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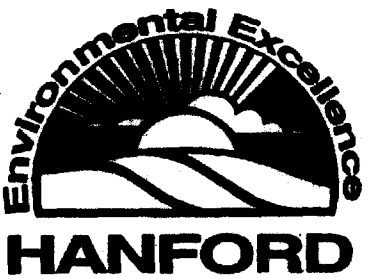
Rev. 1

Geophysical Investigation of the 618-10 and 618-11 Burial Grounds, 300-FF-2 Operable Unit



Prepared for the U.S. Department of Energy
Office of Environmental Restoration

Bechtel Hanford, Inc.
Richland, Washington

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Authors: K. A. Bergstrom
D. J. Bolin
T. H. Mitchell

Approval: C. R. Johnson, 300 Area Task Manager

Charlie R. Johnson 9/18/97
Signature Date

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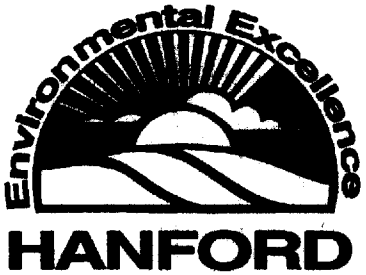

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1.0 INTRODUCTION

This document summarizes the results of geophysical investigations conducted at two radioactive solid waste burial grounds, 618-10 and 618-11. The burial grounds are located approximately 4.5 miles and 7 miles north of the 300 Area, respectively (Figures 1, 2, and 3). These sites are within the 300-FF-2 Operable Unit, where geophysical techniques are being used to characterize the distribution of solid waste in the subsurface as part of the Limited Field Investigations for this operable unit (DOE-RL 1994).

The 618-10 Burial Ground is an inactive burial ground that is documented as used primarily for mixed solid radioactive waste (DeFord et al. 1994). The site is located roughly 4.5 miles north of the 300 Area (Figures 1 and 2). It was previously known as the 300 North Burial Ground and as 318-10. It was active between 1954 and 1963 and received a broad spectrum of low to highly radioactive waste. Documentation on the contents of the burial ground is limited, but existing documentation suggests that the waste is contained in 12 trenches ranging in size from 40 ft wide and 50 ft long to 75 ft wide and 300 ft long (Figure 4). Documentation also shows 94 vertical pipe units (VPUs) in the burial ground. The VPUs are within 6 rows, each row containing 12 to 19 VPUs (Figure 4). The VPUs are believed to be similar in design to those used at the 618-11 Burial Ground (Figure 5).

The 618-11 Burial Ground is an inactive, radioactive solid waste burial ground located directly west of the Washington Public Power Supply System Plant No. 2 (Figures 3 and 6). It also is referred to as the "Y" Burial Ground, 318-11, and the 300 Wye Burial Ground. It was operated from 1962 to 1967. It is roughly 375 ft wide and 1,000 ft long. The burial ground includes three parallel, east- west-trending trenches, 50 VPUs (Figure 5), and an undetermined number of 8-ft-diameter caissons (Figure 7). The trenches are documented as 900 ft long, 50 ft wide, and 25 ft deep (Figure 8). The burial ground contains a vast spectrum of low to highly radioactive waste in various containers (Figure 9).

Ground-penetrating radar (GPR) and electromagnetic induction (EMI) were the geophysical techniques used in the investigations. These methods were selected because both are cost-effective, nonintrusive, and have been successful in similar waste characterization projects conducted on the Hanford Site. A description of each site and the objectives for each investigation are given in Table 1. For a more thorough description of each of the sites, refer to Webb (1993a, 1993b), DeFord et al. (1994), and Demiter and Greenhalgh (1995).

2.0 METHODOLOGY

2.1 GROUND-PENETRATING RADAR

GPR is a noninvasive, environmentally safe method of detecting, locating, and/or mapping shallow subsurface features. The method uses a transducer to transmit FM-frequency, electromagnetic (EM) energy into the ground. Interfaces in the ground, defined by contrasts in dielectric constants, magnetic susceptibility, and to some extent, electrical conductivity, reflect the transmitted energy. The GPR system then measures the travel time between transmitted pulses and arrival of reflected energy. Buried objects such as pipes, barrels, foundations, and wires can cause all or a portion of the transmitted energy to be reflected back towards a receiving antenna. Geologic features such as crossbedding, caliche horizons, paleosols, and clays can also cause reflections of a portion of the EM energy. The velocity of the EM energy is primarily controlled by the dielectric constant and magnetic susceptibility of the medium. Values of EM velocities for depth calculations are determined by experience in an area, by ties to known buried reflectors, and from knowledge of the subsurface medium.

The maximum depth of investigation varies at each site and is a function of the transmitter power, receiver sensitivity, frequency of the antenna, and attenuation of the transmitted energy. The attenuation of the energy is primarily a function of the local soil conditions. High attenuation and, therefore, small penetration depths of the EM energy typically occur where ground conductivity is greater than 10 millisiemens per meter and/or in areas with numerous reflective interfaces. The depth of investigation is also affected by highly conductive material such as metal drums and pipes, which essentially reflect all the energy. The method cannot see directly below areas of highly reflective material because all of the energy is reflected.

The reflected energy provides the means for mapping the subsurface features of interest, whether man-made or geologic. Display and interpretation of GPR data are similar to that of seismic reflection data, e.g., data are displayed as horizontal distance versus time and depict pseudo cross sections of the earth. The end product is a plan view map that shows the location and depth of features detected within the survey area. The interpretation is influenced by the objectives of the survey, the experience of the interpreter, and the data processing techniques used. In some areas interpretations can be straightforward, but a highly variable subsurface often yields complex data that are difficult to interpret.

The GPR equipment used at the 618-11 Burial Ground was a Geophysical Survey Systems, Inc. (GSSI) Subsurface Interface Radar (SIR) (a trademark of Geophysical Survey Systems, Inc.) System 10. A recording window of 108 nanosecond two-way travel time was used. The GPR equipment used at the 618-10 Burial Ground was a GSSI SIR (a trademark of Geophysical Survey Systems, Inc.) System 8, model 4800 (the SIR-10 was not available). A recording window of 100 nanoseconds two-way travel time was used. A 300-MHz antenna was used at both sites. Maximum calculated depths of usable data varied from 10 to 14 ft for these surveys.

2.2 ELECTROMAGNETIC INDUCTION

EMI is also a noninvasive, environmentally safe method of detecting, locating, and/or mapping shallow subsurface features and is often synergetic when used with GPR. The EMI technique investigates electrical conductivity properties of subsurface soil, rock, or groundwater. An alternating current is applied to a transmitter coil, which in turn creates an EM field. This field enters the ground and induces horizontal eddy currents in the earth. A receiver coil detects the resultant secondary EM field, which is linearly related to the subsurface conductivity.

Terrain (ground) conductivity is a function of the natural soil matrix and pore fluid electrical conductivity. The depth of investigation depends on the electrical properties of the subsurface, the distance between the transmitter and receiver coils, the sensitivity of the equipment, and the power of the source. The EMI equipment records a composite conductivity value that represents the combined effect of the thickness, depth, and specific conductivity of each stratigraphic layer, as well as any nonnatural conductive objects (e.g., metallic drums, solid debris). EMI exploration has been successful at many hazardous waste sites because conductivity of metal objects normally overwhelms the background or natural soil conductivity.

EMI data points are normally taken along profile lines within a grid system. Computer software converts these regularly and/or randomly spaced data points to a contour plot (Figure 10). Although general trends are easily discernible, quantitative limits such as depth, size, or area are not readily obtainable from these plots alone. However, zones of high conductivity greatly increase the confidence in GPR analysis.

The Geonics EM-31D (a trademark of Geonics Limited) ground conductivity meter employs a coil separation of 12 ft, which has a maximum effective penetrating depth of 18 ft. Data points were recorded with a Polycorder 516C Data Logger. Data stations as well as profile lines were at 5-ft intervals in both the 618-10 and 618-11 Burial Grounds.

2.3 ACCURACY/RELIABILITY OF THE RESULTS

EMI and GPR are proven geophysical methods for many engineering and environmental objectives. Although the instruments are capable of recording accurate and precise quantitative measurements, the final results of an investigation are based on a subjective interpretation and understanding of the data. The ultimate test of accuracy is through excavation or drilling.

Reliability of these geophysical surveys represents the degree of confidence the interpreter(s) has in the interpretation of the data. Many factors affect the reliability of the geophysical interpretation but generally can be divided into two groups. One group is relatively independent of the geophysicist and includes factors such as soil conditions, topography, accuracy of existing drawings, photographs, accessibility of the area, and geologic understanding of the area. The second group of factors is more dependent on the geophysicist

and the project goals. These factors include the skill of the interpreter, experience in the area, and the density of the data.

This work was performed in accordance with the *Environmental Investigations Procedures*, Environmental Investigations Procedure (EIP) 7.2, "Geophysical Survey Work" (BHI 1994).

3.0 SURVEY GRID PARAMETERS

Table 2 summarizes the grid survey parameters for each site. Labeled stakes are located every 10 ft along the outside perimeter of the grids. The grids are tied to existing concrete burial ground monuments. The southwestern corner of each grid is usually designated E100/N100 and serves as the origin for the survey locations. The letters "E" and "N" refer to a direction that trends generally east or north, respectively. The number refers to a distance in feet. For example, grid point E130/N120 lies 30 ft east and 20 ft north of grid point E100/N100. For purpose of discussion only, it is assumed that the grid is oriented north-south/east-west.

4.0 GEOLOGIC SETTING

The current understanding of the geology underlying the 300 Area is based on an integration of regional data, Hanford Site data, and wells drilled in and adjacent to the 300 Area. The shallow subsurface geology of the 300 Area includes three formations, listed in order of oldest to youngest: Saddle Mountain Basalt of the Columbia River Basalt Group, the Ringold Formation, and the Hanford formation. The effective depths investigated by the geophysical methods are limited to the surficial sediments and the Hanford formation.

The surficial sediments are primarily eolian loess interspersed with lenses of sands mixed with gravel. The Hanford formation, which consists of cataclysmic Missoula flood deposits, primarily contains poorly sorted gravels and coarse sands indicative of a high-energy environment. Cross-bedding and paleosols such as caliche horizons are two of the more common geologic features found in the 300 Area that are often detectable with GPR. A comprehensive summary of the geology of the study area can be found in Lindsey (1991).

5.0 RESULTS

Plates 1 and 2 summarize the integrated interpretation of the EMI and GPR data. These plates should be referred to throughout the discussion of the results. The following five basic types of anomalies or anomalous areas are shown on Plates 1 and 2.

- High Concentrations of Buried Anomalies. Areas interpreted as having high concentrations of buried debris. The average thickness of fill soil overlying the debris is shown within these areas. In general, these areas contain a large amount of metallic debris.

- Moderate Concentrations of Buried Anomalies. Areas that appears to contain debris that is more spread out. Alternatively, these areas could have high concentrations of buried, non-metallic debris that does not respond as well to GPR and EMI.

- Linears. An alignment of single GPR anomalies of similar depth and/or character that were detected on several adjacent GPR profiles. Some of the more common features that form linears are pipes and cables. However, some linears may represent a coincidental alignment of features that just happen to be at the same depth.

- Isolated GPR or EMI Anomalies. A buried feature that is relatively isolated from the main concentrations of buried debris. If it is a GPR anomaly, the depth at which it was detected is shown. In some cases where there is a distinct single anomaly within a zone of anomalies, the single anomaly is highlighted. No estimate of the depths are given for the EMI anomalies.

- Reflecting Horizons/Zone. Area where a strong reflecting horizon does not appear to be a natural soil horizon. They are relatively flat and have the characteristics of a concrete slab, flat-lying metal sheets, or covers. Other common types of features displayed on the interpretations maps include excavation boundaries and reflecting horizons that appear to be geologic layers. However, not all detected geologic features and layering are shown.

5.1 618-10 BURIAL GROUND

The data were collected in two phases. The first phase consisted of collecting EMI and GPR data over the entire burial ground. GPR data were collected in two perpendicular directions, profiles separated by 10 ft. The EMI data were collected along north-south profiles spaced 5 ft apart with readings at 5-ft intervals, which resulted in a 5-ft by 5-ft grid of data. Data from the first phase were analyzed, and the location of the VPUs was interpreted in the southwest quadrant of the burial ground consistent with the available documentation. Based on the results of the first phase, a second phase was implemented that consisted of a denser grid of data in the southwest quadrant. The GPR spacing was decreased to a 5-ft by 5-ft spacing, and

additional EMI data were collected over the same 5-ft by 5-ft grid, but along east-west profiles (Figure 11).

