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FINAL WORK PLAN FOR OIL WATER SEPARATORS NAS FORT WORTH TX
2/1/2000
INTERNATIONAL TECHNOLOGIES

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NAVAL AIR STATION
FORT WORTH JRB
CARSWELL FIELD
TEXAS

ADMINISTRATIVE RECORD
COVER SHEET

AR File Number 511

FINAL
WORK PLAN

NAVAL AIR STATION (NAS)
FORT WORTH JOINT RESERVE BASE,
TEXAS

Phase 2 RCRA FACILITY INVESTIGATION
WORK PLAN FOR
OIL/WATER SEPARATORS (OWS)

CONTRACT NO. F41624-94-D-8047, DELIVERY ORDER D0039

Project No. 768579

February 2000

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Final
Phase 2 RFI Work Plan for
Oil/Water Separators (OWS)
Naval Air Station (NAS)
Fort Worth Joint Reserve Base, Texas

Prepared for:

Air Force Center for Environmental Excellence
Brooks Air Force Base, Texas 78235-5353

February 2000

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List of Acronyms

AFB	Air Force Base
AFCEE	Air Force Center for Environmental Excellence
AOC	area(s) of concern
EPA	U.S. Environmental Protection Agency
FSP	field sampling plan
HGL	Hydrogeologic Inc.
IRP	Installation Restoration Program
IT	IT Corporation
Law	Law Environmental, Inc.
LNAPL	light nonaqueous-phase liquid
MSC	media-specific concentration
mg/kg	milligrams per kilogram
µg/kg	micrograms per kilogram
NAS	Naval Air Station Joint Reserve Base
OWS	oil/water separator
PID	photoionization detector
PQL	practical quantitation limit
QA/QC	quality assurance/quality control
QAPP	quality assurance project plan
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RRS	Risk Reduction Standard
SAP	sampling and analysis
SPLP	Synthetic Precipitation Leaching Procedure
SVOC	semivolatile organic compound
SW	solid waste
SWMU	Solid Waste Management Unit
TCA	trichloroethane
TCE	trichloroethene
TNRCC	Texas Natural Resource Conservation Commission
UTL	upper tolerance level
VOC	volatile organic compound

1.0 Introduction

IT Corporation (IT) has been contracted by the Air Force Center for Environmental Excellence (AFCEE) to conduct a Phase 2 Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) work plan to evaluate existing information, obtain additional data as needed, and prepare a Phase 2 RFI addendum report for 21 oil/water separator (OWS) locations at the Naval Air Station (NAS) Fort Worth Joint Reserve Base, Texas. The RFI addendum report will recommend site closure, additional sampling, or remediation, as needed. IT is performing this work under Contract F41624-94-D-8047, Delivery Order 39.

This Phase 2 RFI work plan is to provide: objectives for the additional investigation of the OWSs at NAS Fort Worth, the plan of investigation for additional field investigation of OWSs, the methods for reporting the regulatory status of each OWS in accordance with Texas Natural Resource and Conservation Commission (TNRCC) Risk Reduction Standards (RRS), and requests for no further action status and closure of selected OWSs connected to the Sanitary Sewer System (Solid Waste Management Unit [SWMU] 66). Results of work previously performed on the OWSs are provided in the draft OWS RFI addendum report (IT, 1998a). This OWS Phase 2 RFI work plan includes by reference the findings provided in the draft Sanitary Sewer System RFI report (IT, 1997a).

Additional investigation of the OWSs will comply with the requirements specified in the work plan and Quality Program Plan for the Sanitary Sewer System investigation (IT, 1997b,c,d). The Quality Program Plan includes a health and safety plan and a sampling and analysis plan (SAP). The health and safety plan 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 Sanitary Sewer RFI FSP describes the methods to be used in the collection and analysis of additional Phase 2 RFI site data samples (IT, 1999). The QAPP documents the data quality objectives and the quality assurance/quality control (QA/QC) procedures to be used in the performance of field and laboratory work.

This document appends the NAS Fort Worth Sanitary Sewer System RFI work plan (IT, 1997b) and FSP (IT, 1997c) and presents the proposed sampling locations and sampling rationale. This plan is to be used as a "stand alone" document, however. The TNRCC will be given the opportunity to comment on the sampling locations and analytical method before field work begins. This document will identify the OWS locations to be further investigated, identify the analytical samples to be collected, reference for sample collection methods, explain the rationale for the sample collection, and provide sufficient information to serve as the Phase 2 FSP. The work plan will be based on the modification of the existing NAS Fort Worth Sanitary Sewer System RFI work plan (IT, 1997b) and FSP (IT, 1997c) and will include:

- Locations for delineation and rationale for sampling
- Draft final OWS RFI report outline
- Conduct Synthetic Precipitation Leaching Procedure (SPLP) sample analysis to allow RRS 2 closure of locations where soils exceed TNRCC Risk Reduction Standard No. 2 (RRS 2) Media Specific Concentrations (MSCs)

1.1 Project Objectives

After completion of the Sanitary Sewer System RFI report, TNRCC comments indicated additional delineation of contaminants detected would be required for completion of the RFI. Compliance with TNRCC RRSs for completion of the OWS RFIs will require additional lateral delineation of contaminants exceeding background UTLs or analytical methods PQLs. The work plan does not include corrective measures, such as detailed contaminant delineation sampling or legal surveys of the contaminated Sanitary Sewer System areas site boundaries and deed restrictions, to provide closure of the site.

The objectives of this investigation are:

- Obtain additional data necessary to adequately assess the extent of OWS-related soil and groundwater contamination for constituents detected above TNRCC RRS 2.
- Consolidate additional OWS data in a Phase 2 RFI addendum report compliant with TNRCC regulations and procedures.
- Prepare an interim corrective measures work plan for the OWSs identified, evaluate candidate technologies, and recommend appropriate remediation, if warranted.
- Prepare reports to document "no further action" for the OWSs where contaminants did not exceed TNRCC RRS 1.

- Prepare reports to document closure in place where contaminants exceeded TNRCC RRS 1, but met closure criteria under RRS 2 standards.

- Allow for property transfer of parcels containing the OWSs.

1.2 Project Investigation Methods

Evaluation of the analytical data from the draft Sanitary Sewer System RFI report indicates sample locations can be categorized as:

- Locations with contaminant concentrations exceeding TNRCC RRS 1 criteria that require further delineation

- Locations requiring sample confirmation due to detections less than one order of magnitude above RRS 1

- Locations not requiring additional delineation due to influences from comingled plumes or proven anthropogenic contaminants

- Locations not requiring additional delineation due to organic analytes not exceeding analytical method PQL or inorganic analytes not exceeding site-wide background UTLs.

The estimated number of soil and groundwater samples is based on the locations that had constituents exceeding background UTLs or PQLs. These investigation locations are divided into confirmation and delineation. These will provide both confirmation of sampling results and additional delineation of the lateral extent of contamination. Samples collected in already delineated areas (SWMUs or previously documented known spill sites) were not used in selection determination.

The basis for selection for removal of the sample locations from the Sanitary Sewer System RFI data is as follows:

- Remove organic analytes not exceeding laboratory method PQLs.

- Remove inorganic analytes not exceeding background UTLs.

- Remove groundwater sample locations from known spill sites and the areas influenced by the Air Force Plant 4 trichloroethene (TCE) groundwater plume.

- Removal of sample locations that have contaminants suspected of anthropogenic source (polynuclear aromatic hydrocarbons from asphalt), removal of sample detections suspected to be caused by laboratory contamination, and removal of single detections of uncommon constituents that do not have an identified local industrial source.

Sample locations were selected for soil and groundwater analysis in order to complete the RFI in compliance with TNRCC RRSs. Completion of the RFI will require additional lateral delineation of contaminants exceeding background UTLs or analytical methods PQLs.

2.0 Background and Existing Site Information

2.1 Site Description

NAS Fort Worth JRB is located in Tarrant County, 8 miles west of downtown Fort Worth, Texas (see Figure 1). The Base is located at approximately 32 degrees north latitude and 97 degrees west longitude. The NAS Fort Worth JRB 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 Trinity River and Westworth Village to the east, Fort Worth to the northeast and southeast, White Settlement to the west and southwest, and AFP 4 to the west. The area surrounding NAS Fort Worth is mostly suburban, including the residential areas of the cities, with their respective populations from the 1990 census; Fort Worth (447,600), Westworth Village (2,350), Sansom Park Village (3,928), River Oaks (6,580), and White Settlement (15,472). The OWSs are located throughout the industrialized areas of NAS Fort Worth JRB (see Figure 2).

2.2 Environmental Setting

Description of the environmental setting at NAS Fort Worth JRB is fully described in the Sanitary Sewer System RFI work plan (IT, 1997b).

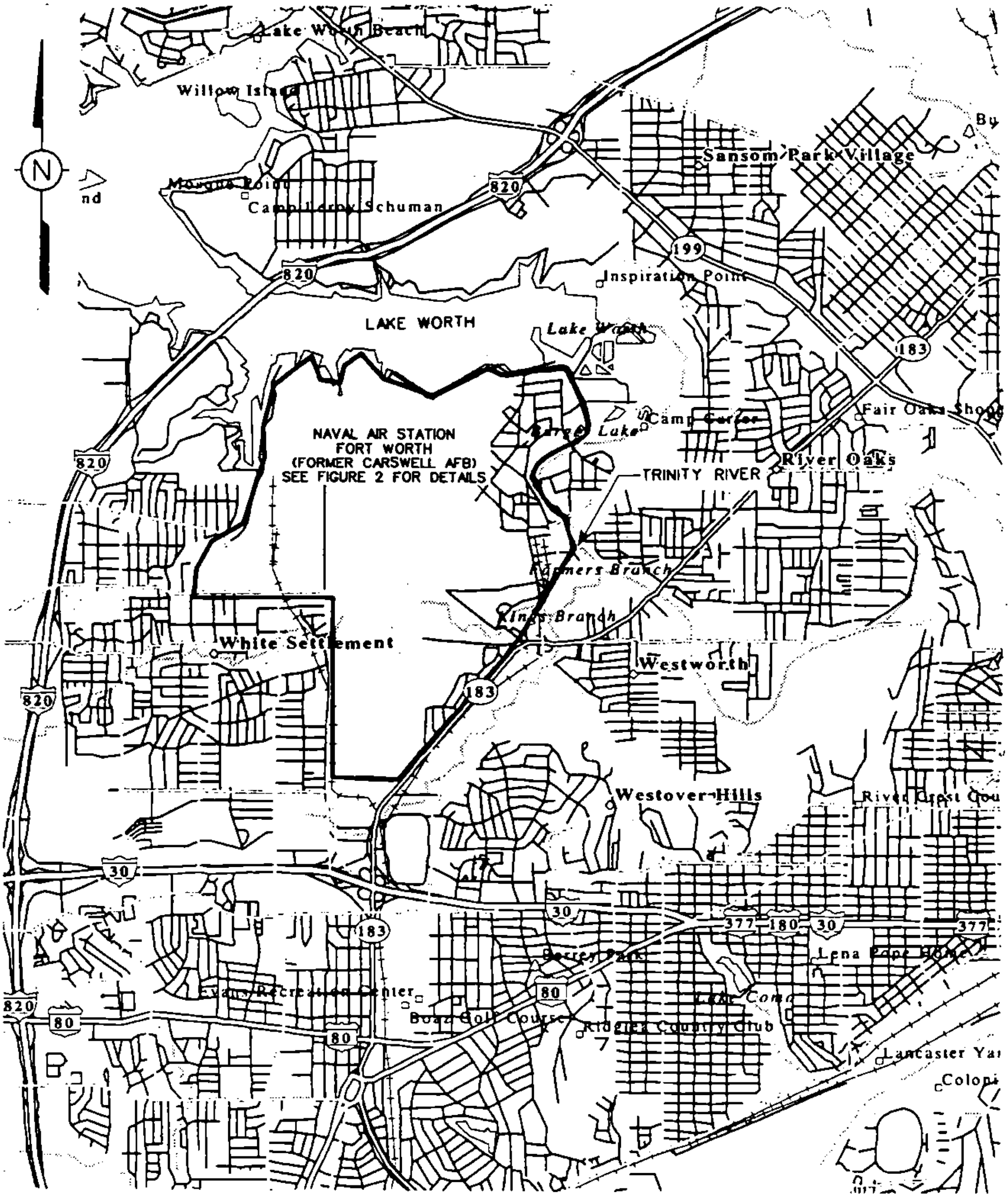
2.3 Site History and Operations

2.3.1 Ownership

Description of the site history and ownership at NAS Fort Worth JRB is fully described in the Sanitary Sewer System RFI work plan (IT, 1997b).

2.3.2 Operation

Before the construction of the initial airfield facilities in 1942, the area now occupied by NAS Fort Worth JRB consisted of pasture and woods. The majority of the NAS Fort Worth JRB property was acquired in the 1940s, with most of the property acquired from the City of Fort Worth in 1941. Additional property, including most of the South Base, the Hospital Area, and the Off-Site Weapons Storage Area, was acquired during the 1950s. Kings Branch and the South Base Residential Areas were acquired in 1960. Several miscellaneous additional properties totaling less than 10 acres have been acquired since 1970 (Jacobs Engineering, 1995a,b).



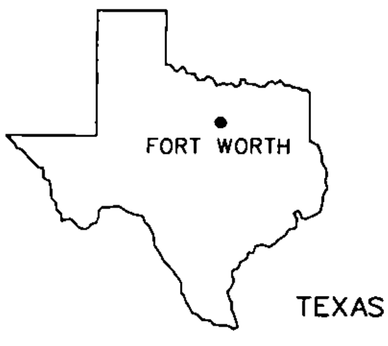
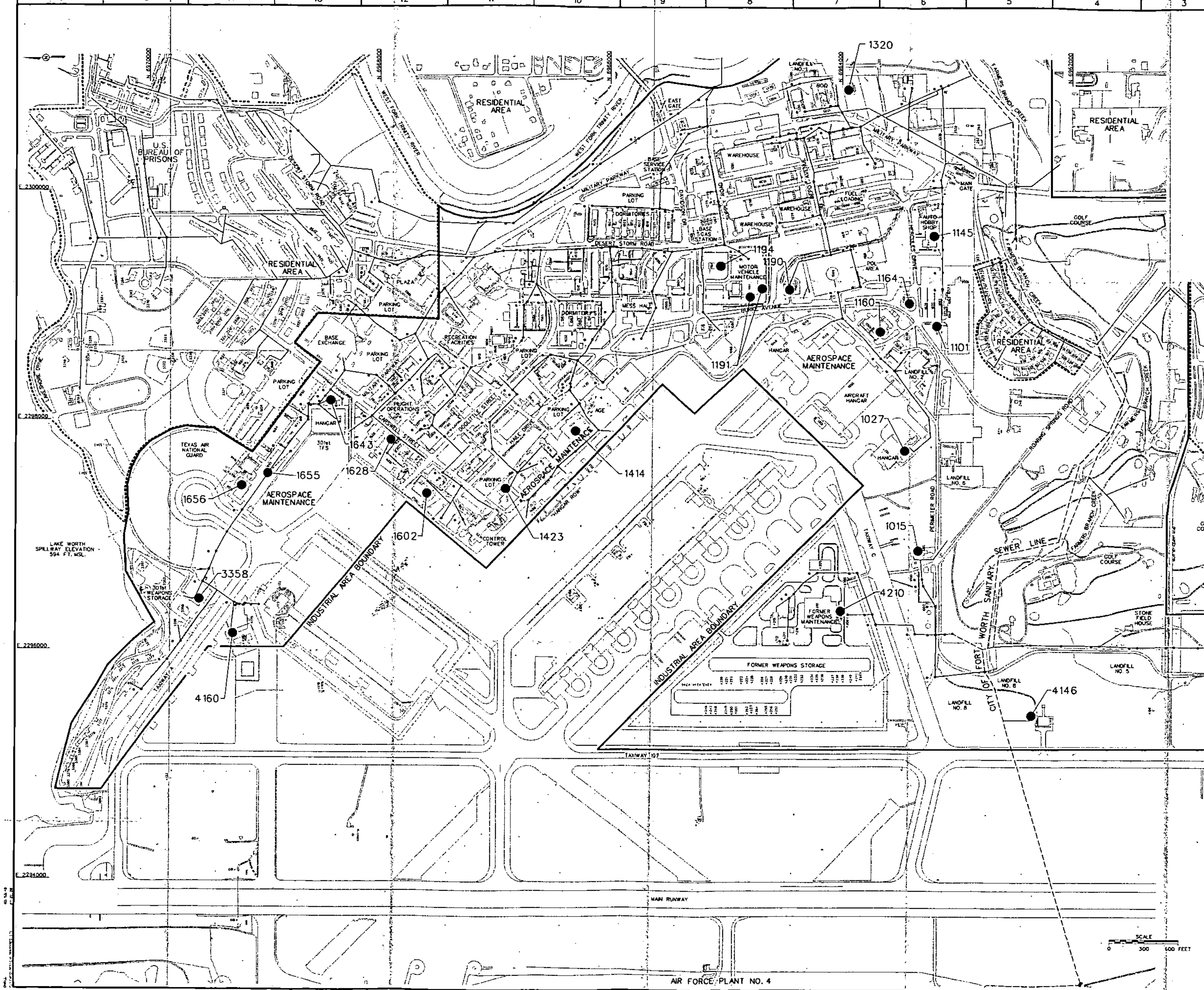


FIGURE 1
SITE LOCATION MAP

PHASE II SANITARY SEWER RFI
NAVAL AIR STATION FORT WORTH
FORT WORTH, TEXAS

INTERNATIONAL TECHNOLOGY CORPORATION

DWG. NO.:...\768579es.146 | PROJ. NO.:765725
INITIATOR: W.CARTER | PROJ. MGR.:W.CARTER
DRAFT. CHCK. BY: C.TUMLIN | ENGR. CHCK. BY: W.CARTER
DATE LAST REV.: | DRAWN BY:
STARTING DATE: 3/20/96 | DRAWN BY: K.BLAIR
09:48:52 02/28/00
mcraft c:\cadd\design\768579es.146



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NOTES:

1. SURVEY CONDUCTED JUNE, 1997 BY SURVEY RESOURCES, INC., 13600 MONTFORT DRIVE, SUITE 230, DALLAS, TEXAS 75240-4347

LEGEND

- SEWER LINE AND MANHOLE
- ● OWS SITE LOCATION

IT INTERNATIONAL TECHNOLOGY CORPORATION

CONFIDENTIAL PROPERTY OF IT CORPORATION

FIGURE 2
NAS FORT WORTH SANITARY
OWS LOCATION MAP

OWS RCRA FACILITY INVESTIGATION
PHASE 2 WORK PLAN
NAVAL AIR STATION FORT WORTH
FORT WORTH, TEXAS

AREA	JOB NO.	DRAWING NO.	REV
SITEWIDE	768579	768579ES.171	

From 1942 until 1994, the former Carswell Air Force Base (AFB) was used as a bomber and bomber training base. Carswell AFB was realigned as NAS Fort Worth JRB in 1994. Wastes have been generated and disposed of at the facility since the beginning of industrial operations in 1942. The major industrial operations at NAS Fort Worth JRB included: maintenance of jet aircraft engines and aerospace ground equipment, aircraft fuel, weapons, and hydraulic operations; maintenance of general and special purpose vehicles; aircraft corrosion control; and nondestructive inspection activities (Jacobs Engineering, 1995a,b).

"Waste oils" generally refers to lubricating fluids, such as crankcase oils and synthetic turbine oils. Hydraulic fluids have also been included in this category. "Recoverable fuels" refers to fuel drained from aircraft tanks and vehicles, such as jet propulsion fuel grade 4 and motor gasoline. "Spent solvents and cleaners" refers to liquid used for degreasing and general cleaning of aircraft, aircraft systems, electronic components, and vehicles. This category includes PD-680 and various chlorinated organic compounds, such as trichloroethylene (TCE) and 1,1,1-trichloroethane (TCA).

Specific types of solvents used by the Air Force have changed over the years. In the 1950s, carbon tetrachloride was in common use. Its use was replaced by TCE about 1960. Since then, TCE and 1,1,1-TCA have been commonly used; however, TCE usage has decreased in favor of 1,1,1-TCA. Today, PD-680 Type II, 1,1,1-TCA, and TCE are used.

Waste paint solvents or thinners and strippers are generated by corrosion control activities. Typical thinners include isobutyl acetate, toluene, methyl ethyl ketone, isopropanol, naphtha, and xylene. Paint strippers generally contain such compounds as methylene chloride, toluene, ammonium hydroxide, and phenolics (CH2M Hill, 1996).

All of these operations generated waste materials, primarily oils, recoverable fuels, spent solvents, and cleaners. Most waste oils, recovered fuels, spent solvents and cleaners were either burned at fire training areas on the NAS Fort Worth JRB, reused on NAS Fort Worth JRB, or processed through the Defense Property Disposal Office. An undetermined amount of these materials were discharged through the OWSs to the Sanitary Sewer System at the NAS Fort Worth JRB (Jacobs Engineering, 1995a,b).

2.3.3 Results of Previous Site Investigations

Since 1984, Air Force IRP studies have been conducted by several contractors, and have focused on the identification and characterization of Solid Waste Management Units (SWMU) and Areas of Concern (AOC) identified in the installation's TNRCC Hazardous Waste Permit (HU-50289). In an RFI report (PR/VSI) (A.T. Kearney, 1989), eight OWSs were designated as SWMUs and four were designated as AOCs.

In 1995, an investigation of 11 OWSs was performed (Law Environmental, 1995[Law]) to assess contamination associated with the OWSs and to evaluate the condition and future use of the OWSs. This report indicated that two of the OWSs, located at Building 1015 (SWMU No. 47) and Building 1194 (SWMU No. 35), were connected to the sanitary sewer system. The discharge connections of the remaining OWSs investigated were also assumed to be connected to the sanitary sewer system (Law, 1995).

During this investigation, surface and subsurface soil samples were collected at the 11 OWSs and analyzed for VOCs and RCRA metals (except mercury). No groundwater samples were analyzed. No samples were above TNRCC RRSs for VOCs, however, soils in the immediate area of each of the 11 OWSs were contaminated with metals concentrations exceeding TNRCC RRSs (Law, 1995).

IT conducted an RFI on the Sanitary Sewer System (SWMU No. 66) in 1997. Results of this August 1997 investigation (IT, 1997a) indicated that no unacceptable risk to human health or the environment occurred from past management practices of the Sanitary Sewer System. However, the extent of some releases at the OWSs were not delineated. The Sanitary Sewer System RFI report indicated no unacceptable risk to human health or the environment from past management practices of the Sanitary Sewer System. The draft RFI reported the extent of some releases was not known.

During a subsequent sanitary sewer system RFI, additional soil, groundwater, and geotechnical data were collected where OWS data gaps had been identified.

At the eight OWSs investigated previously by Law, IT collected soil samples and performed supplemental SVOCs and pesticides/ polychlorinated biphenyls analysis. Monitoring wells were installed and groundwater sampled and analyzed for VOCs, SVOCs, and metals. At OWSs that were not previously investigated by Law, IT collected near surface and subsurface soils that were analyzed for VOCs, SVOCs, pesticides/polychlorinated biphenyls, and metals, and monitoring wells were installed for sampling groundwater for VOCs, SVOCs, and metals. Results of this investigation were published by IT in the draft Sanitary Sewer System RFI report in August 1997. The draft Sanitary Sewer System RFI report identified the Building 1145 and Building 3358 OWSs for additional investigation to determine the vertical and horizontal extent of contaminants in soil and groundwater at the two OWSs (IT, 1998b).

The draft OWS RFI addendum report (IT, 1998a) presented the combined investigation findings from the draft Sanitary Sewer System RFI report and additional investigation of 21 OWSs. As shown by Table 1 of that addendum report, eight OWSs have been identified as SWMUs and four have been identified as AOC. Nine of the OWSs have not been designated as either a SWMU or AOC. These nondesignated OWSs are being investigated to establish a baseline of any contamination to document the condition at the time they were transferred for U.S. Navy use.

Additional investigation was conducted at the Building 1145 OWS (AOC No. 13), where light nonaqueous-phase liquid (LNAPL) was discovered on the groundwater during the 1997 RFI, and at Building 3358. Additional investigation was performed at the Building 3358 OWS to determine the horizontal extent of near-surface soil contamination, and the findings show the metals and organic contamination in surface soils is limited to one sample location. Investigation findings from the Building 1145 OWS show the LNAPL found on the water table in monitoring well WITCTA036 is limited in lateral extent to the vicinity of this location. Dissolved-phase groundwater contamination associated with the monitoring well WITCTA036 LNAPL is also restricted to a limited area surrounding this location. Surface and subsurface soil contamination is also limited in extent due to the removal of the leaking OWS in 1995. Further investigation at Building 1145 will be completed under another contract.

