/l. The highest concentration, 14.8 ug/l, was found in groundwater from well MW08.

Mercury was not detected in any of the monitoring wells. The reporting limit for mercury was 0.2 ug/l.

Selenium was not detected in any of the groundwater samples. The reporting limit for the selenium samples was 5 ug/l.

Silver was detected in only one of the seven wells. A concentration of 2.23 ug/l was reported from MW12.

Zinc was detected in six of the seven wells a concentrations ranging from 2.24 to 243 ug/l. The maximum concentration was reported from groundwater collected from MW09.

Table 3-4 Metal and Anion Results from July 2002 Sampling of Monitoring Wells

Monitoring Well		MW06	MW07	MW08	MW09	MW10	MW11	MW12
Sample Date		7/9/2002	7/9/2002	7/11/2002	7/9/2002	7/11/2002	7/10/2002	7/10/2002
ANIONS	Units							
(Method 300.0)								
Chloride	mg/l	0.879	9.64	5.55	1650	520	8.03	1.74
(Method 353.1)								
Nitrogen, Nitrate/Nitrite	mg/l	9.75	0.010 J	0.030 J	0.020 J	0.020 J	2.8	6.25
METALS								
(Method 6010B)								
Arsenic	ug/l	2.33 J	< 5.00	8.09	3.15 J	< 5.00	< 5.00	< 5.00
Barium	ug/l	193	255	660	51.1	71.6	350	337
Cadmium	ug/l	< 2.00	< 2.00	0.671 J	< 2.00	< 2.00	< 2.00	< 2.00
Chromium	ug/l	0.965 J	< 5.00	28.9	< 5.00	5.77	0.793 J	6.09
Lead	ug/l	< 4.00	< 4.00	14.8	3.48 J	4.67 J	3.68 J	< 4.00
Selenium	ug/l	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00
Silver	ug/l	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00	2.23 J
Zinc	ug/l	2.24 J	< 5.00	57.9	243	29	5.71	12.1
(Method 7470A)								
Mercury	ug/l	< 0.200	< 0.200	< 0.200	< 0.200	< 0.200	< 0.200	< 0.200

J indicates detected quantity is below the reporting limit and should be considered as an estimate.

Volatile Organic Compounds

As shown in Table 3-5, five volatile organic compounds were detected in groundwater samples from the seven monitoring wells. The detections of trichloroethene and daughter products, cis-1,2-dichloroethene and trans-1,2-dichloroethene, confirmed the shallow groundwater plume as identified by the SCAPS investigation. There was a single detection of bromomethane in MW11 at 3.34 ug/l. The detections of 1,4-dichlorobenzene are low level and considered to be due to laboratory contamination as indicated by the detections of this compound in method blank samples.

Semi-Volatile Organic Compounds

As shown in Table 3-5, three semi-volatile organic compounds were detected in groundwater samples from the seven monitoring wells. Bis(2-ethylhexyl)phthalate was detected in groundwater samples from MW10 and MW11. Diethylphthalate was detected in groundwater samples from three wells as well as in laboratory blank samples. One low level detection of di-n-butylphthalate was reported from MW12. Phthalates are common laboratory contaminants and are not expected to be present as a result of site activities.

Table 3-5 Detected Volatile Organic Compounds and Semi-Volatile Organic Compounds from July 2002 Sampling of Monitoring Wells

Monitoring Well		MW06	MW07	MW08	MW09	MW10	MW11	MW12
Collection Date		7/9/2002	7/9/2002	7/11/2002	7/9/2002	7/11/2002	7/1072002	7/10/2002
VOLATILE ORGANIC COMPOUNDS (Method 8260B)								
Trichloroethene	ug/l	< 1.00	< 1.00	**94.9**	< 1.00	< 1.00	**55.4**	< 1.00
cis-1,2-Dichloroethene	ug/l	< 1.00	< 1.00	**36.3**	< 1.00	< 1.00	**5.62**	< 1.00
trans-1,2-Dichloroethene	ug/l	< 1.00	< 1.00	**2.5**	< 1.00	< 1.00	**0.526 J**	< 1.00
Bromomethane	ug/	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	**3.34**	< 1.00
1,4-Dichlorobenzene	ug/l	< 1.00	**0.379 BJ**	**0.278 BJ**	< 1.00	**0.268 BJ**	**0.383 BJ**	**0.331 BJ**
SEMI-VOLATILE ORGANIC COMPOUNDS (Method 8270C)								
bis(2-Ethylhexyl)phthalate	ug/l	< 9.80	< 9.71	< 9.71	< 9.62	**4.69 J**	**9.56 J**	< 9.80
Diethylphthalate	ug/l	< 9.80	**0.935 BJ**	< 9.71	**0.948 BJ**	< 9.71	**0.956 BJ**	< 9.80
Di-n-butylphthalate	ug/l	< 9.80	< 9.71	< 9.71	< 9.62	< 9.71	< 9.80	**1.01 J**

J indicates detected quantity is below the reporting limit and should be considered as an estimate.

B indicates detections were found in laboratory method blanks.

Section 4. Risk Characterization

4.1. Evaluation of Data using Risk Reduction Standards

Data collected from the Site Investigation, ESI Phase I, ESI Phase II, and ESI Phase III were compiled and evaluated using the RRSs and Compliance Memorandum, dated July 23, 1998. Prior to evaluating the data with the RRSs, the data were screened using the four criteria addressed in the Compliance Memorandum. Data that met any of the four following criteria were eliminated from further evaluation:

- The contaminant is detected in less than 5% of the samples for a particular medium; it is not detected in any other sampled medium; its maximum concentration does not exceed health-based concentrations and there is no reason to believe that it is associated with current or historical site activities;
- The contaminant is a common laboratory contaminant; concentrations of the contaminant in all samples for a particular medium are less than ten times the maximum amount detected in any associated blank; the contaminant is not a transformation product of contaminants present at the site; and there is no reason to believe that it is associated with current or historical site activities;
- The contaminant is not considered by the U.S. Environmental Protection Agency (USEPA) to be a common laboratory contaminant as defined above and the concentration detected in all samples for a particular medium are less than five times the maximum amount detected in any associated blank; the contaminant is not a transformation product of contaminants present at the site; and there is no reason to believe that it is associated with current or historical site activities; and

- The contaminant is a tentatively identified compound (TIC); the contaminant is not a transformation product of contaminants present at the site; and there is no reason to believe that it is associated with current or historical site activities.

Using the above data screening criteria, only TICs were eliminated from the compiled data set.

Bis(2-ethylhexyl)phthalate detected in many of the soil samples collected for the Site Investigation was not detected in surface or subsurface soils during subsequent investigations. Therefore, the presence of bis(2-ethylhexyl)phthalate in the site investigation was an artifact of sampling or lab procedures and not an onsite contaminant. (Expanded Site Investigation Report, January 2001). Since bis(2ethylhexyl)phthalate was not due to onsite contamination, it was not included in this risk evaluation.

Other constituents not evaluated include calcium, iron, magnesium, potassium, and sodium. According to TNRCC guidance, these compounds are not considered to be of concern from a human health standpoint.

4.1.1. Risk Reduction Standard 1

To evaluate if closure under Risk Reduction Standard (RRS) 1 is practical at AMS #7, a comparison of sampling results to background was conducted. Since an industrial scenario is assumed for AMS #7, background soil samples from the surface to top of ground water were used to determine the site-specific background values. The soils encountered in this interval were of the Seymore Formation and did not vary significantly in composition. An upper confidence limit (UCL) was calculated using the Chebychev Theorem as outlined in The Lognormal Distribution in Environmental Applications (EPA/60/R-97/006). The size of the sample population varied among constituents since the analyte list during the various phases of the investigation changed. Table 4-1 lists the constituent, sample population size, highest background concentration, and UCL.

Table 4-1. Calculated Background UCL

Atlas Missile Site #7 Vernon, Texas			
Constituent	**Sample Population Size**	**Highest Background Concentration (mg/kg)**	**Upper Confidence Limit (mg/kg)**
Aluminum	6	10,600	13,989
Arsenic	11	1.4	1
Barium	11	74.5	75
Chromium	11	10.1	11
Copper	6	3.4	4
Lead	11	5	5
Manganese	6	92.9	128
Nickel	6	5.4	6
Vanadium	6	16.9	21
Zinc	10	17.2	35

Once the site-specific background values were calculated, a comparison of the highest detected concentration to background was conducted. Several of the metals were above background values. Also, several organic compounds were detected that were not detected in the background samples. Because of metal concentrations above background and the presence of organics at the site, closure under RRS 1 seemed impractical and further evaluation under RRS 2 was necessary. Groundwater was not evaluated under RRS 1 since the decision to evaluate under RRS 2 had been determined based on the soil data. The highest detected concentration and corresponding background value are listed in Table 4-2.

Table 4-2 Comparison of Highest On-Site Concentrations to Background

Atlas Missile Site #7 Vernon, Texas		
Constituent	**Highest On-Site Concentration (mg/kg)**	**Background UCL (mg/kg)**
Aluminum	11,800.0	13,989
Arsenic	3.9	1
Barium	206.3	75
Chromium	13.4	11
Copper	16.0	4
Lead	288.0	5
Manganese	294.0	128
Nickel	8.5	6
Vanadium	17.7	21
Zinc	365.0	35

4.1.2. Risk Reduction Standard 2

Having determined that closing the site to RRS1 was impractical; the compiled data was evaluated using the RRS2 protocol. An industrial exposure scenario was selected as the most reasonable exposure scenario for the current and future land use. AMS No. 7 was identified as excess property and deeded over to the Northside Independent School District No. 905, Vernon, Texas in 1967. The School District has retained ownership of the property since that time and property has been used by the Future Farmers of America (FFA) for livestock shows and other events. Events are held at the site no more than once a month. Since exposure assumptions in the industrial scenario are more frequent and of longer duration than the reasonably anticipated exposures, the industrial scenario is a very conservative approach to assessing exposures at AMS No. 7.

A list of contaminants of potential concern (COPCs) was generated by comparing sampling results to the RRS2 MSCs for an industrial scenario. Any constituents detected above MSCs or may impact the groundwater quality was listed as a COPC. Potential exposure pathways for COPC would then be evaluated.

Determination of Potential Contaminants of Concern

Soil Evaluation with Respect to Medium Specific Concentration Levels

To evaluate the soil data with respect to an industrial scenario, the data were grouped by 0 – 2 ft bgs and 2 ft bgs – top of groundwater. The highest detected concentration of a constituent in each group was compared to the soil medium specific concentration for industrial use based on inhalation, ingestion, and dermal contact (SAI-Ind) and Groundwater Protection Values for industrial scenario (GWP – Ind) listed in Appendix II of the RRS, dated March 28, 2002. The default exposure assumptions used to develop the industrial MSCs are very conservative in comparison to the reasonable maximum exposure an FFA member may actually experience. Therefore, if no risk is anticipated for the industrial worker scenario, it is highly unlikely that there would be a risk for the reasonably anticipated exposure of an FFA member.

0 – 2 ft bgs Soil Interval Evaluation

Table 4-3 lists the constituent, sample location of highest concentration, highest detected concentration, SAI - Ind and GWP – Ind for the 0 – 2 ft bgs group. There were no constituents detected above the SAI-Ind for an industrial scenario for the 0 – 2 ft bgs group. Therefore, there is an acceptable level of risk for an industrial worker exposed to the surface soils at AMS No. 7.

However, there were several constituent levels in the 0-2 ft bgs soils above the GWP – Ind: aluminum, Aroclor 1254, Aroclor 1260, arsenic, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, chromium, and lead. Since these constituents are above the GWP-Ind, there is a chance they may affect the ground water. An evaluation of each constituent's potential to impact the ground water was conducted and follows.

Aluminum was detected in two samples within 0 – 2 ft bgs slightly above the GWP-Ind of 10,000 mg/kg. However, the UCL of background for aluminum is 13, 989 mg/kg. All of the surface soil results were below this background level. It appears that the concentrations of aluminum in the surface soil are within the natural variation of background for that area and are not due activities at AMS No. 7. Any affect aluminum has on the ground water is due to naturally occurring levels.

SPLP analyses were conducted on selected samples to determine if Aroclor 1243, Aroclor 1260 and lead were a potential risk to the ground water. Soil samples AMS7-SS066, AMS7-SS068, AMS7-SS070 were analyzed for lead. Samples AMS7-SS067 and AMS7-SS071 were analyzed for Aroclor 1016, Aroclor 1221, Aroclor 1232, Aroclor 1242, Aroclor 1248, Aroclor 1254 and Aroclor 1260. The results for the SPLP analyses are listed in Table 3-3 in Section 3 of this report.

The SPLP results for AMS7-SS067 and AMS7-SS071 did not indicate any leaching of Aroclor 1254 or Aroclor 1260. AMS7-SS067 contained 52.0 ug/kg Aroclor 1254 and 386 ug/kg Aroclor 1260. Since these are the highest concentrations tested, we do not know at what concentration leaching may occur. As a conservative approach, it is assumed that any samples above 52.0 ug/kg of Aroclor 1254 and 386 ug/kg of Aroclor 1260 may leach. Only five samples had concentrations above these levels: AMS7-SS001, SS006, SS036, SS047, and SS049. Figure 3-4 shows the locations of these samples. It is possible that these samples may have leaching, although we do not have data that demonstrates this. Aroclor 1254 or

Aroclor 1260 has not been detected in soil samples below 2 ft bgs. In addition, groundwater samples collected during the various phases of investigation have not indicated the presence of Aroclor 1254 or Aroclor 1260. These data indicate that the Aroclor 1254 and 1260 have not leached from the surface soils. The detected concentrations of Aroclor 1254 and Aroclor 1260 in the soil do not appear to pose any threat to the ground water if left in place.

The majority of the detections of arsenic in the 0 – 2 ft bgs interval are slightly above the GWP-Ind of 1.0 mg/kg. The highest concentration of arsenic in this interval is 2.3 mg/kg. Although arsenic concentrations are above the GWP-Ind, the groundwater does not appear to been impacted. Arsenic concentrations in the groundwater samples collected during the various phases of investigation do not exceed the MSCs for ground water based on an industrial scenario (GW-Ind).

AMS7-BH07-000 was the only sample with a detection of benzo(a)anthracene, benzo(a)pyrene, and benzo(b)fluoranthene. Due to the limited extent of contamination, it is unlikely that these constituents will adversely affect the groundwater, although their concentrations are above the GWP-Ind. Benzo(a)anthracene, benzo(a)pyrene, and benzo(b)fluoranthene were not detected in any ground water samples or subsurface soil samples.

Chromium was detected above the GWP-Ind value of 10 mg/kg in only one 0-2 ft bgs soil sample. The background UCL for chromium is 11 mg/kg. Therefore it is possible to have naturally occurring levels of chromium above the GWP-Ind. The only sample from 0 – 2 ft bgs that is above the GWP – Ind for chromium is AMS07SS037 at 13.4 mg/kg. This sample is also the only 0-2 ft bgs soil sample above background. Based on this data, it appears that the concentrations of chromium in the surface soils are within the natural variation of background and are not due activities at AMS No. 7. Any impact chromium may have on the ground water would be due to naturally occurring levels.

SPLP analyses were also conducted for lead. The SPLP results for lead in sample AMS7-SS068 did not indicate any leaching, however AMS7-SS066 did. Therefore at some concentration between 12.3 mg/kg (AMS7-SS068) and 148 mg/kg (AMS7-SS066) leaching of lead begins. As a conservative approach, it is assumed that any samples above 12.3 mg/kg of lead may leach. There are a significant number of samples over 12.3 mg/kg of lead within 2 ft bgs. It is possible that these samples may have leaching, although there is no have data that demonstrates this. The majority of the detections of lead in the subsurface soil samples are below the UCL of background for lead. In addition, groundwater results from all phases of the investigation do not indicate any unacceptable levels of lead accept for one sample collected from MW02. MW02 was plugged and abandoned in May 1998 and was not resampled to confirm the lead concentration. MW07 was installed in 2000 near the location of MW02 but was completed at a shallower depth. MW07 was sampled using the low flow protocol as suggested in the Consistency Memorandum and lead levels from MW07 samples are non-detects (below 4.0 ug/l). A probable explanation for the elevated lead level in MW02 may be the use of conventional purging and well development; low flow sampling techniques were not used. It is possible that conventional sampling techniques increased naturally suspended particle concentrations, therefore artificially elevating the lead concentration within the sample. Based on subsurface soil and groundwater data, there is no clear or significant risk to the ground water from lead concentrations within the soil.

Subsurface Soil Evaluation

Subsurface soils consists of soils from 2 ft bgs – top of the ground water. Table 4-4 lists the constituent, sample location of highest concentration for the subsurface soils, highest detected concentration, SAI - Ind and the GWP – Ind. There were no constituents detected above the SAI-Ind for an industrial scenario for the subsurface soils. Therefore, there is an acceptable level of risk for an industrial worker exposed to the these soils at AMS No. 7.

However, there were a few constituents in the subsurface soils above the GWP – Ind: arsenic, chromium, and lead. Since these constituents are above the GWP-Ind, their potential risk to the ground water is discussed below.

As in the case of the 0 – 2 ft bgs interval, the majority of the detections of arsenic in the subsurface soils are slightly above the GWP-Ind of 1.0 mg/kg. The highest concentration of arsenic in this interval is 3.9 mg/kg. Although arsenic concentrations are above the GWP-Ind, the groundwater does not appear to been impacted. Arsenic concentrations in the groundwater samples collected during the various phases of investigation do not exceed the GW-Ind.

Chromium detections in the subsurface soils were very similar to the 0 – 2 ft bgs interval. Chromium was detected above the GWP-Ind value of 10 mg/kg in only three 2 ft bgs to top of ground water interval samples. These are also the only samples in this soil interval above the background level of 11 mg/kg. Based on this data, it appears that the concentrations of chromium in the subsurface soils are within the natural variation of background for that area and are not due activities at AMS No. 7. In addition, groundwater sampling results indicate that the levels of chromium are well below the GW-Ind. Based on this data, there is no clear or significant risk to the ground water from chromium concentrations in the soil.

Table 4-3 Comparison of Soil Sample Results 0-2 ft bgs to MSCs

Constituent	Sample Location	Highest Detected Concentration mg/kg	Site-Specific Background mg/kg	SAI-Ind MSC mg/kg	GWP Ind mg/kg
>C10 - C28 Hydrocarbons	AMS-7-SS-09	2.75E+01		2.00E+06	2.00E+04
1,2,4-Trimethylbenzene	AMS-7-SS-08	4.19E-03		1.40E+02	5.10E+02
1,3,5-Trimethylbenzene	AMS-7-SS-08	2.26E-03		1.20E+02	5.10E+02
2-Butanone	AMS-7-SS-09	7.69E-03		8.60E+03	6.10E+03
2-Butanone	AMS-7-SS-08	7.30E-03		8.60E+03	6.10E+03
Acetone	ATLAS#7-AMS7-BH08-00	1.90E-01		2.40E+03	1.00E+03
Aluminum	ATLAS#7-AMS7-BH07-00	1.08E+04	13,898	1.00E+06	1.00E+04
Aroclor 1254	AMS07SS049	2.98E-01		1.00E+01	5.00E-02
Aroclor 1260	AMS07SS036QC	5.00E-01		1.00E+01	5.00E-02
Arsenic	AMS07SS036	2.26E+00	1	2.00E+02	1.00E+00
Barium	AMS07SS036QC	9.86E+01	75	5.90E+04	2.00E+02
Benzene	AMS-7-SS-08	2.37E-03		1.60E+00	5.00E-01
Benzo (a) anthracene	ATLAS#7-AMS7-BH07-00	1.45E-01		3.40E+00	3.90E-02
Benzo (a) pyrene	ATLAS#7-AMS7-BH07-00	7.60E-02		3.40E-01	2.00E-02
Benzo (b) fluoranthene	ATLAS#7-AMS7-BH07-00	1.26E-01		3.40E+00	3.90E-02
Cadmium	AMS07SS051	4.02E-01		1.50E+03	5.00E-01
Carbon disulfide	AMS-7-SS-14	3.37E-03		1.50E+03	1.00E+03
Chromium	AMS07SS037	1.34E+01	11	3.50E+05	1.00E+01
Chrysene	ATLAS#7-AMS7-BH07-00	1.42E-01		3.40E+02	3.90E+00
Copper	AMS-7-SS-08	1.60E+01	4	7.40E+04	1.30E+02
Lead	AMS07SS007	2.88E+02	5	1.00E+03	1.50E+00
Manganese	AMS-7-SS-10	1.39E+02	128	1.10E+05	1.40E+03
Mercury	AMS07SS035	1.53E-01		9.60E+00	2.00E-01
Methylene chloride	AMS-7-SS-08	4.34E-02		1.60E+01	5.00E-01
Nickel	ATLAS#7-AMS7-BH07-00	6.20E+00	52	1.20E+04	2.00E+02
Phenanthrene	ATLAS#7-AMS7-BH07-00	1.91E-01		2.70E+04	3.10E+02
Pyrene	ATLAS#7-AMS7-BH07-00	3.29E-01	6	2.70E+04	3.10E+02
Toluene	AMS-7-SS-08	1.08E-02		2.40E+03	1.00E+02
Vanadium	ATLAS#7-AMS7-BH07-00	1.66E+01	21	3.00E+03	7.20E+01
Xylenes, Total	ATLAS#7-AMS7-BH07-00	1.94E-03		3.60E+03	1.00E+03
Zinc	AMS7-SS066	9.45E+02	35	4.10E+05	3.10E+03

Note : Background levels are calculated only for metals.

Table 4-4 Comparison of Soil Sample Results 2 ft bgs – Top of Ground Water to MSCs

Constituent	Sample Location	Highest Detected Concentration mg/kg	Site-Specific Background mg/kg	SAI-Ind MSC mg/kg	GWP Ind mg/kg
1,1,2,2-Tetrachloroethane	ATLAS#7-AMS7-BH07-10	1.50E-02		9.80E+00	1.40E+00
1,2,4-Trimethylbenzene	ATLAS#7-AMS7-BH07-05	2.08E-03		1.40E+02	5.10E+02
Acetone	ATLAS#7-AMS7-BH08-15	6.25E+01		2.40E+03	1.00E+03
Aluminum	ATLAS#7-AMS7-BH08-10	7.93E+03		1.00E+06	1.00E+04
Arsenic	BH04--010	3.90E+00	1	2.00E+02	1.00E+00
Barium	ATLAS#7-AMS7-BH07-10	1.31E+02	75	5.90E+04	2.00E+02
Chromium	BH04--005	2.55E+01	11	3.50E+05	1.00E+01
Copper	ATLAS#7-AMS7-BH08-15	5.90E+00		7.40E+04	1.30E+02
Lead	BH05--005	2.23E+01		1.00E+03	1.50E+00
Manganese	ATLAS#7-AMS7-BH08-10	2.94E+02	128	1.10E+05	1.40E+03
Methylene chloride	ATLAS#7-AMS7-BH08-15	3.58E-02		1.60E+01	5.00E-01
Nickel	ATLAS#7-AMS7-BH08-15	1.04E+01	52	1.20E+04	2.00E+02
Toluene	ATLAS#7-AMS7-BH07-05	3.96E-03		2.40E+03	1.00E+02
Vanadium	ATLAS#7-AMS7-BH08-15	2.22E+01	21	3.00E+03	7.20E+01
Xylenes, Total	ATLAS#7-AMS7-BH07-05	4.48E-03		3.60E+03	1.00E+03
Zinc	ATLAS#7-AMS7-BH08-15	2.90E+01	35	4.10E+05	3.10E+03

Note: Background levels are calculated only for metals.

Ground Water Screening

Groundwater data was also evaluated using the RRS2 criteria. Table 4-5 compares the highest concentrations of constituents detected in the ground water to the GW- Ind. The only constituents that had detections that exceeded the GW-Ind are barium, lead, dichloroethene and trichloroethene.

As discussed previously, a possible explanation for the elevated lead level in MW02 may be the use of conventional purging and well development. This would also apply to the elevated levels of barium from MW-01. The highest concentration of barium was detected in MW-01 which was sampled using the same protocol as MW02. All other detections of lead and barium were below their corresponding GW-Ind. It is probable that conventional sampling techniques increased naturally suspended particle concentrations, therefore artificially elevating the lead concentration within the groundwater sample. Naturally occurring levels of barium and lead in the ground water are most likely under the MSC for GW-Ind.

Groundwater sample results indicate the presence of TCE and DCE. TCE and DCE were detected above the GW-Ind at several locations. TCE and DCE will be listed as a COPC and exposure pathways will be evaluated.

Summary of COPCs

Surface soil, subsurface soil and ground water were evaluated using the RRS2 protocol. The highest detected concentration of each constituent was compared to the appropriate MSCs. No constituents in the soil at AMS No. 7 were detected above the SAI-Ind. Therefore, no COPCs were generated for soil exposure pathways for an industrial worker. However, several constituents were detected above the GWP-Ind. These constituents included: aluminum, Aroclor 1254, Aroclor 1260, arsenic, barium, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, chromium, and lead. None of these constituents appear to have impacted the subsurface soils or ground water at AMS No.7, therefore are not considered to be COPC.

TCE and DCE were detected in concentrations above the GW-Ind. Therefore, these constituents are listed as COPCs.

Evaluation of Exposure Pathways for COPCs

TCE and DCE are the only COPCs for AMS No. 7. They were detected in the ground water therefore exposure pathways relating to the use of ground water have been evaluated. Currently, the groundwater at AMS No. 7 is not being used as a drinking water source for human consumption or bathing. However, occasionally it is used as a water source for livestock during FFA events. The AMS No. 7 water well that is used for livestock has been sampled and DCE and TCE have not been detected. The well is not located downgradient of the TCE or DCE contamination and should not be affected in the future. Therefore, AMS No. 7 has no completed pathways for the COPCs in the ground water. If the TCE is left in place, it poses no immediate risk to human health or the environment since there are no completed exposure pathways to the COPCs in the ground water.

Table 4-5 Comparison of Highest Detected Concentration in Groundwater to the Groundwater MSCs – Industrial Scenario

Sample Location	Constituent	Highest Detected Concentration (mg/L)		MSC Ground Water Industrial (mg/L)
FAMS7-MW08	Arsenic	8.09E-03		1.00E-02
MW-01	Barium	5.74E+02		2.00E+00
FAMS7-MW11	Bromomethane	3.34E-03		1.40E-01
FAMS7-MW08	Cadmium	6.71E-04	j	5.00E-03
FAMS7-MW08	Chromium	2.89E-02		1.00E-01
FAMS7-MW08	Cis-1,2-Dichloroethylene	3.63E-02		7.00E-02
P-12	Dichloroethene	1.05E-01		7.00E-03
MW-02	Lead	4.40E-02		1.50E-02
FAMS7-MW12	Silver	2.23E-03	j	5.10E-01
FAMS7-MW08	Trans-1,2-Dichloroethylene	2.50E-03		1.00E-01
P-12	Trichloroethene	1.18E-01		5.00E-03
FAMS7-MW09	Zinc	2.43E-01		3.10E+01

j = estimated value

Section 5. CONCLUSIONS AND RECOMMENDATIONS

5.1. Conclusions

To comply with the recommendations of the TNRCC, additional soil and groundwater sampling has been conducted at the former AMS No. 7. Groundwater monitoring wells have been installed up gradient and down gradient of MW08 to determine the extent and potential source of the TCE contamination in the Seymour aquifer. Soil samples were collected to perform leachate tests to determine site-specific soil to groundwater protection values.

Combining this new subsurface and leachate data with the existing information, an interpretation of the extent of contamination can be derived. Based upon the data collected, the following represents the conclusions drawn from this investigation.

Soil contamination has been identified and confirmed surrounding the incinerator, cooling tower, and former UST site. COPCs are lead and PCBs. The Synthetic Precipitation Leaching Procedure (SPLP) Method 1312 was conducted on selected samples from each identified source of contamination. The SPLP results for lead indicate leaching occurs between 12.3 mg/kg and 148 mg/kg. There are a number of surface soil samples indicating concentrations of lead in excess of 12.3 mg/kg. Groundwater results from all phases of the investigation did not indicate a clear or significant lead contamination, a clear or significant risk to human health, or the environment except for one sample collected from MW02. MW02 was plugged and abandoned May 1998 and was not resampled to confirm the lead concentration. MW07 was installed in 2000 near the location of MW02. Lead results from MW07 samples were below the Groundwater Risk-Based Screening Value. The SPLP results did not indicate any leaching of PCB's with concentrations below 52.0 ug/kg of Aroclor 1254 and 386 ug/kg of Aroclor 1260. Five samples had concentrations above these levels. It is possible that samples above these levels may leach, although there is no data that demonstrates this. Groundwater data collected during the various phases of investigation does not indicate the presence of Aroclor 1254 or Aroclor 1260; demonstrating that no leaching has been detected at AMS #7.

Groundwater samples collected from the downgradient wells reported TCE concentrations. TCE was detected at concentrations ranging from 0.51 to 246.74 ug/l. Samples taken from screened intervals wholly within the lower zone (representing the bottom of the silo) were free of TCE or other volatile constituents whereas samples from the upper zone at the same locations had volatile organic compounds detected. A definitive source area for the TCE was not determined.

Discrepancies in regional groundwater flow reported in earlier investigations were resolved which resulted in flow patterns similar to the direction in which contamination appears to be migrating to the northeast. Groundwater elevations indicate the groundwater to be mounded in the immediate vicinity of the silo with near radial flow away from the silo area with the apparent regional flow direction to the east-northeast. The horizontal hydraulic gradient of the mapped potentiometric surface ranges from 0.22 ft/ft around the silo near MW07 to approximately 0.002 ft/ft further away from the silo, both to the north and south. Texas

records contain only one well and two test wells within a one-half mile radius of the site. All three wells produce from the Seymour aquifer. The one well that is present within the one-half mile radius is the well drilled at the missile site. This well is not located downgradient to the silo or in an area of suspected contamination. Texas records indicate the well to be drilled to a depth of 100' in 1958. Water samples taken from the onsite well have not indicated the presence of any organic contamination.

SVOC's detected in soil samples collected for the original Site Investigation have not been detected above laboratory detection limits in subsequent investigations. Therefore, the presence of bis(2-ethylhexyl)phthalate in the site investigation was an artifact of sampling or lab procedures and not an onsite contaminant. (Expanded Site Investigation Report, January 2001). Since bis(2ethylhexyl)phthalate was not due to onsite contamination, it was not included the risk evaluation.

5.2. Recommendations

This section summarizes the results and findings of the field investigation and regulatory compliance review. Groundwater sample results do indicate the presence of a TCE plume. TCE was detected above the Groundwater Risk-Based Screening Value in several locations. Although TCE levels are above the Groundwater Risk-Based Screening Value, no receptors have been identified to complete the exposure pathway. If the TCE is left in place, it poses no immediate risk to human health or the environment since there are no completed exposure pathways.

