E. GROUNDWATER MONITORING

Hydrogeologic characterization and review of existing groundwater monitoring well data at the BGC indicate that there are several distinct plume areas emanating from different point sources within the BGC (Fig. E-1). Each of these plume areas has been subjected to a separate site characterization plume definition. Future statistical analysis, development of GWPSs, and corrective actions will be developed as shown in Table E.8.1-1.

As previously discussed with SCDHEC, characterization of the MWMF groundwater constituent plumes has continued in a phased manner. Groundwater characterization work for the Southwest, Northwest, Northeast, and Southeast Plume Areas has been completed. Section E.2.2 includes detailed hydrogeologic information specific to the Southwest Plume Area. Section E.2.3 includes hydrogeologic information specific to the Northwest Plume Area. Section E.2.4 includes hydrogeologic information specific to the Northeast Plume Area. Section E.2.5 includes hydrogeologic information specific to the Southeast Plume Area. Fig. E-2 depicts the map boundaries of the four plume areas that will be used during the plume-specific groundwater discussion.

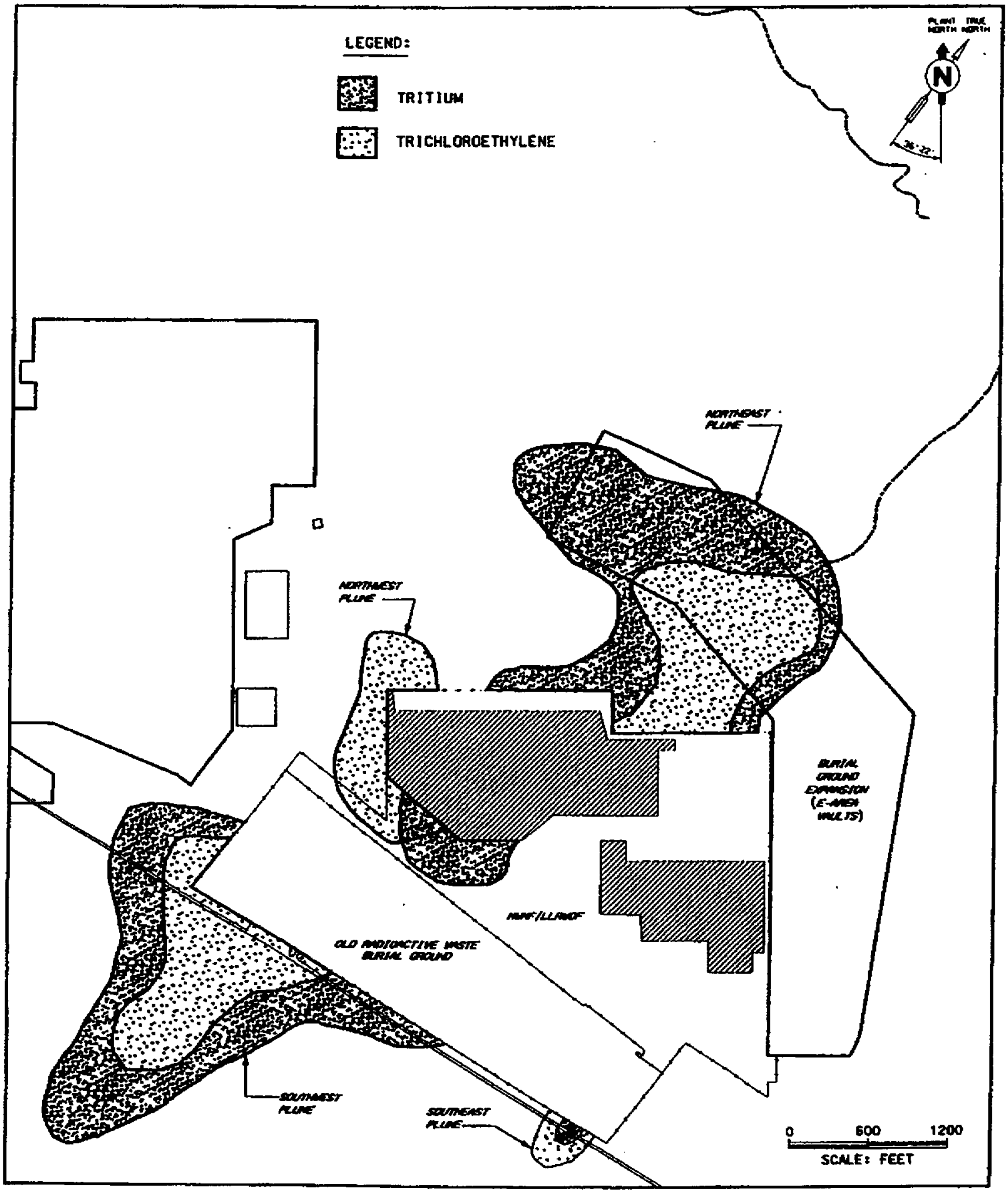

Fig. E-1. Burial Ground Complex Generalized Plume Map

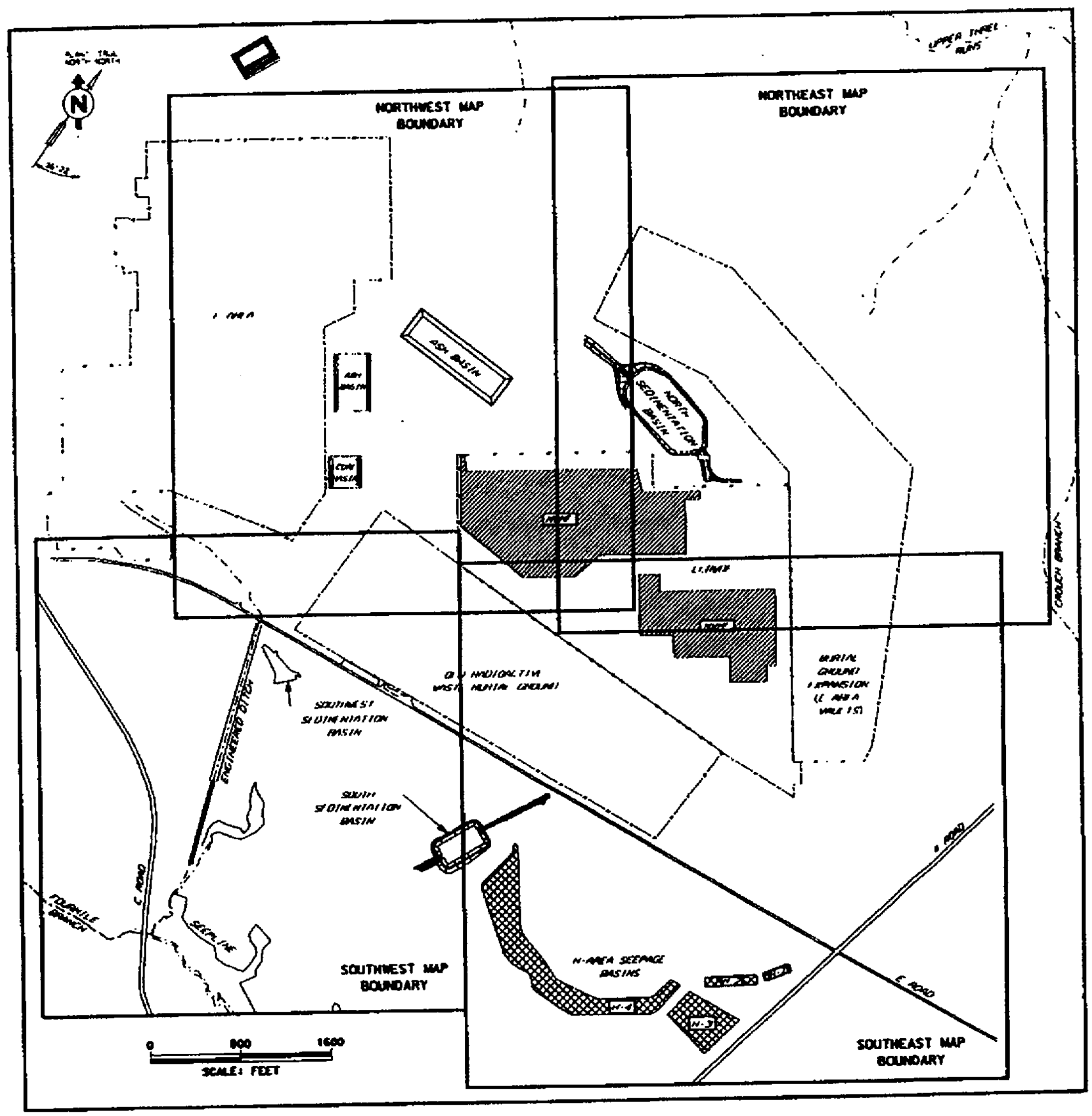

Fig. E-2. Map Boundaries of the Four Plume Areas

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E.1 Interim Status Monitoring Data

[REF: R.61-79.270.14(c)(1); 265.90 through 265.94]

In 1986, a RCRA Part B Permit Application was submitted for the initial MWMF trenches. Since that time, the facility has been operating under Interim Status. Ongoing activities in and around the BGC have been conducted to determine the nature and extent of any releases from facilities located within the BGC. As these activities have continued, regulatory requirements have changed. As additional information pertaining to releases from both regulated and nonregulated units has become available, subsequent modifications to the MWMF RCRA Part B Permit Application have been submitted.

As statistically significant concentrations of constituents migrated from the MWMF and were detected at the facility POC wells, the emphasis on groundwater monitoring shifted from detection monitoring to compliance monitoring. Continued monitoring identified the presence of **four** contaminant plumes migrating away from the MWMF in **four** varying directions. In response to this **plume migration**, the facility **is developing** a corrective action monitoring program **for the four plume areas as noted in Table E.8.1-1**.

Initial characterization activities used data from monitoring wells located throughout the BGC. The results of information and statistical analyses from these investigations for the BGC are discussed in Sections E.1, E.2, E.4, and E.5. During these characterization activities, it became apparent that the presence of the groundwater divide may have caused commingling of MWMF plumes with plumes associated with the adjacent ORWBG (see Section B for a complete discussion of individual facilities located within the BGC), which is undergoing RCRA/CERCLA investigation activities. Since CERCLA and RCRA have the primary goal of quantifying and reducing risk to human health and the environment from releases, the groundwater in the commingled areas beneath the ORWBG and the MWMF is addressed by the MWMF RCRA Corrective Action Program as previously discussed and agreed upon with SCDHEC.

Since plume migration appears to be independent and in varying directions to separate POEs, characterization activities have been separated and phased to address each plume individually. The field investigations have been phased and began with the plume emanating from the southwest corner of the MWMF and the ORWBG (Southwest Plume Area) and continued to the Northwest and Northeast Plume Areas, respectively. **However, field data collected from what is now referred to as the Southeast Plume Area indicated the presence of groundwater contamination emanating from the BGC. Additional characterization was conducted to further monitor the extent of groundwater contamination in this area.** Results from individual plume characterization activities are discussed in Sections E.2.2, E.2.3, E.2.4, **E.2.5**, E.4.2, E.4.3, E.4.4, **E.4.5**, and E.8.

E.1.1 DESCRIPTION OF WELLS

[REF: R.61-79.265.91]

Installation of the current groundwater monitoring well network for the BGC began in 1987 and has continued to the present as characterization/monitoring activities have progressed. Table E.1.1-1 lists the wells in this network and identifies well designation (background, POC, and assessment) as determined during the Interim Status period. Fig. E.1.1-1 depicts well cluster locations.

The monitoring wells in the BGC are screened in two saturated units within **the Floridan Aquifer System.** These units are as follows:

1. **The UTRA** (subdivided into two aquifer zones)
   - **The UAZ** (Water Table Aquifer) (Fig. E.1.1-2)
   - **The LAZ** (Fig. E.1.1-3)
2. Gordon Aquifer (Fig. E.1.1-4)

Table E.1.1-1. Monitoring Wells and Well Clusters at the Burial Ground Complex

Background Wells	POC Wells		Assessment Wells		
BGO 01D[1]	BGO 03A[3]	BGO 14C(R)[2]	BGO 09AA[3]	BGO 44B[2]	BGO 53A[3]
BGO 02D[1]	BGO 03C[2]	BGO 14D(R)[1]	BGO 10AA[3]	BGO 44C[2]	BGO 53B[2]
HSB 85A[3]	BGO 03D(R)[1]	BGO 15D[1]	BGO 10B[2]	BGO 44D[1]	BGO 53C[2]
HSB 85B[2]	BGO 04D[1]	BGO 26A[3]	BGO 16A(R)[3]	BGO 45A[3]	BGO 53D[1]
HSB 85C[1]	BGO 05C[2]	BGO 26D[1]	BGO 16B[2]	BGO 45B[2]	BSE 01C[2]
	BGO 05D[1]	BGO 27C[2]	BGO 16D[1]	BGO 45C[2]	BSE 01D[1]
	BGO 06A[3]	BGO 27D[1]	BGO 17D(R)[1]	BGO 45D[1]	BSE 02C[2]
	BGO 06B[2]	BGO 28D[1]	BGO 18A[3]	BGO 46B[2]	BSE 02D[1]
	BGO 06C[2]	BGO 30C[2]	BGO 18D[1]	BGO 46C[2]	BSE 03C[2]
	BGO 06D[1]	BGO 30D[1]	BGO 19D(R)[1]	BGO 46D[1]	BSE 03D[1]
	BGO 07D[1]	BGO 31C[2]	BGO 20AA[3]	BGO 47A[3]	BGX 01A[3]
	BGO 08A(R)[3]	BGO 31D[1]	BGO 20A[3]	BGO 47C[2]	BGX 01C[2]
	BGO 08C[2]	BGO 32D[1]	BGO 20B[2]	BGO 47D[1]	BGX 01D[1]
	BGO 08D[1]	BGO 33C[2]	BGO 20C[2]	BGO 48C[2]	BGX 02B[2]
	BGO 09D[1]	BGO 33D[1]	BGO 20D[1]	BGO 48D[1]	BGX 02D[2]
	BGO 10A(R)[3]	BGO 34D[1]	BGO 21D[1]	BGO 49A[3]	BGX 03D[2]
	BGO 10C[2]	BGO 35C[2]	BGO 22D(X)[1]	BGO 49C[2]	BGX 04A[3]
	BGO 10D(R)[1]	BGO 35D[1]	BGO 23D[1]	BGO 49D[1]	BGX 04C[2]
	BGO 11D(R)[1]	BGO 36D[1]	BGO 24D[1]	BGO 50A[3]	BGX 04D[2]
	BGO 12A(X)[3]	BGO 37C[2]	BGO 25A[3]	BGO 50C[2]	BGX 05D[2]
	BGO 12C(X)[2]	BGO 37D[1]	BGO 29A[3]	BGO 50D[1]	BGX 06D[2]
	BGO 12D(R)[1]	BGO 38D[1]	BGO 29C[2]	BGO 51AA[3]	BGX 07D[2]
	BGO 13D(R)[2]	BGO 39A[3]	BGO 29D[1]	BGO 51A[3]	BGX 08D(R)[2]
	BGO 14A(R)[3]	BGO 39C[2]	BGO 40D[1]	BGO 51B[2]	BGX 09D[1]
		BGO 39D[1]	BGO 41A[3]	BGO 51C[2]	BGX 10D[1]
			BGO 42C[2]	BGO 51D[1]	BGX 11D[1]
			BGO 43AA[3]	BGO 52AA[3]	BGX 12C[2]
			BGO 43A[3]	BGO 52A[3]	BGX 12D[1]
			BGO 43C(R)[2]	BGO 52B[2]	HMD 01D[2]
			BGO 43D[2]	BGO 52C[2]	HMD 02D[2]
			BGO 44AA[3]	BGO 52D[1]	HMD 03D[2]
			BGO 44A[3]	BGO 53AA[3]	HMD 04D[2]

NOTES: POC Point of Compliance
(R) indicates replacement well
(X) indicates replacement of (R)

Number of wells/aquifer
1 – UAZ-UTRA 57
2 – LAZ-UTRA 59
3 – Gordon Aquifer 34

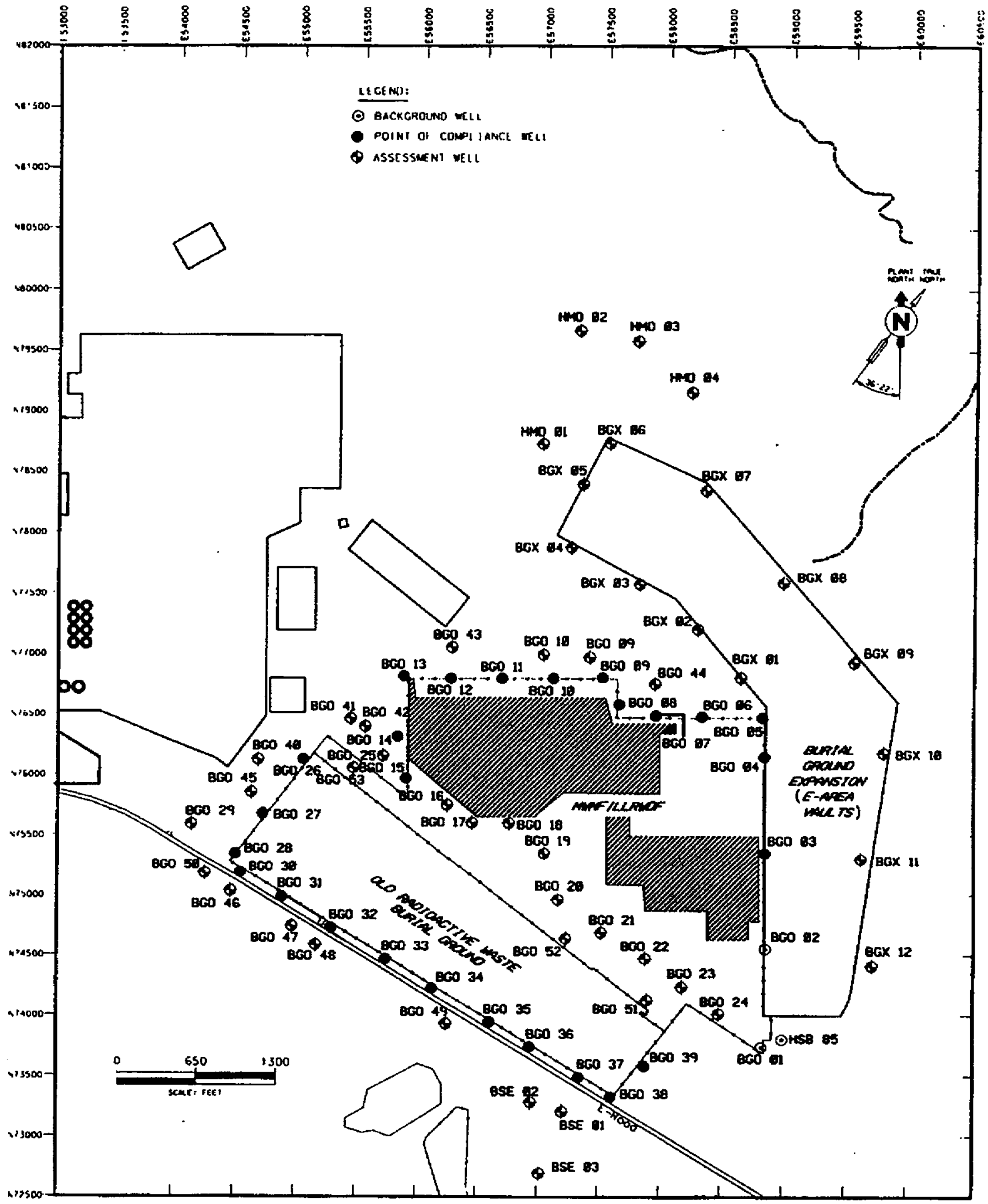


Fig. E.1.1-1. Locations of Wells and Well Clusters at the Burial Ground Complex

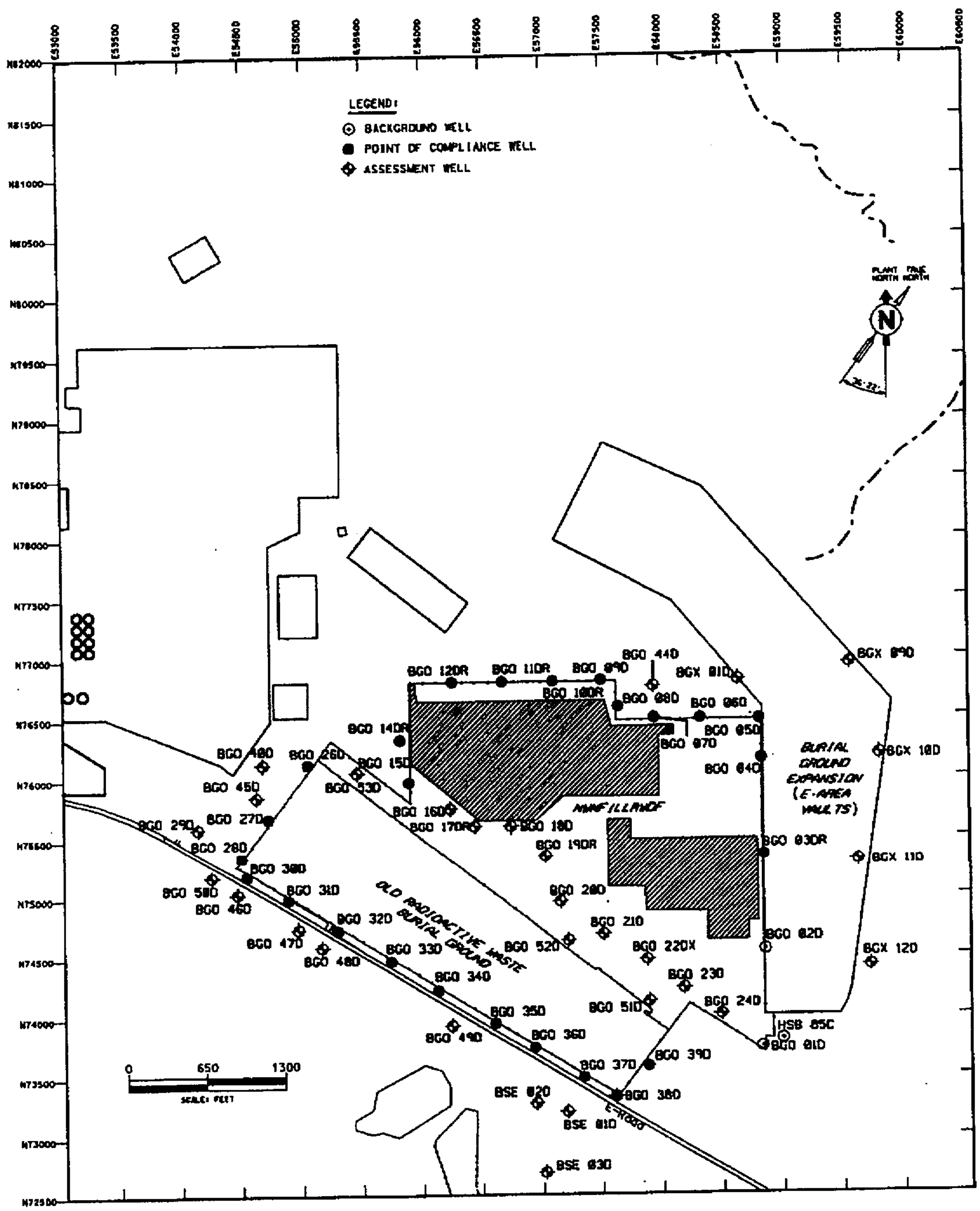


Fig. E.1.1-2. Location of the Upper Aquifer Zone of the Upper Three Runs Aquifer (Water Table Aquifer) Wells at the Burial Ground Complex

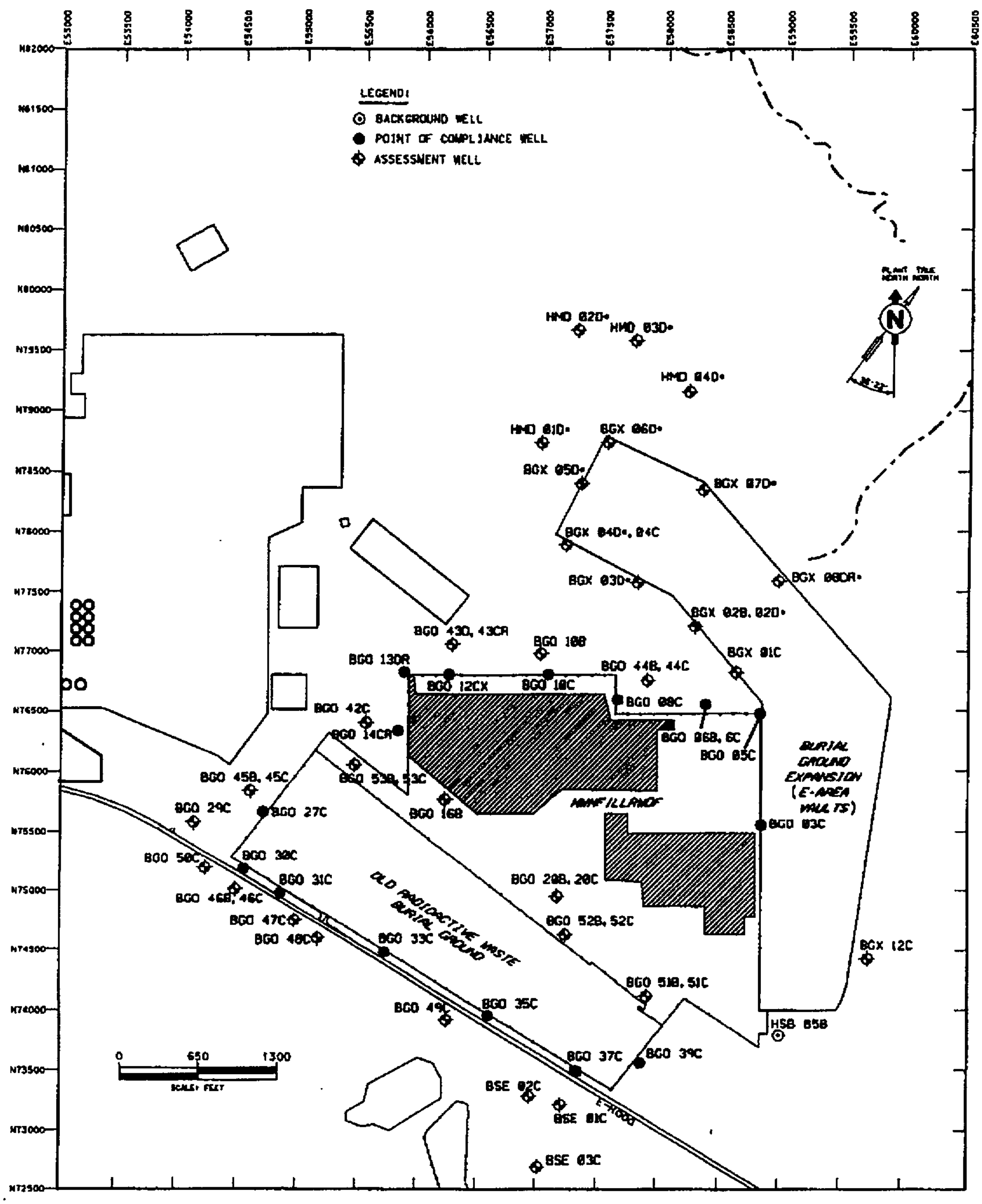


Fig. E.1.1-3. Location of the Lower Aquifer Zone of the Upper Three Runs Aquifer Wells at the Burial Ground Complex

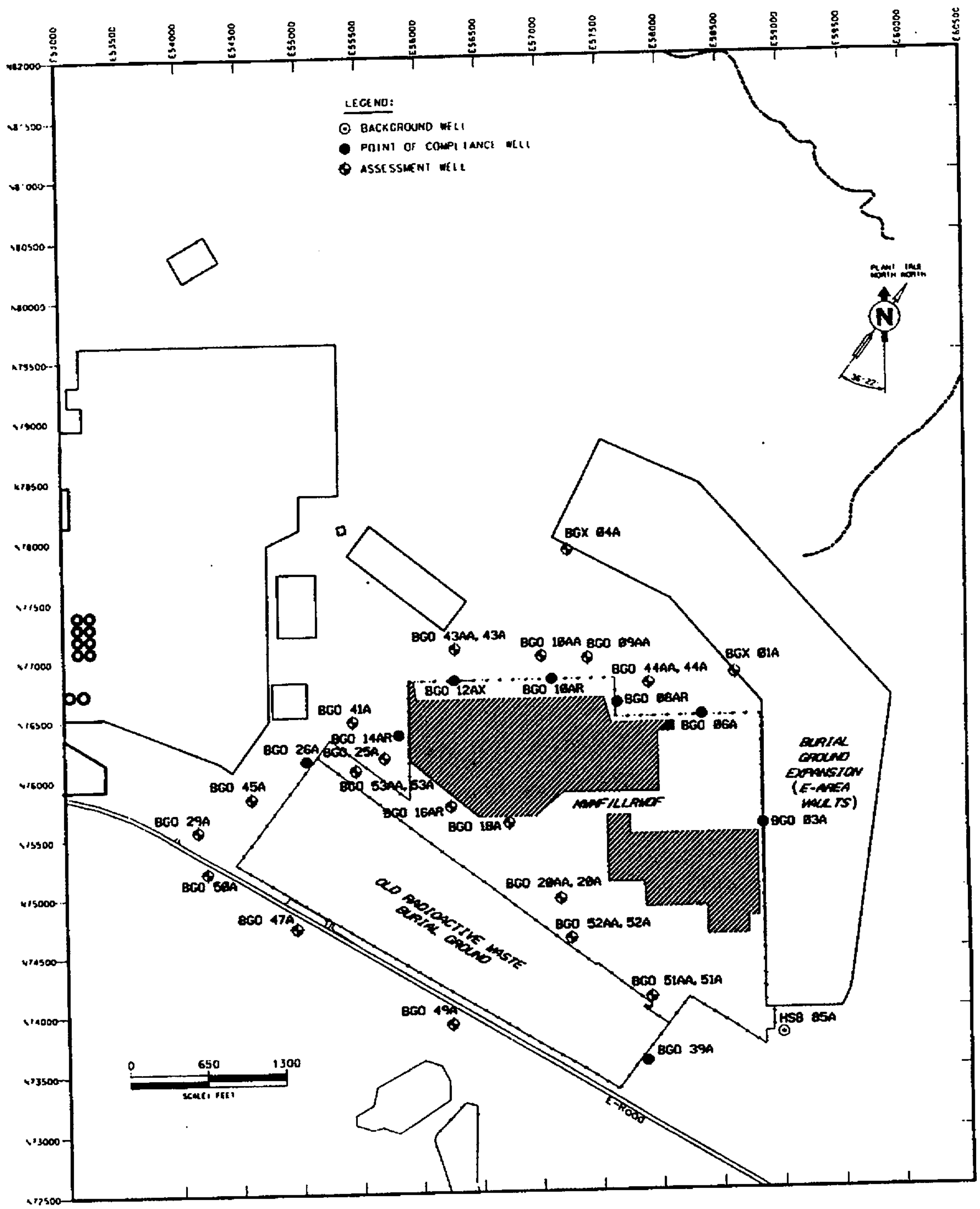
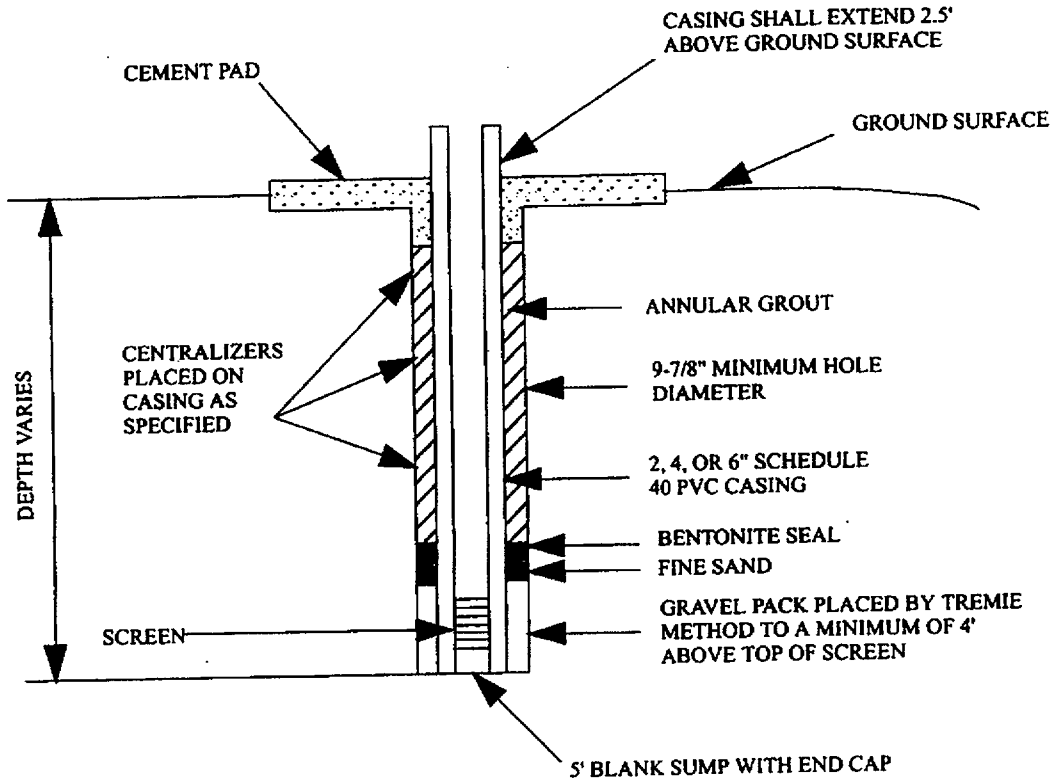


Fig. E.1.1-4. Location of the Gordon Aquifer Wells at the Burial Ground Complex

Monitoring wells in each unit are generally designated by the following letters:

- "AA" and "A" wells - **Gordon Aquifer**
- "B" and "C" wells - **LAZ-UTRA**
- "D" wells - **UAZ-UTRA**
- "D*" or "DC" wells - water table wells screened in **the LAZ**-UTRA
- "R" wells - Replacement wells
- "X" wells - Replacement of R wells

Fig. E.1.1-5 is a typical well construction diagram for monitoring wells constructed in the BGC. Graphic boring logs showing lithologic, geophysical, and well construction data for particular wells are shown in the Geologic Boring Logs for the Burial Ground Complex (U) (WSRC-RP-95-183, **Rev. 1**), submitted to SCDHEC on **April 29, 1999**. Wells installed as part of ongoing characterization activities are described in A Field Investigation Plan for the Burial Ground Complex (U) (WSRC-RP-93-848, **Rev. 1**), submitted to SCDHEC in November 1994. Phase I FIP well installation details are provided in the Burial Ground Complex Field Investigation Preliminary Data Report #1 (WSRC-RP-94-1286), submitted to SCDHEC in January 1995. Phase II FIP monitoring well installations are not plume-specific and were designed to address background groundwater quality and the water table divide. **These well details are provided in the Burial Ground Complex Field Investigation Preliminary Data Report #2 (WSRC-RP-96-060), submitted to SCDHEC in April 1996.**



SCREEN	Flush-jointed schedule 40 PVC with slot size of 0.0125 inches. No glue shall be used.
CASING	Threaded schedule 40 PVC casing.
GRAVEL PACK	Grain size distribution of 0.45 to 0.55 mm with uniformity coefficient of <1.7. Installed to a minimum of 4' above top of screen.
FINE SAND	1' minimum. Grain size distribution 0.30 to 0.45 mm.
BENTONITE SEAL	4' minimum. 3/8- to 1/2-inch uncoated bentonite pellets.
ANNULAR GROUT	6.5-7.5 gallons of potable water, 1 sack (94 lb) Portland cement, 2 lb of sodium bentonite powder per 1.4 cubic feet of grout.
CONCRETE PAD	5-foot x 5-foot x 6-inch, 3,000-psi concrete pad, the concrete extends down the protective housing forming a seal with the top of the annular grout.
mm	millimeter
psi	pounds per square inch
PVC	Polyvinyl Chloride

Fig. E.1.1-5. Typical Well Construction Diagram for Monitoring Wells

E.1.2 DESCRIPTION OF SAMPLING/ANALYSIS PROCEDURES

[REF: R.61-79.265.92]

A general description of the sampling and analysis procedures for the MWMF monitoring wells is provided in **the reports listed on Table E.1.1-2**, along with a discussion of sample collection, sample preservation, sample shipment, analytical procedures, and chain-of-custody control.

The primary objectives of the groundwater sampling and analysis program are as follows:

- To determine the direction of groundwater flow within each saturated zone beneath the facility
- To determine the groundwater quality in the vicinity of each monitoring well by collecting and analyzing representative groundwater samples.

E.1.3 MONITORING DATA

[REF: R.61-79.265.92]

Groundwater quality samples have been collected quarterly for the MWMF from March 1988 (1Q88) through March 1995 (1Q95). Groundwater assessment reports have been provided to SCDHEC for each of these quarters. **Since 1995, groundwater quality samples have been collected twice a year from the POC wells and annually from the assessment wells with reports submitted to SCDHEC annually.** Table E.1.1-2 lists the reports submitted from 1Q88 to **4Q98**

Table E.1.1-2. List of Groundwater Monitoring Reports

Control Number	Title
WSRC-RP-95-184	*Groundwater Quality Data for the MWMF from the First, Second, and Third Quarters of 1988*
WSRC-TR-89-902	*MWMF, Fourth Quarter 1988, Groundwater Monitoring Report*
WSRC-TR-89-903	*MWMF, First Quarter 1989, Groundwater Monitoring Report*
WSRC-TR-89-904	*MWMF, Second Quarter 1989, Groundwater Monitoring Report*
WSRC-TR-90-038	*MWMF, Third Quarter 1989, Groundwater Monitoring Report*
WSRC-TR-90-147	*MWMF, Fourth Quarter 1989, Groundwater Monitoring Report*
WSRC-TR-90-223	*MWMF, First Quarter 1990, Groundwater Monitoring Report*
WSRC-TR-90-369	*MWMF, Second Quarter 1990, Groundwater Monitoring Report*
WSRC-TR-90-555	*MWMF, Third Quarter 1990, Groundwater Monitoring Report*
WSRC-TR-91-095	*MWMF, Fourth Quarter 1990, Groundwater Monitoring Report*
WSRC-TR-91-388	*MWMF, First Quarter 1991, Groundwater Monitoring Report*
WSRC-TR-91-518	*MWMF, Second Quarter 1991, Groundwater Monitoring Report*
WSRC-TR-91-639	*MWMF, Third Quarter 1991, Groundwater Monitoring Report*
WSRC-TR-92-056	MWMF, Fourth Quarter 1991, Groundwater Monitoring Report
WSRC-TR-92-221	MWMF, First Quarter 1992, Groundwater Monitoring Report
WSRC-TR-92-390	MWMF, Second Quarter 1992, Groundwater Monitoring Report
WSRC-TR-92-511	MWMF, Third Quarter 1992, Groundwater Monitoring Report
WSRC-TR-93-060	MWMF, Fourth Quarter 1992, Groundwater Monitoring Report
WSRC-TR-93-272	MWMF, First Quarter 1993, Groundwater Monitoring Report
WSRC-TR-93-390	MWMF, Second Quarter 1993, Groundwater Monitoring Report
WSRC-TR-93-567	MWMF, Third Quarter 1993, Groundwater Monitoring Report
WSRC-TR-94-005	MWMF, Fourth Quarter 1993, Groundwater Monitoring Report
WSRC-TR-94-240	MWMF, First Quarter 1994, Groundwater Monitoring Report
WSRC-TR-94-345	MWMF, Second Quarter 1994, Groundwater Monitoring Report
WSRC-TR-94-486	MWMF, Third Quarter 1994, Groundwater Monitoring Report
WSRC-TR-94-610	MWMF, Fourth Quarter 1994, Groundwater Monitoring Report
WSRC-TR-95-0139-1	MWMF, First Quarter 1995, Groundwater Monitoring Report
WSRC-TR-95-0139-2	MWMF, Fourth Quarter 1995 and 1995 Annual Groundwater Monitoring Report
WSRC-TR-96-0139-4	MWMF, Fourth Quarter 1996 and 1996 Annual Groundwater Monitoring Report
WSRC-TR-98-00005	MWMF, Fourth Quarter 1997 and 1997 Annual Groundwater Monitoring Report
WSRC-TR-99-00015	MWMF, Fourth Quarter 1998 and 1998 Annual Groundwater Monitoring Report

NOTES: Data from items listed in italics have been used in statistical analysis for the general BGC area. Data for individual plume statistics are from a subset of all items listed in the table.

Data from the first three quarters of 1988 were combined into one report and submitted to SCDHEC as shown in Table E.1.1-2.

E.1.4 STATISTICAL PROCEDURES

[REF: R.61-79.265.93]

The results of the statistical procedures used to analyze the initial 15 quarters of detection monitoring data (1988-1991) are presented in the most recent revision of the supplemental document to this RCRA Part B Permit Renewal Application, entitled Statistical Analysis of Groundwater Data for the Mixed Waste Management Facility 1st Quarter of 1988 through 3rd Quarter of 1991 (U) (WSRC-RP-95-185).

Statistical analyses on data collected since 1991 will be performed on a plume-by-plume basis to determine plume-specific COCs necessary to develop each plume-specific GWPS and to assess effective and appropriate corrective actions as discussed at the beginning of Section E.8. Data selected for statistical analysis will generally comprise the most recent four quarters of data available from each plume-specific set of monitoring wells. **However, data from previous quarters may be used to supplement inconsistencies associated with data results.**

The schedule for completion of plume-specific statistical analysis of data and COC determination is provided in Section E.8. **Details of statistical analysis for each plume are discussed in Section E.5.**

E.1.5 GROUNDWATER ASSESSMENT PLAN

[REF: R.61-79.265.93(d)(2)]

The results of implementing the Groundwater Quality Assessment Monitoring Plan, Addendum 2 (U) (WSRC-ESH-ERG-95-0147) were submitted to SCDHEC in the form of MWMF Groundwater Monitoring Reports (Table E.1.1-2). These reports include an assessment of the rate and extent of contamination.

The groundwater characterization activities were performed in a phased manner designed to characterize distinct and separate plumes emanating from the BGC. This phased approach is described in A Field Investigation Plan for the Burial Ground Complex (U) (WSRC-RP-93-848), submitted to SCDHEC in November 1994. The hydrogeologic and contaminant data collected from these phases are presented in the Burial Ground Complex Field Investigation Preliminary Data Report #1 (WSRC-RP-94-1286) and **Data Report #2 (WSRC-RP-96-060)**, submitted to SCDHEC in January 1995 **and April 1996, respectively. A BGC Aquifer Test Plan (WSRC-RP-96-302, Rev. 1), submitted to SCDHEC in September 1998, outlined a series of pumping tests to be conducted at three test pads around the BGC (Fig. E.1.1-6). Results of the BGC aquifer test will be submitted under separate cover to SCDHEC according to Table E.8.1-1.**

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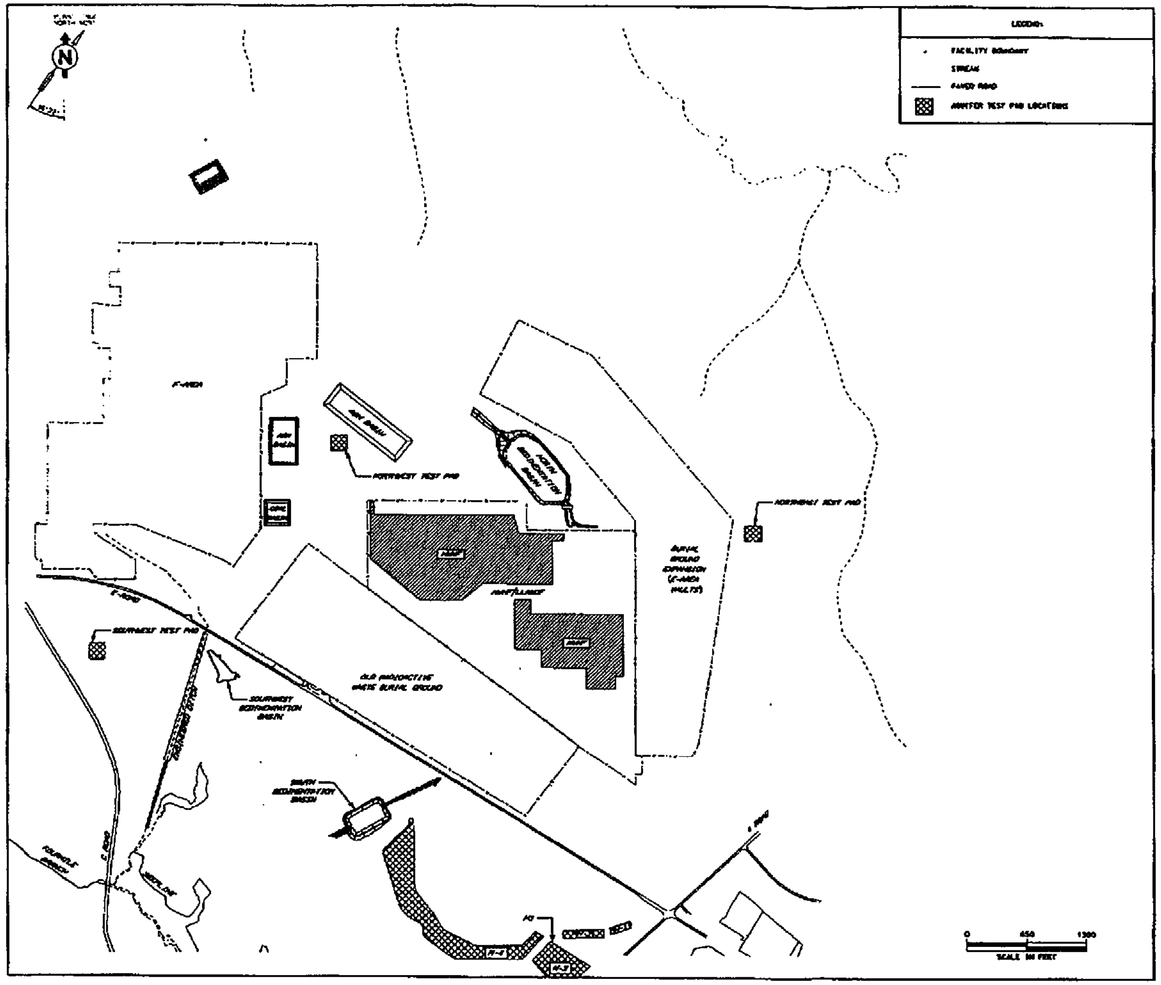

Fig. E.1.1-6. Burial Ground Complex Aquifer Test Locations

E.2 General Hydrogeologic Information

[REF: R.61-79.270.14(c)(2)]

E.2.1 HYDROLOGIC INFORMATION ASSOCIATED WITH THE GENERAL BURIAL GROUND COMPLEX

Potentiometric surface maps of the UAZ-UTRA (Water Table Aquifer), the LAZ-UTRA, and the Gordon Aquifer for the GSA are provided in Appendix 1 as Maps 4, 5, and 6, respectively. Groundwater flow direction and rates are also depicted on the maps. A discussion of these flow rates is included in Section E.2.1.2.1.

Generally, there is a prominent groundwater divide present within the UAZ-UTRA (Water Table Aquifer) and the LAZ-UTRA. This groundwater divide runs through the BGC resulting in diverging flow paths to natural outcrops. The potentiometric surface of the UAZ-UTRA (Water Table Aquifer) and the LAZ-UTRA generally follows the topography of the GSA.

E.2.1.1 Surface Hydrology of the Burial Ground Complex

The BGC is located on a topographic high between two streams, Upper Three Runs and Fourmile Branch, that incise the land surface and influence the local hydrogeology. Upper Three Runs is located approximately 3,000 feet to the north and northwest, and Fourmile Branch is located approximately 4,000 feet to the south, of the MWMF. The interstream topography is relatively flat, but the slope increases near the streams.

The primary natural drainage in the vicinity of the BGC is an unnamed tributary channel of Fourmile Branch (locally referred to as the Old F-Area Effluent Stream). This tributary originates near the western boundary of the BGC and has a channel length of approximately 1 mile. **Additionally, an engineered ditch transports runoff to Fourmile Branch.** Two other natural drainages originate approximately 0.3 mile northwest and 0.5 mile northeast of the northern boundary of the BGC. The 100-year flood limits for Upper Three Runs and Fourmile Branch are approximately 0.7 mile north and 0.5 mile south of the BGC, respectively.

E.2.1.2 Hydrogeology of the Burial Ground Complex

The hydrostratigraphy of SRS has been described by several different classifications over the years. This RCRA Part B Permit Renewal Application incorporates the **recent hydrostratigraphic** nomenclature currently established for the SRS vicinity (Aadland et al., 1995). The nomenclature is correlated with the local lithostratigraphy **to the more recently used alpha-numeric nomenclature** in Fig. E.2.1-1. A thorough description and review of the hydrostratigraphy of the SRS region are available in **Hydrogeologic Framework of West-Central South Carolina** (Aadland et al., 1995).

In the BGC, there are three significant hydrogeologic zones. In descending order, these zones include the regulatory uppermost aquifer, the principal confining unit, and the principal confined aquifer (shallowest confined aquifer beneath the BGC). The regulatory uppermost aquifer is defined in R.61-79.260.10 as "the geologic formation nearest the natural ground surface that is an aquifer, as well as lower aquifers that are hydraulically interconnected with this aquifer

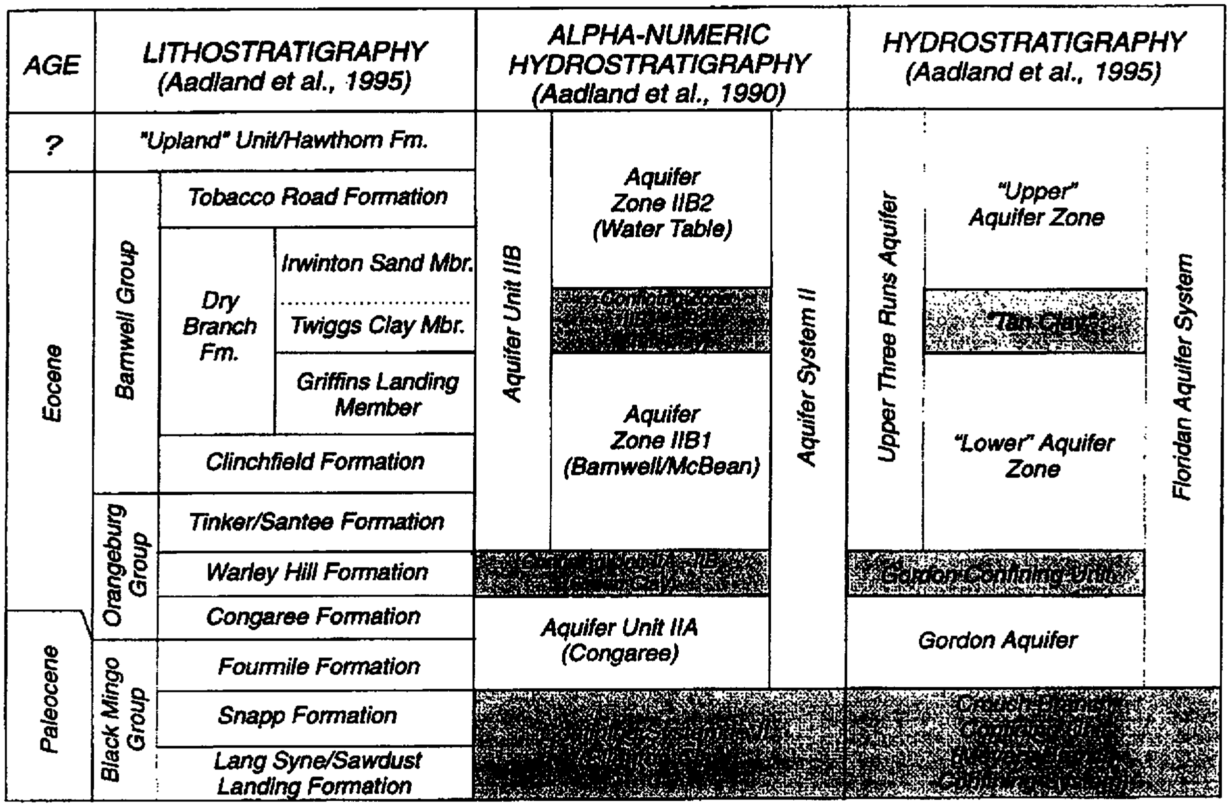

Fig. E.2.1-1. Hydrostratigraphic Nomenclature of the Burial Ground Complex

within the facility's property boundary." The principal confining unit is the unit that provides the effective separation between the regulatory uppermost aquifer and underlying hydrologic zones. The principal confined aquifer refers to the shallowest aquifer under the BGC that is effectively separated from overlying hydrologic zones. A schematic diagram of the BGC hydrostratigraphy is also presented on Fig. E.2.1-1.

Regional geology is provided in Volume I. Due to the recent and ongoing characterization effort for the BGC and the F- and H-Area HWMFs, the hydrogeology of the GSA is currently being revised. A detailed discussion of the hydrogeology of the GSA will be provided in a future revision to Volumes IV and V (F- and H-Area HWMF, respectively) of the SRS RCRA Part B Permit Renewal Application.

E.2.1.2.1 Identification of the Regulatory Uppermost Aquifer Beneath the Burial Ground Complex

This section describes the general hydrogeologic characteristics of the BGC. The more recent characterization strategies target specific plumes within the BGC. The completed plume-specific hydrogeologic data are provided in Sections E.2.2 through E.2.5.

The regulatory uppermost aquifer beneath the BGC consists of several saturated units. The regulatory uppermost aquifer has been defined by various subsurface investigations, which began in the 1950s. Monitoring wells were installed and screened in three saturated zones known as **the UAZ-UTRA** (Water Table Aquifer), **the LAZ-UTRA,** and **the Gordon Aquifer**. Although these units are separated by low

permeability layers, there is evidence of varying degrees of hydraulic connection between them. Therefore, in accordance with the definition referenced above, these hydrogeologic units are grouped together and considered to compose the regulatory uppermost aquifer.

Upper Aquifer Zone of the Upper Three Runs Aquifer (Water Table Aquifer)

The **UAZ-UTRA** (Water Table Aquifer) consists of the saturated unit that lies above **the discontinuous "tan clay" confining zone**. It is the shallowest hydrostratigraphic unit that lies beneath the BGC. The zone is a silty, fine-grained sand with varying amounts of clay. Primary recharge is from downward movement of precipitation through the unsaturated zone. The major recharge source to this unconfined aquifer is local rainwater. The thickness of the saturated zone ranges from 0 feet to approximately 45 feet.

Fig. E.2.1-2 presents the potentiometric surface map for the **UAZ-UTRA** (Water Table Aquifer) constructed from water levels measured during 4Q95. As shown on Fig. E.2.1-2, there is a groundwater divide that trends approximately east-west between the MWMF and the ORWBG. To the south of the divide, groundwater flows south and southwest toward Fourmile Branch. North of the divide, groundwater flows north and northwest toward Upper Three Runs.

North of the MWMF, the water table abuts the "tan clay" confining zone (Fig. E.2.1-2). This contact defines the northern limit of saturation in the **UAZ-UTRA** (Water Table Aquifer). Flow continues

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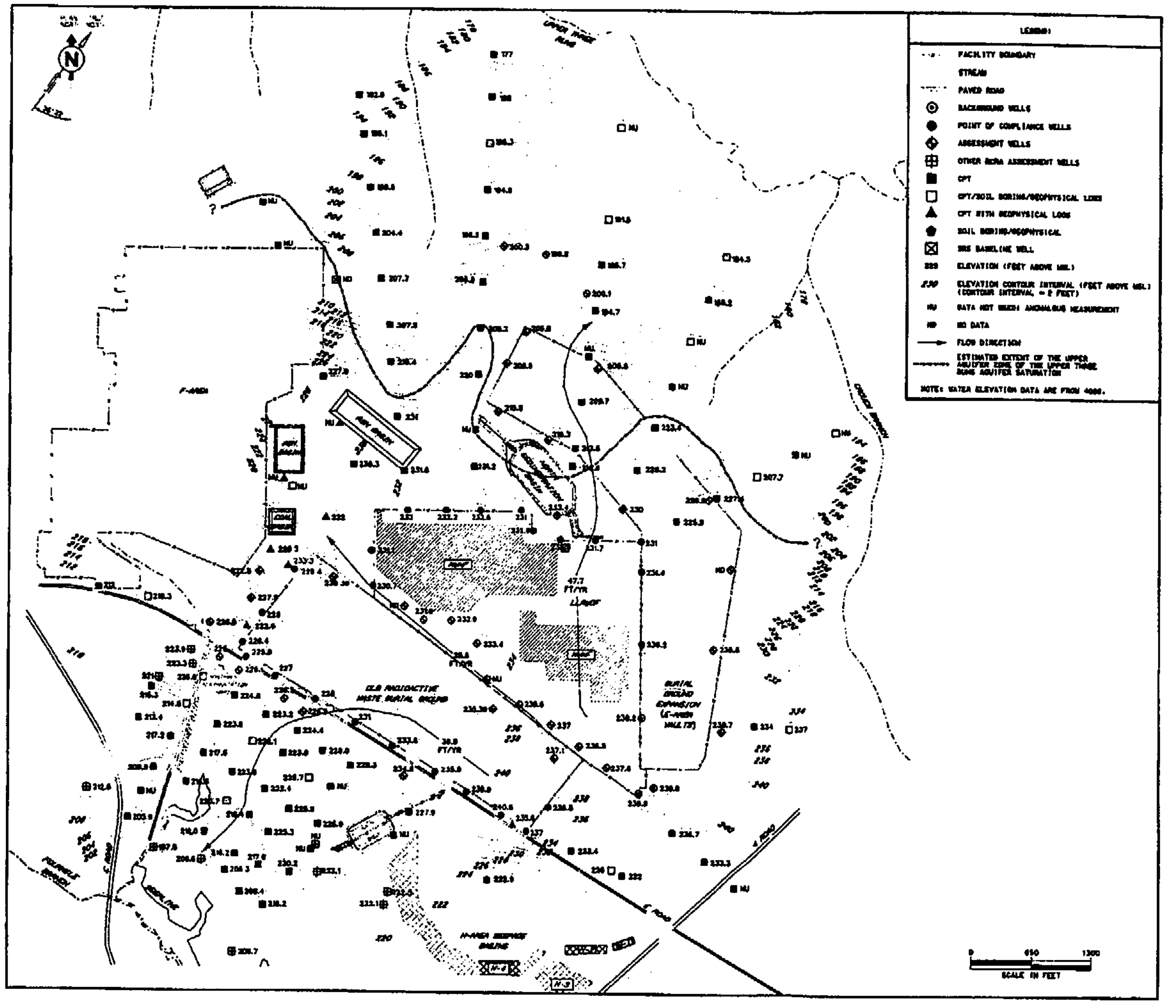

Fig. E.2.1-2. Potentiometric Surface Map of the Upper Aquifer Zone of the Upper Three Runs Aquifer (Water Table Aquifer) in the Burial Ground Complex, 4Q95

northwest, passing through the **"tan clay" confining zone** and into the **LAZ-UTRA**, and coalescing into the Gordon Aquifer.