Plate 1 shows the integrated interpretation of the EMI and GPR data. A contour map of the EMI data is shown in Figure 10. The southwest quadrant of EMI data is shown in Figure 11. Refer to Plate 1 and Figures 10 and 11 during the following discussion of the results. For discussion purposes, it is assumed that the grid is oriented north-south.

Few documents are available that describe the contents of the 618-10 Burial Ground: Webb (1993a) and DeFord et al. (1994). In general, the correlation between the limited documentation (Figure 4) and the results of the geophysical investigation ranges from poor in the eastern half of the site to satisfactory in the western half of the site. An interpreted paleosol (Figure 12) was used as a key marker horizon to map several trenches in the western half of the site. However, the paleosol was not easily identified throughout the entire burial ground. In many places it appears to have been removed during excavations for the trenches, and in other areas the readings were simply too weak to map with any consistency. Several other reflecting horizons are identified that have a signature similar to a paleosol, but do not appear to be a geologic phenomenon. Some are believed to be an emplaced layer, possibly used to prevent wind erosion. However, there is no known documentation to support this. For organizational purposes, results from the 618-10 Burial Ground are discussed in two sections, the western half and the eastern half.

5.1.1 Western Half, E100 to E300

A primary objective of the investigation was to verify and/or locate the VPUs that are believed to be located in the western half of the burial ground (Figure 4). The documentation shows four parallel rows of VPUs in the southwestern corner of the burial ground from E100 to E300 and N40 to N210. Four parallel rows of both GPR and EMI anomalies correspond with the documented location of the VPUs. However, the character of the anomalies are quite variable, suggesting that there are possibly several different designs of VPUs and/or additional debris buried near the VPUs that changes their signature. Figure 11 shows the relative variability in the EMI signature over the VPUs when compared to the uniform VPU signature in the 618-11 Burial Ground (Figure 13).

The documentation also indicates that there are two additional rows of VPUs northeast of the four rows of VPUs mentioned earlier (Figure 4). These VPUs are documented as oriented approximately north-south. There are notable linears at E295/N180 to N240 and E340/N210 to N260, but the character of the EMI linears are significantly different than the other four rows of apparent VPUs. A closely spaced grid of GPR data is required to adequately characterize all 94 VPUs.

North of the VPUs, between N290 and N350 and from E150 to E300, is an area with a heavy concentration of GPR anomalies, but with minimal response to the EMI. This is interpreted as a trench filled primarily with nonmetallic debris and/or metallic debris, buried deeper than 15 ft. Roughly 7 ft to 11 ft of fill is interpreted over the buried debris.

North of N320 are several pockets of scattered, mixed anomalies. Documentation suggests two east-west-trending trenches and one north-south-trending trench in this area. The geophysical data do not clearly identify the boundaries between trenches. A strong, shallow GPR reflector, at 0 to 2 ft, covers a significant portion of this area. This reflector appears to have been emplaced/developed after the waste was buried. It has the characteristics of a material that may have been used to cover this portion of the burial ground, possibly to prevent wind erosion. However, no known documentation exists that supports this scenario.

5.1.2 Eastern Half, E300 to E580

The eastern half of the site primarily shows minimal correlation with the available documentation. South of N120, the most notable features are two relatively large areas dominated by a strong GPR reflector. Each area also shows a strong EMI response. The most eastern area is elongated along an east-west axis with the reflector 3 to 5 ft below the surface. The westernmost area is elongated along a north-south axis with the reflector averaging 6 ft below the surface. No known documentation was discovered in this study regarding the type of waste or containers that are causing these anomalous features.

There appear to be pockets of buried debris from N120 to roughly N270, and most pockets showed little to no EMI response. This area appears to be dominated by waste containing minimal metallic material. The waste appears to be predominantly in two east-west trending trenches.

Between N120 and N270 the anomalies extend beyond both the eastern edge of the grid (E580) and the cement burial ground monuments. The grid was extended to the edge of the fence between N100 and N300. Only GPR data were collected in the extension. Scattered anomalies were detected between N140 and N270, out to roughly E590. No anomalies were detected east of E590. Between N100 and N140 a group of shallow (<2 ft deep) but distinct anomalies appears to extend up to the edge of the fence.

North of N270, the burial ground is dominated by large concentrations of buried debris of a mixed and somewhat confusing nature. The most unusual features are the 14 to 16 shallow (1 to 3 ft below the surface), elongated anomalies (Figure 14). These anomalies have a strong EMI and GPR signature, appear to have relatively flat tops, and are roughly 10 to 15 ft wide and 50 to 100 ft long. They are roughly 5 to 10 ft apart and form a radial, fan-like pattern. The vertical dimensions could not be determined. Documentation shows only three trenches/pits in this area, but the data suggest that it is one large area filled with high concentrations of buried waste.

The northeastern corner of the burial ground (N560/E580) has an anomalous GPR signature (Figure 15), but no corresponding EMI signature. This area has the characteristics of features related to the formation of clastic dikes or possibly an area dominated by localized concentrations of caliche. However, the possibility that the anomalous response is associated with buried debris cannot be discounted.

5.2 618-11 BURIAL GROUND

Plate 2 shows the integrated interpretation of the EMI and GPR data. A contour map of the EMI data is shown in Figure 13. Refer to Plate 2 and Figure 13 during the following discussion.

In general, the correlation between the existing documentation and the results of the geophysical investigation is relatively good. Figure 8 summarizes the documented layout of the burial ground. The data indicate that there are three long, east-west trenches, all beginning in the vicinity of E140 and terminating around E1040. The centerline of the southern trench, trench 3, is roughly N170. The centerline of the middle trench, trench 2, is N260, and the centerline of the northern trench, trench 1, is approximately N370.

Only the eastern- (E830 to E1040) and westernmost (E140 to E320) ends of trench 3 appear to contain detectable debris. The data suggest that the types of waste containers are highly variable and vary in concentration from relatively concentrated to scattered. The middle portion of trench 3 appears to never have been used for solid waste.

Two large portions of trench 3 (E320 to E530 and E620 to E780) have a unique geophysical signature that is not observed in other portions of the burial ground. It is referred to here as a dead zone (Figure 16). No solid waste/debris, with the possible exception of contaminated soil, appears to be buried within either of the dead zones. The material used to fill these portions of trench 3 is homogeneous and is similar in character to the local eolian sands. It appears that this portion of the trench was never used for solid debris-type waste. From E530 to E620, the data have a different character than the surrounding dead zones. No obvious debris is buried in this area either.

The middle trench, trench 2, has the largest concentration of detectable waste. It appears to be relatively full throughout the entire length of the trench.

The northern trench, trench 1, is relatively full of debris between E390 and E1040. However, in the western end of trench 1 (E100 to E460), only a few isolated areas contain detectable buried debris. Additionally, the excavation boundaries in the western end of this trench (E100 to E460) are not clear. Refer to Plate 2 for further details.

The VPUs and caissons were detected in the northeastern portion of the burial ground, which is consistent with existing documentation and aerial photographs (Figures 6 and 8). The data suggest that two 8-ft-diameter caissons are most likely between E640 and E680 along N440. Between E710 and E860 there is a row of what appear to be 13 VPUs. The three apparent VPUs on the western end of this row, from E710 and E750, are approximately 15 ft apart. The 10 VPUs between E760 and E860 are roughly 10 ft apart.

Further to the east, along N440 and between E980 and E1080, is another row of what appear to be VPUs. There appear to be ten (10) VPUs in this row, all approximately 10 ft apart. Thirty feet to the north, along N470 from E880 to E1080, is a third row of interpreted VPUs,

containing an additional 20 VPUs spaced roughly 10 ft apart. A fourth row of VPUs was detected along N410. This row appears to contain an additional ten VPUs spaced about 10 ft apart. A total of 53 possible VPUs were detected, as well as two large-diameter caissons. The exact locations of the VPUs cannot be mapped without more closely spaced GPR profiles.

6.0 SUMMARY/RECOMMENDATIONS

Plates 1 and 2 summarize the results from the geophysical investigations of the 618-10 and 618-11 Burial Grounds.

The survey design and interpretation philosophy were reconnaissance in nature with the exception of the southwest corner of the 618-10 Burial Ground. Therefore, many isolated anomalies were not plotted or detected. Typical depths were posted at generalized locations and do not represent the actual interpreted depth to an individual anomaly. However, in some cases, individual anomalies are plotted if they are relatively isolated or stand out among the surrounding debris. The entire set of GPR and EMI data for both the 618-10 and 618-11 Burial Grounds can be found in the 300-FF-2 Operable Unit project file. Additional detailed analyses, along with individual GPR profiles, can be provided. These detailed analyses, rather than the summary interpretation provided in this document, should be used for planning intrusive activities.

In general, the documentation on the number of trenches and VPUs in the 618-11 Burial Ground matched the geophysical data. The three documented east-west trenches correlate relatively well with the results of the geophysical interpretation. Additionally, the number and spacing of reported VPUs and caissons in 618-11 correlates with the geophysical data. The geophysical data contain 53 similar anomalies, spaced and located where documentation indicates VPUs. Two larger geophysical anomalies correlate with documentation suggesting two large-diameter caissons. The VPUs in 618-11 all appear to have similar designs with the exception of the two large-diameter caissons.

The documentation for 618-10 is limited and much of what exists is not reliable, particularly for the eastern half of the burial ground. The general location of the rows of VPUs from known documentation correlates with the geophysical data. However, the variability of the geophysical anomalies over the interpreted VPUs in 618-10 suggests several different designs and possibly different materials (e.g., non-ferrous) than that found in the 618-11 Burial Ground.

Three or four pit/trench areas can be inferred from the geophysical data in the western half of 618-10. This generally agrees with documentation. However, correlation between documented pits and the geophysical interpretation is poor in the eastern portion of the burial ground. In particular, a series of 14 to 16 shallow, relatively narrow, elongated, strong anomalies in the northeastern quadrant are an enigma.

A close-spaced grid will typically provide additional information on the nature and volume of the buried waste. However, the 10-ft spacing between profiles was sufficient to meet the objective of the surveys, with the exception of the area surrounding the VPUs in 618-10. To clearly delineate the location and depths of these VPUs, a tighter grid of GPR data, on the order of 1 to 2 ft, with possibly a higher resolution antenna (e.g., 500 MHz) will be required. The locations and depths of the VPUs in the 618-11 Burial Ground are better delineated. Again, a tighter spacing between GPR profiles would increase the resolution in 618-11, especially over the two apparent 8-ft-diameter caissons.

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Figure 1. Hanford Site Location Map.