The results of soil and groundwater sampling and leachate tests indicate no significant levels of contamination. Operations at the former Atlas Missile Silo Number 7 ceased more than 30 years ago; therefore, natural attenuation of biodegradable products should be expected if aerobic soil and groundwater conditions prevail. No further action is recommended for this site.

Section 6. REFERENCES

The following references were utilized in the preparation of this report.

American Society for Testing Materials (ASTM), 1990. Standards Practice for Description and Identification of Soils (Visual-Manual Procedure). ASTM D-2488-90.

Morrison Knudsen (MK), *Expanded Site Investigation Report, Former Atlas Missile Site No. 7, Vernon, Texas*, prepared for the U.S. Army Corps of Engineers (USACE), Tulsa District. (January 2001).

Texas Natural Resource Conservation Commission (TNRCC), 1999, Chapter 335-Industrial Solid Waste and Municipal Hazardous Waste, Subchapter S.

EPA, 1996. *Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures,* in Ground Water Issue, EPA/540/S-95/504 (April)

Price, R.D., 1979. *Occurrence, Quality and Quantity of Ground Water in Wilbarger County, Texas*, Report 240, published by Texas Department of Water Resources (November).

Willis, G.W., and Knowles, 1953. *Ground-Water Resources of the Odell Sand Hills, Wilbarger County, Texas*, published by the Texas Board of Water Engineers (January).

Appendix A

Analytical Data Results

Arranged by Investigation

PA/SI
ESI Phase I
ESI Phase II
ESI Phase III

ESI Phase I
DETECTION TABLES FOR
SURFACE SOIL LOCATIONS
AMS NO. 7 ESI

Analyte	ATLAS#7-AMS-7-SS-05	ATLAS#7-AMS-7-SS-06	ATLAS#7-AMS-7-SS-07	ATLAS#7-AMS-7-SS-08	ATLAS#7-AMS-7-SS-09
SW 8260B (µg/Kg)					
VOCs					
Acetone	**97.4**	**184**	**155**	9.46 U	9.12 U
Benzene	1.84 U	1.77 U	1.53 U	**2.37**	1.87 U
2-Butanone	9.08 U	8.65 U	7.76 U	**7.10 J**	**7.69 J**
Carbon disulfide	1.84 U	1.77 U	1.53 U	2.47	1.87 U
Methylene chloride	**6.22**	**31.1**	**4.29**	**43.4**	**34.7**
Toluene	1.84 U	1.77 U	1.53 U	**10.8**	1.87 U
Trichloroethene	1.84 U	1.77 U	1.53 U	1.94 U	1.87 U
1,2,4-Trimethylbenzene	1.84 U	1.77 U	1.53 U	**4.19**	1.87 U
1,3,5-Triinethylbenzene	1.84 U	1.77 U	1.53 U	**2.26**	1.87 U
Xylenes, Total	1.84 U	1.77 U	1.53 U	**16.5**	1.87 U
VOC TICs					
Acetic acid, methyl ester	ND	ND	ND	ND	ND
Butane, 2-methyl-	ND	ND	ND	**33 JN**	ND
Pentane	ND	ND	ND	**59 JN**	ND
Pentane, 2-methyl-	ND	ND	ND	**17 JN**	ND
Hexane	ND	ND	ND	**23 JN**	ND
Cyclohexane	ND	ND	ND	**10 JN**	ND
Cyclohexane, methyl-	ND	ND	ND	**13 JN**	ND
Hexanal	**22 JN**	**52 JN**	**56 JN**	**190 JN**	**160 JN**
Pentanal	ND	**15 JN**	**13 JN**	ND	**26 JN**
Benzaldehyde	ND	ND	ND	ND	ND
2-Furancarboxaldehyde	**3 JN**	**28 JN**	**17 JN**	ND	ND
Carbon dioxide	**75 JN**	**210 JN**	**160 JN**	ND	ND
Butanal, 3-methyl-	**5 JN**	ND	ND	ND	ND
Cyclotrisiloxane, hexamethyl	**3 JN**	**4 JN**	**4 JN**	ND	ND
Cyclotetrasiloxane,octarnethyl	**8 JN**	**11 JN**	**7 JN**	ND	ND
Acetaldehyde	ND	**5 JN**	**5 JN**	ND	ND
Butanal	ND	**6 JN**	**4 JN**	ND	ND
Heptanal	ND	**3 JN**	ND	ND	ND
Arsenous acid, tris(timethylsilyl)	ND	ND	ND	ND	ND
SW8082 (µg/Kg)					
PCBs					
Aroclor 1260	20.4 U	20.8 U	20.4 U	**28**	22 U
TX 1005 (µg/Kg)					
TRPH					
>C10 - C28 Hydrocarbons	25500 U	2~0600 U	25500 U	26900 U	27500
C6 - C28 Hydrocarbons	51000 U	52100 U	5 1000 U	53800 U	54900 U
SW 6010B (mg/Kg)					
Metals					
Aluminum	**4360**	**10600**	**8390**	**8600**	**7840**
Arsenic	I U	I U	**1.2**	1.1 U	1.1 U
Barium	**30.3**	**63.9**	**74.5**	**96.9**	**61.4**
Calcium	**570**	**1230**	**1590**	**53600**	**6390**
Chromium	**5.4**	**9.9**	**9.4**	**124**	**8.2**
Copper	**1.8**	**3.4**	**2.9**	**16**	**4.2**
Iron	**3660**	**7000**	**6720**	**6760**	**6810**
Lead	**3**	**5**	**4.9**	**152**	**19.3**
Magnesium	**781**	**1660**	**1540**	**3580**	**2840**

Note: Detected analyte concentrations are reported in **bold** font.

Analyte	ATLAS#7-AMS-7-SS-05	ATLAS#7-AMS-7-SS-06	ATLAS#7-AMS-7-SS-07	ATLAS#7-AMS-7-SS-08	ATLAS#7-AMS-7-SS-09
Manganese	**68.7**	**106**	**122**	**149**	**129**
Nickel	**2.8**	**5.4**	**4.7**	**5.8**	**4.6**
Potassium	**858**	**2060**	**1770**	**2330**	**1740**
Sodium	**21.1**	**54.2**	**38.3**	**86.2**	**30.3**
Vanadium	10 U	**16.9**	**16**	**15.4**	**13.2**
Zinc	10 U	**13.9**	**14.9**	**102**	**45.6**

Analyte	ATLAS#7-AMS-7-SS-10	ATLAS#7-AMS-7-SS-11	ATLAS#7-AMS-7-SS-12	ATLAS#7-AMS-7-SS-13	ATLAS#7-AMS-7-SS-14
SW 8026B (µg/Kg)					
VOCs					
Acetone	**109**	10.0 U	8.62 U	9.57 U	10.1 U
Benzene	1.94 U	2.02 U	1.70 U	1.94 U	**2.42**
2-Butanone	9.59 U	**7.87 J**	**4.57 J**	**9.14 J**	**4.11 J**
Carbon disulfide	1.94 U	2.02 U	1.70 U	1.94 U	3.37
Methylene chloride	**31.7**	**9.21 U**	**7.45 U**	**6.67 U**	**6.32 U**
Toluene	1.94 U	**2.92**	1.70 U	**3.44**	**10.7**
Trichloroethene	1.94 U	**2.25 J**	1.70 U	1.94 U	2.00 U
1,2,4-Triinethylbenzene	1.94 U	2.02 U	1.70 U	1.94 U	**5.37**
1,3,5-Trimethylbenzene	1.94 U	2.02 U	1.71 U	1.94 U	**2.74**
Xylenes, Total	1.94 U	2.47 U	1.70 U	**3.23**	**17.8**
VOC TICs					
Acetic Acid, methyl ester	ND	**56 JN**	ND	ND	ND
Butane, 2-methyl-	ND	ND	ND	**11 JN**	**35 JN**
Pentane	ND	ND	ND	ND	ND
Pentane, 2-methyl-	ND	ND	ND	ND	**19 JN**
Hexane	ND	ND	ND	ND	**25 JN**
Cyclohexane	ND	ND	ND	ND	ND
Cyclohexane, methyl-	ND	ND	ND	ND	**14 JN**
Hexanal	**29 JN**	**130 JN**	**55 JN**	**200 JN**	**58 JN**
Pentanal	**6 JN**	**26 JN**	**ND**	**42 JN**	ND
Benzaldehyde	ND	7 JN	ND	ND	ND
2-Fuiancarboxaldehyde	**6 JN**	ND	ND	ND	ND
Carbon dioxide	**360 JN**	ND	ND	ND	ND
Butanal, 3-methyl-	ND	ND	ND	ND	ND
Cyclotrisiloxane, hexamethyl	ND	ND	ND	ND	ND
Cyclotetrasiloxane,octarnethyl	**8 JN**	ND	ND	ND	ND
Acetaldehyde	ND	ND	ND	ND	ND
Butanal	ND	ND	ND	**10 JN**	ND
Heptanal	ND	ND	ND	ND	ND
Arsenous acid, tris(timethylsilyl)	**3 JN**	ND	ND	ND	ND
SW 8082 (µg/Kg)					
PCBs					
Aroclor 1260	20.4 U	**166 J**	21.3 U	**106 J**	**142 J**
TX 1005 (µg/Kg)					
TRPH					
>C10 - C28 Hydrocarbons	25500 U	28100 U	26600 U	26900 U	26300 U
C6 - C28 Hydrocarbons	51000 U	56200 U	53200 U	53800 U	52600 U

Note: Detected analyte concentrations are reported in **bold** font.

Analyte	ATLAS#7-AMS-7-SS-10	ATLAS#7-AMS-7-SS-11	ATLAS#7-AMS-7-SS-12	ATLAS#7-AMS-7-SS-13	ATLAS#7-AMS-7-SS-14
SW 6010B (mg/Kg)					
Metals					
Aluminum	**10500**	**8710**	**7380**	**7850**	**3100**
Arsenic	I U	**1.5**	1.1 U	1.1 U	1.0 U
Barium	**72**	**84.1**	**47**	**79.8**	**42.4**
Calcium	**5650**	**11200**	**2620**	**31600**	**28300**
Chromium	**9.8**	**9.8**	**7.5**	**12.3**	**4.5**
Copper	**4.1**	**9.2**	**3.2**	**5.6**	**2.9**
Iron	**7180**	**6530**	10.7 U	**7550**	**3080**
Lead	**10.4**	**18.4**	**6.6**	**22.2**	**14.5**
Magnesium	**1890**	**2380**	**5320**	**3510**	**2360**
Manganese	**139**	**129**	**83.9**	**153**	**51.9**
Nickel	**5.5**	**5.6**	**4.1**	**7.5**	**2.7**
Potassium	**2180**	**1880**	**1520**	**1970**	**569**
Sodium	**39.8**	**41.9**	**41.8**	**77.6**	**41.6**
Vanadium	**16.3**	**14.1**	**12**	**13.8**	10.3 U
Zinc	**18.8**	**181**	**32.2**	**44.3**	**11**

Qualifiers applied by data validator

J: Estimated value
UJ: Detection limit above the practical quantitation limit.
U: Non-detect to practical quantitation limit
ND: Not detected
JN: Estimated value, compound not included in calibration

Note: Detected analyte concentrations are reported in **bold** font.

DETECTION TABLES FOR

BORE HOLES
AMS NO. 7 ESI

Analyte	ATLAS#7-AMS7-BH06-S-00	ATLAS#7-AMS7-BH06-S-05	ATLAS#7-AMS7-BH06-S-10	ATLAS#7-AMS7-BH06-S-18	ATLAS#7-AMS7-BH06-S-76
SW 8260B (ug/Kg)					
VOCs					
Acetone	**86.0**	**41.2**	11.9 U	**16.1**	**34.6**
Methylene chloride	**21.2**	**44.0**	**51.0**	**32.7**	37.8 U
Toluene	1.72 U	2.16 U	2.36 U	1.79 U	2.10 U
Trichloroethene	1.72 U	2.16 U	2.36 U	1.79 U	2.10 U
1,2,4-trimethylbenzene	1.72 U	2.16 U	2.36 U	1.79 U	2.10 U
Xylenes, Total	1.72 U	2.16 U	2.36 U	1.79 U	2.10 U
VOCs TICs					
Pentane	ND	ND	ND	ND	ND
Hexanal	ND	ND	ND	ND	ND
2-Furancarboxaldehyde	ND	ND	ND	ND	ND
SW 8270 C (ug/Kg)					
SVOCs					
Benzo (a) anthracene	333 U	340 U	371 U	347 U	407 U
Benzo (a) pyrene	333 U	340 U	371 U	347 U	407 U
Benzo (b) fluoranthene	333 U	340 U	371 U	347 U	407 U
Chrysene	333 U	340 U	371 U	347 U	407 U
Fluoranthene	333 U	340 U	371 U	347 U	407 U
Phenanthrene	333 U	340 U	371 U	347 U	407 U
Pyrene	333 U	340 U	371 U	347 U	407 U
SVOC TICs					
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	ND
TX1005 (ug/Kg)					
TRPH					
>C10 - C28 Hydrocarbons	25300 U	25800 U	28100 U	26300 U	30900 U
C6 - C28 Hydrocarbons	50500 U	51500 U	56200 U	52600 U	61700 U
SW 6010B (mg/Kg)					
Metals					
Aluminum	**8200**	**5520**	**13400**	**8000**	**6120**
Arsenic	**1.4**	1.0 U	1.1 U	1.1 U	**2.2**
Barium	**54.1**	**39.7**	**69.5**	**38.9**	**35.9**
Calcium	**794**	**507**	**822**	**693**	**13300**
Chromium	**7.9**	**5.7**	**10.1**	**7.2**	**8.7**
Copper	**2.2**	**2.0**	**2.7**	**2.3**	**4.0**
Iron	**5800**	**3440**	**7100**	**5260**	**7390**
Lead	**3.2**	**2.2**	**3.4**	**2.5**	**3.0**
Magnesium	**1310**	**778**	**1680**	**1090**	**3590**
Manganese	**92.9**	**49.1**	**74.4**	**58.7**	**191**
Nickel	**4.2**	**4.5**	**5.4**	**4.2**	**6.9**
Potassium	**1390**	**811**	**2550**	**1530**	**1410**
Sodium	**38.6**	**24**	**94.7**	**60.2**	**99.2**
Vanadium	**14.9**	9.8 U	**12.7**	10.5 U	**15.9**
Zinc	**11.1**	**15.7**	**17.2**	**11.2**	**13.9**

Note: Detected analyte concentrations are reported in **bold** font.

Analytes	ATLAS#7-AMS7-BH07-S-00	ATLAS#7-AMS7-BH07-S-05	ATLAS#7-AMS7-BH07-S-10		ATLAS#7-AMS7-BH08-S-00
SW 8260B (ug/Kg)					
VOCs					
Acetone	7.74 U	9.48 U	12.5 U		**190**
Methylene chloride	**16.5**	**21.1**	**25.2**		**5.27**
Toluene	**2.15**	**3.96**	2.47 U		1.94 U
Trichloroethene	1.51 U	1.88 U	2.47 U		1.94 U
1,2,4-Trimethylbenzene	1.51 U	**2.08**	2.47 U		1.94 U
Xylenes, Total	**1.94**	**4.48**	2.47 U		1.94 U
VOC TICs					
Pentane	ND	**12.5J**	ND		ND
Hexanal	**25.8 J**	ND	ND		**37.6 J**
2-Furancarboxaldehyde	ND	ND	ND		**19.4 J**
SW 8270C (ug/KG)					
SVOCs					
Benzo (a) anthracene	**145 J**	344 U	371 U		355 U
Benzo (a) pyrene	**76 J**	344 U	371 U		355 U
Benzo (b) fluoranthene	**126 J**	344 U	371 U		355 U
Chrysene	**142 J**	344 U	371 U		355 U
Fluoranthene	**426**	344 U	371 U		355 U
Phenanthrene	**191 J**	344 U	371 U		355 U
Pyrene	**329 J**	344 U	371 U		355 U
SVOC TICs					
1,1,2,2-Tetrachloroethane	ND	ND	**15 J**		ND
TX 1005 (ug/Kg)					
TRPH					
>C10 - C28 Hydrocarbons	26900 U	26000 U	28100 U		26900 U
C6 - C28 Hydrocarbons	53800 U	52100 U	56200 U		53800 U
SW 6010B (mg/Kg)					
Metals					
Aluminum	**10800**	**11100**	**1390**		**9870**
Arsenic	**1.3**	**1.8**	1.1 U		1.1 U
Barium	**79.1**	**83.9**	**131**		**64.5**
Calcium	**16700**	**46600**	**40500**		**4540**
Chromium	**10.6**	**10.4**	**1.8**		**9.9**
Copper	**3.2**	**3.9**	1.1 U		**4.7**
Iron	**7610**	**8740**	**2090**		**7270**
Lead	**3.7**	**4.7**	**3.2**		**8.8**
Magnesium	**2670**	**4900**	**1240**		**2030**
Manganese	**132**	**186**	**169**		**132**
Nickel	**6.2**	**6.7**	1.1 U		**5.8**
Potassium	**2480**	**3020**	**348**		**2340**
Sodium	**70.2**	**121**	**59**		**69.7**
Vanadium	**16.6**	**17**	11.3 U		**15.3**
Zinc	**13.6**	**16.7**	11.3 U		**28.2**

Note: Detected analyte concentrations are reported in **bold** font.

Analytes	ATLAS#7-AMS7-BH08-S-05	ATLAS#7-AMS7-BH08-S-10	ATLAS#7-AMS7-BH08-S-15	ATLAS#7-AMS7-BH08-S-18	ATLAS#7-AMS7-BH08-S-80
SW 8260B (ug/Kg)					
VOCs					
Acetone	**52.2**	**26.4**	**62.5**	**27.8**	**26.7**
Methylene chloride	**26.7**	**30.5**	**35.8**	**34.6**	**20.5**
Toluene	1.63 U	2.29 U	2.00 U	1.83 U	1.79 U
Trichloroethene	1.63 U	2.29 U	2.00 U	**36.7**	1.79 U
1,2,4-Trimethylbenzene	1.63 U	2.29 U	2.00 U	1.83 U	1.79 U
Xylenes, Total	1.63 U	2.29 U	2.00 U	1.83 U	1.79 U
VOC TICs					
Pentane	ND	ND	ND	ND	ND
Hexanal	ND	ND	ND	ND	ND
2-Furancarboxaldehyde	ND	ND	ND	ND	ND
SW 8270C (ug/Kg)					
SVOCs					
Benzo (a) anthracene	359 U	398 U	388 U	402 U	393 U
Benzo (a) pyrene	359 U	398 U	388 U	402 U	393 U
Benzo (b) fluoranthene	359 U	398 U	388 U	402 U	393 U
Chrysene	359 U	398 U	388 U	402 U	393 U
Fluoranthene	359 U	398 U	388 U	402 U	393 U
Phenanthrene	359 U	398 U	388 U	402 U	393 U
Pyrene	359 U	398 U	388 U	402 U	393 U
SVOC TICs					
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	ND
TX 1005 (ug/Kg)					
TRPH					
>C10 - C28 Hydrocarbons	27200 U	30100 U	29400 U	30500 U	29800 U
C6 - C28 Hydrocarbons	54300 U	60200 U	58800 U	61000 U	59500 U
SW 6010B (mg/Kg)					
Metals					
Aluminum	**11800**	**7930**	**17700**	**15900**	**1670**
Arsenic	**1.9**	**1.4**	**2.9**	**2.5**	1.1 U
Barium	**70.8**	**54.8**	**95.2**	**122**	**13.6**
Calcium	**4950**	**13000**	**3050**	**2670**	**9340**
Chromium	**13.1**	**10.9**	**17.9**	**17**	**3.4**
Copper	**3.2**	**1.7**	**5.9**	**7.6**	1.1 U
Iron	**9370**	**10800**	**13800**	**16000**	**2400**
Lead	**4.6**	**3.8**	**7.2**	**7.4**	**1.6**
Magnesium	**2780**	**8250**	**3760**	**4240**	**916**
Mamganese	**163**	**294**	**134**	**342**	**58**
Nickel	**7.4**	**8.5**	**10.4**	**13.1**	**1.8**
Potassium	**2590**	**2870**	**4370**	**3740**	**336**
Sodium	**15.8**	**123**	11.3 U	12.3 U	**45.6**
Vanadium	**17.7**	**14.5**	**22.2**	**21.9**	11.3 U
Zinc	**19.6**	**19.7**	**29**	**36.5**	11.3 U

Qualifiers applied by data validator
J: Estimated value
UJ: Detection limit above the practical quantitation limit.
U: Non-detect tp practical quantitation limit
ND: Non-detect
R: Data rejected by data validator
JN: Estimated value, compound not included in calibration

Note: Detected analyte concentrations are reported in **bold** font.

GROUND WATER
AMS NO. 7 ESI

ANALYTE	ATLAS#7-AMS7-MW06-GW	ATLAS#7-AMS7-MW07-GW	ATLAS#7-AMS7-MW08-GW	ATLAS#7-AMS7-MW09-GW
EPA 200.8 (ug/L)				
Metals				
Antimony	<0.2	<0.2	1.0	<1.0
Barium	**200**	**410**	**320**	**260**
Chromium	**12**	**15**	**8.3**	**1.3**
Copper	**7.9**	**10**	**4.1**	**4.3**
Lead	**14**	**6.8**	<0.5	<2.5
Nickel	**12**	**18**	**8.7**	**100**
EPA 300.0 (mg/L)				
Nitrate				
Nitrate	**9.5**	<0.5	**0.5**	**0.7**
EPA 353.2 (mg/L)				
Nitrite				
Nitrite	**0.01**	<0.01	<0.01	<0.01
EPA 380-75WE (mg/L)				
Fluoride				
Fluoride	**0.9**	**0.6**	**0.6**	<0.1
EPA 524.2 (ug/L)				
VOCs				
Chloroform	<0.1	<0.1	**0.5**	<0.1
1,1-Dichloroethylene	<0.2	<0.2	**0.3**	<0.2
cis-1,2-Dichloroethylene	<0.1	<0.1	**30**	<0.1
trans-1,2-Dichloroethylene	<0.1	<0.1	**2.8**	<0.1
4-Isopropyltoluene	<0.1	<0.1	**0.1**	<0.1
Trichloroethylene	<0.1	<0.1	**140**	<0.1
Vinyl chloride	<0.2	<0.2	**0.2**	<0.2
Acetone	ND	ND	**8.7**	ND
EPA 525.2 (ug/L)				
SVOCs				
Di(2-ethylhexyl)phthalate	<0.6	<0.6 J	**1.0 J**	**1.3 J**
Camphorosulfonic Acid	ND	ND	**3.8**	ND
Hydrocarbon oil	ND	**21**	ND	ND
Tetradecanoic acid	ND	ND	**17**	ND
Unknown compound	ND	ND	**3.3**	ND
Dodecanoic acid	ND	ND	**27**	ND

Qualifiers applied by data validator

J: Estimated value
UJ: Detection limit above the practical quantitation limit.
U: Non-detect to practical quantitation limit.
ND: Non-detect
R: Data was rejected by the data validator
JN: Estimated value, compound not included in calibration (~)

Note: Detected analyte concentrations are reported in **bold** font.

Analytical Results For Surface Soil Samples

INCINERATOR

Sample ID	Arsenic	Barium	Chromium	Lead	Zinc	PCBs	Units
AMS07SS001	1.6	56.1	6.8	**34.4**	58.5	**.055**	mg/kg
AMS07SS002	1.2	55.4	6.6	**34.9**	33.1	<.0200	mg/kg
AMS07SS003	1.7	56.2	7.5	**16.2**	25.7	<.0200	mg/kg
AMS07SS004	1.6	51.8	6.9	**10.6**	33.1	<.0200	mg/kg
AMS07SS005	1.2	53.9	8.6	**10**	28	<.0200	mg/kg
AMS07SS006	1.4	921	6.9	**104**	136	**.228**	mg/kg
AMS07SS007	1.8	98	9.8	**288**	82.2	<.0200	mg/kg
AMS07SS008	1.4	63.2	6.2	**38.4**	31.8	<.0200	mg/kg
AMS07SS008QC	1.7	64.3	7.12	**39.4**	31.9	<.0200	mg/kg
AMS07SS009	1.4	51.3	6.2	**15.3**	33.6	<.0200	mg/kg
AMS07SS010	2.0	48.2	6.7	**14**	24.1	<.0200	mg/kg
AMS07SS011	1.4	43.6	5.7	**10.4**	25	<.0200	mg/kg
AMS07SS012	2.2	73.9	6.7	**64.5**	44.1	<.0200	mg/kg
AMS07SS013	<1.000	47.9	5.1	**11.5**	24.6	<.0200	mg/kg
AMS07SS014	1.6	73	9.4	**163**	88.4	<.0200	mg/kg
AMS07SS015	1.4	84.6	8.3	**38.8**	62.4	<.0200	mg/kg
AMS07SS016	<.969	73.6	7.6	**24**	40.1	<.0200	mg/kg
AMS07SS017	<.978	49.2	5.7	**17.2**	22.3	<.0200	mg/kg
AMS07SS018	.988B	46.1	5.1	**11.5**	27.1	<.0200	mg/kg
AMS07SS018QC	<.956	43.1	6.2	**9.5**	29.2	<.0680	mg/kg
AMS07SS019	1.4	55	7.3	**32.1**	35.3	<.0200	mg/kg
AMS07SS020	1.6	73.4	7.2	**26.6**	33.6	<.0200	mg/kg
AMS07SS021	NA	NA	NA	**NA**	NA	<.0200	mg/kg
AMS07SS022	<.944	44.4	6.8	**21.9**	25.7	<.0200	mg/kg
AMS07SS023	1.4	48.8	8.7	**12.2**	26.9	<.0200	mg/kg

COOLING TOWER

Sample ID	Arsenic	Barium	Chromium	Lead	Zinc	PCBs	Units
AMS07SS024	1.2	55.5	5.6	**6.6**	36J	<.0202	mg/kg
AMS07SS025	<1.004	53.0	5.8	**4.6**	24.5J	<.0204	mg/kg
AMS07SS026	1.0BJ	47.4	6.6	**4.0**	23.1J	<.0202	mg/kg
AMS07SS027	1.2	43.8	6.9	**3.8**	21.2J	<.0202	mg/kg
AMS07SS028	1.0BJ	36.8	6.3	**3.8**	50.6J	<.0202	mg/kg
AMS07SS028QC	<.977	32.8	5.1	**3.3**	53.1J	<.0202	mg/kg
AMS07SS029	1.2	89.8	7.2	**18.2**	89.4J	**.286**	mg/kg
AMS07SS030	1.4	61.1	6.7	**9.3**	46.3J	<.0204	mg/kg
AMS07SS031	1.0BJ	53.1	7.7	**4.8**	33.1J	<.0202	mg/kg
AMS07SS032	1.2	46.9	7.3	**3.7**	21.1J	<.0202	mg/kg
AMS07SS032QC	1.2	206	6.9	**3.7**	21.4	<.0202	mg/kg
AMS07SS033	<1.033	41.1	5.4	**3.7**	19.8	<.0213	mg/kg
AMS07SS034	<.962	32.5	3.5	**4.2**	17.9	<.0202	mg/kg
AMS07SS035	1.2	38.8	5.8	**5.4**	50.1	**.082**	mg/kg
AMS07SS036	2.3	97.1	11.3	**89.6**	221	**.395**	mg/kg
AMS07SS036QC	1.8	98.6	11.6	**46.4**	216J	**.5J**	mg/kg
AMS07SS037	1.9	96.3	13.4	**46.5**	131J	<.0206	mg/kg
AMS07SS038	1.0BJ	47.4	6.4	**6.2**	52.2J	<.0202	mg/kg
AMS07SS039	1.0BJ	53.5	6.7	**5.7**	46.5J	<.0202	mg/kg

COOLING TOWER

Sample ID	Arsenic	Barium	Chromium	Lead	Zinc	PCBs	Units
AMS07SS040	1.0BJ	40.8	7.0	**4.8**	67.5J	**.067J**	mg/kg
AMS07SS041	1.6	80.5	9.8	**15.7**	144J	<.0204	mg/kg
AMS07SS042	1.4	74.9	10	**13.9**	89.4J	.046	mg/kg
AMS07SS043	1.4	69.2	5.8	**18.0**	76.8	<.0204	mg/kg
AMS07SS044	1.0	58.3	6.7	**4.5**	28.0	<.0202	mg/kg
AMS07SS045	1.2	42.5	5.2	**3.7**	19.0	<.0202	mg/kg
AMS07SS046	<1.008	36.1	5.8	**5.0**	82.5	<.0202	mg/kg
AMS07SS047	1.6	99.3	10.4	**54.0**	365.0	**.115**	mg/kg
AMS07SS048	1.6	66.5	6.4	**7.0**	34.5	<.0202	mg/kg
AMS07SS049	1.4	62.8	7.8	**5.8**	43.4	**.298**	mg/kg
AMS07SS050	<.972	39.2	6.2	**7.3**	120.2	<.0202	mg/kg
AMS07SS050QC	<.996	33.1	5.0	**6.6**	108J	<.0202	mg/kg
AMS07SS051	1.8	84.5	10.1	**58.6**	346.1	<.0202	mg/kg
AMS07SS052	1.8	74.1	7.0	**15.8**	66.1	<.0202	mg/kg
AMS07SS053	1.4	61.1	9.1	**9.1**	67.3	.024	mg/kg

FORMER UNDERGROUND STORAGE TANK AREA

Sample ID	Arsenic	Barium	Chromium	Lead	Zinc	PCBs	Units
AMS07SS054	1.7	69.8	10.2	**12.9**	34.8	.045J	mg/kg
AMS07SS055	1.5	69.9	12.0	**22.1**	40.4	**.170**	mg/kg
AMS07SS056	1.4	66.2	9.1	**10.9**	38.5	<.1010	mg/kg
AMS07SS057	1.3	82.3	12.3	**30.6**	34.8	<.1010	mg/kg
AMS07SS058	1.4	71.8	10.3	**40.8**	35.4	<.1010	mg/kg
AMS07SS059	1.8	55.8	7.0	**13.3**	26.8	<.1010	mg/kg
AMS07SS059QC	1.9	59.1	8.4.0	**11.9**	26.4	<.1010	mg/kg
AMS07SS060	1.8	75.9	12.3	**37.2**	48.2	**.065**	mg/kg
AMS07SS061	1.0	64.4	7.0	**7.0**	30.8	<.0202	mg/kg

BACKGROUND

Sample ID	Arsenic	Barium	Chromium	Lead	Zinc	PCBs	Units
AMS07SS062	1.4	35.7	60.5	**3.3**	16.2	<.0202	mg/kg
AMS07SS063	1 BJ	19.9	3.6	**1.7**	<9.56	<.0200	mg/kg
AMS07SS064	<.990	26.3	3	**2.8**	10.5	<.0202	mg/kg
AMS07SS065	<.990	27.5	4.6	**3**	11.1	<.0202	mg/kg

ND – Non Detect
NA – Not Available
J – Estimated
Bold/ Shaded – Exceeds the Screen Level for Groundwater Protection (GWP) RRS-II MSC