Estimated flow rates are shown on Fig. E.2.1-2. Flow rates have been calculated following the procedures discussed in the remainder of this section.

The average linear velocity of groundwater has been estimated by the following equation:

$$V = \frac{K_h I}{n_e}$$

where: V = groundwater velocity (feet/year)

K_h = horizontal hydraulic conductivity (feet/day)

I = hydraulic gradient (dh/dl) (feet/feet)

dh = change in head (feet)

dl = distance over which head changes (feet)

n_e = effective porosity (unitless)

Using a hydraulic gradient (I) (feet/feet) for each flow path indicated in Fig. E.2.1-2, Fig. E.2.1-3, and Fig. E.2.1-4, an average horizontal hydraulic conductivity (K_h) (feet/day) based on slug test data, and an

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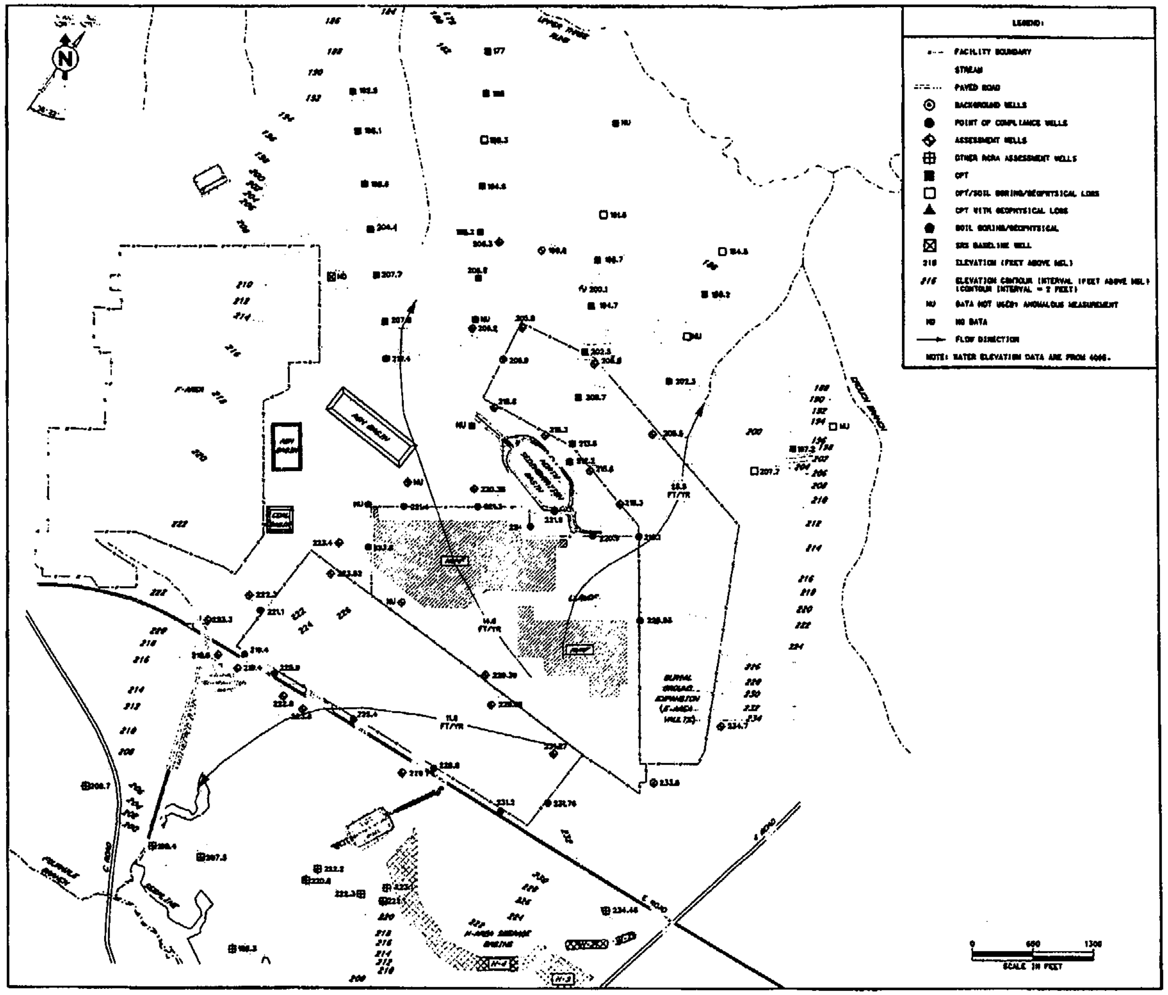

Fig. E.2.1-3. Potentiometric Surface Map of the Lower Aquifer Zone of the Upper Three Runs Aquifer in the Burial Ground Complex, 4Q95

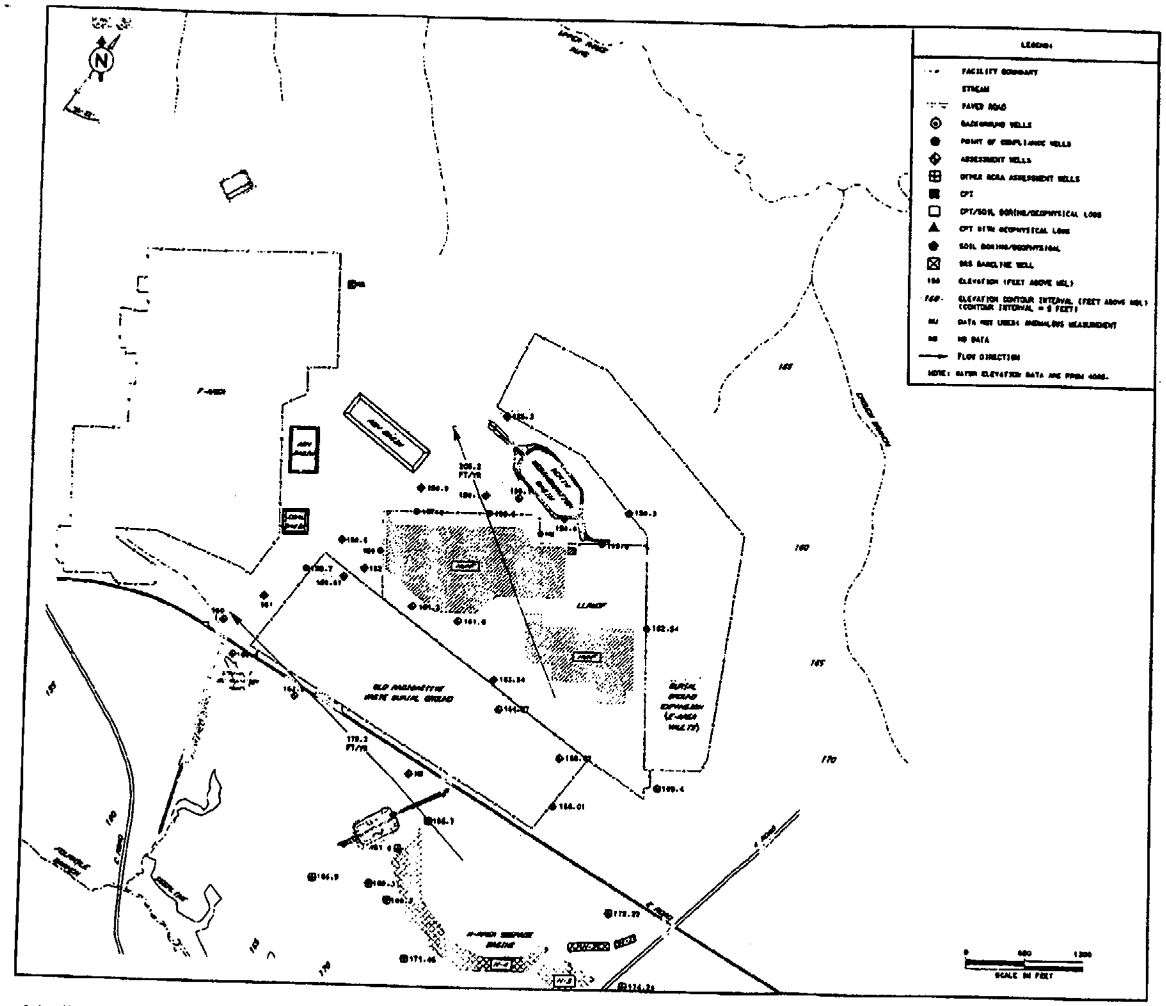

Fig. E.2.1-4. Potentiometric Surface Map of the Gordon Aquifer in the Burial Ground Complex, 4Q95

effective porosity (n_e) of 0.20, the linear groundwater velocity for each flow path has been calculated.

The **BGC** groundwater velocity for **the UAZ-UTRA** (Water Table Aquifer) was calculated in a range of **25.5 to 47.7** feet/year based on an effective porosity of 0.20, an average hydraulic conductivity of **2.81** feet/day, and hydraulic gradients in a range of **0.0050** to **0.0093** feet/feet, respectively.

The groundwater velocity (feet/day) was calculated along the flow lines shown on the potentiometric maps from the start and end points indicated. Velocity was calculated for the flow lines, and the velocity was then multiplied by 365 to produce a rate per year.

Groundwater velocity varies around the BGC. Generally, groundwater velocity is slowest along the groundwater divide and faster when groundwater nears a natural outcrop. Groundwater velocities were calculated to depict a range of flow rates at different locales around the BGC.

The GSA groundwater velocity for the UAZ-UTRA (Water Table Aquifer) was calculated at 30.8 feet/year based on an effective porosity of 0.20, an average hydraulic conductivity of 2.81 feet/day, and a hydraulic gradient of 0.0060 feet/feet (Appendix 1, Map 4).

"Tan Clay" Confining Zone

The "tan clay" confining zone separates the **UAZ-UTRA** (Water Table Aquifer) and the **LAZ-UTRA** and is therefore a component of the regulatory uppermost aquifer. Lithologically, the zone consists of

alternating beds of clay and sandy clay with minor interbeds of clayey sand and sand. Thicknesses range from approximately 2 to 25 feet and average approximately 10 feet at the BGC.

The "tan clay" confining zone is discontinuous and allows for direct hydraulic connection between the **UAZ-UTRA** (Water Table Aquifer) and the **LAZ-UTRA.**

Lower Aquifer Zone of the Upper Three Runs Aquifer

The LAZ-UTRA consists of all the saturated strata that lie between **the "tan clay" confining zone and the Gordon Confining Unit**. Some hydraulic communication exists between **the LAZ-UTRA** and the underlying and overlying aquifer zones within the regulatory uppermost aquifer. Thicknesses range from approximately 50 to 90 feet and average approximately 70 feet at the BGC.

The potentiometric surface map **of the LAZ-UTRA** is presented in Fig. E.2.1-3. Groundwater flows to the west and southwest under the ORWBG and flows northwest under the MWMF, HW/MWDV, and EAV. Estimated flow rates for the representative flow paths shown on Fig. E.2.1-3 have been calculated following the same procedures previously discussed for **calculating flow rates in the UAZ-UTRA** (Water Table Aquifer).

The **BGC** groundwater velocity for **the LAZ-UTRA** was calculated in a range of **11.8 to 25.5** feet/year based on an effective porosity of 0.20, an average hydraulic conductivity of **1.38** feet/day, and a hydraulic gradient ranging from **0.0047 to 0.0101** feet/feet.

The GSA groundwater velocity for the LAZ-UTRA was calculated at 11.3 feet/year based on an effective porosity of 0.20, an average hydraulic conductivity of 1.38 feet/day, and a hydraulic gradient of 0.0045 feet/feet (Appendix 1, Map 5).

Gordon Confining Unit (Green Clay)

The Gordon Confining Unit (Green Clay) separates **the LAZ-UTRA** from **the Gordon** Aquifer and is included in the regulatory uppermost aquifer.

Lithologically, this unit consists of clay and sandy clay with locally interbedded sand, clayey sand, and calcareous mud. Thicknesses range from approximately 1 to 15 feet and average approximately 5 feet beneath the BGC.

Gordon Aquifer

The **Gordon** Aquifer consists of all the saturated strata between the **Gordon** Confining **Unit** and **the Meyers Branch Confining System.** This unit is the lowermost distinct hydrologic unit within the regulatory uppermost aquifer. The **Gordon Aquifer** receives localized recharge from the **LAZ-UTRA** via leakage across the **Gordon** Confining **Unit. The thickness** of the **Gordon Aquifer** in the BGC **area is approximately 45 feet.**

Groundwater flow in **the Gordon Aquifer** is northwest toward Upper Three Runs (Fig. E.2.1-4). To the south, **Fourmile Branch** does not incise **the Gordon** Confining Unit; therefore, it does not influence flow in the underlying **Gordon Aquifer**.

Discharge from the **Gordon** Aquifer in the vicinity of the BGC is to Upper Three Runs. An upward flow potential exists between the **Crouch Branch** Aquifer and the **Gordon** Aquifer. Contaminant migration from the **Gordon Aquifer** across the **Meyers Branch** Confining System is unlikely due to this upward potential and the competency of the **Meyers Branch** Confining System. **Additionally, wells installed in the lower Gordon Aquifer exhibit an upward flow potential that exists in the lower sections of the Gordon Aquifer.**

Long duration, multi-well aquifer tests have been conducted using wells screened in the **Gordon** Aquifer (CH_2M Hill 1989; Albenesius et al., 1990). Hydraulic conductivity estimates from these tests ranged from 30 to 60 feet/day. Transmissivity estimates ranged from 1,800 to 2,600 square feet/day. Storage coefficients from the tests ranged from 2.0E-04 to 3.1E-04, indicative of a confined aquifer. Although these tests were not conducted at the MWMF, both were near the BGC (**Appendix 1, Map 7**). Lithologic data indicate similar sediments throughout the BGC for the **Gordon Aquifer**.

Estimates of flow rates have been based on the multi-well, long duration pumping test results because these results are available and because such tests represent the ideal method of subsurface hydraulic data collection.

Currently, additional Gordon Aquifer testing is being conducted at three areas around the BGC in fulfillment of the BGC FIP (WSRC-RP-93-848, Rev. 1) and an Aquifer Test Plan for the Burial Ground Complex (WSRC-RP-96-302, Rev. 1). However, at the time of this permit renewal, the data were being tabulated and were not available

for inclusion in the renewal. A summary of the data will be submitted in accordance with Table E.8-1.

The BGC groundwater velocity for the **Gordon Aquifer** was calculated **(as described previously) in a range of 175.2 to 205.2** feet/year based on an effective porosity of 0.25, an average hydraulic conductivity of 45 feet/day (based on pumping tests), and a hydraulic gradient **ranging from 0.0027 to 0.0031 feet/feet.**

The GSA groundwater velocity for the Gordon Aquifer was calculated at 203 feet/year based on an effective porosity of 0.25, an average hydraulic conductivity of 45.00 feet/day, and a hydraulic gradient of 0.0031 feet/feet (Appendix 1, Map 5).

Meyers Branch Confining System

The regulatory principal confining unit for the BGC is **the Meyers Branch** Confining System. This system is considered to be an effective hydraulic barrier in the BGC based on a consistent thickness, continuous areal extent, consistent low hydraulic conductivity, and an upward flow potential across the system from the underlying confined aquifer. The **Dublin-Midville and Floridan Aquifer Systems** are separated by this regionally recognized confining system throughout the entire BGC. No streams in the BGC incise the **Meyers Branch Confining System**; however, the unit is incised by the Savannah River to the west.

The **Meyers Branch Confining System** is primarily composed of clays, silts, and clayey sands. This system is recognized regionally and

at SRS by core and geophysical data. It is also recognized in updip outcrops and beyond the site boundary (Prowell et al., 1985). Within the vicinity of the BGC, laboratory-calculated vertical and horizontal hydraulic conductivities for the **Meyers Branch** Confining System are consistently low (Bledsoe et al., 1990). The low horizontal and vertical hydraulic conductivity values provide evidence of the unit's ability to act as a hydraulic barrier.

The lateral continuity of the **Meyers Branch** Confining System has been verified by geophysical and lithological data. In general, the clays and silts are very fissile and highly micaceous. The gamma ray curves are very distinct with spikes typical of clay. The resistivity curves indicate a high clay content with the typical significant reduction in resistivity associated with the gamma spikes.

The lithological and geophysical characteristics of the **Meyers Branch** Confining System can be correlated over the entire area. In the vicinity of the BGC, **varying thicknesses of the Meyers Branch** Confining System have been penetrated **at numerous locations at the BGC as an outcome of recent FIP activities.** Lithologies consisting of interbedded clays and silts, clayey sands, and sands are typical of the **Meyers Branch** Confining System.

The fact that the **Gordon Aquifer** is incised by, and discharges into, Upper Three Runs, while flow in the underlying **Crouch Branch** Aquifer is unaffected, provides further evidence of the hydraulic separation provided by the **Meyers Branch** Confining System. Discharge to Upper Three Runs results in a head reversal, a situation where hydraulic head in the underlying Cretaceous sediments is higher

The fact that the **Gordon Aquifer** is incised by, and discharges into, Upper Three Runs, while flow in the underlying **Crouch Branch** Aquifer is unaffected, provides further evidence of the hydraulic separation provided by the **Meyers Branch** Confining System. Discharge to Upper Three Runs results in a head reversal, a situation where hydraulic head in the underlying Cretaceous sediments is higher than that in the uppermost aquifer, in the vicinity of the BGC. Although the magnitude of the head difference across the **Meyers Branch** Confining System has fluctuated with time, the presence of the reversal has remained relatively constant.

E.2.1.2.2 Cross Sections of the Burial Ground Complex

Fig. E.2.1-5 shows locations of geologic cross sections discussed in this volume of the renewal application. Cross Sections **A-A′, B-B′, and C-C′** (Fig. **E.2.1-6,** Fig. **E.2.1-7, and** Fig. **E.2.1-8, respectively) illustrate** the hydrostratigraphy in east-west transects through the **BGC. Cross Sections D-D′ and E-E′ (Fig. E.2.1-9 and Fig. E.2.1-10, respectively) represent north-south transects through the BGC.** Screen zones, aquifer zones, confining units, and lithology are presented.

In summary, the hydrostratigraphy is consistent with that described in Hydrogeologic Framework of West-Central South Carolina (Aadland et al., 1995). The sediments that constitute the UAZ-UTRA (Water Table Aquifer) and the "tan clay" confining zone suggest lower delta plain and lagoonal environments of deposition. The sediments that constitute the LAZ-UTRA are suggestive of near-shore and shallow-shelf

environments. Conditions were also favorable for formation of carbonates in the form of calcareous sands and mud and crystalline limestone. Carbonate material is discontinuous across the BGC, but it is present along each cross section transect. The dissolution of carbonate-rich sediments is interpreted to be the causal mechanism for the slump features depicted on cross sections D-D' and E-E'. Whether the slump features associated with the dissolution of LAZ carbonates resulted in folding of the overlying sediments and/or faulting that breached the "tan clay" confining zone has not been determined in most cases and further data are needed. Note that confining units are defined by their inferred hydraulic properties, rather than by strict correlation of stratigraphic units.

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In summary, the hydrostratigraphy is consistent with that described in Hydrogeologic Framework of West-Central South Carolina (Aadland et al., 1995). The sediments that constitute the UAZ-UTRA (Water Table Aquifer) and the "tan clay" confining zone suggest lower delta plain and lagoonal environments of deposition. This interpretation is supported by such features as the channel in cross section A-A′ at BGX 09. In addition, slump faulting in the "tan clay" confining zone is depicted on cross sections C-C′ and E-E′ and on the maps presented in Section E.2.3.

The sediments that constitute the LAZ-UTRA are suggestive of near-shore and shallow-shelf environments. Conditions were also favorable

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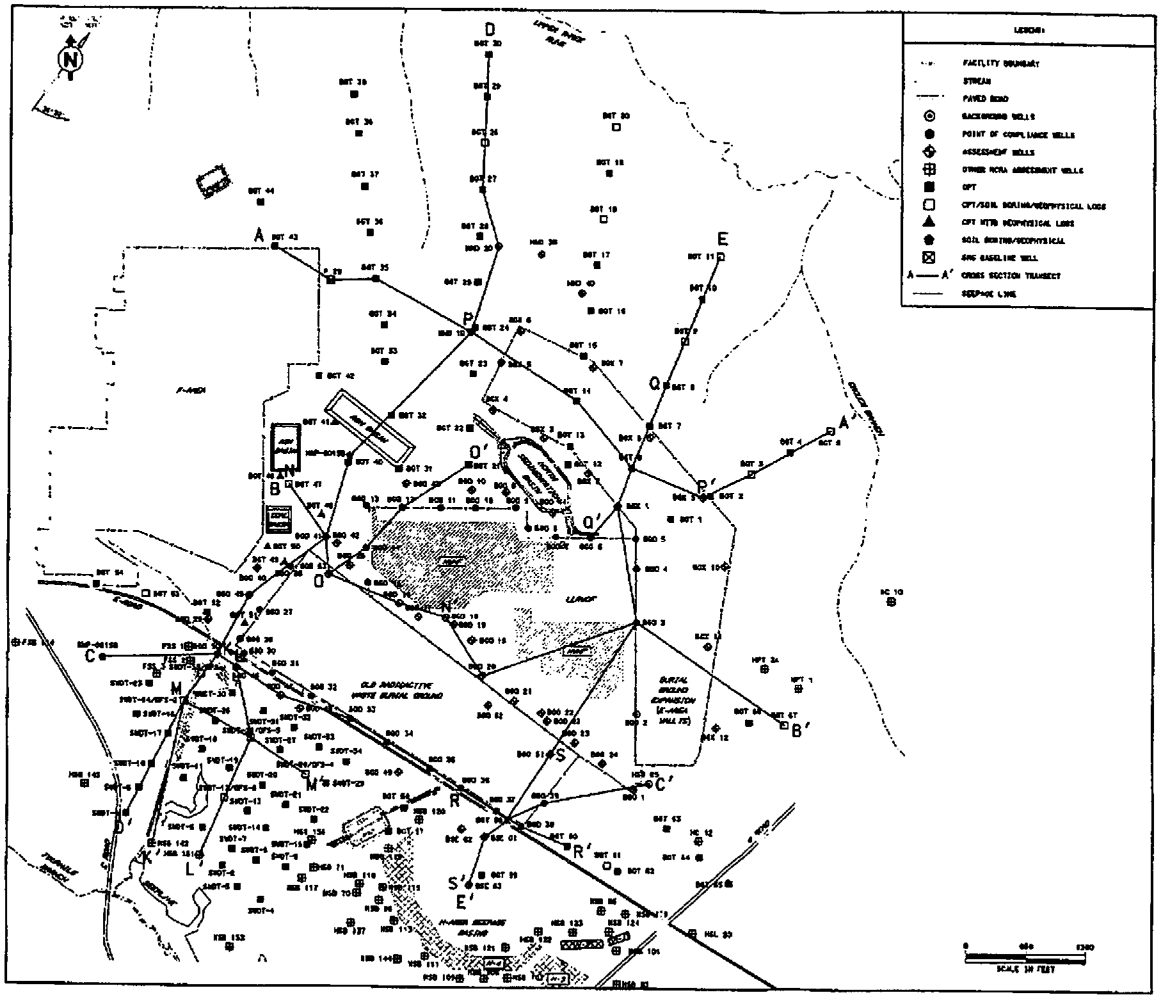

Fig. E.2.1-5. Locations of Hydrostratigraphic Cross Sections in the Burial Ground Complex

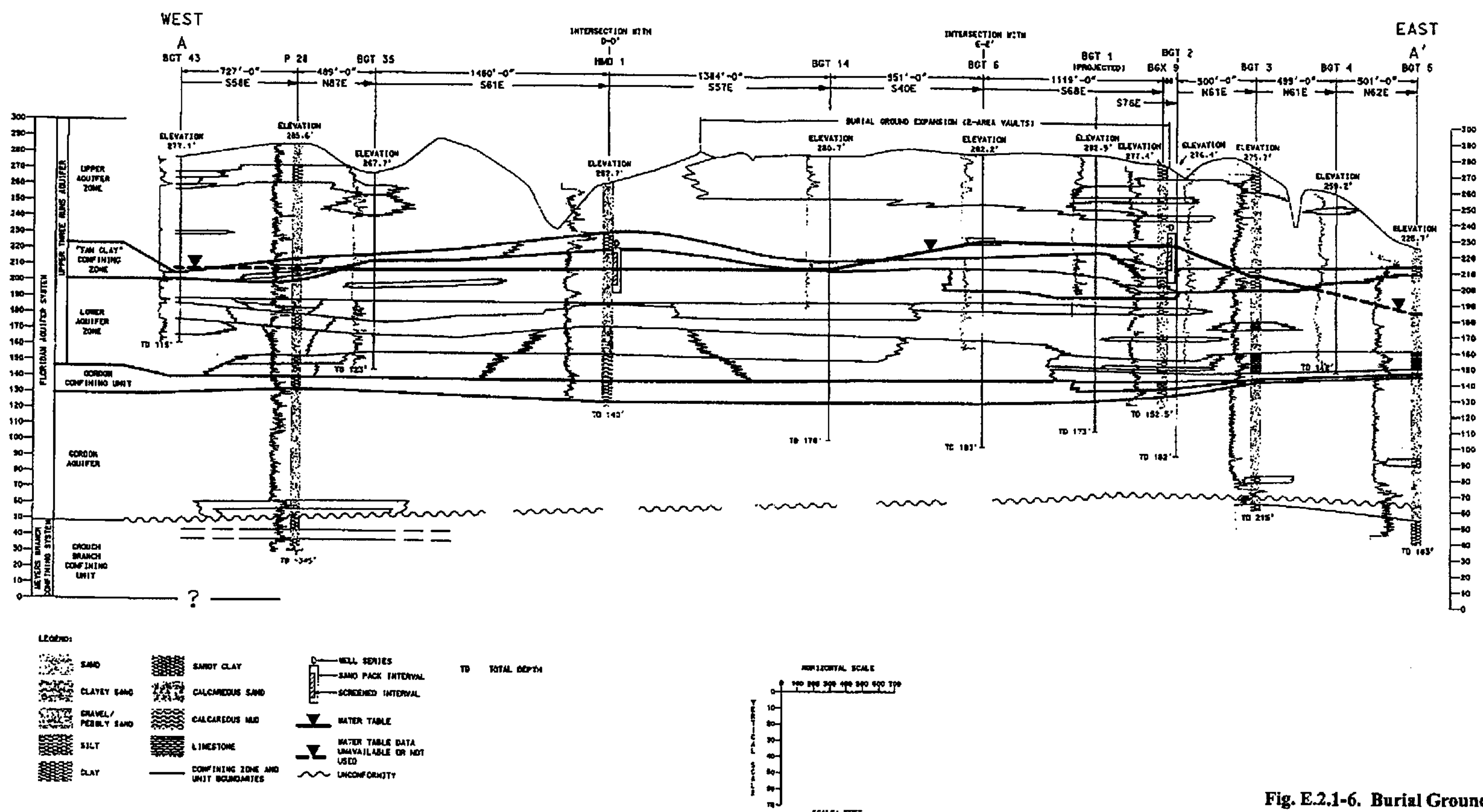

Fig. E.2.1-6. Burial Ground Complex Hydrostratigraphic Cross Section A-A'

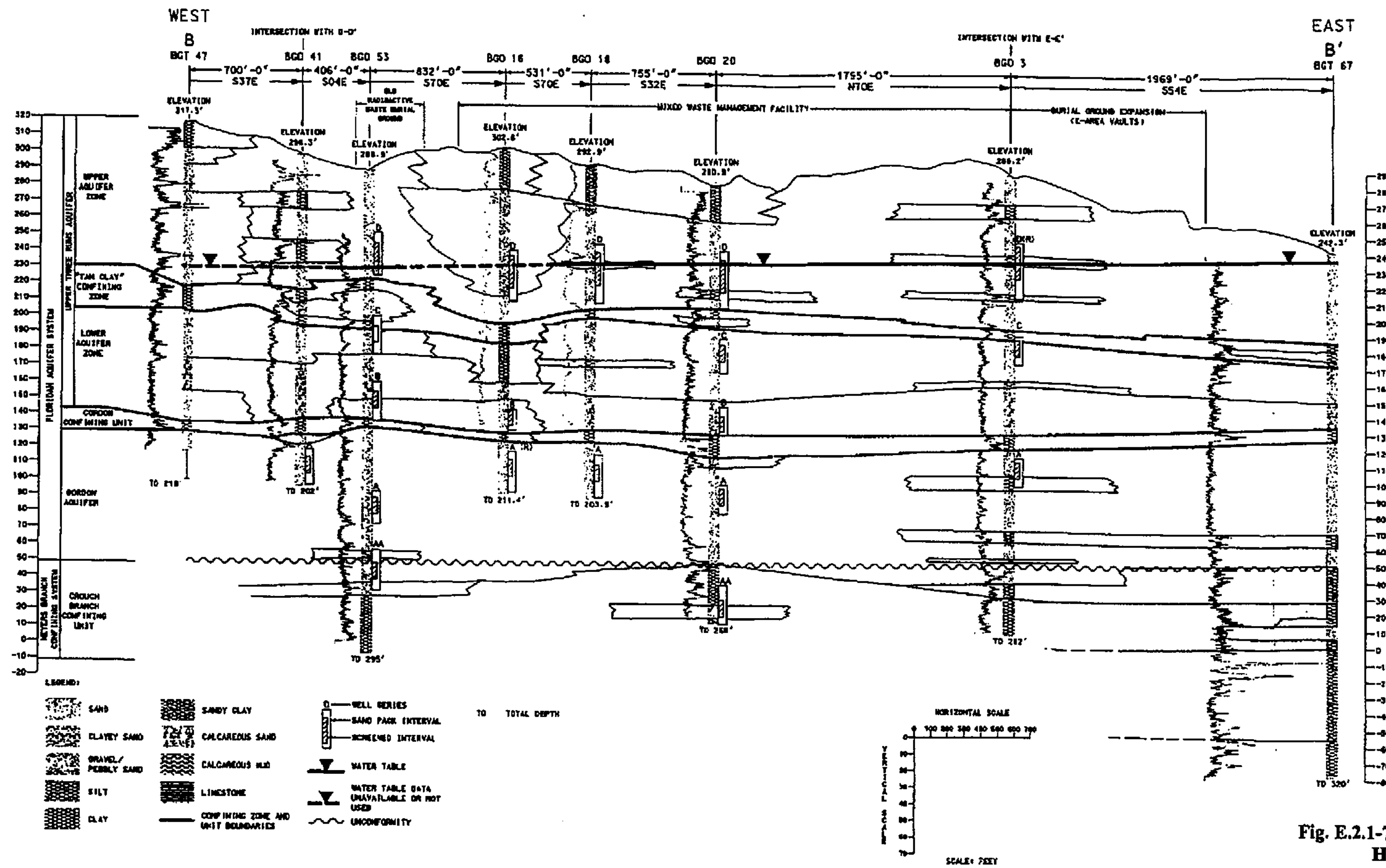

Fig. E.2.1-7. Burial Ground Complex Hydrostratigraphic Cross Section B-B'

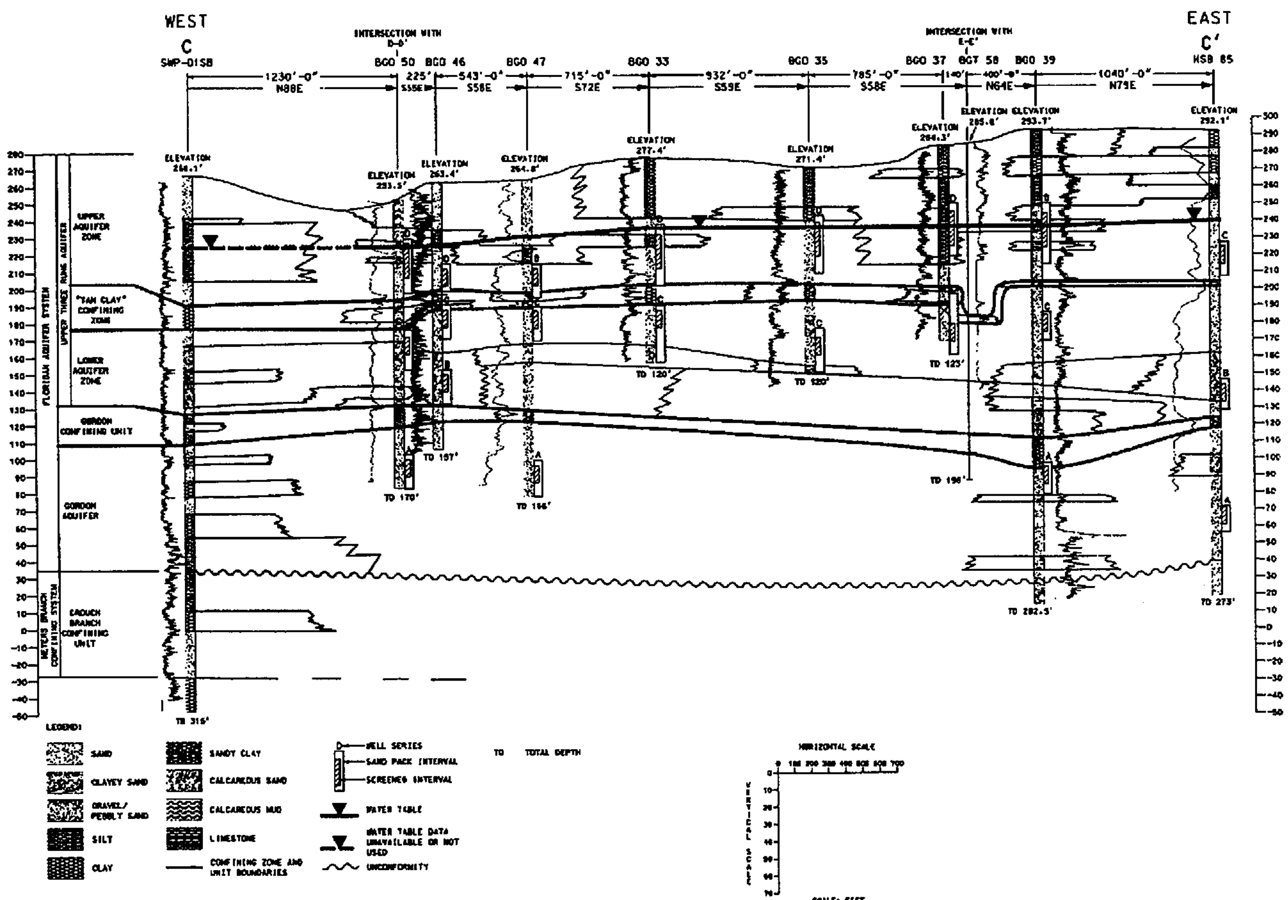

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Fig. E.2.1-8. Burial Ground Complex Hydrostratigraphic Cross Section C-C'

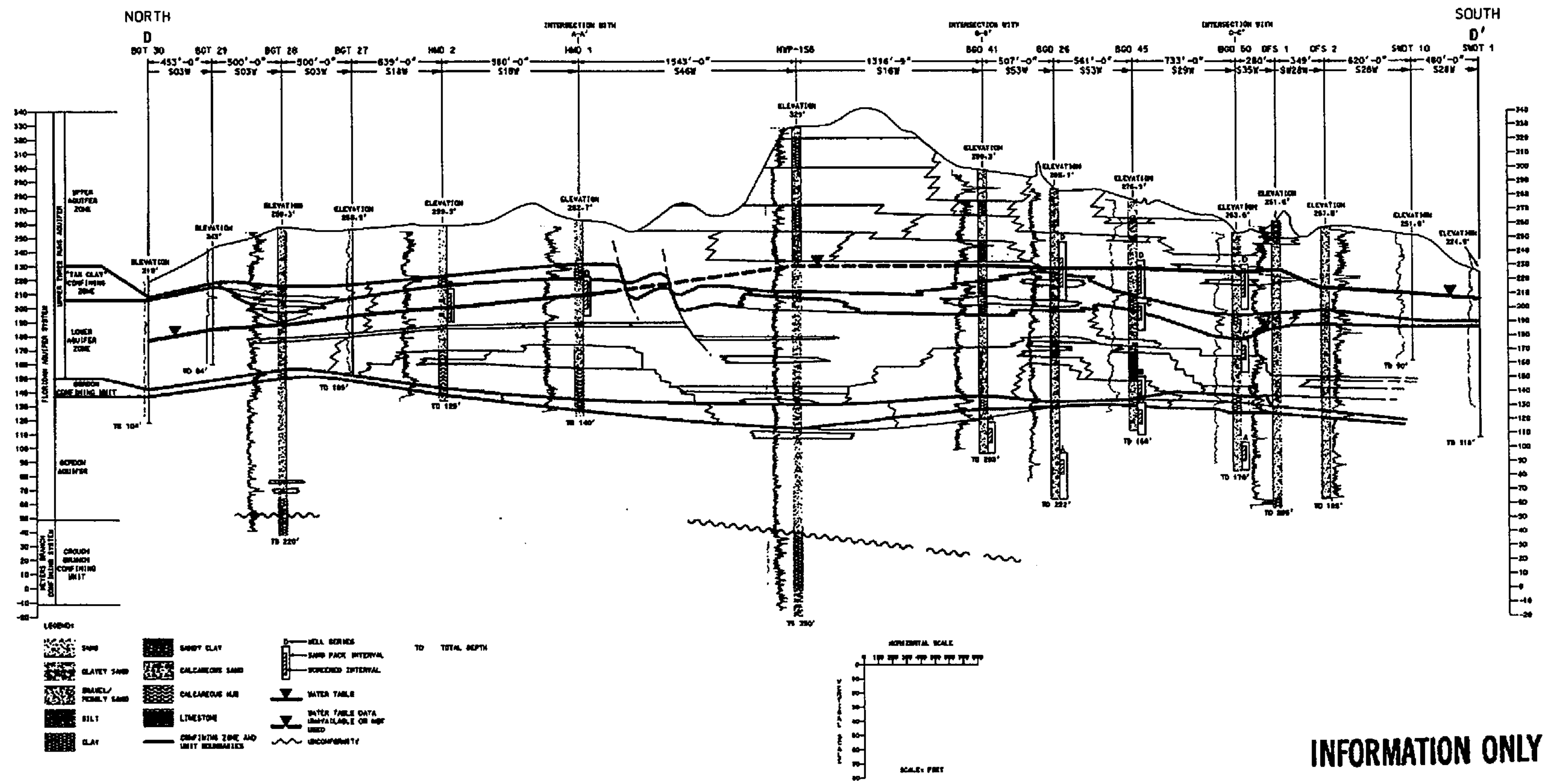

Fig. E.2.1-9. Burial Ground Complex Hydrostratigraphic Cross Section D-D'

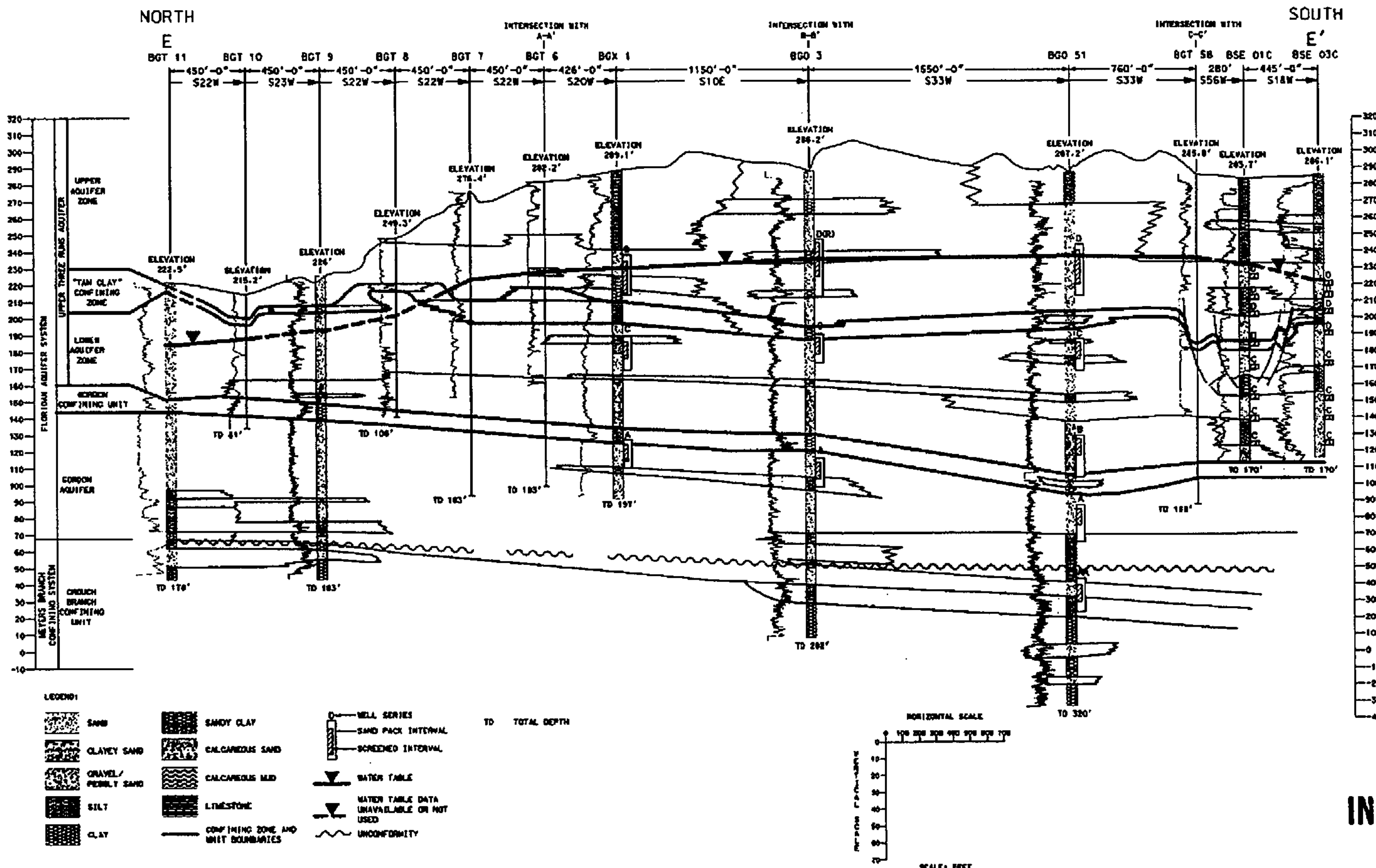

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Fig. E.2.1-10. Burial Ground Complex Hydrostratigraphic Cross Section E-E'

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E.2.2 HYDROGEOLOGIC INFORMATION ASSOCIATED WITH THE SOUTHWEST PLUME AREA

A plume specific topography map of the Southwest Plume Area is included in Appendix 1, Map 8 at a scale of 1 inch equals 200 feet.

Characterization of the Southwest Plume Area was completed utilizing two DPT methods (CPT and hydropunch) and field screening measurement techniques. These technologies allowed for the rapid collection of lithologic and water quality samples at closely spaced locations (Fig. E.2.2-1). Data collected using DPT have been integrated with BGC groundwater monitoring well and core data to provide a detailed characterization of the Southwest Plume Area.

Of the two DPT methods employed, CPT was used most extensively to characterize the Southwest Plume Area because it provides samples quickly, efficiently, and cost effectively. CPT is a simple push technology, which does not involve mud-rotary drilling, and was utilized for sampling the **UAZ-UTRA (Water Table Aquifer) and the LAZ-UTRA**. The second DPT method, hydropunch, utilized mud-rotary drilling, which allows sampling at greater depths than does CPT. Hydropunch was used to collect data from **the Gordon** Aquifer and deeper sections of the **LAZ-UTRA**. At each hydropunch location,

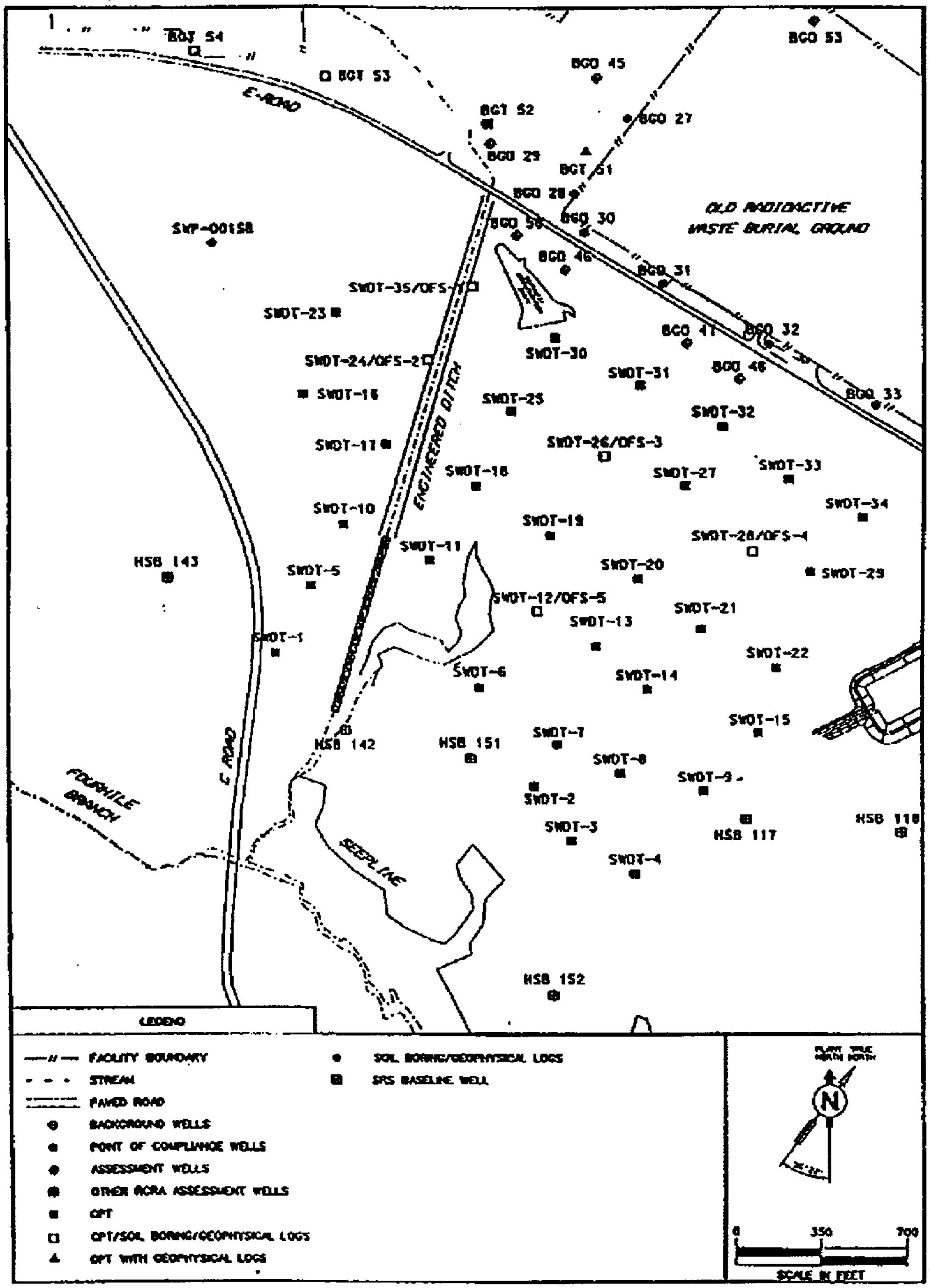

Fig. E.2.2-1. Sample Locations for the Southwest Plume Area

for formation of carbonates in the form of calcareous sands and mud and crystalline limestone. Carbonate material is discontinuous across the BGC, but it is present along each cross section transect. Note that confining units are defined by their inferred hydraulic properties, rather than by strict correlation of stratigraphic units.

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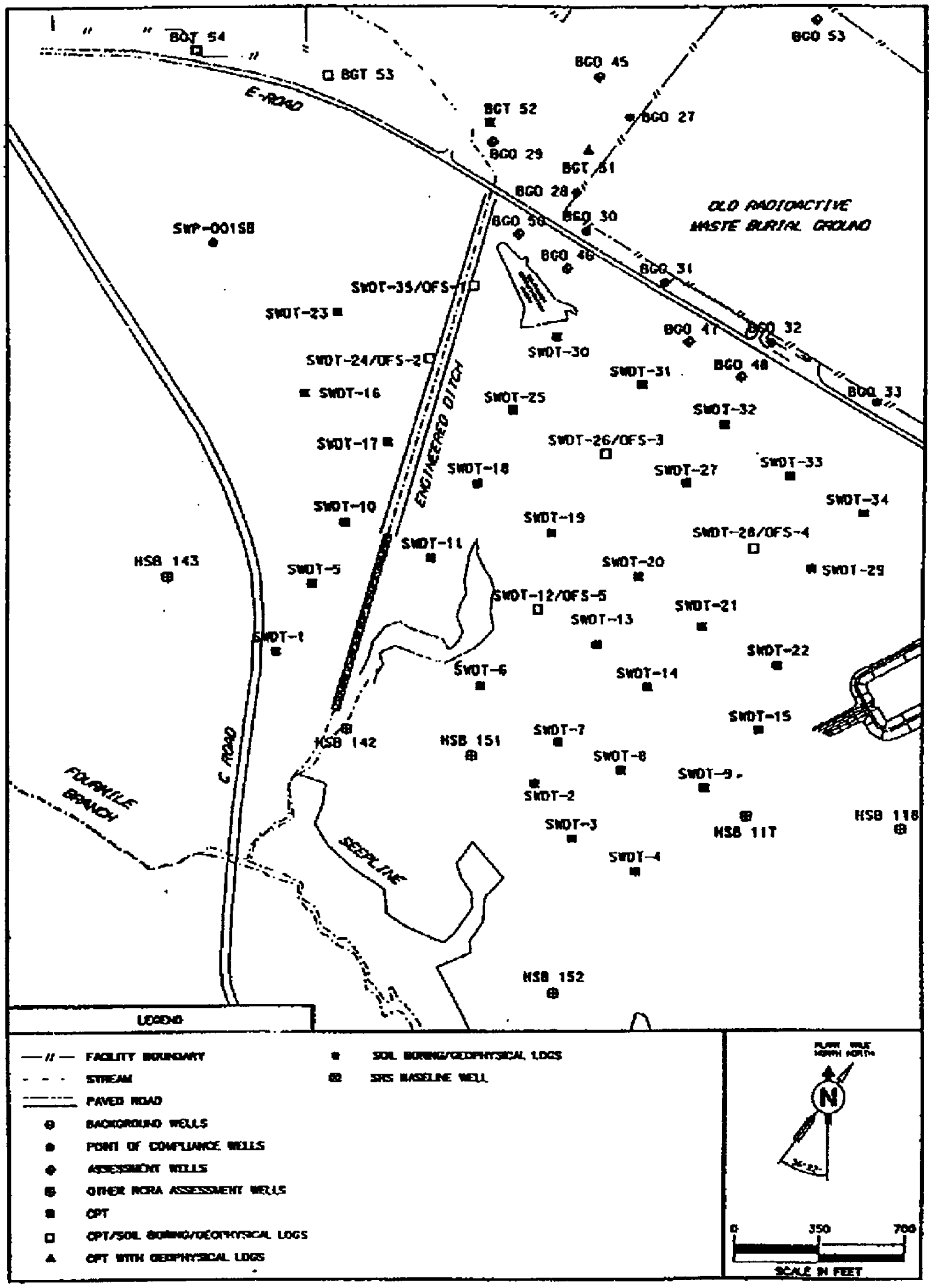

Fig. E.2.2-1. Sample Locations for the Southwest Plume Area

the first water sample was collected at the same depth as the deepest CPT sample. This technique allowed for a comparison of results between the two sampling methods.

Thirty-five locations were selected to characterize the Southwest Plume Area. Electronic lithologic data were collected by CPT at all 35 locations prior to water sampling. The electronic lithologic logs consist of tip and sleeve friction, pore pressure, and friction ratio. Natural gamma logging was conducted at 15 of the locations. Electronic logs were correlated with the natural gamma logs, and depth-discrete CPT water sampling locations were chosen based on the correlation. CPT samples were collected with a 40-mL stainless steel bailer from 6- or 12-inch sampling intervals. This sampling apparatus allows for the collection of water samples in thin discrete sand zones as identified on the electronic logs.

Hydropunch and coring activities were conducted at five of the 35 locations. Geophysical logs and cores were collected to depths of approximately 200 feet. These data were used to determine the groundwater sampling depths. Each hydropunch borehole was augered or mud-rotary drilled to within a few feet of the target sample zone. The hydropunch tool was pushed through undisturbed sediment to the base of the sample interval. The screen was exposed to allow water to flow into the sample chamber of the tool. The samples were extracted by bailer. Hydropunch samples were collected from a variable number of approximately 3- to 5-foot depth-discrete sample intervals within the **LAZ-UTRA** and the **Gordon** Aquifer.

Detailed descriptions of the sampling methods have been provided in the Burial Ground Complex Field Investigation Preliminary Data Report #1 (WSRC-RP-94-1286).

Lithologic data and geophysical logs from coreholes and ECPT logs were used to determine unit elevations and thicknesses. Sampling locations from which data on all tables in Section E were derived are shown on Map 8 in Appendix 1 and on Fig. E.2.2-1. Table E.2.2-1 depicts the unit elevations and thickness from cores at the BGC. Table E.2.2-2 (hydrostratigraphic picks from ECPT) depicts the unit elevations and thicknesses interpreted from CPT electronic lithologic logs collected in the Southwest Plume Area. Structure contour and isopach maps for each of the aquifers and aquitards in the Southwest Plume Area were constructed using a composite of data from these two tables.

Fig. E.2.2-2 and Fig. E.2.2-3 are the structure contour and isopach maps, respectively, of the "tan clay" confining zone. The density of data points allows for detailed mapping of the unit surface and thickness. Undulations in the confining zone surface and facies changes could potentially influence horizontal and vertical contaminant transport. The structure map indicates a section of "tan clay" where dissolution of the underlying carbonates has resulted in a settling of the above sediments thereby creating offset. This feature is also depicted on the Southeast Plume Area "tan clay" confining zone structure map. The isopach map illustrates a thinning of the "tan clay" confining zone in the vicinity of the OFES, which is indicative of scouring from discharge of F-Area process water.