In the draft OWS RFI addendum report (IT, 1998a), evaluation of the closure status of each of the 21 OWS units was made to TNRCC RRSs. All OWSs were recommended for either TNRCC RRS 1/2 closure. The RRSs define the following three tiers of cleanup standards:

- RRS 1 requires a cleanup to nondetectable levels or background levels unaffected by waste management activities for all contaminants. This level of a cleanup is commonly referred to as "clean closure." Deed certification on the property and post-closure care is not required under this standard.

- RRS 2 requires a cleanup to health-based levels such that any substantial threat to human health or the environment is reduced to acceptable levels. Deed certification on the property is required.

- RRS 3 requires a site-specific baseline risk assessment to define alternative cleanup levels based on health effects. Deed certification and post-closure care are required under this standard.

The draft OWS RFI addendum report (IT, 1998a) presented the TNRCC RRSs status of each OWS at NAS Fort Worth JRB. Where the contaminant concentrations did not exceed background UTL, the OWS was recommended for TNRCC RRS 1/2 closure. One OWS of the 21 investigated, the Building 1628 OWS, met this requirement. Where contaminant concentrations exceeded background UTLs only and not media-specific concentrations (MSC), the OWS was recommended for RRS 2 closure, which requires deed certification. Seven of the OWSs met these RRS 2 closure requirements. For an OWS that has contaminants exceeding both UTLs and MSCs in soil and/or groundwater, the OWS was recommended for RRS 2 closure. The report indicated that for most of the OWSs, one or more of the soil sample locations had metals, specifically arsenic and cadmium, that were approximately twice the concentration of the MSCs. It was recommended that additional sampling be performed at these locations to determine if the detections of metals are statistically significant.

Based on TNRCC review of the draft OWS RFI addendum report, discussions were held between the Air Force and TNRCC to define the process for evaluating the existing data and selecting sites requiring additional investigation. Additional investigation is required for the OWSs exceeding RRS 2 levels. Criteria developed for determining the selection of locations requiring additional assessment of selected environmental media are as follows:

- Locations requiring resampling to confirm constituent detections less than one order of magnitude above RRS 1 background concentration UTL criteria (Table 2-1)

- Locations requiring contaminant lateral delineation due to detections exceeding an order of magnitude above the background concentration UTL and the occurrence of the contaminant is consistent with past waste operations at the site

- Locations requiring analysis by the SPLP (EPA SW846 Method 1312) to determine if contaminants exceeding the RRS 2 criteria may leach from soil to groundwater.

Table 2-1

Oil/Water Separator RFI
Metals Concentrations
Soil and Groundwater Background Upper Tolerance Limits
NAS Fort Worth, Texas

Analyte	Surface Soils UTL (mg/kg)	Subsurface Soils UTL (mg/kg)	Groundwater UTL (mg/L)
ALUMINUM	22035	17180	1.332
ANTIMONY	0.56	0.712	ND at 0.002
ARSENIC	5.855	5.533	ND at 0.0049
BARIUM	233	128.1	0.587
BERYLLIUM	1.02	0.957	0.0003
CALCIUM	167788	272000	266.3
CADMIUM	0.5562	0.5891	ND at 0.0005
CHROMIUM	21.056	16.31	0.006
COBALT	11.05	6.191	ND at 0.0089
COPPER	17.373	13.72	0.0028
IRON	17717	15224	0.2239
LEAD	30.97	12.66	ND at 0.0016
MAGNESIUM	3003	2420	37.8
MANGANESE	849.1	351.7	0.175
MERCURY	0.14	ND at 0.035	ND at 0.0001
MOLYBDENUM	1.46	1.93	ND at 0.0144
NICKEL	14.6	19.76	0.0204
POTASSIUM	2895	1717	15.03
SELENIUM	0.9072	0.3130	0.0077
SILVER	0.213	0.1277	0.0002
SODIUM	25800	53200	167.2
THALLIUM	63.9	65.4	ND at 0.0632
VANADIUM	46.26	37.39	0.0123
ZINC	38.8	31.27	0.118

Source:
Surface soil upper tolerance limit (statistical value determined from background levels) Jacobs Engineering Group, Inc., 1997. *NAS Fort Worth JRB, Texas (Formerly Carswell AFB, Texas), Basewide Background Study, Volume I*, January.

3.0 Plan of Investigation

This chapter of the work plan defines the scope of work to be performed during the additional investigation at the OWSs listed in Table 3-1. Activities associated with the collection of analytical data for site characterization at each site are addressed in this chapter. These investigation activities include collection of soil samples (surface/near-surface and subsurface), groundwater, and surface water.

The location of NAS Fort Worth JRB is shown in Figure 1. The locations of the OWSs throughout the industrialized areas of the facility are shown in Figure 2.

3.1 OWS Investigation Locations

Varying methods will be used for collection at different media and allow contaminant delineation in the near-surface soil, subsurface soil, and groundwater. The data presented in Table 3-2 summarizes the contaminants at specific locations that exceeded TNRCC RRSs. Data presented in Table 3-2 show OWS sample locations where contaminants exceeded either the background concentration, the TNRCC RRSs, or the human health protective limits developed in the Sanitary Sewer System RFI risk assessment. Information presented in Table 3-2 was used to identify the data gaps that need to be closed to allow completion of the OWS RFI assessment under the TNRCC RRSs.

Table 3-3 shows soil sample locations and Table 3-4 shows groundwater sample locations requiring additional OWS contaminant delineation, which include:

- Eleven surface soil sample locations
- Fifteen subsurface soil sample locations
- Four installed monitoring wells and delineation groundwater samples
- Nine monitoring well groundwater confirmation samples.

Table 3-5 shows the number of analyses required to delineate lateral contamination including:

- Soils (45 specific metals, 17 SPLP for specific metals)
- Groundwater samples (4 VOCs, 21 metals)

Table 3-1

Oil/Water Separator RFI Locations
OWS Phase 2 RFI Work Plan
NAS Fort Worth, Texas

Building Number	AOC/ SWMU No.	Previous Soil Investigation	Type	Capacity (gallons)	Year of Installation	Outlet
1015	SWMU 47	LAW and IT	A	N/D	1967	Sanitary Sewer
1027	SWMU 44	LAW and IT	A	N/D	N/D	Sanitary Sewer
1060	AOC 11	LAW and IT	A	750	1985	Sanitary Sewer
1064	AOC 10	LAW and IT	A	18,000	1988	Sanitary Sewer
1101	N/D	IT	B	4,000	N/D	Sanitary Sewer
1190	SWMU 52	LAW and IT	A	2,000	NA	Sanitary Sewer
1191	SWMU 37	LAW and IT	A	N/D	1982	Sanitary Sewer
1194	SWMU 35	LAW and IT	A	N/D	N/D	Sanitary Sewer
1194	N/D	IT	B	N/D	N/D	Sanitary Sewer
1320	N/D	IT	B	400	N/D	Sanitary Sewer
1414	SWMU 41	LAW and IT	A	1,000	N/D	Sanitary Sewer
1423	N/D	IT	A	2,700	N/D	Sanitary Sewer
1602	N/D	IT	B	18,524	N/D	Sanitary Sewer
1628	SWMU 7	IT	A	5,113	1980	Sanitary Sewer
1643	SWMU 40	IT	A	20,000	1982	Sanitary Sewer
1655	N/D	IT	A	N/D	N/D	Sanitary Sewer
1656	N/D	IT	A	18,524	1989	Sanitary Sewer
3358	N/D	IT	B	N/D	N/D	Sanitary Sewer
4146	N/D	IT	A	N/D	1983	Sanitary Sewer
4160	N/D	IT	B	N/D	1984	Sanitary Sewer
4210	AOC 12	IT	A	N/D	N/D	Sanitary Sewer

Notes:

A - Oil/water separator.
B - Grit/oil interceptor.
N/D - Not determined.

Table 3-2

Oil/Water Separator Phase 2 RFI Status Table With Recommended TNRCC Risk Reduction Program Action OWS Phase 2 RFI Work Plan NAS Fort Worth, Texas

(Page 1 of 7)

OWS Bldg.	SWMU/ AOC	Sample Locations	Media Affected	Constituent	Depth	Max Result	Units	Proposed TNRCC RRS[4]	Recommendations
1015	SWMU 47	101501 SBA	SS	ARSENIC	0-2'	10	mg/kg	RRS2 pass SPLP	Run SPLP 1312 for surface and subsurface soils
		101502 SBA	SS	CADMIUM	0-2'	2.3	mg/kg		
				CALCIUM	0-2'	280000	mg/kg		
		101501 SBC	SSS	ARSENIC	4-6'	11	mg/kg	RRS2 pass SPLP	
		101502 SBC	SSS	CADMIUM	4-6'	1.2	mg/kg		
		101503 SBC	SSS	COPPER	4-6;	25	mg/kg		
1027	SWMU 44	102701 SBA	SS	ARSENIC	0-2'	10	mg/kg	RRS2 pass SPLP	Run SPLP 1312 for surface and subsurface soils
			SS	CADMIUM	0-2'	6.1	mg/kg		
			SS	COPPER	0-2'	26	mg/kg		
			SS	LEAD	0-2'	58	mg/kg		
			SS	ZINC	0-2'	690	mg/kg		
		102704 SBD	SSS	MAGNESIUM	6-8'	2900	mg/kg		
		102704 SBF	SSS	ARSENIC	10-12'	14	mg/kg	RRS2 pass SPLP	
		102704 SBF	SSS	CADMIUM	10-12'	1.5	mg/kg		
		102704 SBF	SSS	COPPER	10-12'	30	mg/kg		
		102702 SBG	SSS	MANGANESE	12-14'	600	mg/kg		
		WITCTA037	GW	BERYLLIUM	N/A	0.36	µg/L		
1060	AOC 11	WITCTA022	GW	BERYLLIUM	N/A	0.37	µg/L		Run SPLP 1312 for surface and subsurface soils
				IRON	N/A	444	µg/L		
		106003 SBA	SS	ARSENIC	0-2'	9.6	mg/kg	RRS2 pass SPLP	
			SS	CADMIUM	0-2'	0.74	mg/kg		
			SS	CALCIUM	0-2'	290000	mg/kg		
			SS	COPPER	0-2'	30	mg/kg		
			SS	MAGNESIUM	0-2'	6400	mg/kg		

Table 3-2

Oil/Water Separator Phase 2 RFI Status Table
With Recommended TNRCC Risk Reduction Program Action
OWS Phase 2 RFI Work Plan
NAS Fort Worth, Texas

OWS Bldg.	SWMU/ AOC	Sample Locations	Media Affected	Constituent	Depth	Max Result	Units	Proposed TNRCC RRS[4]	Recommendations
1060	AOC	106003 SBA	SS	COPPER	0-2'	30	mg/kg		
(Continued)	11	106001 SBF	SSS	CADMIUM	2-4'	2.2	mg/kg		
		106001 SBB	SSS	IRON	2-4'	16000	mg/kg		
		106001 SBF	SSS	ARSENIC	10-12'	12	mg/kg	RRS2 pass SPLP	
		106001 SBF	SSS	MAGNESIUM	10-12'	3400	mg/kg		
		106003 SBF	SSS	MANGANESE	11-13'	1100	mg/kg		
1064	AOC	WITCTA035	GW	IRON	N/A	1070	μg/L		Run SPLP 1312
	10		GW	MANGANESE	N/A	965	μg/L		for surface and subsurface soils
		106402SBA	SS	CADMIUM	0-2'	1.6	mg/kg	RRS2 pass SPLP	
		106402 SBB	SSS	ARSENIC	2-4'	16	mg/kg	RRS2 pass SPLP	
		106402 SBB	SSS	CADMIUM	2-4'	4.0	mg/kg		
		106402 SBB	SSS	COPPER	2-4'	87	mg/kg		
		106402 SBB	SSS	MANGANESE	2-4'	470	mg/kg		
		106402 SBB	SSS	ZINC	2-4'	44	mg/kg		
		106401 SBB	SSS	MAGNESIUM	8-10'	5600	mg/kg		
1101	ND	SB110101	SSS	BERYLLIUM	0-2'	1.1	mg/kg	RRS2 pass SPLP	Run SPLP 1312
		SB110101	SSS	IRON	0-2'	18400	mg/kg		for surface and subsurface soils
		SB110102	SSS	CADMIUM	0-2'	0.69	mg/kg		
		SB110101	SSS	ARSENIC	14-16'	11.3	mg/kg	RRS2 pass SPLP	
		SB110101	SSS	CADMIUM	14-16'	0.7	mg/kg		
		SB110101	SSS	IRON	14-16'	15600	mg/kg		
		SB110101	SSS	VANADIUM	14-16'	49.5	mg/kg		
		WITCTA019	GW	BERYLLIUM	N/A	0.51	μg/L		
			GW	MANGANESE	N/A	315	μg/L		

Table 3-2

Oil/Water Separator Phase 2 RFI Status Table
With Recommended TNRCC Risk Reduction Program Action
OWS Phase 2 RFI Work Plan
NAS Fort Worth, Texas

(Page 3 of 7)

OWS Bldg.	SWMU/ AOC	Sample Locations	Media Affected	Constituent	Depth	Max Result	Units	Proposed TNRCC RRS[4]	Recommendations
1190	SWMU 52	WITCTA032	GW	ARSENIC	N/A	35.8	μg/L		Run SPLP 1312 for surface soils
				IRON	N/A	4880	μg/L		
				MANGANESE	N/A	663	μg/L		
		11903 SBA	SS	ARSENIC	0-2'	7.6	mg/kg	RRS2 pass SPLP	
		11903 SBA	SS	CADMIUM	0-2'	3.6	mg/kg		
1191	SWMU 35	WITCTA031	GW	ARSENIC	N/A	51.7	μg/L		Additional Contaminant Delineation Sample west wall OWS surface soils for VOCs & metals SPLP 1312 for surface and subsurface soils Resample WITCTA031
				BARIUM	N/A	1490	μg/L		
				IRON	N/A	5350	μg/L		
				MANGANESE	N/A	1720	μg/L		
		119104 SB	SS	SILVER	0-2'	2	mg/kg	RRS2 pass SPLP	
		119104 SB	SS	CALCIUM	0-2'	404000	mg/kg		
		119103 SBB	SSS	ARSENIC	2-4'	14	mg/kg	RRS2 pass SPLP	
		119103 SBB	SSS	CALCIUM	2-4'	370000	mg/kg		
		119103 SBB	SSS	COPPER	2-4'	16	mg/kg		
		119101 SBC	SSS	CADMIUM	3-5'	2.7	mg/kg		

Table 3-2

Oil/Water Separator Phase 2 RFI Status Table
With Recommended TNRCC Risk Reduction Program Action
OWS Phase 2 RFI Work Plan
NAS Fort Worth, Texas

(Page 4 of 7)

OWS Bldg.	SWMU/ AOC	Sample Locations	Media Affected	Constituent	Depth	Max Result	Units	Proposed TNRCC RRS[4]	Recommendations
1194	SWMU 35	BGSMW01	GW	IRON	N/A	2310	µg/L		Additional Contaminant Delineation
				MANGANESE	N/A	528	µg/L		SPLP 1312
				MERCURY	N/A	0.11	µg/L		for surface and subsurface soils
Investigated by HGL		WITCTA027	GW	IRON	N/A	2870	µg/L		
			GW	SILVER	N/A	4.6	µg/L		
		119402 SBA	SS	COBALT	1-3'	11	mg/kg	RRS2 pass SPLP	
		119402 SBA	SS	COPPER	1-3'	24	mg/kg		
		119402 SBB	SSS	ARSENIC	3-5'	5.7	mg/kg	RRS2 pass SPLP	
		119402 SBB	SSS	CADMIUM	3-5'	3 +	mg/kg		
		119401 SBB	SSS	MANGANESE	3-5'	370	mg/kg		
1320	ND	SB132002	SSS	SILVER	5-7'	3.8	mg/kg	RRS2 pass SPLP	**No Further Action**
1414	SWMU 41	WITCTA016	GW	IRON	N/A	249	µg/L		Run SPLP 1312 for surface and subsurface soils
		DP1703 SBA	SS	ARSENIC	1-3'	8.7	mg/kg	RRS2 pass SPLP	
			SS	CADMIUM	1-3'	2.2	mg/kg		
			SS	COBALT	1-3'	16	mg/kg		
			SS	IRON	1-3'	16000	mg/kg		
			SS	LEAD	1-3'	51	mg/kg		
			SS	MANGANESE	1-3'	430	mg/kg		
		DP1702 SBD	SSS	ARSENIC	7-9'	11	mg/kg	RRS2 pass SPLP	
		DP1702 SBD	SSS	BARIUM	7-9'	150	mg/kg		
		DP1703 SBD	SSS	CADMIUM	7-9'	1.6	mg/kg		
		DP1703 SBD	SSS	COPPER	7-9'	18	mg/kg		
		DP1703 SBD	SSS	MAGNESIUM	7-9'	3100	mg/kg		
		DP1703 SBD	SSS	MANGANESE	7-9'	500	mg/kg		

Table 3-2

Oil/Water Separator Phase 2 RFI Status Table
With Recommended TNRCC Risk Reduction Program Action
OWS Phase 2 RFI Work Plan
NAS Fort Worth, Texas

OWS Bldg.	SWMU/ AOC	Sample Locations	Media Affected	Constituent	Depth	Max Result	Units	Proposed TNRCC RRS[4]	Recommendations
1423	ND	WITCTA014	GW	IRON	N/A	2720	µg/L		**No Further Action**
		SB142301	SS	SILVER	0-2'	0.53	mg/kg	RRS2 pass SPLP	
		SB142302	SSS	SILVER	16-18'	0.39	mg/kg	RRS2 pass SPLP	
1602	ND	WITCTA011	GW	ARSENIC	N/A	24.4	µg/L	RRS2 pass SPLP	Run SPLP 1312 for surface and subsurface soils
			GW	IRON	N/A	799	µg/L		
			GW	MANGANESE	N/A	630	µg/L		
		SB160202	SS	CHROMIUM	0-2'	46.5	mg/kg	RRS2 pass SPLP	
		SB160201	SS	LEAD	0-2'	10	mg/kg		
		SB160202	SS	MOLYBDENUM	0-2'	1.6	mg/kg		
		SB160202	SS	SILVER	0-2'	0.42	mg/kg		
		SB160201	SSS	ARSENIC	14-16'	9.1	mg/kg	RRS2 pass SPLP	
		SB160201	SSS	BERYLLIUM	14-16'	0.67	mg/kg		
		SB160201	SSS	COBALT	14-16'	8.5	mg/kg		
		SB160201	SSS	IRON	14-16'	18300	mg/kg		
		SB160202	SSS	SILVER	14-16'	0.51	mg/kg		

Table 3-2

Oil/Water Separator Phase 2 RFI Status Table
With Recommended TNRCC Risk Reduction Program Action
OWS Phase 2 RFI Work Plan
NAS Fort Worth, Texas

OWS Bldg.	SWMU/ AOC	Sample Locations	Media Affected	Constituent	Depth	Max Result	Units	Proposed TNRCC RRS[4]	Recommendations
1628	SWMU 7	MS1418	SS	SILVER	0-2'	0.76	mg/kg		Run SPLP 1312 for subsurface soils
Investigated by HGL		MS1422	SSS	MANGANESE	6-8'	377	mg/kg	RRS2 pass SPLP	
				SILVER	6-8'	0.47	mg/kg		
1643	SWMU 40	WITCTA006	GW	ARSENIC	N/A	28.2	µg/L		Run SPLP 1312 for surface soils
				IRON	N/A	1740	µg/L		
Investigated by HGL				MANGANESE	N/A	1660	µg/L		
		SB164302	SS	CADMIUM	0-1'	1	mg/kg	RRS2 pass SPLP	
		SB164302	SS	LEAD	0-1'	81.8	mg/kg		
		SB164301	SSS	IRON	10-12'	17000	mg/kg	RRS2 pass SPLP	
1655	ND	WITCTA004	GW	IRON	N/A	1470	µg/L		**No Further Action**
				MANGANESE	N/A	977	µg/L		
				SODIUM	N/A	177000	µg/L		
		SB165502	SSS	BARIUM	10-12'	136	mg/kg	RRS2 pass SPLP	
		SB165502	SSS	MANGANESE	10-12'	2210	mg/kg		
		SB165601	SS	MAGNESIUM	1-3'	3320	mg/kg		
1656	ND	SB165602	SS	CALCIUM	1-3'	302000	mg/kg		**No Further Action**
		SB165602	SS	SILVER	1-3'	1.8	mg/kg		
3358	ND	SB335801	SS	ARSENIC	0-2'	7.8	mg/kg	RRS2 pass SPLP	Run SPLP 1312 for surface soils
		SB335801	SS	LEAD	0-2'	91.6	mg/kg		
		SB335801	SS	ZINC	0-2'	91.5	mg/kg		

Table 3-2

Oil/Water Separator Phase 2 RFI Status Table
With Recommended TNRCC Risk Reduction Program Action
OWS Phase 2 RFI Work Plan
NAS Fort Worth, Texas

QWS Bldg.	SWMU/ AOC	Sample Locations	Media Affected	Constituent	Depth	Max Result	Units	Proposed TNRCC RRS[4]	Recommendations
4146	ND	SB414602	SS	CALCIUM	0-2'	234000	mg/kg	RRS2 pass SPLP	Run SPLP 1312
		SB414603	SS	LEAD	0-2'	42	mg/kg		for surface soils
		SB414603	SS	MOLYBDENUM	0-2'	1.6	mg/kg		
		SB414603	SS	SILVER	0-2'	0.62	mg/kg		
		SB414604	SSS	CALCIUM	16-18'	325000	mg/kg	RRS2 pass SPLP	
		SB414603	SSS	MAGNESIUM	18-20'	2810	mg/kg		
		SB414604	SSS	MANGANESE	16-18'	859	mg/kg		
		SB414604	SSS	SILVER	18-18'	0.42	mg/kg		
4160	ND	SB416001	SSS	SILVER	0-2'	0.53	mg/kg	RRS2 pass SPLP	**No Further Action**
4210	AOC	WITCTA020	GW	BERYLLIUM	N/A	0.51	µg/L		Additional Contaminant Delineation
	12		GW	IRON	N/A	306	µg/L		Sample SS for VOCs and metals - Run SPLP 1312
		421004 SBF	SSS	COPPER	10-12'	52	mg/kg		
		421001 SBF	SSS	MANGANESE	10-12'	660	mg/kg		
		421001 SBF	SSS	NICKEL	10-12'	16	mg/kg		
		421004 SBF	SSS	VANADIUM	10-12'	38	mg/kg		
		421004 SBF	SSS	ZINC	10-12'	32	mg/kg		
		421004 SBG	SSS	ARSENIC	12-14'	19	mg/kg	RRS2 pass SPLP	for SSS
		421004 SBG	SSS	CADMIUM	12-14'	1.8	mg/kg		
		421004 SBG	SSS	COBALT	12-14'	12	mg/kg		
		421004 SBG	SSS	IRON	12-14'	17000	mg/kg		
		421002 SBH	SSS	LEAD	14-16'	58	mg/kg		

1 - Media affected: SS- Suface Soil; SSS - Subsurface Soil; GW - Groundwater.

2 - RR1 or RR2: TNRCC Risk Reduction Program Standards 1 or 2.

3 - RRS2 pass SPLP - Standard 2 closure can be achieved if soils pass SPLP 1312.

[Box] Boxed cell represents constituent concentration greater than both the RRS 1 and the MSC.

Organic compounds exceed the method PQL.