Atlas Missile Site No. 7
Vernon, Texas
Groundwater Sampling Results
July 2002

Monitoring Well		MW06	MW07	MW08	MW09	MW10	MW11	MW12
Collection Date		7/9/2002	7/9/2002	7/11/2002	7/9/2002	7/11/2002	7/1072002	7/10/2002
ANIONS								
(Method 300.0)	Units							
Chloride	mg/l	0.879	9.64	5.55	1650	520	8.03	1.74
(Method 353.1)								
Nitrogen, Nitrate/Nitrite	mg/l	9.75	0.010 J	0.030 J	0.020 J	0.020 J	2.8	6.25
METALS (Method 6010B)								
Arsenic	ug/l	2.33 J	< 5.00	8.09	3.15 J	< 5.00	< 5.00	< 5.00
Barium	ug/l	193	255	660	51.1	71.6	350	337
Cadmium	ug/l	< 2.00	< 2.00	0.671 J	< 2.00	< 2.00	< 2.00	< 2.00
Chromium	ug/l	0.965 J	< 5.00	28.9	< 5.00	5.77	0.793 J	6.09
Lead	ug/l	< 4.00	< 4.00	14.8	3.48 J	4.67 J	3.68 J	< 4.00
Selenium	ug/l	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00
Silver	ug/l	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00	2.23 J
Zinc	ug/l	2.24 J	< 5.00	57.9	243	29	5.71	12.1
(Method 7470A)								
Mercury	ug/l	< 0.200	< 0.200	< 0.200	< 0.200	< 0.200	< 0.200	< 0.200
VOLATILE ORGANIC COMPOUNDS (Method 8260B)								
1,1,1,2-Tetrachloroethane	ug/l	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00
1,1,1-Trichloroethane	ug/l	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00
1,1,2,2-Tetrachloroethane	ug/l	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00
1,1,2-Trichloroethane	ug/l	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00
1,1-Dichloroethane	ug/l	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00
1,1-Dichloroethylene	ug/l	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00
1,2,3-Trichloropropane	ug/l	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00
1,2,4-Trichlorobenzene	ug/l	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00
1,2-Dibromo-3-chloropropane	ug/l	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00
1,2-Dibromoethane	ug/l	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00
1,2-Dichlorobenzene	ug/l	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00
1,2-Dichloroethane	ug/l	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00
1,2-Dichloropropane	ug/l	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00
1,3-Dichlorobenzene	ug/l	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00
1,4-Dichlorobenzene	ug/l	< 1.00	0.379 BJ	0.278 BJ	< 1.00	0.268 BJ	0.383 BJ	0.331 BJ
2-Butanone	ug/l	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00
2-Chloroethylvinyl ether	ug/l	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00
2-Hexanone	ug/l	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00
4-Methyl-2-pentanone	ug/l	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00
Acetone	ug/l	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00
Acetonitrile	ug/l	< 25.0	< 25.0	< 25.0	< 25.0	< 25.0	< 25.0	< 25.0
Acrolein	ug/l	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00
Acrylonitrile	ug/l	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00
Benzene	ug/l	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00
Bromochloromethane	ug/l	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00
Bromodichloromethane	ug/l	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00
Bromoform	ug/l	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00
Bromomethane	ug/l	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	3.34	< 1.00
Carbon disulfide	ug/l	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00
Carbon tetrachloride	ug/l	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00
Chlorobenzene	ug/l	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00
Chloroethane	ug/l	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00

Atlas Missile Site No. 7
Vernon, Texas
Groundwater Sampling Results
July 2002

Monitoring Well		MW06	MW07	MW08	MW09	MW10	MW11	MW12
Collection Date		7/9/2002	7/9/2002	7/11/2002	7/9/2002	7/11/2002	7/1072002	7/10/2002
Chloroform	ug/l	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00
Chloromethane	ug/l	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00
cis-1,2-Dichloroethylene	ug/l	< 1.00	< 1.00	36.3	< 1.00	< 1.00	5.62	< 1.00
cis-1,3-Dichloropropylene	ug/l	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00
Dibromochloromethane	ug/l	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00
Dibromomethane	ug/l	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00
Dichlorodifluoromethane	ug/l	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00
Ethyl methacrylate	ug/l	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00
Ethylbenzene	ug/l	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00
Hexachlorobutadiene	ug/l	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00
Iodomethane	ug/l	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00
Methacrylonitrile	ug/l	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00
Methyl methacrylate	ug/l	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00
Methylene chloride	ug/l	< 2.00	< 2.00	< 2.00	< 2.00	< 2.00	< 2.00	< 2.00
Naphthalene	ug/l	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00
Propionitrile	ug/l	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00
Styrene	ug/l	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00
Tetrachloroethylene	ug/l	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00
Toluene	ug/l	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00
trans-1,2-Dichloroethylene	ug/l	< 1.00	< 1.00	2.5	< 1.00	< 1.00	0.526 J	< 1.00
trans-1,3-Dichloropropylene	ug/l	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00
trans-1,4-Dichloro-2-butene	ug/l	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00
Trichloroethylene	ug/l	< 1.00	< 1.00	94.9	< 1.00	< 1.00	55.4	< 1.00
Trichlorofluoromethane	ug/l	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00
Vinyl acetate	ug/l	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00
Vinyl chloride	ug/l	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00	< 1.00
Xylenes (total)	ug/l	< 3.00	< 3.00	< 3.00	< 3.00	< 3.00	< 3.00	< 3.00
SEMI-VOLATILE ORGANIC COMPOUNDS (Method 8270C)								
1,2,4,5-Tetrachlorobenzene	ug/l	< 9.80	< 9.71	< 9.71	< 9.62	< 9.71	< 9.80	< 9.80
2,3,4,6-Tetrachlorophenol	ug/l	< 9.80	< 9.71	< 9.71	< 9.62	< 9.71	< 9.80	< 9.80
2,4,5-Trichlorophenol	ug/l	< 9.80	< 9.71	< 9.71	< 9.62	< 9.71	< 9.80	< 9.80
2,4,6-Trichlorophenol	ug/l	< 9.80	< 9.71	< 9.71	< 9.62	< 9.71	< 9.80	< 9.80
2,4-Dichlorophenol	ug/l	< 9.80	< 9.71	< 9.71	< 9.62	< 9.71	< 9.80	< 9.80
2,4-Dimethylphenol	ug/l	< 9.80	< 9.71	< 9.71	< 9.62	< 9.71	< 9.80	< 9.80
2,4-Dinitrophenol	ug/l	< 19.6	< 19.4	< 19.4	< 19.2	< 19.4	< 19.6	< 19.6
2,4-Dinitrotoluene	ug/l	< 9.80	< 9.71	< 9.71	< 9.62	< 9.71	< 9.80	< 9.80
2,6-Dichlorophenol	ug/l	< 9.80	< 9.71	< 9.71	< 9.62	< 9.71	< 9.80	< 9.80
2,6-Dinitrotoluene	ug/l	< 9.80	< 9.71	< 9.71	< 9.62	< 9.71	< 9.80	< 9.80
2-Chloronaphthalene	ug/l	< 0.980	< 0.971	< 0.971	< 0.962	< 0.971	< 0.980	< 0.980
2-Chlorophenol	ug/l	< 9.80	< 9.71	< 9.71	< 9.62	< 9.71	< 9.80	< 9.80
2-Methyl-4,6-dinitrophenol	ug/l	< 9.80	< 9.71	< 9.71	< 9.62	< 9.71	< 9.80	< 9.80
2-Methylnaphthalene	ug/l	< 0.980	< 0.971	< 0.971	< 0.962	< 0.971	< 0.980	< 0.980
2-Nitrophenol	ug/l	< 9.80	< 9.71	< 9.71	< 9.62	< 9.71	< 9.80	< 9.80
3,3'-Dichlorobenzidine	ug/l	< 9.80	< 9.71	< 9.71	< 9.62	< 9.71	< 9.80	< 9.80
3,3'-Dimethylbenzidine	ug/l	< 9.80	< 9.71	< 9.71	< 9.62	< 9.71	< 9.80	< 9.80
4-Bromophenylphenylether	ug/l	< 9.80	< 9.71	< 9.71	< 9.62	< 9.71	< 9.80	< 9.80
4-Chloro-3-methylphenol	ug/l	< 9.80	< 9.71	< 9.71	< 9.62	< 9.71	< 9.80	< 9.80
4-Chloroaniline	ug/l	< 9.80	< 9.71	< 9.71	< 9.62	< 9.71	< 9.80	< 9.80
4-Chlorophenylphenylether	ug/l	< 9.80	< 9.71	< 9.71	< 9.62	< 9.71	< 9.80	< 9.80
4-Nitrophenol	ug/l	< 9.80	< 9.71	< 9.71	< 9.62	< 9.71	< 9.80	< 9.80

Atlas Missile Site No. 7
Vernon, Texas
Groundwater Sampling Results
July 2002

Monitoring Well		MW06	MW07	MW08	MW09	MW10	MW11	MW12
Collection Date		7/9/2002	7/9/2002	7/11/2002	7/9/2002	7/11/2002	7/1072002	7/10/2002
Acenaphthylene	ug/l	< 0.980	< 0.971	< 0.971	< 0.962	< 0.971	< 0.980	< 0.980
Acetophenone	ug/l	< 9.80	< 9.71	< 9.71	< 9.62	< 9.71	< 9.80	< 9.80
Aniline	ug/l	< 9.80	< 9.71	< 9.71	< 9.62	< 9.71	< 9.80	< 9.80
Anthracene	ug/l	< 0.980	< 0.971	< 0.971	< 0.962	< 0.971	< 0.980	< 0.980
Benzo(a)anthracene	ug/l	< 0.980	< 0.971	< 0.971	< 0.962	< 0.971	< 0.980	< 0.980
Benzo(a)pyrene	ug/l	< 0.980	< 0.971	< 0.971	< 0.962	< 0.971	< 0.980	< 0.980
Benzo(b)fluoranthene	ug/l	< 0.980	< 0.971	< 0.971	< 0.962	< 0.971	< 0.980	< 0.980
Benzo(ghi)perylene	ug/l	< 0.980	< 0.971	< 0.971	< 0.962	< 0.971	< 0.980	< 0.980
Benzo(k)fluoranthene	ug/l	< 0.980	< 0.971	< 0.971	< 0.962	< 0.971	< 0.980	< 0.980
Benzyl alcohol	ug/l	< 9.80	< 9.71	< 9.71	< 9.62	< 9.71	< 9.80	< 9.80
bis(2-Chloroethoxy)methane	ug/l	< 9.80	< 9.71	< 9.71	< 9.62	< 9.71	< 9.80	< 9.80
bis(2-Chloroethyl) ether	ug/l	< 9.80	< 9.71	< 9.71	< 9.62	< 9.71	< 9.80	< 9.80
bis(2-Ethylhexyl)phthalate	ug/l	< 9.80	< 9.71	< 9.71	< 9.62	4.69 J	9.56 J	< 9.80
Butylbenzylphthalate	ug/l	< 9.80	< 9.71	< 9.71	< 9.62	< 9.71	< 9.80	< 9.80
Chlorobenzilate	ug/l	< 9.80	< 9.71	< 9.71	< 9.62	< 9.71	< 9.80	< 9.80
Chrysene	ug/l	< 0.980	< 0.971	< 0.971	< 0.962	< 0.971	< 0.980	< 0.980
Dibenzo(a,h)anthracene	ug/l	< 0.980	< 0.971	< 0.971	< 0.962	< 0.971	< 0.980	< 0.980
Dibenzofuran	ug/l	< 9.80	< 9.71	< 9.71	< 9.62	< 9.71	< 9.80	< 9.80
Diethylphthalate	ug/l	< 9.80	0.935 BJ	< 9.71	0.948 BJ	< 9.71	0.956 BJ	< 9.80
Dimethylphthalate	ug/l	< 9.80	< 9.71	< 9.71	< 9.62	< 9.71	< 9.80	< 9.80
Di-n-butylphthalate	ug/l	< 9.80	< 9.71	< 9.71	< 9.62	< 9.71	< 9.80	1.01 J
Di-n-octylphthalate	ug/l	< 9.80	< 9.71	< 9.71	< 9.62	< 9.71	< 9.80	< 9.80
Diphenylamine	ug/l	< 9.80	< 9.71	< 9.71	< 9.62	< 9.71	< 9.80	< 9.80
Ethyl Methanesulfonate	ug/l	< 9.80	< 9.71	< 9.71	< 9.62	< 9.71	< 9.80	< 9.80
Fluoranthene	ug/l	< 0.980	< 0.971	< 0.971	< 0.962	< 0.971	< 0.980	< 0.980
Fluorene	ug/l	< 0.980	< 0.971	< 0.971	< 0.962	< 0.971	< 0.980	< 0.980
Hexachlorobenzene	ug/l	< 9.80	< 9.71	< 9.71	< 9.62	< 9.71	< 9.80	< 9.80
Hexachlorocyclopentadiene	ug/l	< 9.80	< 9.71	< 9.71	< 9.62	< 9.71	< 9.80	< 9.80
Hexachloroethane	ug/l	< 9.80	< 9.71	< 9.71	< 9.62	< 9.71	< 9.80	< 9.80
Indeno(1,2,3-cd)pyrene	ug/l	< 0.980	< 0.971	< 0.971	< 0.962	< 0.971	< 0.980	< 0.980
m,p-Cresols	ug/l	< 9.80	< 9.71	< 9.71	< 9.62	< 9.71	< 9.80	< 9.80
Methyl methanesulfonate	ug/l	< 9.80	< 9.71	< 9.71	< 9.62	< 9.71	< 9.80	< 9.80
m-Nitroaniline	ug/l	< 9.80	< 9.71	< 9.71	< 9.62	< 9.71	< 9.80	< 9.80
Nitrobenzene	ug/l	< 9.80	< 9.71	< 9.71	< 9.62	< 9.71	< 9.80	< 9.80
N-Methyl-N-nitrosomethylamine	ug/l	< 9.80	< 9.71	< 9.71	< 9.62	< 9.71	< 9.80	< 9.80
N-Nitrosodiethylamine	ug/l	< 9.80	< 9.71	< 9.71	< 9.62	< 9.71	< 9.80	< 9.80
N-Nitrosodi-n-butylamine	ug/l	< 9.80	< 9.71	< 9.71	< 9.62	< 9.71	< 9.80	< 9.80
N-Nitrosodipropylamine	ug/l	< 9.80	< 9.71	< 9.71	< 9.62	< 9.71	< 9.80	< 9.80
o-Cresol	ug/l	< 9.80	< 9.71	< 9.71	< 9.62	< 9.71	< 9.80	< 9.80
o-Nitroaniline	ug/l	< 9.80	< 9.71	< 9.71	< 9.62	< 9.71	< 9.80	< 9.80
Pentachlorobenzene	ug/l	< 9.80	< 9.71	< 9.71	< 9.62	< 9.71	< 9.80	< 9.80
Pentachloronitrobenzene	ug/l	< 9.80	< 9.71	< 9.71	< 9.62	< 9.71	< 9.80	< 9.80
Pentachlorophenol	ug/l	< 9.80	< 9.71	< 9.71	< 9.62	< 9.71	< 9.80	< 9.80
Phenacetin	ug/l	< 9.80	< 9.71	< 9.71	< 9.62	< 9.71	< 9.80	< 9.80
Phenanthrene	ug/l	< 0.980	< 0.971	< 0.971	< 0.962	< 0.971	< 0.980	< 0.980
Phenol	ug/l	< 9.80	< 9.71	< 9.71	< 9.62	< 9.71	< 9.80	< 9.80
p-Nitroaniline	ug/l	< 9.80	< 9.71	< 9.71	< 9.62	< 9.71	< 9.80	< 9.80
Pyrene	ug/l	< 0.980	< 0.971	< 0.971	< 0.962	< 0.971	< 0.980	< 0.980
Pyridine	ug/l	< 9.80	< 9.71	< 9.71	< 9.62	< 9.71	< 9.80	< 9.80

Appendix B

Lithologic Logs
And
Well Information
From
Pre-Phase III
Investigations

Preliminary Assessment
And
Site Inspection
June 1995

HOLE NO. 78H01

DRILLING LOG	DIVISION: SOUTHWEST	INSTALLATION: HIGHWAYS: TEXAS 91 & U.S. 283	SHEET 1 OF 1 SHEETS
1. PROJECT: FORMER ATLAS MISSILE SITE No. 7		10. SIZE AND TYPE OF BIT: 9" ROCKBIT	
2. LOCATION: 0.00 (Coordinates or Station) 0.00		11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MSL	
3. DRILLING AGENCY: COE, TULSA DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL: CME	
4. HOLE NO. (As shown on drawing title and file number): 78H01		13. OVERBURDEN SAMPLES: DISTURBED / UNDISTURBED	
5. NAME OF DRILLER: RAY YOILS		14. TOTAL NUMBER CORE BOXES: 0	(22JUN95)
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER: 14.2' BELOW GROUND SURFACE	
7. THICKNESS OF OVERBURDEN: 40.0		16. DATE HOLE: STARTED 06/14/95 / COMPLETED	
8. DEPTH DRILLED INTO ROCK: 0.0		17. ELEVATION TOP OF HOLE: 0.0	
9. TOTAL DEPTH OF HOLE: 40.0 BELOW GROUND SURFACE		18. TOTAL CORE RECOVERY FOR BORING: 0.0 %	
MERLIN W. DEAN	INSPECTOR		

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
	4		CLAY (CL) (0.0 - 10.0) RED, SANDY, MODERATELY FIRM, MOIST.			STICKUP OF 4"PVC 3.0' ABOVE SURFACE. GROUT: 10.0'-SURFACE SEAL: TO 10.0' SAND: 12.0' TOP OF SCREEN: 17.0' BOTTOM OF SCREEN: 37.0' BOTTOM OF HOLE: 40.0'
	8					
-10.0						
	12		SAND (SC) (10.0 - 15.0) LIGHT-TAN, SOFT, MOIST.			
-15.0						
	16		SAND (SC) (15.0 - 40.0) RED-TAN, SOFT, MOIST.			
	20					
	24					
	28					
	32					
	36					
-40.0	40		BOTTOM OF HOLE: 40.0'			

PROJECT: FORMER ATLAS MISSILE SITE No. 7 | HOLE NO. 78H01

ATLASH07.DGN/ATLAUX07.DGN
27FEB'97 / RBP

HOLE NO. 78H03

DRILLING LOG	DIVISION SOUTHWEST	INSTALLATION HIGHWAYS: TEXAS 91 & U.S. 283	SHEET 1 OF 3 SHEETS
1. PROJECT FORMER ATLAS MISSILE SITE No. 7		10. SIZE AND TYPE OF BIT 9" ROCKBIT	
2. LOCATION (Coordinates or Station) 0.00	0.00	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL	
3. DRILLING AGENCY COE, TULSA DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number)	78H03	13. OVERBURDEN SAMPLES DISTURBED 4	UNDISTURBED
5. NAME OF DRILLER BEAVERS / VOILS		14. TOTAL NUMBER CORE BOXES 0	(22JUN95)
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER 16.0' BELOW GROUND SURFACE	
		16. DATE HOLE STARTED 06/02/95	COMPLETED 06/14/95
7. THICKNESS OF OVERBURDEN 42.0		17. ELEVATION TOP OF HOLE 0.0	
8. DEPTH DRILLED INTO ROCK 108.0		18. TOTAL CORE RECOVERY FOR BORING 0.0 %	
9. TOTAL DEPTH OF HOLE 170.0 BELOW GROUND SURFACE		(UNKNOWN)	INSPECTOR

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
	4		SAND (SP) (0.0 - 10.0) MEDIUM-TAN, FINE, NP, SOFT, MOIST.			STICKUP: 3.0' 133.3' OF 4"PVC PIPE. 20.0'- 4"-SCREEN. JARS @ 6.0' AND READINGS OF 4.0' (0-20 SCALE). GROUT: 113.0'-SURFACE BENTONITE SEAL: 113.0' SAND TO 117.0' SCREEN: 130.3'-150.3' BOTTOM OF WELL: 150.3' BOTTOM OF HOLE: 170.0'
	8				J-1	
-10.0						
	12		SAND (SC) (10.0 - 22.0) TAN, 20-25 LL, FIRM, MOIST.		J-2	06/13/95: HOLE HAD FILLED IN TO 60.0'. VOILS ROCK-BITTED BACK TO 170.0', HUNG IN HOLE @ 42.0'. 06/14/95: SUCCEEDED IN REMOVING PIPE & ROCKBIT.
	16				J-3	
	20				J-4	SAMPLE DEPTH J-1 6.0- 10.0 J-2 10.0- 14.0 J-3 14.0- 18.0 J-4 18.0- 22.0
-22.0						
	24		SAND (SC) (22.0 - 42.0) MEDIUM-TAN, FIRM.			
	28					
	32					
	36					
	40					
-42.0						
	44		SANDSTONE (SS) (42.0 - 96.0)			
	48					
	52					
	56					
-60.0	60					

PROJECT FORMER ATLAS MISSILE SITE No. 7 | HOLE NO. 78H03

ATLASM07.DGN/ATLAUX07.DGN
27FEB'97 / RBP

HOLE NO. 7BH03

DRILLING LOG	DIVISION SOUTHWEST	INSTALLATION HIGHWAYS: TEXAS 91 & U.S. 283	SHEET 2 OF 3 SHEETS
1. PROJECT FORMER ATLAS MISSILE SITE No. 7		10. SIZE AND TYPE OF BIT 9" ROCKBIT	
2. LOCATION (Coordinates or Station) 0.00 0.00		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL	
3. DRILLING AGENCY COE, TULSA DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number) 7BH03		13. OVERBURDEN SAMPLES DISTURBED 4	UNDISTURBED
5. NAME OF DRILLER BEAVERS / VOILS		14. TOTAL NUMBER CORE BOXES 8 (22JUN95)	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER 16.0' BELOW GROUND SURFACE	
7. THICKNESS OF OVERBURDEN 42.0		16. DATE HOLE STARTED 06/02/95	COMPLETED 06/14/95
8. DEPTH DRILLED INTO ROCK 108.8		17. ELEVATION TOP OF HOLE 0.0	
9. TOTAL DEPTH OF HOLE 170.0 BELOW GROUND SURFACE		18. TOTAL CORE RECOVERY FOR BORING 0.0 %	
		(UNKNOWN)	INSPECTOR

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
	64		SANDSTONE (SS) (42.0 - 96.0)			
	68					
	72					
	76					
	80					
	84					
	88					
	92					
-96.0	96					
	100		CLAY (CL) (96.0 - 110.0) SHALEY, RED.			
	104					
	108					
-110.0						
	112		SANDSTONE (SS) (110.0 - 118.0) MODERATELY-HARD.			
	116					
-118.0						
-120.0	120		SILTSTONE (ST) (118.0 - 120.0) RED, HARD.			

ATLASH07.DGN/ATLAUX07.DGN
27FEB'97 / RBP

HOLE NO. 78H03

DRILLING LOG	DIVISION SOUTHWEST	INSTALLATION HIGHWAYS: TEXAS 91 & U.S. 283	SHEET 3 OF 3 SHEETS
1. PROJECT FORMER ATLAS MISSILE SITE No. 7		10. SIZE AND TYPE OF BIT 9" ROCKBIT	
2. LOCATION (Coordinates or Station) 0.00	0.00	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL	
3. DRILLING AGENCY COE, TULSA DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number) 78H03		13. OVERBURDEN SAMPLES DISTURBED 4	UNDISTURBED
5. NAME OF DRILLER BEAVERS / VOILS		14. TOTAL NUMBER CORE BOXES 0	(22JUN95)
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER 16.0' BELOW GROUND SURFACE	
7. THICKNESS OF OVERBURDEN 42.0		16. DATE HOLE STARTED 06/02/95	COMPLETED 06/14/95
8. DEPTH DRILLED INTO ROCK 108.8		17. ELEVATION TOP OF HOLE 0.0	
9. TOTAL DEPTH OF HOLE 170.0 BELOW GROUND SURFACE		18. TOTAL CORE RECOVERY FOR BORING 0.0 %	
		(UNKNOWN)	INSPECTOR

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
-120.0						
	124		SANDSTONE (SS) (120.0 - 130.0) MODERATELY-HARD.			
	128					
-130.0						
	132		SILTSTONE (ST) (130.0 - 150.0) SILTSTONE & SHALE, INTERMITTENTLY.			
	136					
	140					
	144					
	148					
-150.0						
	152		SANDSTONE (SS) (150.0 - 170.0) SANDSTONE, SILTSTONE & SHALE, INTERMITTENTLY.			
	156					
	160					
	164					
	168					
-170.0			BOTTOM OF HOLE: 170.0'			
	172					
	176					
	180					

PROJECT FORMER ATLAS MISSILE SITE No. 7 | HOLE NO. 78H03

ATLASM07.DGN/ATLAUX07.DGN
27FEB'97 / RBP

HOLE NO. 7BH04

DRILLING LOG	DIVISION SOUTHWEST	INSTALLATION HIGHWAYS: TEXAS 91 & U.S. 283	SHEET 1 OF 1 SHEETS
1. PROJECT FORMER ATLAS MISSILE SITE No. 7		10. SIZE AND TYPE OF BIT SPLITSPOON	
2. LOCATION 0.00 (Coordinates or Station) 0.00		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL	
3. DRILLING AGENCY COE, TULSA DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number) 7BH04		13. OVERBURDEN SAMPLES	DISTURBED / UNDISTURBED
5. NAME OF DRILLER BEAVERS / VOILS		14. TOTAL NUMBER CORE BOXES 0	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER 20.0' BELOW GROUND SURFACE	
		16. DATE HOLE STARTED 06/02/95	COMPLETED 06/02/95
7. THICKNESS OF OVERBURDEN 0.0		17. ELEVATION TOP OF HOLE 0.0	
8. DEPTH DRILLED INTO ROCK 0.0		18. TOTAL CORE RECOVERY FOR BORING 0.0 %	
9. TOTAL DEPTH OF HOLE 22.0 BELOW GROUND SURFACE		MERLIN W. DEAN	INSPECTOR

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
			SAND (SM) (0.0 - 3.5) BROWN, SILTY, SOFT, MOIST.		J-1	WATER-TABLE: 20.0' BOTTOM OF HOLE: 22.0'
-3.5	4		SAND (SM) (3.5 - 8.5) LIGHT-BROWN, SILTY, FIRM, MOIST.		J-2	SAMPLE DEPTH J-1 0.0- 2.0 J-2 5.0- 7.0 J-3 10.0- 12.0 J-4 15.0- 17.0
-8.5	8		SAND (SM) (8.5 - 13.5) RED, SILTY, GRAVELLY, SOFT, MOIST.		J-3	
-13.5	12		SAND (SC) (13.5 - 22.0) LIGHT-TAN, FIRM, MOIST.		J-4	
-22.0	16 20		BOTTOM OF HOLE: 22.0'			
	24 28 32 36 40					

PROJECT FORMER ATLAS MISSILE SITE No. 7 | HOLE NO. 7BH04

ATLASH07.DGN/ATLAUX07.DGN
27FEB'97 / RBP

HOLE NO. 7BH05

DRILLING LOG	DIVISION: SOUTHWEST	INSTALLATION: HIGHWAYS: TEXAS 91 & U.S. 283	SHEET 1 OF 1 SHEETS
1. PROJECT: FORMER ATLAS MISSILE SITE No. 7		10. SIZE AND TYPE OF BIT: SOLID-STEM AUGER	
2. LOCATION (Coordinates or Station): 0.00 0.00		11. DATUM FOR ELEVATION SHOWN (TBM or MSL): MSL	
3. DRILLING AGENCY: COE, TULSA DISTRICT		12. MANUFACTURER'S DESIGNATION OF DRILL: FAILING 1500	
4. HOLE NO. (As shown on drawing title and file number): 7BH05		13. OVERBURDEN SAMPLES: DISTURBED / UNDISTURBED	
5. NAME OF DRILLER: RAY VOILS		14. TOTAL NUMBER CORE BOXES: 0	
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER: DATA NOT AVAILABLE.	
		16. DATE HOLE: STARTED 06/02/95 / COMPLETED 06/02/95	
7. THICKNESS OF OVERBURDEN: 0.0		17. ELEVATION TOP OF HOLE: 0.0	
8. DEPTH DRILLED INTO ROCK: 0.0		18. TOTAL CORE RECOVERY FOR BORING: 0.0 %	
9. TOTAL DEPTH OF HOLE: 27.0 BELOW GROUND SURFACE		INSPECTOR	

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)
			SAND (SM) (0.0 - 7.5) REDDISH-BROWN, FINE-MEDIUM GRAIN, LOOSE, TRACE GRAVEL.		J-1	WATER LEVEL: SOIL WET AT 20.5' BOTTOM OF HOLE: 27.0'
	3					SAMPLE DEPTH J-1 0.0- 5.0 J-2 10.0- 10.5 J-3 15.0- 17.0 J-4 20.0- 22.0 J-5 22.0- 25.0
-7.5	6					
	9		SILT (ML) (7.5 - 10.5) YELLOW/BROWN - REDDISH, SANDY, TRACE WORM BURROWS AT BASE.			
-10.5					J-2	
	12		SAND (SM) (10.5 - 25.0) YELLOWISH/TAN - BROWNISH-RED, FINE, SILTY, TRACE WELL ROUNDED GRAVEL OF QUARTZ AND GRANITE. REDDISH-BROWN FROM 20'-25'.			
	15				J-3	
	18					
	21				J-4	
	24				J-5	
-25.0						
-27.0	27		SILT (ML) (25.0 - 27.0) SANDY, BROWN AND MOTTLED, WITH RED/YELLOW AND BLACK. BOTTOM OF HOLE: 27.0'			
	30					

PROJECT: FORMER ATLAS MISSILE SITE No. 7 | HOLE NO. 7BH05

ATLASH07.DGN/ATLAUX07.DGN
27FEB'97 / RBP

Expanded Site Investigation
July 2000

MORRISON KNUDSEN CORPORATION
ENVIRONMENTAL SERVICES GROUP

BOREHOLE LOG

Sheet 1 of 3
Project Number: 4423-0220
Hole Number: BH06

Project: AMS No. 7 ESI
Location: AMS No. 7, Vernon Texas
Coordinates: (N) 7543291.90 (E) 1719524.29
Drilling Contractor: Horizon Drilling
Drill Make and Model / Drilling Method: Longyear BK-81 / HSA
Depth Top of Rock: 76.7
Depth Casing & Size: NA
Hole Size: 8"
Elevation: 1365.0 (MSL)
Angle from Vert. and Bearing: NA
Depth Bottom of Hole: 79.0'
Water Level: 21.5' / 18.3' (in core) (in open hole)
Fluid & Additives: Mud (100% bentonite)
Date Start: 7/19/00
Date Finish: 7/19/00
Logger: PHIL Hammons