Table E.2.2-1. Hydrostratigraphic Picks from Core Data in the Southwest Plume Area

Boring ID	"Tan Clay" Confining Zone		Lower Aquifer Zone		Gordon Confining Unit		Gordon Aquifer		Meyers Branch Confining System
	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)
BGO 03A	197	10	187	57	130	9	121	93	28
BGO 05C	218	17	201						
BGO 06A	210	15	195	74	121	1	120		
BGO 06B	203	11	192	55	137	14	123		
BGO 08A	213	14	199	69	130	10	120		
BGO 09AA	224	13	211	76	135	10	125		
BGO 10A	209	2	207	76	131	7	124		
BGO 10AA	219	12	207	77	130	4	126		
BGO 12A	200	14	186	47	139	10	129		
BGO 14A	218	9	209	71	138	22	116		
BGO 16A	196	12	184	55	129	5	124		
BGO 18A	203	5	198	67	131	7	124		
BGO 20AA	206	13	193	64	129	21	108	64	44
BGO 25A	212	11	201	63	138	10	128		
BGO 26A	224	19	205	72	133	4	129		
BGO 27C	199	7	192						
BGO 29A	196	11	185	53	132	13	119		
BGO 31C	198	10	188						
BGO 33C	203	12	191						
BGO 35C	203	10	193						
BGO 37C	201	11	190						
BGO 39A	204	11	193	81	112	18	94	66	28
BGO 41A	214	8	206	69	137	16	121		
BGO 42C	216	7	209						

Table E.2.2-1. Hydrostratigraphic Picks from Core Data in the Southwest Plume Area

Boring ID	"Tan Clay" Confining Zone		Lower Aquifer Zone		Gordon Confining Unit		Gordon Aquifer		Meyers Branch Confining System
	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)
BGO 43AA	195	11	184	53	131	18	113		
BGO 44AA	222	23	199	68	131	11	120		
BGO 45A	207	10	197	63	134	4	130		
BGO 46B	200	12	188	60	128	6	122		
BGO 47A	198	9	189	60	129	7	122		
BGO 48C	198	6	192						
BGO 49A	201	9	192	73	119	4	115		
BGO 50A	194	17	177	45	132	13	119		
BGO 51AA	204	11	193	87	106	18	88	53	35
BGO 52AA	207	10	197	72	125	9	116	98	18
BGO 53AA	223	31	192	55	137	5	132	95	37
BGX 01A	211	13	198	64	134	9	125		
BGX 02B	216	18	198	58	140	13	127		
BGX 04A	225	12	213	84	129	12	117		
BGX 07D	225	5	220	63	157	13	144		
BGX 09D	207	12	195	53	142	10	132		
BGX 11D	193	16	177	51	126	9	117		
BSE 01C	218	15	180	67	113				
BSE 02C	195	7	188						
BSE 03C	211	15	196						
HMD 01C	232	11	221	82	139	13	126		
HMD 02C	223	7	216	73	143	5	138		
HMD 03C	224	5	219	64	155	5	150		
HMD 04C	224	4	220	67	153	12	141		

Table E.2.2-1. Hydrostratigraphic Picks from Core Data in the Southwest Plume Area

	"Tan Clay" Confining Zone		Lower Aquifer Zone		Gordon Confining Unit		Gordon Aquifer		Meyers Branch Confining System
Boring ID	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)
HSB 143	**198**		**179**						
HSB 151	**193**		**183**						
HSB 152	**198**		**186**						
HSB 85A	204	10	194	70	124	6	118	79	39
NWP 01SB	212	5	207	**76**	131	**17**	**114**	75	39
OFS 01SB			186	**57**	129	**5**	**124**		
OFS 02SB	198	**10**	188	**62**	126	**6**	121		
OFS 03SB	196	**11**	185	**60**	125	**5**	120		
OFS 04SB	196	**4**	192	**65**	127	**5**	122		
OFS 05SB	189	**11**	178	**56**	122	**5**	117		
P 28TA	215	**4**	211	**70**	141	**8**	133	69	64
SWP 01SB	**192**	**14**	**178**	**50**	**128**	**18**	**110**	75	35

NOTES:

[box] These cores were utilized in the hydrostratigraphic description of the Southwest Plume Area.
msl - mean sea level
ft - feet

Table E.2.2-2. Hydrostratigraphic Picks from Electric Cone Penetrometer Testing Logs in the Southwest Plume Area

Sampling Location ID	Northing	Easting	Ground Elevation (ft msl)	UAZ-UTRA (Water Table Aquifer)		"Tan Clay" Confining Zone		LAZ-UTRA		Gordon Confining Unit		Gordon Aquifer	
				Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)	Thickness (ft)
BGT 51	**75519.18**	**54505.65**	**272.64**	**193**	**7**	**186**							
BGT 53	**75837.68**	**53422.04**	**278.25**	**200**	**9**	**191**							
BGT 54	**75941.66**	**52889.14**	**279.96**	**205**	**9**	**196**							
SWC 01	73448	53220	224.9	205.9	15	190.9	5	185.9					
SWC 02	72892	54284	212.3	206.3	18	188.3	3	185.3					
SWC 03	72660	54443	213.4	208.4	23	185.4	9	176.4					
SWC 04	72524	54700	231.2	216.2	33	183.2	12	171.2					
SWC 05	73728	53360	246.5	218.5	30	188.5	6	182.5					
SWC 06	73303	54058	224.0	212	28	184	7	177					
SWC 07	73068	54388	233.2	216.2	21	195.2	7	188.2					
SWC 08	72946	54647	235.9	217.9	27	190.9	11	179.9					
SWC 09	72875	54982	236.2	220.2	24	196.2	8	188.2					
SWC 10	73984	53497	251.9	209.9	19	190.9	5	185.9					
SWC 11	73835	53853	248.3	216.3	36	180.3	10	170.3					
SWC 12/OFS 05SB	73623	54298	228.7	220.7	33	187.7	9	178.7	57	121.7	7	114.7	
SWC 13	73478	54550	245.4	218.4	40	178.4	8	170.4					
SWC 14	73296	54758	243.3	225.3	35	190.3	12	178.3					
SWC 15	73114	55211	246.8	218.8	36	182.8	6	176.8					
SWC 16	74522	53331	249.4	213.4	21	192.4	10	182.4					
SWC 17	74319	53679	255.2	217.2	27	190.2	8	182.2					
SWC 18	74145	54047	225.5	217.5	30	187.5	5	182.5					
SWC 19	73942	54356	249.6	223.6	40	183.6	14	169.6					
SWC 20	73758	54714	249.4	222.4	41	181.4	10	171.4					
SWC 21	73545	54976	251.9	225.9	47	178.9	7	171.9					
SWC 22	73391	55285	254.9	225.9	34	191.9	10	181.9					

Table E.2.2-2. Hydrostratigraphic Picks from Electric Cone Penetrometer Testing Logs in the Southwest Plume Area

Sampling Location ID	Northing	Easting	Ground Elevation (ft msl)	UAZ-UTRA (Water Table Aquifer)		"Tan Clay" Confining Zone		LAZ-UTRA		Gordon Confining Unit		Gordon Aquifer	
				Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)	Thickness (ft)
SWC 23	74860	53466	251.3	215.3	7	208.3	5	203.3					
SWC 24/OFS 02SB	74671	53848	257.5	214.5	22	198	10	188	62	126	6	121	
SWC 25	74454	54192	242.9	223.9	42	181.9	7	174.9					
SWC 26/OFS 03SB	74270	54579	258.1	222.1	27	195.1	10	185.1	60	125.1	5	120.1	
SWC 27	74145	54908	266.9	223.9	32	191.9	8	183.9					
SWC 28/OFS 04SB	73874	55188	258.7	217.7	22	195.7	5	190.7	64	126.7	5	121.7	
SWC 29	73788	55423	259.6	234.6	36	198.6	4	194.6					
SWC 30	74763	54376	242.8	224.8	34	190.8	5	185.8					
SWC 31	74560	54724	253.2	223.2	31	192.2	5	187.2					
SWC 32	74386	55063	276.4	224.4	29	195.4	9	186.4					
SWC 33	74174	55333	271.0	228	38	190	6	184					
SWC 34	74019	55633	266.3	228.3	35	193.3	14	179.3					
SWC 35/OFS 01SB	74975	54050	261.6	226.6	32	195	9	186	57	129	5	124	

NOTES: Hydrostratigraphic picks from the ECPT logs are not exact. There is a difference of (+) or (-) 1 foot.
Hydrostratigraphic picks from the five cores identified as 'OFS' were utilized in determining the units versus the ECPT logs and were used as control points for the hydrostratigraphic picks from the ECPT logs.
ft feet
msl mean sea level

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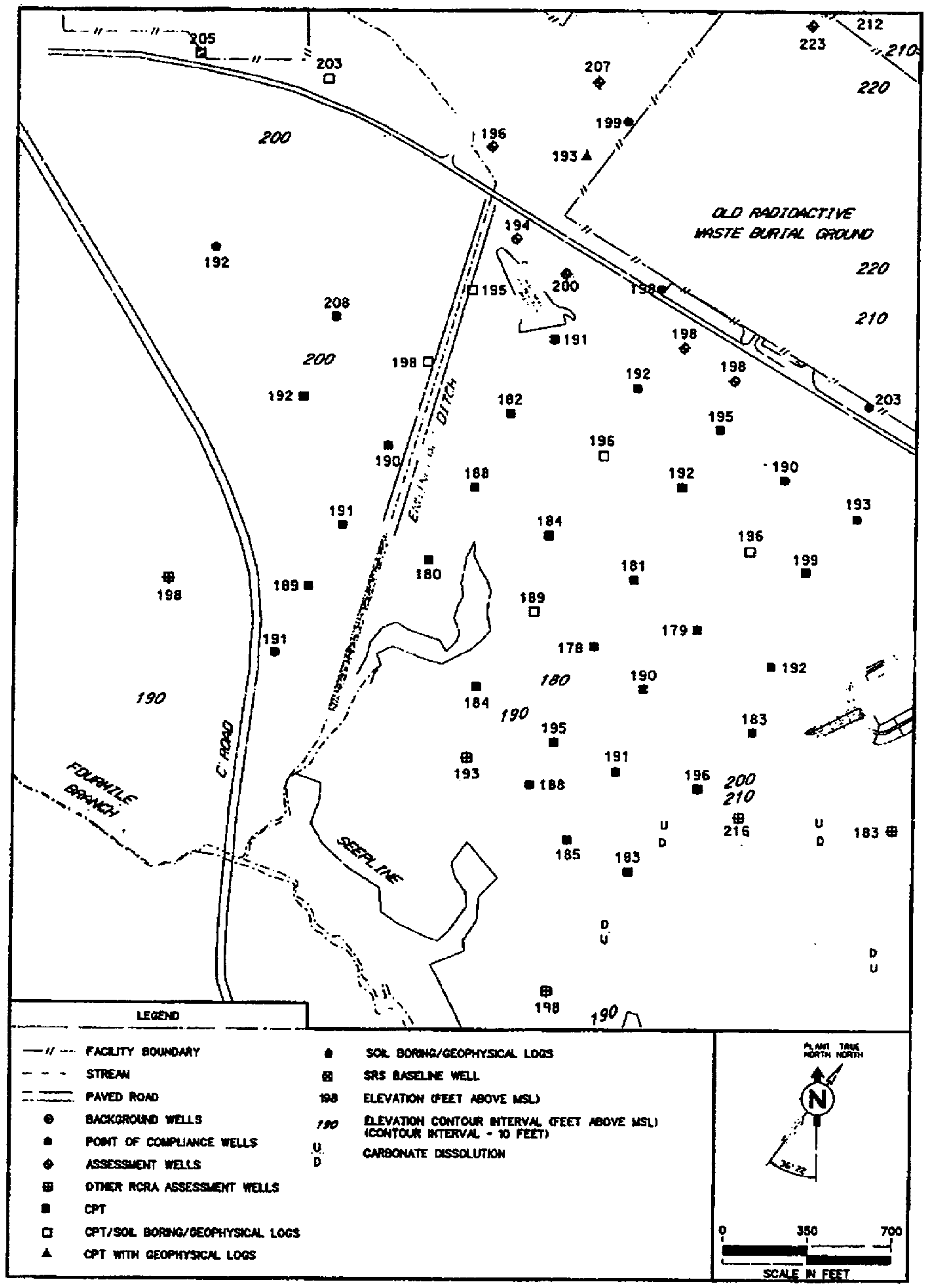

Fig. E.2.2-2. Structure Contour Map of the "Tan Clay" Confining Zone in the Southwest Plume Area

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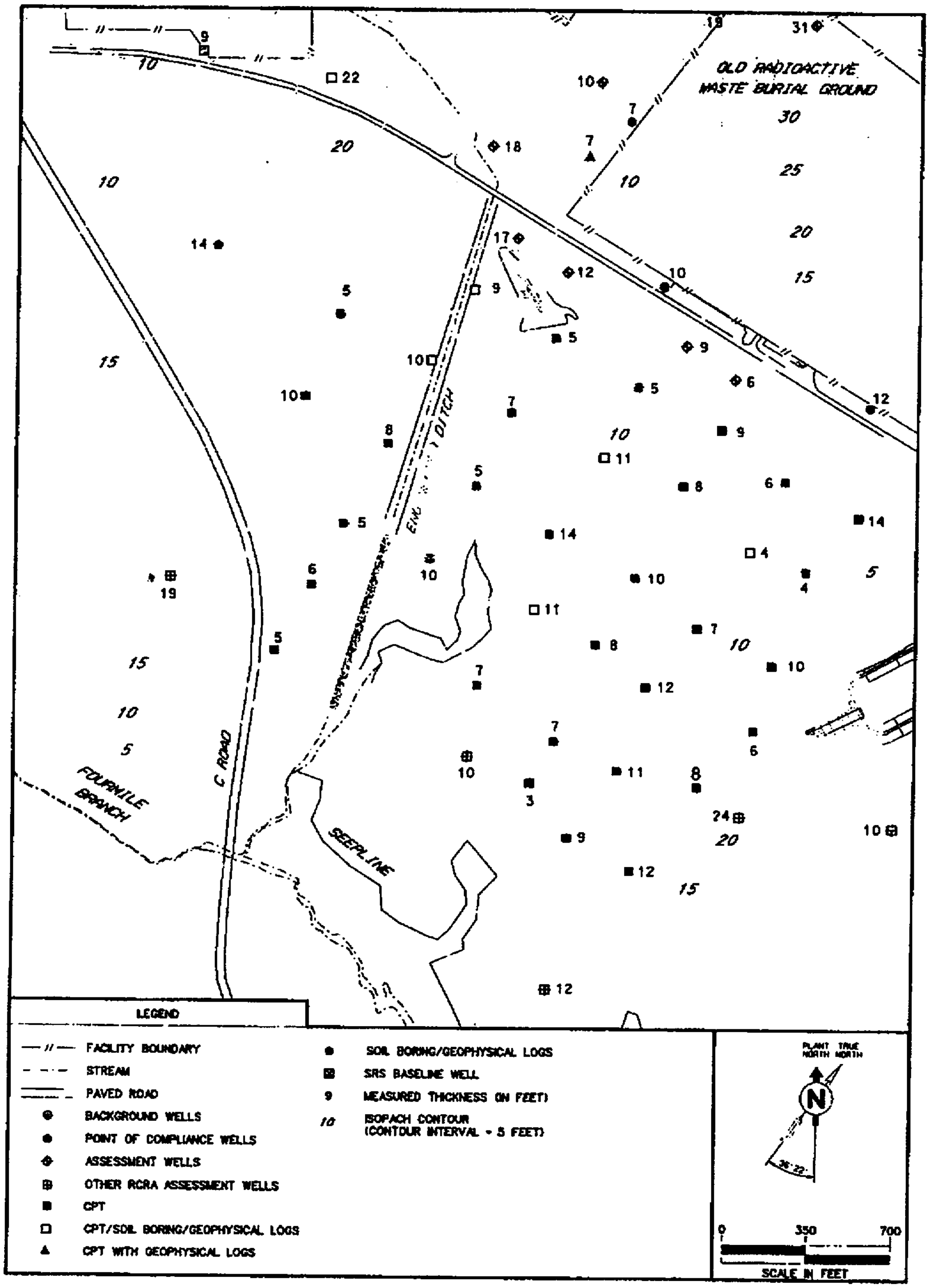

Fig. E.2.2-3. Isopach Map of the "Tan Clay" Confining Zone in the Southwest Plume Area

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Fig. E.2.2-4, Fig. E.2.2-5, and Fig. E.2.2-6 depict the structure contour, thickness of the **LAZ-UTRA**, and the thickness of the calcareous zone within this aquifer, respectively. The calcareous zone includes calcareous sands, sandy limestones, and sandy muddy limestones. The location of calcareous zones could potentially influence contaminant transport. In an area directly south of the ORWBG, calcareous material makes up the bulk of the **LAZ-UTRA**. In another area at the southwest corner of the ORWBG, there is a substantial amount of calcareous material within the unit. Table E.2.2-3 presents the thickness of the calcareous zone from cores in the Southwest Plume Area.

Fig. E.2.2-7 and Fig. E.2.2-8 are the structure contour and isopach maps of the **Gordon** Confining Unit, respectively. The structure contour **of the Gordon Confining Unit is rather uniform across the area.** However, the isopach map shows a thickening of the confining unit **to the west of the ORWBG.**

Fig. E.2.2-9 and Fig. E.2.2-10 are the structure contour and isopach maps of the Gordon Aquifer, respectively. The structural surface of the Gordon Aquifer rises along the nose of a ridge that trends northeast. The thickness of the Gordon Aquifer decreases along the same ridge.

Fig. E.2.2-11 is the structure contour map of the Crouch Branch Confining Unit. The structure of the top of the Crouch Branch Confining Unit increases in elevation to the northeast.

Fig. E.2.1-5 shows the locations of hydrostratigraphic cross sections in the Southwest Plume Area. **These figures depict the relatively continuous nature of the units across most of the area.**

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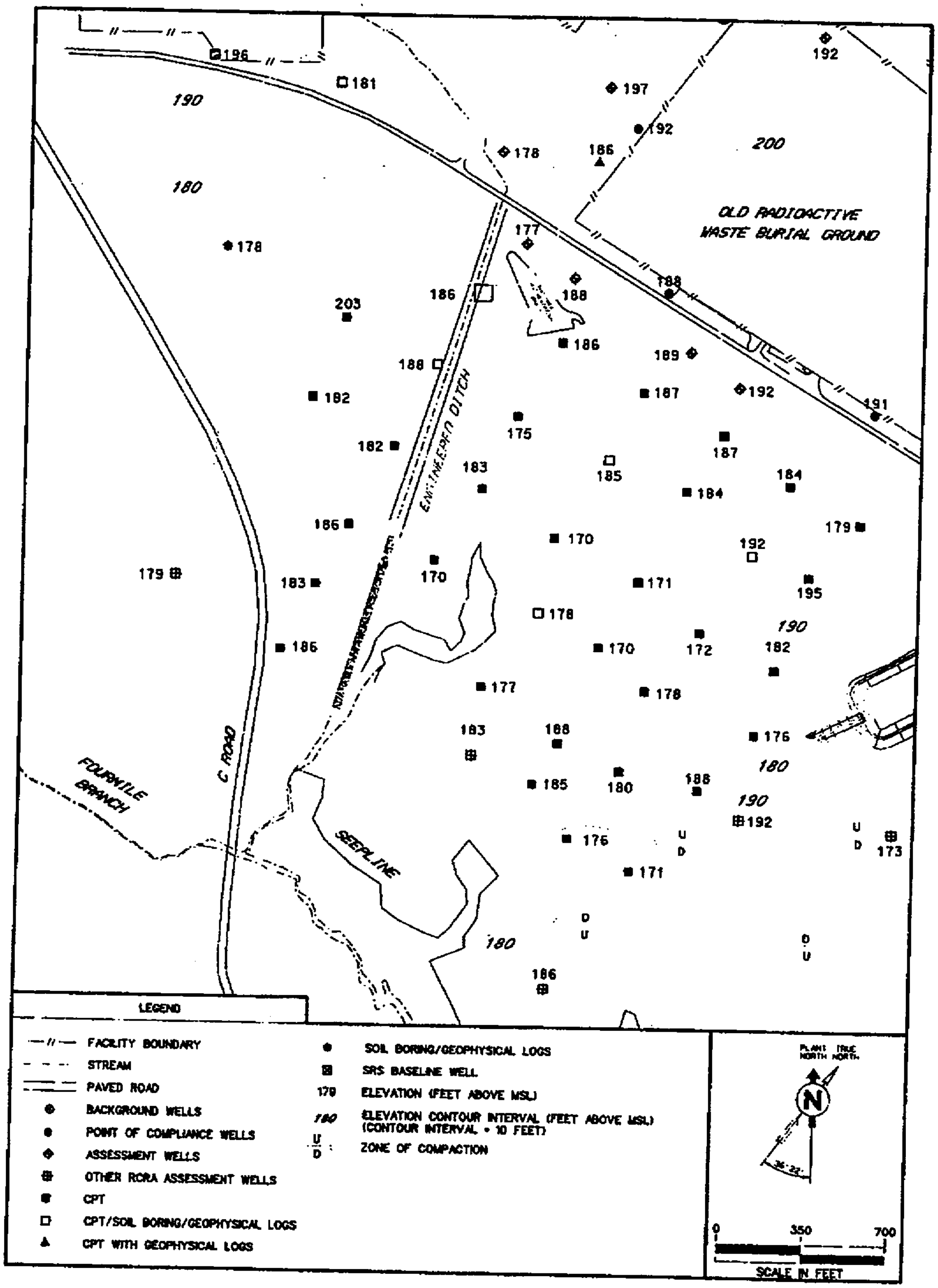

Fig. E.2.2-4. Structure Contour Map of the Lower Aquifer Zone of the Upper Three Runs Aquifer in the Southwest Plume Area

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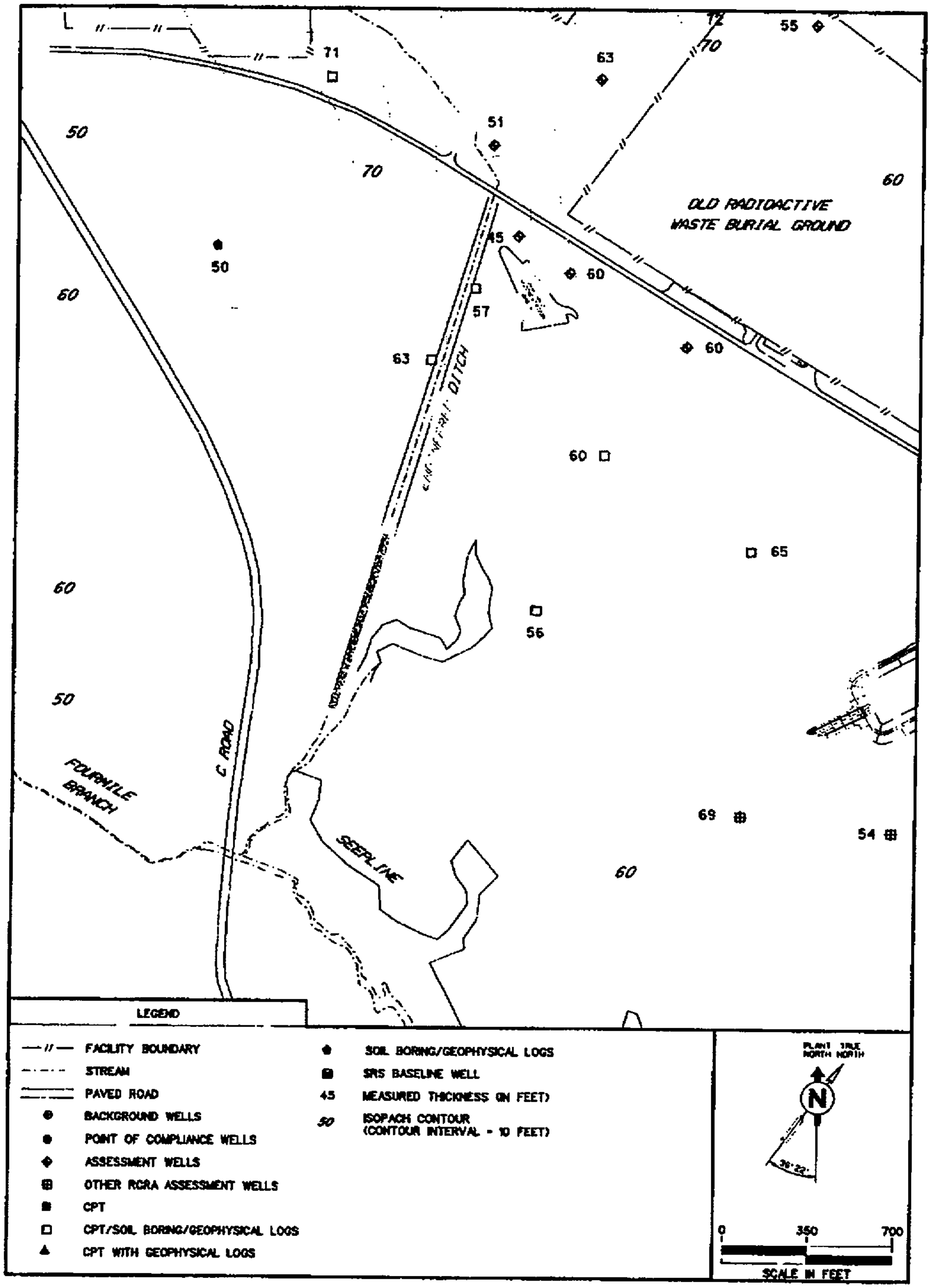

Fig. E.2.2-5. Isopach Map of the Lower Aquifer Zone of the Upper Three Runs Aquifer in the Southwest Plume Area

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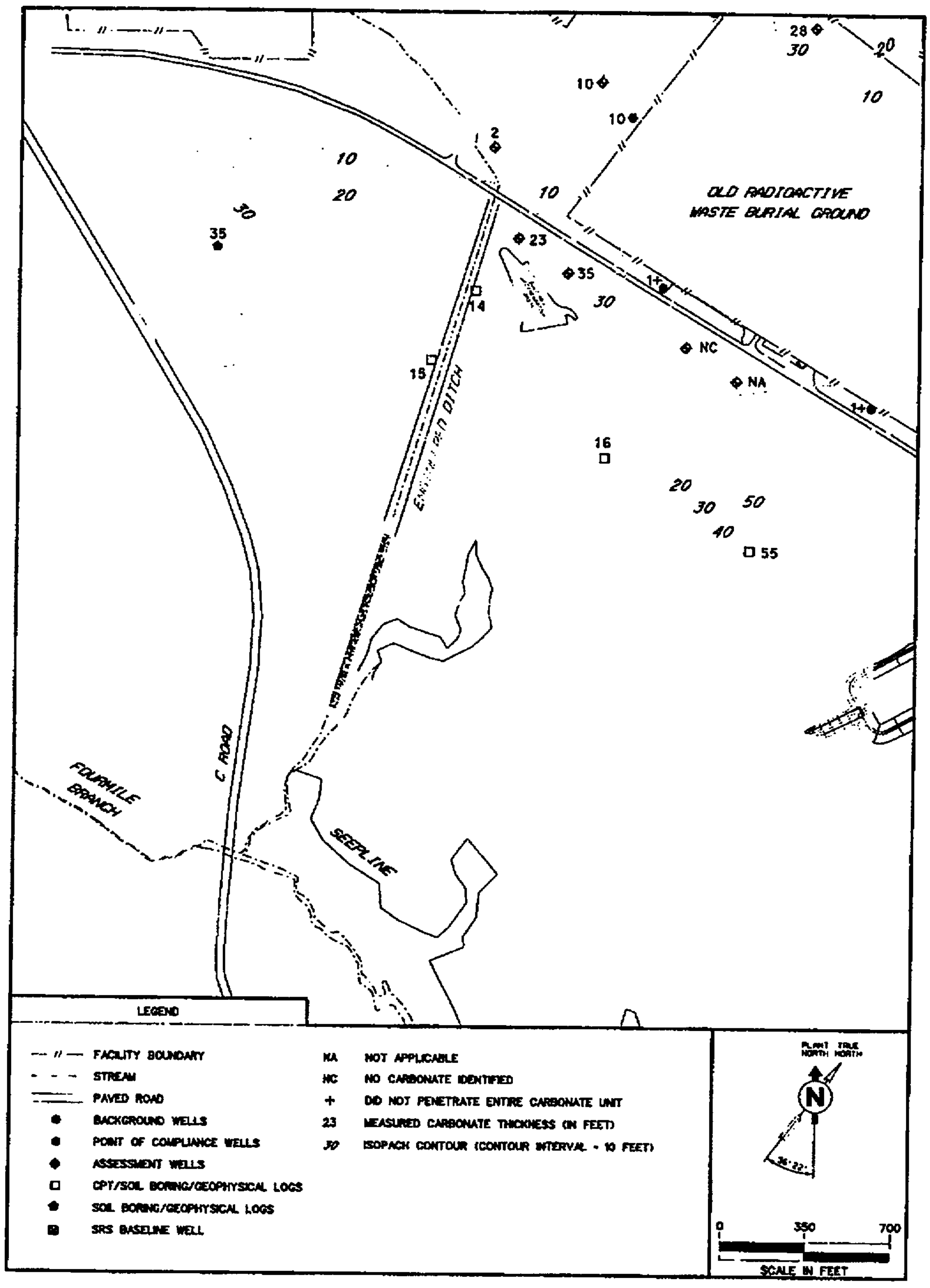

Fig. E.2.2-6. Isopach Map of Calcareous Sediments in the Lower Aquifer Zone of the Upper Three Runs Aquifer in the Southwest Plume Area

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Table E.2.2-3. Carbonate Hydrostratigraphy of the Southwest Plume Area

Well	Ground Elevation (ft msl)	Calcareous Interval (ft msl)		Thickness (ft)	Hydrostratigraphic Unit
		Top	Bottom		
BGO 26A	**285.1**	**178.0**	**159.0**	**19**	**LAZ-UTRA**
BGO 27C	273.9	157.9	147.9	10	LAZ-UTRA
BGO 33C	277.4	159.4	158.4	1	LAZ-UTRA
BGO 45A	276.9	172.9	162.9	10	LAZ-UTRA
BGO 46B	**263.4**	**163.0**	**128.0**	**35**	**LAZ-UTRA**
BGO 50A	253.5	155.5	136.5	19	LAZ-UTRA
BGO 53AA	**288.9**	**177.0**	**149.0**	**28**	**LAZ-UTRA**
SWC 35/OFS 001SB	261.6	151	137	14	LAZ-UTRA
SWC 24/OFS 002SB	257.5	150	136	15	LAZ-UTRA
SWC 26/OFS 003SB	258.1	183.1	167.1	16	LAZ-UTRA
SWC 28/OFS 004SB	258.7	190.7	135.7	55	LAZ-UTRA
SWP 01SB	**268.1**	**167**	**132**	**35**	**LAZ-UTRA**

NOTES: msl mean sea level
ft feet

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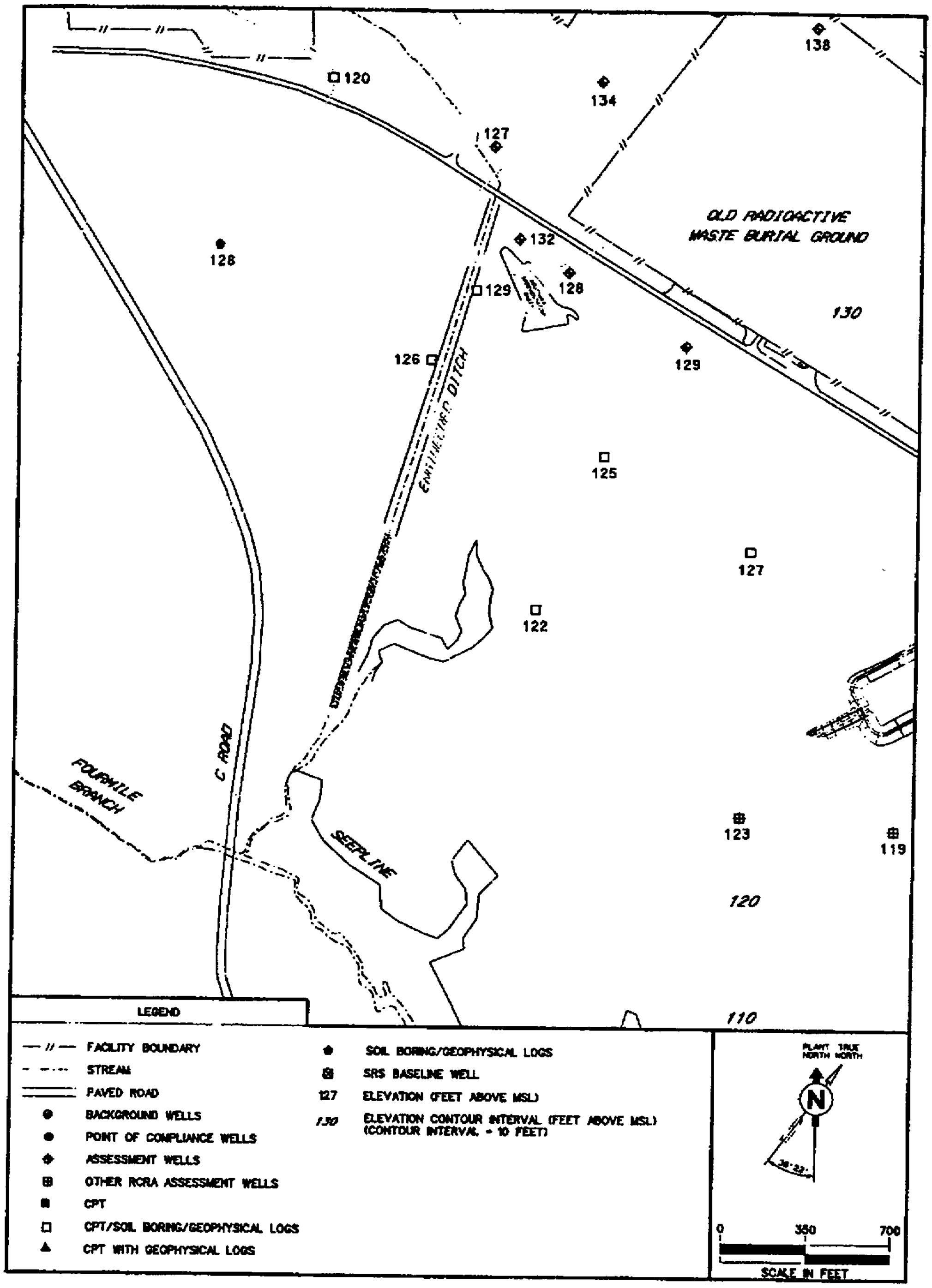

Fig. E.2.2-7. Structure Contour Map of the Gordon Confining Unit in the Southwest Plume Area

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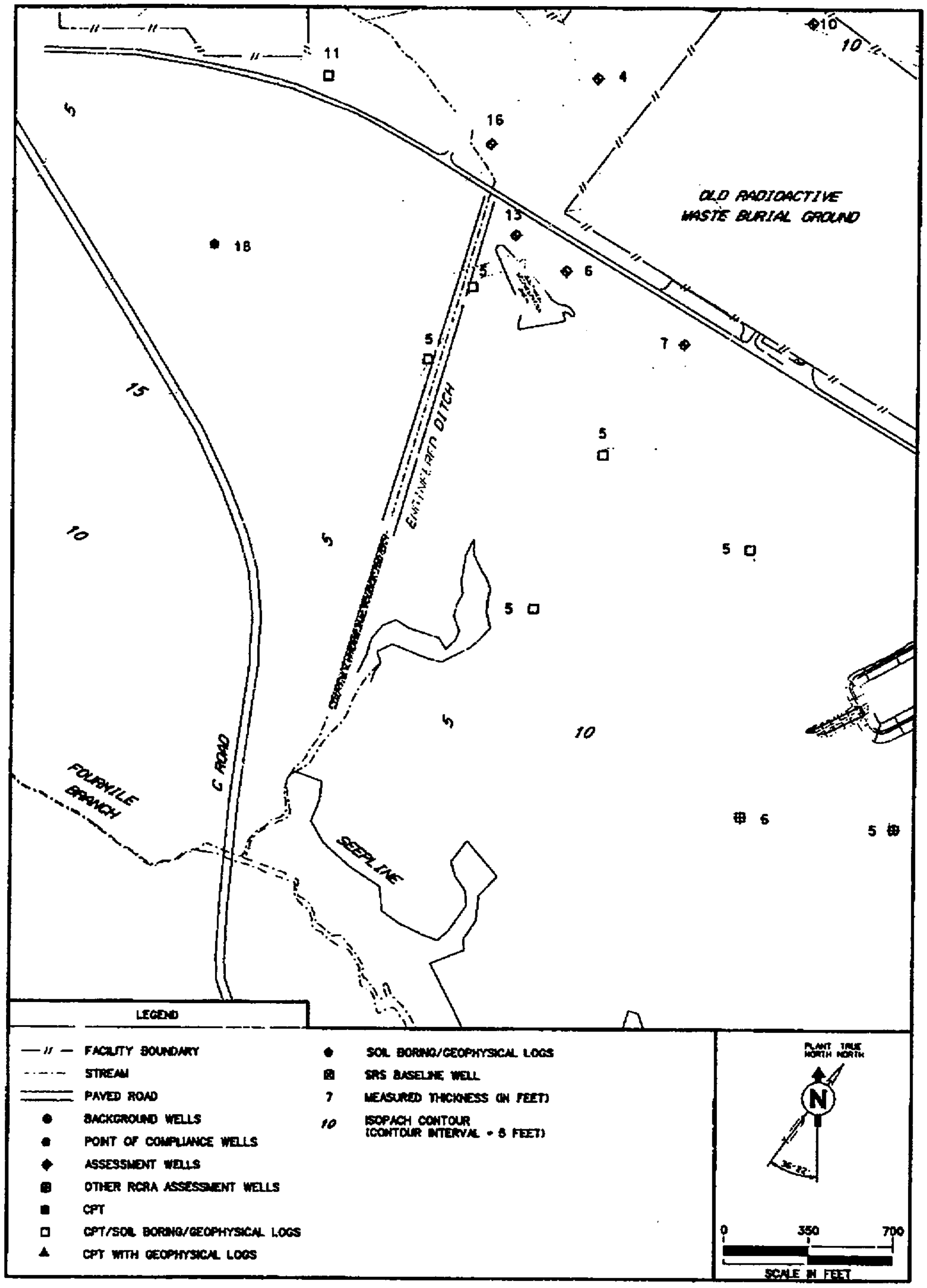

Fig. E.2.2-8. Isopach Map of the Gordon Confining Unit in the Southwest Plume Area

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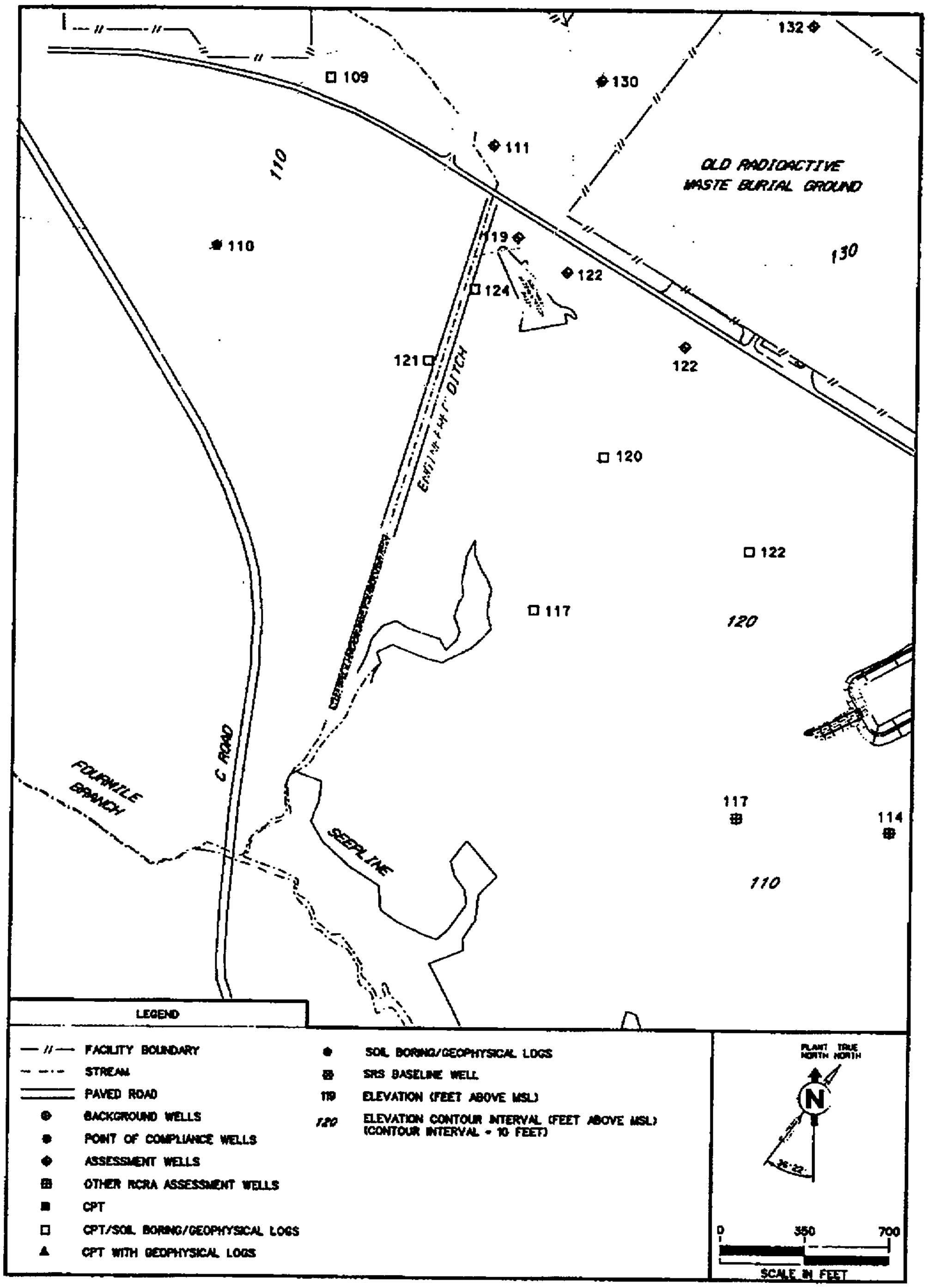

Fig. E.2.2-9. Structure Contour Map of the Gordon Aquifer in the Southwest Plume Area

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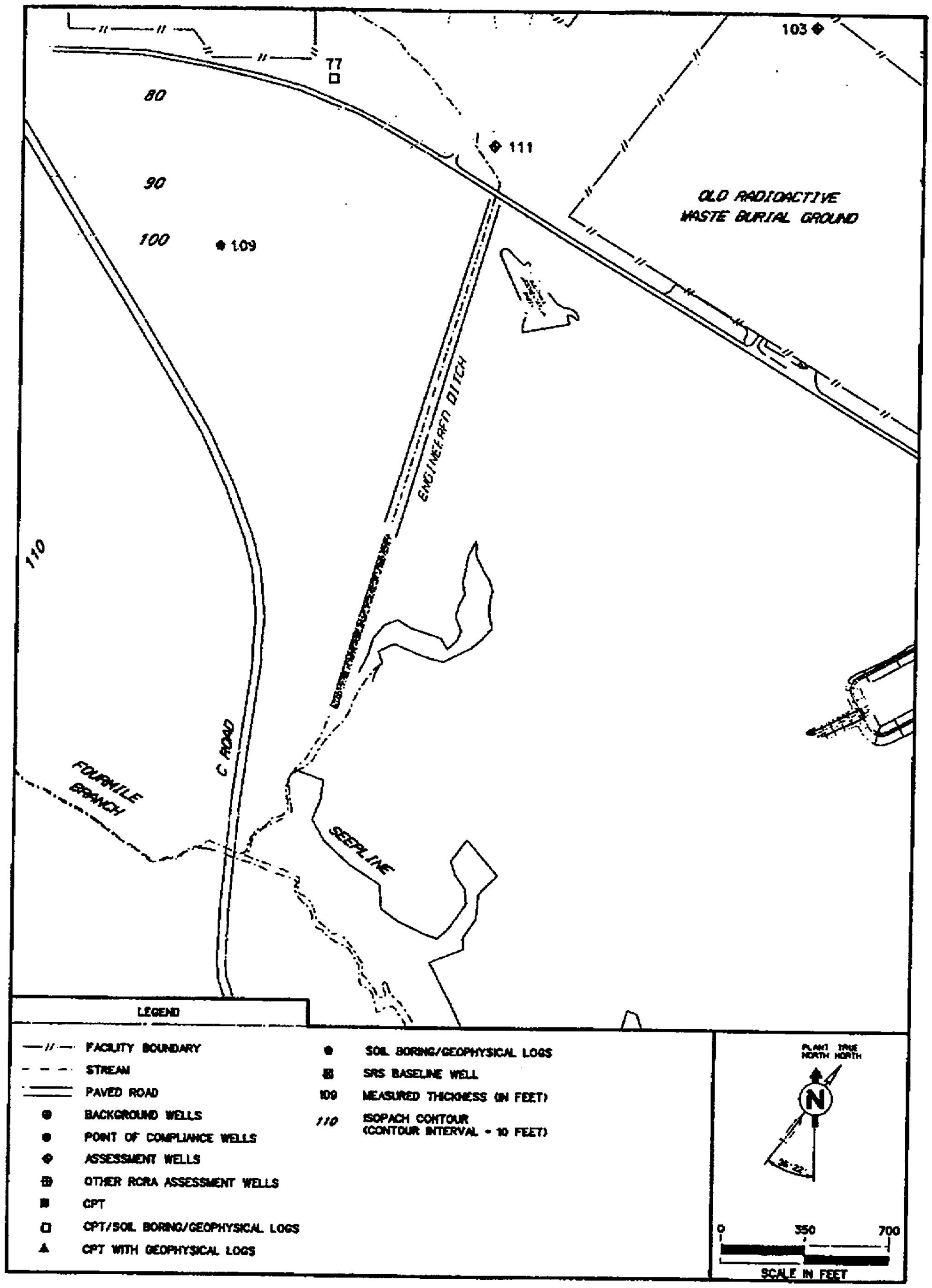

Fig. E.2.2-10. Isopach Map of the Gordon Aquifer in the Southwest Plume Area

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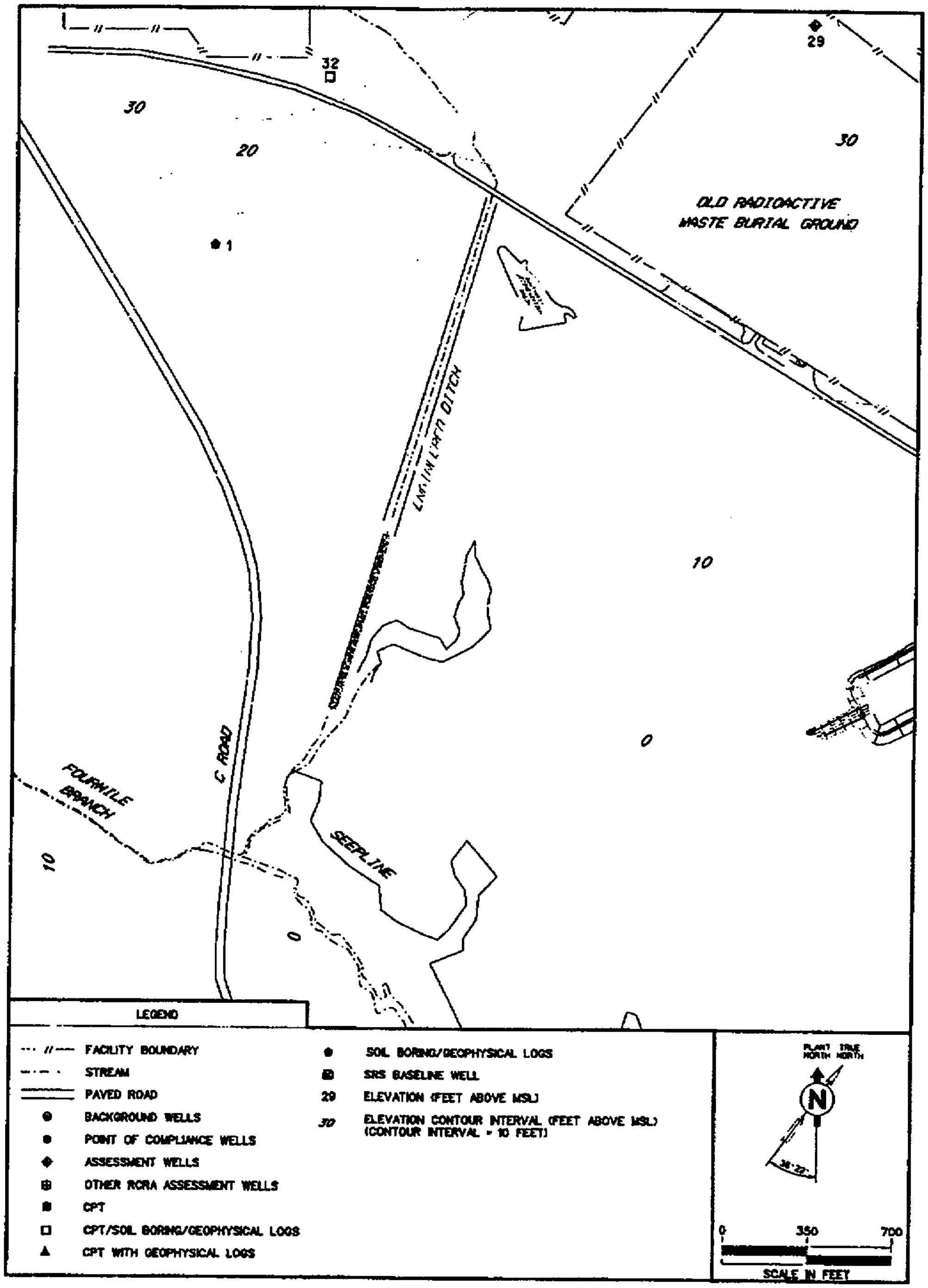

Fig. E.2.2-11. Structure Contour Map of the Crouch Branch Confining Unit in the Southwest Plume Area

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Cross Sections K-K′ and L-L′ (Fig. E.2.2-12 and Fig. E.2.2-13) are north-south transects across the Southwest Plume Area. The "tan clay" confining zone is not represented at wells HSB-142C and HSB-151C, which are located near Fourmile Branch. Core descriptions from these wells indicate that sediments at the elevation where the "tan clay" confining zone is usually encountered are typical of alluvium. The absence of the aquitard could potentially influence vertical contaminant transport in this area. Cross Section M-M′ (Fig. E.2.2-14) depicts an east-west line in the Southwest Plume Area. The calcareous zone within the LAZ-UTRA is illustrated on the section.

E.2.2.1 Groundwater Flow

Groundwater flow rates and directions have been determined based, in part, on hydraulic head data from BGC monitoring wells within the Southwest Plume Area. Table E.2.2-4 summarizes head data for each well cluster. It also includes calculation of head difference across aquitards. Groundwater monitoring wells located in the Southwest Plume Area are shaded on Table E.2.2-4.

Upper Aquifer Zone of the Upper Three Runs Aquifer

Groundwater flow in the water table at the Southwest Plume Area is southwest from the ORWBG toward Fourmile Branch. Fig. E.2.2-15 is a detailed potentiometric map of the **UAZ-UTRA** (Water Table Aquifer) in the Southwest Plume Area. A combination of hydraulic head data from groundwater monitoring wells screened in the water table and from the 35 electronic pore pressure logs were used in the development of the potentiometric surface map. Estimated flow rates

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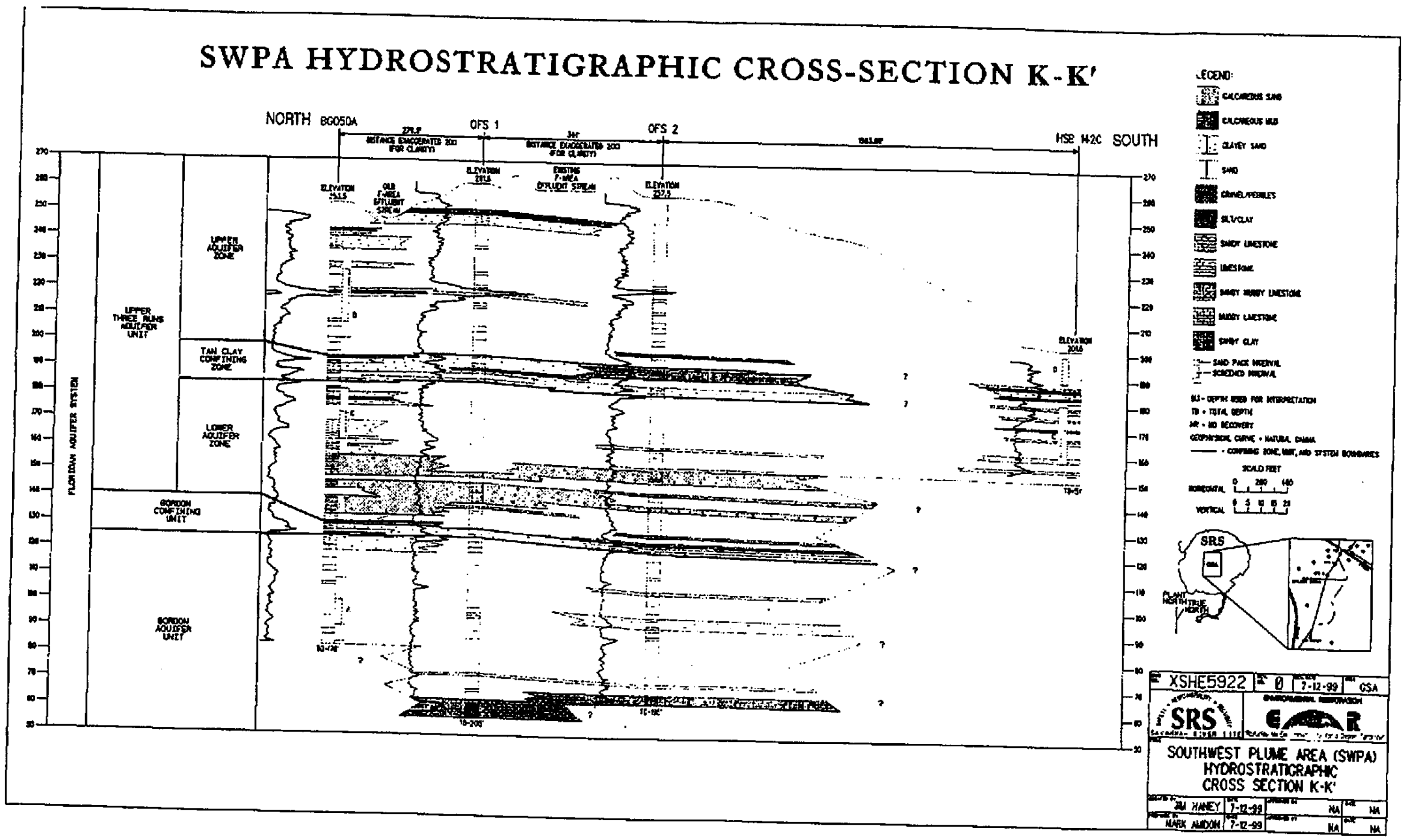

Fig. E.2.2-12. Hydrostratigraphic Cross Section K-K' in the Southwest Plume Area

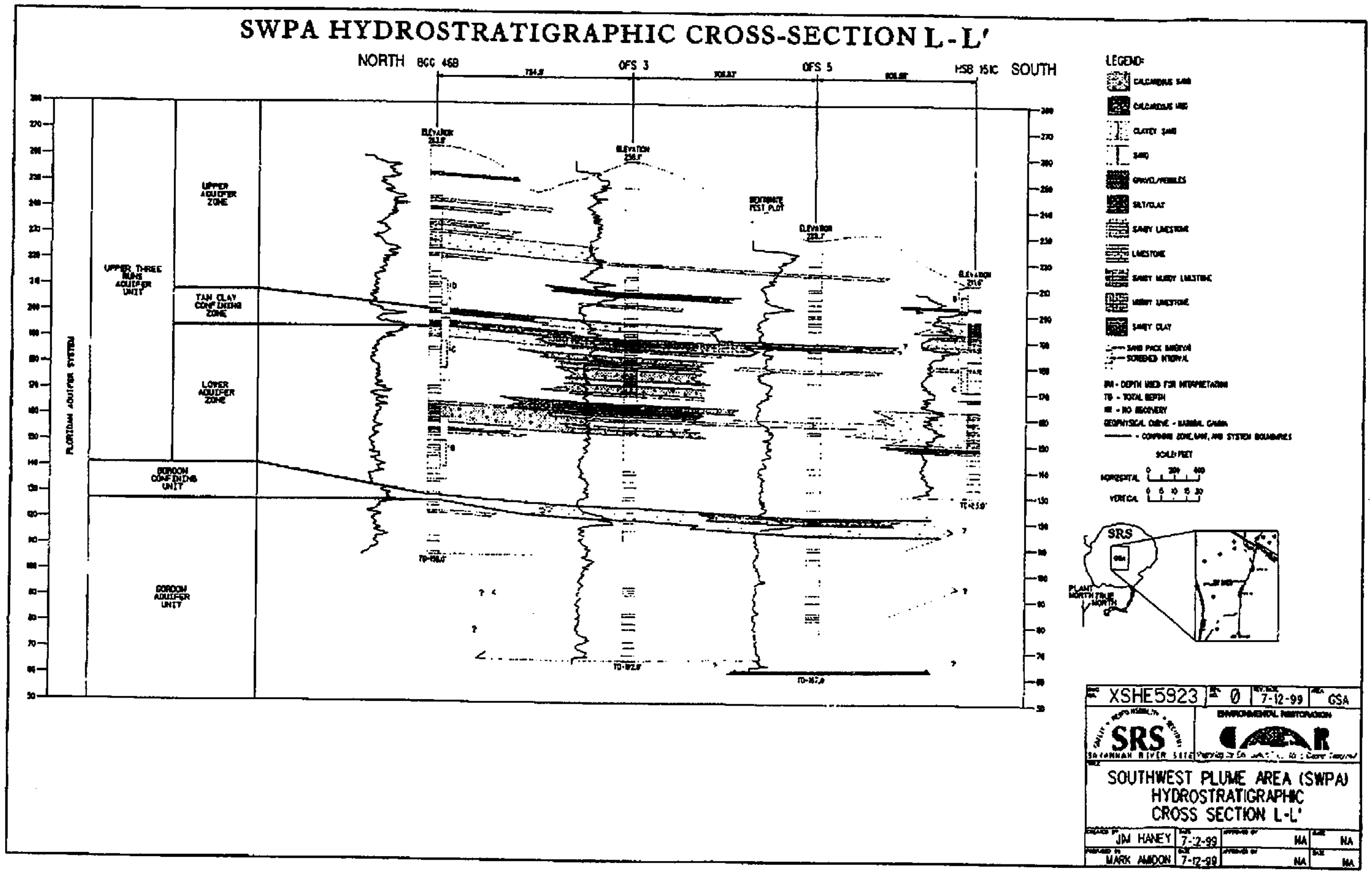

Fig. E.2.2-13. Hydrostratigraphic Cross Section L-L' in the Southwest Plume Area

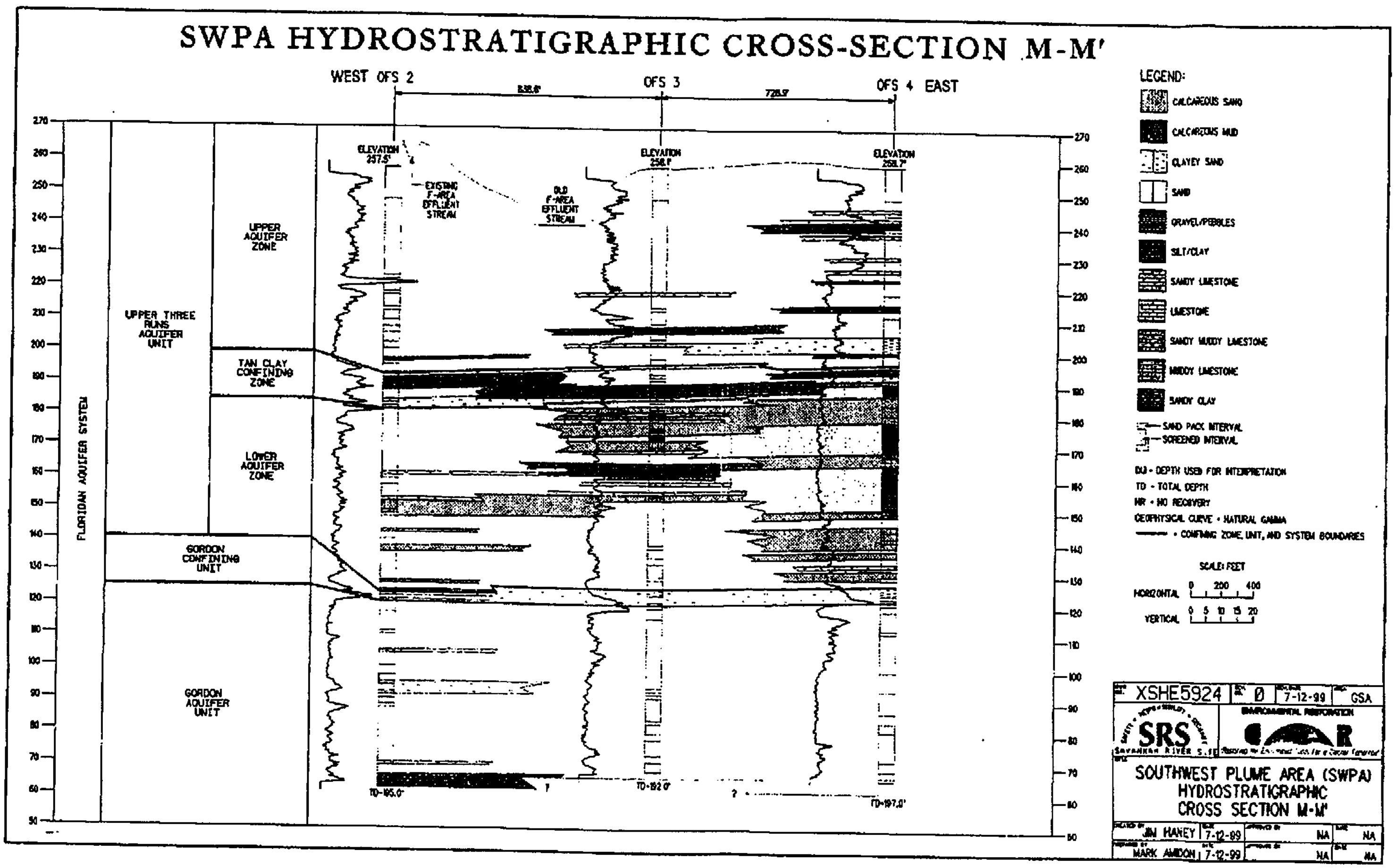

Fig. E.2.2-14. Hydrostratigraphic Cross Section M-M' in the Southwest Plume Area

Table E.2.2-4. Water Table and Piezometric Data for the Southwest Plume Area, Based on 4Q95 Analytical Data