511 27

Table 3-3

Proposed OWS Phase 2 RFI Soil Boring Sample Locations and Analytical Methods
NAS Fort Worth, Texas

Analysis		No. of field samples to be taken at each location excluding QC samples. Please see Note 1			TAL Metals by SW6010B/7000 (Trace)	SPLP Metals by SW1312/SW6010B (Trace)
Location	Map Location	Surface	Subsurface	Rationale: Confirm/ Delineate	None, 4°C 180 Days	
SB101503	BLDG1015	1	1	Delineate Law 1015-SB02	X	X
SB101504	BLDG1015	1	1	Confirm Law 1015-SB01	X	
SB101505	BLDG1015	1	1	Delineate Law 1015-SB02	X	S
SB101506	BLDG1015	1	1	Delineate Law 1015-SB02	X	X
SB102703	BLDG1027	1	1	Delineate Law 1027-SB01	X	X
SB102704	BLDG1027	0	1	Confirm Law 1027-SB04	X	
SB106003	BLDG1060	1	1	Delineate Law 1060-SB03	X	X
SB106004	BLDG1060	0	1	Delineate Law 1060-SB01	X	
SB106403	BLDG1064	1	1	Delineate Law 1064-SB02	X	X
SB106404	BLDG1064	0	1	Delineate Law 1064-SB01	X	
SB110103	BLDG1101	1	1	Confirm IT SB110101	X	X
SB119103	BLDG1191	1	0	Delineate IT SB119103	X	
SB119105	BLDG1191	0	1	Delineate Law 1191-SB01&-SB03	X	X
SB141403	BLDG1414	0	1	Delineate Law 1414-SB01	X	
SB141404	BLDG1414	1	1	Delineate Law 1414-SB03	X	X
SB160203	BLDG1602	1	1	Confirm IT SB160201	X	X
SB335808	BLDG3358	1	0	Confirm IT SB335801	X	
SB414605	BLDG4146	1	0	Confirm IT SB 414602	X	X
SB421003	BLDG4210	0	1	Confirm Law 421001	X	X
SB421004	BLDG4210	0	1	Delineate Law 421001	X	
	Totals	14	18			

Note 1 - QC samples to be taken: MS/MSD - 5% of total field samples, 1 set per SDG or 1 set per 20 samples.
Dup. - 10% of total field samples. Mat. Blk - 1 per water soutce/matrix.
Total blk - 1 per VOC cooler. Equip. Rinse - 1 per day.

Table 3-4

Proposed OWS Phase 2 RFI Groundwater Sample Locations
NAS Fort Worth, Texas

Analysis					TAL Metals by SW6010B/7000 (Trace)		
Location	Map Location	Figure No.	No. of field samples to be taken at each location excluding QC samples. Please see Note 1 Confirm	Delineate	HNO_3, < 4°C 500 ml glass 180 Days	Rationale/DQO	Field Parameters (See Table 6)
WITCTA037	BLDG1027	4	1		X - Be	Confirm/Resample -Be only	X
WITCTA022	BLDG1060	5	1		X - Be	Confirm/Resample -Be only	X
WITCTA019	BLDG1101	7	1		X - Be	Confirm/Resample -Be only	X
WITCTA031	BLDG1191	10	1		X - As, Ba, Mn	Confirm/Resample - As, Ba, Mn	X
WITCTA1191_1	BLDG1191	10		1	X - As, Ba, Mn	Delineate - As, Ba, Mn Only	X
WITCTA1191_2	BLDG1191	10		1	X - As, Ba, Mn	Delineate - As, Ba, Mn Only	X
WITCTA1191_3	BLDG1191	10		1	X - As, Ba, Mn	Delineate - As, Ba, Mn Only	X
WITCTA1191_4	BLDG1191	10		1	X - As, Ba, Mn	Delineate - As, Ba, Mn Only	X
WITCTA011	BLDG1602	13	1		X - As	Confirm/Resample -As only	X
WITCTA020	BLDG4210	17	1		X - Be	Confirm/Resample -Be only	X
	Total		6	4			

Note 1 - QC samples to be taken: MS/MSD - 5% of total field samples, 1 set per SDG or 1 set per 20 samples.
Dup. - 10% of total field samples. Mat. Blk - 1 per water soutce/matrix.
Total blk - 1 per VOA cooler. Equip. Rinse - 1 per day.

Table 3-5

Summary Table of all OWS Phase 2 RFI Soil Boring and Groundwater Samples NAS Fort Worth, Texas

Parameter	Analytical Method	Matrix	Number of Field samples	Field Duplicate 10%	Matrix Spike 5%	Matrix Spike Duplicate 5%	Material Blank 1 per source/ matrix	Equip. Rinsate 1 per Day	Trip Blank 1 per VOA cooler	Total No. of Samples	Combined Total No. of Water/Soil Samples
Volatiles	SW8260	Soil	0	0	0	0	0	0	0	0	NONE
		Water	0	0	0	0	0	0	0	0	
		Combined									0
TAL Metals	SW6010B Trace/	Soil	49	5	3	3	0	5	0	59	
	7000	Water	20	2	1	1	1	2	0	24	
		Combined	69								83
SPLP Metals	EPA Method 1312	Soil	14	2	1	1	0	0	0	15	
	SW60101B Trace	Water	0	0	0	0	0	0	0	0	
	/7300	Combined									15
Field	See Table 7	Soil	0	0	0	0	0	0	0	0	
		Water	13	0	0	0	0	0	0	13	
		Combined									13

- Eleven groundwater metals analyses (6 existing monitoring wells, 4 new monitoring wells).

These analyses do not include the number of field (10 percent field blanks and 1 daily equipment blank) and laboratory QA/QC samples (5 percent matrix spike/matrix spike duplicate).

3.2 OWS Phase 2 RFI Surface Soil Investigation

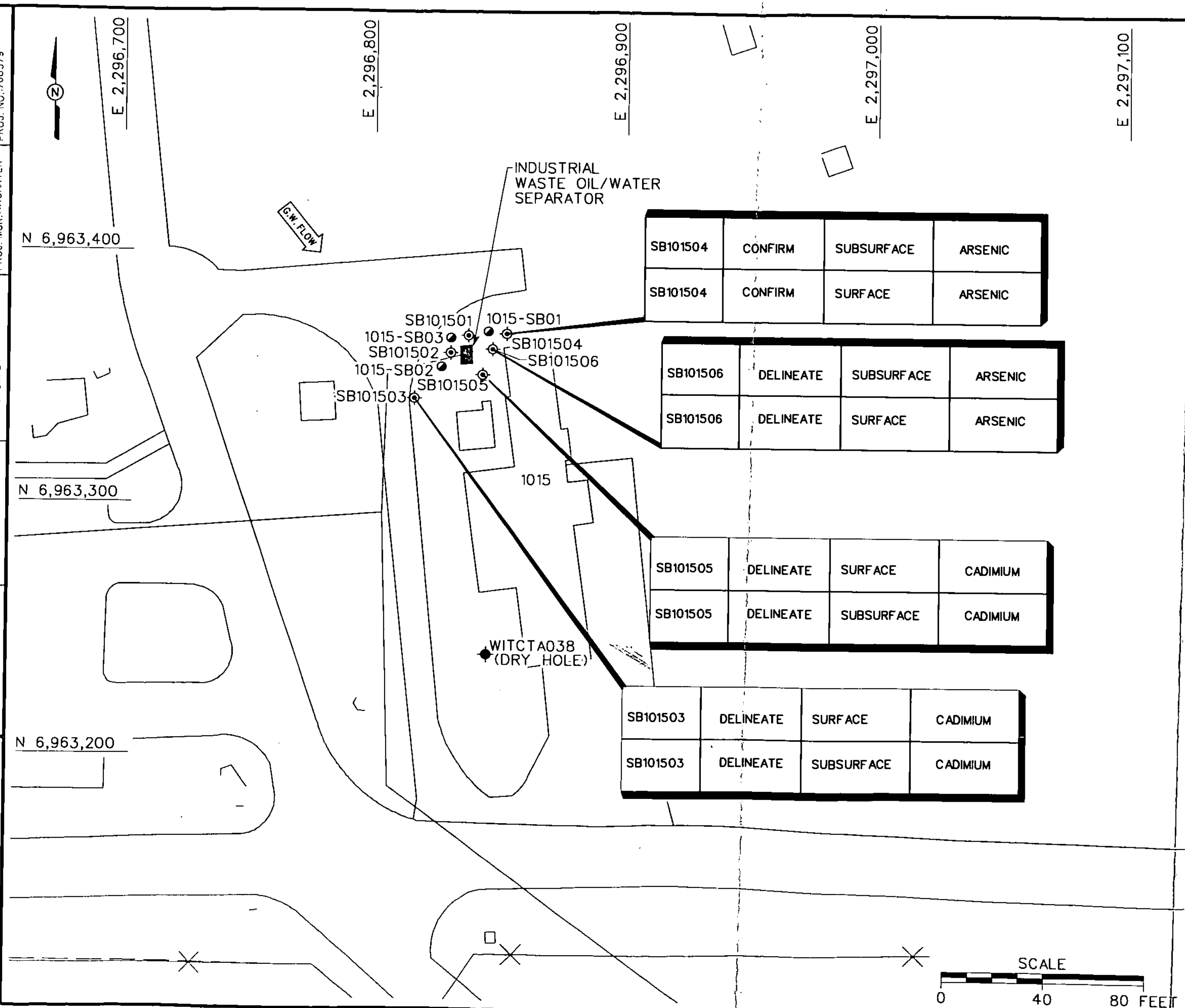
Soil samples will be collected to either delineate potential soil contamination or confirm low detections of contaminants. The near-surface soil samples will be discrete grab samples collected from 0 to 2 feet in depth. The surface soil samples will be collected at locations shown on Figures 3 through 16. The number of soil samples to be collected and parameters to be analyzed are shown in Table 3-3.

The sample tubes will be driven into the ground with a direct-push technology soil probe. All sampling equipment will be decontaminated before its use. Specific soil sample collections techniques are provided in the FSP (IT, 1997c) and in Attachment 1 of this document.

Criteria for selection of surface soil sample locations are as follows:

- Locations requiring resampling to confirm constituent detections less than one order of magnitude above RRS 1 background concentration UTL criteria
- Locations requiring contaminant lateral delineation due to detections exceeding an order of magnitude above the background concentration UTL and the occurrence of the contaminant is consistent with past waste operations at the site
- Locations requiring analysis by the SPLP (EPA SW846 Method 1312) to determine if contaminants exceeding the RRS 2 criteria may leach from soil to groundwater.

Lab Methods. Surface soil samples will be submitted for analysis using EPA SW846 Method SW6010B Trace RCRA metals, including mercury. Metals analysis will be performed to ensure the method reporting limit is lower than the constituent background UTL concentration. Analytical parameters and the number of samples to be collected are shown in Tables 3-1 and 3-5.



LEGEND

SB101501	IT CORP. SOIL BORING
	IT CORP. MONITORING WELL
1015-SB01	LAW ENGINEERING SOIL BORING
G.W. FLOW	GROUNDWATER FLOW DIRECTION

FIGURE 3
SOIL BORING AND GROUNDWATER MONITORING LOCATIONS BUILDING 1015 OWS

OWS RFI PHASE 2
NAS FORT WORTH
FORT WORTH, TEXAS

INTERNATIONAL TECHNOLOGY CORPORATION

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PROJ. NO.:768579	PROJ. MGR.:W.CARTER	ENGR. CHCK. BY: M. MAKI	DRAWN BY:	DRAWN BY: L. STOUT	02/28/00

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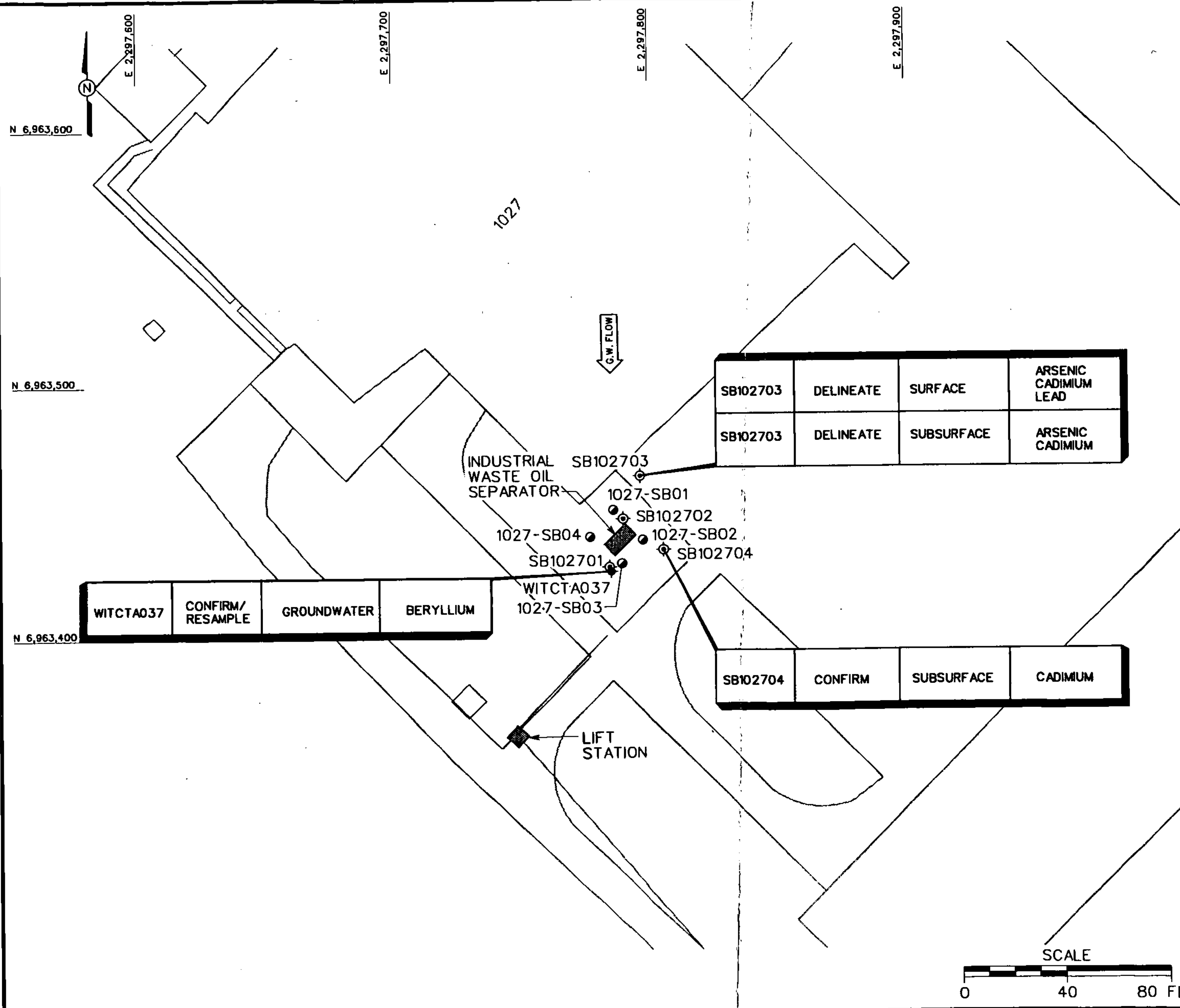
mcroft



SB102703	DELINEATE	SURFACE	ARSENIC CADIMIUM LEAD
SB102703	DELINEATE	SUBSURFACE	ARSENIC CADIMIUM

SB102704	CONFIRM	SUBSURFACE	CADIMIUM

WITCTA037	CONFIRM/ RESAMPLE	GROUNDWATER	BERYLLIUM

LEGEND

- SB102704 — IT CORP. SOIL BORING
- IT CORP. MONITORING WELL
- 1064-SB01 — LAW ENGINEERING SOIL BORING
- G.W. FLOW — GROUNDWATER FLOW DIRECTION

FIGURE 4
SOIL BORING AND GROUNDWATER MONITORING LOCATIONS BUILDING 1027 OWS

OWS RFI PHASE 2
NAS FORT WORTH
FORT WORTH, TEXAS

INTERNATIONAL TECHNOLOGY CORPORATION

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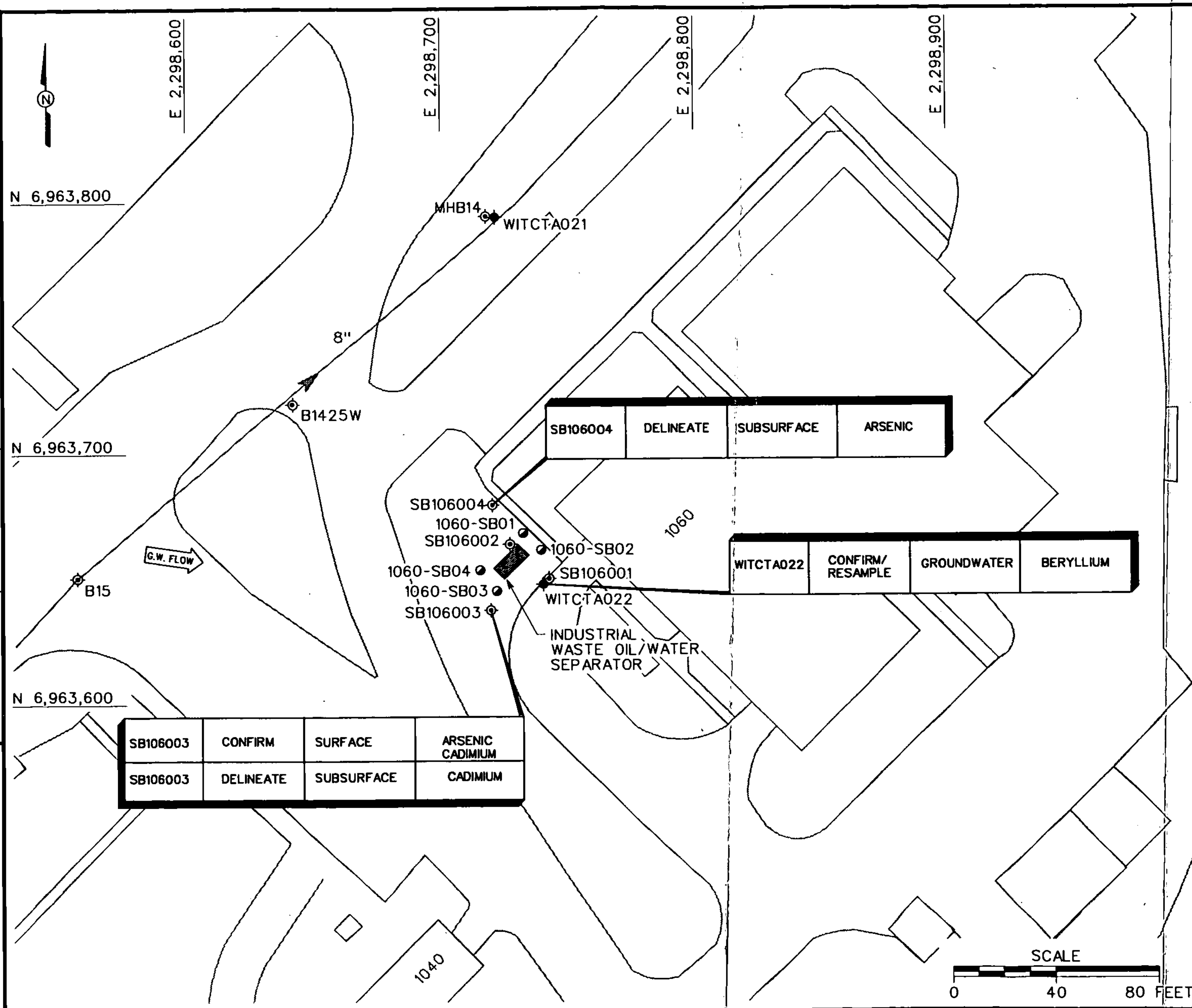

LEGEND

- SB106001 — IT CORP. SOIL BORING
- IT CORP. MONITORING WELL
- 1060-SB01 — LAW ENGINEERING SOIL BORING
- SEWER LINE AND DIRECTIONAL FLOW
- G.W. FLOW — GROUNDWATER FLOW DIRECTION

FIGURE 5
SOIL BORING AND GROUNDWATER MONITORING LOCATIONS
BUILDING 1060 OWS

OWS RFI PHASE 2
NAS FORT WORTH
FORT WORTH, TEXAS

INTERNATIONAL TECHNOLOGY CORPORATION

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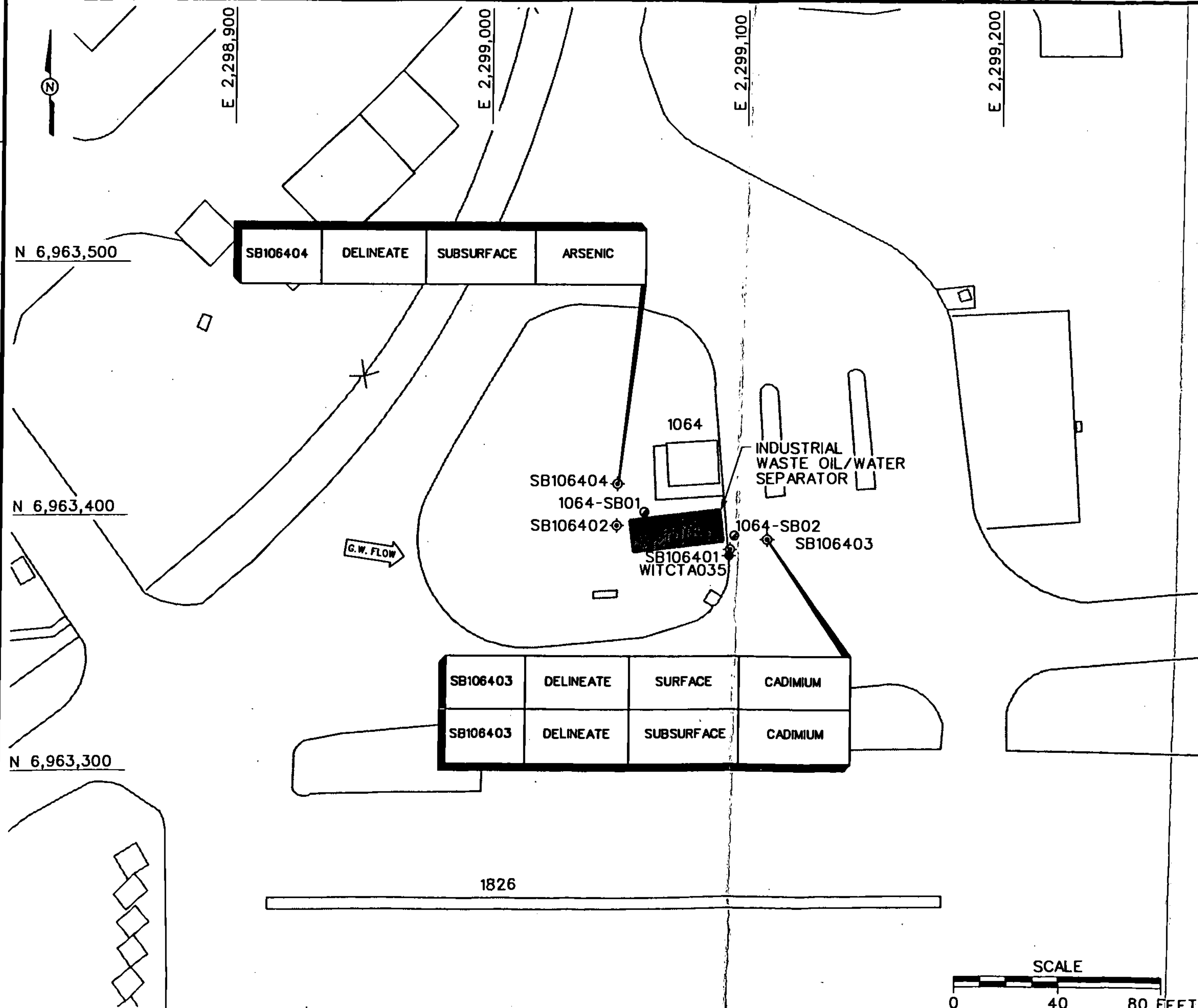

LEGEND

- ◈ SB106401 — IT CORP. SOIL BORING
- ● 1064-SB01 — LAW ENGINEERING SOIL BORING
- ✦ WITCTA035 — IT CORP. MONITORING WELL
- G.W. FLOW — GROUNDWATER FLOW DIRECTION

