N83447.AR.000265
NAS FORT WORTH
5090.3a

FINAL WORK PLAN FOR REMEDIAL INVESTIGATION AT BASE SERVICE STATION NAS FORT WORTH TX

7/1/1996

INTERNATIONAL TECHNOLOGIES

File: 17G
A.F.

296000

NAVAL AIR STATION FORT WORTH JRB CARSWELL FIELD TEXAS

ADMINISTRATIVE RECORD COVER SHEET

AR File Number 296

HQ Air Force Center for Environmental Excellence

Final
Work Plan

Prepared for:

Site Characterization of Base Gas Station
Naval Air Station Fort Worth Joint Reserve Base
Carswell Field, Texas

F41624-94-D8047-032
Project No. 765725

July 1996

296002

FINAL
WORK PLAN
For
Site Characterization of Base Service Station and Base Gas Station
LPST ID No. 104524

for
Naval Air Station Fort Worth
Fort Worth, Texas
Revision 1, July 1996

Approved: _____ Date 7/8/96
IT QA/QC Manager

Approved _____ Date 7/8/96
IT Project Manager

Approved: _____ Date _____
TNRCC

Approved: _____ Date _____
AFCEE Team Chief

F41624-94-D8047-032

296003

Final

Work Plan
Remedial Investigation Base Gas Station
Naval Air Station Fort Worth
Joint Reserve Base, Carswell Field
Fort Worth, Texas
LPST ID No. 104524
Facility ID No. 009696

Prepared for:

Air Force Center for Environmental Excellence
Brooks Air Force Base, Texas
Contract No. F41624-94-D-8047
Delivery Order No. 0032

Prepared by:

IT Corporation
312 Directors Drive
Knoxville, Tennessee 37923

Project No. 765725
Revision 1

July 1996

296004

Table of Contents

Page

296005

Table of Contents (Continued)

296006

List of Tables

List of Figures

296007

List of Acronyms

AFCEE	Air Force Center for Environmental Excellence
AST	aboveground storage tank
CAM	California Administrative Metals List
CAP	Corrective Action Plan
CWA	Clean Water Act
°F	degrees Fahrenheit
DQO	Data Quality Objectives
FSP	Field Sampling Plan
gpd/ft	gallons per day per foot
HSP	Health and Safety Plan
ID	inside diameter
IRP	Installation Restoration Program
IT	IT Corporation
LNAPL	light nonaqueous phase liquid
mgd	million gallons per day
NAS	Naval Air Station
NCTCOG	North Central Texas Council of Governments
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
msl	mean sea level
MTBE	methyl tertiary butyl ether
PAH	polycyclic aromatic hydrocarbons
PID	photoionization detector
ppm	parts per million
PST	Petroleum Storage Tank
PVC	polyvinyl chloride
QAPP	Quality Assurance Project Plan
QA/QC	quality assurance/quality control
SAP	Sampling Analysis Plan
TDS	total dissolved solids
TNRCC	Texas Natural Resources Conservation Commission
TPH	total petroleum hydrocarbons

296008

List of Acronyms (Continued)

TWC	Texas Water Commission
USACE	U.S. Army Corps of Engineers
UST	underground storage tank
VOC	volatile organic carbons

296009

TAB

1.0

1.0 Introduction

The Air Force Center for Environmental Excellence (AFCEE) has contracted IT Corporation (IT) to prepare a work plan and a quality program plan, evaluate existing information, obtain additional data as needed, and prepare assessment reports, and remedial action plans for both the Base Service Station and the Base Gas Station at the Naval Air Station Fort Worth Joint Reserve Base, Carswell Field, Texas (NAS Fort Worth). IT is performing this work under Contract F41624-94-D-8047, Delivery Order 32.

Chapter 2.0 describes the existing background, physical, and environmental setting, and summarizes the operational and investigation/remediation history at the sites. The plan for data consolidation and site investigation is provided in Chapter 3.0 for each site and summarizes existing data, describes the plan for acquiring additional data, and defines the planned reporting approach. Chapter 4.0 provides the planned schedule.

The quality program plan includes a health and safety plan (HSP) and a sampling and analysis plan (SAP). The HSP is a project-specific and site-specific plan. The SAP consists of two volumes: the field sampling plan (FSP) and the quality assurance project plan (QAPP). The FSP describes the field and analytical methods to be used in the collection of additional site data. The QAPP documents the data quality objectives (DQO) and the quality assurance/quality control (QA/QC) procedures to be used in the performance of field and laboratory work.

1.1 Project Objectives

The objectives of this project are:

- Consolidate available information and data pertinent to the Base Service Station in an assessment report compliant with Texas Natural Resources Conservation Commission (TNRCC) Petroleum Storage Tank (PST) regulations and procedures. This should require no added site investigation.

- Conduct site investigation to obtain additional data necessary to adequately assess the Base Gas Station and consolidate the new and existing data in an assessment report compliant with TNRCC PST regulations and procedures.

296011

- In the process of obtaining site characterization data, obtain data needed for risk assessment and to evaluate remedial technologies.

- Prepare a remedial action plan for both facilities that identifies and evaluates candidate technologies and recommends an appropriate remedy, if remediation is warranted.

296012

TAB

2.0

296013

2.0 Existing Site Information

2.1 Description of Site

NAS Fort Worth Joint Reserve Base is in north-central Texas in Tarrant County, 8 miles west of downtown Fort Worth (Figure 2-1). The Base property, totaling 2,555 acres, consists of the main Base and two, noncontiguous parcels. The main Base comprises 2,264 acres and is bordered by Lake Worth to the north, the West Fork of the Trinity River and Westworth Village to the east, Fort Worth to the northeast and southeast, White Settlement to the west and southwest, and Air Force Plant 4 to the west. The area surrounding NAS Fort Worth is mostly suburban, including the residential areas of the cities of Fort Worth, Westworth Village, and White Settlement.

2.2 Environmental Setting

2.2.1 Climate

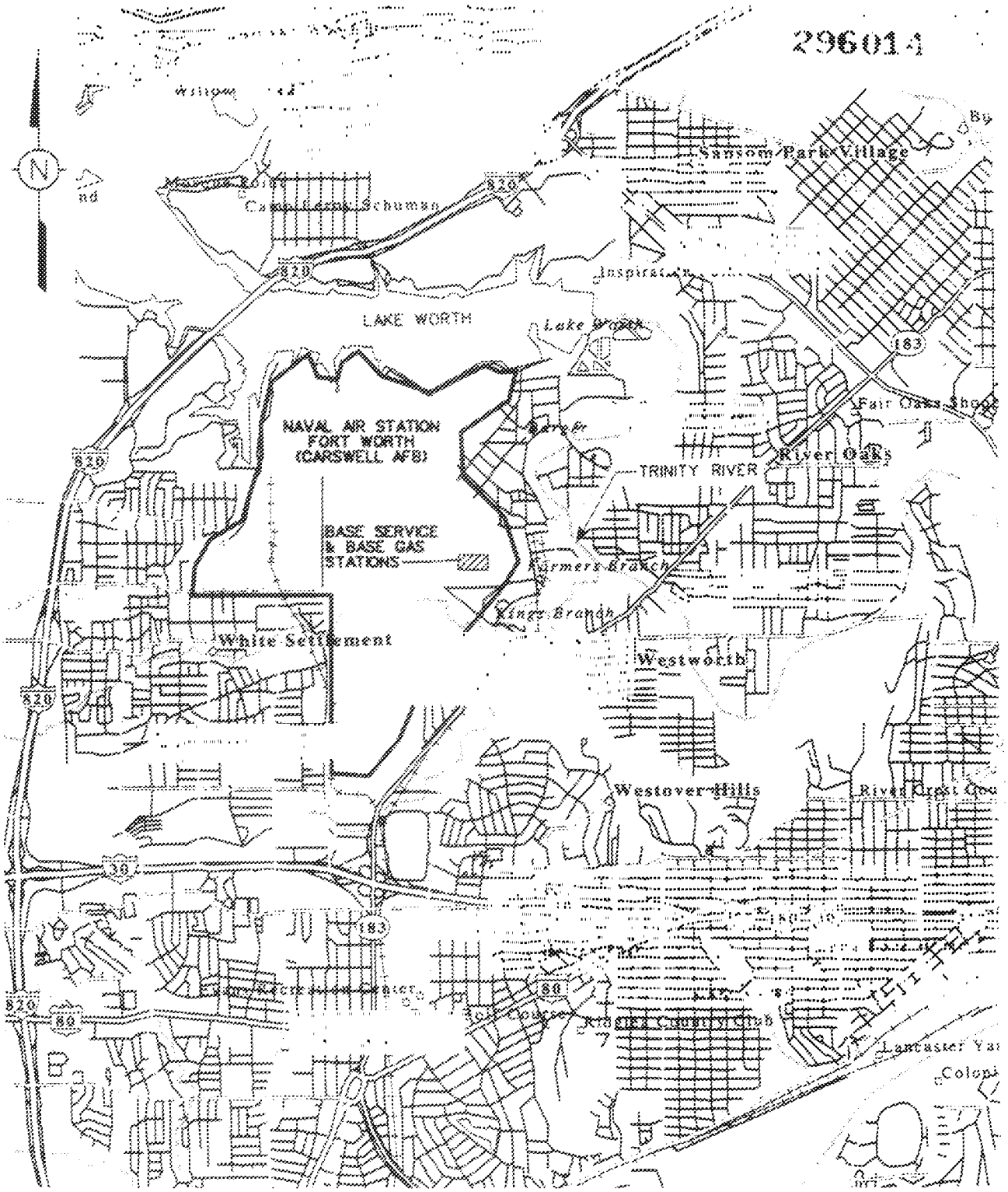
The climate in the Fort Worth region is subhumid with mild winters and hot, humid summers. The average annual precipitation is 31.5 inches, with the majority falling between April and October. The average annual temperature is 66 degrees Fahrenheit (°F). July is the hottest month with an average monthly temperature of 86°F, while January is the coldest month with an average monthly temperature of 45°F. Temperature changes are rapid and often change 20° to 30° in several hours. The average annual relative humidity is 63 percent.

Prevailing winds are primarily southerly from March through November and northerly from December through February; the average wind speed is 8 knots. Severe thunderstorms with wind speeds of 65 knots and hail storms are common. Climate conditions in summer make tornado formations possible, although there is more property damage each year due to hail than to tornadoes.

2.2.2 Sensitive Habitats

Sensitive habitats include those areas that can potentially restrict the reuse of the land, such as wetlands under the jurisdiction of the Clean Water Act (CWA), plant communities designated as unusual or of limited distribution, and important seasonal use areas for wildlife (e.g., migration route, breeding areas, or crucial summer/winter habitat that is of agency concern). This includes areas associated with a protected species, or those areas critical to a species of population.

29601-1



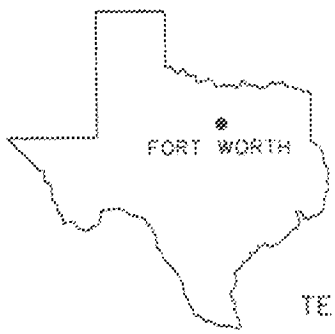


FIGURE 2-1
SITE LOCATION MAP

NAVAL AIR STATION FORT WORTH
FORT WORTH, TEXAS

INTERNATIONAL TECHNOLOGY CORPORATION

DWG NO 7657	
PROJ NO 765	
INITIATOR W CARTER	
PROJ MGR W CARTER	
DRAFT CHCK BY C TUMLIN	
ENGR CHCK BY W CARTER	
DATE LAST REV	
DRAWN BY	
CHECKED BY K BLAIR	
CHECKED DATE 3/20/96	

AS/7256.005 09:11:06 Nov 15, 1996 RHB

The shore of Lake Worth is considered a sensitive habitat due to its importance to migratory birds, including state- and federal-listed species. The great blue heron rookeries by the Fort Worth Nature Center are sensitive nesting areas along the northern banks of Lake Worth. The birds are especially vulnerable to human intrusion during the nesting season. The Texas Department of Parks and Wildlife protects these rookeries as sensitive wildlife areas.

2.2.3 Wetlands

NAS Fort Worth has a total of 0.6 acre of jurisdictional wetlands designated by the U.S. Army Corps of Engineers (USACE), Fort Worth, Texas. USACE defines wetlands as "those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions." Areas that are periodically wet, but do not meet all three criteria (hydrophytic vegetation, hydric soils, and wetland hydrology), may still be jurisdictional wetlands subject to Section 404 of the federal CWA if they qualify as problem wetlands.

Drainage ditches are not considered as "waters of the United States" and are not classified as "jurisdictional" for protection under Section 404 of the CWA by the Fort Worth USACE. Although water flows through Farmers Branch Creek and is found in various small ponds on the golf course, very little wetland vegetation is associated with these areas. Likewise, wetland vegetation along Lake Worth is infrequent and usually emergent when present. These areas do not support enough wetland cover to be classified as jurisdictional wetlands.

Jurisdictional wetland areas on station are found in the natural drainage stream southeast of Air Force Plant 4, totaling approximately 0.5 acre, and on the west side of the off-site Weapons Storage Area (WSA), totaling approximately 0.1 acre.

2.2.4 Surface Waters

NAS Fort Worth and all of Tarrant County are within the Trinity River watershed. Surface water resources near the station include the West Fork and Kings Branch of the Trinity River, Farmers Branch Creek, Lake Worth, two ponds in the golf course area, and one small pond in the off-site WSA.

The water the Trinity River receives is controlled by the watershed runoff from impervious areas during storms, by releases and overflows from the series of manmade reservoirs along

the forks and tributaries by natural runoff, and by the discharge of effluent from sewage treatment plants. Lake Worth, a manmade reservoir on the West Fork of the Trinity River, is north of NAS Fort Worth and is owned and operated by the City of Fort Worth. These waters are used for public water supply and recreation. Lake Worth covers an area of 3,558 acres and is 12 miles long. The lake has a conservation storage capacity of 38,130 acre-feet (or approximately 12.4 billion gallons).

Surface water is the main source of potable water near NAS Fort Worth. The City of Fort Worth Water Department is the primary supplier to the areas surrounding and including the station. Water from the Farmers Branch Creek is used to irrigate the on-station golf course. White Settlement and Sansom Park obtain water from 12 and 9 groundwater wells, respectively, but when required, they purchase surface water from Fort Worth to supplement their water supplies. NAS Fort Worth purchased 0.93 million gallons per day (mgd), 0.77 mgd, and 0.76 mgd of water from Forth Worth in 1989, 1990, and 1991, respectively.

Surface drainage at NAS Fort Worth is collected by the storm drainage system and routed into the sewer system, or as outfall into Lake Worth. An underground drainage culvert conducts surface runoff generated from areas west of the Base eastward to Farmers Branch Creek.

The North Central Texas Council of Governments (NCTCOG) has implemented a Continuous Automated Monitoring (CAM) system on the Trinity River. Two monitoring stations are located along the West Fork of the Trinity River, downstream from NAS Fort Worth. Current results of analyses of water from the first CAM station downstream from the Base showed that 100 percent of the samples were below the criteria value of 5.5 milligrams per liter (mg/L) for dissolved oxygen, and that measure of acidity and alkalinity (pH) values range from 6.6 to 9.8 due to the presence of substantial attached algal communities. The EPA secondary drinking water standard for pH is a range from 6.5 to 8.5; this range is a guideline, not a requirement.

Storm water runoff from the Base not routed to the Base or city sewer system is discharged into Lake Worth. The outfall is permitted under the NPDES and monitoring results document compliance with permit discharge limitations.

The water quality of Lake Worth is moderately hard, and contains slightly elevated salt levels during the warm summer season. Historically, Lake Worth has experienced problems with high sediment loads. Lake Worth was included in the 1990 nonpoint source report for having

known problems with sedimentation from agricultural and vacant lands. Using Eagle Mountain Lake as a sediment trap has reduced the sedimentation problems.

The potential for contamination of surface water is present at several locations on NAS Fort Worth. Potential for migration of hazardous contaminants through the surface water is considered high, primarily due to the proximity of identified sites to the West Fork of the Trinity River, Farmers Branch Creek, and Lake Worth. In addition, shallow groundwater carrying dissolved contaminants may discharge to these surface waters.

2.2.5 Geography and Physiography

NAS Fort Worth is within the Grand Prairie section of the Central Lowlands Physiographic Province. Broad terrace surfaces characterize the area sloping gently eastward, interrupted by westward-facing escarpments. The topography of the station is fairly flat, except areas near Farmers Branch Creek and the Trinity River. Elevations average 650 feet above mean sea level (msl) and range from 550 feet above msl in the east to 690 feet above msl in the southwest.

Soils in the area generally consist of the Aledo-Bolar-Sanger Association which is defined as gently sloping to moderately steep, very shallow to deep, loamy and clayey soils on uplands.

The land uses west of the Base are predominandy residential and industrial. These include single-family residences, commercial centers, Air Force Plant 4, and an industrial complex in White Settlement.

