REPORT

GEOTECHNICAL INVESTIGATION CINDER LAKE LANDFILL EXPANSION

Prepared for
City of Flagstaff
Department of Public Works
Flagstaff, Arizona

Woodward-Clyde Project No. 96A199-0400

February 4, 1997

Woodward-Clyde

Woodward-Clyde Consultants
Sunroad Plaza 3, Suite 1000
1615 Murray Canyon Road
San Diego, CA 92108
(619) 294-9400 Fax (619) 293-7920

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Woodward-Clyde
Engineering & sciences applied to the earth & its environment

February 4, 1997

Mr. Ben Fisk
City of Flagstaff
211 West Aspen Avenue
Flagstaff, AZ 86001

Subject: Geotechnical Investigation
Cinder Lake Landfill Expansion
Woodward-Clyde Project No. 96A199-0400

Dear Mr. Fisk:

Woodward-Clyde is pleased to submit this report with the results of our geologic and geotechnical investigation for the proposed expansion of the Cinder Lake Landfill. This report presents the results of our field investigations, our interpretations of the available data, and our conclusions concerning site conditions and specifically the rippability of the site relative to the proposed expansion. Our work is intended to provide information to assist the City of Flagstaff and their consultants in the design of the landfill expansion. This report finalizes our draft report dated December, 1996 and incorporates responses to your comments on the draft geotechnical report. We appreciate the opportunity to provide these services to the City of Flagstaff.

Very truly yours,

WOODWARD-CLYDE

Michael E. Hatch
Project Geologist

David L. Schug, R.G. 22749
Director, Engineering Geology

REGISTERED GEOLOGIST
CERTIFICATE NO.
22749
DAVID L.
SCHUG
Date Signed 2-4-97
ARIZONA, U.S.A.

David E. Marx
Project Manager

MEH/DEM/DLS:hal

Attachment

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This report presents the results of geologic and geotechnical investigations for the proposed expansion of the Cinder Lake Landfill performed by Woodward-Clyde for the City of Flagstaff (City). The City operates the Cinder Lake Landfill located approximately 8 miles northeast of the City. Figure 1 shows the project location. A Final Environmental Assessment for the Cinder Lake Landfill Expansion and Land Transfer (EA) was prepared by Woodward-Clyde in November 1995 for the City of Flagstaff and the United States Forest Service (USFS). On November 8, 1995 the USFS issued a Decision Notice and Finding of No Significant Impact for the project. Since the configuration of the landfill expansion was changed by the USFS during the EA process, a new geotechnical investigation was considered necessary to support the design of landfill cells in the new expansion area.

This report presents the results of the geotechnical work performed on the landfill expansion area. The work consists primarily of a rippability study for the proposed expansion area located east of the existing landfill (Figures 2 and 3). Rippability is also evaluated in the existing borrow area located southeast of the existing landfilling operations. In addition to the rippability evaluations, we have also performed field explorations to investigate the limits of part of the existing landfill in the southeastern portion of the site. Our work has been performed under the direction and guidance of an Arizona Registered Geologist.

The purpose of the rippability evaluations was to develop subsurface and geophysical information to estimate:

- the depth of basalt bedrock
- rippability characteristics of the volcanic soils and the basalt bedrock

This information is intended to assist in formulating plans for future development of the proposed expansion area located east of the existing landfill and to assist in plans for continued use and eventual solid waste disposal in the current borrow area. These two areas are shown on Figure 2.

The scope of work for the rippability evaluation of the proposed expansion area included; geophysical profiling (seismic refraction traverses utilizing a 24 channel seismograph), hollow-stem auger drilling, and limited rock core drilling. Within the proposed expansion area 6 seismic refraction traverses covering over 9,000 lineal feet were performed and 16 hollow-stem auger borings were extended to refusal of the hollow-stem augers. Five of these borings were subsequently extended into basalt using diamond bit rock coring techniques. Locations of our field investigations are shown on Figure 3. The field explorations are described in Appendices A and B.

Rippability within the existing borrow area was also evaluated as part our field investigation. Five hollow-stem auger borings were extended to refusal in this area and the previous work performed in this area by Western Technologies, Inc. in 1992 was evaluated.

Backhoe trenching and hollow-stem auger drilling were performed in the southeastern portion of the site to better establish the vertical and aerial extent of past landfilling operations in this area. Fifteen backhoe trenches were excavated to document the margins of the area previously estimated from historic aerial photographs. Five hollow-stem auger borings were advanced through the solid waste and into the underlying volcanic soils. One additional boring was performed outside of the landfill limits to evaluate the depth to bedrock in this area.

One additional boring was performed in the area of the proposed infiltration pond in the southwestern portion of the site. This boring provides basic geotechnical information including depth to bedrock for planning purposes.

2.1 PREVIOUS STUDIES

Previous investigations performed for the City of Flagstaff containing information reviewed and integrated into this study include:

- Landfill Engineering Study, Cinder Lake Landfill, Cocinino County, Arizona, prepared by Western Technologies Inc. (WTI), dated May, 1991.
- Additional Landfill Engineering Study, Cinder Lake Landfill, Flagstaff, Arizona, prepared by WTI, dated 1992.
- Final Letter Report, Installation of 1995 Vadose Zone Monitoring Devices, Cinder Lake Landfill, Flagstaff, Arizona, prepared by Woodward-Clyde, dated February, 1996

The previous study by WTI, 1992 had performed single channel refraction surveys and two borings (converted to gas monitoring wells) in the existing borrow area.

Relevant portions of these reports, including boring logs and tabular summaries of data have been included here in Appendix C.

3.1 GEOPHYSICAL INVESTIGATION

A geophysical survey was performed during the week of October 7, 1996 by geophysicists and an engineering geologist from Woodward-Clyde. The survey consisted of 9,350 feet of seismic refraction lines performed using a 24-channel seismograph (Figure 3). The details of the geophysical survey including a discussion of the basic principles of seismic refraction, the limitations and accuracy of the data, and the interpretation of the data are presented in Appendix A. The results of the traverses are presented as interpreted profiles in Figures A-1 through A-6.

3.2 SUBSURFACE INVESTIGATIONS

Subsurface investigations consisting of hollow-stem auger drilling and limited rock coring were performed in four areas of the landfill site.

- Sixteen hollow-stem borings were performed in the proposed expansion area. Five of these borings were extended into basaltic bedrock by the use of diamond core drilling techniques.
- Six hollow-stem auger borings were performed in and adjacent to the existing landfill's southeastern corner to evaluate the limits of the solid waste disposal in this area.
- Five hollow-stem auger borings were performed in and adjacent to the existing borrow area in the southeastern portion of the site.
- One hollow-stem auger/core boring was performed in the proposed infiltration area located in the southwestern portion of the site.

The locations of the borings were surveyed by Northland Research, Inc. following the completion of the boring program. The boring locations and the locations of previous borings and wells are shown on the Site Plan, Figure 3. Appendix B presents a more detailed discussion of the drilling program and also presents the Boring Logs as Figures B-2 through B-29. Figure B-1 presents a Key to Logs.

The site and geologic conditions have been described in previous documents prepared for the City of Flagstaff, including most recently the Design, Operations, Maintenance and Permitting Document for the Cinder Lake Landfill, prepared in March 1994 by Woodward-Clyde. Abbreviated discussions of site and geologic conditions are included here.

4.1 SURFACE CONDITIONS

The site is located within the physiographic feature known as Cinder Lake. This small, dry sedimentary basin covers approximately 5 square miles and is located approximately 12 miles northeast of the City of Flagstaff and one mile east of Highway 89. Elevations across the site range from 6600 to 6700 feet above mean sea level.

4.2 GEOLOGIC SETTING

The site lies along the distal easterly flanks of the San Francisco peaks and the geologic setting of the site is dominated by Cenozoic age volcanic deposits. These deposits include cinders, interbedded alluvial deposits, and basaltic flow units.

The relevant units from a geotechnical perspective for planning purposes are the near-surface units that were described in the 1996 Woodward-Clyde document as the Cinder Unit and the Basalt Unit. These two units are described below based on our review of previous reports and our recent subsurface investigations.

4.3 GEOLOGIC UNITS

4.3.1 Cinder Unit

The cinder unit is comprised of interbedded cinders and alluvial and colluvial soils. The cinders vary in color from dark grey to red with textures ranging from silty sand with gravels to well graded gravels. Alluvial materials ranging from silty to clayey sands with gravels and sandy clays are a lesser component of the stratigraphic section in the area based on our subsurface investigations. Also present within the cinder unit are some relatively minor occurrences of fused cinders and interbedded basaltic flow rock. The cinder unit extends to depths ranging from 10 to 61 feet below land surface (bls) based on our drilling program.

4.3.2 Basalt Unit

The basalt unit is characterized by gray, variably weathered basalt that is locally vesicular. Based on the boring program and the geophysical surveys, the top of the basalt unit appears to be highly to extremely weathered and variably fractured. Refusal to auger drilling was encountered within the upper portion of the basalt unit at depths ranging from 1 to 11 feet below the top of the basalt unit based on the interpretations made during drilling and sampling. Based on area drillers' logs the base of the basaltic unit lies at a depth of approximately 325 feet bls.

4.4 SUBSURFACE CONDITIONS

4.4.1 Expansion Area

Within the expansion area the cinder unit extends to depths ranging from 35 to 61 feet bls. Locally within the cinder unit, minor layers of fused cinders or ash (agglomerate, or welded tuff) and basalt flows are encountered. For example, Boring WC-8 located in the northwest corner of the proposed expansion area encountered a basalt flow roughly 3 feet thick at a depth of about 28 feet. Similarly boring MW- 3 (WTI) encountered refusal at a depth of 33 feet in this area while other adjacent borings encountered refusal at greater depths. This suggests that the basalt flows within the cinder unit encountered within the expansion area are not laterally or vertically extensive.

The top of the basalt unit, based on drilling rate changes and interval sampling, is characterized by highly to extremely weathered basaltic rock. This uppermost zone of the basalt unit was augerable to depths ranging from 1 to 9 feet below the inferred contact before refusal to further auger drilling was experienced. Within the expansion area, refusal to auger drilling was encountered at depths ranging from 37 to 65 feet bls. Given the topographic relief of the site these depths represent differences in elevation ranging from 6,583 to 6,608 feet above mean sea level (amsl).

4.4.2 Existing Landfill - Southeast Quadrant

Landfill Limits

As part of the scope of work, the limits of the existing landfill within the southeastern portion of the active landfill site were investigated. The approximate areal extent of this area was previously estimated from a review of historic aerial photographs. This approximate boundary was further refined by a series of 15 test pits (see Figure 3) which located the margins of the solid waste fill. Figure 4 shows the minor revisions to landfill margins in this area.

The vertical extent of the solid waste deposits in this southeastern area was evaluated by hollow-stem auger borings in 5 locations. Solid waste was encountered to depths ranging from 19 to 27 feet bls in this area. The locations of the boring are shown on Figure 3. Cross sections based on the borings and the test pits are presented on Figure 5.

Borrow Area

Subsurface conditions in the borrow area are more variable than conditions noted in the expansion area relative to the occurrence of relatively shallow basaltic rock. Basalt crops out in the northern portion of the borrow area as a round knob rising about 15 feet above the adjacent land surface. A basalt flow is also present at the ground surface along the eastern margin of the borrow area. Basaltic rock is currently being encountered by the borrow operations at relatively shallow depths ranging from approximately 15 to 25 feet below the original ground surface. This

rock is variably weathered and fractured. A review of the boring data suggests that such shallow rock occurs throughout most of the borrow area.

The boring along the southeastern margin of the borrow area (WC-19) and those borings just outside the borrow area to the north and northeast (LFL-6, V-4) suggest basalt conditions more similar to the expansion area. In these areas the basalt unit is encountered at depths (39 to 57 feet bgs) similar to those encountered in the expansion area and it is overlain by the cinder unit with little if any shallow basaltic rock. For example Borings WC-19 and LFL-6 encountered the cinder unit down to elevations of 6583 feet and 6594 feet amsl, respectively (depths of 39 and 47 feet bls, respectively). In the borrow area, Borings WC-17, -18, -20, -21, encountered basalt at much higher elevations, ranging from 6608 to 6611 feet amsl. The remaining borings in the borrow area and nearby to the northwest (MW-18) reach basalt at various depths that are generally shallower than expected based on the expansion area data. In addition, the single channel refraction survey conducted by WTI interpreted the depth to basalt as variable. Higher velocity materials were interpreted in only 5 of the WTI seismic lines. The remaining lines are interpreted as being underlain by low velocity materials to depths of at least 35 feet. We anticipate variable conditions consisting of multiple thin interbeds of basalt that appear to be limited in lateral continuity.

Infiltration Area

The infiltration area is underlain by the cinder unit to a depth of approximately 17 feet based our boring (IA-1) located in the central portion of the area. Other borings (MW-16 and MW-20 by WTI and Vadose Zone Well V-1) located adjacent to this area encountered basalt at about the same elevation suggesting fairly uniform conditions within the infiltration area. However, Vadose Zone Well V-1 located to the west of the infiltration area did not encountered the basalt unit until reaching a depth of about 34 feet. Also the rock observed in the cored portion of Boring IA-1 suggested thin flows with zones of highly to extremely weathered rock interlayered with highly vesicular rock extending to the bottom of hole at a depth of 39 feet.

4.5 GROUNDWATER

As discussed in previous investigations the depth to groundwater in the site area is estimated at 1,400 to 1,600 feet bls based on area well information. Perched water conditions have been noted in regional studies and some evidence of perched water has been observed in one Vadose Zone monitoring well (V-1).

Borings advanced as part of this investigation encountered minor zones of moist to wet conditions typically within thin (3 to 12 inches) clayey zones. Specifically, Borings WC-1, -2, -3, and -12, encountered such minor zones at depths ranging from 5 to 41 feet bls. One boring, WC-13, contained obvious free water which was observed in the drive sampler. Consecutive samples at depths of 20, 30 and 40 from WC-13 encountered free water while samples above and below were not saturated.

5.1 SOIL/ROCK EXCAVATION CHARACTERISTICS/RIPPABILITY

5.1.1 Expansion Area

As shown on the annotated seismic velocity profiles (Figures 6 through 11) and as presented in Appendix A, three velocity layers have been interpreted. A fourth layer has been inferred for discussion purposes (Figures 6 through 11).

- **Layer A.** A surficial layer with a p-wave velocity of about 900 feet per second and a thickness of between 4 and 8 feet. This layer appears to correspond to the loose, unconsolidated cinder gravel material that appears at the surface. This material can be easily excavated with a scraper.
- **Layer B.** An intermediate layer with p-wave velocities ranging from about 1,500 to 2,500 feet per second, extending down to depths between 40 and 85 feet below ground surface. This layer appears to correspond to the denser cinders and alluvial materials and to the upper portions of the weathered basalt. The cinders and alluvium can be easily excavated with a scraper. The lower part of the Layer B contains weathered basalt which will require dozer ripping.
- **Layer C.** A deep layer with p-wave velocities that range from 3,400 to 7,700 feet per second. This layer appears to correspond to the relatively less-weathered basalt that includes rippable and marginally rippable rock. This layer will require moderate and heavy ripping effort to excavate. Localized zones of nonrippable rock are possible.
- **Layer D.** A fourth layer (Layer D) has been proposed for discussion purposes. It is based on an assumed seismic velocity of 10,000 feet per second and the shallowest hypothetical occurrence of the high velocity rock. This represents non-rippable conditions for large equipment (Caterpillar D11N or equivalent).

The relationship between this geophysical model and the actual geologic layering is discussed in the following paragraphs on subsurface conditions.

Table 1 presents a summary of rock depths and refusal depths as indicated by the test borings.

The refraction surveys detect a deep layer of higher velocity material that represents less weathered and fractured basaltic rock (Layer C). Our interpretation of the depth to the boundary between the contrasting seismic velocities generally lies below the geologic contact between the cinders and the basalt unit. This suggests that there is not a substantial difference in p-wave velocity between the cinder unit and the highly weathered and fractured basalt. Subsequently, seismic refraction surveys alone cannot differentiate between the highly to extremely weathered upper portion of the basalt unit and the cinder unit. Even the drilling activities do not easily distinguish between the highly to extremely weathered rock and very gravelly cinder deposits. This is because the weathered uppermost portion of the basalt unit has physical properties closely associated with the unconsolidated cinder unit. Therefore, for discussions of rippability, the uppermost portion of the basalt unit can be included within the cinder unit, because of their similar physical properties.

The top of the marginally rippable rock (Layer C) has been contoured based on an evaluation of the boring and seismic data and is presented as Figure 4. The assessment of marginally rippable conditions as presented here represent our best estimate using a somewhat conservative approach. The conservatism results from our working definition of "marginally rippable rock" as being represented by auger refusal. Based on the geophysical profiles, this zone of material generally is characterized by seismic velocities ranging from about 4,000 to 7,700 fps. Relative to published estimates of ripper performance of heavy equipment, these values of seismic velocity are the middle to higher end of the charted rippable rock zone. For example, ripper performance as charted in the Caterpillar Performance Handbook (1993) lists marginally rippable values for a Caterpillar D9N dozer at between approximately 7,500 and 8,600 fps for basalt. Such performance charts are prefaced by qualifying statements that describe ripping as "more art than science." Some of the variables inherent in successful ripping including; tooth penetration (regardless of seismic velocity), operator skill and experience, fracturing and layering within the rock mass, and type and number of equipment being used. For this project the contoured surface represents the difference between apparent soil-like excavation conditions and rock excavation conditions (rippable and marginally rippable conditions with localized zones of non-rippable rock). Based on the available information, we anticipate that the cinders and highly weathered basalt above the marginally rippable rock surface (Layers A and B) can be excavated with a Caterpillar D7 Dozer (or equivalent). Alternately, a scraper could be used to excavate the cinders (Layer A and the upper portion of Layer B). We anticipate that a dozer would be required to excavate the lower portion of Layer B (highly weathered basalt).

If excavations below the marginally rippable rock surface (into Layer C) are planned, then heavy ripping type rock excavation is anticipated and larger equipment is probably called for from a practical standpoint. With heavy duty equipment (Caterpillar D9 or larger) and experienced operators, we anticipate that extensive rock excavation could proceed to depths below the marginally rippable rock surface in most areas. Within this zone of heavy ripping type rock excavation, oversized material will be generated and localized areas of non-rippable rock will likely be encountered. Such areas would require hydraulic breakers or blasting to break up the rock mass to allow excavation. Based on the geophysical model, the shallowest occurrence of a hypothetical nonrippable rock layer (10,000 fps) is at depths of 100 to 150 feet bgs. This is shown as Layer D on the annotated profiles on Figures 6 through 11.

In summary, we anticipate that excavation in the expansion area will proceed with little difficulty in the cinder unit with the exception of localized fused cinders and possible thin basalt flows. Only one boring (Boring WC-8 in the northwestern corner of the expansion area) encountered drilling refusal on an interbedded basalt flow within the cinder unit. In addition, the upper portion of the basalt unit will be rippable although significant effort may be needed locally given the potentially variably weathered and fractured condition of the rock mass. The depth to marginally rippable rock has been estimated based primarily on a review of drill refusal depths and secondarily on the depths to high velocity layers based on the geophysical surveys performed.

In general terms, marginally rippable rock is located at an elevation of 6,600 feet amsl or lower in the expansion area. The only area where the basalt unit is above 6,600 feet amsl (based on

cinders and weathered basalt materials can be excavated to depths between about 50 to 60 feet across the proposed expansion area. Figure 4 shows depths to marginally rippable rock in addition to the elevation contouring. We estimate that deeper excavation involving heavy ripping equipment and localized breaking or blasting is possible. This kind of heavy ripping type excavation with possibly increasing zones of localized breaking or blasting could extent to depths of 100 to 150 feet bls.

5.1.2 Borrow Area

The shallow occurrence of basalt in localized areas within the borrow area suggests that significant rock excavation begins at elevations of about 6,615 feet amsl. An exception to this would be the basalt knob area (Figure 4). The lateral and vertical extent of subsurface basalt in the knob area is not known and the need for blasting in this knob area can not be precluded. Seismic lines by WTI to the south of the knob did not encounter higher velocity rock within 35 feet of the ground surface.

Elsewhere in the borrow area it would appear that rippable and marginally rippable rock conditions would prevail to elevations of approximately 6,600 or deeper. Clearly along the southeastern margin of the borrow area much deeper excavations can be made before any rock excavation begins based on Boring WC-19.

5.1.3 Infiltration Area

Based on Boring IA-1, the central portion of the infiltration area is characterized by easily excavated cinder unit materials down to an elevation of approximately 6,600 feet amsl. Adjacent Borings V-1, MW-16 and MW-20 encountered the cinder unit to an elevation 6,600 feet amsl or lower.

The rock observed in the cored portion of Boring IA-1 consisted of thin (1 to 2 feet thick), highly weathered and highly vesicular basalt flows. Rock excavation could proceed to depths of 10 to 20 feet below the rock contact given the rock observed in Boring IA-1. Thus in our estimation, rippable rock conditions could extend to elevations of 6,590 to possible 6,580 feet amsl.

5.2 GROUNDWATER

Boring WC-13 in the east-central portion of the expansion area encountered wet conditions in two successive samples at depths of 20 and 30 feet. A third sample at 40 feet revealed the cinder/basalt unit contact and noted wet conditions only in the overlying cinder unit. No measurable water table was noted within the borehole during drilling suggesting that these saturated samples may represent discrete zones of perched water. Free water was not present within the lower portion of the boring.

Perched water could affect proposed construction within the expansion if significant amounts of water are present. We recommend that monitoring wells be constructed in the expansion area to better characterize the perched water conditions noted in Boring WC-13. The construction of 3 to 6 monitoring wells extending through the cinder unit in the southeastern portion of the

expansion area would provide the basic information needed to further assess perched water in this area. The well construction and subsequent monitoring program would provide information on lateral extent and seasonal variations of perched water. The wells would also allow the sampling and testing of the perched water, if necessary.

5.3 SLOPE STABILITY

Specific slope stability analyses were not part of this scope of work and have not been performed here for any existing or proposed slopes within the expansion area. However, previous studies (Woodward-Clyde, 1994) were conducted that address slope stability for the previously proposed expansion area adjacent to the southern margins of the landfill site. Based on our current subsurface investigations, it is our opinion that the subsurface characterization and stability analyses provided for the previous expansion site are valid and are expected to be applicable to slopes within the currently proposed expansion area.

We have observed only a small portion of the pertinent subsurface conditions. The recommendations made herein are based on the assumption that subsurface conditions do no deviate appreciably from those found during ours or previous site investigations.

Geotechnical engineering and the geologic sciences are characterized by uncertainty. Professional judgments presented herein are based partly on our understanding of the proposed expansion, and partly on our general experience. Though our work and judgments rendered meet current professional standards, they should not be construed as a guarantee of the performance of the project in any respect.

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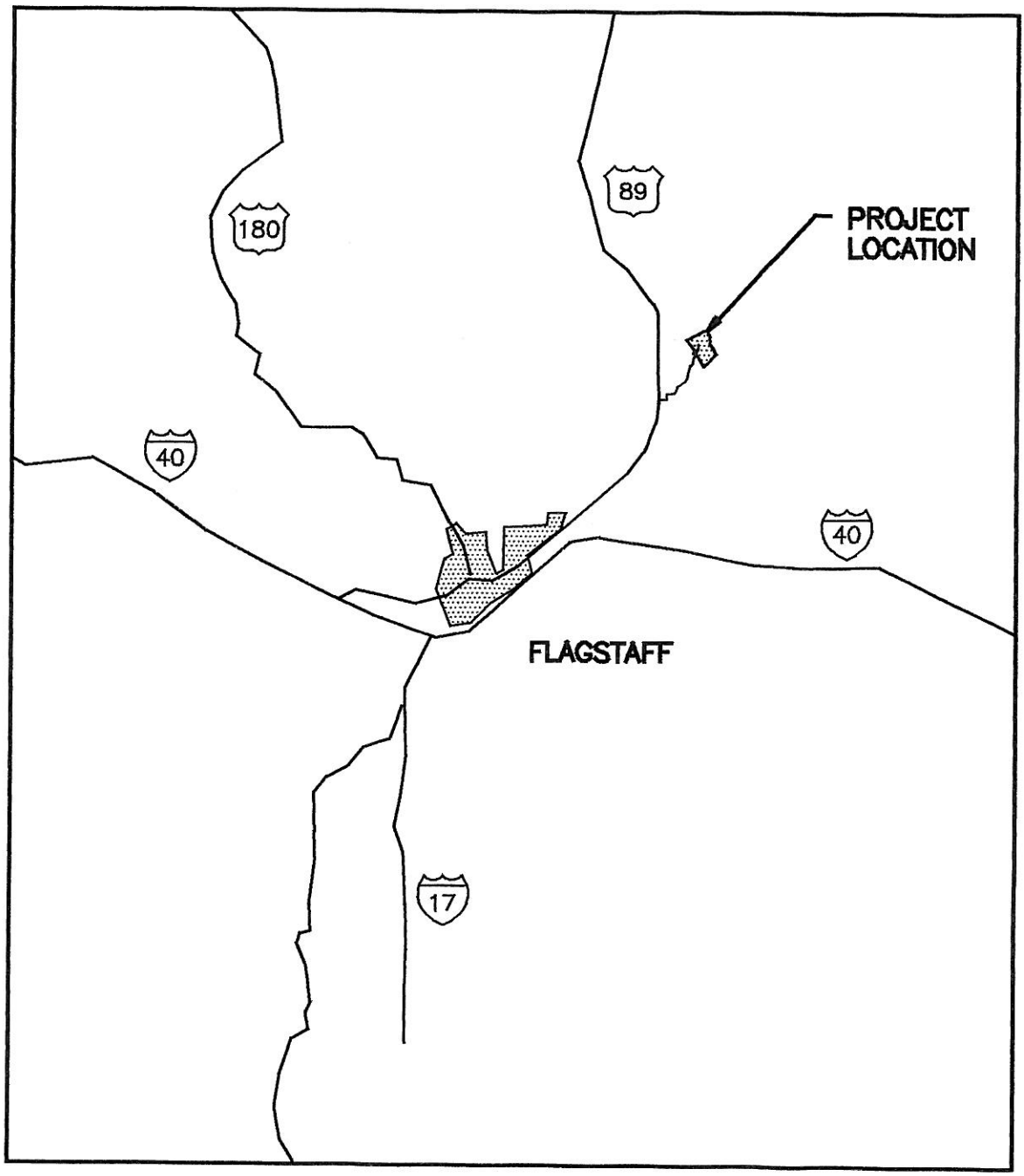
Table 1
SUMMARY OF BORINGS

Boring (Elevation, surveyed)	Depth to Rock	Elevation to Rock	Depth to Refusal	Elevation to Refusal
WC-1 (6,646)	43	6,603	46	6,600
WC-2 (6,641)	46	6,595	50	6,591
WC-3 (6,633)	38.5	6,594	40	6,593
WC-4 (6,635)	39	6,596	43	6,592
WC-5 (6,645)	46	6,599	47	6,598
WC-6 (6,661)	50.5	6,610	54	6,607
WC-7 (6,658)	57	6,600	60	6,597
WC-8 (6,656)	57	6,600	60	6,597
WC-9 (6,663)	61	6,602	65	6,598
WC-10 (6,647)	54	6,593	56	6,591
WC-11 (6,641)	43	6,598	44	6,597
WC-12 (6,643)	51	6,592	60	6,583
WC-13 (6,640)	40.5	6,599	50	6,590
WC-14 (6,663)	61	6,602	70	6,593
WC-15 (6,645)	35	6,610	37	6,608
WC-16 (6,652)	39.5	6,612	46	6,606
LFL-6 (6,641)	47	6,594	61	6,580
WC-17 (6,619)	10.5	6,608	13	6,606
WC-18 (6,619)	11	6,608	20	6,599
WC-19 (6,622)	39	6,583	46	6,576
IA-1 (6,619)	17	6,602	20	6,599
WC-20 (6,606*)	0	6,606	11	6,595
WC-21 (6,612)	5	6,607	6	6,606

* Elevation estimated from topographic map (October 1996 aerial survey)

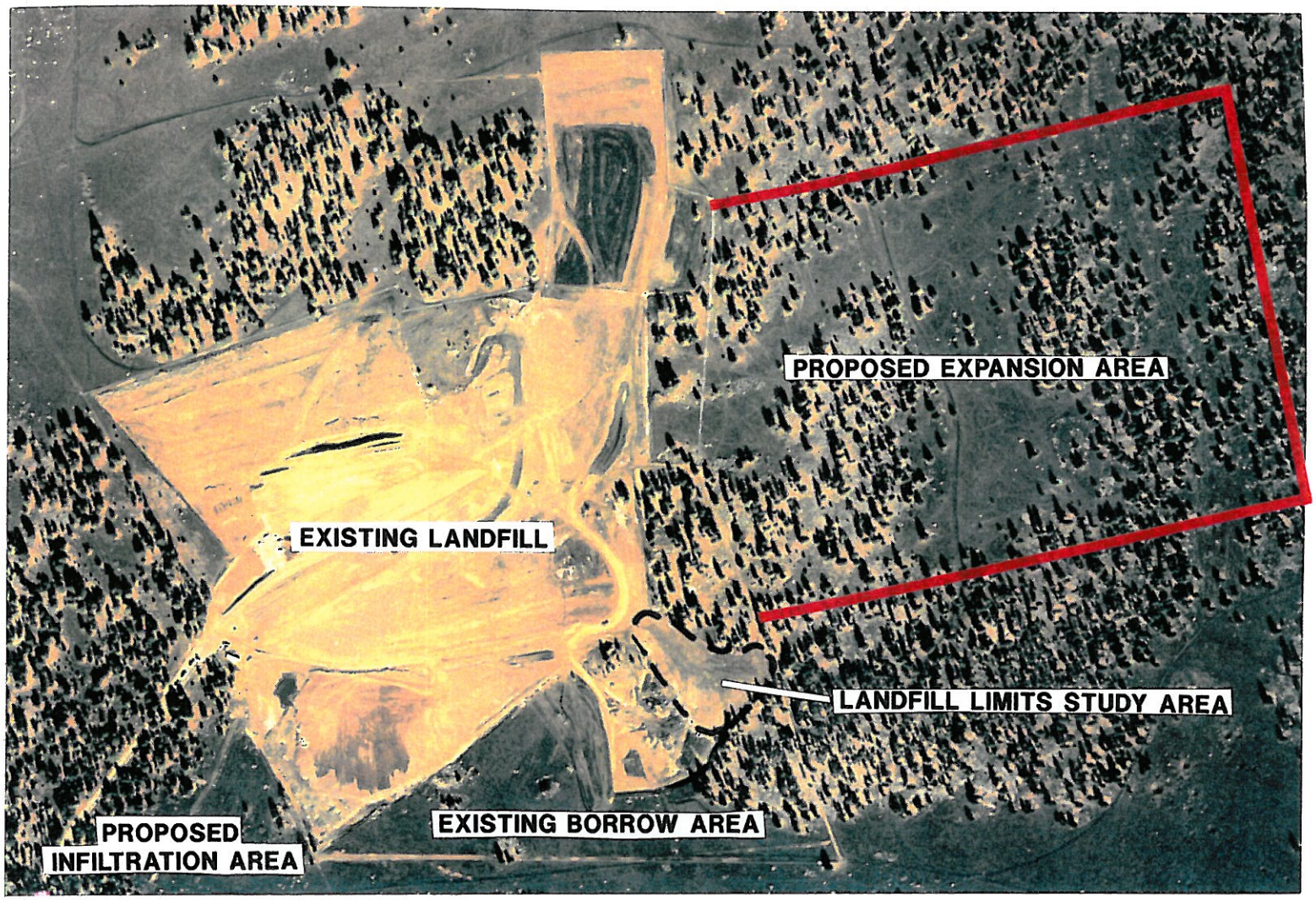
FIGURES



SITE LOCATION MAP
CINDER LAKE LANDFILL

FN: CL1	DRAWN BY: SH	CHECKED BY: mch	PROJECT NO: 96A199-400	DATE: 11-27-96	FIGURE NO: 1

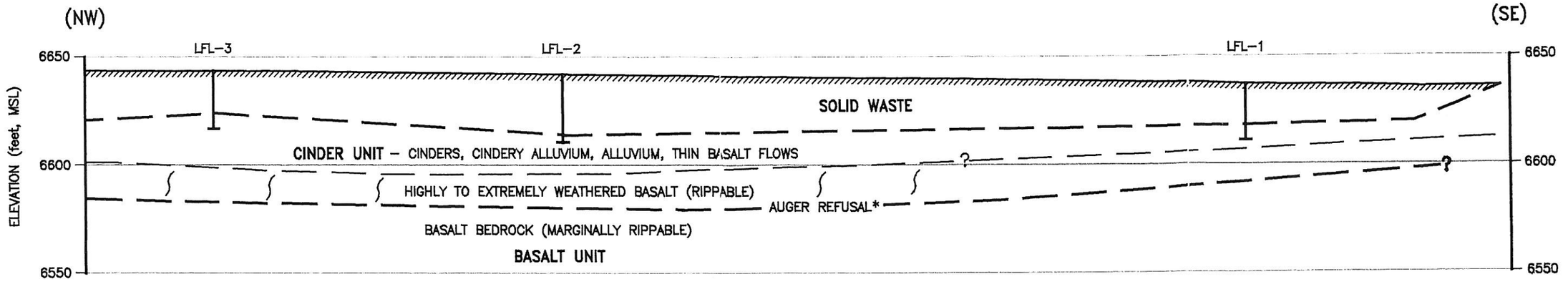
WOODWARD-CLYDE CONSULTANTS



STUDY AREAS
CINDER LAKE LANDFILL

DRAWN BY: cb	CHECKED BY: mk	PROJECT NO: 96A199-0400	DATE: 11-25-96	FIGURE NO: 2

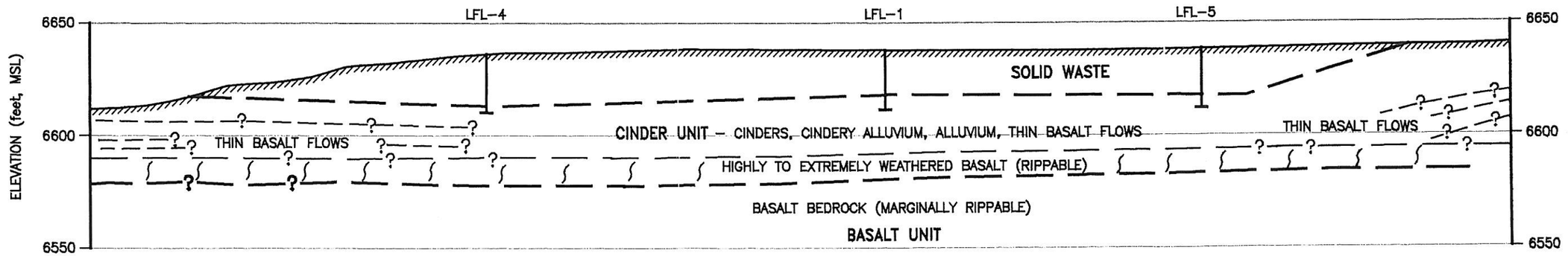
Woodward-Clyde



* BASED ON PROJECTION OF REFUSAL ENCOUNTERED IN BORING LFL-6

LANDFILL LIMITS SOUTHEASTERN SITE AREA (A 3|5)

SCALE: HORIZ. – 1"= 50'
VERT. – 1"= 50'



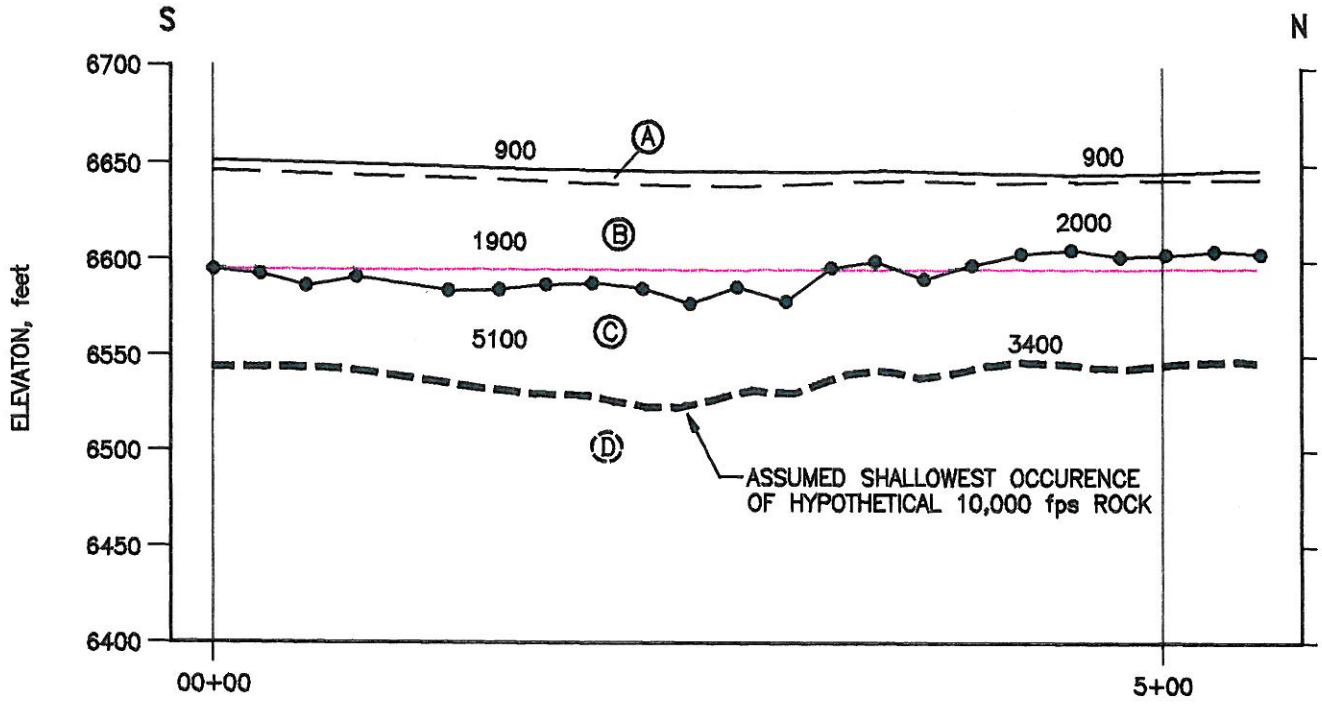
LANDFILL LIMITS SOUTHEASTERN SITE AREA (B 3|5)

SCALE: HORIZ. – 1"= 50'
VERT. – 1"= 50'

GEOLOGIC CROSS SECTIONS
LANDFILL LIMITS SOUTHEASTERN SITE AREA
CINDER LAKE LANDFILL

DRAWN BY: JA	CHECKED BY:	FIGURE NO: 5
FN: SECTSAB	DATE: 11-27-96	PROJECT NO: 96A199-0400

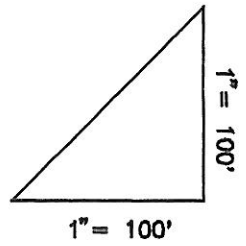
WOODWARD-CLYDE



LEGEND:

Ⓐ	LOW VELOCITY LAYER – EASILY EXCAVATED CINDERS AND SOIL
Ⓑ	LOW VELOCITY LAYER – EASILY EXCAVATED CINDERS AND SOIL BECOMING RIPPABLE ROCK IN LOWER PART OF LAYER
Ⓒ	HIGHER VELOCITY LAYER – RIPPABLE AND MARGINALLY RIPPABLE ROCK WITH LOCALIZED ZONES OF NON RIPPABLE ROCK. ANTICIPATE GREATER EXCAVATION DIFFICULTY WITH DEPTH.
Ⓓ	HYPOTHETICAL HIGH VELOCITY LAYER – NON RIPPABLE ROCK
~~	INTERPRETED TOP OF MARGINALLY RIPPABLE ROCK AS CONTOURED IN FIGURE 4.