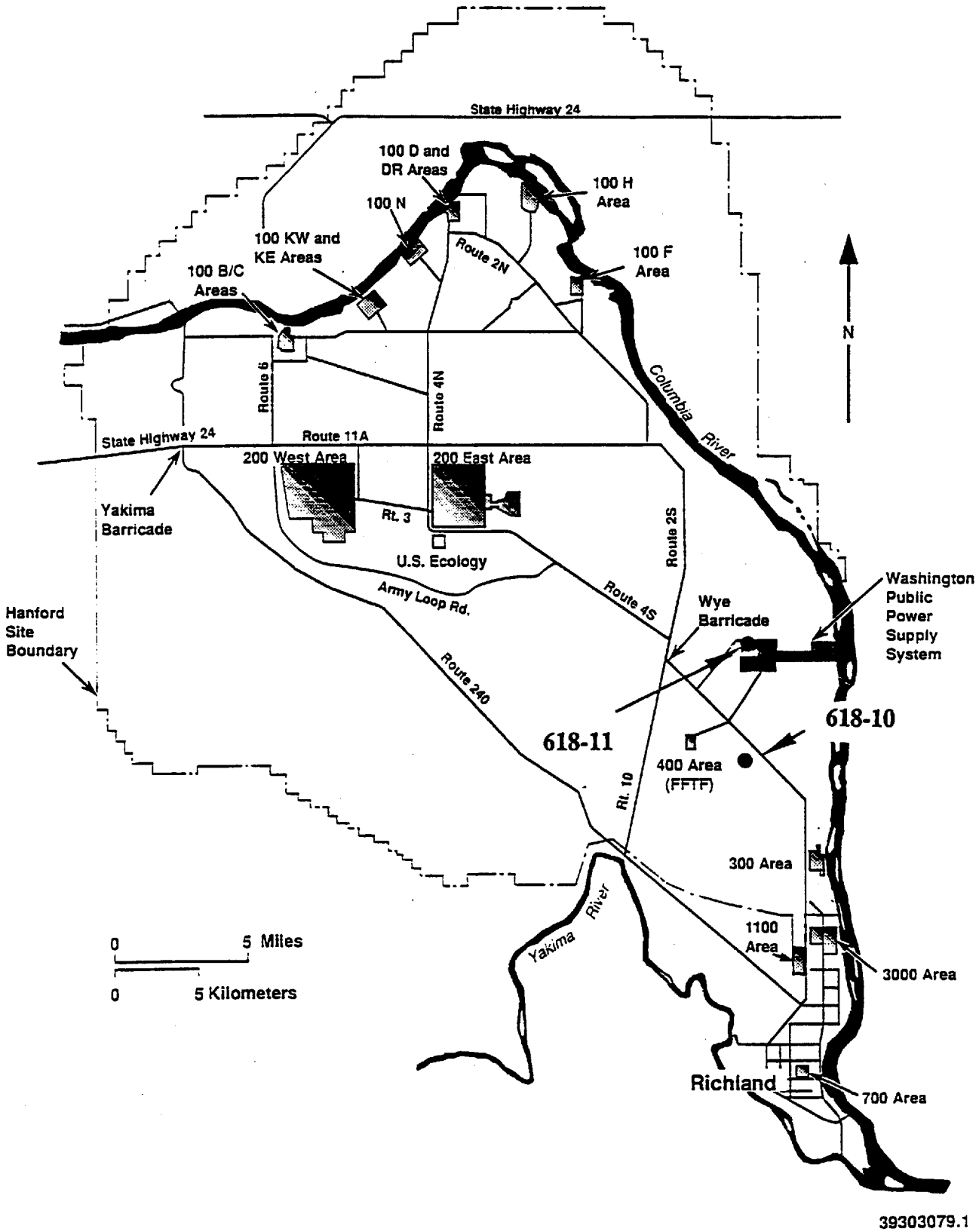


Figure 2. Location Map of the 618-10 Burial Ground.

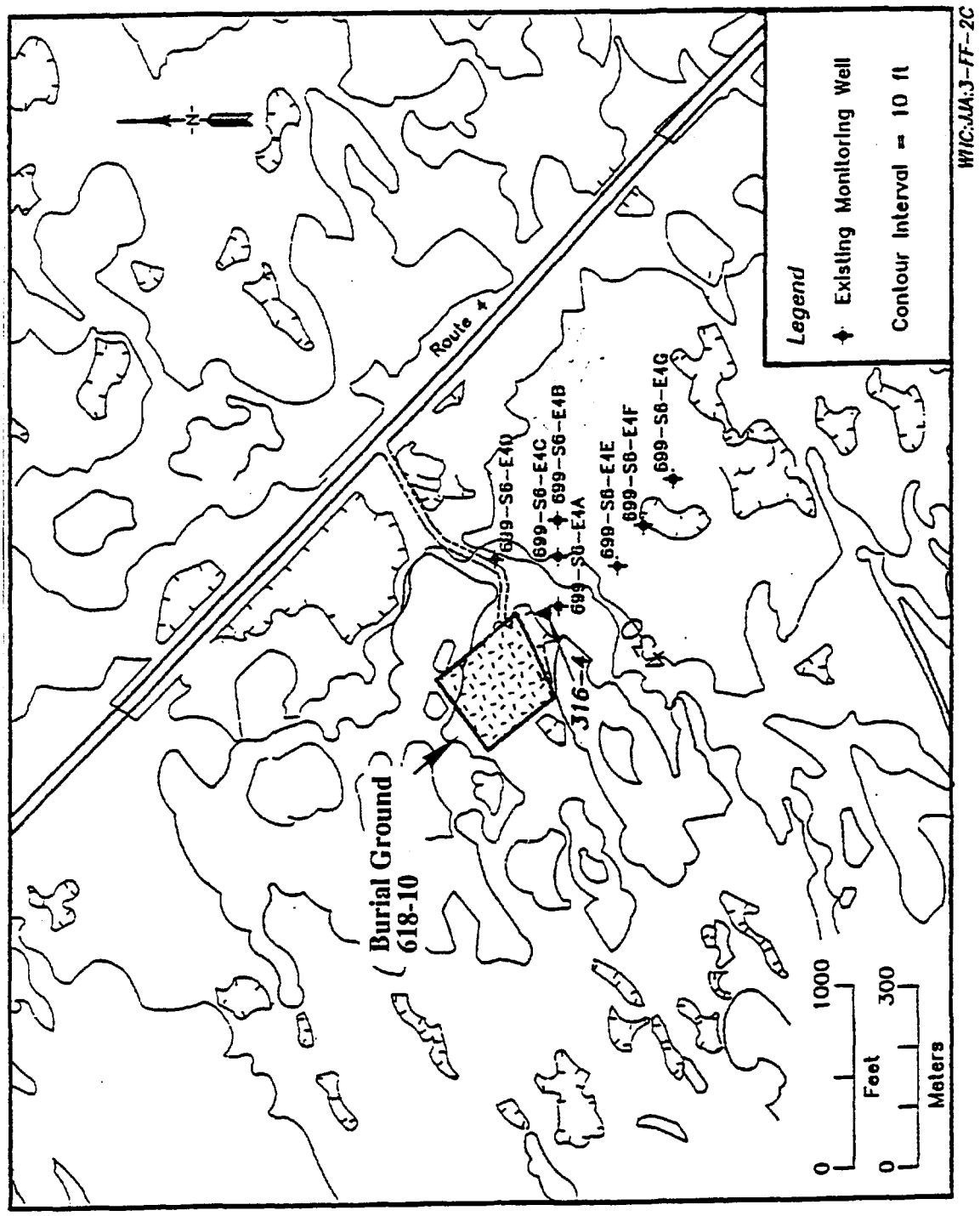
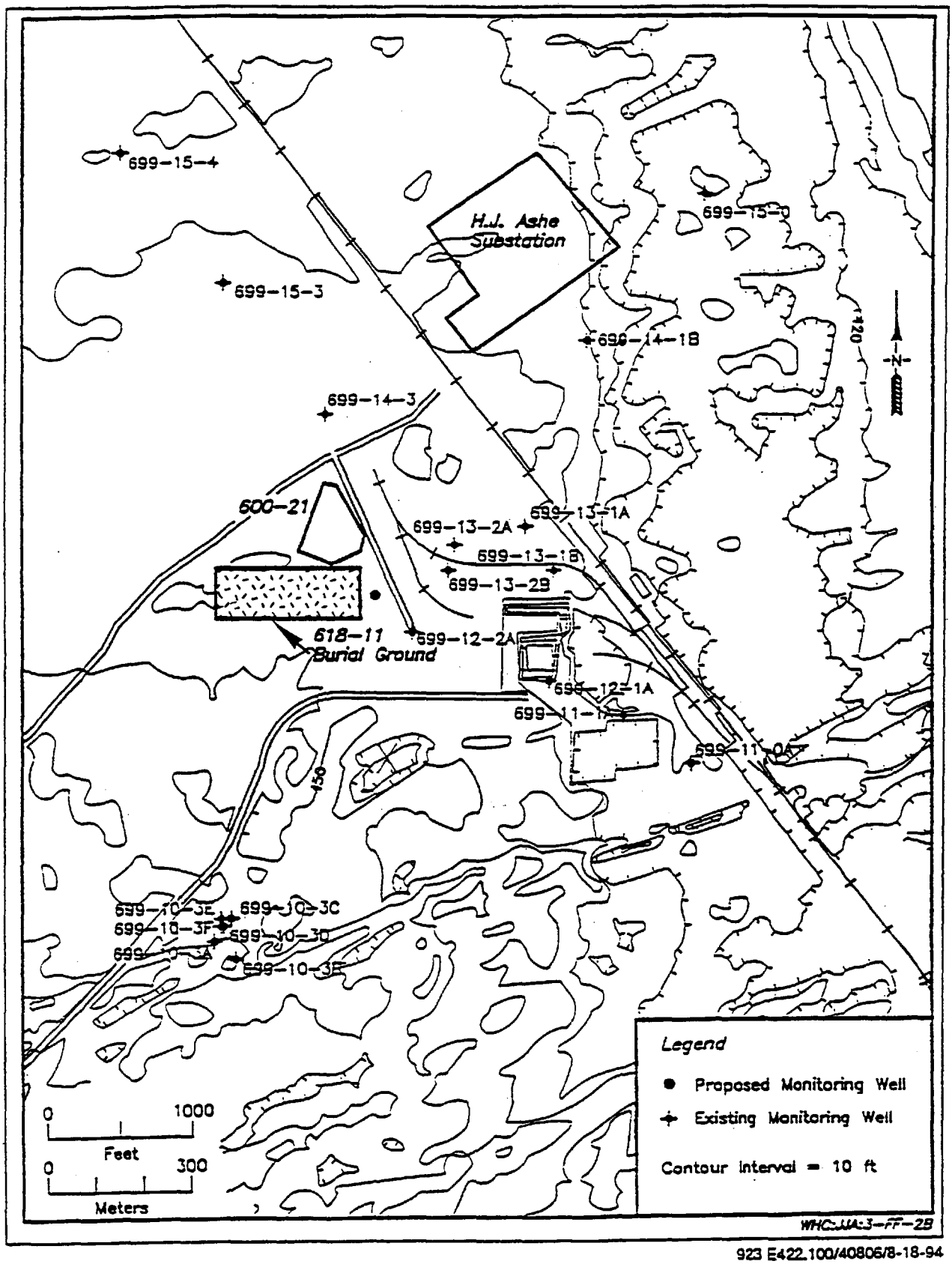


Figure 3. Location Map of the 618-11 Burial Ground.



923 E422.100/40806/8-18-94

Figure 4. Documented Layout of the 618-10 Burial Ground (from AEC Drawing Number H-3-9982 [1962]).

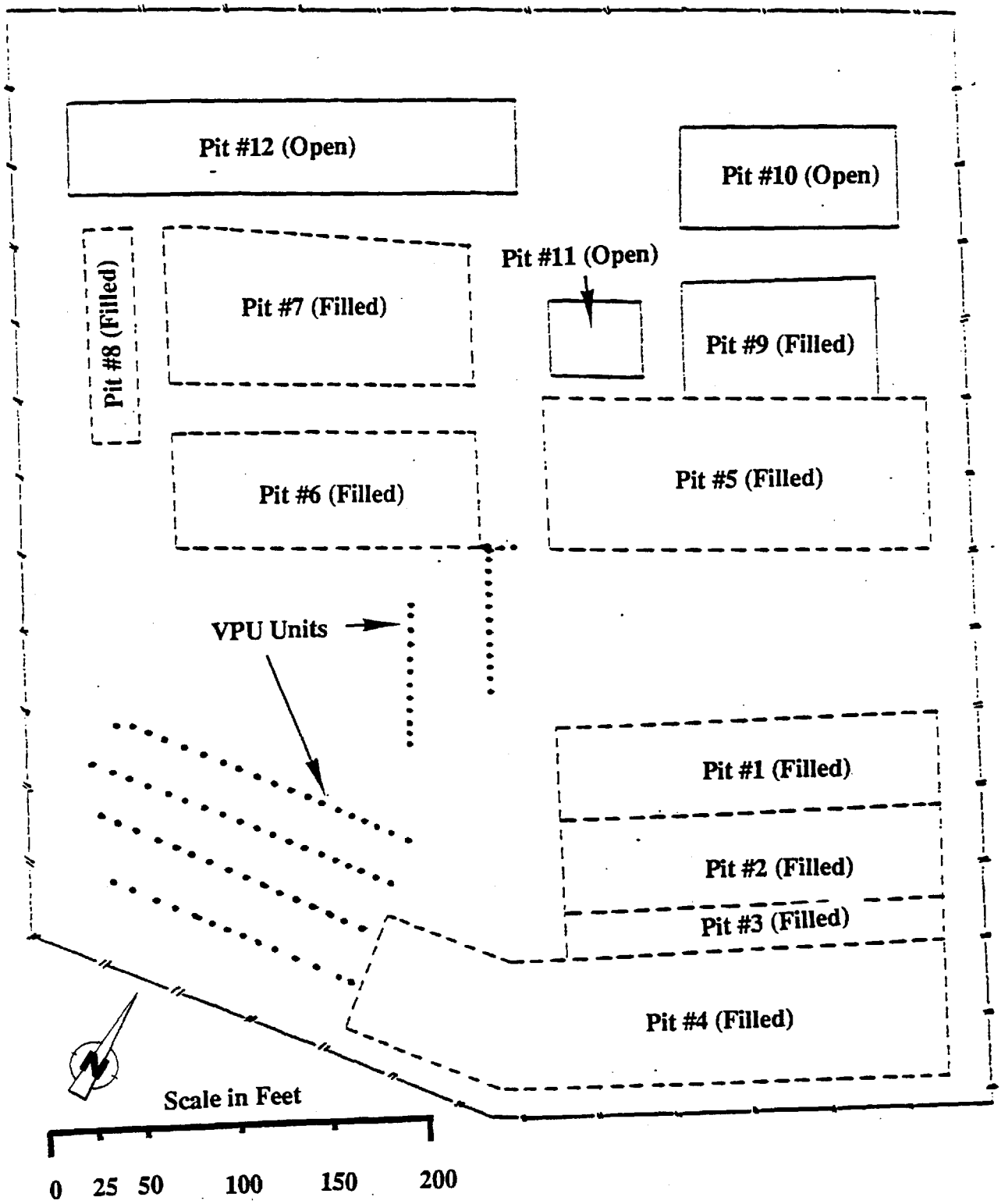


Figure 5. Documented Design of Vertical Pipe Unit.