The predominant development south of the Base is the commercial area at the Interstate 30 and State Highway 183 interchange. This area includes a discount retail center, a regional shopping mall, and a convenience center.

Various types of residential development occur southeast of the Base, north of Interstate 30. South of River Oaks Boulevard and Roaring Springs Road are country club estates and upscale townhouses. Farther south is middle- to upper-income, single-family housing, and multi-family units mixed with commercial office development. Single-family housing is also found on the eastern side of the Base, from the Kings Branch housing tract north to Meandering Road.

Public/recreational land uses occur north of the Base, surrounding Lake Worth. Public access along the southern shore of Lake Worth is currently restricted due to NAS Fort Worth Joint Reserve Base activities. A fish hatchery, YMCA camp, and private recreation lands occur along the West Fork of the Trinity River, northeast of the Base.

2.3 Base Service Station

2.3.1 Site History

The Base Service Station is at the northwest corner of the intersection of Jennings Drive and Rogner Drive along the eastern edge of NAS Fort Worth (Figure 2-2). The Base Service Station is approximately 500 feet west of the western bank of the West Fork Trinity River and approximately 450 feet west of the eastern installation boundary.

The Base Service Station was built and placed into service in 1972. The Base Service Station was built with four 10,000-gallon fiberglass underground storage tanks (UST) in an excavation on the north side of the facility and one 600-gallon waste oil tank in a separate excavation. Six fueling islands, a central pay office, and a service building were also at the Base Service Station. The Base Service Station was constructed and operated as part of Carswell Air Force Base until 1991, when the base was realigned as NAS Fort Worth, a Joint Reserve Base.

In December 1983 three leaking flexible lines in the Base Service Station fuel distribution system were replaced. In November 1984, gasoline was discovered in the drainage ditch along Rogner Drive. A loss of 1,900 gallons of gasoline over a period of 3 weeks was recorded in the Base Service Station record books that month and a leaking rubber transfer line to one pump were discovered and repaired. In December 1984, gasoline was again discovered in the drainage ditch. The regular and unleaded gasoline lines were tested and found to be leaking. It was reported that 10 to 15 gallons of gasoline per day was being removed from the drainage ditch between the Base Service Station and Rogner Drive (USACE, 1994). In August 1992, a 900-gallon petroleum variance was noted at the Base Service Station.

In April 1992, a petroleum seep was noted along the west bank of the Trinity River about 500 feet downgradient of the Base Service Station. The petroleum seep was reported to the Texas Water Commission (TWC), which issued a Notice of Violation for the release to the river. TWC issued LPST ID No. 104524 to the Base Service Station facility.

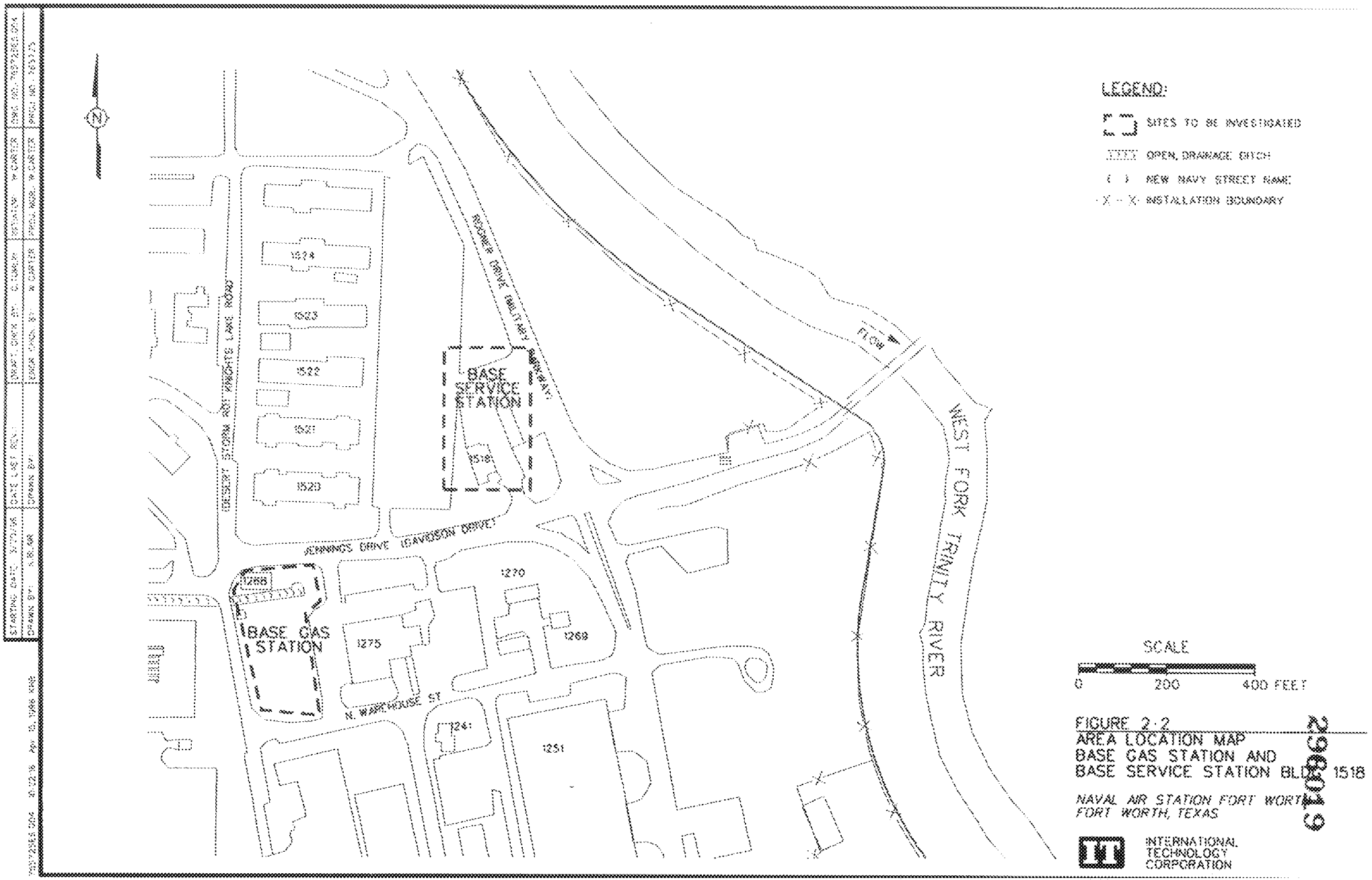


FIGURE 2-2
AREA LOCATION MAP
BASE GAS STATION AND
BASE SERVICE STATION BLDG 1518

NAVAL AIR STATION FORT WORTH
FORT WORTH, TEXAS

INTERNATIONAL TECHNOLOGY CORPORATION

23003.09

296020

In September 1992, the Base Service Station USTs were tested for integrity; three tanks failed the integrity testing. TWC was notified and requested immediate removal of free product discovered in monitor well Base Service Station B. Gasoline sales were terminated at the Base Service Station in the middle of September 1992. The USTs were removed from the ground, transported off-site, and a certificate of their destruction was issued by S&H Tank Company. The fluids remaining in the tanks were collected and recycled by Mobeley Company (Williams, 1993).

2.3.2 Geology

Quaternary alluvium is found at the surface through most of the Base Service Station area. The alluvium consists of floodplain and fluvial terrace deposits of gravel, sand, silt, and clay that occur as a veneer on the eroded surface of Upper Cretaceous strata. The Quaternary alluvium found at the Base Service Station was deposited by the Trinity River in terrace deposits along the river valley banks because of changing sea level during the Pleistocene and the Holocene (Recent) Epochs. Reworking and deposition of these deposits by the ancestral and present Trinity River has created a series of "terraced" river alluvium deposits of varying elevations placed by the river at various elevations due to its corresponding level influence by sea level changes during Quaternary continental glaciation.

Previous drilling activities near the Base Service Station indicate that the alluvial deposits vary in thickness from less than 10 feet to about 50 feet in thickness and generally thicken in an east to southeastern direction toward the Trinity River. The irregular thickness of the alluvium is due to depositional events, stream channeling, and erosion. In general, silt and clay with varying amounts of sand and gravel occur at the land surface down to depths of 5 to 10 feet. Underlying the silt and clay is a sand and gravel unit that normally increases in grain size with increasing depth. The sand deposits are fine- to coarse-grained, tan to rust in color, and composed predominantly of quartz grains. Gravel is mostly limestone and fossilized limestone shell fragments ranging in size from fine to cobbles. The gravel was deposited as channel lag deposits on the scoured upper surface of the underlying Cretaceous strata.

Underlying the Quaternary alluvium is the Cretaceous-aged Goodland and Walnut Formations. Both formations consist of interbedded, fossiliferous, hard limestone and calcareous shale. The rock is fractured and there is considerable jointing and flaking, which gives the limestone a fractured appearance. These strata are generally dry, although small amounts of water are occasionally present in the shale and clay units (Radian, 1991).

296021

The Cretaceous-age strata have a regional dip to the southeast. The surface elevation of the Cretaceous strata surface varies considerably across the area of the Base Service Station due to erosion of the Trinity River and its ancient stream course. Erosion of the Trinity River has removed the Goodland and Walnut Formations to the west of NAS Fort Worth and along the erosional valley of the Trinity River to the north and the east of the site. The locally irregular topography of the top of the bedrock is characteristic of an erosional surface modified by fluvial processes, which is characterized by the variable nature and thickness of the overlying sequence of Quaternary alluvial sediments. The thickness of the Walnut Formation in the area of the Base Service Station is shown to be only about 20 feet thick and the Goodland Formation is absent based on the sample log of Paluxy monitoring well USGS05, near the former Base Gas Station. Correlations of monitoring well logs east of the Base Service Station suggest that the Walnut Formation is absent, having been removed by erosion, and the Quaternary alluvium overlies the Paluxy Formation near the Trinity River.

Underlying the Goodland and Walnut Formations is the Cretaceous-aged Paluxy Formation. Regionally, a shale unit divides the Paluxy Formation into upper and lower sand members. The sands in the upper part of the Paluxy are reported to be fine-grained with shale interbeds. The lower sand member generally consists of two separate and distinct sand strata, but the individual sand beds do not maintain constant thickness or lithology over long distances. The lower part of the Paluxy Formation generally consists of coarse-grained sand that grades upward into fined-grained sand with variable amounts of shale and limestone. The Paluxy Formation thickness ranges from 140 to 190 feet, averaging 160 feet in Tarrant County (Radian, 1991).

The Paluxy is exposed along the southern shore of Lake Worth to the north of the Base Service Station and along the erosional channel of the Trinity River. The Paluxy Formation either is aerially exposed or is in contact with overlying Quaternary alluvium where the Goodland and Walnut Formations have been removed by erosion.

2.3.3 Hydrogeology

Three hydrogeologic units exist beneath NAS Fort Worth that are relevant to subsurface conditions at Base Service Station. From the shallowest to the deepest, they are: 1) the Quaternary alluvium aquifer containing unconfined groundwater associated with the Trinity River alluvial terrace deposits, 2) an aquitard of predominantly dry limestone of the Goodland and Walnut Formations, and 3) an aquifer in the Paluxy Formation.

296022

The Quaternary alluvial groundwater is found under unconfined conditions at NAS Fort Worth. Low permeability is typical of the alluvium because of the large amounts of clay and silt. However, there are zones of greater permeability in the saturated sands and gravels of former channel deposits. Recharge to the water-bearing sediments is local, from rainfall and infiltration from stream channels and drainage ditches. The direction of groundwater flow is generally controlled either by bedrock topography or discharge zones at primary or secondary streams. Previous reports indicate that the groundwater flow in these sediments at the location of Base Service Station is generally eastward toward the Trinity River at the eastern boundary of the facility. In January 1994, the groundwater gradient for these deposits was reported to be 1 foot per 25 feet, or 0.04, across most of the site, but was steepest in the area adjacent to the Base Service Station at 4 feet per 25 feet, or 0.16 (USACE, 1994). Figure 2-3 shows the groundwater gradient of the site. Quaternary alluvium river channel deposits at the western boundary of NAS Fort Worth had a measured hydraulic conductivity of 2.9×10^{-1} from a 1991 pump test (Radian, 1991).

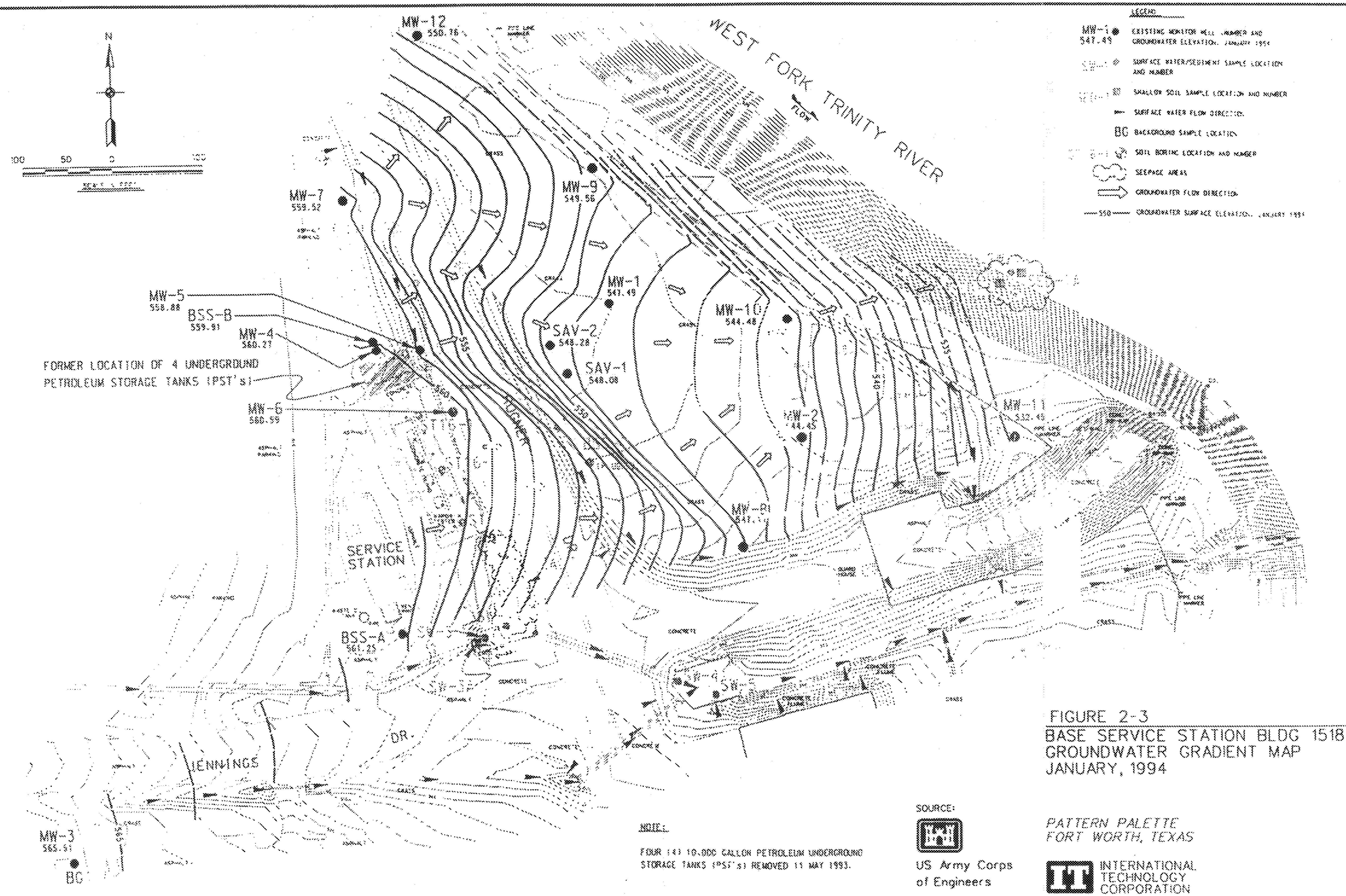
The unconfined groundwater found in the Quaternary alluvium is generally separated from the underlying Paluxy Aquifer by the low permeability limestones and calcareous shales where Goodland and Walnut Formations are present. The aquitard is composed of moist clay and shale layers interbedded with dry limestone beds.

The Paluxy Aquifer is the shallowest Cretaceous-aged aquifer underlying NAS Fort Worth. In the area, water in the uppermost part of the Paluxy Formation would occur under confined conditions beneath the Goodland and Walnut formations, except where these units have been eroded away. However, extensive groundwater pumping in the Fort Worth area, including the Cities of White Settlement and Samson Park, has lowered the Paluxy Aquifer potentiometric surface below the top of the formation, resulting in unconfined conditions.

Recharges to the Paluxy Aquifer occur where the formation crops out. The Paluxy Formation crops out west of Air Force Plant 4, and north of NAS Fort Worth in the bed of Lake Worth. The lake is a major recharge area for the aquifer and creates a potentiometric high in its vicinity. Regional groundwater flow is southeastward in direction of the regional dip. Transmissivities in the Paluxy Aquifer range from 1,263 to 13,808 gallons per day per foot (gpd/ft), and average 3,700 gpd/ft (Radian, 1991).