Well	Ground Elevation (ft msl)	UAZ-UTRA (Water Table Aquifer) Water Level (ft msl)	LAZ-UTRA		Gordon Aquifer		Vadose Zone Thickness (ft)	Head Difference UAZ-UTRA (Water Table Aquifer) to LAZ-UTRA (ft)	Head Difference LAZ-UTRA to Gordon Aquifer (ft)
			Well Measured	Water Level (ft msl)	Well Measured	Water Level (ft msl)			
BGO 01D	293	239.9					53.1		
BGO 02D	294.9	238.2					56.7		
BGO 03D	290.8	235.2	BGO 03C	225.93	BGO 03A	163.42	55.6	9.27	62.51
BGO 04D	295.6	231.4					64.2		
BGO 05D	294.2	231	BGO 05C	216.1			63.2	14.9	
BGO 06D	283.2	231.7	BGO 06C	220.9	BGO 06A	159.6	51.5	10.8	61.3
			BGO 06B	219.61					
BGO 07D	285.2	232.6					52.6		
BGO 08D	285.6	232.9	BGO 08C	224	BGO 08AR	165.82	52.7	8.9	58.18
BGO 09D	283.2	231			BGO 09AA	ND	52.2		
BGO 10DR	298.3	232.6	BGO 10C	221.3	BGO 10AR	158.6	65.7	11.3	62.7
			BGO 10B	220.35	BGO 10AA	158.1			
BGO 11D	303.3	232.2					71.1		
BGO 12D	311.8	232	BGO 12CR	221.4	BGO 12AR	157.8	79.8	10.6	63.6
BGO 13DR	317.3		BGO 13DR	231.3					
BGO 14DR	298.2	231.1	BGO 14CR	223.8	BGO 14AR	159	67.1	7.3	64.8
BGO 15D	296.7	230.7					66		
BGO 16D	302.3	ND	BGO 16B	218.72	BGO 16AR	161.34	ND	ND	57.38
BGO 17DR	296.9	231.8					65.1		
BGO 18D	292.6	232.9			BGO 18A	161.8	59.7		
BGO 19D	287.8	233.4					54.4		
BGO 20D	281.3	240.8					40.5		
BGO 21D	283	235.6					47.4		

Table E.2.2-4. Water Table and Piezometric Data for the Southwest Plume Area, Based on 4Q95 Analytical Data

Well	Ground Elevation (ft msl)	UAZ-UTRA (Water Table Aquifer) Water Level (ft msl)	LAZ-UTRA		Gordon Aquifer		Vadose Zone Thickness (ft)	Head Difference UAZ-UTRA (Water Table Aquifer) to LAZ-UTRA (ft)	Head Difference LAZ-UTRA to Gordon Aquifer (ft)
			Well Measured	Water Level (ft msl)	Well Measured	Water Level (ft msl)			
BGO 22DR	284.2	237					47.2		
BGO 23D	287	236.5					50.5		
BGO 24D	291	237.6					53.4		
BGO 25A	294.7				BGO 25A	162			
BGO 26D	283.5	228.4			BGO 26A	159.7	55.1		
BGO 27D	274.3	228	BGO 27C	221.1			46.3	6.9	
BGO 28D	275.1	226.4					48.7		
BGO 29D	263.5	226.5	BGO 29C	223.3	BGO 29A	160	37	3.2	63.3
BGO 30D	272.8	225.9	BGO 30C	219.4			46.9	6.5	
BGO 31D	271.6	227	BGO 31C	225.9			44.6	1.1	
BGO 32D	279.5	228					51.5		
BGO 33D	278.1	231	BGO 33C	225.4			47.1	5.6	
BGO 34D	272.7	233.8					38.9		
BGO 35D	271.4	235.9	BGO 35C	228.8			35.1	7.1	
BGO 36D	273.3	238.9					34.4		
BGO 37D	285.1	240.6	BGO 37C	231.2			44.5	9.4	
BGO 38D	289.3	237					52.3		
BGO 39D	293.7	236.5					57.2		
BGO 40D	286.4	222.8					63.6		
BGO 41A	298.3				BGO 41A	158.5			
BGO 42C	295.9		BGO 42C	223.4					
BGO 43D	313.2		BGO 43D	231.74	BGO 43A	158.9			72.84
			BGO 43CR	225.85	BGO 43AA	156.6			

Table E.2.2-4. Water Table and Piezometric Data for the Southwest Plume Area, Based on 4Q95 Analytical Data

Well	Ground Elevation (ft msl)	UAZ-UTRA (Water Table Aquifer) Water Level (ft msl)	LAZ-UTRA		Gordon Aquifer		Vadose Zone Thickness (ft)	Head Difference UAZ-UTRA (Water Table Aquifer) to LAZ-UTRA (ft)	Head Difference LAZ-UTRA to Gordon Aquifer (ft)
			Well Measured	Water Level (ft msl)	Well Measured	Water Level (ft msl)			
BGO 44D	283.4	233.4	BGO 44C	221.87	BGO 44A	158.8	50	11.53	63.07
			BGO 44B	221.95	BGO 44AA	159.05			
BGO 45D	276.6	227.9	BGO 45C	223.3	BGO 45A	161	48.7	4.6	62.3
			BGO 45B	219.42					
BGO 46D	263.1	225.1	BGO 46C	219.4			38	5.7	
			BGO 46B	217.98					
BGO 47D	265.4	226.2	BGO 47C	222.8	BGO 47A	162.5	39.2	3.4	60.3
BGO 48D	275	226.6	BGO 48C	223.6			48.4	3	
BGO 49D	269.5	234.6	BGO 49C	228.1	BGO 49A	ND	34.9	6.5	ND
BGO 50D	254	225	BGO 50C	218.6	BGO 50A	159.6	29	6.4	59
BGO 51D	287	237.1	BGO 51C	231.27	BGO 51A	168.84	49.9	5.83	62.43
			BGO 51B	230.44	BGO 51AA	168.36			
BGO 52D	282.1	235.39	BGO 52C	229.93	BGO 52A	164.25	46.71	5.46	65.68
			BGO 52B	ND	BGO 52AA	163.25			
BGO 53D	288.9	230.37	BGO 53C	223.23	BGO 53A	159.46	58.53	7.14	63.77
			BGO 53B	226.96	BGO 53AA	158.29			
BGX 01D	289.2	230	BGX 01C	216.3	BGX 01A	158.3	59.2	13.7	58
BGX 02D	289.1		BGX 02D	215.61			73.49		
			BGX 02B	213.1					
BGX 03D	289.1		BGX 03D	215.3			73.8		
BGX 04D	288.8		BGX 04D	215.8	BGX 04A	155.3	73		60.5
			BGX 04C	214.7					
BGX 05D	283		BGX 05D	208.9			74.1		

Table E.2.2-4. Water Table and Piezometric Data for the Southwest Plume Area, Based on 4Q95 Analytical Data

Well	Ground Elevation (ft msl)	UAZ-UTRA (Water Table Aquifer) Water Level (ft msl)	LAZ-UTRA		Gordon Aquifer		Vadose Zone Thickness (ft)	Head Difference UAZ-UTRA (Water Table Aquifer) to LAZ-UTRA (ft)	Head Difference LAZ-UTRA to Gordon Aquifer (ft)
			Well Measured	Water Level (ft msl)	Well Measured	Water Level (ft msl)			
BGX 06D	275		BGX 06D	**205.8**			**69.2**		
BGX 07D	277.1		BGX 07D	**205.8**			**71.3**		
BGX 08DR	276.1		BGX 08DR	**205.5**			**70.6**		
BGX 09D	277.4	**226.9**					51.14		
BGX 10D	274.8	**ND**					49.59		
BGX 11D	273.8	**235.6**					38.82		
BGX 12D	273.2	**238.7**	BGX 12C	**234.7**			**34.5**	**4**	**65.3**
HSB 85C	292	**239.9**	HSB 85B	**233.6**	HSB 85A	**169.4**	**52.1**	**6.3**	**64.2**
HMD 01D	**262.7**		**HMD01D**	**209.2**			**53.5**		
HMD 02D	**259.3**		**HMD 02D**	**200.26**			**59.04**		
HMD 03D	**257.5**		**HMD 03D**	**199.8**			**57.7**		
HMD 04D	**248.5**		**HMD 04D**	**200.1**			**48.4**		

NOTES: ☐ These wells were utilized in the hydrostratigraphic description of the Southwest Plume Area.
msl mean sea level
ND No Data
ft feet

Table E.2.2-4. Water Table and Piezometric Data for the Southwest Plume Area, Based on 4Q95 Analytical Data

Well	Ground Elevation (ft msl)	UAZ-UTRA (Water Table Aquifer) Water Level (ft msl)	LAZ-UTRA Well Measured	LAZ-UTRA Water Level (ft msl)	Gordon Aquifer Well Measured	Gordon Aquifer Water Level (ft msl)	Vadose Zone Thickness (ft)	Head Difference UAZ-UTRA (Water Table Aquifer) to LAZ-UTRA (ft)	Head Difference LAZ-UTRA to Gordon Aquifer (ft)
BGX 06D	275		BGX 06D	205.8			69.2		
BGX 07D	277.1		BGX 07D	205.8			71.3		
BGX 08DR	276.1		BGX 08DR	205.5			70.6		
BGX 09D	277.4	226.9					51.14		
BGX 10D	274.8	ND					49.59		
BGX 11D	273.8	235.6					38.82		
BGX 12D	273.2	238.7	BGX 12C	234.7			34.5	4	65.3
HSB 85C	292	239.9	HSB 85B	233.6	HSB 85A	169.4	52.1	6.3	64.2
HMD 01D	262.7		HMD01D	209.2			53.5		
HMD 02D	259.3		HMD 02D	200.26			59.04		
HMD 03D	257.5		HMD 03D	199.8			57.7		
HMD 04D	248.5		HMD 04D	200.1			48.4		

NOTES: ☐ These wells were utilized in the hydrostratigraphic description of the Southwest Plume Area.
msl mean sea level
ND No Data
ft feet

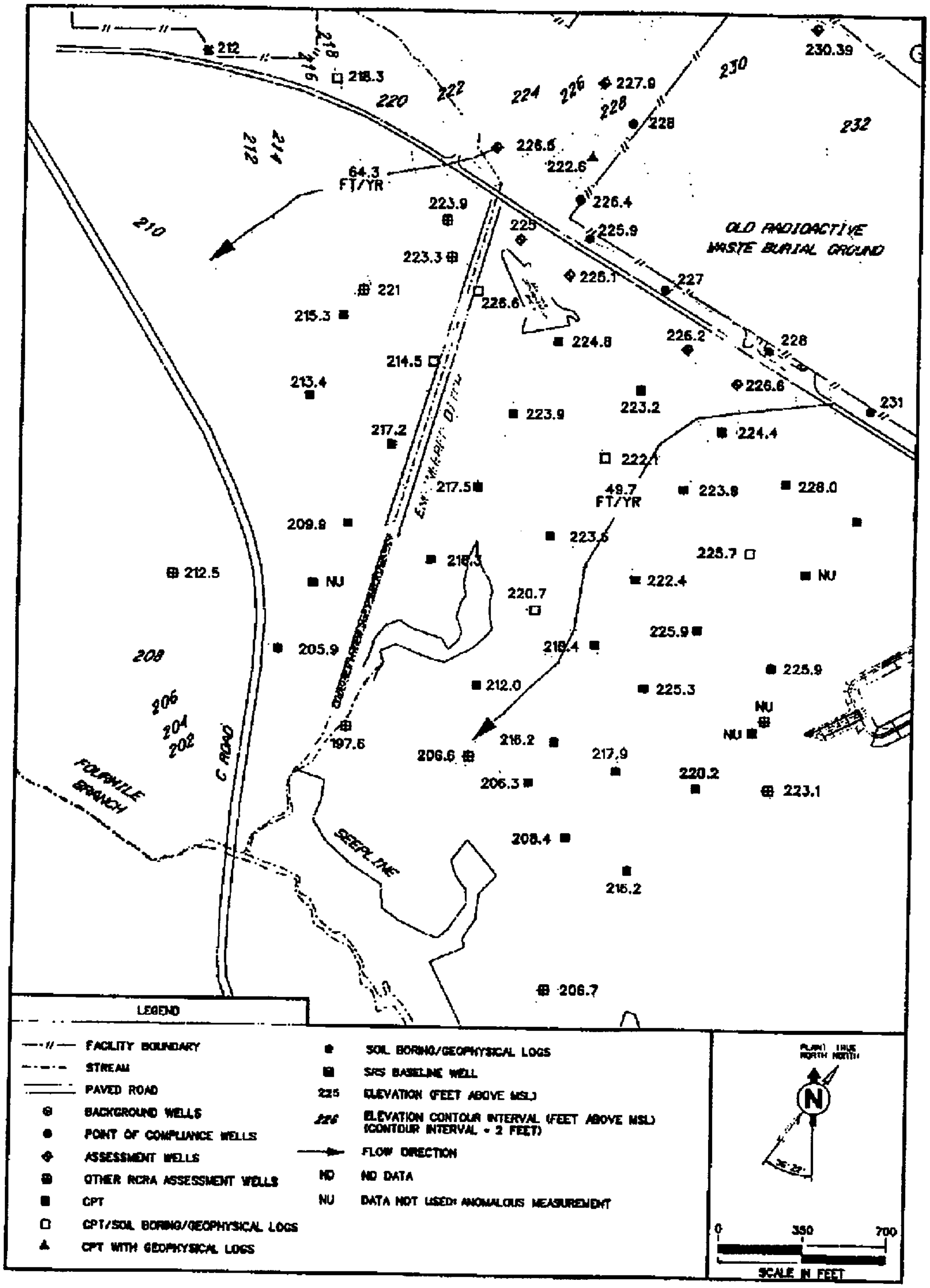

Fig. E.2.2-15. Potentiometric Surface Map of the Upper Aquifer Zone of the Upper Three Runs Aquifer (Water Table Aquifer), Southwest Plume Area

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range from **49.7** to **64.3** feet/year. Flow rates are calculated as discussed in Section E.2.1.2.1. Flow estimates are based on average hydraulic conductivity values from slug tests at the BGC (**2.81** feet/day). Table E.2.2-5 lists slug test data from the Southwest Plume Area. The estimated flow rates were calculated using an effective porosity of 0.20, a hydraulic gradient ranging from **0.0097** to **0.0125** feet/feet, and an average hydraulic conductivity of **2.81** feet/day.

"Tan Clay" Confining Zone

Groundwater flow across **the "tan clay" confining zone** is downward into **the LAZ-UTRA.** Six undisturbed samples of **the "tan clay" confining zone** were subjected to laboratory permeameter tests in order to determine vertical hydraulic conductivity. The test results are recorded in Table E.2.2-6. The vertical hydraulic conductivity ranges from **2.00E-09** to **1.42E+00** feet/day in the entire BGC. The vertical hydraulic conductivity range in the Southwest Plume Area is from **4.20E-09** to **1.42E+00** feet/day. These numbers indicate that the confining unit is characterized by highly variable permeability.

Lower Aquifer Zone of the Upper Three Runs Aquifer

Groundwater flow in **the LAZ-UTRA** at the Southwest Plume Area is southwest from the ORWBG toward Fourmile Branch. Fig. E.2.2-16 is a detailed potentiometric map of **the LAZ-UTRA** in the Southwest Plume Area. The flow rate for the representative flow path was calculated at a range of **18.5** feet/year. The flow rate was calculated as discussed in Section E.2.1.2.1. Flow estimates are based on average

Table E.2.2-5. Hydraulic Conductivity Data Based on Slug Tests for the Upper Aquifer Zone of the Upper Three Runs Aquifer (Water Table Aquifer) in the Southwest Plume Area

WELL	HYDRAULIC CONDUCTIVITY (cm/sec)	(ft/day)
BGO 27D	3.77E-04	1.07
BGO 28D	8.68E-04	2.46
BGO 29D	5.57E-04	1.58
BGO 32D	5.57E-04	1.58
BGO 33D	1.59E-04	0.45
BGO 45D	2.14E-03	6.07
BGO 46D	4.06E-03	11.51
BGO 47D	5.60E-03	15.87
BGO 48D	3.87E-03	10.97
BGO 50D	5.68E-04	1.61
BGO 53D	6.70E-04	1.9
HSB 117D	4.30E-03	12.2
HSB 151D	8.11E-04	2.3
BGC MAXIMUM	5.60E-03	15.87
BGC MINIMUM	2.47E-05	0.07
BGC AVERAGE	9.92E-04	2.81
Southwest Plume Area MAXIMUM	5.60E-03	15.87
Southwest Plume Area MINIMUM	1.59E-04	0.45
Southwest Plume Area AVERAGE	1.89E-03	5.35

NOTES:

cm/sec centimeters per second
ft/day feet per day
BGC Burial Ground Complex

SOURCES: Sirrine 1991a, 1991b, 1992; DOE 1988; WSRC 1995a, 1996a

Table E.2.2-6. Hydraulic Conductivity Data Based on Laboratory Tests for the "Tan Clay" Confining Zone, Southwest Plume Area

WELL	VERTICAL CONDUCTIVITY (cm/sec)	VERTICAL CONDUCTIVITY (ft/day)	HORIZONTAL CONDUCTIVITY (cm/sec)	HORIZONTAL CONDUCTIVITY (ft/day)
BGO 45A	1.53E-01	5.39E-05	2.50E-08	7.09E-05
BGO 53C	1.19E-05	4.20E-09	9.00E-07	2.55E-03
BGT 53	5.10E-05	1.80E-08	6.00E-09	1.70E-05
OFS 03SB	2.27E-01	8.02E-05	6.00E-05	1.70E-01
OFS 04SB	1.77E+00	6.24E-04	1.90E-06	5.39E-03
OFS 05SB	4.03E+03	1.42E+00	5.01E-04	1.42E+00
BGC MAXIMUM	4.03E+03	1.42E+00	5.01E-04	1.42E+00
BGC MINIMUM	5.67E-06	2.00E-09	6.00E-09	1.70E-05
BGC AVERAGE	1.67E+02	5.88E-02	3.01E-05	8.54E-02
Southwest Plume Area MAXIMUM	4.03E+03	1.42E+00	5.01E-04	1.42E+00
Southwest Plume Area MINIMUM	1.19E-05	4.20E-09	6.00E-09	1.70E-05
Southwest Plume Area AVERAGE	6.71E+02	2.37E-01	9.40E-05	2.66E-01

NOTES:

cm/sec centimeters per second
ft/day feet per day
BGC Burial Ground Complex

SOURCES: Sirrine 1991a, 1991b, 1992; DOE 1988; WSRC 1995a, 1996a

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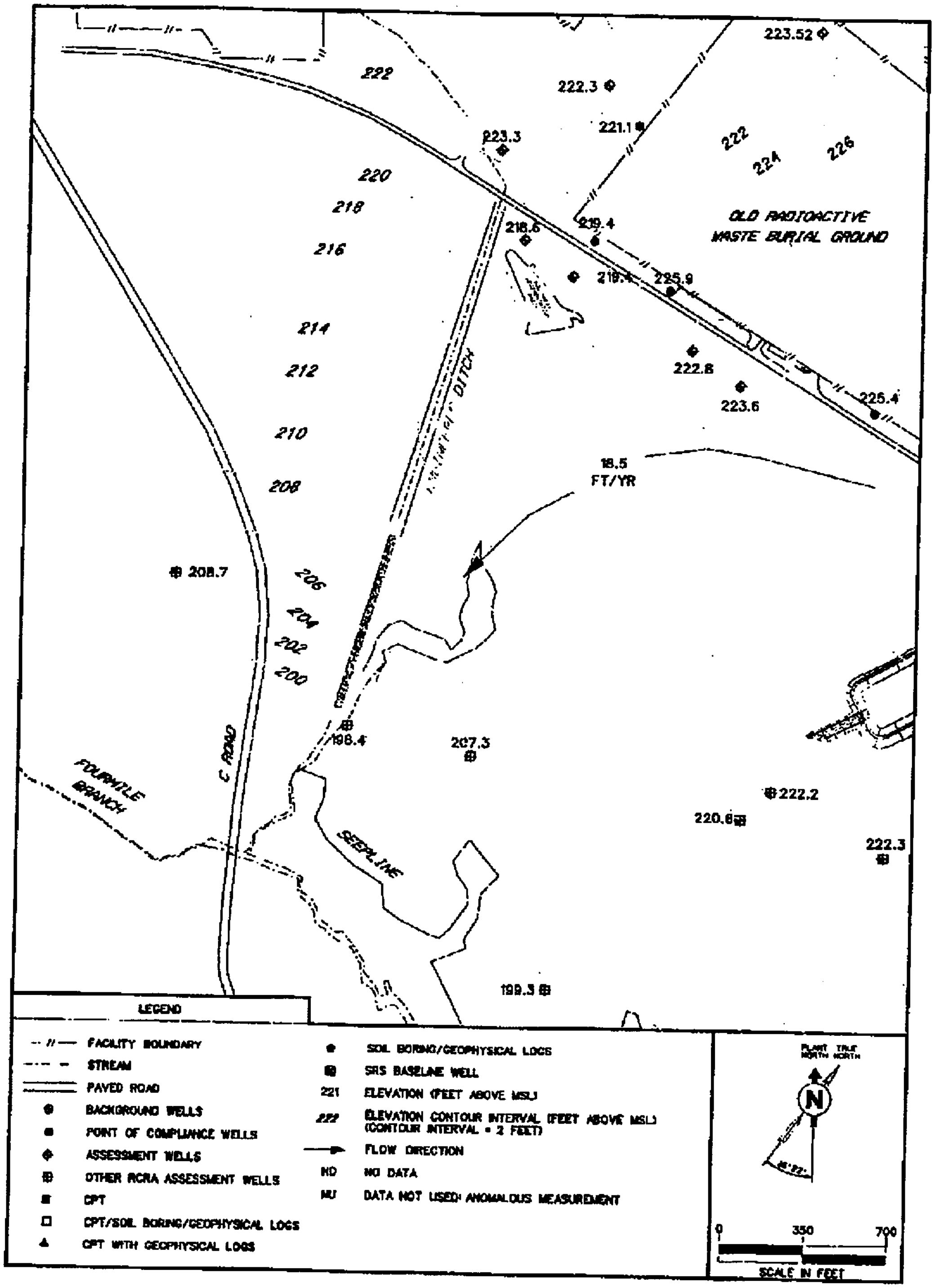

Fig. E.2.2-16. Potentiometric Surface Map of the Lower Aquifer Zone of the Upper Three Runs Aquifer, Southwest Plume Area

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hydraulic conductivity values from slug tests in the BGC. Table E.2.2-7 lists slug test data from the Southwest Plume Area.

The estimated flow rate was calculated using an effective porosity of 0.20, a hydraulic gradient of 0.0073 feet/feet, and an average hydraulic conductivity of 1.38 feet/day.

Gordon Confining Unit

Groundwater flow across the Gordon Confining Unit is downward into the Gordon Aquifer. Laboratory permeameter tests were conducted on six undisturbed samples of the Gordon Confining Unit in order to determine hydraulic conductivity (Table E.2.2-8). These analyses exhibited a range of vertical conductivities from 2.30E-09 feet/day to 3.40E-03 feet/day. These low vertical conductivities indicate low permeability and low vertical flow rates across the unit.

Gordon Aquifer

Groundwater flow in the Gordon Aquifer is northwest toward Upper Three Runs. Fig. E.2.2-17 is a detailed potentiometric map of the Gordon Aquifer in the Southwest Plume Area.

The flow rate for the Gordon Aquifer is estimated at 127 feet/year. The flow rate was calculated as discussed in Section E.2.1.2.1. Flow estimates are based on hydraulic conductivity values from pumping tests in the BGC. Table E.2.2-9 provides additional hydraulic conductivity information from slug test data in the Gordon Aquifer.

Table E.2.2-7. Hydraulic Conductivity Data Based on Slug Tests for the Lower Aquifer Zone of the Upper Three Runs Aquifer in the Southwest Plume Area

WELL	HYDRAULIC CONDUCTIVITY (cm/sec)	(ft/day)
BGO 29C	1.02E-04	0.29
BGO 45B	4.23E-05	0.12
BGO 45C	4.30E-04	1.22
BGO 46B	8.22E-04	2.33
BGO 46C	4.94E-05	0.14
BGO 47C	1.62E-04	0.46
BGO 48C	7.58E-04	2.15
BGO 50C	1.16E-04	0.33
BGO 53B	4.23E-05	0.12
BGO 53C	8.11E-04	2.3
HSB 117C	2.05E-04	0.58
BGC MAXIMUM	7.19E-03	20.38
BGC MINIMUM	3.53E-06	0.01
BGC AVERAGE	4.86E-04	1.38
Southwest Plume Area MAXIMUM	8.22E-04	2.33
Southwest Plume Area MINIMUM	4.23E-05	0.12
Southwest Plume Area AVERAGE	3.22E-04	0.91

NOTES:
cm/sec centimeters per second
ft/day feet per day
BGC Burial Ground Complex

SOURCES: Sirrine 1991a, 1991b, 1992; DOE 1988; WSRC 1995a, 1996a

Table E.2.2-8. Hydraulic Conductivity Data Based on Laboratory Tests for the Gordon Confining Unit, Southwest Plume Area

WELL	VERTICAL CONDUCTIVITY		HORIZONTAL CONDUCTIVITY	
	(cm/sec)	(ft/day)	(cm/sec)	(ft/day)
BGO 45A	5.78E-01	2.04E-04	4.52E-08	1.28E-04
BGO 47A	9.64E+00	3.40E-03	2.00E-06	5.67E-03
BGO 53B	6.52E-06	2.30E-09	2.50E-09	7.09E-06
OFS 03SB	1.36E-02	4.81E-06	2.80E-09	7.94E-06
OFS 04SB	3.20E-02	1.13E-05	2.30E-08	6.52E-05
OFS 05SB	1.29E-02	4.54E-06	6.31E-09	1.79E-05
BGC MAXIMUM	9.64E+00	3.40E-03	6.50E-06	1.84E-02
BGC MINIMUM	6.52E-06	2.30E-09	1.90E-09	5.39E-06
BGC AVERAGE	6.51E-01	2.30E-04	7.05E-07	2.00E-03
Southwest Plume Area MAXIMUM	9.64E+00	3.40E-03	2.00E-06	5.67E-03
Southwest Plume Area MINIMUM	6.52E-06	2.30E-09	2.50E-09	7.09E-06
Southwest Plume Area AVERAGE	1.71E+00	6.04E-04	3.47E-07	9.83E-04

NOTES:

cm/sec centimeters per second
ft/day feet per day
BGC Burial Ground Complex

SOURCES: Sirrine 1991a, 1991b, 1992; DOE 1988; WSRC 1995a, 1996a

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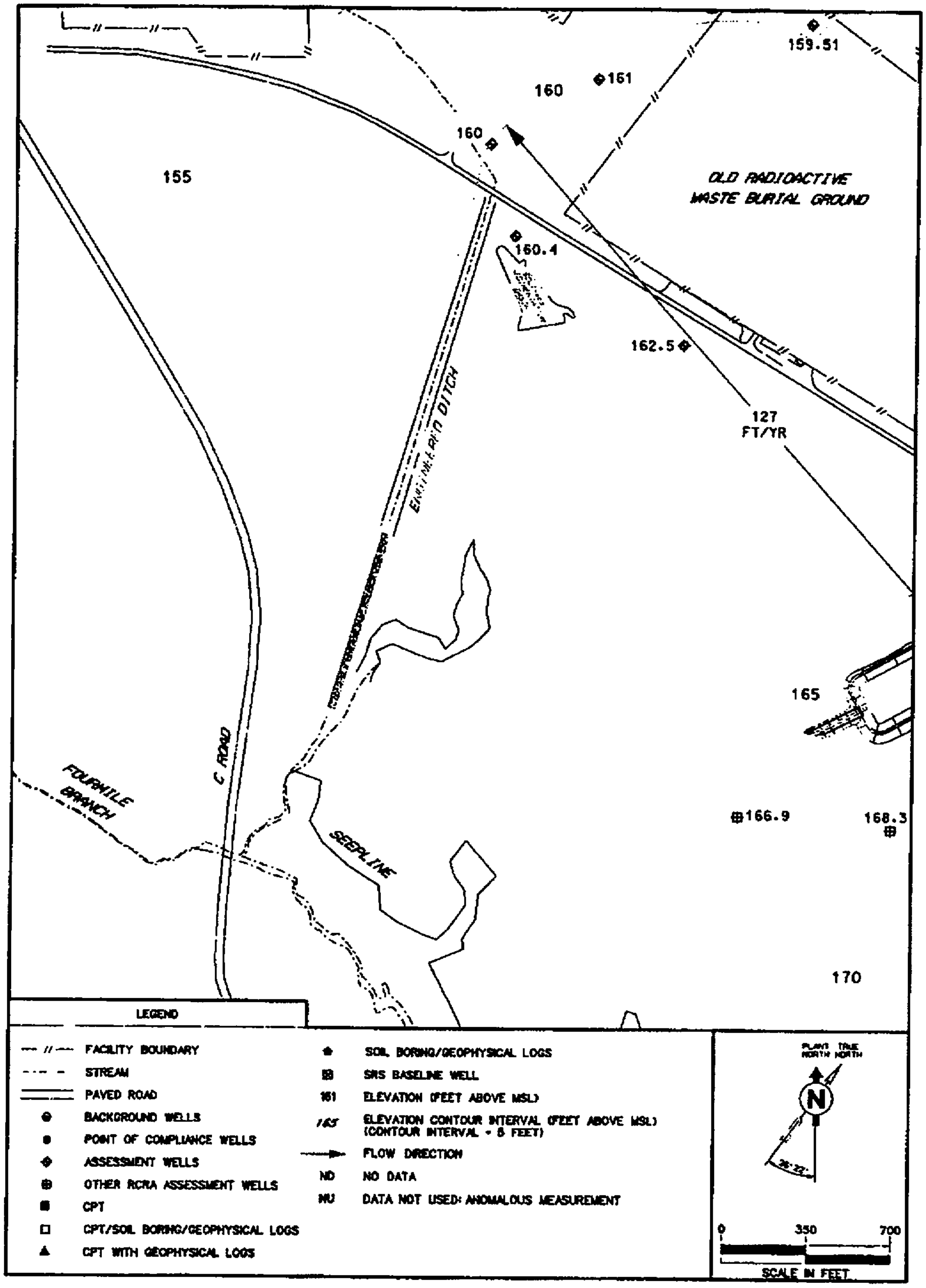

Fig. E.2.2-17. Potentiometric Surface Map of the Gordon Aquifer for the Southwest Plume Area

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Table E.2.2-9. Hydraulic Conductivity Data Based on Slug Tests for the Gordon Aquifer in the Southwest Plume Area

WELL	HYDRAULIC CONDUCTIVITY (cm/sec)	(ft/day)
BGO 45A	8.64E-04	2.45
BGO 47A	1.08E-03	3.06
BGO 50A	1.41E-04	0.4
BGO 53A	1.34E-04	0.38
BGO 53AA	3.88E-04	1.1
HSB 117A	5.64E-05	0.16
BGC MAXIMUM	4.23E-03	11.98
BGC MINIMUM	1.76E-06	0.01
BGC AVERAGE	7.06E-04	2.00
Southwest Plume Area MAXIMUM	1.08E-03	3.06
Southwest Plume Area MINIMUM	5.64E-05	0.16
Southwest Plume Area AVERAGE	4.44E-04	1.26

NOTES:

cm/sec centimeters per second
ft/day feet per day
BGC Burial Ground Complex

SOURCES: Sirrine 1991a, 1991b, 1992; DOE 1988; WSRC 1995a, 1996a

The estimated flow rate was calculated using an effective porosity of 0.25, a hydraulic gradient of **0.0019** feet/feet, and an average hydraulic conductivity of 45 feet/day (based on pumping tests).

E.2.3 HYDROGEOLOGIC INFORMATION ASSOCIATED WITH THE NORTHWEST PLUME AREA

Characterization of the Northwest Plume Area was completed utilizing two DPT methods (CPT and hydropunch) and field screening measurement techniques. These technologies allowed for the rapid collection of lithologic and water quality samples at closely spaced locations (Fig. E.2.3-1). Data collected using DPT have been integrated with BGC groundwater monitoring well and core data to provide a detailed characterization of the Northwest Plume Area.

Of the two DPT methods employed, CPT was used most extensively to characterize the Northwest Plume Area because it provides samples quickly, efficiently, and cost effectively. CPT is a simple push technology, which does not involve mud-rotary drilling, and was utilized for sampling the UAZ-UTRA (Water Table Aquifer) and the LAZ-UTRA. The second DPT method, hydropunch, utilized mud-rotary drilling, which allows sampling at greater depths than does CPT. Hydropunch was used to collect data from the Gordon Aquifer and deeper sections of the LAZ-UTRA. At each hydropunch location, the first water sample was collected at the same depth as the deepest CPT sample. This technique allowed for a comparison of results between the two sampling methods.

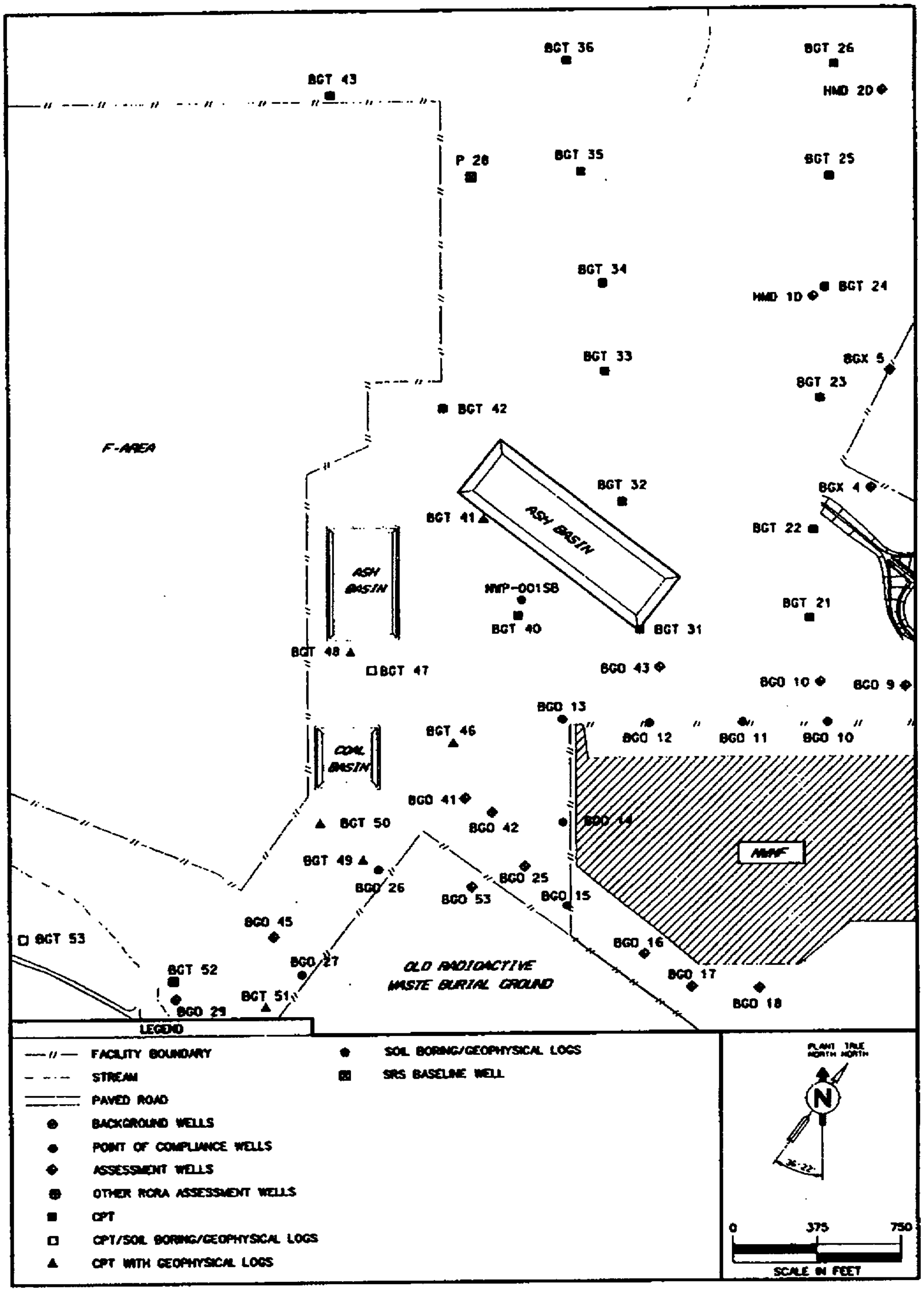

Fig. E.2.3-1. Sample Locations for the Northwest Plume Area

Thirty locations were selected to characterize the Northwest Plume Area. Several of the same locations were also used to assist in defining the Northeast Plume Area due to the proximity of the plumes versus sampling locations. Electronic lithologic data were collected by CPT at 30 locations prior to water sampling. The electronic lithologic logs consist of tip and sleeve friction, pore pressure, and friction ratio. Natural gamma logging was conducted at 18 of the locations. Electronic logs were correlated with the natural gamma logs, and depth-discrete CPT water sampling locations were chosen based on the correlation. CPT samples were collected with a 40-mL stainless steel bailer from 6- or 12-inch sampling intervals. This sampling apparatus allows for the collection of water samples in thin discrete sand zones as identified on the electronic logs.

Hydropunch and coring activities were conducted at 13 and 3 of the 30 locations, respectively. Geophysical logs and cores were collected to varying depths. These data were used to determine the groundwater sampling depths. Each hydropunch borehole was augered or mud-rotary drilled to within a few feet of the target sample zone. The hydropunch tool was pushed through undisturbed sediment to the base of the sample interval, and the screen was exposed to allow water to flow into the sample chamber of the tool. The samples were extracted by bailer. Hydropunch samples were collected from a variable number of approximately 3- to 5-foot depth-discrete sample intervals in the LAZ-UTRA and the Gordon Aquifer.

The strategy employed in the Northwest Plume Area consisted of collecting groundwater samples from locations closest to the MWMF and extending outward along a determined transect. Sample collections

terminated when TCE and tritium concentrations in each interval sampled from each aquifer were below instrument detection limits.

Detailed descriptions of the sampling methods have been provided in the Burial Ground Complex Field Investigation Preliminary Data Report #2 (WSRC-RP-96-060).

Lithologic data and geophysical logs from coreholes and ECPT logs were used to determine unit elevations and thicknesses. Sampling locations from which data on all tables in Section E were derived are shown on Map 9 in Appendix 1 and on Fig. E.2.3-1. Table E.2.3-1 depicts the unit elevations and thickness from cores at the BGC. Table E.2.3-2 (hydrostratigraphic picks from ECPT) depicts the unit elevations and thicknesses interpreted from ECPT collected in the Northwest Plume Area. Structure contour and isopach maps for each of the aquifers and aquitards in the Northwest Plume Area were constructed using a composite of data from these two tables.

Fig. E.2.3-2 and Fig. E.2.3-3 are the structure contour and isopach maps, respectively, of the "tan clay" confining zone. The density of data points allows for detailed mapping of the unit surface and thickness. Undulations in the confining unit surface, changes in lithology, and structural features could potentially influence horizontal and vertical contaminant transport. The structure contour and isopach maps both illustrate a crevasse splay or fan deposit across the northwest corner of the ORWBG. East of that feature is a low area where subsidence has resulted in mass wasting and gravity sliding in the "tan clay" confining zone. To the north, as the confining zone topography

Table E.2.3-1. Hydrostratigraphic Picks from Core Data in the Northwest Plume Area

Boring ID	"Tan Clay" Confining Zone		Lower Aquifer Zone		Gordon Confining Unit		Gordon Aquifer		Meyers Branch Confining System
	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)
BGO 03A	197	10	187	57	130	9	121	93	28
BGO 05C	218	17	201						
BGO 06A	210	15	195	74	121	1	120		
BGO 06B	203	11	192	55	137	14	123		
BGO 08A	213	14	199	69	130	10	120		
BGO 09AA	224	13	211	76	135	10	125		
BGO 10A	209	2	207	76	131	7	124		
BGO 10AA	219	12	207	77	130	4	126		
BGO 12A	200	14	186	47	139	10	129		
BGO 14A	218	9	209	71	138	22	116		
BGO 16A	196	12	184	55	129	5	124		
BGO 18A	203	5	198	67	131	7	124		
BGO 20AA	206	13	193	64	129	21	108	64	44
BGO 25A	212	11	201	63	138	10	128		
BGO 26A	224	19	205	72	133	4	129		
BGO 27C	199	7	192						
BGO 29A	196	11	185	53	132	13	119		
BGO 31C	198	10	188						
BGO 33C	203	12	191						
BGO 35C	203	10	193						
BGO 37C	201	11	190						
BGO 39A	204	11	193	81	112	18	94	66	28
BGO 41A	214	8	206	69	137	16	121		
BGO 42C	216	7	209						

Table E.2.3-1. Hydrostratigraphic Picks from Core Data in the Northwest Plume Area

Boring ID	"Tan Clay" Confining Zone		Lower Aquifer Zone		Gordon Confining Unit		Gordon Aquifer		Meyers Branch Confining System
	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)
BGO 43AA	195	11	184	53	131	18	113		
BGO 44AA	222	23	199	68	131	11	120		
BGO 45A	207	10	197	63	134	4	130		
BGO 46B	200	12	188	60	128	6	122		
BGO 47A	198	9	189	60	129	7	122		
BGO 48C	198	6	192						
BGO 49A	201	9	192	73	119	4	115		
BGO 50A	194	17	177	45	132	13	119		
BGO 51AA	204	11	193	87	106	18	88	53	35
BGO 52AA	207	10	197	72	125	9	116	98	18
BGO 53AA	223	31	192	55	137	5	132	95	37
BGX 01A	211	13	198	64	134	9	125		
BGX 02B	216	18	198	58	140	13	127		
BGX 04A	225	12	213	84	129	12	117		
BGX 07D	225	5	220	63	157	13	144		
BGX 09D	207	12	195	53	142	10	132		
BGX 11D	193	16	177	51	126	9	117		
BSE 01C	218	15	180	67	113				
BSE 02C	195	7	188						
BSE 03C	211	15	196						
HMD 01C	232	11	221	82	139	13	126		
HMD 02C	223	7	216	73	143	5	138		
HMD 03C	224	5	219	64	155	5	150		
HMD 04C	224	4	220	67	153	12	141		

Table E.2.3-1. Hydrostratigraphic Picks from Core Data in the Northwest Plume Area

	"Tan Clay" Confining Zone		Lower Aquifer Zone		Gordon Confining Unit		Gordon Aquifer		Meyers Branch Confining System
Boring ID	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)
HSB 143	198		179						
HSB 151	193		183						
HSB 152	198		186						
HSB 85A	204	10	194	70	124	6	118	79	39
NWP 01SB	212	5	207	76	131	17	114	75	39
OFS 01SB			186	57	129	5	124		
OFS 02SB	198	10	188	62	126	6	121		
OFS 03SB	196	11	185	60	125	5	120		
OFS 04SB	196	4	192	65	127	5	122		
OFS 05SB	189	11	178	56	122	5	117		
P 28TA	215	4	211	70	141	8	133	69	64
SWP 01SB	192	14	178	50	128	18	110	75	35

NOTES:
[box] These cores were utilized in the hydrostratigraphic description of the Northwest Plume Area.
msl - mean sea level
ft - feet

Table E.2.3-2. Hydrostratigraphic Picks from Electric Cone Penetrometer Testing Logs in the Northwest Plume Area

Sampling Location ID	Northing	Easting	Ground Elevation (ft msl)	"Tan Clay" Confining Zone		Lower Aquifer Zone		Gordon Confining Unit		Gordon Aquifer		Meyers Branch Confining System
				Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)
BGT 01	76700.60	59178.40	282.90	223	14	195	59	136	6	130		
BGT 02	76957.60	59607.20	276.40	213	15	198	61	138	5	133		
BGT 03	77197.60	60045.90	275.70	213	14	199	56	143	2	141	72	69
BGT 04	77437.60	60484.50	259.20	213	9	204	56	148				
BGT 05	77677.60	60924.10	225.70	214	5	209	62	147	2	145	81	64
BGT 06	77254.80	58746.70	282.20	218	20	198	56	142	15	127		
BGT 07	77717.80	58935.70	276.40	212	13	199	58	141	9	132		
BGT 08	78161.50	59118.60	249.30	221	4	217	68	149				
BGT 09	78642.30	59316.70	226.00	208	4	204	55	149	10	139	74	65
BGT 10	79104.60	59507.20	215.20	201	7	194	44	150	40	140		
BGT 11	79566.90	59697.70	222.50					156	12	144	77	67
BGT 12	77291.20	58045.90	284.20	225	11	214						
BGT 13	77488.90	58074.00	287.80	224	8	216						
BGT 14	77984.00	58143.40	280.70	215	6	209	69	140	13	127		
BGT 15	78479.20	58212.80	277.50	209	8	201	51	150				
BGT 16	78974.10	58283.50	250.70					151				
BGT 17	79469.70	58350.00	240.70					150				
BGT 18	79965.30	58416.50	216.50					162	15	147	92	55
BGT 20	80956.40	58549.60	159.50					151	11	140	70	70
BGT 21	77280.70	56952.50	294.20	223	7	216						
BGT 22	77860.30	56970.30	281.00	233	18	215	89	126	12	114	64	50

Table E.2.3-2. Hydrostratigraphic Picks from Electric Cone Penetrometer Testing Logs in the Northwest Plume Area

Sampling Location ID	Northing	Easting	Ground Elevation (ft msl)	"Tan Clay" Confining Zone Elevation Top (ft msl)	"Tan Clay" Confining Zone Thickness (ft)	Lower Aquifer Zone Elevation Top (ft msl)	Lower Aquifer Zone Thickness (ft)	Gordon Confining Unit Elevation Top (ft msl)	Gordon Confining Unit Thickness (ft)	Gordon Aquifer Elevation Top (ft msl)	Gordon Aquifer Thickness (ft)	Meyers Branch Confining System Elevation Top (ft msl)
BGT 23	78279.70	56997.00	270.00	216	6	210						
BGT 24	78779.20	57019.20	265.80	227	7	220						
BGT 25	79278.70	57041.40	264.80	229	5	224						
BGT 27	80277.70	57085.90	256.90	217	10	207	55	152				
BGT 28	80777.20	57108.10	258.30	216	26	190	34	156	6	150	98	52
BGT 29	81276.70	57130.40	243.00	218	3	215						
BGT 30	81726.30	57150.40	219.00	208	2	206	64	142	5	137		
BGT 31	77228.97	56189.75	308.76	220	5	215						
BGT 32	77791.41	56121.10	310.12	237	3	234						
BGT 33	78404.46	56037.17	290.42	239	16	223						
BGT 34	78803.92	56027.45	286.76	221	7	214						
BGT 35	79305.84	55929.89	267.73	217	4	213						
BGT 36	79801.93	55867.47	261.36	226	11	215	67	148				
BGT 37	80298.03	55805.00	251.60	222	7	215	82	133				
BGT 40	77297.15	55644.42	332.32	209	6	203						
BGT 41	77734.75	55490.12	328.37	224	5	219	70	149	7	142		
BGT 42	78240.66	55313.07	310.92	224	5	219						
BGT 43	79655.92	54816.04	277.08	205	4	201						
BGT 44	80127.67	54650.36	276.20	214	5	209						
BGT 45	80461.74	54533.05	285.28	218	9	209	59	150				
BGT 46	76714.30	55354.96	310.00	213	8	205	71	134	9	125		
BGT 47	77051.85	54986.57	317.32	218	15	203	63	140	11	129		

Table E.2.3-2. Hydrostratigraphic Picks from Electric Cone Penetrometer Testing Logs in the Northwest Plume Area

Sampling Location ID	Northing	Easting	Ground Elevation (ft msl)	"Tan Clay" Confining Zone Elevation Top (ft msl)	"Tan Clay" Confining Zone Thickness (ft)	Lower Aquifer Zone Elevation Top (ft msl)	Lower Aquifer Zone Thickness (ft)	Gordon Confining Unit Elevation Top (ft msl)	Gordon Confining Unit Thickness (ft)	Gordon Aquifer Elevation Top (ft msl)	Gordon Aquifer Thickness (ft)	Meyers Branch Confining System Elevation Top (ft msl)
BGT 48	77135.74	54895.09	314.33	217	8	209						
BGT 49	76203.90	54946.30	297.26	222	8	214	79	135	9	126		
BGT 50	76359.30	54756.20	296.27	221	7	214	82	132	8	124		
BGT 51	75519.81	54505.65	272.64	193	7	186						
BGT 53	75837.68	53422.04	278.25	200	9	191	71	120	11	109	77	32
BGT 54	75941.66	52889.14	279.96	205	9	196						
BGT 56	73521.24	56265.77	262.94	182	7	175						
BGT 57	73268.51	56104.24	259.35	179	10	169						
BGT 58	73406.90	57399.60	285.76	192	2	190	78	112	9	103		
BGT 59	72802.60	57123.20	281.88	182	9	173						
BGT 60	73120.63	58057.22	291.42	186	10	176						
BGT 61	72911.77	58490.09	284.30	184	6	178	70	108	7	101		
BGT 62	72854.40	58609.00	282.03	190	14	176						
BGT 63	73319.43	59146.34	293.67	195	6	189						
BGT 63A	73646.40	58768.10	290.79	198	4	194						
BGT 64	73013.74	59499.95	283.25	195	7	188	65	123				
BGT 66	74476.55	60033.67	244.04	195	7	188						
BGT 67	74443.06	60426.74	242.30	187	14	173	38	135	8	127	99	50

NOTES: Hydrostratigraphic picks from the ECPT logs are not exact. There is a difference of (+) or (-) 1 foot.
[boxed] These CPTs were utilized in the hydrostratigraphic description of the Northwest Plume Area.
msl - mean sea level
ft - feet

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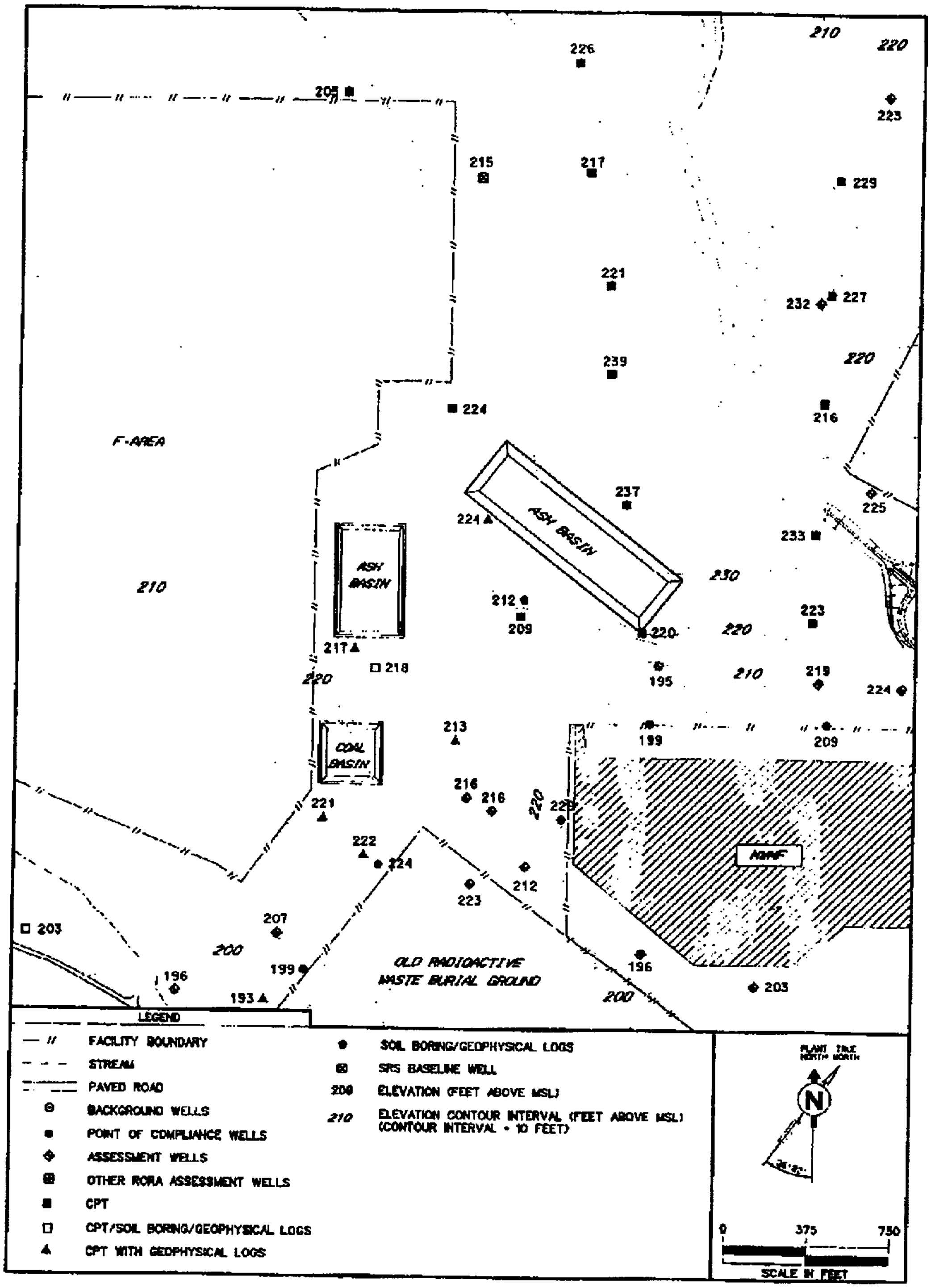

Fig. E.2.3-2. Structure Contour Map of the "Tan Clay" Confining Zone in the Northwest Plume Area

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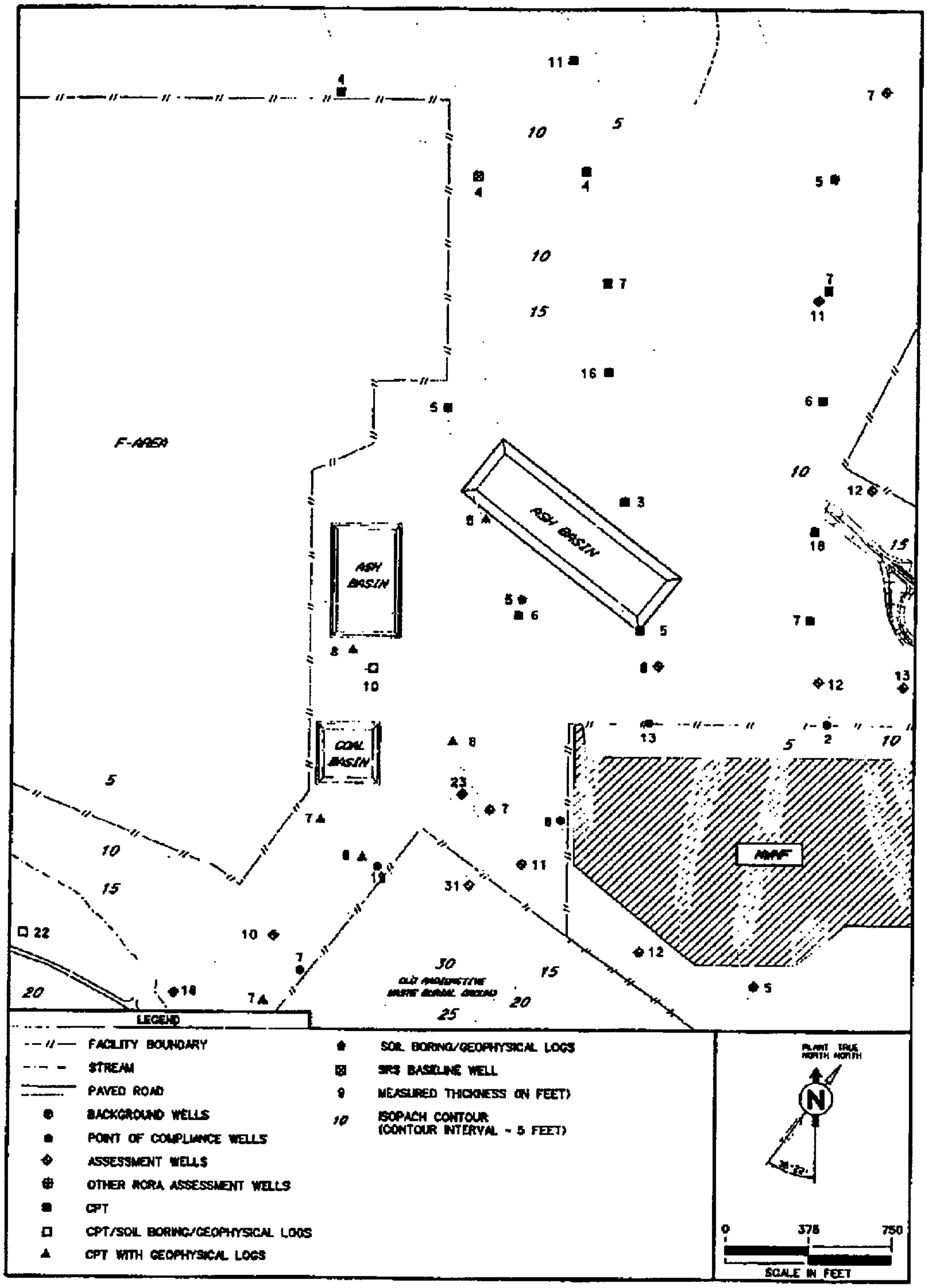

Fig. E.2.3-3. Isopach Map of the "Tan Clay" Confining Zone in the Northwest Plume Area

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drops to the level of Upper Three Runs, the "tan clay" confining zone crops out at approximately the 210-foot elevation. These structural features are depicted on the structure contour and isopach maps.