ELEVATION	DEPTH BELOW SURFACE (ft)	SAMPLE INTERVAL (Time)	SAMPLE TYPE & NUMBER	SAMPLE % RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SYMBOLIC LOG	SOIL DESCRIPTION (Name, color, grain size, sorting (or gradation), plasticity, weathering, mineralogy, inclusions, angularity, moisture content.)
	0	(0-0.5') 1200	AMS-BH06-S-00 PID=0.0 chemical	5.0/5.0			SAND WITH SOME SILT (SM), moderate brown (5YR 4/4), v. fine grained, quartzose, 15% silt, dry (Upper seasonal ft probable AF due to closure activities). PID=0.0
	5	(5.0-6.0) 1405	-05 PID=0.0 chemical	5.0/5.0			grades to grayish orange (10YR 7/4) PID=0.0
	10	(10.0-11.0) 1415	-10 chemical PID=0.0	5.0/5.0			laminated moderate reddish brown (10R 4/6) and very pale orange (10YR 8/2) PID=0.0 gradational
	15	(16.0-18.0) 1425	-18 (QA/QC) chemical PID=0.0	5.0/5.0			SAND (SP), moderate reddish brown (10R 3/4, 4/6), v. fine grained, quartzose, no silt PID=0.0
18.3' W (in core)	20			5.0/5.0			Very silty sand (sm), moderate reddish brown (10R 4/6), very fine grained, quartzose, 30% silt, saturated
							-20.5' grades to silty Sand (SM), light brown (5 YR 5/6), 15-20% silt PID=0.0
				3.0/5.0			SANDY CLAY (CL), pale yellowish brown (10YR 6/2), 20% v. fine grained sand, low plasticity, saturated
	25						

MORRISON KNUDSEN CORPORATION
ENVIRONMENTAL SERVICES GROUP

BOREHOLE LOG

Sheet 2 of 3
Project Number: 4423-0220
Hole Number: BH 06

Project: AMS No.7 ESI
Location: AMS No.7 Vernon, Texas

ELEVATION	DEPTH BELOW SURFACE ft	SAMPLE INTERVAL	SAMPLE TYPE & NUMBER	SAMPLE % RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SYMBOLIC LOG	SOIL DESCRIPTION (Name, color, grain size, sorting (or gradation), plasticity, weathering, mineralogy, inclusions, angularity, moisture content)
							CL (as above) gradational
				5.0/5.0			CLAYEY SAND (SC), light brown (5YR 5/6), v. fine grained, quartzose, 35-40% clay, soft, saturated. PID = ϕ.ϕ
	30			4.8/5.0			SANDY CLAY (CL), very pale orange (10YR 8/2), 25-30% v. fine grained sand, stiff, abundant calcine nodules (2-3 mm diam.) PID = ϕ.ϕ
	35			4.0/5.0			Silty SAND (SM), mottled light brown (5YR 5/6) and very pale orange (10YR 8/2), v. fine grained, quartzose, 10-20% silt, soft. flowing sand PID = ϕ.ϕ
	40			2.1/5.0			SAND (SP), light brown (5YR 5/6), v. fine grained, subrounded to subangular, soft, flowing sand PID = ϕ.ϕ
	45			1.0/5.0			PID = ϕ.ϕ
	50			1.3/5.0			- grades to rounded grains PID = ϕ.ϕ
	55						

MORRISON KNUDSEN CORPORATION
ENVIRONMENTAL SERVICES GROUP

BOREHOLE LOG

Sheet 3 of 3
Project Number: 4423-0220
Hole Number: BH06

Project: AMS No.7 ESI
Location: AMS No.7 Vernon, Texas

ELEVATION	DEPTH BELOW SURFACE (ft)	SAMPLE INTERVAL (TIME)	SAMPLE TYPE & NUMBER	% RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SYMBOLIC LOG	SOIL DESCRIPTION (Name, color, grain size, sorting (or gradation), plasticity, weathering, mineralogy, inclusions, angularity, moisture content.)
							SAND (SP) as above
				1.7/5.0			PID = 0.0
60							
				1.6/5.0			PID = 0.0
65							
							PID = 0.0
				3.0/5.0			SILT (ML), light brown (5YR 6/4), hard
70							SAND (SP) as above
				2.6/5.0			PID = 0.0
75		75.5-76.5 (1015)	AMS7-BH06-5-76 chunnel PID = 0.0				Top of Bedrock at 76.7'
				3.2/5.0 4.0 push			SANDSTONE, moderate reddish brown (10R 4/6), very fine grained, trace silt, faint low angle x-bedding, highly weathered.
							T.D. at 79.0'
80							

MORRISON KNUDSEN CORPORATION
ENVIRONMENTAL SERVICES GROUP

BOREHOLE LOG

Sheet 1 of 4
Project Number: 4423-0220
Hole Number: BH-07

Project: AMS NO. 7 ESI
Location: AMS No. 7/Vernon TEXAS
Coordinates: (N) 7543371.68 (E) 1719805.76
Drilling Contractor: Horizon Drilling
Drill Make and Model / Drilling Method: Longyear BK-81
Depth Top of Rock: 85.5'
Depth Casing & Size: NA
Hole Size: 8"
Elevation: 1367.0 (MSL)
Angle from Vert. and Bearing: NA
Depth Bottom of Hole: 87.0'
Water Level: 11.3' (in open hole) 10' (in core)
Fluid & Additives: Insta-Vis (Mfg) Liquid Polymer
Date Start: 7/17/00
Date Finish: 7/18/00
Logger: Phil Hammons

ELEVATION	DEPTH BELOW SURFACE #1	SAMPLE INTERVAL (Time)	SAMPLE TYPE & NUMBER	SAMPLE % RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SYMBOLIC LOG	SOIL DESCRIPTION
	0	0-1.5' (1510)	AMST-BH07-S-00 (Chemical) PID=0	3.3/5.0			SAND (SM), moderate reddish brown (10R 4/6), very fine to medium grained, 10% silt, 5% gravel, trace caliche nodules, Artificial Fill, soft
							PID = 0.0'
	5	5-6' (1520)	-05 (Chemical) PID=0	1.8/5.0			(as above)
							approximate
▽	10	(10-11') (1525)	-10 (Chemical) PID=0	2.0/5.0			SAND (SP), grayish orange (10YR 7/4), medium to coarse grained, subrounded to rounded grains, quartz saturated at 10.0' in core, soft (AF?)
							SAND with some silt (SM), mottled moderate reddish brown (10R 4/6) and light brown (5YR 5/6), very fine grained, trace medium grained, quartz, 15% silt, soft
	15			2.5/5.0			PID = 0.0
							approximate
	20			5.0/5.0			CLAYEY SAND (SC), laminated light brown (5YR 5/6) and moderate yellowish brown (10YR 5/4), fine grained, quartz, 35% fines, trace caliche nodules stiff
							PID = 0.0
	25						

MORRISON KNUDSEN CORPORATION
ENVIRONMENTAL SERVICES GROUP

BOREHOLE LOG

Sheet 2 of 4
Project Number: 4423-0220
Hole Number: BH-07

Project: AMS No. 7 ESI
Location: AMS No. 7, Vernon Texas

ELEVATION	DEPTH BELOW SURFACE (ft)	SAMPLE INTERVAL	SAMPLE TYPE & NUMBER	SAMPLE % RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SYMBOLIC LOG	SOIL DESCRIPTION (Name, color, grain size, sorting (or gradation), plasticity, weathering, mineralogy, inclusions, angularity, moisture content.)
				5.0/5.0			(as above) PID = 0.0
	30			5.0/5.0			trace gravel (up to 1" diameter), some caliche nodules and layers PID = 0.0
	35			3.8/5.0			SAND with some gravel (SW), moderate yellowish brown (10YR 5/4), fine grained, gravel up to 1.5" diameter, soft (36.0-36.8') CLAYEY SAND (SC), laminated pale olive (10Y 6/2) and moderate yellowish brown (10YR 5/4), fine grained, 20% clay, stiff
	40			4.0/5.0			approximate SAND WITH some SILT (SM), mottled light brown (5YR 5/6) and grayish orange (10YR 7/4), V. fine grained, trace clay, flowing sands PID = 0.0
	45			3.8/5.0			approximate SAND (SP), light brown (5YR 6/4), fine grained, poorly graded, trace silt, quartzose, flowing sands PID = 0.0
	50			4.0/5.0			(as above) Core barrel stuck in augers due to flowing sand on 50-55' run. Could not dislodge. Had to pull augers and rods out of hole to dislodge and go back in.
	55						

MORRISON KNUDSEN CORPORATION
ENVIRONMENTAL SERVICES GROUP

BOREHOLE LOG

Sheet 3 of 4
Project Number: 4423-0220
Hole Number: BH-07

Project: AMS No. 7 ESI
Location: AMS No. 7, Vernon, Texas

ELEVATION	DEPTH BELOW SURFACE (ft)	SAMPLE INTERVAL	SAMPLE TYPE & NUMBER	% RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SYMBOLIC LOG	SOIL DESCRIPTION (Name, color, grain size, sorting (or gradation), plasticity, weathering, mineralogy, inclusions, angularity, moisture content)
	60						Drilled ahead without sampling from 55-65'. AT 65' added Insta-Vis liquid Polymer to mud pit to bring up cuttings and flush out HSA. (ACETCO product)
	65			0.9/2.0'			From 65'-86', switched from continuous sampling to drive sampling with downhole hammer and 2' spoons (2" diameter). SAND (SP) as above, flowing sands
				0.7/2.0'			PID=0.0
	70			0.4/2.0			
				1.0/2.0			PID=0.0
				2.0/2.0			
	75			1.3/2.0			SANDY SILT (ML), light brown (5YR 5/6), sand is v. fine grained (30%), trace clay.
				1.0/2.0			SAND (SP) as above. PID=0.0. Drilled ahead without sampling from 79'-83', push to 86'
	80						
		845' (1740)	AMS7-BH07-5-85 (chemical) PID=0.0	3.0/4.0			SAND (SP) as above
	85						

MORRISON KNUDSEN CORPORATION
ENVIRONMENTAL SERVICES GROUP

BOREHOLE LOG

Sheet 4 of 4
Project Number: 4423-0221
Hole Number: BH-07

Project: AMS No. 7 ESI
Location: AMS No. 7 Vernon, Texas

ELEVATION	DEPTH BELOW SURFACE (ft)	SAMPLE: INTERVAL	SAMPLE: TYPE & NUMBER	SAMPLE: % RECOVERY	STANDARD PENETRATION TEST RESULTS: 6"-6"-6" (N)	SYMBOLIC LOG	SOIL DESCRIPTION: Name, color, grain size, sorting (or gradation), plasticity, weathering, mineralogy, inclusions, angularity, moisture content.
				3/4			SAND (SP) as above — TOP OF BEDROCK at 85.5'
							SANDSTONE, moderate reddish brown (10R 4/6), silty, hard
							T.D. @ 87.0'
90							
95							

MORRISON KNUDSEN CORPORATION
ENVIRONMENTAL SERVICES GROUP

BOREHOLE LOG

Sheet 1 of 3

Project Number: 4423-0220

Hole Number: BH-08

Project: AMS No. 7 ESI

Location: AMS No. 7, Vernon Texas

Coordinates: (N) 7543550.53 (E) 1719815.19

Drilling Contractor: Houzon Drilling

Drill Make and Model / Drilling Method: Long Year BK 81 / HSA

Depth Top of Rock: 80.5'

Depth Casing & Size: NA

Hole Size: 8"

Elevation: 1362.5 (msl)

Angle from Vert. and Bearing: N/A

Depth Bottom of Hole: 85.0'

Water Level: 15.0' in 18.5' in core open hole

Fluid & Additives: Mud / Bentonite (100%)

Date Start: 7/20/00

Date Finish: 7/20/00

Logger: PHL Hammons

ELEVATION	DEPTH BELOW SURFACE (ft)	SAMPLE INTERVAL (TIME)	SAMPLE TYPE & NUMBER / PID	SAMPLE % RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SYMBOLIC LOG	SOIL DESCRIPTION: Name, color, grain size, sorting (or gradation), plasticity, weathering, mineralogy, inclusions, angularity, moisture content.
	0	0'-0.5' 7/20/00 (1205)					SAND (SP), light brown (5YR 5/6), v. fine grained, trace silt dry.
		0.5-6.0' 7/20/00 (1250)	AMS-7-BH08-S-0.5 chemical PID=0.0	3.0 / 5.0			
	5		S-0.5 chemical				approximate
		10.0-11.0' (1300)	S-10 chemical	5.0 / 5.0			SILTY SAND, (SM), mod. reddish brown (10R 4/6), v. fine grained, 15% silt, trace gravel (rounded, <1" diameter), abundant caliche nodules (2-4" diam.).
							from 5-15' slight oil odor
	10			5.0 / 5.0			- grades to light brown (5YR 5/6) with some very pale orange (10YR 8/2) mottling
				5.0 / 5.0			- trace caliche nodules (3-4 mm)
	15	15.0-16.0' (1325)	S-15 chemical				- silt content increases to 30%
			S-18.0 VOC chemical	5.0 / 5.0			
		16.5-18.5' (1340)	(15-17.5' Pressure)				
			PID = 0.0	3.5 / 5.0			SANDY CLAY (CL), light brown (5YR 5/6), v. fine grained sand (35%), some caliche nodules, low plasticity.
	20						
	25						

Core 18.5'

MORRISON KNUDSEN CORPORATION
ENVIRONMENTAL SERVICES GROUP

BOREHOLE LOG

Sheet 2 of 3
Project Number: 4423-0220
Hole Number: BH-08

Project: AMS No. 7 ESI
Location: AMS No. 7, Vernon TX.

ELEVATION	DEPTH BELOW SURFACE #1	SAMPLE INTERVAL	SAMPLE TYPE & NUMBER	SAMPLE % RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SYMBOLIC LOG	SOIL DESCRIPTION (Name, color, grain size, sorting (or gradation), plasticity, weathering, mineralogy, inclusions, angularity, moisture content)
			PID ϕ.ϕ	5.0/5.0			SANDY CLAY (CL) as above 25-27' - grayish orange (10YR 7/4) with abundant caliche nodules (3-7mm dia.). - grades to light brown (5YR 5/6) without caliche
30			PID ϕ.ϕ	5.0/5.0			30.0-32.2 grayish orange (10YR 7/4), abundant caliche nodules (3-7mm) - grades to l. brown (5YR 5/6) gradational
35			PID ϕ.ϕ	4.0/5.0			SILTY SAND (SM), light brown (5YR 5/6), v. fine grained, quartzose, well rounded, 20% silt, trace clay, soft, flowing sand
40			PID ϕ.ϕ	1.3/5.0			
45			PID ϕ.ϕ	1.0/5.0			SANDY SILT (ML), mod. orange pink (5YR 8/4), 15% v. fine sand, hard
							SAND WITH SOME SILT (SM), l. brown (5YR 5/6), v. fine grained, quartzose, well rounded, 10% silt, flowing sand, soft
50			PID ϕ.ϕ	4.1/5.0			
55							

MORRISON KNUDSEN CORPORATION
ENVIRONMENTAL SERVICES GROUP

BOREHOLE LOG

Sheet 3 of 3
Project Number: 4423-0220
Hole Number: BH-08

Project: AMS No. 7 ESI
Location: AMS No. 7, Vernon Tx

ELEVATION	DEPTH BELOW SURFACE (ft)	SAMPLE INTERVAL	SAMPLE TYPE & NUMBER	SAMPLE % RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SYMBOLIC LOG	SOIL DESCRIPTION: Name, color, grain size, sorting (or gradation), plasticity, weathering, mineralogy, inclusions, angularity, moisture content.
			PID ϕ.ϕ	1.0/5.0			SAND WITH SOME SILT (SM) as above
	60		PID ϕ.6	0.6/5.0			
	65		PID ϕ.6	2.2/5.0			VERY SANDY SILT, l. brown (5YR 6/4), 40% v. fine gr. sand, stiff.
							SAND (SP), light brown (5YR 6/4), v. fine grained, quartzose, rounded, flowing sand.
	70		PID ϕ.6	1.2/5.0			
	75			1.0/5.0			
	80	(80.1-80.5') 1750	S-80 (ES) chemical PID=ϕ.ϕ				Top of Bedrock at 80.5'
				2.8/5.0			SANDSTONE, Mod. reddish brown, v. fine grained; faint low angle x-bedding; highly weathered
	85						T.D. at 85' bgs

MORRISON KNUDSEN CORPORATION
ENVIRONMENTAL SERVICES GROUP

BOREHOLE LOG

Sheet 1 of 4
Project Number: 4423-0220
Hole Number: BH-09

Project: AMS NO.7 ESI
Location: AMS No.7, Veron Texas
Coordinates: (N) 7543566.68 (E) 1719814.85
Drilling Contractor: Horizon Drilling / Peterson Drilling
Drill Make and Model / Drilling Method: Gardner-Denver 1500 / Mud Rotary
Longyear BK-81 / Air Rotary / Mud Rotary
Depth Top of Rock: pwh 84' 80.5'
Depth Casing & Size: Isolation Casing 91' 8 5/8" (Stick-up)
Hole Size: 0-95' (12 1/4"), 95'-210' (8 1/4") 3
Elevation: pwh NR / 1362.82 (MSL)
168' Disk Vis added 168-210 Bentonite mud
Angle from Vert. and Bearing: Borehole Reamed w/ Diltek D40K
Depth Bottom of Hole: 210'
Water Level:
Fluid & Additives: 0-95' - Bentonite Mud; 95-168' - None
Date Start: 7/12/00
Date Finish: 8/03/00
Logger: PHIL HAMMONS

ELEVATION	DEPTH BELOW SURFACE (ft)	SAMPLE INTERVAL	SAMPLE TYPE & NUMBER	SAMPLE % RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SYMBOLIC LOG	SOIL DESCRIPTION
	10	N/A	N/A		N/A		Drilled from 0.0' to 88' bgs with 4.25" tricone; logged cuttings (see log of adjacent Borehole BH08 for lithologies)
	20						▼ approximate depth to groundwater
	30						
	40						
	50						

MORRISON KNUDSEN CORPORATION
ENVIRONMENTAL SERVICES GROUP

BOREHOLE LOG

Sheet 2 of 4
Project Number: 4423-022C
Hole Number: BH-09

Project: AMS No.7 ESI
Location: AMS No. 7, Vernon Texas

ELEVATION	DEPTH BELOW SURFACE #1	SAMPLE INTERVAL	SAMPLE TYPE NUMBER PID	SAMPLE % RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SYMBOLIC LOG	SOIL DESCRIPTION
	60						see log of adjacent Borehole BH08 for lithologies
	70						
	80						Top of Bedrock at 80.5' (based on contact encountered in adjacent BH08)
							weathered bedrock
							unweathered bedrock at 84.0' based on drilling change
	90	Boring isolation casing		5.0/5.0	N/A		SANDSTONE, moderate reddish brown (10R 4/6), v. fine grained, quartose, prominent low angle cross-bedding, hard dry
		91.0'					Reamed pilot (4.25") borehole with 12.25" tricone bit from 0.0' to 98' bgs. Set 8 5/8" steel casing to 91' bgs and grouted in place.
							Begin Air Coring at 98.0' on 7/19/00
	100						SILTSTONE N:IN some sand, moderate reddish brown (10R 4/6), sand is v. fine grained (10%), dry, possible water bearing fractures
			0.0	6.5/10	NA		SILTY SANDSTONE, moderate reddish brown (10R 4/6), sand is fine grained, quartose, 25-30% silt, dry, low angle x-l
							approximate
	110			5.7/10	NA		SANDSTONE, pale reddish brown (10R 5/4) with pale olive (10Y 6/2) mottling, v. fine grained, quartz and rk fragments, abundant elongate shale clasts marcas, prominent low angle x-bedding, small (2-10 mm) solution cavities, some filled w/ crystals.

MORRISON KNUDSEN CORPORATION
ENVIRONMENTAL SERVICES GROUP

BOREHOLE LOG

Sheet 3 of 4
Project Number: 4423-0220
Hole Number: BH-09

Project: Ams No. 7 ESI
Location: Ams No. 7, Vernon Texas

ELEVATION	DEPTH BELOW SURFACE (ft)	SAMPLE INTERVAL	SAMPLE TYPE & NUMBER PID	SAMPLE % RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SYMBOLIC LOG	SOIL DESCRIPTION (Name, color, grain size, sorting (or gradation), plasticity, weathering, mineralogy, inclusions, angularity, moisture content.)
							as above
			ϕ.ϕ	5.7/10	NA		SANDY SHALE, pale reddish brown (10 R 5/4) with pale olive (10 y 6/2) mottling sand is vf fine grained (20-30%)
							approximate
							SANDSTONE, Pale reddish brown (10 R 5/4), v. fine, rained, quartzose, low angle x-bedding, moderately cemented.
120			ϕ.ϕ	6.8/10	NA		122'-128' - clayey
							131.5 - 134.0 mottled pale olive (10y 6/2) with abundant shale clasts
130			ϕ.ϕ	8.7/10	NA		(from 116-138' loss of ≈ 100 gallons to Fm.)
							138.5'-140.2' mottled pale olive (10y 6/2) with abundant shale clasts
140			ϕ.ϕ	4.9/10	NA		140.2'-142.9' - weakly cemented
							weakly cemented, no noticeable x-bedding
150			ϕ.ϕ	3.0/10	NA		
							159.2'-160.7' - mottled pale olive (10y 6/2) with abundant shale clasts
160			ϕ.ϕ	6.0/10	NA		160.7'-164.0' - weakly cemented
							(from 138-168' loss of ≈ 160 gallons to Fm) Drillers added InstaVis Liquid Polymer at 168' (Flushed out pit prior to coring)
170				6.0/10	NA		168.0'-170.6' well cemented, abundant solution cavities (1-4 mm) prominent x-bedding (low angle)

MORRISON KNUDSEN CORPORATION
ENVIRONMENTAL SERVICES GROUP

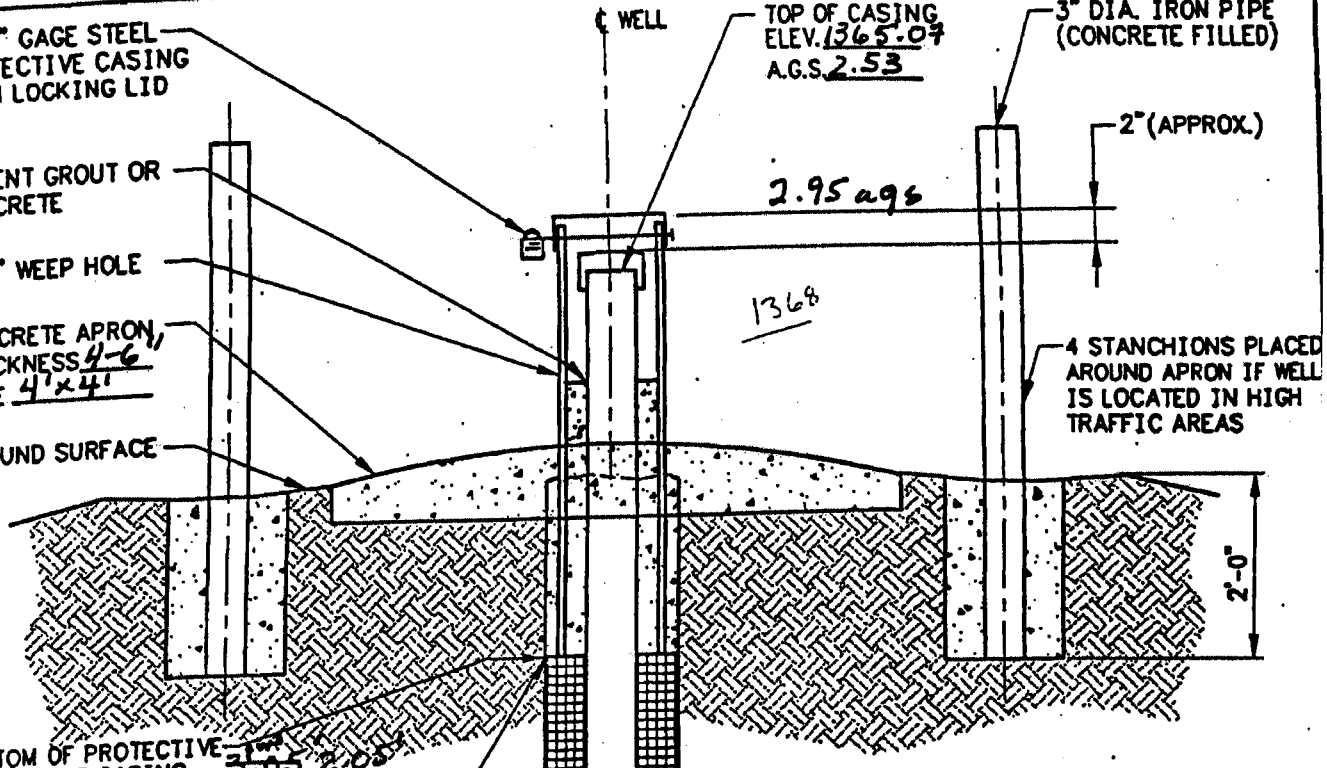
BOREHOLE LOG

Sheet 4 of 4
Project Number: 4423-0226
Hole Number: BH-09

Project: AMS No. 7 ESI
Location: AMS No. 7, Vernon, Texas

ELEVATION	DEPTH BELOW SURFACE (ft)	SAMPLE: INTERVAL	SAMPLE: TYPE & NUMBER / PID	SAMPLE: % RECOVERY	STANDARD PENETRATION TEST RESULTS: 6"-6"-6" (N)	SYMBOLIC LOG	SOIL DESCRIPTION: Name, color, grain size, sorting (or gradation), plasticity, weathering, mineralogy, inclusions, angularity, moisture content.
							170.5-171.5 - weakly cemented
			0.7	6.0/10	NA		SILTSTONE, Greenish gray (5G 6/1), shaley in areas, sand content (5%) weakly cemented
							approximate
							SHALE, moderate reddish brown (10R 4/6) with thin bands of greenish gray (5G 4/1)
	180						178'-180' - soft, wet
							180'-181.8' very hard, dry
			2.6	6.1/10	NA		181.8-184' - alternating soft and hard, damp to dry
							moderate reddish brown (10R 4/6) with occassional greenish gray (5G 4/1) spots, very hard, dry, fractures in areas (possible water bearing).
	190		>2000	4.8/5			
			>2000	5.0/5.0			
	200		>2000	3.7/5.0			
			NR	2.1/5.0			low battery on PID, lamp will not light
			NR	1.4/2.0			T.D. at 210' bgs
	210						
	220						
	230						

MW06



BOTTOM OF PROTECTIVE CASING 3.05 2.05' B.G.S.

TOP OF GROUT 2' B.G.S.

BOREHOLE DIAMETER 8"

CASING TYPE & DIAMETER PVC schedule 40 2"

GROUT TYPE Portland/Bentonite Mix

TOP OF SEAL 10.0' B.G.S.

SEAL TYPE 1/4" bentonite pellets

TOP OF FILTER PACK 13.0' B.G.S. 21.68'

STATIC WATER LEVEL 23.12 bgs

DATE 7/24/00

TOP OF SCREEN 16.0' B.G.S.

SCREEN TYPE PVC schedule 80

DIAMETER 2"

LENGTH 15' (base 31.0')

SLOT SIZE 0.01"

FILTER PACK TYPE 20/40 SILICA SAND

10 bags (50lb bags)

BOTTOM OF WELL 31.0 .26' bgs 4' B.G.S. 33.79-2.53

BOREHOLE TOTAL DEPTH 31.5' B.G.S.

NOT TO SCALE

TULSA TERC
Standard Operating Procedures
DOCUMENT NO 10-GW-04

Attachment 1A

WELL CONSTRUCTION RECORD
(ABOVE-GROUND COMPLETION)

USACE TULSA DISTRICT

MORRISON KNUDSEN CORPORATION

FILE NAME (CAD) 1801022.DWG DATE 05/01/00

WORK ORDER 4493 TASK 0180 DRAWING NUMBER REV. A

end original copy by certified mail to: TNRCC, P.O. Box 13087, Austin, TX 78711-3087

Please use black ink.

ATTENTION OWNER: *Confidentiality Privilege Notice on Reverse Side*

State of Texas
WELL REPORT

Texas Water Well Drillers Advisory Council
P.O. Box 13087
Austin, TX 78711-3087
512-239-0530

1) OWNER North Side Indep. School District (Name) Attn: Jim Reid ADDRESS 18040 Hwy 283 (Street or RFD) Vernon (City) TX (State) 76384 (Zip)

2) ADDRESS OF WELL: County Wilbarger NE¼ of Section 29, Block 11 of the H&TC RR Co. Survey Formerly known as Atlas Missile Site #7 (Street, RFD or other) (City) (State) (Zip) GRID # 13-46-2

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

4) PROPOSED USE (Check): ☒ Monitor ☐ Environmental Soil Boring ☐ Domestic ☐ Industrial ☐ Irrigation ☐ Injection ☐ Public Supply ☐ De-watering ☐ Testwell
If Public Supply well, were plans submitted to the TNRCC? ☐ Yes ☐ No

5)

6) WELL LOG: MW-06
Date Drilling: Started 7/20 2000 Completed 7/20 2000

DIAMETER OF HOLE

Dia. (in.)	From (ft.)	To (ft.)
8"	Surface	31'

7) DRILLING METHOD (Check): ☐ Driven ☐ Air Rotary ☐ Mud Rotary ☐ Bored ☐ Air Hammer ☐ Cable Tool ☐ Jetted ☒ Other Augers

N

From (ft.) To (ft.) Description and color of formation material

0' - 12' tan silty clay
12' - 31' tan sands

8) Borehole Completion (Check): ☐ Open Hole ☐ Straight Wall ☐ Underreamed ☒ Gravel Packed ☐ Other
If Gravel Packed give interval ... from 13' ft. to 31' ft.