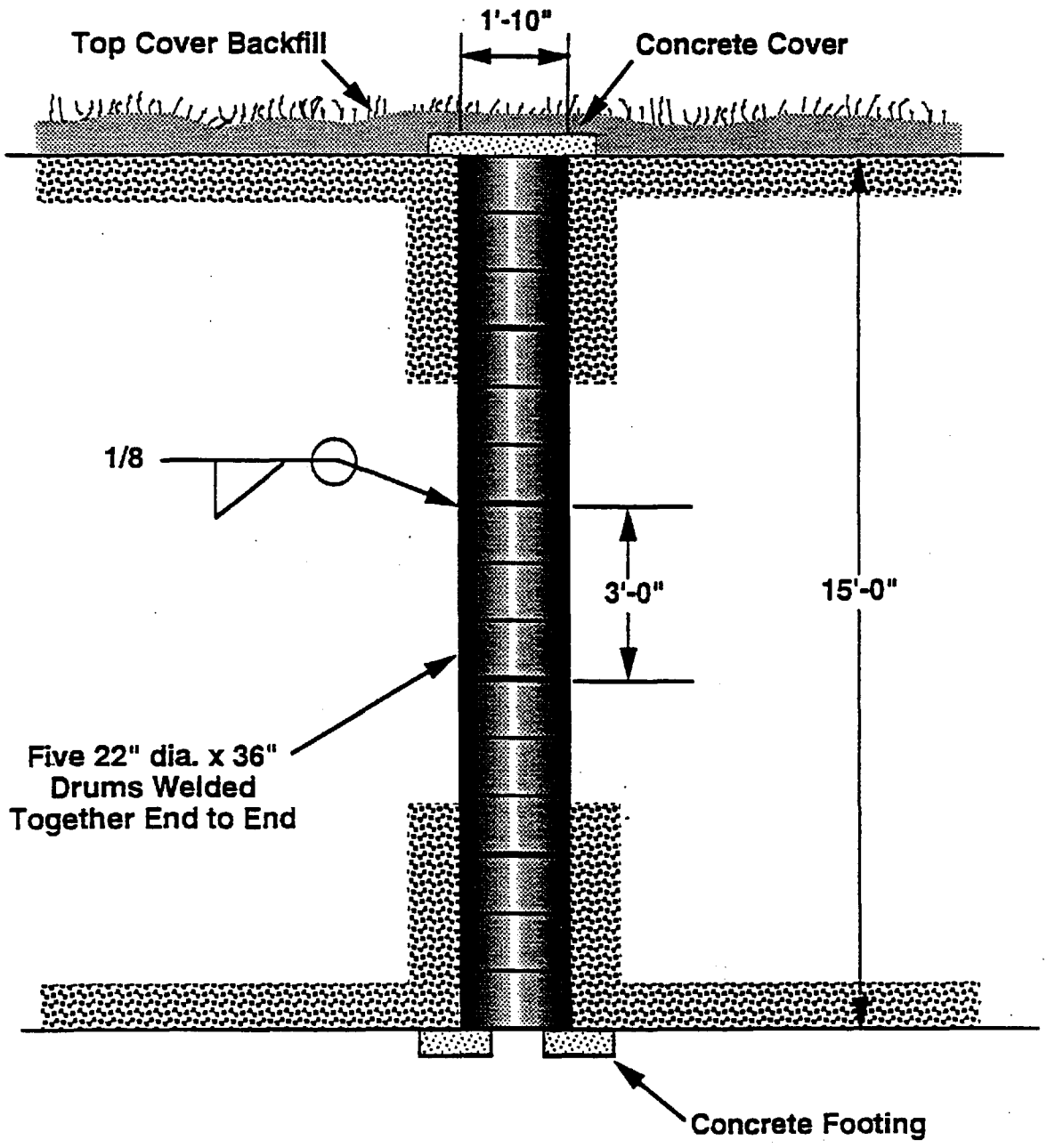


Figure 6. Aerial Photograph of the 618-11 Burial Ground (August 6, 1964).

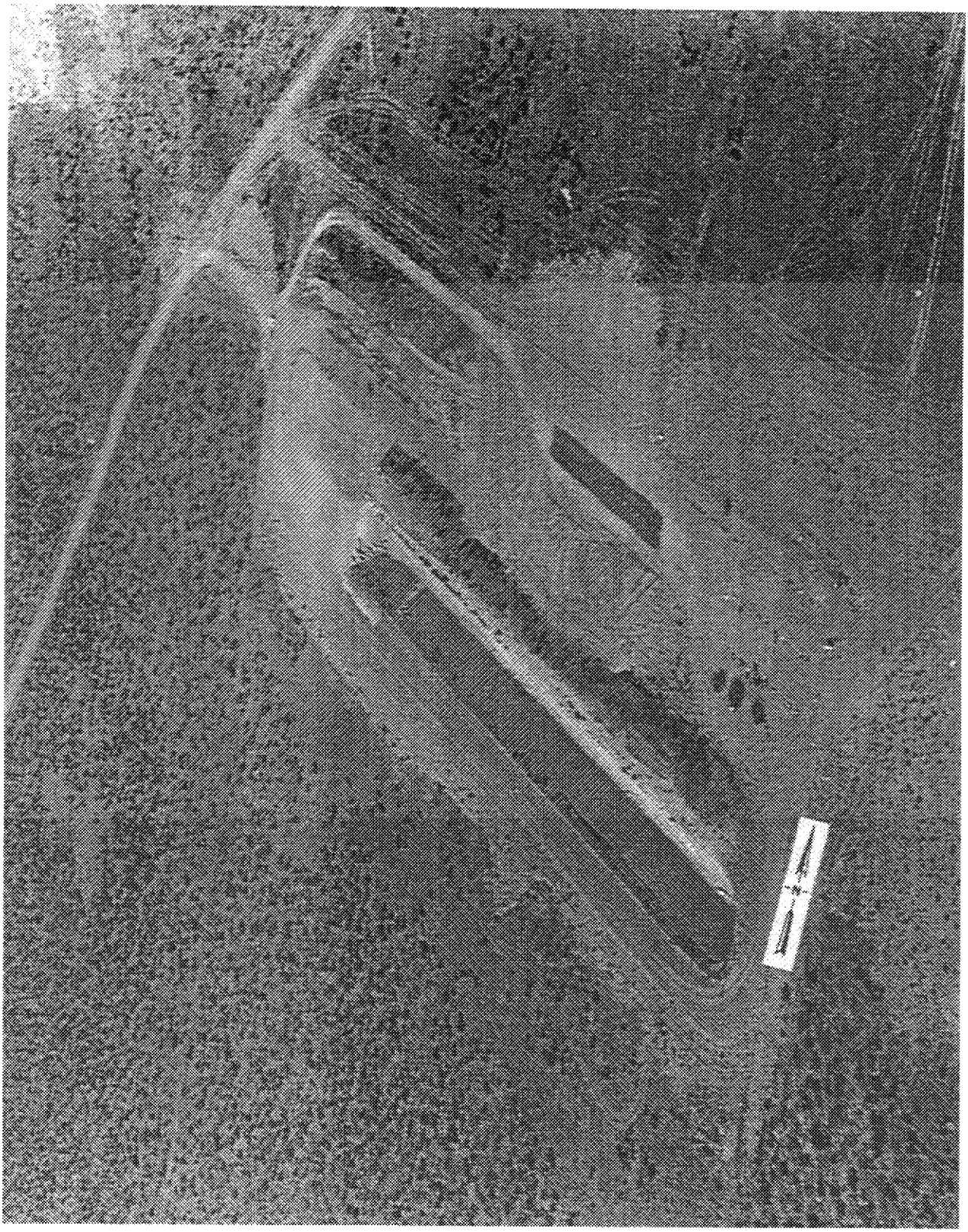
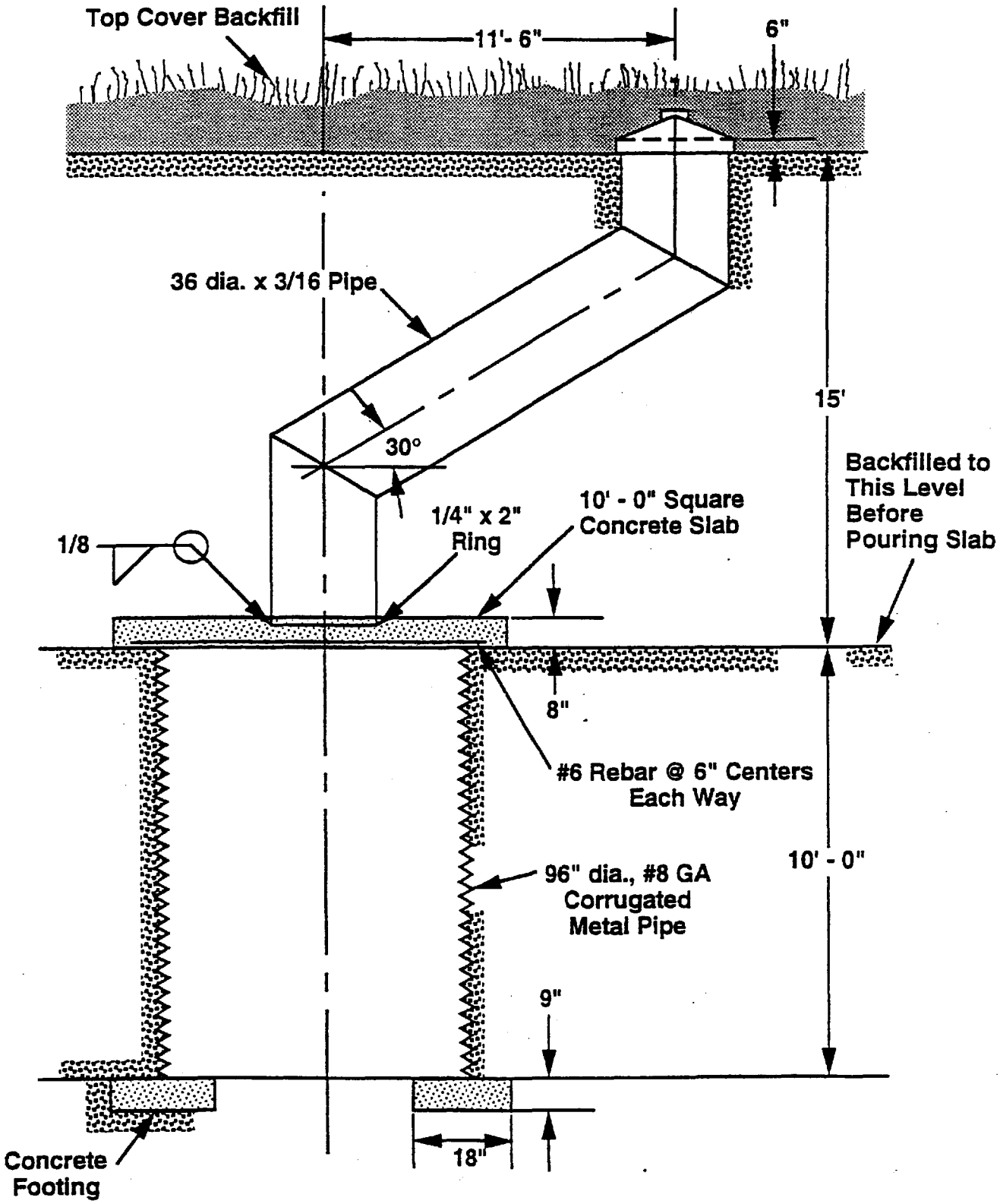


Figure 7. Documented Design of 8-ft Caisson.