FIGURE 6
SOIL BORING AND GROUNDWATER MONITORING LOCATIONS
BUILDING 1064 OWS

OWS RFI PHASE 2
NAS FORT WORTH
FORT WORTH, TEXAS

INTERNATIONAL TECHNOLOGY CORPORATION

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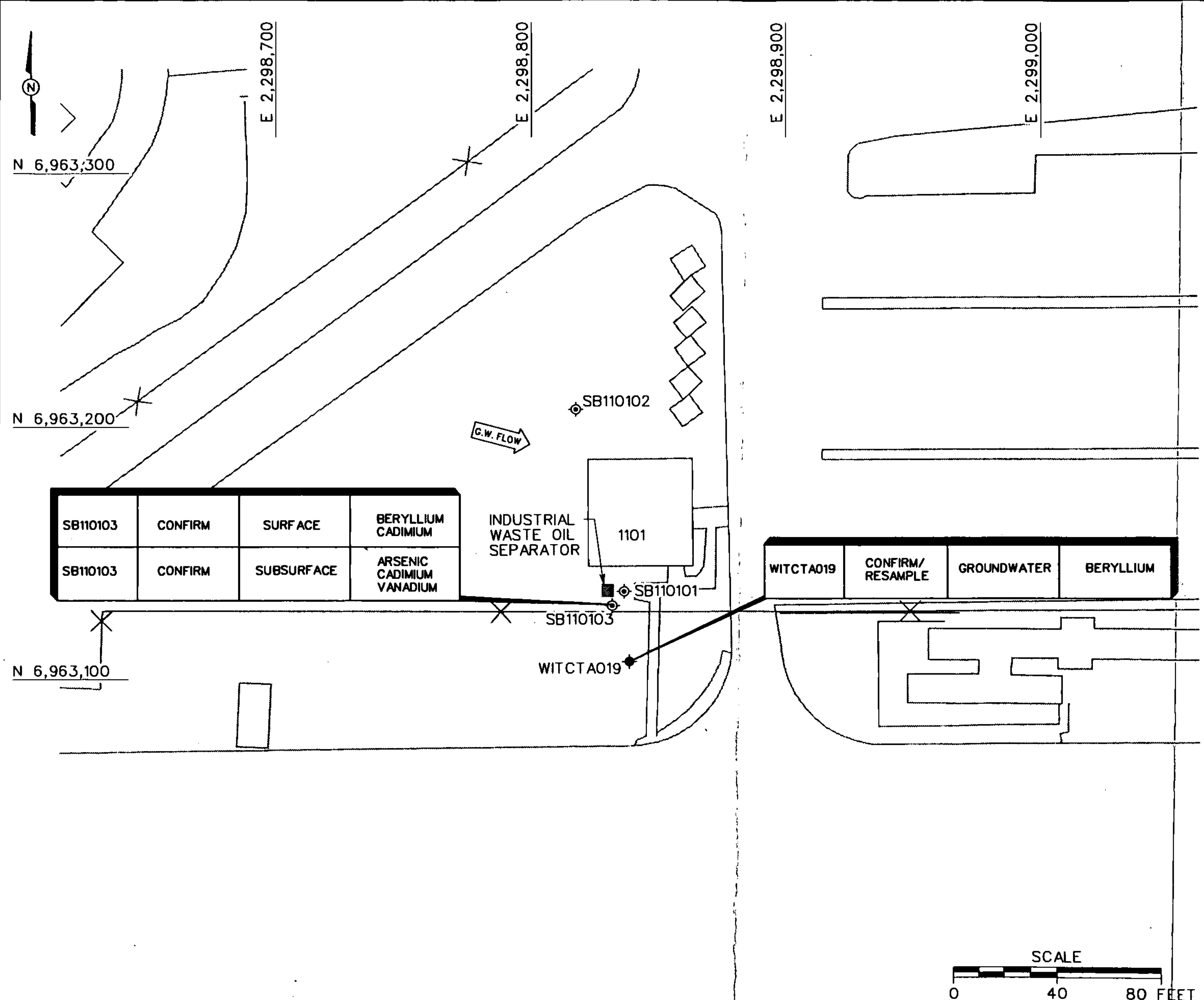

LEGEND

- SB106401 — IT CORP. SOIL BORING
- 1064-SB01 — LAW ENGINEERING SOIL BORING
- WITCTA035 — IT CORP. MONITORING WELL
- G.W. FLOW — GROUNDWATER FLOW DIRECTION

FIGURE 7
SOIL BORING AND GROUNDWATER MONITORING LOCATIONS
BUILDING 1101 OWS

OWS RFIPHASE 2
NAS FORT WORTH
FORT WORTH, TEXAS

INTERNATIONAL TECHNOLOGY CORPORATION

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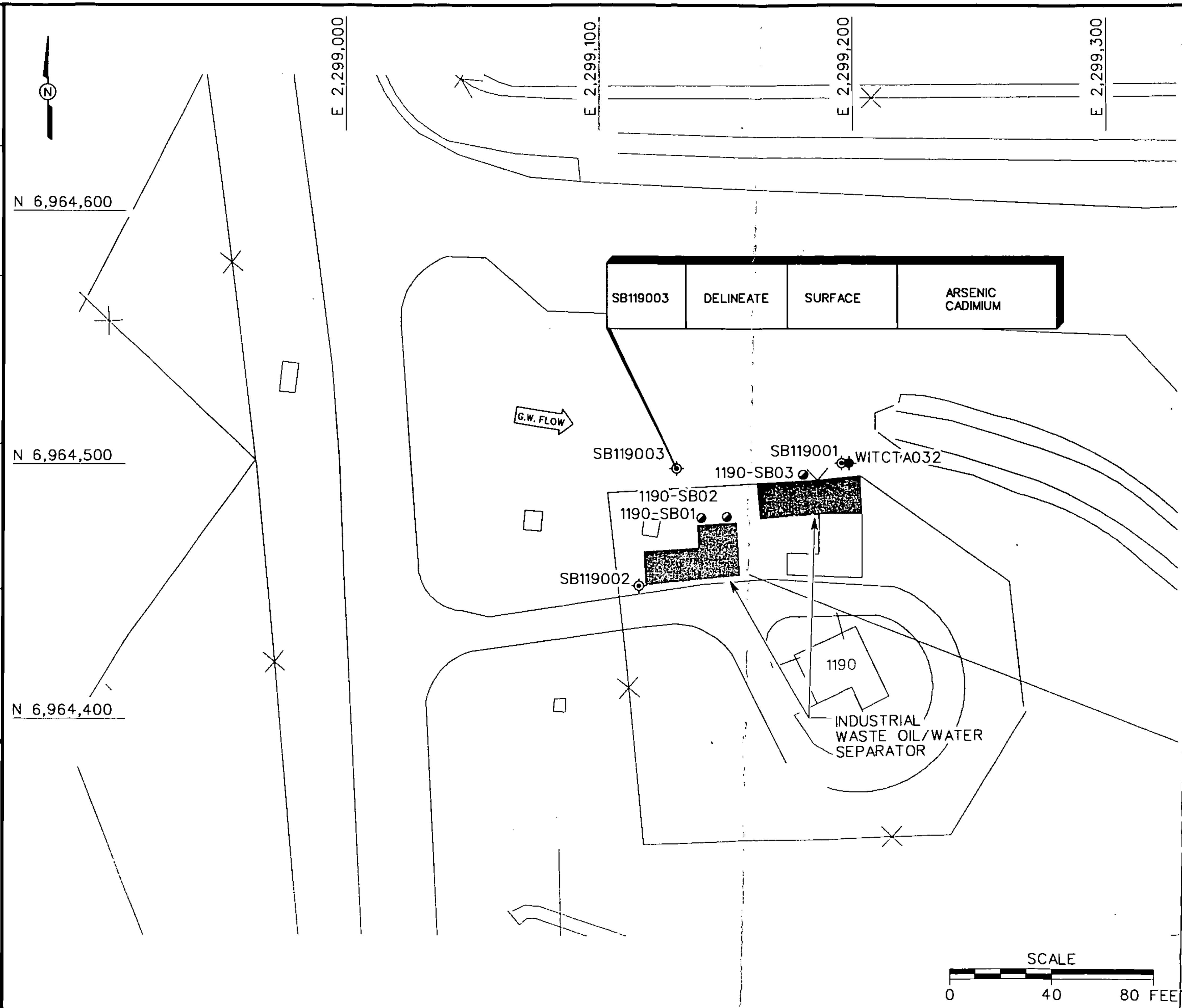

LEGEND

SB119001	IT CORP. SOIL BORING
	IT CORP. MONITORING WELL
1190-SB01	LAW ENGINEERING SOIL BORING
	SEWER LINE AND DIRECTIONAL FLOW
G.W. FLOW	GROUNDWATER FLOW DIRECTION

FIGURE 8
SOIL BORING AND GROUNDWATER MONITORING LOCATIONS
BUILDING 1190 OWS

OWS RFIPHASE 2
NAS FORT WORTH
FORT WORTH, TEXAS

INTERNATIONAL TECHNOLOGY CORPORATION

STARTING DATE: 10/7/97	DATE LAST REV.:	DRAFT. CHCK. BY: R. KNIGHT	INITIATOR: M. MAKI	DWG. NO.:.\768579es.154	09:16:38
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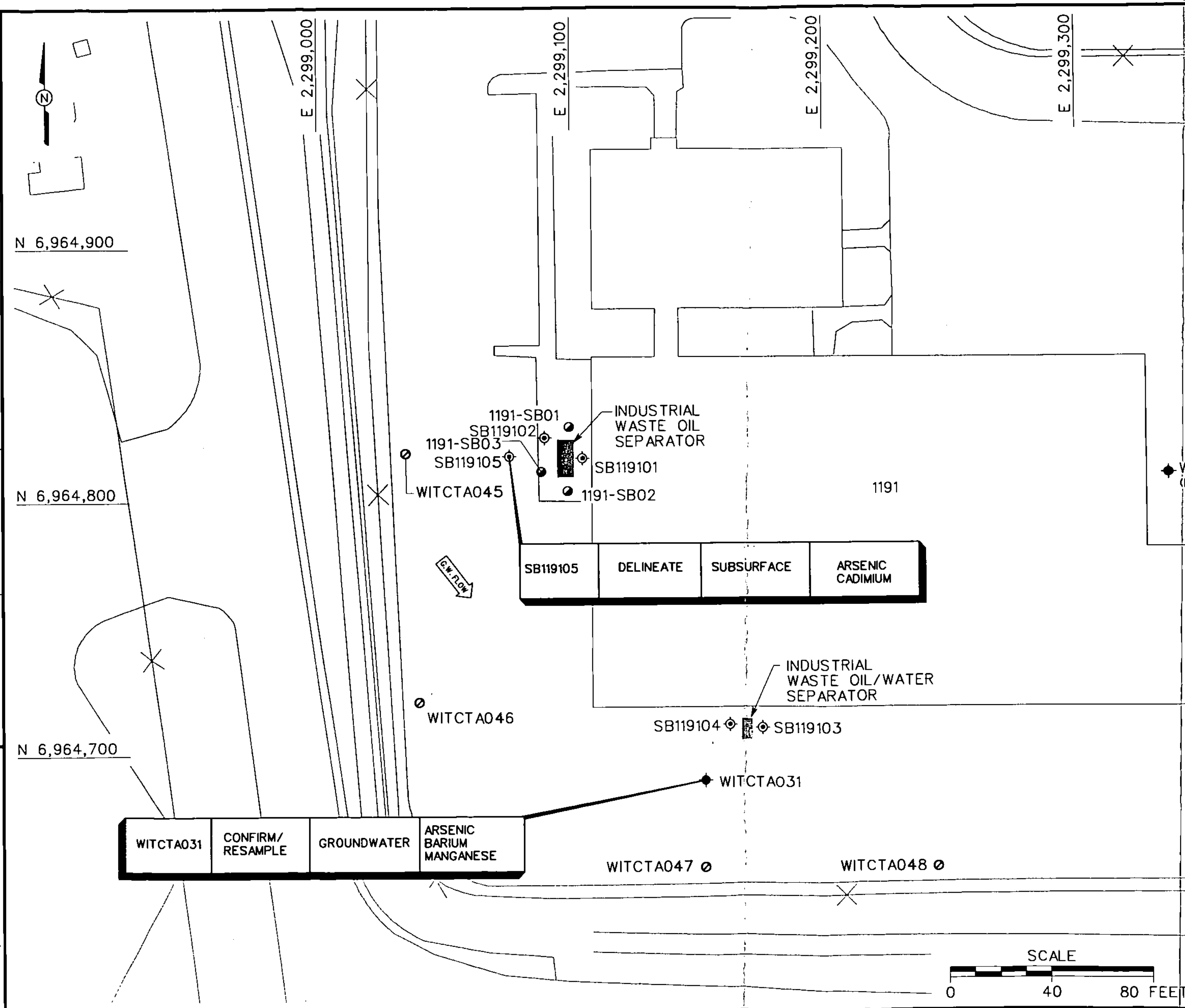

LEGEND

- IT CORP. SOIL BORING
- LAW ENGINEERING SOIL BORING
- IT CORP. MONITORING WELL
- PROPOSED IT MONITORING WELL LOCATION
- G.W. FLOW — GROUNDWATER FLOW DIRECTION

NOTES:

WELLS 1191-1 THROUGH 1191-4 WILL BE INSTALLED TO DELINATE As ,Ba, Mn

FIGURE 9
SOIL BORING AND GROUNDWATER MONITORING LOCATIONS BUILDING 1191 OWS

OWS RFI PHASE 2
NAS FORT WORTH
FORT WORTH, TEXAS

INTERNATIONAL TECHNOLOGY CORPORATION

STARTING DATE: 10/7/97	DATE LAST REV.:	DRAFT. CHCK. BY: R. KNIGHT	INITIATOR: M. MAKI	DWG. NO.:..\768579es.170	09:17:51
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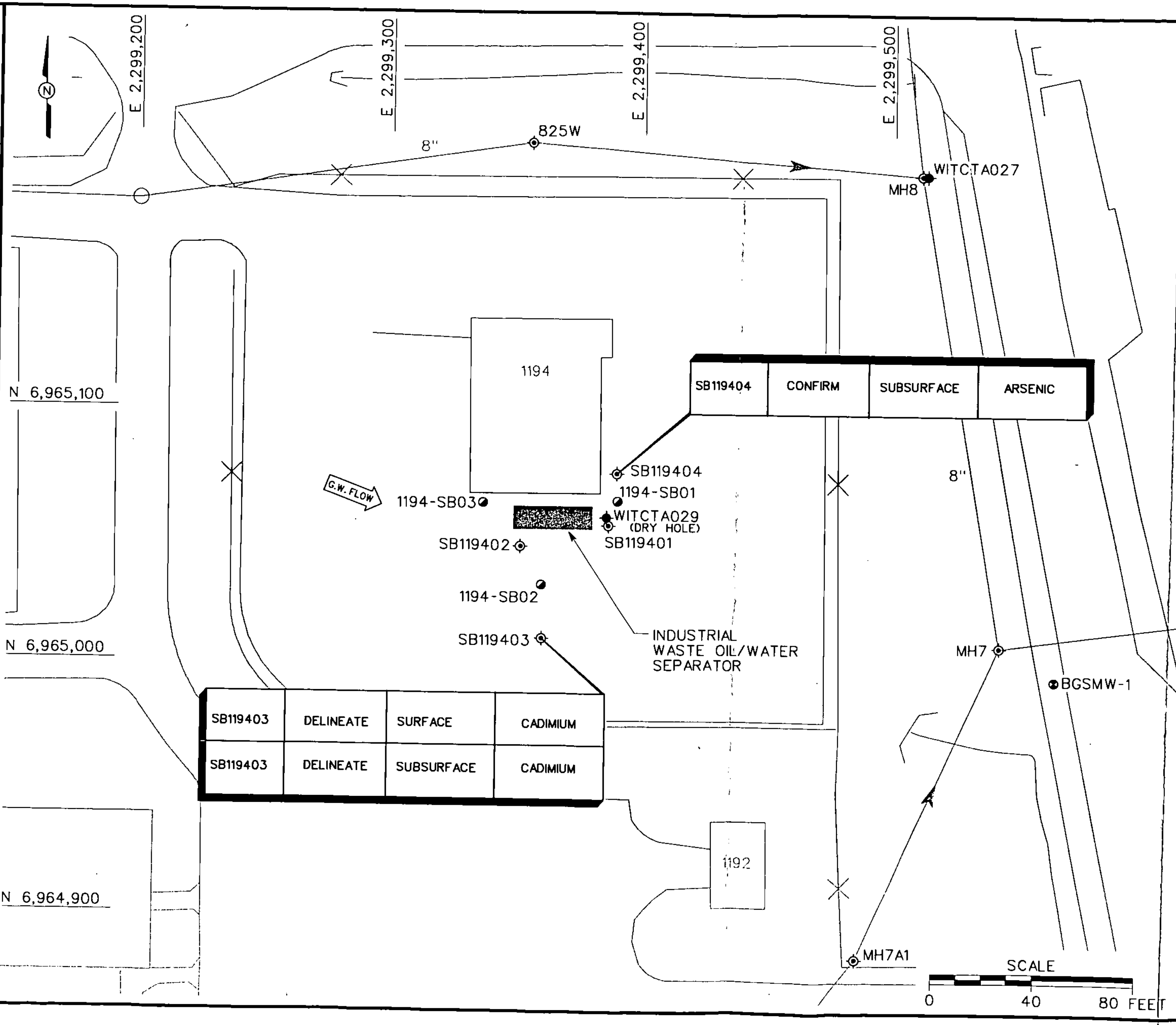

LEGEND

- IT CORP. SOIL BORING
- IT CORP. MONITORING WELL
- EXISTING MONITORING WELL
- LAW ENGINEERING SOIL BORING
- SEWER LINE AND DIRECTIONAL FLOW
- G.W. FLOW — GROUNDWATER FLOW DIRECTION

NOTE:

INVESTIGATED BY HGL

FIGURE 10
SOIL BORING AND GROUNDWATER MONITORING LOCATIONS BUILDING 1194 OWS

OWS RFIPHASE 2
NAS FORT WORTH
FORT WORTH, TEXAS

INTERNATIONAL TECHNOLOGY CORPORATION

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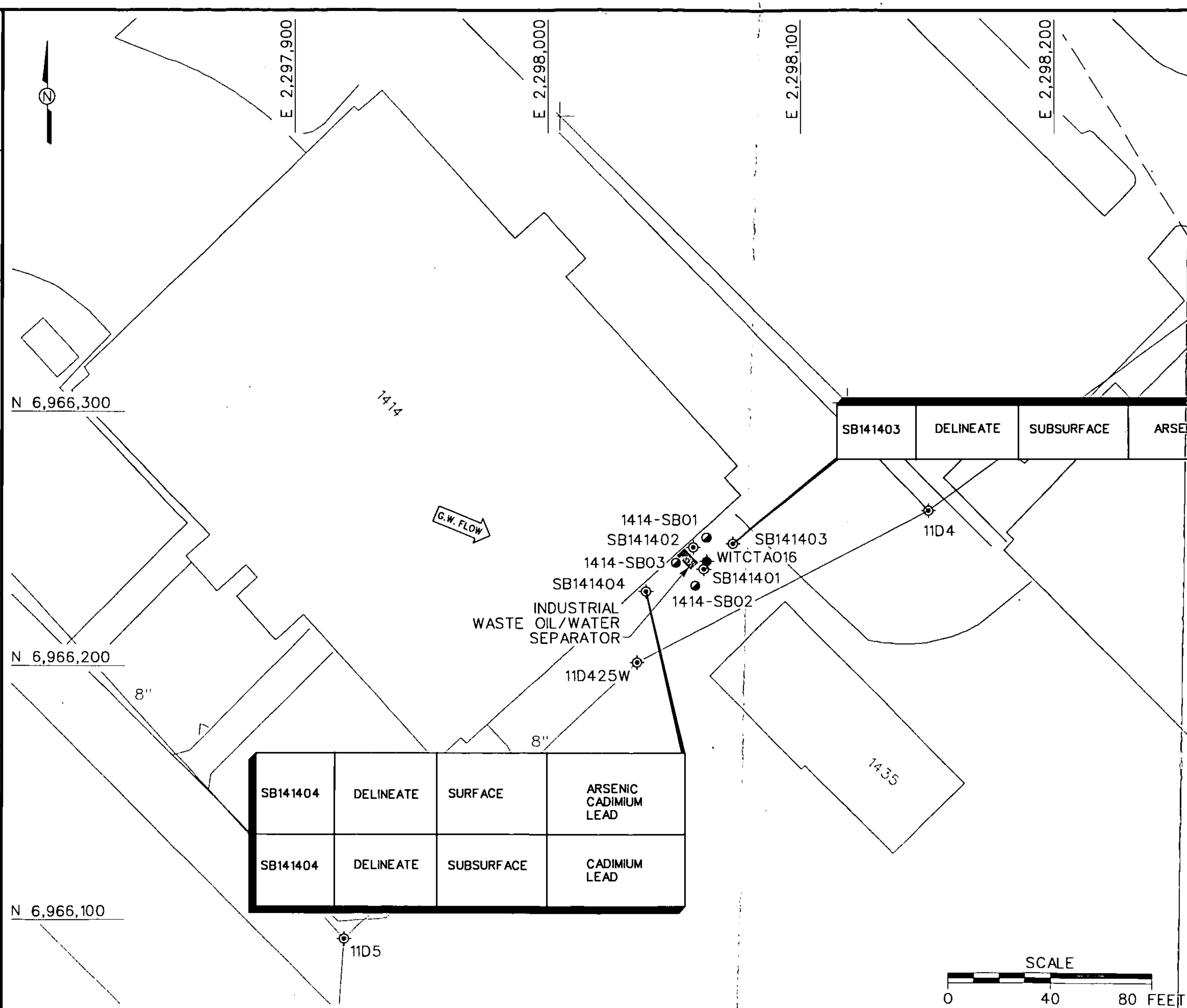

LEGEND

- IT CORP. SOIL BORING
- LAW ENGINEERING SOIL BORING
- IT CORP. MONITORING WELL
- SEWER LINE AND DIRECTIONAL FLOW
- GROUNDWATER FLOW DIRECTION

NOTE:

NO SAMPLE CAN BE TAKEN WITHIN BLDG. 1414 UPGRADIENT OF UST.