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 Casting Screen
2"	N	PVC	0'	16'	406
2"	N	PVC	16'	31'	.010

(Use reverse side if necessary)

9) CEMENTING DATA [Rule 338.44(1)]
Cemented from 10 ft. to 3' ft. No. of sacks used 3
ft. to ft. No. of sacks used
Method used Hand mix
Cemented by Horizon Drilling
Distance to septic system field lines or other concentrated contamination ft.
Method of verification of above distance

10) SURFACE COMPLETION
☒ Specified Surface Slab Installed [Rule 338.44(2)(A)]
☐ Specified Steel Sleeve Installed [Rule 338.44(3)(A)]
☐ Pitless Adapter Used [Rule 338.44(3)(b)]
☐ Approved Alternative Procedure Used [Rule 338.71]

11) WATER LEVEL: NA
Static level ft. below land surface Date
Artesian flow gpm. Date

12) PACKERS:

Type	Depth
Bentonite chips	10-13'

13) TYPE PUMP: NA
☐ Turbine ☐ Jet ☐ Submersible ☐ Cylinder ☐ Other
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 you knowingly 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 Horizon Drilling (Type or print) WELL DRILLER'S LICENSE NO. 4922-M

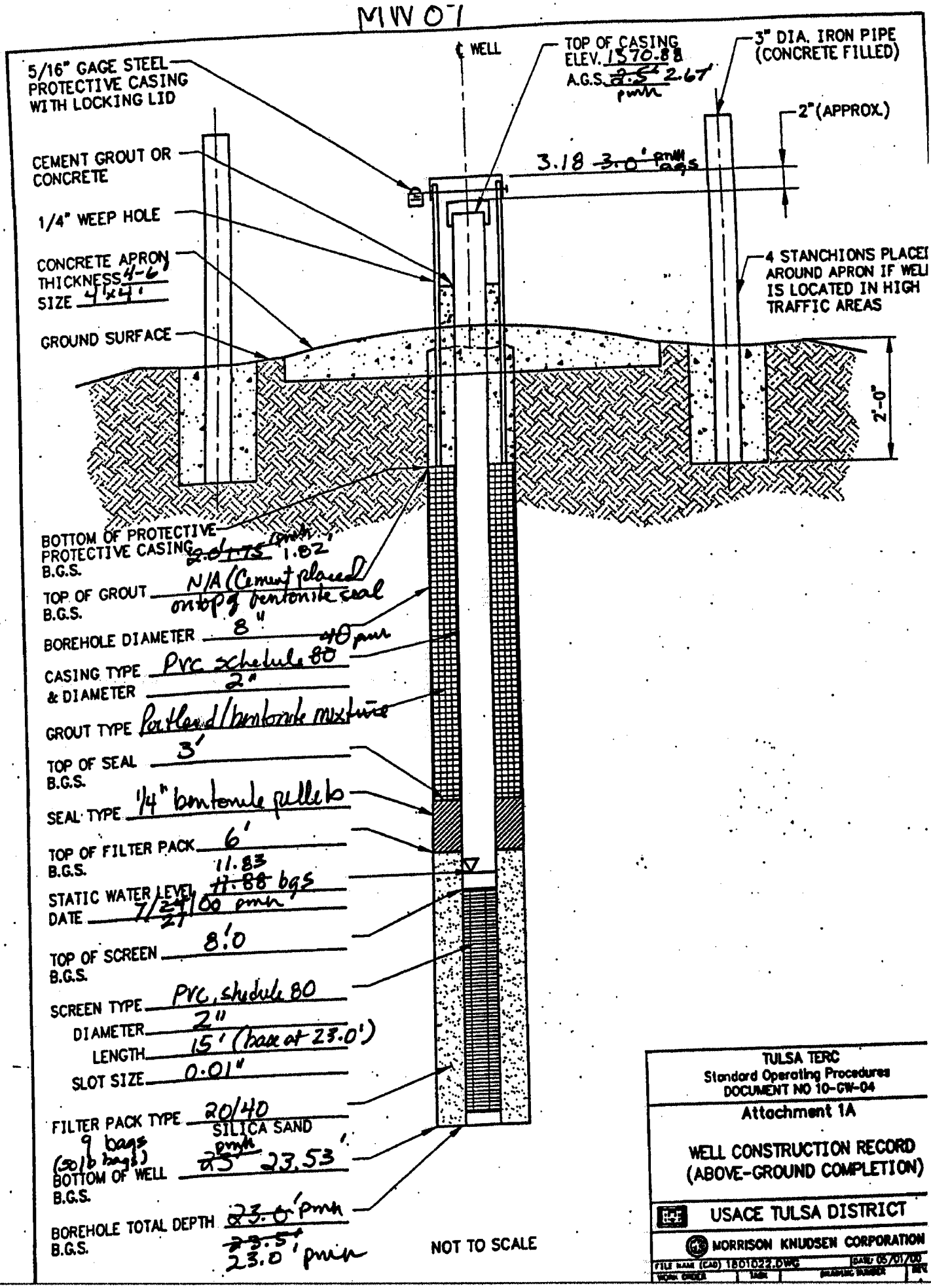
ADDRESS Rt 4 Box 103 (Street or RFD) Tryon (City) OK (State) 74875 (Zip)

(Signed) (Licensed Well Driller)

(Signed) (Registered Driller Trainee)

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

MW 07



TULSA TERC
Standard Operating Procedures
DOCUMENT NO 10-GW-04

Attachment 1A

WELL CONSTRUCTION RECORD
(ABOVE-GROUND COMPLETION)

USACE TULSA DISTRICT

MORRISON KNUDSEN CORPORATION

FILE NAME (CAD) 1501022.DWG DATE 05/01/00
WORK ORDER | DGN | DRAWING NUMBER | REV

end original copy by certified mail to: TNRCC, P.O. Box 13087, Austin, TX 78711-3087

Please use black ink.

ATTENTION OWNER: *Confidentiality Privilege Notice on Reverse Side*

State of Texas
WELL REPORT

Texas Water Well Drillers Advisory Council
P.O. Box 13087
Austin, TX 78711-3087
512-239-0530

1) OWNER North Side Indep. School District (Name) ADDRESS 18040 Hwy 283 (Street or RFD) Vernon (City) TX (State) 76384 (Zip)
Attn: Jim Reed

2) ADDRESS OF WELL: County Wilbarger NE¼ of Section 29, Block 11 of the H&TC RR Co. Survey Formerly known as Atlas Missile Site #7 (Street, RFD or other) (City) (State) (Zip) GRID # 13-46-2

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

4) PROPOSED USE (Check): ☒ Monitor ☐ Environmental Soil Boring ☐ Domestic ☐ Industrial ☐ Irrigation ☐ Injection ☐ Public Supply ☐ De-watering ☐ Testwell
If Public Supply well, were plans submitted to the TNRCC? ☐ Yes ☐ No

5) N

6) WELL LOG: MW-07
Date Drilling: Started 7/19 19 2000 Completed 7/19 19 2000

DIAMETER OF HOLE		
Dia. (in.)	From (ft.)	To (ft.)
8"	Surface	23'

7) DRILLING METHOD (Check): ☐ Driven ☐ Air Rotary ☐ Mud Rotary ☐ Bored ☐ Air Hammer ☐ Cable Tool ☐ Jetted ☒ Other Auger

From (ft.)	To (ft.)	Description and color of formation material
0'	10'	tan silty clay
10'	23'	tan sands

8) Borehole Completion (Check): ☐ Open Hole ☐ Straight Wall ☐ Underreamed ☒ Gravel Packed ☐ Other
If Gravel Packed give interval ... from 23' ft. to 6' ft.

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 Casting Screen
2"	N	PVC	23'	8'	.010
2"	N	PVC	8'	0'	40G

(Use reverse side if necessary)

9) CEMENTING DATA [Rule 338.44(1)]
Cemented from 5' ft. to 0' ft. No. of sacks used 2'
ft. to ft. No. of sacks used
Method used Tremmie
Cemented by Horizon Drilling
Distance to septic system field lines or other concentrated contamination ft.
Method of verification of above distance

10) SURFACE COMPLETION
☒ Specified Surface Slab Installed [Rule 338.44(2)(A)]
☐ Specified Steel Sleeve Installed [Rule 338.44(3)(A)]
☐ Pitless Adapter Used [Rule 338.44(3)(b)]
☐ Approved Alternative Procedure Used [Rule 338.71]

11) WATER LEVEL: N/A
Static level ft. below land surface Date
Artesian flow gpm. Date

12) PACKERS: Type Depth
Bent. chips 6'-5'

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

14) WELL TESTS: N/A
Type test: ☐ Pump ☐ Bailer ☐ Jetted ☐ Estimated
Yield: gpm with ft. drawdown after hrs.

15) WATER QUALITY:
Did you knowingly 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 Horizon Drilling (Type or print) WELL DRILLER'S LICENSE NO. 4922-M

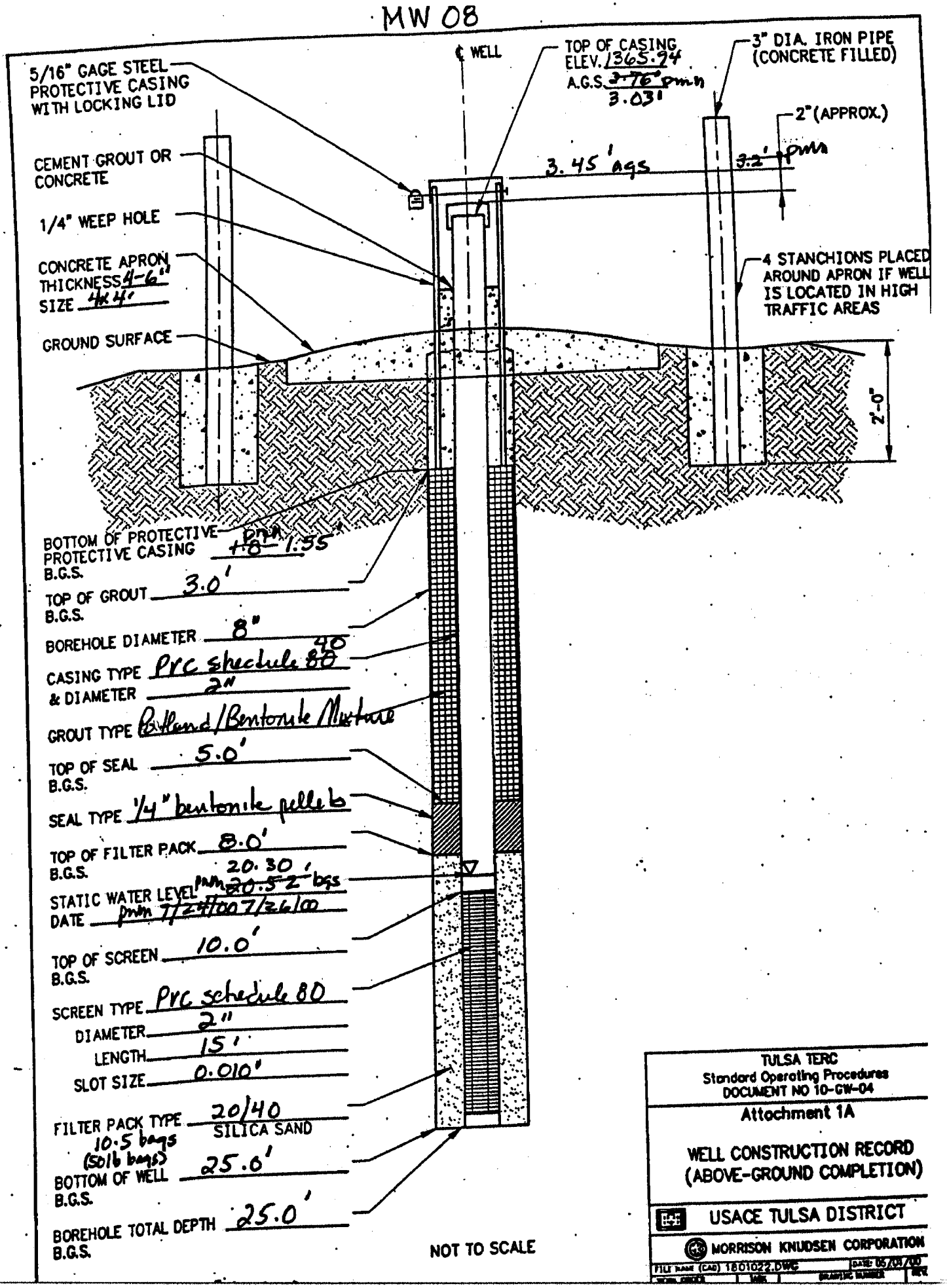
ADDRESS RT 1 Box 103 (Street or RFD) Tryon (City) OK (State) 74875 (Zip)

(Signed) (Licensed Well Driller)

(Signed) (Registered Driller Trainee)

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

MW 08



TULSA TERC
Standard Operating Procedures
DOCUMENT NO 10-GW-04

Attachment 1A

WELL CONSTRUCTION RECORD
(ABOVE-GROUND COMPLETION)

USACE TULSA DISTRICT

MORRISON KNUDSEN CORPORATION

FILE NAME (CAD) 1801022.DWG DATE: 05/01/00

Send original copy by certified mail to: TNRCC, P.O. Box 13087, Austin, TX 78711-3087

Please use black ink.

ATTENTION OWNER: *Confidentiality Privilege Notice on Reverse Side*

State of Texas
WELL REPORT

Texas Water Well Drillers Advisory Council
P.O. Box 13087
Austin, TX 78711-3087
512-239-0530

1) OWNER North Side Indep. School District (Name) Attn: Jim Reed ADDRESS 18040 Hwy 283 (Street or RFD) Vernon (City) TX (State) 7638 (Zip)

2) ADDRESS OF WELL: County Wilbarger NE¼ of Section 29, Block 11 of the H&TC RR Co. Survey Formerly known as Atlas Missile Site #7 (Street, RFD or other) (City) (State) (Zip) GRID # 13-46-2

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

4) PROPOSED USE (Check): ☒ Monitor ☐ Environmental Soil Boring ☐ Domestic ☐ Industrial ☐ Irrigation ☐ Injection ☐ Public Supply ☐ De-watering ☐ Testwell
If Public Supply well, were plans submitted to the TNRCC? ☐ Yes ☐ No

5)

6) WELL LOG: MW-08
Date Drilling: Started 7/21 19 2000 Completed 7/21 19 2000

DIAMETER OF HOLE

Dia. (in.)	From (ft.)	To (ft.)
8"	Surface	25'

7) DRILLING METHOD (Check): ☐ Driven ☐ Air Rotary ☐ Mud Rotary ☐ Bored ☐ Air Hammer ☐ Cable Tool ☐ Jetted ☒ Other Auger

N

From (ft.)	To (ft.)	Description and color of formation material
0	15'	tan silty clay
15'	25'	tan sand

8) Borehole Completion (Check): ☐ Open Hole ☐ Straight Wall ☐ Underreamed ☒ Gravel Packed ☐ Other
If Gravel Packed give interval ... from 8' ft. to 25' ft.

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 Casting Screen
2"	N	PVC	0'	10'	40
2"	N	PVC	10'	25'	.010

(Use reverse side if necessary)

9) CEMENTING DATA [Rule 338.44(1)]
Cemented from 5' ft. to 0' ft. No. of sacks used 2
ft. to ft. No. of sacks used
Method used trimmie
Cemented by Horizon Drilling
Distance to septic system field lines or other concentrated contamination ft.
Method of verification of above distance

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

10) SURFACE COMPLETION
☒ Specified Surface Slab Installed [Rule 338.44(2)(A)]
☐ Specified Steel Sleeve Installed [Rule 338.44(3)(A)]
☐ Pitless Adapter Used [Rule 338.44(3)(b)]
☐ Approved Alternative Procedure Used [Rule 338.71]

14) WELL TESTS: N/A
Type test: ☐ Pump ☐ Bailer ☐ Jetted ☐ Estimated
Yield: gpm with ft. drawdown after hrs.

11) WATER LEVEL: N/A
Static level ft. below land surface Date
Artesian flow gpm. Date

15) WATER QUALITY:
Did you knowingly 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

12) PACKERS:

Type	Depth
Bent. chips	8'-5'

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.

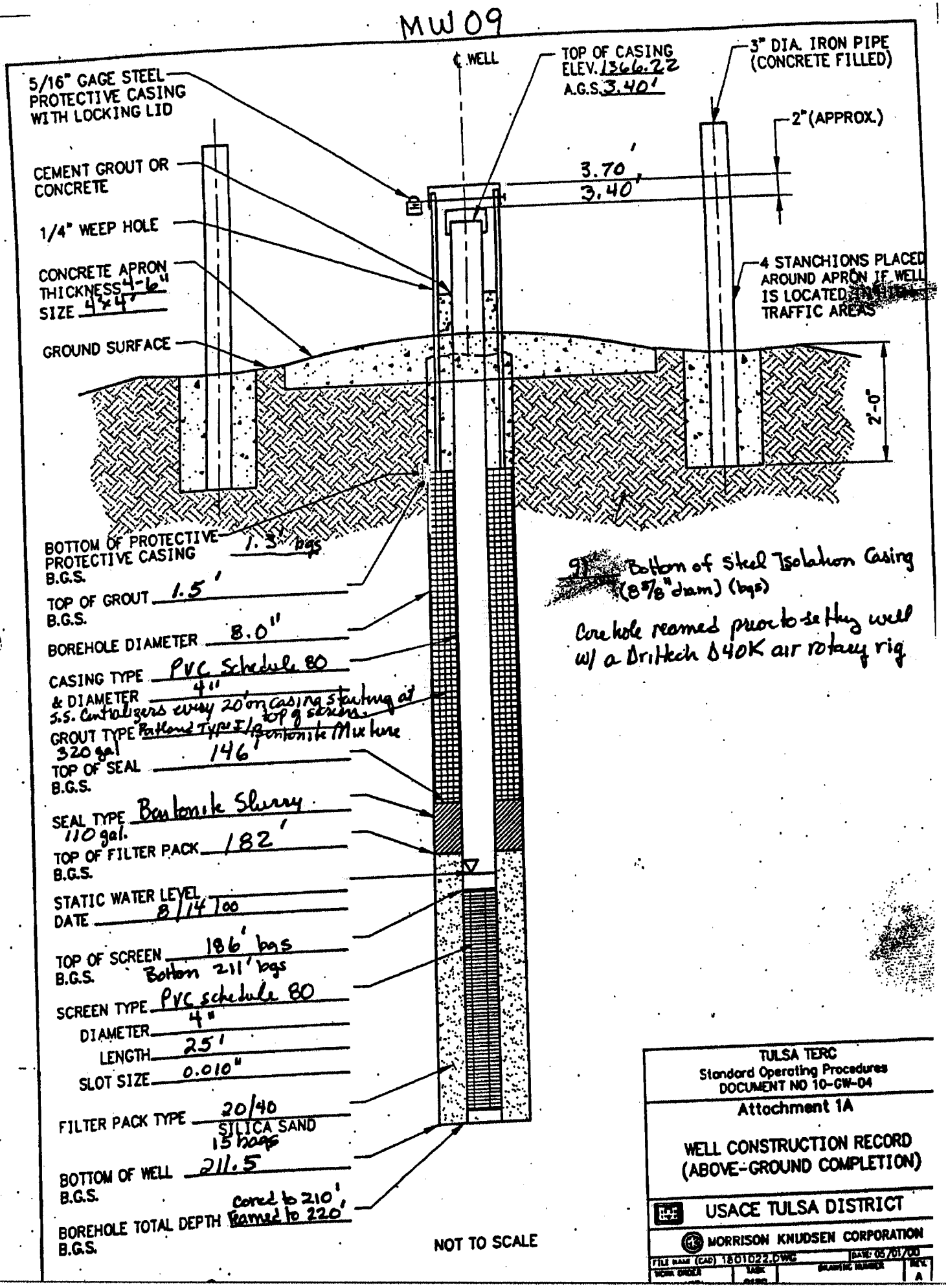
COMPANY NAME Horizon Drilling (Type or print) WELL DRILLER'S LICENSE NO. 4922-M

ADDRESS Rt 1 Box 103 (Street or RFD) Tryon (City) OK (State) 74875 (Zip)

(Signed) (Licensed Well Driller) (Signed) (Registered Driller Trainee)

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

MW09



TULSA TERC
Standard Operating Procedures
DOCUMENT NO 10-GW-04

Attachment 1A

WELL CONSTRUCTION RECORD
(ABOVE-GROUND COMPLETION)

USACE TULSA DISTRICT

MORRISON KNUDSEN CORPORATION

FILE NAME (CAD) 1801022.DWG | DATE 05/01/00
WORK ORDER | TASK | DRAWING NUMBER | REV. A

Send original copy by certified mail to: TNRCC, P.O. Box 13087, Austin, TX 78711-3087

Please use black ink.

ATTENTION OWNER: *Confidentiality Privilege Notice on Reverse Side*

State of Texas
WELL REPORT

Texas Water Well Drillers Advisory Council
P.O. Box 13087
Austin, TX 78711-3087
512-239-0530

1) OWNER Northside Ind. Sch. District (Name) ADDRESS 18040 Hwy 283 Vernon Tx 76384 (Street or RFD) (City) (State) (Zip)

2) ADDRESS OF WELL: County Wilbarger Attn: Jim Reed NE 1/4 Sect 29 Block 11 Former Missile Site #7 (Street, RFD or other) (City) (State) (Zip) GRID # 13-46-2

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

4) PROPOSED USE (Check): ☒ Monitor ☐ Environmental Soil Boring ☐ Domestic ☐ Industrial ☐ Irrigation ☐ Injection ☐ Public Supply ☐ De-watering ☐ Testwell
If Public Supply well, were plans submitted to the TNRCC? ☐ Yes ☐ No

5)

6) WELL LOG: MW-09
Date Drilling: Started 7-12 2000 Completed 8-10 2000

DIAMETER OF HOLE

Dia. (in.)	From (ft.)	To (ft.)
12.25	Surface	91
7 7/8	91	220

7) DRILLING METHOD (Check): ☐ Driven ☒ Air Rotary ☒ Mud Rotary ☐ Bored ☐ Air Hammer ☐ Cable Tool ☐ Jetted ☐ Other

From (ft.)	To (ft.)	Description and color of formation material
0	10	tan silty Clay
10	84	red to fine sands w/ interbedded clays
84	98	red to fine sandstone
98	172	poorly cemented sandstone & clayey red beds
172	200	Harder Brown Shales
200	220	Interbedded Shales and sandstones, some sands

(Use reverse side if necessary)

8) Borehole Completion (Check): ☐ Open Hole ☐ Straight Wall ☐ Underreamed ☒ Gravel Packed ☐ Other
If Gravel Packed give interval ... from 182 ft. to 220 ft.

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
8 5/8	N	steel	surface	91	
4	N	sch. 80 PVC	+3	186	010
4	N	PVC screen	186	211.5	.010

9) CEMENTING DATA [Rule 338.44(1)]
Cemented from 0 ft. to 91 ft. No. of sacks used 50
0 ft. to 182 ft. No. of sacks used 20
Method used pressure grout / tremie
Cemented by Patterson / Horizon Drilling
Distance to septic system field lines or other concentrated contamination N/A ft.
Method of verification of above distance

10) SURFACE COMPLETION
☒ Specified Surface Slab Installed [Rule 338.44(2)(A)]
☐ Specified Steel Sleeve Installed [Rule 338.44(3)(A)]
☐ Pitless Adapter Used [Rule 338.44(3)(b)]
☐ Approved Alternative Procedure Used [Rule 338.71]

11) WATER LEVEL:
Static level ____ ft. below land surface Date ____
Artesian flow ____ gpm. Date ____

12) PACKERS: 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 you knowingly 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 Horizon Drilling (Type or print) WELL DRILLER'S LICENSE NO. 5032M

ADDRESS Rt 1 Box 103 Tryon OK 74875 (Street or RFD) (City) (State) (Zip)

(Signed) Mike Dean (Licensed Well Driller) (Signed) ____ (Registered Driller Trainee)

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

Appendix C

Site Characterization
And Penetrometer Analysis System
(SCAPS)

Investigation

Expanded Site Investigation, Phase III (May/June 2002)

The Tulsa District, Corps of Engineers Site Characterization and Analysis Penetrometer System (SCAPS) unit was deployed to the former Atlas Missile Site No. 7 (AMS No. 7) in April/May 2002 to delineate both the vertical and horizontal extent of chlorinated solvent contamination in the groundwater. Data collected as part of these efforts enabled optimal placement of future monitoring wells and the identification of potential source areas. Using numerous temporary water sample collection wells (i.e. microwells) discrepancies in regional groundwater flow were resolved and resulted in flow patterns similar to the direction in which contamination appears to be migrating. Field activities were conducted in accordance with the SCAPS workplan for AMS No. 7 dated March 2002 as an addendum to the Remedial Investigation workplan developed by Deeringwater Environmental, April 2002. This section is a summary of the SCAPS efforts, field analytic techniques, sample analysis and other tasks completed during the Tulsa District's SCAPS deployment at the AMS No. 7 in Vernon, Texas.

SCAPS Work

The Tulsa District's SCAPS unit is equipped with the necessary tools to deploy cone penetrometer testing (CPT) sensors and a variety of other in-situ devices providing real-time measurements of subsurface contamination. The primary technology used at AMS No. 7 was the CPT system modified by the USACE ERDA laboratory to include through-the-tip grouting. CPT is used to determine soil stratigraphy (soil strength and soil type). This is done using a probe that can measure tip resistance and sleeve friction. The CPT uses the 20-ton mass of the SCAPS rig as a reaction force as well as hydraulics to push the CPT probe through the soil. Tip resistance is measured using strain gauges and sleeve friction is measured using a floating cylindrical sleeve located behind the cone tip. The measurements are independent and can distinguish porous sands from silts and clays. Tulsa District SCAPS gathers CPT data by following ASTM Methods D3441 and D5778. This data was used to determine screening intervals for micro-well installation and to identify any preferential pathways for contaminant migration. The CPT results are provided in the end of this report.

Based on results from the CPT sensor, the SCAPS unit collected groundwater samples from zones of interest using commercially available direct push Hydropunch equipment. Two methods were used to collect these samples and are outlined in Tulsa District's Standard Operating Procedure (SOP) M-002-SWT-03. The first method consisted of installing temporary microwells with polyvinyl chloride (PVC) pipe as the well casing, having a 0.75" inner diameter and 1.1" outer diameter. The screen was 40-mil slotted PVC with 0.010-inch slots and averaged ten feet in length for each well. These micro-wells were allowed sufficient time for re-charging that enabled collection of representative groundwater samples. This method is similar to conventional monitoring wells with the exception of having a sand pack to filter fines from the sample and the absence of above ground protective structures. The second method involved collecting groundwater samples through the push rods of the SCAPS unit. Once the depth of interest was achieved, the SCAPS push rods were retracted in order to expose approximately ten feet of screen and enable groundwater infiltration. The push rods create an annular seal in the subsurface, which prevents water from above the screen from infiltrating into the zone of interest. Balers were then lowered through the rods and into the screen for collection of samples.

The SCAPS rods were decontaminated between each well. This method is dependent on high yielding aquifers and can demonstrate considerable cost savings by eliminating the need for riser pipe. For most of the locations that had temporary wells installed to the ground surface, water levels were assessed after approximately 24 hours of recharge time. Using a surveying level, elevations for the top of these pipes was determined to allow the calculation of groundwater elevation. All groundwater samples were obtained using small diameter disposable Teflon bailers.

Collection of Water Samples

From April through May 2002, sixty-eight groundwater samples were collected from 20 locations and analyzed in real time using the Direct Sampling Ion Trap Mass Spectrometer (DSITMS). By providing immediate results, the SCAPS unit was able to setup in areas in which contaminant limits were not fully defined. On-site chemical analysis was performed in accordance with EPA Method 8265. Refer to Figure C-1 for the specific micro-well locations. Each location consisted of a shallow (S) and deep (D) groundwater sample. On a few occasions where interpretation of the CPT proved to be more challenging, an intermediate (I) sample was also collected. In general the shallow zone ranged from 15 to 30 feet below top of casing (ft btoc) and the deep zone averaged 40 to 60 ft btoc. The intermediate zone ranged between 25 to 40 ft btoc. A summary of the total number of samples collected and analyzed is presented in Table C-1.

Nine quality assurance (QA) samples were sent to a U.S. Army Corps of Engineers certified laboratory as part of the Corps overall QA program to confirm delineation of the contaminant plume and to aide in validating the results from the on-site DSITMS.

During the April 2002 mobilization, only one SCAPS location was profiled for volatile organic compounds (VOC). Several intervals were targeted based on interpretation of the CPT logs. Due to funding constraints the SCAPS unit was demobilized and scheduled to return in May 2002.

The May 2002 field efforts consisted of installing micro-wells at 19 locations while targeting various depths to sample and analyze groundwater using the on-site DSITMS. In many instances duplicate and sometimes even triplicate samples were collected from the constructed micro-wells in order to assess reproducibility in analytical data and water level measurements. For the samples collected through the SCAPS push pipe only an initial grab sample was obtained. At the conclusion of this field effort the shallow micro-wells were purged in accordance with SOP M-002-SWT-03 and re-analyzed. For reporting purposes the later data was used to evaluate site contamination and determine groundwater flow direction.