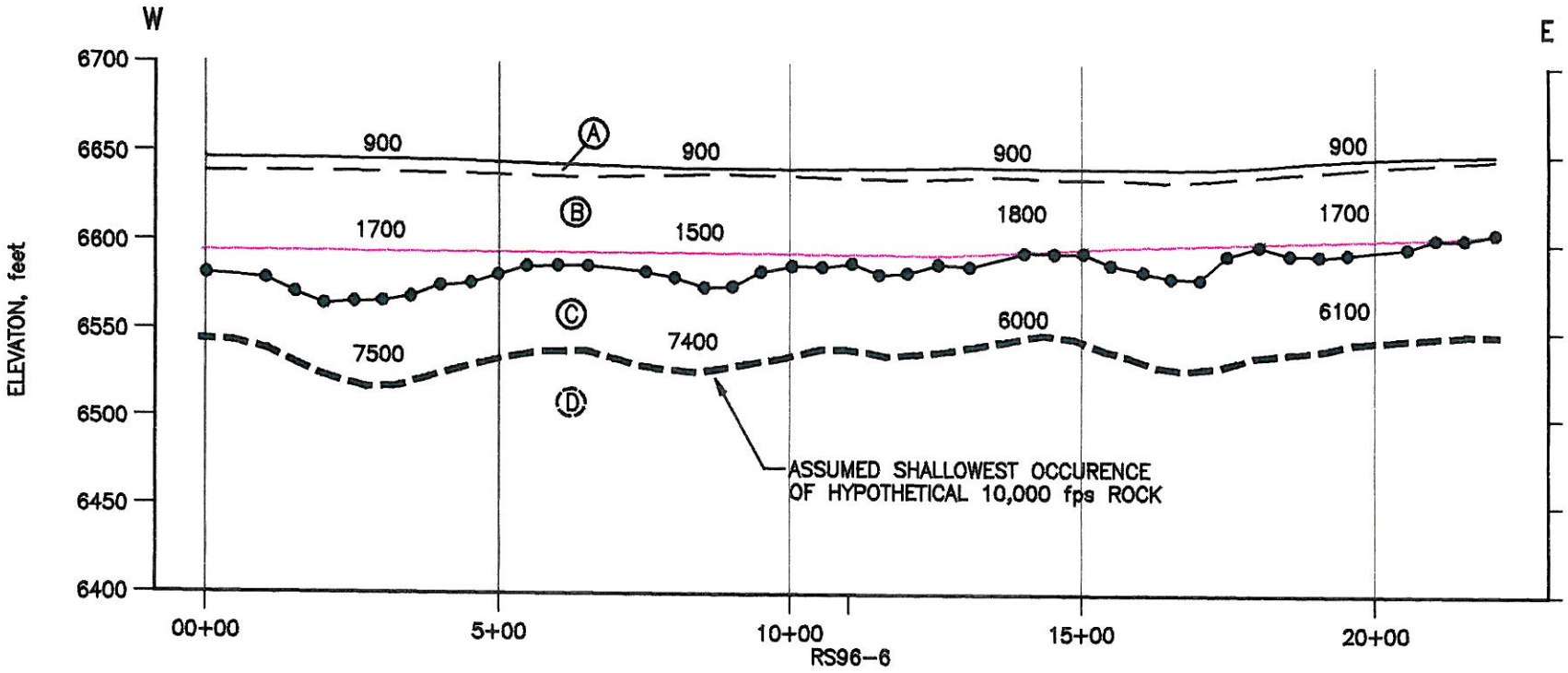
NOTE: P–WAVE VELOCITIES IN FEET PER SECOND



ANNOTATED SEISMIC REFRACTION PROFILE RS96–1
CINDER LAKE LANDFILL

FN: REF_PROF	DRAWN BY: JA	CHECKED BY:	PROJECT NO: 96A199–0410	DATE: 1–30–97	FIGURE NO: 6

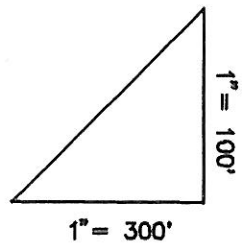
WOODWARD–CLYDE



LEGEND:

Ⓐ	LOW VELOCITY LAYER – EASILY EXCAVATED CINDERS AND SOIL
Ⓑ	LOW VELOCITY LAYER – EASILY EXCAVATED CINDERS AND SOIL BECOMING RIPPABLE ROCK IN LOWER PART OF LAYER
Ⓒ	HIGHER VELOCITY LAYER – RIPPABLE AND MARGINALLY RIPPABLE ROCK WITH LOCALIZED ZONES OF NON RIPPABLE ROCK. ANTICIPATE GREATER EXCAVATION DIFFICULTY WITH DEPTH.
Ⓓ	HYPOTHETICAL HIGH VELOCITY LAYER – NON RIPPABLE ROCK
———	INTERPRETED TOP OF MARGINALLY RIPPABLE ROCK AS CONTOURED IN FIGURE 4.

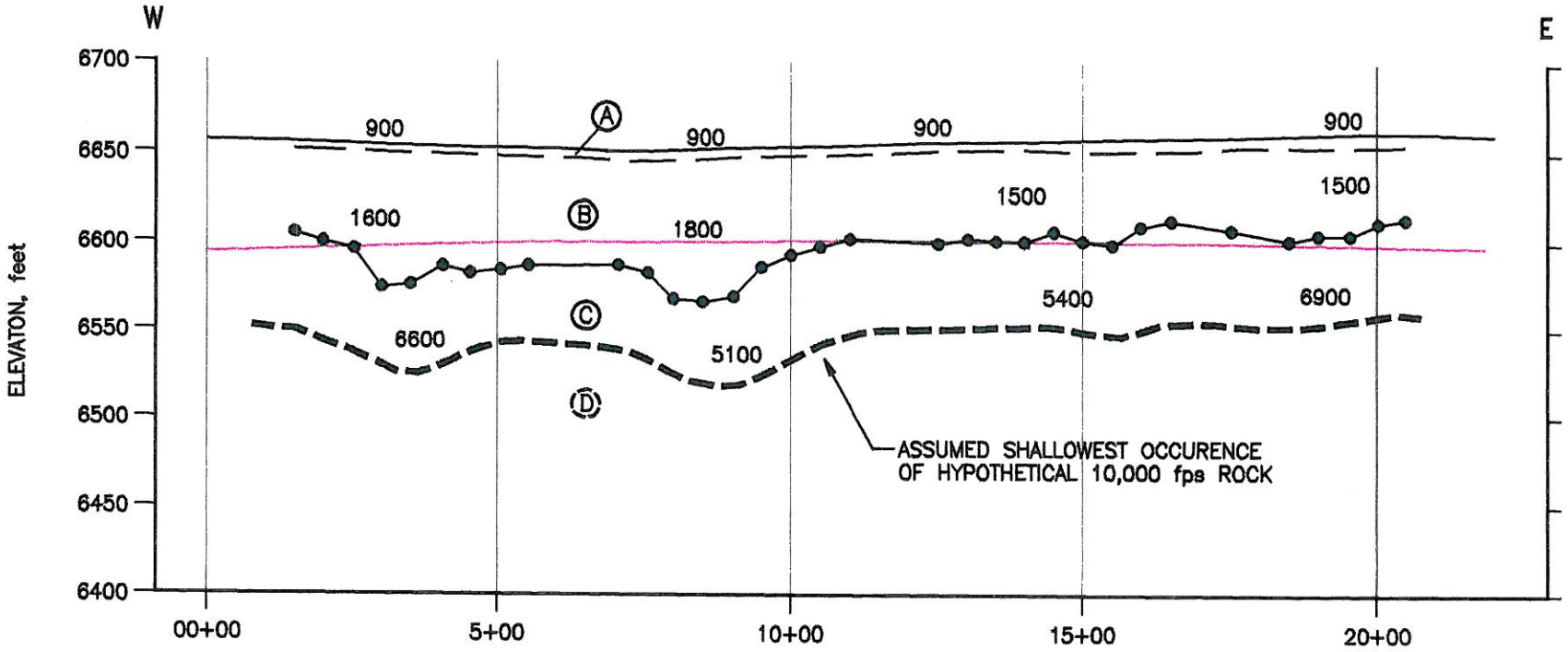
NOTE: P-WAVE VELOCITIES IN FEET PER SECOND



ANNOTATED SEISMIC REFRACTION PROFILE RS96-2
CINDER LAKE LANDFILL

FN: REF_PROF	DRAWN BY: JA	CHECKED BY:	PROJECT NO: 96A199-0410	DATE: 1-30-97	FIGURE NO: 7

WOODWARD-CLYDE



LEGEND:

- (A) LOW VELOCITY LAYER – EASILY EXCAVATED CINDERS AND SOIL
- (B) LOW VELOCITY LAYER – EASILY EXCAVATED CINDERS AND SOIL BECOMING RIPPABLE ROCK IN LOWER PART OF LAYER
- (C) HIGHER VELOCITY LAYER – RIPPABLE AND MARGINALLY RIPPABLE ROCK WITH LOCALIZED ZONES OF NON RIPPABLE ROCK. ANTICIPATE GREATER EXCAVATION DIFFICULTY WITH DEPTH.
- (D) HYPOTHETICAL HIGH VELOCITY LAYER – NON RIPPABLE ROCK
- INTERPRETED TOP OF MARGINALLY RIPPABLE ROCK AS CONTOURED IN FIGURE 4.

NOTE: P–WAVE VELOCITIES IN FEET PER SECOND

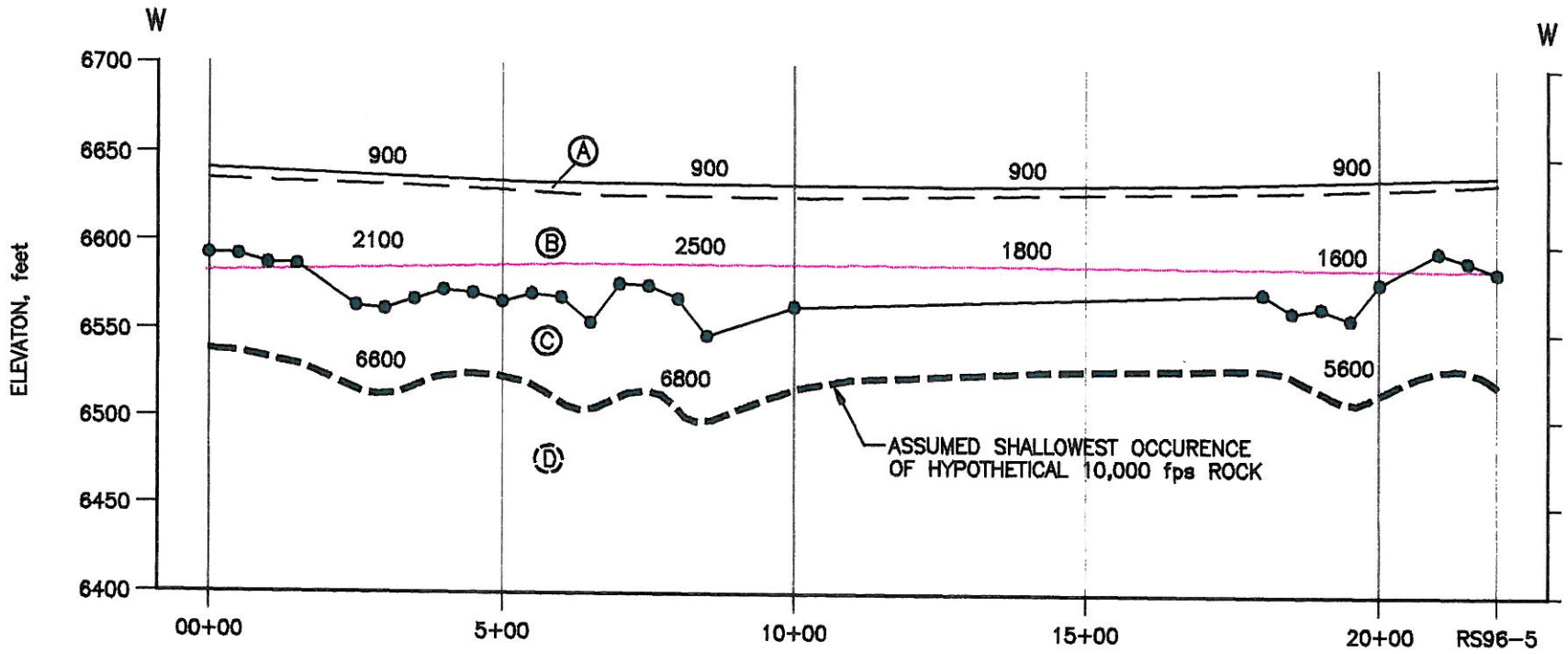
1" = 100'

1" = 300'

ANNOTATED SEISMIC REFRACTION PROFILE RS96–3
CINDER LAKE LANDFILL

FN: REF_PROF	DRAWN BY: JA	CHECKED BY:	PROJECT NO: 96A199–0410	DATE: 1–30–97	FIGURE NO: 8

WOODWARD–CLYDE



LEGEND:

Ⓐ LOW VELOCITY LAYER – EASILY EXCAVATED CINDERS AND SOIL

Ⓑ LOW VELOCITY LAYER – EASILY EXCAVATED CINDERS AND SOIL BECOMING RIPPABLE ROCK IN LOWER PART OF LAYER

Ⓒ HIGHER VELOCITY LAYER – RIPPABLE AND MARGINALLY RIPPABLE ROCK WITH LOCALIZED ZONES OF NON RIPPABLE ROCK. ANTICIPATE GREATER EXCAVATION DIFFICULTY WITH DEPTH.

Ⓓ HYPOTHETICAL HIGH VELOCITY LAYER – NON RIPPABLE ROCK

INTERPRETED TOP OF MARGINALLY RIPPABLE ROCK AS CONTOURED IN FIGURE 4.

NOTE: P-WAVE VELOCITIES IN FEET PER SECOND

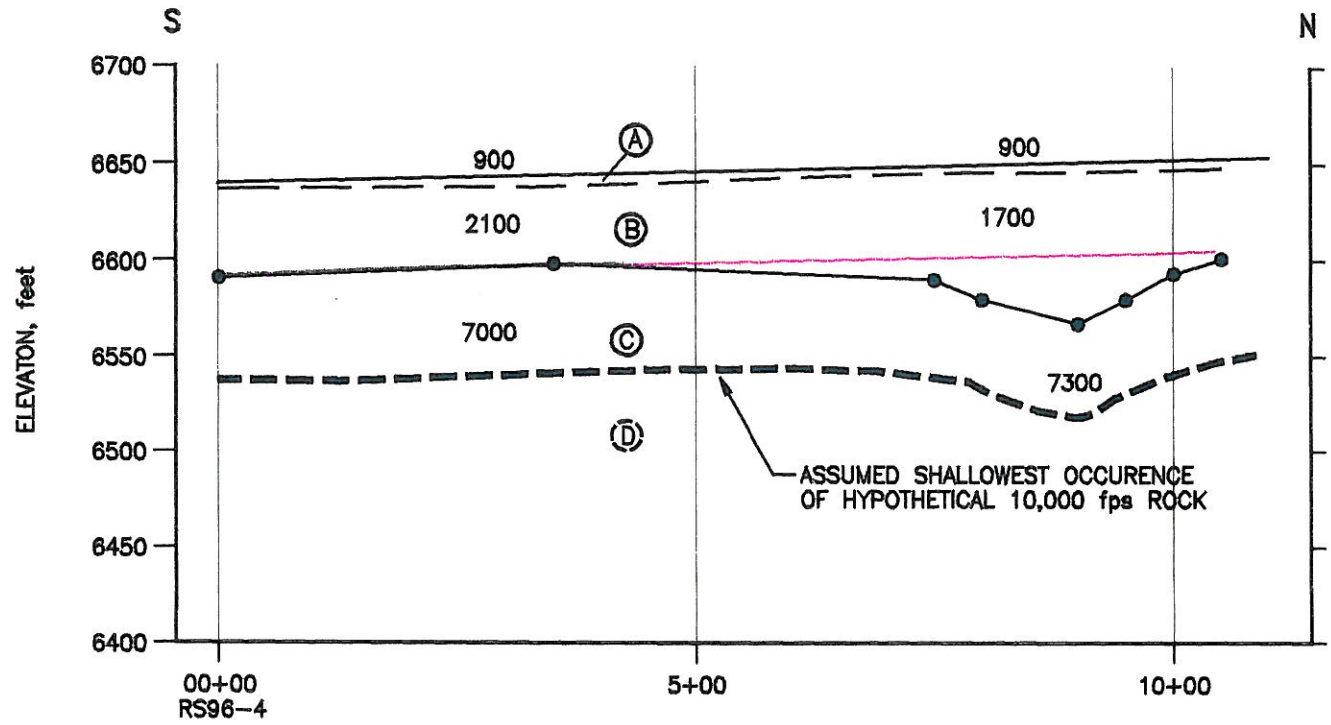
1" = 100'

1" = 300'

ANNOTATED SEISMIC REFRACTION PROFILE RS96-4
CINDER LAKE LANDFILL

FN: REF_PROF	DRAWN BY: JA	CHECKED BY:	PROJECT NO: 96A199-0410	DATE: 1-30-97	FIGURE NO: 9

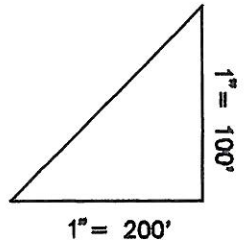
WOODWARD-CLYDE



LEGEND:

Ⓐ	LOW VELOCITY LAYER – EASILY EXCAVATED CINDERS AND SOIL
Ⓑ	LOW VELOCITY LAYER – EASILY EXCAVATED CINDERS AND SOIL BECOMING RIPPABLE ROCK IN LOWER PART OF LAYER
Ⓒ	HIGHER VELOCITY LAYER – RIPPABLE AND MARGINALLY RIPPABLE ROCK WITH LOCALIZED ZONES OF NON RIPPABLE ROCK. ANTICIPATE GREATER EXCAVATION DIFFICULTY WITH DEPTH.
Ⓓ	HYPOTHETICAL HIGH VELOCITY LAYER – NON RIPPABLE ROCK
———	INTERPRETED TOP OF MARGINALLY RIPPABLE ROCK AS CONTOURED IN FIGURE 4.

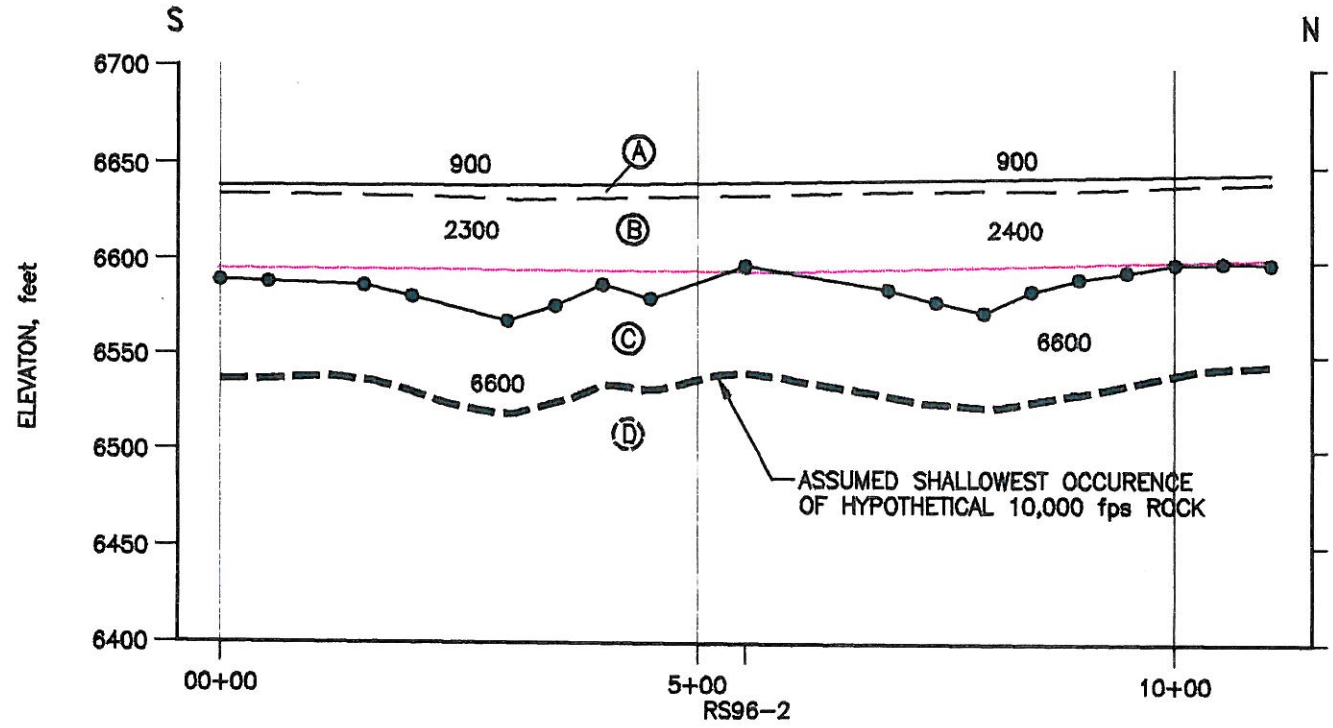
NOTE: P–WAVE VELOCITIES IN FEET PER SECOND



ANNOTATED SEISMIC REFRACTION PROFILE RS96–5
CINDER LAKE LANDFILL

FN: REF_PROF	DRAWN BY: JA	CHECKED BY:	PROJECT NO: 96A199–0410	DATE: 1–30–97	FIGURE NO: 10

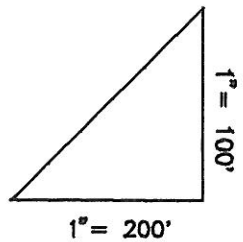
WOODWARD–CLYDE



LEGEND:

Ⓐ	LOW VELOCITY LAYER – EASILY EXCAVATED CINDERS AND SOIL
Ⓑ	LOW VELOCITY LAYER – EASILY EXCAVATED CINDERS AND SOIL BECOMING RIPPABLE ROCK IN LOWER PART OF LAYER
Ⓒ	HIGHER VELOCITY LAYER – RIPPABLE AND MARGINALLY RIPPABLE ROCK WITH LOCALIZED ZONES OF NON RIPPABLE ROCK. ANTICIPATE GREATER EXCAVATION DIFFICULTY WITH DEPTH.
Ⓓ	HYPOTHETICAL HIGH VELOCITY LAYER – NON RIPPABLE ROCK
~~	INTERPRETED TOP OF MARGINALLY RIPPABLE ROCK AS CONTOURED IN FIGURE 4.

NOTE: P–WAVE VELOCITIES IN FEET PER SECOND



ANNOTATED SEISMIC REFRACTION PROFILE RS96–6
CINDER LAKE LANDFILL

FN: REF_PROF	DRAWN BY: JA	CHECKED BY:	PROJECT NO: 96A199–0410	DATE: 1–30–97	FIGURE NO: 11

WOODWARD–CLYDE

APPENDIX A

Geophysical surveys were completed at the Cinder Lake Landfill site on September 19 and 20, 1996. These surveys consisted of seismic refraction measurements along six profiles (RS96-1 through RS96-6). The purpose of these surveys is to help evaluate the depth and seismic properties of subsurface layers for rippability analysis. The locations of the seismic refraction surveys are shown on Figure 3.

Methods and Limitations

The seismic refraction method is based on the principle that compressional waves travel through different lithologic units at different velocities. Seismic refraction surveying involves measuring the time required for a compressional wave (p-wave) to travel from a sourcepoint (shotpoint) to one or more co-linear sensors (geophones). The time required for the induced wave to travel over a measured distance provides an estimate of the compressional wave velocity and depth of subsurface geologic layers. Seismic refraction travel times were plotted on time-distance graphs and interpreted using time-term methods (the generalized reciprocal method). The resulting models represent the rock and soil depths and velocities that would account for the measured travel times. These models are non-unique but appear to be the most reasonable solutions based on the known geology. The generally accepted value for depth accuracy is 20%. The success of seismic refraction is dependent on the following assumptions:

(1) compressional wave velocity increases with increasing depth,
(2) layers are relatively continuous and thick enough to be individually resolved, and
(3) significant velocity differences are present between layers or across faults.

Seismic refraction measurements were obtained using a Geometrics S24 seismograph with twenty-four 8 Hertz (Hz) geophones. Geophones were spaced at 25 or 50 foot intervals and were usually in-line with the source. Compressional waves were produced by striking a groundplate with a sledgehammer. Shotpoints were nominally placed at the center of each line, at each end, and offset between 200 to 400 feet beyond each end, yielding a maximum source-receiver distance between 650 and 1,500 feet. The end geophones of contiguous line segments were generally overlapped to provide continuous profiles.

The primary constraint on data quality was heavy equipment (adjacent to the site during landfill activity) and wind noise. Site geometry and surface conditions sometimes limited shotpoint and geophone positioning and the subsequent interpretation.

Results and Discussion

The seismic refraction interpreted profiles are shown in Figures A-1 through A-6. Figure A-7 explains the symbols and terminology used to reduce the refraction data. Annotated seismic refraction profiles are shown in Figures 6 through 11 in the report section of this document. The time-distance plots and interpretations for the profiles are shown on Figures A-8 through A-25.

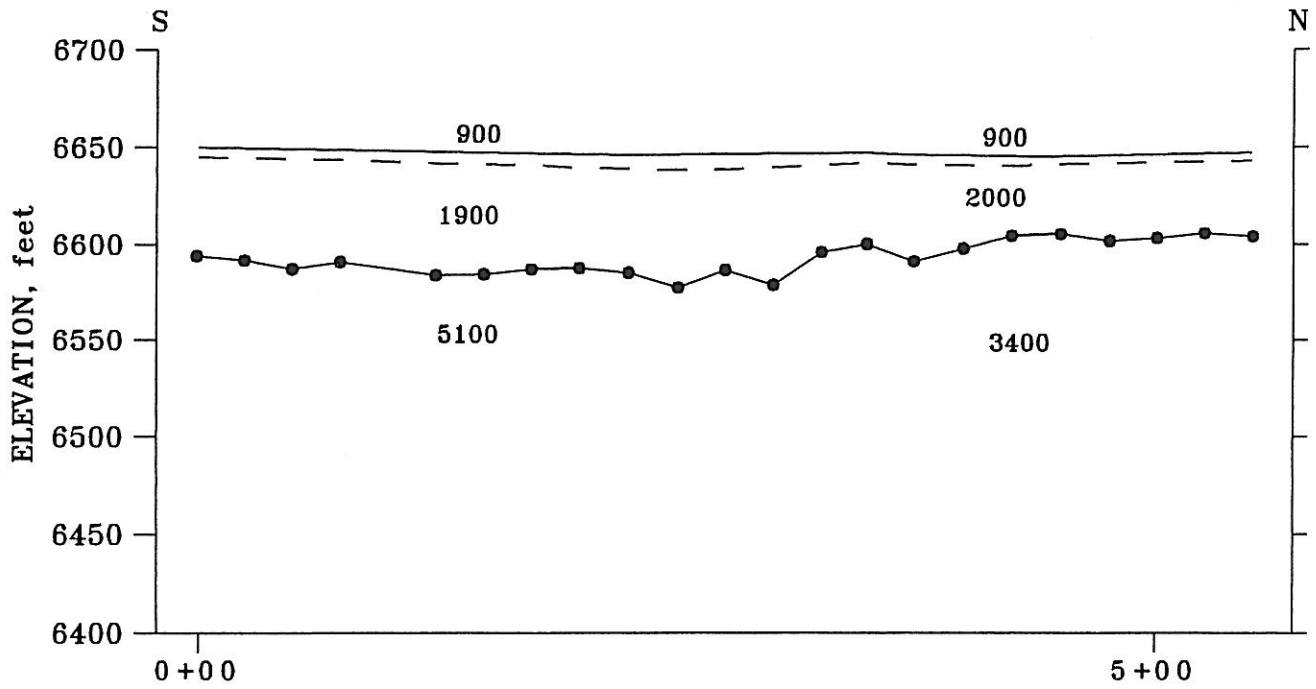
Layer A represents readily rippable alluvium. The upper portion of Layer B represents readily rippable alluvium with localized thin basalt flows or fused cinders. Density inversions within Layer B were noted from blow-count data on some of the preliminary boring logs. Density

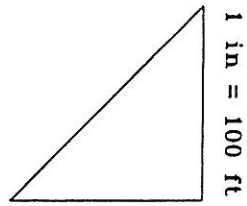
preliminary boring data, there exists locally within Layer B thin intermediate layers. These intermediate layers are too thin to be individually resolved with seismic refraction and thus violate assumption (2), above. The p-wave velocity of Layer B represents an average for that material. It should be noted that there may be intermediate zones within Layer B that might be harder than the average seismic velocity would indicate. Also, because of the averaging effect within Layer B, the depth accuracy to the top of Layer C may exceed 20%.

The lowest portion of Layer B is extremely to highly weathered basalt. From analysis of preliminary boring data, the thickness of the weathered basalt at the base of Layer B ranges from about 5 to 30 feet. Thus, more difficult ripping conditions may be encountered at elevations between 5 to 30 feet higher than the base of Layer B or top of Layer C. Also, there may exist thin intermediate layers within Layer B that may be difficult to rip.

Layer C represents rock excavation conditions including primarily rippable and marginally rippable rock with potential zones of non-rippable rock.

Layer D is a hypothetical layer consisting of 10,000 fps material (non-rippable). Our geophysical surveys did not encounter any 10,000 fps material. However, based on the geophysical model and assuming a 10,000 fps velocity, we can calculate the shallowest occurrence of such a layer that would be expected given the characteristics of Layer C. Layer D is shown on the Annotated Seismic Refraction Profiles (Figures 6 through 11).

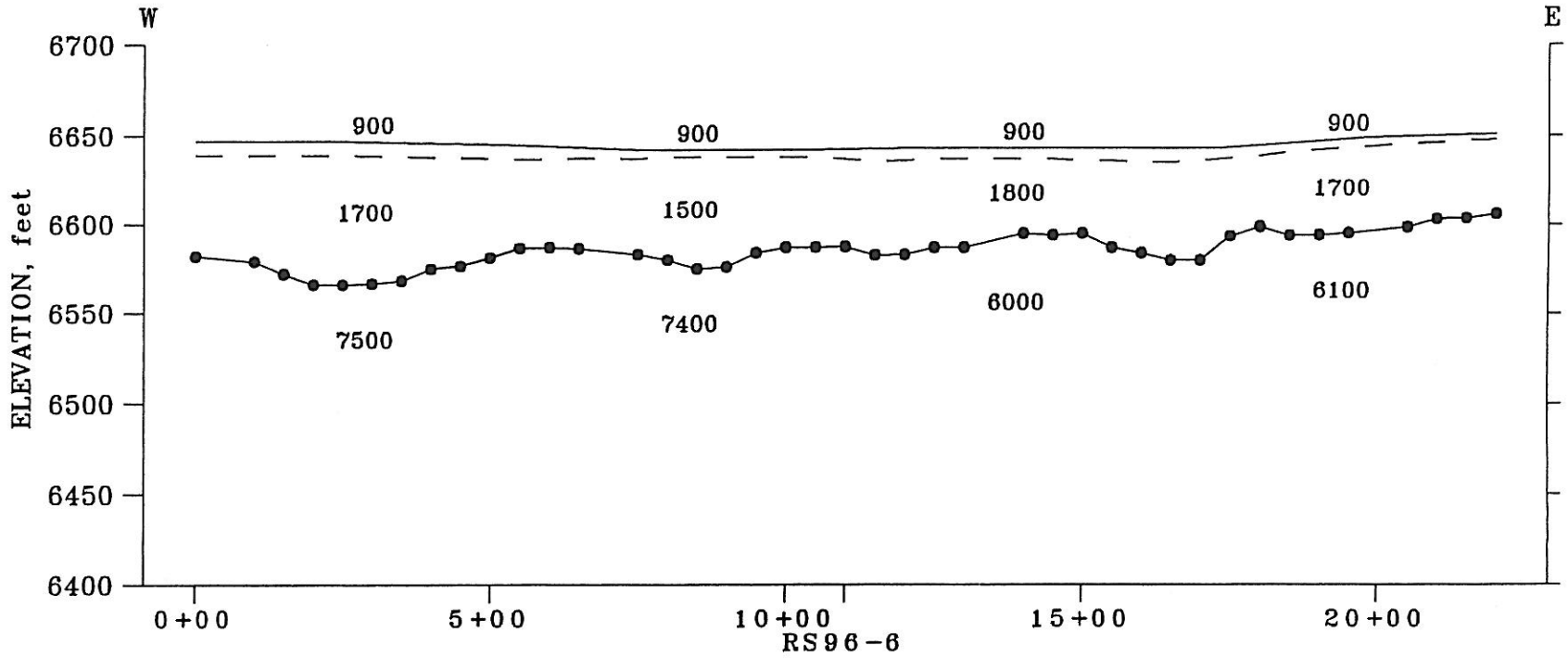


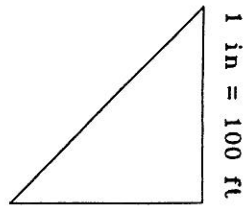


P-wave velocities in feet per second

SEISMIC REFRACTION PROFILE RS96-1

Project No.: 96A199	Date: 9/19/96	Project: CINDER LAKE LANDFILL	Fig. A-1



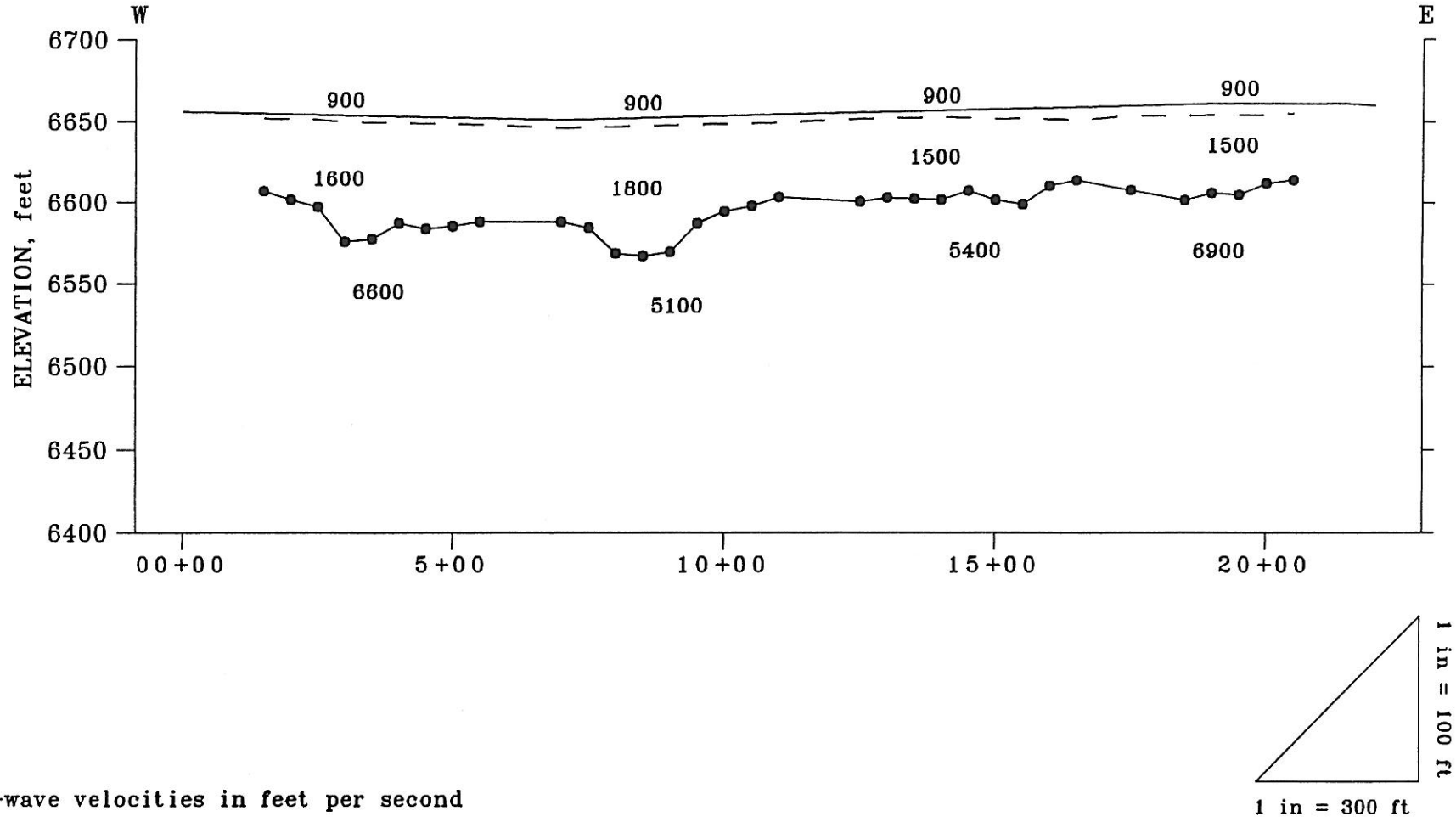


1 in = 300 ft

P-wave velocities in feet per second

SEISMIC REFRACTION PROFILE RS96-2

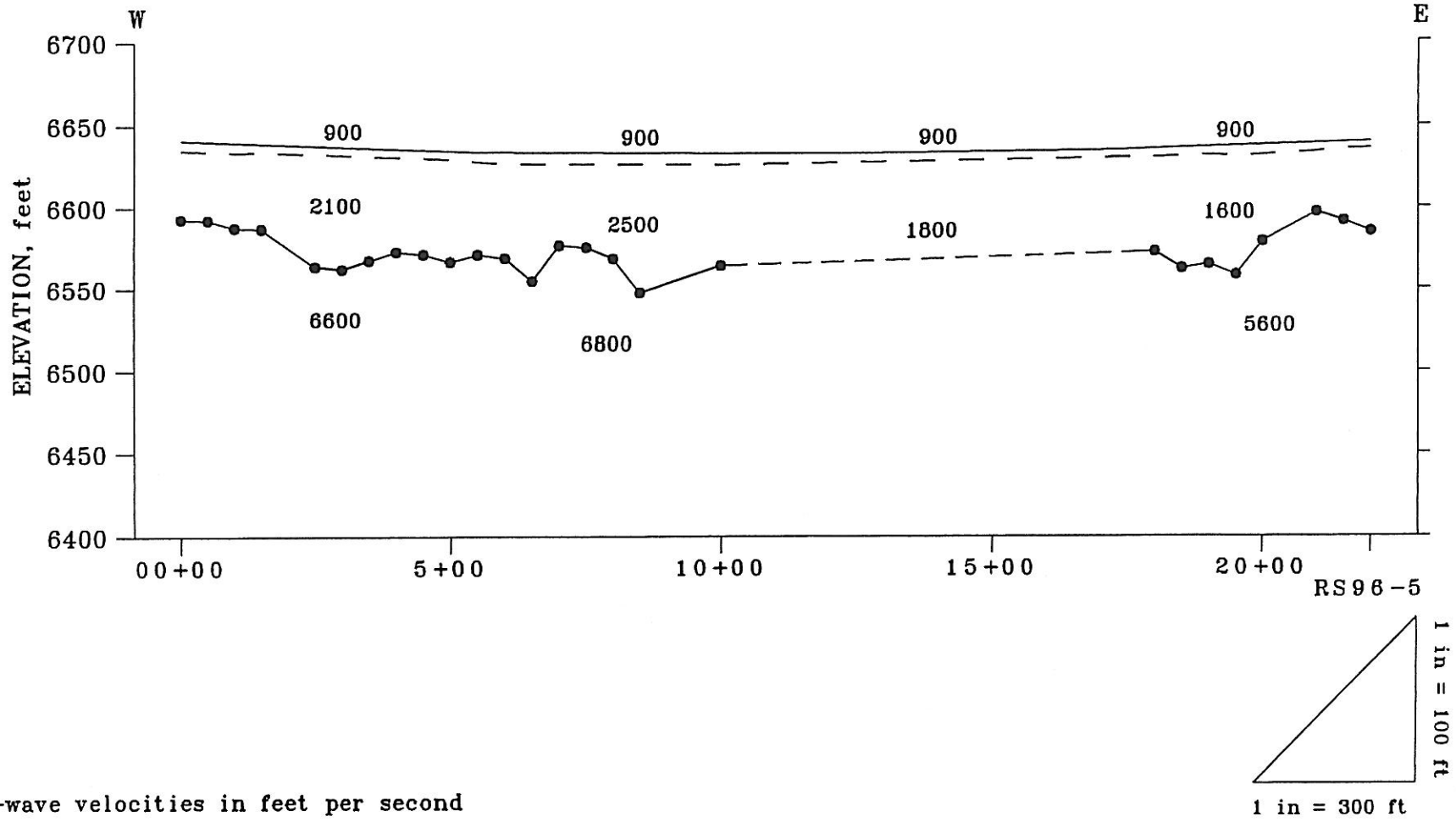
Project No.: 96A199	Date: 9/19/96	Project: CINDER LAKE LANDFILL	Fig. A-2



P-wave velocities in feet per second

SEISMIC REFRACTION PROFILE RS96-3

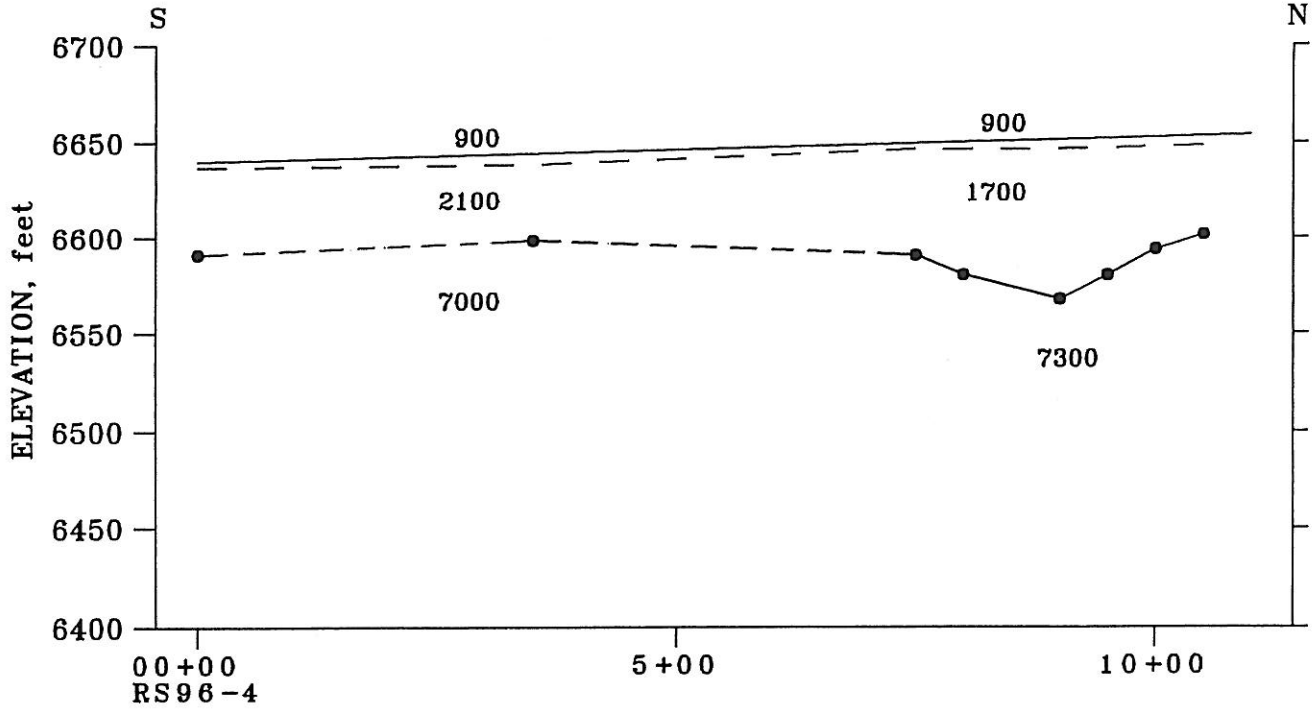
Project No.: 96A199	Date: 9/19/96	Project: CINDER LAKE LANDFILL	Fig. A-3