FIGURE 11
SOIL BORING AND GROUNDWATER MONITORING LOCATIONS
BUILDING 1414 OWS

OWS RFI PHASE 2
NAS FORT WORTH
FORT WORTH, TEXAS

INTERNATIONAL TECHNOLOGY CORPORATION

STARTING DATE: 10/8/97	DATE LAST REV.:	DRAFT. CHCK. BY: R. KNIGHT	INITIATOR: M. MAKI	DWG. NO.:.\768579es.157	
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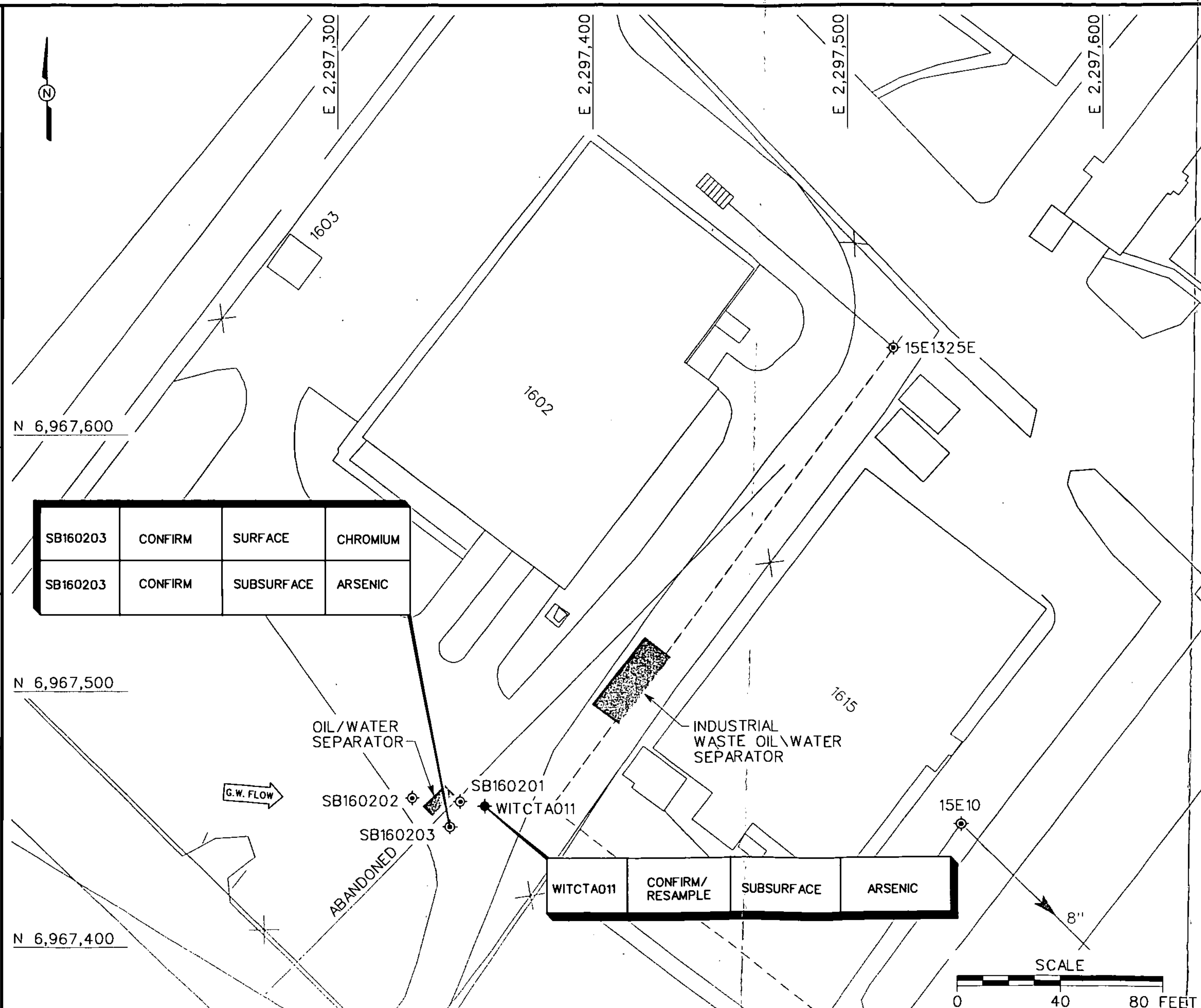

FIGURE 12
SOIL BORING AND GROUNDWATER MONITORING LOCATIONS
BUILDING 1602 OWS

OWS RFI PHASE 2
NAS FORT WORTH
FORT WORTH, TEXAS

INTERNATIONAL TECHNOLOGY CORPORATION

STARTING DATE: 10/8/97	DATE LAST REV.:	DRAFT. CHCK. BY: R. KNIGHT	INITIATOR: M. MAKI	DWG. NO.:..\768579es.159	09:23:59
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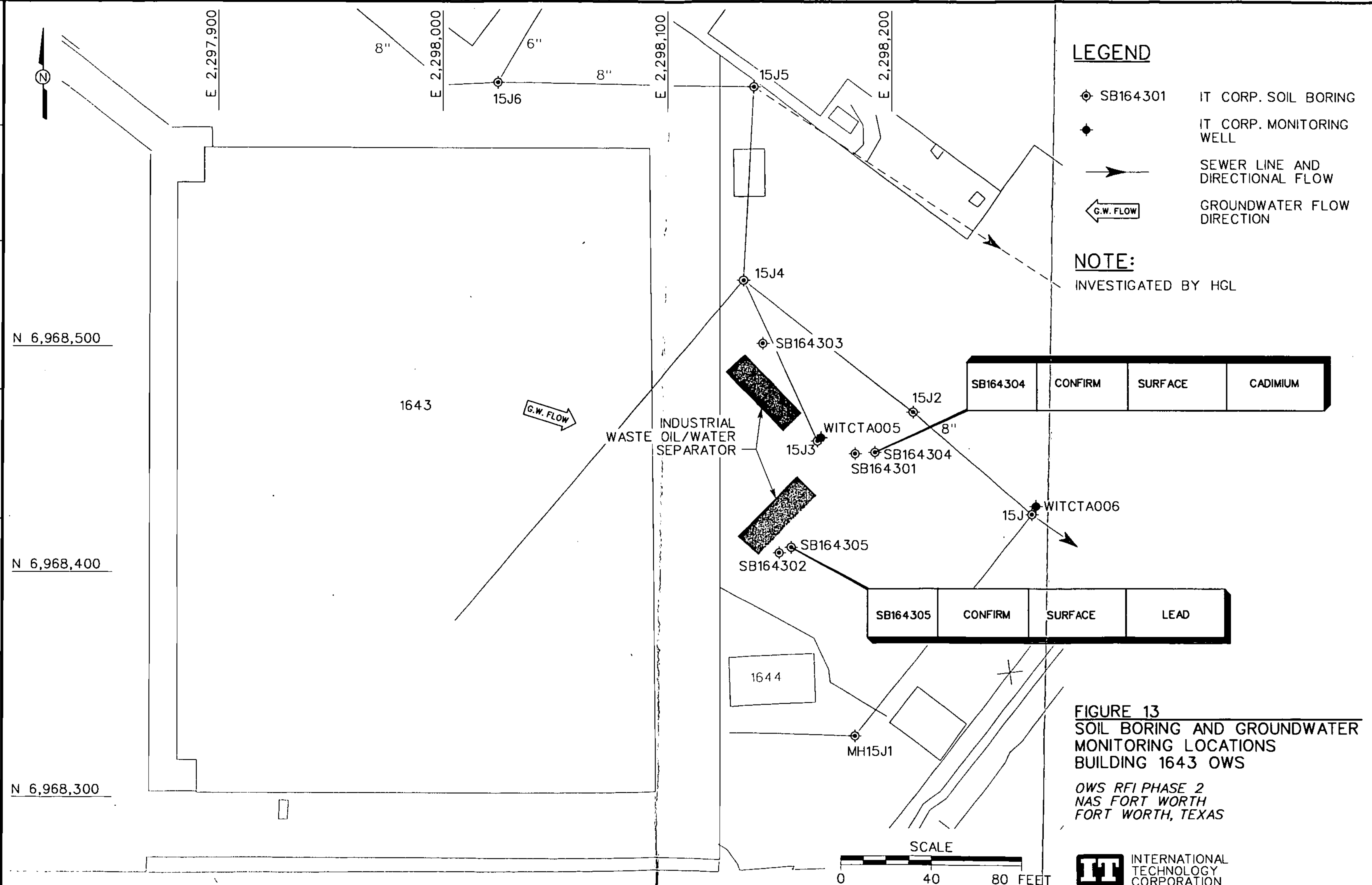

FIGURE 13
SOIL BORING AND GROUNDWATER MONITORING LOCATIONS
BUILDING 1643 OWS

OWS RFI PHASE 2
NAS FORT WORTH
FORT WORTH, TEXAS

IT INTERNATIONAL TECHNOLOGY CORPORATION

DWG. NO.:...\768579es.161	INITIATOR: M. MAKI	DRAFT. CHCK. BY: R. KNIGHT	DATE LAST REV.:	STARTING DATE: 10/8/97
PROJ. NO.:768579	PROJ. MGR.:W.CARTER	ENGR. CHCK. BY: M. MAKI	DRAWN BY:	DRAWN BY: L. STOUT

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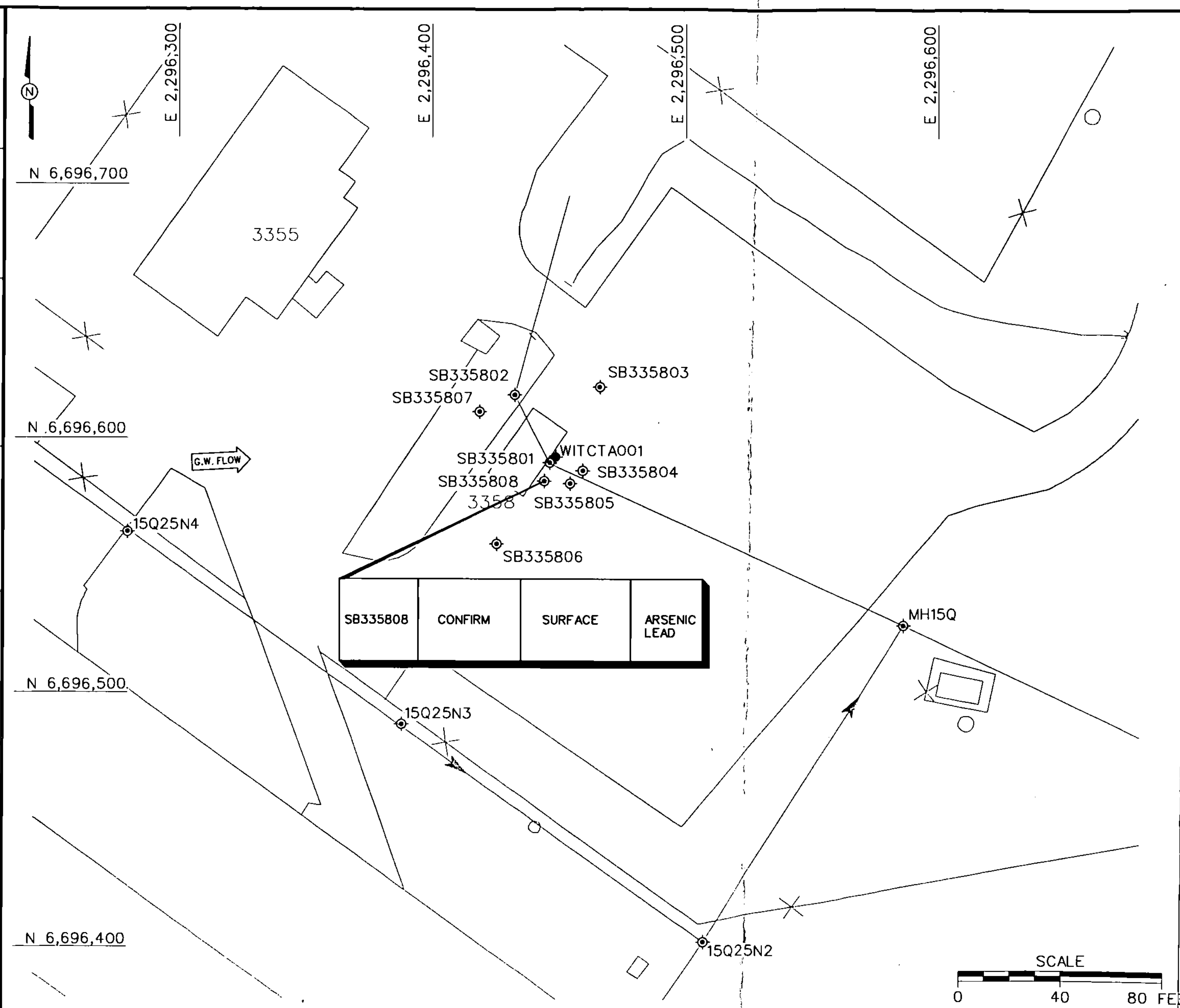

LEGEND

Symbol	Description
⊙	IT CORP. SOIL BORING
◆	IT CORP. MONITORING WELL
→	SEWER LINE AND DIRECTIONAL FLOW
G.W. FLOW	GROUNDWATER FLOW DIRECTION

FIGURE 14
SOIL BORING AND GROUNDWATER MONITORING LOCATIONS
BUILDING 3358 OWS

OWS RFI PHASE 2
NAS FORT WORTH
FORT WORTH, TEXAS

INTERNATIONAL TECHNOLOGY CORPORATION

DWG. NO.:...\768579es.164	INITIATOR: M. MAKI	DRAFT. CHCK. BY: R. KNIGHT	02/28/00 DATE LAST REV.:
PROJ. NO.:768579	PROJ. MGR.: W. CARTER	ENGR. CHCK. BY: M. VAKI	mcraft DRAWN BY:
STARTING DATE: 10/17/97	DRAWN BY: R. KNIGHT		

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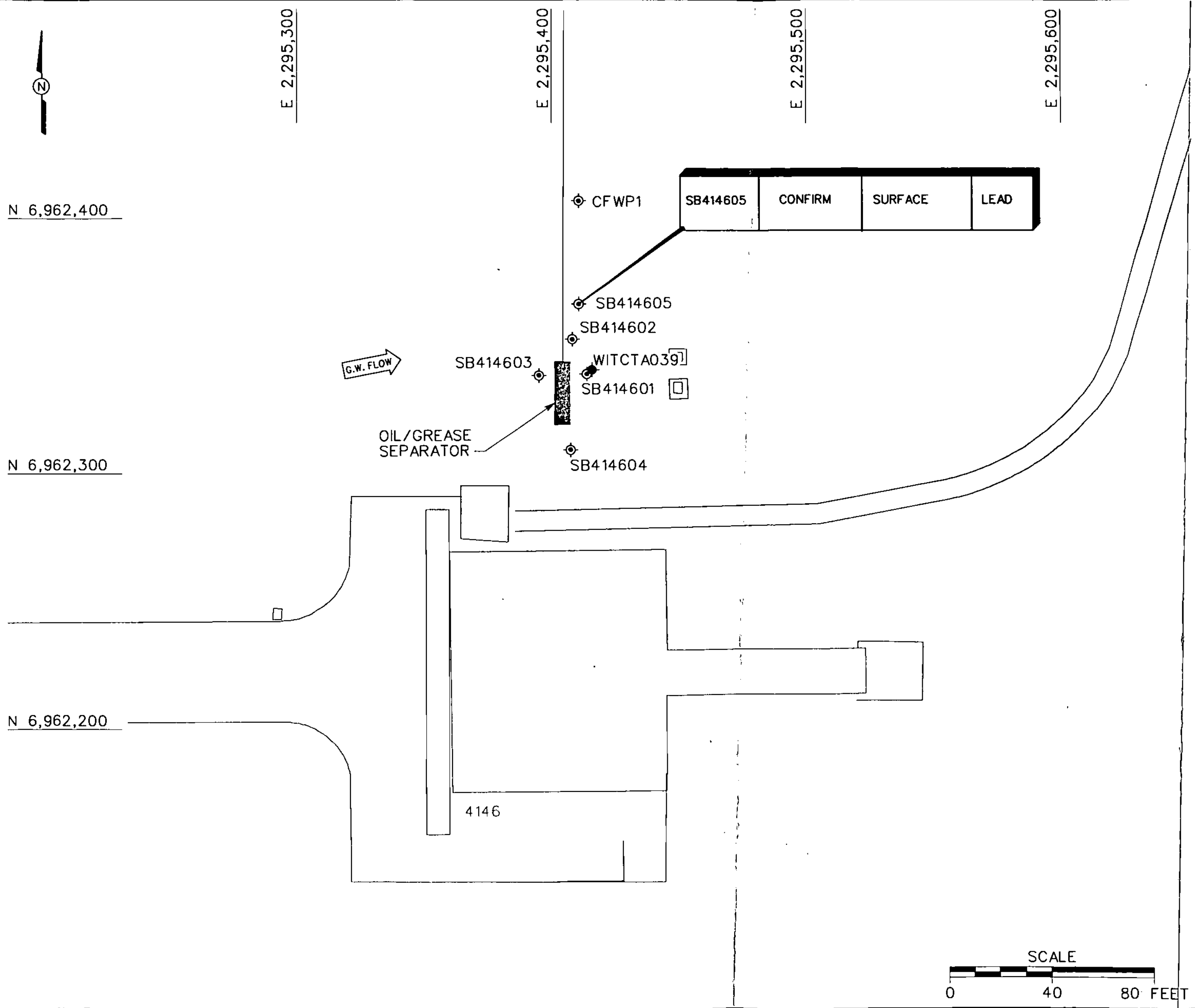

LEGEND

- SB414605 — IT CORP. SOIL BORING
- IT CORP. MONITORING WELL
- SEWER LINE AND DIRECTIONAL FLOW
- G.W. FLOW — GROUNDWATER FLOW DIRECTION

FIGURE 15
SOIL BORING AND GROUNDWATER MONITORING LOCATIONS BUILDING 4146 OWS

OWS RFI PHASE 2
NAS FORT WORTH
FORT WORTH, TEXAS

INTERNATIONAL TECHNOLOGY CORPORATION

DWG. NO.:..\768579es.165	INITIATOR: M. MAKI	DRAFT. CHCK. BY: R. KNIGHT	DATE LAST REV.:	STARTING DATE: 10/8/97	09:27:35	mcroft
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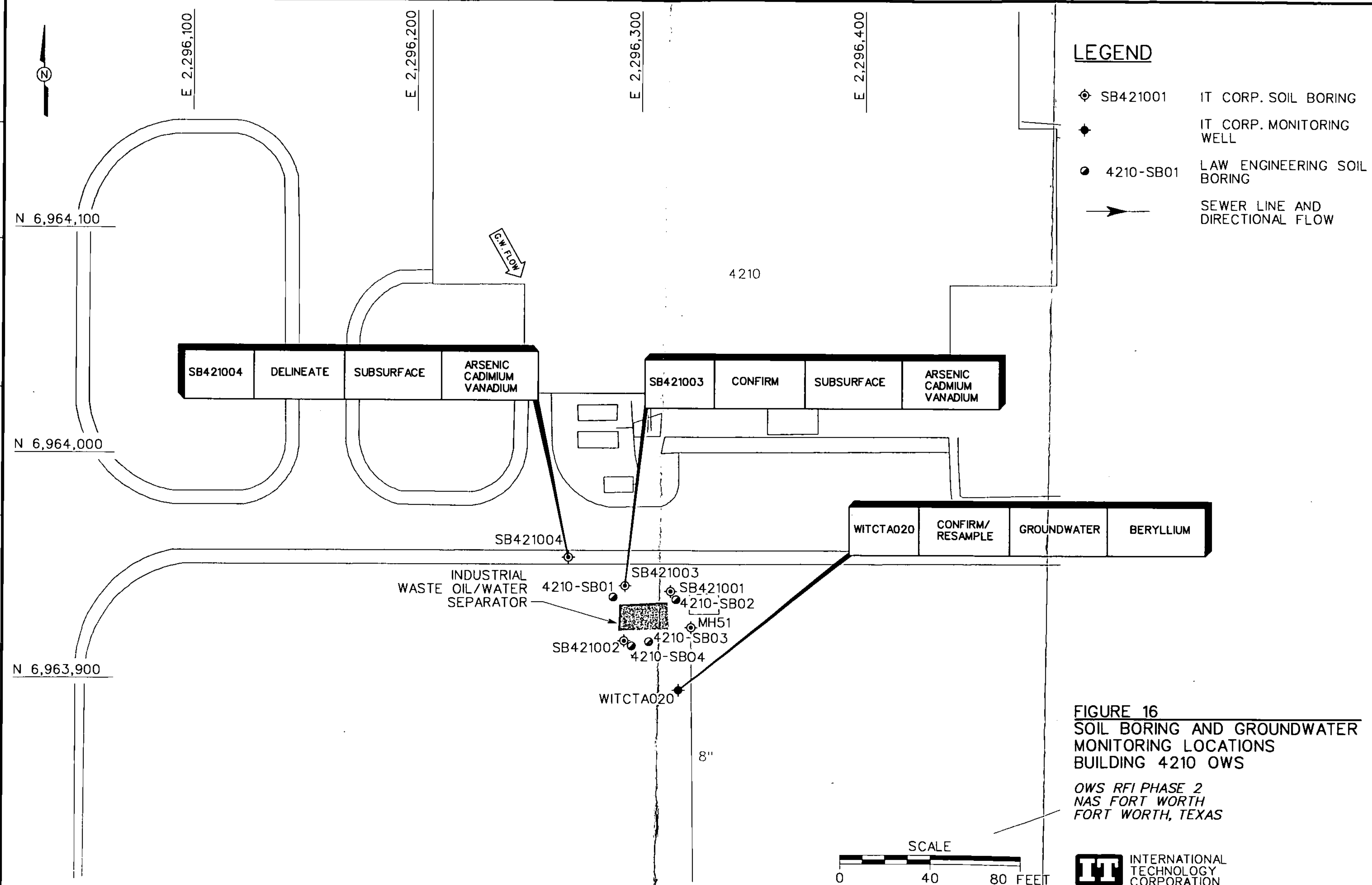

FIGURE 16
SOIL BORING AND GROUNDWATER MONITORING LOCATIONS
BUILDING 4210 OWS

OWS RFI PHASE 2
NAS FORT WORTH
FORT WORTH, TEXAS

INTERNATIONAL TECHNOLOGY CORPORATION

STARTING DATE: 10/8/97	DATE LAST REV.:	DRAFT. CHCK. BY: R. KNIGHT	INITIATOR: M. MAKI	DWG. NO.: \768579es.167
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3.3 OWS Phase 2 RFI Subsurface Soil Investigation

Subsurface soil samples will be collected at several locations at the OWSs requiring additional investigation. The subsurface soil sampling locations are shown on Figures 3 through 16. The sample location and proposed analytical parameters selected for each soil sample are shown on Table 3-3.

The subsurface soil samples will be collected with direct-push technology soil probe methods as described in Attachment 1 of this document.

Criteria for the subsurface soil sampling locations follow the same criteria as those used for soil samples, as described in the previous section.

One subsurface soil sample will be collected at each soil boring. The subsurface soil sample will be collected at 2 feet directly above the water table. Field screening procedures will be used where visible contamination is observed or headspace soil field screening indicates the presence of organic contaminants. The project manager will be called to determine if an additional subsurface soil sample is required if unanticipated organic contamination is detected. Field screening procedures will follow those outlined in the Sanitary Sewer RFI FSP (IT, 1997c).

Lab Methods. Subsurface soil samples will be submitted for analysis using EPA SW846 Method SW6010B Trace RCRA metals, including mercury. Metals analysis will be performed to ensure the method reporting limit is lower than the constituent background UTL concentration. Analytical parameters and the number of samples to be collected are shown in Tables 3-3 and 3-5.

3.4 OWS Phase 2 RFI Groundwater Investigation

Groundwater will be investigated at ten OWS locations for this phase of work. Groundwater samples will be collected to either confirm previous detections of constituents less than one order of magnitude above background concentration UTLs and PQLs, or delineate contaminants exceeding RRS 2 MSCs. Fourteen locations will be sampled by low flow methods to confirm the low concentration of constituents detected during the Sanitary Sewer System RFI (IT, 1998a). Eleven locations will be sampled to confirm low detections of specific inorganic constituents. One location will have three wells resampled to confirm chlorinated VOCs detected in wells installed during the first phase of the OWS RFI investigation. One location (monitoring well

WITCTA031) will have the original monitoring well resampled to confirm the original detection of 51 micrograms per liter arsenic, which exceeded the maximum contaminant level (MCL). Four monitoring wells will be installed surrounding the monitoring well WITCTA031 to determine the extent of the dissolved arsenic plume.

Objectives of the groundwater sampling are as follows:

- Confirm the presence of groundwater constituents exceeding background concentration UTL (Table 2-1).
- Confirm the presence of groundwater constituents exceeding TNRCC RRS 2 MSCs and EPA MCLs.
- Define the lateral extent of the groundwater constituents exceeding TNRCC RRS 2 MSCs.

Investigation Procedures. Proposed groundwater monitoring well locations for the Building 1191 SWMU will be determined in the field. Two wells will be installed west of Building 1191, which is upgradient of the two OWS. Two wells will be placed south of Building 1191 along the southern boundary fence to determine the extent of the arsenic detections. The monitoring wells will be installed to determine the lateral extent of the dissolved metals groundwater plume. The objective of the program will guide subsequent monitoring well placement if the original monitoring wells do not define the lateral extent of the groundwater plumes.

One monitoring well will be located upgradient of the OWS in an area determined by examination of the groundwater gradient. One monitoring well will be placed downgradient of the OWS but outside of the plume. Two monitoring wells will be installed laterally from the monitoring well WITCTA031 to define the extent of the dissolved metals plume. Monitoring wells will be built according to construction procedures outlined in the project SAP. Low flow sampling methods and the field measurement of groundwater parameters outlined in the Sanitary Sewer System FSP will be used to collect groundwater samples from the permanent monitoring wells (IT, 1997c). The groundwater sampling methods are provided in Attachment 1 of this document.

Laboratory Methods. Groundwater confirmation samples from permanent monitoring wells will be collected and submitted for analysis using EPA SW846 Methods SW8260 VOA and

SW6010 RCRA metals, including mercury. Analytical parameters for both temporary and permanent monitoring well groundwater samples are shown in Table 3-4. The total number of samples collected, including QC samples, are shown in Table 3-5.

Groundwater field parameters will be measured during collection of samples from both temporary monitoring wells and permanent monitoring wells that have been installed. Parameters to be measured in the field include pH, temperature, conductivity, dissolved oxygen, turbidity, and redox potential. Field analysis parameters are shown on Table 3-6.

3.5 Investigation-Derived Waste Management

Wastes that may be generated during the RFI site investigation include: (1) purged groundwater, (2) decontamination water, (3) drill cuttings, (4) expendable personal protective equipment (e.g., Tyvek), and (5) general trash. Modifications to the planned waste management may be made if waste attributes change or field observations warrant a change. The general waste management approach is presented in this subsection; the detailed approach is included in the FSP (IT, 1997c).

All groundwater generated during monitoring well development and purging and decontamination water generated during decontamination process will be contained on-site (base) at the central storage location. All water will be stored in labeled, 55-gallon, U.S. Department of Transportation drums. The water will be tested for VOCs, diesel range organics, gasoline range organics, and metals and the analytical results reviewed to determine if the water requires treatment before disposal. If treatment is required, the water will be treated using carbon and tested prior to discharge to the sanitary sewer. The analytical results will be provided to NAS Fort Worth JRB environmental authorities for review and approval before discharge to the NAS Fort Worth JRB Sanitary Sewer System. The current designated authority is the U.S. Navy Environmental Affairs Office.