STARTING DATE: 3/28/95	DATE LAST REV.:	DRAFT. CHCK. BY: C.TUMLIN	INITIATOR: W.CARTER	DWG. NO. 765725ES.007
DRAWN BY: K.BLAIR	DRAWN BY:	ENGR. CHCK. BY: W.CARTER	PROJ. MGR.: W.CARTER	PROJ. NO. 765725

296023



NOTE:

FOUR (4) 10,000 GALLON PETROLEUM UNDERGROUND STORAGE TANKS (PST's) REMOVED 11 MAY 1993.

SOURCE:

US Army Corps of Engineers

FIGURE 2-3
BASE SERVICE STATION BLDG 1518
GROUNDWATER GRADIENT MAP
JANUARY, 1994

PATTERN PALETTE
FORT WORTH, TEXAS

INTERNATIONAL TECHNOLOGY CORPORATION

296024

2.3.4 Investigation Activities

In 1987, the Base Service Station was added to the Installation Restoration Program (IRP) and the initial site investigation at Base Service Station was conducted. The initial subsurface investigation was performed under Stage 2 of the IRP by Radian Corporation, who installed and sampled one soil boring and three monitoring wells, BSS-A, BSS-B, and BSS-C, at the Base Service Station. Monitor well BSS-C was plugged by COE in December 1993.

Additional site investigations in August and September of 1992 by Maxim Engineers, Inc., indicated groundwater and soils were impacted with petroleum hydrocarbons to the east and downgradient (hydrogeologic) of the Base Service Station (Maxim, 1992). Monitor wells MW-1 and MW-2 were installed to the east of the Base Service Station and MW-3 was installed west of site.

In September 1992, UST Services, Inc., leak-tested the four USTs at Base Service Station. One tank could not be filled and was emptied, one tank passed, and two tanks tested product loss rates of 0.75 gallon per hour. The TWC visited the site and issued a 9-point corrective action letter.

In October 1992, Leak-Tec installed monitoring well MW-4, MW-5, and MW-6 at the Base Service Station. The monitoring wells were installed near the USTs. The abandoned Chevron pipeline, located between the installation eastern boundary and the Trinity River, was excavated by the Tarrant County Water Board in three areas along 100 feet of pipeline immediately up slope and upgradient of the seepage area on the west bank of the Trinity River. No evidence of release of hydrocarbons from the pipeline was noted with this activity. No other information from this activity is available for review (USACE, 1994).

In December 1992, the USACE was tasked with performing a remedial investigation at the Base Service Station. Three soil borings were installed by USACE along fuel lines. Analytical results indicate soil total petroleum hydrocarbons (TPH) concentrations ranging from 20 to 216 mg/kg from the three soil borings installed along the fuel dispenser system (USACE, 1994). In January 1993, USACE was tasked with pulling the Base Service Station tanks.

USACE contracted Target Environmental Services, Inc., to perform a soil gas survey in February 1993. The soil gas survey indicated significant levels of petroleum hydrocarbons present along the sewer line east of Rogner Drive and along the western side of Rogner Drive near the Base Service Station. The chromatogram signature of the soil gas samples collected along the western

296025

side of Rogner Drive were characteristic of unweathered gasoline. Low levels of gasoline hydrocarbons were detected along the eastern boundary of the survey area, near the Base installation fence. No volatile hydrocarbons were detected in samples collected from the central portion of the survey area, which is in the open field east of the Base Service Station (Target, 1993).

In April 1993, Professional Service Industries, Inc., installed recovery wells SAV-1 and SAV-2 for the Air Force. Initial groundwater measurements of SAV-1 and SAV-2 indicated several inches of floating hydrocarbons in both wells. Later groundwater measurements did not detect floating hydrocarbons in these wells. Completion of the recovery system was halted at the request of TWC.

In May 1993, USACE surveyed the site, sampled existing site monitoring wells, and collected a shallow soil sample and a surface water sample from the Trinity River at the petroleum seep area on the river bank. USACE also collected four surface water samples along surface drainage paths leading from the Base Service Station. Groundwater sampled in the monitoring wells was impacted with elevated concentrations of petroleum hydrocarbons. The shallow soil sample also had elevated concentrations of petroleum hydrocarbons.

In September and October 1993, USACE collected an additional shallow soil sample and four additional surface water samples along surface drainage paths leading from the Base Service Station. In December 1993, USACE installed monitor wells MW-7 through MW-12, plugged a damaged monitor well Base Service Station-C (BSS-C), and recompleted and surveyed SAV-1 and SAV-2. Surface water samples indicated petroleum hydrocarbons were leaching into the ditch by Rogner Drive but were not detected farther downstream. The additional monitoring wells define the boundaries of the groundwater plume.

All site monitoring wells were sampled by USACE in January 1994 and the comprehensive site assessment report was submitted to the Air Force Base Conversion Agency. The report indicates that groundwater at the facility is impacted with petroleum hydrocarbons. The shallow depth of groundwater at the Base Service Station (5 to 7 feet) allowed the groundwater to become impacted by releases of hydrocarbons from the UST system. Figures 2-4 and 2-5 show the distribution of petroleum compounds in the alluvial aquifer and locations of the monitor wells as of January 1994 (USACE, 1994).

STARTING DATE: 3/26/96	DATE LAST REV.:	DRAFT. CHCK. BY: C.TUMLIN	INITIATOR: W.CARTER	DWG. NO.:765725E5.008
DRAWN BY: K.BLAIR	DRAWN BY:	ENGR. CHCK. BY: W.CARTER	PROJ. MGR.: W.CARTER	PROJ. NO.:765725

765725E5.008 09.50.23 Apr 15, 1996 KHB

296026

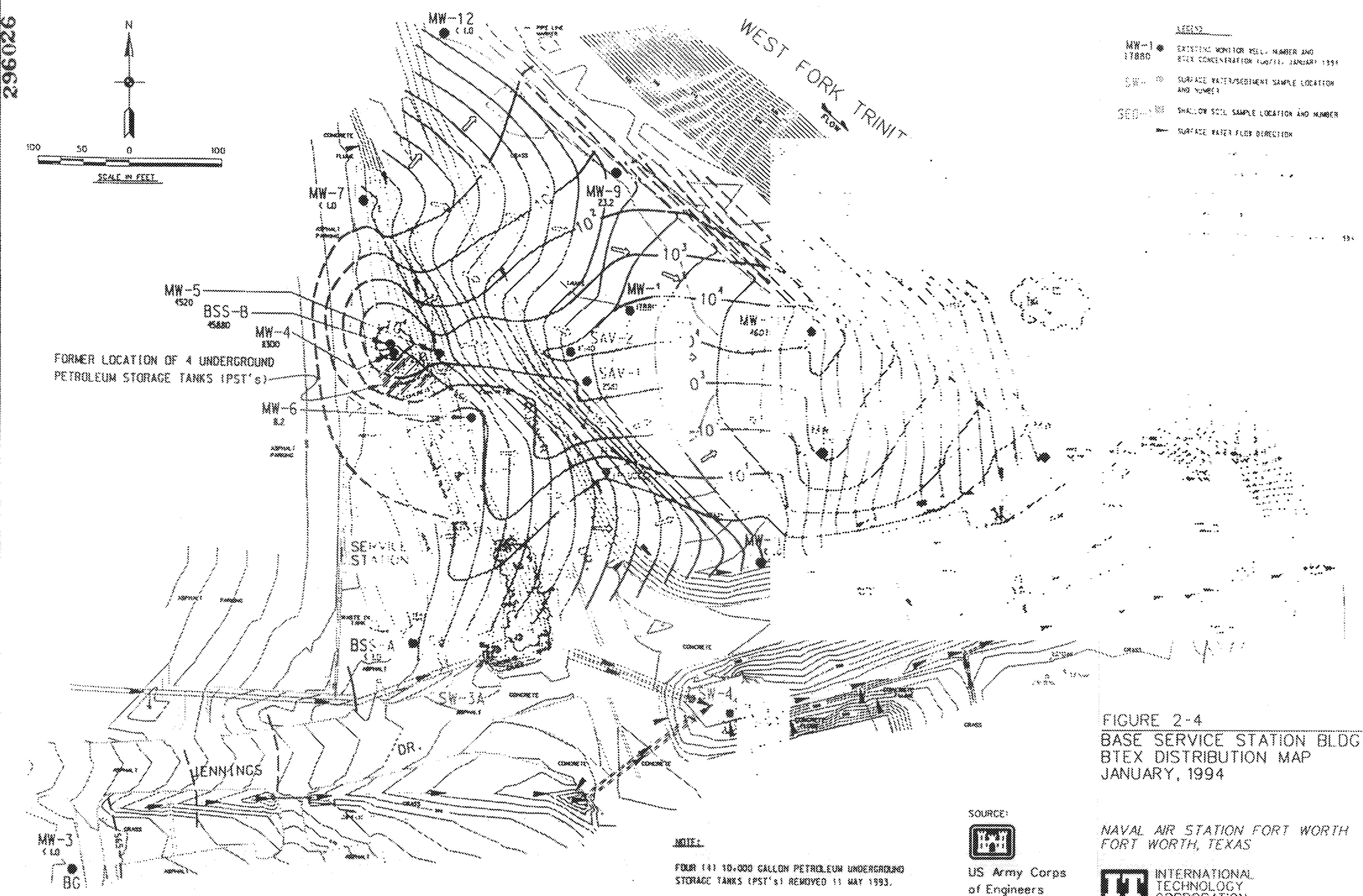


FIGURE 2-4
BASE SERVICE STATION BLDG 1518
BTEX DISTRIBUTION MAP
JANUARY, 1994

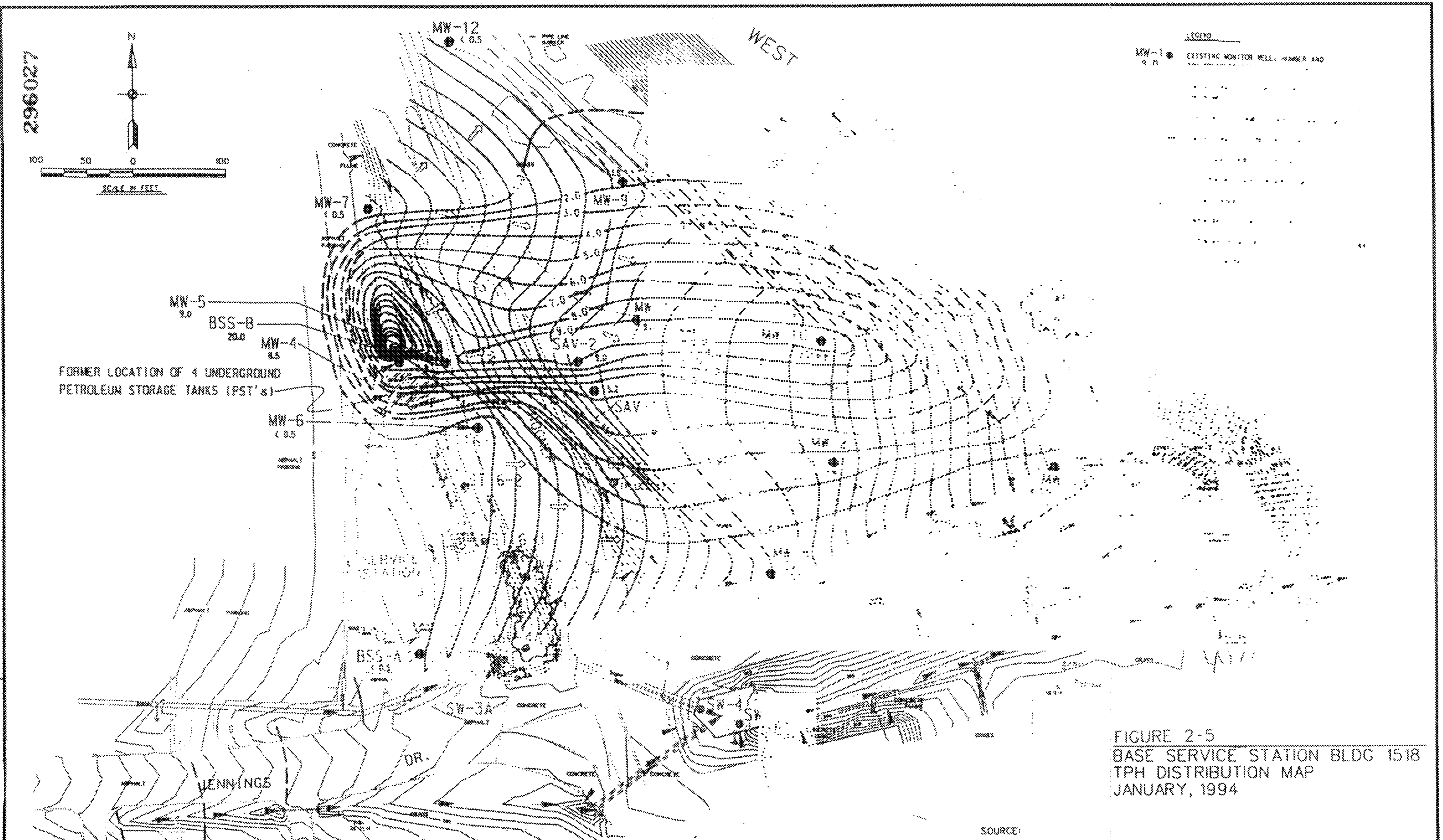
SOURCE:
US Army Corps of Engineers

NAVAL AIR STATION FORT WORTH
FORT WORTH, TEXAS

INTERNATIONAL TECHNOLOGY CORPORATION

STARTING DATE: 3/28/96 | DATE LAST REV.: | DRAFT. CHCK. BY: C.TUMLIN | INITIATOR: W.CARTER | DWG. NO. 765729ES.009

765729ES.009 09:50:03 Apr 15, 1996 KHB



NOTE:

FOUR (4) 10,000 GALLON PETROLEUM UNDERGROUND STORAGE TANKS (PST's) REMOVED 11 MAY 1993.

SOURCE:

US Army Corps of Engineers

FIGURE 2-5
BASE SERVICE STATION BLDG 1518
TPH DISTRIBUTION MAP
JANUARY, 1994

NAVAL AIR STATION FORT WORTH
FORT WORTH, TEXAS

INTERNATIONAL TECHNOLOGY CORPORATION

296028

A plume of petroleum impacted groundwater was found to extend from the Base Service Station eastward across Rogner Drive in the general direction of monitoring well MW-10 and the location of the petroleum seep on the west bank of the Trinity River (Figure 2-6). The concentration of BTEX and TPH compounds was greatest at the source of the petroleum release at the former Base Service Station UST system and decreased in concentration toward the eastern facility boundary. The report states that groundwater elevations indicate discharge to the river is occurring where the contaminated seepage has been observed (USACE, 1994).