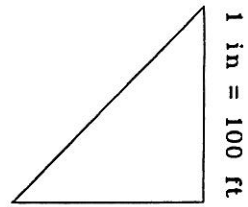


P-wave velocities in feet per second

SEISMIC REFRACTION PROFILE RS96-4

Project No.: 96A199	Date: 9/19/96	Project: CINDER LAKE LANDFILL	Fig. A-4



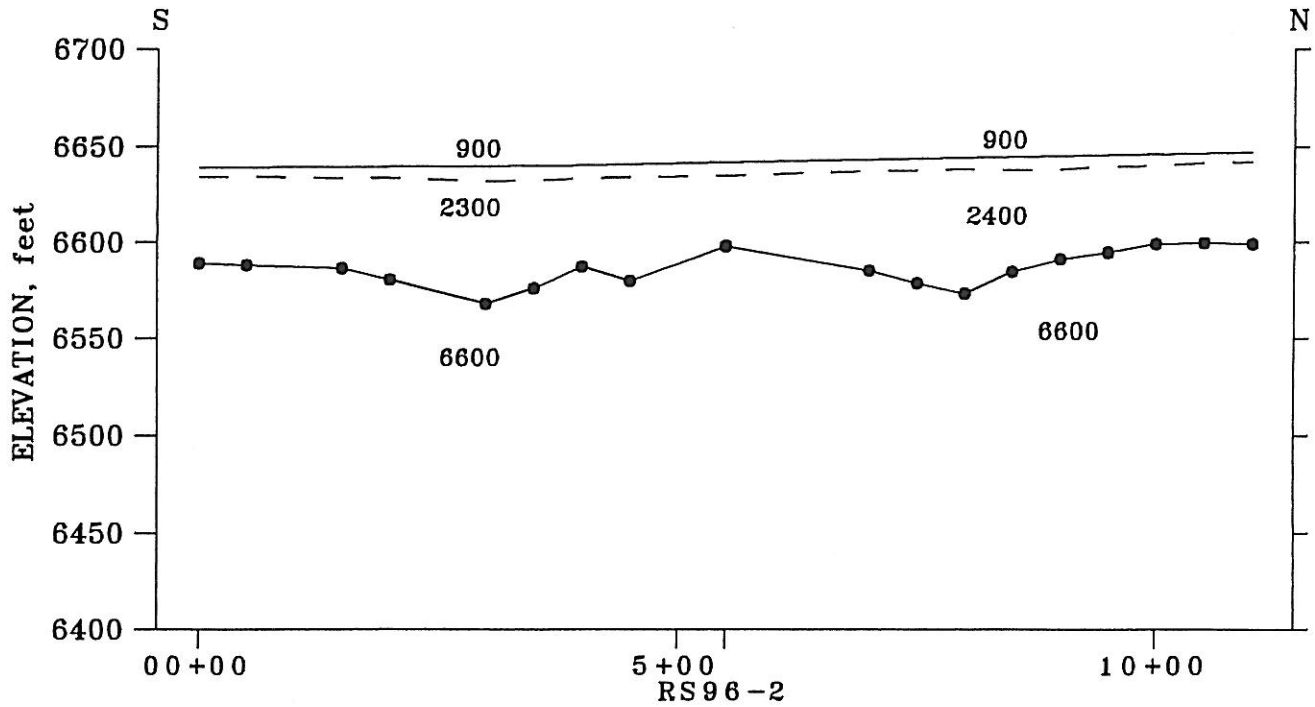


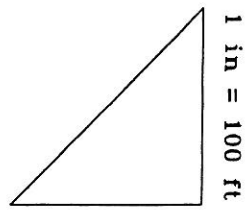
1 in = 200 ft

P-wave velocities in feet per second

SEISMIC REFRACTION PROFILE RS96-5

Project No.: 96A199	Date: 9/19/96	Project: CINDER LAKE LANDFILL	Fig. A-5





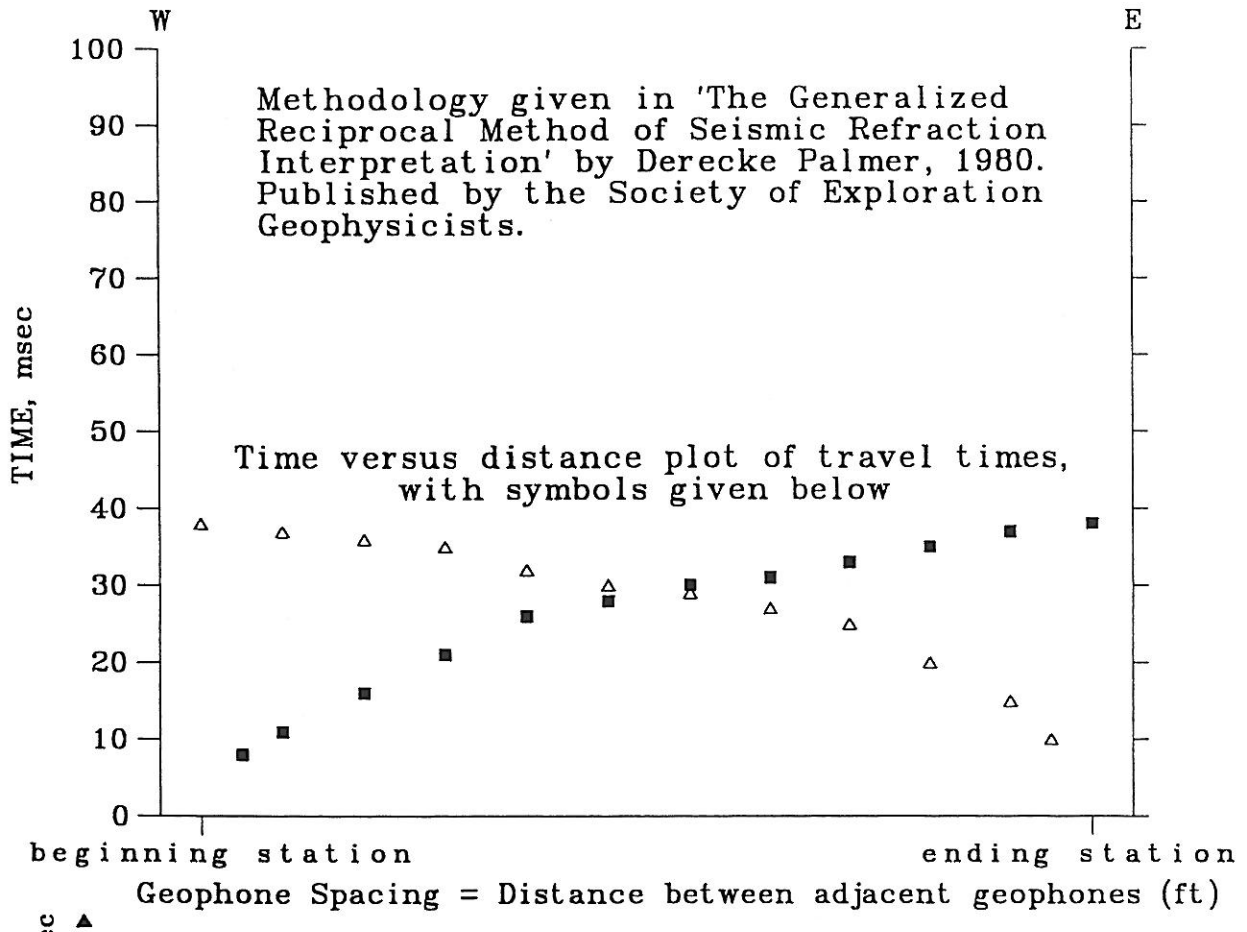
1 in = 200 ft

P-wave velocities in feet per second

SEISMIC REFRACTION PROFILE RS96-6

Project No.: 96A199	Date: 9/19/96	Project: CINDER LAKE LANDFILL	Fig. A-6

KEY TO SYMBOLS AND NOTATION USED ON SEISMIC REFRACTION DATA SHEETS

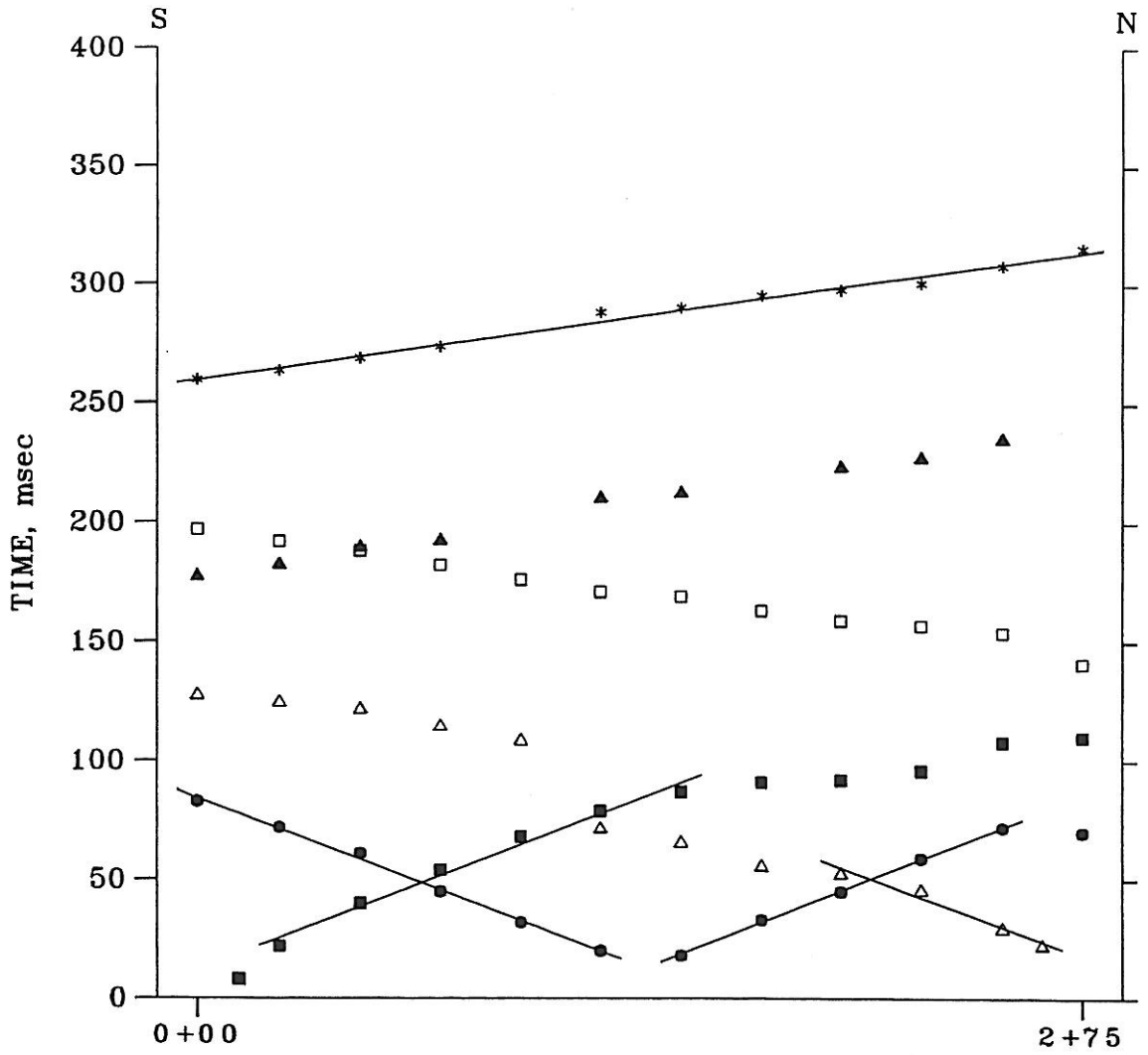


t_{ab}= Reciprocal time, end-to-end travel time (msec)
XY = Geophone analysis separation distance (ft)
t_a= Travel times of refracted arrivals from end shot (msec)
t_b= Travel times of refracted arrivals from reversed shot (msec)
* $\frac{1}{2}\Delta t$= Velocity analysis function, plotted above travel times on time-distance plot (msec)
t_g= Time depth, $(t_a+t_b-t_{ab})/2$ (msec)
t_c= Delay times due to thin surface layer ($\frac{1}{2}$ time intercept at shotpoints) with z_0 depth and v_0 velocity (msec)

---

z_i= Calculated depth to the i^{th} layer, assumed normal to the
z_{i+1}= surface, (t_g-t_c) x Velocity Function (ft)
v_i= Velocity of the i^{th} layer from the Velocity Function
v_{i+1}= or the inverse slope of the raw data (ft/sec)
v_{i+2}=

[Line Number]			
Project No.:	Date:	Project:	Fig. **A-7**



Geophone spacing = 25 ft

Arrival Time, msec												
▲	178	183	190	193		211	213		224	228	236	
■	8	22	40	54	68	79	87	91	92	96	108	110
●	83	72	61	45	32	20	18	33	45	59	72	70
△	128	125	122	115	109	72	66	56	53	46	30	23
□	197	192	188	182	176	171	169	163	159	157	154	141

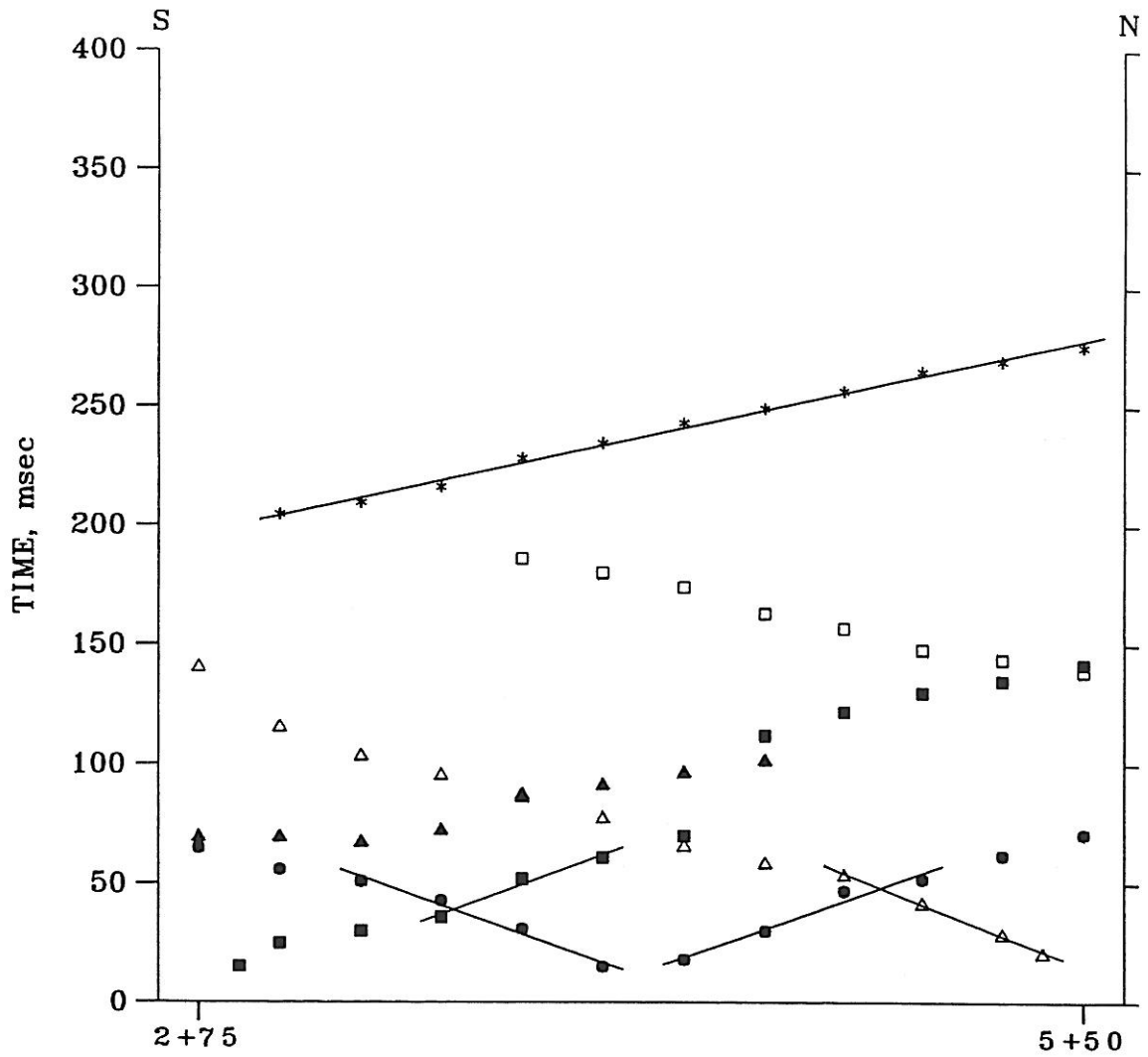
t_{ab}= 119 msec; XY = 0

t_a=	52	57	64	67		85	87	91	92	96	108	110
t_b=	128	125	122	115	109	104	102	96	92	90	87	74
* ½Δt=	−38	−34	−29	−24		−9½	−7½	−2½	0	3	10½	18
t_g=	30½	31½	33½	31½		35	35	34	32½	33½	38	32½
t_c=	6	6	6	6	6	7	7	7	8	8	9	9

z_0=	5	5	5	5		6	6	6	7	7	8	8 ft
z_1=	57	59	63	59		65	64	61	59	61	69	60 ft
v_0=						900						fps
v_1=			1920		1940			1870		2030		fps
v_2=						5070						fps

RS96-1

Project No.: 96A199	Date: 9/19/96	Project: CINDER LAKE LANDFILL	Fig. **A-8**



Geophone spacing = 25 ft

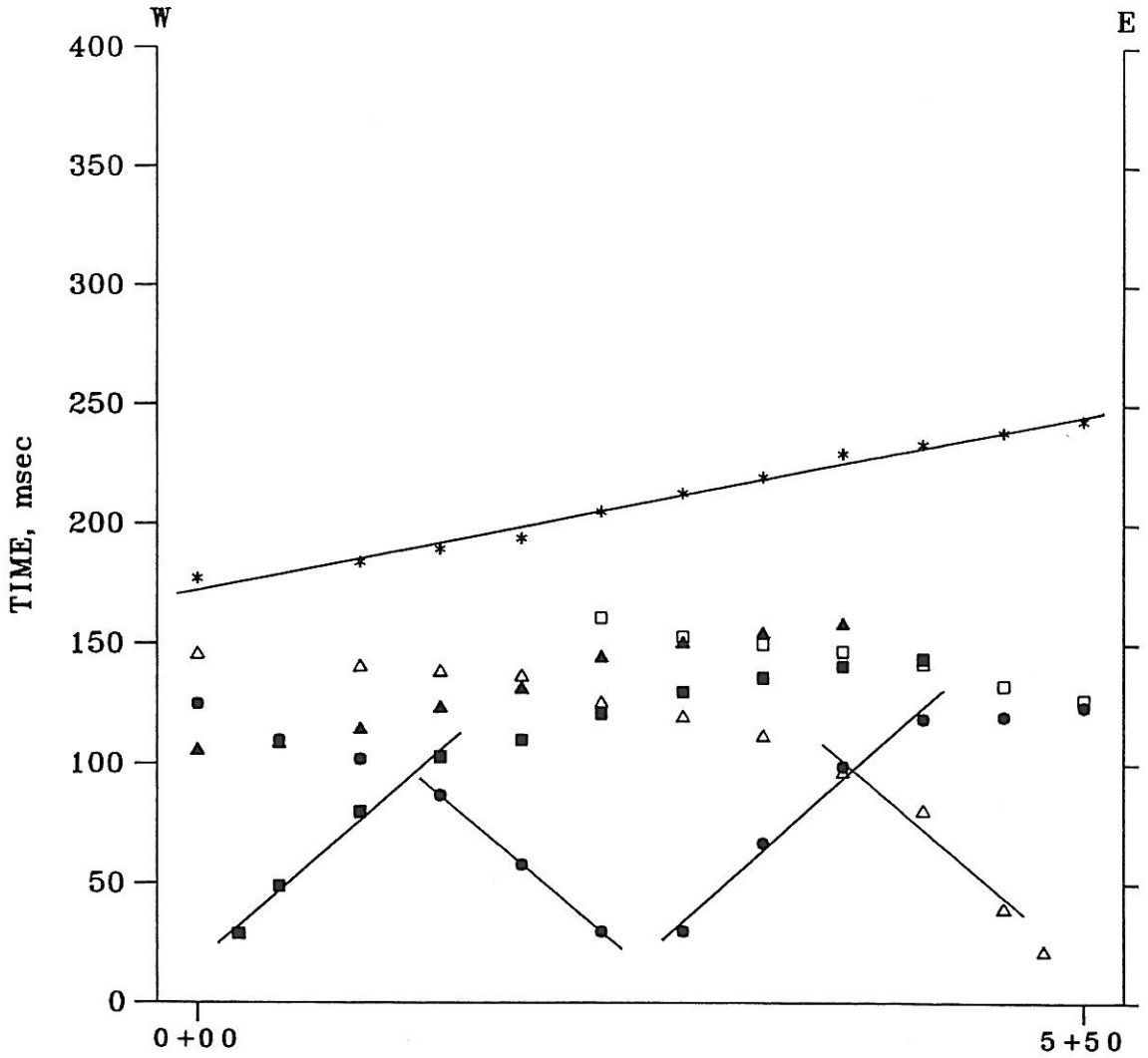
Arrival Time, msec													
▲	70	70	68	73	88	92	97	102					
■	15	25	30	36	52	61	70	112	122	130	135	142	
●	65	56	51	43	31	15	18	30	47	52	62	71	
△	141	116	104	96	87	78	66	59	54	42	29	21	
□					186	180	174	163	157	148	144	139	

t_{ab} = 134 msec; XY = 0

t_a =		80	78	83	98	102	107	112	122	130	135	142	
t_b =	125	116	104	96	87	78	66	59	54	45	41	36	
* $\frac{1}{2}\Delta t$ =		-18	-13	-6½	5½	12	20½	26½	34	42½	47	53	
t_g =		31	24	22½	25½	23	19½	18½	21	20½	21	22	
t_c =	9	8	7	6	6	6	6	5	5	5	5	5	
z_0 =		7	6	5	5	5	5	5	5	5	5	5	ft
z_1 =		68	51	48	55	49	42	41	44	43	42	44	ft
v_0 =						900							fps
v_1 =		2000			2080			2100			1910		fps
v_2 =						3380							fps

RS96-1

Project No.: 96A199	Date: 9/19/96	Project: CINDER LAKE LANDFILL	Fig. A-9



Geophone spacing = 50 ft

Arrival Time, msec

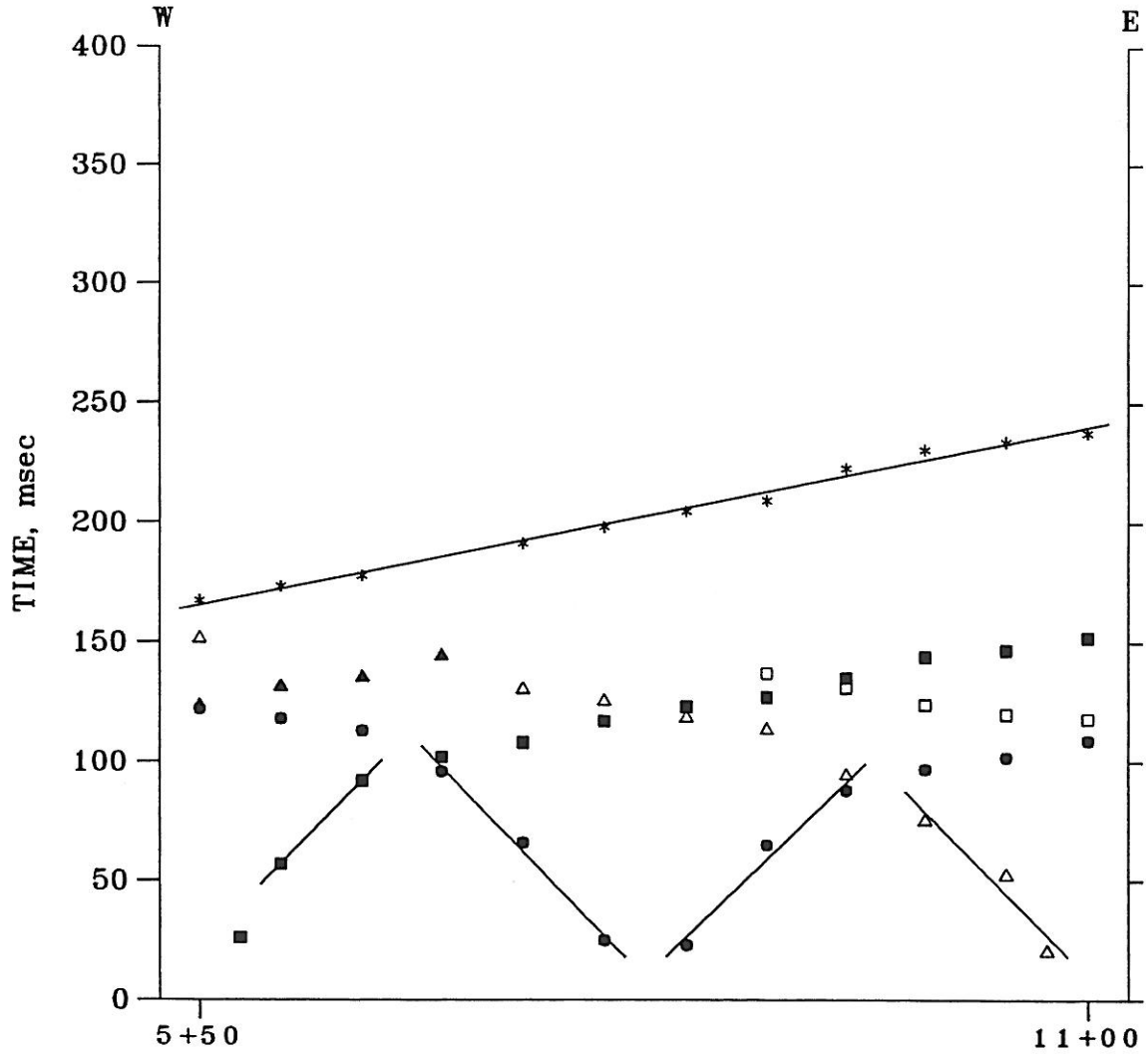
▲	106	109	115	124	132	145	151	155	159			
■	29	49	80	103	110	121	130	136	141	144		
●	125	110	102	87	58	30	30	67	99	119	120	124
△	146		141	139	137	126	120	112	97	81	40	22
□						161	153	150	147	142	133	127

t_{ab}= 148 msec; XY = 0

	t_a=	85	88	94	103	110	121	130	136	141	144	145	149	
	t_b=	146		141	139	137	126	120	112	97	92	83	77	
*	½Δt=	-30½		-23½	-18	-13½	-2½	5	12	22	26	31	36	
	t_g=	41½		43½	47	49½	49½	51	50	45	44	40	39	
	t_c=	9	9	9	9	9	9	9	9	9	9	9	9	
	z_0=	8		8	8	8	8	8	8	8	8	8	8	ft
	z_1=	65		68	75	81	81	80	78	71	70	64	62	ft
	v_0=						900							fps
	v_1=		1700			1750			1670			1750		fps
	v_2=						7530							fps

RS96-2

Project No.: 96A199	Date: 9/19/96	Project: CINDER LAKE LANDFILL	Fig. A-10



Geophone spacing = 50 ft

Arrival Time, msec												
▲	124	132	136	145								
■	26	57	92	102	108	117	123	127	135	144	147	152
●	122	118	113	96	66	25	23	65	88	97	102	109
△	152				131	126	119	114	95	76	53	21
□								137	131	124	120	118

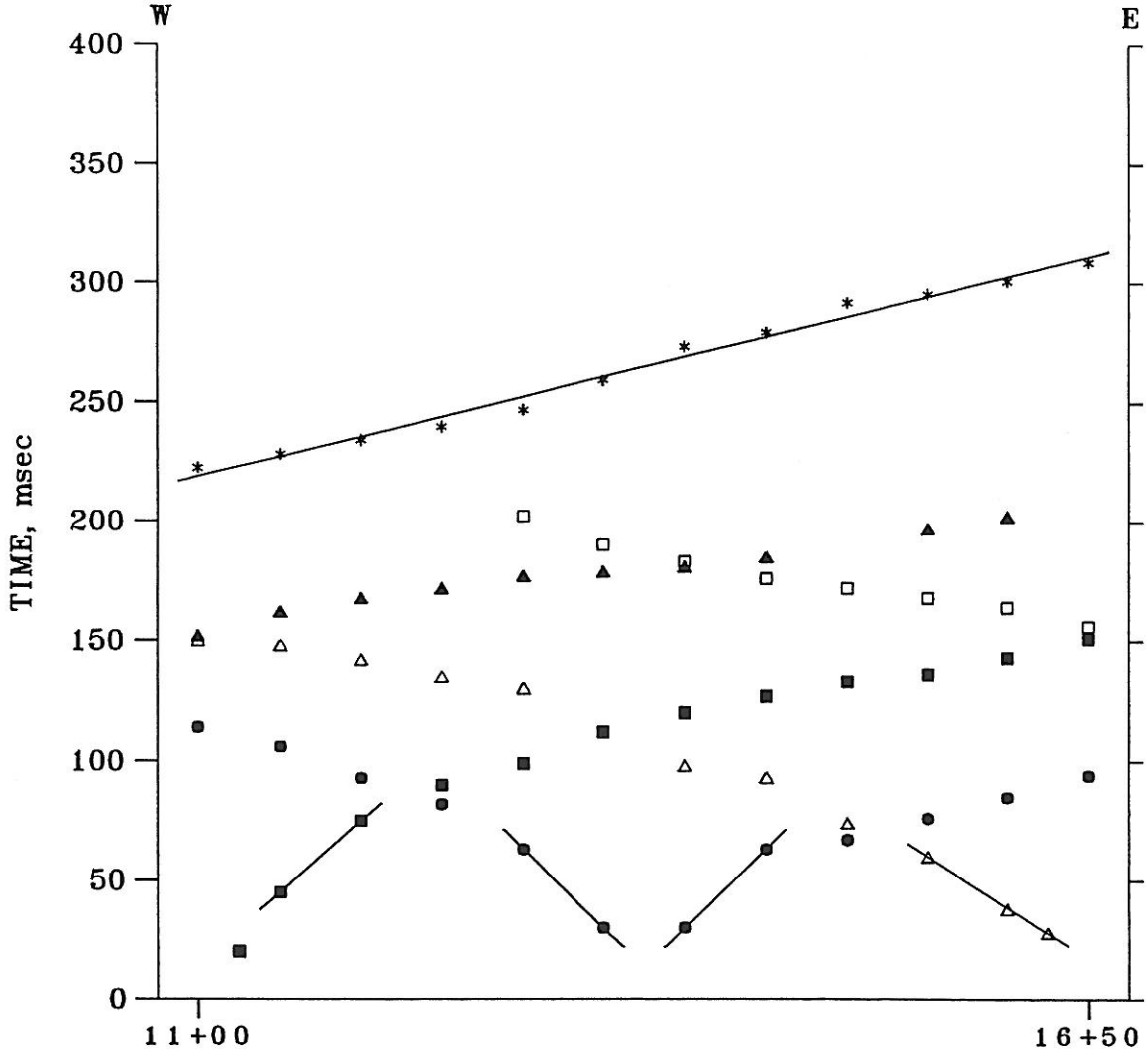
t_{ab}= 152 msec; XY = 0

t_a=	81	89	93	102	108	117	123	127	135	144	147	152
t_b=	152	148	143		131	126	119	114	95	88	84	82
* ½△t=	-35½	-29½	-25		-11½	-4½	2	6½	20	28	31½	35
t_g=	40½	42½	42		43½	45½	45	44½	39	40	39½	41
t_c=	9	8	7	7	6	5	5	5	5	5	5	5

z_0=	8	7	6		5	5	5	5	5	5	5	5 ft
z_1=	54	57	57		59	63	67	67	58	56	55	57 ft
v_0=						900						fps
v_1=			1430			1410			1540			1440 fps
v_2=							7370					fps

RS96-2

Project No.: 96A199	Date: 9/19/96	Project: CINDER LAKE LANDFILL	Fig. A-11



Geophone spacing = 50 ft

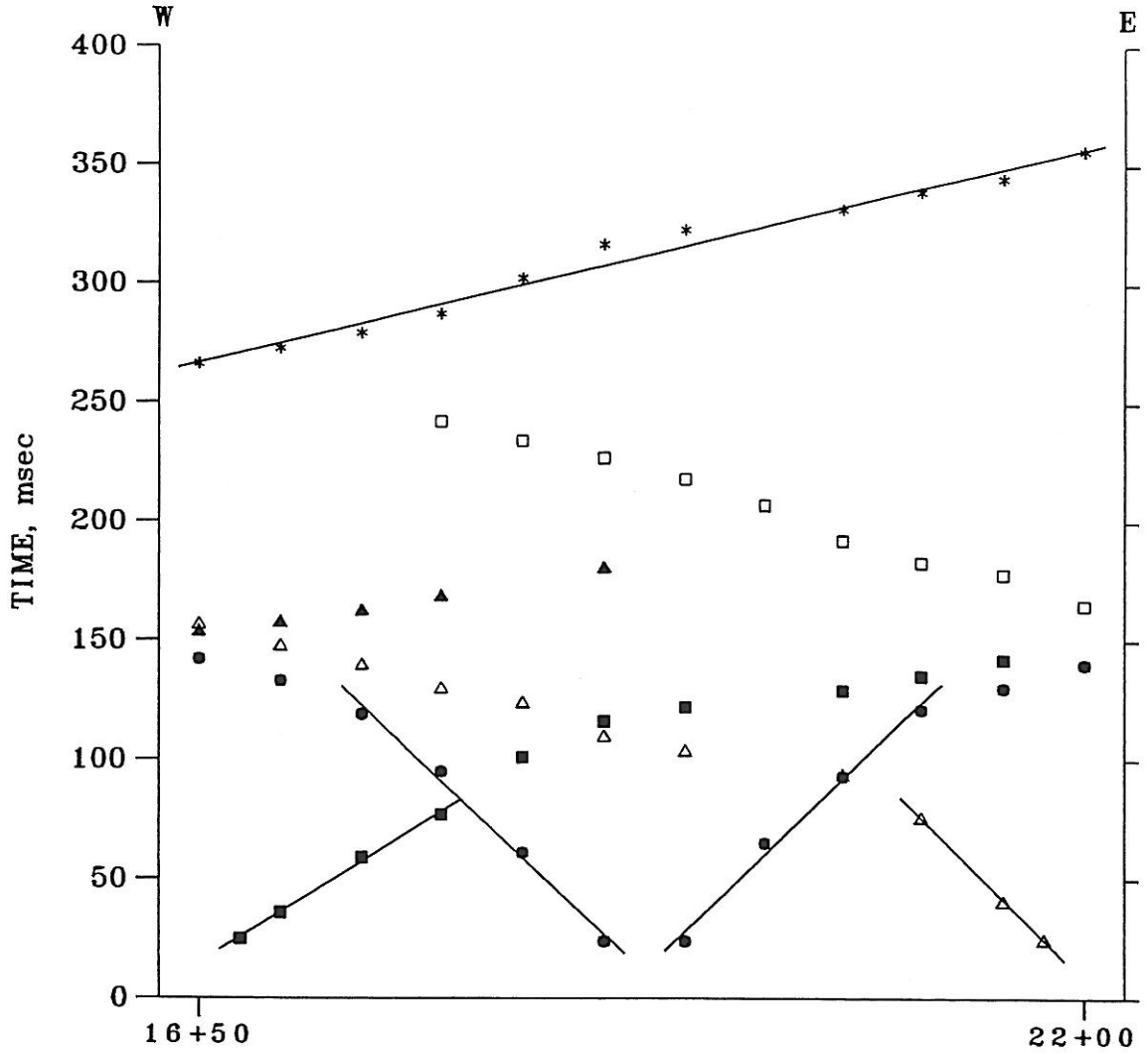
Arrival Time, msec													
▲	152	162	168	172	177	179	181	185		197	202		
■	20	45	75	90	99	112	120	127	133	136	143	151	
●	114	106	93	82	63	30	30	63	67	76	85	94	
△	150	148	142	135	130		98	93	74	60	38	28	
□					202	190	183	176	172	168	164	156	

t_{ab}= 151 msec; XY = 0

t_a=	70	80	86	90	99	112	120	127	133	136	143	151	
t_b=	150	148	142	135	130	118	98	93	74	70	66	58	
* ½Δt=	-40	-34	-28	-22½	-15½	-3	11	17	29½	33	38½	46½	
t_g=	34½	38½	38½	37	39	39½	33½	34½	28	27½	29	29	
t_c=	8	8	8	7	7	7	7	7	8	8	9	9	
z_0=	7	7	7	6	6		6	6	7	7	8	8	ft
z_1=	53	60	60	56	57		48	50	48	57	59	59	ft
v_0=						900							fps
v_1=		1670			1520			1520			2330		fps
v_2=						5950							fps

RS96-2

Project No.: 96A199	Date: 9/19/96	Project: CINDER LAKE LANDFILL	Fig. **A-12**



Geophone spacing = 50 ft

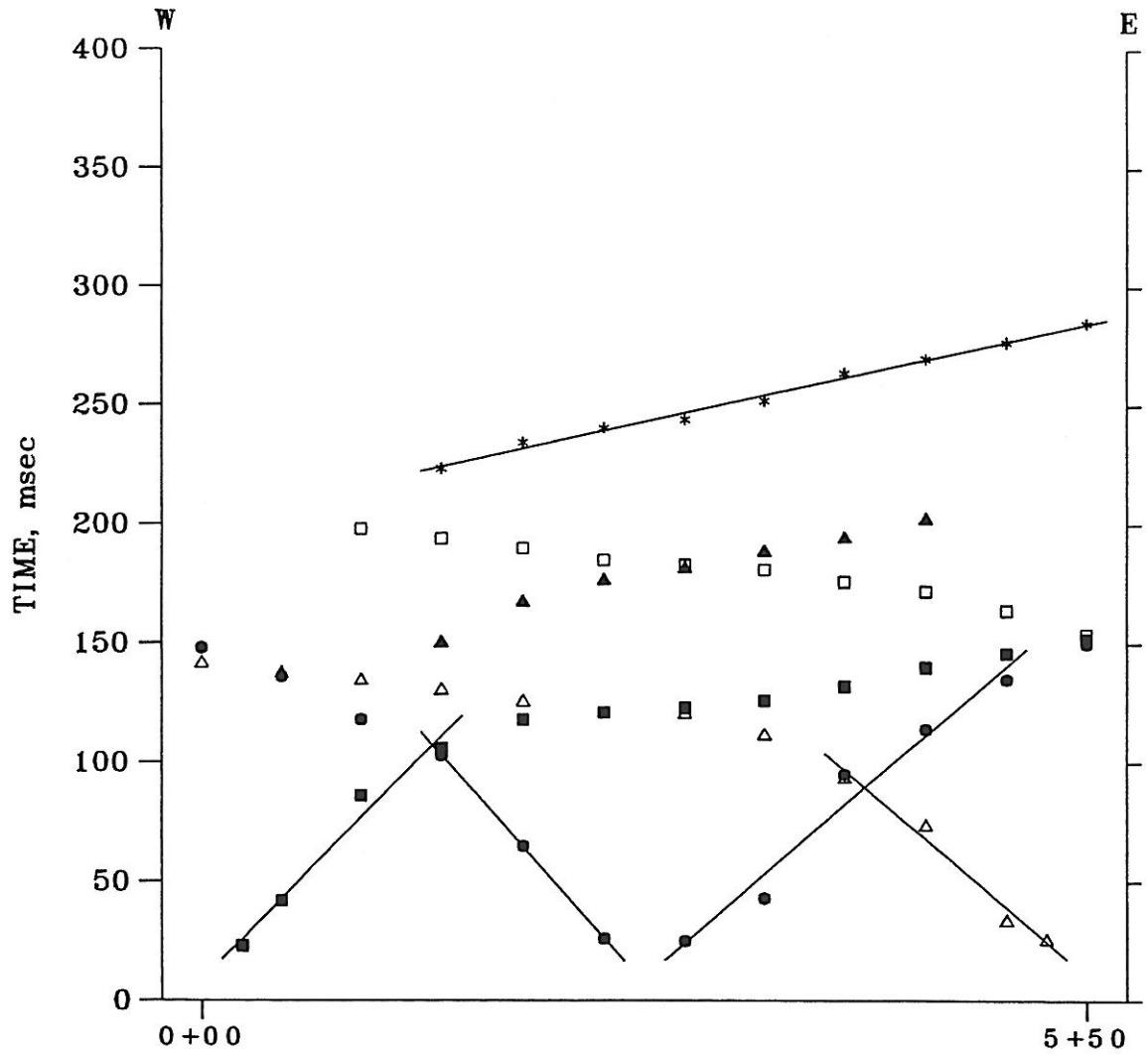
Arrival Time, msec													
▲	154	158	163	169		181							
■	25	36	59	77	101	116	122		129	135	142		
●	142	133	119	95	61	24	24	65	93	121	130	140	
△	157	148	140	130	124	110	104		94	76	41	25	
□				242	234	227	218	207	192	183	178	165	

t_{ab}= 155 msec; XY = 0

t_a=	62	66	71	77	101	116	122		129	135	142	152	
t_b=	157	148	140	130	124	110	104		94	85	80	67	
* ½Δt=	-47½	-41	-34½	-26½	-11½	3	9		17½	25	31	42½	
t_g=	32	29½	28	26	35	35½	35½		34	32½	33½	32	
t_c=	9	8	7	7	6	6	6	6	5	5	4	4	
z_0=	8	7	6	6	5	5	5		5	5	4	4	ft
z_1=	68	63	50	46	53	53	53		52	48	48	46	ft
v_0=						900							fps
v_1=		2380			1570			1570			1460		fps
v_2=						6090							fps