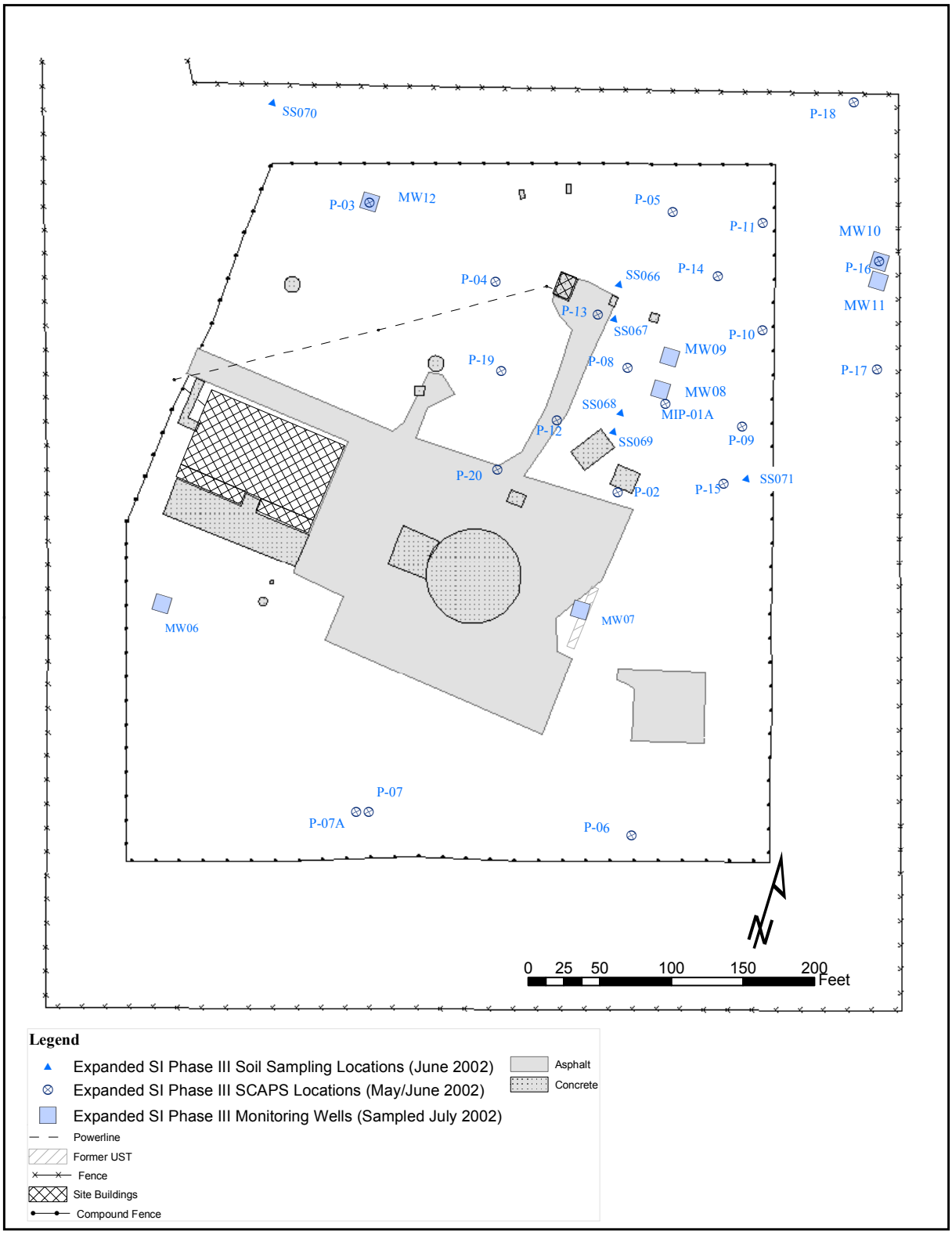


Figure C-1 ESI Phase III Sampling Locations

Table C- 1 Synopsis of Groundwater Samples Collected and Analyzed

Installation Date	Location/Sample ID	Depth (ft bgs)	Date Sampled	Comments	Water Level (ft btoc)	Groundwater Zone	QA Sample	Analytical Date
04/05/02	MIP-01A	15-25	04/06/02		nr	S		4/6/02
		25-30	04/05/02		nr	I		4/5/02
		30-40	04/05/02		nr	I		4/5/02
		40-50	04/05/02		nr	D		4/5/02
05/25/02	P-2	25-35	05/25/02		nr	S		5/25/02
		25-35	05/27/02		25.47	S	Y	5/27/02
		35-45	05/25/02	Sampled through push rods	nr	D		5/25/02
05/22/02	P-3	25-35	05/23/02		24.36	S		5/23/02
		25-35	05/27/02		24.42	S		5/27/02
		40-50	05/23/02		24.78	D		5/23/02
05/22/02	P-4	20-30	05/23/02		24.20	S		5/23/02
		20-30	05/27/02		24.22	S		5/27/02
		37-47	05/23/02		24.52	D		5/23/02
05/23/02	P-5	21-31	05/23/02		23.21	S	Y	5/23/02
		21-31	05/27/02		23.23	S		5/27/02
		32-52	05/23/02	Sampled through push rods	nr	I		5/23/02
		58-68	05/23/02		23.28	D		5/23/02
05/23/02	P-6	18-28	05/24/02		23.90	S		5/24/02
		18-28	05/27/02		23.89	S		5/27/02
		36-46	05/23/02	Sampled through push rods	nr	I		5/23/02
		50-60	05/24/02		23.86	D		5/24/02
05/24/02	P-7	20-30	05/24/02		22.16	S		5/24/02
		20-30	05/27/02		22.20	S		5/27/02
		47-57	05/24/02	Sampled through push rods	nr	D		5/24/02
05/24/02	P-8	20-30	05/24/02		24.60	S	Y	5/24/02
		20-30	05/25/02		23.83	S		5/25/02
		20-30	05/27/02		23.85	S		5/27/02
		30-40	05/24/02	Sampled through push rods	nr	D	Y	5/24/02
05/24/02	P-9	20-30	dry		dry	S		5/25/02
		20-30	05/26/02		25.98	S		5/26/02
		20-30	05/27/02		24.53	S		5/27/02
		30-40	05/24/02	Sampled through push rods	26	I		5/24/02
05/24/02	P-10	20-30	05/25/02		21.70	S		5/25/02
		20-30	05/27/02		21.72	S		5/27/02
		30-40	05/24/02	Sampled through push rods	nr	I		5/24/02
		45-55	05/27/02	Sampled through push rods	nr	D		5/27/02
05/24/02	P-11	20-30	05/25/02		21.97	S		5/25/02
		20-30	05/27/02		21.99	S		5/27/02
		30-40	05/24/02	Sampled through push rods	nr	D		5/24/02
05/25/02	P-12	20-30	05/25/02		27.47	S		5/25/02
		20-30	5/26/02		27.43	S		5/26/02
		20-30	05/27/02		27.43	S		5/27/02
		25-35	05/25/02		27.16	I		5/25/02
		25-35	05/27/02		26.78	I		5/27/02
		25-35	05/26/02		26.87	I		5/26/02
		40-50	05/25/02	Sampled through push rods	nr	D		5/25/02
05/25/02	P-13	20-30	05/23/02		29.27	S		5/26/02
		20-30	05/27/02		28.58	S		5/27/02
		40-50	05/25/02	Sampled through push rods	nr	I		5/25/02
		48-58	05/27/02	Sampled through push rods	nr	D		5/27/02
05/25/02	P-14	20-30	05/26/02		22.34	S		5/26/02
		20-30	05/27/02		22.34	S		5/27/02

Installation Date	Location/Sample ID	Depth (ft bgs)	Date Sampled	Comments	Water Level (ft btoc)	Groundwater Zone	QA Sample	Analytical Date
		40-50	05/25/02	Sampled through push rods	nr	D		5/25/02
05/26/02	P-15	22-32	05/26/02		21.83	S		5/26/02
		22-32	05/27/02		21.85	S		5/27/02
05/26/02	P-16	25-35	05/25/02		21.06	S	Y	5/27/02
		37-47	05/26/02	Sampled through push rods	nr	I		5/26/02
		45-55	05/27/02	Sampled through push rods	nr	D		5/27/02
05/26/02	P-17	20-30	05/27/02		20.32	S	Y	5/27/02
		37-47	05/26/02	Sampled through push rods	nr	D		5/26/02
	P-18	20-30	05/27/02		22.41	S	Y	5/27/02
		40-50			nr	D		5/27/02
05/27/02	P-19	20-30	05/27/02		24.80	S	Y	5/27/02
05/27/02	P-20	22-32	05/27/02		27.40	S	Y	5/27/02
NA	AMS7-WW	0	05/25/02	On-site water well				5/25/02
5/27/02	SCAPS Decon	0	5/27/02	SCAPS decon water				5/27/02

nr – data not reported.
S – represents the shallowest zone sampled.
I – represents an intermediate zone sampled.
D – represents the deepest zone sampled.

Field Analytical DSITMS

Once groundwater samples were collected, the Tulsa District's SCAPS unit also provided and operated the on-site DSITMS modified by the Department of Energy, Oakridge National Laboratory to comply with EPA Method 8265 and California EPA Certification 01-01-034 for the analysis of VOCs. DSITMS is a method for the quantitative measurement, continuous real-time monitoring, and quantitative and qualitative preliminary screening of VOCs in water, soil, and air. This method is applicable to the determination of VOCs in batch samples taken to the laboratory and to on-site measurement and monitoring. The DSITMS is best suited for the routine quantitative monitoring of sampling locations characterized once using standard gas chromatography mass spectrometry methods, for analyzing samples for the presence of VOCs, and for support of site characterization and remediation activities requiring the analysis of large numbers of samples in a short period of time or requiring on-line continuous monitoring. The modified DSITMS is not currently commercially available. For the effort at AMS No. 7, the Tulsa District also provided personnel with extensive experience in the operation and interpretation of the DSITMS results.

DSITMS Calibration

Calibration of the DSITMS system was performed to a mixture of trichloroethylene (TCE) and total dichloroethylene (DCE). The procedure as outline in SOP M-005-SWT-01 consists of analyzing a mixture of TCE/DCE in 40 milliliters of deionized water. As warranted, additional contaminants of concern can be calibrated once identified as being presence in the field samples.

Operations began on April 4, 2002 by setting up the DSITMS, connecting it to the direct sampling device and establishing carrier gas flow. The DSITMS was allowed to run over night to achieve operating temperature and pressure. Figure C-2 shows the results from the April 2002

calibration of the DSITMS completed on April 5, 2002. The linear relationship between known calibration concentration and DSITMS response was used to determine concentrations of TCE and total DCE in subsurface samples collected and analyzed during the period between April 5 through 6, 2002.

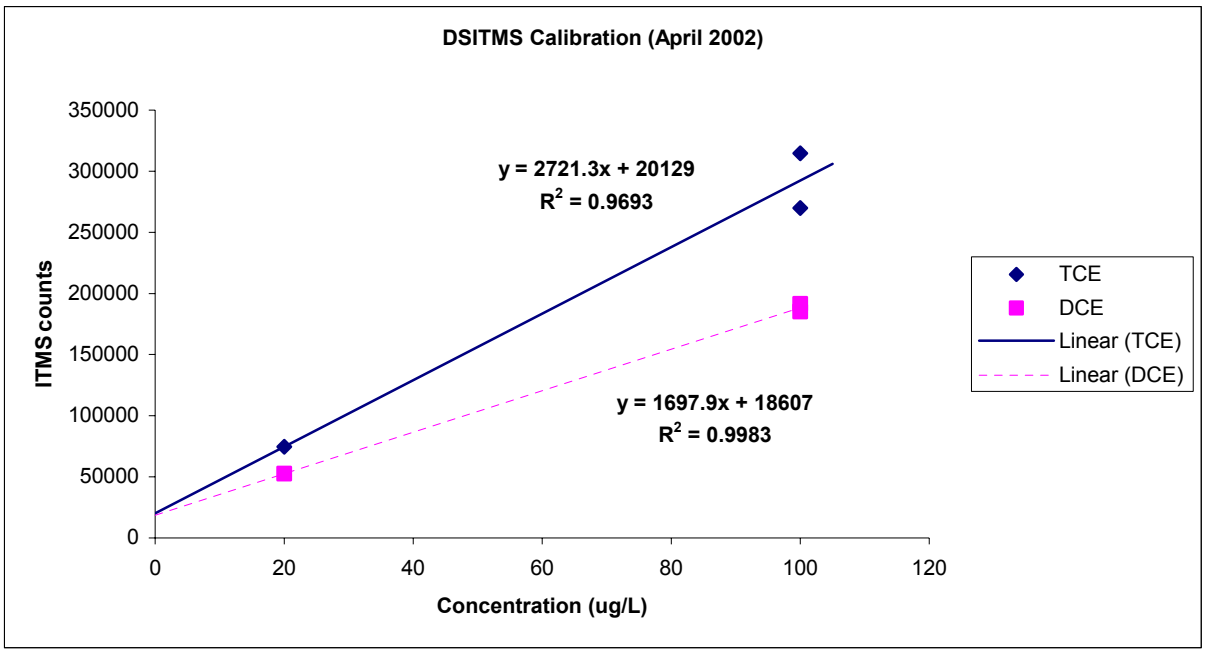


Figure C-2 DSITMS Calibration Curve - April 5, 2002

Similar setup operations were done for the second mobilization. Samples collected May 23-28, 2002 were analyzed using the calibration in Figure C-3.

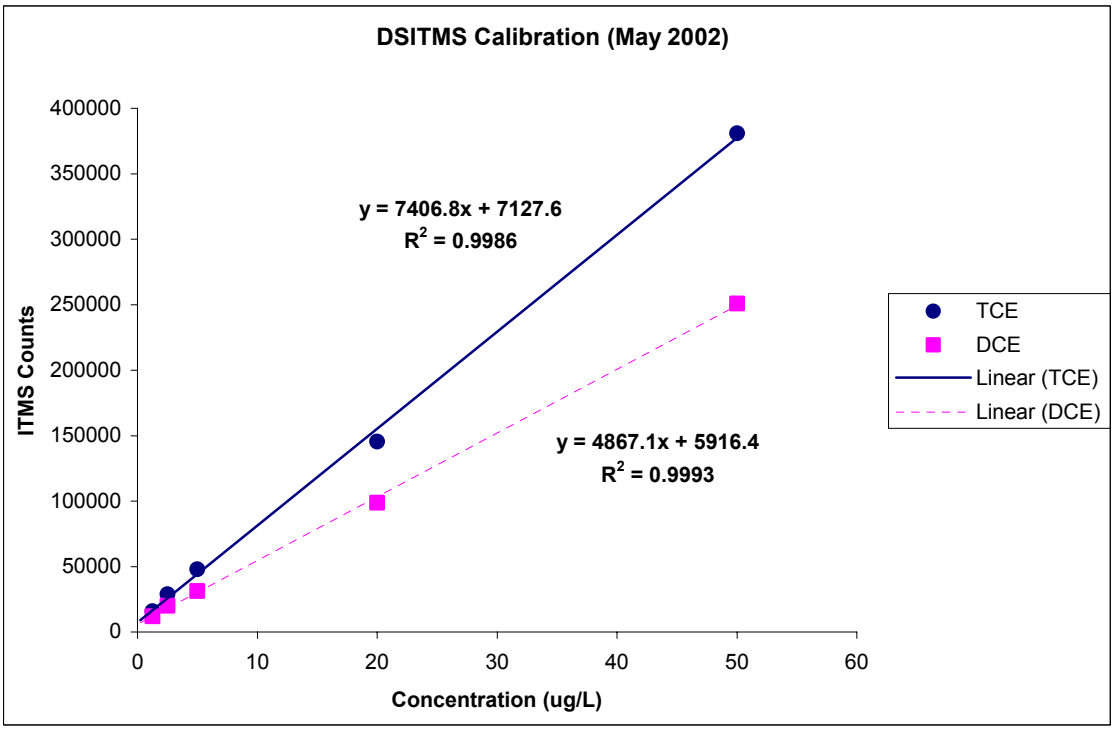


Figure C-3 DSITMS Calibration Curve - May 23, 2002

As demonstrated in Figures C-1 and C-2, the coefficient of determination values (i.e. R^2 values) for DCE on both the April and May calibrations is greater than 0.99. The values for TCE is greater than 0.96 for the April calibration and 0.99 for the May calibration. These exceptional R^2 values demonstrate the degree of linearity and competency in analyst techniques in operation of the DSITMS.

DSITMS Quality Control

As with most analytical instrumentation, quality control was monitored during sample analysis. The stability of the DSITMS was assessed through the use of laboratory check samples (LCS), external performance evaluation check samples (PECS) and internal laboratory duplicates. Analysis of a solution containing known concentrations of TCE and total DCE was performed at least twice daily to monitoring system performance. Analysis of certified PECS was also performed on a regular basis as a further check to the DSITMS operation and accuracy of the calibration solutions. In addition, analysis of laboratory duplicates was performed at least once daily to monitor system reproducibility. Figures C-4, C-5 and C-6 show the performance of the 20 ppb LCS, the 25 ppb PECs and the results of laboratory duplicates. Laboratory blanks were also run periodically to monitor system carryover between samples. Samples that showed a positive hit were generally followed by a method blank prior to analyzing additional samples.

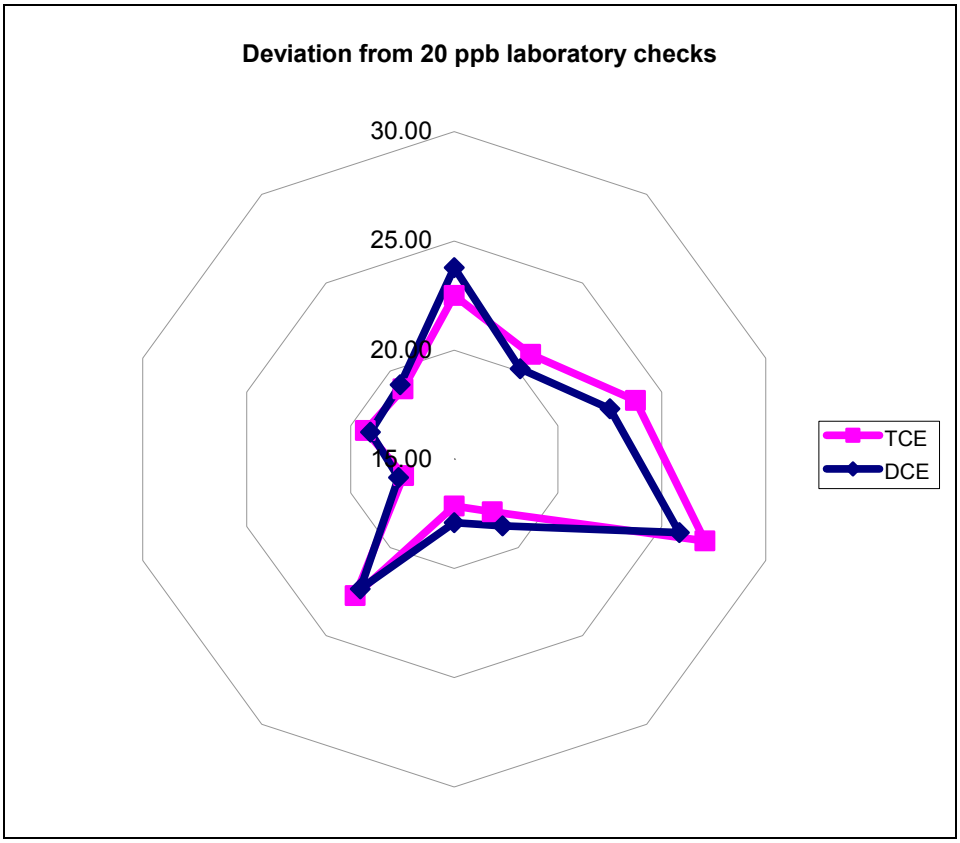


Figure C-4 TCE and DCE Results from Laboratory Check Samples

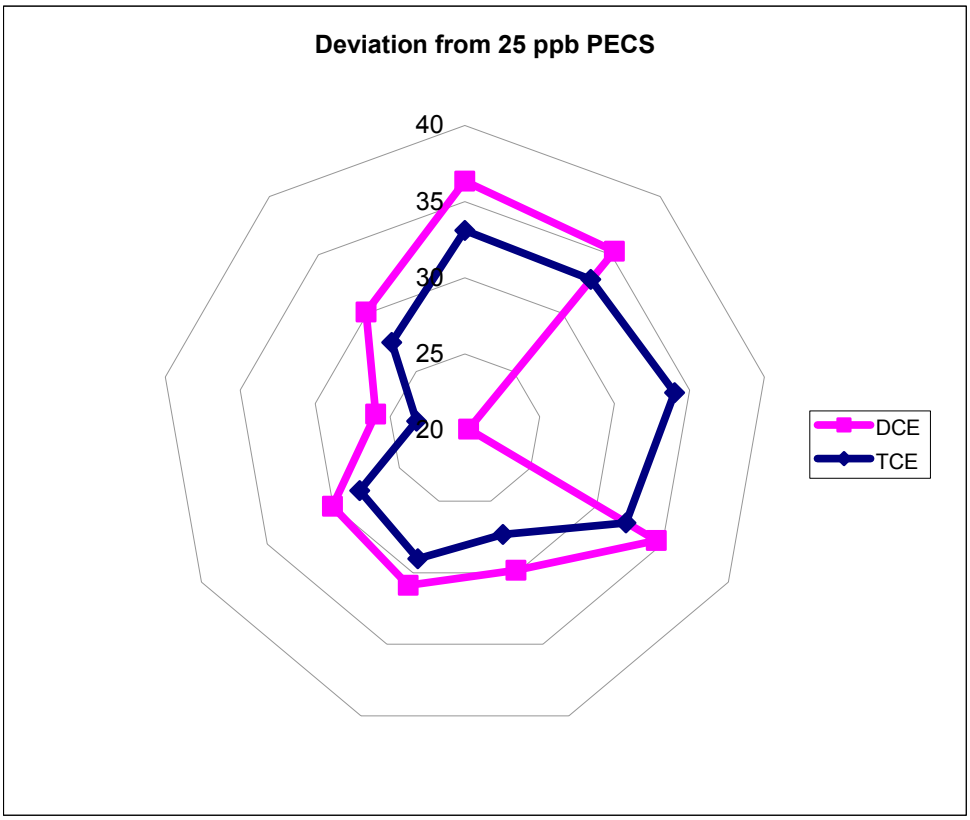


Figure C-5 TCE and DCE Results from Performance Evaluation Check Samples

The radial plots of the LCS and PEC samples show the relative distance of sample results in comparison to the true value of the PEC. Table C-2 shows a statistical evaluation of the LCS and PEC sample analysis. These visual aids validate the conclusion that instrument and analyst performance were optimal.

Table C- 2 Statistical Evaluation of LCS and PEC Standards

	20 ppb LCS		25 ppb PECS	
	TCE	DCE	TCE	DCE
Standard deviation	3.21	2.74	3.58	5.01
Average	19.18	19.08	27.09	27.83
95 % Confidence level	1.99	1.70	2.34	3.27
Upper 95 % limit	21.17	20.78	29.43	31.10
Lower 95% limit	17.19	17.38	24.75	24.56

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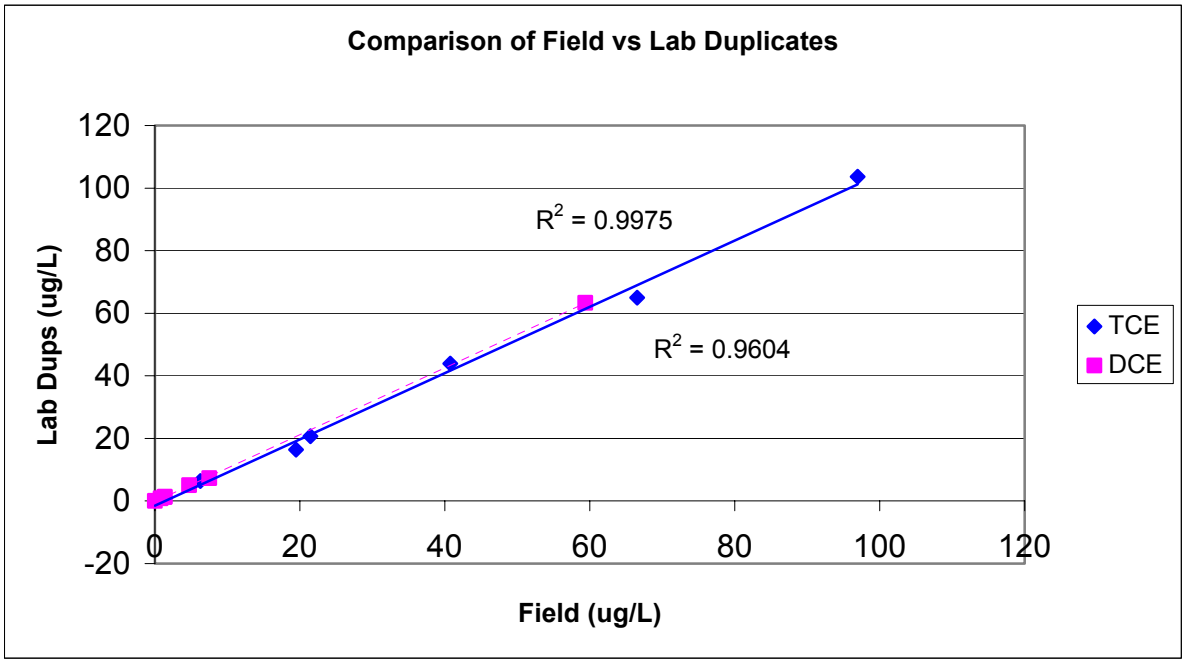


Figure C-6 Comparison of Field Results vs Laboratory Duplicates

As shown in Figure C-6, the comparison of field sample results to laboratory duplicate results revealed coefficients of determination values greater than 0.99 for TCE and 0.96 for DCE. These values show excellent correlation and demonstrated both analyst and system reproducibility.

ITMS Results

Each sample was analyzed for all compounds with a mass to charge ratio from 50 to 200 daltons with calibrated concentrations reported for TCE (m/z – 130 & 132) and total DCE (m/z – 96 & 98). Table C-3 is a complete listing of all DSITMS analytical results. Figure C-7 shows the actual sample locations and their respective values.

QA Sample Results

As part of the Tulsa District's quality assurance program, confirmation samples were collected at a ratio of approximately fifteen percent and sent to a fixed laboratory for verification analysis. The QA samples were sent to General Engineering Laboratory, a Corps of Engineers certified lab and analyzed by SW-846 Method 8260B analysis. Figure C-8 shows a comparison of the DSITMS field values and the results from the QA laboratory. Comparison of the field samples to the quality assurance samples revealed excellent correlation with coefficient of determination values of greater than .99 for TCE and .96 for DCE.

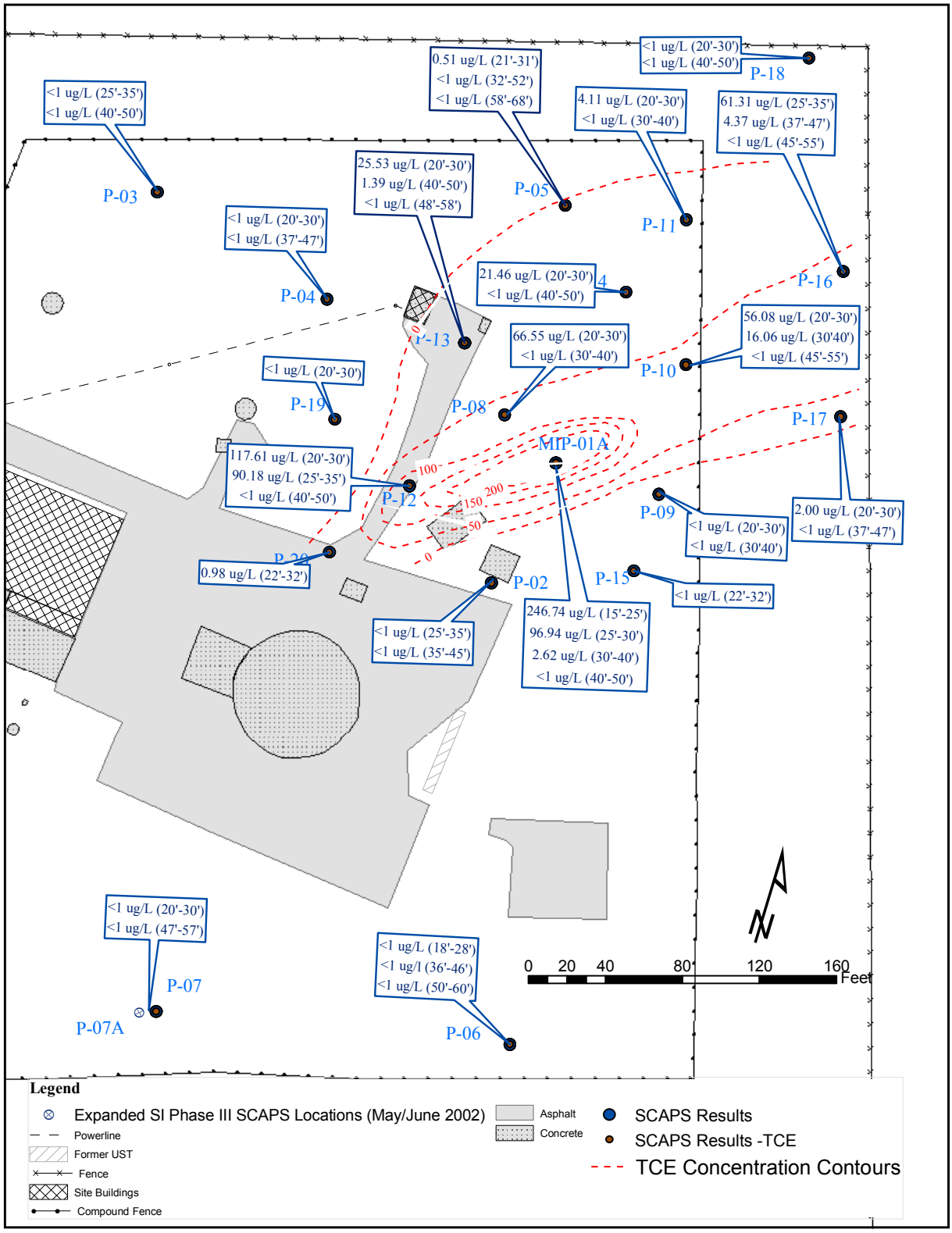


Figure C- 7 DSITMS TCE Results and TCE Iso-concentration Contours

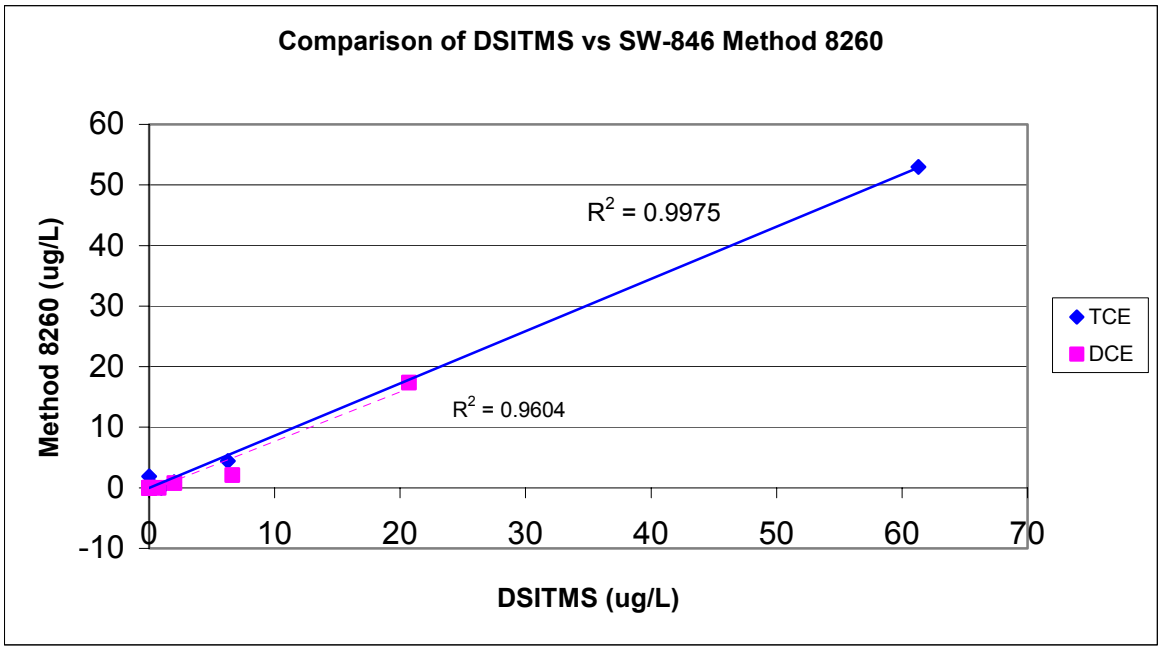


Figure C- 8 Comparison of DSITMS Results to SW-846 Method 8260 Results

Table C- 3 Direct Sampling Ion Trap Mass Spectrometer Results

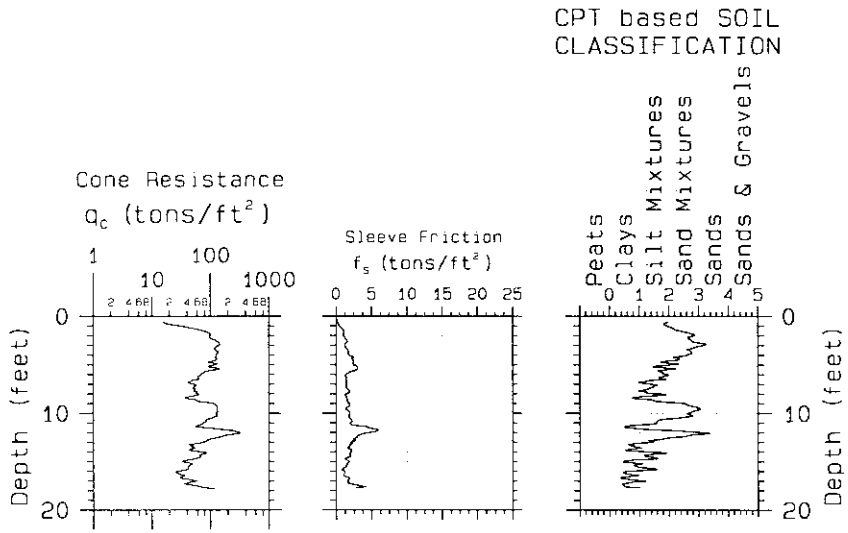
Analytical Date	Location/Sample ID	Depth (ft bgs)	Water Level (ft btoc)	Units	Analyte(s)		QA sample	Comment
					TCE	DCE		
4/6/2002	MIP-01A	15-25	nr	ug/L	**246.74**	**156.27**		
4/5/2002	MIP-01A	25-30	nr	ug/L	**96.94**	**59.37**		
4/5/2002	MIP-01A	30-40	nr	ug/L	**2.62**	**1.51**		
4/5/2002	MIP-01A	40-50	nr	ug/L	<1	<1		
5/25/2002	P-2	25-35	nr	ug/L	<1	<1		suspect unknown VOCs
5/27/2002	P-2	25-35	25.47	ug/L	<1	<1	Y	purged on 5/26/02 and resampled on 5/27/02; suspect unknown VOCs
5/25/2002	P-2	35-45	nr	ug/L	<1	<1		
5/23/2002	P-3	25-35	24.36	ug/L	<1	<1		
5/27/2002	P-3	25-35	24.42	ug/L	<1	<1		purged on 5/26/02 and resampled on 5/27/02
5/23/2002	P-3	40-50	24.78	ug/L	<1	<1		
5/23/2002	P-4	20-30	24.20	ug/L	<1	<1		
5/27/2002	P-4	20-30	24.22	ug/L	<1	<1		purged on 5/26/02 and resampled on 5/27/02
5/23/2002	P-4	37-47	24.52	ug/L	<1	<1		
5/23/2002	P-5	21-31	23.21	ug/L	0.23 J	<1	Y	
5/27/2002	P-5	21-31	23.23	ug/L	**0.51**	**<1**		purged on 5/26/02 and resampled on 5/27/02
5/23/2002	P-5	32-52	nr	ug/L	<1	<1		suspect screen interval
5/23/2002	P-5	58-68	23.28	ug/L	<1	<1		
5/24/2002	P-6	18-28	23.90	ug/L	<1	<1		
5/27/2002	P-6	18-28	23.89	ug/L	<1	<1		purged on 5/26/02 and resampled on 5/27/02
5/23/2002	P-6	36-46	nr	ug/L	<1	<1		
5/24/2002	P-6	50-60	23.86	ug/L	<1	<1		
5/24/2002	P-7	20-30	22.16	ug/L	<1	<1		
5/27/2002	P-7	20-30	22.20	ug/L	<1	<1		purged on 5/26/02 and resampled on 5/27/02
5/24/2002	P-7	47-57	nr	ug/L	<1	<1		
5/24/2002	P-8	20-30	24.60	ug/L	6.27	0.77 J	Y	
5/25/2002	P-8	20-30	23.83	ug/L	40.73	4.72		