Fig. E.2.3-4, Fig. E.2.3-5, and Fig. E.2.3-6 depict the structure contour, thickness of the LAZ-UTRA, and the thickness of the calcareous zone within this aquifer, respectively. The calcareous zone includes calcareous sands, sandy limestones, and sandy muddy limestones. The location of calcareous zones could potentially influence contaminant transport. In another area at the northwest corner of the ORWBG, there is a substantial amount of calcareous material within the unit. Table E.2.3-3 presents the thickness of the calcareous zone from cores in the Northwest Plume Area. Field descriptions of the calcareous material indicate a vuggy limestone, which can affect local groundwater flow and direction within this area, thereby spreading the contaminants in groundwater.

Fig. E.2.3-7 and Fig. E.2.3-8 are the structure contour and isopach maps of the Gordon Confining Unit, respectively. The structure of the top of the Gordon Confining Unit is sloping gently toward the south-southwest. The isopach map indicates that the unit is thicker west of the MWMF and thins outward.

Fig. E.2.3-9 and Fig. E.2.3-10 are the structure contour and isopach maps of the Gordon Aquifer, respectively. The structural surface of the Gordon Aquifer begins to rise along a narrow ridge that trends to the northwest. It also thickens to the north and the south.

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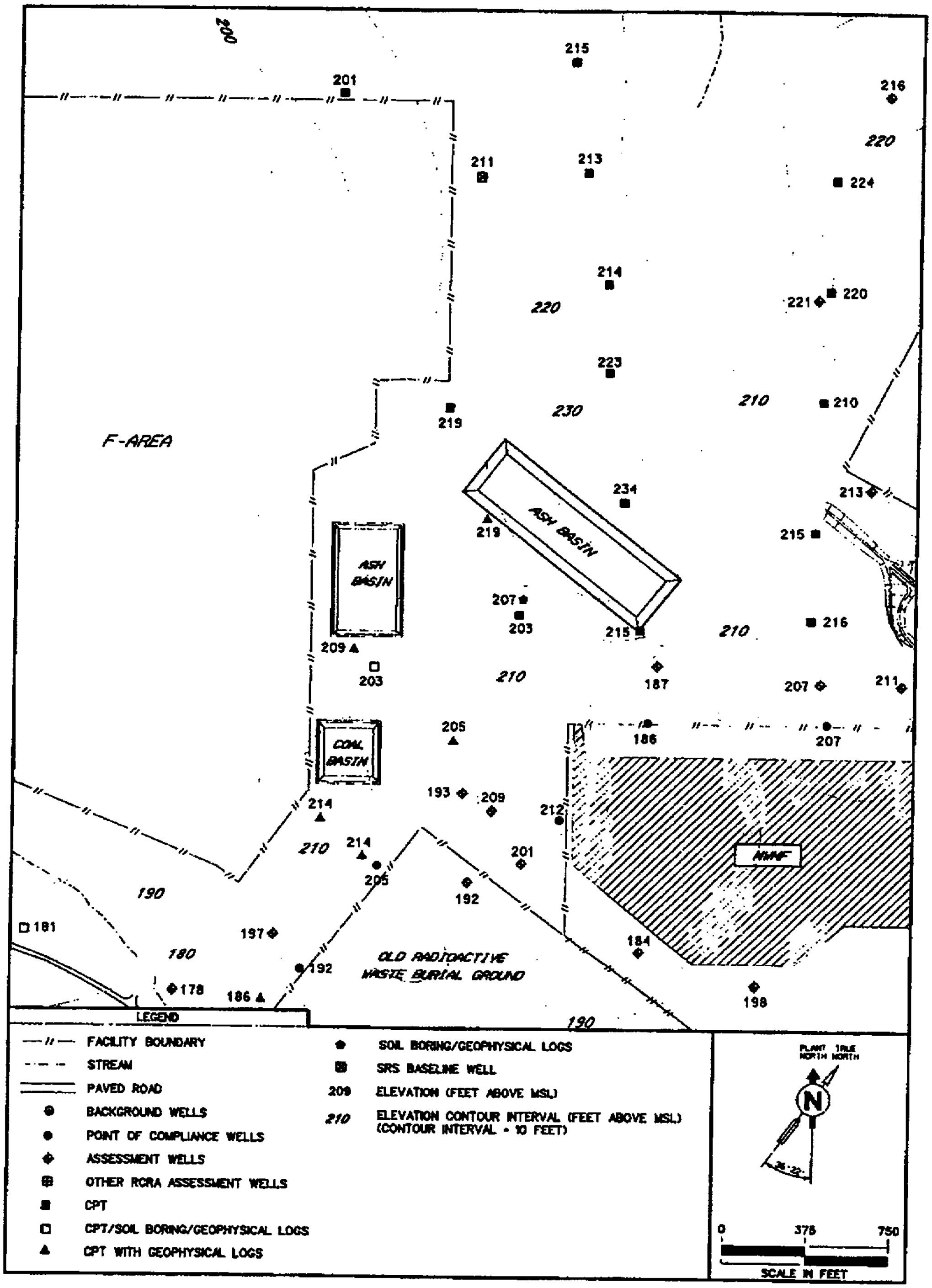

Fig. E.2.3-4. Structure Contour Map of the Lower Aquifer Zone of the Upper Three Runs Aquifer in the Northwest Plume Area

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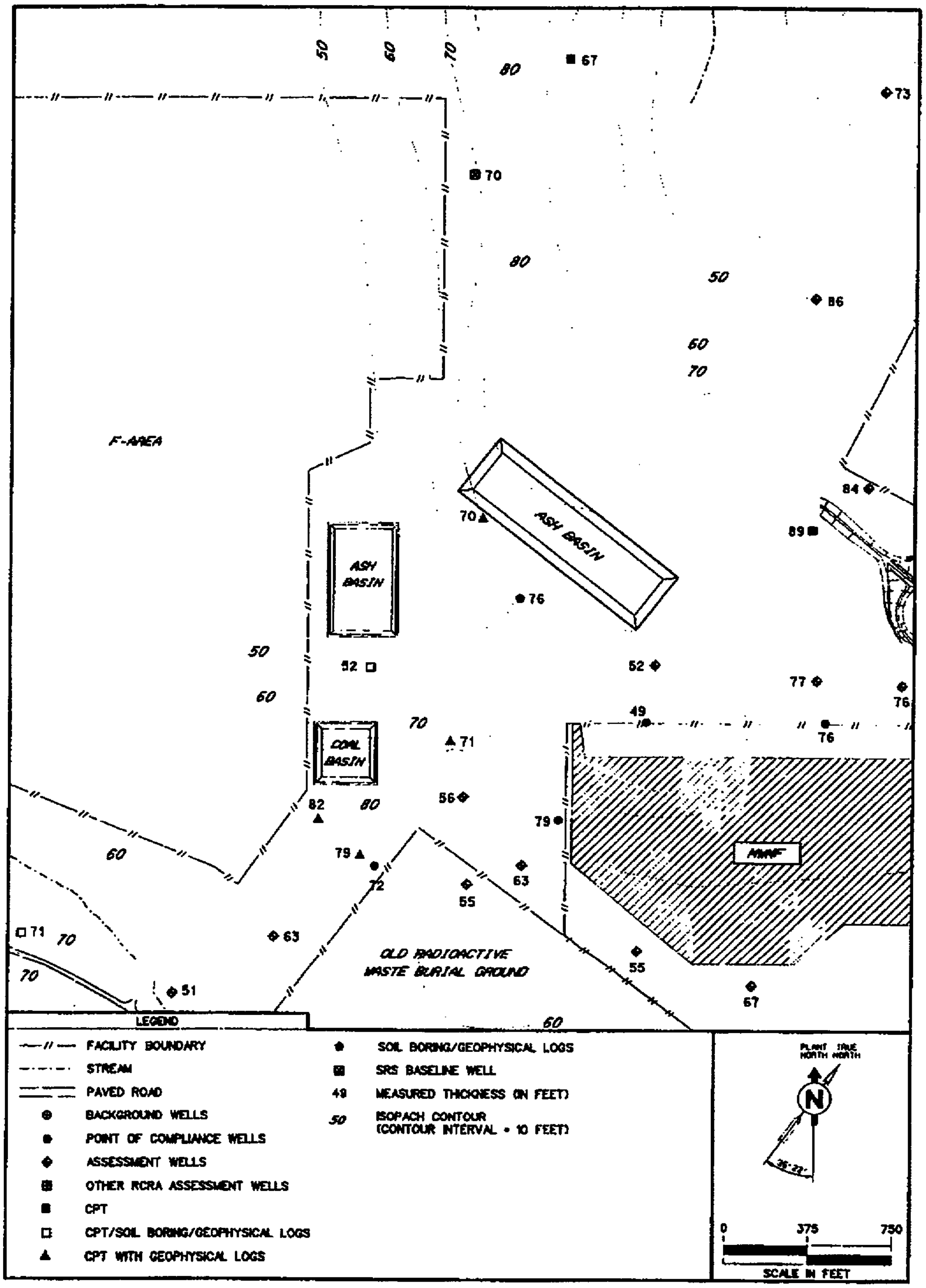

Fig. E.2.3-5. Isopach Map of the Lower Aquifer Zone of the Upper Three Runs Aquifer in the Northwest Plume Area

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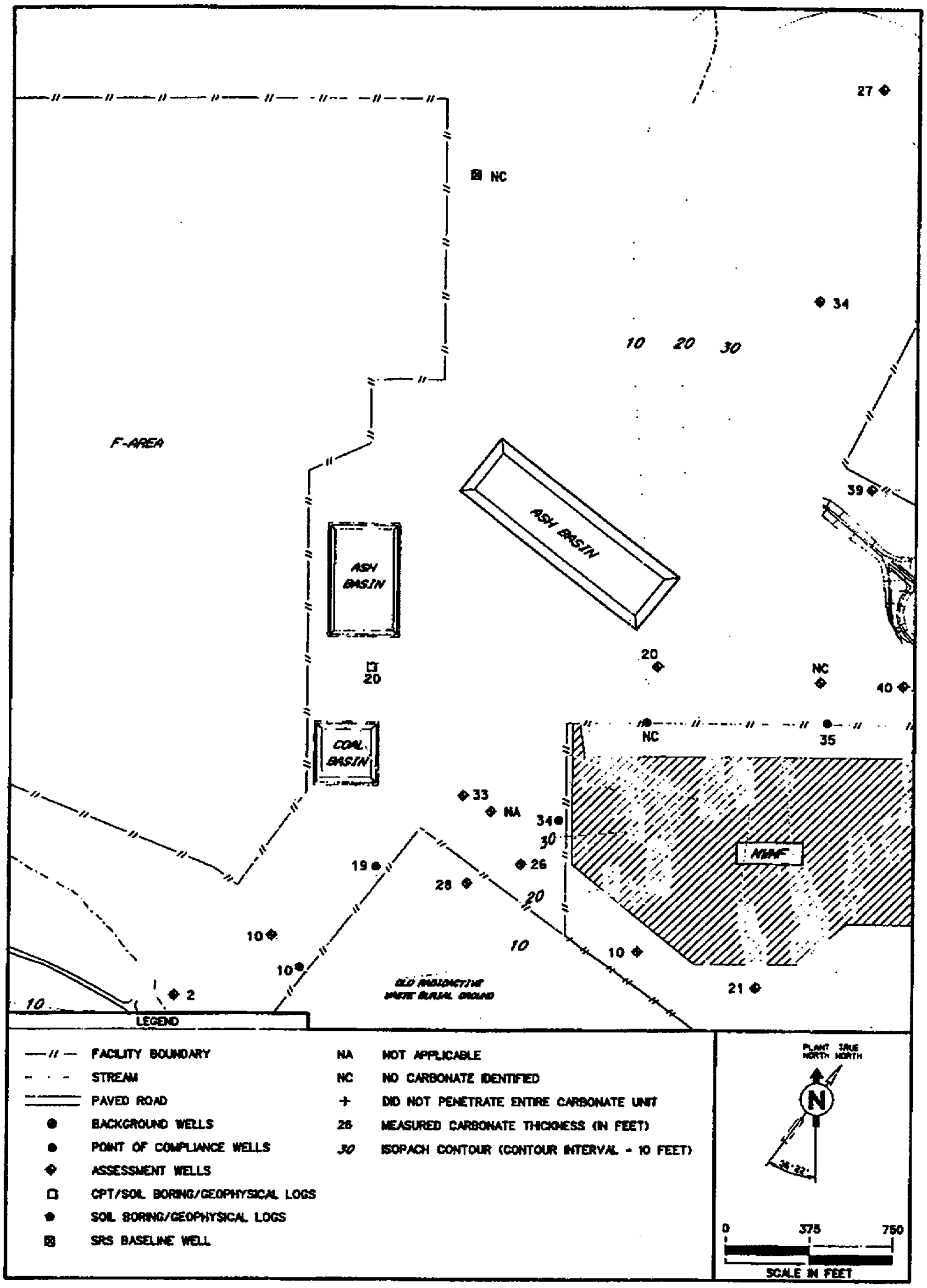

Fig. E.2.3-6. Isopach Map of Calcareous Sediments in the Lower Aquifer Zone of the Upper Three Runs Aquifer in the Northwest Plume Area

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Table E.2.3-3. Carbonate Hydrostratigraphy of the Northwest Plume Area

Well	Ground Elevation (ft msl)	Calcareous Interval (ft msl)		Thickness (ft)	Hydrostratigraphic Unit
		Top	Bottom		
BGO 09AA	282.8	170	130	40	LAZ-UTRA
BGO 10A	299.1	171	136	35	LAZ-UTRA
BGO 14A	300.2	180	146	34	LAZ-UTRA
BGO 16A	302.8	160	150	10	LAZ-UTRA
BGO 18A	292.9	152	131	21	LAZ-UTRA
BGO 26A	285.1	178	159	19	LAZ-UTRA
BGO 27C	273.9	157	147	10	LAZ-UTRA
BGO 41A	298.3	170	137	33	LAZ-UTRA
BGO 43AA	312.2	150	130	20	LAZ-UTRA
BGO 45AA	276.9	173	163	10	LAZ-UTRA
BGO 53AA	288.9.	177	149	28	LAZ-UTRA
BGT 47SB	317.3	174	154	20	LAZ-UTRA
BGX 04A	288.8	122	83	39	LAZ-UTRA
HMD 01D	262.7	173	139	34	LAZ-UTRA
HMD 02D	259.3	170	143	27	LAZ-UTRA

NOTES: msl mean sea level
ft feet

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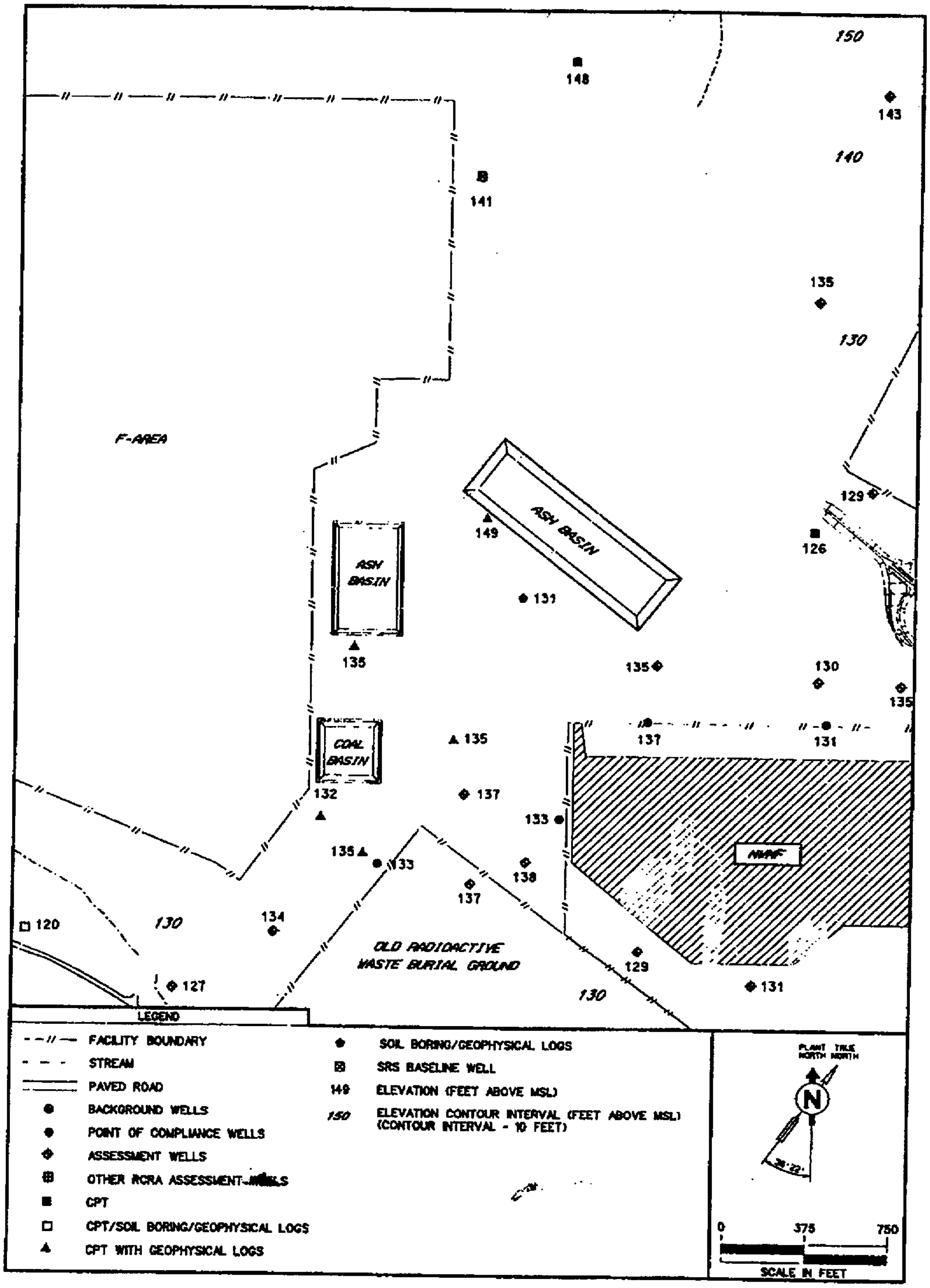

Fig. E.2.3-7. Structure Contour Map of the Gordon Confining Unit in the Northwest Plume Area

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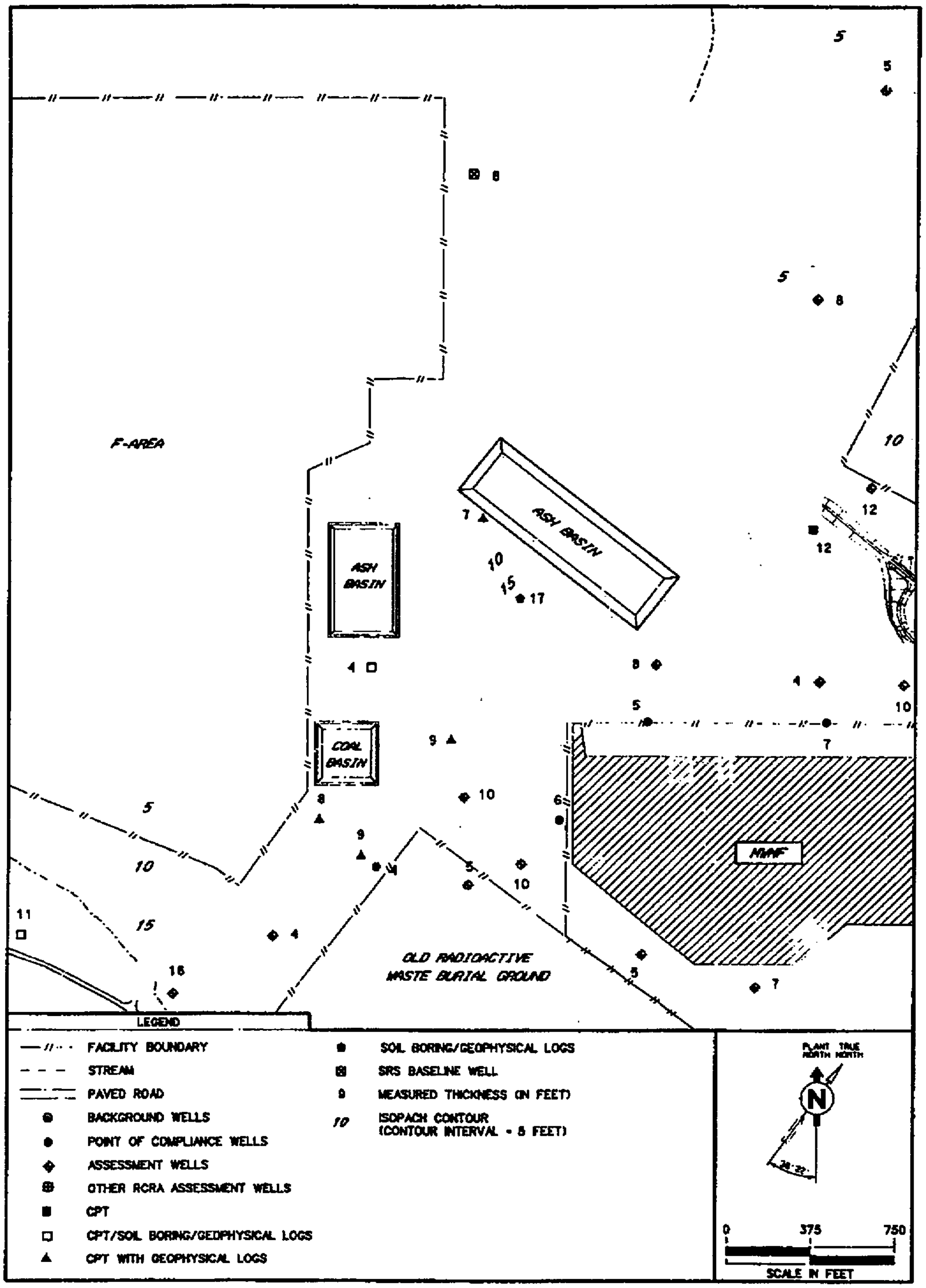

Fig. E.2.3-8. Isopach Map of the Gordon Confining Unit in the Northwest Plume Area

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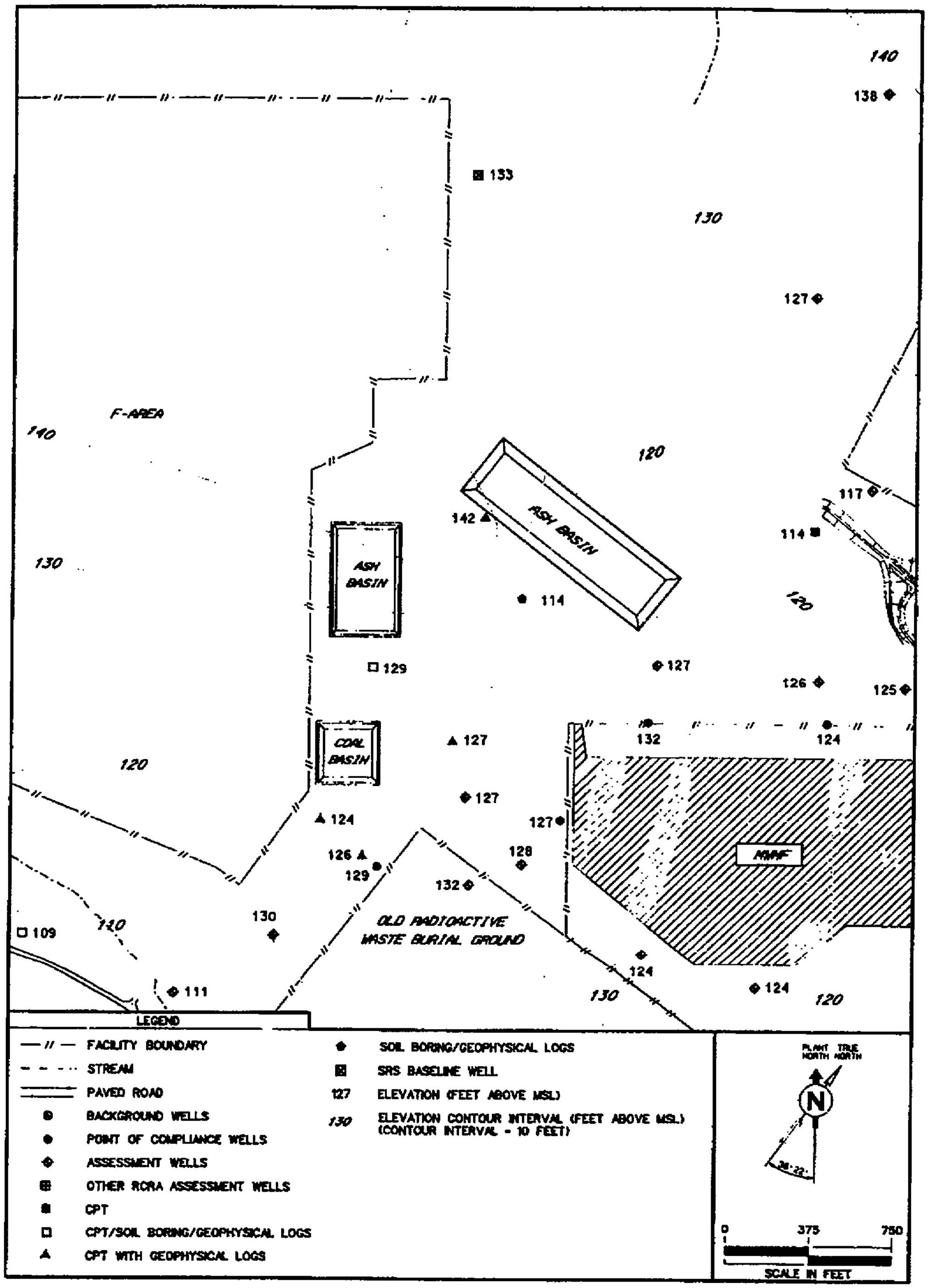

Fig. E.2.3-9. Structure Contour Map of the Gordon Aquifer in the Northwest Plume Area

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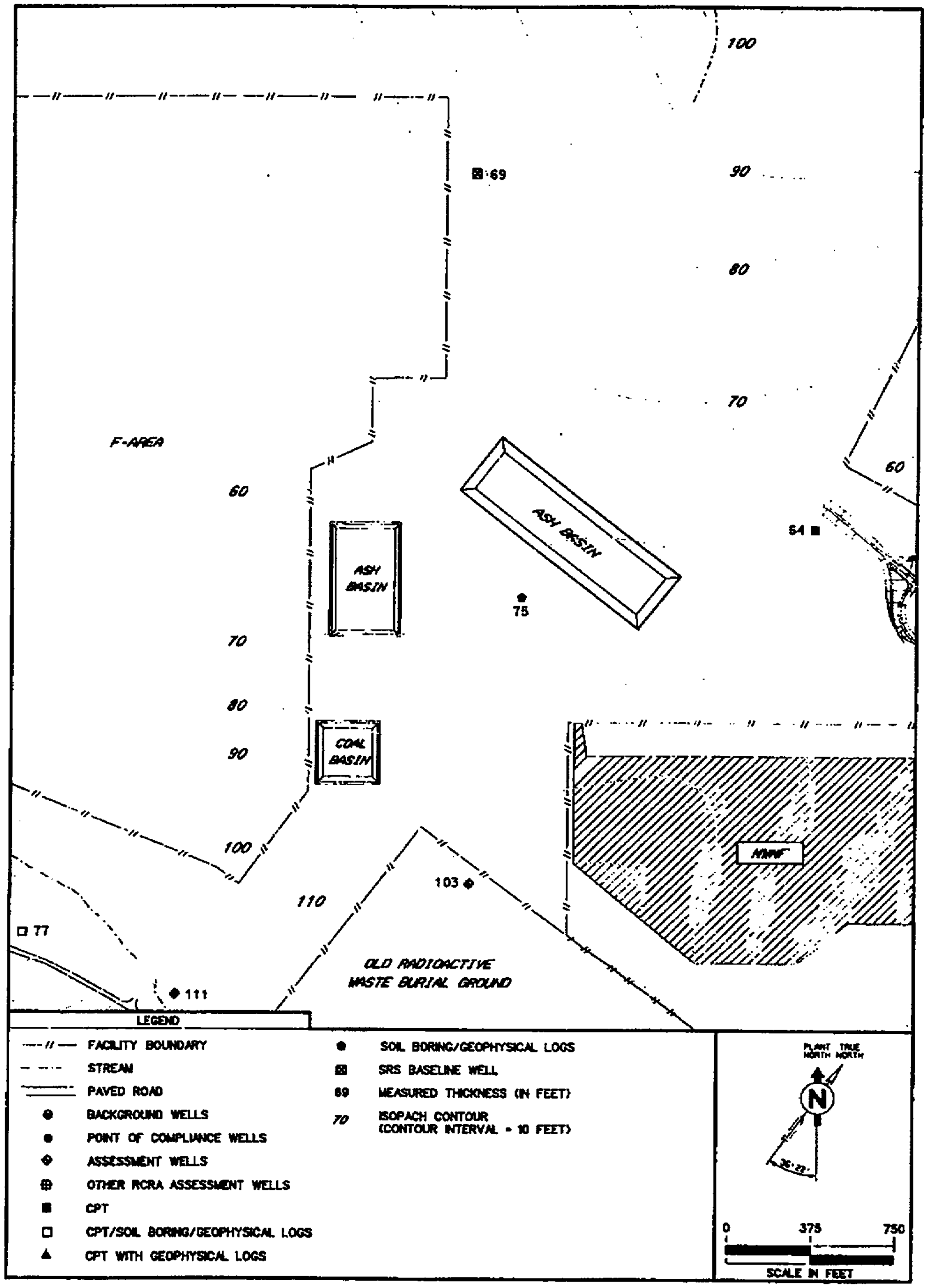

Fig. E.2.3-10. Isopach Map of the Gordon Aquifer in the Northwest Plume Area

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Fig. E.2.3-11 is the structure contour map of the Crouch Branch Confining Unit. The structure of the top of the Crouch Branch Confining Unit increases in elevation to the northeast.

Fig. E.2.1-5 shows the locations of hydrostratigraphic cross sections in the Northwest Plume Area. Cross Section O-O′ (Fig. E.2.3-12) is a southwest-northeast transect across the Northwest Plume Area. A dominant feature in this cross section is the block sliding in the "tan clay" confining zone that has displaced the tan clay along high angle shear planes. In the LAZ-UTRA beneath the slide feature, the calcareous sand is absent, which may explain the subsidence that resulted in the structure. This breach in the "tan clay" confining zone provides an avenue of communication between the UAZ-UTRA (Water Table Aquifer) and the LAZ-UTRA. This breach, in turn, results in a pathway for contaminant migration. Cross Section N-N′ (Fig. E.2.3-13) depicts an east-west line in the Northwest Plume Area. The prominent feature in this cross section is the large wedge of sand bounded on the top and bottom by the "tan clay" confining zone. This crevasse splay is also depicted on the structure contour and isopach maps (Fig. E.2.3-2 and Fig. E.2.3-3, respectively). The continuity of the overlying and underlying clay beds may determine if this sand affects contaminant migration.

E.2.3.1 Groundwater Flow

Groundwater flow rates and directions have been determined based, in part, on hydraulic head data from BGC monitoring wells within the Northwest Plume Area. Table E.2.3-4 summarizes head data for each

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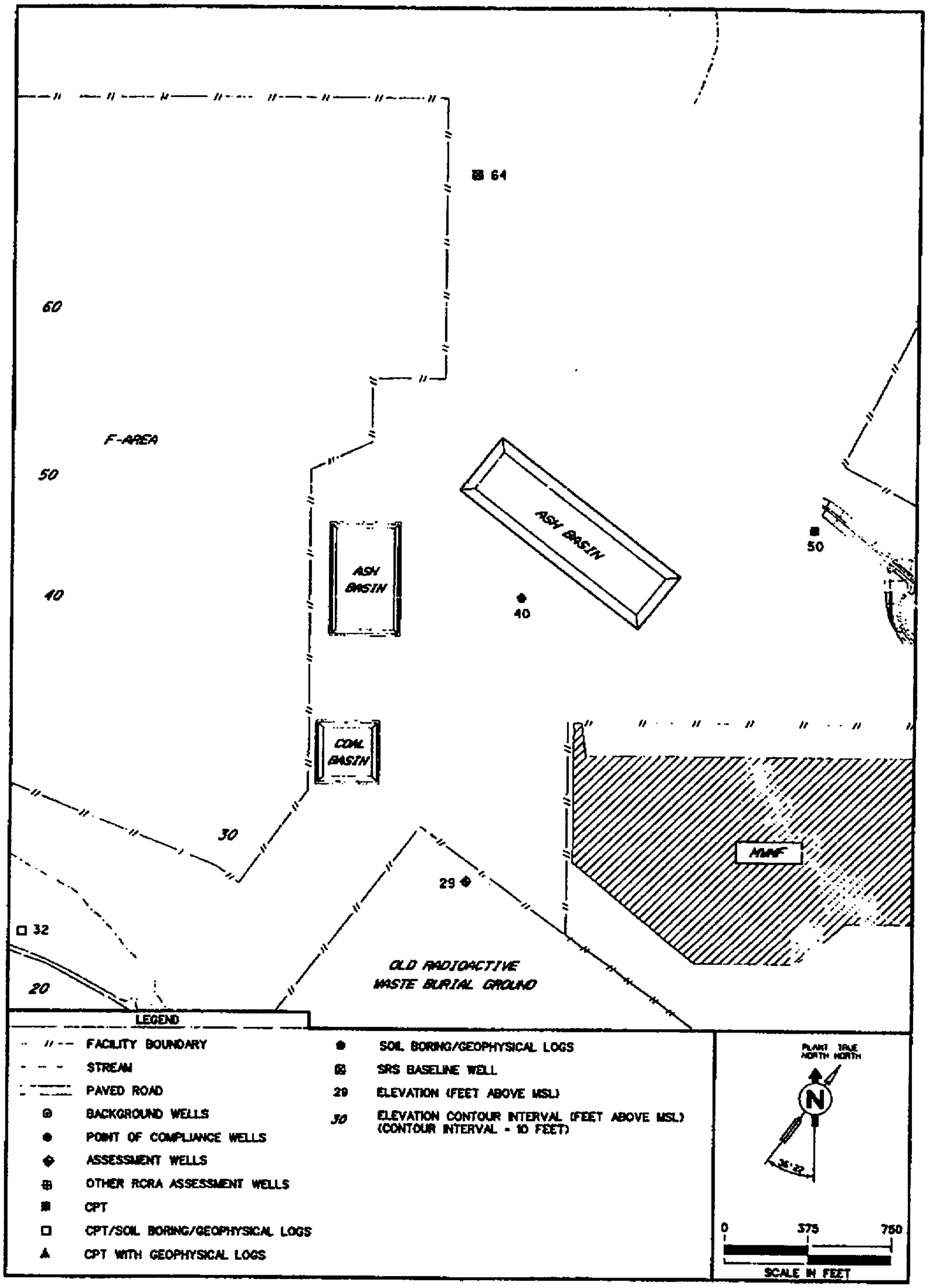

Fig. E.2.3-11. Structure Contour Map of the Crouch Branch Confining Unit in the Northwest Plume Area

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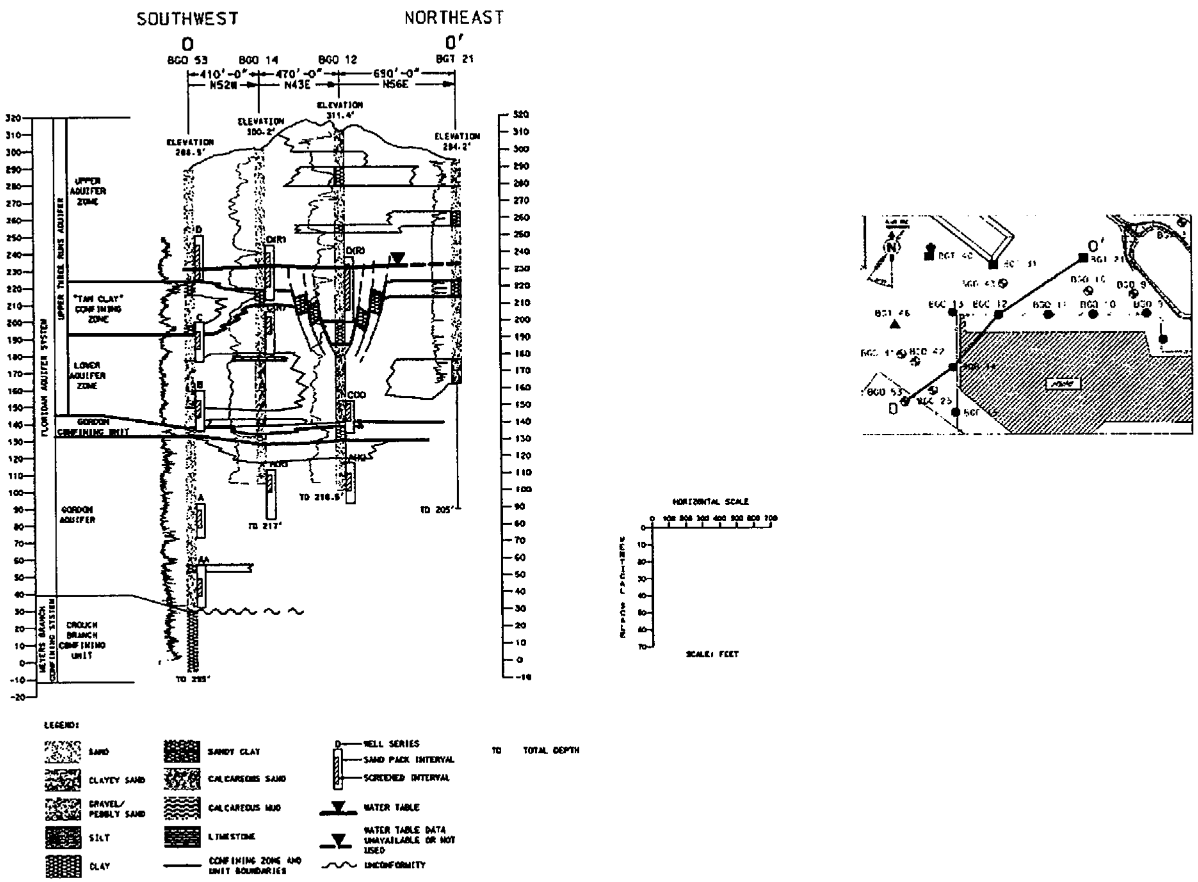

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Fig. E.2.3-12. Hydrostratigraphic Cross Section O-O' in the Northwest Plume Area

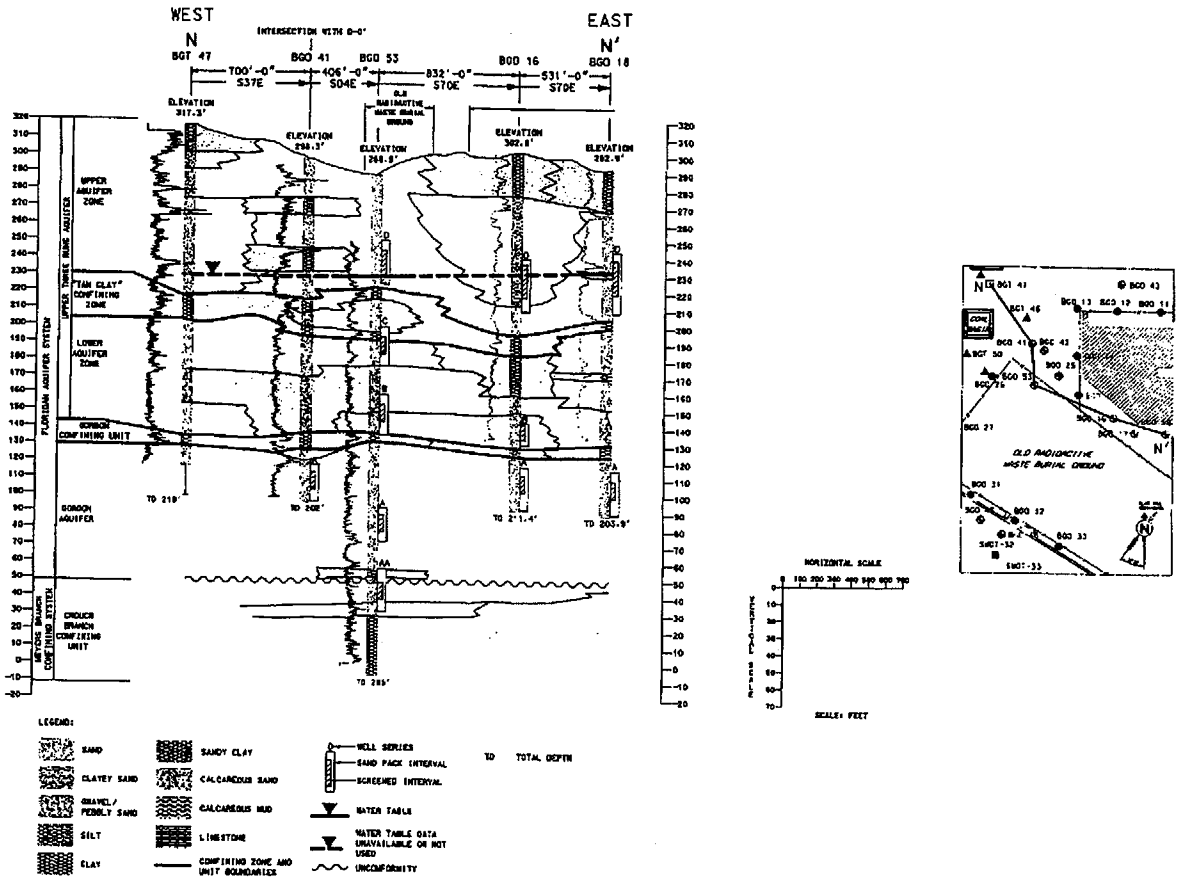

Fig. E.2.3-13. Hydrostratigraphic Cross Section N-N' in the Northwest Plume Area

Table E.2.3-4. Water Table and Piezometric Data for the Northwest Plume Area, Based on 4Q95 Analytical Data

Well	Ground Elevation (ft msl)	UAZ-UTRA (Water Table Aquifer) Water Level (ft msl)	LAZ-UTRA Well Measured	LAZ-UTRA Water Level (ft msl)	Gordon Aquifer Well Measured	Gordon Aquifer Water Level (ft msl)	Vadose Zone Thickness (ft)	Head Difference UAZ-UTRA (Water Table Aquifer) to LAZ-UTRA (ft)	Head Difference LAZ-UTRA to Gordon Aquifer (ft)
BGO 01D	293	239.9					53.1		
BGO 02D	294.9	238.2					56.7		
BGO 03D	290.8	235.2	BGO 03C	225.93	BGO 03A	163.42	55.6	9.27	62.51
BGO 04D	295.6	231.4					64.2		
BGO 05D	294.2	231	BGO 05C	216.1			63.2	14.9	
BGO 06D	283.2	231.7	BGO 06C	220.9	BGO 06A	159.6	51.5	10.8	61.3
			BGO 06B	219.61					
BGO 07D	285.2	232.6					52.6		
BGO 08D	285.6	232.9	BGO 08C	224	BGO 08AR	165.82	52.7	8.9	58.18
BGO 09D	283.2	231			BGO 09AA	ND	52.2		
BGO 10DR	298.3	232.6	BGO 10C	221.3	BGO 10AR	158.6	65.7	11.3	62.7
			BGO 10B	220.35	BGO 10AA	158.1			
BGO 11D	303.3	232.2					71.1		
BGO 12D	311.8	232	BGO 12CR	221.4	BGO 12AR	157.8	79.8	10.6	63.6
BGO 13DR	317.3		BGO 13DR	231.3					
BGO 14DR	298.2	231.1	BGO 14CR	223.8	BGO 14AR	159	67.1	7.3	64.8
BGO 15D	296.7	230.7					66		
BGO 16D	302.3	ND	BGO 16B	218.72	BGO 16AR	161.34	ND	ND	57.38
BGO 17DR	296.9	231.8					65.1		
BGO 18D	292.6	232.9			BGO 18A	161.8	59.7		
BGO 19D	287.8	233.4					54.4		
BGO 20D	281.3	240.8					40.5		
BGO 21D	283	235.6					47.4		
BGO 22DR	284.2	237					47.2		
BGO 23D	287	236.5					50.5		
BGO 24D	291	237.6					53.4		
BGO 25A	294.7				BGO 25A	162			
BGO 26D	283.5	228.4			BGO 26A	159.7	55.1		
BGO 27D	274.3	228	BGO 27C	221.1			46.3	6.9	
BGO 28D	275.1	226.4					48.7		
BGO 29D	263.5	226.5	BGO 29C	223.3	BGO 29A	160	37	3.2	63.3

Table E.2.3-4. Water Table and Piezometric Data for the Northwest Plume Area, Based on 4Q95 Analytical Data

Page 2 of 3

Well	Ground Elevation (ft msl)	UAZ-UTRA (Water Table Aquifer) Water Level (ft msl)	LAZ-UTRA Well Measured	LAZ-UTRA Water Level (ft msl)	Gordon Aquifer Well Measured	Gordon Aquifer Water Level (ft msl)	Vadose Zone Thickness (ft)	Head Difference UAZ-UTRA (Water Table Aquifer) to LAZ-UTRA (ft)	Head Difference LAZ-UTRA to Gordon Aquifer (ft)
BGO 30D	272.8	225.9	BGO 30C	219.4			46.9	6.5	
BGO 31D	271.6	227	BGO 31C	225.9			44.6	1.1	
BGO 32D	279.5	228					51.5		
BGO 33D	278.1	231	BGO 33C	225.4			47.1	5.6	
BGO 34D	272.7	233.8					38.9		
BGO 35D	271.4	235.9	BGO 35C	228.8			35.1	7.1	
BGO 36D	273.3	238.9					34.4		
BGO 37D	285.1	240.6	BGO 37C	231.2			44.5	9.4	
BGO 38D	289.3	237					52.3		
BGO 39D	293.7	236.5					57.2		
BGO 40D	286.4	222.8					63.6		
BGO 41A	298.3				BGO 41A	158.5			
BGO 42C	295.9		BGO 42C	223.4					
BGO 43D	313.2		BGO 43D	231.74	BGO 43A	158.9			72.84
			BGO 43CR	225.85	BGO 43AA	156.6			
BGO 44D	283.4	233.4	BGO 44C	221.87	BGO 44A	158.8	50	11.53	63.07
			BGO 44B	221.95	BGO 44AA	159.05			
BGO 45D	276.6	227.9	BGO 45C	223.3	BGO 45A	161	48.7	4.6	62.3
			BGO 45B	219.42					
BGO 46D	263.1	225.1	BGO 46C	219.4			38	5.7	
			BGO 46B	217.98					
BGO 47D	265.4	226.2	BGO 47C	222.8	BGO 47A	162.5	39.2	3.4	60.3
BGO 48D	275	226.6	BGO 48C	223.6			48.4	3	
BGO 49D	269.5	234.6	BGO 49C	228.1	BGO 49A	ND	34.9	6.5	ND
BGO 50D	254	225	BGO 50C	218.6	BGO 50A	159.6	29	6.4	59
BGO 51D	287	237.1	BGO 51C	231.27	BGO 51A	168.84	49.9	5.83	62.43
			BGO 51B	230.44	BGO 51AA	168.36			
BGO 52D	282.1	235.39	BGO 52C	229.93	BGO 52A	164.25	46.71	5.46	65.68
			BGO 52B	ND	BGO 52AA	163.25			
BGO 53D	288.9	230.37	BGO 53C	223.23	BGO 53A	159.46	58.53	7.14	63.77
			BGO 53B	226.96	BGO 53AA	158.29			

Table E.2.3-4. Water Table and Piezometric Data for the Northwest Plume Area, Based on 4Q95 Analytical Data

Well	Ground Elevation (ft msl)	UAZ-UTRA (Water Table Aquifer) Water Level (ft msl)	LAZ-UTRA		Gordon Aquifer		Vadose Zone Thickness (ft)	Head Difference UAZ-UTRA (Water Table Aquifer) to LAZ-UTRA (ft)	Head Difference LAZ-UTRA to Gordon Aquifer (ft)
			Well Measured	Water Level (ft msl)	Well Measured	Water Level (ft msl)			
BGX 01D	289.2	230	BGX 01C	216.3	BGX 01A	158.3	59.2	13.7	58
BGX 02D	289.1		BGX 02D	215.61			73.49		
			BGX 02B	213.1					
BGX 03D	289.1		BGX 03D	215.3			73.8		
BGX 04D	288.8		BGX 04D	215.8	BGX 04A	155.3	73		60.5
			BGX 04C	214.7					
BGX 05D	283		BGX 05D	208.9			74.1		
BGX 06D	275		BGX 06D	205.8			69.2		
BGX 07D	277.1		BGX 07D	205.8			71.3		
BGX 08DR	276.1		BGX 08DR	205.5			70.6		
BGX 09D	277.4	226.9					51.14		
BGX 10D	274.8	ND					49.59		
BGX 11D	273.8	235.6					38.82		
BGX 12D	273.2	238.7	BGX 12C	234.7			34.5	4	65.3
HSB 85C	292	239.9	HSB 85B	233.6	HSB 85A	169.4	52.1	6.3	64.2
HMD 01D	262.7		HMD01D	209.2			53.5		
HMD 02D	259.3		HMD 02D	200.26			59.04		
HMD 03D	257.5		HMD 03D	199.8			57.7		
HMD 04D	248.5		HMD 04D	200.1			48.4		

NOTES: [box] These wells were utilized in the hydrostratigraphic description of the Northwest Plume Area.
msl mean sea level
ND No Data
ft feet

well cluster. It also includes calculation of head difference across aquitards. Groundwater monitoring wells located in the Northwest Plume Area are shaded on Table E.2.3-4.

Upper Aquifer Zone of the Upper Three Runs Aquifer

Groundwater flow in the water table at the Northwest Plume Area is northwest from the ORWBG toward Upper Three Runs. Fig. E.2.3-14 is a detailed potentiometric map of the UAZ-UTRA (Water Table Aquifer) in the Northwest Plume Area. A combination of hydraulic head data from groundwater monitoring wells screened in the water table and from the 30 ECPT logs were used in the development of the potentiometric surface map. Estimated flow rates range from 44.6 to 82.6 feet/year. Flow rates are calculated as discussed in Section E.2.1.2.1. Flow estimates are based on average hydraulic conductivity values from slug tests in the BGC (2.81 feet/day). Table E.2.3-5 lists slug test data from the Northwest Plume Area. The estimated flow rates were calculated using an effective porosity of 0.20, a hydraulic gradient ranging from 0.0087 to 0.0161 feet/feet, and an average hydraulic conductivity of 2.81 feet/day.

"Tan Clay" Confining Zone

Groundwater flow across the "tan clay" confining zone is downward into the LAZ-UTRA. Six undisturbed samples of the "tan clay" confining zone at the BGC were subjected to laboratory permeameter tests in order to determine vertical hydraulic conductivity. The test results are recorded in Table E.2.3-6. The vertical hydraulic

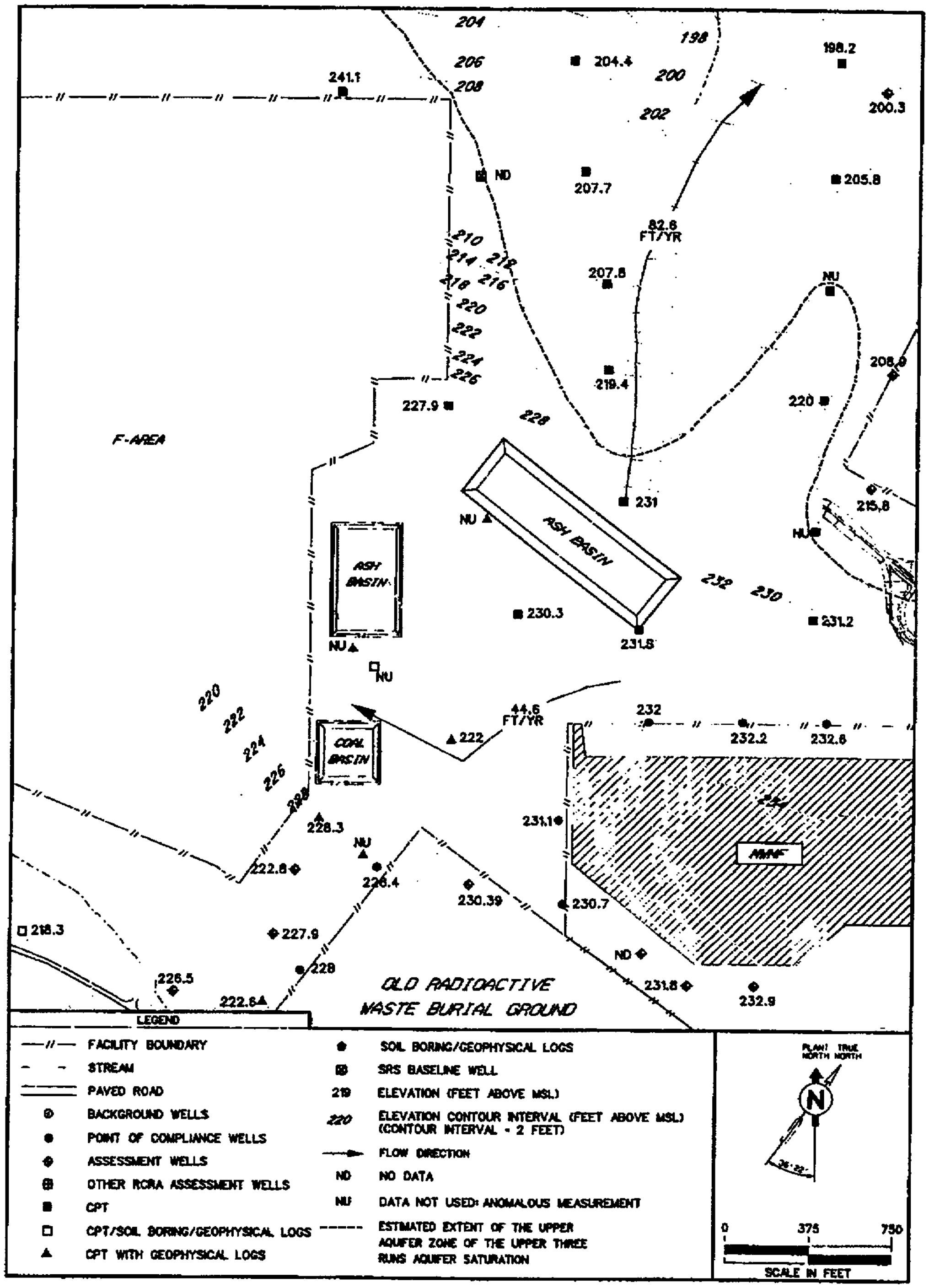

Fig. E.2.3-14. Potentiometric Surface Map of the Upper Aquifer Zone of the Upper Three Runs Aquifer (Water Table Aquifer), Northwest Plume Area

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Table E.2.3-5. Hydraulic Conductivity Data Based on Slug Tests for the Upper Aquifer Zone of the Upper Three Runs Aquifer (Water Table Aquifer) in the Northwest Plume Area

WELL	HYDRAULIC CONDUCTIVITY (cm/sec)	(ft/day)
BGO 10D	1.16E-04	0.33
BGO 10D(R)	4.09E-04	1.16
BGO 11D	8.96E-04	2.54
BGO 11D(R)	4.62E-04	1.31
BGO 12D	4.23E-05	0.12
BGO 12D(R)	4.59E-05	0.13
BGO 13D	4.94E-05	0.14
BGO 14D	1.98E-04	0.56
BGO 14D(R)	7.58E-04	2.15
BGO 15D	3.92E-04	1.11
BGO 16D	2.47E-05	0.07
BGO 17D	4.52E-04	1.28
BGO 17D(R)	3.86E-03	10.94
BGO 18D	4.45E-03	12.6
BGO 19D	1.59E-04	0.45
BGO 19D(R)	1.73E-03	4.90
BGO 26D	2.00E-03	5.67
BGO 27D	3.77E-04	1.07
BGO 29D	5.57E-04	1.58
BGO 45D	2.14E-03	6.07
BGO 53D	6.70E-04	1.9
BGC MAXIMUM	5.60E-03	15.87
BGC MINIMUM	2.47E-05	0.07
BGC AVERAGE	9.92E-04	2.81
Northwest Plume Area MAXIMUM	4.45E-03	12.60
Northwest Plume Area MINIMUM	2.47E-05	0.07
Northwest Plume Area AVERAGE	9.42E-04	2.67

NOTES:
cm/sec centimeters per second
ft/day feet per day
BGC Burial Ground Complex

SOURCES: Sirrine 1991a, 1991b, 1992; DOE 1988; WSRC 1995a, 1996a

Table E.2.3-6. Hydraulic Conductivity Data Based on Laboratory Tests for the "Tan Clay" Confining Zone, Northwest Plume Area

WELL	VERTICAL CONDUCTIVITY		HORIZONTAL CONDUCTIVITY	
	(cm/sec)	(ft/day)	(cm/sec)	(ft/day)
BGO 41A	2.73E+02	9.64E-02	3.00E-07	8.50E-04
BGO 45A	1.53E-01	5.39E-05	2.50E-08	7.09E-05
BGO 53C	1.19E-05	4.20E-09	9.00E-07	2.55E-03
BGT 22	5.67E-06	2.00E-09	1.10E-08	3.12E-05
BGT 47	2.83E-03	1.00E-06	NA	NA
BGT 53	5.10E-05	1.80E-08	6.00E-09	1.70E-05
BGC MAXIMUM	4.03E+03	1.42E+00	5.01E-04	1.42E+00
BGC MINIMUM	5.67E-06	2.00E-09	6.00E-09	1.70E-05
BGC AVERAGE	1.67E+02	5.88E-02	3.01E-05	8.54E-02
Northwest Plume Area MAXIMUM	2.73E+02	9.64E-02	9.00E-07	2.55E-03
Northwest Plume Area MINIMUM	5.67E-06	2.00E-09	6.00E-09	1.70E-05
Northwest Plume Area AVERAGE	4.56E+01	1.61E-02	2.48E-07	7.04E-04

NOTES:

cm/sec	centimeters per second
ft/day	feet per day
BGC	Burial Ground Complex
NA	Not Available

SOURCES: Sirrine 1991a, 1991b, 1992; DOE 1988; WSRC 1995a, 1996a

conductivity ranges from 2.00E-09 to 1.42E+00 feet/day in the entire BGC. The vertical hydraulic conductivity range in the Northwest Plume Area is from 2.00E-09 to 9.64E-02 feet/day. These numbers indicate that the confining unit is characterized by highly variable permeability.