RS96-2

Project No.: 96A199	Date: 9/19/96	Project: CINDER LAKE LANDFILL	Fig. A-13



Geophone spacing = 50 ft

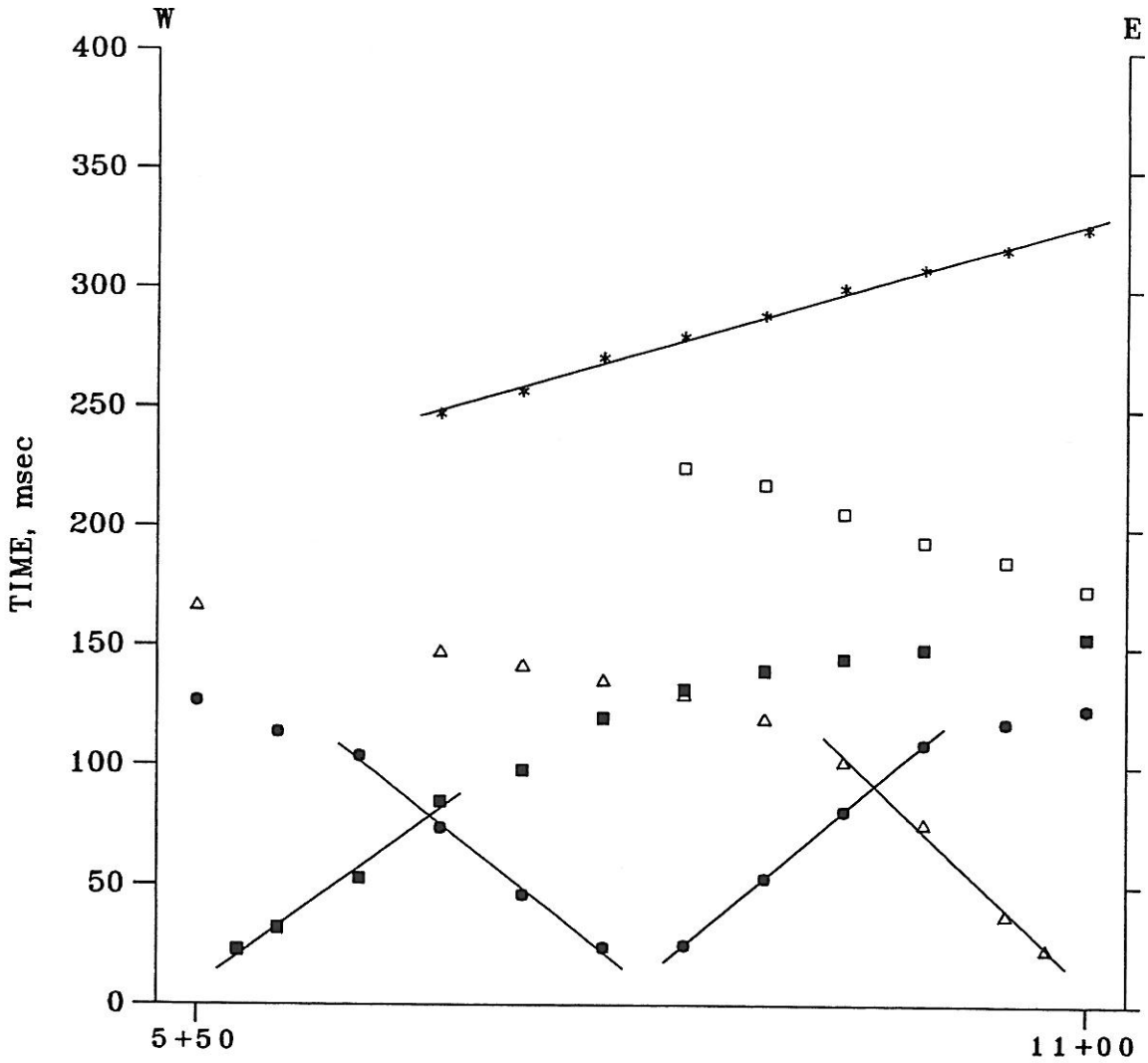
Arrival Time, msec													
▲				151	168	177	182	189	195	203			
■	23	42	86	106	118	121	123	126	132	140	146	152	
●	148	136	118	103	65	26	25	43	95	114	135	150	
△	142	138	135	131	126		121	112	94	74	34	26	
□			198	194	190	185	183	181	176	172	164	154	

t_{ab} = 147 msec; XY = 0

t_a =				88	105	114	119	126	132	140	146	152	
t_b =	142	138	135	131	126	123	121	112	94	90	82	72	
* $\frac{1}{2}\Delta t$ =				-21½	-10½	-4½	-1	7	19	25	32	40	
t_g =				36	42	45	46½	45½	39½	41½	40½	38½	
t_c =	4	4	4	4	4	4	5	5	5	5	5	5	
z_0 =				4	4	4	5	5	5	5	5	5	ft
z_1 =				49	54	58	78	77	66	70	68	65	ft
v_0 =						900							fps
v_1 =		1460			1300			1720			1730		fps
v_2 =						6630							fps

RS96-3

Project No.: 96A199	Date: 9/19/96	Project: CINDER LAKE LANDFILL	Fig. A-14



Geophone spacing = 50 ft

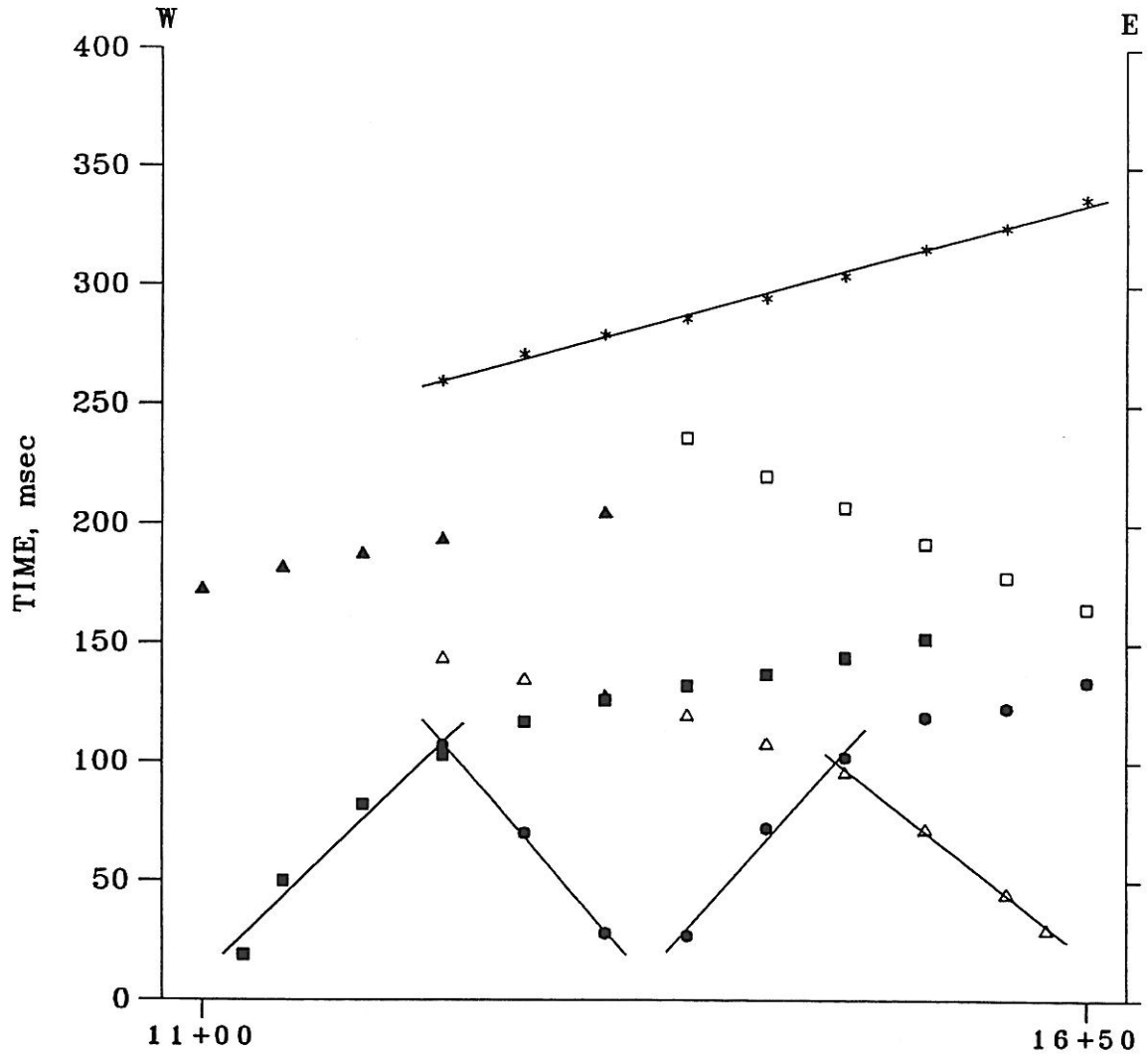
Arrival Time, msec													
▲													
■	23	32	53	85	98	120	132	140	145	149		154	
●	127	114	104	74	46	24	25	53	81	109	118	124	
△	167			148	142	136	130	120	102	76	38	24	
□							225	218	206	194	186	174	

t_{ab}= 166 msec; XY = 0

t_a=				85	98	120	132	140	145	149	158	164	
t_b=	167	154		148	142	136	130	120	102	90	82	70	
* $\frac{1}{2}\Delta t$=				−31½	−22	−8	1	10	21½	29½	38	47	
t_g=				33½	37	45	48	47	40½	36½	37	34	
t_c=	4	5	6	6	6	6	6	6	6	6	6	6	
z_0=				5	5	5	5	5	5	5	5	5	ft
z_1=				63	68	84	86	84	67	60	56	51	ft
v_0=						900							fps
v_1=		2030			1870			1790			1560		fps
v_2=						5090							fps

RS96-3

Project No.: 96A199	Date: 9/19/96	Project: CINDER LAKE LANDFILL	Fig. **A-15**



Geophone spacing = 50 ft

Arrival Time, msec												
▲	173	182	188	194		205						
■	19	50	82	103	117	126	132	137	144	152		
●				107	70	28	27	72	102	119	123	134
△				144	135	128	120	108	96	72	45	30
□							236	220	207	192	178	165

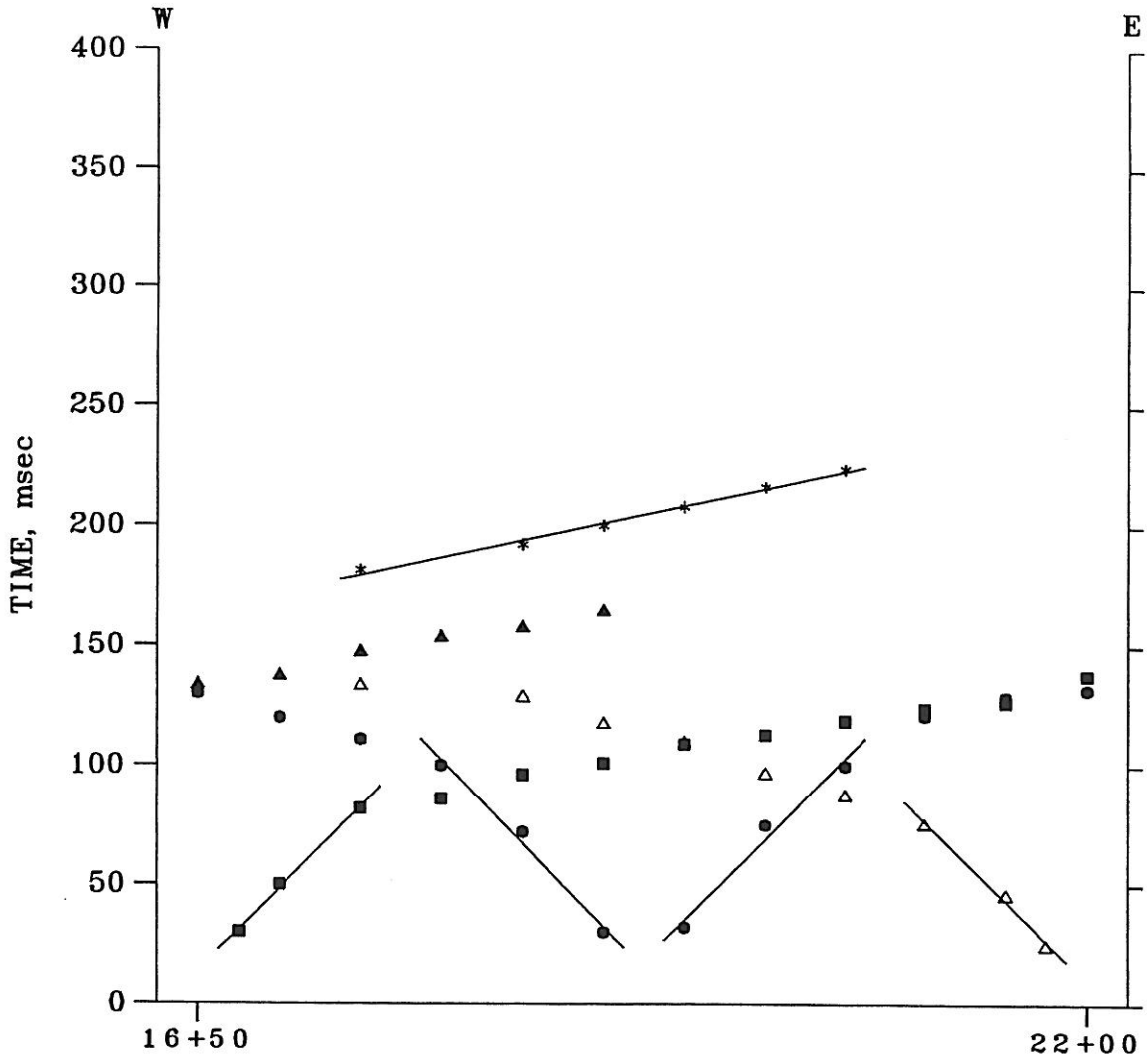
t_{ab}= 167 msec; XY = 0

t_a=	82	91	97	103	117	126	132	137	144	152	156	167
t_b=				144	135	128	120	108	96	81	67	54
* ½Δt=				-20½	-9	-1	6	14½	24	35½	44½	56½
t_g=				40	42½	43½	42½	39	36½	33	28	27
t_c=	5	5	5	5	5	5	5	6	7	7	8	9

z_0=				5	5	5	5	5	6	6	7	8 ft
z_1=				55	54	55	56	51	56	59	48	45 ft
v_0=						900						fps
v_1=		1540			1270			1330			1900	fps
v_2=						5360						fps

RS96-3

Project No.: 96A199	Date: 9/19/96	Project: CINDER LAKE LANDFILL	Fig. **A-16**



Geophone spacing = 50 ft

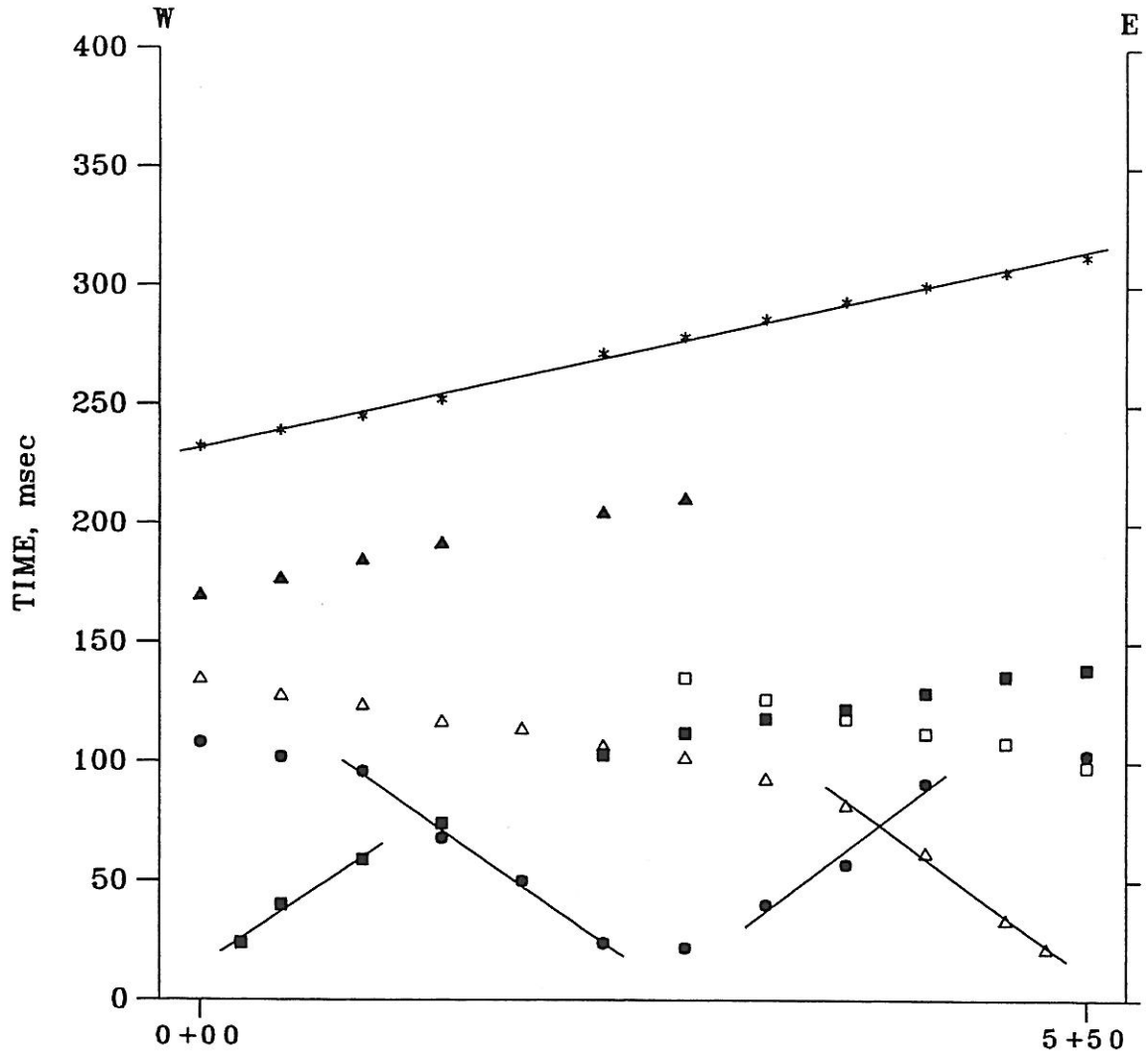
Arrival Time, msec												
▲	134	138	148	154	158	165						
■	30	50	82	86	96	101	109	113	119	124	127	138
●	130	120	111	100	72	30	32	75	100	121	129	132
△			134		129	118	110	97	88	76	46	25
□												

t_{ab}= 138 msec; XY = 0

t_a=	66	70	80	86	96	101	109	113	119	124	127	138	
t_b=			134		129	118	110	97	88				
* ½△t=			-27		-16½	-8½	-0½	8	15½				
t_g=			38		43½	40½	40½	36	34½				
t_c=	7	7	7	8	8	8	8	8	7	7	6	5	
z_0=			6		7	7	7	7	6				ft
z_1=			53		59	55	56	49	48				ft
v_0=						900							fps
v_1=		1460			1430			1470			1500		fps
v_2=						6900							fps

RS96-3

Project No.: 96A199	Date: 9/19/96	Project: CINDER LAKE LANDFILL	Fig. A-17



Geophone spacing = 50 ft

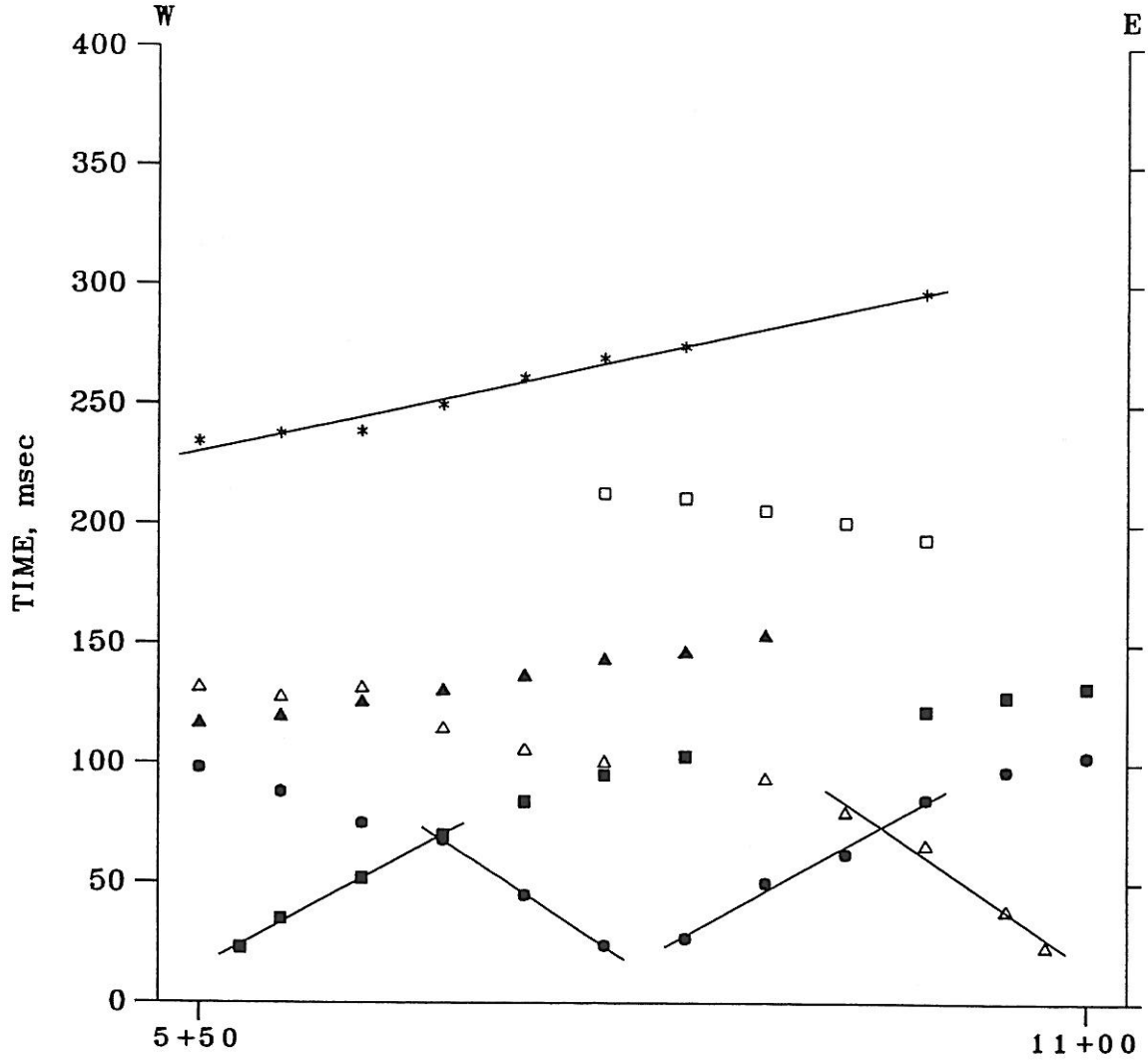
Arrival Time, msec													
▲	170	177	185	192		205	211						
■	24	40	59	74		103	112	118	122	129	136	139	
●	108	102	96	68	50	24	22	40	57	91		103	
△	135	128	124	117	114	107	102	93	82	62	34	22	
□							135	126	118	112	108	98	

t_{ab} = 137 msec; XY = 0

	t_a =	52	59	67	74		103	112	118	122	129	136	139	
	t_b =	135	128	124	117	114	107	102	93	82	76	71	61	
*	½Δt =	-41½	-34½	-28½	-21½		-2	5	12½	20	26½	32½	39	
	t_g =	25	25	27	27		36½	38½	37	33½	34	35	31½	
	t_c =	7	7	7	6	6	6	6	6	6	6	6	6	
	z_0 =	6	6	6	5		5	5	5	5	5	5	5	ft
	z_1 =	48	48	52	53		74	75	69	63	64	68	60	ft
	v_0 =						900							fps
	v_1 =		2200			2140			1960			2050		fps
	v_2 =						6620							fps

RS96-4

Project No.: 96A199	Date: 9/19/96	Project: CINDER LAKE LANDFILL	Fig. **A-18**



Geophone spacing = 50 ft

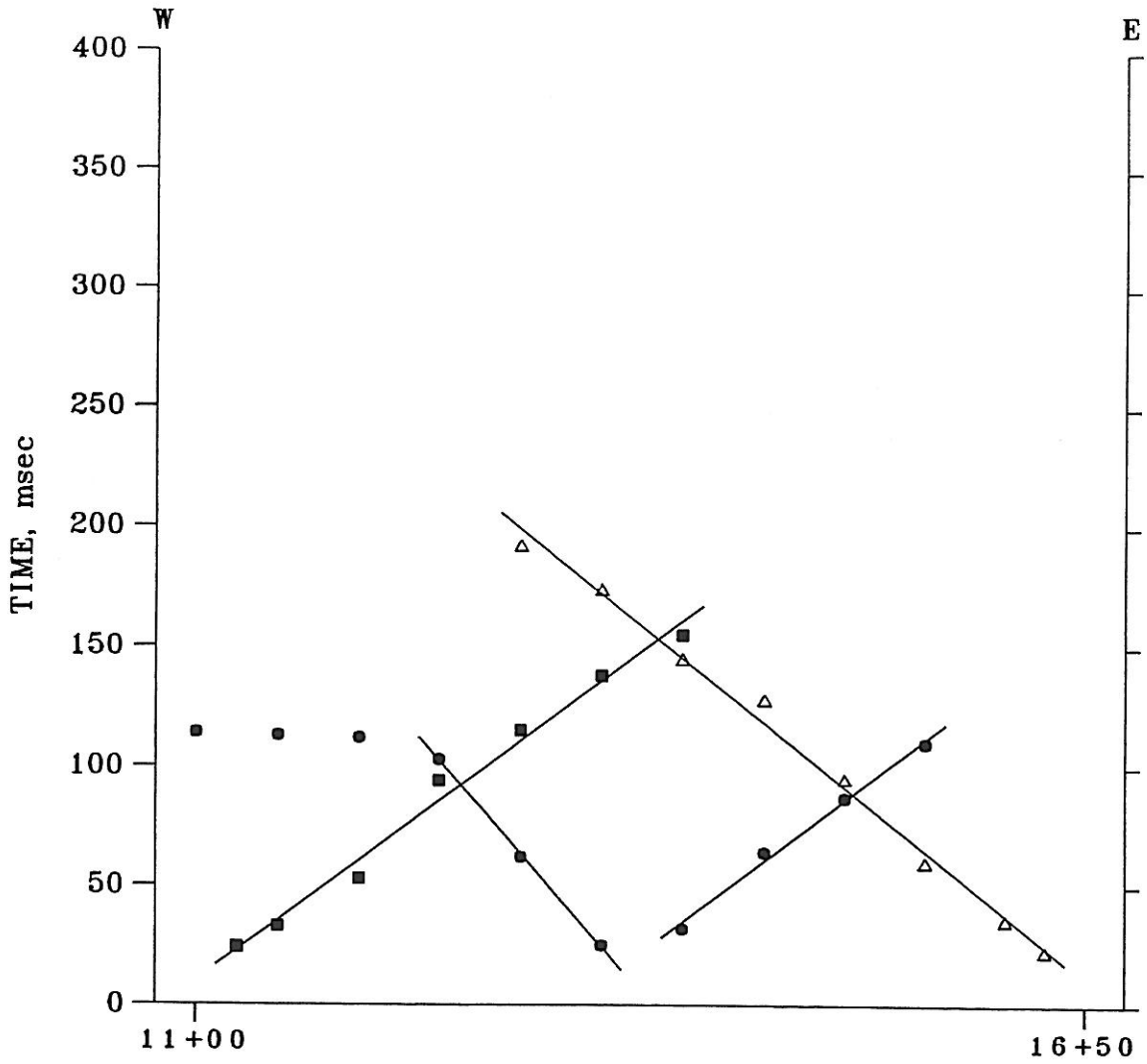
Arrival Time, msec													
▲	117	120	126	131	137	144	147	154					
■	23	35	52	70	84	95	103				122	128	132
●	98	88	75	68	45	24	27	50	62	85	97	103	
△	132	128	132	115	106	101		94	80	66	39	24	
□						213	211	206	201	194			

t_{ab} = 132 msec; XY = 0

t_a =	56	59	65	70	84	95	103			122	128	132	
t_b =	132	128	132	115	106	101	99	94	80	73			
* $\frac{1}{2}\Delta t$ =	-38	-34½	-33½	-22½	-11	-3	2			24½			
t_g =	28	27½	32½	26½	29	32	35			31½			
t_c =	8	8	8	8	8	8	8	8	8	8	8	8	
z_0 =	7	7	7	7	7	7	7			7			ft
z_1 =	66	65	80	57	58	65	86			69			ft
v_0 =						900							fps
v_1 =		2710			2270			2690		2210			fps
v_2 =						6770							fps

RS96-4

Project No.: 96A199	Date: 9/19/96	Project: CINDER LAKE LANDFILL	Fig. **A-19**



Geophone spacing = 50 ft

Arrival Time, msec

▲												
■	24	33	53	94	115	138	155					
●	114	113	112	103	62	25	32	64	87	110		
△					192	174	145	128	95	60	36	23
□												

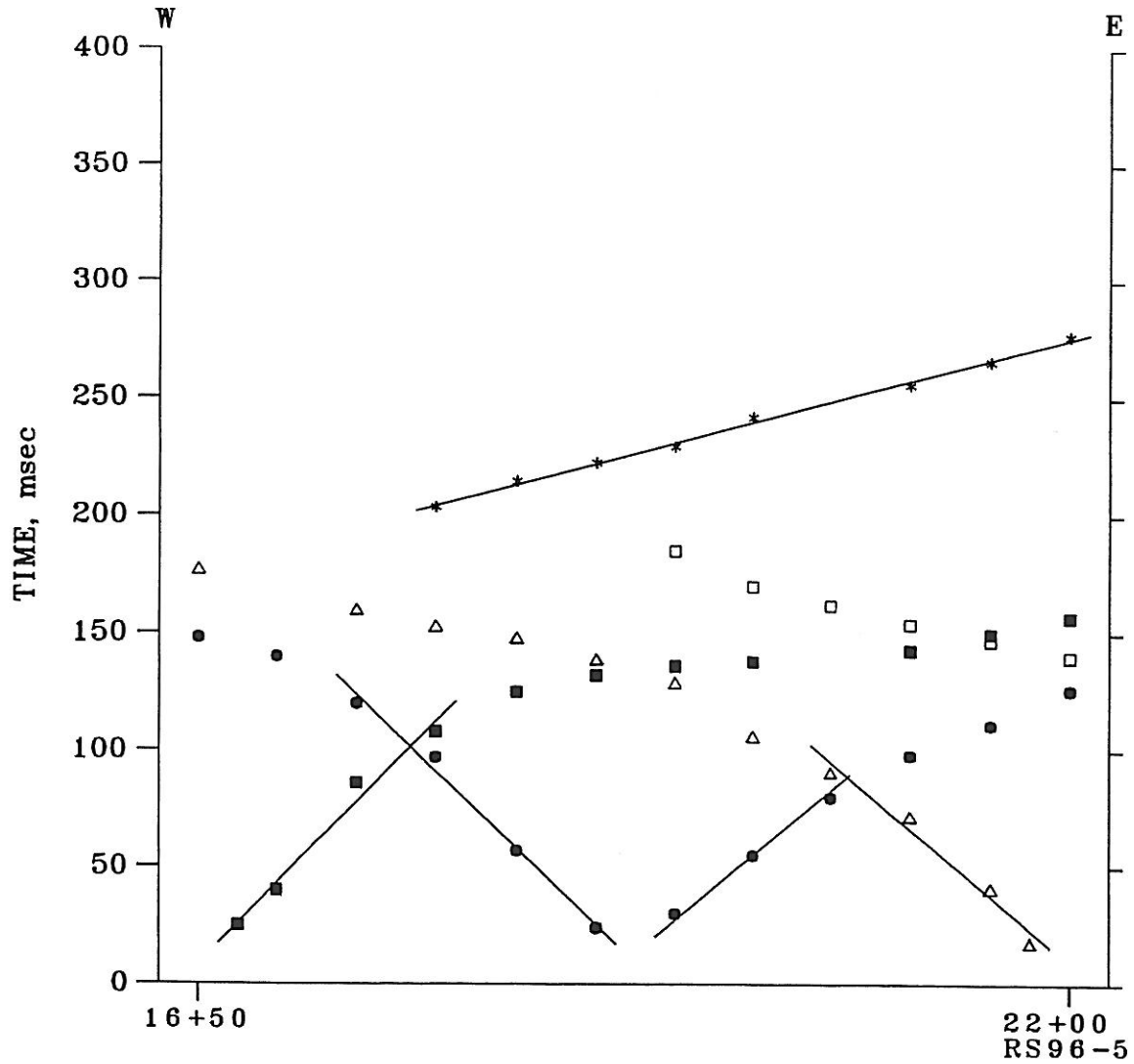
t_{ab}= 240 msec; XY = 0

t_a=												
t_b=	240	235	225	215								
* $\frac{1}{2}\Delta t$=												
t_g=												
t_c=	6	6	5	5	5	5	6	6	6	6	5	5

z_0=					ft
z_1=					ft
v_0=			900		fps
v_1=	1990	1280	1950	1860	fps
v_2=					

RS96-4

Project No.: 96A199	Date: 9/19/96	Project: CINDER LAKE LANDFILL	Fig. A-20

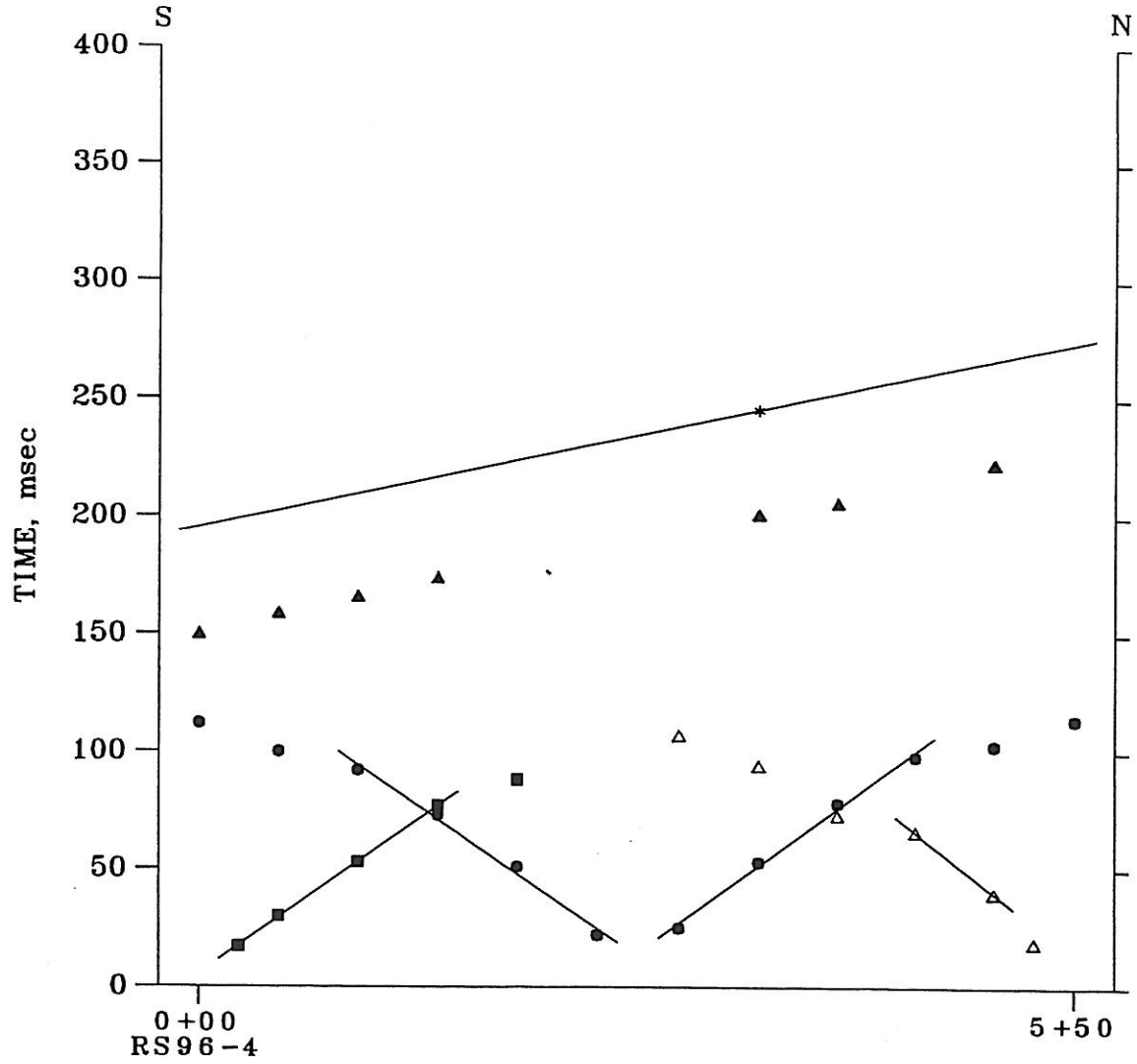


Geophone spacing = 50 ft

Arrival Time, msec													
▲													
■	25	40	86	108	125	132	136	138		143	150	157	
●	148	140	120	97	57	24	30	55	80	98	111	126	
△	177		160	153	148	139	129	106	91	72	41	18	
□							185	170	162	154	147	140	
				t_{ab}= 174 msec; XY = 0									
t_a=				108	125	132	136	138		143	156	171	
t_b=	177	169	160	153	148	139	129	106	91	83	76	69	
* $\frac{1}{2}\Delta t$=				-22½	-11½	-3½	3½	16		30	40	51	
t_g=				43½	49½	48½	45½	35		26	29	33	
t_c=	6	6	6	6	6	6	7	7	6	6	5	5	
z_0=				5	5	5	6	6		5	5	5	ft
z_1=				63	74	73	79	60		42	48	56	ft
v_0=						900							fps
v_1=		1440			1520			1800			1740		fps
v_2=						5610							fps

RS96-4

Project No.: 96A199	Date: 9/19/96	Project: CINDER LAKE LANDFILL	Fig. **A-21**



Geophone spacing = 50 ft

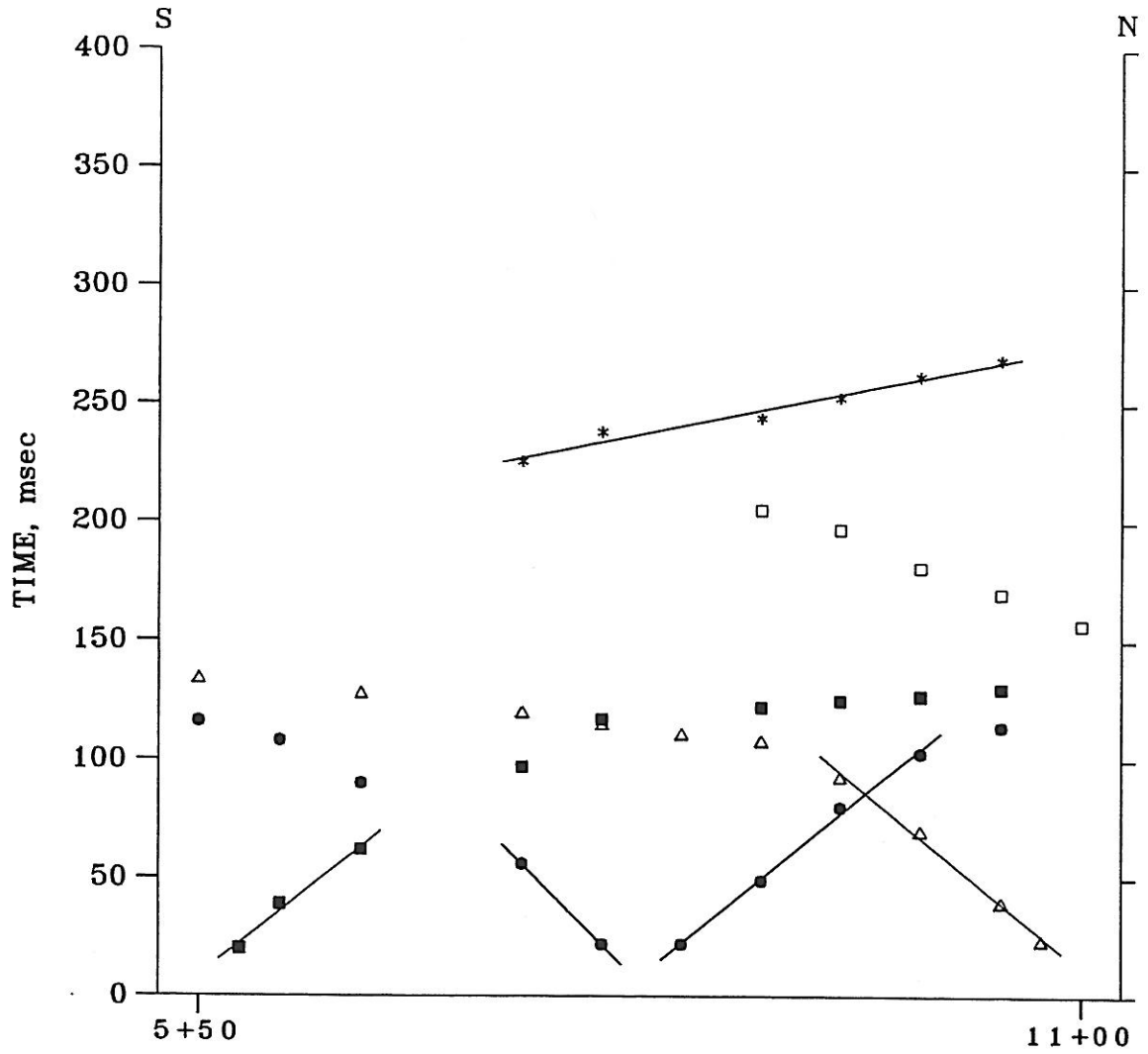
Arrival Time, msec													
▲	150	159	166	174				201	206		223		
■	17	30	53	77	88								
●	112	100	92	73	51	22	25	53	78	98	103	114	
△							107	94	73	66	40	19	
□													

t_{ab}= 147 msec; XY = 0

t_a=	17	30	53	77	88			104	109		136	147	
t_b=							107	94					
* ½△t=								5					
t_g=								25½					
t_c=	3	4	5	6	7	7	7	7	7	7	6	6	
z_0=								6					ft
z_1=								46					ft
v_0=						900							fps
v_1=		2100			2160			2050			1920		fps
v_2=						7000							fps