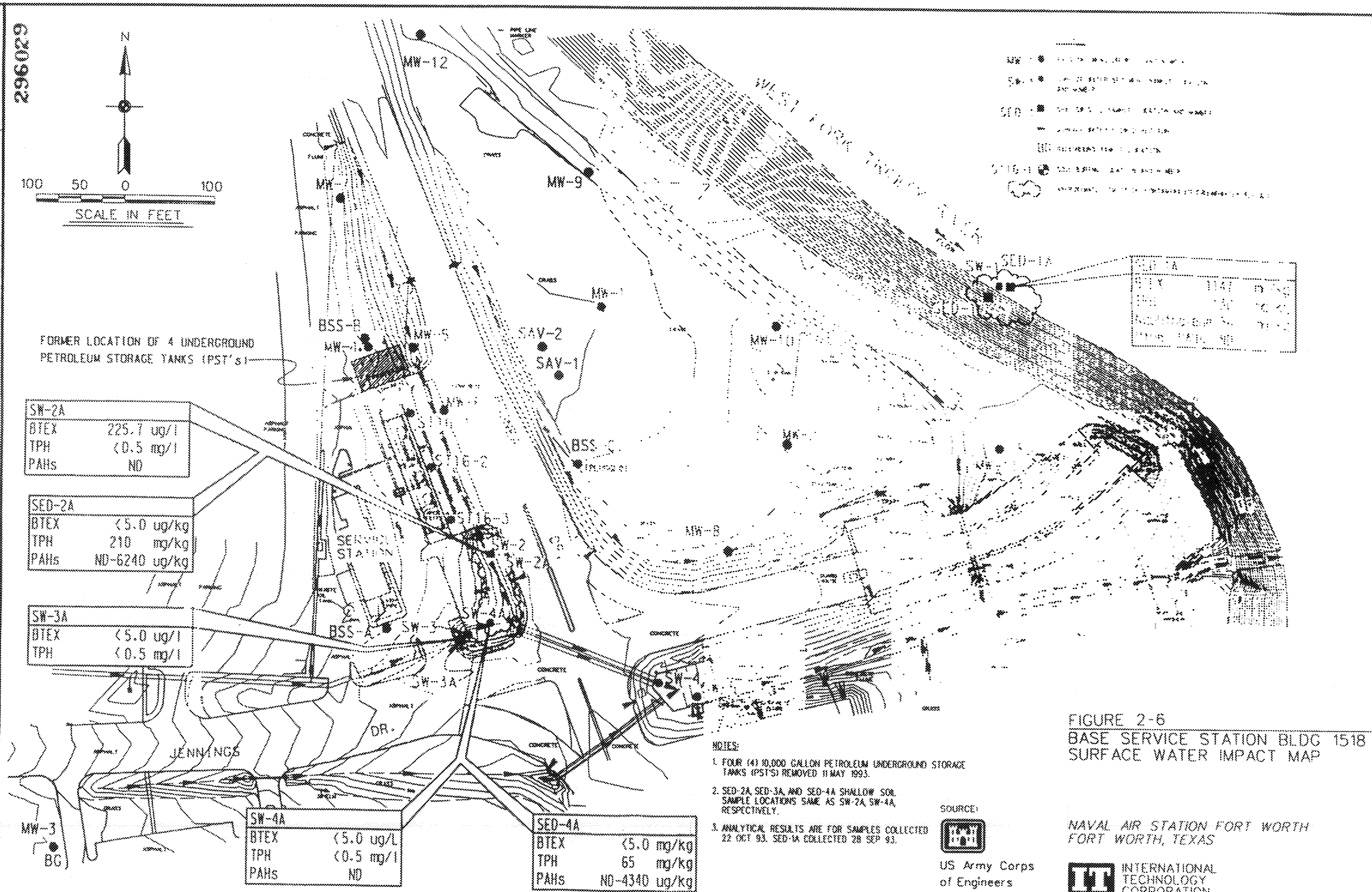
Soil samples collected from three soil borings found along the fuel lines leading to the dispensers were collected from the vadose zone and all samples detected TPH above the detection limit of 20 parts per million (ppm). Soil sample analytical data from this report indicated soil contamination from the UST release extends from the areal extent of the tank excavation and along all associated fuel lines to the shallow depth in which groundwater occurs in the immediate area of the Base Service Station. Petroleum hydrocarbon concentrations in the soil vadose zone were highest in samples collected throughout the Base Service Station UST and piping system. Petroleum hydrocarbons were not detected in monitoring well soils drilled outside the Base Service Station release area, except MW-11 and MW-3. MW-3 is upgradient near the former Base Gas Station. Elevated concentrations of petroleum hydrocarbons were detected in the vadose zone, at the groundwater interface, and at boring total depth in the saturated zone in MW-11, which is southeast of the Base Service Station and the edge of the known groundwater plume.

The USACE Comprehensive Site Assessment Report indicates that groundwater is discharging to surface water at two locations of the Base Service Station study area. Figure 2-6 shows locations where surface water and sediment samples have been collected to date and the analytical results of surface water and sediment samples. These areas include the location of impacted groundwater discharge south-southeast of the Base Service Station fuel islands and the area of discharge along the west bank of the West Fork of the Trinity River. The report indicates that petroleum hydrocarbon concentrations at the river seep area soils are highly elevated but that the concentration of petroleum hydrocarbons in the groundwater discharging to the river itself is not known. The report also states that impacted groundwater is discharging from the Base Service Station into ditches that ultimately drain to the river (USACE, 1994).

STARTING DATE: 3/26/96	DATE LAST REV.:	DRAFT. CHCK. BY: C.TUMLIN	INITIATOR: W.CARTER	DWG. NO.:765705ES.010
DRAWN BY: K.BLAIR	DRAWN BY:	ENGR. CHCK. BY: W.CARTER	PROJ. MGR.: W.CARTER	PROJ. NO.:765725

765705ES.010 09:50:23 Apr. 15, 1996 KHB

296029



NOTES:

1. FOUR (4) 10,000 GALLON PETROLEUM UNDERGROUND STORAGE TANKS (PST'S) REMOVED 11 MAY 1993.
2. SED-2A, SED-3A, AND SED-4A SHALLOW SOIL SAMPLE LOCATIONS SAME AS SW-2A, SW-4A, RESPECTIVELY.
3. ANALYTICAL RESULTS ARE FOR SAMPLES COLLECTED 22 OCT 93. SED-1A COLLECTED 28 SEP 93.

SOURCE: US Army Corps of Engineers

FIGURE 2-6
BASE SERVICE STATION BLDG 1518
SURFACE WATER IMPACT MAP

NAVAL AIR STATION FORT WORTH
FORT WORTH, TEXAS

INTERNATIONAL TECHNOLOGY CORPORATION

296030

2.3.5 Removal Activities

In May 1993, the four 10,000-gallon fiberglass USTs were removed by Perry Williams, Inc., under contract to the USACE. The tanks were inerted, cleaned, and transported off site for destruction and disposal. A total of 310 feet of fuel dispenser pipe was capped and abandoned in-place. No record was found of integrity testing of the piping before the piping was abandoned in-place. An additional 75 feet of piping was removed and disposed of off site. The excavation was backfilled with stockpiled soils from the tank excavation, a plastic liner was placed over these soils, and then an additional 216 yards of fill material was placed in the excavation and compacted to grade. The remaining service buildings at the facility were left in place. Soil samples of the tank excavation indicated soils on the north, east and south walls of the tank excavation were impacted with petroleum hydrocarbons. BTEX compounds also impacted groundwater in the tank excavation. Figure 2-7 shows the Base Service Station UST system layout and the tank excavation soil concentrations.

2.4 Base Gas Station

2.4.1 Site History

The Base Gas Station occupied about 45,000 square feet on the northeast corner of Knights Lake Road and Warehouse Street at NAS Fort Worth (Figure 2-2). The Base Gas Station was originally constructed as a gas station in the 1950s and had three USTs. Sometime in the 1960s or 1970s the facility was converted to an aboveground storage tank (AST) facility with fuel dispensing facilities. The facility was active until 1989 when operations were ceased and the facility was left unused until 1994. In February 1994, Metcalf and Eddy, under contract to AFCEE, dismantled and removed the ASTs and other associated equipment from the former Base Gas Station.

The facility consisted of:

- One 12,000-gallon diesel fuel AST
- One 12,000-gallon unleaded fuel AST
- One 6,000-gallon unleaded fuel AST
- Three 12,000-gallon regular fuel ASTs
- Concrete foundations for the tanks
- Above and below ground piping
- Fuel dispensing island
- Miscellaneous structures such as pumphouse and filling area
- Fencing and berms to contain spills.

296031

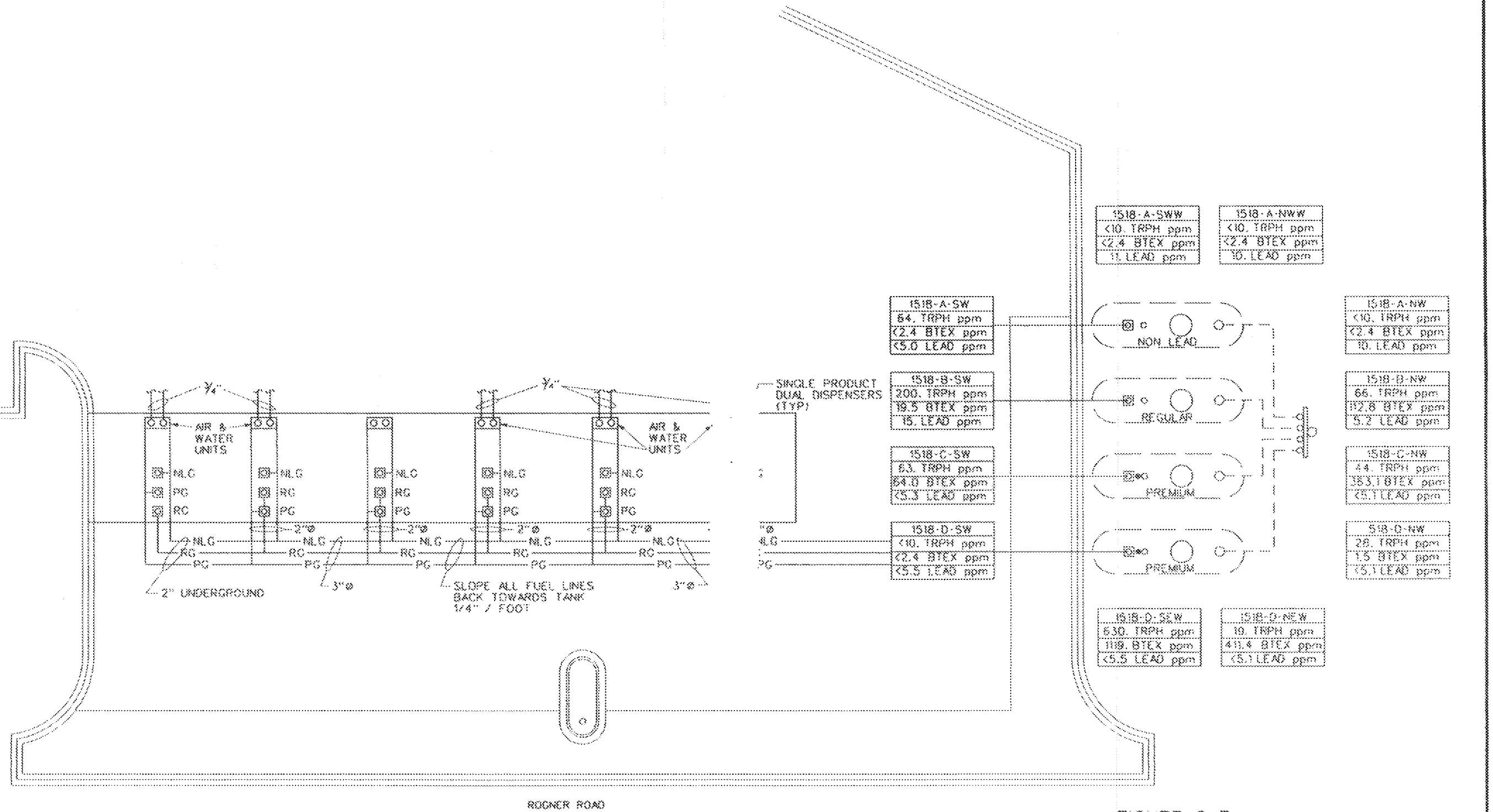


FIGURE 2-7
BASE SERVICE STATION BLDG 1518
TANKHOLD SOIL CONCENTRATIONS
AND PIPING SYSTEM LAYOUT

SOURCE:
US Army Corps of Engineers
AS BUILT:
27 JULY 1972

NAVAL AIR STATION FORT WORTH
FORT WORTH, TEXAS

INTERNATIONAL TECHNOLOGY CORPORATION

DRAFT, CHK'D BY: C DUNLIN | INITIATOR: N CARTER | DWG NO: "1972SES.DP"
BRIEFING DATE: 3/26/96 | DATE LAST REV:
"1972SES.DP" 09:45:00 Apr 15, 1996 dwg

2.4.2 Geology

A limited amount of subsurface data on the geologic site conditions of the Base Gas Station currently exist. Monitoring wells MW-3 and USGS05P, located to the east and north of the Base Gas Station provides some information on the subsurface geology. A boring log from MW-3 indicates dark brown to gray moist clay from 3 feet to 15 feet below surface. At 15 feet, the clay grades into a tan, wet sand with iron stains and limestone fragments. At 20 feet the sand terminates and the boring encounters hard limestone bedrock. The boring log from Paluxy monitoring well USGS05P, located next to MW-3, indicates the top of the Walnut Formation is at 20 feet, 9 inches. The Walnut Formation is described as hard, gray to dark gray, fossiliferous limestone with some interbedded clay lenses. The Walnut extends to 40 feet in depth where it overlies the Paluxy Formation.

The Base Gas Station is relatively close to the Base Service Station so the area geology is as described in Section 2.3.2 of this plan.

2.4.3 Hydrogeology

The little hydrogeologic data available for the site conditions at the Base Gas Station are provided by MW-3 and USGS05P monitoring well logs described in the previous subsection. Groundwater was found at 15 feet below surface at the top of the sand bed, indicating unconfined conditions in the shallow aquifer. Groundwater in USGS05P is found at about 40 feet below surface, near the top of the Paluxy Formation. The area hydrogeology is described in Section 2.3.3 of this plan.

2.4.4 Investigation Activities

During the removal action of the ASTs and ancillary equipment, it was discovered that the volume of soils impacted at the facility was larger than stated in the original project scope. A change in scope was approved by AFCEE personnel which deleted the removal of a limited volume of impacted soil and started a slightly expanded sampling program to document the site conditions.

Soil samples were collected where field screening results, visual observations, and AFCEE personnel indicated areas of the Base Gas Station may be impacted with petroleum hydrocarbons. Soil samples were collected from both surface locations near site equipment and at a depth from test pits dug at two areas. One test pit was dug to 13 feet in depth near the center of the ASTs near the tank foundations. Water appeared at 10.5 feet below surface with

a strong odor and had a product layer on the surface. The second test pit was dug to a depth of 13 feet near the north end of the site. Upon reaching the final excavation depth, the test pit began to fill with water that had a product sheen (Metcalf & Eddy, 1994).

Thirteen soil samples and one water sample were collected from various areas of the Base Gas Station. Elevated concentrations of petroleum hydrocarbons were detected in the surface soil samples at the Knights Lake Road fuel island, the gasoline pumping unit closest to the fuel island, and at equipment near the south end of the site. Laboratory analysis indicated soil concentrations ranged from nondetect to 23,000 mg/kg for TPH and from nondetect to 281 mg/kg for total BTEX. Subsurface soil samples indicated elevated concentrations of petroleum hydrocarbons (maximum concentrations of 78 mg/kg total BTEX and 2,300 mg/kg TPH) in Test Pit No.1, at the ASTs. Elevated concentrations of lead up to 180 mg/kg were detected at the Base Gas Station pumping unit from surface soil samples. The groundwater sample collected from Test Pit No.1 indicated elevated concentrations of petroleum hydrocarbons.

2.4.5 Removal Actions

In February 1994, Metcalf and Eddy, under contract to AFCEE, completed demolition and removal of the Base Gas Station, ASTs, and equipment. The equipment removed from the facility consisted of:

- One 12,000-gallon diesel fuel AST
- One 12,000-gallon unleaded fuel AST
- One 6,000-gallon unleaded fuel AST
- Three 12,000-gallon regular fuel ASTs
- Concrete foundations for the tanks
- Above and below ground piping
- Fuel dispensing island
- Miscellaneous structures such as pumphouse and filling area
- Site fencing.

The ASTs were inerted, the tanks purged of free hydrocarbons, and the wash waters were collected and hauled off site. The ASTs were then removed from the supports and hauled off site for destruction. The concrete tank saddles and foundations were demolished and removed off site. The fencing, light fixtures, and ancillary equipment were dismantled and removed. The buried piping was evacuated with a vacuum truck, excavated, and transported off-site.

During the AST and equipment removal, it was discovered that soils were impacted beyond the original scope of investigation. All soils impacted by petroleum at the site were returned to the

296034

excavation area, and the site was backfilled and leveled until additional characterization of the site could be completed (Metcalf & Eddy, 1994).

296035

TAB

3.0

296036

3.0. Plan of Investigation

3.1 Base Service Station

3.1.1 Evaluation of Existing Data

Since no added investigation will be conducted at the site, the following section will discuss the data that exists for the affected media at the Base Service Station. The following section will also identify data gaps necessary for conducting the baseline risk assessment, preparation of the remedial action plan, and to satisfy TNRCC PST regulations.

3.1.1.1 Soils

The majority of laboratory data for Base Service Station soils consists of analyses for TPH, BTEX, methy-tertiary-butyl-ether (MTBE), and lead. Samples were generally collected from soils where field screening indicated the presence of petroleum compounds and were selected in each boring from the vadose zone, the groundwater interface zone, and the total depth of the boring. Base Service Station analytical data indicate petroleum hydrocarbon impacted soils at the release sites at the area of the USTs and associated underground piping and at the seep on the west bank of the Trinity River. Analyses for polycyclic aromatic hydrocarbons (PAH) were performed for shallow soil samples collected along drainage pathways downstream (east and south) of the Base Service Station. Data exist on the soil types, the vertical and horizontal extent of the soils, and the soil properties.

Geotechnical samples were collected and analyzed for: water content, wet density, dry density, specific gravity of solids, organic matter, and porosity, from monitoring wells MW-8 (7 to 8 feet below ground surface) and MW-10 (2 to 4 feet below ground surface) (Figures 2.3 through 2-6).

No PAH data exist for soils from areas of higher petroleum hydrocarbon concentration at the release areas near the USTs or the underground piping at the Base Service Station. No analysis has been performed for soil vapor concentrations of oxygen or carbon dioxide for development of the corrective action plan (CAP). Data are also not available to assess potential vapors inside the site building, which is currently unoccupied.

