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SITE CHARACTERIZATION SUMMARY FOR AREA OF CONCERN SITE INSPECTION NAS FORT WORTH TX

2/1/2001

SCIENCE APPLICATIONS INTERNATIONAL CORPORATIOIN

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NAVAL AIR STATION FORT WORTH JRB CARSWELL FIELD TEXAS

ADMINISTRATIVE RECORD COVER SHEET

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File: 174-88
D.E. 697

697 1

AOC 20 SITE INSPECTION
NAS FORT WORTH JRB, TEXAS

SITE CHARACTERIZATION SUMMARY ITIR

Prepared for

U. S. Air Force Center for Environmental Excellence
Brooks Air Force Base, Texas

Prepared by

SCIENCE APPLICATIONS INTERNATIONAL CORPORATION
San Antonio, Texas

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February 2001

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ACRONYMS AND ABBREVIATIONS

AFP 4	Air Force Plant 4
AOC	area of concern
CIS-1,2-DCE	Cis-1,2-Dichloroethene
COC	Chain of Custody
EI	electrical imaging
ITIR	Informal Technical Information Report
JRB	Joint Reserve Base
NAS	Naval Air Station
SI	Site Inspection
TA	Terrace alluvium
TCE	trichloroethene
VOC	volatile organic compound

Abbreviations

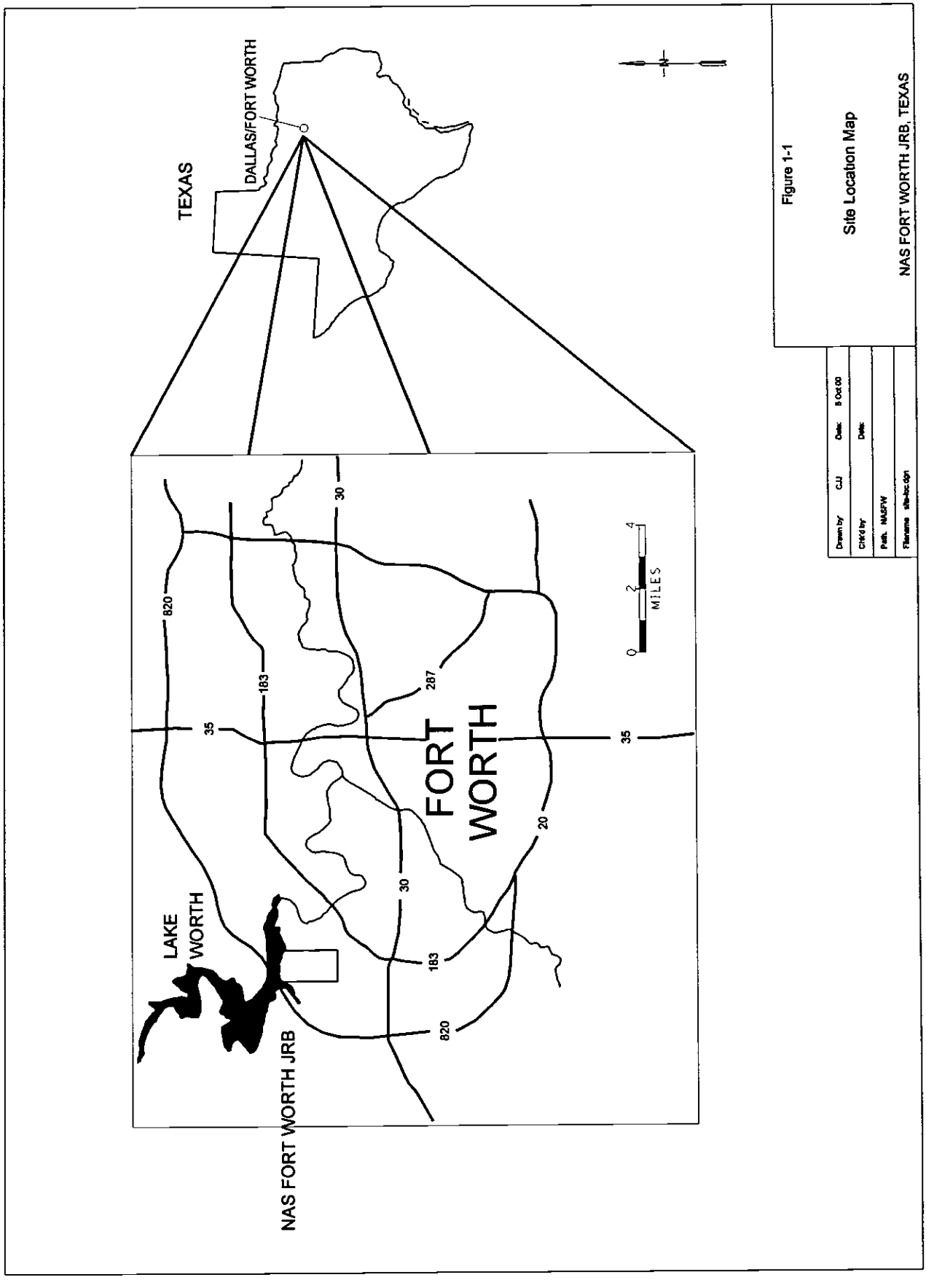
mg/L	milligrams per liter
µg/L	micrograms per liter

1. INTRODUCTION

The Site Inspection (SI) being conducted at Area of Concern (AOC) 20, Naval Air Station Fort Worth Joint Reserve Base (NAS Fort Worth JRB, Figure 1-1) focuses on the runway area in NAS Fort Worth JRB, next to Air Force Plant 4 (AFP 4) (Figure 1-2). AOC 20 is part of AOC 2, which is loosely defined as the portion of the shallow aquifer located in the Quaternary terrace alluvium (TA) that is contaminated with dissolved phase trichloroethene (TCE). The purpose of the SI is to delineate paleochannels (erosional depressions on the aquitard filled by alluvial deposits) and preferential groundwater pathways in AOC 20. Specific objectives of the SI include:

- Determination of aquitard topography
- Delineation of the gravel paleochannels above the aquitard
- Mapping the groundwater plume

This Informal Technical Information Report (ITIR) summarizes the field activities conducted for this SI and presents major issues of preliminary channel delineation results to support project decision-making activities. A detailed narrative describing field procedures and including all field forms and analytical laboratory data will be presented in the forthcoming SI Report.