RS96-5

Project No.: 96A199	Date: 9/19/96	Project: CINDER LAKE LANDFILL	Fig. **A-22**



Geophone spacing = 50 ft

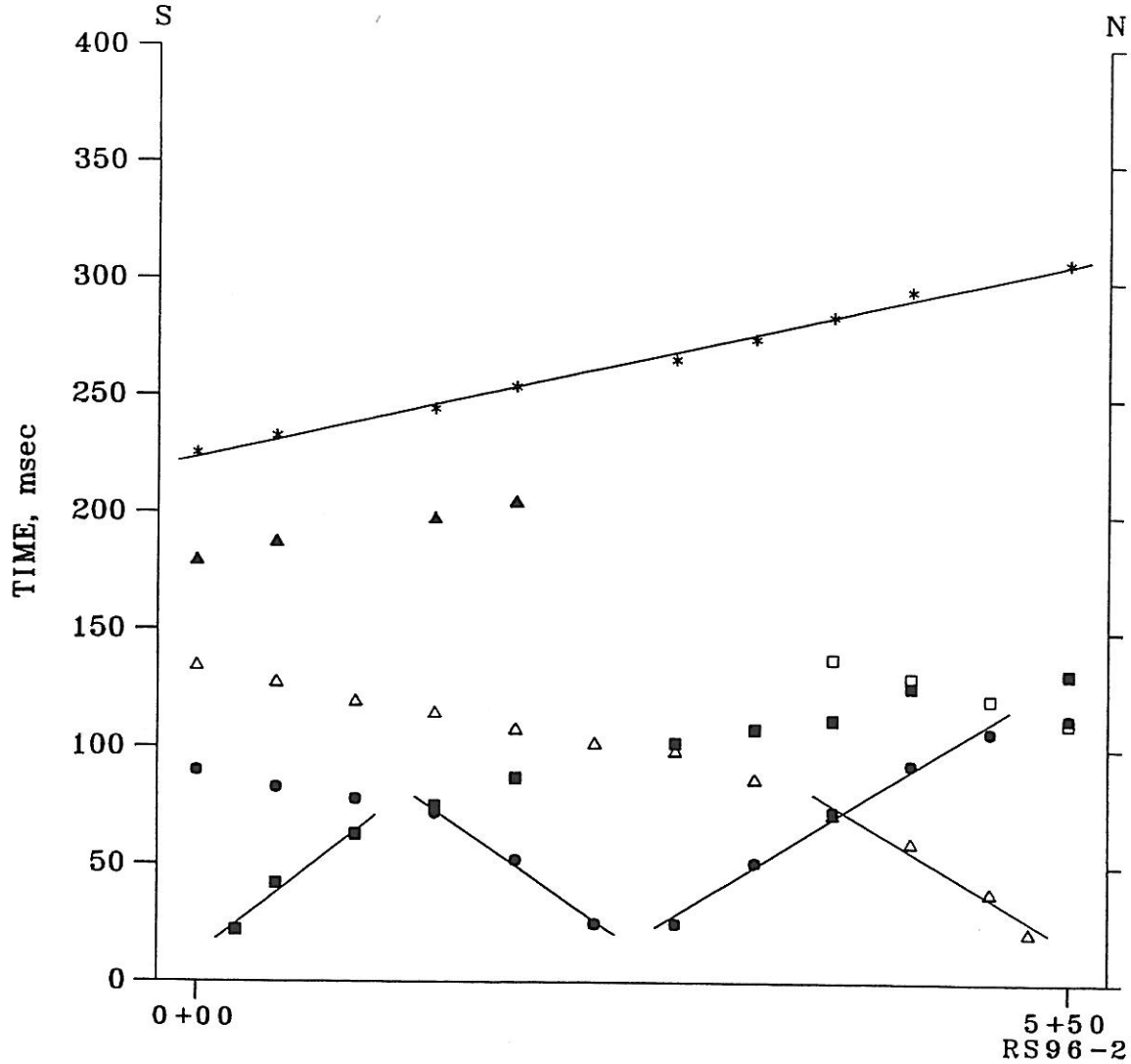
Arrival Time, msec													
▲													
■	20	39	62		97	117		122	125	127	130		
●	116	108	90		56	22	22	49	80	103	114		
△	134		128		120	115	111	108	93	70	40	24	
□								205	197	181	170	157	

t_{ab}= 134 msec; XY = 0

t_a=					97	117		122	125	127	130		
t_b=	134		128		120	115	111	108	93	77	66	53	
* $\frac{1}{2}\Delta t$=					−11½	1		7	16	25	32		
t_g=					41½	49		48	42	35	31		
t_c=	4	4	4	4	4	5	5	6	6	6	6	6	
z_0=					4	5		5	5	5	5		ft
z_1=					60	71		84	73	60	52		ft
v_0=						900							fps
v_1=		1830			1470			1820		1810			fps
v_2=						7330							fps

RS96-5

Project No.: 96A199	Date: 9/19/96	Project: CINDER LAKE LANDFILL	Fig. A-23



Geophone spacing = 50 ft

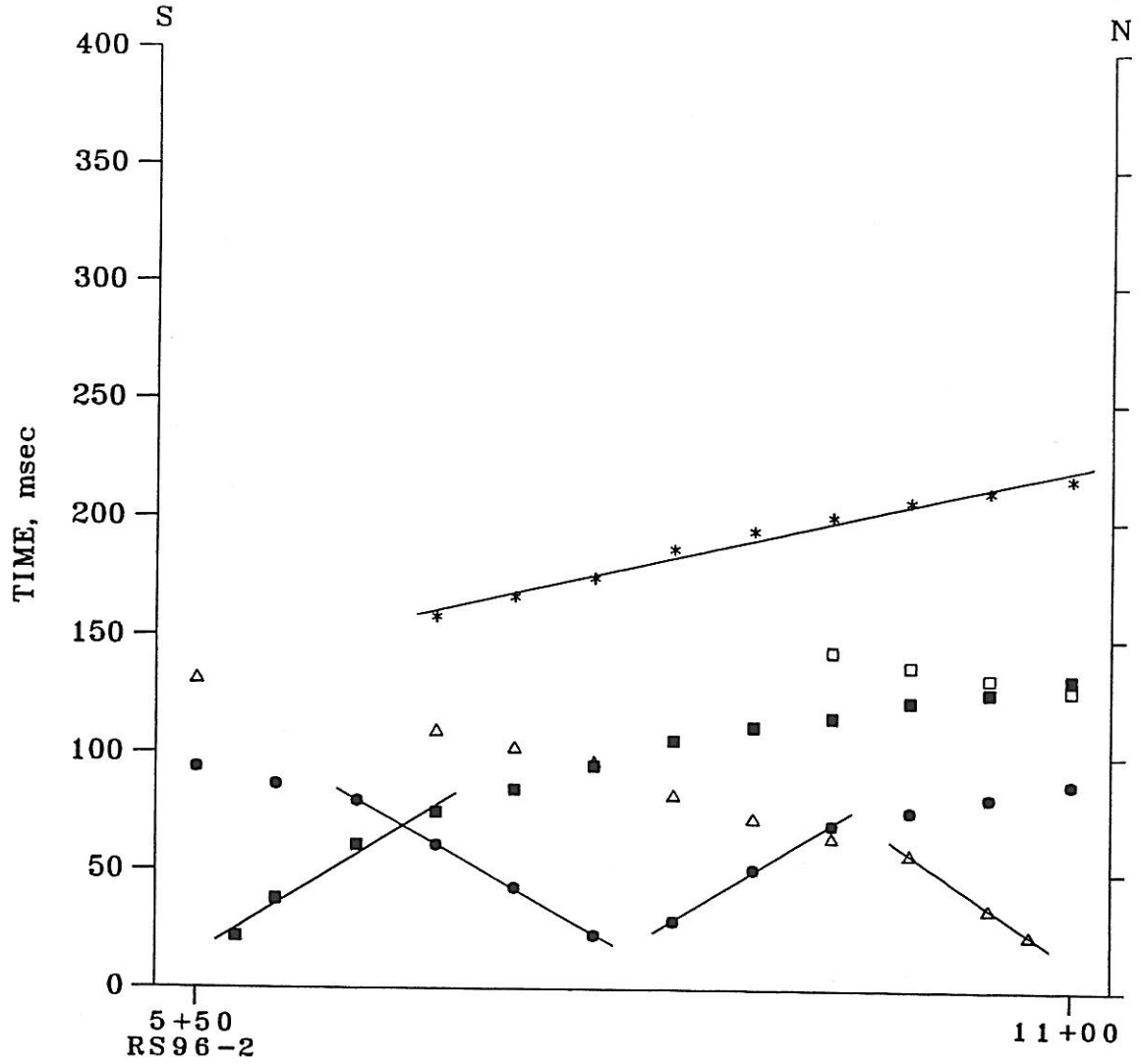
Arrival Time, msec													
▲	180	188		198	205								
■	22	42	63	75	87		102	108	112	126		132	
●	90	83	78	72	52	25	25	51	73	93	107	113	
△	135	128	120	115	108	102	99	87	72	60	39	22	
□									138	130	121	111	

t_{ab}= 134 msec; XY = 0

t_a=	57	65		75	87		102	108	112	126		132	
t_b=	135	128	120	115	108	102	99	87	72	64	55	45	
* $\frac{1}{2}\Delta t$=	-39	-31½		-20	-10½		1½	10½	20	31		43½	
t_g=	29	29½		28	30½		33½	30½	25	28		21½	
t_c=	6	6	6	7	7	8	9	9	8	8	8	8	
z_0=	5	5		6	6		8	8	7	7		7	ft
z_1=	51	52		54	59		72	64	53	61		45	ft
v_0=						900							fps
v_1=		1890			2130			2430			2550		fps
v_2=						6590							fps

RS96-6

Project No.: 96A199	Date: 9/19/96	Project: CINDER LAKE LANDFILL	Fig. **A-24**



Geophone spacing = 50 ft

Arrival Time, msec													
▲													
■	22	38	61	75	85	95	106	112	116	123	127	133	
●	94	87	80	61	43	23	29	51	70	76	82	88	
△	132			110	103	97	83	73	65	58	35	24	
□									144	138	133	128	
				t_{ab}= 133 msec; XY = 0									
t_a=				75	85	95	106	112	116	123	127	133	
t_b=	132	125		110	103	97	83	73	65	59	54	49	
* ½Δt=				−17½	−9	−1	11½	19½	25½	32	36½	42	
t_g=				26	27½	29½	28	26	24	24½	24	24½	
t_c=	7	7	7	7	7	7	8	8	7	7	6	6	
z_0=				6	6	6	7	7	6	6	5	5	ft
z_1=				58	66	71	60	54	51	47	47	49	ft
v_0=						900							fps
v_1=		2380			2650			2440			2200		fps
v_2=						6600							fps

RS96-6

Project No.: 96A199	Date: 9/19/96	Project: CINDER LAKE LANDFILL	Fig. A-25

APPENDIX B

GPS Activities and Airspace Calculations

- I will be doing a final survey for the fiscal year on Wednesday and Thursday of this week. I will process the data and get you a final report on Airspace and remaining soil by the second week of June.

South Borrow Pit

- I met with Wood Bros last week to discuss their schedule and ways which we could attack the excavation activities in Phases. We discussed the following steps
  - Phase IIA-Exploration and excavation activities
    - Initial excavation of the problem areas in the South Borrow Pit.
    - Difficult areas will be exposed in order to determine the true final depth that can be achieved for the Pit.
  - Phase IIB-segregate all material and stockpile rock and fines
  - Phase IIC-examine costs for milling operation and determine whether to proceed or stockpile material for future sale to area markets
  - Phase II D-final grading of South Borrow Pit
- I met with Joe Dirt Excavation (Jamie) yesterday to get his ideas on what it would take for him to do this project.
- I anticipate meeting with Dennis Clinger of Flagstaff Concrete Products to discuss his qualifications
- I have yet to contact Cemex (AKA Rinker) but I will be contacting them next to see if they would be interested.

CEMEX - ANDY -

Waste Profile

- We have not begun work on this project yet. I anticipate starting this in July 2009.

Network (Survey) Adjustment

- I have given Northland Explorations the necessary information to start processing data and working on the network adjustment.

Environmental Services Division

Memo

To: Pat Bourque, Environmental Services Director

From: Matt Morales, Project Manager

CC: Mike Gallegos, Cinder Lake Landfill Operations Manager

Ken Robinson, Project Manager

Date: 5/11/09

Re: Weekly Report

Maintenance Building

- Filtration system -
  - Jeff Ely has installed a one way valve and strainer to prevent any backflow from the Venturi meter to the Ozonator. The ozonator is one one of the most expensive pieces of equipment on this unit. If water were to flow into the ozonator it would lead to serious problems.
- Garage Bay Doors
  - I am coordinating with Cobra Steel this week to have the headers installed.
  - The new doors will be in Phoenix on the 19th of May. I am anticipating that the doors will be installed shortly thereafter.
- Crane
  - As I understand, the crane will be delayed until the FY 2011.

ADEQ

- SWPPP-
  - ADEQ water quality Division has begun to take comments for the new rules for the Stormwater Pollution Prevention Plans. These comments are being accepted and meetings are being held in Phoenix on the 19th of May. After talking with Steve Smith it is believed that this rule will go by the wayside until at least the next fiscal year.

Ken Robinson

- Ken will be returning on the 20th of May and we should see him around much more often at the Landfill.

Tier II Sampling

- I have received confirmation from the State that the Tier II is not reviewed by the Air Quality Division until our Title V permit is due (the Title V permit renewal is due in 2010).
- I am working with James Peck on the Invoicing for this project. I expect to have those paid in final during the next couple of weeks.

Our subsurface investigations were conducted between September 30, 1996 and October 9, 1996 under the direction of an engineering geologist from our office and consisted of:

- Sixteen borings in the proposed expansion area
- Six borings and 15 test pits in and adjacent to the existing landfill
- Five borings in the existing borrow area
- One boring in the proposed infiltration area.

All borings were advanced with a truck mounted CME 75 drill rig using hollow-stem augers. The borings in the proposed expansion area, the borrow area, and the infiltration area were advanced to refusal on basalt. In addition, five selected locations in the proposed expansion area and the boring in the infiltration area were extended into the basalt unit using diamond bit core drilling methods to verify the presence of substantial basalt layers and to observe the character of the rock.

Soil samples were obtained from drive samples and consisted of undisturbed and disturbed samples. Representative undisturbed samples of the subsurface soils were obtained using a modified California drive sampler (2-inch inside diameter and 2½-inch outside diameter) with thin metal liners. The sampler was generally driven 18 inches into the material at the bottom of the hole by a 140-pound hammer falling 30 inches. Relatively undisturbed samples contained in the thin metal liners were removed from the sampler and sealed with plastic caps to preserve the natural moisture content of the samples. Disturbed soil samples were obtained from a standard penetration test (SPT) drive sampler and placed in sealed, labeled plastic bags. Disturbed soil and rock core samples were stored on site. Undisturbed samples were returned to our laboratory.

The borings were advanced to depths of approximately 6 to 79 feet below the ground surface. Borings were backfilled with native soil cuttings.

After auger refusal, Borings WC-1, -2, -8, -12, -15, and IA-1 were advanced into bedrock using a diamond-bit coring method. Rock core samples were retrieved using an NX-wireline coring method to collect a relatively continuous rock core from the depth of auger refusal to the bottom of these borings. Core runs ranged in length from 3 to 10 feet. Each run was photographed after removal from the core barrel and logged. Logged core was then placed in core boxes, photographed, and stored on site. Photographs of the boxed core are presented as Figures B-30 through B-33.

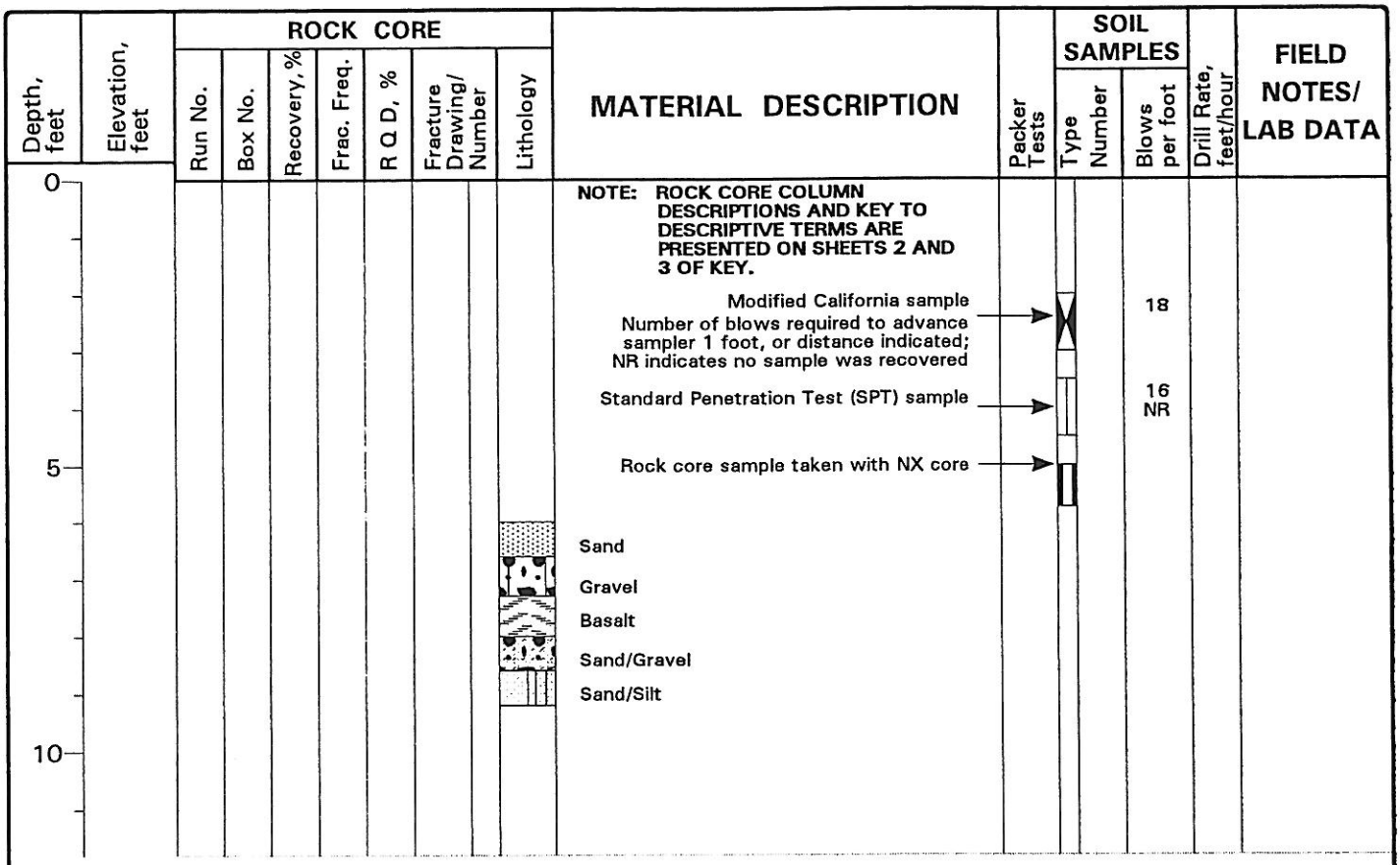
Logs of all hollow-stem and diamond-bit borings were made in the field by observing the soil samples, rock cores, drill cuttings, and/or drilling rates. Soil samples were visually logged using the Unified Soil Classification System in general accordance with ASTM D2488. NX rock cores were logged by noting characteristics, such as color, degree of weathering, strength, and rock quality designation (RQD). The RQD is calculated for each core run by dividing the cumulative length of "sound" core pieces greater than 4 inches in length by the total length of the core run, then multiplying the result by 100 to yield a percentage. The length of a core piece is measured at the middle of each end. Therefore, a core piece with high-angle fractures extending throughout the length of the core piece would be too short to include in the RQD calculation.

In terms of weathering, extremely weathered rock is defined as where original minerals of rock have been almost entirely decomposed to secondary minerals, although original fabric may be intact; material can be granulated by hand. Highly weathered rock is defined as a condition where more than half of the rock is decomposed; rock is weakened so that a minimum 2-inch-diameter sample can be broken readily by hand across rock fabric. Moderately weathered rock is where rock is discolored and noticeably weakened, but less than half is decomposed; a minimum 2-inch-diameter sample cannot be broken readily by hand across fabric. Slightly weathered rock is where rock is slightly discolored, but not noticeably lower in strength than fresh rock. Fresh rock is where rock shows no discoloration, loss of strength, or other effect of weathering or alteration.

A Key to Boring Logs and definitions of rock descriptors are presented on Figure A-1. Final boring logs are presented on Figures A-2 through A-29. Specific sampling intervals are indicated on the boring logs. The location of each boring (except Boring B-20) as shown on Figures 3 and 4 and the elevations shown on the boring logs are based on survey data, which were provided to us by Northland Research, Inc. The location of Boring B-20 was estimated based on the available topographic map of the site area. Elevations are referenced to Mean Sea Level (MSL) datum and are approximate.

Project: Cinder Lake Landfill
Project Location:
Project Number: 96A199-0400

Key to Boring Log



GENERAL NOTES

1. Classifications are based on field descriptions using the Unified Soil Classification System and include consistency, moisture, and color.

2. Surface elevations are based on topographic maps and field surveys.

3. Descriptions on these boring logs apply only at the specific boring locations and at the time the borings were made. They are not warranted to be representative of subsurface conditions at other locations or times.

Project: Cinder Lake Landfill
Project Location:
Project Number: 96A199-0400

Key to Boring Log

Depth, feet	Elevation, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Frac. Freq.	R Q D, %	Fracture Drawing/ Number	Lithology	MATERIAL DESCRIPTION	Packer Tests	SOIL SAMPLES: Type	Number	Blows per foot	Drill Rate, feet/hour	FIELD NOTES/ LAB DATA
0															
1	2	3	4	5	6	7	8	9 10	11 QUARTZITE, light gray, fine-grained, moderately weathered, moderately strong, hard.	13		14		15	16
		1	1	100		80			12 a b c d e f g h 1: 75, J, VN, Fe, Su, Pl, S, VC					45	Slow drilling
														15	
5															

1 Depth: Distance (in feet) from the collar of the borehole.

2 Elevation: Elevation (in feet) from the collar of the borehole.

3 Run No.: Number of the individual coring interval, starting at the top of bedrock.

4 Box No.: Number of the core box which contains core from the corresponding run.

5 Recovery: Amount (in percent) of core recovered from the coring interval; calculated as the length of core recovered divided by the length of the run.

6 Frac. Freq.: (Fracture Frequency) The number of naturally occurring fractures in each foot of core; does not include mechanical breaks, which are considered to be induced by drilling. Recorded as >10 for highly fractured zones.

7 R Q D: (Rock Quality Designation) Amount (in percent) of intact core (pieces of sound core greater than 4 inches in length) in each coring interval; calculated as the sum of the lengths of intact core divided by the length of the core run.

8 Fracture Drawing: Sketch of the naturally occurring fractures and mechanical breaks, showing the angle of the fractures relative to the cross-sectional axis of the core. "NR" indicates no recovery.

9 Fracture Number: Location of each naturally occurring fracture (numbered) and mechanical break (labeled "M").

terms defined on Sheet 3 (Items a - h).

10 Lithology: A graphic log presentation using symbols to represent differing rock types.

11 Description: Lithologic description in this order: rock type, color, texture, grain size, foliation, weathering, strength, and other features; descriptive terms are defined on Sheet 3. A detailed descriptive log of overburden materials is not necessarily provided.

12 Discontinuity Description: Abbreviated description of fracture corresponding to number of naturally occurring fracture in Column 9 using terms defined on Sheet 3 (Items a - h).

13 Packer Tests: Not performed for this project.

14 Soil Samples: Refer to Sheet 1 of Key to Boring Log.

15 Drill Rate: Rate (in feet per hour) of penetration of drilling. "N/O" indicates rate not observed.

16 Field Notes/Lab Data: Comments on drilling.

Project: Cinder Lake Landfill Project Location: Project Number: 96A199-0400	Key to Boring Log Sheet 3 of 3

Depth, feet	Elevation, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Frac. Freq.	R Q D, %	Fracture Drawing/ Number	Lithology	MATERIAL DESCRIPTION	Packer Tests	SOIL SAMPLES: Type Number	Blows per foot	Drill Rate, feet/hour	FIELD NOTES/ LAB DATA

KEY TO DESCRIPTIVE TERMS USED ON CORE LOGS

DISCONTINUITY DESCRIPTORS

a Dip of fracture surface measured relative to horizontal

b **Discontinuity Type:**

- F - Fault
- J - Joint
- Sh - Shear
- Fo - Foliation
- V - Vein
- B - Bedding

c **Discontinuity Width (inches):**

- W - Wide (0.5-2.0)
- MW - Moderately Wide (0.1-0.5)
- N - Narrow (0.05-0.1)
- VN - Very Narrow (<0.05)
- T - Tight (0)

d **Type of Infilling:**

- Cl - Clay
- Ca - Calcite
- Ch - Chlorite
- Fe - Iron Oxide
- Gy - Gypsum/Talc
- H - Healed
- No - None
- Py - Pyrite
- Qz - Quartz
- Sd - Sand

e **Amount of Infilling:**

- Su - Surface Stain
- Sp - Spotty
- Pa - Partially Filled
- Fi - Filled
- No - None

f **Surface Shape of Joint:**

- Wa - Wavy
- Pl - Planar
- St - Stepped
- Ir - Irregular

g **Roughness of Surface:**

- Slk - Slickensided [surface has smooth, glassy finish with visual evidence of striations]
- S - Smooth [surface appears smooth and feels so to the touch]
- SR - Slightly Rough [asperities on the discontinuity surfaces are distinguishable and can be felt]
- R - Rough [some ridges and side-angle steps are evident; asperities are clearly visible, and discontinuity surface feels very abrasive]
- VR - Very Rough [near-vertical steps and ridges occur on the discontinuity surface]

h **Discontinuity Spacing (feet):**

- EW - Extremely Wide (>6)
- W - Wide (2-6)
- M - Moderate (0.7-2)
- C - Close (0.2-0.7)
- VC - Very Close (<0.2)

ROCK WEATHERING / ALTERATION

Description	Recognition
Residual Soil	Original minerals of rock have been entirely decomposed to secondary minerals, and original rock fabric is not apparent; material can be easily broken by hand
Completely Weathered/Altered	Original minerals of rock have been almost entirely decomposed to secondary minerals, minerals, although original fabric may be intact; material can be granulated by hand
Highly Weathered/Altered	More than half of the rock is decomposed; rock is weakened so that a minimum 2-inch-diameter sample can be broken readily by hand across rock fabric
Moderately Weathered/Altered	Rock is discolored and noticeably weakened, but less than half is decomposed; a minimum 2-inch-diameter sample cannot be broken readily by hand across rock fabric
Slightly Weathered/Altered	Rock is slightly discolored, but not noticeably lower in strength than fresh rock
Fresh	Rock shows no discoloration, loss of strength, or other effect of weathering/alteration

ROCK STRENGTH

Description	Recognition	Approximate Uniaxial Compressive Strength (psi)
Extremely Weak Rock	Can be indented by thumbnail	35 - 150
Very Weak Rock	Can be peeled by pocket knife	150 - 700
Weak Rock	Can be peeled with difficulty by pocket knife	700 - 3,500
Medium Strong Rock	Can be indented 5 mm with sharp end of pick	3,500 - 7,200
Strong Rock	Requires one hammer blow to fracture	7,200 - 14,500
Very Strong Rock	Requires many hammer blows to fracture	14,500 - 35,000
Extremely Strong Rock	Can only be chipped with hammer blows	>35,000

Project: Cinder Lake Landfill Project Location: Project Number: 96A199-0400	**Log of Boring WC- 1** Sheet 1 of 2

Date(s) Drilled	9/30/96	Logged By	M. Hatch	Checked By	
Drilling Method	Hollow stem auger/NX core	Drill Bit Size/Type	8"	Total Depth Drilled (feet)	55.0
Drill Rig Type	CME 75	Drilled By	Heber Mining and Exploration	Hammer Weight/ Drop (lbs/in.)	140/30
Apparent Downhole Groundwater Depth	None encountered			Surface Elevation (feet)	6646
Coordinates	N10128.2 E14107.4			Elevation Datum	MSL

Depth, feet	Elevation, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Frac. Freq.	R Q D, %	Fracture Drawing/ Number	Lithology	MATERIAL DESCRIPTION	Packer Tests	SOIL SAMPLES: Type	Number	Blows per foot	Drill Rate, feet/hour	FIELD NOTES/ LAB DATA
0	6645								CINDER UNIT Loose, dry, dark gray, silty sand with fine gravel (SM) and silty gravel with sand (GM) (cinders)						
									Medium dense, moist to wet, reddish brown, locally silty fine to coarse sand with gravel (SM) (cinders and alluvium)						
5	6640								With interbedded poorly graded sand (SP)			1-1	16		
									Interbedded clayey sand (SC) and silty sand with gravel						
10	6635											1-2	25		
									Loose, moist, dark gray, poorly graded sand with gravel (SP) (cinders)						
15	6630											1-3	7		
									Medium dense, moist, reddish brown and dark gray, silty gravel with sand (GM), vesicular cinders to 1"						
20	6625											1-4	23		
									Larger gravels						
25	6620											1-5	12		
									Medium dense, moist, red, silty fine to coarse sand (SM) with trace gravel (cinders)						
30															

Woodward-Clyde

Figure B-2

11/27/96 1GLG17 6A199

Project: Cinder Lake Landfill
Project Location:
Project Number: 96A199-0400

Log of Boring WC- 1

Sheet 2 of 2

Depth, feet	Elevation, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Frac. Freq.	R Q D, %	Fracture Drawing/ Number	Lithology	MATERIAL DESCRIPTION	Packer Tests	SOIL SAMPLES: Type Number	Blows per foot	Drill Rate, feet/hour	FIELD NOTES/ LAB DATA
30	6615										1-6	26		
35	6610								Dense, moist, red, silty fine to coarse sand with gravel becoming silty gravel (GM) with silty fine to coarse sand with gravel (SM) layers		1-7	50/ 5.5"		
40	6605										1-8	50/ 5"		
45	6600	1	1	100	2 0	80			BASALT UNIT Gray, vesicular basalt, highly fractured, highly weathered, weak to moderately strong Moderately weathered Becomes moderately to slightly weathered, slightly fractured strong rock				N/O	Refusal at 46' Switch to rock coring
50	6595	2		99	1 1 0 0 0 0 0	74							18	
55	6590								Bottom of boring at 55 feet					
60	6585													
65														

Woodward-Clyde

Figure B-2

11/27/96 1GLG17 6A199

Project: Cinder Lake Landfill Project Location: Project Number: 96A199-0400	**Log of Boring WC- 2** Sheet 1 of 2

Date(s) Drilled	10/1/96	Logged By	M. Hatch	Checked By	
Drilling Method	Hollow stem auger/NX core	Drill Bit Size/Type	8"	Total Depth Drilled (feet)	64.0
Drill Rig Type	CME 75	Drilled By	Heber Mining and Exploration	Hammer Weight/ Drop (lbs/in.)	140/30
Apparent Downhole Groundwater Depth	None encountered			Surface Elevation (feet)	6641
Coordinates	N09632.1 E14327.1			Elevation Datum	MSL

Depth, feet	Elevation, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Frac. Freq.	R Q D, %	Fracture Drawing/ Number	Lithology	MATERIAL DESCRIPTION	Packer Tests	SOIL SAMPLES: Type	Number	Blows per foot	Drill Rate, feet/hour	FIELD NOTES/ LAB DATA
0	6640								CINDER UNIT Loose, dry, dark gray, well graded sand with gravel (SM) (cinders)						
									Loose, moist, dark gray, silty fine to coarse sand (SM) (cinders)						
5	6635								Medium dense, moist, brown, silty fine to medium sand (SM) (alluvium)			2-1	14		
10	6630								Loose, moist, brown, clayey sand Medium dense, dark gray cinders			2-2	16		
15	6625								Medium dense, moist, reddish brown and brown, silty fine to coarse sand with fine gravels (SM) (cinders)			2-3	12		
20	6620								Medium dense, moist, reddish brown and red, silty fine to coarse sand with gravels (up to 1") (SM) (cinders)			2-4	21		
25	6615														
30															

Woodward-Clyde

Figure B-3

1/14/97 1GLG17 6A199

Project: Cinder Lake Landfill
Project Location:
Project Number: 96A199-0400

Log of Boring WC- 2

Sheet 2 of 2

Depth, feet	Elevation, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Frac. Freq.	R Q D, %	Fracture Drawing/ Number	Lithology	MATERIAL DESCRIPTION	Packer Tests	SOIL SAMPLES: Type Number	Blows per foot	Drill Rate, feet/hour	FIELD NOTES/ LAB DATA
30	6610								Red ash (ML) Red cinders		2-5			
35	6605								Gravelly (or thin flow)					
40	6600								Medium dense, moist to wet, dark gray to red, silty fine to coarse and with gravels (SM) Dense, moist, dusky red, silty gravel with sand (GM)		2-6			
45	6595								BASALT UNIT Gray, vesicular basalt, highly weathered					
50	6590	1	1	95	2 2 3	50			Gray, vesicular basalt, moderately weathered, highly fractured, weak to moderately strong rock @50-51', highly weathered				12	Refusal at 50' Switch to rock coring
55	6585	2		100	1 4 3 3	78			Gray, basalt, slightly weathered, highly to moderately fractured, moderately strong to strong rock					
60	6580		2		0 4 0 1 0 0 0								9.8	
65									Bottom of boring at 64 feet					

Woodward-Clyde

Figure B-3

1/30/97 1GLG17 6A199

Project: Cinder Lake Landfill Project Location: Project Number: 96A199-0400	Log of Boring WC- 3 Sheet 1 of 2

Date(s) Drilled	10/1/96	Logged By	M. Hatch	Checked By	
Drilling Method	Hollow stem auger	Drill Bit Size/Type	8"	Total Depth Drilled (feet)	40.5
Drill Rig Type	CME 75	Drilled By	Heber Mining and Exploration	Hammer Weight/ Drop (lbs/in.)	140/30
Apparent Downhole Groundwater Depth	None encountered			Surface Elevation (feet)	6633
Coordinates	N08980.5 E14851.0			Elevation Datum	MSL

Depth, feet	Elevation, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Frac. Freq.	R Q D, %	Fracture Drawing/ Number	Lithology	MATERIAL DESCRIPTION	Packer Tests	SOIL SAMPLES: Type Number	Blows per foot	Drill Rate, feet/hour	FIELD NOTES/ LAB DATA
0									CINDER UNIT Loose, dry, dark gray, cinders, coarse sand to fine gravel (SW) interbedded with silty fine to coarse sand (SM) layers					
	6630													
5											3-1	16		
									Medium dense, moist to wet, brown, silty fine to coarse sand (SM) (alluvium)					
	6625								Medium dense, moist, dark gray, well graded sand (cinders) (SW) with gravels					
10											3-2	24		
									Loose and medium dense, interbedded cinders, silty sand (SM), clayey sand (SC) 10.5'-11', moist to wet, clayey sand					
	6620													
15									Moist to wet, brown, sandy clay (CL) Well graded sand (SW) (cinder)		3-3	9		
	6615													
20											3-4	19		
									Cinders with thin soil/alluvium layers					
	6610													
25											3-5	15		
	6605													
30									Medium dense, moist, brown, sandy lean clay, trace gravels (CL)					

Woodward-Clyde

Figure B-4

11/27/96 1GLG17 6A199

Project: Cinder Lake Landfill
Project Location:
Project Number: 96A199-0400

Log of Boring WC- 3

Sheet 2 of 2

Depth, feet	Elevation, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Frac. Freq.	R Q D, %	Fracture Drawing/ Number	Lithology	MATERIAL DESCRIPTION	Packer Tests	SOIL SAMPLES: Type	Number	Blows per foot	Drill Rate, feet/hour	FIELD NOTES/ LAB DATA
30									Medium dense, moist, red, silty fine to coarse sand (SM/SW) with gravels (cinders)			3-6	14		
	6600														
35															
	6595														
40									BASALT UNIT Weathered rock/gravel layer, highly weathered basalt, locally weathered to clay			3-7	50/ 1.5"		
									Refusal at 40.5 feet on highly weathered basalt						
	6590														
45															
	6585														
50															
	6580														
55															
	6575														
60															
	6570														
65															

Woodward-Clyde

Figure B-4

11/27/96 1GLG17 6A199

Project: Cinder Lake Landfill Project Location: Project Number: 96A199-0400	**Log of Boring WC- 4** Sheet 1 of 2

Date(s) Drilled	10/2/96	Logged By	M. Hatch	Checked By	
Drilling Method	Hollow stem auger	Drill Bit Size/Type	8"	Total Depth Drilled (feet)	43.0
Drill Rig Type	CME 75	Drilled By	Heber Mining and Exploration	Hammer Weight/ Drop (lbs/in.)	140/30
Apparent Downhole Groundwater Depth	None encountered			Surface Elevation (feet)	6635
Coordinates	N09271.7 E15371.9			Elevation Datum	MSL

Depth, feet	Elevation, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Frac. Freq.	R Q D, %	Fracture Drawing/ Number	Lithology	MATERIAL DESCRIPTION	Packer Tests	SOIL SAMPLES: Type	Number	Blows per foot	Drill Rate, feet/hour	FIELD NOTES/ LAB DATA
0	6635								CINDER UNIT Loose, dry, dark gray, well graded sand (SW) with gravel (cinders)						
									Medium dense, moist, brown, silty fine to coarse sand (SM) with thin clayey sand layers (2"-4") (alluvium)						
5	6630											4-1	12		
10	6625											4-2	9		
									Loose, moist, dark gray, silty fine to coarse sand to well graded sand with silt (SM/SW) (cinders)						
15	6620								Medium dense, moist, dark gray grading to red, silty fine to coarse sand (SM) with few fine gravels (cinders)			4-3	27		
20	6615								Very dense, moist, red agglomerate or flow			4-4	50/ 4"		
									Medium dense, moist, reddish brown, silty fine to coarse sand (SM) with gravels (cinders)						
25	6610											4-5	12		
									Grading to silty gravel with sand (GW (red cinders-locally fused-agglomerate)						
30	6605														

Woodward-Clyde

Figure B-5

1/14/97 1GLG17 6A199

Project: Cinder Lake Landfill
Project Location:
Project Number: 96A199-0400

Log of Boring WC- 4

Sheet 2 of 2

Depth, feet	Elevation, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Frac. Freq.	R Q D, %	Fracture Drawing/ Number	Lithology	MATERIAL DESCRIPTION	Packer Tests	SOIL SAMPLES: Type	Number	Blows per foot	Drill Rate, feet/hour	FIELD NOTES/ LAB DATA
30	6605											4-6	36		
									Medium dense, moist, red, well graded sand with gravels (SM) (cinders)						
35	6600														
									BASALT UNIT Dark gray, vesicular basalt, highly weathered			4-7	50/ 2"		
40	6595														
									Refusal at 43 feet on basalt						
45	6590														
50	6585														
55	6580														
60	6575														
65	6570														

Woodward-Clyde

Figure B-5

1/14/97 1GLG17 6A199

Project: Cinder Lake Landfill Project Location: Project Number: 96A199-0400	Log of Boring WC- 5 Sheet 1 of 2