Data are lacking on the full horizontal extent of petroleum hydrocarbon concentrations at the area of the Base Service Station release sites (UST area and underground piping), the waste oil tank at

296037

the Base Service Station, and the impact of petroleum hydrocarbons on utility conduits near the southern half of the Base Service Station and the Sanitary Sewer east of Rogner Drive.

3.1.1.2 Groundwater

Groundwater data prior to 1994 and available for review indicate that dissolved phase BTEX, MTBE, PAH, and TPH exist at elevated concentrations in groundwater beneath and downgradient of the Base Service Station. BTEX and TPH were detected in elevated concentrations in monitoring wells SAV-1, SAV-2, MW-1, MW-2, MW-4, Base Service Station-B, MW-5, and MW-10. Detections of BTEX and TPH were slightly above detection limits in MW-9. Although no petroleum hydrocarbons were detected, MTBE was detected in MW-6 and MW-8. Lead concentrations ranged from 0.0052 mg/L to 41 mg/L in several wells. PAH compounds have been detected in the groundwater in monitoring wells MW-10, MW-1, SAV-2, and Base Service Station-B.

Additional analyses performed include TDS, pH, temperature, and conductivity. Less than 0.1 foot of light, nonaqueous, phase liquid (LNAPL) hydrocarbons were detected in monitor wells Base Service Station-B, SAV-1 and SAV-2 in 1993, but were not detected in later sample events during dry periods.

Figures 2-3, 2-4, and 2-5 indicate a plume of impacted groundwater extending from under the Base Service Station eastward toward the eastern facility boundary. The gradient of the groundwater is about 1 foot per 25 feet (0.40) but is steepest in the area of the Base Service Station at a gradient of 4 feet per 25 feet (0.16). The boundaries of the dissolved-phase concentrations of BTEX and TPH compounds are mapped with the plume boundaries defined by analytical detection limits upgradient and laterally. Two distinct areas of ten elevated dissolved phase BTEX and TPH compounds are shown on Figures 2-4 and 2-5. One area is adjacent to and north of the former tank excavation at monitor wells MW-4 and BSS-13 and the other area is east of the tank excavation at monitoring wells SAV-1, SAV-2, MW-2, and MW-10.

Significant background data not available for characterization of the site include: a water well inventory of the area, a walked sensitive receptor survey on a 500-foot radius, and groundwater analyses for biodegradation indicators (dissolved oxygen, dissolved carbon dioxide, dissolved methane, iron, nitrate, and sulfate).

296038

No localized Quaternary aquifer characterization data are available to determine aquifer hydraulic conductivity of the aquifer for determining rate of plume movement and selecting remedial options at the site. No data exist to determine if the Paluxy Aquifer is impacted from the dissolved phase plume in the area downgradient of the Base Service Station. Available data from the river bank does not conclusively support the notion that groundwater discharge from the Base Service Station plume is discharging into the Trinity River.

3.1.1.3 Surface Water

Surface water sample data (Figure 2-6) indicate elevated concentrations of BTEX compounds from ditch samples located immediately downgradient of the Base Service Station culvert along Rogner Drive. No BTEX or TPH compounds were detected from surface water samples further downstream in the station surface drainage system.

No surface water analytical results are available from the seep area at the west bank of the Trinity River to determine impact of this surface water discharge to the Trinity River. Data requirements include BTEX, TPH, PAH, and lead analyses.

3.1.1.4 Subsurface Vapor

The soil gas survey performed in 1993 indicates areas of vadose zone soil impacted with petroleum hydrocarbon vapors. The survey was limited to the immediate area along Rogner Drive and the field east of the Base Service Station. Two areas have elevated concentrations of petroleum hydrocarbon vapors: the area immediately east of the former tank excavation and the eastern limit of the facility boundary along the Trinity River.

No soil gas vapor data were collected south of the petroleum release at the service building during the survey. Identification of petroleum hydrocarbon soil gas vapor impacts on the building may be necessary for consideration of future use of the service building.

3.1.1.5 Below-Ground Potential Horizontal Conduits

It is possible that fuel released from the Base Gas Station has migrated to the Base Service Station area or to the Trinity River along buried sewer and utility lines. This hypothesis is based on the observation of product in the groundwater at the Base Service Station, a sheen on the river water after significant rain events and the presence of buried lines that run from the Base Gas Station area to the Base Service Station area.

As discussed in Section 3.1.1.2, product has not been detected in the Base Service Station wells during dry periods. During rain events, the rising groundwater level may float product up to contact buried utility and sewer lines and their bedding material (generally gravel or other transmissive material). The product may then move along the downward slope of the buried line, aided by the movement of rainwater through the bedding material.

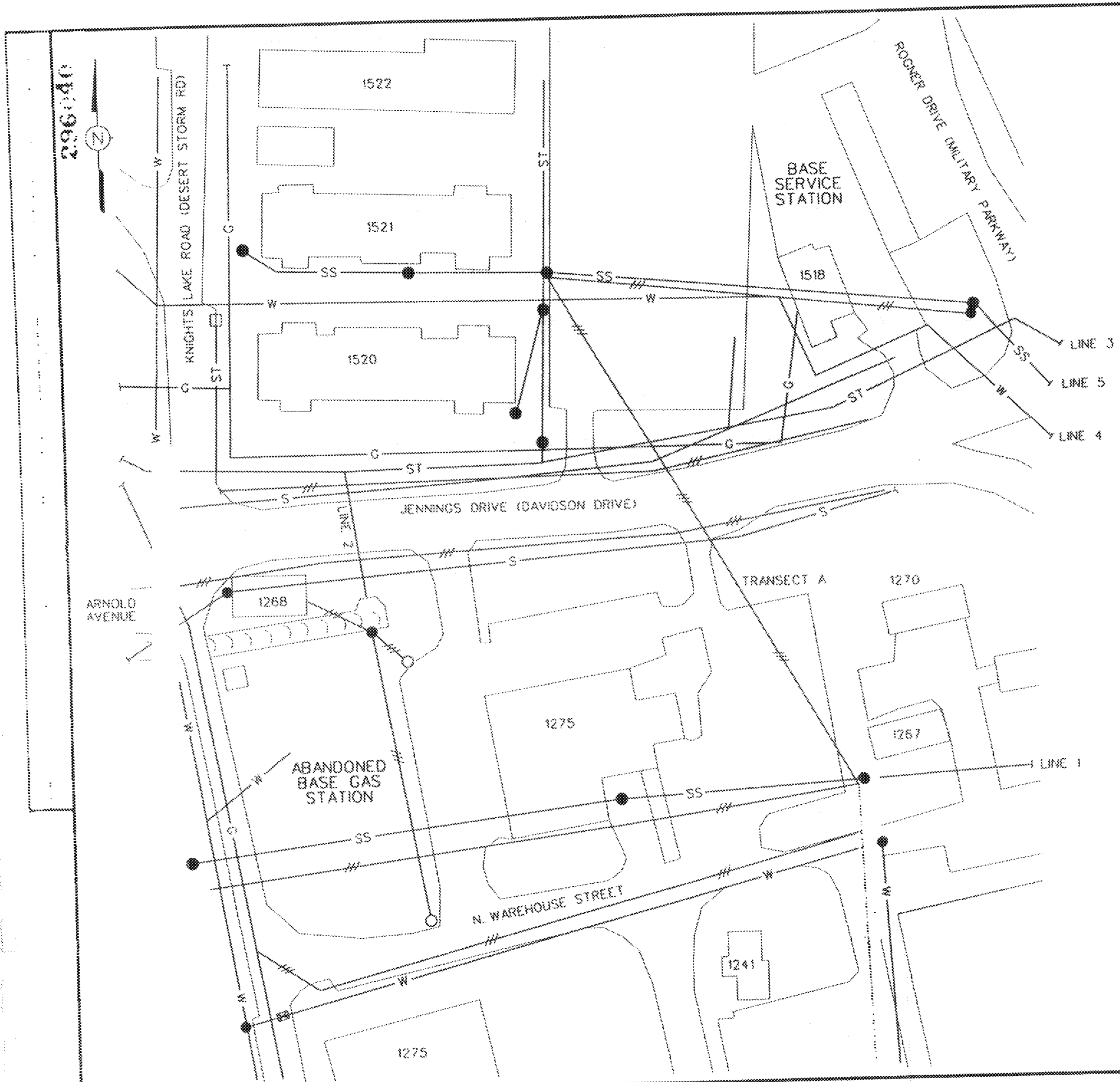
Two significant conduits exist that are in position to facilitate fuel migration from the Base Gas Station. As shown in Figure 3-1, the first of these pathways encountered (Line 1) is a 12-inch sanitary sewer line that runs east-west through the south side of the site. The second significant pathway is a 24-inch culvert (Line 2) that runs from a ditch on the north side of the Base Gas Station to the storm drain (Line 3) north of Jennings Drive. Line 3, a 5-foot by 4-foot storm drain, drains to the east and runs just south of the Base Service Station. Farther to the north, both a water line (Line 4) and a sanitary sewer (Line 5) run from west to east, through the Base Service Station area, but they are farther away from the Base Gas Station than the other lines mentioned, and do not appear to have linkage from Base Gas Station area.

No other significant manmade conduits are known to exist in the site area. Additionally, no natural conduits, such as relict stream or erosion channels, are currently known to exist in this area. It is possible; however, that such a natural pathway exists and acts in much the same way that a manmade conduit would act to provide a preferential pathway for Base Gas Station contaminants.

Because the source of contaminants under investigation relative to horizontal conduits likely originate at the Base Gas Station, conduit investigation is discussed in Section 3.2.2. Data will be reported in the Base Gas Station assessment report.

3.1.2 Additional Site Characterization

An IT risk assessment specialist will visit the site area to verify the existing information regarding ecological and human receptors. No other field activities at the Base Service Station are planned.



LEGEND:

- W — WATER
- G — GAS
- S — UNDERGROUND ELECTRIC LINE
- SS — SANITARY SEWER
- ST — STORM DRAIN
- POWER LINE (OVERHEAD)
- OPEN DRAINAGE
- MANHOLE
- LINE • — GEOPROBE ● SAMPLE LINES
- ⊕ — GEOPROBE LOCATIONS
- ( ) — NEW NAVY STREET DESIGNATIONS
- POWER POLE
- WATER VALVE

SOURCE:

COMPREHENSIVE PLAN, COMPOSITE UTILITY SYSTEM, CARSWELL AIR FORCE BASE, G-11; SHEET 15 OF 22 (30 OCT 89 UPDATE)

SCALE

0 100 200 FEET

FIGURE 3-1
UTILITY LINE LAYOUT IN AREA OF BASE GAS STATION AND BASE SERVICE STATION

NAVAL AIR STATION FORT WORTH
FORT WORTH, TEXAS

INTERNATIONAL TECHNOLOGY CORPORATION

296041

3.2 Base Gas Station

3.2.1 Evaluation of Existing Data

The following section reviews the data that exist for the affected media at the Base Gas Station and identifies where data gaps exist. It is necessary to close these data gaps, complete the baseline risk assessment, prepare the remedial action plan, and to satisfy TNRCC PST requirements.

3.2.1.1 Soils

The majority of laboratory data for Base Gas Station soils consist of analyses for TPH, BTEX, the volatile compound chlorobenzene, and lead. Samples were generally collected from soils where field screening, visual observation, and experience indicated the presence of petroleum compounds. Soil samples were collected either from the surface or from two test pits dug at the site.

Laboratory data indicate elevated concentrations of BTEX and TPH gasoline fraction compounds near gasoline storage and handling equipment, whereas elevated concentrations of TPH diesel fraction compounds and low concentrations of BTEX compounds were found to occur near storage and equipment for diesel fuel. Chlorobenzene, the only volatile organic compound (VOC) analyzed for, was not detected in the soil samples. Lead was detected in the soils in concentrations up to 180 ppm.

Field data indicated that a significantly larger area of the Base Gas Station was impacted with petroleum hydrocarbons than was expected. Insufficient data exist for the vertical and horizontal extent of the petroleum impacted soils. Characterization of the types of soils, the geotechnical properties of the soils, and occurrence of potential phase separated hydrocarbons in the soils is insufficient. No soil samples were submitted for analysis of PAH, or MTBE.

3.2.1.2 Groundwater

Very little information on groundwater encountered at the site is available. A groundwater sample was collected from one test pit where groundwater had leached into the pits during excavation. Analysis of the groundwater sample indicates elevated concentrations of TPH, BTEX compounds, and lead. No VOCs were detected. Groundwater analysis from monitoring well MW-3, located east and north of the former Base Gas Station, indicates no detections of BTEX or TPH. Monitor well USGS05P indicates the Walnut Formation is at a depth of about

20 feet and extends downward another 20 feet to the top of the Paluxy Formation at 40 feet below ground surface.

No groundwater monitoring wells have been installed in areas with high soil contaminant concentration or areas surrounding the former Base Gas Station, resulting in insufficient data to characterize the groundwater conditions of the facility. No quantitative groundwater data collected from monitoring wells exist within the Base Gas Station boundaries. Laboratory analysis of regulated compounds, including TPH, BTEX, PAH, and lead, are lacking at the site.

Significant background data not available for characterization of the site include a water well inventory of the area, a walked sensitive receptor survey on a 500-foot radius, and groundwater analyses for biodegradation indicators (dissolved oxygen, dissolved carbon dioxide, dissolved methane, iron, nitrate, and sulfate), total dissolved solids, pH, temperature, and conductivity.

No localized Quaternary aquifer characterization data are available to determine aquifer hydraulic conductivity of the aquifer for determining rate of plume movement and selecting remedial options at the site.

3.2.1.3 Surface Water

No analytical data are available for potential surface water impacts from the Base Gas Station. Surface water runs eastward off the site to a surface drainage ditch along Warehouse Street. The surface ditch discharges into the station surface water management system, which discharges into the West Fork of the Trinity River.

3.2.1.4 Subsurface Vapor

No data are available on the potential impact of petroleum hydrocarbons in soil vapors on structures and utilities at the Base Gas Station.

No soil gas vapor data have been collected at the site. Identification of petroleum hydrocarbon soil gas vapor impacts on the building or buried utilities may be necessary for consideration of future use of the site but are part of this work.

3.2.1.5 Below-Ground Horizontal Conduits

As discussed in Section 3.1.1.5, it is possible that fuels from the Base Gas Station have migrated along buried utility and sewer lines or along natural pathways to the Base Service

Station area and possibly Trinity River. Investigation of the horizontal conduits will be conducted as part of the Base Gas Station assessment and is discussed in Section 3.2.2.3.

3.2.2 Additional Site Characterization

Additional field work will be conducted to fill data gaps at the Base Gas Station. Samples will be collected from subsurface soils, groundwater, alongside utility lines, and from the West Fork of the Trinity River. The sampling and analytical plans are described in detail in the FSP. The sampling and analytical objectives and an overview of the sampling approach are provided in the following subsections.