TEXAS
DALLAS/FORT WORTH
LAKE WORTH
NAS FORT WORTH JRB
FORT WORTH
820
183
287
35
30
20
0
2
4
MILES
Figure 1-1
Site Location Map
NAS FORT WORTH JRB, TEXAS
Drawn by: CJJ
Date: 5 Oct 00
Chkd by:
Date:
Path: NASFW
Filename: site-loc.dgn

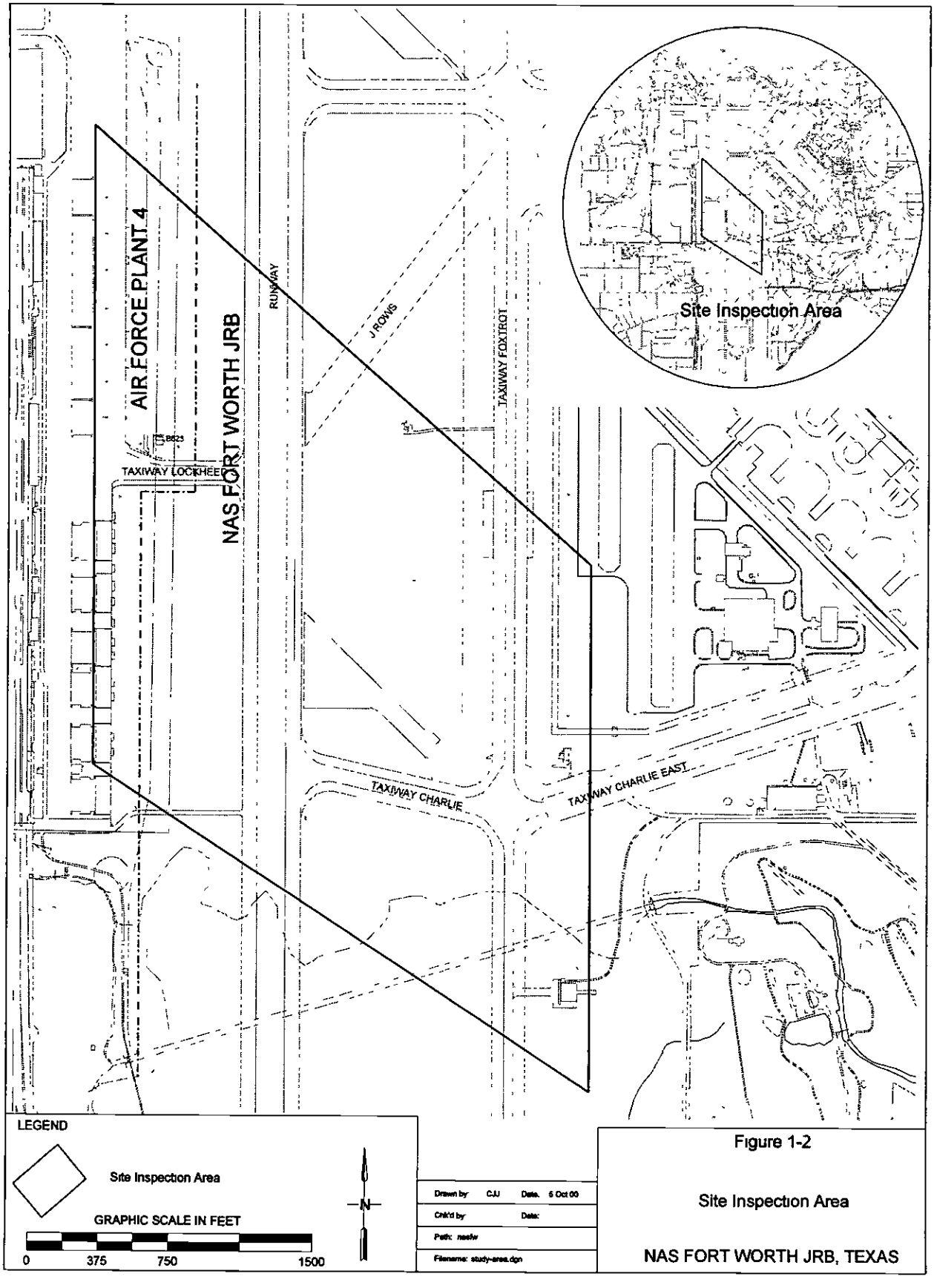


Figure 1-2

Site Inspection Area

NAS FORT WORTH JRB, TEXAS

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2. SUMMARY OF FIELD WORK

Fieldwork was conducted in two phases. The Phase I fieldwork included a seismic reflection survey that determined aquitard topography and an electrical imaging (EI) survey that mapped the TA deposits. Phase II fieldwork involved the installation of soil borings and groundwater monitoring wells to confirm the results of the geophysical surveys and to collect soil and groundwater samples. Fieldwork consisted of the following:

- Performance of a seismic survey (864 shot points, spaced 10 feet apart)
- Performance of a seismic velocity survey (two locations, LF05-02 and WHGLTA302)
- Performance of an EI survey (2,100 meters, electrode spacing 6 meters)
- Installation of two soil borings (ERPIMS location identification numbers [LOC ID] BSAICTA001 and BSAICTA006)
- Installation of four groundwater monitoring wells (LOC IDs WSAICTA002, WSAICTA003, WSAICTA004, and WSAICTA005)
- Collection of six soil samples (one sample from each soil boring and groundwater monitoring well)
- Collection of 20 groundwater samples
- Performance of a geographical survey of geophysical line end point/intersect, soil boring, and groundwater monitoring well locations

Locations of all seismic shot points, EI electrodes, new soil borings, and new groundwater monitoring wells are shown in Figure 2-1.

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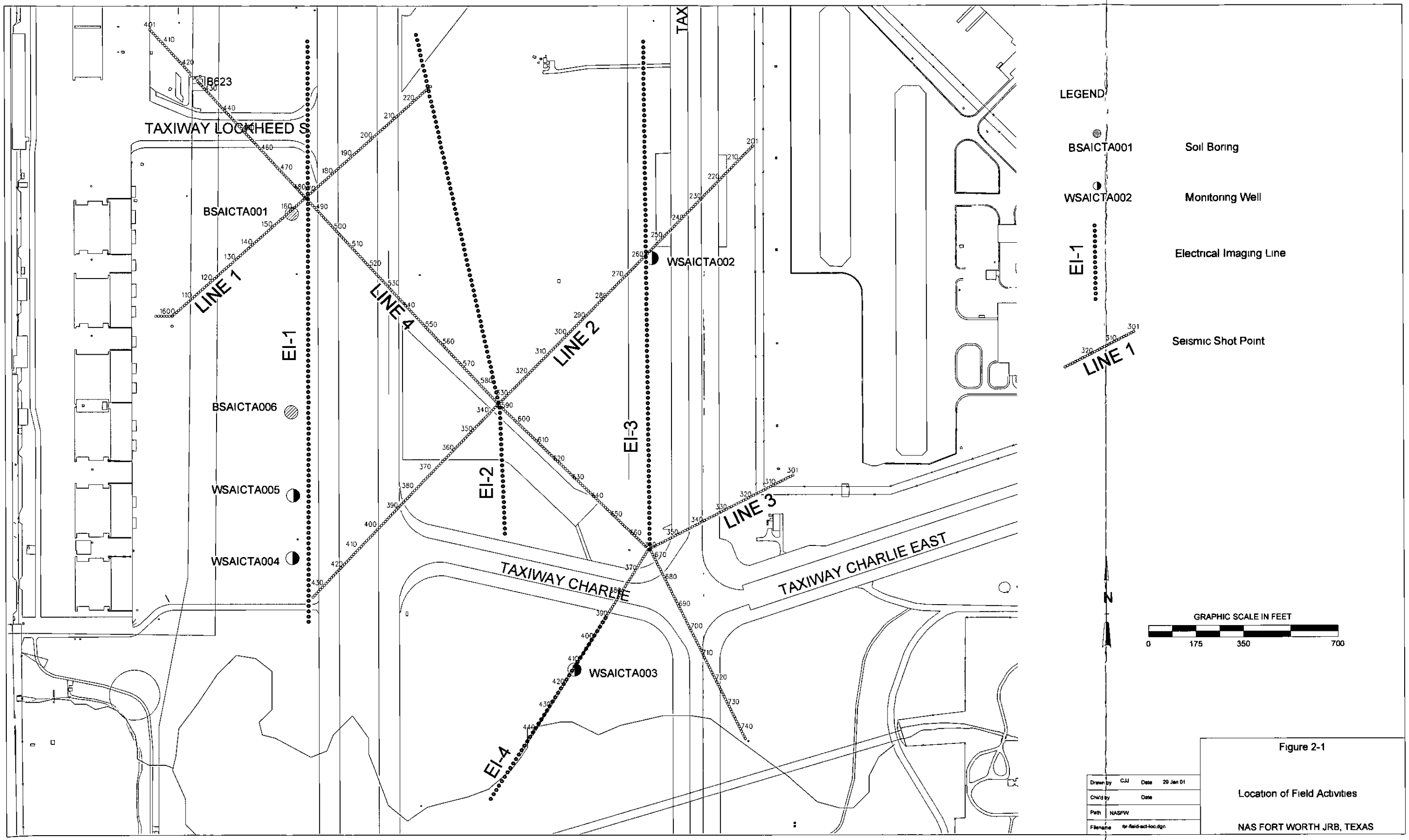