873-RJR-20059/2-92-GEM

Figure 8. Documented Layout of the 618-11 Burial Ground.

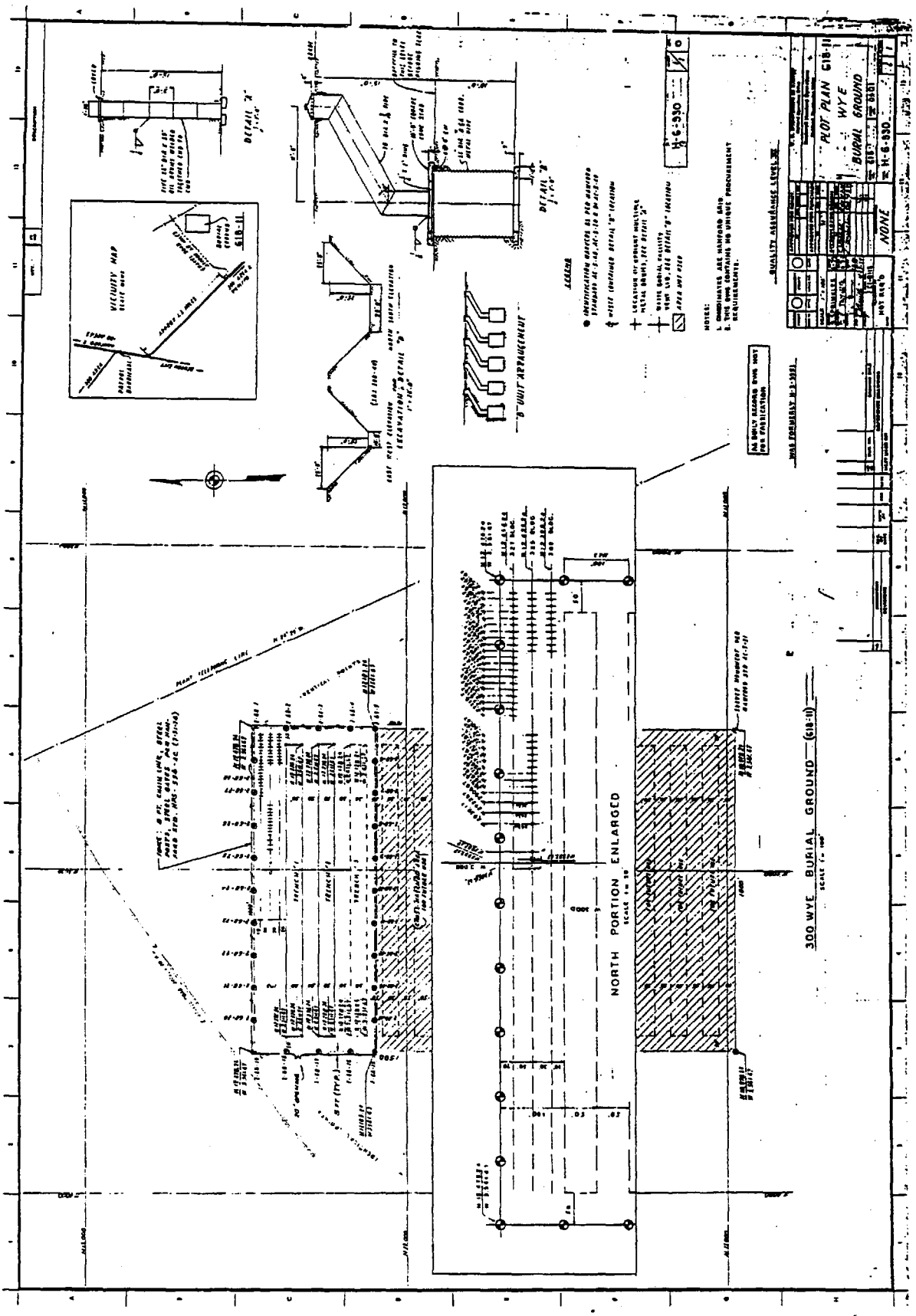


Figure 9. Mixed Radioactive Waste being Dumped into the 618-11 Burial Ground.

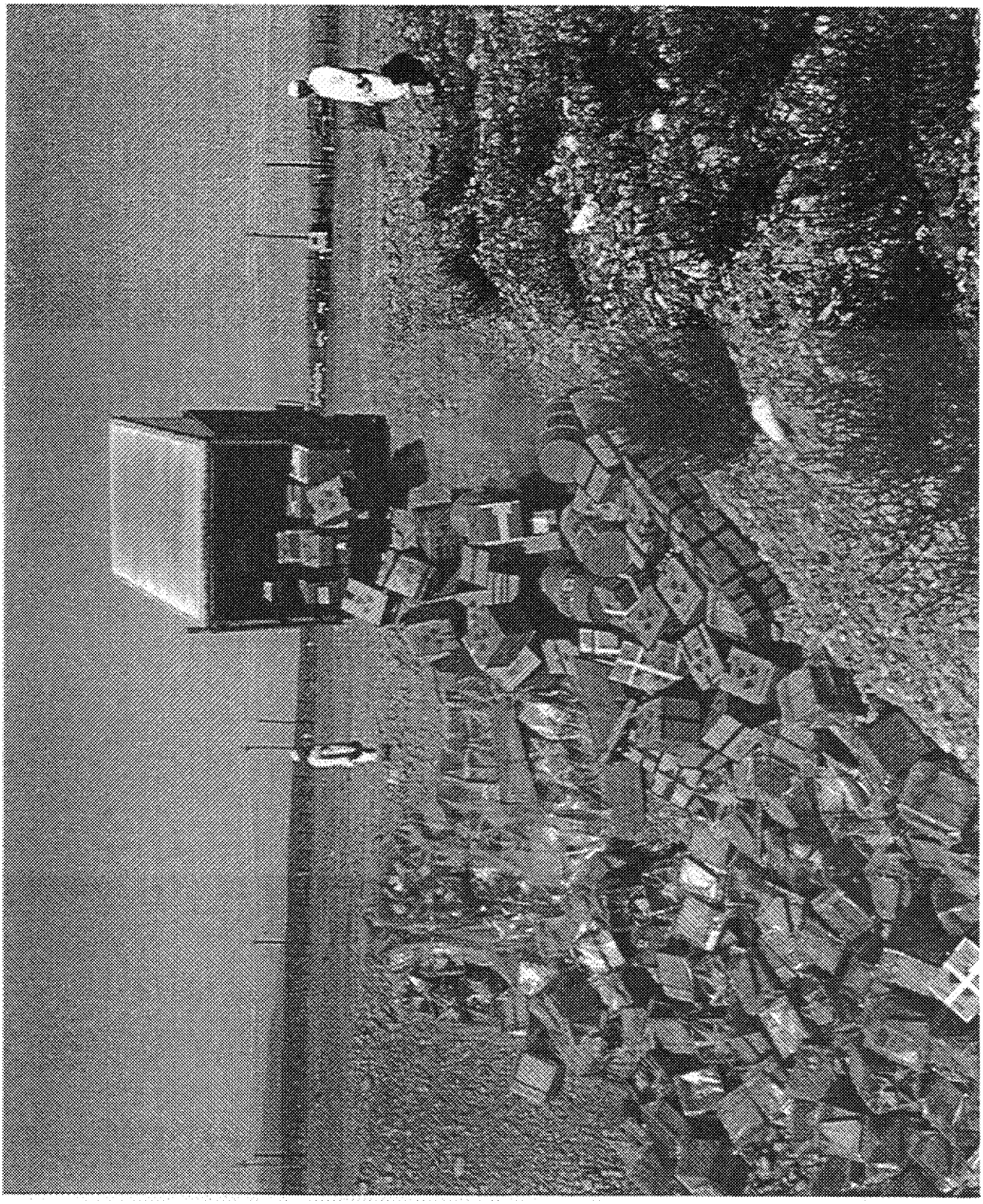


Figure 10. Ground Conductivity Contour Map of the 618-10 Burial Ground.

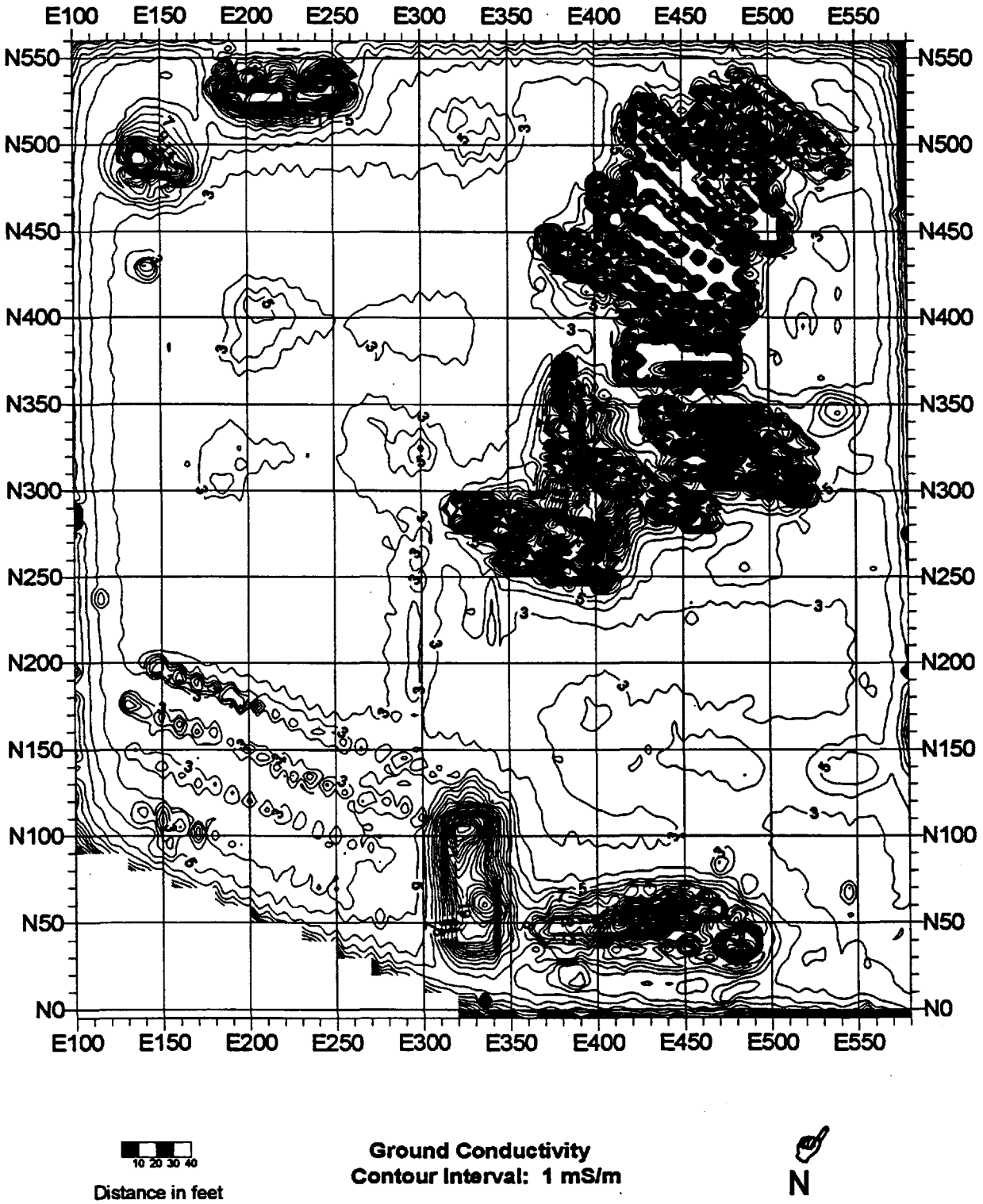
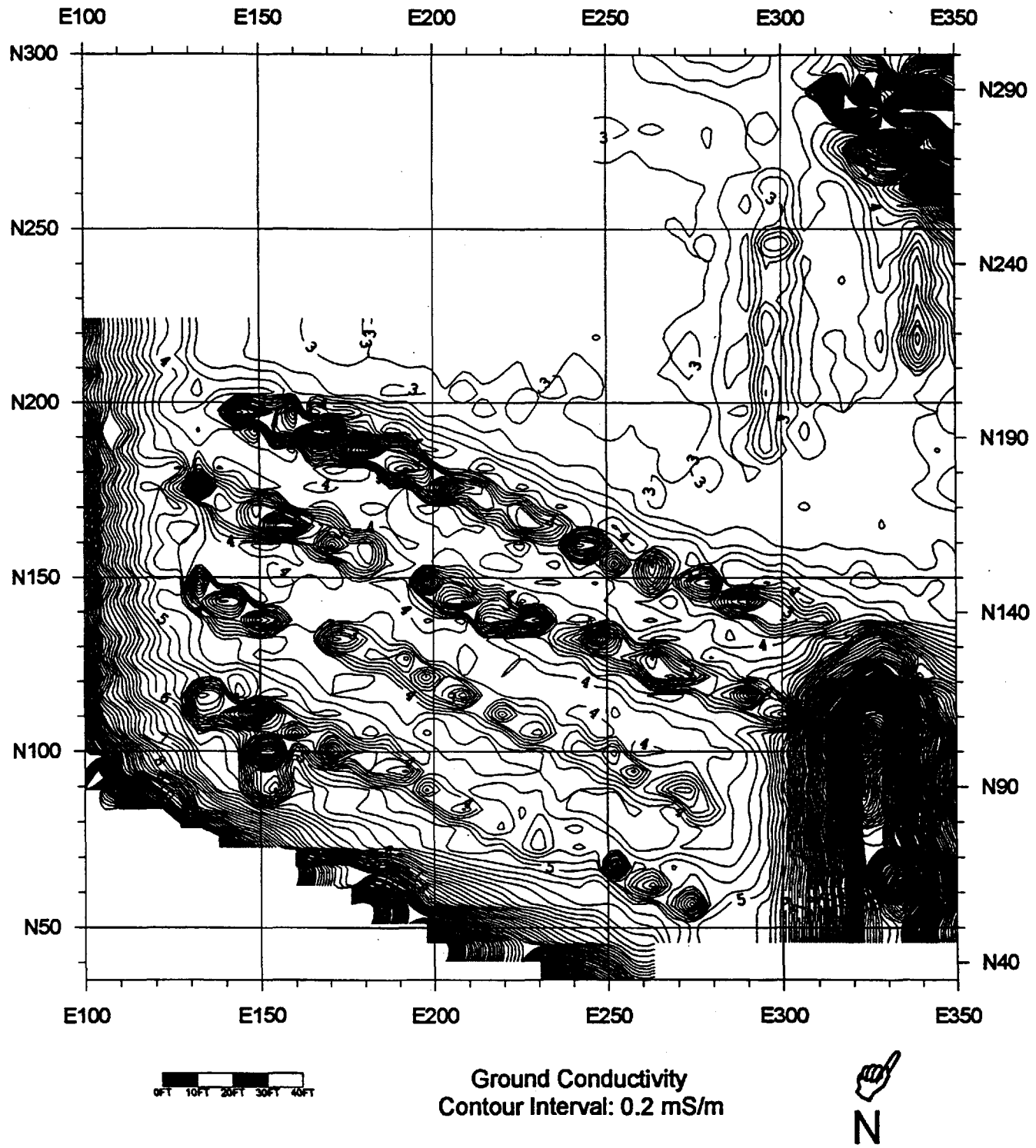