Lower Aquifer Zone of the Upper Three Runs Aquifer

Groundwater flow in the LAZ-UTRA at the Northwest Plume Area is northwest. Fig. E.2.3-15 is a detailed potentiometric map of the LAZ-UTRA in the Northwest Plume Area. The flow rate for the representative flow path shown was calculated at 12.6 feet/year. The flow rate was calculated as discussed in Section E.2.1.2.1. Flow estimates are based on average hydraulic conductivity values from slug tests in the BGC. Table E.2.3-7 lists slug test data from the Northwest Plume Area.

The estimated flow rate was calculated using an effective porosity of 0.20, a hydraulic gradient of 0.0050 feet/feet, and an average hydraulic conductivity of 1.38 feet/day.

Gordon Confining Unit

Groundwater flow across the Gordon Confining Unit is downward into the Gordon Aquifer. Laboratory permeameter tests were conducted on eight undisturbed samples of the Gordon Confining Unit in order to determine hydraulic conductivity (Table E.2.3-8). These analyses exhibited a range of vertical conductivities from 2.30E-09 to 2.04E-04

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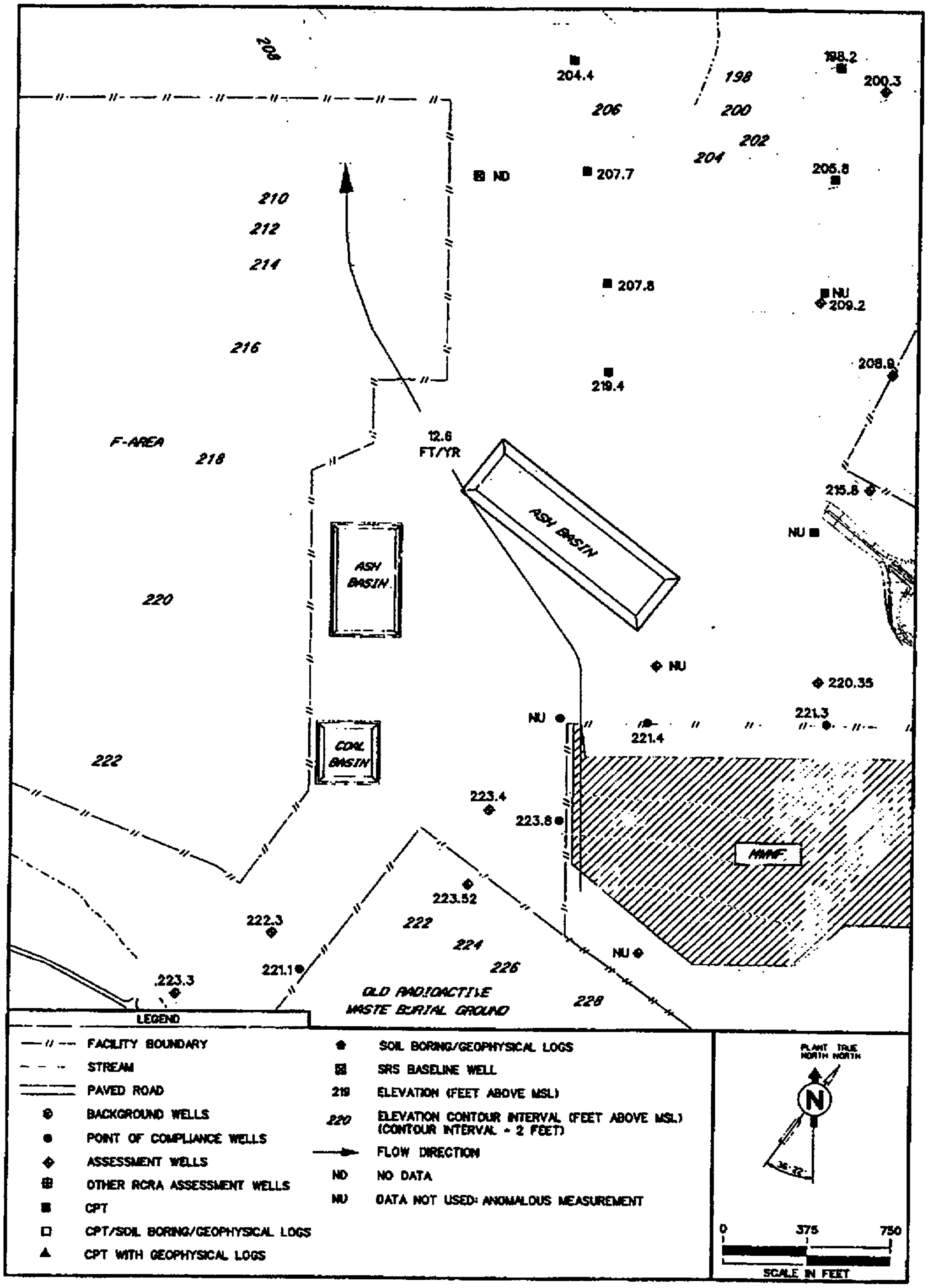

Fig. E.2.3-15. Potentiometric Surface Map of the Lower Aquifer Zone of the Upper Three Runs Aquifer, Northwest Plume Area

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Table E.2.3-7. Hydraulic Conductivity Data Based on Slug Tests for the Lower Aquifer Zone of the Upper Three Runs Aquifer in the Northwest Plume Area

WELL	HYDRAULIC CONDUCTIVITY (cm/sec)	(ft/day)
BGO 10B	1.09E-04	0.31
BGO 10C	2.47E-05	0.07
BGO 12C(R)	5.64E-05	0.16
BGO 12CX	4.40E-06	0.013
BGO 14C	3.46E-04	0.98
BGO 14C(R)	1.41E-04	0.4
BGO 29C	1.02E-04	0.29
BGO 42C	1.59E-04	0.45
BGO 43C(R)	1.09E-04	0.31
BGO 45B	4.23E-05	0.12
BGO 45C	4.30E-04	1.22
BGO 53B	4.23E-05	0.12
BGO 53C	8.11E-04	2.3
BGX 4C	4.09E-04	1.16
BGX 4D	1.02E-03	2.89
HMD 2D	3.21E-04	0.91
BGC MAXIMUM	7.19E-03	20.38
BGC MINIMUM	3.53E-06	0.01
BGC AVERAGE	4.86E-04	1.38
Northwest Plume Area MAXIMUM	1.02E-03	2.89
Northwest Plume Area MINIMUM	4.40E-06	0.01
Northwest Plume Area AVERAGE	2.58E-04	0.73

NOTES:

cm/sec centimeters per second
ft/day feet per day
BGC Burial Ground Complex

SOURCES: Sirrine 1991a, 1991b, 1992; DOE 1988; WSRC 1995a, 1996a

Table E.2.3-8. Hydraulic Conductivity Data Based on Laboratory Tests for the Gordon Confining Unit, Northwest Plume Area

WELL	VERTICAL CONDUCTIVITY (cm/sec)	VERTICAL CONDUCTIVITY (ft/day)	HORIZONTAL CONDUCTIVITY (cm/sec)	HORIZONTAL CONDUCTIVITY (ft/day)
BGO 41A	8.02E-02	2.83E-05	1.30E-07	3.69E-04
BGO 43AA	2.49E-02	8.79E-06	8.61E-09	2.44E-05
BGO 45A	5.78E-01	2.04E-04	4.52E-08	1.28E-04
BGO 53B	6.52E-06	2.30E-09	2.50E-09	7.09E-06
BGT 22	8.50E-04	3.00E-07	6.50E-06	1.84E-02
BGT 47	5.67E-03	2.00E-06	5.90E-06	1.67E-02
HMD 01C	3.77E-03	1.33E-06	2.10E-08	5.95E-05
HMD 02C	3.20E-03	1.13E-06	1.90E-09	5.39E-06
BGC MAXIMUM	9.64E+00	3.40E-03	6.50E-06	1.84E-02
BGC MINIMUM	6.52E-06	2.30E-09	1.90E-09	5.39E-06
BGC AVERAGE	6.51E-01	2.30E-04	7.05E-07	2.00E-03
Northwest Plume Area MAXIMUM	5.78E-01	2.04E-04	6.50E-06	1.84E-02
Northwest Plume Area MINIMUM	6.52E-06	2.30E-09	1.90E-09	5.39E-06
Northwest Plume Area AVERAGE	8.71E-02	3.07E-05	1.58E-06	4.47E-03

NOTES:

cm/sec centimeters per second
ft/day feet per day
BGC Burial Ground Complex

SOURCES: Sirrine 1991a, 1991b, 1992; DOE 1988; WSRC 1995a, 1996a

feet/day. These low vertical conductivities indicate low permeability and low vertical flow rates across the unit.

Gordon Aquifer

Groundwater flow in the Gordon Aquifer is northwest toward Upper Three Runs. Fig. E.2.3-16 is a detailed potentiometric map of the Gordon Aquifer in the Northwest Plume Area.

The flow rate for the Gordon Aquifer is estimated at 218.2 feet/year. The flow rate was calculated as discussed in Section E.2.1.2.1. Flow estimates are based on hydraulic conductivity values from aquifer tests conducted in the BGC. Table E.2.3-9 provides additional hydraulic conductivity information from slug test data in the Gordon Aquifer. The estimated flow rate was calculated using an effective porosity of 0.25, a hydraulic gradient of 0.0033 feet/feet, and an average hydraulic conductivity of 45 feet/day (based on aquifer tests, see Section E.2.1.2.1).

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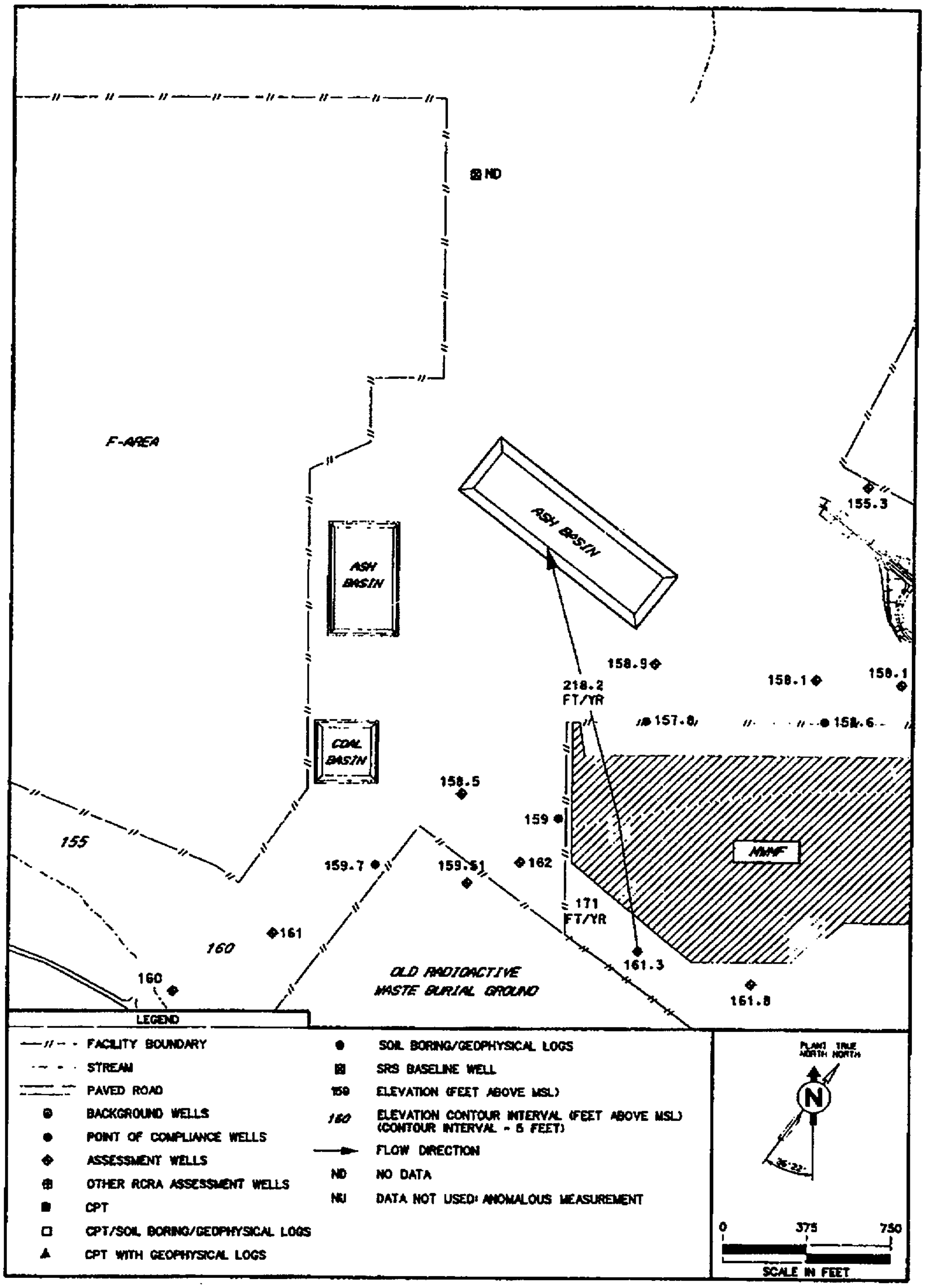

Fig. E.2.3-16. Potentiometric Surface Map of the Gordon Aquifer for the Northwest Plume Area

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Table E.2.3-9. Hydraulic Conductivity Estimates Based on Slug Tests for the Gordon Aquifer in the Northwest Plume Area

WELL	HYDRAULIC CONDUCTIVITY (cm/sec)	(ft/day)
BGO 10A	5.64E-05	0.16
BGO 10A(R)	3.00E-04	0.85
BGO 10AA	1.52E-04	0.43
BGO 12A	1.76E-06	0.005
BGO 12A(R)	3.46E-04	0.98
BGO 12AX	4.27E-04	1.21
BGO 14A	1.41E-05	0.04
BGO 14A(R)	5.82E-04	1.65
BGO 16A	5.29E-05	0.15
BGO 18A	4.23E-03	11.98
BGO 41A	4.59E-05	0.13
BGO 43AA	3.03E-04	0.86
BGO 45A	8.64E-04	2.45
BGO 53A	1.34E-04	0.38
BGO 53AA	3.88E-04	1.1
BGX 04A	6.46E-04	1.83
BGC MAXIMUM	4.23E-03	11.98
BGC MINIMUM	1.76E-06	0.01
BGC AVERAGE	7.06E-04	2.00
Northwest Plume Area MAXIMUM	4.23E-03	11.98
Northwest Plume Area MINIMUM	1.76E-06	0.01
Northwest Plume Area AVERAGE	5.34E-04	1.51

NOTES:

cm/sec centimeters per second
ft/day feet per day
BGC Burial Ground Complex

SOURCES: Sirrine 1991a, 1991b, 1992; DOE 1988; WSRC 1995a, 1996a

E.2.4 HYDROGEOLOGIC INFORMATION ASSOCIATED WITH THE NORTHEAST PLUME AREA

Characterization of the Northeast Plume Area was completed utilizing two DPT methods (CPT and hydropunch) and field screening measurement techniques. These technologies allowed for the rapid collection of lithologic and water quality samples at closely spaced locations (Fig. E.2.4-1). Data collected using DPT have been integrated with BGC groundwater monitoring well and core data to provide a detailed characterization of the Northeast Plume Area.

Of the two DPT methods employed, CPT was used most extensively to characterize the Northeast Plume Area because it provides samples quickly, efficiently, and cost effectively. CPT is a simple push technology, which does not involve mud-rotary drilling, and was utilized for sampling the UAZ-UTRA (Water Table Aquifer) and the LAZ-UTRA. The second DPT method, hydropunch, utilized mud-rotary drilling, which allows sampling at greater depths than does CPT. Hydropunch was used to collect data from the Gordon Aquifer and deeper sections of the LAZ-UTRA. At each hydropunch location, the first water sample was collected at the same depth as the deepest CPT sample. This technique allowed for a comparison of results between the two sampling methods.

Thirty locations were selected to characterize the Northeast Plume Area. Several of the 30 locations were also used to define the extent of the Northwest Plume Area. Electronic lithologic data were collected by

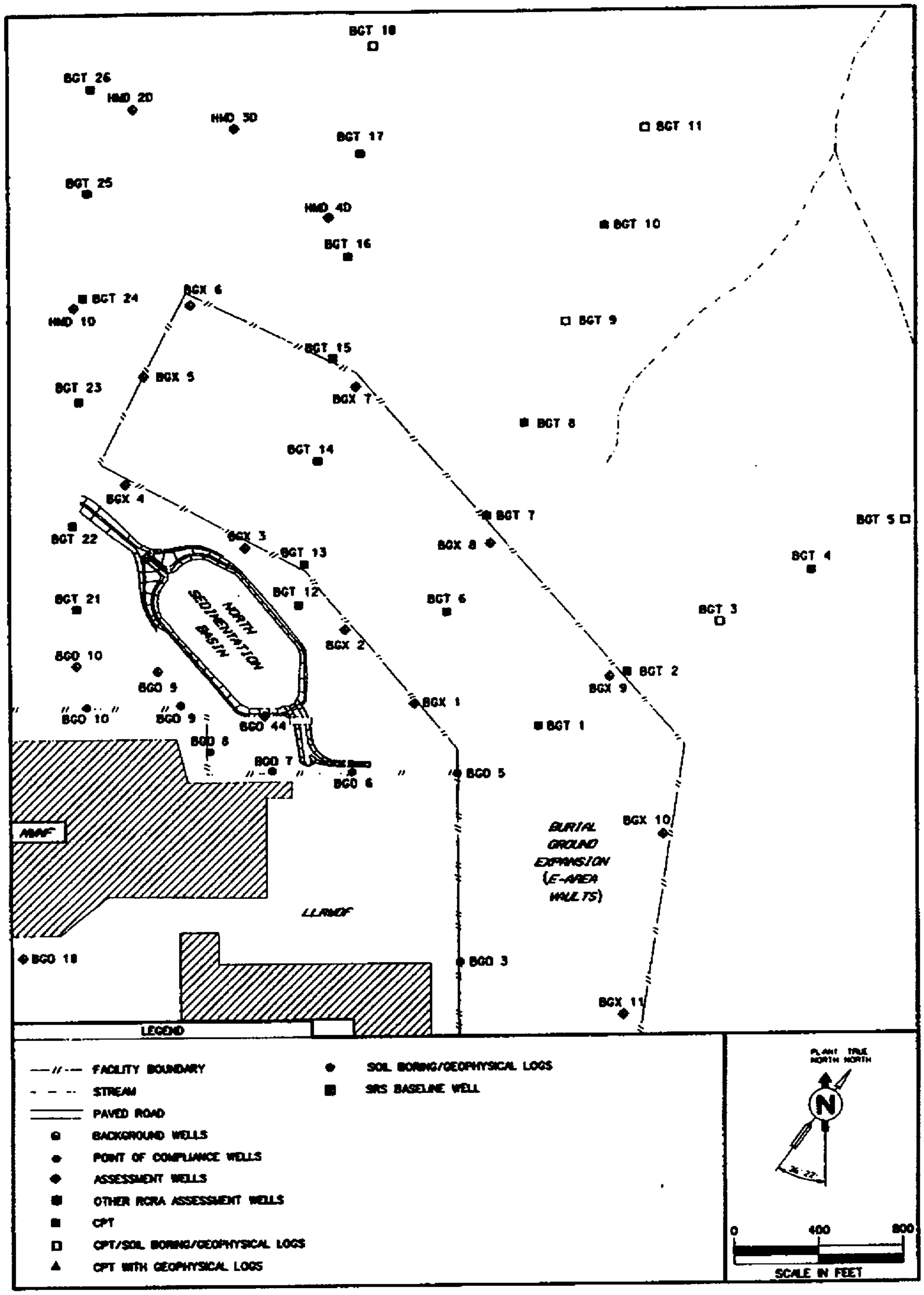

Fig. E.2.4-1. Sample Locations for the Northeast Plume Area

CPT at all 30 locations with the exception of one that was not accessible.

The electronic lithologic logs consist of tip and sleeve friction, pore pressure, and friction ratio. Natural gamma logging was conducted at 26 of the 30 locations. Electronic logs were correlated with the natural gamma logs, and depth-discrete CPT water sampling locations were selected based on the correlation. CPT samples were collected with a 40-mL stainless steel bailer from 6- or 12-inch sampling intervals. This sampling apparatus allows for the collection of water samples in thin discrete sand zones as identified on the electronic logs.

Hydropunch and coring activities were conducted at eight of the 30 locations. Geophysical logs and core were collected to depths of approximately 200 feet with one as deep as 276 feet. These data were used to determine the groundwater sampling depths. Each hydropunch borehole was augered or mud-rotary drilled to within a few feet of the target sample zone. The hydropunch tool was pushed through undisturbed sediment to the base of the sample interval. The screen was exposed to allow water to flow into the sample chamber of the tool; the samples were extracted with a bailer. Hydropunch samples were collected from a variable number of approximately 3- to 5-foot depth-discrete sample intervals in the LAZ-UTRA and the Gordon Aquifer.

The strategy employed in the Northeast Plume Area consisted of collecting groundwater samples from locations closest to the MWMF and extending outward along a predetermined transect. Sample collections terminated when TCE and tritium concentrations in each

interval sampled from each aquifer were below instrument detection limits.

Detailed descriptions of the sampling methods have been provided in the Burial Ground Complex Field Investigation Preliminary Data Report #2 (WSRC-RP-96-060).

Lithologic data and geophysical logs from coreholes and ECPT logs were used to determine unit elevations and thicknesses. Sampling locations from which data on all tables in Section E were derived are shown on Map 10 in Appendix 1 and on Fig. E.2.4-1. Table E.2.4-1 depicts the unit elevations and thickness from cores at the BGC. Table E.2.4-2 depicts the unit elevations and thicknesses interpreted from ECPT logs collected in the Northeast Plume Area. Structure contour and isopach maps for each of the aquifers and aquitards in the Northeast Plume Area were constructed using a composite of data from these two tables.

Fig. E.2.4-2 and Fig. E.2.4-3 are the structure contour and isopach maps, respectively, of the "tan clay" confining zone. The density of data points allows for detailed mapping of the unit surface and thickness. Undulations in the confining unit surface, changes in lithology, and structural features could potentially influence horizontal and vertical contaminant transport. To the north, as topography drops to the level of Upper Three Runs, the "tan clay" confining zone

Table E.2.4-1. Hydrostratigraphic Picks from Core Data in the Northeast Plume Area

	"Tan Clay" Confining Zone		Lower Aquifer Zone		Gordon Confining Unit		Gordon Aquifer		Meyers Branch Confining System
Boring ID	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)
BGO 03A	197	10	187	57	130	9	121	93	28
BGO 05C	218	17	201						
BGO 06A	210	15	195	74	121	1	120		
BGO 06B	203	11	192	55	137	14	123		
BGO 08A	213	14	199	69	130	10	120		
BGO 09AA	224	13	211	76	135	10	125		
BGO 10A	209	2	207	76	131	7	124		
BGO 10AA	219	12	207	77	130	4	126		
BGO 12A	200	14	186	47	139	10	129		
BGO 14A	218	9	209	71	138	22	116		
BGO 16A	196	12	184	55	129	5	124		
BGO 18A	203	5	198	67	131	7	124		
BGO 20AA	206	13	193	64	129	21	108	64	44
BGO 25A	212	11	201	63	138	10	128		
BGO 26A	224	19	205	72	133	4	129		
BGO 27C	199	7	192						
BGO 29A	196	11	185	53	132	13	119		
BGO 31C	198	10	188						
BGO 33C	203	12	191						
BGO 35C	203	10	193						
BGO 37C	201	11	190						
BGO 39A	204	11	193	81	112	18	94	66	28
BGO 41A	214	8	206	69	137	16	121		

Table E.2.4-1. Hydrostratigraphic Picks from Core Data in the Northeast Plume Area

	"Tan Clay" Confining Zone		Lower Aquifer Zone		Gordon Confining Unit		Gordon Aquifer		Meyers Branch Confining System
Boring ID	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)
BGO 42C	216	7	209						
BGO 43AA	195	11	184	53	131	18	113		
BGO 44AA	222	23	199	68	131	11	120		
BGO 45A	207	10	197	63	134	4	130		
BGO 46B	200	12	188	60	128	6	122		
BGO 47A	198	9	189	60	129	7	122		
BGO 48C	198	6	192						
BGO 49A	201	9	192	73	119	4	115		
BGO 50A	194	17	177	45	132	13	119		
BGO 51AA	204	11	193	87	106	18	88	53	35
BGO 52AA	207	10	197	72	125	9	116	98	18
BGO 53AA	223	31	192	55	137	5	132	95	37
BGX 01A	211	13	198	64	134	9	125		
BGX 02B	216	18	198	58	140	13	127		
BGX 04A	225	12	213	84	129	12	117		
BGX 07D	225	5	220	63	157	13	144		
BGX 09D	207	12	195	53	142	10	132		
BGX 11D	193	16	177	51	126	9	117		
BSE 01C	218	15	180	67	113				
BSE 02C	195	7	188						
BSE 03C	211	15	196						
HMD 01C	232	11	221	82	139	13	126		
HMD 02C	223	7	216	73	143	5	138		

Table E.2.4-1. Hydrostratigraphic Picks from Core Data in the Northeast Plume Area

Boring ID	"Tan Clay" Confining Zone		Lower Aquifer Zone		Gordon Confining Unit		Gordon Aquifer		Meyers Branch Confining System
	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)
HMD 03C	224	5	219	64	155	5	150		
HMD 04C	224	4	220	67	153	12	141		
HSB 85A	204	10	194	70	124	6	118	79	39
HSB 143	198		179						
HSB 151	193		183						
HSB 152	198		186						
NWP-01SB	212	5	207	76	131	17	114	75	39
OFS 01SB			186	57	129	5	124		
OFS 02SB	198	10	188	62	126	6	121		
OFS 03SB	196	11	185	60	125	5	120		
OFS 04SB	196	4	192	65	127	5	122		
OFS 05SB	189	11	178	56	122	5	117		
P-28TA	215	4	211	70	141	8	133	69	64
SWP 01SB	192	14	178	50	128	18	110	75	35

NOTES:

[box] These cores were utilized in the hydrostratigraphic description of the Northeast Plume Area.
msl - mean sea level
ft - feet

Table E.2.4-2. Hydrostratigraphic Picks from Electric Cone Penetrometer Testing Logs in the Northeast Plume Area

Sampling Location ID	Northing	Easting	Ground Elevation (ft msl)	"Tan Clay" Confining Zone		Lower Aquifer Zone		Gordon Confining Unit		Gordon Aquifer		Meyers Branch Confining System
				Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)
BGT 01	76700.60	59178.40	282.90	223	14	195	59	136	6	130		
BGT 02	76957.60	59607.20	276.40	213	15	198	61	138	5	133		
BGT 03	77197.60	60045.90	275.70	213	14	199	56	143	2	141	72	69
BGT 04	77437.60	60484.50	259.20	213	9	204	56	148				
BGT 05	77677.60	60924.10	225.70	214	5	209	62	147	2	145	81	64
BGT 06	77254.80	58746.70	282.20	218	20	98	56	142	15	127		
BGT 07	77717.80	58935.70	276.40	212	13	199	58	141	9	132		
BGT 08	78161.50	59118.60	249.30	221	4	217	68	149				
BGT 09	78642.30	59316.70	226.00	208	4	204	55	149	10	139	74	65
BGT 10	79104.60	59507.20	215.20	201	7	194	44	150	10	140		
BGT 11	79566.90	59697.70	222.50					156	12	144	77	67
BGT 12	77291.20	58045.90	284.20	225	11	214						
BGT 13	77488.90	58074.00	287.80	224	8	216						
BGT 14	77984.00	58143.40	280.70	215	6	209	69	140	13	127		
BGT 15	78479.20	58212.80	277.50	209	8	201	51	150				
BGT 16	78974.10	58283.50	250.70					151				
BGT 17	79469.70	58350.00	240.70					150				
BGT 18	79965.30	58416.50	216.50					162	15	147	92	55
BGT 20	80956.40	58549.60	159.50					151	11	140	70	70
BGT 21	77280.70	56952.50	294.20	223	7	216						
BGT 22	77860.30	56970.30	281.00	233	18	215	89	126	12	114	64	50
BGT 23	78279.70	56997.00	270.00	216	6	210						
BGT 24	78779.20	57019.20	265.80	227	7	220						

Table E.2.4-2. Hydrostratigraphic Picks from Electric Cone Penetrometer Testing Logs in the Northeast Plume Area

Sampling Location ID	Northing	Easting	Ground Elevation (ft msl)	"Tan Clay" Confining Zone		Lower Aquifer Zone		Gordon Confining Unit		Gordon Aquifer		Meyers Branch Confining System
				Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)
BGT 25	79278.70	57041.40	264.80	229	5	224						
BGT 27	80277.70	57085.90	256.90	217	10	207	55	152				
BGT 28	80777.20	57108.10	258.30	216	26	190	34	156	6	150	98	52
BGT 29	81276.70	57130.40	243.00	218	3	215						
BGT 30	81726.30	57150.40	219.00	208	2	206	64	142	5	137		
BGT 31	77228.97	56189.75	308.76	220	5	215						
BGT 32	77791.41	56121.10	310.12	237	3	234						
BGT 33	78404.46	56037.17	290.42	239	16	223						
BGT 34	78803.92	56027.45	286.76	221	7	214						
BGT 35	79305.84	55929.89	267.73	217	4	213						
BGT 36	79801.93	55867.47	261.36	226	11	215	67	148				
BGT 37	80298.03	55805.00	251.60	222	7	215	82	133				
BGT 40	77297.15	55644.42	332.32	209	6	203						
BGT 41	77734.75	55490.12	328.37	224	5	219	70	149	7	142		
BGT 42	78240.66	55313.07	310.92	224	5	219						
BGT 43	79655.92	54816.04	277.08	205	4	201						
BGT 44	80127.67	54650.36	276.20	214	5	209						
BGT 45	80461.74	54533.05	285.28	218	9	209	59	150				
BGT 46	76714.30	55354.96	310.00	213	8	205	71	134	9	125		
BGT 47	77051.85	54986.57	317.32	218	15	203	63	140	11	129		
BGT 48	77135.74	54895.09	314.33	217	8	209						
BGT 49	76203.90	54946.30	297.26	222	8	214	79	135	9	126		
BGT 50	76359.30	54756.20	296.27	221	7	214	82	132	8	124		

Table E.2.4-2. Hydrostratigraphic Picks from Electric Cone Penetrometer Testing Logs in the Northeast Plume Area

				"Tan Clay" Confining Zone		Lower Aquifer Zone		Gordon Confining Unit		Gordon Aquifer		Meyers Branch Confining System
Sampling Location ID	Northing	Easting	Ground Elevation (ft msl)	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)
BGT 51	75519.81	54505.65	272.64	193	7	186						
BGT 53	75837.68	53422.04	278.25	200	9	191	71	120	11	109	77	32
BGT 54	75941.66	52889.14	279.96	205	9	196						
BGT 56	73521.24	56265.77	262.94	182	7	175						
BGT 57	73268.51	56104.24	259.35	179	10	169						
BGT 58	73406.90	57399.60	285.76	192	2	190	78	112	9	103		
BGT 59	72802.60	57123.20	281.88	182	9	173						
BGT 60	73120.63	58057.22	291.42	186	10	176						
BGT 61	72911.77	58490.09	284.30	184	6	178	70	108	7	101		
BGT 62	72854.40	58609.00	282.03	190	14	176						
BGT 63	73319.43	59146.34	293.67	195	6	189						
BGT 63A	73646.40	58768.10	290.79	198	4	194						
BGT 64	73013.74	59499.95	283.25	195	7	188	65	123				
BGT 66	74476.55	60033.67	244.04	195	7	188						
BGT 67	74443.06	60426.74	242.30	187	14	173	38	135	8	127	99	50

NOTES:
Hydrostratigraphic picks from the ECPT logs are not exact. There is a difference of (+) or (-) 1 foot.
[box] These CPTs were utilized in the hydrostratigraphic description of the Northeast Plume Area.
msl mean sea level
ft feet

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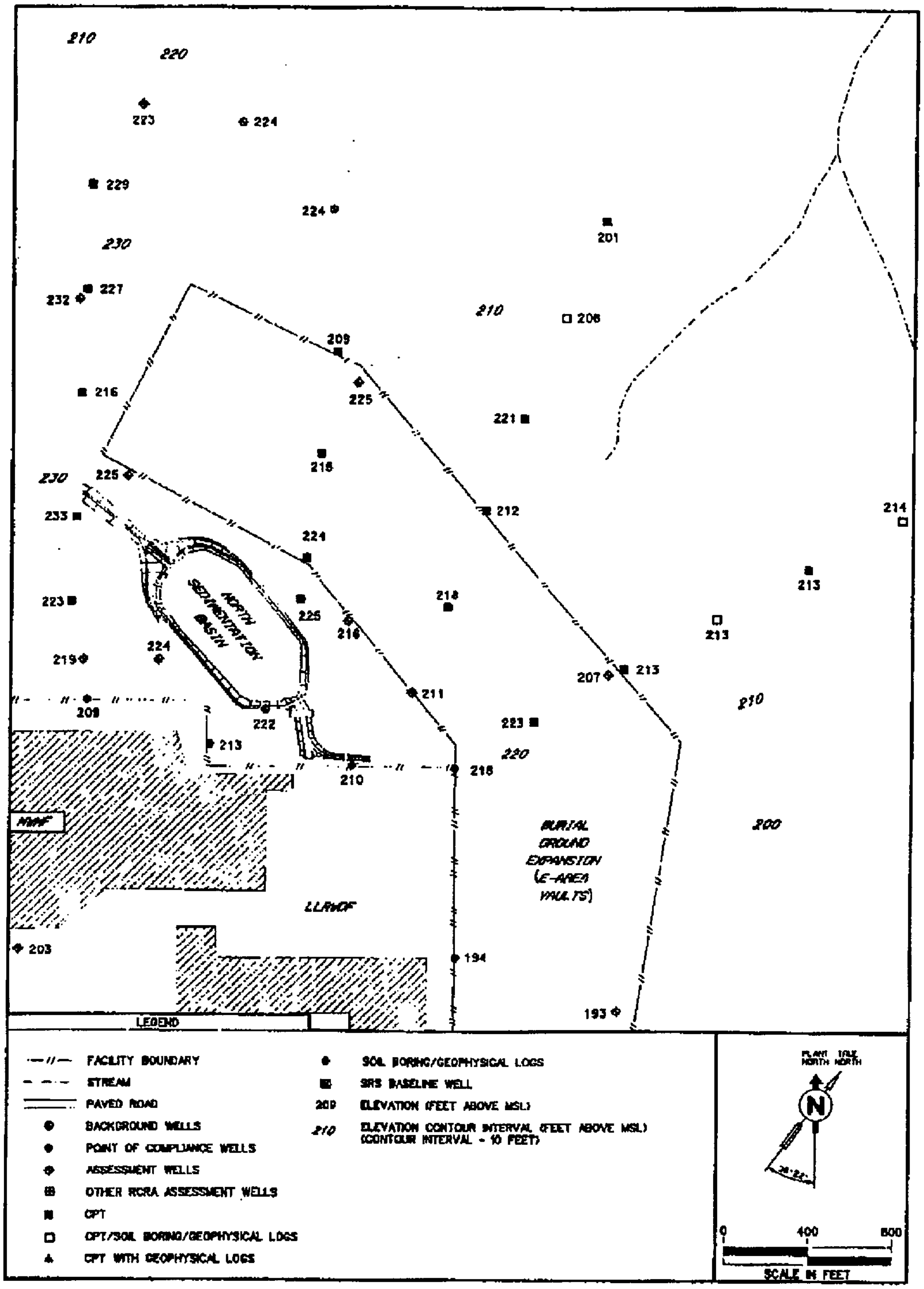

Fig. E.2.4-2. Structure Contour Map of the "Tan Clay" Confining Zone in the Northeast Plume Area

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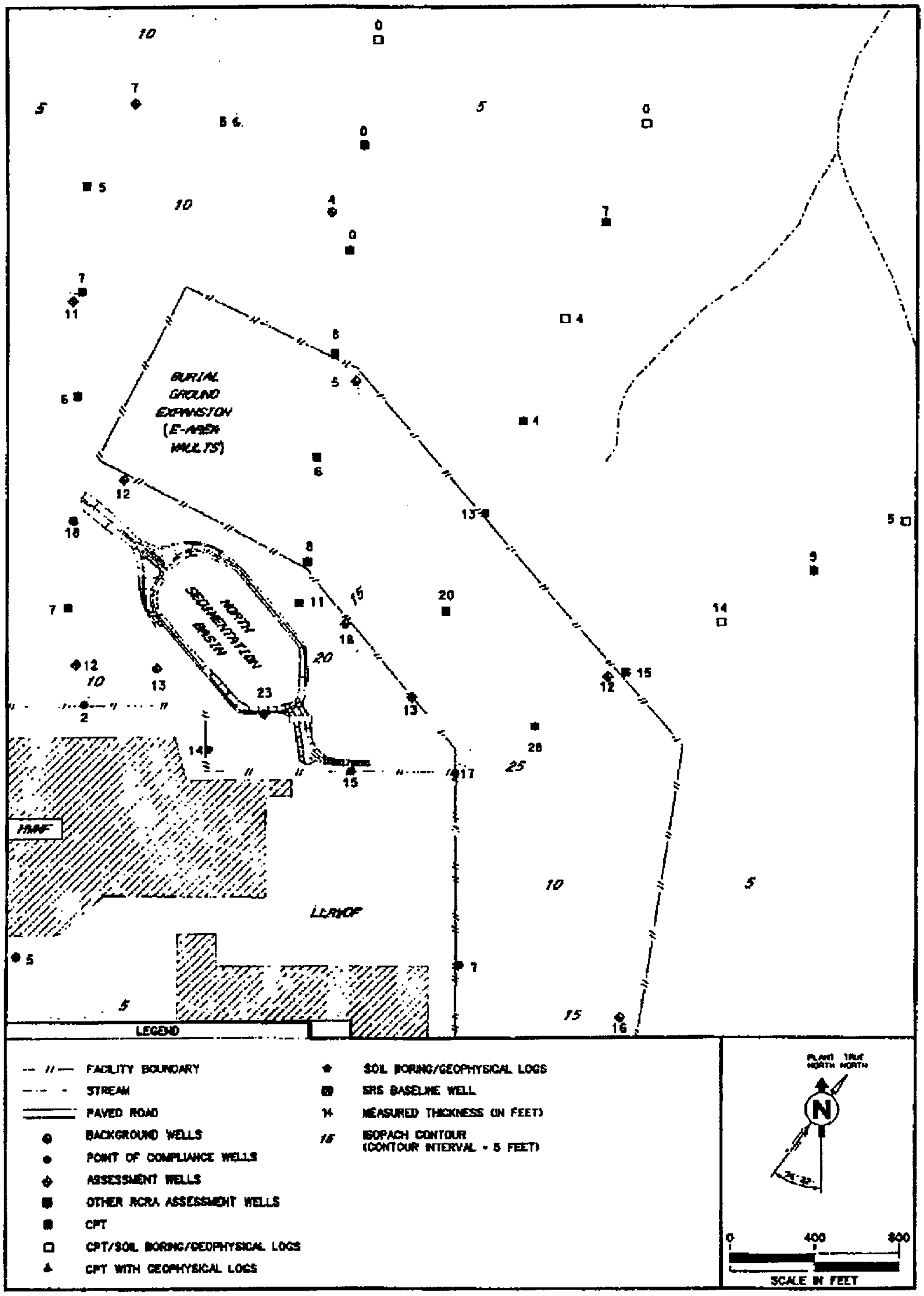

Fig. E.2.4-3. Isopach Map of the "Tan Clay" Confining Zone in the Northeast Plume Area

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crops out at approximately the 210-foot elevation. This contact is depicted on the structure contour and isopach maps. A small channel is also depicted to the east and on cross section A-A' (Fig. E.2.1-6) at BGT 01 and BGT 02.

Fig. E.2.4-4, Fig. E.2.4-5, and Fig. E.2.4-6 depict the structure contour, thickness of the LAZ-UTRA, and thickness of the calcareous zone within this aquifer, respectively. The calcareous zone includes calcareous sands, sandy limestones, and sandy muddy limestones. The location of calcareous zones could potentially influence contaminant transport. Table E.2.4-3 presents the thickness of the calcareous zone from cores in the Northeast Plume Area.

Fig. E.2.4-7 and Fig. E.2.4-8 are the structure contour and isopach maps of the Gordon Confining Unit, respectively. West of the North Sedimentation Basin is a low area depicted on the structure contour map and troughs that trend to the south and east. The Gordon Confining Unit is thicker north and south of the MWMF.

Fig. E.2.4-9 and Fig. E.2.4-10 are the structure contour and isopach maps of the Gordon Aquifer, respectively. The structural surface of the Gordon Aquifer depicts a depression northwest of the North Sedimentation Basin but an overall trend of rising to the northeast. The Gordon Aquifer also thickens to the northeast.

Fig. E.2.4-11 is the structure contour map of the Crouch Branch Confining Unit. The structure of the top of the Crouch Branch Confining Unit increases in elevation to the northeast.

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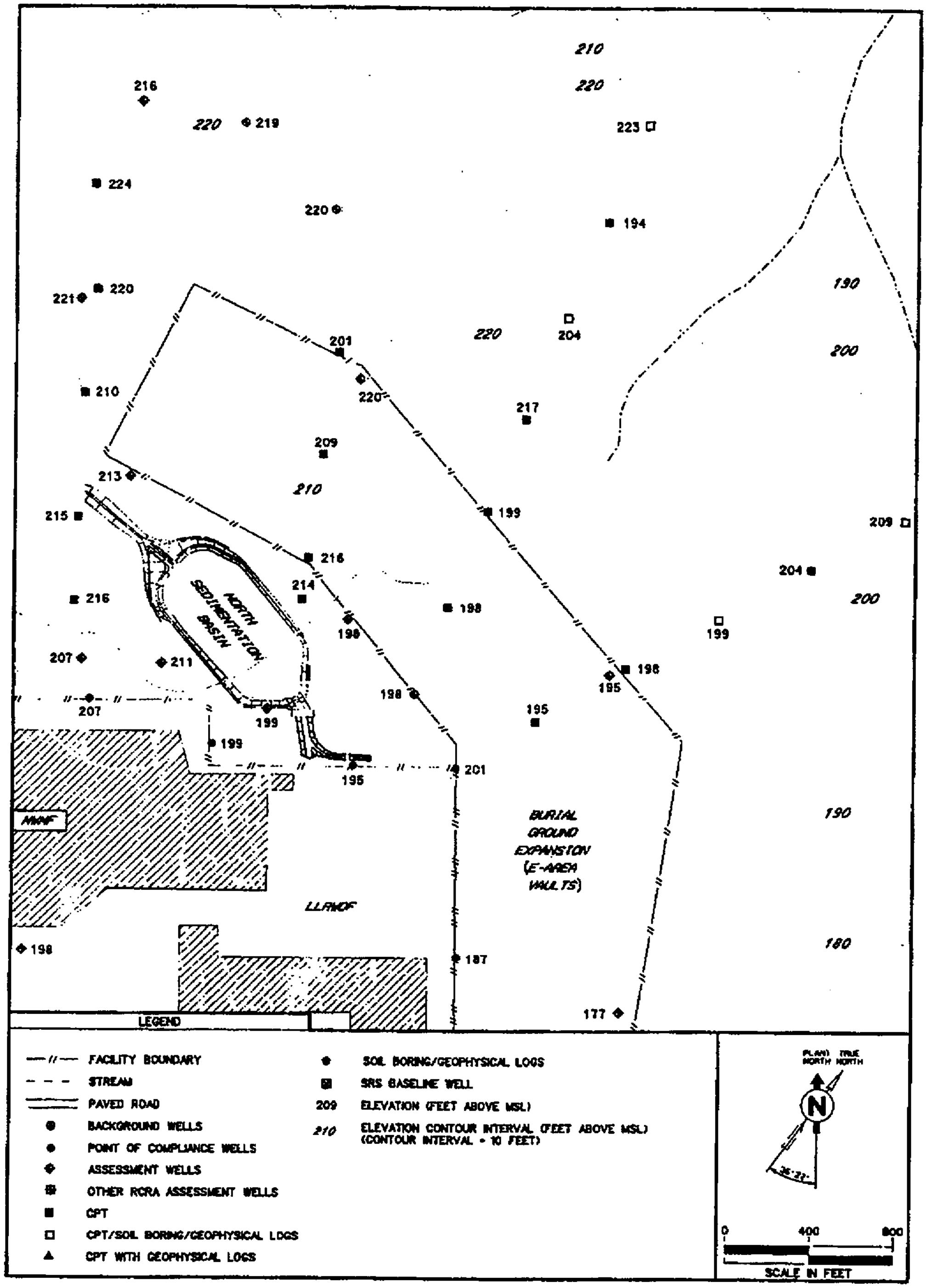

Fig. E.2.4-4. Structure Contour Map of the Lower Aquifer Zone of the Upper Three Runs Aquifer in the Northeast Plume Area

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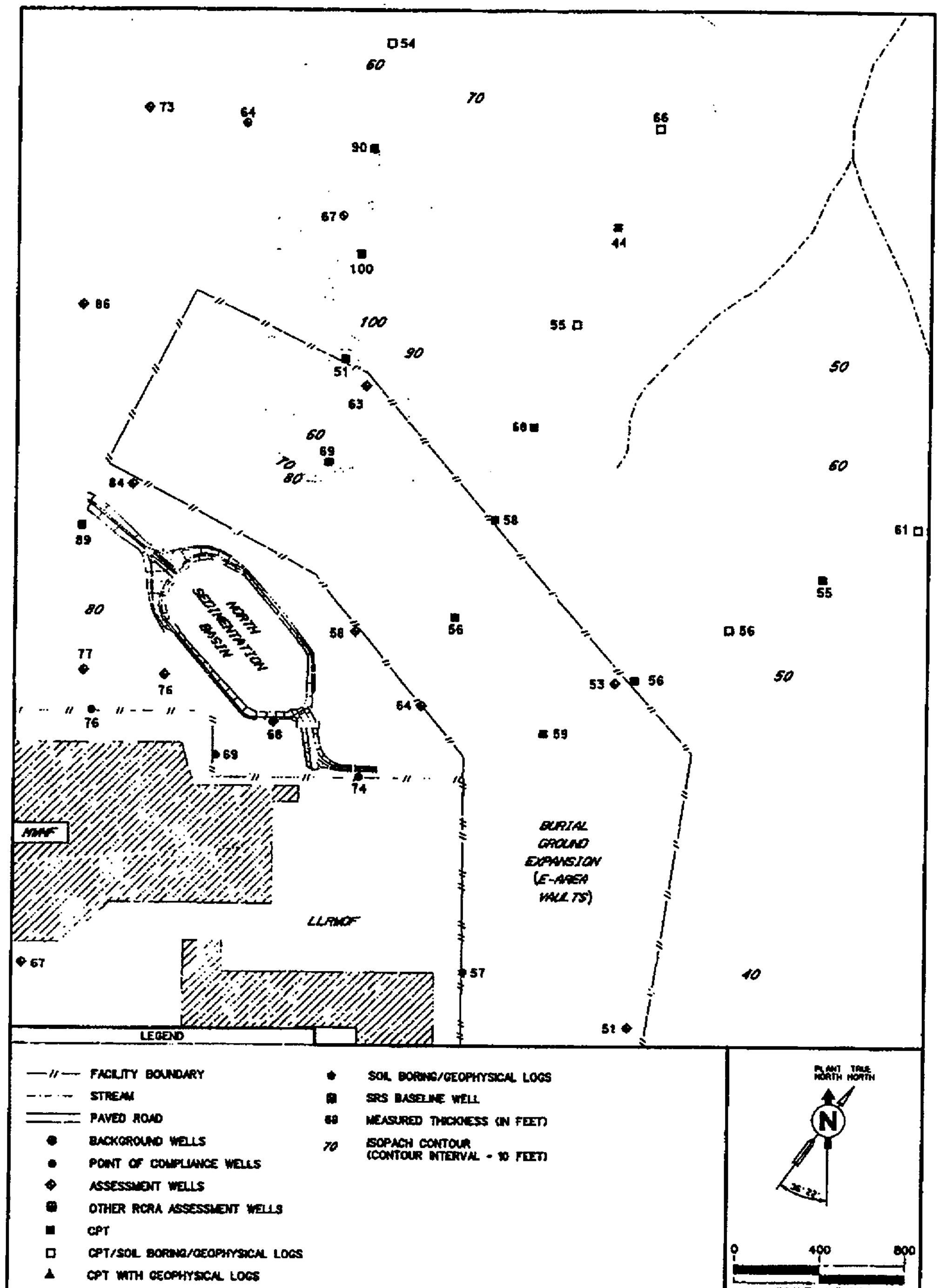

Fig. E.2.4-5. Isopach Map of the Lower Aquifer Zone of the Upper Three Runs Aquifer in the Northeast Plume Area

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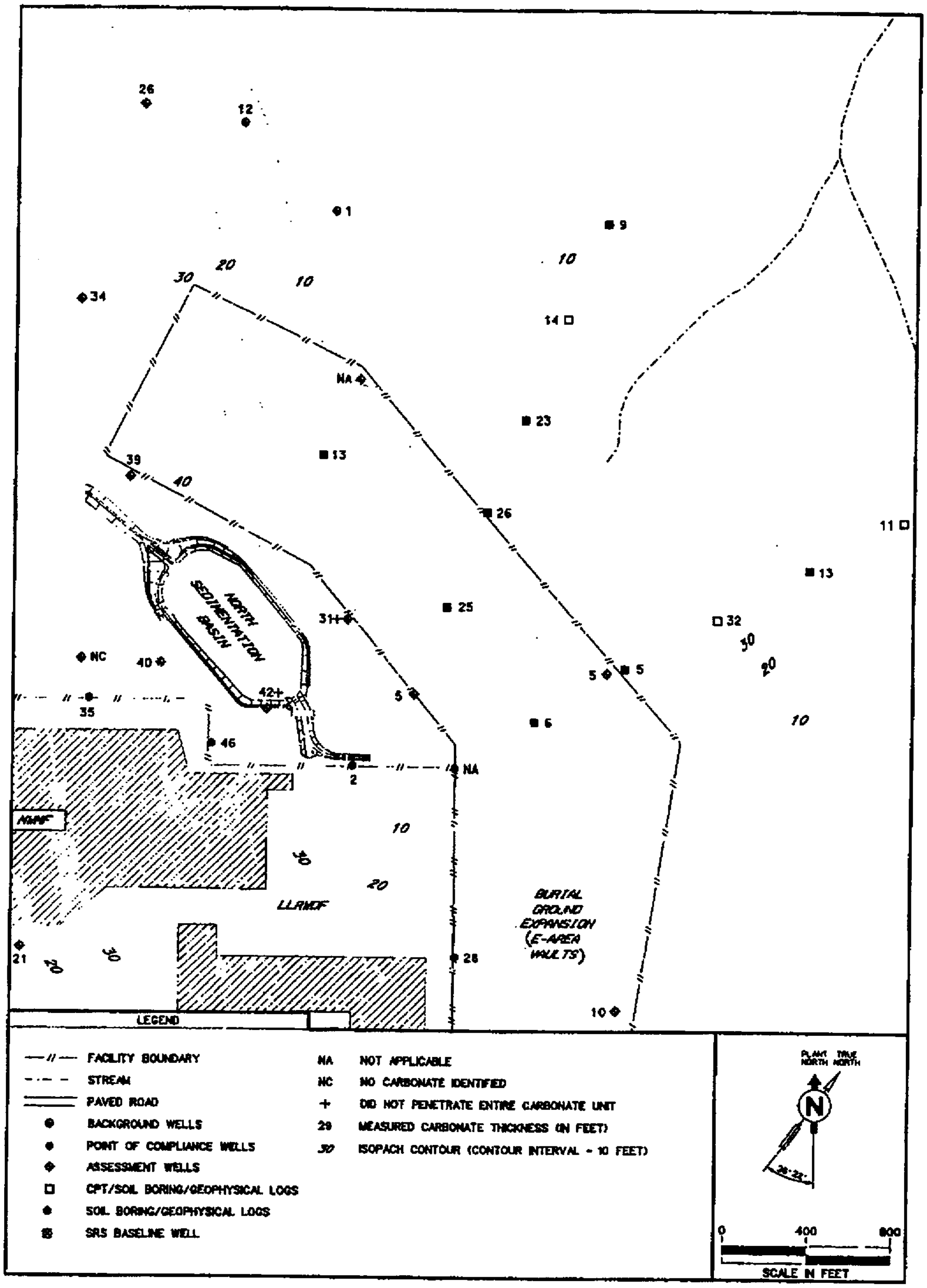

Fig. E.2.4-6. Isopach Map of Calcareous Sediments in the Lower Aquifer Zone of the Upper Three Runs Aquifer in the Northeast Plume Area

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Table E.2.4-3. Carbonate Hydrostratigraphy of the Northeast Plume Area

Well	Ground Elevation (ft msl)	Calcareous Interval (ft msl)		Thickness (ft)	Hydrostratigraphic Unit
		Top	Bottom		
BGO 03A	288.2	1598	130	28	LAZ-UTRA
BGO 06A	284.5	164	162	2	LAZ-UTRA
BGO 08A	281.3	171	125	46	LAZ-UTRA
BGO 09AA	282.8	170	130	40	LAZ-UTRA
BGO 10A	299.1	171	136	35	LAZ-UTRA
BGO 18A	292.9	152	131	21	LAZ-UTRA
BGO 44AA	283.3	166	124	42	LAZ-UTRA
BGT 01*	282.9	142	136	6	LAZ-UTRA
BGT 02*	276.4	142	138	5	LAZ-UTRA
BGT 03	275.7	180	148	13	LAZ-UTRA
BGT 04*	259.2	161	148	13	LAZ-UTRA
BGT 05	225.7	161	150	11	LAZ-UTRA
BGT 06*	282.2	166	141	25	LAZ-UTRA
BGT 07*	276.4	166	141	26	LAZ-UTRA
BGT 08*	249.3	168	145	23	LAZ-UTRA
BGT 09	226.0	163	149	14	LAZ-UTRA
BGT 10*	215.2	162	153	9	LAZ-UTRA
BGT 14*	280.7	153	140	13	LAZ-UTRA
BGX 01A	289.1	164	134	30	LAZ-UTRA
BGX 02B	289.2	169	138	31	LAZ-UTRA
BGX 04A	288.4	166	127	39	LAZ-UTRA
BGX 09D	277.4	142	138	5	LAZ-UTRA
BGX 11D	273.8	157	147	10	LAZ-UTRA
HMD 01D	262.7	173	139	34	LAZ-UTRA
HMD 02D	259.3	181	155	26	LAZ-UTRA
HMD 03D	257.5	169	157	12	LAZ-UTRA
HMD 04D	248.5	164	163	1	LAZ-UTRA