Figure 2-1

Location of Field Activities

NAS FORT WORTH JRB, TEXAS

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3. PRELIMINARY FINDINGS

3.1 AQUITARD TOPOGRAPHY

The aquitard in the AOC 20 area consists of limestone, marl, shale, and limey clay of the Goodland/Walnut Formation. Two aquitard topographic maps were generated that incorporated all available existing soil boring log data and seismic data. Figure 3-1 depicts the aquitard topography using existing data as well as the recently collected soil boring log data. Figure 3-2 shows aquitard topography using existing data, the recently collected soil boring log data, and the new seismic data.

An analysis of the soil boring logs indicates that aquitard material is absent at wells WJETA083 and WJEUS008; therefore, the aquifer at AOC 2 is in direct communication with the deeper Paluxy aquifer.

The aquitard topography based on a combination of soil boring log data and seismic data appears much more complex than the topography based on soil borings alone, indicating potential small channels within the large channel. There appear to be some additional linear features trending northwest-southeast. The seismic data used in preparation of the topographic map was calibrated with soil borings in close proximity to the shot points, and has an estimated maximum error of ± 2 feet. The only exceptions are along seismic line 3 around WHGLTA302 (11-foot error) and WSAICTA003 (5-foot error). There is fill material in this area, and the seismic velocity of the fill material may be different from that of other areas. At the time the seismic survey was performed, there were no wells suitable for a velocity survey in the area. Therefore, the data from point 390 to point 445 along line 3 were not used in the contouring of the bedrock elevation. The velocity at WSAICTA003 should be measured to make these data usable.

A special extrapolation was placed at the center of the paleochannel to highlight the narrow deepest portion of the paleochannel. Because the extrapolation has not been confirmed with boring log data, the channel has been contoured with a dash line. A soil boring should be installed to confirm the extrapolation at a future date.

3.2 GRAVEL DISTRIBUTION

In AFP4 and NAS Forth Worth JRB, the TA deposits have been characterized as two general units: clay and basal gravel. Analysis of soil boring logs in the AOC 2 area determined that only a few boring logs (e.g., W-153) documented significant amounts of gravel in the study area (Figure 3-3), and the distribution of this gravel appears to be random and does not correlate with the paleochannel.

Figure 3-3 should be interpreted with caution because gravel is difficult to log with typical drilling equipment (2-inch split spoon); therefore, gravel could be underrepresented. For this reason, another geophysical method (EI) was used to map gravel channels.

Figure 3-4 shows four profiles constructed from the EI survey. Lithology is approximately represented by resistivity and reflected by color contrast in these figures (except for the northern section of line 1 [colored red] where the concrete taxiway interfered with data collection). Bedrock (shown using warm colors) has a higher resistivity than the TA deposits (shown using cool colors). Warmer colors seen within the TA deposit indicate higher gravel content, and cooler colors indicate higher clay content. The TA deposits seem to be quite heterogeneous.

3.3 REFINEMENT OF GROUNDWATER PLUME GEOMETRY

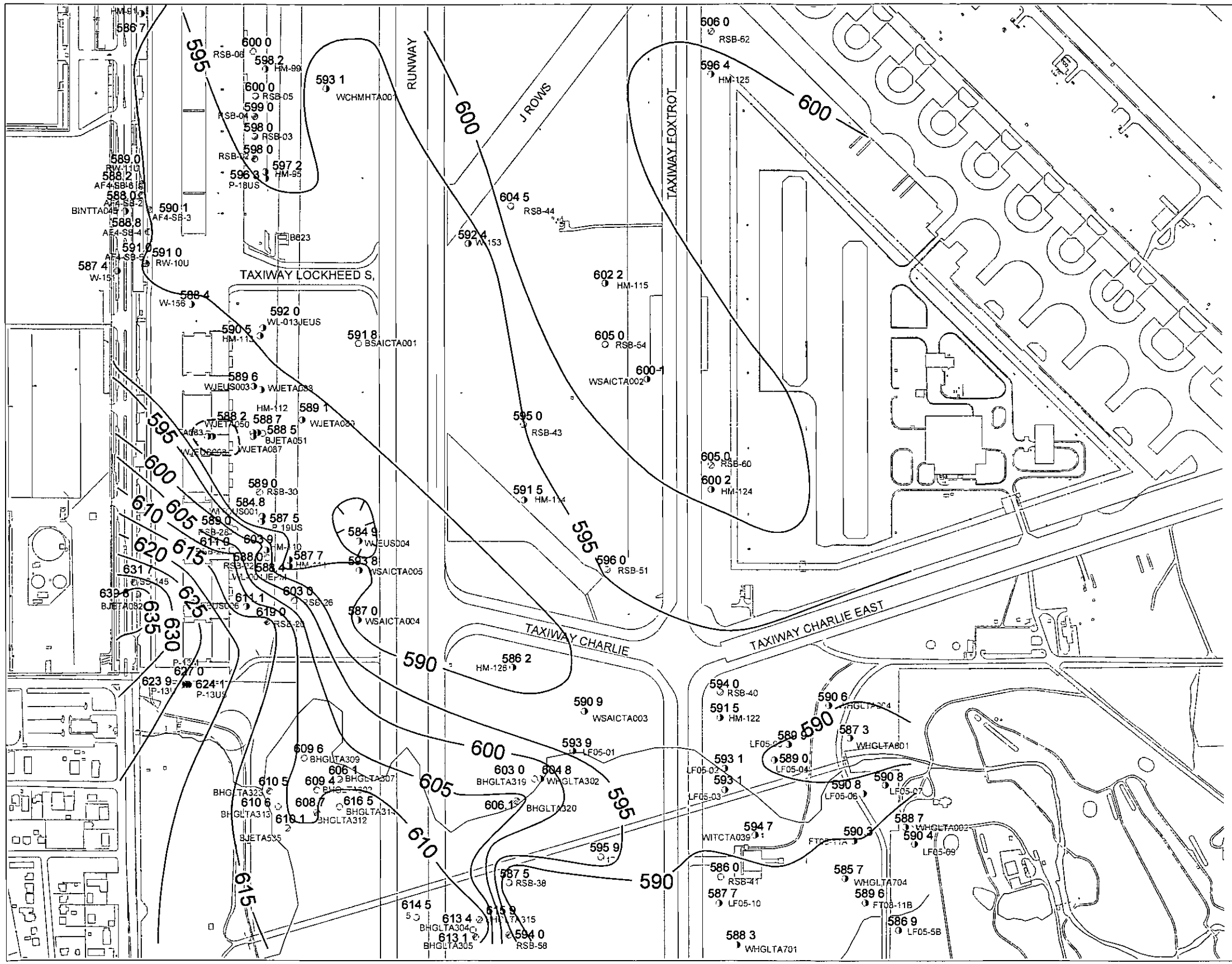
Groundwater samples were collected from the four newly installed groundwater monitoring wells (WSAICTA002, WSAICTA003, WSAICTA004, and WSAICTA005) as well as ten existing wells (HM-110, HM-112, HM-113, HM-114, HM-124, HM-126, W-153, W-156, WHGLTA302, and LF05-02, Figure 3-3). Groundwater samples were collected from the top, middle, and bottom of the water column in three of the four wells (WSAICTA003, WSAICTA004, and WSAICTA005) to evaluate vertical plume stratification. These samples were analyzed for volatile organic compounds (VOCs), arsenic, and natural attenuation parameters. Analytical results are provided in Table 3-1.