Figure 11. Ground Conductivity Contour Map Southwest Quadrant of the 618-10 Burial Ground.



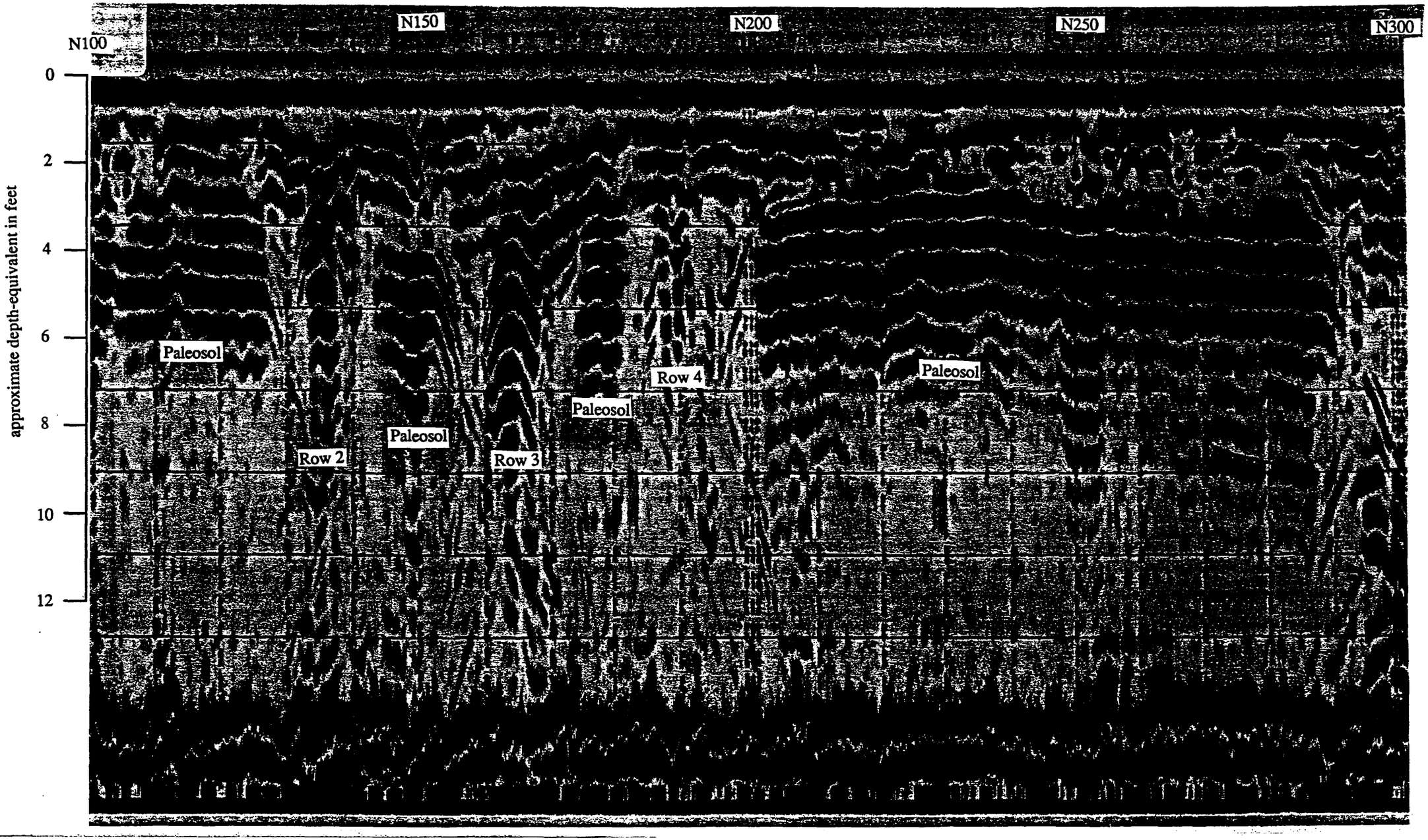


Figure 12. GPR Profile E160, N100 to N250, 618-10 Burial Ground (300-MHz Antenna, 108 NS Window, Depth Scale 2.3 ft/in.).

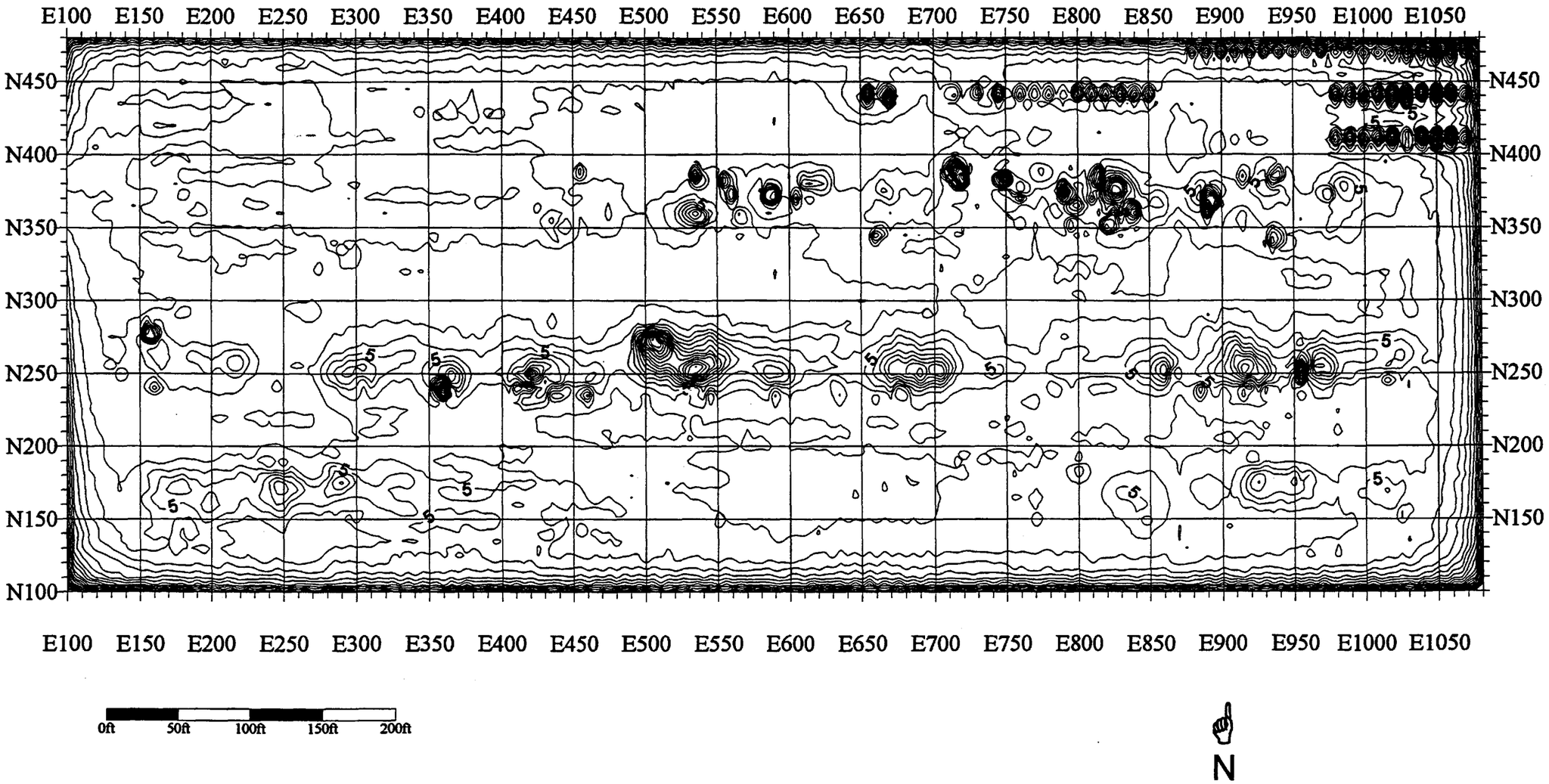


Figure 13. Ground Conductivity, 618-11 Burial Ground Contour Interval (1 mS/m).