Analytical Date	Location/Sample ID	Depth (ft bgs)	Water Level (ft btoc)	Units	Analyte(s)		QA sample	Comment
					TCE	DCE		
5/27/2002	P-8	20-30	23.85	ug/L	**66.55**	**7.49**		purged on 5/26/02 and resampled on 5/27/02
5/24/2002	P-8	30-40	nr	ug/L	<1	<1	Y	
5/25/2002	P-9	20-30	dry	ug/L	na	na		
5/26/2002	P-9	20-30	25.98	ug/L	<1	<1		
5/27/2002	P-9	20-30	24.53	ug/L	<1	<1		purged on 5/26/02 and resampled on 5/27/02
5/24/2002	P-9	30-40	26.00	ug/L	<1	<1		
5/25/2002	P-10	20-30	21.70	ug/L	86.37	15.89		
5/25/2002	P-10 (dil)	20-30	21.70	ug/L	62.00	13.28		diluted sample 2:1
5/27/2002	P-10	20-30	21.72	ug/L	86.49	16.46		purged on 5/26/02 and resampled on 5/27/02
5/27/2002	P-10 (dil)	20-30	21.72	ug/L	**56.08**	**10.84**		2:1 dil, purged on 5/26/02 and resampled on 5/27/02
5/24/2002	P-10	30-40	nr	ug/L	**16.06**	**3.38**		
5/27/2002	P-10	45-55	nr	ug/L	<1	<1		
5/25/2002	P-11	20-30	21.97	ug/L	3.16	<1		
5/27/2002	P-11	20-30	21.99	ug/L	**4.11**	**<1**		purged on 5/26/02 and resampled on 5/27/02
5/24/2002	P-11	30-40	nr	ug/L	<1	<1		
5/25/2002	P-12	20-30	27.47	ug/L	49.69	66.08		
5/26/2002	P-12	20-30	27.43	ug/L	428.31	306.42		resampled well next day
5/27/2002	P-12 (dil)	20-30	27.43	ug/L	121.02	108.85		3:1 dil, purged on 5/26/02 and resampled on 5/27/02
5/27/2002	P-12 (dil)	20-30	27.43	ug/L	**117.61**	**104.52**		10:1 dil, purged on 5/26/02 and resampled on 5/27/02
5/25/2002	P-12	25-35	27.16	ug/L	24.55	29.50		
5/26/2002	P-12	25-35	26.87	ug/L	50.11	48.09		resampled well next day
5/27/2002	P-12 (dil)	25-35	26.78	ug/L	**90.18**	**79.28**		3:1 dil, purged on 5/26/02 and resampled on 5/27/02
5/25/2002	P-12	40-50	nr	ug/L	<1	<1		
5/26/2002	P-13	20-30	29.27	ug/L	19.56	1.40		
5/27/2002	P-13	20-30	28.58	ug/L	**25.53**	**1.59**		purged on 5/26/02 and resampled on 5/27/02
5/25/2002	P-13	40-50	nr	ug/L	**1.39**	<1		

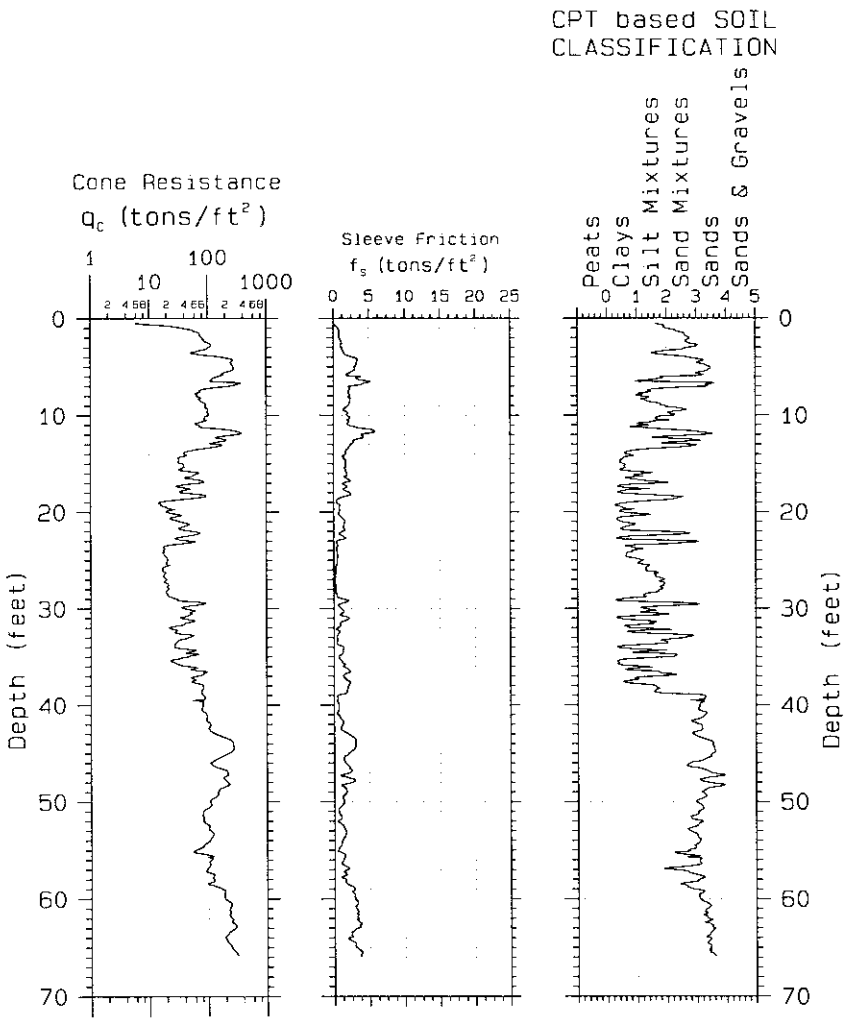
Analytical Date	Location/Sample ID	Depth (ft bgs)	Water Level (ft btoc)	Units	Analyte(s)		QA sample	Comment
					TCE	DCE		
5/27/2002	P-13	48-58	nr	ug/L	<1	<1		
5/26/2002	P-14	20-30	22.34	ug/L	**19.04**	**1.29**		
5/27/2002	P-14	20-30	22.34	ug/L	**21.46**	**1.33**		purged on 5/26/02 and resampled on 5/27/02
5/25/2002	P-14	40-50	nr	ug/L	<1	<1		
5/26/2002	P-15	22-32	21.83	ug/L	<1	<1		
5/27/2002	P-15	22-32	21.85	ug/L	<1	<1		purged on 5/26/02 and resampled on 5/27/02
5/27/2002	P-16	25-35	21.06	ug/L	**61.31**	**6.63**	Y	purged on 5/26/02 and sampled on 5/27/02
5/26/2002	P-16	37-47	nr	ug/L	**14.37**	**1.87**		
5/27/2002	P-16	45-55	nr	ug/L	<1	<1		
5/27/2002	P-17	20-30	20.32	ug/L	**2.00**	**2.01**	Y	purged on 5/26/02 and sampled on 5/27/02
5/26/2002	P-17	37-47	nr	ug/L	<1	<1		
5/27/2002	P-18	20-30	22.41	ug/L	<1	<1	Y	purged on 5/26/02 and sampled on 5/27/02
5/27/2002	P-18	40-50	nr	ug/L	<1	<1		
5/27/2002	P-19	20-30	24.80	ug/L	<1	<1	Y	
5/27/2002	P-20	22-32	27.40	ug/L	**0.98**	**20.71**	Y	
5/25/2002	AMS7-WW			ug/L	<1	<1		sampled on site well water
5/27/2002	SCAPS Decon Water			ug/L	<1	<1		

TCE - trichloroethene
DCE - total dichloroethene
NR - no water level, sampled through SCAPS push rods
NS - no sample
Dil - sample required dilution to be within calibration range
Bold values indicate results used to assess contamination

SCAPS CPT Logs



CPT: MIP-01 Project: Atlas Missle Site #7



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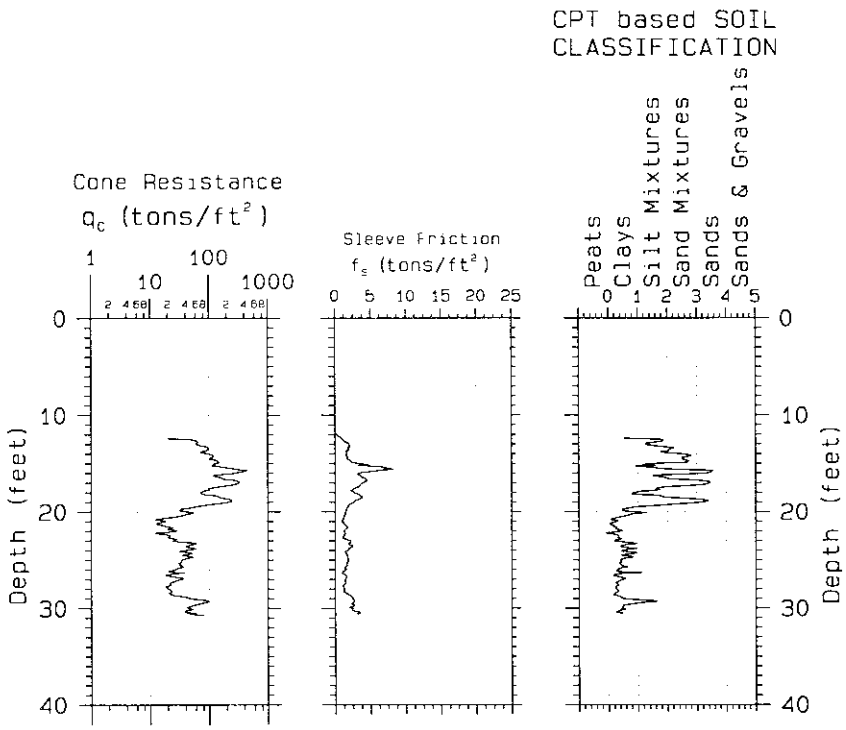

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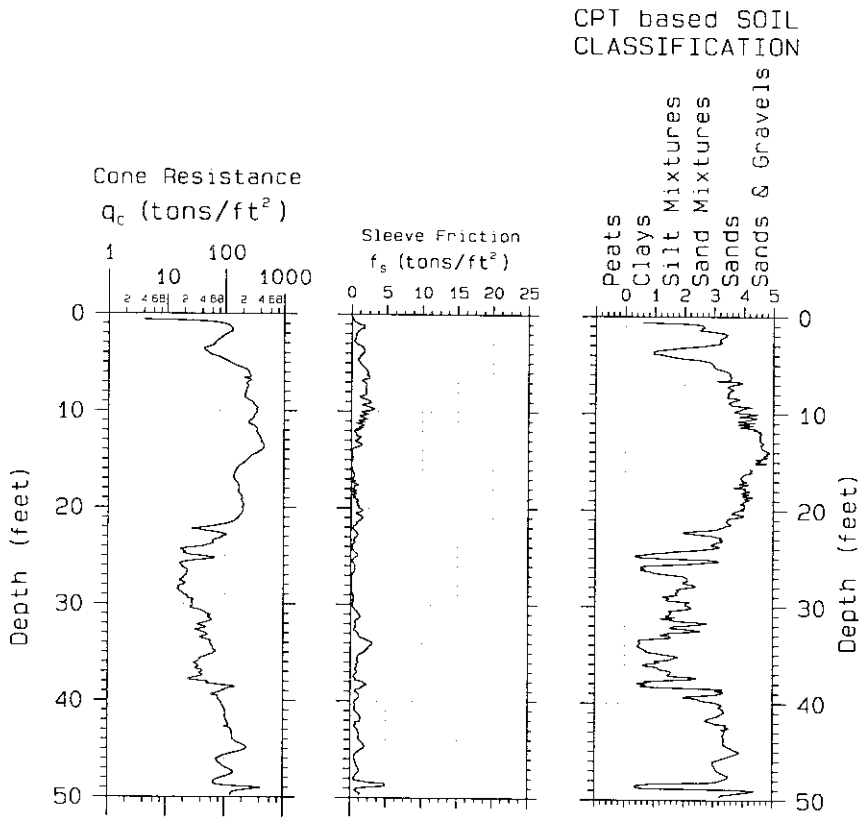

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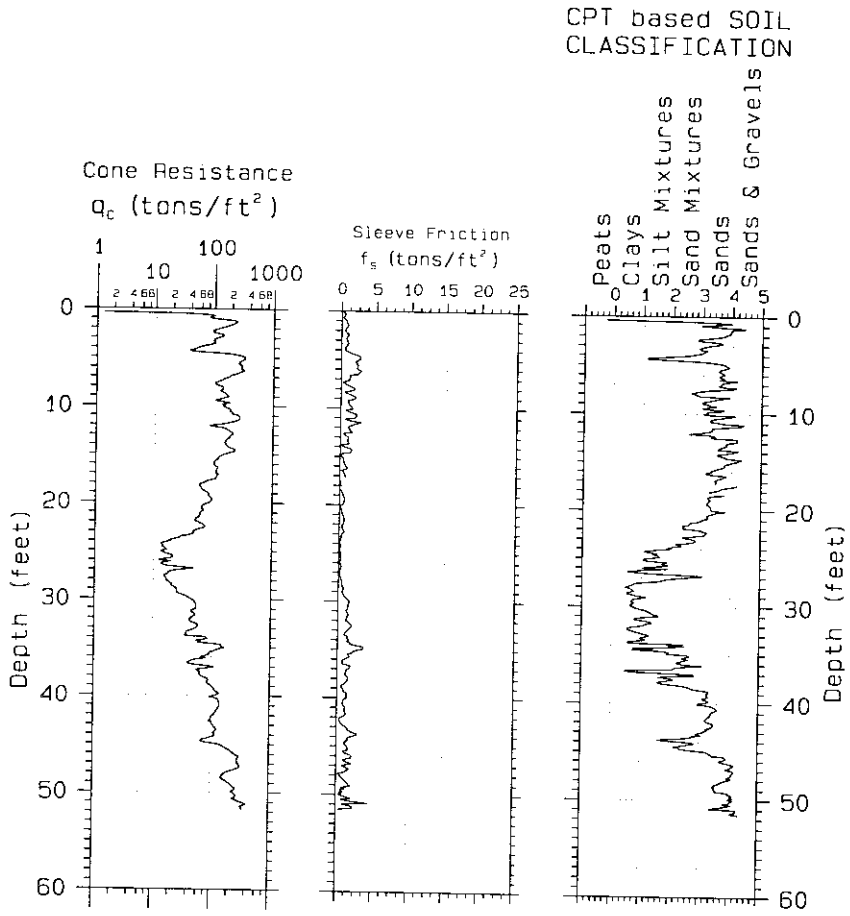

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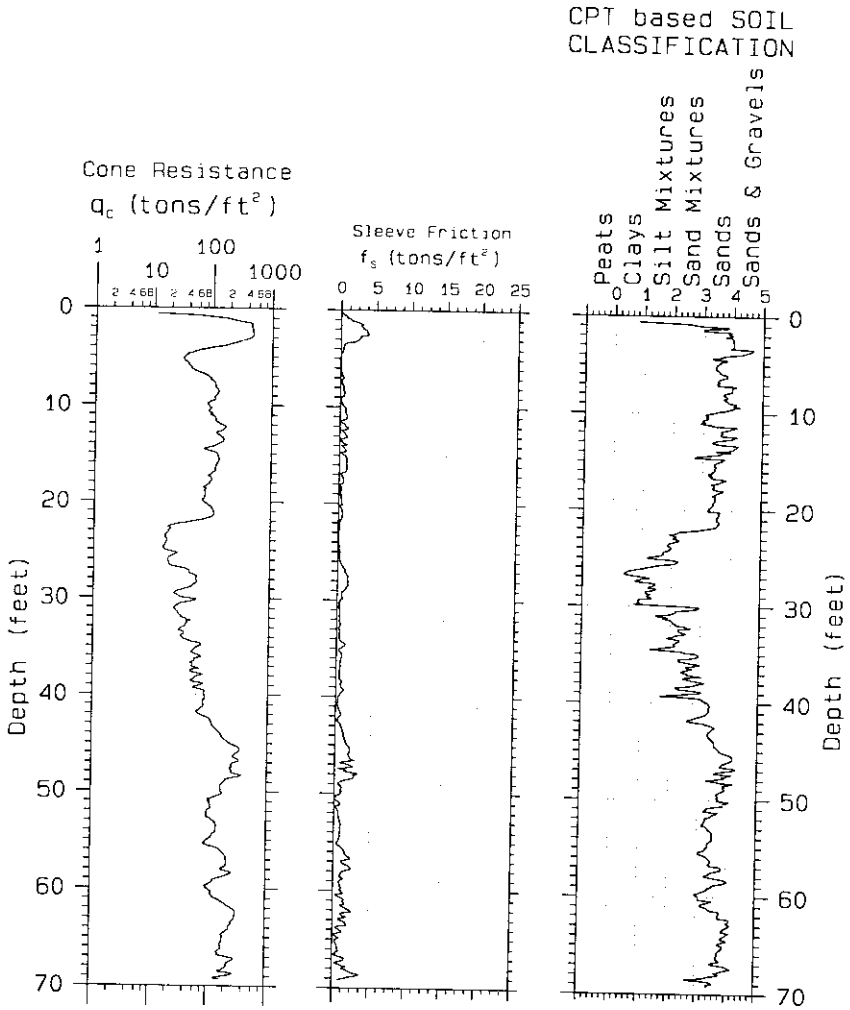

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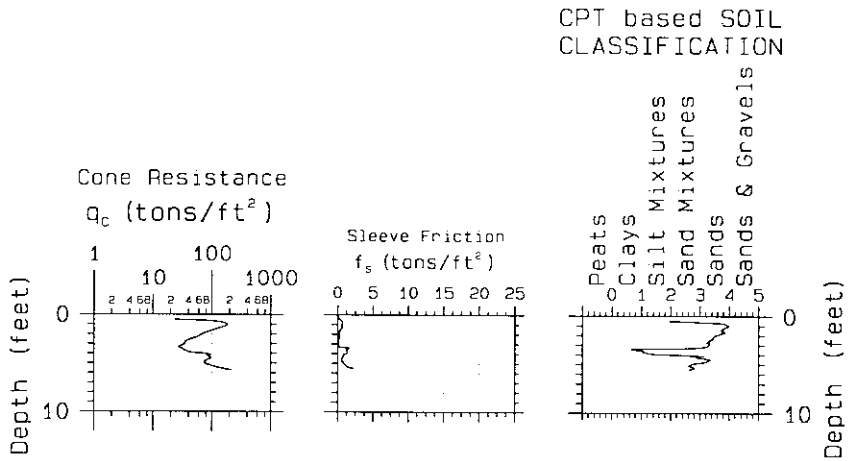

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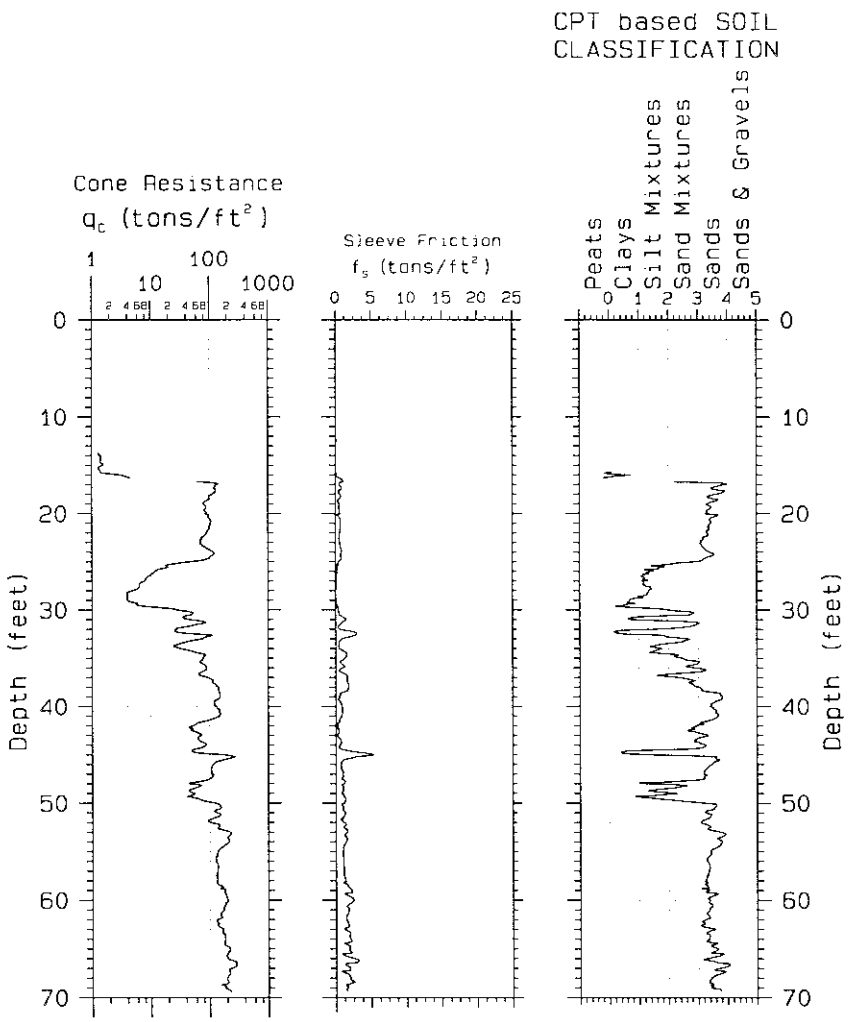

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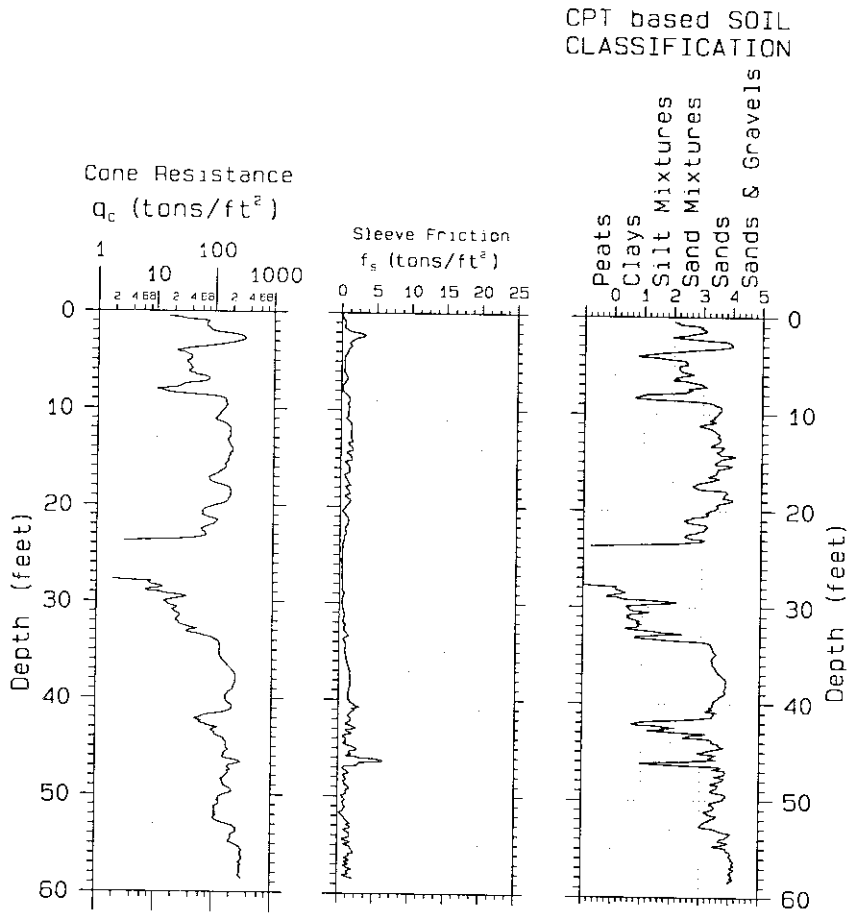

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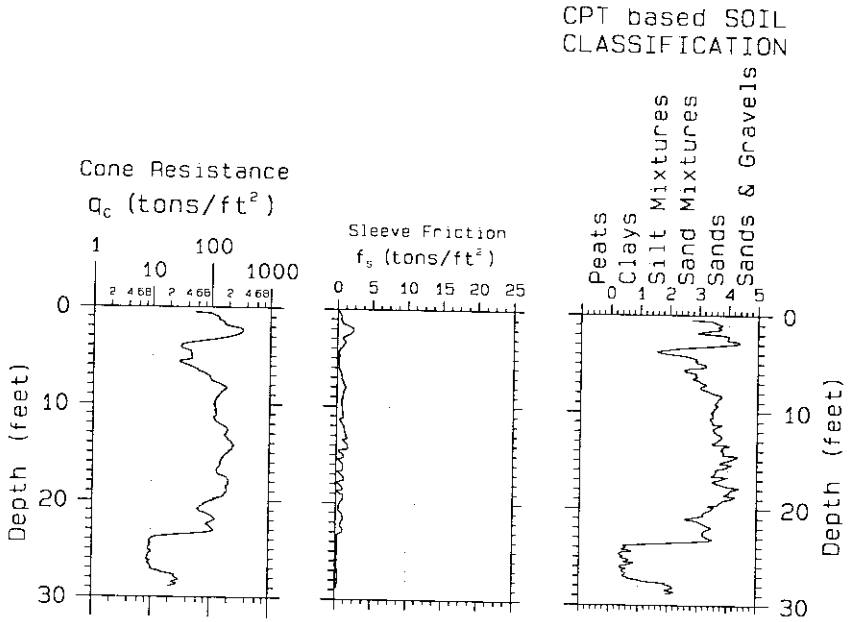

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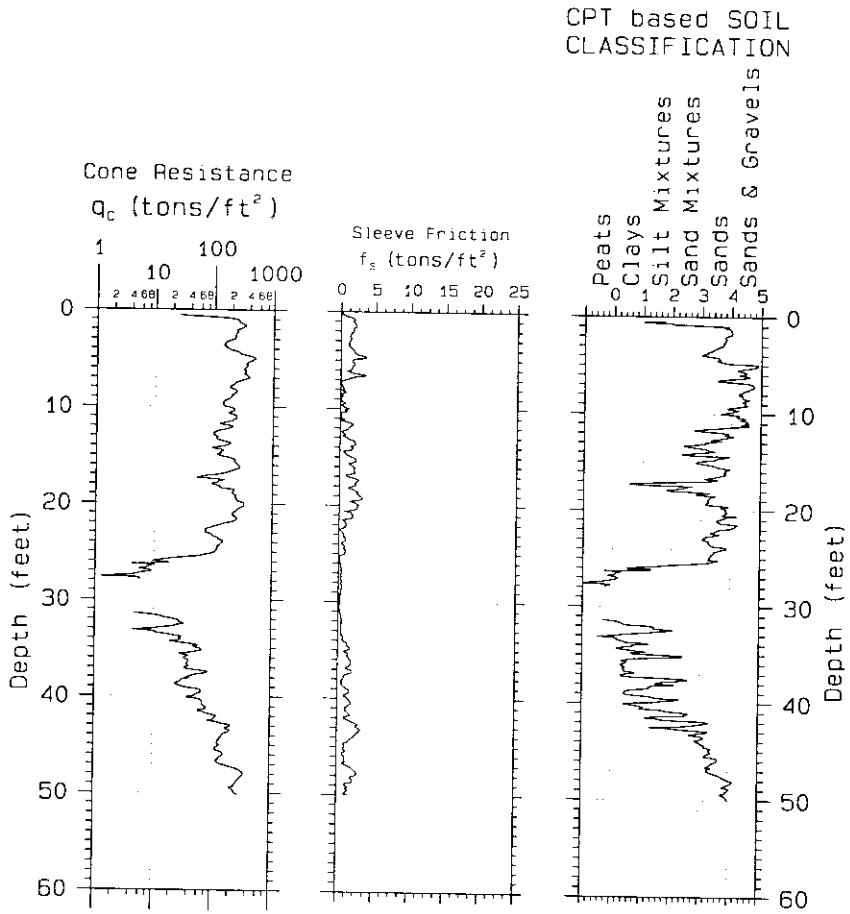