Groundwater samples collected around Landfill 5 (from WHGLTA302, LF05-02, and WSAICTA003) contain relatively higher concentrations of cis-1,2-dichloroethene (cis-1,2-DCE) as well as high levels of methane and ethene, indicating biodegradation is occurring in this region. Although some TCE has been degraded all the way to ethene in the sample collected from WHGLTA302, a significant amount of cis-1,2-DCE is present, indicating degradation is only partially complete at this time and is localized.

A comprehensive groundwater plume map was created using all the analytical results from groundwater samples collected in the project timeframe (including data generated by different projects). In the instance where multiple chemical data existed for a particular well, the highest chemical concentration was selected as representative. Because biodegradation has been documented, two separate plume maps were used to illustrate site conditions. One map depicts the distribution of TCE (Figure 3-5) and the other the distribution of total solvents (sum of tetrachlorethene, TCE, 1,2-DCE, and vinyl chloride) (Figure 3-6). Data from wells screened in the Paluxy aquifer were consistent with data from the shallow aquifer and were considered in refining plume contours; however, it was not posted on the plume maps. As shown in Figures 3-5 and 3-6, the biodegradation of TCE visually divides the plume into two distinct plumes; the total solvents plume is continuous.

3.4 PALEOCHANNEL AND PLUME MIGRATION PATHWAYS

Preliminary data indicate that within the broad paleochannel (Figure 3-1), there may be a deeper, narrow channel (Figure 3-2). The paleochannel is the primary contaminant migration pathway, and the plume is more than 2,000 feet wide. However, the most concentrated portion (TCE concentrations greater than 1,000 μg/L) of the plume is contained in or next to a narrow band with a width of less than 500 feet. There is a slight vertical stratification, but it is all within the same order of magnitude.



LEGEND

600 — Bedrock Elevation Contours (feet above mean seal level)

Soil Borings

HM-124 — Monitoring Wells

687 0 — Bedrock Elevation (feet)

Area Bedrock Missing

N

GRAPHIC SCALE IN FEET

0 250 500 1000

Figure 3-1

Bedrock Elevation Contours
Based on Soil Borings
NAS FORT WORTH JRB, TEXAS

Drawn by: CJJ Date: 30 Jan 01
Chk'd by: Date
Path NASFW
Filename ftb-ele-sb-fig4.dgn

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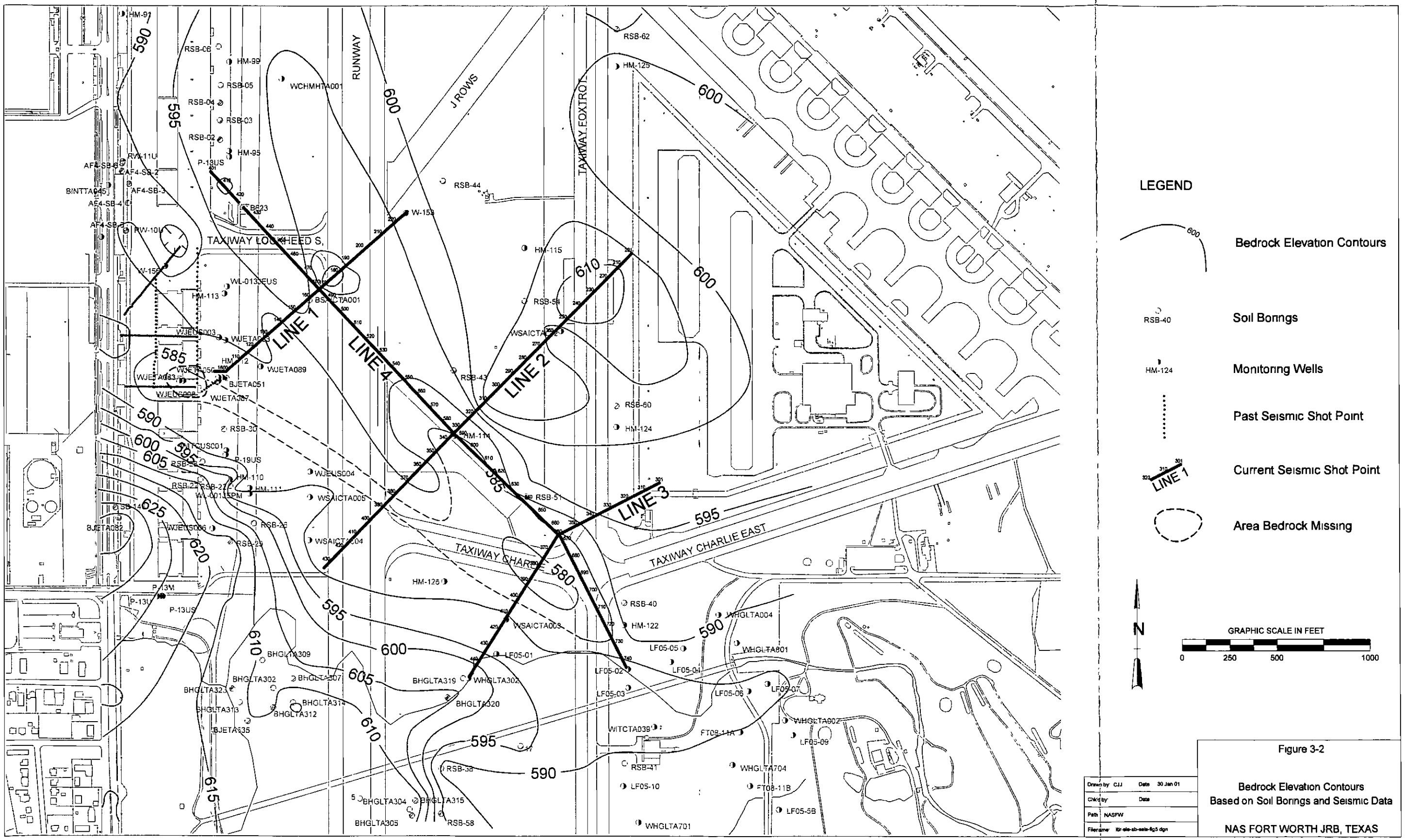