Date(s) Drilled	10/2/96	Logged By	M. Hatch	Checked By	
Drilling Method	Hollow stem auger	Drill Bit Size/Type	8"	Total Depth Drilled (feet)	47.0
Drill Rig Type	CME 75	Drilled By	Heber Mining and Exploration	Hammer Weight/ Drop (lbs/in.)	140/30
Apparent Downhole Groundwater Depth	None encountered			Surface Elevation (feet)	6645
Coordinates	N09907.9 E15693.8			Elevation Datum	MSL

Depth, feet	Elevation, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Frac. Freq.	R Q D, %	Fracture Drawing/ Number	Lithology	MATERIAL DESCRIPTION	Packer Tests	SOIL SAMPLES: Type	Number	Blows per foot	Drill Rate, feet/hour	FIELD NOTES/ LAB DATA
0	6645								CINDER UNIT Loose, dry, dark gray, well graded sand (SM) with thin, brown, silty to clayey sand layers (SM/SC) (cinders)						
5	6640											5-1	4		
									Medium dense, moist, brown, silty fine sand (SM) (alluvium, cinder layers)						
10	6635											5-2	27		
15	6630											5-3	25		
									Medium dense, moist, dark gray, silty fine sand (SM) (cinders)						
20	6625											5-4	26		
									Medium dense, moist, brown, silty fine sand (SM) trace clay (alluvium)						
25	6620								Medium dense, moist, dark gray, silty medium to fine sand (SM) (cinders)						
30	6615														

Woodward-Clyde

Figure B-6

11/27/96 1GLG17 6A199

Project: Cinder Lake Landfill
Project Location:
Project Number: 96A199-0400

Log of Boring WC- 5

Sheet 2 of 2

Depth, feet	Elevation, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Frac. Freq.	R Q D, %	Fracture Drawing/ Number	Lithology	MATERIAL DESCRIPTION	Packer Tests	SOIL SAMPLES: Type	Number	Blows per foot	Drill Rate, feet/hour	FIELD NOTES/ LAB DATA
30	6615								Medium dense, moist, dark gray, silty medium to fine sand (SM) (cinders)			5-5	13		
35	6610														
40	6605								Medium dense, moist, dark gray becoming red, silty fine to coarse sand (SM) (cinders)			5-6	11		
45	6600								BASALT UNIT Dark gray, basalt, highly weathered			5-7	50/ 4"		
									Refusal at 47 feet on basalt						
50	6595														
55	6590														
60	6585														
65	6580														

11/27/96 1GLG17 6A199

Woodward-Clyde

Figure B-6

Project: Cinder Lake Landfill Project Location: Project Number: 96A199-0400	**Log of Boring WC- 6** Sheet 1 of 2

Date(s) Drilled	10/2/96	Logged By	M. Hatch	Checked By	
Drilling Method	Hollow stem auger	Drill Bit Size/Type	8"	Total Depth Drilled (feet)	54.0
Drill Rig Type	CME 75	Drilled By	Heber Mining and Exploration	Hammer Weight/ Drop (lbs/in.)	140/30
Apparent Downhole Groundwater Depth	None encountered			Surface Elevation (feet)	6661
Coordinates	N10610.6 E15281.3			Elevation Datum	MSL

Depth, feet	Elevation, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Frac. Freq.	R Q D, %	Fracture Drawing/ Number	Lithology	MATERIAL DESCRIPTION	Packer Tests	SOIL SAMPLES: Type	Number	Blows per foot	Drill Rate, feet/hour	FIELD NOTES/ LAB DATA
0	6660								CINDER UNIT Loose, dry becoming moist, dark gray, cinders, well graded to silty fine to coarse sand (SM)						
									Loose, moist, brown, silty fine sand (SM) (alluvium)						
5	6655											6-1	8		
10	6650								Interbedded loose, moist, dark brown and light brown, silty fine to coarse sand and silty fine sand (SM) (alluvium)			6-2	5		
15	6645											6-3	11		
									Loose, moist, dark gray, silty fine to coarse sand (cinders) (SM)						
20	6640								Loose, moist, light brown, silty fine sand to fine sand silt (SM-ML) (alluvium)			6-4	8		
25	6635														
									Loose to medium dense, moist, dark gray, silty fine to coarse sand (SM) (cinders)						
30															

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Figure B-7

1/14/97 1GLG17 6A199

Project: Cinder Lake Landfill
Project Location:
Project Number: 96A199-0400

Log of Boring WC- 6

Sheet 2 of 2

Depth, feet	Elevation, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Frac. Freq.	R Q D, %	Fracture Drawing/ Number	Lithology	MATERIAL DESCRIPTION	Packer Tests	SOIL SAMPLES: Type Number	Blows per foot	Drill Rate, feet/hour	FIELD NOTES/ LAB DATA
30	6630								Loose to medium dense, moist, dark gray, silty fine to coarse sand (SM) (cinders)		6-5	11		
35	6625													
40	6620								Medium dense, moist, reddish brown, silty fine to coarse sand with gravels (SM) (cinders)		6-6	32		
45	6615													
50	6610								BASALT UNIT Gray basalt, highly weathered		6-7	50/ 6"		
55	6605								Refusal at 54 feet on basalt					
60	6600													
65														

11/27/96 1GLG17 6A199

Woodward-Clyde

Figure B-7

Project: Cinder Lake Landfill Project Location: Project Number: 96A199-0400	**Log of Boring WC- 7** Sheet 1 of 2

Date(s) Drilled	10/2/96	Logged By	M. Hatch	Checked By	
Drilling Method	Hollow stem auger	Drill Bit Size/Type	8"	Total Depth Drilled (feet)	60.0
Drill Rig Type	CME 75	Drilled By	Heber Mining and Exploration	Hammer Weight/ Drop (lbs/in.)	140/30
Apparent Downhole Groundwater Depth	None encountered			Surface Elevation (feet)	6658
Coordinates	N10747.7 E14574.6			Elevation Datum	MSL

Depth, feet	Elevation, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Frac. Freq.	R Q D, %	Fracture Drawing/ Number	Lithology	MATERIAL DESCRIPTION	Packer Tests	SOIL SAMPLES: Type Number	Blows per foot	Drill Rate, feet/hour	FIELD NOTES/ LAB DATA
0									CINDER UNIT Loose, moist, dark gray, silty fine to coarse sand (SM) (cinders)					
	6655													
5											7-1	8		
									Loose, moist, light brown, silty medium to fine sand (SM) (alluvium)					
	6650													
									Loose, moist, dark gray, silty fine to coarse sand (SM) (cinders)					
10											7-2	12		
									Medium dense becoming dense, moist, brown, silty fine to medium sand with gravels, trace clay (SM) (alluvium)					
	6645													
15											7-3	41		
	6640													
20									Dark gray cinder layer		7-4	22		
									Dark gray cinder layer					
	6635													
25														
									Gravel or agglomerate layer					
	6630								Medium dense, brown, silty fine to medium sand (SM) with dark gray, silty fine to coarse sand with gravels (SM) (interbedded alluvium and cinders)		7-5	28		
30														

Figure B-8

Woodward-Clyde

11/27/96 1GLG17 6A199

Project: Cinder Lake Landfill
Project Location:
Project Number: 96A199-0400

Log of Boring WC- 7

Sheet 2 of 2

Depth, feet	Elevation, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Frac. Freq.	R Q D, %	Fracture Drawing/ Number	Lithology	MATERIAL DESCRIPTION	Packer Tests	SOIL SAMPLES: Type Number	Blows per foot	Drill Rate, feet/hour	FIELD NOTES/ LAB DATA
30														
	6625													
35														
	6620													
40											7-6	16		
									Medium dense, moist, red, silty fine to coarse sand (SM) with fine gravels (cinders)					
	6615													
45														
	6610													
									Dense, moist, red becoming dusky red, silty fine sand with gravels (SM), silty gravel (GM) with sand					
50											7-7	35		
	6605													
55														
	6600													
									BASALT UNIT Gray basalt, highly weathered					
60														
									Refusal at 60 feet on basalt					
	6595													
65														

Woodward-Clyde

Figure B-8

11/27/96 1GLG17 6A199

Project: Cinder Lake Landfill Project Location: Project Number: 96A199-0400	**Log of Boring WC- 8** Sheet 1 of 3

Date(s) Drilled	10/2/96	Logged By	M. Hatch	Checked By	
Drilling Method	Hollow stem auger/NX core	Drill Bit Size/Type	8"	Total Depth Drilled (feet)	73.5
Drill Rig Type	CME 75	Drilled By	Heber Mining and Exploration	Hammer Weight/ Drop (lbs/in.)	140/30
Apparent Downhole Groundwater Depth	None encountered			Surface Elevation (feet)	6656
Coordinates	N10148.3 E131981.4			Elevation Datum	MSL

Depth, feet	Elevation, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Frac. Freq.	R Q D, %	Fracture Drawing/ Number	Lithology	MATERIAL DESCRIPTION	Packer Tests	SOIL SAMPLES: Type Number	Blows per foot	Drill Rate, feet/hour	FIELD NOTES/ LAB DATA
0	6655								CINDER UNIT Loose, moist, dark gray, silty fine to coarse sand (SM)					
5	6650										8-1	14		
									Medium dense, moist, brown, silty fine sand (SM) (alluvium with interbedded cinder layers)					
10	6645													
									Loose, moist, brown, silty fine to coarse sand (SM) trace clay (cindery alluvium)					
15	6640										8-2	6		
									Loose, moist, dark gray, well graded sand with gravel (SW) (cinders)					
20	6635													
25	6630										8-3	37		
									Gray, vesicular basalt, highly weathered					
30														

Woodward-Clyde

Figure B-9

11/27/96 1GLG17 6A199

Project: Cinder Lake Landfill
Project Location:
Project Number: 96A199-0400

Log of Boring WC- 8

Sheet 2 of 3

Depth, feet	Elevation, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Frac. Freq.	R Q D, %	Fracture Drawing/ Number	Lithology	MATERIAL DESCRIPTION	Packer Tests	SOIL SAMPLES: Type	Number	Blows per foot	Drill Rate, feet/hour	FIELD NOTES/ LAB DATA
30	6625								Dense, moist, red, silty gravel and silty fine to coarse sand with gravels, interbedded cinders (GM-SM)			8-4 8-5	50/ 3"		Refusal at 30' Switch to rock coring Core run 30-33' Return to HSA drilling
35	6620											8-6	40		
40	6615								Medium dense, moist, dusky red, silty fine to coarse sand (SM) with gravels (cinders)			8-7	15		
45	6610														
50	6605								Gray			8-8	21		
55	6600														
60	6595								BASALT UNIT Gray and reddish brown, vesicular basalt, highly weathered						
65		1	1	95	>10				Gray, vesicular basalt, highly weathered, highly fractured, weak rock Highly to moderately weathered, highly fractured					14	Refusal 60' Switch to rock coring

Figure B-9

Woodward-Clyde

1/30/97 1GLG17 6A199

Project: Cinder Lake Landfill
Project Location:
Project Number: 96A199-0400

Log of Boring WC- 8

Sheet 3 of 3

Depth, feet	Elevation, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Frac. Freq.	R Q D, %	Fracture Drawing/ Number	Lithology	MATERIAL DESCRIPTION	Packer Tests	SOIL SAMPLES: Type	Number	Blows per foot	Drill Rate, feet/hour	FIELD NOTES/ LAB DATA
65															
	6590				> 10										
		2	1	97		0			Intensely fractured zone						
					> 10										
70			2						Grades to moderately weathered, highly fractured, moderately strong rock					9.6	
	6585				> 10										
					2				Slightly weathered						
					0										
									Bottom of boring at 73.5 feet						
75															
	6580														
80															
	6575														
85															
	6570														
90															
	6565														
95															
	6560														
100															

Woodward-Clyde

Figure B-9

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Project: Cinder Lake Landfill Project Location: Project Number: 96A199-0400	Log of Boring WC- 9 Sheet 1 of 2

Date(s) Drilled	10/3/96	Logged By	M. Hatch	Checked By	
Drilling Method	Hollow stem auger/NX core	Drill Bit Size/Type	8"	Total Depth Drilled (feet)	65.0
Drill Rig Type	CME 75	Drilled By	Heber Mining and Exploration	Hammer Weight/ Drop (lbs/in.)	140/30
Apparent Downhole Groundwater Depth	None encountered			Surface Elevation (feet)	6663
Coordinates	N08818.6 E13611.8			Elevation Datum	MSL

Depth, feet	Elevation, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Frac. Freq.	R Q D, %	Fracture Drawing/ Number	Lithology	MATERIAL DESCRIPTION	Packer Tests	SOIL SAMPLES: Type	Number	Blows per foot	Drill Rate, feet/hour	FIELD NOTES/ LAB DATA
0									CINDER UNIT Loose, dry, dark gray, silty fine to coarse sand (SM) with gravels (cinders)						
	6660														
5									Medium dense, moist, red, silty fine to medium sand (SM) with gravels (cinders)			9-1	25		
	6655														
10									Increasing gravels			9-2	18		
	6650								Medium dense, moist, dusky red, well graded sand with gravels (SM) (cinders)						
15												9-3	20		
	6645														
20									Dense, moist, dusky red becoming gray, silty fine to coarse sand (SC) with gravels (cinders)			9-4	37		
	6640														
25															
	6635								Dense to very dense, moist, gray, silty fine to coarse sand (SM) with gravels (cinders)						
30															

Figure B-10

Woodward-Clyde

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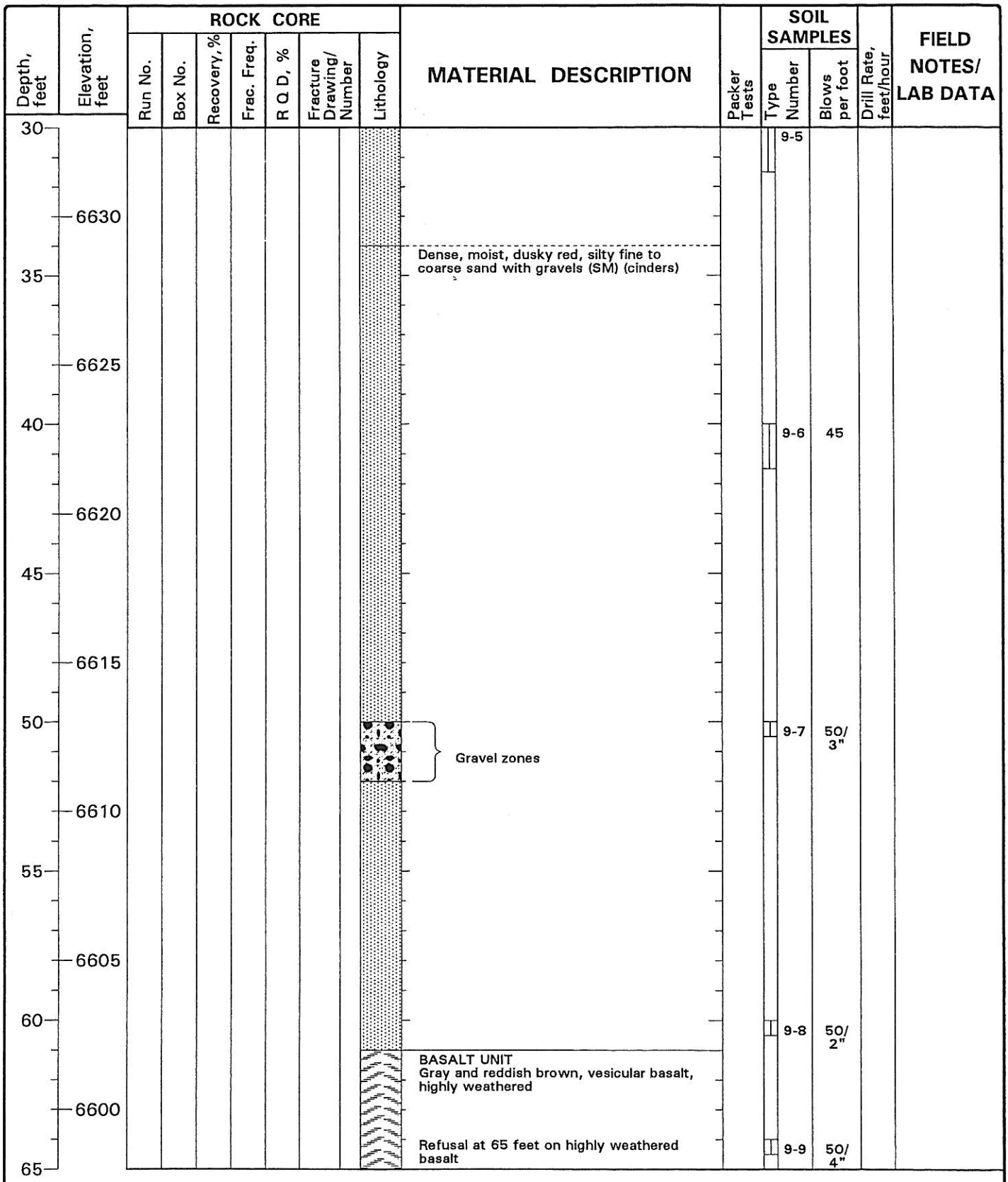
Project: Cinder Lake Landfill
Project Location:
Project Number: 96A199-0400

Log of Boring WC- 9

Sheet 2 of 2



Woodward-Clyde

Figure B-10

1/14/97 1GLG17 6A199

Project: Cinder Lake Landfill Project Location: Project Number: 96A199-0400	**Log of Boring WC-10** Sheet 1 of 2

Date(s) Drilled	10/3/96	Logged By	M. Hatch	Checked By	
Drilling Method	Hollow stem auger	Drill Bit Size/Type	8"	Total Depth Drilled (feet)	56.0
Drill Rig Type	CME 75	Drilled By	Heber Mining and Exploration	Hammer Weight/ Drop (lbs/in.)	140/30
Apparent Downhole Groundwater Depth	None encountered			Surface Elevation (feet)	6647
Coordinates	N09595.6 E13611.6			Elevation Datum	MSL

Depth, feet	Elevation, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Frac. Freq.	R Q D, %	Fracture Drawing/ Number	Lithology	MATERIAL DESCRIPTION	Packer Tests	SOIL SAMPLES: Type	Number	Blows per foot	Drill Rate, feet/hour	FIELD NOTES/ LAB DATA
0	6645								CINDER UNIT Loose, dry becoming moist, brown, well graded sand with gravels (SW) (cinders)						
5	6640								Medium dense, moist, brown, silty fine sand (SM) (alluvium)			10-1	10		
10	6635								Medium dense, moist, dark gray and reddish brown, silty fine to coarse sand with gravels (SM) (cinders)			10-2	13		
15	6630											10-3	8		
20	6625								Medium dense, moist, dusky red, silty fine to coarse sand with gravels (SM) (cinders)			10-4	27		
25	6620														
30															

Woodward-Clyde

Figure B-11

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Project: Cinder Lake Landfill
Project Location:
Project Number: 96A199-0400

Log of Boring WC-10

Sheet 2 of 2

Depth, feet	Elevation, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Frac. Freq.	R Q D, %	Fracture Drawing/ Number	Lithology	MATERIAL DESCRIPTION	Packer Tests	SOIL SAMPLES: Type Number	Blows per foot	Drill Rate, feet/hour	FIELD NOTES/ LAB DATA
30									Medium dense, moist, dusky red, silty fine to coarse sand with gravels (SM) (cinders)		10-5	23		
	6615													
35														
	6610													
40									Medium dense, moist, reddish brown, interbedded silty fine to coarse sand with fine gravel (GM) and gravelly sand (SW) and well graded sand (cinders)		10-6	18		
	6605													
45														
	6600													
50											10-7	50/ 6"		
	6595													
55									BASALT UNIT Gray and reddish brown, vesicular basalt, highly weathered					
	6590								Refusal at 56 feet on basalt					
60														
	6585													
65														

Woodward-Clyde

Figure B-11

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Project: Cinder Lake Landfill Project Location: Project Number: 96A199-0400	**Log of Boring WC-11** Sheet 1 of 2

Date(s) Drilled	10/3/96	Logged By	M. Hatch	Checked By	
Drilling Method	Hollow stem auger	Drill Bit Size/Type	8"	Total Depth Drilled (feet)	44.0
Drill Rig Type	CME 75	Drilled By	Heber Mining and Exploration	Hammer Weight/ Drop (lbs/in.)	140/30
Apparent Downhole Groundwater Depth	None encountered			Surface Elevation (feet)	6641
Coordinates	N09180.3 E114219.4			Elevation Datum	MSL

Depth, feet	Elevation, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Frac. Freq.	R Q D, %	Fracture Drawing/ Number	Lithology	MATERIAL DESCRIPTION	Packer Tests	SOIL SAMPLES: Type Number	Blows per foot	Drill Rate, feet/hour	FIELD NOTES/ LAB DATA
0	6640								CINDER UNIT Loose, dry becoming moist, brown, silty fine to coarse sand with gravels (SM) (cinders)					
5	6635								Medium dense, moist, brown, silty fine sand (SM) (alluvium)		11-1	12		
10	6630										11-2	40		
15	6625													
20	6620								Medium dense, moist, dark gray, silty fine to coarse sand (SM) (cinders) with interbedded silty to clayey sand (alluvium)		11-3	27		
25	6615													
30														

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Figure B-12

Project: Cinder Lake Landfill
Project Location:
Project Number: 96A199-0400

Log of Boring WC-11

Sheet 2 of 2

Depth, feet	Elevation, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Frac. Freq.	R Q D, %	Fracture Drawing/ Number	Lithology	MATERIAL DESCRIPTION	Packer Tests	SOIL SAMPLES: Type Number	Blows per foot	Drill Rate, feet/hour	FIELD NOTES/ LAB DATA
30	6610								Brown, clayey sand		11-4	17		
35	6605													
40	6600								Dense, moist, dusky red, silty fine sand (SM) (cinders)		11-5	37		
									BASALT UNIT Gray and reddish brown, vesicular basalt, highly weathered					
45	6595								Refusal at 43 feet on basalt					
50	6590													
55	6585													
60	6580													
65														

Woodward-Clyde

Figure B-12

11/27/96 1GLG17 6A199

Project: Cinder Lake Landfill Project Location: Project Number: 96A199-0400	**Log of Boring WC-12** Sheet 1 of 3

Date(s) Drilled	10/3/96	Logged By	M. Hatch	Checked By	
Drilling Method	Hollow stem auger/NX core	Drill Bit Size/Type	8"	Total Depth Drilled (feet)	78.5
Drill Rig Type	CME 75	Drilled By	Heber Mining and Exploration	Hammer Weight/ Drop (lbs/in.)	140/30
Apparent Downhole Groundwater Depth	None encountered			Surface Elevation (feet)	6643
Coordinates	N08416.1 E13778.8			Elevation Datum	MSL

Depth, feet	Elevation, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Frac. Freq.	R Q D, %	Fracture Drawing/ Number	Lithology	MATERIAL DESCRIPTION	Packer Tests	SOIL SAMPLES: Type	Number	Blows per foot	Drill Rate, feet/hour	FIELD NOTES/ LAB DATA
0									CINDER UNIT Loose, dry becoming wet, brown, well graded sand (SM)						
	6640														
5									Very dense, moist, brown, silty fine sand (SM) (alluvium with interbedded cinders)			12-1	56		
	6635														
10									Cinder layer			12-2	16		
	6630														
15															
	6625														
20									Medium dense, moist, dark gray, well graded sand with silt and gravel (SM) (cinders)			12-3	11		
	6620														
25									Gravelly or fused cinder layer						
	6615								Dense to very dense, moist, brown, silty fine to medium sand (SM) (cindery alluvium)						
30															

Woodward-Clyde

Figure B-13

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Project: Cinder Lake Landfill
Project Location:
Project Number: 96A199-0400

Log of Boring WC-12

Sheet 2 of 3

Depth, feet	Elevation, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Frac. Freq.	R Q D, %	Fracture Drawing/ Number	Lithology	MATERIAL DESCRIPTION	Packer Tests	SOIL SAMPLES: Type Number	Blows per foot	Drill Rate, feet/hour	FIELD NOTES/ LAB DATA
30									Dense, moist, red, silty fine sand (SM) (cinders)		12-4	32		
	6610													
35														
	6605													
40									With large gravels (scoria)		12-5	50/ 4"		
	6600													
45														
	6595													
50											12-6	87		
	6590								BASALT UNIT Dusky red, highly vesicular basalt, extremely weathered					
55														
	6585													
60											12-7	50/ 3"		
		1	1	97	3	57			Mottled gray and dusky red, highly vesicular, basalt, highly weathered, weak rock					Refusal at 60' Switch to rock coring
	6580				3				Moderately weathered with highly weathered zones					
					1									
					4									
65					3				Slightly weathered					

Woodward-Clyde

Figure B-13

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Project: Cinder Lake Landfill
Project Location:
Project Number: 96A199-0400

Log of Boring WC-12

Sheet 3 of 3

Depth, feet	Elevation, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Frac. Freq.	R Q D, %	Fracture Drawing/ Number	Lithology	MATERIAL DESCRIPTION	Packer Tests	SOIL SAMPLES: Type	Number	Blows per foot	Drill Rate, feet/hour	FIELD NOTES/ LAB DATA
65															
	6575	1			3 1 1 1 3									14.2	
		2	2	100	1 2 0 0 0	86								10.6	
70															
	6570	3		100	0 0 2 0 1	98			Moderately strong to strong rock					12	
75					0										
	6565														
80									Bottom of boring at 78.5 feet						
	6560														
85															
	6555														
90															
	6550														
95															
	6545														
100															

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Woodward-Clyde

Figure B-13

Project: Cinder Lake Landfill
Project Location:
Project Number: 96A199-0400

Log of Boring WC-13

Sheet 1 of 2

Date(s) Drilled	10/4/96	Logged By	M. Hatch	Checked By	
Drilling Method	Hollow stem auger	Drill Bit Size/Type	8"	Total Depth Drilled (feet)	50.0
Drill Rig Type	CME 75	Drilled By	Heber Mining and Exploration	Hammer Weight/ Drop (lbs/in.)	140/30
Apparent Downhole Groundwater Depth	Perched water 30-40'			Surface Elevation (feet)	6640
Coordinates	N09582.8 E14956.4			Elevation Datum	MSL

Depth, feet	Elevation, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Frac. Freq.	R Q D, %	Fracture Drawing/ Number	Lithology	MATERIAL DESCRIPTION	Packer Tests	SOIL SAMPLES: Type	Number	Blows per foot	Drill Rate, feet/hour	FIELD NOTES/ LAB DATA
0	6640								CINDER UNIT Loose, dry becoming moist, brown, poorly graded sand with gravel (SM) (cinders)						
									Loose, moist, brown, silty fine sand (SM) (alluvium)						
5	6635											13-1	4		
									Medium dense, moist, dark gray, well graded fine gravel with sand (GW) (cinders)						
10	6630								Dense, moist, brown, silty fine sand (SM) (alluvium)			13-2	37		
									Medium dense and dense, moist, gray, silty fine to coarse sand with gravels and poorly graded sand with gravels (cinders), interbedded with silty and clayey sand (alluvium)						
15	6625														
20	6620								Medium dense, moist to wet, dark gray mottled with brown, poorly graded sand with silt (SM) laminated (alluvium)			13-3	21		
25	6615														
30	6610														

Woodward-Clyde

Figure B-14

11/27/96 1GLG17 6A199

Project: Cinder Lake Landfill
Project Location:
Project Number: 96A199-0400

Log of Boring WC-13

Sheet 2 of 2

Depth, feet	Elevation, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Frac. Freq.	R Q D, %	Fracture Drawing/ Number	Lithology	MATERIAL DESCRIPTION	Packer Tests	SOIL SAMPLES: Type	Number	Blows per foot	Drill Rate, feet/hour	FIELD NOTES/ LAB DATA
30	6610								Medium dense, wet, dark gray mottled, well graded sand with gravels (SM) (cinders) Dark gray cinder cobble			13-4	20		
35	6605														
40	6600								Dense, wet, dark gray, poorly graded sand with gravels (SP) (cinders)			13-5	65		
									BASALT UNIT Very dense, moist to wet, red, silty fine to coarse sand with gravels and clay (SM) extremely weathered basalt						
45	6595														
									Highly weathered basalt						
50	6590								Refusal at 50 feet on basalt			13-6	50/ 2"		
55	6585														
60	6580														
65	6575														

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Woodward-Clyde

Figure B-14

Project: Cinder Lake Landfill Project Location: Project Number: 96A199-0400	Log of Boring WC-14 Sheet 1 of 3

Date(s) Drilled	10/4/96	Logged By	M. Hatch	Checked By	
Drilling Method	Hollow stem auger	Drill Bit Size/Type	8"	Total Depth Drilled (feet)	70.0
Drill Rig Type	CME 75	Drilled By	Heber Mining and Exploration	Hammer Weight/ Drop (lbs/in.)	140/30
Apparent Downhole Groundwater Depth	None encountered			Surface Elevation (feet)	6663
Coordinates	N11114.7 E15003.2			Elevation Datum	MSL

Depth, feet	Elevation, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Frac. Freq.	R Q D, %	Fracture Drawing/ Number	Lithology	MATERIAL DESCRIPTION	Packer Tests	SOIL SAMPLES: Type	Number	Blows per foot	Drill Rate, feet/hour	FIELD NOTES/ LAB DATA
0	6660								CINDER UNIT Loose becoming medium dense, moist, dark gray, silty fine to coarse sand (SM) (cinders)						
5	6655								Medium dense, moist, brown, sandy silt to silty sand (ML/SM) (alluvium)			14-1	12		
10	6650								Medium dense, moist, dark gray, poorly graded sand with gravels grading to silty fine sand (SM) (cinders)			14-2	13		
15	6645								Grading to red						
20	6640								Medium dense, moist, mottled brown gray, reddish brown, poorly graded sand with silt (SP/SM) faint laminations (alluvium)			14-3	26		
25	6635								Medium dense, moist, reddish brown and dark gray, silty fine gravels, poorly graded sand with gravels and silty fine to coarse sand (cinders)						
30															

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Figure B-15

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Project: Cinder Lake Landfill
Project Location:
Project Number: 96A199-0400

Log of Boring WC-14

Sheet 2 of 3

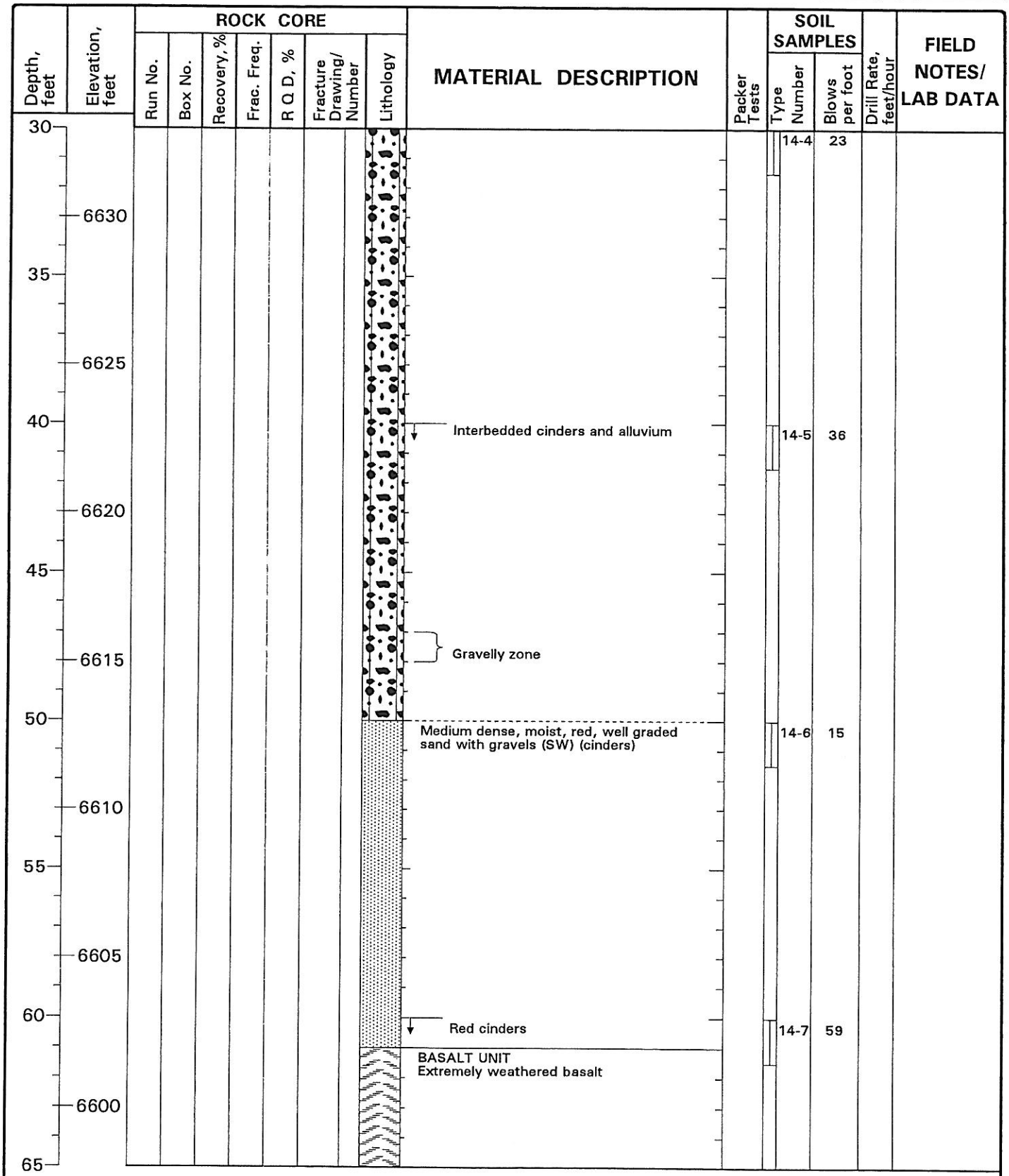

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Figure B-15

Project: Cinder Lake Landfill
Project Location:
Project Number: 96A199-0400

Log of Boring WC-14

Sheet 3 of 3

Depth, feet	Elevation, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Frac. Freq.	R Q D, %	Fracture Drawing/ Number	Lithology	MATERIAL DESCRIPTION	Packer Tests	SOIL SAMPLES: Type	Number	Blows per foot	Drill Rate, feet/hour	FIELD NOTES/ LAB DATA
65															
	6595								Gray basalt, highly weathered						
70									Refusal at 70 feet on weathered basalt						
	6590														
75															
	6585														
80															
	6580														
85															
	6575														
90															
	6570														
95															
	6565														
100															

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Figure B-15

11/27/96 1GLG17 6A199

Project: Cinder Lake Landfill
Project Location:
Project Number: 96A199-0400

Log of Boring WC-15

Sheet 1 of 2

Date(s) Drilled	10/7/96	Logged By	M. Hatch	Checked By	
Drilling Method	Hollow stem auger/NX core	Drill Bit Size/Type	8"	Total Depth Drilled (feet)	44.0
Drill Rig Type	CME 75	Drilled By	Heber Mining and Exploration	Hammer Weight/ Drop (lbs/in.)	140/30
Apparent Downhole Groundwater Depth	None encountered			Surface Elevation (feet)	6657
Coordinates	N10135.9 E14676.3			Elevation Datum	MSL

Depth, feet	Elevation, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Frac. Freq.	R Q D, %	Fracture Drawing/ Number	Lithology	MATERIAL DESCRIPTION	Packer Tests	SOIL SAMPLES: Type Number	Blows per foot	Drill Rate, feet/hour	FIELD NOTES/ LAB DATA
0	6655								CINDER UNIT Loose, dry becoming moist, brown, poorly graded sand with gravels and silty gravels with sand (SM-GM) (cinders)					
5									Medium dense, moist, dark gray, silty fine to coarse sand (SM) (cinders)		15-1	16		
	6650								Medium dense, moist, brown, silty fine sand (SM) (alluvium)					
									Medium dense, moist, dark gray, silty fine to coarse sand (SM) (cinders) with organics					
10											15-2	26		
	6645								Medium dense, moist, brown, silty fine sand with clay (SM) (alluvium)					
15									Moist to wet zone		15-3	25		
	6640													
20											15-4	14		
	6635								Medium dense, moist, red, poorly graded sand with silt and fine gravels (SM/SP) (cinders)					
25									Becomes silty gravels with sand (GM)		15-5	21		
	6630													
30									Increasing gravel size					

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Figure B-16

11/27/96 1GLG17 6A199

Project: Cinder Lake Landfill
Project Location:
Project Number: 96A199-0400

Log of Boring WC-15

Sheet 2 of 2

Depth, feet	Elevation, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Frac. Freq.	R Q D, %	Fracture Drawing/ Number	Lithology	MATERIAL DESCRIPTION	Packer Tests	SOIL SAMPLES: Type Number	Blows per foot	Drill Rate, feet/hour	FIELD NOTES/ LAB DATA
30									Medium dense, moist, red silty gravel with sand (GM)		15-6			
	6625													
35									BASALT UNIT Reddish brown and gray, vesicular basalt, highly weathered highly fractured with zones of moderately to highly weathered rock, intense fracturing		15-7	50/ 3"		
	6620	1		94		0			Moderately to highly weathered				16	Refusal at 37', switch to rock coring
40									Moderately to highly weathered Reddish brown and gray, basalt, highly weathered, highly fractured					
	6615													
45									Refusal at 44 feet on basalt					
	6610													
50														
	6605													
55														
	6600													
60														
	6595													
65														

Woodward-Clyde

Figure B-16

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Project: Cinder Lake Landfill Project Location: Project Number: 96A199-0400	**Log of Boring WC-16** Sheet 1 of 2

Date(s) Drilled	10/7/96	Logged By	M. Hatch	Checked By	
Drilling Method	Hollow stem auger	Drill Bit Size/Type	8"	Total Depth Drilled (feet)	46.0
Drill Rig Type	CME 75	Drilled By	Heber Mining and Exploration	Hammer Weight/ Drop (lbs/in.)	140/30
Apparent Downhole Groundwater Depth	None encountered			Surface Elevation (feet)	6652
Coordinates	N10343.4 E13664.0			Elevation Datum	MSL

Depth, feet	Elevation, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Frac. Freq.	R Q D, %	Fracture Drawing/ Number	Lithology	MATERIAL DESCRIPTION	Packer Tests	SOIL SAMPLES: Type Number	Blows per foot	Drill Rate, feet/hour	FIELD NOTES/ LAB DATA
0	6650								CINDER UNIT Loose, dry becoming moist, dark gray, poorly graded sand with gravels (SP) (cinders)					
5	6645								Dense, moist, light brown, sandy silt to silt sand (SM/ML)		16-1	40		
10	6640								Medium dense, moist, dark gray cinders with interbedded brown, silty sand (alluvium)		16-2	22		
15	6635								Medium dense, moist, brown, silty fine sand (SM) (alluvium)		16-3	11		
20	6630								Medium dense, moist, dark gray, silty fine to coarse sand (SM) (cinders)		16-4	11		
25	6625								Medium dense, moist, red, well graded sand with gravel (SM) (cinders) With thin (1-2") brown clayey soil layers Increasing gravels		16-5	12		
30														

Figure B-17

Woodward-Clyde

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Project: Cinder Lake Landfill
Project Location:
Project Number: 96A199-0400

Log of Boring WC-16

Sheet 2 of 2

Depth, feet	Elevation, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Frac. Freq.	R Q D, %	Fracture Drawing/ Number	Lithology	MATERIAL DESCRIPTION	Packer Tests	SOIL SAMPLES: Type Number	Blows per foot	Drill Rate, feet/hour	FIELD NOTES/ LAB DATA
30									Medium dense, moist, red, well graded sand with gravel (SM) (cinders)		16-6			
	6620													
35														
	6615													
40									BASALT UNIT Dusky red and gray, vesicular basalt, highly weathered		16-7	50/ 2"		
	6610													
45														
	6605								Refusal at 46 feet on basalt					
50														
	6600													
55														
	6595													
60														
	6590													
65														

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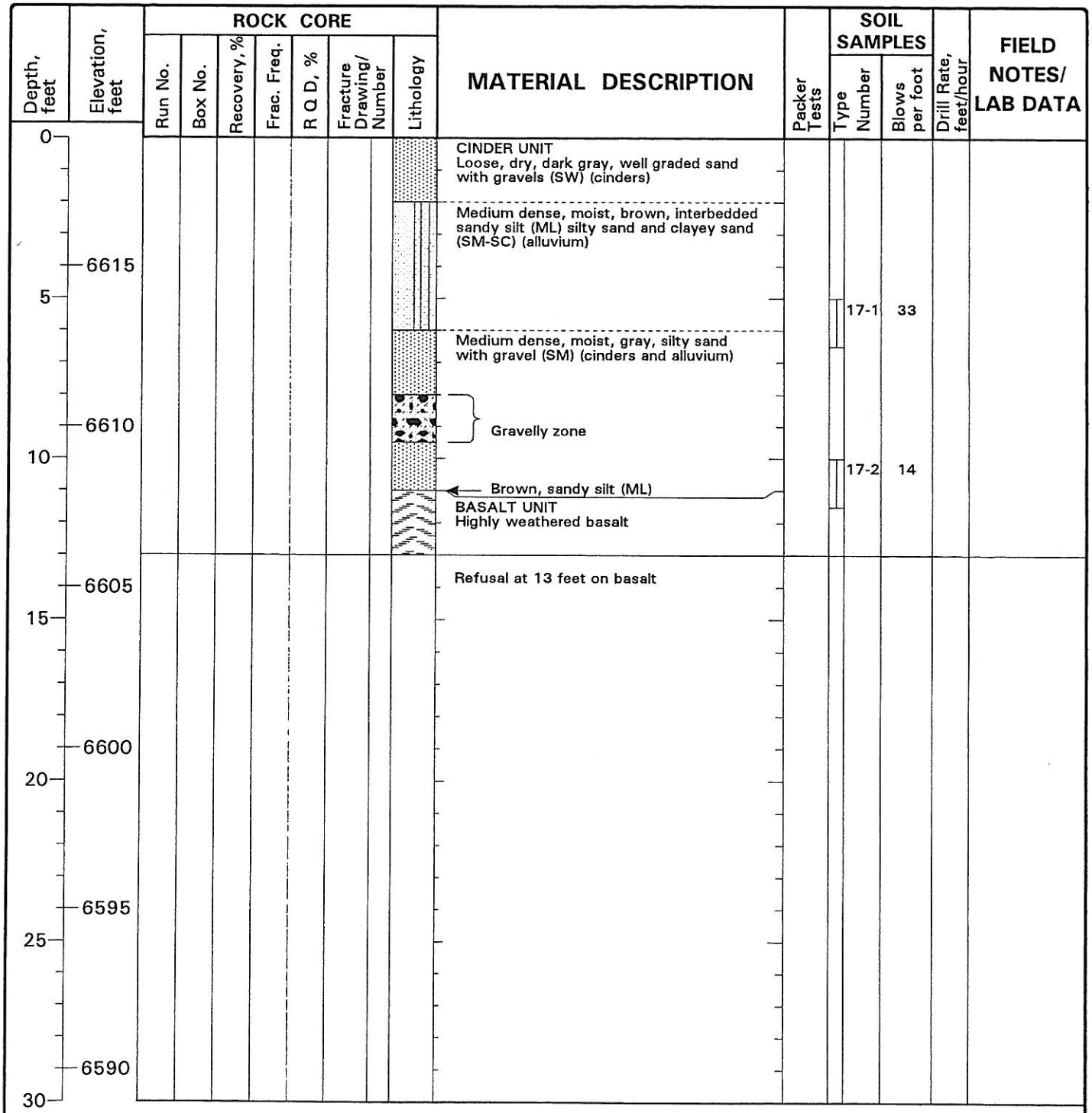
Woodward-Clyde