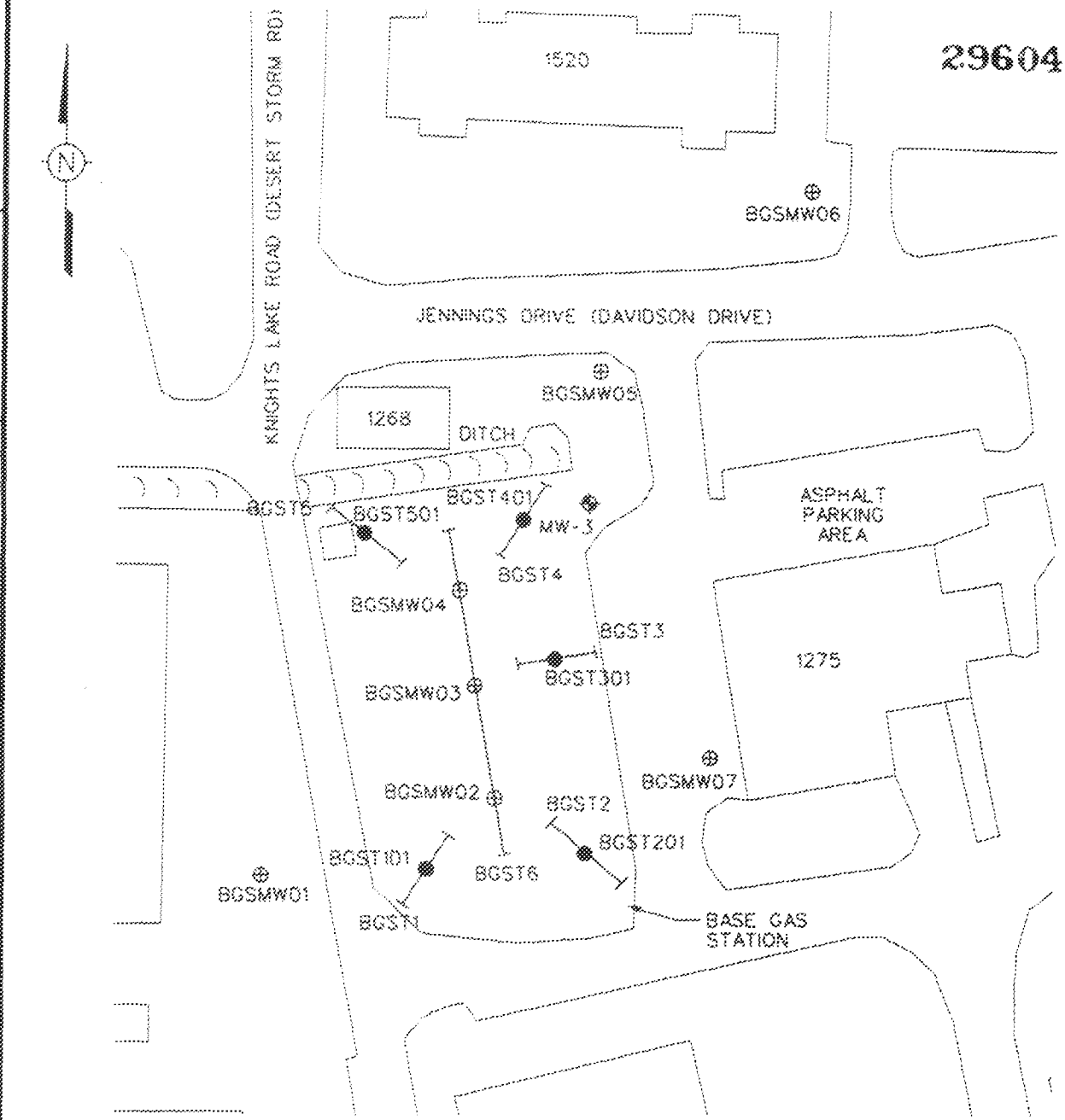
3.2.2.1 Subsurface Soil

Soil borings will be installed along transects BGST-1 through BGST-5 (Figure 3-2), by Geoprobe® soil probe method, and sampled to the top of the saturated zone; borings will be drilled with an auger rig and sampled to auger refusal (top of Walnut formation) at seven other locations (BGSMW01 through BGSMW07) and installed as monitoring wells (Figure 3-2). Each boring will be continuously sampled and samples will be retained for analysis from the saturated zone and at the depth with the highest indication of contaminants (photoionization detector [PID] readings, visual staining). The borings will be grouted after completion.

Boring locations BGST101, BGST201, BGST301, BGST401, and BGST501, from which samples will be taken for analysis will be along transects BGST1 through BGST5, and are positioned at the periphery of the tank area and will measure the extent of lateral contamination. The exact locations for sample collection will be determined after transects (BGST1, BGST2, etc.) of two to four borings along each transect have been completed.

One boring location, BGSMW01, will be used to characterize the presumed background conditions. Locations BGSMW02, BGSMW03, and BGSMW04 are near the location of the removed tanks and equipment and are expected to measure the highest levels of soil contamination. Monitoring wells BGSMW02, BGSMW03, and BGSMW04 will be installed in areas of significant soil contamination or LNAPL on Transect 6 (BGST6), spaced "on centers" for future use in remediation. Corings BGST101, BGST201, BGST301, BGST401, and BGST501 represent the coring selected for laboratory analysis of field samples. The specific core selected will be based on field screening data and will be the "uncontaminated" (as determined by field data) coring nearest the former tank locations.

296044



SCALE

0 100 200 FEET

LEGEND:

- NEW WELL
- NEW CORING
- EXISTING WELL
- SOIL PROBE TRANSECTS

FIGURE 3-2
LOCATION OF CORINGS AND MONITORING WELLS AT BASE GAS STATION

NAVAL AIR STATION FORT WORTH
FORT WORTH, TEXAS

INTERNATIONAL TECHNOLOGY CORPORATION

STARTING DATE: 4/15/96	DATE LAST REV.	DRAFT CHK BY: C TUMLIN	INITIATOR: W.CARTER
DRAWN BY: K.BLAIR	DRAWN BY:	ENGR CHK BY: W.CARTER	PROJ. MGR: W.CARTER
			DWG. NO: 765723ES.017
			PROJ. NO: 765723

765723ES.017 16:16:20 JUL 1 1996 1HB

296045

BGSMW07 is positioned east of the former tank location and will measure migration in the downgradient direction. BGSMW05 and BGSMW06 are to intercept contaminants migrating toward the Base Service Station. These locations will be used, in conjunction with the horizontal conduit investigation, to assess if contaminants from the Base Gas Station are migrating toward the Base Service Station, whether via a natural or manmade pathway.

All soil samples will be analyzed for BTEX, TPH, and PAH, as called for by the TNRCC *Guidance for Risk-Based Assessments at LPST Sites in Texas* (TNRCC, 1995), and for lead due to the possible storage of leaded fuels. The guidance calls for BTEX and TPH analyses at gasoline sites and BTEX, PAH, and TPH analyses of diesel; jet fuels; and Nos. 1, 2, and 4 fuel oils. VOCs will be continuously monitored in the borehole with a PID.

Two of the soil borings for monitoring wells at the Base Gas Station, BGSMW02 and BGSMW04, will also be used to obtain geotechnical data in support of remedial design. These borings are planned for the area of greatest fuel contamination. Samples from these borings will be analyzed for dry bulk density, effective porosity, fraction organic carbon, intrinsic permeability, and water content, in addition to the chemical analyses.

Field and analytical methods are provided in the FSP. Sampling objectives and analyses for soil borings are summarized in Table 3-1.

3.2.2.2 Groundwater

Monitoring wells will be installed at seven of the Base Gas Station boring locations (Figure 3-2). The wells will be screened from 5 feet above the top of the saturated zone to the top of the Walnut formation. The wells will be of 4-inch inside diameter (ID) polyvinyl chloride (PVC) casing with flush-mount surface completion. The well borings will be sampled as described for the soil borings.

Groundwater from these monitoring wells will be sampled twice, once after installation and development and once three months later. If free product is encountered, it will be removed with a downhole LNAPL recovery pump before sampling.

BGSMW01 is positioned in an upgradient location. Wells BGSMW02, BGSMW03, and BGSMW04 are in the former tank area and may be used in remediation of the tank area, as well as for site characterization. BGSWM05 and BGSMW06 are positioned to intercept

Table 3-1

Sampling Objectives and Analyses for Soil Borings at the Base Gas Station NAS Fort Worth Project No. 765725

(Page 1 of 2)

Boring[a]	Objective	Lab Analyses[b]	Field Analyses[c]
BGST101	Lateral extent of contaminant migration	BTEX, TPH, PAH, Pb	VOC, visual
BGST201	Lateral extent of contaminant migration	BTEX, TPH, PAH, Pb	VOC, visual
BGST301	Lateral extent of contaminant migration	BTEX, TPH, PAH, Pb	VOC, visual
BGST401	Lateral extent of contaminant migration	BTEX, TPH, PAH, Pb	VOC, visual
BGST501	Lateral extent of contaminant migration	BTEX, TPH, PAH, Pb	VOC, visual
BGSMW01	Background characterization	BTEX, TPH, PAH, Pb NH_4, PO_4, TKN, $\%H_2O$, pH	VOC, visual O_2, CO_2, CH_4
BGSMW02	Characterization of tank location, product recovery	BTEX, TPH, PAH, Pb, bulk density, porosity, organic carbon, permeability, water content NH_4, PO_4, TKN, $\%H_2O$, pH	VOC, visual O_2, CO_2, CH_4
BGSMW03	Characterization of tank location, product recovery	BTEX, TPH, PAH, Pb	VOC, visual
BGSMW04	Characterization of tank location, product recovery	BTEX, TPH, PAH, Pb, bulk density, porosity, organic carbon, permeability, water content, NH_4, PO_4, TKN, $\%H_2O$, pH	VOC, visual O_2, CO_2, CH_4

Table 3-1

Sampling Objectives and Analyses for Soil Borings at the Base Gas Station NAS Fort Worth Project No. 765725

(Page 2 of 2)

Boring[a]	Objective	Lab Analyses[b]	Field Analyses[c]
BGSMW05	Extent of contaminant migration toward Base Service Station	BTEX, TPH, PAH, Pb	VOC, visual
BGSMW06	Extent of contaminant migration toward Base Service Station	BTEX, TPH, PAH, Pb	VOC, visual
BGSMW07	Extent of downgradient migration	BTEX, TPH, PAH, Pb NH_4, PO_4, TKN, % H_2O, pH	VOC, visual O_2, CO_2, CH_4

[a] Two samples will be collected at each location: at the saturated zone and at the zone of highest apparent contamination.

[b] BTEX = benzene, toluene, ethyl benzene, and xylene
TPH = total petroleum hydrocarbons
PAH = polycyclic aromatic hydrocarbons
Pb = lead

[c] VOC = volatile organic hydrocarbons, as measured by a photoionization detector.

2396047

contaminants migrating toward the Base Service Station. BGSMW07 is in a presumed downgradient direction of the tank area.

Laboratory analysis of the initial groundwater samples will be for BTEX, TPH, MTBE, total dissolved solids (TDS), and PAH, as called for by the TNRCC *Guidance for Risk-Based Assessments at LPST Sites in Texas* (TNRCC, 1995); for nitrate and sulfate to facilitate evaluation of natural attenuation and allow for assessment of in situ bioremediation technologies; and for lead due to the possible storage of leaded fuels. Nitrate, sulfate, and TDS analyses are not planned for the second sampling event.

Field analyses to be conducted during the first sampling event are ferrous iron, sulfide, carbon dioxide, dissolved oxygen, redox potential, pH, conductivity, temperature, and total volatiles (as measured by a PID). These analyses are largely to facilitate evaluation of in situ bioremediation technologies for the groundwater. The pH, temperature, conductivity, and PID readings will be repeated for the second sampling.

Field and laboratory analytical methods are provided in the FSP. The groundwater sampling objectives and analyses are provided in Table 3-2.

3.2.2.3 Utility Lines

A Geoprobe® soil probe will be used to collect continuous cores from the surface to the estimated invert elevation of the sewer or other utility line. The probes will be as close to the buried lines as possible without unreasonable risk of puncturing the line. The lines will be "cleared" and staked before the probes are advanced.

Up to two soil samples will be collected from each probe: one from the invert elevation and the other from the depth of highest apparent contamination, as determined by a PID and visual observation. If no contamination is noted, only the sample from the invert elevation will be collected.

Additionally, probes will be advanced along a north-south Transect 7, just east of the Base Service Station, to determine if a natural east-west pathway (e.g., gravel bed) exists (Figure 3-3). The probes will be advanced to bedrock and a maximum of two samples will be taken if contaminants are detected by field screening. All probes will be continuously logged. All samples will be analyzed for BTEX, TPH, and lead. These analyses are to provide a link, if

Table 3-2
Sampling Objectives and Analyses for Groundwater at the Base Gas Station
NAS Fort Worth, Carswell Field, Texas

Well Location	Objectives
BGSMW-1	Characterize background conditions.
BGSMW-2	Characterize former tank area, facilitate product removal.
BGSMW-3	Characterize former tank area, facilitate product removal.
BGSMW-4	Characterize former tank area, facilitate product removal.
BGSMW-5	Determine migration toward Base Service Station.
BGSMW-6	Determine migration toward Base Service Station
BGSMW-7	Determine downgradient migration

Field Analyses (All Wells)	
1st Sampling	2nd Sampling
Ferrous iron	Total Volatiles (PID)
Sulfide	pH
Carbon dioxide	Temperature
Dissolved oxygen	Conductivity
Redox potential	
pH	
Total Volatiles (PID)	
Temperature	
Conductivity	
Methane	

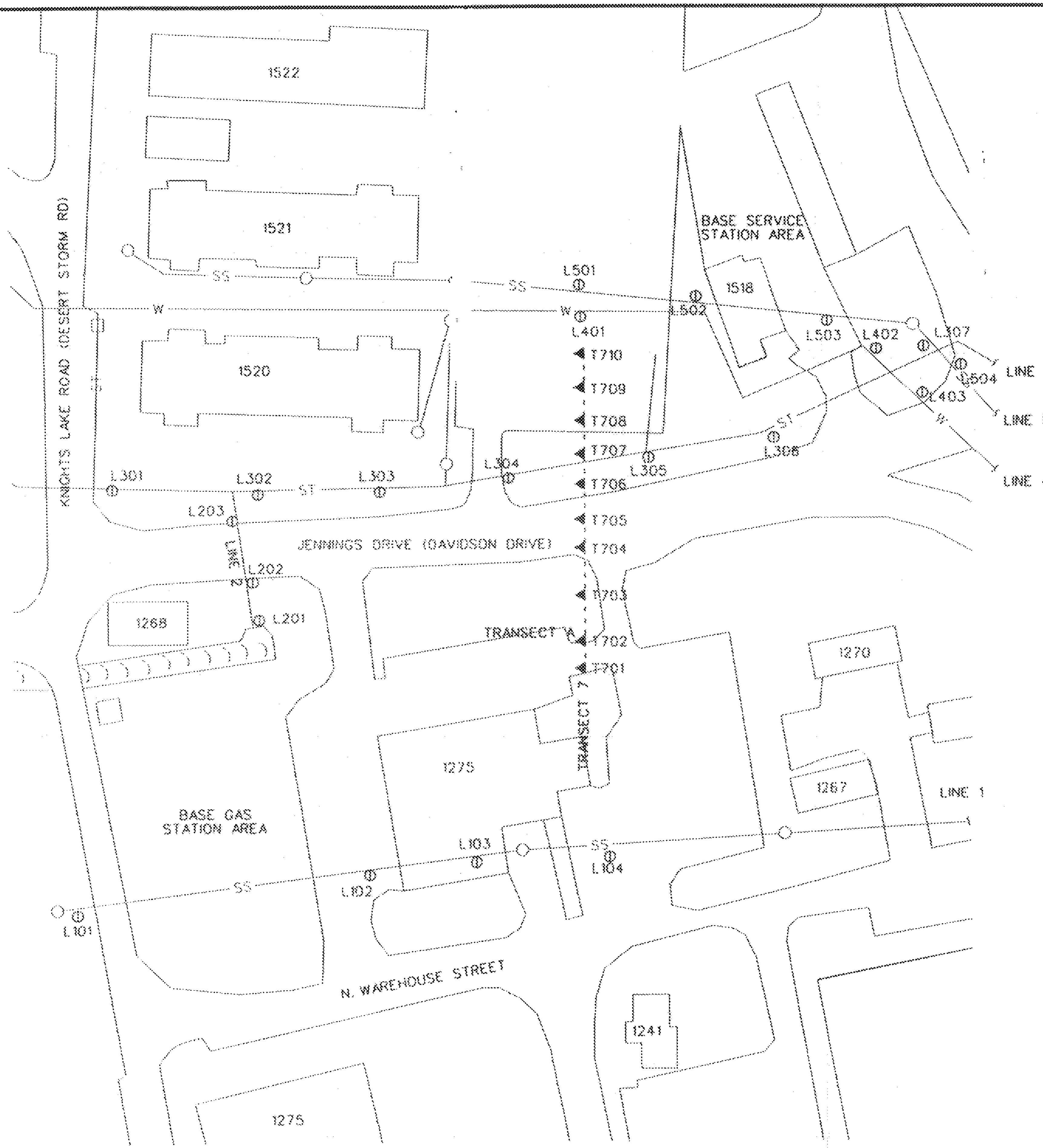
Laboratory Analyses (All Wells)[a]	
1st Sampling	2nd Sampling
BTEX	BTEX
TPH	TPH
Nitrate	MTBE
Sulfate	PAH
MTBE	Lead
TDS	
PAH	
Lead	
Methane	
Alklinity	

[a] BTEX = benzene, toluene, ethyl benzene, xylene
TPH = total petroleum hydrocarbon
MTBE = methyl tertiary butyl ether
TDS = total dissolved solids
PAH = polycyclic aromatic hydrocarbons

2960149

STARTING DATE: 3/19/98	DATE LAST REV.	DRAFT. CHCK. BY: D.TUMLIN	INITIATOR: W.CARTER	DWG. NO 765725ES.003
DRAWN BY: K.BLAIR	DRAWN BY:	ENGR. CHCK. BY: W.CARTER	PROJ. MGR: W.CARTER	PROJ. NO 765725

296050



LEGEND:

—W—	WATER
—SS—	SANITARY SEWER
—ST—	STORM DRAIN
((((	OPEN DRAINAGE
○	MANHOLE
LINE *	SOIL PROBE SAMPLE LINES
⦶	SOIL PROBE POINT
( )	NEW NAVY STREET DESIGNATIONS
▲	TRANSECT 7 PROBE LOCATIONS
●	POWER POLE

NOTE:

1. THE PREFIX "BCS" IS NOT INCLUDED IN THE SOIL PROBE POINT NUMBERS TO SIMPLIFY FIGURE.

SCALE

0 100 200 FEET

FIGURE 3-3
HORIZONTAL CONDUIT
SOIL PROBE LOCATIONS

NAVAL AIR STATION FORT WORTH
FORT WORTH, TEXAS

INTERNATIONAL TECHNOLOGY CORPORATION

one exists, between contaminants at the Base Gas Station and the Base Service Station. The objectives of each sample location and the analyses to be performed are summarized in Table 3-3. The holes will be grouted after completion.