Figure 3-2

Bedrock Elevation Contours
Based on Soil Borings and Seismic Data

NAS FORT WORTH JRB, TEXAS

Drawn by: CJJ Date: 30 Jan 01
Chkd by: Date:
Path: NASFW
Filename: fdr-ele-sb-seis-fig5.dgn

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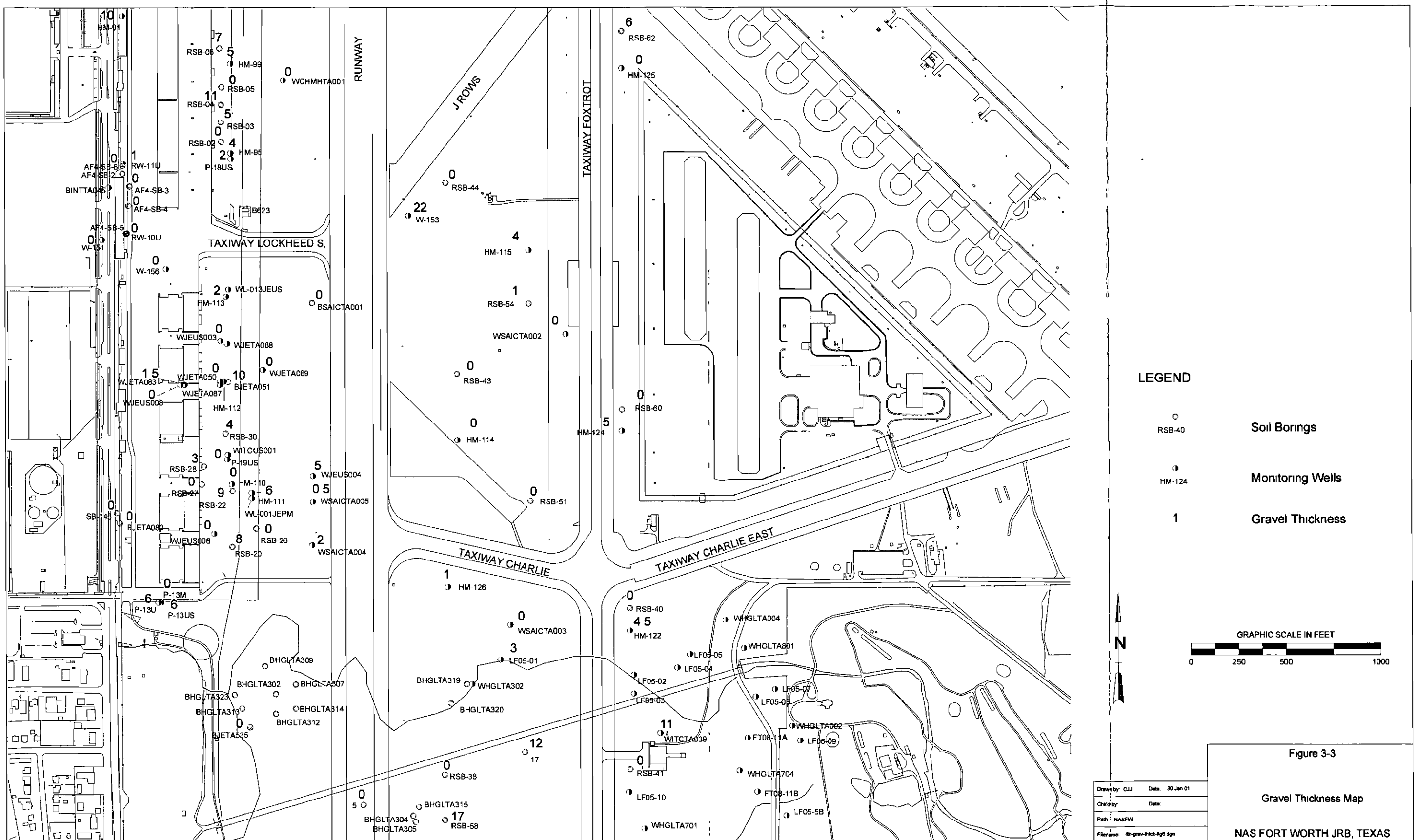
RUNWAY
J ROWS
TAXIWAY FOXTROT
TAXIWAY LOCKHEED S.
TAXIWAY CHARLIE
TAXIWAY CHARLIE EAST
LEGEND
RSB-40 Soil Borings
HM-124 Monitoring Wells
1 Gravel Thickness
N
GRAPHIC SCALE IN FEET
0 250 500 1000
Figure 3-3
Gravel Thickness Map
NAS FORT WORTH JRB, TEXAS

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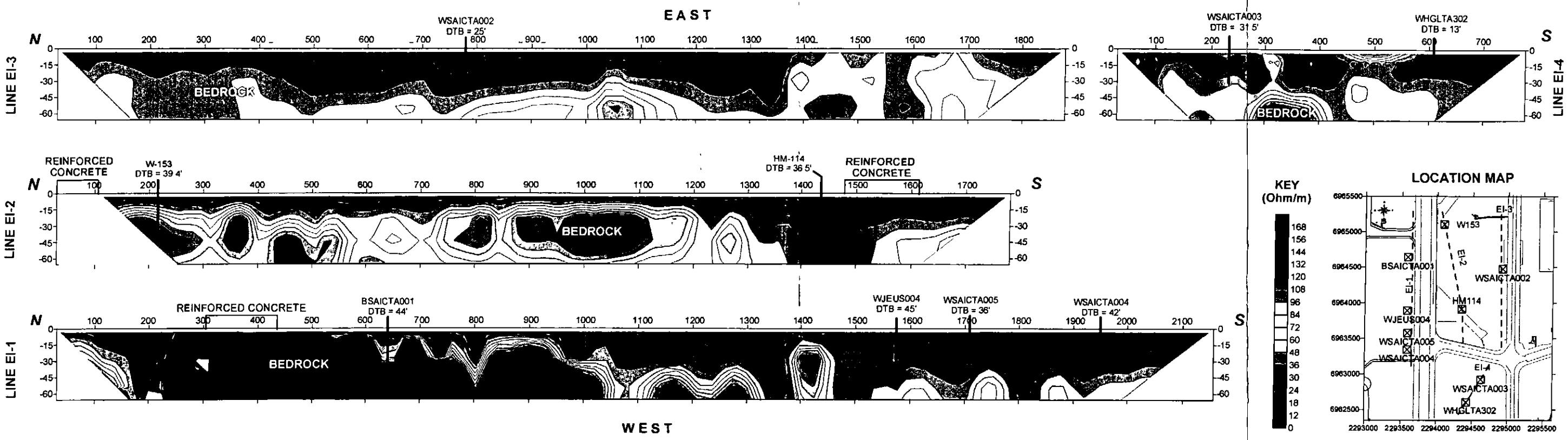