Drill cuttings from soil probe and drilling activities will be contained in drums, which will be labeled and kept at the NAS Fort Worth JRB designated storage location until analytical data are received. Contaminated soils will be disposed of at an appropriate licensed landfill, most likely as industrial, nonhazardous waste.

Waste disposal activity will be coordinated with NAS Fort Worth JRB environmental authorities. Any hazardous waste disposal will be at a site selected by NAS Fort Worth JRB environmental

Table 3-6

Groundwater Field Sampling Test and Method Table
OWS Phase 2 RFI Work Plan
NAS Fort Worth, Texas
Project No. 768579

Field Analysis	Method
Dissolved Oxygen	E360.1
Redox Potential	Martin Marietta Energy Systems, Inc. Environmental Surveillance Procedures, ESP-307-5
pH	SW9040
Total Volatiles	PID Organic Vapor Monitor
Conductivity	SW9050
Temperature	E170.1
Turbidity	E180.1

authorities, who will sign any transportation manifest as the "generator." Because there has been no hazardous waste generated in the past none is anticipated from this investigation. All waste management practices will follow the guidelines established by the TNRCC.

4.0 Reporting

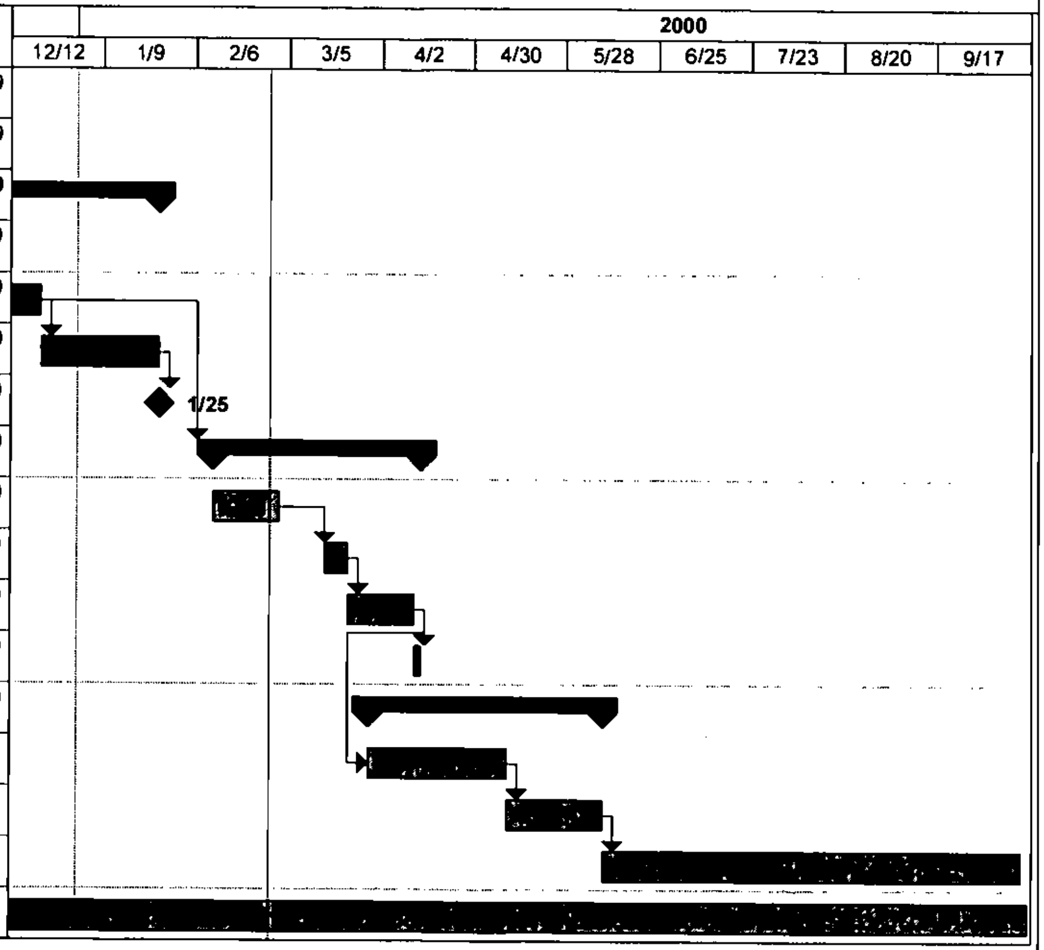
After the available data have been evaluated, including field characterization data from the OWS RFI, a report will be prepared that compiles and evaluates the information. The primary objective of the OWS Phase 2 RFI addendum report will be to compile all existing data, evaluate the data by current TNRCC regulations, and present conclusions as to the need for remedial or other actions.

5.0 Schedule

The project schedule is shown on Figure 17.

Figure 17
Project Schedule - OWS Phase 2 RFI
NAS Ft Worth, TX

ID	Task Name	Duration	Start	Finish
1	**Proposal**	0 days	Fri 4/30/99	Fri 4/30/99
2	**Notice to proceed**	0 days	Thu 7/22/99	Thu 7/22/99
3	**Plans**	**133 days**	**Fri 7/23/99**	**Tue 1/25/00**
4	Work Plan addendum	90 days	Fri 7/23/99	Thu 11/25/99
5	Review plans	17 days	Fri 11/26/99	Mon 12/20/99
6	Revise Plans	26 days	Tue 12/21/99	Tue 1/25/00
7	Issue DF Plans	0 days	Tue 1/25/00	Tue 1/25/00
8	**Environmental sampling**	**45 days**	**Fri 2/11/00**	**Thu 4/13/00**
9	Clearance	14 days	Fri 2/11/00	Wed 3/1/00
10	Mobilization	5 days	Thu 3/16/00	Wed 3/22/00
11	Sampling	14 days	Thu 3/23/00	Tue 4/11/00
12	Demob	2 days	Wed 4/12/00	Thu 4/13/00
13	**Data Management**	**51 days**	**Wed 3/29/00**	**Wed 6/7/00**
14	Analyses	30 days	Wed 3/29/00	Tue 5/9/00
15	Data Verification	21 days	Wed 5/10/00	Wed 6/7/00
16	**RFI Report Addendum**	90 days	Thu 6/8/00	Wed 10/11/00
17	**Project Administration**	321 days	Fri 7/23/99	Fri 10/13/00



Project: OWS NAS Ft Worth
Date: Mon 2/28/00

Task	Rolled Up Task	Project Summary
Progress	Rolled Up Milestone	Split
Milestone	Rolled Up Progress	Rolled Up Split
Summary	External Tasks	

511 53

6.0 Project Management

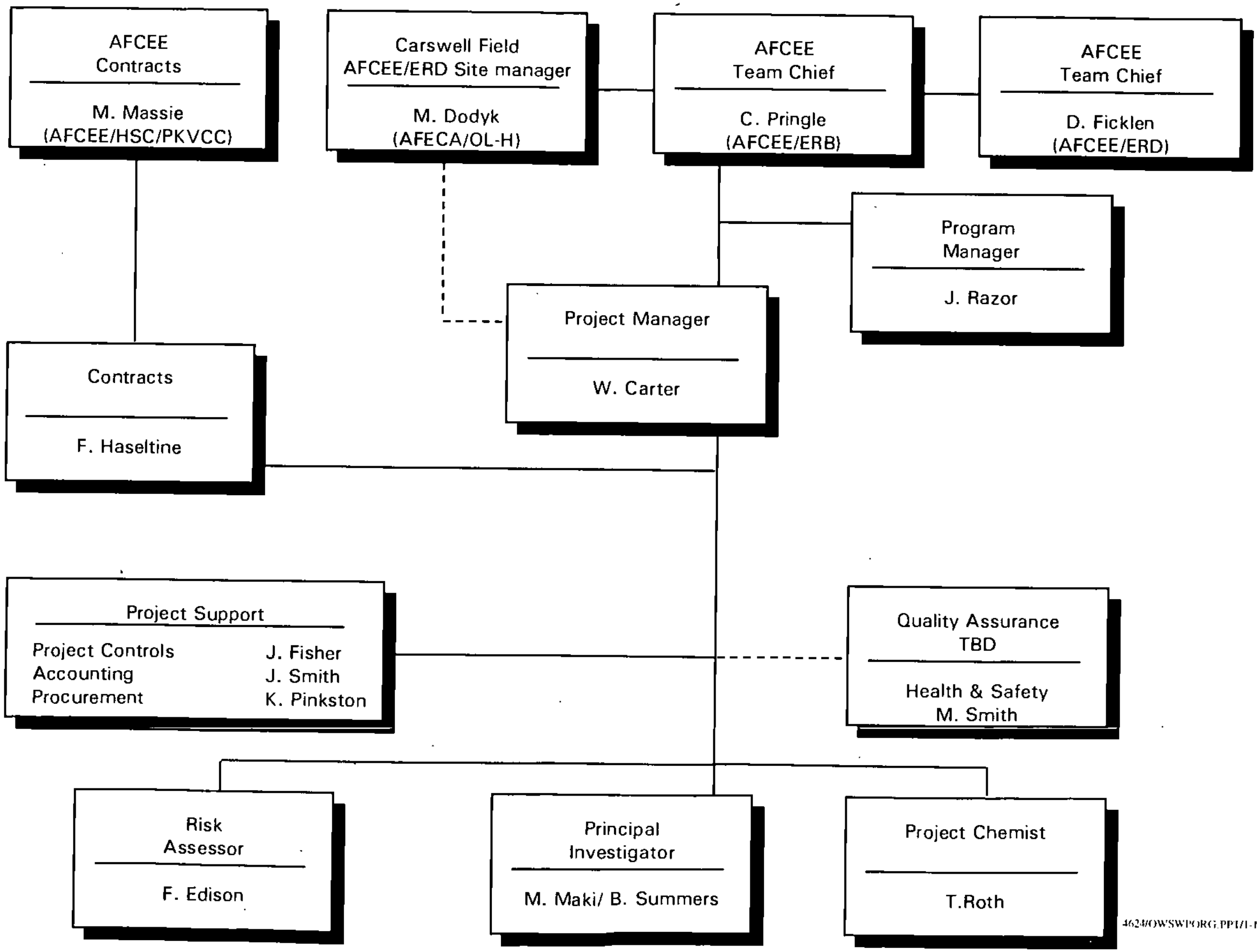
The objectives of this OWS Phase 2 RFI investigation are to:

- Complete OWS Phase 2 RFI addendum report tasks in accordance with this work plan, the Sanitary Sewer System RFI health and safety plan, and the Sanitary Sewer System Phase 2 RFI QAPP as scheduled and within the allotted budget.
- Communicate with project participants (Air Force Base Conversion Agency, AFCEE, TNRCC, EPA) the technical compliance, scheduled and actual program progress, and budgetary status of the project as appropriate.
- Complete and issue an OWS Phase 2 RFI addendum report.
- Submit to regulatory agencies recommendations for suggested remedial actions at OWS.

This task includes coordinating among other RFI project participants, as well as tracking schedules and budgets and preparing monthly status reports to AFCEE. Preparation of project information, forecasting, and updating of schedules and budgets will also be done under this task.

A more detailed description of project organization and responsibility is provided in Section 3.0 of the QAPP (IT, 1999). The project organization is shown on Figure 18.

Figure 18. Project Organization - OWS Phase 2 RFI (Project No. 768579)



4624/OWSWPORG.PPT/1-18-00

511 55

7.0 References

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CH2M Hill, 1996, ***HQ Air Force Center for Environmental Excellence, Interim Draft, Naval Air Station Fort Worth Joint Reserve Base, Base-Wide Quality Assurance Project Plan***, August 1996.

IT Corporation (IT), 1998a, ***Air Force Center for Environmental Excellence, NAS Fort Worth Joint Reserve Base, Fort Worth, Texas, Draft Oil Water Separator RCRA Facility Investigation Addendum Report***, July 1998.

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IT Corporation (IT), 1997b, ***Air Force Center for Environmental Excellence, NAS Fort Worth Joint Reserve Base, Fort Worth, Texas, Sanitary Sewer System RCRA Facility Investigation Work Plan***, January 1997.

IT Corporation (IT), 1997c, ***Air Force Center for Environmental Excellence, NAS Fort Worth Joint Reserve Base, Fort Worth, Texas, Sanitary Sewer System RCRA Facility Investigation Field Sampling Plan***, January 1997.

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Kearney, A. T., 1989, ***RCRA Facility Assessment, PR/VSI Report, Carswell Air Force Base, Fort Worth, Texas***, March 1989.

Law Environmental, Inc., 1995, ***Installation Restoration Program, Naval Air Station Fort Worth Joint Reserve Base, Final Oil/Water Separator Assessment Report***, November 1995.

ATTACHMENT I

FIELD SAMPLING PLAN PROCEDURES FOR OIL/WATER SEPARATOR PHASE 2 RFI

5.0 Field Operations

5.1 Geologic Standards

The lithologic descriptions for consolidated materials (igneous, metamorphic, and sedimentary rocks) shall follow the standard professional nomenclature (Tennissen, 1983), with special attention given to describing fractures, vugs, solution cavities and their fillings or coatings, and any other characteristics affecting permeability. Colors shall be designated by the Munsell Color System.

The lithologic descriptions for unconsolidated materials (soils [engineering usage] or deposits) shall use the name of the predominant particle size (e.g., silt, fine sand, etc.). The dimensions of the predominant and secondary sizes shall be recorded using the metric system. The grain size and name of the deposit shall be accompanied by the predominant mineral content, accessory minerals, color, particle angularity, and any other characteristics. The clastic deposit descriptions shall include, as a supplement, symbols of the Unified Soil Classification System (USCS). The color descriptions shall be designated by the Munsell Color System.

The sedimentary, igneous, and metamorphic rocks and deposits shall be represented graphically by the patterns shown in Figure 5-1. Columnar sections, well and boring logs, well construction diagrams, cross sections, and three-dimensional (3-D) diagrams shall use these patterns. Supplementary patterns shall follow Swanson, 1981. Geologic structure symbols shall follow 1989 American Geological Institute Data Sheets.

The scales for maps, cross sections, or 3-D diagrams shall be selected in accordance with the geologic and hydrologic complexity of the area and the purposes of the illustrations. Geophysical logs shall be run at a constant vertical scale of 1 inch equals 20 feet. When geophysical logs are superimposed on geologic logs, cross sections, or 3-D diagrams, the scales shall be the same. If defining geological conditions requires other scales, additional logs at those scales shall be provided.

For orientation, the cross sections shall show the northern end on the viewer's right. If the line of cross section is predominantly east-west, the eastern end is on the right. Maps shall be oriented with north toward the top, unless the shape of the area dictates otherwise. Indicate orientation with a north arrow.

5.2 Site Reconnaissance, Preparation, and Restoration Procedures

A request will be made by IT's principal investigator through the Air Force to "clear" all utility lines where there will be subsurface investigation. These areas shall be cleared by the Air Force or its designee for the presence of underground utilities. Utility locations will be determined using existing utility maps. NAS Fort Worth facility engineering personnel will clear utilities at intrusive sampling locations before issuing a digging permit. These will be updated in the field and are verified using a hand-held magnetometer or utility probe. Vehicle access routes to sampling locations shall be determined prior to any field activity. Caution tape and barricades will be used to delimit work areas. Personnel will be trained by NAS Fort Worth personnel before permitted access to flight line operations areas.

A designated decontamination area shall be provided for drilling rigs and equipment. The decontamination area shall be large enough to allow storage of cleaned equipment and materials prior to use, as well as to stage drums of decontamination waste. The decontamination area shall be lined with a minimum 6-mil heavy gauge plastic sheeting, and designed with a collection system to capture decontamination waters. Solid wastes shall be accumulated in 55-gallon drums or roll-off boxes and subsequently transported to a waste storage area designated by the Air Force. Smaller decontamination areas for personnel and portable equipment shall be provided as necessary. These locations shall include basins or tubs to capture decontamination fluids, which shall be transferred to a large accumulation tank as necessary. These designated areas of decontamination shall be arranged with NAS Fort Worth and AFBCA personnel prior to mobilization.

The contractor's field operation office will be established in that area designated by the AFBCA remedial project manager.

Each work site or sampling location shall be returned to its original condition when possible. Efforts shall be made to minimize impacts to work sites and sampling locations, particularly those in or near sensitive environments such as wetlands. Following the completion of work at a site, all drums, trash, and other waste shall be removed. Decontamination and/or purge water and soil cuttings shall be transported to the designated locations as described in Section 5.12.

5.3 Geophysical Surveys

No geophysical surveys will be performed as part of this investigation.

5.4 Soil Gas Surveys

No volatile organic compound soil gas surveys will be performed as part of this investigation.

5.5 Soil Probe Installations, Lithologic Sampling, Logging, and Abandonment

5.5.1 Soil Probe Borings

The sanitary sewer system soil assessment will be performed with soil probe sample locations located along the length of the Base sanitary sewer system. Subsurface assessment of soil for the sanitary sewer system RFI will be performed with soil probe methods to define the vertical and horizontal extent of soils impacted from any releases of contaminants from the sanitary sewer system.

Soil probe assessment borings will be performed with decontaminated Geoprobe® or equivalent hydraulic equipment. Either a large bore (1.0625-inch inside diameter [ID]) or Maccro-core® (1.5-inch ID) soil sampler will be used with a polyethylene terephthalate (PET) or cellulose acetate butyrate (CAB) liner in the sample tube.

Soil probes will be advanced and samples collected continuously from the surface to the top of the groundwater table. The soil probe unit consists of a truck-mounted hydraulic-driven soil probe with steel probe rods, and assorted sampling equipment. A hydraulically driven hammer drill will penetrate paved or hard surfaces before continuous sampling begins. All parts of the soil probe assembly that contact soils will be decontaminated between each use.

Soil boring locations will be located as close to the buried sanitary sewer lines as possible without unreasonable risk of puncturing the line as determined by the accuracy of the utility field location. This will usually be within 2 to 3 feet from the centerline of the sanitary sewer or 2 feet from the edge of a manhole or OWS structure. The field geologist will estimated the centerline of the sewer line based on the alignment of consecutive manholes straddling the sewer line sampling location and confirmation of the line location and its diameter on utility maps provided by the Air Force. During advancement of the boring, the field geologist will determine from recovered samples if the material has characteristics of select fill material or disturbed or undisturbed native material. Disturbed native material, created during installation of the line, may have erratic soil structure and artifacts such as angular limestone gravel clasts. The characteristics of the material will be noted on field logs (Appendix A). The data will be used to determine the acceptable locations for groundwater sampling.

Soil borings will be advanced by directly pushing the drive probe to 4 feet above the estimated water table based on historical groundwater elevations at the boring for the time if year when the sample is being collected. The soil will then be continuously sampled until either 2 feet above the water table where contaminated groundwater has previously been determined to exist or immediately above the water table where there is no evidence of previous groundwater contamination. The sample at the deepest point sampled but above groundwater will be sent for analysis.

The soil sample device has a retractable drive point that will allow driving the sampler to the calculated elevation above the groundwater table, releasing the drive point, and then continuing to drive the sampling tube across the selected soil simple interval. The probe unit then retracts the soil sampler to the surface where the soil sample is extracted from the sampling tube. The soil sample will be encased in a clear PET or CAB liner that will allow visual classification of the soil and collection of soil samples by the field geologist. The sleeve containing the selected soil sample will be capped with Teflon® tape and slip-on end caps.

Field screening will be accomplished by use of a PID measuring headspace vapors of selected portions of the soil sample. Soil samples will be placed in a sealable plastic bag with boring number, depth, and time marked on it, and the bagged sample allowed to adjust to ambient surface temperature. Headspace concentrations in the plastic bag will be checked by puncturing the bag with a PID probe, measuring the headspace concentration in the bag, and recording the PID reading and time on the soil classification log in Appendix A.

Continuous soil sampling and logging of soils will be performed at subsurface soil sampling locations instead of grab sampling techniques at locations where a groundwater monitoring well will be installed. The monitoring well locations are shown on Figure 3-2. The soil probe will be advanced until suitable aquifer material for setting the probe is found or to probe refusal. Local changes in geologic conditions, such as unanticipated shallow bedrock or a shallow groundwater table elevation may result in the field geologist moving and resampling the subsurface soil sample location using continuous soil sampling techniques. This will be performed in order to collect additional stratigraphic data in the area; identify the groundwater table; identify the soil interval above the groundwater table for collection of an unsaturated soil sample; and to identify suitable aquifer material for monitoring well installation in the immediate area.

5.5.2 Plugging and Abandonment

Completed soil probe and other borings will be abandoned by filling the boring with bentonite chips placed from total depth to the surface, tamping the chips in the boring with a rod, and hydrating the chips with potable water. The boring will be reinspected by the field geologist within 24 hours to determine if grouting of the boring is satisfactory and if additional grout materials may be needed. Borings located on paved surfaces will be capped with an asphaltic material plug.

At each sampling point in the hardened areas, a fully penetrating, 3- to 4-inch-diameter concrete core will be installed. The core bit will be cooled by water. To keep the work area clean, the water and concrete cuttings mixture will be collected by the operator. Upon completion of the sampling activities in the hardened areas, bentonite pellets/chips will be placed down the annulus of the boring to approximately 6 inches below the base of the concrete, followed by clean potable water to allow for hydration. After the bentonite pellets/chips have been allowed to hydrate for a minimum of 2 hours, the remainder of the cored sample location will be filled to grade with a mixture of 60 pounds of Sakrete and 94 pounds of Portland cement and allowed to dry. This mixture will give the concrete core a dry compressional strength of approximately 5,000 pounds per square inch. Due to the small diameter of the concrete core, rebar will not be used to strengthen the location.

5.6 Monitoring Wells

5.6.1 Permanent Monitoring Well Installation

The hollow-stem auger method will be used to install monitoring wells required during the NAS Fort Worth sanitary sewer system RFI. All drilling equipment that will come in contact with the borehole or groundwater will be decontaminated in accordance with approved methods in Section 5.12. A soil boring will be enlarged by over-reaming, if necessary, and completed as a monitoring well. The ID of the decontaminated over-reaming auger shall be at least 6 inches in outside diameter. Figure 5-2 shows a general monitoring well design.

Well screens will be 2-inch ID Schedule 40 polyvinyl chloride (PVC) pipe with a 0.01-inch slot (No. 10) size with a threaded cap below the screen. The well screen will be steam-cleaned no more than 24 hours before installation and wrapped in uncontaminated plastic to protect its cleanliness until use. The condition of the well screen will be inspected by the geologist prior to its placement. Connections between the screen and well casing will be flush-threaded with no glue used to join casing. A direct measurement of the borehole depth by the use of a weighted tape will be made before screen placement. The depth, to the nearest tenth of a foot, will be recorded on the well construction log. The screen for monitoring wells will cover the full saturated thickness of the water bearing unit, but it will not exceed 10 feet in length. The top of the screened interval will extend a maximum of 2 feet above the top of the saturated interval for future potential remedial uses of the well. Screen length may be increased in the field in areas where the saturated thickness exceeds 10 feet, with concurrence from the AFCEE designated field representative.

The well casing will be 2-inch ID Schedule 40 PVC blank pipe with threaded connections. The well casing will extend from the top of the screen to approximately ground surface for a flush-mount style completion. The top of the well casing will be secured with a well cap to prevent entry of foreign objects during completion (Figure 5-2).

After the screen is placed inside the augers, the filter pack will be placed between the screen and inner wall of the hollow-stem auger. The filter pack is to be placed in the well by tremmie pipe in such a manner as to be distributed around the screen at a uniform height and density. For wells with a total depth shallower than 25 feet, however, the filter pack sand may be placed in the annulus between the well screen and the augers as the augers are withdrawn from the boring to allow the filter pack to slump against the side walls of the boring and prevent borehole caving.

The filter pack will extend a minimum of 2 feet and a maximum of 5 feet above the top of the well screen. The filter pack will consist of a washed, rounded 95 plus percent silicious aggregate, and will be free of lignite and chlorides. The filter pack sand for the wells will be 20/40 sized sand. The field geologist will inspect the filter pack prior to placement.

The bentonite seal will consist of at least 2 feet of bentonite above the filter pack and below the grout seal. The well construction will be designed so the bentonite is placed in a nontransmissive zone and effectively isolates the screened interval. The bentonite will be 100-percent sodium bentonite pellets and will be placed on top of the sand pack in the annular space between the well casing and the augers. The augers will be raised to allow the bentonite pellets to slump against the side walls of the boring. After the elevation of the top of the bentonite seal is confirmed by weighted tape, the bentonite pellets will be hydrated with potable water and well activity will cease for 2 hours to allow the bentonite to hydrate. After the hydration period, the top of the bentonite seal will be determined by direct measurement with a weighted tape and recorded on the well construction log.