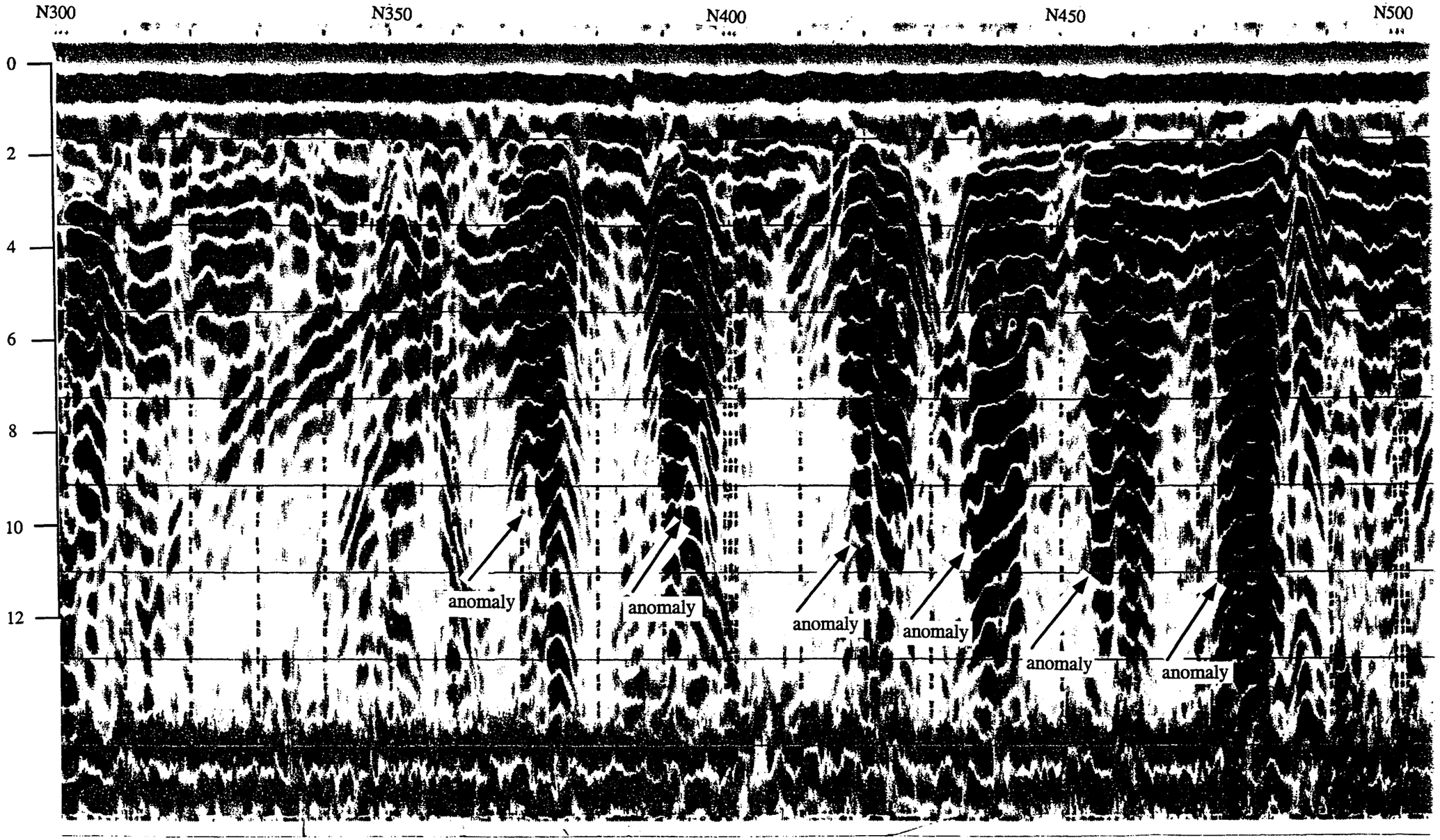
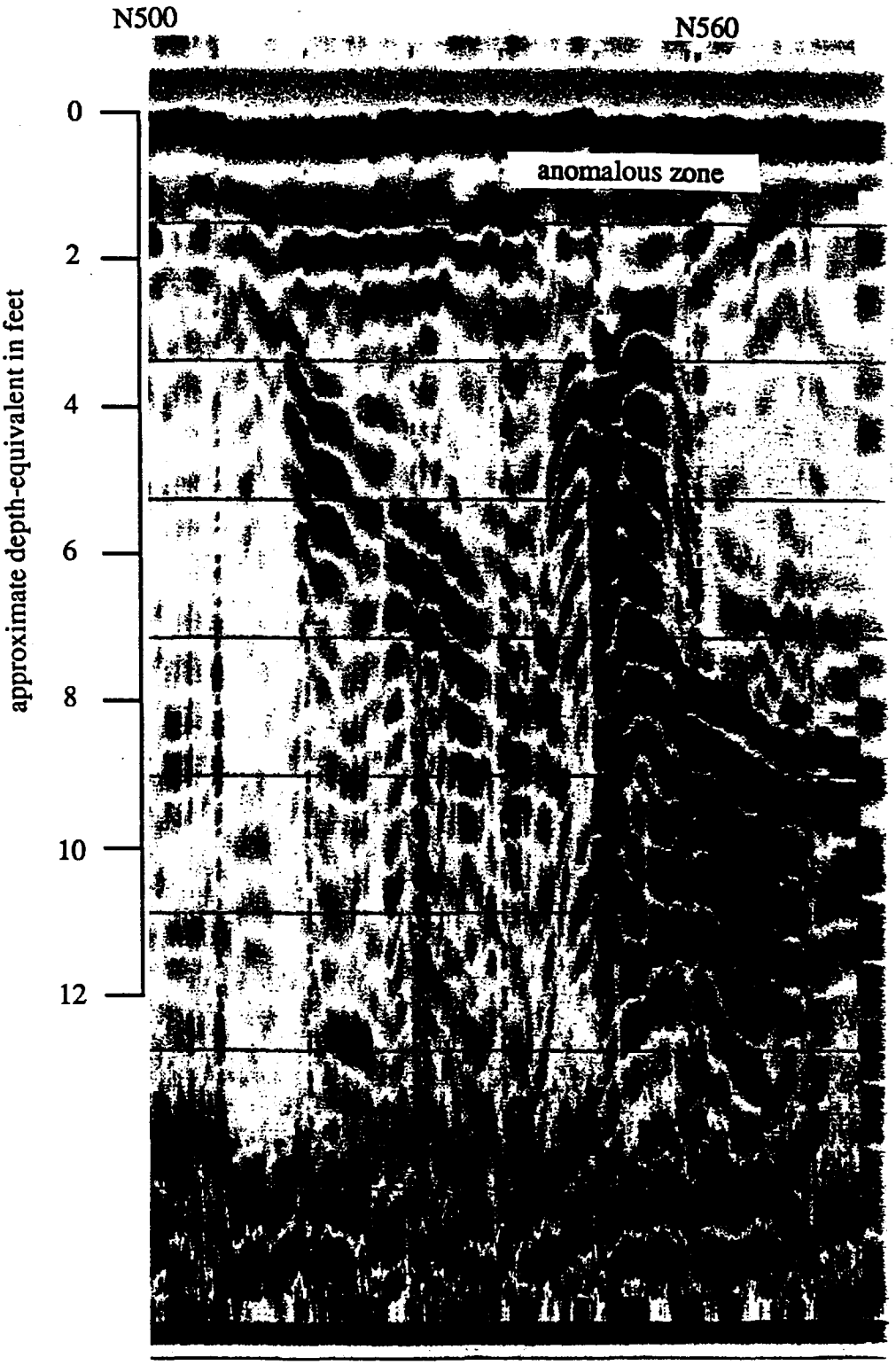


Figure 14. GPR Profile E420, N300 to N500, 618-10 Burial Ground.
(Cross-section shows series of anomalous reflecting horizons observed in northeastern portion of burial ground [300-MHz antenna,108-NS window, depth scale 2.3 ft/in.]).

Figure 15. GPR Profile E570, N500 to N560, 618-10 Burial Ground. (Buried debris or clastic dike [300-MHz antenna, 108 NS window, depth scale 2.3 ft]).