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NOTES

Roll-along resistivity survey performed Oct 23-27, 2000 using Advanced Geosciences, Inc, Sting R1 IP and Swift controller unit

DTB = Depth to bedrock

Horizontal scale 1 in = 100 ft (approximate)
Vertical scale 1 in = 50 ft (approximate)
Vertical exaggeration = 2x

DES	LSB	11/05/00
DRN	LSB	11/05/00
CHK	PJH	12/05/00
REV	PJH	1/23/01
APP		
PROJ MGR	PJH	10/30/00
OPER.		

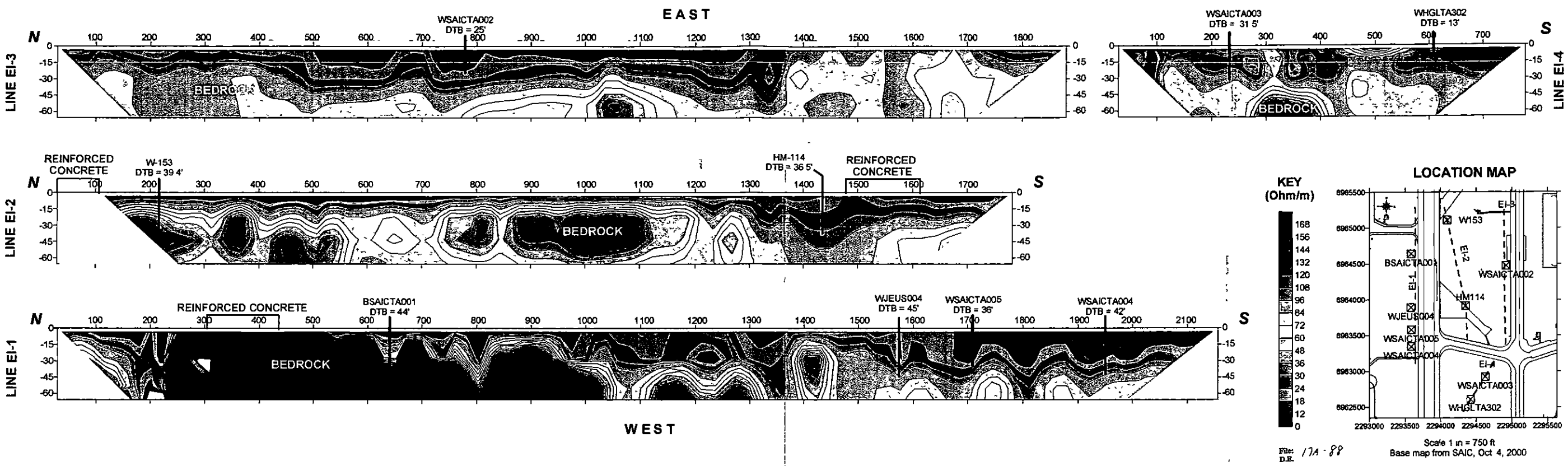
PROJECT:
Ft Worth Naval Air Station Joint Reserve Base

SHEET TITLE:
Figure 3-4 Electrical Imaging Profiles

The HUTCHINSON GROUP, Ltd.
4299 OLD WM. PENN HWY
MURRYSVILLE, PENNSYLVANIA 15668

SAIC Channel Delineation Study

DRAWING NO.
102300-001



NOTES

Roll-along resistivity survey performed Oct. 23-27, 2000 using Advanced Geosciences, Inc, Sting R1 IP and Swift controller unit

DTB = Depth to bedrock

Horizontal scale 1 in = 100 ft (approximate)
Vertical scale 1 in = 50 ft (approximate)
Vertical exaggeration = 2x

File: 17A-88
D.F.

DES	LSB	11/05/00
DRN	LSB	11/05/00
CHK	PJH	12/05/00
REV	PJH	1/23/01
APP		
PROJ MGR.	PJH	10/30/00
OPER.		

PROJECT:
Ft Worth Naval Air Station Joint Reserve Base

SHEET TITLE:
Figure 3-4 Electrical Imaging Profiles

The HUTCHINSON GROUP, Ltd.
4230 OLD WM. PENN HWY
MURRYSVILLE, PENNSYLVANIA 15668

SAIC Channel Delineation Study

DRAWING NO.
102300-001

Table 3-1
Groundwater Analytical Data

Sample Location	HM-110	HM-112	HM-112	HM-113	HM-114	HM-124	HM-126	LF05-02	W-153	W-153	W-156	WHGLTA302
Sample Date	08-Dec-00	08-Dec-00	08-Dec-00	08-Dec-00	07-Dec-00	07-Dec-00	07-Dec-00	07-Dec-00	07-Dec-00	07-Dec-00	08-Dec-00	08-Dec-00
Sample Type	N1	N1	FD1	N1	N1	N1	N1	N1	N1	FD1	N1	N1
Organics (µg/L)												
1,1-Dichloroethene					1.4		1.3	1.1	1.2	1.3		
Chloroform							0.72 J		0.57 J	0.68 J		
Cis-1,2-Dichloroethene	110	330	340	79	77	1.8	170	290	110	130	270	2400
Hexachlorobutadiene											120 J	
Napthalene											110 J	
Tetrachloroethene					1.3	0.73 J	0.92 J	0.74 J	4 8	5.9		
Trans-1,2-Dichloroethene				29 J	2.3		3.9	24	2.30	4.0		47 J
Trichloroethene	540	5200	6500	520	520	4.0	3800	38	780	910	6800	
Trichlorofluoromethane									1.1	3.7		
Vinyl Chloride								12				
Metals (mg/L)												
Arsenic												
Geochemical Parameters (mg/L)												
Ethane	5.6 J			41				1.7 J				56 J
Ethene					0.48 J	0.9 J		56 J	0.31 J	0.41 J	0.53 J	280
Methane		5.3 J	4.8 J	48	11	40	37	1300J/4500E	4.6 J	5 5 J	9.0 J	5600J/24000E
Alkalinity, Total (AS CACO3)	328	306	308	140	316	230	254	432	316	338	294	460
Chloride (AS CL)	9.67	19.3	19.0	3.63	17.9	0.901	14.4	5 98	23.6	24.0	23.1	18.2
Nitrogen, Nitrate (AS N)	1.9	5.3	5.2		2.3	0.55	2.8	0.12	5.3	5.4	5.8	
Sulfate (AS SO4)	34.3	86.4	90.7	5.27	11.0	6.34	31.6	10.3	14.6	15.2	35.7	55.1
Total Organic Carbon	6.1	7.9	7.5	6.2	9.3	8.1	9.6	17	8.4	8.9	7.3	12
Dissolved Oxygen*	5.00	5.24	5.24	3.98	5.18	5.04	4.19	4.66	4.23	4 23	4.67	4.27
Total Suspended Solids	31	4 0		15	30	5.0		100				650
Ferrous Iron**	0.34	0.00	0.00	0.06	0.00	0.00	0.00	0.47	0.00	0.00	0.01	2.49
Other Parameters												
ORP (mv)*	160	170	170	-20	186	151	191	24	159	159	201	-78
Turbidity (NTU)*	0 0	0.0	0.0	0.0	40.4	0.0	0.0	272.0	2.1	2 1	0.0	179.0
Specific Conductivity (ms/cm)*	0.645	0.838	0.838	0.273	0.630	0.401	0.687	0.754	0.709	0.709	0.761	0.831
pH*	6.81	6.79	6.79	6.88	6.60	6.80	6.63	6.44	6.76	6.76	6.81	6.78
Temperature (C)*	21.2	20.5	20.5	17.8	20.5	20.9	20.0	14.6	21.7	21.7	16.1	18.7