NOTES: msl mean sea level
ft feet
* Inferred data from cross sections

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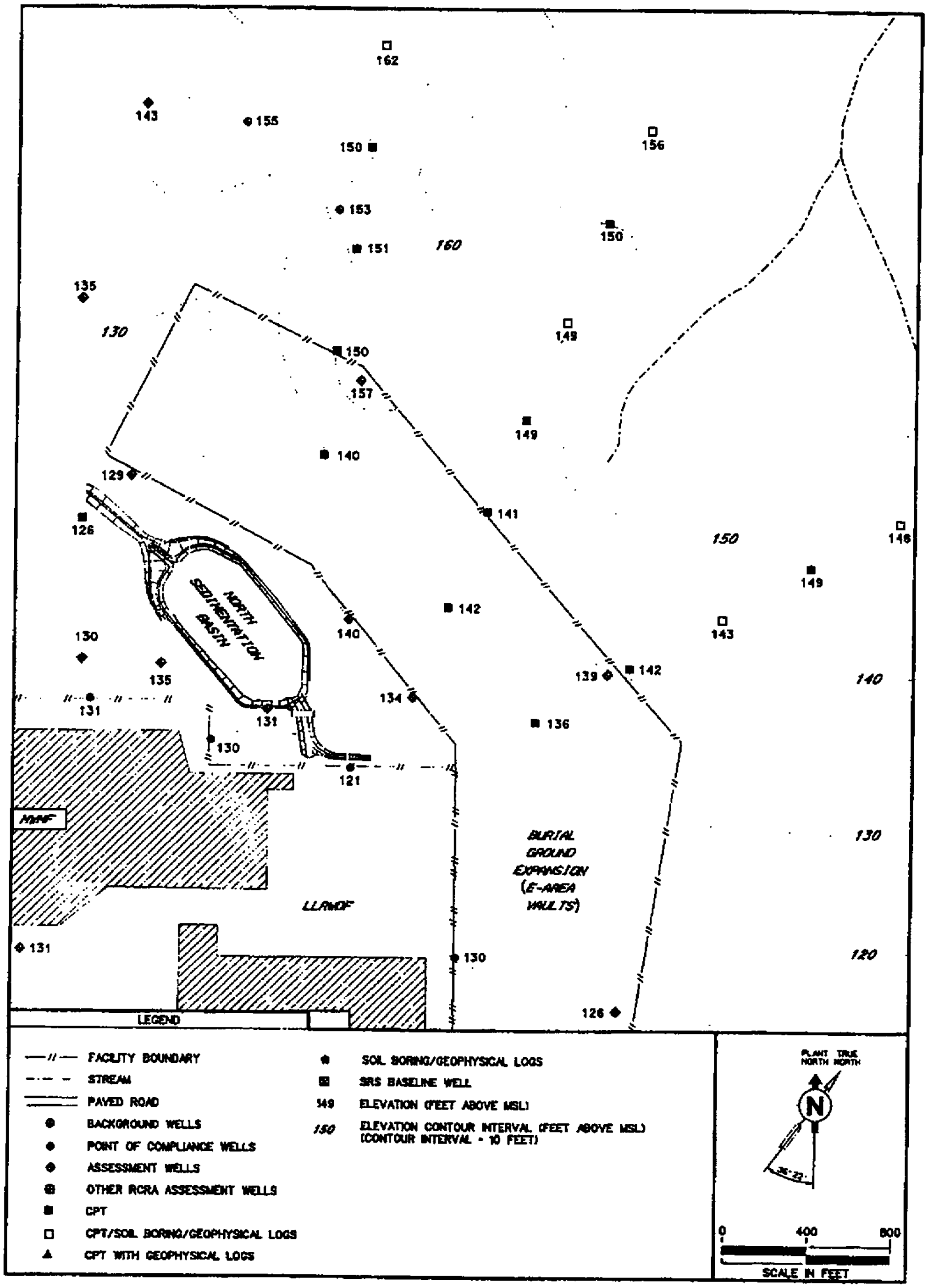

Fig. E.2.4-7. Structure Contour Map of the Gordon Confining Unit in the Northeast Plume Area

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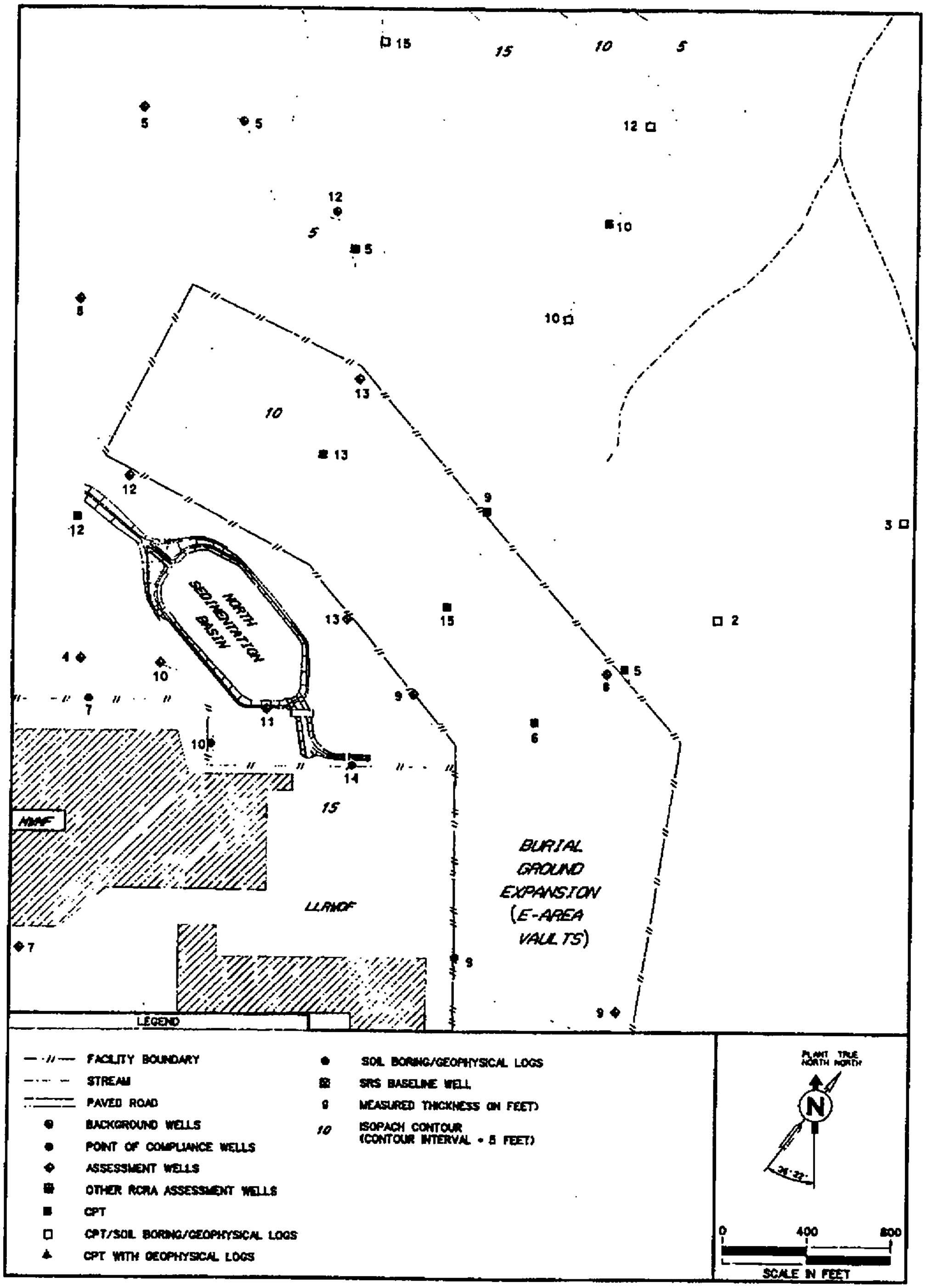

Fig. E.2.4-8. Isopach Map of the Gordon Confining Unit in the Northeast Plume Area

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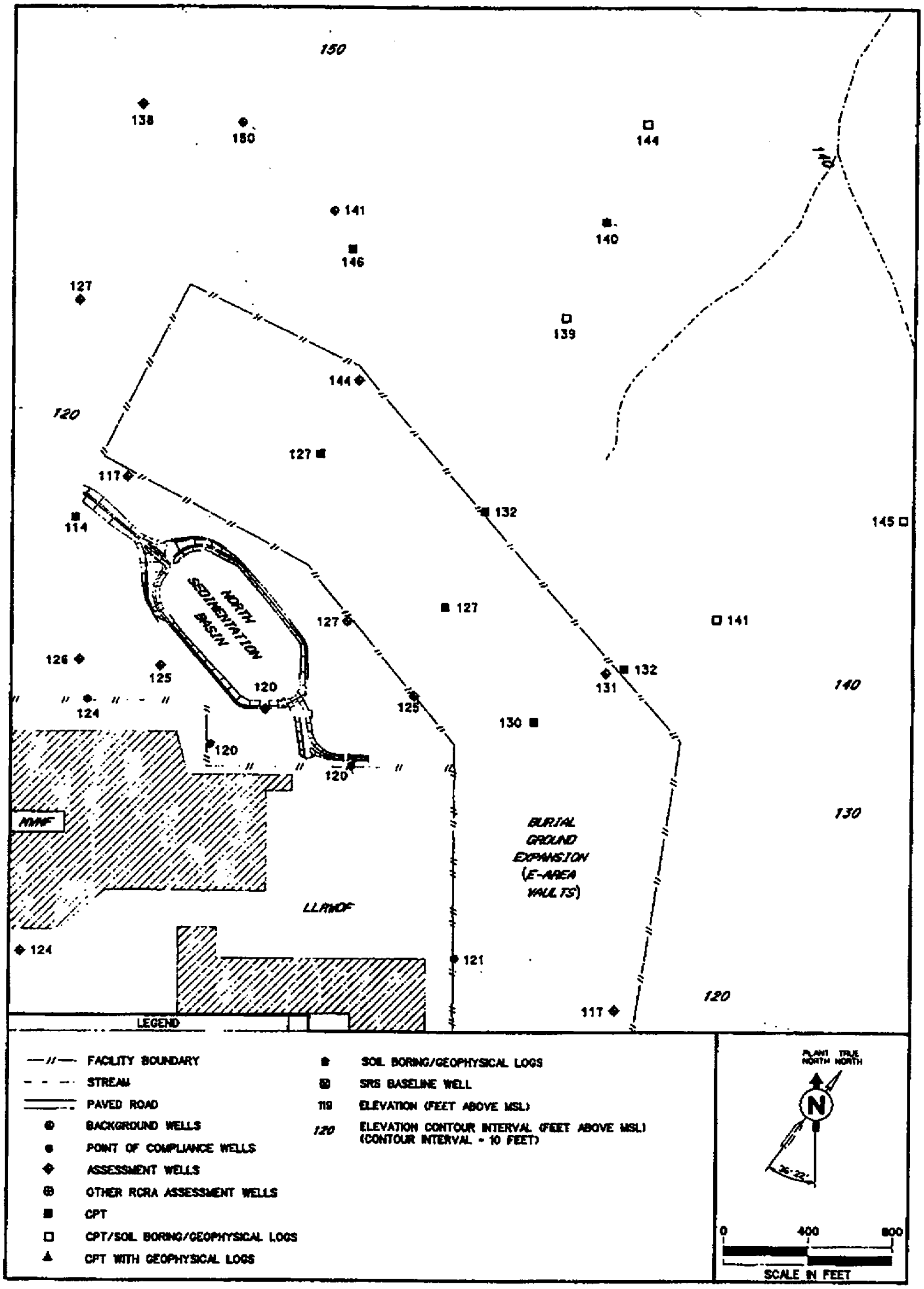

Fig. E.2.4-9. Structure Contour Map of the Gordon Aquifer in the Northeast Plume Area

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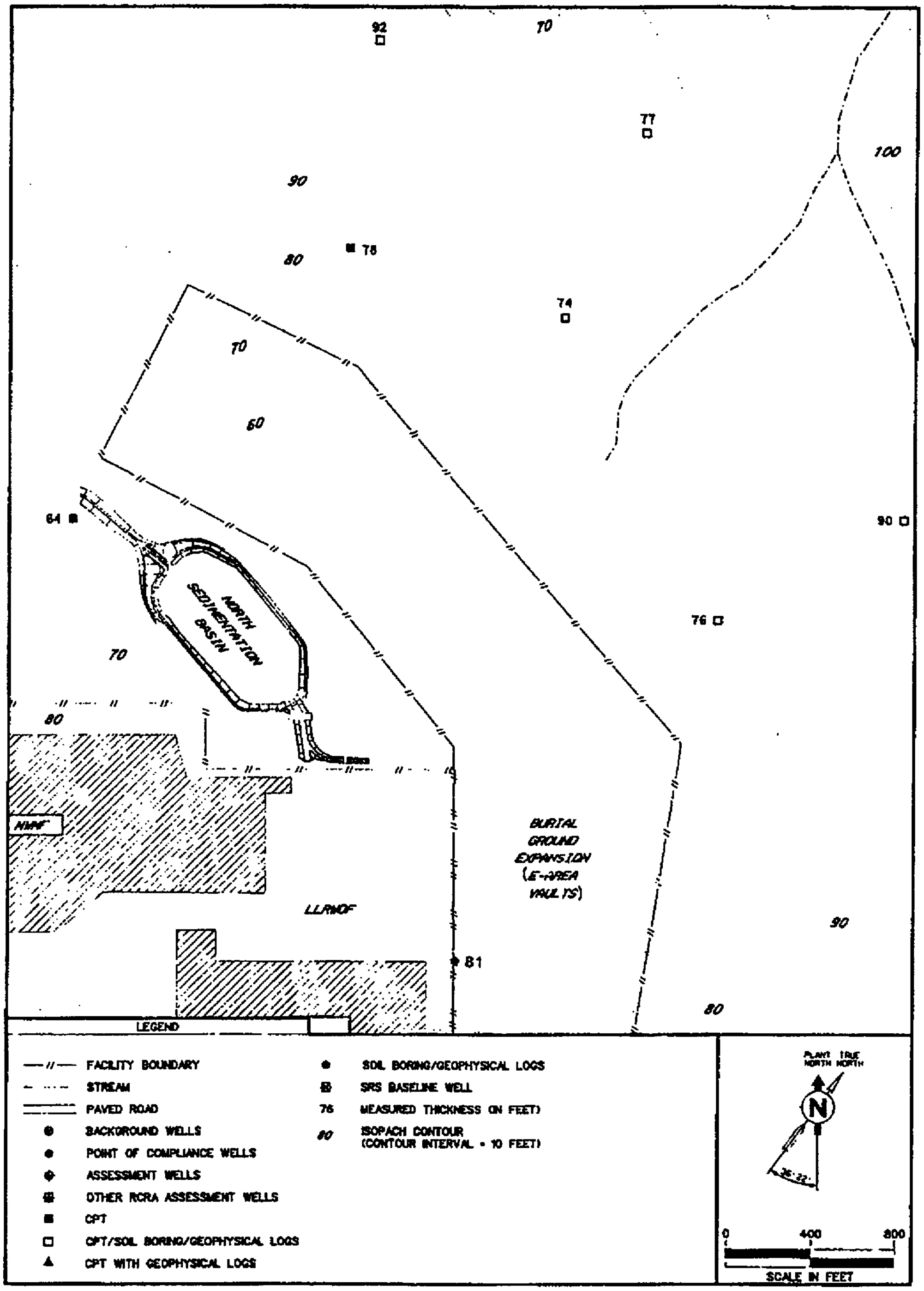

Fig. E.2.4-10. Isopach Map of the Gordon Aquifer in the Northeast Plume Area

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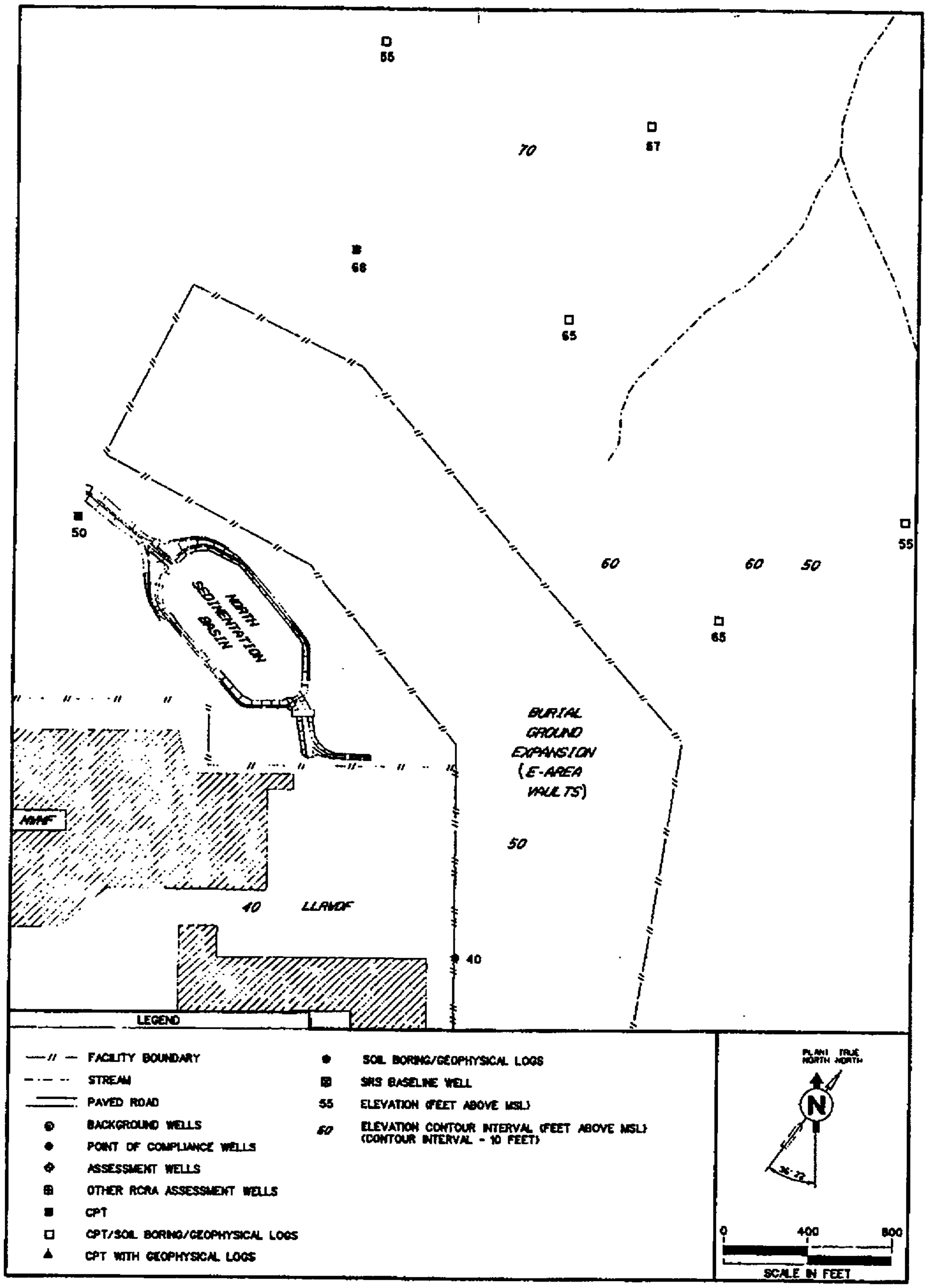

Fig. E.2.4-11. Structure Contour Map of the Crouch Branch Confining Unit in the Northeast Plume Area

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Fig. E.2.1-5 shows the locations of hydrostratigraphic cross sections in the Northeast Plume Area. Cross Section Q-Q′ (Fig. E.2.4-12) is a north-south transect across the Northeast Plume Area. Cross Section P-P′ (Fig. E.2.4-13) depicts an east-west line in the Northeast Plume Area. The calcareous zone within the LAZ-UTRA is illustrated on the section. A channel is present at the east end (BGX 09) and is better depicted on regional cross section A-A′ (Fig. E.2.1-6). The "tan clay" confining zone has been incised and filled with gravel and sands. The size of the channel suggests that it is not a major distributory channel. The sand and gravel provide a pathway for contaminant migration along the "tan clay" confining zone. It is likely that scouring has eroded through the "tan clay" confining zone in places, resulting in direct communication between the UAZ-UTRA (Water Table Aquifer) and the LAZ-UTRA.

E.2.4.1 Groundwater Flow

Groundwater flow rates and directions have been determined based, in part, on hydraulic head data from BGC monitoring wells within the Northeast Plume Area. Table E.2.4-4 summarizes head data for each well cluster and also includes calculation of head difference across aquitards. Groundwater monitoring wells located in the Northeast Plume Area are shaded on Table E.2.4-4.

Upper Aquifer Zone of the Upper Three Runs Aquifer

Groundwater flow in the water table at the Northeast Plume Area is northeast from the ORWBG toward Upper Three Runs.

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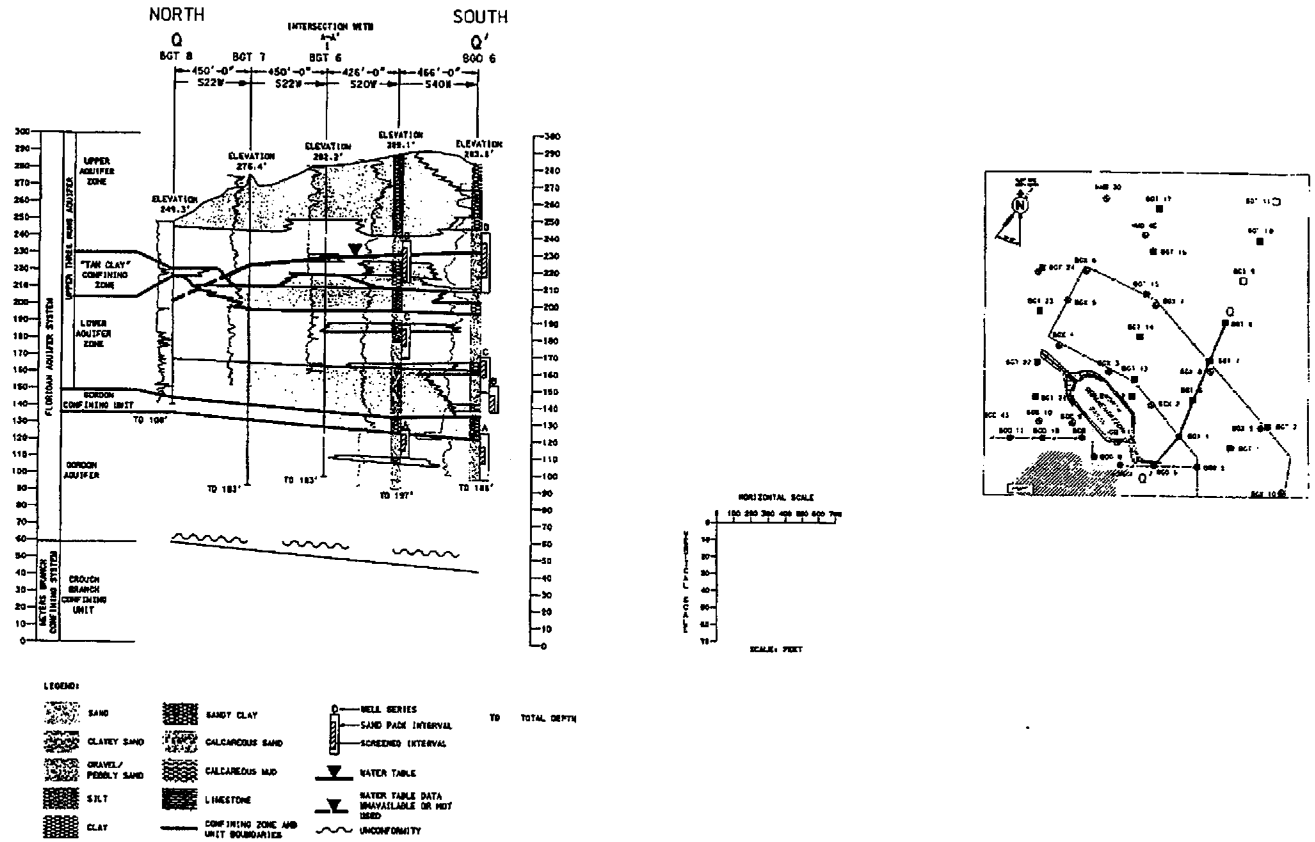

Fig. E.2.4-12. Hydrostratigraphic Cross Section Q-Q' in the Northeast Plume Area

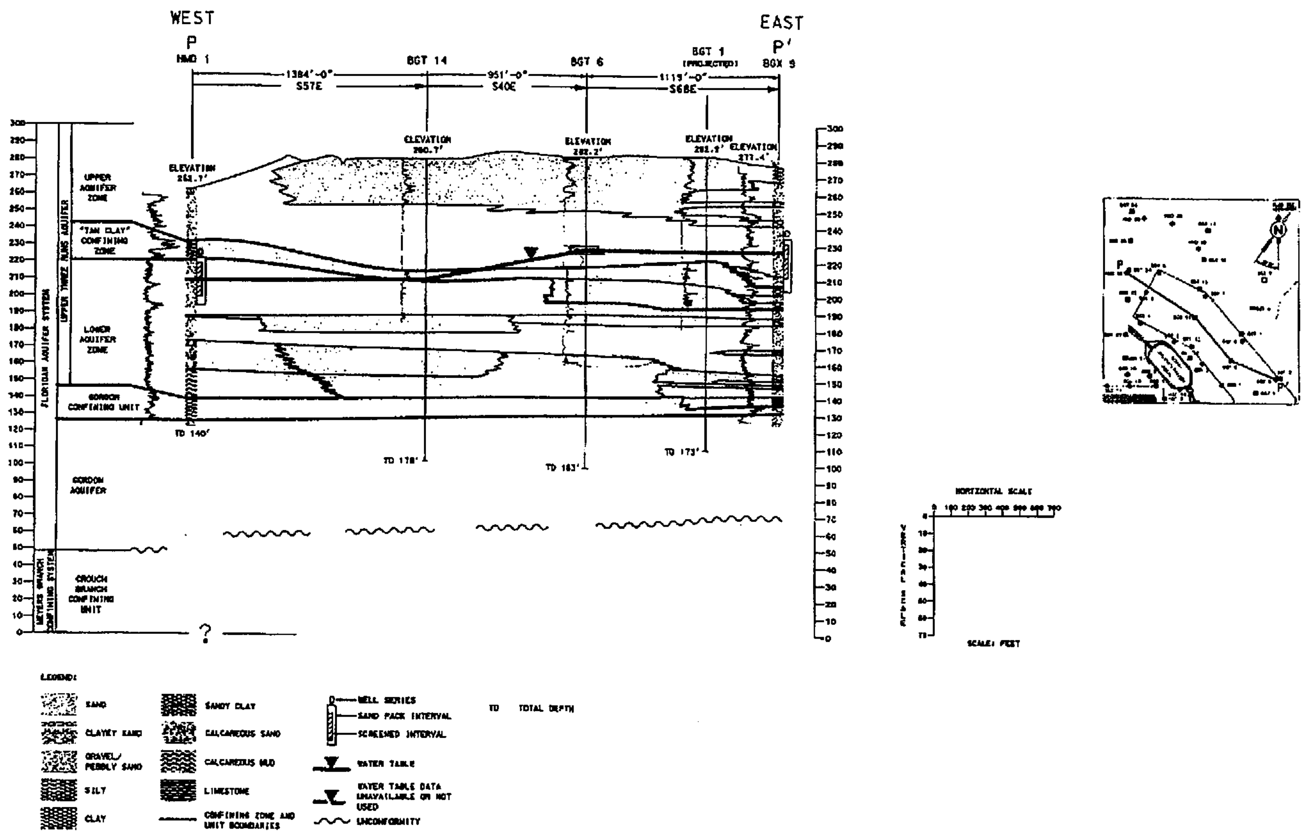

Fig. E.2.4-13. Hydrostratigraphic Cross Section P-P′ in the Northeast Plume Area

Table E.2.4-4. Water Table and Piezometric Data for the Northeast Plume Area, Based on 4Q95 Analytical Data

Well	Ground Elevation (ft msl)	UAZ-UTRA (Water Table Aquifer) Water Level (ft msl)	LAZ-UTRA		Gordon Aquifer		Vadose Zone Thickness (ft)	Head Difference UAZ-UTRA (Water Table Aquifer) to LAZ-UTRA (ft)	Head Difference LAZ-UTRA to Gordon Aquifer (ft)
			Well Measured	Water Level (ft msl)	Well Measured	Water Level (ft msl)			
BGO 01D	293	239.9					53.1		
BGO 02D	294.9	238.2					56.7		
BGO 03D	290.8	235.2	BGO 03C	225.93	BGO 03A	163.42	55.6	9.27	62.51
BGO 04D	295.6	231.4					64.2		
BGO 05D	294.2	231	BGO 05C	216.1			63.2	14.9	
BGO 06D	283.2	231.7	BGO 06C	220.9	BGO 06A	159.6	51.5	10.8	61.3
			BGO 06B	219.61					
BGO 07D	285.2	232.6					52.6		
BGO 08D	285.6	232.9	BGO 08C	224	BGO 08AR	165.82	52.7	8.9	58.18
BGO 09D	283.2	231			BGO 09AA	ND	52.2		
BGO 10DR	298.3	232.6	BGO 10C	221.3	BGO 10AR	158.6	65.7	11.3	62.7
			BGO 10B	220.35	BGO 10AA	158.1			
BGO 11D	303.3	232.2					71.1		
BGO 12D	311.8	232	BGO 12CR	221.4	BGO 12AR	157.8	79.8	10.6	63.6
BGO 13DR	317.3		BGO 13DR	231.3					
BGO 14DR	298.2	231.1	BGO 14CR	223.8	BGO 14AR	159	67.1	7.3	64.8
BGO 15D	296.7	230.7					66		
BGO 16D	302.3	ND	BGO 16B	218.72	BGO 16AR	161.34	ND	ND	57.38
BGO 17DR	296.9	231.8					65.1		
BGO 18D	292.6	232.9			BGO 18A	161.8	59.7		
BGO 19D	287.8	233.4					54.4		
BGO 20D	281.3	240.8					40.5		
BGO 21D	283	235.6					47.4		
BGO 22DR	284.2	237					47.2		
BGO 23D	287	236.5					50.5		
BGO 24D	291	237.6					53.4		
BGO 25A	294.7				BGO 25A	162			
BGO 26D	283.5	228.4			BGO 26A	159.7	55.1		
BGO 27D	274.3	228	BGO 27C	221.1			46.3	6.9	

Table E.2.4-4. Water Table and Piezometric Data for the Northeast Plume Area, Based on 4Q95 Analytical Data

Page 2 of 3

Well	Ground Elevation (ft msl)	UAZ-UTRA (Water Table Aquifer) Water Level (ft msl)	LAZ-UTRA		Gordon Aquifer		Vadose Zone Thickness (ft)	Head Difference UAZ-UTRA (Water Table Aquifer) to LAZ-UTRA (ft)	Head Difference LAZ-UTRA to Gordon Aquifer (ft)
			Well Measured	Water Level (ft msl)	Well Measured	Water Level (ft msl)			
BGO 28D	275.1	226.4					48.7		
BGO 29D	263.5	226.5	BGO 29C	223.3	BGO 29A	160	37	3.2	63.3
BGO 30D	272.8	225.9	BGO 30C	219.4			46.9	6.5	
BGO 31D	271.6	227	BGO 31C	225.9			44.6	1.1	
BGO 32D	279.5	228					51.5		
BGO 33D	278.1	231	BGO 33C	225.4			47.1	5.6	
BGO 34D	272.7	233.8					38.9		
BGO 35D	271.4	235.9	BGO 35C	228.8			35.1	7.1	
BGO 36D	273.3	238.9					34.4		
BGO 37D	285.1	240.6	BGO 37C	231.2			44.5	9.4	
BGO 38D	289.3	237					52.3		
BGO 39D	293.7	236.5					57.2		
BGO 40D	286.4	222.8					63.6		
BGO 41A	298.3				BGO 41A	158.5			
BGO 42C	295.9		BGO 42C	223.4					
BGO 43D	313.2		BGO 43D	231.74	BGO 43A	158.9			72.84
			BGO 43CR	225.85	BGO 43AA	156.6			
BGO 44D	283.4	233.4	BGO 44C	221.87	BGO 44A	158.8	50	11.53	63.07
			BGO 44B	221.95	BGO 44AA	159.05			
BGO 45D	276.6	227.9	BGO 45C	223.3	BGO 45A	161	48.7	4.6	62.3
			BGO 45B	219.42					
BGO 46D	263.1	225.1	BGO 46C	219.4			38	5.7	
			BGO 46B	217.98					
BGO 47D	265.4	226.2	BGO 47C	222.8	BGO 47A	162.5	39.2	3.4	60.3
BGO 48D	275	226.6	BGO 48C	223.6			48.4	3	
BGO 49D	269.5	234.6	BGO 49C	228.1	BGO 49A	ND	34.9	6.5	ND
BGO 50D	254	225	BGO 50C	218.6	BGO 50A	159.6	29	6.4	59
BGO 51D	287	237.1	BGO 51C	231.27	BGO 51A	168.84	49.9	5.83	62.43
			BGO 51B	230.44	BGO 51AA	168.36			
BGO 52D	282.1	235.39	BGO 52C	229.93	BGO 52A	164.25	46.71	5.46	65.68

Table E.2.4-4. Water Table and Piezometric Data for the Northeast Plume Area, Based on 4Q95 Analytical Data

Well	Ground Elevation (ft msl)	UAZ-UTRA (Water Table Aquifer) Water Level (ft msl)	LAZ-UTRA		Gordon Aquifer		Vadose Zone Thickness (ft)	Head Difference UAZ-UTRA (Water Table Aquifer) to LAZ-UTRA (ft)	Head Difference LAZ-UTRA to Gordon Aquifer (ft)
			Well Measured	Water Level (ft msl)	Well Measured	Water Level (ft msl)			
BGO 53D	288.9	230.37	BGO 52B BGO 53C BGO 53B	ND 223.23 226.96	BGO 52AA BGO 53A BGO 53AA	163.25 159.46 158.29	58.53	7.14	63.77
BGX 01D	289.2	230	BGX 01C	216.3	BGX 01A	158.3	59.2	13.7	58
BGX 02D	289.1		BGX 02D	215.61			73.49		
			BGX 02B	213.1					
BGX 03D	289.1		BGX 03D	215.3			73.8		
BGX 04D	288.8		BGX 04D	215.8	BGX 04A	155.3	73		60.5
			BGX 04C	214.7					
BGX 05D	283		BGX 05D	208.9			74.1		
BGX 06D	275		BGX 06D	205.8			69.2		
BGX 07D	277.1		BGX 07D	205.8			71.3		
BGX 08DR	276.1		BGX 08DR	205.5			70.6		
BGX 09D	277.4	226.9					51.14		
BGX 10D	274.8	ND					49.59		
BGX 11D	273.8	235.6					38.82		
BGX 12D	273.2	238.7	BGX 12C	234.7			34.5	4	65.3
HSB 85C	292	239.9	HSB 85B	233.6	HSB 85A	169.4	52.1	6.3	64.2
HMD 01D	262.7		HMD 01D	209.2			53.5		
HMD 02D	259.3		HMD 02D	200.26			59.04		
HMD 03D	257.5		HMD 03D	199.8			57.7		
HMD 04D	248.5		HMD 04D	200.1			48.4		

NOTES: ☐ These wells were utilized in the hydrostratigraphic description of the Northeast Plume Area.
msl mean sea level
ND No Data
ft feet

Fig. E.2.4-14 is a detailed potentiometric map of the UAZ-UTRA (Water Table Aquifer) in the Northeast Plume Area. A combination of hydraulic head data from groundwater monitoring wells screened in the water table and from the 30 electronic pore pressure logs were used to develop the potentiometric surface map. Estimated flow was calculated at 70.8 feet/year. The flow rate was calculated as discussed in Section E.2.1.2.1. Flow estimates are based on average hydraulic conductivity values from slug tests in the BGC (2.81 feet/day). Table E.2.4-5 lists slug test data from the Northeast Plume Area. The estimated flow rates were calculated using an effective porosity of 0.20, a hydraulic gradient of 0.0138 feet/feet, and an average hydraulic conductivity of 2.81 feet/day.

"Tan Clay" Confining Zone

Groundwater flow across the "tan clay" confining zone is downward into the LAZ-UTRA. Eleven undisturbed samples of the "tan clay" confining zone at the BGC were subjected to laboratory permeameter tests in order to determine vertical hydraulic conductivity. The test results are recorded in Table E.2.4-6. The vertical hydraulic conductivity ranges from 2.00E-09 to 1.42E+00 feet/day in the entire BGC. The vertical hydraulic conductivity range in the Northeast Plume Area is from 2.00E-09 to 9.07E-03 feet/day.

These numbers indicate that the confining unit is characterized by highly variable permeability.

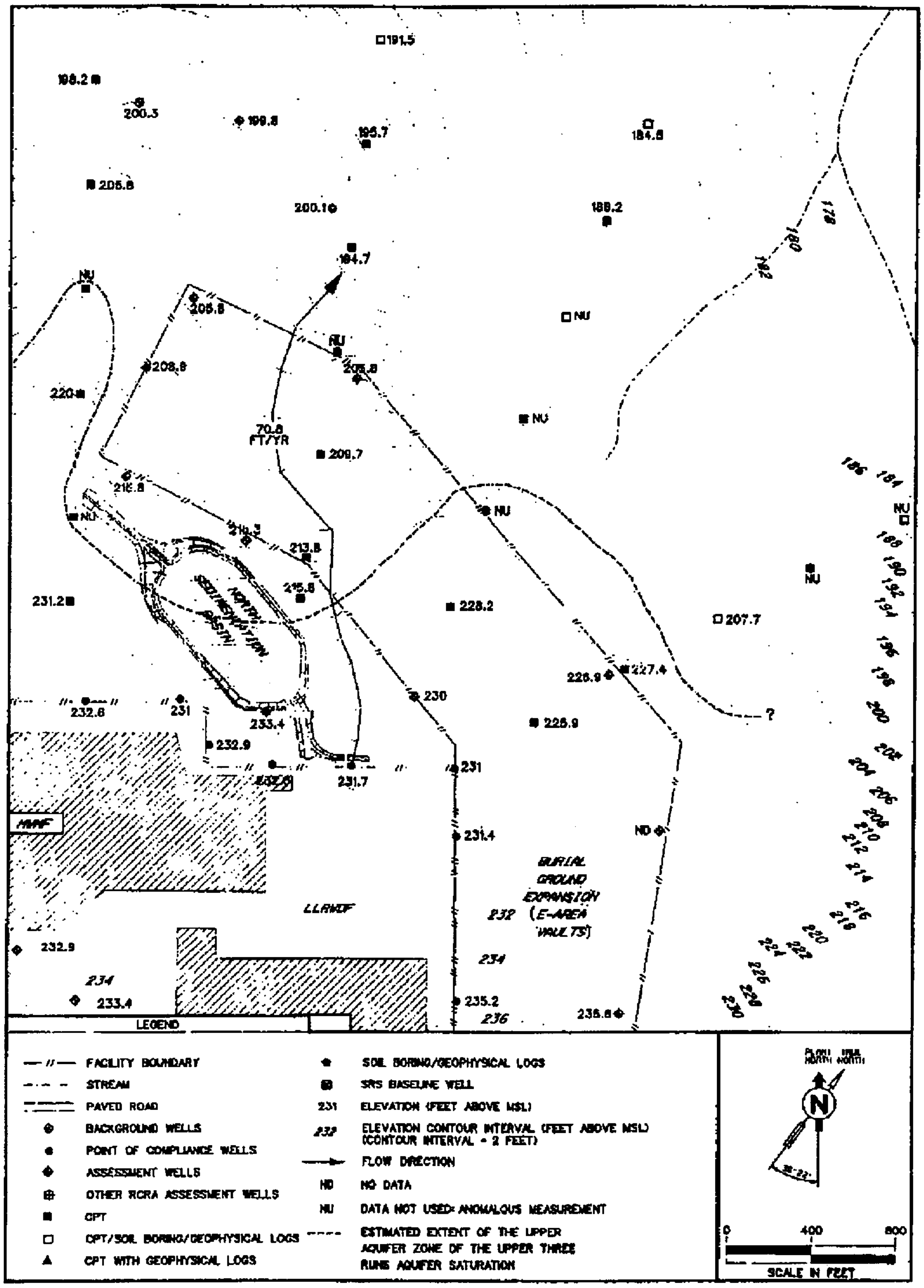

Fig. E.2.4-14. Potentiometric Surface Map of the Upper Aquifer Zone of the Upper Three Runs Aquifer (Water Table Aquifer), Northeast Plume Area

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Table E.2.4-5. Hydraulic Conductivity Data Based on Slug Tests for the Upper Aquifer Zone of the Upper Three Runs Aquifer (Water Table Aquifer) in the Northeast Plume Area

WELL	HYDRAULIC CONDUCTIVITY (cm/sec)	(ft/day)
BGO 03D	4.94E-05	0.14
BGO 03D(R)	8.20E-04	2.33
BGO 05D	2.58E-04	0.73
BGO 06D	1.34E-04	0.38
BGO 08D	6.60E-04	1.87
BGO 09D	3.53E-05	0.10
BGO 10D	1.16E-04	0.33
BGO 10D(R)	4.09E-04	1.16
BGO 18D	4.45E-03	12.6
BGO 19D	1.59E-04	0.45
BGO 19D(R)	1.73E-03	4.90
BGO 44D	4.58E-03	12.98
BGX 01D	5.82E-04	1.65
BGX 09D	1.27E-04	0.36
BGC MAXIMUM	5.60E-03	15.87
BGC MINIMUM	2.47E-05	0.07
BGC AVERAGE	9.92E-04	2.81
Northeast Plume Area MAXIMUM	4.58E-03	12.98
Northeast Plume Area MINIMUM	3.53E-05	0.10
Northeast Plume Area AVERAGE	1.01E-03	2.86

NOTES:
- cm/sec centimeters per second
- ft/day feet per day
- BGC Burial Ground Complex

SOURCES: Sirrine 1991a, 1991b, 1992; DOE 1988; WSRC 1995a, 1996a

Table E.2.4-6. Hydraulic Conductivity Data Based on Laboratory Tests for the "Tan Clay" Confining Zone, Northeast Plume Area

WELL	VERTICAL CONDUCTIVITY (cm/sec)	VERTICAL CONDUCTIVITY (ft/day)	HORIZONTAL CONDUCTIVITY (cm/sec)	HORIZONTAL CONDUCTIVITY (ft/day)
BGO 03C	1.93E-01	6.80E-05	3.10E-06	8.79E-03
BGO 09AA	1.61E-01	5.67E-05	7.30E-08	2.07E-04
BGT 09	8.22E-04	2.90E-07	6.00E-07	1.70E-03
BGT 22	5.67E-06	2.00E-09	1.10E-08	3.12E-05
BGX 01A	9.64E-03	3.40E-06	8.29E-09	2.35E-05
BGX 02B	1.20E-02	4.25E-06	6.99E-09	1.98E-05
BGX 04A	2.33E-02	8.22E-06	6.00E-09	1.70E-05
BGX 04C	1.69E-01	5.95E-05	4.69E-08	1.33E-04
BGX 09D	2.73E-01	9.64E-05	1.20E-07	3.40E-04
BGX 11D	3.20E+00	1.13E-03	NA	NA
HMD 04C	2.57E+01	9.07E-03	2.70E-05	7.65E-02
BGC MAXIMUM	4.03E+03	1.42E+00	5.01E-04	1.42E+00
BGC MINIMUM	5.67E-06	2.00E-09	6.00E-09	1.70E-05
BGC AVERAGE	1.67E+02	5.88E-02	3.01E-05	8.54E-02
Northeast Plume Area MAXIMUM	2.57E+01	9.07E-03	2.70E-05	7.65E-02
Northeast Plume Area MINIMUM	5.67E-06	2.00E-09	6.00E-09	1.70E-05
Northeast Plume Area AVERAGE	2.70E+00	9.54E-04	3.10E-06	8.78E-03

NOTES:

- cm/sec centimeters per second
- ft/day feet per day
- BGC Burial Ground Complex
- NA Not Available

SOURCES: Sirrine 1991a, 1991b, 1992; DOE 1988; WSRC 1995a, 1996a

Lower Aquifer Zone of the Upper Three Runs Aquifer

Groundwater flow in the LAZ-UTRA at the Northeast Plume Area is northeast from the ORWBG toward Upper Three Runs.

Fig. E.2.4-15 is a detailed potentiometric map of the LAZ-UTRA in the Northeast Plume Area. The flow rate for the representative flow path shown is 25.7 feet/year. The flow rate was calculated as discussed in Section E.2.1.2.1. Flow estimates are based on average hydraulic conductivity values from slug tests in the BGC. Table E.2.4-7 lists slug test data from the Northeast Plume Area.

The estimated flow rate was calculated using an effective porosity of 0.20, a hydraulic gradient of 0.0102 feet/feet, and an average hydraulic conductivity of 1.38 feet/day.

Gordon Confining Unit

Groundwater flow across the Gordon Confining Unit is downward into the Gordon Aquifer. Laboratory permeameter tests were conducted on 11 undisturbed samples of the Gordon Confining Unit in order to determine hydraulic conductivity (Table E.2.4-8). These analyses exhibited a range of vertical conductivities from 1.10E-07 to 1.90E-03 feet/day. These low vertical conductivities indicate low permeability and low vertical flow rates across the unit.

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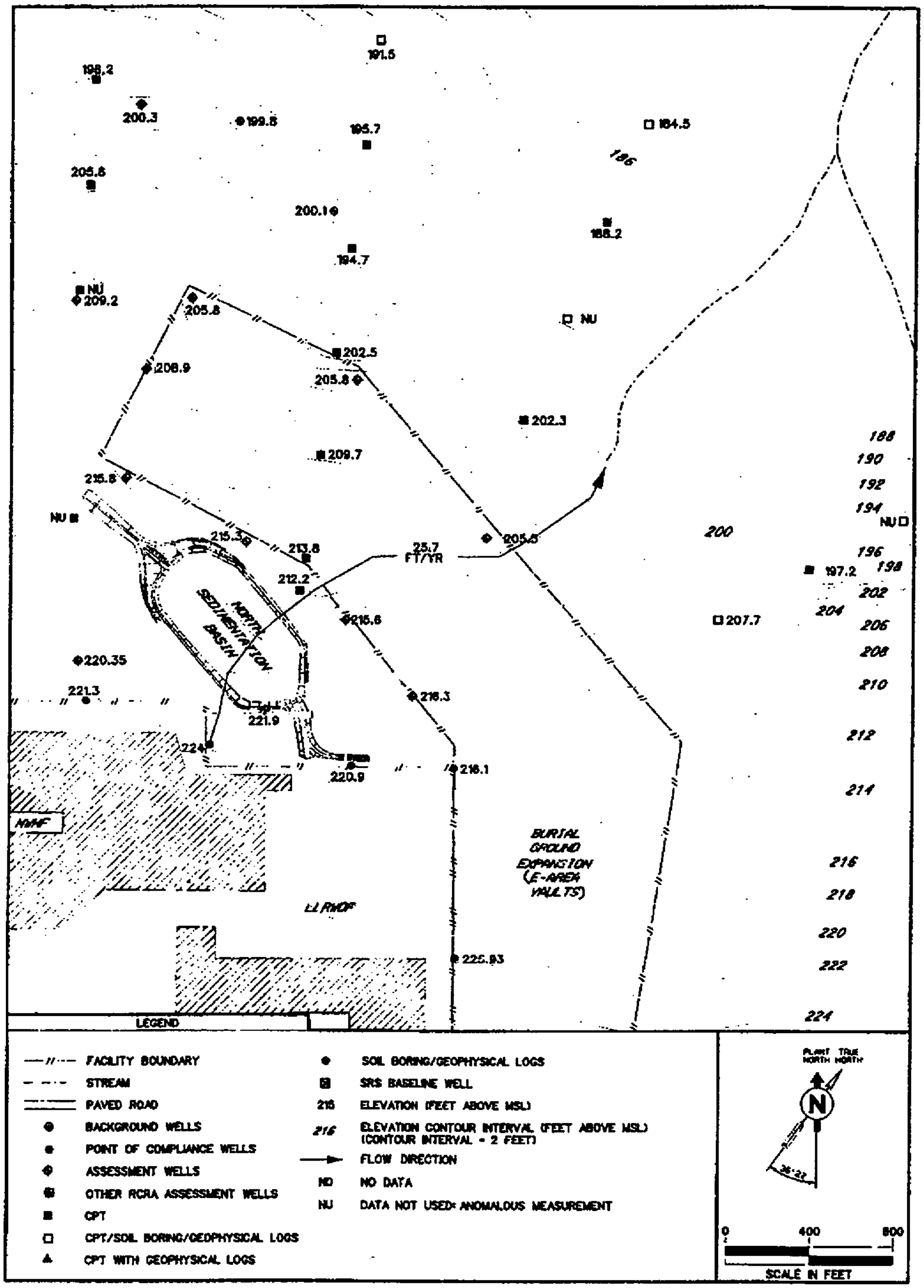

Fig. E.2.4-15. Potentiometric Surface Map of the Lower Aquifer Zone of the Upper Three Runs Aquifer, Northeast Plume Area

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Table E.2.4-7. Hydraulic Conductivity Data Based on Slug Tests for the Lower Aquifer Zone of the Upper Three Runs Aquifer in the Northeast Plume Area

WELL	HYDRAULIC CONDUCTIVITY (cm/sec)	(ft/day)
BGO 03C	3.53E-06	0.01
BGO 04C	4.09E-04	1.16
BGO 05C	4.59E-05	0.13
BGO 06C	5.33E-04	1.51
BGO 08C	4.90E-04	1.39
BGO 10B	1.09E-04	0.31
BGO 10C	2.47E-05	0.07
BGO 44B	2.12E-05	0.06
BGO 44C	2.82E-05	0.08
BGX 01C	1.27E-04	0.36
BGX 02B	7.41E-05	0.21
BGX 02D	1.20E-04	0.34
BGX 04C	4.09E-04	1.16
BGX 04D	1.02E-03	2.89
BGX 07D	7.19E-03	20.38
HMD 02D	3.21E-04	0.91
HMD 03D	6.00E-06	0.017
HMD 04D	1.23E-04	0.35
BGC MAXIMUM	7.19E-03	20.38
BGC MINIMUM	3.53E-06	0.01
BGC AVERAGE	4.86E-04	1.38
Northeast Plume Area MAXIMUM	7.19E-03	20.38
Northeast Plume Area MINIMUM	3.53E-06	0.01
Northeast Plume Area AVERAGE	6.14E-04	1.74

NOTES:
cm/sec centimeters per second
ft/day feet per day
BGC Burial Ground Complex

SOURCES: Sirrine 1991a, 1991b, 1992; DOE 1988; WSRC 1995a, 1996a

Table E.2.4-8. Hydraulic Conductivity Data Based on Laboratory Tests for the Gordon Confining Unit, Northeast Plume Area

WELL	VERTICAL CONDUCTIVITY		HORIZONTAL CONDUCTIVITY	
	(cm/sec)	(ft/day)	(cm/sec)	(ft/day)
BGO 03A	3.20E-01	1.13E-04	7.41E-09	2.10E-05
BGT 09	8.22E-04	2.90E-07	1.10E-06	3.12E-03
BGT 11	3.12E-04	1.10E-07	3.50E-07	9.92E-04
BGT 22	8.50E-04	3.00E-07	6.50E-06	1.84E-02
BGX 02B	5.22E-02	1.84E-05	1.40E-08	3.97E-05
BGX 07D	1.85E-01	6.52E-05	4.69E-08	1.33E-04
BGX 09D	3.54E-01	1.25E-04	1.60E-07	4.54E-04
BGX 11D	5.30E-02	1.87E-05	3.20E-08	9.07E-05
HMD 01D	3.77E-03	1.33E-06	2.10E-08	5.95E-05
HMD 02D	3.20E-03	1.13E-06	1.90E-09	5.39E-06
HMD 03D	5.39E+00	1.90E-03	1.20E-06	3.40E-03
BGC MAXIMUM	9.64E+00	3.40E-03	6.50E-06	1.84E-02
BGC MINIMUM	6.52E-06	2.30E-09	1.90E-09	5.39E-06
BGC AVERAGE	6.51E-01	2.30E-04	7.05E-07	2.00E-03
Northeast Plume Area MAXIMUM	5.39E+00	1.90E-03	6.50E-06	1.84E-02
Northeast Plume Area MINIMUM	3.12E-04	1.10E-07	1.90E-09	5.39E-06
Northeast Plume Area AVERAGE	5.78E-01	2.04E-04	8.58E-07	2.43E-03

NOTES:

cm/sec centimeters per second
ft/day feet per day
BGC Burial Ground Complex

SOURCES: Sirrine 1991a, 1991b, 1992; DOE 1988; WSRC 1995a, 1996a

Gordon Aquifer

Groundwater flow in the Gordon Aquifer is northwest toward Upper Three Runs. Fig. E.2.4-16 is a detailed potentiometric map of the Gordon Aquifer in the Northeast Plume Area.

The flow rate for the Gordon Aquifer is estimated at 233 feet/year. Flow rate was calculated as discussed in Section E.2.1.2.1. The flow estimates are based on hydraulic conductivity values from aquifer tests in the BGC. Table E.2.4-9 provide additional hydraulic conductivity information from slug test data in the Gordon Aquifer. The estimated flow rate was calculated using an effective porosity of 0.25, a hydraulic gradient of 0.0035 feet/feet, and an average hydraulic conductivity of 45 feet/day (based on pumping tests).

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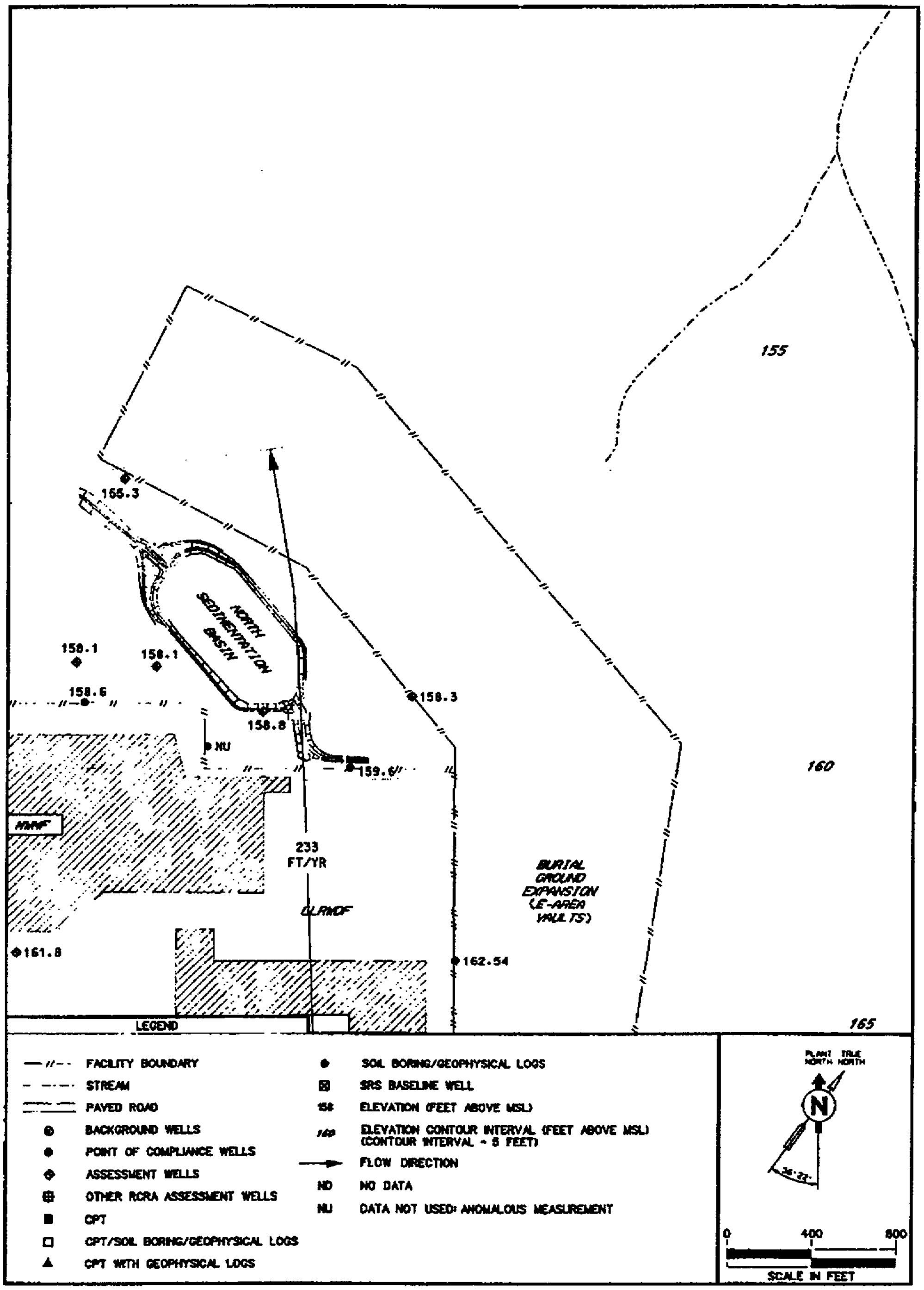

Fig. E.2.4-16. Potentiometric Surface Map of the Gordon Aquifer for the Northeast Plume Area

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Table E.2.4-9. Hydraulic Conductivity Estimates Based on Slug Tests for the Gordon Aquifer in the Northeast Plume Area

WELL	HYDRAULIC CONDUCTIVITY (cm/sec)	(ft/day)
BGO 03A	1.47E-03	4.18
BGO 06A	2.72E-04	0.77
BGO 08A	7.41E-05	0.21
BGO 08A(R)	5.64E-05	0.16
BGO 10AA	1.52E-04	0.43
BGO 10A	5.64E-05	0.16
BGO 10A(R)	3.00E-04	0.85
BGO 18A	4.23E-03	11.98
BGO 44A	1.42E-03	4.03
BGO 44AA	1.54E-03	4.37
BGX 01A	3.53E-06	0.01
BGX 04A	6.46E-04	1.83
BGC MAXIMUM	4.23E-03	11.98
BGC MINIMUM	1.76E-06	0.01
BGC AVERAGE	7.06E-04	2.00
Northeast Plume Area MAXIMUM	4.23E-03	11.98
Northeast Plume Area MINIMUM	3.53E-06	0.01
Northeast Plume Area AVERAGE	8.52E-04	2.42

NOTES:

cm/sec centimeters per second
ft/day feet per day
BGC Burial Ground Complex

SOURCES: Sirrine 1991a, 1991b, 1992; DOE 1988; WSRC 1995a, 1996a

E.2.5 HYDROGEOLOGIC INFORMATION ASSOCIATED WITH THE SOUTHEAST PLUME AREA

As part of the more recent groundwater investigations, according to the BGC FIP (WSRC-RP-93-848, Rev. 1), DPT (CPT and hydropunch) and field screening techniques were employed for delineating groundwater contamination at the BGC. The DPT and field screening technologies allowed for rapid collection of lithologic and water quality samples at closely spaced locations (Fig. E.2.5-1). Data collected using DPT have been integrated with BGC groundwater monitoring well and core data to provide a detailed characterization of the Southeast Plume Area.

Hydropunch was also used at three locations in conjunction with CPT to characterize the extent of groundwater contamination at the Southeast Plume Area. CPT was initially used to characterize the Southeast Plume Area because it provides samples quickly, efficiently, and cost effectively. CPT is a simple push technology, which does not involve mud-rotary drilling, and was utilized for sampling the UAZ-UTRA (Water Table Aquifer) and the LAZ-UTRA.