Cement/bentonite grout will consist of portland cement and powdered sodium bentonite mixed to a 13.8 plus or minus 0.3 lbs/gal (5 percent mix) slurry weight. The grout will be pumped using a side discharge tremmie pipe until the grout returns to the surface. The level of the grout mixture will be left 1 foot bgs to allow installation of flush mount casing protectors.

Flush mount surface completions will be flush with the land surface if located on a paved surface. The casing protector will be located in the middle of a 4-by-4-foot by 4-inch-thick concrete pad that slopes away from the casing protector at 1/4 inch per foot. The identity of the well shall be permanently marked on the well cover lid and the casing cap and secured by lock and key.

5.6.2 Well/Piezometer Completion Diagrams

A completion diagram shall be submitted for each permanent monitoring well or piezometer installed. It shall include the following information: (1) well identification (this shall be identical to the boring identification described), (2) drilling method, (3) installation date(s), (4) elevations of ground surface and the measuring point notch, (5) total boring depth, (6) lengths and descriptions of the screen and casing, (7) lengths and descriptions of the filter pack, bentonite seal, casing grout, and any back-filled material, (8) elevation of water surface before and immediately after development, and (9) summary of the material penetrated by the boring.

Forms for these data are in Appendix A of this document.

5.6.3 Monitoring Well Development

Each well will be developed using a decontaminated submersible pump, bottom discharge/filling bailer, or a surge block as soon as practical, but not sooner than 48 hours nor longer than 7 calendar days after placement of the internal cement/bentonite well grout seal. Prior to development, the static water level will be measured from the top of the casing and recorded. During purging, water throughout the entire water column will be removed by periodically raising and lowering the development equipment.

Well development will consist of evacuating water and surging the well until the groundwater produced is clear and the sediment thickness remaining in the well is less than 1 percent of the screen length. Representative groundwater is presumed to have been obtained when:

- A minimum of five casing volumes of water have been removed from the well.
- The water is clear to the unaided eye and is relatively free of suspended sediments. Turbidity measurements will not be taken.
- Field measurement of the water for pH is within 0.1 standard unit of the previous reading.
- Field measurement of the water specific conductivity is within 5 percent of the previous reading.
- Field measurement of the water temperature is within 1 °C of the previous reading.

tubing. The groundwater sample device will be purged by pumping to allow formation water into the sampler before the sample is collected.

5.6.6 Temporary Monitoring Well Purging

Well development using the temporary sample device will require evacuation of groundwater from the well until the groundwater produced is relatively clear to slightly turbid and the sediment thickness remaining in the well is less than 10 percent of the screen length. Representative groundwater is presumed to have been obtained when:

- A minimum of five casing volumes of water have been removed from the sampling device.
- The water is relatively clear to the unaided eye and is relatively free of suspended sediments.
- Field measurement of the water for pH is within 0.1 standard unit of the previous reading.
- Field measurement of the water specific conductivity is within 5 percent of the previous reading.
- Field measurement of the water temperature is within 1 °C of the previous reading.

Field measurements will be recorded on the groundwater well development/purge log in Appendix A.

After collection of the groundwater sample, the sampling device and rods will be retrieved from the boring and the hole grouted. Plugging and abandonment procedures in Section 5.5.2 will be used to abandon these temporary wells.

5.7 Aquifer Tests

No aquifer tests will be performed.

5.8 Test Pit Excavation

No test pits will be installed.

5.9 Surveying

All surveying locations of field activities shall be measured by a certified land surveyor as the distance in feet from a reference location that is tied to the state plane system. The surveys shall be third order (Urquhart, 1962). An XY-coordinate system shall be used to identify locations. The X-coordinate shall be the east-west axis; the Y-coordinate shall be the north-south axis. The reference location is the origin. All surveyed locations shall be reported using the state plane coordinate system. The surveyed control information for all data collection points shall be recorded and displayed in a table. The table shall give the X and Y coordinates in state plane coordinate values, the ground elevation, and the measuring point elevation if the location is a ground-water monitoring well. The elevation of all newly installed wells and piezometers shall be surveyed at the water level measuring point (notch) on the riser pipe. Include the elevation of the ground surface in the survey. Soil probe locations will be surveyed with elevation of the ground surface measured and recorded.

5.10 Equipment Decontamination

5.10.1 Nonsampling Equipment

A centrally located decontamination station will be established for decontamination of equipment. The decontamination station will include a pad on which the drilling rig, soil probe unit, and other large equipment, such as auger flights, can be steam-cleaned. The decontamination pad will be of a temporary construction. The decontamination pad will consist of two layers of minimum 6-mil high-density polyethylene plastic sheeting laid out on a level, firm surface. The pad edges will be built up with material (lumber or steel) to contain decontamination water. A collection sump will be furnished inside the pad to allow removal of the decontamination waters. Coordination with NAS Fort Worth personnel will be required to identify the location of the decontamination station. Access to the decontamination station area will be controlled by caution tape, barricades, and warning signs.

The drill rigs and other equipment that could come in contact with the soil being investigated will be steam-cleaned between each hole. The general procedures for nonsampling equipment are as follows:

- Augers and other drilling equipment in contact with soil will be decontaminated before coming onto the NAS Fort Worth sanitary sewer RFI site and before leaving the site.
- Augers, bits, and rods will be decontaminated with high-pressure hot water, scrubbed with phosphate-free detergent, rinsed thoroughly by steam cleaning, and allowed to air dry.
- All casings, screens, and other downhole equipment will be steam-cleaned prior to installation and wrapped in plastic to prevent recontamination.

5.10.2 Sampling Equipment

Field measurement equipment will be kept free of contamination. All reusable field equipment used to collect, handle, or measure samples shall be decontaminated before coming into contact with any sample. Brushes and soap will be used to remove dirt from equipment that comes into contact with soils.

The decontamination procedures for sampling equipment are as follows:

- Use potable water from a known source with a phosphate-free detergent to wash and brush soil from the sampling item.
- Rinse sampling item thoroughly with potable water; check item for any residual dirt, and rewash if necessary.
- Rinse item with ASTM Type II Reagent-grade deionized water.
- Rinse item with solvent (methanol) to remove residual organics. Follow with a deionized water rinse if fuels are encountered. Solvents will be pesticide grade or better. A hexane rinse will only be used in highly contaminated areas where liquid wastes are present on the tools.
- Allow item to completely air-dry prior to any use. Cover item with uncontaminated plastic if it is not intended for immediate use.

5.11 Waste Handling

The potential investigation waste types generated from work performed during field activities are:

- Drill cuttings and soil samples
- Developments and purge water from well installation and sampling
- Decontamination water
- Personnel protective equipment and decontamination equipment.

Procedures for disposal of these wastes will be coordinated with Base personnel. Analytical testing of these wastes may be required to characterize the waste for disposal. An analytical sample for VOCs, SVOCs, total petroleum hydrocarbons, and metals will be collected from each 50 cubic yards of investigation-derived waste soils to determine if the soils are hazardous by TNRCC Risk Reduction Standards and to subcontract disposal options. All decontamination fluid will be collected, contained in an appropriate vessel, properly labeled, and stored on-site at an approved storage facility at the Base. All soils generated during soil borings, well installation, and sampling activities will be collected, contained in drums or roll-off boxes, properly labeled, and stored on site until disposal or treatment is conducted. All drums will be clearly labeled with the contents, date of accumulation, location generated, and generator.

5.12 Hydrogeological Conceptual Model

Modeling is not part of this project.

6.0 Environmental Sampling

All purging and sampling equipment shall be decontaminated according to the specifications in Section 5.12 prior to any sampling activities and shall be protected from contamination until ready for use.

6.1 Soil Sampling Procedures

6.1.1 Surface Soil Sampling

Surface soil samples will be collected from the 0-to-1-foot interval. The surface soil samples will be collected with the direct-push rig in PET or CAB liners. If the samples cannot be collected due to either surface fill material or poor soil cohesiveness, a California modified shoe with brass liners will be driven through the interval in 6-inch increments with a slide hammer. The samples will be collected, described, logged, labeled, preserved, and stored for analyses.

Surface soil locations are at selected locations of the Base and are presented in Table 3-2.

6.1.2 Subsurface Soil Probe Sampling

Soil samples will be visually examined by a certified geologist experienced with the Base's lithology. Samples will be described in accordance with ASTM D-2487 (USCS) and the Munsell Color Chart. All information regarding soil texture, consistency, and color shall be recorded on drilling logs. Additional information recorded on the borehole log will be soil sampling location, the method of sampling, the percent recovery of the sample, the depth to first water encountered, and the results of field screening.

Field screening of the soil samples with a PID will provide qualitative information on the location of soils potentially impacted with petroleum hydrocarbons. Each sample collected from a boring will be observed for physical evidence of contamination, such as staining or presence of residues. The soil cores will be collected in clear PET or CAB liners of either 24 or 48 inches in length. The length will be determined in the field by the supervising geologist. The cores will be visually examined through the clear liner for soil properties classification and visual hydrocarbon staining. The interval selected for soil analysis will be isolated from the rest of the core by cutting the sample (including the liner) from the rest of the core using a decontaminated knife. The ends of each sample tube will be covered with Teflon® tape and capped with a vinyl or polyethylene cap. The geologist will maintain detailed boring logs in conformance with standard operating procedures outlined in the QAPP. The soil probe rig will be decontaminated prior to collecting samples, and any part of the rig will be decontaminated that will contact a sample between boreholes.

The geologist will classify the soil by ASTM methods, including soil type, color, moisture, and firmness, and will note other soil characteristics such as staining. Additional information recorded on the borehole log will be soil sampling location, the method of sampling, the percent recovery of the sample, the depth to first water encountered, and the results of field screening. All hand soil sampling tools will be decontaminated between each use. Care will be taken not to touch the ends of the sleeves before capping. The exterior of the cap will be taped to the tube holding the sample, the sample will be labeled accordingly, and stored in a cooler at the site at 4°C before submittal to the laboratory for analysis.

PID readings for field screening will be taken at the exposed ends of the sample. The remaining portion of each sample will be placed in a resealable plastic bag for field screening. Each jar and bag will be marked with the boring number, depth of sample collected, and time of sample collection. Headspace concentrations in the plastic bags will be checked after 10 minutes by puncturing the bag with the PID probe, measuring the headspace concentration in the bag, and recording the PID reading and time on the borehole log.

The soil probe sample names, the number of samples to be collected at each location, the laboratory analysis, and QC samples to be collected are shown in Table 3-2. Twelve biotechnical samples will be collected from six selected soil borings in both the vadose zone and the saturated zones. The biotechnical samples will be collected in the PET or CAB tubes, the ends of the tube sealed with Teflon tape and a vinyl cap, and the sample labeled before submittal for analysis. Biotechnical sample analyses are provided in Table 3-5. Twelve geotechnical samples will be collected from six selected soil borings. The geotechnical samples will be collected in brass tubes, the ends of the tubes sealed with Teflon tape and a vinyl cap, and labeled. Geotechnical sample analysis is provided in Table 3-6.

6.2 Groundwater Sampling

Groundwater samples for laboratory analysis will be collected from temporary groundwater sampling points and any monitor wells installed at NAS Fort Worth during the sanitary sewer system RFI. Groundwater sample collection procedures will follow standard procedures outlined in Section 5.0 of the QAPP addendum. Low flow groundwater sampling techniques will be utilized to collect samples from groundwater monitoring wells.

The air in the breathing zone will be checked with a PID each time a well cap is removed prior to monitoring well activity. Each well shall be inspected for signs of tampering or other damage. If tampering is suspected, it will be recorded on the Field Activity Daily Log, on the sampling form, and reported to the principal investigator. Wells that are suspected to have been tampered with will not be sampled until the matter has been cleared by the principal investigator or the project manager. Each well will be measured with an interface probe to collect water level data and to check for and measure light nonaqueous-phase liquid thickness. The forms of recording data are in Appendix A. The field geologist will calculate the volume of water for the well bore volume and the total for three well bore volumes of groundwater needed to purge the well.

Before the start of sampling activities, plastic sheeting will be placed on the ground surrounding the well. Remove any water in the well protective casing before venting and purging the well. Well purging will consist of evacuation of water until the groundwater has little visible turbidity (i.e., is clear) and the groundwater parameters (temperature, pH, and conductivity) have stabilized as defined in the following paragraphs. Purging and sampling of the wells will be performed in a manner that minimizes agitation of sediment in the well and formation. Equipment will not be allowed to free fall into the well.

The groundwater sample numbers, the number of analytical samples to be collected at each location, the laboratory analysis, and QC samples to be collected are shown on Table 3-3. Field analytical tests and methods for groundwater samples are shown on Table 3-7.

In addition to the information required in Chapter 8.0, the following information shall be recorded each time a well is purged and sampled (forms are in Appendix A). This information shall be encoded in IRP Information Management System (IRPIMS) files when required: (1) depth to water before and after purging, (2) well bore volume calculation, (3) total depth of the monitor well as measured with a tape, (4) the condition of each well, including visual (mirror) survey, (5) the thickness of any nonaqueous layer, and (6) field parameters, such as pH, temperature, specific conductance, and turbidity.

6.2.1 Water Level Measurement

An interface probe shall be used if a nonconductive nonaqueous-phase liquid (NAPL) is suspected in a monitoring well. The interface probe shall be used to determine the presence of light or dense NAPL, if any, during measurement of the groundwater level.

Water levels will be measured from the top of monitor well casing and recorded on the well sampling form. If well casings are not notched, measurements will be taken from the north edge of the top of the well casing, and a notch will be made with using a decontaminated metal file. Following water level measurement, the total depth of the temporary well point or monitoring well from the top of the casing will be determined using the electric water level indicator or the interphase probe (monitoring well) and recorded on the well sampling form. The water level depth will then be subtracted from the total depth of the well to determine the height of the water column present in the well casing. Groundwater field sampling forms are located in Appendix A. All water level and total depth measuring devices shall be routinely checked at least annually with a tape measure to ensure measurements are accurate.

The volume of a 1-foot section of the well borehole (F) can also be calculated using the formula:

$$F = \pi(D/2)^2 \times 7.48 \ gal/ft^3$$

where:

π = 3.14
D = the inside diameter of the well borehole in feet.

6.2.2 Groundwater Sample Collection

Before collecting groundwater samples, the sampler will don clean, phthalate-free protective gloves. From monitoring wells, VOC samples will be collected first using disposable clear polyethylene tubing discharging directly into the sample container. Low flow sampling will use small positive displacement pumps. Samples to be analyzed for volatile or gaseous constituents will not be withdrawn with pumps that exert a vacuum on the sample. Polyethylene tubing used for sample collection will be used once and then disposed of.

The sampler will establish a pump flow rate to minimize groundwater head drawdown low flow groundwater sampling procedures. After the flow rate is established, the sampler will monitor groundwater parameters of temperature, pH, dissolved oxygen, and conductivity and record the measurements on a groundwater sample collection log (Appendix A). Low flow sampling procedures will be conducted by the following methods:

- The sampling pump should be installed at the same depth in each well. Moderate sustained well yields of 5 gallons per minute are common and pumps will be set in the upper third of the saturated well screen due to low expected drawdown. If low-yielding wells are present in an area, then the pump should be positioned towards the bottom one-third of the saturated well screen.

- A pumping rate that minimizes drawdown in the well will be established. Initial purge rates will begin at 0.2 liter per minute (L/min). If the well drawdown is very low, the purge rate may be increase to up to 2.0 L/min. Well drawdown should not exceed one-third of the water column.

- A minimum of three casing volumes of water will be purged from the well.

- Purging a monitoring well will be considered complete where three casing volumes of water have been removed, and:

  - Field measurement of groundwater turbidity is less than or equal to 5 nephelometric turbidity unit (NTU) in one of three consecutive readings or three consecutive turbidity readings less than 10 NTUs are attained.

  - Field measurement of the water for pH is within 0.1 standard unit of the previous reading.

  - Field measurement of the water specific conductivity is within 5 percent of the previous reading.

  - Field measurement of the water temperature is within 1°C of the previous reading.

  - Field measurement of the dissolved oxygen is within 0.3 milligrams per liter of the previous reading.

- Once the parameters stabilize and the purge is complete, the flow rate will be reduced to 100 milliliters per minute before collecting the groundwater sample.

If the parameters do not stabilize, the sample will be collected after a maximum of six well volumes have been removed, and the nonstabilizing parameters will be documented and brought to the task leaders attention. All field measurements of groundwater collected by low flow methods will be made with the instrument probes submerged in a flow cell.

An initial groundwater sample will be collected at least 24 hours after completion of monitoring well development. Subsequent samples may be collected when scheduled. A groundwater sample may not be collected until three well bore volumes have been removed and the listed field parameters have stabilized. The sample will then be collected immediately after the water level has recovered to 80 percent of its static level or 8 hours after completion of purging, whichever comes first. The field geologist will record measurements on a groundwater sample collection log (Appendix A) all pertinent information from the well being developed; the water level; the groundwater parameters measured after each well volume removed; and total volume removed.

VOC sample bottles will have been prepared by the laboratory with hydrochloric acid preservative. The sample will be collected from the bailer with a bottom discharge device down the side of a tilted sample vial to minimize volatilization. The sample vial will be filled until a meniscus is visible and immediately sealed. When the bottle is capped, it will be inverted and gently tapped to ensure no air bubbles are present in the vial. Vials with trapped air will be refilled until no bubbles are present in the vial. These samples will never be composited, homogenized, or filtered.

Following collection of VOC samples, remaining water samples will be collected in the following order: SVOCs, pesticides/PCBs (if collected at that location), metals, sulfate, nitrate, alkalinity (if biotechnical samples are collected at that location) and field analytical methods for ferrous iron, carbon dioxide, and sulfide. The pH of preserved sample will be checked by pouring a small amount of a non-VOC water sample onto pH paper. The paper will not touch the inside of the container. The preservation checks will be documented in the chain-of-custody forms. One preserved VOC sample a day that will not be submitted for laboratory analysis will be checked with pH paper to verify proper preservation.

6.3 Surface Water Sampling

Surface water samples for laboratory analysis will be collected from springs located near the sanitary sewer within 8 hours after any seepage is observed. Surface water sample collection procedures will follow standard procedures outlined later in this section.

The temperature, pH, conductivity, and dissolved oxygen will be measured and recorded at each surface water sampling location before and after each sample is collected. The surface water sample names, the number of analytical samples to be collected at each location, the laboratory analyses, and QC samples to be collected are shown in Table 3-4.

The samples will be collected from the spring at each surface water location with a decontaminated, polyethylene pitcher. Samples will be collected at the surface of the water. Sample collection order will be VOCs, SVOCs, total metals, nitrate, sulfate, total dissolved solids, and alkalinity.

The background surface water sample, upstream of the spring, will be collected first. The second surface water sample will be located at the source of the spring. Each sampling location will be marked with a stake with the sample location marked on it. The field geologist will record on a specified field form all pertinent information of the surface water sampling location, including; the location of the spring, any sewers of discharge pipes, the estimated width, depth, and flow rate of the spring, the surface water parameters measured with field instruments, instrument calibration, and the samples collected and submitted for analysis.

6.4 Sediment Sampling

There will be no sediment sampling.

6.5 Soil Gas Sampling

There will be no soil gas sampling.

6.6 Indoor Air Sampling

Indoor air sampling is not applicable to the project.

6.7 Sample Handling

6.7.1 Sample Containers

Sample containers are purchased precleaned and treated according to EPA specifications for the methods. Containers will be stored in clean areas to prevent exposure to fuels, solvents, and other contaminants. Amber glass bottles are used routinely where glass containers are specified in the sampling protocol.

6.7.2 Sample Volumes, Container Types, and Preservation Requirements

Sample volumes, container types, and preservation requirements for the analytical methods performed on samples are listed in Section 5.0 of the QAPP.

6.7.3 Sample QA/QC Requirements

These requirements are defined and specified in Section 4.4 of the QAPP.

7.0 Field Measurements

7.1 Parameters

Table 3-7 specified the parameters that will be field measured.

7.2 Equipment Calibration and Quality Control

Equipment calibration requirements are specified in Section 4.3 of the QAPP.

7.3 Equipment Maintenance and Decontamination

Preventative maintenance for equipment will be completed per Section 10.0 of the QAPP. Decontamination will be in accordance with that specified in Chapter 5.0.

7.4 Field Monitoring Measurements

7.4.1 Groundwater Level Measurements

Water level measurements shall be taken in all wells to determine the elevation of the water table within a single 24-hour period prior to a sampling round or initial well development. These measurements shall be taken after all wells have been installed and developed and their water levels have completely recovered. Any conditions that may affect water levels shall be recorded in the field log.

Water level measurements may be taken with electric sounders, air lines, pressure transducers, or water level recorders (e.g., Stevens recorder). Devices that may alter sample composition shall not be used. All measuring equipment shall be decontaminated according to the specifications in Section 5.12. Groundwater level shall be measured to the nearest 0.01 foot. Measurements will be taken to top of casing at the notched point.

Static water levels shall be measured prior to each time a well is sampled. If the casing cap is airtight, allow time prior to measurement for equilibration of pressures after the cap is removed. Repeat measurements until water level is stabilized.

7.4.2 Light or Dense Nonaqueous-Phase Liquid Measurements

The thickness of light or dense NAPL in monitor wells shall be measured with an electronic interface probe. Hydrocarbon detection paste, or any other method that may affect water chemistry, shall not be used. When detected, the presence of NAPL materials shall be confirmed by withdrawing a sample with a clear, bottom-fill bailer.

7.4.3 Groundwater Discharge Measurements

Groundwater discharge measurements shall be obtained during monitor well purging. Groundwater discharges may be measured with orifice meters, containers of known volume, in-line meters, flumes, or weirs, following the guidelines specified in the *Water Measurement Manual*, Bureau of Reclamation, 1967. If discharge measuring devices are upstream of sample collection points, the devices shall be decontaminated. Measurement devices shall be calibrated using containers of known volume.

7.5 Field Performance and System Audits

The field performance and system audits, if conducted, will be completed as specified in Section 9.0 of the QAPP.

8.0 Record Keeping

The contractor shall maintain field records sufficient to recreate all sampling and measurement activities and to meet all IRPIMS data loading requirements. The requirements listed in this section apply to all measuring and sampling activities. Requirements specific to individual activities are listed in the section that addresses each activity. The information shall be recorded on forms provided in Appendix A of this document with waterproof black indelible ink. These records shall be archived in an easily accessible form and made available to the Air Force upon request.

The following information shall be recorded for all field activities: (1) location, (2) date and time, (3) identity of people performing activity, and (4) weather conditions. For field measurements, the following shall be recorded: (1) the numerical value and units of each measurement, and (2) the identity of and calibration results for each field instrument. The specific records are specified in the QAPP.

The following additional information shall be recorded for all sampling activities: (1) sample type and sampling method, (2) the identity of each sample and depth(s), where applicable, from which it was collected, (3) the amount of each sample, (4) sample description (e.g., color, odor, clarity), (5) identification of sampling devices, and (6) identification of conditions that might affect the representativeness of a sample (e.g., refueling operations, damaged casing).