Blank cell = below method detection limit.
ORP = Oxidation-Reduction Potential
* Dissolved oxygen, ORP, turbidity, specific conductivity, pH, and temperature were analyzed in the field at the time of sampling using a Horiba U-22 Water Quality Meter
** Ferrous iron was analyzed in the field using Hach Fe^{2+} kit

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Table 3-1
Groundwater Analytical Data (cont.)

Sample Location	WSAICTA003 (21.0-22.0')	WSAICTA003 (24.0-25.0')	WSAICTA003 (29.0-30.0')	WSAICTA003 (29.0-30.0')	WSAICTA002	WSAICTA004 (28.0-29.0')	WSAICTA004 (34.0-35.0')	WSAICTA004 (40.0-41.0')	WSAICTA005 (23.0-24.0')	WSAICTA005 (27.0-28.0')	WSAICTA005 (33.0-34.0')
Sample Date	11-Dec-00	11-Dec-00	11-Dec-00	11-Dec-00	14-Dec-00	14-Dec-00	14-Dec-00	14-Dec-00	14-Dec-00	14-Dec-00	14-Dec-00
3.5 SAMPLE TYPE	N1	N1	N1	FD1	N1	N1	N1	N1	N1	N1	N1
Organics (µg/L)											
1,1-Dichloroethene											
Chloroform											
Cis-1,2-Dichloroethene	410	470	500	400	1.2	9 6	21	23	11	86	84
Hexachlorobutadiene											
Napthalene											
Tetrachloroethene											
Trans-1,2-Dichloroethene	18 J		29	18 J						1.1 J	
Trichloroethene	800	1100	980	910	21	100	230	270	87	600 E	600
Trichlorofluoromethane											
Vinyl Chloride											
Metals (mg/L)											
Arsenic											
Geochemical Parameters (mg/L)											
Ethane	5.4 J	9.9 J	13 J	11 J/25 J	1 6 J	1.5 J	1.9 J	1.3 J	0.82 J	0.66 J	0.73 J
Ethene	8.6 J	28 J			3.8 J	3.0 J	3.0 J	1.9 J	1.8 J	1.7 J	1.6 J
Methane	520	580	640J/2300E	560	23	18	18	14	14	9.6	13
Alkalinity, Total (AS CACO3)	354	334	332	320	852	384	388	366	360	330	328
Chloride (AS CL)	12.4	11.8	12.2	12.6	4.87	4.32	6.09	7.14	7.04	12.10	11.60
Nitrogen, Nitrate (AS N)	0.47	0.63	0.67	0 65	0 40	0.89	1.1	1.2	0.26	1.6	1.5
Sulfate (AS SO4)	23.9	23.3	23.4	48.4	31.2	21.2	20.9	21.7	12.3	33.7	32.3
Total Organic Carbon	19	13	13	12	2.4	30	25	1.9	1.6	1.5	1.5
Dissolved Oxygen*	6.49	6.67	6.57	6 57	6 05	6.04	5.07	4.62	6.37	5.61	5.56
Total Suspended Solids	750	380	60	100	770	180	190	65	97	61	55
Ferrous Iron**	0.06	0.22	0.10	0.19	0.22	0.11	0.04	0.00	0.00	0 00	0.00
Other Parameters											
ORP (mv)*	214	67	66	66	338	253	243	231	289	266	237
Turbidity (NTU)*	51.6	51.0	50.7	50.7	50.9	9.0	30.7	8.6	9.9	7.0	3.9
Specific Conductivity (ms/cm)*	0.728	0.688	0.688	0.688	0.848	0.780	0.753	0.750	0.649	0 710	0.736
pH*	6.84	6.85	6.85	6.85	6.69	6.60	6 70	6.72	6.73	6.29	6.13
Temperature (C)*	15.5	15.9	15.8	15.8	16.1	15.9	16.5	18.5	18 1	18 2	17.8

Blank cell = below method detection limit

ORP = Oxidation-Reduction Potential

* Dissolved oxygen, ORP, turbidity, specific conductivity, pH, and temperature were analyzed in the field at the time of sampling using a Horiba U-22 Water Quality Meter