3.2.2.4 Surface Water

The West Fork of the Trinity River will be sampled as soon after a rain event as possible if fuel seepage is observed in the river downgradient of the Base Gas Station and Base Service Station. Such a discharge would be evidenced by a visible sheen on the water surface. If no sheen is observed, no sampling will occur and the river will again be monitored after the next rain event for a evidence of fuel seepage.

Four samples will be collected, all from the bank. One sample will be collected well upstream of the sheen to define background conditions; one sample will be collected at the apparent origin of the sheen to define the highest contaminant concentrations; one sample will be taken just within the downstream edge of the sheen to determine the area of the plume; and the last sample will be collected either at the far bank or just outside the downstream edge of the sheen, depending on the configuration of the sheen, to further define the area of the plume. All samples will be collected at the water surface. The approximate location of the previous sheen is shown on Figure 3-4. It is assumed that any additional seepage would also be located in that area. A conceptual sampling layout is presented in Figure 3-5.

All surface water samples will be analyzed for BTEX, TPH, PAH, and lead to determine which, if any, fuel components are reaching the river. No field analyses will be conducted.

Field and laboratory procedures are provided in the FSP. The surface water sampling objectives and analyses are provided in Table 3-4.

3.2.2.5 Verification of Human and Ecological Receptors and Pathways

Prior to initiating field work, an IT risk assessment specialist will visit the Base Gas Station area to verify available information regarding human and ecological receptors and pathways. This field investigation will be conducted for the Base Gas Station and Base Service Station during the same site visit.

Table 3-3

Soil Probe Objectives and Analyses, Base Gas Station and Base Service Station Area, NAS Fort Worth, Carswell Field, Texas

Location	Objective	Lab Analyses	Field Analysis
Line 1[a]:			
BGSL101	Background on Line 1	BTEX, TPH, Pb	VOC, visual
BGSL102	Downgradient on Line 1	BTEX, TPH, Pb	VOC, visual
BGSL103	Downgradient on Line 1	BTEX, TPH, Pb	VOC, visual
BGSL104	Downgradient on Line 1	BTEX, TPH, Pb	VOC, visual
Line 2:			
BGSL201	Entrance to culvert	BTEX, TPH, Pb	VOC, visual
BGSL202	After crossing Jennings Rd.	BTEX, TPH, Pb	VOC, visual
BGSL203	Before joining Line 3	BTEX, TPH, Pb	VOC, visual
Line 3[a]:			
BGSL301	Background on Line 3	BTEX, TPH, Pb	VOC, visual
BGSL302	After receiving influent from Line 2	BTEX, TPH, Pb	VOC, visual
BGSL303	Downgradient on Line 3	BTEX, TPH, Pb	VOC, visual
BGSL304	Downgradient on Line 3	BTEX, TPH, Pb	VOC, visual
BGSL305	Downgradient on Line 3	BTEX, TPH, Pb	VOC, visual
BGSL306	Downgradient on Line 3	BTEX, TPH, Pb	VOC, visual
BGSL307	Downgradient on Line 3	BTEX, TPH, Pb	VOC, visual

Table 3-3

Soil Probe Objectives and Analyses, Base Gas Station and Base Service Station Area, NAS Fort Worth, Carswell Field, Texas

Location	Objective	Lab Analyses	Field Analysis
Line 4[a]:			
BGSL401	Background on Line 4, probe to bedrock as point on Transect 1	BTEX, TPH, Pb	VOC, visual
Line 4 (cont.)			
BGSL402	Downgradient of Base Service Station	BTEX, TPH, Pb	VOC, visual
BGSL403	Downgradient on Line 4	BTEX, TPH, Pb	VOC, visual
Line 5[b]:			
BGSL501	Background on Line 5, probe to bedrock as point on Transect 1	BTEX, TPH, Pb	VOC, visual
BGSL502	Immediately upgradient of Base Service Section	BTEX, TPH, Pb	VOC, visual
BGSL503	Immediately downgradient of Base Service Station	BTEX, TPH, Pb	VOC, visual
BGSL504	Downgradient of crossing line 3	BTEX, TPH, Pb	VOC, visual
Transect 7[b]:			
BGST701	Lithology (probe to bedrock)	BTEX, TPH, Pb	VOC, visual
BGST702	Lithology (probe to bedrock)	BTEX, TPH, Pb	VOC, visual
BGST703	Lithology (probe to bedrock)	BTEX, TPH, Pb	VOC, visual
BGST704	Lithology (probe to bedrock)	BTEX, TPH, Pb	VOC, visual

Table 3-3

Soil Probe Objectives and Analyses, Base Gas Station and Base Service Station Area, NAS Fort Worth, Carswell Field, Texas

Location	Objective	Lab Analyses	Field Analysis
BGST705	Lithology (probe to bedrock)	BTEX, TPH, Pb	VOC, visual
BGST706	Lithology (probe to bedrock)	BTEX, TPH, Pb	VOC, visual
BGST707	Lithology (probe to bedrock)	BTEX, TPH, Pb	VOC, visual
BGST708	Lithology (probe to bedrock)	BTEX, TPH, Pb	VOC, visual
Transect 7 (cont.) BGST709	Lithology (probe to bedrock)	BTEX, TPH, Pb	VOC, visual
BGST710	Lithology (probe to bedrock)	BTEX, TPH, Pb	VOC, visual

[a] One sample for lab analysis will be taken from the invert elevation of the utility line and a second sample will be taken from the zone of greatest apparent contamination, if contaminants are noted by field screening.

[b] 0-2 samples will be taken for lab analyses based on results of field screening.

Table 3-4

Sampling Objectives and Analyses for Surface Water in Trinity River
NAS Fort Worth
Project No. 765725

Sample Location	Objectives	Analyses[a]
BGSSW-1	Characterize background (upstream).	BTEX, TPH, PAH, Pb
BGSSW-2	Characterize highest plume concentration	BTEX, TPH, PAH, Pb
BGSSW-3	Determine plume boundary.	BTEX, TPH, PAH, Pb
BGSSW-4	Determine plume boundary.	BTEX, TPH, PAH, Pb

[a] BTEX = benzene, toluene, ethyl benzene, xylene
TPH = total petroleum hydrocarbon
PAH = polycyclic aromatic hydrocarbons
Pb = lead

STARTING DATE: 4/12/96	DATE LAST REV.:	DRAFT. CHCK. BY: C. TUMLIN	INITIATOR: W. CARTER	DWG. NO.: 265725ES.013
DRAWN BY: K.BLAIR	DRAWN BY:	ENGR. CHCK. BY: W. CARTER	PROJ. MGR.: W. CARTER	PROJ. NO.: 265725

265725ES.013 09:21:58 Apr. 15, 1996 KHB

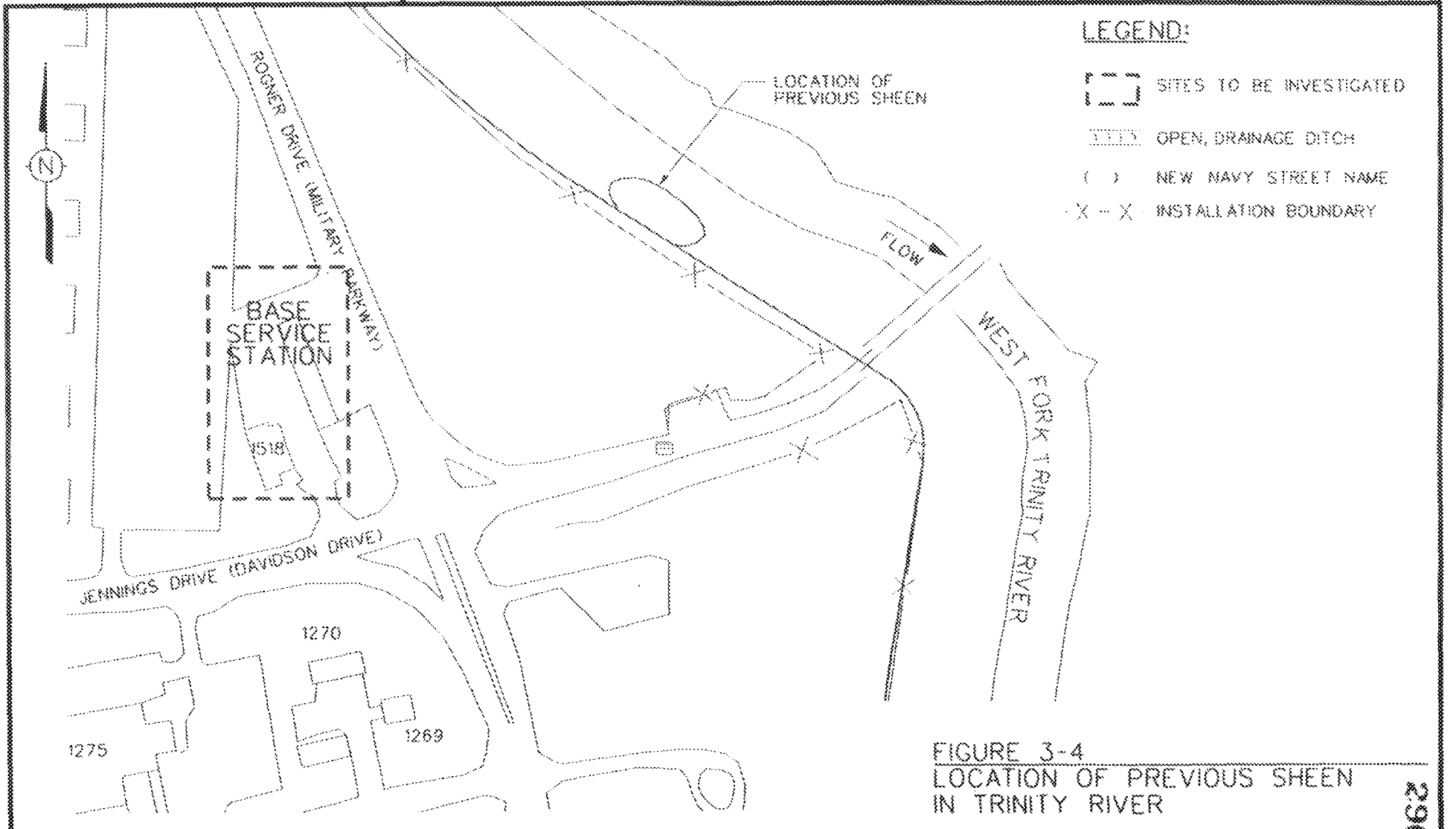


FIGURE 3-4
LOCATION OF PREVIOUS SHEEN IN TRINITY RIVER

NAVAL AIR STATION FORT WORTH
FORT WORTH, TEXAS

INTERNATIONAL TECHNOLOGY CORPORATION

950962

765725ES.006 09:18:45 Apr 15, 1996 KHB

STARTING DATE: 3/20/96	DATE LAST REV.:	DRAFT. CHCK BY: C.TOMLIN	INITIATOR: W.CARTER	DWG. NO. 765725ES.006
DRAWN BY: K.B.AR	DRAWN BY	ENGR. CHCK. BY: W.CARTER	PROJ. MGR. W.CARTER	PROJ. NO. 765725

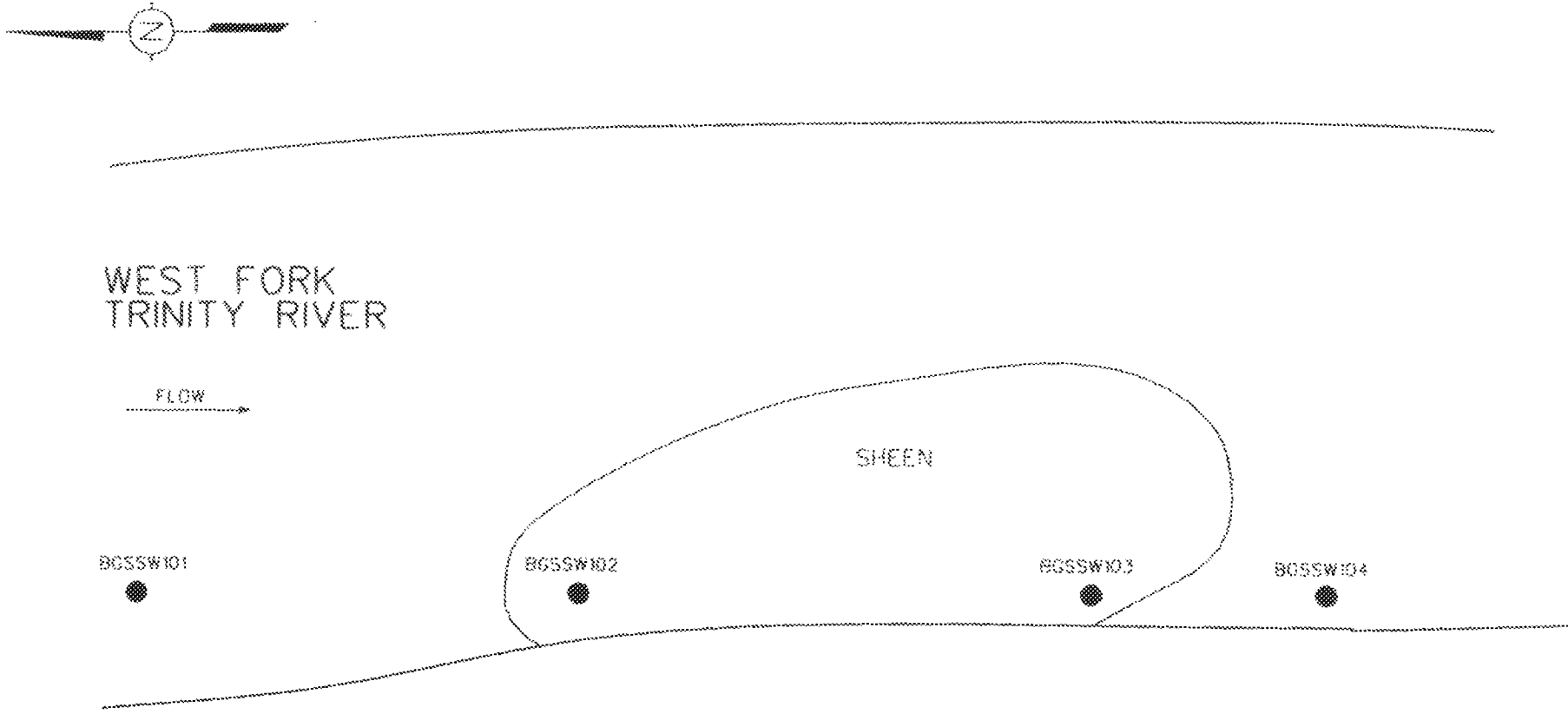


FIGURE 3-5
SURFACE WATER
SAMPLING LAYOUT
BASE GAS STATION

NAVAL AIR STATION FORT WORTH
FORT WORTH, TEXAS

INTERNATIONAL
TECHNOLOGY
CORPORATION

NOTES:

1. EXACT SAMPLE POINT TO BE FIELD DETERMINED.
2. SAMPLING WILL BE DONE WHEN AND WHERE SHEEN APPEARS.
3. REFERENCE FIG. 3-4 FOR RELATIVE LOCATION.

SCALE: NTS

296058

3.2.2.6 Waste Management

Wastes that may be generated during Base Gas Station characterization are: purged groundwater, drill cuttings, recovered product (fuel), decontamination water, expendable protective clothing (Tyvek), and general trash. Modifications to the planned waste management approach may be made if field observations or waste attributes change, but the planned approach is presented in general in this subsection and in detail in the FSP.

Purged water generated during well development and during well purging and decontamination water generated during decontamination of field drilling and sampling equipment will be contained onsite in a steel tank(s). The water will be passed through activated carbon for treatment and contained in a separate tank for testing prior to discharge to the sanitary sewer. The water will be tested for TPH, chlorinated hydrocarbons, and lead. The analytical results will be provided to Base personnel for review and approval before discharge to the sanitary sewer. A sample of the activated carbon will be submitted to the carbon vendor for analysis and acceptance after its use. If acceptable by the vendor, the activated carbon will be shipped to the vendor for regeneration/recycling.

Drill cuttings collected during drilling of borings will be contained in drums, labeled, and kept at the site in a designated location until analytical data are received. If the data indicate that some of the cuttings are uncontaminated, the uncontaminated cuttings will be spread or otherwise disposed onsite at a designated area. Contaminated cuttings will be disposed of at an appropriate licensed landfill, most likely as industrial, nonhazardous waste. Cores from utility line probes will be handled as drill cuttings. Disposal of clothing and trash will be disposed of as part of refuse service. This activity will be coordinated with Base authorities. All waste management practices will follow the guidelines established by the TNRCC.