DPT sampling was conducted at four locations. All four locations were sampled via CPT while three locations were sampled via hydropunch. ECPT and gamma logs were collected at all four locations. Additional DPT sampling was conducted at eight sampling locations upgradient of the Southeast Plume Area. These locations were used to determine the impact, if any, from the upgradient sources. The electronic lithologic logs consist of tip and sleeve friction, pore pressure, and friction ratio. ECPT logs were correlated with the natural gamma logs and core to

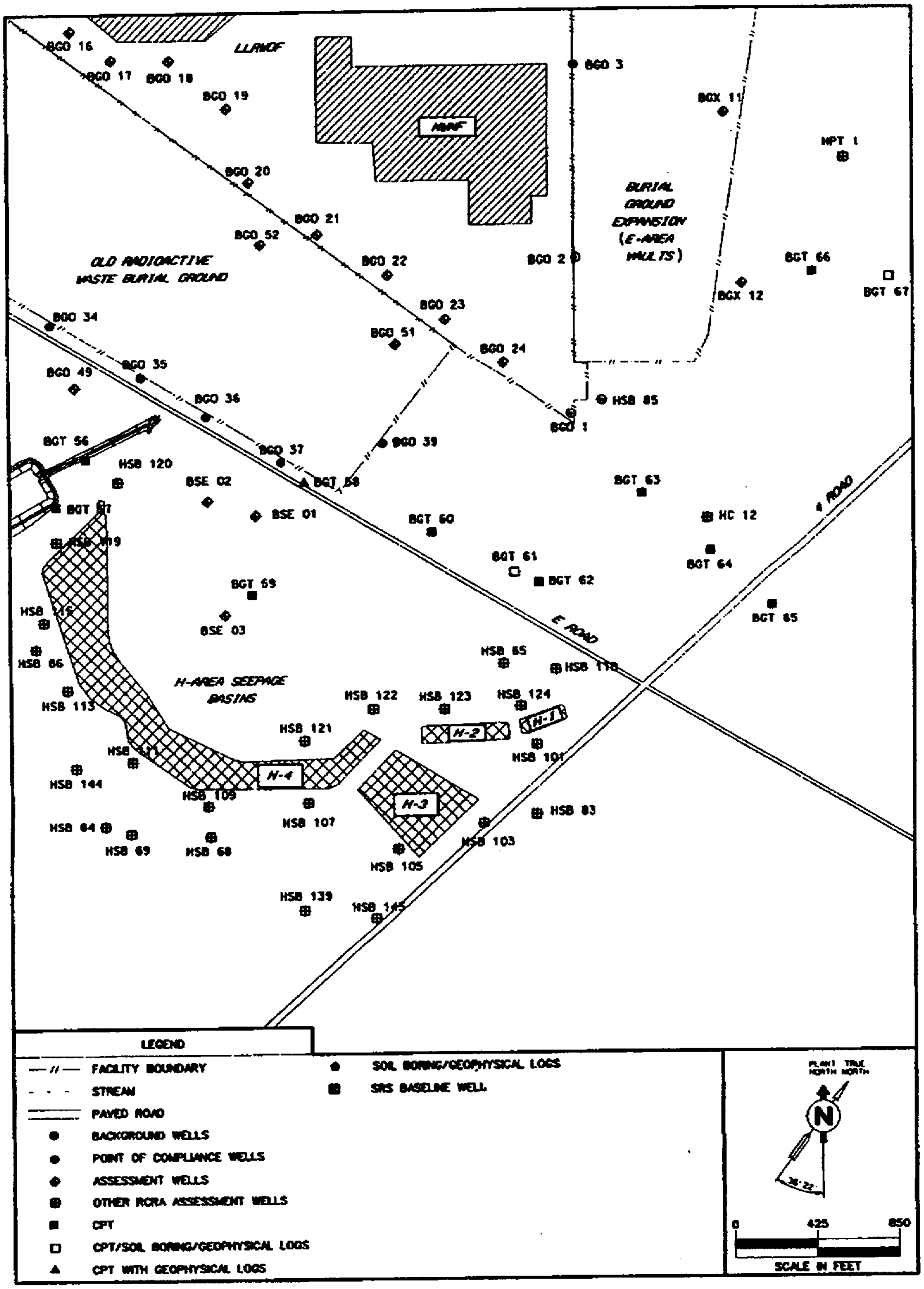

Fig. E.2.5-1. Sample Locations for the Southeast Plume Area

determine the depth-discrete DPT water sampling depths. Of the two DPT methods employed, CPT was used most extensively to characterize the Southeast Plume Area. The second DPT method, hydropunch, utilized mud-rotary drilling, which allows sampling at greater depths than does CPT. Hydropunch was used to collect data from the Gordon Aquifer and deeper sections of the LAZ-UTRA. At each hydropunch location, the first water sample was collected at the same depth as the deepest CPT sample. This technique allowed for a comparison of results between the two sampling methods. Detailed descriptions of the sampling methods have been provided in the Burial Ground Complex Field Investigation Preliminary Data Report #2 (WSRC-RP-96-060).

Originally, it was known that three distinct plume areas existed based on data collected from groundwater monitoring wells. However, as an outcome of the DPT activities, a fourth plume, the Southeast Plume Area, was identified. In 1997, three multi-level monitoring well clusters were installed to provide long-term monitoring at the Southeast Plume Area. Each well cluster contained two wells each with four depth-discrete screen zones for sampling. The screen zones were based on the FIP DPT data.

Lithologic data and geophysical logs from core locations and ECPT logs were used to determine unit elevations and thicknesses.

Sampling locations from which data on all tables in Section E were derived are shown on Map 11 in Appendix 1 and on Fig. E.2.5-1. Table E.2.5-1 depicts the unit elevations and thickness from cores at the BGC. Table E.2.5-2 depicts the unit elevations and thicknesses

Table E.2.5-1. Hydrostratigraphic Picks from Core Data in the Southeast Plume Area

Boring ID	"Tan Clay" Confining Zone		Lower Aquifer Zone		Gordon Confining Unit		Gordon Aquifer		Meyers Branch Confining System
	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)
BGO 03A	197	10	187	57	130	9	121	93	28
BGO 05C	218	17	201						
BGO 06A	210	15	195	74	121	1	120		
BGO 06B	203	11	192	55	137	14	123		
BGO 08A	213	14	199	69	130	10	120		
BGO 09AA	224	13	211	76	135	10	125		
BGO 10A	209	2	207	76	131	7	124		
BGO 10AA	219	12	207	77	130	4	126		
BGO 12A	200	14	186	47	139	10	129		
BGO 14A	218	9	209	71	138	22	116		
BGO 16A	196	12	184	55	129	5	124		
BGO 18A	203	5	198	67	131	7	124		
BGO 20AA	206	13	193	64	129	21	108	64	44
BGO 25A	212	11	201	63	138	10	128		
BGO 26A	224	19	205	72	133	4	129		
BGO 27C	199	7	192						
BGO 29A	196	11	185	53	132	13	119		
BGO 31C	198	10	188						
BGO 33C	203	12	191						
BGO 35C	203	10	193						
BGO 37C	201	11	190						
BGO 39A	204	11	193	81	112	18	94	66	28
BGO 41A	214	8	206	69	137	16	121		

Table E.2.5-1. Hydrostratigraphic Picks from Core Data in the Southeast Plume Area

Boring ID	"Tan Clay" Confining Zone		Lower Aquifer Zone		Gordon Confining Unit		Gordon Aquifer		Meyers Branch Confining System
	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)
BGO 42C	216	7	209						
BGO 43AA	195	11	184	53	131.	18	113		
BGO 44AA	222	23	199	68	131	11	120		
BGO 45A	207	10	197	63	134	4	130		
BGO 46B	200	12	188	60	128	6	122		
BGO 47A	198	9	189	60	129	7	122		
BGO 48C	198	6	192						
BGO 49A	201	9	192	73	119	4	115		
BGO 50A	194	17	177	45	132	13	119		
BGO 51AA	204	11	193	87	106	18	88	53	35
BGO 52AA	207	10	197	72	125	9	116	98	18
BGO 53AA	223	31	192	55	137	5	132	95	37
BGX 01A	211	13	198	64	134	9	125		
BGX 02B	216	18	198	58	140	13	127		
BGX 04A	225	12	213	84	129	12	117		
BGX 07D	225	5	220	63	157	13	144		
BGX 09D	207	12	195	53	142	10	132		
BGX 11D	193	16	177	51	126	9	117		
BSE 01C	218	15	180	67	113				
BSE 02C	195	7	188						
BSE 03C	211	15	196						
HMD 01C	232	11	221	82	139	13	126		
HMD 02C	223	7	216	73	143	5	138		

Table E.2.5-1. Hydrostratigraphic Picks from Core Data in the Southeast Plume Area

Page 3 of 3

Boring ID	"Tan Clay" Confining Zone		Lower Aquifer Zone		Gordon Confining Unit		Gordon Aquifer		Meyers Branch Confining System
	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)
HMD 03C	224	5	219	64	155	5	150		
HMD 04C	224	4	220	67	153	12	141		
HSB 143	198		179						
HSB 151	193		183						
HSB 152	198		186						
HSB 85A	204	10	194	70	124	6	118	79	39
NWP 01SB	212	5	207	76	131	17	114	75	39
OFS 01SB			186	57	129	5	124		
OFS 02SB	198	10	188	62	126	6	121		
OFS 03SB	196	11	185	60	125	5	120		
OFS 04SB	196	4	192	65	127	5	122		
OFS 05SB	189	11	178	56	122	5	117		
P 28TA	215	4	211	70	141	8	133	69	64
SWP 01SB	192	14	178	50	128	18	110	75	35

NOTES:

[box] These cores were utilized in the hydrostratigraphic description of the Southeast Plume Area.

msl mean sea level

ft feet

Table E.2.5-2. Hydrostratigraphic Picks from Electric Cone Penetrometer Testing Logs in the Southeast Plume Area

				"Tan Clay" Confining Zone		Lower Aquifer Zone		Gordon Confining Unit		Gordon Aquifer		Meyers Branch Confining System
Sampling Location ID	Northing	Easting	Ground Elevation (ft msl)	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (msl)
BGT 01	76700.60	59178.40	282.90	223	14	195	59	136	6	130		
BGT 02	76957.60	59607.20	276.40	213	15	198	61	138	5	133		
BGT 03	77197.60	60045.90	275.70	213	14	199	56	143	2	141	72	69
BGT 04	77437.60	60484.50	259.20	213	9	204	56	148				
BGT 05	77677.60	60924.10	225.70	214	5	209	62	147	2	145	81	64
BGT 06	77254.80	58746.70	282.20	218	20	198	56	142	15	127		
BGT 07	77717.80	58935.70	276.40	212	13	199	58	141	9	132		
BGT 08	78161.50	59118.60	249.30	221	4	217	68	149				
BGT 09	78642.30	59316.70	226.00	208	4	204	55	149	10	139	74	65
BGT 10	79104.60	59507.20	215.20	201	7	194	44	150	10	140		
BGT 11	79566.90	59697.70	222.50					156	12	144	77	67
BGT 12	77291.20	58045.90	284.20	225	11	214						
BGT 13	77488.90	58074.00	287.80	224	8	216						
BGT 14	77984.00	58143.40	280.70	215	6	209	69	140	13	127		
BGT 15	78479.20	58212.80	277.50	209	8	201	51	150				
BGT 16	78974.10	58283.50	250.70					151				
BGT 17	79469.70	58350.00	240.70					150				
BGT 18	79965.30	58416.50	216.50					162	15	147	92	55
BGT 20	80956.40	58549.60	159.50					151	11	140	70	70
BGT 21	77280.70	56952.50	294.20	223	7	216						
BGT 22	77860.30	56970.30	281.00	233	18	215	89	126	12	114	64	50
BGT 23	78279.70	56997.00	270.00	216	6	210						

Table E.2.5-2. Hydrostratigraphic Picks from Electric Cone Penetrometer Testing Logs in the Southeast Plume Area

Sampling Location ID	Northing	Easting	Ground Elevation (ft msl)	"Tan Clay" Confining Zone		Lower Aquifer Zone		Gordon Confining Unit		Gordon Aquifer		Meyers Branch Confining System
				Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)	Thickness (ft)	Elevation Top (ft msl)
BGT 24	78779.20	57019.20	265.80	227	7	220						
BGT 25	79278.70	57041.40	264.80	229	5	224						
BGT 27	80277.70	57085.90	256.90	217	10	207	55	152				
BGT 28	80777.20	57108.10	258.30	216	26	190	34	156	6	150	98	52
BGT 29	81276.70	57130.40	243.00	218	3	215						
BGT 30	81726.30	57150.40	219.00	208	2	206	64	142	5	137		
BGT 31	77228.97	56189.75	308.76	220	5	215						
BGT 32	77791.41	56121.10	310.12	237	3	234						
BGT 33	78404.46	56037.17	290.42	239	16	223						
BGT 34	78803.92	56027.45	286.76	221	7	214						
BGT 35	79305.84	55929.89	267.73	217	4	213						
BGT 36	79801.93	55867.47	261.36	226	11	215	67	148				
BGT 37	80298.03	55805.00	251.60	222	7	215	82	133				
BGT 40	77297.15	55644.42	332.32	209	6	203						
BGT 41	77734.75	55490.12	328.37	224	5	219	70	149	7	142		
BGT 42	78240.66	55313.07	310.92	224	5	219						
BGT 43	79655.92	54816.04	277.08	205	4	201						
BGT 44	80127.67	54650.36	276.20	214	5	209						
BGT 45	80461.74	54533.05	285.28	218	9	209	59	150				
BGT 46	76714.30	55354.96	310.00	213	8	205	71	134	9	125		
BGT 47	77051.85	54986.57	317.32	218	15	203	63	140	11	129		
BGT 48	77135.74	54895.09	314.33	217	8	209						
BGT 49	76203.90	54946.30	297.26	222	8	214	79	135	9	126		

Table E.2.5-2. Hydrostratigraphic Picks from Electric Cone Penetrometer Testing Logs in the Southeast Plume Area

Sampling Location ID	Northing	Easting	Ground Elevation (ft msl)	"Tan Clay" Confining Zone Elevation Top (ft msl)	"Tan Clay" Confining Zone Thickness (ft)	Lower Aquifer Zone Elevation Top (ft msl)	Lower Aquifer Zone Thickness (ft)	Gordon Confining Unit Elevation Top (ft msl)	Gordon Confining Unit Thickness (ft)	Gordon Aquifer Elevation Top (ft msl)	Gordon Aquifer Thickness (ft)	Meyers Branch Confining System Elevation Top (msl)
BGT 50	76359.30	54756.20	296.27	221	7	214	82	132	8	124		
BGT 51	75519.81	54505.65	272.64	193	7	186						
BGT 53	75837.68	53422.04	278.25	200	9	191	71	120	11	109	77	32
BGT 54	75941.66	52889.14	279.96	205	9	196						
BGT 56	73521.24	56265.77	262.94	182	7	175						
BGT 57	73268.51	56104.24	259.35	179	10	169						
BGT 58	73406.90	57399.60	285.76	192	2	190	78	112	9	103		
BGT 59	72802.60	57123.20	281.88	182	9	173						
BGT 60	73120.63	58057.22	291.42	186	10	176						
BGT 61	72911.77	58490.09	284.30	184	6	178	70	108	7	101		
BGT 62	72854.40	58609.00	282.03	190	14	176						
BGT 63	73319.43	59146.34	293.67	195	6	189						
BGT 63A	73646.40	58768.10	290.79	198	4	194						
BGT 64	73013.74	59499.95	283.25	195	7	188	65	123				
BGT 66	74476.55	60033.67	244.04	195	7	188						
BGT 67	74443.06	60426.74	242.30	187	14	173	38	135	8	127	99	50

NOTES: Hydrostratigraphic picks from the ECPT logs are not exact. There is a difference of (+) or (-) 1 foot.

[box] These CPTs were utilized in the hydrostratigraphic description of the Southeast Plume Area.

msl mean sea level

ft feet

interpreted from ECPT logs collected in the Southeast Plume Area. Structure contour and isopach maps for each of the aquifers and aquitards in the Southeast Plume Area were constructed using a composite of data from these two tables.

Fig. E.2.5-2 and Fig. E.2.5-3 are the structure contour and isopach maps, respectively, of the "tan clay" confining zone. The density of data points allows for detailed mapping of the unit surface and thickness. Undulations in the confining unit surface, changes in lithology, and structural features could potentially influence horizontal and vertical contaminant transport. There is a structural low located to the southeast and a structural high located to the southwest. The low and high areas correspond with thinning and thickening, respectively, of the "tan clay" confining zone, as shown on the isopach map. However, on the structure map there is a prominent feature possibly caused by carbonate dissolution. This dissolution would have caused the overlying sediments to settle, thereby creating an offset within the "tan clay" confining zone.

Fig. E.2.5-4, Fig. E.2.5-5, and Fig. E.2.5-6 depict the structure contour, thickness of the LAZ-UTRA, and the thickness of the calcareous zone within this aquifer, respectively. The calcareous zone includes calcareous sands, sandy limestones, and sandy muddy limestones. The location of calcareous zones could potentially influence contaminant transport.

At the southeast corner of the ORWBG, there is a substantial amount of calcareous material within the LAZ-UTRA. Table E.2.5-3 presents the thickness of the calcareous zone from cores in the Southeast Plume Area. The calcareous zone thins to the southeast as it extends beyond the ORWBG.

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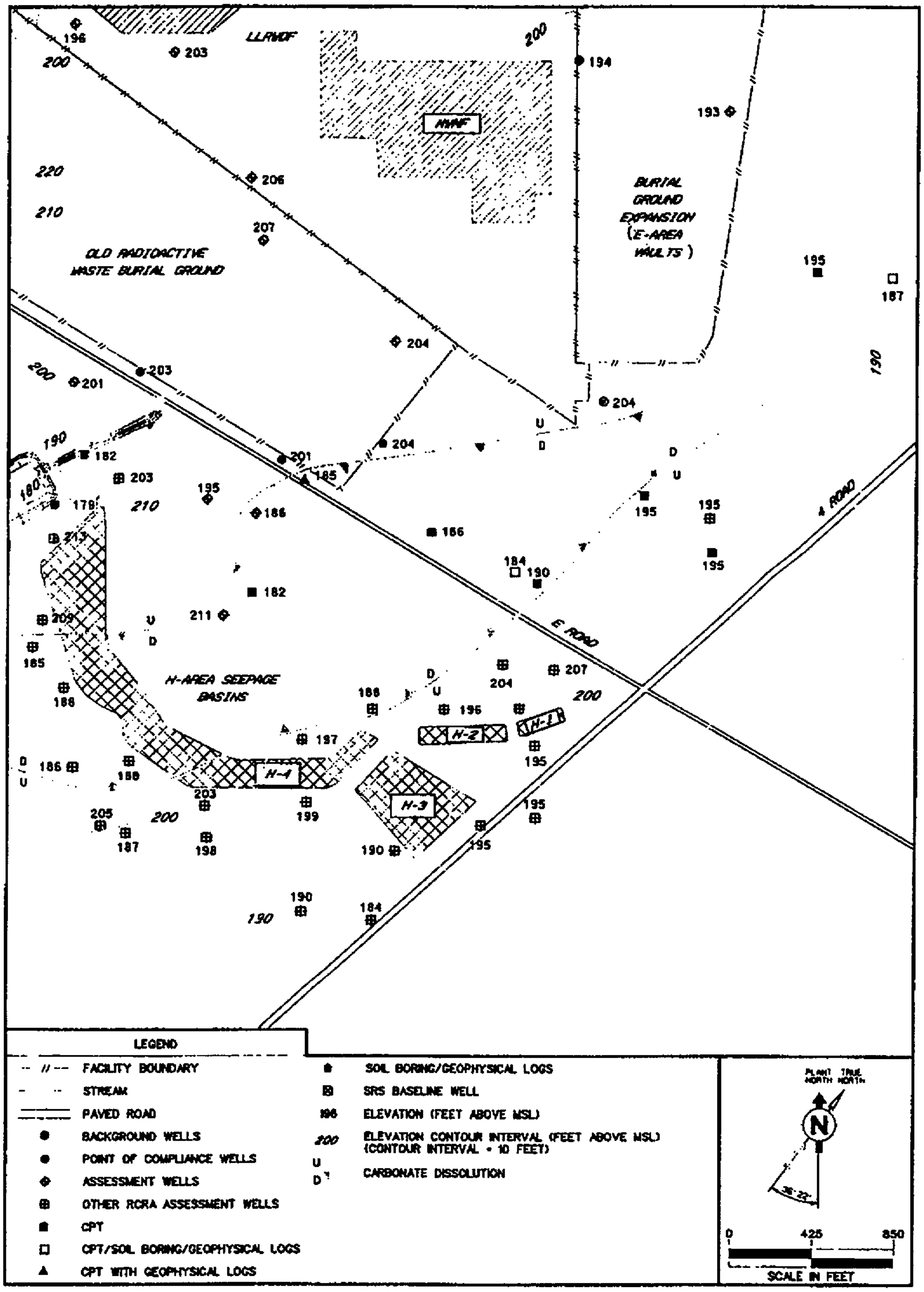

Fig. E.2.5-2. Structure Contour Map of the "Tan Clay" Confining Zone in the Southeast Plume Area

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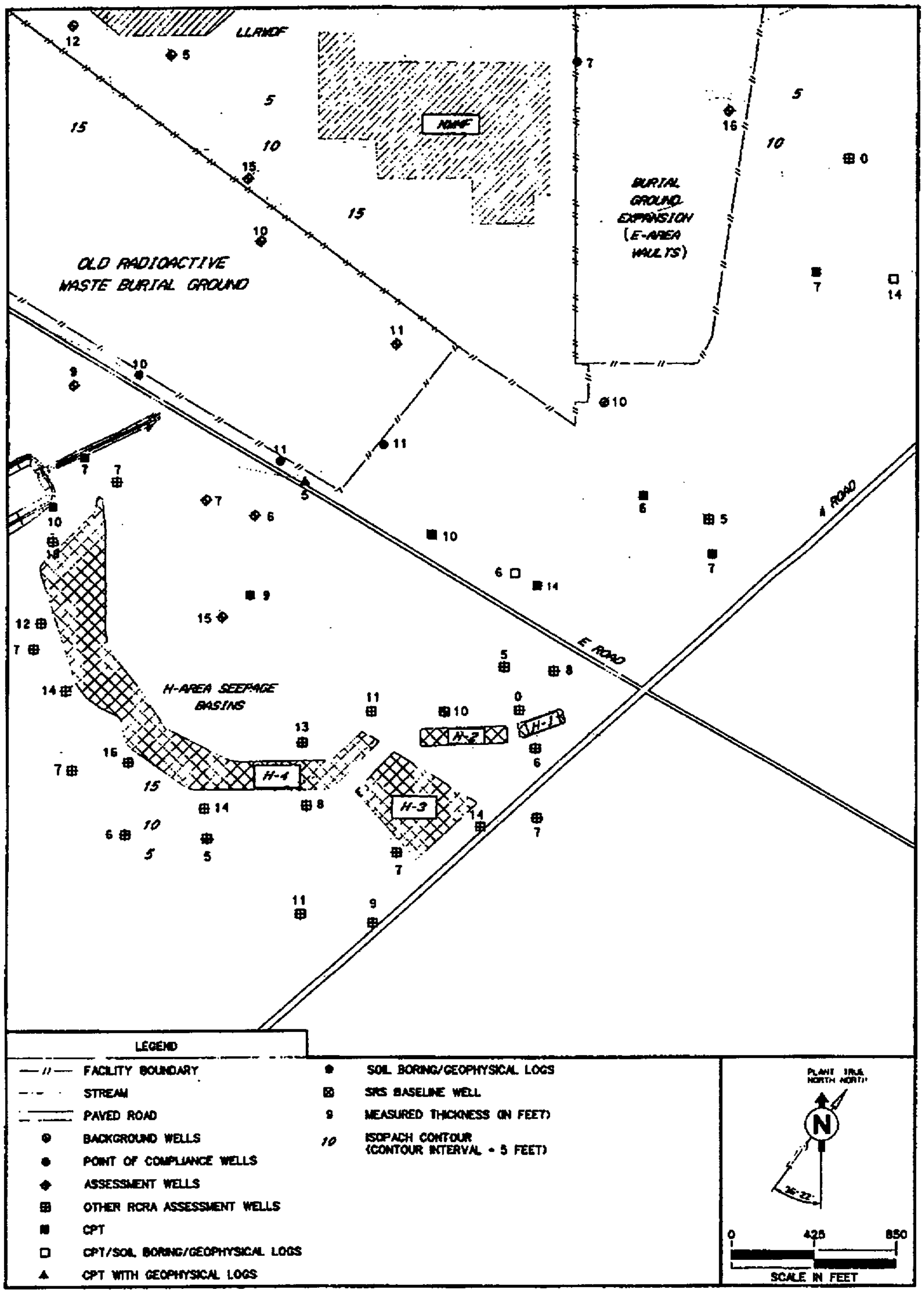

Fig. E.2.5-3. Isopach Map of the "Tan Clay" Confining Zone in the Southeast Plume Area

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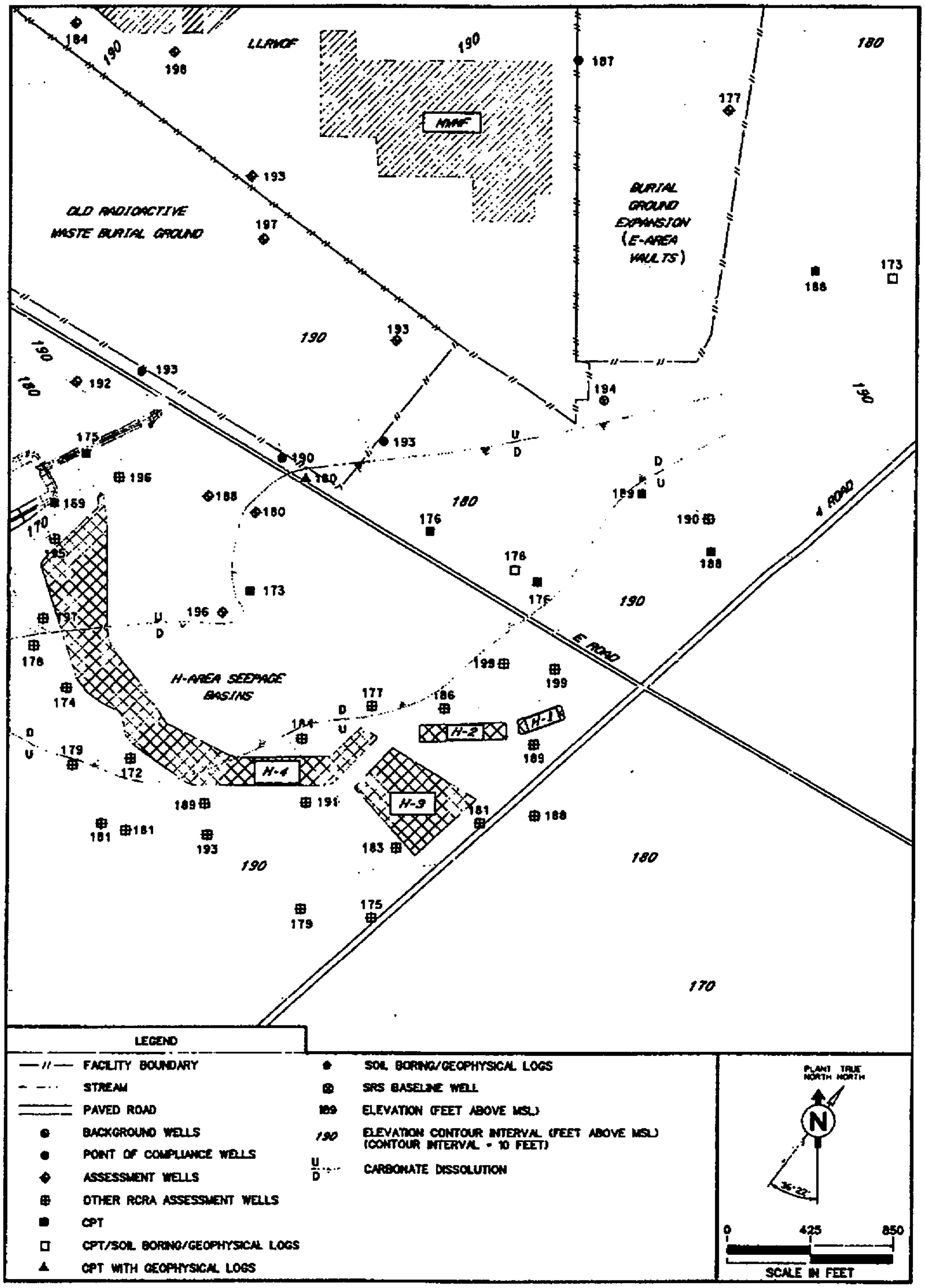

Fig. E.2.5-4. Structure Contour Map of the Lower Aquifer Zone of the Upper Three Runs Aquifer in the Southeast Plume Area

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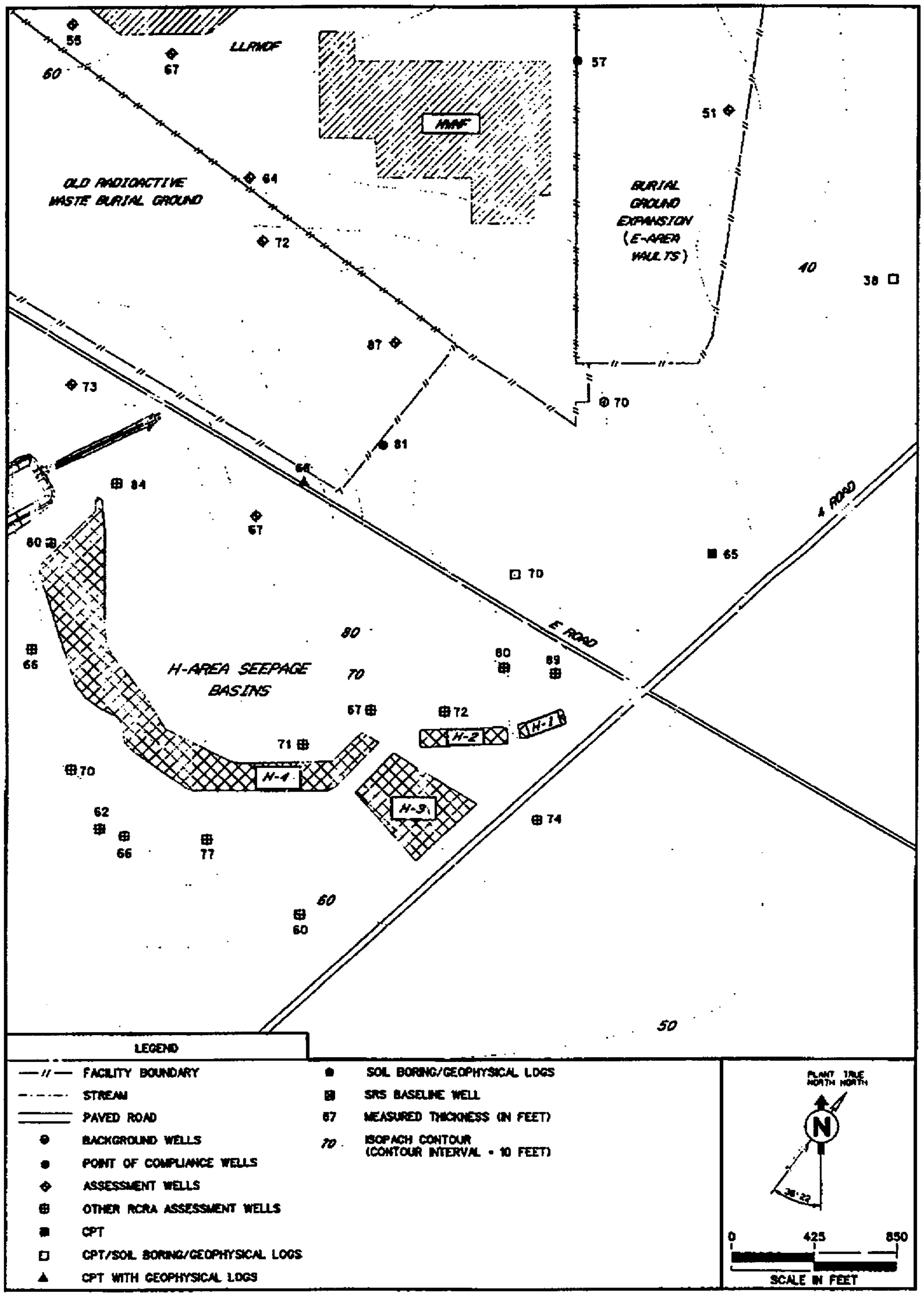

Fig. E.2.5-5. Isopach Map of the Lower Aquifer Zone of the Upper Three Runs Aquifer in the Southeast Plume Area

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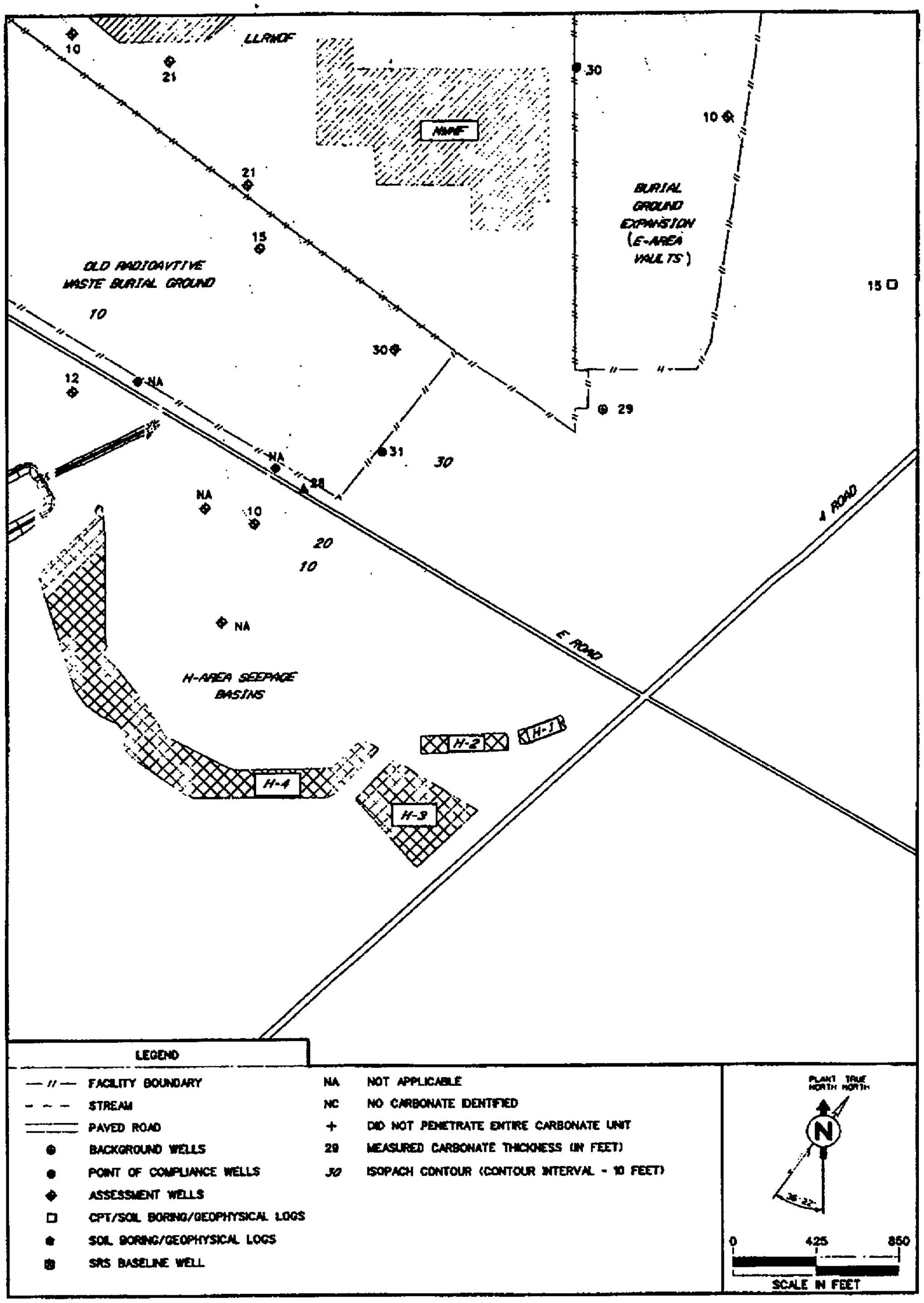

Fig. E.2.5-6. Isopach Map of Calcareous Sediments in the Lower Aquifer Zone of the Upper Three Runs Aquifer in the Southeast Plume Area

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Table E.2.5-3. Carbonate Hydrostratigraphy of the Southeast Plume Area

Well	Ground Elevation (ft msl)	Calcareous Interval (ft msl)		Thickness (ft)	Hydrostratigraphic Unit
		Top	Bottom		
BGO 03	288.2	158	130	28	LAZ-UTRA
BGO 16	302.8	160	150	10	LAZ-UTRA
BGO 18	292.9	152	131	21	LAZ-UTRA
BGO 20	280.9	150	129	21	LAZ-UTRA
BGO 39	293.7	143	112	31	LAZ-UTRA
BGO 49	269.1	146	134	12	LAZ-UTRA
BGO 51	289.2	136	106	30	LAZ-UTRA
BGO 52	281.6	130	115	15	LAZ-UTRA
BGT 58*	285.8	146	115	32	LAZ-UTRA
BGT 67	284.3	150	135	15	LAZ-UTRA
BGX 11	273.8	157	147	10	LAZ-UTRA
BSE 01	283.7	124	113	10	LAZ-UTRA
HSB 85	292.1	162	133	29	LAZ-UTRA

NOTES:
msl mean sea level
ft feet
* Inferred data from cross sections

The structural low in the "tan clay" confining zone at the base of the UAZ-UTRA (Water Table Aquifer) is still present in the underlying LAZ-UTRA.

Fig. E.2.5-7 and Fig. E.2.5-8 are the structure contour and isopach maps of the Gordon Confining Unit, respectively. The structural low area in the UAZ-UTRA (Water Table Aquifer) has shifted to the northeast and is accompanied by thinning of the Gordon Confining Unit.

Fig. E.2.5-9 and Fig. E.2.5-10 are the structure contour and isopach maps of the Gordon Aquifer, respectively. A structural high is located to the northeast as the Gordon Aquifer thickens in the same direction.

Fig. E.2.5-11 is the structure contour map of the Crouch Branch Confining Unit. The structure of the top of the Crouch Branch Confining Unit increases in elevation to the northeast.

Fig. E.2.1-5 shows the locations of hydrostratigraphic cross sections in the Southeast Plume Area. Cross Section S-S′ (Fig. E.2.5-12) is a north-south transect across the Southeast Plume Area, and Cross Section R-R′ (Fig. E.2.5-13) is an east-west transect across the Southeast Plume Area. These figures depict the relatively continuous nature of the units across most of the area. The calcareous zone within the LAZ-UTRA is illustrated on the section.

The one notable feature is the slump faulting in the area around BGT 58. This point provides an intersection point for the R-R′ and S-S′ transects. It appears that the calcareous zone has thinned significantly from the area to the west. This thinning has created instability in the upper hydrostratigraphic units causing subsidence and the associated

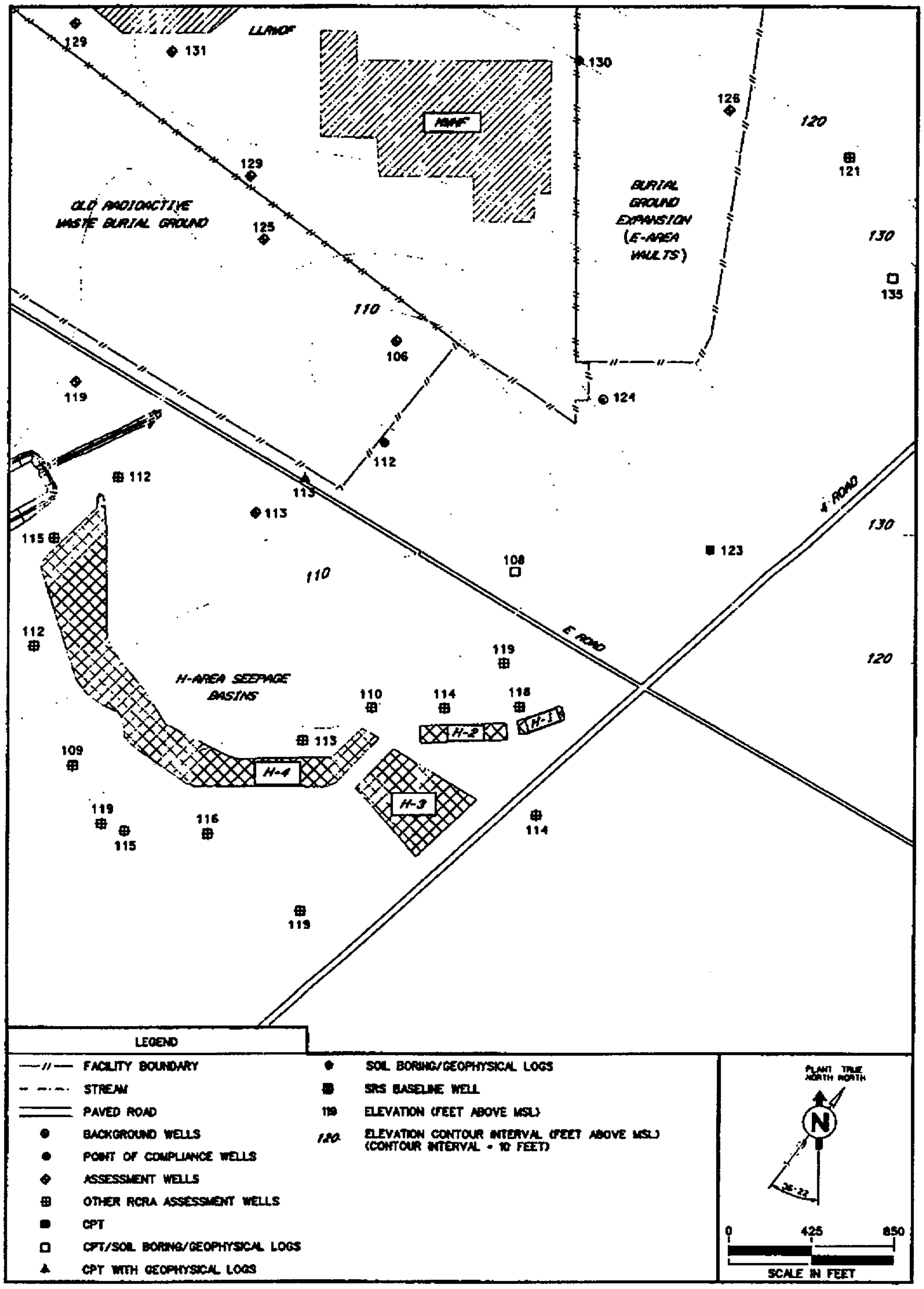

Fig. E.2.5-7. Structure Contour Map of the Gordon Confining Unit in the Southeast Plume Area

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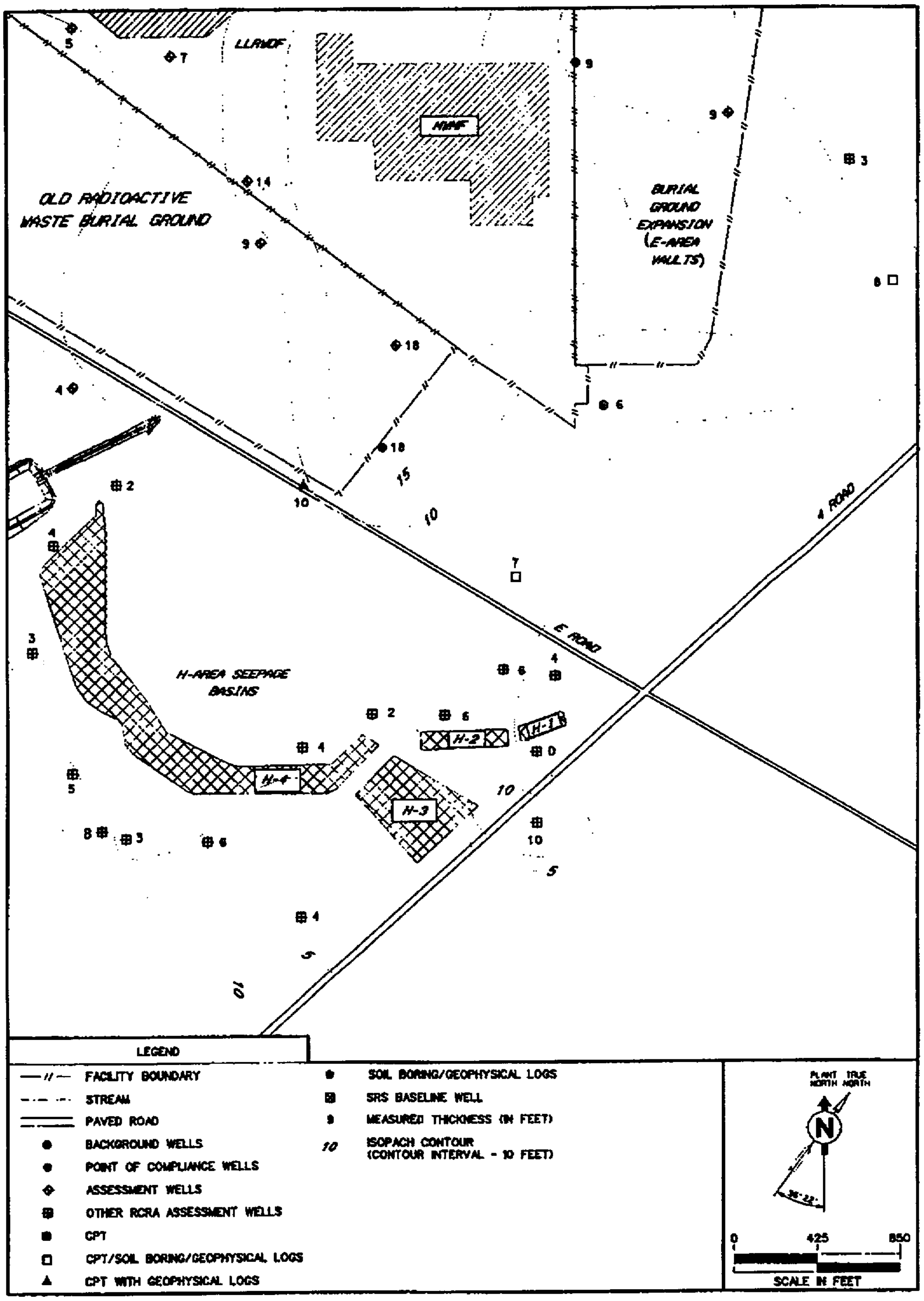

Fig. E.2.5-8. Isopach Map of the Gordon Confining Unit in the Southeast Plume Area

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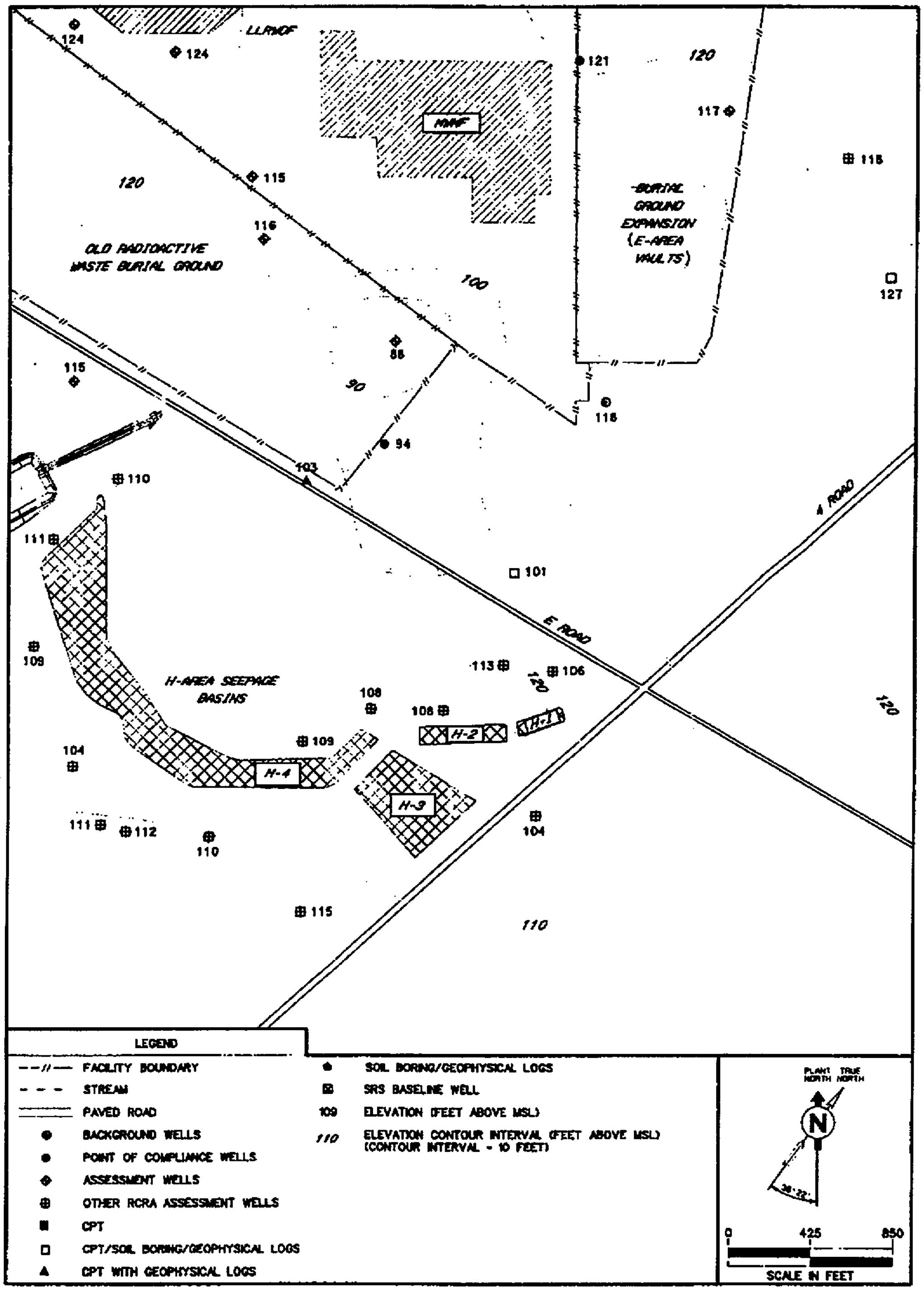

Fig. E.2.5-9. Structure Contour Map of the Gordon Aquifer in the Southeast Plume Area

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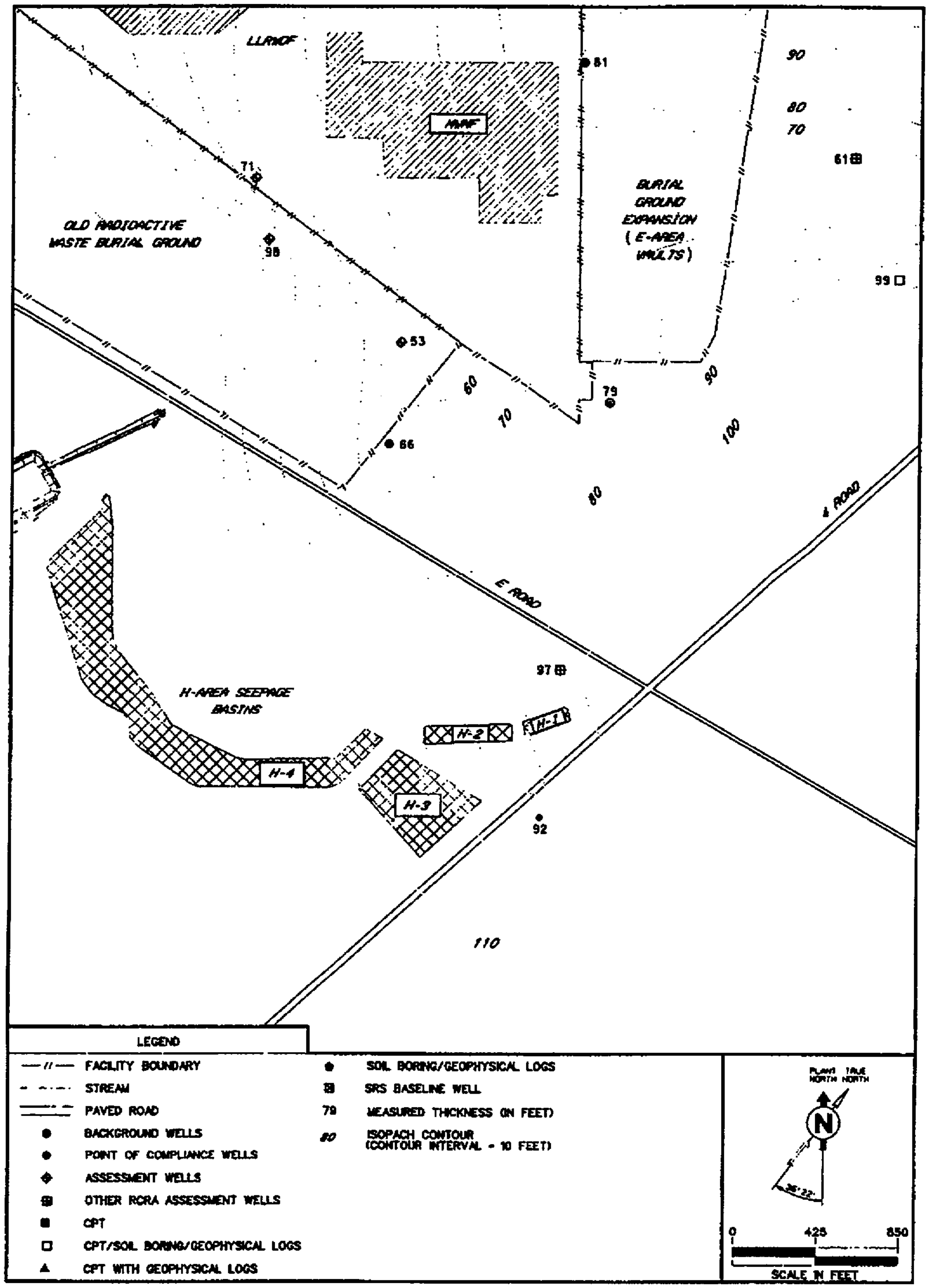

Fig. E.2.5-10. Isopach Map of the Gordon Aquifer in the Southeast Plume Area

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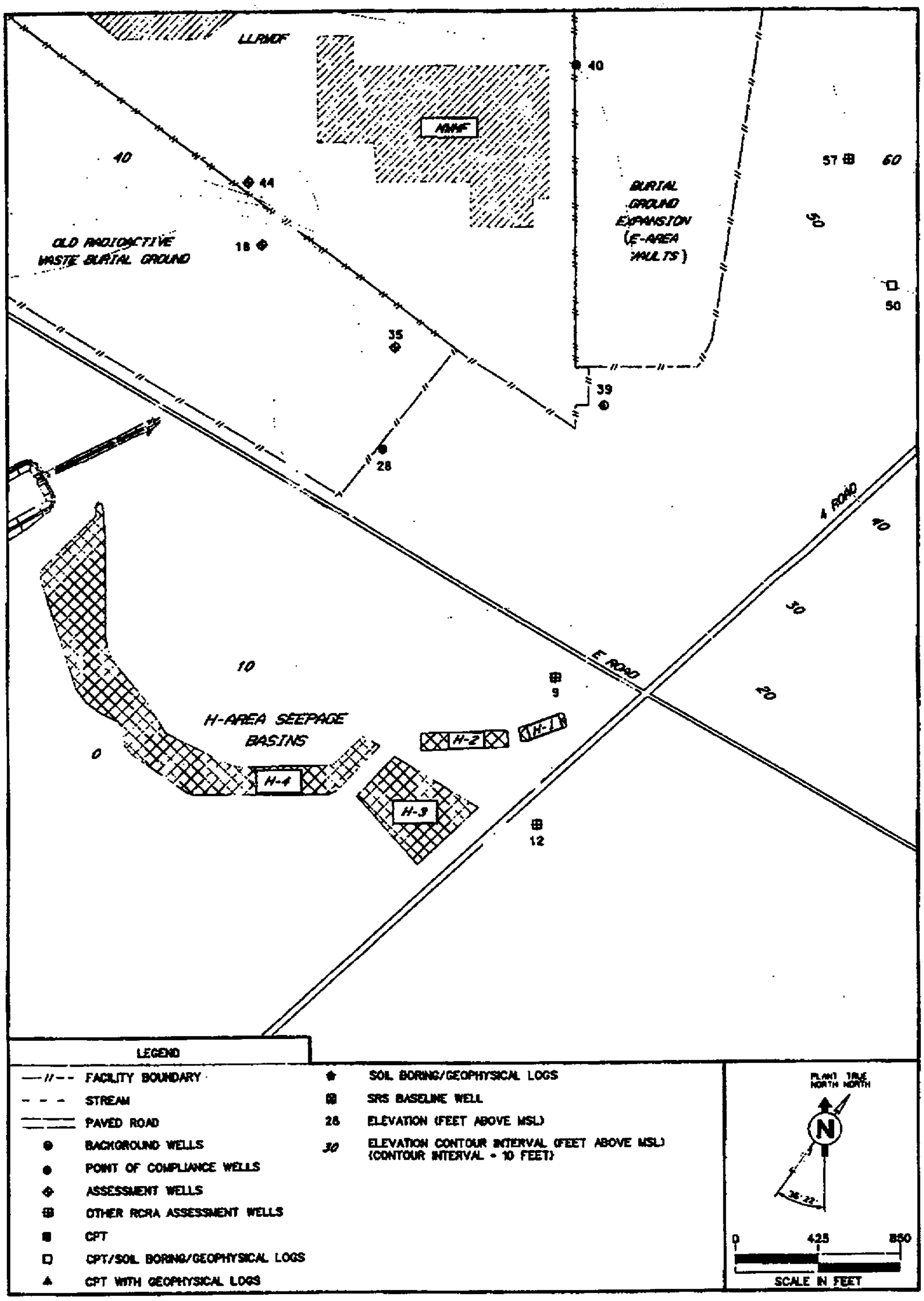

Fig. E.2.5-11. Structure Contour Map of the Crouch Branch Confining Unit in the Southeast Plume Area

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