** Ferrous iron was analyzed in the field using Hach Fe^{2+} kit

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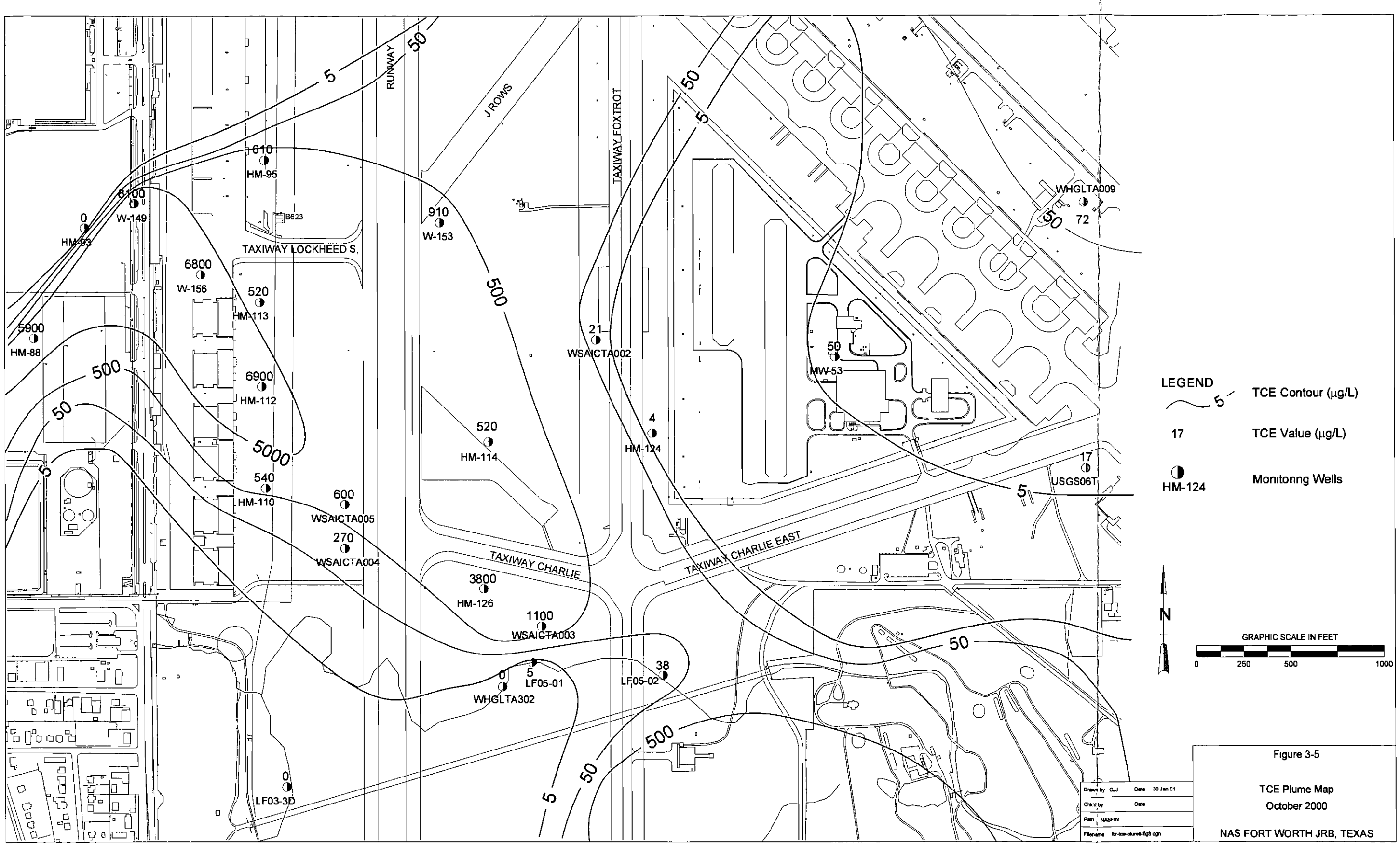

Figure 3-5

TCE Plume Map
October 2000

NAS FORT WORTH JRB, TEXAS

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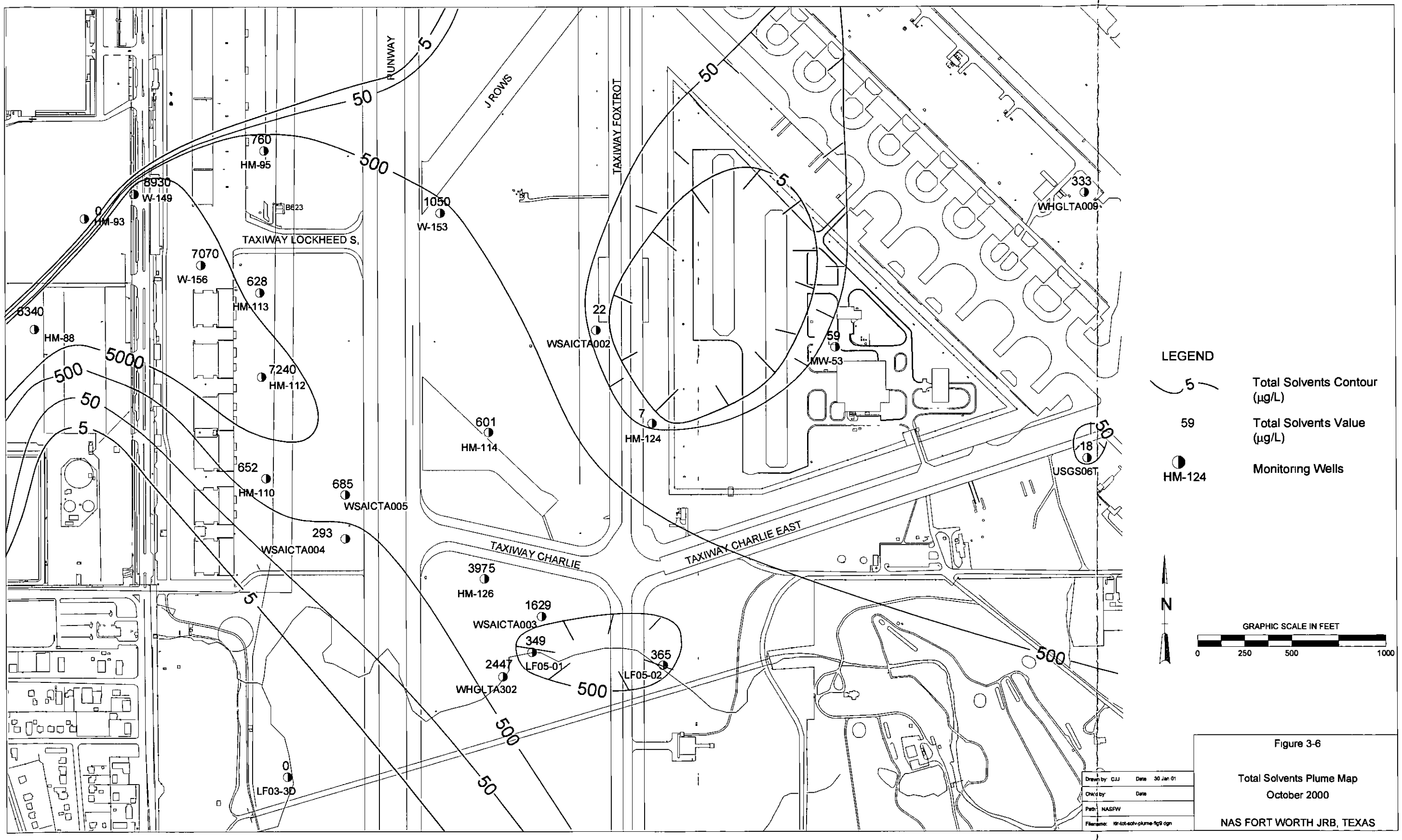

Figure 3-6

Total Solvents Plume Map
October 2000

NAS FORT WORTH JRB, TEXAS

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4. SUMMARY

The preliminary results of this SI are in general agreement with the existing geological interpretation of the area (e.g., Parsons Engineering 1998) at AOC 20. A summary of the preliminary findings follows:

- The northwest to southeast trending paleochannel is apparent in the aquitard topographic maps, with one potential narrower, deeper (approximately 50 feet wide) lineament. The most concentrated portion of the plume (TCE concentrations greater than 1,000 µg/L) is less than 500 feet wide and is confined within the paleochannel.

- The aquifer is highly heterogeneous, but does not appear to contain a significant amount of gravel.

- Biodegradation is occurring at Landfill 5. TCE degradation products (DCE and ethane) are present.

- The TCE plume has a slight vertical stratification, but the concentrations are within the same order of magnitude.

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FINAL PAGE

ADMINISTRATIVE RECORD

FINAL PAGE