296059

TAB

4.0

296060

4.0 Schedule

The project schedule is shown on Figure 4-1.

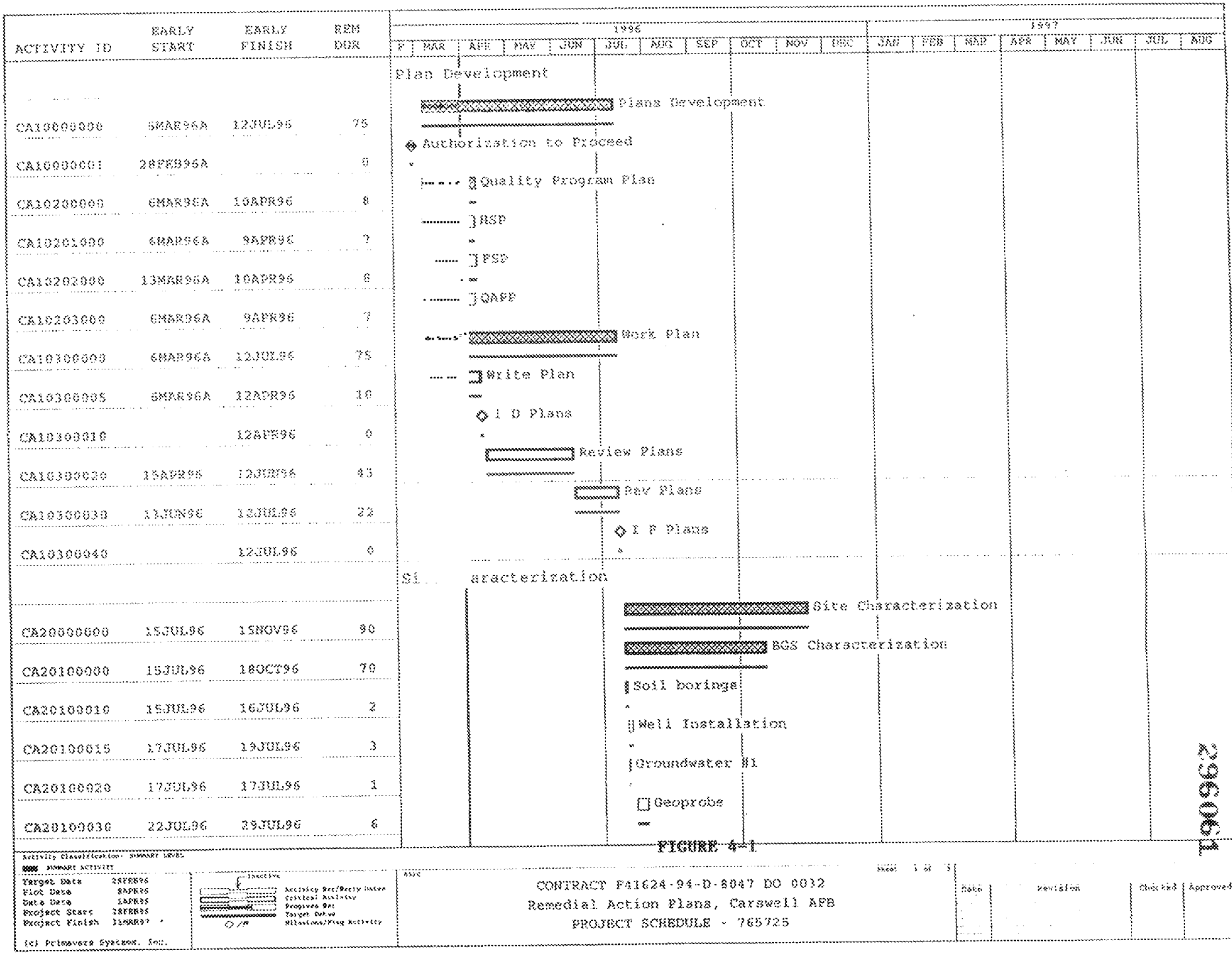


FIGURE 4-1

2960964

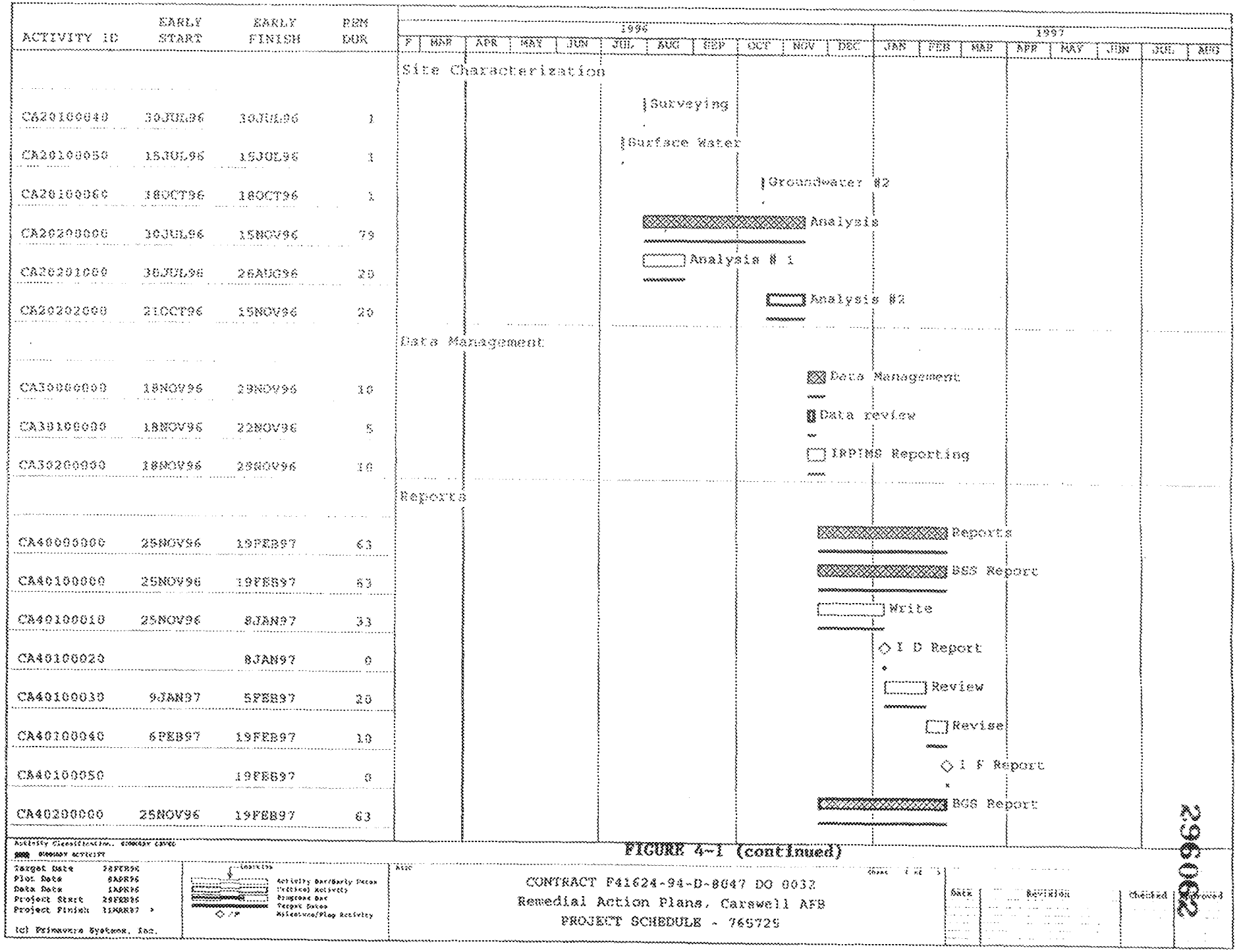


FIGURE 4-1 (continued)

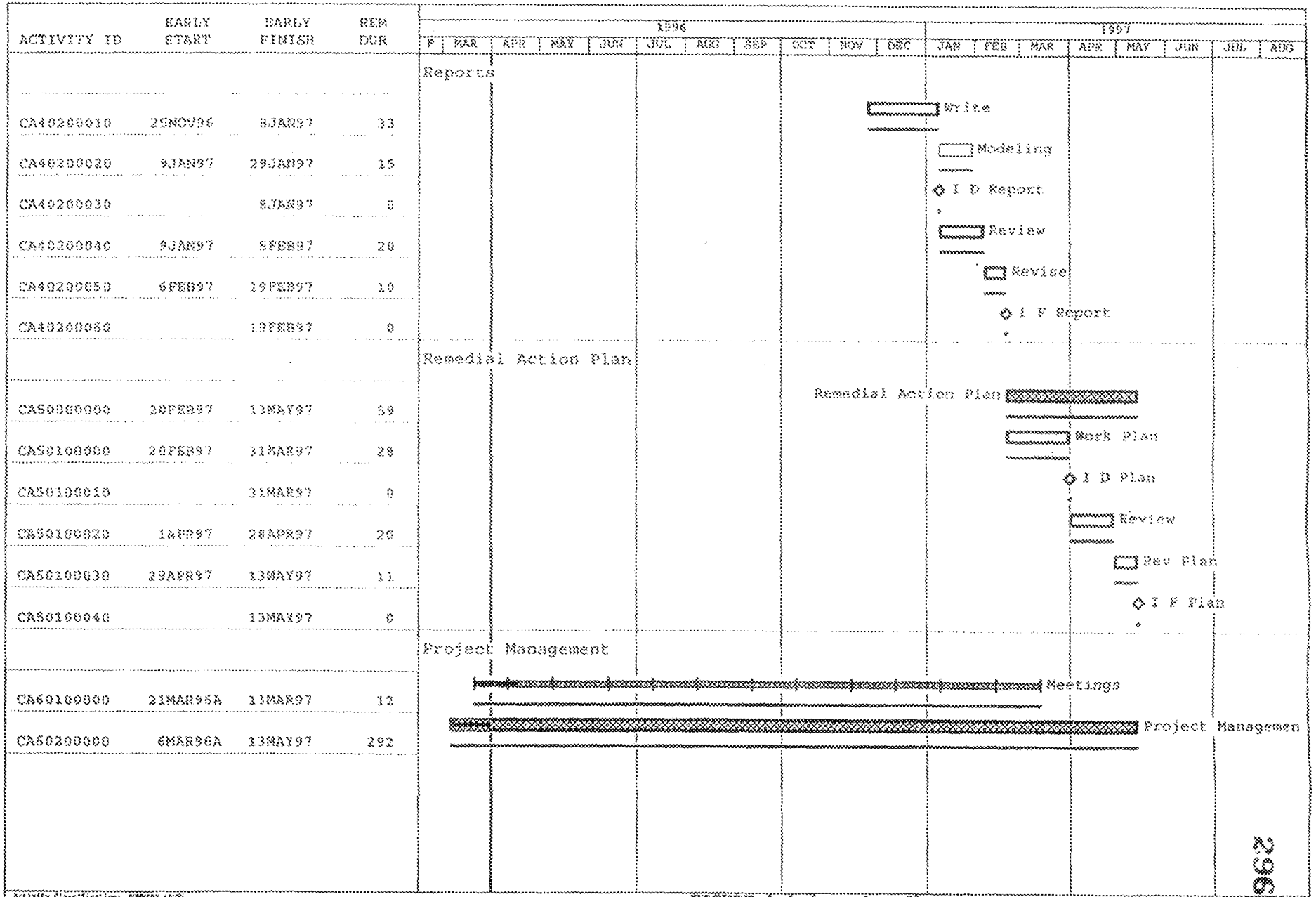


FIGURE 4-1 (continued)

TAB

5.0

5.0 Reporting

5.1 Assessment Report

Existing reports describing removal or investigation activities at the Base Service Station and the Base Gas Station will be reviewed for the objective of preparing a comprehensive report. Interviews of knowledgeable persons such as regulatory agency personnel and current and former Base personnel will also be conducted to supplement the reports. Existing aerial photographs, maps, and other sources of information will be reviewed if available and potentially beneficial.

After the available data have been evaluated, including field characterization data from the planned Base Gas Station investigation, a report will be prepared that compiles and evaluates the information. The primary objective of the report will be to compile all existing data, evaluate the data by current TNRCC regulations, and present conclusions as to the need for remedial or other actions. The report will be a "stand-alone" document; it will contain all pertinent data from previous investigations as well as this one.

The data will be compared to the TNRCC "Plan A" criteria. If, however, Plan A criteria are exceeded, a "Plan B" evaluation will be performed. The TNRCC Assessment Report Form will be prepared for each site and included in the report.

A preliminary outline of the report is shown in Figure 5-1. The report will include a risk assessment that will follow the outline specified by TNRCC (RG-36, 1994) for a comprehensive site assessment report and for a risk assessment. If contaminants are within "Plan A" criteria, the report will be reduced in scope. The groundwater data will be modeled in a "Plan B" evaluation, using Modflow and Bioplume II models, to:

- Develop and calibrate the Groundwater flow model
- Establish contaminant transport scenario
- Evaluate contaminant migration rates and direction
- Determine biodegradation rates based on site data.

5.2 Remedial Action Plan

A remedial action plan will be prepared if remediation is recommended in the assessment report. The plan will follow the TNRCC guidance for remedial action plans (PST 93-03) and will describe and evaluate at least two remedial alternatives that incorporate the technologies

most feasible for the site. The plan will be based upon the results of the site assessment including the contaminants of concern and the remedial action objectives resulting from a risk-based analysis of the analytical results.

Page(s) 5.0; 3-4 of 4

are Missing From the

Official Government

Document

Figure 5-1
Preliminary Assessment Report Outline
NAS Fort Worth, Texas

ASSESSMENT REPORT
BASE GAS STATION AND BASE SERVICE STATION
NAS FORT WORTH
CARSWELL FIELD, TEXAS

Executive Summary

1.0 Introduction
- 1.1 Project Objectives and Report Organization
- 1.2 Site Descriptions
- 1.3 Previous Site Investigations and Remedial Activities
- 1.4 Data Quality Objectives

2.0 Environmental and Cultural Setting
- 2.1 Demography and Land Use
- 2.2 Regional Geology
- 2.3 Regional Hydrogeology
- 2.4 Soils
- 2.5 Climatology
- 2.6 Local Ecological Setting
  - 2.6.1 Aquatic Ecosystems
  - 2.6.1 Terrestrial Ecosystems

3.0 Investigation Approach
- 3.1 Soil
  - 3.1.1 Field Procedures
    - 3.1.1.1 Base Service Station
    - 3.1.1.2 Base Gas Station
  - 3.1.2 Lab Methods
    - 3.1.2.1 Base Service Station
    - 3.1.2.1 Base Gas Station
- 3.2 Horizontal Conduits
  - 3.2.1 Field Procedures
  - 3.2.2 Lab Methods
- 3.3 Groundwater
  - 3.3.1 Field Procedures
    - 3.3.1.1 Base Service Station
    - 3.3.1.2 Base Gas Station
  - 3.3.2 Lab Methods
    - 3.3.2.1 Base Service Station
    - 3.3.2.2 Base Gas Station
- 3.4 Surface Water
  - 3.4.1 Field Procedures
  - 3.4.2 Lab Methods

Figure 5-1
Preliminary Assessment Report Outline
NAS Fort Worth, Texas

- 3.5 Soil Gas Survey
- 4.0 Soil Investigation Results
  - 4.1 Base Service Station
  - 4.2 Base Gas Station
- 5.0 Horizontal Conduit Investigation Results
- 6.0 Groundwater Investigation Results
  - 6.1 Base Service Station
    - 6.1.1 Analytical Data
    - 6.1.2 Modeling
  - 6.2 Base Gas Station
    - 6.2.1 Analytical Data
    - 6.2.2 Modeling
- 7.0 Surface Water Investigation Results
- 8.0 Risk Assessment
  - 8.1 Identification of Chemicals of Concern
  - 8.2 Exposure Assessment
    - 8.2.1 Exposure Setting Characterization
      - 8.2.1.1 Site Conditions
      - 8.2.1.2 Land Use
      - 8.2.1.3 Water Use
    - 8.2.2 Potentially Exposed Populations
    - 8.2.3 Exposure Pathway Analysis
  - 8.3 Exposure Point Concentration
  - 8.4 Estimation of Chemical Intake
  - 8.5 Toxicity Assessment
  - 8.6 Risk Characterization
  - 8.7 Uncertainty Analysis
  - 8.8 Special Considerations
  - 8.9 Proposed Cleanup Levels
  - 8.10 Compliance Point
- 9.0 Conclusions and Recommendations
- 10.0 References

Appendices

- A Boring/Probe Logs
- B Soil Analytical Data
- C Monitoring Well Diagrams
- D Groundwater Analytical Data
- E Surface Water Analytical Data
- F TNRCC Site Assessment Form for Base Service Station
- G TNRCC Site Assessment Form for Base Gas Station

TAB

6.0

296071

FINAL PAGE

ADMINISTRATIVE RECORD

FINAL PAGE

296072

FINAL PAGE

ADMINISTRATIVE RECORD

FINAL PAGE