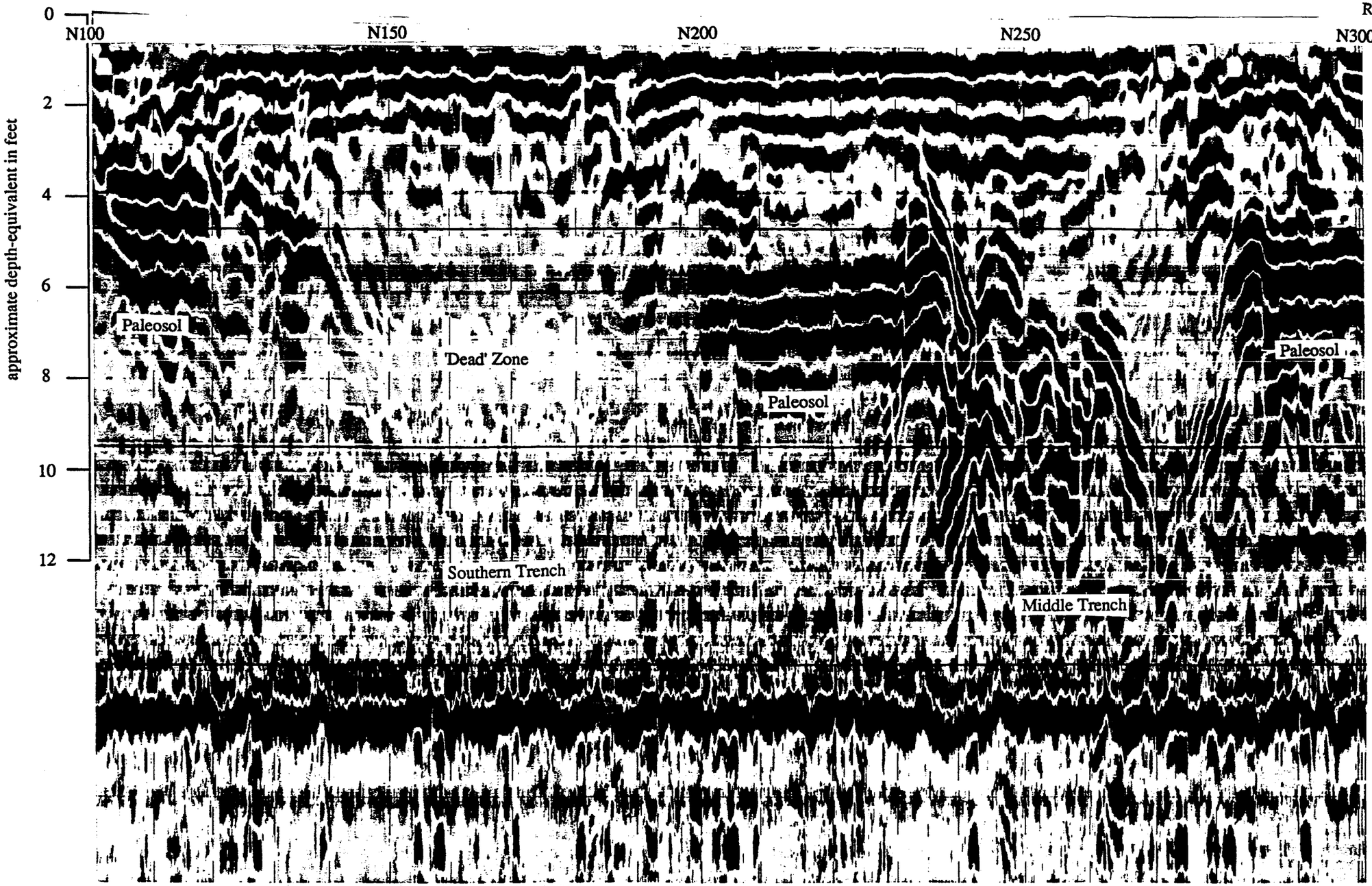


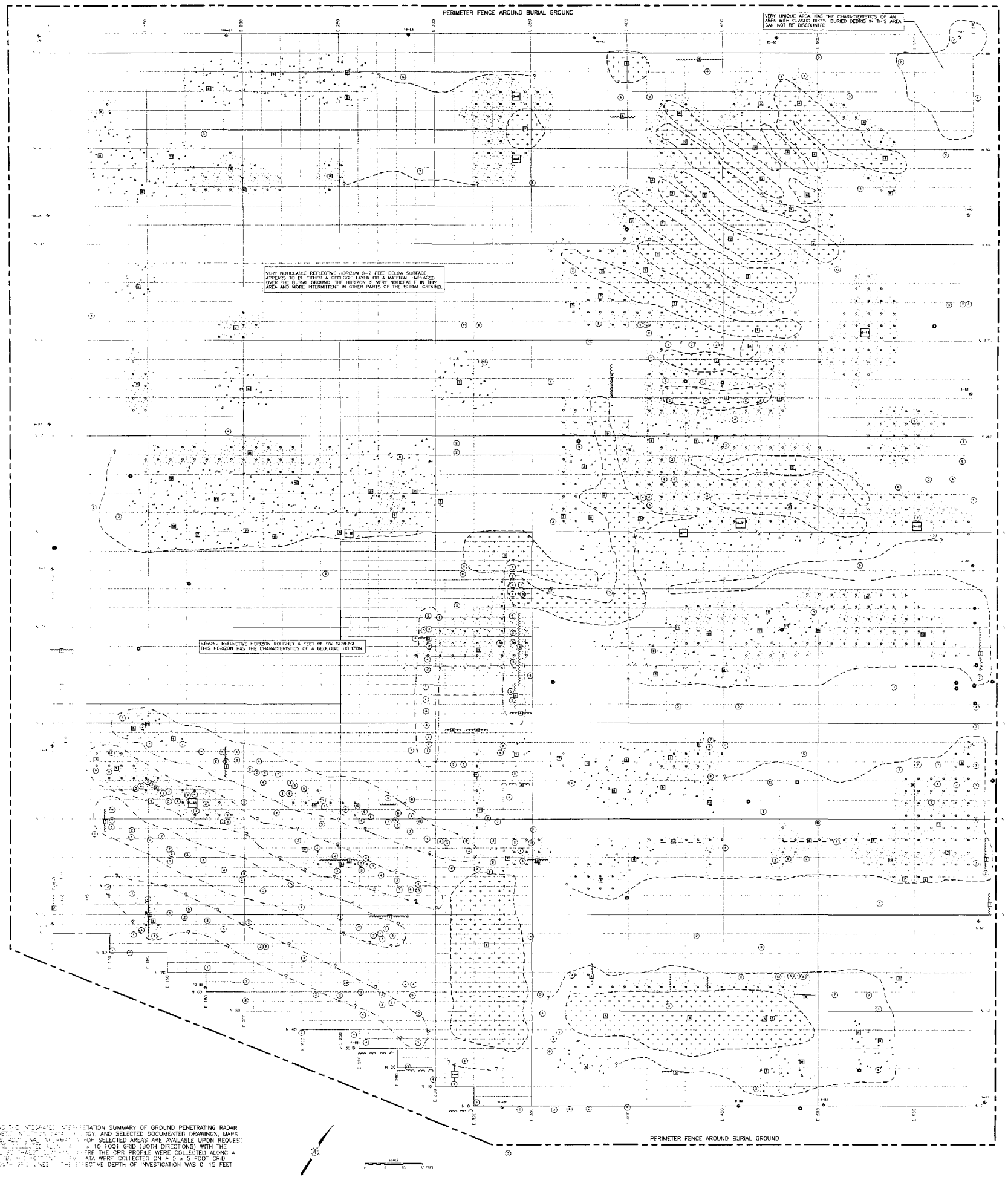
Figure 16. GPR Profile E430, N100 to N300, 618-10 Burial Ground. (Cross-section shows southern and middle trench [300-MHz antenna, 108 NS window, depth scale 2.3 ft/in.]).

Table 1. Objectives for Geophysical Investigations of the 618-10 and 618-11 Burial Grounds.

Site	Description	Objectives
618-10 (Figure 2)	Solid mixed waste burial ground. Believed to include 12 trenches and 94 vertical pipe units. The burial ground includes low and highly radioactive waste.	To delineate the boundaries of individual trenches, locate the highest concentrations of debris within the trenches, determine the thickness of the overlying fill, locate vertical pipe units, and evaluate and update existing documentation.
618-11 (Figure 3)	Solid radioactive waste burial ground. Believed to include three 900-ft-long trenches, 53 vertical pipe units, and an undetermined number of 8-ft- diameter caissons.	To delineate the boundaries of individual trenches, locate the highest concentrations of debris within the trenches, determine the thickness of the overlying fill, locate vertical pipe units and caissons, and evaluate and update existing documentation.

Table 2. Summary of the Survey/Grid Parameters.

Site	Survey Size (ft)	Grid Size (ft)	GPR Spacing (ft)	EMI Spacing (ft)
618-10	~480 x 560	10 x 10	10 x 10	5 x 5 north-south
618-10, SW Quadrant	~200 X 250	10 x 10	5 x 5	5 x 5 east-west
618-11	380 x 980	10 x 10	10 x 10	5 x 5 north-south



NOTES

THIS MAP CONTAINS THE INTERPRETATION SUMMARY OF GROUND PENETRATING RADAR AND ELECTROMAGNETIC INDUCTION SURVEY, AND SELECTED DOCUMENTED DRAWINGS, MAPS, AND PHOTOGRAPHS. ADDITIONAL INFORMATION ON SELECTED AREAS ARE AVAILABLE UPON REQUEST. GPR PROFILES WERE COLLECTED ALONG A 10 FOOT GRID (BOTH DIRECTIONS) WITH THE EXCEPTION OF THE SOUTHEAST CORNER WHERE THE GPR PROFILE WERE COLLECTED ALONG A 5 FOOT GRID. BOTH GPR AND EMI DATA WERE COLLECTED ON A 5 X 5 FOOT GRID (ALONG NORTH-SOUTH AND EAST-WEST LINES). THE EFFECTIVE DEPTH OF INVESTIGATION WAS 0-15 FEET.

BURIAL GROUND MONUMENT LOCATIONS

1-82 E674 N559	10-83 E338/N62
3-82 E676 N374	12-83 E180/N53
4-83 E782 N164	14-83 E100/N189
7-82 E587 N32	16-83 E97/N363
9-82 E419 N32	17-83 E95/N559
11-82 E258 N31	18-83 E286/N559
13-83 E701 N96	20-83 E479/N558

LEGEND

- INTERPRETED BOUNDARY OF AN EXCAVATION/TRENCH OR AN EDGE OF A LARGE, RELATIVELY DISTINCT FEATURE, DISTINCT GPR BOUNDARY CONDITION OFTEN ATTRIBUTED TO THE CHARACTER CHANGE FROM UNDISTURBED TO DISTURBED GEOLOGIC CONDITIONS.
- INFERRED BOUNDARY OF AN EXCAVATION/TRENCH, OR DISTINCT GEOLOGIC FEATURE.
- AREA SUSPECTED AS CONTAINING VERTICAL PIPE UNITS (VPU's)
- PERIMETER FENCELINE
- DISCONTINUOUS SECTION ALONG A GPR PROFILE POSSIBLY INDICATIVE OF AN ISOLATED, SMALL ZONE OF BURIED DEBRIS.
- SHALLOW, ISOLATED ANOMALY (0-2 FEET BELOW THE SURFACE)
- 3 AVERAGE THICKNESS (IN FEET) OF THE FILL MATERIAL OVER ABUNDANT ANOMALIES IN THE GENERAL LOCATION OF THE SYMBOL
- 4 ISOLATED OR UNIQUELY IDENTIFIED ANOMALY. THE NUMBER REFERS TO THE APPROXIMATE DEPTH, IN FEET, BELOW THE SURFACE TO THE ANOMALY.
- AREA WITH A MODERATE CONCENTRATION OF ANOMALIES WITH VARIABLE CHARACTER, SIZE AND DEPTH. THIS AREA MAY ALSO REPRESENT A ZONE WITH MINIMAL METALLIC DEBRIS.
- AREA WITH A HIGH CONCENTRATION OF ANOMALIES WITH VARIABLE CHARACTER, SIZE, AND DEPTH.
- AREA DOMINATED BY STRONG REFLECTIVE HORIZON THAT IS RELATIVELY FLAT. IN MOST CASES, THE GPR ENERGY DOES NOT PENETRATE THROUGH THE REFLECTOR THUS LIMITING THE DEPTH OF INVESTIGATION TO THE TOP OF THE REFLECTOR.
- BURIAL GROUND MONUMENT

PLATE I

GEOPHYSICAL INTERPRETATION SUMMARY MAP,
618-10 BURIAL GROUND, OPERABLE UNIT 300-FF-2

BHI-00291
Rev. 1

FENCE AT N495

FENCE AT E85

FENCE AT E1085

FENCE AT N85

PERIMETER FENCE AROUND BURIAL GROUND (N85)

ABRUPT TERMINATION OF APPARENT GEOLOGIC LAYER

AREA MOST LIKELY TO CONTAIN TWO 6 FOOT DIAMETER EXCAVONS.

THOSE APPEARS TO BE ONLY SCATTERED POCKETS OF WASTE BURIED IN THIS AREA. THE TRENCH BOUNDARIES ARE NOT OBVIOUS.

ABRUPT TERMINATION OF APPARENT GEOLOGIC LAYER

AREA APPEARS TO HAVE BEEN EXCAVATED BUT THERE ARE NO SIGNS OF BURIED DEBRIS IN IT

PART OF A TRENCH THAT APPEARS TO HAVE NEVER BEEN USED FOR SOLID WASTE BUT HAS A SIGNIFICANTLY DIFFERENT CHARACTER THAN THE SURROUNDING "DEAD ZONE"

"DEAD ZONE" - TRENCH APPEARS TO HAVE BEEN EXCAVATED BUT NEVER USED FOR SOLID WASTE

"DEAD ZONE" - TRENCH APPEARS TO HAVE BEEN EXCAVATED BUT NEVER USED FOR SOLID WASTE

NOTES

THIS MAP CONTAINS THE INTEGRATED INTERPRETATION SUMMARY OF GROUND PENETRATING RADAR AND ELECTROMAGNETIC INDUCTION DATA, GEOLOGY, AND SELECTED DOCUMENTED DRAWINGS, MAPS AND PHOTOGRAPHS. ADDITIONAL INFORMATION FOR SELECTED AREAS ARE AVAILABLE UPON REQUEST. GPR PROFILES WERE COLLECTED ALONG A 10 x 10 FOOT GRID (BOTH DIRECTIONS). THE EFFECTIVE DEPTH OF INVESTIGATION WAS 0-15 FEET. FOR ADDITIONAL INFORMATION PLEASE CONTACT: T.H. MITCHELL OR K.A. BERGSTROM AT 376-4024.

◆ BURIAL GROUND MONUMENT LOCATIONS

2-68-1 E1091/N491	2-68-8 E790/N90	2-68-15 E89.5/N85	2-68-22 E391/N490
2-68-2 E1090/N390	2-68-9 E690/N90	2-68-16 E90/N190	2-68-23 E491/N490
2-68-3 E1090/N291	2-68-10 E590/N90	2-68-17 E90/N290	2-68-24 E591/N490
2-68-4 E1090/N191	2-68-11 E489/N90	2-68-18 E90/N390	2-68-25 E692/N491
2-68-5 E1090/N90	2-68-12 E390/N90	2-68-19 E91/N490	2-68-26 E791/N490
2-68-6 E990/N90	2-68-13 E290/N90	2-68-20 E191/N490	2-68-27 E890/N490
2-68-7 E890/N90	2-68-14 E190/N90	2-68-21 E291/N490	2-68-28 E990/N491

INTERPRETED BOUNDARY OF AN EXCAVATION/TRENCH OR AN EDGE OF A LARGE, RELATIVELY DISTINCT FEATURE. DISTINCT GPR BOUNDARY CONDITION OFTEN ATTRIBUTED TO THE CHARACTER CHANGE FROM UNDISTURBED TO DISTURBED GEOLOGIC CONDITIONS.

INFERRED BOUNDARY OF AN EXCAVATION/TRENCH, OR DISTINCT GEOLOGIC FEATURE.

ISOLATED OR UNIQUELY IDENTIFIED ANOMALY. THE NUMBER REFERS TO THE APPROXIMATE DEPTH, IN FEET, BELOW THE SURFACE TO THE ANOMALY.

PERIMETER FENCELINE

LEGEND

"DISTURBED" SECTION ALONG A GPR PROFILE. POSSIBLY INDICATIVE OF AN ISOLATED, SMALL ZONE OF BURIED DEBRIS.

SHALLOW, ISOLATED ANOMALY (0-2 FEET BELOW THE SURFACE)

AVERAGE THICKNESS (IN FEET) OF THE FILL MATERIAL OVER ABUNDANT ANOMALIES IN THE GENERAL LOCATION OF THE SYMBOL.

AREA WITH A HIGH CONCENTRATION OF ANOMALIES WITH VARIABLE CHARACTER, SIZE, AND DEPTH.

BURIAL GROUND MONUMENT

AREA WITH A MODERATE CONCENTRATION OF ANOMALIES WITH VARIABLE CHARACTER, SIZE AND DEPTH. THIS AREA MAY ALSO REPRESENT A ZONE WITH MINIMAL METALLIC DEBRIS.

INTERPRETED ROW OF VERTICAL PIPE UNITS. APPROXIMATE LOCATIONS ARE WITHIN CIRCLE.

"DEAD ZONE" - PORTION OF A TRENCH THAT APPEARS TO NEVER HAVE BEEN USED FOR SOLID WASTE.

SCALE: 0 15 30 60 FEET

N

30

⚠ REVISED AREA FOR REV. 01

PLATE II

GEOPHYSICAL INTERPRETATION SUMMARY MAP, 618-11 BURIAL GROUND, OPERABLE UNIT 300-FF-2 BHI-00291 (REV. 01)

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