Figure B-17

Project: Cinder Lake Landfill Project Location: Project Number: 96A199-0400	Log of Boring WC-17 Sheet 1 of 1

Date(s) Drilled	10/9/96	Logged By	M. Hatch	Checked By	
Drilling Method	Hollow stem auger	Drill Bit Size/Type	8"	Total Depth Drilled (feet)	13.0
Drill Rig Type	CME 75	Drilled By	Heber Mining and Exploration	Hammer Weight/ Drop (lbs/in.)	140/30
Apparent Downhole Groundwater Depth	None encountered			Surface Elevation (feet)	6619
Coordinates	N06991.5 E13065.5			Elevation Datum	MSL



Woodward-Clyde

Figure B-18

11/27/96 1GLG17 6A199

Project: Cinder Lake Landfill Project Location: Project Number: 96A199-0400	**Log of Boring WC-18** Sheet 1 of 1

Date(s) Drilled	10/9/96	Logged By	M. Hatch	Checked By	
Drilling Method	Hollow stem auger	Drill Bit Size/Type	8"	Total Depth Drilled (feet)	20.0
Drill Rig Type	CME 75	Drilled By	Heber Mining and Exploration	Hammer Weight/ Drop (lbs/in.)	140/30
Apparent Downhole Groundwater Depth	None encountered			Surface Elevation (feet)	6619
Coordinates	N07030.3 E13268.5			Elevation Datum	MSL

Depth, feet	Elevation, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Frac. Freq.	R Q D, %	Fracture Drawing/ Number	Lithology	MATERIAL DESCRIPTION	Packer Tests	SOIL SAMPLES: Type	Number	Blows per foot	Drill Rate, feet/hour	FIELD NOTES/ LAB DATA
0									CINDER UNIT Loose, dry, dark gray well graded sand with silt and gravels (SW)						
	6615								Medium dense, moist, brown, silty to clayey sand and sandy silt (SM-ML) (alluvium) interbedded with dark gray, cinder layers						
5															
	6610								Gravelly layer						
10												18-1			
	6605								BASALT UNIT Reddish brown and gray, highly vesicular, basalt, extremely weathered with highly weathered zones						
15															
	6600														
20									Refusal at 20 on basalt						
	6595														
25															
	6590														
30															

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Woodward-Clyde

Figure B-19

Project: Cinder Lake Landfill Project Location: Project Number: 96A199-0400	**Log of Boring WC-19** Sheet 1 of 2

Date(s) Drilled	10/9/96	Logged By	M. Hatch	Checked By	
Drilling Method	Hollow stem auger	Drill Bit Size/Type	8"	Total Depth Drilled (feet)	46.0
Drill Rig Type	CME 75	Drilled By	Heber Mining and Exploration	Hammer Weight/ Drop (lbs/in.)	140/30
Apparent Downhole Groundwater Depth	None encountered			Surface Elevation (feet)	6622
Coordinates	N07288.2 E13657.2			Elevation Datum	MSL

Depth, feet	Elevation, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Frac. Freq.	R Q D, %	Fracture Drawing/ Number	Lithology	MATERIAL DESCRIPTION	Packer Tests	SOIL SAMPLES: Type	Number	Blows per foot	Drill Rate, feet/hour	FIELD NOTES/ LAB DATA
0	6620								CINDER UNIT Loose, dry becoming moist, brown, well graded sand with gravels (SW)						
5	6615								Loose, moist, brown, sandy silt (ML) (alluvium)			19-1	7		
10	6610								Loose, moist, dark gray, silty fine to coarse sand (SM) with gravels (cinders)			19-2	6		
15	6605								Gravelly zone						
20	6600								Medium dense, moist, dark gray with reddish brown zones, well graded sand with silt and gravel (SW) (cinders)			19-3	14		
25	6595								Medium dense, moist, reddish brown, silty fine sand with gravel (SM) (cinders)						
30															

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Figure B-20

Project: Cinder Lake Landfill
Project Location:
Project Number: 96A199-0400

Log of Boring WC-19

Sheet 2 of 2

Depth, feet	Elevation, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Frac. Freq.	R Q D, %	Fracture Drawing/ Number	Lithology	MATERIAL DESCRIPTION	Packer Tests	SOIL SAMPLES: Type Number	Blows per foot	Drill Rate, feet/hour	FIELD NOTES/ LAB DATA
30	6590								Gravel or cobble layer		19-4	22		
35	6585													
40	6580								BASALT UNIT Reddish brown, highly to extremely weathered vesicular basalt		19-5	30		
45									Gray, vesicular basalt, highly weathered					
	6575								Refusal at 46 feet on basalt					
50	6570													
55	6565													
60	6560													
65														

Woodward-Clyde

Figure B-20

11/27/96 1GLG17 6A199

Project: Cinder Lake Landfill Project Location: Project Number: 96A199-0400	Log of Boring WC-20 Sheet 1 of 1

Date(s) Drilled	10/19/96	Logged By	M. Hatch	Checked By	
Drilling Method	Hollow stem auger	Drill Bit Size/Type	8"	Total Depth Drilled (feet)	11.0
Drill Rig Type	CME 75	Drilled By	Heber Mining and Exploration	Hammer Weight/ Drop (lbs/in.)	140/30
Apparent Downhole Groundwater Depth	None encountered			Surface Elevation (feet)	6606
Coordinates	N7131.5 E12872.1			Elevation Datum	MSL

Depth, feet	Elevation, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Frac. Freq.	R Q D, %	Fracture Drawing/ Number	Lithology	MATERIAL DESCRIPTION	Packer Tests	SOIL SAMPLES: Type	Number	Blows per foot	Drill Rate, feet/hour	FIELD NOTES/ LAB DATA
0	6605								BASALT UNIT Red, reddish brown and dark gray, vesicular basalt, highly weathered, jointed, blocky						
5	6600														
10	6595								Refusal at 11 feet on basalt						
15	6590														
20	6585														
25	6580														
30															

Woodward-Clyde

Figure B-21

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Project: Cinder Lake Landfill Project Location: Project Number: 96A199-0400	Log of Boring WC-21 Sheet 1 of 1

Date(s) Drilled	10/9/96	Logged By	M. Hatch	Checked By	
Drilling Method	Hollow stem auger	Drill Bit Size/Type	8"	Total Depth Drilled (feet)	6.0
Drill Rig Type	CME 75	Drilled By	Heber Mining and Exploration	Hammer Weight/ Drop (lbs/in.)	140/30
Apparent Downhole Groundwater Depth	None encountered			Surface Elevation (feet)	6612
Coordinates	N07571.2 E13657.2			Elevation Datum	MSL

Depth, feet	Elevation, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Frac. Freq.	R Q D, %	Fracture Drawing/ Number	Lithology	MATERIAL DESCRIPTION	Packer Tests	SOIL SAMPLES: Type	Number	Blows per foot	Drill Rate, feet/hour	FIELD NOTES/ LAB DATA
0	6610								CINDER UNIT Loose, moist, dark gray, silty fine to coarse sand with gravel and well graded sand with gravel (SM) (cinders)						
5									BASALT UNIT Reddish brown, basalt, highly weathered						
	6605								Refusal at 6 feet on basalt						
10	6600														
15	6595														
20	6590														
25	6585														
30															

Woodward-Clyde

Figure B-22

11/27/96 1GLG17 6A199

Project: Cinder Lake Landfill Project Location: Project Number: 96A199-0400	**Log of Boring LFL-1** Sheet 1 of 1

Date(s) Drilled	10/8/96	Logged By	M. Hatch	Checked By	
Drilling Method	Hollow stem auger	Drill Bit Size/Type	8"	Total Depth Drilled (feet)	26.0
Drill Rig Type	CME 75	Drilled By	Heber Mining and Exploration	Hammer Weight/ Drop (lbs/in.)	140/30
Apparent Downhole Groundwater Depth	None encountered			Surface Elevation (feet)	6635
Coordinates	N07903.0 E13615.3			Elevation Datum	MSL

Depth, feet	Elevation, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Frac. Freq.	R Q D, %	Fracture Drawing/ Number	Lithology	MATERIAL DESCRIPTION	Packer Tests	SOIL SAMPLES: Type	Number	Blows per foot	Drill Rate, feet/hour	FIELD NOTES/ LAB DATA
0	6635								SOIL COVER Moist, reddish brown, silty sand						
									SOLID WASTE Moist, dark brown to black silty sand with plastic, paper, cloth and wood material						
5	6630														
10	6625								Predominantly paper and plastic						
15	6620								At 15', wood fragments						
									At 18', wood fragments						
									At 19', metal strips						
20	6615								CINDER UNIT Moist, red, silty fine to coarse sand with fine gravel						
25	6610											1			
									Bottom of boring at 26 feet						
30	6605														

Figure B-23

Woodward-Clyde

11/27/96 1GLG17 6A199

Project: Cinder Lake Landfill Project Location: Project Number: 96A199-0400	Log of Boring LFL-2 Sheet 1 of 1

Date(s) Drilled	10/8/96	Logged By	M. Hatch	Checked By	
Drilling Method	Hollow stem auger	Drill Bit Size/Type	8"	Total Depth Drilled (feet)	30.0
Drill Rig Type	CME 75	Drilled By	Heber Mining and Exploration	Hammer Weight/ Drop (lbs/in.)	140/30
Apparent Downhole Groundwater Depth	None encountered			Surface Elevation (feet)	6642
Coordinates	N08045.9 E13333.6			Elevation Datum	MSL

Depth, feet	Elevation, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Frac. Freq.	R Q D, %	Fracture Drawing/ Number	Lithology	MATERIAL DESCRIPTION	Packer Tests	SOIL SAMPLES: Type	Number	Blows per foot	Drill Rate, feet/hour	FIELD NOTES/ LAB DATA
0	6640								SOIL COVER Moist, brown, silty sand						
									SOLID WASTE Paper, plastic, wood debris						
5	6635														
10	6630														
15	6625														
20	6620														
25	6615								CINDER UNIT Medium dense, moist, red, well graded sand with gravels (SW)						
30									Bottom of boring at 30 feet						

Woodward-Clyde

Figure B-24

11/27/96 1GLG17 6A199

Project: Cinder Lake Landfill Project Location: Project Number: 96A199-0400	Log of Boring LFL-3 Sheet 1 of 1

Date(s) Drilled	10/8/96	Logged By	M. Hatch	Checked By	
Drilling Method	Hollow stem auger	Drill Bit Size/Type	8"	Total Depth Drilled (feet)	26.5
Drill Rig Type	CME 75	Drilled By	Heber Mining and Exploration	Hammer Weight/ Drop (lbs/in.)	140/30
Apparent Downhole Groundwater Depth	None encountered			Surface Elevation (feet)	6645
Coordinates	N08086.2 E13187.6			Elevation Datum	MSL

Depth, feet	Elevation, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Frac. Freq.	R Q D, %	Fracture Drawing/ Number	Lithology	MATERIAL DESCRIPTION	Packer Tests	SOIL SAMPLES: Type	Number	Blows per foot	Drill Rate, feet/hour	FIELD NOTES/ LAB DATA
0	6645								SOIL COVER Dry becoming moist, brown, silty fine to coarse sand						
									SOLID WASTE Trash and woody debris						
5	6640														
10	6635														
									Soil with wood debris						
15	6630											1	NR/ 12"		
									CINDER UNIT Loose, moist, dark gray, well graded sand (SW) with gravels (cinders)						
20	6625														
25	6620											2	7		
									Bottom of boring at 26.5 feet						
30	6615														

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Woodward-Clyde

Figure B-25

Project: Cinder Lake Landfill Project Location: Project Number: 96A199-0400	Log of Boring LFL-4 Sheet 1 of 1

Date(s) Drilled	10/8/96	Logged By	M. Hatch	Checked By	
Drilling Method	Hollow stem auger	Drill Bit Size/Type	8"	Total Depth Drilled (feet)	25.0
Drill Rig Type	CME 75	Drilled By	Heber Mining and Exploration	Hammer Weight/ Drop (lbs/in.)	140/30
Apparent Downhole Groundwater Depth	None encountered			Surface Elevation (feet)	6636
Coordinates	N07788.4 E13485.1			Elevation Datum	MSL

Depth, feet	Elevation, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Frac. Freq.	R Q D, %	Fracture Drawing/ Number	Lithology	MATERIAL DESCRIPTION	Packer Tests	SOIL SAMPLES: Type	Number	Blows per foot	Drill Rate, feet/hour	FIELD NOTES/ LAB DATA
0	6635								SOIL COVER						
									SOLID WASTE Trash and woody debris						
5	6630														
10	6625														
15	6620														
20	6615														
25	6610								CINDER UNIT Dense, moist, dark gray, silty fine to coarse sand with gravels (SM) Bottom of boring at 25 feet						
30															

Figure B-26

Woodward-Clyde

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Project: Cinder Lake Landfill Project Location: Project Number: 96A199-0400	Log of Boring LFL-5 Sheet 1 of 1

Date(s) Drilled	10/8/96	Logged By	M. Hatch	Checked By	
Drilling Method	Hollow stem auger	Drill Bit Size/Type	8"	Total Depth Drilled (feet)	26.5
Drill Rig Type	CME 75	Drilled By	Heber Mining and Exploration	Hammer Weight/ Drop (lbs/in.)	140/30
Apparent Downhole Groundwater Depth	None encountered			Surface Elevation (feet)	6637
Coordinates	N08035.7 E13675.7			Elevation Datum	MSL

Depth, feet	Elevation, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Frac. Freq.	R Q D, %	Fracture Drawing/ Number	Lithology	MATERIAL DESCRIPTION	Packer Tests	SOIL SAMPLES: Type	Number	Blows per foot	Drill Rate, feet/hour	FIELD NOTES/ LAB DATA
0	6635								SOIL COVER Dry becoming moist, brown, silty fine to coarse sand						
5	6630								SOLID WASTE Trash and woody debris						
10	6625														
15	6620								Increasing woody organic debris			1			
20	6615								CINDER UNIT Well graded sand with silt and gravel (red cinders)			2			
25	6610											3			
30									Bottom of boring at 26.5 feet						

Project: Cinder Lake Landfill Project Location: Project Number: 96A199-0400	Log of Boring LFL-6 Sheet 1 of 2

Date(s) Drilled	10/8/96	Logged By	M. Hatch	Checked By	
Drilling Method	Hollow stem auger	Drill Bit Size/Type	8"	Total Depth Drilled (feet)	61.0
Drill Rig Type	CME 75	Drilled By	Heber Mining and Exploration	Hammer Weight/ Drop (lbs/in.)	140/30
Apparent Downhole Groundwater Depth	None encountered			Surface Elevation (feet)	6641
Coordinates	N08141.7 E13398.3			Elevation Datum	MSL

Depth, feet	Elevation, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Frac. Freq.	R Q D, %	Fracture Drawing/ Number	Lithology	MATERIAL DESCRIPTION	Packer Tests	SOIL SAMPLES: Type	Number	Blows per foot	Drill Rate, feet/hour	FIELD NOTES/ LAB DATA
0	6640								CINDER UNIT Loose, dry becoming moist, dark gray, well graded sand with gravel (SW) (cinders)						
5	6635											1	8		
10	6630								Becoming dark gray to black			2			
15	6625														
20	6620								Medium dense, moist, red, well graded sand with fine gravel (SW) (cinders)			3	16		
25	6615														
30															

Project: Cinder Lake Landfill
Project Location:
Project Number: 96A199-0400

Log of Boring LFL-6

Sheet 2 of 2

Depth, feet	Elevation, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Frac. Freq.	R Q D, %	Fracture Drawing/ Number	Lithology	MATERIAL DESCRIPTION	Packer Tests	SOIL SAMPLES: Type	Number	Blows per foot	Drill Rate, feet/hour	FIELD NOTES/ LAB DATA
30	6610								Medium dense, moist, red, well graded sand with fine gravel (SW)			4	14		
35	6605														
40	6600								Dense, dry, red, well graded silty sand with fine gravel (SW)			5	59		
45	6595														
50	6590								BASALT UNIT Dark gray, vesicular basalt, highly to extremely weathered			6	50/ 7"		
55	6585														
60	6580											7	50/ 1"		
65									Refusal at 61 feet on basalt						

11/27/96 1GLG17 6A199

Woodward-Clyde

Figure B-28

Project: Cinder Lake Landfill Project Location: Project Number: 96A199-0400	**Log of Boring IA-1** Sheet 1 of 2

Date(s) Drilled	10/9/96	Logged By	M. Hatch	Checked By	
Drilling Method	Hollow stem auger/NX core	Drill Bit Size/Type	8"	Total Depth Drilled (feet)	38.5
Drill Rig Type	CME 75	Drilled By	Heber Mining and Exploration	Hammer Weight/ Drop (lbs/in.)	140/30
Apparent Downhole Groundwater Depth	None encountered			Surface Elevation (feet)	6619
Coordinates	N06896.7 E11269.8			Elevation Datum	MSL

Depth, feet	Elevation, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Frac. Freq.	RQD, %	Fracture Drawing/ Number	Lithology	MATERIAL DESCRIPTION	Packer Tests	SOIL SAMPLES: Type	Number	Blows per foot	Drill Rate, feet/hour	FIELD NOTES/ LAB DATA
0									CINDER UNIT Loose, dry becoming moist, dark gray, well graded sand with gravels (SW) (cinders)						
	6615								Medium dense, moist, brown, silty fine sand with gravels (SM) (alluvium)						
5												A1-1	22		
									Very gravelly						
	6610														
10												A1-2	26		
									Medium dense, moist, dark gray and brownish gray, silty fine to coarse sand (SM) and well graded sand (SW) with gravel (cinders)						
	6605														
15												A1-3	17		
									BASALT UNIT Medium dense, moist, dark gray, silty gravels with sand (GM) (extremely weathered basalt)						
	6600														
20		1	1	82					Reddish brown, vesicular basalt, weak rock					27	Refusal at 20', switch to rock coring
									Highly weathered, highly vesicular						
					>10				Highly to moderately weathered, highly fractured, less vesicular						
	6595														
25					>10				Highly weathered, moderately vesicular						
									Highly weathered, highly vesicular						
	6590	2		65											
30					>10				Washed out, highly with extremely weathered zones						

Woodward-Clyde

Figure B-29

Project: Cinder Lake Landfill
Project Location:
Project Number: 96A199-0400

Log of Boring IA-1

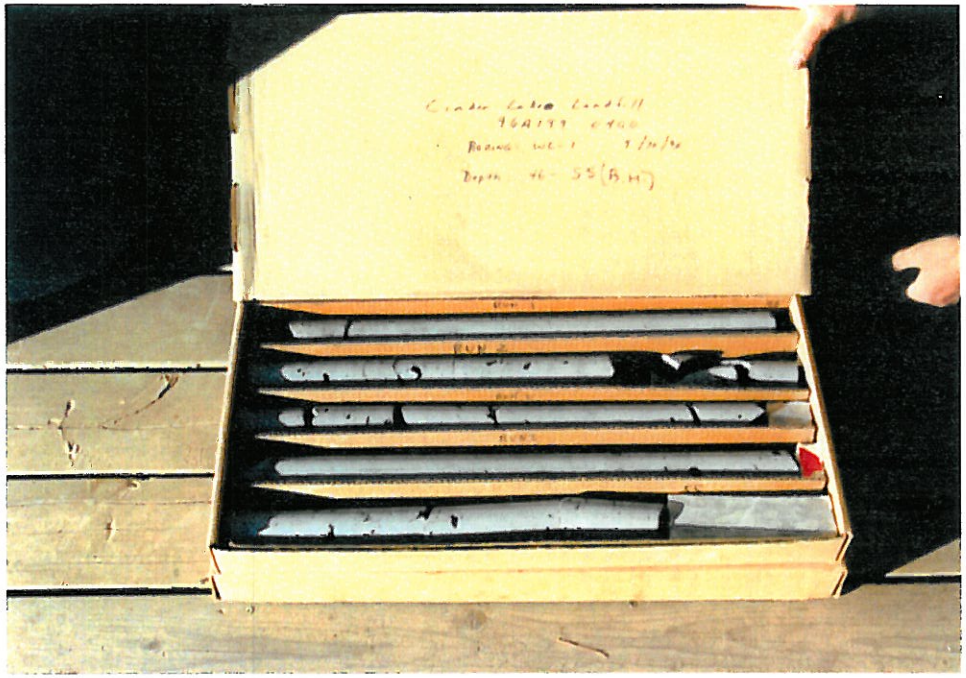
Sheet 2 of 2

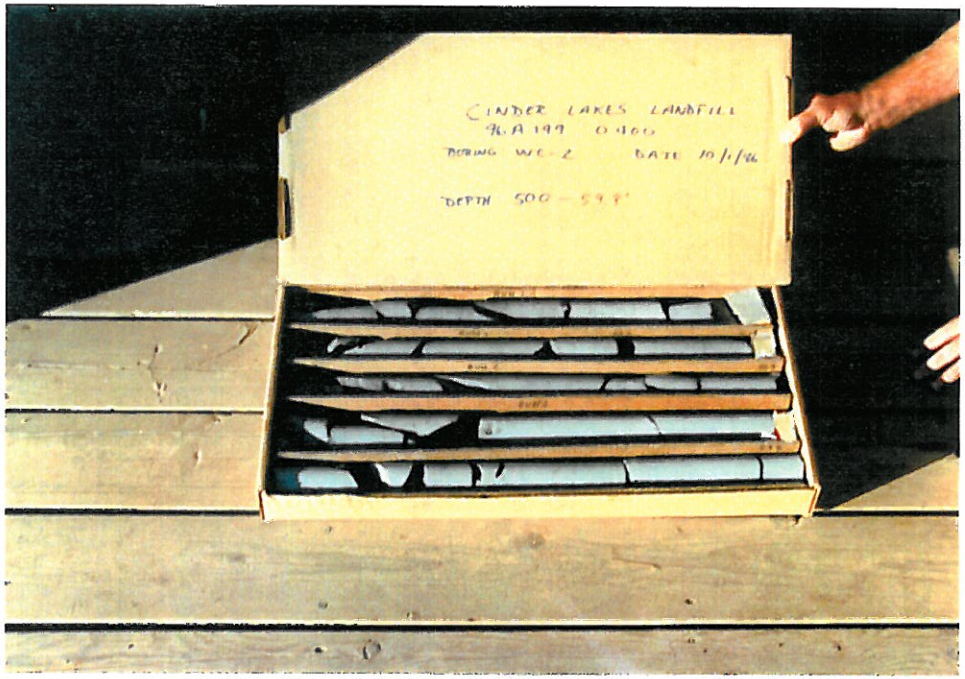
Depth, feet	Elevation, feet	ROCK CORE: Run No.	Box No.	Recovery, %	Frac. Freq.	R Q D, %	Fracture Drawing/ Number	Lithology	MATERIAL DESCRIPTION	Packer Tests	SOIL SAMPLES: Type	Number	Blows per foot	Drill Rate, feet/hour	FIELD NOTES/ LAB DATA
30															
		2	1		> 10	NA			Highly weathered, highly fractured, highly vesicular weak rock					31.3	
	6585														
35			2		> 10				Extremely fractured						
	6580								Bottom of boring at 38.5 feet						
40															
	6575														
45															
	6570														
50															
	6565														
55															
	6560														
60															
	6555														
65															

Woodward-Clyde

Figure B-29

11/27/96 1GLG17 6A199





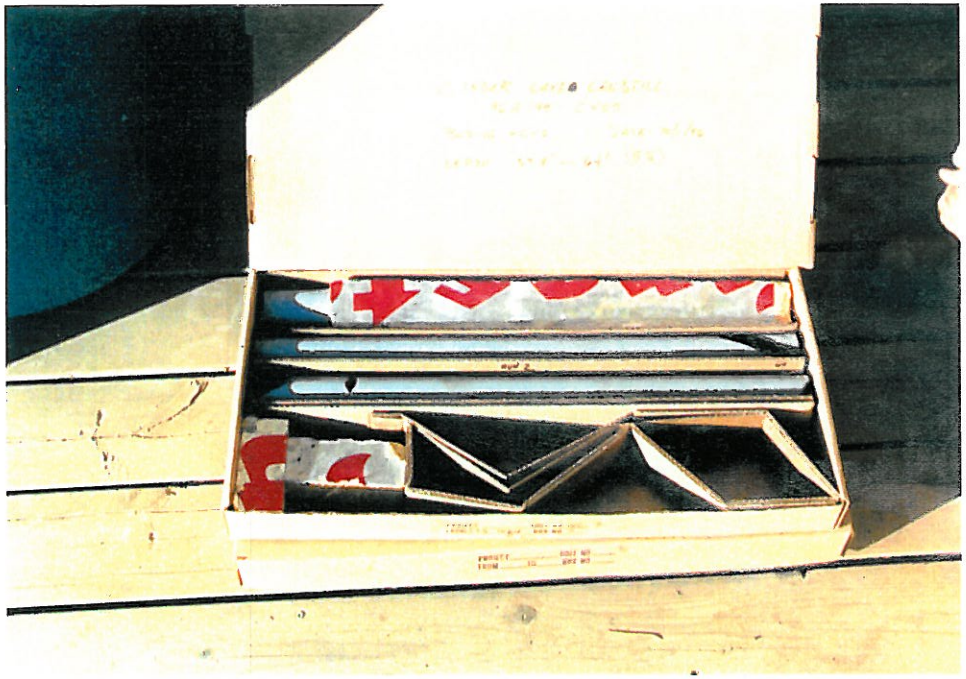


FIGURE B-30

ROCK CORE PHOTOGRAPHS
BORING WC-1 AND WC-2
CINDER LAKE LANDFILL

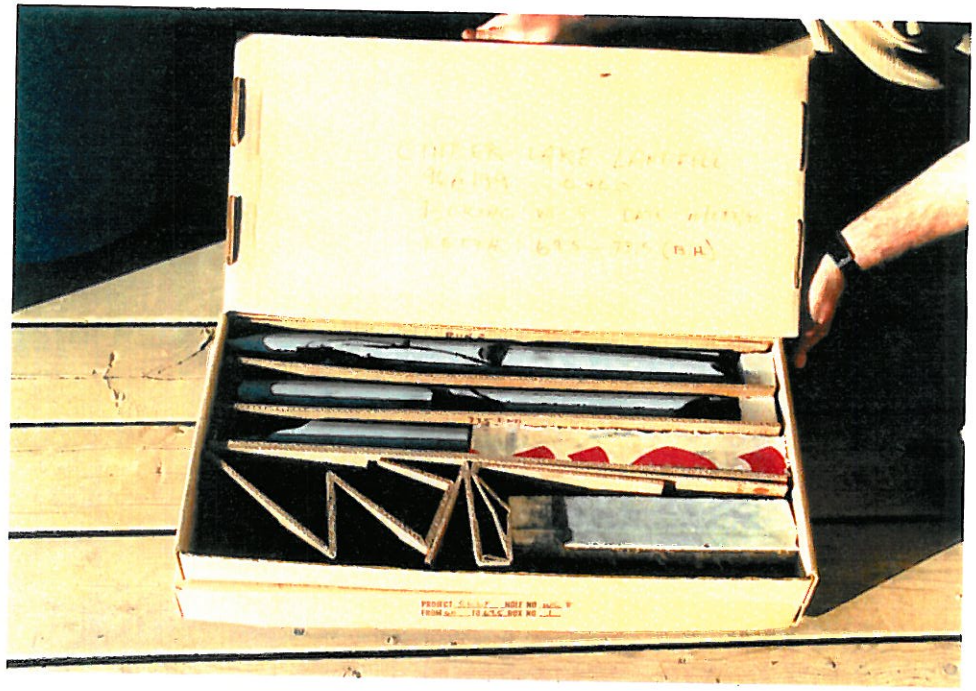


FIGURE B-31

ROCK CORE PHOTOGRAPHS
BORING WC-8
CINDER LAKE LANDFILL

FIGURE B-32

ROCK CORE PHOTOGRAPHS
BORING WC-12
CINDER LAKE LANDFILL

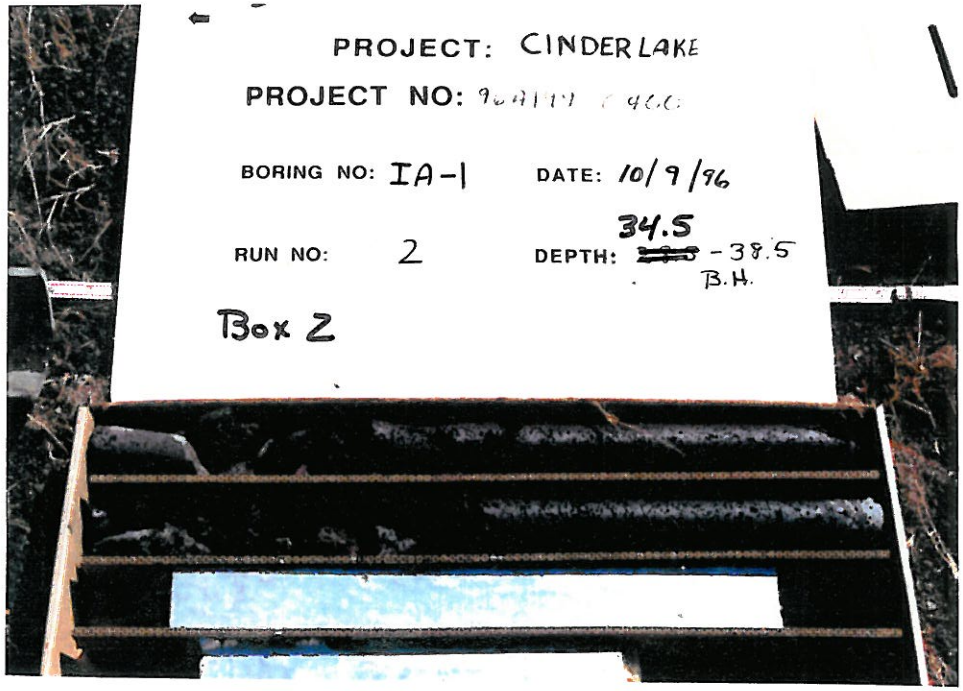


FIGURE B-33

ROCK CORE PHOTOGRAPHS
BORING IA-1
CINDER LAKE LANDFILL

APPENDIX C

We have included Boring Logs and tabulated seismic refraction data from previous studies to provide basic background for consideration of subsurface conditions in the Cinder Lake Landfill area. The Boring Logs include 21 gas monitoring wells installed by WTI in 1991, and 5 vadose zone wells installed by Woodward-Clyde in 1995. The location of these wells is shown on Figure 4.

Table C-1 summarizes the single-channel seismic refraction traverses performed by WTI in the Borrow Area in 1992. The locations of the seismic lines are shown on Figure 4.

Log of Boring No. 1

Project **Cinder Lake Landfill** Job No. **7181K001**

Elevation **Not Determined** Datum

Type/Size Boring **H.S.A. / 7"** Rig Type **CME 75**

Groundwater Conditions **Not Encountered** Date **1-28-91**

WESTERN TECHNOLOGIES INC. - Phoenix Division

Depth (ft)	Blows / Foot C	Blows / Foot N/R	Sample Type	Graphic	Time	OVM	Unified Soil Class	Soil Description
1							SP	POORLY GRADED SAND WITH GRAVEL; black, loose, damp, coarse-grained fraction is composed of volcanic cinders
5		18	N		1325	0	CL	LEAN CLAY WITH SAND; light brown, very stiff, damp
10		17	N		1330	0	SC	CLAYEY SAND; light brown, very stiff, dry
15		9	N		1338	0	GP	POORLY GRADED GRAVEL WITH CLAY AND SAND; black, loose, dry, no odor or staining, gravel = cinders
							GC	CLAYEY GRAVEL WITH SAND; black, loose, damp, gravel = cinders
20		10	N		1345	0		
25		8	N		1355	0		
30		10	N		1405	0		Boring Log continued on next page

Log of Boring No. 1

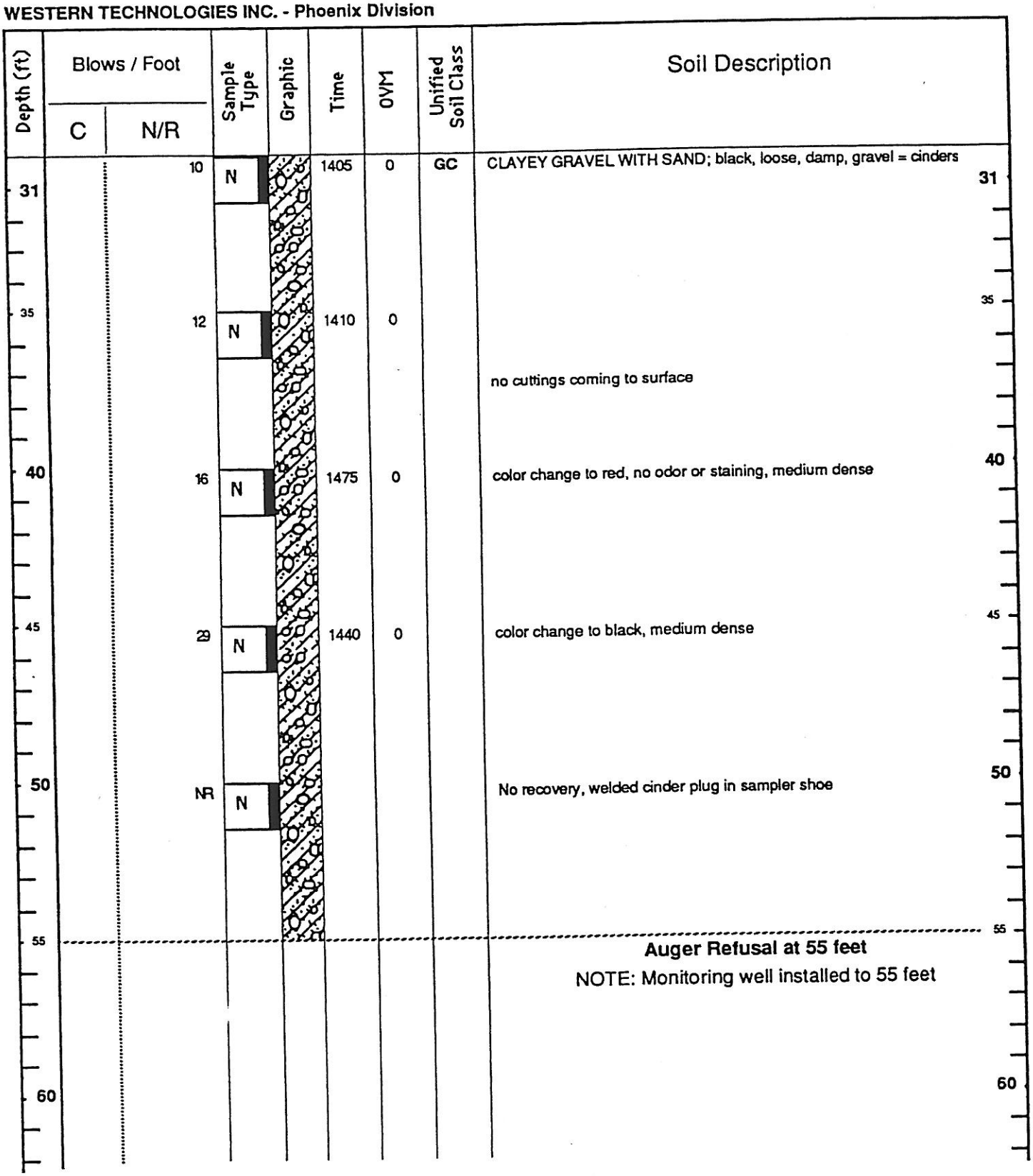
Project **Cinder Lake Landfill** Job No. **7181K001**

Elevation **Not Determined** Datum

Type/Size Boring **H.S.A. / 7"** Rig Type **CME 75**

Groundwater Conditions **Not Encountered** Date **1-28-91**

WESTERN TECHNOLOGIES INC. - Phoenix Division



A-3 Cont

Log of Boring No. 2

Project Cinder Lake Landfill

Elevation Not Determined

Type/Size Boring H.S.A. / 10"

Groundwater Conditions Not Encountered

Job No. 7181K001

Datum

Rig Type CME 75

Date 2-1-91

WESTERN TECHNOLOGIES INC. - Phoenix Division

Depth (ft)	Blows / Foot C	Blows / Foot N/R	Sample Type	Graphic	Time	OVM	Unified Soil Class	Soil Description
1							SP	POORLY GRADED SAND; with gravel and trace silt, black, loose, course fraction composed chiefly of basalt, probably fill
							Waste	Solid Waste (paper, plastics, metal, etc.) from approximately 2.5 feet
5								
10								
15								
20								
25								
30								

Boring Log continued on next page

Log of Boring No. 2

Project **Cinder Lake Landfill** Job No. **7181K001**

Elevation **Not Determined** Datum

Type/Size Boring **H.S.A. / 10"** Rig Type **CME 75**

Groundwater Conditions **Not Encountered** Date **2-1-91**

WESTERN TECHNOLOGIES INC. - Phoenix Division

Depth (ft)	Blows / Foot C	Blows / Foot N/R	Sample Type	Graphic	Time	OVM	Unified Soil Class	Soil Description
31							Waste	Solid Waste (paper, plastics, metal, etc.) from approximately 2.5 feet
40							SP	POORLY GRADED SAND; with gravel, red with black (basaltic) cinders, medium dense to dense, cinders evidence welding
45		69/6"	N					**Auger Refusal (on Basalt?) at 45 feet**
								NOTE: Monitoring well installed to 43.5 feet
50								
55								
60								

A-4 Cont

Log of Boring No. 3

Project **Cinder Lake Landfill** Job No. **7181K001**

Elevation **Not Determined** Datum

Type/Size Boring **H.S.A. / 7"** Rig Type **CME 75**

Groundwater Conditions **Not Encountered** Date **1-28-91**

WESTERN TECHNOLOGIES INC. - Phoenix Division

Depth (ft)	Blows / Foot C	Blows / Foot N/R	Sample Type	Graphic	Time	OVM	Unified Soil Class	Soil Description
1							SP	POORLY GRADED SAND; trace silt - brown and black; loose; mois
5		13	N					
								POORLY GRADED SAND; with silt and clay - brown; loose to medium dense; moist; low plasticity
10		18	N					medium dense
								POORLY GRADED SAND; with gravel - black, red and brown; loose; moist
15		8	N					
20		19	N					red
								Auger Refusal at 23.5 feet
25								NOTE: Monitoring well installed at 22 feet
30								

Log of Boring No. 4

Project **Cinder Lake Landfill** Job No. **7181K001**

Elevation **Not Determined** Datum

Type/Size Boring **H.S.A. / 7"** Rig Type **CME 75**

Groundwater Conditions **Not Encountered** Date **1-28-91**

WESTERN TECHNOLOGIES INC. - Phoenix Division

Depth (ft)	Blows / Foot C	Blows / Foot N/R	Sample Type	Graphic	Time	OVM	Unified Soil Class	Soil Description
1			N				SP	POORLY GRADED SAND; with gravel (≈15%) trace silt - black, loose moist
5		7	N		1215		SP	SILTY SAND; some gravel (≈10%) - brown, loose, moist
10							GP	POORLY GRADED GRAVEL; some sand - black, loose,moist
15		8	N		1235		SM	SILTY SAND; some gravel (≈10%) - brown; loose moist
							SP	POORLY GRADED SAND; with grave - (≈15%), trace silt - black; loos moist
20		8	N		1245			increase percent gravel (≈20%); no silt
								Auger Refusal at 23.5 feet
25								NOTE: Monitoring well installed at 22 feet
30								