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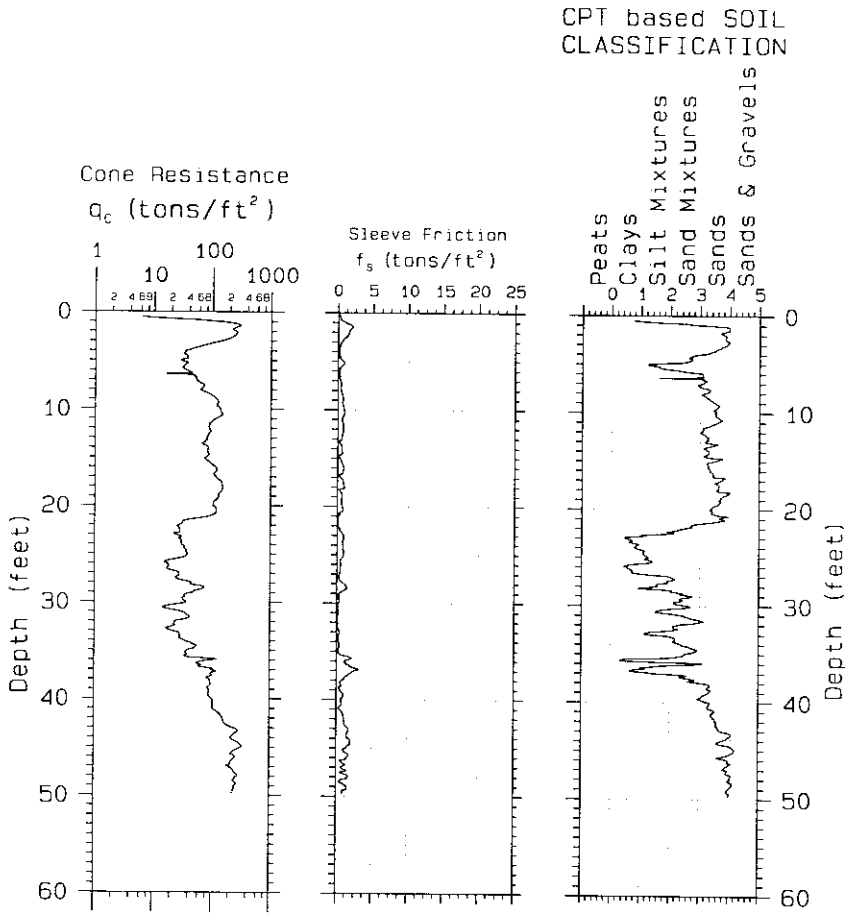
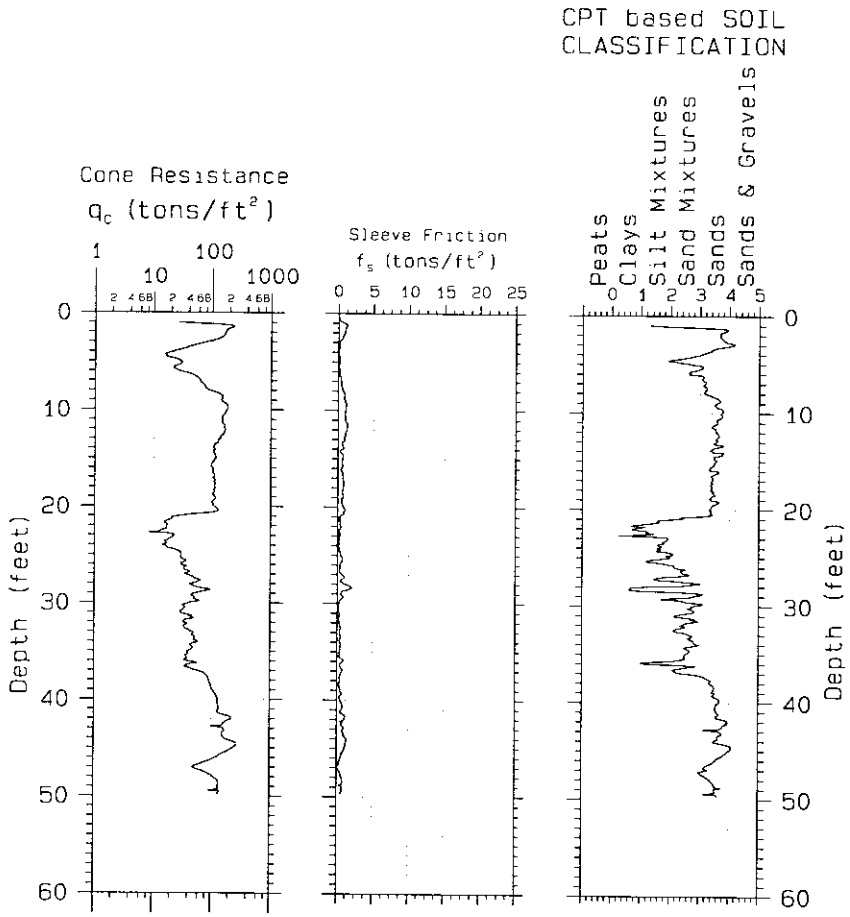


CPT: CPT-16 Project: Atlas Missle Site #7



CPT: CPT-17 Project: Atlas Missle Site #7

Appendix D

Expanded Site Investigation
Phase III
Well Completion Data

Hole No. MW10

DRILLING LOG	DIVISION	INSTALLATION	SHEET 1 OF 2 SHEETS
		ATlas Missile Site No 7	

1. PROJECT ATlas Missile Site No. 7	10. SIZE AND TYPE OF BIT 12 1/4" & 8"
2. LOCATION *(Coordinates or Station)* Northing 7543673, Easting 1719936; State Plane NAD 83; No Cent TX; ft	11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)*
3. DRILLING AGENCY Cherokee American Drilling/Mohawk Drilling, Inc	12. MANUFACTURERS DESIGNATION OF DRILL
4. HOLE NO. *(As shown on drawing title and title number)* MW10	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN — DISTURBED 0 — UNDISTURBED 0
5. NAME OF DRILLER Allan Brantley / Steve Waldrep	14. TOTAL NUMBER CORE BOXES 0
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 16. DATE HOLE — STARTED 26 June 2002 — COMPLETED 30 June 2002
7. THICKNESS OF OVERBURDEN 84'	17. ELEVATION TOP OF HOLE
8. DEPTH DRILLED INTO ROCK 126'	18. TOTAL CORE RECOVERY FOR BORING
9. TOTAL DEPTH OF HOLE 210'	19. SIGNATURE OF INSPECTOR

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
			0-10' Tan Silty clay			6/26/2002 0-140' Drilled using 12 1/4-inch drill bit and mud rotarty rig.
	20		10-84' Medium to fine grained sands.			
	40					
	60					
	80		Top Sandstone at approx. 84'.			
	100					
	120					
	140		Rust red fine-medium grained sandstone.			Set 8 5/8-inch threaded steel casing. Circulated cement/bentonite grout to surface. Displaced cement with water and left hanging in slips. 6/28/2002 Drilled out with 8-inch bit and air rotary rig. Tagged top of cement at 107'. Cement chip were firm. Drilled out of casing and began making water.

DRILLING LOG (Cont Sheet)	ELEVATION TOP OF HOLE	Hole No. MW10
PROJECT: Atlas Missile Site No. 7	INSTALLATION: Atlas Missile Site No 7	SHEET 2 OF 2 SHEETS

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
			170' to 190' alternating zones of rust red and tan fine to medium grained sandstone.			Making water contiunuously. Well surged in heads while drilling. 6/29/2002 Continued drilling at 170'.
	180					
	200		190'-210' rust red fine to medium grained sandstone.			
			Total Depth of 210'			
	220					
	240					

Hole No.

DRILLING LOG	DIVISION	INSTALLATION: ATlas Missile Site No 7 — MW11	SHEET 1 OF 1 SHEETS

1. PROJECT: ATlas Missile Site No. 7	10. SIZE AND TYPE OF BIT: 8-inch hollow stem auger
2. LOCATION *(Coordinates or Station)*: Northing 7543659, Easting 1719939; State Plane NAD 83; No Cent TX; ft	11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)*
3. DRILLING AGENCY: Cherokee American Drilling/Mohawk Drilling, Inc	12. MANUFACTURERS DESIGNATION OF DRILL
4. HOLE NO. *(As shown on drawing title and title number)*: MW11	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 0; UNDISTURBED 0
5. NAME OF DRILLER: Allan Brantley / Steve Waldrep	14. TOTAL NUMBER CORE BOXES: 0
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
	16. DATE HOLE: STARTED 27 June 2002; COMPLETED 28 June 2002
7. THICKNESS OF OVERBURDEN: 35'	17. ELEVATION TOP OF HOLE
8. DEPTH DRILLED INTO ROCK	18. TOTAL CORE RECOVERY FOR BORING
9. TOTAL DEPTH OF HOLE: 35	19. SIGNATURE OF INSPECTOR

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
			0-13' Tan Silty clay			6/27/2002
	20		14-20' reddish brown medium grained-well sorted sand 20-23' silty sand 23-25' clayey sand			
			25-27' dense gray clay, some gravel 27-35' clayey silt and sand TD 35'			
	40					

Hole No.

DRILLING LOG	DIVISION	INSTALLATION: ATlas Missile Site No 7 — MW12	SHEET 1 OF 1 SHEETS

1. PROJECT: ATlas Missile Site No. 7	10. SIZE AND TYPE OF BIT: 8-inch hollow stem auger
2. LOCATION *(Coordinates or Station)*: Northing 7543610, Easting 1719583; State Plane NAD 83; No Cent TX; ft	11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)*
3. DRILLING AGENCY: Cherokee American Drilling/Mohawk Drilling, Inc	12. MANUFACTURERS DESIGNATION OF DRILL
4. HOLE NO. *(As shown on drawing title and title number)*: MW12	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 0; UNDISTURBED 0
5. NAME OF DRILLER: Allan Brantley / Steve Waldrep	14. TOTAL NUMBER CORE BOXES: 0
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
	16. DATE HOLE: STARTED 27 June 2002; COMPLETED 28 June 2002
7. THICKNESS OF OVERBURDEN: 37'	17. ELEVATION TOP OF HOLE
8. DEPTH DRILLED INTO ROCK	18. TOTAL CORE RECOVERY FOR BORING
9. TOTAL DEPTH OF HOLE: 37'	19. SIGNATURE OF INSPECTOR

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
			0-13' Tan Silty clay			6/27/2002
	20		14-20' reddish brown medium grained-well sorted sand 20-23' silty sand 23-25' clayey sand			
			25-30' dense gray clay, some gravel 27-35' clayey silt and sand TD 37'			
	40					

Send original copy by certified mail to: TNRCC, P.O. Box 13087, Austin, TX 78711-3087

Please use black ink.

ATTENTION OWNER: *Confidentiality Privilege Notice on Reverse Side*

State of Texas WELL REPORT

RECEIVED AUG 2 0 [illegible]

Texas Water Well Drillers Advisory Council
P.O. Box 13087
[illegible]

COPY

1) **OWNER** Army Corps of Engineers (Name) **ADDRESS** 18040 Hwy 283 (Street or RFD) Vernon (City) TX (State) 76384 (Zip)

2) **ADDRESS OF WELL:** County Wilbarger NE ¼ of Section 29 Block 11 of the H&TC Formerly Known As Altus missile site #7 (Street, RFD or other) (City) (State) (Zip) **GRID #** 13-46-2

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

4) **PROPOSED USE (Check):** ☒ Monitor ☐ Environmental Soil Boring ☐ Domestic ☐ Industrial ☐ Irrigation ☐ Injection ☐ Public Supply ☐ De-watering ☐ Testwell
If Public Supply well, were plans submitted to the TNRCC? ☐ Yes ☐ No

5)

6) **WELL LOG:** MW-10
Date Drilling:
Started 6/26 2002
Completed 6/28 2002

DIAMETER OF HOLE		
Dia. (in.)	From (ft.)	To (ft.)
12¼	Surface	140'
8	140	217

7) **DRILLING METHOD (Check):** ☐ Driven ☒ Air Rotary ☒ Mud Rotary ☐ Bored ☐ Air Hammer ☐ Cable Tool ☐ Jetted ☐ Other

N

From (ft.)	To (ft.)	Description and color of formation material
0	10	TAN SILTY CLAY
10	84	Med To Fine SANDS
84	172	Med To Fine Red Sand Stone
172	217	Harder Brown Shale
	217 TD	

(Use reverse side if necessary)

8) **Borehole Completion (Check):** ☒ Open Hole ☐ Straight Wall ☐ Underreamed ☒ Gravel Packed ☐ Other
If Gravel Packed give interval ... from 196 ft. to 210 ft.

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 Casting Screen
8⅝	N	Steel	0	140	
4"	N	PVC Sch. 80 Screen	200	210	.010
4"	N	Sch. 80 PVC Casing	+3	200	

9) **CEMENTING DATA** [Rule 338.44(1)]
Cemented from 0 ft. to 140 ft. No. of sacks used _____
_____ ft. to _____ ft. No. of sacks used _____
Method used Pressure Grouted
Cemented by ~~Concrete~~ Fleet Cementers Inc
Distance to septic system field lines or other concentrated contamination N/A ft.
Method of verification of above distance _____

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

10) **SURFACE COMPLETION**
☒ Specified Surface Slab Installed [Rule 338.44(2)(A)]
☐ Specified Steel Sleeve Installed [Rule 338.44(3)(A)]
☐ Pitless Adapter Used [Rule 338.44(3)(b)]
☐ Approved Alternative Procedure Used [Rule 338.71]

14) **WELL TESTS:** N/A
Type test: ☐ Pump ☐ Bailer ☐ Jetted ☐ Estimated
Yield: _____ gpm with _____ ft. drawdown after _____ hrs.

11) **WATER LEVEL:** N/A
Static level _____ ft. below land surface Date _____
Artesian flow _____ gpm. Date _____

15) **WATER QUALITY:**
Did you knowingly 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

12) **PACKERS:**

Type	Depth
Bentonite Chips	196 To 140

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 Mohawk Drilling, Inc. (Type or print) **WELL DRILLER'S LICENSE NO.** 54689M

ADDRESS 10010 E. 16th ST (Street or RFD) Tulsa (City) OK. (State) 74128 (Zip)

(Signed) Lee Allen Brantley (Licensed Well Driller) (Signed) _____ (Registered Driller Trainee)

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

TNRCC-0199 (Rev. 11-01-94)

TNRCC COPY

Send original copy by certified mail to: TNRCC, P.O. Box 13087, Austin, TX 78711-3087

Please use black ink.

ATTENTION OWNER: *Confidentiality Privilege Notice on Reverse Side*

State of Texas WELL REPORT

Texas Water Well Drillers Advisory Council
P.O. Box 13087
Austin, TX 78711-3087
512-239-0530

1) OWNER Army Corps of Engineers (Name) ADDRESS 18040 Hwy 287 (Street or RFD) Vernon (City) Tx (State) 76384 (Zip)

2) ADDRESS OF WELL: County Wilbarger NEly of Section 29 Block 1 on the MKT RR Formerly known as Altus Missile Site #7 (Street, RFD or other) (City) (State) (Zip) GRID # 13-46-2

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

4) PROPOSED USE (Check): ☒ Monitor ☐ Environmental Soil Boring ☐ Domestic ☐ Industrial ☐ Irrigation ☐ Injection ☐ Public Supply ☐ De-watering ☐ Testwell
If Public Supply well, were plans submitted to the TNRCC? ☐ Yes ☐ No

5) ●

6) WELL LOG: MW-11
Date Drilling: Started 6/27 2002 Completed 6/27 2002

DIAMETER OF HOLE		
Dia. (in.)	From (ft.)	To (ft.)
8	Surface	35

7) DRILLING METHOD (Check): ☐ Driven ☐ Air Rotary ☐ Mud Rotary ☐ Bored ☐ Air Hammer ☐ Cable Tool ☐ Jetted ☒ Other Hollow Stem Augers

N

From (ft.)	To (ft.)	Description and color of formation material
0	14	Tan silty clay
14	35	Tan sands

(Use reverse side if necessary)

8) Borehole Completion (Check): ☐ Open Hole ☐ Straight Wall ☐ Underreamed ☐ Gravel Packed ☐ Other
If Gravel Packed give interval ... from 35 ft. to 23 ft.

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 Casting Screen
4	N	PVC Sch 40 0.10	35	25	0.10
4	N	PVC Sch 40	25	+3	

9) CEMENTING DATA [Rule 338.44(1)]
Cemented from 20 ft. to 0 ft. No. of sacks used 5
ft. to ft. No. of sacks used
Method used Tremmie Pipe
Cemented by Mohawk
Distance to septic system field lines or other concentrated contamination ft.
Method of verification of above distance

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

10) SURFACE COMPLETION
☒ Specified Surface Slab Installed [Rule 338.44(2)(A)]
☐ Specified Steel Sleeve Installed [Rule 338.44(3)(A)]
☐ Pitless Adapter Used [Rule 338.44(3)(b)]
☐ Approved Alternative Procedure Used [Rule 338.71]

14) WELL TESTS: N/A
Type test: ☐ Pump ☐ Bailer ☐ Jetted ☐ Estimated
Yield: gpm with ft. drawdown after hrs.

11) WATER LEVEL: N/A
Static level ft. below land surface Date
Artesian flow gpm. Date

15) WATER QUALITY:
Did you knowingly 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

12) PACKERS: Type Depth
Bent Chips 23 to 20ft

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 Mohawk Drilling, Inc. (Type or print) WELL DRILLER'S LICENSE NO. 54689M

ADDRESS 10010 E. 16th Street (Street or RFD) Tulsa (City) OK (State) 74128 (Zip)

(Signed) Lee Allen Brantley (Licensed Well Driller) (Signed) (Registered Driller Trainee)

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

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State of Texas
WELL REPORT

Texas Water Well Drillers Advisory Council
P.O. Box 13087
Austin, TX 78711-3087
512-239-0530

1) OWNER Army Corps of Engineers (Name) ADDRESS 19040 Hwy 287 (Street or RFD) Vernon (City) TX (State) 76384 (Zip)

2) ADDRESS OF WELL: County Wichbarger NE ¼ of Section 27 Block 5 of the H&TC RR. Formerly known as Altus missile Site #7 (Street, RFD or other) (City) (State) (Zip) GRID # 13-46-2

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

4) PROPOSED USE (Check): ☐ Monitor ☐ Environmental Soil Boring ☐ Domestic ☐ Industrial ☐ Irrigation ☐ Injection ☐ Public Supply ☐ De-watering ☐ Testwell
If Public Supply well, were plans submitted to the TNRCC? ☐ Yes ☐ No

5) 8

6) WELL LOG: MW-12
Date Drilling:
Started 6/27 2002
Completed 6/27 2002

DIAMETER OF HOLE		
Dia. (in.)	From (ft.)	To (ft.)
8	Surface	37

7) DRILLING METHOD (Check): ☐ Driven ☐ Air Rotary ☐ Mud Rotary ☐ Bored ☐ Air Hammer ☐ Cable Tool ☐ Jetted ☒ Other Hollow Stem Augers

N

From (ft.)	To (ft.)	Description and color of formation material
0	16	Silty Tan Clay
16	37	Tan Sands

(Use reverse side if necessary)

8) Borehole Completion (Check): ☐ Open Hole ☐ Straight Wall ☐ Underreamed ☒ Gravel Packed ☐ Other
If Gravel Packed give interval ... from 37 ft. to 25 ft.

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 Casting Screen
4	N	PVC Sch 40	37	27	010
4	N	PVC Sch 40	27	+3	

9) CEMENTING DATA [Rule 338.44(1)]
Cemented from 22 ft. to 0 ft. No. of sacks used 5
ft. to ft. No. of sacks used
Method used Trimmie
Cemented by MOHAWK
Distance to septic system field lines or other concentrated contamination N/A ft.
Method of verification of above distance

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

10) SURFACE COMPLETION
☒ Specified Surface Slab Installed [Rule 338.44(2)(A)]
☐ Specified Steel Sleeve Installed [Rule 338.44(3)(A)]
☐ Pitless Adapter Used [Rule 338.44(3)(b)]
☐ Approved Alternative Procedure Used [Rule 338.71]

14) WELL TESTS: N/A
Type test: ☐ Pump ☐ Bailer ☐ Jetted ☐ Estimated
Yield: gpm with ft. drawdown after hrs.

11) WATER LEVEL: N/A
Static level ft. below land surface Date
Artesian flow gpm. Date

15) WATER QUALITY:
Did you knowingly 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

12) PACKERS: Type Depth
Bent Chips 25 to 22

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 MOHAWK Drilling, INC. (Type or print) WELL DRILLER'S LICENSE NO. 54689M

ADDRESS 10010 E. 16th Street (Street or RFD) Tulsa (City) OK. (State) 74128 (Zip)

(Signed) Lee Allan Brantley (Licensed Well Driller) (Signed) (Registered Driller Trainee)

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

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Atlas Missile Site No 7

25 June 2002
Arrived at location at 1530.
Backhoe was delivered by RSC at approx 1540.
Steve Waldrep and Randy Rodgers w/CRC arrived at about 1615. Michael Steele arrived less than 5 minutes after CRC folks did.
Left location by 1700.

26 June 2002
Personnel on-site: CRC(Steve Waldrep, Randy Rodgers), COE (Cliff Murray, Michael Steele)
0700 Arrive onsite

Prepare site for larger rig to drill surface casing for deep welt(MW10).
Randy dug mudpit.
Tom Hall Inc rig arrived @1100. Crew of Philip, Bob, and Shane. Set up on location and mixed mud.
Allan Brantley arrived at approximately 1200.
Drilled to 140'. Circulated hole then tripped out to run casing. Ran all of casing into hole (approx 140').
1630 Rigged up cementing unit (Precise Drilling) and circulated cement to surface then pumped fresh water down hole to displace cement inside casing. Left pressure on top of casing. Rigged down cementers.
Left location around 1830.

27 June 2002
Personnel on-site: CRC(Steve , Randy Rodgers, Allan Brantley), COE (Cliff Murray, Michael Steele)

0900-begln drilling MW12
Iron Stainlng start @13'10"
Red iron oxide staining 15'-20'.
1020 @apprx. 27' retaining bolt failed on joint 2' below ground surface. Dug around pipe and connected to remainder of augers. Sampler was full. Upper 1.5' was saturated clayey sand. Next two feet dense clay. Lower 2' was saturated clayey silt.
30'-35' interval: Full recovery but upper2' probably fallen in from upper portion.

Reached TD of 37'@1125.
Placed pipe. Begin to place sand at 1200. Filled sand to 25'.
Began placing bentonite chips @1240. Bentonite 25'-22'.

Decon pipe.(augers).
Set up on MW11.
Began drilling at 1435.
25'-30'-intervat contained light gravelly clay layer as in MW12.
Reached TD of 35' at 1545.
Ran pipe. Top sand at 23'.
Placed bentonite chips w/top at 21'.

Moved rig to MW10.
Left location at 1700.

28 June2002
Personnel on-site: CRC(Steve Waldrep, Randy Rodgers, Allan Brantley), COE (Cliff Murray, Michael Steele)

GPS Locations using Garmin GPS 12XL
MW12 N 34° 21' 45.9" W 99° 19' 28.9"
MW11 N 34° 21' 46.4" W 99° 19' 24.6"
MW10 N 34° 21' 46.5" W 99° 19' 24.7"

Air compressor delivered at approx 0830. Rigged up CRC rig on MW10. Tagged of cement at 107'. Drilled w/air. Cement chips were firm. At approx 140' began making water. After connections well surged large volumes of water. While drilling estimated water production to be 40-60 gpm. Cuttings and water were generally rust red. Between 170' and 190' colored alternated between rust red and tan.
1100 pit filled w/water and cuttings. Steve ordered a rolloff and liner.
1200 Michael Steele left for Tulsa.
1315 Allan Brantley left the site.
Rolloff was delivered at about 1400 while Steve and Randy were at Altus buying supplies. At about 1600 began to fill rolloff. Developed leak in 6 mil plastlc liner due to hose nozzle whipping around. Pumped out water.

29 June 2000
Personnel on-site: CRC(Steve Waldrep , Randy Rodgers), COE (Cliff Murray)

Placed new liner purchased the night before in rolloff, secured hose and pumped water out of mud pit.
Steve had learned that pipe will be in Witchlta Falls, TX so we will continue drilling .
Returned to drilling at 815.

at 170' approx cuttings changed from rust red to light brown.
@~175' turned rust red.
~177' milky white, fine sand,silt.
~182' rusty red.
Randy left site @930 to pick up pipe.
Reached TD @0940.Blew hole for 5 min and began tripping out. Out of hole @1045. Water in hole approx 29' bgs @1050
8"-freeboard on center of west side of rolloff .
Filled annular space in MW12 from bentonite seal to 3' bgs w/cement. Built forms for pad, mixed concrete and poured pad.
At MW10 measured water level to be approx 21' bgs then ran in hole w/drill pipe. Had to hook up to air compressor at ~140' (base of surface casing) and blolv hole and rotate. Continued running into hole until 195'. Drilled to 217' and tripped out of hole.
At 1700 began running 4" casing into hole. Placed centralizers on top and bottom of screen. Opted not to use centralizers on risers to avoid entangling tape measure when measuring fill placement.
Bottom of pipe placed at 211'. Poured in 14 bags of sand.
Left location at 1900.

30 June 2002
Personnel on-site: CRC(Steve Waldrep , Randy Rodgers), COE (Cliff Murray)

0700 checked top of sand. Top of sand at 196'. Added bentonite chips to bring bentonite seal into surface casing. Began preparing site for pads.

0945 Steve went to Altus to buy supplies-concrete. He does not have equipment with him to develop wells; especially the deeper well.
Measured top of bentonite to be at approx 107' bgs.
1130-Steve left w/drill rig to drive back to Tulsa to pick up pump to develop wells.
1130 Randy and I began mixing cement/bentonite mixture to fill annular space of MW10. Filled annular space to approx 4' bgs and built pads for MW10 and MW11. Finished mixing concrete for pads at 1615. Used all of concrete that we had onsite. Randy dug holes for bollards on all three pads. Finished digging holes at 1730.
Left location at 1745.

1 July 2002

Personnel on-site: CRC(Steve Waldrep , Randy Rodgers), COE (Cliff Murray)
0715 Arrived on site after checking out of hotel room.
0830 Randy arrived at site after buying more concrete.
Checked depth of MW10. 213' to top of riser.
Mixed concrete and set bollards.
1030 Randy went to Altus.
1310 Randy return to site. Steve arrived within 5 minutes. Prepared submersible pump.
1440 Water levels MW10 17.17'
MW11 23.35
1500 Tried to put pump in MW10. Would not fit due to reduced ID of schedule 80 pipe.
1515 Third rolloff delivered.
1615 Test pump on MW11. 5 gal/17 sec. Water color tan/milky.
pumped 40 sec dry. Wait 2 min. Water level a24'.
Pumped 50 sec-dry. Wait 2 min.
Water level 23.5
Pumped 4 min. Rate decreased to. 30 sec/5 gal. Wtr level @35' when pump shut down.
Recharged 10' in 1 min. 2.5min water level@ 24'.
5min aft shut down pump again. Pumped 5 min. Rate decreased to 5 gal/35 sec. Recharged 3 min. Flowed 1 min. Clearing up momentarily about halfway thru flow.
Recharged 1.5 min. Flow 0.5 min.
Recharged 1 min. Flow 1 min.
Recharged 2 min. Flow 2.75 min. Flow at 5. Gal/30 sec. Still cloudy.
Recharged 2 min. Flow 2 min.
Recharged 2 min. Flow 2.5 min. slightly cloudy in pop bottle.
Recharged 2 min. Flowed 1 min. End development @1710 with water slightly murky .
1800 MW12 water level 27.15
began pumping. Water muddy. Would only pump 2-3 gal before going dry. Pumped then recharged for 2-4 min then pumped. Set water level indicator at 31.35' and pumped when it rang.
1822 pumped 5 gal. Still murky.
1827 pumped 5 gal.
1830 pumped 4.5 gal.
1834 pumped 4.5 gal..
1838 pumped 4.5 gal.
1842 pumped 4.5 gal.
1846 pumped 4.5 gal.
1850 pumped 4.5 gal.
1853:30 pumped 4.5 gal.
1858 pumped 4.5 gal.
1905 pumped 4.5 gal.(delay due to lack of place to dump water)
1908 pumped 4.5 gal.
1912 pumped 4 gal.

Ended development for the day. Pulled pumped above water level and tied it up for the night.

1945 Left location .

2 July 2002

Personnel on-site: CRC(Steve Waldrep , Randy Rodgers), COE (Cliff Murray)
0655 Arrived onsite.
0710
0715 MW12 water level 27.05'
0717 pumped 5-6 gal
0721 pumped 5 gal.
0726 pumped 4 gal.
0729 pumped 4 gal
0733 pumped 4 gal
0738 pumped 4 gal
0738 pumped 4 gal
0746 pumped 5 gal.(delay due to lack of place to dump water)
0749:30 pumped 4 gal
0802 pumped 5 gal.(delay due to lack of place to dump water)
0806 pumped 4 gal
0811 pumped 4 gal.(delay due to lack of place to dump water)
0816 pumped 4 gal
0820:30 pumped 4 gal (still murky)
0825 pumped 3 gal
0830:30 pumped 3 gal
0843 pumped 6 gal.(delay due to lack of place to dump water)
0847:30 pumped 4 gal
0852 pumped 4 gal
0858 pumped 4 gal
0902 pumped 4 gal
0906 pumped 4 gal (murky after surging pump)
0912 pumped 4 gal
0929 pumped 6 gal.(delay due to lack of place to dump water)
0932 pumped 4 gal
Ended development @0945.
Randy emptied mud pit, putting soil/cuttings in rolloff and back filling trench with excavated material.
1030 sampled soil rolloff.
1050 sampled west water rolloff. Used ID of IDW-H2OW.
1130 placed covers on rolloffs with water.
Prepare to leave site.
1145 Steve and Randy left site.
1145