INTERNATIONAL TECHNOLOGY CORPORATION

New Location Log

Carswell Field D.O. 39 Sanitary Sewer System, NAS Fort Worth, Texas
PROJECT: 768579
AIR FORCE INSTALLATION ID: CRSWL

SITE ID: ____________________

LOCATION ID: ________________

LOCATION CLASSIFICATION: (Circle one) BH-borehole SL-surface location
TP - test pit WL-well NA - not applicable
_________(other)

Geohydrologic Flow Classification (Circle one) : U= Upgradient D=Downgradient C=Crossgradient
O=On Site-within site boundaries B=background

LOCATION PROXIMITY (Circle one): I=Inside Site Boundary O=Outside Site Boundary

ELEVATION: ______________

NORTH COORDINATE: ___________

EAST COORDINATE: _____________

ESTABLISHING COMPANY: ITC

DRILLING COMPANY: ______________

CONSTRUCTION METHOD: DT-driven tube HA-hand augered CP - Cone Penetrometer NA-not
(Circle one): applicable B - Bored or Augered SS-Solid Stem Auger HS-Hollow Stem Auger

EXCAVATING COMPANY: ______________

DATE ESTABLISHED: ☐☐/☐☐/☐☐ (Date finished)

DEPTH: ___________________________ (XXXX.XX in Feet)

BORING HOLE DIAMETER: __________(XX.XX in Inches) Prepared by:________________

LOCATION DESCRIPTION: ____

____

INTERNATIONAL TECHNOLOGY CORPORATION

Soil Sample Collection Log

Carswell Field D.O. 39 Sanitary Sewer System, NAS Fort Worth, Texas
PROJECT: 768579
AIR FORCE INSTALLATION ID: CRSWL

SITE ID: ____________

LOCATION ID: ________________ SAMPLE #: ______________________

LOG DATE: ____/____/____ LOG TIME: ______________________(HHMM)

BEGINNING DEPTH: _____ ENDING DEPTH: ______ LOG CODE: ITC LOCATION CLASS: SL PH BL TP BH

MATRIX: SO SQ SAMPLING METHOD: SS T G HA HP

Enter sample numbers for QA/QC samples associated to this sample:

Matrix Spike (MS): ____________ Matrix Spike Dup (SD): ____________

Field Dup(FD): ____________ Original (N): ____________

Material Blank (MB): ____________ Trip Blank (TB): ____________

Equipment Blank (EB): ____________ Ambient Blank (AB): ____________

COMMENTS: ____

SAMPLER(S): ______________________ PREPARED BY: ______________________

Layout/Site Diagram

---------------------- For Data Management Only ----------------------

SAMPLE /QC TYPE: ____________ LOT CONTROL #: ____________

Chain-of-Custody: ____________ Air Bill # ____________ Ship Date: ____________

Checked by : ____________ Date: ________ Logged in by: ________ Date: ________

QAed by: ____________ Date: ________ Filed by: ________ Date: ________

INTERNATIONAL TECHNOLOGY CORPORATION

DATE	
TIME	
PAGE ____ OF ____	
PAGE	
PROJECT NO.	

SAMPLE COLLECTION LOG

PROJECT NAME ____________________

SAMPLE NO. ____________________

SAMPLE LOCATION ____________________

SAMPLE TYPE ____________________

COMPOSITE ____ YES ____ NO

COMPOSITE TYPE ____________________

DEPTH OF SAMPLE ____________________

WEATHER ____________________

CONTAINERS USED	AMOUNT COLLECTED

COMMENTS:

PREPARED BY: ____________________

INTERNATIONAL TECHNOLOGY CORPORATION

VISUAL CLASSIFICATION OF SOILS

PROJECT NUMBER:	PROJECT NAME:	
BORING NUMBER:	COORDINATES:	DATE:
ELEVATION:	GWL: Depth Date/Time	DATE STARTED:
ENGINEER/GEOLOGIST:	Depth Date/Time	DATE COMPLETED:
DRILLING METHODS:		PAGE OF

DEPTH ( )	SAMPLE TYPE & NO.	BLOWS ON SAMPLER PER ( )	RECOVERY ( )	DESCRIPTION	USCS SYMBOL	MEASURED CONSISTENCY (TSF)	REMARKS

NOTES:

INTERNATIONAL TECHNOLOGY CORPORATION

Lithologic Codes Log

Carswell Field D.O. 39 Sanitary Sewer System, NAS Fort Worth, Texas
PROJECT: 768579
AIR FORCE INSTALLATION ID: CRSWL

SITE ID: ______________

LOCATION ID: ______________ ☐ **EXISTING** ☐ **NEW**

Logging Company Code: ITC **Log Date:** ☐☐/☐☐/☐☐ (MM/DD/YR)

Beginning Depth (XXX.XX in feet)	Ending Depth (XXX.XX in feet)	Lithology Code	ASTM Soil Classification Code	Stratigraphic Order	Visual Description

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Lithology Code (LITHCODE)			
LITHCODE	LITHOLOGY CODE	LITHCODE	LITHOLOGY CODE
ASPT	Asphalt	LOES	Loess
BNTN	Bentonite	LS	Limestone
BREC	Breccia	LSDL	Limestone and Dolomite, interbedded
CHLK	Chalk	LSSS	Limestone and Sandstone, interbedded
CHER	Chert, bedded	LSSH	Limestone and Shale, interbedded
CLAY	Clay	LSCH	Limestone, cherry
CLSN	Claystone	LSCL	Limestone, clayey
COAL	Coal	LSSD	Limestone, sandy
COBL	Cobble or Boulder	LSSL	Limestone, silty
CN	Concrete	MRBL	Marble
CONG	Conglomerate	MARL	Marl
DOLO	Dolomite	META	Metamorphic (Undifferentiated)
DREF	Drill Bit Refusal	MDSN	Mudstone
FILL	Fill or other Man-Made Deposits	NSNR	No Sample or No Recovery Obtained
GBBR	Gabbro	NDPS	No description provided, problems in sampling
GLDR	Glacial Drift or Undifferentiated Glacial Deposits	NDUN	No description provided, reasons unknown
GLTL	Glacial Till	NAUM	Not applicable; Unconsolidated Material
GNSS	Gneiss	PTHM	Peat, Humus, and other Organic Material
GRNT	Granite	PMFR	Permafrost
GRNS	Greenstone	QRTZ	Quartzite
GVL	Gravel	RYLT	Rhyolite
GVCL	Gravel and Clay	SALT	Salt
GVST	Gravel and Silt	SCHS	Schist
GVLB	Gravel; predominantly cobble or boulder-sized	SD	Sand
GVLG	Gravel, predominantly granule-sized	SDCL	Sand & Clay
GVLP	Gravel;, predominantly pebble-sized	SDGR	Sand & Gravel
GYPS	Gypsum	SDSL	Sand & Silt
HRDP	Hardpan	SDCR	Sand, coarse
IGNS	Igneous (Undifferentiated)	SDFN	Sand, fine
LGNT	Lignite	SDMD	Sand, Medium
LOAM	Loam	SDVC	Sand, very coarse

Lithology Code (LITHCODE) Continued			
LITHCODE	LITHOLOGY CODE	LITHCODE	LITHOLOGY CODE
SDVF	Sand, very fine	SSCL	Sandstone, clayey
SEDU	Sedimentary (Undifferentiated)	SSSH	Sandstone and Shale, interbedded
SHLE	Shale	SSSL	Sandstone and Siltstone, interbedded
SILT	Silt	SSST	Sandstone, silty
SLAT	Slate	STCL	Silt & Clay
SLCA	Siltstone, calcareous	UNCS	Sedimentary deposits, not specified
SLCL	Siltstone, clayey	VLAS	Volcanic Ash
SLCR	Siltstone, carbonaceous	VLBA	Basalt Lava
SLSH	Siltstone and Shale, interbedded	VLCU	Volcanic Rock, Undifferentiated
SLSS	Siltstone, sandy	VLTF	Volcanic Tuff
SLST	Siltstone	VLUN	Volcanic Deposits, Undifferentiated
SS	Sandstone	VOID	Void or cavity
SSCA	Sandstone, calcareous	XLN	Crystalline Igneous or Metamorphic, (Undifferentiated)
SSCR	Sandstone, carbonaceous		

ASTMCODE	ASTM Soil Classification	ASTMCODE	ASTM Soil Classification
CH	Inorganic clays of high plasticity, fat clays.	NACM	Not Applicable: Consolidated Material
CL	Inorganic clays or low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.	NDPS	No Description Provided. Problems in Sampling.
CM	Consolidated Material	NSNR	No sample or No Recovery Obtained
GC	Clayey gravels, poorly graded gravel-sand-clay mixture.	OH	Organic clays of medium to high plasticity.
GM	Silky gravels, poorly graded gravel-sand-silt mixtures.	OL	Organic silts and organic silt-clays of low plasticity.
GP	Poorly graded gravels, gravel-sand mixture: little or no fines.	PT	Peat and other highly organic soils.
GW	Well graded gravels, gravel-sand mixtures: little or no fines.	SW	Well graded sands, gravely sands: little or no fines.
MH	Inorganic silts, maicaceous or diatomaceous fine sandy or silty soils, elastic silts.	SM	Silty sands, poorly graded sand-silt mixtures.
ML	Inorganic silts and very fine sands, rock floor, silty or clayey fine sands with slight plasticity.	SC	Clayey sands, poorly graded sand-clay mixtures.
NA	Not Applicable	SP	Poorly graded sands, gravelly sands: little or no fines.

INTERNATIONAL TECHNOLOGY CORPORATION

Well Completion Information

Carswell Field D.O. 39 Sanitary Sewer System, NAS Fort Worth, Texas
PROJECT: 768579

LOCATION ID: ________

DATE INSTALLED: ☐☐/☐☐/☐☐ (MM/DD/YR)

WELL OWNER: USAF ______ (other) WELL TYPE: PZ MNW ________ (other)

COMPLETION METHOD: GS S P ____ (other)

GEOLOGIC ZONE: A L C P S ? U W

SOLE SOURCE AQUIFER: NCSA _______ (other)

SEAL END DEPTH: ________ (XXXX.XX in feet) FILTER PACK LENGTH: ________ (XXX.XX in feet)

MEASURING PT ELEVATION (Top of Casing): ____________ (XXXXX.XX)

TOTAL CASING DEPTH: __________ (XXX.XX in feet)

CASING INSIDE DIAMETER: _______ *Should be smaller than the borehole diameter.

CASING MATERIAL: PVC SLS GLS ______ (other)

SCREEN BEGINNING DEPTH: __________ (XXXX.XX is feet)

SCREEN LENGTH: __________ (XXX.XX in feet)

SCREEN SLOT SIZE: __________ (XXX.XX in inches)

SCREEN DIAMETER: __________ (XXX.XX in inches)

PERCENT OPEN AREA: __________ (XX.X)

REMARKS: ____

Prepared By: ________________

INTERNATIONAL TECHNOLOGY CORPORATION

Well Completion Information

prepared for:

__________ AFB ________ (St)

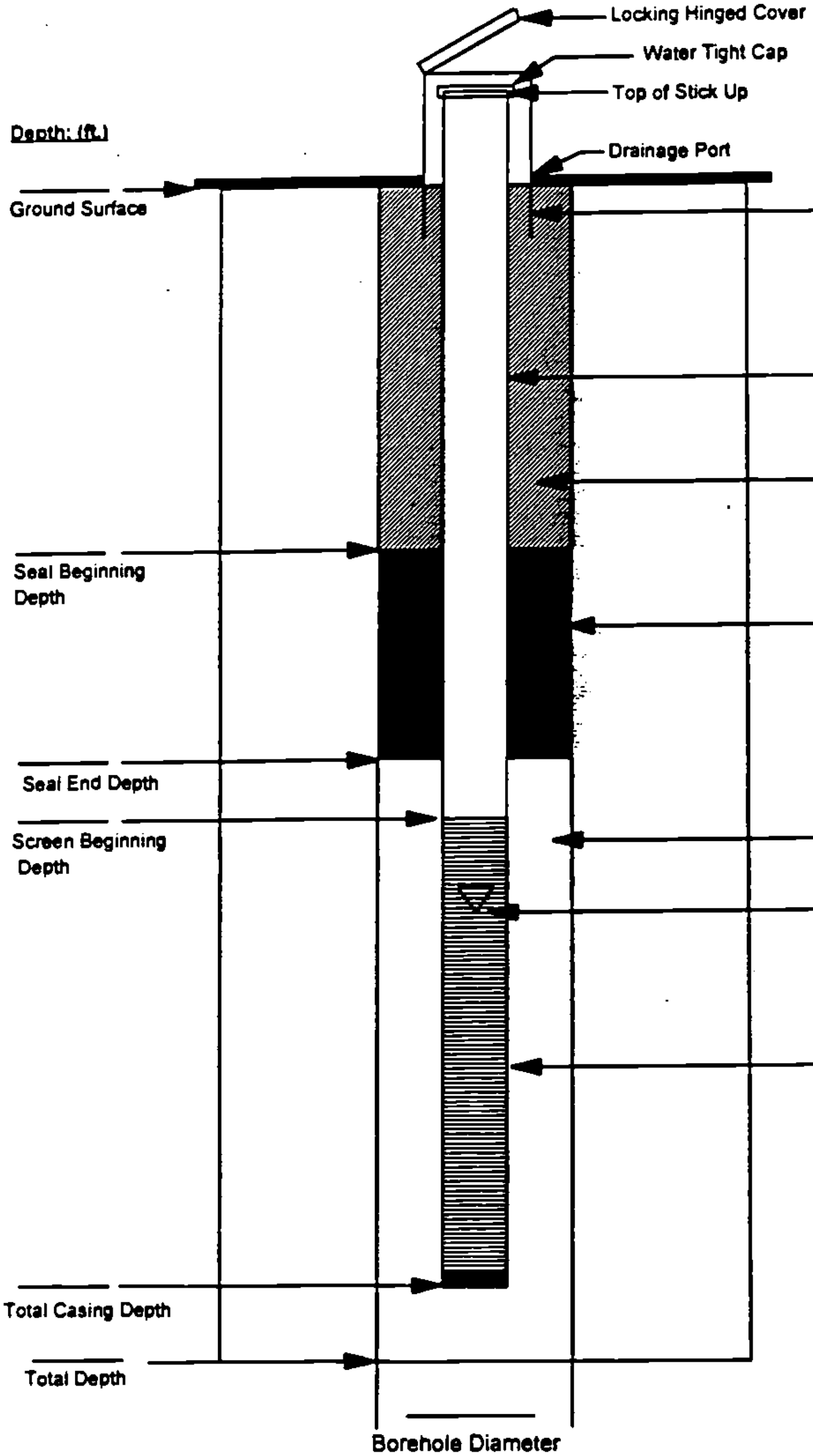
Project # ______________ D.O.# _______

Well Owner: USAF

Location I.D.: ____________

Installation Date: ____________

N.T.S.



Casing Material: __________

Casing Inside Diameter: ________(in.)

Sand Filter Pack Length: ________(ft.)

Encountered Groundwater at _______(ft.) on date: ________ time: ________

Screen Material: ________

Screen Length: ________(ft.)

Screen Inside Diameter: ________(in.)

Screen Slot Size: ______(in.)

Percent Open Area: ______

Well Type: MNW PZ ________(other)

Competion Method: GS S P ______(other)

Geologic Zone: A L C P S ? U W

Sole Source Aquifer: UNK ______(other)

Elevation Top of Casing: __________

SUPPLIES		
Sand	________	lbs
Grout	________	lbs
Bentonite	________	lbs
Other	________	

INTERNATIONAL TECHNOLOGY CORPORATION

Groundwater Elevation Log

Carswell Field D.O. 39 Sanitary Sewer System, NAS Fort Worth, Texas
PROJECT: 768579
AIR FORCE INSTALLATION ID: CRSWL

Site ID	Location ID	Log Date (MM-DD-YY)	Log Time (HHMM)	Depth of Well (xxxx.xx)	Static Depth to Water (xxxx.xx)	Hnu (ppm)

Gr undwater Well Development/Purge L g

Carswell Field D.O. 39 Sanitary Sewer System, NAS Fort Worth, Texas
PROJECT: 768579
AIR FORCE INSTALLATION ID: CRSWL

SITE ID: ____________ **LOCATION ID:** ____________ (Well Number) **Static Water Level:** _______ ft **Sample No.:** _______________

Target Purge Volume: _____ gal **WELL DEPTH:** ________ (ft from TOC) **Well Casing Diameter:** ________ in. **Total Volatiles (PID):** ___________

S/P	Date mmddyy	Time (24hr)	Purge Rate (gal /min)	Water Level (ft)	Volume purged (gal)	Temp °C	pH	Cond. ______	Turbidity (NTU)	Dissolved oxygen (mg/L)	Redox (mV)	Prepared By (init.)	Water Description

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INTERNATIONAL TECHN LOGY CORPORATION

FIELD CALIBRATION LOG

Job Name: ______________________ Job No. __________ PH. ____ TSK. ____ SUBTSK. ____

Checked By: ________________ Date: ______ Instrument Source: ☐ IT Equipment ☐ Rental

Date/Time	Instrument Make/Model/Serial #/IT#	Calibrated By	Standard/Manuf./Lot #/ Cal. Method	Instrument Readings	Instrument Settings	Pass/Fail Description	Comments

Resolution for Instrument Failure ____

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INTERNATIONAL TECHNOLOGY CORPORATION

EQUIPMENT CALIBRATION AND MAINTENANCE RECORD

Equipment Type ______________________ Serial and/or ID Number ______________ Page _____ of _____

Date of Calibration	Calibration Technician	Reason for Calibration	Calibration References	Comments (e.g. Date and Reason for Repair)

INTERNATIONAL TECHNOLOGY CORPORATION

Water Sample Collection Log

Carswell Field D.O. 39 Sanitary Sewer System, NAS Fort Worth, Texas
PROJECT: 768579
AIR FORCE INSTALLATION ID: CRSWL

SITE ID: ___________

LOCATION ID: ________________ SAMPLE #: ______________________

LOG DATE: ____/____/____ LOG TIME: ____________________(HHMM)

BEGINNING DEPTH: _____ ENDING DEPTH: ______ LOG CODE: ITC LOCATION CLASS: WL PH TP SL WW CH

MATRIX: WG WS SAMPLING METHOD: B G HP SP

Enter sample numbers for QA/QC samples associated to this sample:

Matrix Spike (MS): ____________ Matrix Spike Dup (SD): ____________

Field Dup(FD): ____________ Original (N): ____________

Material Blank (MB): ____________ Trip Blank (TB): ____________

Equipment Blank (EB): ____________ Ambient Blank (AB): ____________

COMMENTS:____

____

SAMPLER(S):__________________________ PREPARED BY:________________________

Layout/Site Diagram

= For Data Management Only =

SAMPLE /QC TYPE: ____________ LOT CONTROL #: ______________

Chain-of-Custody: ____________ Air Bill # __________________ Ship Date: ____________

Checked by : ___________ Date: ________ Logged in by: ________ Date: ________

QAed by: ___________ Date: ________ Filed by: ________ Date: ________

INTERNATIONAL TECHNOLOGY CORPORATION

QC Water Sample Collection Log

Carswell Field D.O. 39 Sanitary Sewer System, NAS Fort Worth, Texas
PROJECT: 768579
AIR FORCE INSTALLATION ID: CRSWL

SITE ID: ______________

LOCATION ID: ____________________ SAMPLE #: ____________________________

LOG DATE: _____/_____/_____ LOG TIME: ________________________(HHMM)

BEGINNING DEPTH: 0 ENDING DEPTH: 0 LOG CODE: ITC LOCATION CLASS: NA

MATRIX: WQ WH SAMPLING METHOD: NA

Enter sample numbers for QA/QC samples associated to this sample:

Matrix Spike (MS): _______________ Matrix Spike Dup (SD): _______________

Field Dup(FD): _______________ Original (N): _______________

Material Blank (MB): _______________ Trip Blank (TB): _______________

Equipment Blank (EB): _______________ Ambient Blank (AB): _______________

COMMENTS: ____

____

SAMPLER(S): ______________________________ PREPARED BY: ______________________________

Layout/Site Diagram

- For Data Management Only -

SAMPLE /QC TYPE: _______________ LOT CONTROL #: _________________

Chain-of-Custody: _______________ *Air Bill #* ______________________ *Ship Date:* _______________

Checked by : _______________ Date: __________ Logged in by: __________ Date: __________

QAed by: _______________ Date: __________ Filed by: __________ Date: __________

INTERNATIONAL TECHNOLOGY CORPORATION

VARIANCE LOG
CHRONOLOGICAL LIST OF PROJECT VARIANCES

PROJECT NUMBER ______________________ PAGE ______ OF ______

PROJECT NAME ______________________

DATE	VARIANCE GRANTED AND APPLICABLE DOCUMENT	RESPONSIBLE INDIVIDUAL

INTERNATIONAL TECHNOL GY CORPORATI N

VARIANCE FORM

VARIANCE NO. ______

PROJECT NO. ______ PAGE ______ OF ______

PROJECT NAME ______ DATE ______

VARIANCE (INCLUDE JUSTIFICATION)

APPLICABLE DOCUMENT:

CC:

REQUESTED BY ______ DATE ______

APPROVED BY ______ DATE ______
Project Manager

______ DATE ______
Quality Assurance Officer

INTERNATIONAL TECHNOLOGY CORPORATION

NONCONFORMANCE REPORT

NCR Number:	Project Name and Number:	Date:	Page______ of ______

Nonconformance Description (include specific requirement violated):

Identified By: Date:

Root Cause of Nonconforming Condition:

Corrective Action to be Taken (include date when action(s) will completed):

To be Performed By: Anticipated Completion Date:

Action to be Taken to Preclude Recurrence:

To be Performed By: Anticipated Completion Date:

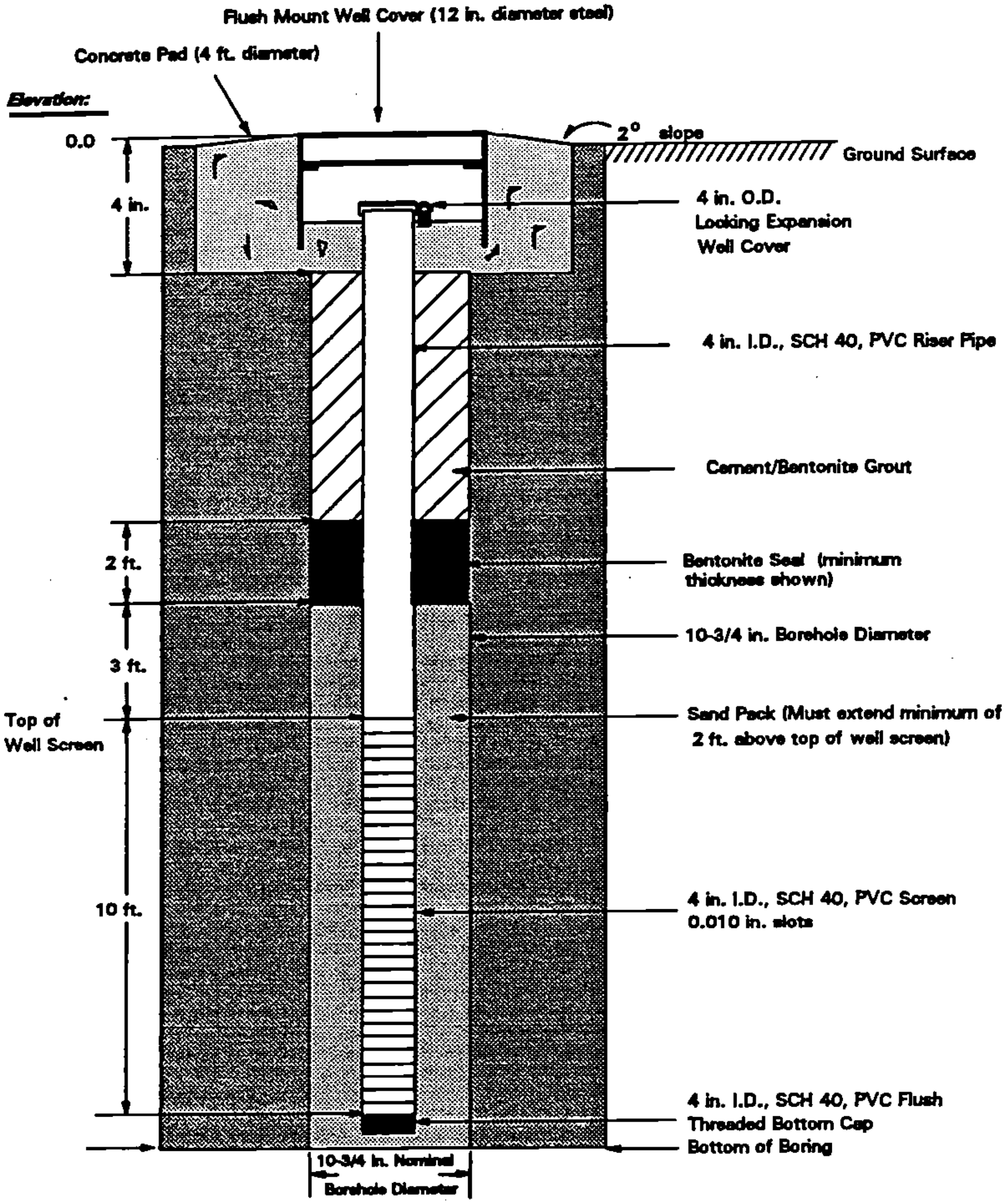
Acceptance By:______________________ Date:__________ Acceptance By:______________________ Date__________
Project Manager QA Officer

Corrective Actions Completed By and Date:	Verification Completed By and Date:

c:

INTERNATIONAL TECHNOLOGY CORPORATION

(Not To Scale)



Monitoring Well Design
prepared for:

NAVAL AIR STATION FORT WORTH
FORT WORTH, TEXAS

FINAL PAGE

ADMINISTRATIVE RECORD

FINAL PAGE