Log of Boring No. 5

Project **Cinder Lake Landfill** Job No. **7181K001**

Elevation **Not Determined** Datum

Type/Size Boring **H.S.A. / 7"** Rig Type **CME 75**

Groundwater Conditions **Not Encountered** Date **1-28-91**

WESTERN TECHNOLOGIES INC. - Phoenix Division

Depth (ft)	Blows / Foot C	Blows / Foot N/R	Sample Type	Graphic	Time	OVM	Unified Soil Class	Soil Description
1							SP	POORLY GRADED SAND; with gravel and trace silt - black, loose, moist
							SM	SILTY SAND; some gravel - brown; loose; moist
5		8	N		1400			trace gravel
10		24	N		1410		SC	CLAYEY SAND; some to trace gravel - brown, medium dense, moist
							SP	POORLY GRADED SAND; with gravel (≈15%), trace silt - black, loose to medium dense, moist
15		15	N		1420			
							SM	SILTY SAND; some gravel (≈10%) - black, medium dense, moist
20								**Auger Refusal at 20 feet**
								NOTE: Monitoring well installed at 22 feet
25								
30								

Log of Boring No. 6

Project **Cinder Lake Landfill**

Job No. **7181K001**

Elevation **Not Determined**

Datum

Type/Size Boring **H.S.A. / 7"**

Rig Type **CME 75**

Groundwater Conditions **Not Encountered**

Date **2-1-91**

WESTERN TECHNOLOGIES INC. - Phoenix Division

Depth (ft)	Blows / Foot C	Blows / Foot N/R	Sample Type	Graphic	Time	OVM	Unified Soil Class	Soil Description
1							SP	POORLY GRADED SAND; some gravel and trace silt, brown to black loose, course fraction composed largely of volcanic cinders, probably fill
5								
							Waste	Solid Waste (paper, plastics, wood, etc.)
10								
15								
20								
25								
30								

Boring Log continued on next page

Log of Boring No. 6

Project **Cinder Lake Landfill** Job No. **7181K001**

Elevation **Not Determined** Datum

Type/Size Boring **H.S.A. / 7"** Rig Type **CME 75**

Groundwater Conditions **Not Encountered** Date **2-1-91**

WESTERN TECHNOLOGIES INC. - Phoenix Division

Depth (ft)	Blows / Foot C	Blows / Foot N/R	Sample Type	Graphic	Time	OVM	Unified Soil Class	Soil Description
31							Waste	Solid Waste (paper, plastics, wood, etc.)
35								
40		41	N				SP	POORLY GRADED SAND; with gravel (= 20%), black, dense to very dense, composed chiefly of basaltic cinders
45		79	N					BASALT; black and red, very hard, no sample recovery
50		50/0"	N					**Auger Refusal at 50.5 feet** NOTE: Monitoring well installed to 49 feet
55								
60								

A-8 Cont

Log of Boring No. 7

Project **Cinder Lake Landfill** Job No. **7181K001**

Elevation **Not Determined** Datum

Type/Size Boring **H.S.A. / 7"** Rig Type **CME 75**

Groundwater Conditions **Not Encountered** Date **1-28-91**

WESTERN TECHNOLOGIES INC. - Phoenix Division

Depth (ft)	Blows / Foot C	Blows / Foot N/R	Sample Type	Graphic	Time	OVM	Unified Soil Class	Soil Description
1							SP	POORLY GRADED SAND; trace silt - black and brown, loose, moist
								POORLY GRADED SAND; with silt and some clay - brown, loose, moist, low plasticity
5		15	N					trace silt, loose to medium dense
10		13	N					POORLY GRADED SAND; some gravel and trace silt - black and brown, medium dense to dense, moist, gravel - sized fraction consists of basalt cinders
15			N					POORLY GRADED SAND; with silt and trace clay - brown, loose, moist, low plasticity
								POORLEY GRADED SAND; some clay - brown; loose, moist
20		13	N				GP	POORLY GRADED GRAVEL; with sand - black, loose to medium dense, moist
								Auger Refusal at 23.5 feet
25								NOTE: Monitoring well installed at 22 feet
30								

Log of Boring No. 8

Project **Cinder Lake Landfill** Job No. **7181K001**

Elevation **Not Determined** Datum

Type/Size Boring **H.S.A. / 7"** Rig Type **CME 75**

Groundwater Conditions **Not Encountered** Date **1-29-91**

WESTERN TECHNOLOGIES INC. - Phoenix Environmental Division

Depth (ft)	Blows / Foot C	Blows / Foot N/R	Sample Type	Graphic	Time	OVM	Unified Soil Class	Soil Description
1							SP	POORLY GRADED SAND; with gravel - black; loose; dry; coarse-grained fraction = volcanic cinders
5		33	N		1418		SC	CLAYEY SAND; light brown; dense; dry
10		13	N		1426		SM	SILTY SAND; some clay; light brown; medium dense; dry
15		9	N		1435		GP	POORLY GRADED GRAVEL; with sand - medium brown; loose; slightly damp
20		50/1" NR	N					**Auger Refusal at 20 feet** NOTE: Monitoring well installed to 20 feet NR = no recovery
25								
30								

Log of Boring No. 10

Project **Cinder Lake Landfill** Job No. **7181K001**

Elevation **Not Determined** Datum

Type/Size Boring **H.S.A. / 7"** Rig Type **CME 75**

Groundwater Conditions **Not Encountered** Date **1-29-91**

WESTERN TECHNOLOGIES INC. - Phoenix Environmental Division

Depth (ft)	Blows / Foot C	Blows / Foot N/R	Sample Type	Graphic	Time	OVM	Unified Soil Class	Soil Description
1							SP	POORLY GRADED SAND; with gravel - black; loose; dry; coarse-grained fraction = volcanic cinders
							SC	CLAYEY SAND - light brown; dense; damp
5		28	N					
10		59	N				GP	POORLY GRADED GRAVEL - black; very dense; dry; course grained fraction = volcanic cinders
15		25	N					dense; dry
								hard drilling at 12.0 feet
20		25	N					
25		75/3"	N					very dense; dry; poor recovery
30								**Auger Refusal at 30 feet**
								NOTE: Monitoring well installed to 30 feet

Log of Boring No. 11

Project Cinder Lake Landfill — Job No. 7181K001

Elevation Not Determined — Datum

Type/Size Boring H.S.A. / 7" — Rig Type CME 75

Groundwater Conditions Not Encountered — Date 1-28-91

WESTERN TECHNOLOGIES INC. - Phoenix Division

Depth (ft)	Blows / Foot C	Blows / Foot N/R	Sample Type	Graphic	Time	OVM	Unified Soil Class	Soil Description
1							SP	POORLY GRADED SAND; black, loose, coarse fraction consists of basalt cinders, probably fill
5							Waste	SOLID WASTE (paper, plastics, wood, etc)
10								
15								
20							CL	SANDY CLAY; black, firm, sand, sized fraction (≈25%), low plasticity no cementation
25		13	N				SC	CLAYEY SAND; black, medium dense, moist, volcanic cinders notec
30							SP	POORLY GRADED SAND; trace silt - black, medium dense, moist, volcanic cinders noted, angular grain shape

Auger Refusal at 32 feet

NOTE: Monitoring well installed at 26 feet

Log of Boring No. 12

Project Cinder Lake Landfill — Job No. 7181K001

Elevation Not Determined — Datum

Type/Size Boring H.S.A. / 7" — Rig Type CME 75

Groundwater Conditions Not Encountered — Date 1-28-91

WESTERN TECHNOLOGIES INC. - Phoenix Division

Depth (ft)	Blows / Foot C	Blows / Foot N/R	Sample Type	Graphic	Time	OVM	Unified Soil Class	Soil Description
1							SP	POORLY GRADED SAND; trace brown to black, loose, probably fill
5							Waste	SOLID WASTE (paper, plastics, wood, rubber, etc)
10								
15								
20							SP	POORLY GRADED SAND; trace silt, black, medium dense, damp, volcanic cinders noted, angular grain shapes
25		34	N					POORLY GRADED SAND; with gravel and trace silt - red, medium dense, grain shape is angular, volcanic cinders noted
30								POORLY GRADED SAND; with gravel - red

Auger Refusal at 32 feet

NOTE: Monitoring well installed at 28 feet

Log of Boring No. 13

Project **Cinder Lake Landfill** Job No. **7181K001**

Elevation **Not Determined** Datum

Type/Size Boring **H.S.A. / 10"** Rig Type **CME 75**

Groundwater Conditions **Not Encountered** Date **1-31-91**

WESTERN TECHNOLOGIES INC. - Phoenix Division

Depth (ft)	Blows / Foot C	Blows / Foot N/R	Sample Type	Graphic	Time	OVM	Unified Soil Class	Soil Description
1							SM	SILTY SAND; black, loose, damp, volcanic cinders noted, probably fill
5								some gravel (≈ 10%)
10								
15								
							SC	CLAYEY SAND; black, medium dense, moist to very moist, probably fill
							Waste	Solid Waste (paper, plastic, wood, etc.)
20								
25								
30								

Boring Log continued on next page

Log of Boring No. 14

Project **Cinder Lake Landfill** Job No. **7181K001**

Elevation **Not Determined** Datum

Type/Size Boring **H.S.A. / 10"** Rig Type **CME 75**

Groundwater Conditions **Not Encountered** Date **2-2-91**

WESTERN TECHNOLOGIES INC. - Phoenix Division

Depth (ft)	Blows / Foot C	Blows / Foot N/R	Sample Type	Graphic	Time	OVM	Unified Soil Class	Soil Description
1							SP	POORLY GRADED SAND; black, loose, moist, volcanic cinders noted, probably fill
							Waste	Solid Waste (paper, plastic, wood, fabric, etc.)
5								
10								
15								
20								
25								
30								Boring Log continued on next page

Log of Boring No. 14

Project **Cinder Lake Landfill** Job No. **7181K001**

Elevation **Not Determined** Datum

Type/Size Boring **H.S.A. / 10"** Rig Type **CME 75**

Groundwater Conditions **Not Encountered** Date **2-2-91**

WESTERN TECHNOLOGIES INC. - Phoenix Division

Depth (ft)	Blows / Foot C	Blows / Foot N/R	Sample Type	Graphic	Time	OVM	Unified Soil Class	Soil Description
31							Waste	Solid Waste (paper, plastic, wood, fabric, etc.)
							SP	POORLY GRADED SAND; with gravel, red to brown, medium dense
35								
40								
		20	R					
45								**Boring Terminated at 45 feet**
								NOTE: Monitoring well installed to 43 feet
50								
55								
60								

A-15 Cont

Log of Boring No. 15

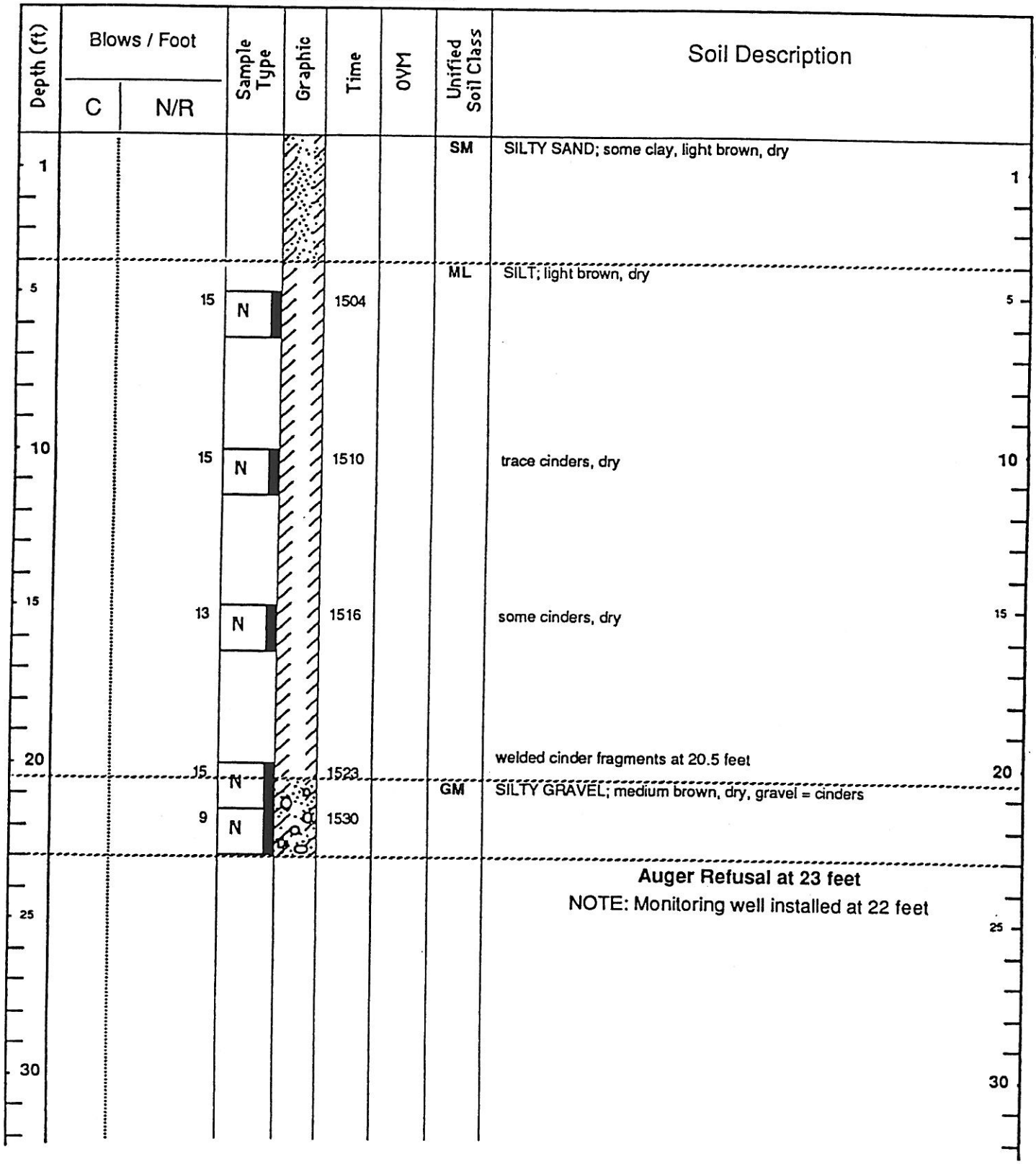
Project **Cinder Lake Landfill** Job No. **7181K001**

Elevation **Not Determined** Datum

Type/Size Boring **H.S.A. / 7"** Rig Type **CME 75**

Groundwater Conditions **Not Encountered** Date **1-28-91**

WESTERN TECHNOLOGIES INC. - Phoenix Division



Log of Boring No. 16

Project **Cinder Lake Landfill** Job No. **7181K001**

Elevation **Not Determined** Datum

Type/Size Boring **H.S.A. / 7"** Rig Type **CME 75**

Groundwater Conditions **Not Encountered** Date **1-28-91**

WESTERN TECHNOLOGIES INC. - Phoenix Division

Depth (ft)	Blows / Foot C	Blows / Foot N/R	Sample Type	Graphic	Time	OVM	Unified Soil Class	Soil Description
1							SP	POORLY GRADED SAND; black, loose
5		5	N				CL	SANDY LEAN CLAY; brown, soft, damp to moist
10		11	N				SP	POORLY GRADE D SAND; some gravel (≈10%) - black, loose to medium dense, volcanic cinders noted
15		23	N					cobbles noted from 16 feet
20		17	N				GP	POORLY GRADED GRAVEL; black, medium dense, gravel is basaltic and evidences welding
		33	N					no recovery
25								**Auger Refusal at 24.5 feet**
								NOTE: Monitoring well installed at 22 feet
30								

Log of Boring No. 17

Project **Cinder Lake Landfill** Job No. **7181K001**

Elevation **Not Determined** Datum

Type/Size Boring **H.S.A. / 7"** Rig Type **CME 75**

Groundwater Conditions **Not Encountered** Date **1-31-91**

WESTERN TECHNOLOGIES INC. - Phoenix Division

Depth (ft)	Blows / Foot C	Blows / Foot N/R	Sample Type	Graphic	Time	OVM	Unified Soil Class	Soil Description
1							SP	POORLY GRADED SAND; brown to black, volcanic cinders, probably fill
5							Waste	Solid Waste (paper, plastic, fabric, etc.)
10								
							SP	POORLY GRADED SAND; brown to black, volcanic cinders noted, probably fill
15								
							Waste	Solid Waste (paper, plastic, fabric, etc.)
20							SM	SILTY SAND; light brown, medium dense, damp to moist
		21	N					
25								some gravel (≈ 10%) from 26 feet
30								

Boring Log continued on next page

Log of Boring No. 17

Project **Cinder Lake Landfill** Job No. **7181K001**

Elevation **Not Determined** Datum

Type/Size Boring **H.S.A. / 7"** Rig Type **CME 75**

Groundwater Conditions **Not Encountered** Date **1-31-91**

WESTERN TECHNOLOGIES INC. - Phoenix Division

Depth (ft)	Blows / Foot C	Blows / Foot N/R	Sample Type	Graphic	Time	OVM	Unified Soil Class	Soil Description
31							SM	BASALT COBBLES; black, very dense, cobbles evidence welding
		64/11"	N					
35								**Auger Refusal at 34.5 feet**
								NOTE: Monitoring well installed to 32 feet
40								
45								
50								
55								
60								

Log of Boring No. 18

Project **Cinder Lake Landfill** Job No. **7181K001**

Elevation **Not Determined** Datum

Type/Size Boring **H.S.A. / 10"** Rig Type **CME 75**

Groundwater Conditions **Not Encountered** Date **2-2-91**

WESTERN TECHNOLOGIES INC. - Phoenix Division

Depth (ft)	Blows / Foot C	Blows / Foot N/R	Sample Type	Graphic	Unified Soil Class	Soil Description
1					SP-SM	POORLY GRADED SAND; with silt (and some gravel (≈ 10%)), black, loose, moist
					SC	CLAYEY SAND; some gravel (≈ 10%), brown, loose
					SM	SILTY SAND; trace gravel, brown, loose, moist
5		9	N			
10		6	N		SP-SM	POORLY GRADED SAND; with silt (and some gravel (≈ 10%)), black, loose, moist
					SM	SILTY SAND; trace gravel, brown, loose, moist
15						**Auger Refusal at 24.5 feet** NOTE: Monitoring well installed to 24 feet
20						
25						
30						

Log of Boring No. 19

Project **Cinder Lake Landfill** Job No. **7181K001**

Elevation **Not Determined** Datum

Type/Size Boring **H.S.A. / 7"** Rig Type **CME 75**

Groundwater Conditions **Not Encountered** Date **1-30-91**

WESTERN TECHNOLOGIES INC. - Phoenix Division

Depth (ft)	Blows / Foot C	Blows / Foot N/R	Sample Type	Graphic	Unified Soil Class	Soil Description
1					SP-SM	POORLY GRADED SAND; with silt (and some gravel (≈ 10%)), black, loose, moist
					SC	CLAYEY SAND; some gravel (≈ 10%), brown, loose
5		9	N		SM	SILTY SAND; trace gravel, brown, loose, moist
10		6	N		SP-SM	POORLY GRADED SAND; with silt (and some gravel (≈ 10%)), black, loose, moist
					SM	SILTY SAND; trace gravel, brown, loose, moist
15						**Auger Refusal at 31 feet**
						NOTE: Monitoring well installed to 31 feet
20						
25						
30						

Log of Boring No. **20**

Project **Cinder Lake Landfill** Job No. **7181K001**

Elevation **Not Determined** Datum

Type/Size Boring **H.S.A. / 7"** Rig Type **CME 75**

Groundwater Conditions **Not Encountered** Date **1-30-91**

WESTERN TECHNOLOGIES INC. - Phoenix Division

Depth (ft)	Blows / Foot C	Blows / Foot N/R	Sample Type	Graphic	Unified Soil Class	Soil Description
1					SP-SM	POORLY GRADED SAND; with silt (and some gravel (= 10%)), black, loose, moist
					SC	CLAYEY SAND; some gravel (= 10%), brown, loose
5		9	N		SM	SILTY SAND; trace gravel, brown, loose, moist
10		6	N		SP-SM	POORLY GRADED SAND; with silt (and some gravel (= 10%)), black, loose, moist
					SM	SILTY SAND; trace gravel, brown, loose, moist
15						**Boring Terminated at 23 feet**
						NOTE: Monitoring well installed to 22 feet
20						
25						
30						

Log of Boring No. 21

Project **Cinder Lake Landfill** Job No. **7181K001**

Elevation **Not Determined** Datum

Type/Size Boring **H.S.A. / 7"** Rig Type **CME 75**

Groundwater Conditions **Not Encountered** Date **1-30-91**

WESTERN TECHNOLOGIES INC. - Phoenix Division

Depth (ft)	Blows / Foot C	Blows / Foot N/R	Sample Type	Graphic	Time	OVM	Unified Soil Class	Soil Description
1							SP-SM	POORLY GRADED SAND; with silt (and some gravel (≈ 10%)), black, loose, moist
							SC	CLAYEY SAND; some gravel (≈ 10%), brown, loose
5		9	N				SM	SILTY SAND; trace gravel, brown, loose, moist
10		6	N				SP-SM	POORLY GRADED SAND; with silt (and some gravel (≈ 10%)), black, loose, moist
							SM	SILTY SAND; trace gravel, brown, loose, moist
15								**Auger Refusal on Basalt at 13.5 feet** NOTE: Monitoring well installed to 13 feet
20								
25								
30								

Log of Boring No. 21

Project **Cinder Lake Landfill** Job No. **7181K001**

Elevation **Not Determined** Datum

Type/Size Boring **H.S.A. / 7"** Rig Type **CME 75**

Groundwater Conditions **Not Encountered** Date **1-30-91**

WESTERN TECHNOLOGIES INC. - Phoenix Division

Depth (ft)	Blows / Foot C	Blows / Foot N/R	Sample Type	Graphic	Time	OVM	Unified Soil Class	Soil Description
1							SP-SM	POORLY GRADED SAND; with silt (and some gravel (≈ 10%)), black, loose, moist
							SC	CLAYEY SAND; some gravel (≈ 10%), brown, loose
5		9	N				SM	SILTY SAND; trace gravel, brown, loose, moist
10		6	N				SP-SM	POORLY GRADED SAND; with silt (and some gravel (≈ 10%)), black, loose, moist
							SM	SILTY SAND; trace gravel, brown, loose, moist
15								**Auger Refusal on Basalt at 13.5 feet** NOTE: Monitoring well installed to 13 feet
20								
25								
30								

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LAKE LANDFILL Coconino County, Arizona

...attached Figure for lysimeter/NPAT installation construction detail			GROUND SURFACE ELEVATION: TOP OF WELL CASING ELEVATION:
...G ...CY	Layne Environmental	DRILLER D.Peterson	DATE STARTED: 9/28/95 DATE FINISHED: 9/29/95
...LING ...UIPMENT	AP 1000		COMPLETION DEPTH (ft) 41.2
DRILLING METHOD	Dualtube Percussion	DRILL BIT 10-7/8"	HAMMER 140 lbs
SIZE AND TYPE OF CASING	See attached Figure for construction details		NUMBER OF SAMPLES BULK.: 0 DRIVE.: 8
TYPE OF PERFORATION		FROM TO	WATER DEPTH FIRST: COMPL.: 24 hrs.:
SIZE AND TYPE OF PACK		FROM TO	LOGGED BY W.Dittman CHECKED BY

TYPE OF SEAL	TYPE	FR	TO	TYPE	FR	TO
	No. 1:			No. 3:		
	No. 2:			No. 4:		

LOG OF BORING V-1

DEPTH (feet)	MATERIAL DESCRIPTION	SOIL GRAPHIC	WELL GRAPHIC	Hnu, ppm	OVA, ppm	WATER LEVEL	DEPTH (feet)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY (feet)	SAMPLES BLOWS/foot	INDEX PROPERTIES MOISTURE CONTENT (%)	INDEX PROPERTIES DRY DENSITY (pcf)	INDEX PROPERTIES UNCONFINED COMPRESSIVE STRENGTH (psf)	NOTES
0	GRAVELLY SAND (SW) Dry, dark grayish brown (10YR 4/2), fine to coarse sand, some fine gravel to 3/8 inch, (volcanics)						5	1		0.25	50/4"				
5	SILT (ML) Very dense, dry, yellow brown (10YR 5/8), trace fine sand														
10	Dark brown (7.5YR 3/4), dry, trace clay, very dense, white mottling						10	2		0.5	37/3"	13.8			
15	SAND (SW) Dense, moist, very dark gray (7.5YR 3/1), fine to coarse sand, trace fine gravel to 1/2 inch, angular - subrounded (volcanics)						15	3		1.5	41	22.2			
20	SANDY GRAVEL (GP) Very dense, damp, very dark gray (7.5YR 3/1), fine to coarse sand, skip graded to coarse gravel to 3 inches, angular (volcanics)						20	4		0.5	50/4"	10.0			
25	GRAVEL (GW) Very dense, dry, very dark gray (7.5YR 3/1), trace to some fine to coarse sand, fine to coarse gravel to 2 inches, angular (volcanics)						25	5		0.8	68				
30							30	6		1.0	50/4"	4.8			
35	Decrease in gravel size to 1 inch						35	7		0.5	50/6"	5.0			Caved to 40'4" prior to lysimeter installation
40															

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PROJECT NO. 9553119D FIGURE:

CINDER LAKE LANDFILL
Coconino County, Arizona

LOG OF BORING V-1
Continued-- Sheet 2 of 2

DEPTH (feet)	LITHOLOGIC DESCRIPTION	SOIL GRAPHIC	WELL GRAPHIC	Hnu, ppm	OVA, ppm	WATER LEVEL	DEPTH (feet)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY (feet)	SAMPLES: BLOWS/foot	INDEX PROPERTIES: MOISTURE CONTENT (%)	INDEX PROPERTIES: DRY DENSITY (pcf)	INDEX PROPERTIES: UNCONFINED COMPRESSIVE STRENGTH (psf)	NOTES
40	Dark brown (7.5YR 3/2)							8	X	1.0	50/2"	5.3			GS
	BASALT - Bedrock - Gray (10YR 5/1)														Very hard drilling at 41'
	BOTTOM OF BORING AT 41 FEET														
45							45								
50							50								
55							55								
60							60								
65							65								
70							70								
75							75								
80							80								
85							85								
90							90								

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PROJECT NO. 9553119D

FIGURE:

CINDER LAKE LANDFILL Coconino County, Arizona

NOTE: See attached Figure for lysimeter/NPAT installation			GROUND SURFACE ELEVATION: TOP OF WELL CASING ELEVATION:
DRILLING AGENCY	Layne Environmental	DRILLER Gil's	DATE STARTED: 9/19/95 DATE FINISHED: 10/4/95
DRILLING EQUIPMENT	Reedrill, Failing F10 & AP 1000		COMPLETION DEPTH (ft) 45.5
DRILLING METHOD	SFA and Dualtube Percussion	DRILL BIT 24,8 & 10-7/8"	HAMMER 140 lbs
SIZE AND TYPE OF CASING	See attached Figure for construction details		NUMBER OF SAMPLES BULK.: 0 DRIVE.: 12
TYPE OF PERFORATION		FROM TO	WATER DEPTH FIRST: COMPL.: 24 hrs.:
SIZE AND TYPE OF PACK		FROM TO	LOGGED BY W.Dittman CHECKED BY

TYPE OF SEAL	TYPE	FR	TO	TYPE	FR	TO
	No. 1:			No. 3:		
	No. 2:			No. 4:		

LOG OF BORING V-2

DEPTH (feet)	MATERIAL DESCRIPTION	SOIL GRAPHIC	WELL GRAPHIC	Hnu, ppm	OVA, ppm	WATER LEVEL	DEPTH (feet)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY (feet)	SAMPLES BLOWS/foot	INDEX PROPERTIES MOISTURE CONTENT (%)	INDEX PROPERTIES DRY DENSITY (pcf)	INDEX PROPERTIES UNCONFINED COMPRESSIVE STRENGTH (psf)	NOTES
0	Soil Cover														Boring initially drilled to 17' with 24" auger Then drilled to 32' with 8" HSA
	SOLID WASTE - Paper, plastic, etc.														
5							5								
10							10								
15							15								
20							20	1		1.0					
								2		0.1	24				
								3							
								4							
								5		0.2	121				
25	GRAVELLY						25	6		0.2	N/A				
	SAND ~~(SW)~~ (GW-GM)														
	1 Very dense, moist, black (10YR 2/1), fine to coarse sand, trace silt (volcanic cinders), some refuse until drive 9 - no evidence of refuse in 9							7		0.2	80				
30							30	8		0.5	61				
								9		0.5	57	24.0			GS
35	Wet (water likely from conductor casing installation), some fine to coarse gravel						35	10		0.25	54				
	Some fine to coarse gravel to 2-1/2 inches							11		0.5	50/5"				
40															

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PROJECT NO. 9553119D FIGURE:

CINDER LAKE LANDFILL
Coconino County, Arizona

LOG OF BORING V-2
Continued-- Sheet 2 of 2

DEPTH (feet)	LITHOLOGIC DESCRIPTION	SOIL GRAPHIC	WELL GRAPHIC	Hnu, ppm	OVA, ppm	WATER LEVEL	DEPTH (feet)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY (feet)	SAMPLES: BLOWS/foot	INDEX PROPERTIES: MOISTURE CONTENT (%)	INDEX PROPERTIES: DRY DENSITY (pcf)	INDEX PROPERTIES: UNCONFINED COMPRESSIVE STRENGTH (psf)	NOTES
40	Moist, some fine gravel to 2-1/2 to 4 inches, dark reddish gray (2.5YR 3/1)							12		0.5	70	4.0			
45	fine to coarse gravel 45 to 45-1/2 feet						45								
	REFUSAL AT 45-1/2 FEET (BASALT - BEDROCK, GRAY (7.5Y 5/1))														Very hard drilling at 45'
50							50								
55							55								
60							60								
65							65								
70							70								
75							75								
80							80								
85							85								
90							90								

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PROJECT NO. 9553119D

FIGURE:

CINDER LAKE LANDFILL Coconino County, Arizona

NOTE: See attached Figure for lysimeter/NPAT installation				GROUND SURFACE ELEVATION:	
				TOP OF WELL CASING ELEVATION:	
DRILLING AGENCY	Layne Environmental	DRILLER	D.Peterson	DATE STARTED: 9/21/95	
				DATE FINISHED: 10/4/95	
DRILLING EQUIPMENT	Reedrill & AP 1000			COMPLETION DEPTH (ft)	49.0
DRILLING METHOD	SFA and DTP	DRILL BIT	24 & 10-7/8"	HAMMER	140 lbs
SIZE AND TYPE OF CASING	See attached Figure for construction details			NUMBER OF SAMPLES	BULK.: 0 DRIVE.: 5
TYPE OF PERFORATION		FROM	TO	WATER DEPTH	FIRST: COMPL.: 24 hrs.:
SIZE AND TYPE OF PACK		FROM	TO	LOGGED BY	W.Dittman CHECKED BY

TYPE OF SEAL	TYPE	FR	TO	TYPE	FR	TO
	No. 1:			No. 3:		
	No. 2:			No. 4:		

LOG OF BORING V-3

DEPTH (feet)	MATERIAL DESCRIPTION	SOIL GRAPHIC	WELL GRAPHIC	Hnu, ppm	OVA, ppm	WATER LEVEL	DEPTH (feet)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY (feet)	SAMPLES BLOWS/foot	INDEX PROPERTIES MOISTURE CONTENT (%)	INDEX PROPERTIES DRY DENSITY (pcf)	INDEX PROPERTIES UNCONFINED COMPRESSIVE STRENGTH (psf)	NOTES
0	Soil Cover														24" diameter boring to 30'
	SOLID WASTE - Paper, plastic, etc.														
30	SAND (SW) Dense, moist, black (10YR 2/1), fine to coarse sand, trace to some fine gravel; angular (volcanics)							1		1.0	33				
								2		1.0	70				
40															

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PROJECT NO. 9553119D FIGURE:

CINDER LAKE LANDFILL
Coconino County, Arizona

LOG OF BORING V-3
Continued-- Sheet 2 of 2

DEPTH (feet)	LITHOLOGIC DESCRIPTION	SOIL GRAPHIC	WELL GRAPHIC	Hnu, ppm	OVA, ppm	WATER LEVEL	DEPTH (feet)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY (feet)	SAMPLES BLOWS/foot	INDEX PROPERTIES MOISTURE CONTENT (%)	INDEX PROPERTIES DRY DENSITY (pcf)	INDEX PROPERTIES UNCONFINED COMPRESSIVE STRENGTH (psf)	NOTES
40	Damp, some fine to coarse gravel							3		1.0	49	8.3 15.8			
	GRAVEL (GW) Very dense, dry, gray (7.5YR 5/1), trace fine to coarse sand, fine to coarse gravel to 1-1/2 inch, angular (volcanics), vesicular basalt														
45	Penetrated 3 inches into BASALT (Bedrock) - Dark gray (7.5YR 5/1), vesicular						45	4		0.25	65				
								5			50/4"	2.3			Refusal at 49'
50	BOTTOM OF BORING AT 49 FEET						50								
55							55								
60							60								
65							65								
70							70								
75							75								
80							80								
85							85								
90							90								

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PROJECT NO. 9553119D

FIGURE:

CINDER LAKE LANDFILL Coconino County, Arizona

NOTE: See attached Figure for lysimeter/NPAT installation			GROUND SURFACE ELEVATION: TOP OF WELL CASING ELEVATION:
DRILLING AGENCY	Layne Environmental	DRILLER D.Peterson	DATE STARTED: 9/19/95 DATE FINISHED: 10/4/95
DRILLING EQUIPMENT	SFA and Dualtube Percussion		COMPLETION DEPTH (ft) 56.0
DRILLING METHOD	HSA, SFA & DTP	DRILL BIT 8,24 & 10-7/8"	HAMMER 140 lbs
SIZE AND TYPE OF CASING	See attached Figure for construction details		NUMBER OF SAMPLES BULK.: 0 DRIVE.: 8
TYPE OF PERFORATION		FROM TO	WATER DEPTH FIRST: COMPL.: 24 hrs.:
SIZE AND TYPE OF PACK		FROM TO	LOGGED BY W.Dittman CHECKED BY

TYPE OF SEAL	TYPE	FR	TO	TYPE	FR	TO
	No. 1:			No. 3:		
	No. 2:			No. 4:		

LOG OF BORING V-4

DEPTH (feet)	MATERIAL DESCRIPTION	SOIL GRAPHIC	WELL GRAPHIC	Hnu, ppm	OVA, ppm	WATER LEVEL	DEPTH (feet)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY (feet)	SAMPLES BLOWS/foot	INDEX PROPERTIES MOISTURE CONTENT (%)	INDEX PROPERTIES DRY DENSITY (pcf)	INDEX PROPERTIES UNCONFINED COMPRESSIVE STRENGTH (psf)	NOTES
0	Soil Cover														Boring drilled to 39' with 24" SFA
	SOLID WASTE - Paper, plastic, etc.														
5							5								
10							10								
15							15								
20							20								
25							25								
30							30								
35							35	1		0.5	28				
								2		0.7	20				
								3		0.2	32				
								4		0.7	28				
								5		0.7	30				
40	SILTY SAND (SM) Medium dense, dry, dark reddish brown (2.5YR 3/4), trace to some silt, fine to coarse sand, trace to some fine gravel to 1 inch, cobbles in cuttings, volcanic														

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PROJECT NO. 9553119D FIGURE:

CINDER LAKE LANDFILL
Coconino County, Arizona

LOG OF BORING V-4
Continued-- Sheet 2 of 2

DEPTH (feet)	LITHOLOGIC DESCRIPTION	SOIL GRAPHIC	WELL GRAPHIC	Hnu, ppm	OVA, ppm	WATER LEVEL	DEPTH (feet)	SAMPLES NUMBER TYPE	SAMPLES RECOVERY (feet)	SAMPLES BLOWS/ foot	INDEX PROPERTIES MOISTURE CONTENT (%)	INDEX PROPERTIES DRY DENSITY (pcf)	INDEX PROPERTIES UNCONFINED COMPRESSIVE STRENGTH (psf)	NOTES
40	origin, angular Wet - saturated to 44-1/2 feet													
45	Possible Cobble or large Boulder layer (Basalt)						45	6	0.2	50/4"				Very hard drilling 44.5-47.5'
	SANDY GRAVEL (GP) Dry, dusky red (10R 3/2), fine to coarse gravel, skip graded coarse gravel range, fine to coarse sand, angular to subrounded (volcanics)							7		50/4"				Cobble in tip of #7 - no recovery GA
50	GRAVELLY SAND (SP) Very dense, dry, dusky red (10R 3/2), predominately very fine to fine sand, trace medium to coarse angular to subrounded sand, some fine to coarse gravel to 3 inches						50	8	0.5	50/6"				
55	Increase in Cobbles and Boulders to 5 inches >55 feet						55							Refusal at 56'
	REFUSAL AT 56 FEET (BASALT - Bedrock; dark gray (10YR 4/1) vesicular)													
60							60							
65							65							
70							70							
75							75							
80							80							
85							85							
90							90							

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PROJECT NO. 9553119D

FIGURE:

CINDER LAKE LANDFILL Coconino County, Arizona

NOTE: See attached Figure for lysimeter/NPAT installation			GROUND SURFACE ELEVATION: TOP OF WELL CASING ELEVATION:
DRILLING AGENCY	Layne Environmental	DRILLER D.Peterson	DATE STARTED: 9/21/95 DATE FINISHED: 10/4/95
DRILLING EQUIPMENT	Reedrill & AP 1000		COMPLETION DEPTH (ft) 50.4
DRILLING METHOD	SFA & Dualtube Percussion	DRILL BIT 24 & 10-7/8"	HAMMER 140 lbs
SIZE AND TYPE OF CASING	See attached Figure for construction details		NUMBER OF SAMPLES BULK.: 0 DRIVE.: 7
TYPE OF PERFORATION		FROM TO	WATER DEPTH FIRST: COMPL.: 24 hrs.:
SIZE AND TYPE OF PACK		FROM TO	LOGGED BY W.Dittman CHECKED BY

TYPE OF SEAL	TYPE	FR	TO	TYPE	FR	TO
	No. 1:			No. 3:		
	No. 2:			No. 4:		

LOG OF BORING V-5

DEPTH (feet)	MATERIAL DESCRIPTION	SOIL GRAPHIC	WELL GRAPHIC	Hnu, ppm	OVA, ppm	WATER LEVEL	DEPTH (feet)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY (feet)	SAMPLES BLOWS/foot	INDEX PROPERTIES MOISTURE CONTENT (%)	INDEX PROPERTIES DRY DENSITY (pcf)	INDEX PROPERTIES UNCONFINED COMPRESSIVE STRENGTH (psf)	NOTES
0	SOIL COVER														
	SOLID WASTE - Paper, plastic, etc.														
5							5								
10							10								
15							15								
20							20								
25	GRAVEL (GW) Wet, dark reddish brown (2.5YR 3/3), some fine to coarse sand, fine to coarse gravel to 1 inch (alluvium) angular to subrounded; (volcanics) Vesicular gravels						25								
30	Damp to wet						30	1		0.25	50/2"				
								2		1.2	67	17.0 18.6			GS GS
	Dry														
35	Dark red (2.5YR 3/6), dry						35	3		1.1	46	13.9			
	SAND (SW) Dry, dark red (2.5YR 3/6), fine to coarse sand , some fine gravel to 3/4 inch, angular to subrounded (alluvium) (volcanics), vesicular gravels							4		0.8	65				
40								5		1.5	74	8.4			GS

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PROJECT NO. 9553119D FIGURE:

CINDER LAKE LANDFILL
Coconino County, Arizona

LOG OF BORING V-5
Continued-- Sheet 2 of 2

DEPTH (feet)	LITHOLOGIC DESCRIPTION	SOIL GRAPHIC	WELL GRAPHIC	Hnu, ppm	OVA, ppm	WATER LEVEL	DEPTH (feet)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY (feet)	SAMPLES BLOWS/foot	INDEX PROPERTIES MOISTURE CONTENT (%)	INDEX PROPERTIES DRY DENSITY (pcf)	INDEX PROPERTIES UNCONFINED COMPRESSIVE STRENGTH (psf)	NOTES
40												7.0			
45	GRAVEL (GW) Dry, reddish brown (2.5YR 5/3), some fine to coarse sand, fine to coarse gravel to 3 inches (volcanic/alluvium), vesicular gravels						45	6		0.8	67	5.2			GS
50	Dusky red (2.5YR 3/2), trace fine to coarse sand BASALT (Bedrock) - Dark gray (5YR 5/1) BOTTOM OF BORING AT 50-5/12 FEET						50	7		0.2	ref.				Refusal at 50'
55							55								
60							60								
65							65								
70							70								
75							75								
80							80								
85							85								
90							90								

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PROJECT NO. 9553119D

FIGURE:

TABLE 1
SUMMARY OF SEISMIC REFRACTION DATA
Cinder Lake Landfill
Coconino County, Arizona

Seismic Traverse No.	Average Depth (ft)		Compression Wave Velocity (fps)		
	Layer 1	Layer 2	Layer 1	Layer 2	Layer 3
1	5	--	783	2826	--
2	6.5	--	844	3233	--
3	6	24.5	750	1872	4235
4	10	32	900	2342	5500
5	3	30	717	1394	5906
6	3	28	703	1544	3098
7	8	--	850	2115	--
8	6.5	30	724	2223	3975
9	5.5	--	686	2813	--
10	10	--	794	1710	--
11	5.5	--	800	2123	--
12	4	--	714	1398	--
13	4.5	--	715	1469	--
14	5	--	808	1455	--
15	4.5	19	678	2027	5388
16	5.5	--	794	1752	--
17	6	--	888	1573	--
18	4.5	--	792	1563	--
19	7.5	--	795	2392	--
20	6	--	782	2318	--
21	5	21	816	1723	2858
22	7	--	784	2100	--
23	8	--	748	2185	--
24	8	40	676	2212	5000
25	10.5	--	767	2291	--
26	10	--	778	2343	--
27	6	32.5	789	1798	6205

PLATE A2