ENGINEERING REPORT

EXCAVATION AND REDISPOSAL OF THE AVONDALE LANDFILL

PREPARED FOR:

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

SCS ENGINEERS

STEARNS, CONRAD AND SCHMIDT
CONSULTING ENGINEERS, INC.

ENGINEERING REPORT

REMOVAL AND REDISPOSAL OF AVONDALE LANDFILL, MARICOPA COUNTY, ARIZONA

Prepared for:

Flood Control District
of Maricopa County
3335 West Durango Street
Phoenix, Arizona 85009

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File No. 18422

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File No. 18422

Mr. Richard G. Perrault
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Subject: Transmittal of Engineering Report - Excavation and Redisposal of Avondale Landfill

Dear Dick:

Enclosed are four (4) copies of the subject report. Key findings of the site investigation are:

- About 300,000 cu yd (in place) of refuse and soil will be removed in the operation; the excavation will cover roughly 10 acres to a depth of 19 ft.
- Soil underlying the Avondale site has not been significantly contaminated; therefore, major overexcavation is not warranted.
- Toxic concentrations of gases within the refuse were not detected, although a precautionary program of job site and community safety is recommended.

Some issues remain to be resolved. The most important concern: whether to utilize an accelerated construction schedule; which of the Yuma Road Landfill appurtenances are to be incorporated into the redisposal project; and how to expedite permitting.

I suggest that a meeting be arranged between SCS and representatives of the District, the County Landfill Department, and the Arizona Department of Health Services (ADHS) to discuss these issues, as soon as practical after you have had a chance to review this report.

OFFICES IN RESTON, VIRGINIA; LONG BEACH, CALIFORNIA; BELLEVUE, WASHINGTON; COVINGTON, KENTUCKY

In the interim, please call if you have any questions.

Very truly yours,

Mark B. Beizer, P.E.
Project Manager

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MBB/KKS:rwb
Enclosure

CONTENTS

SECTION 1

INTRODUCTION AND BACKGROUND

This report discusses the excavation and removal of all deposited refuse at the Avondale Landfill and its haul to and redisposal at a site about 10 miles west near the intersection of Yuma Road and Airport Road.

The Avondale Landfill was operated during 1979 and 1980 by Maricopa County. It is located in the floodplain of the Agua Fria River along the west bank just north of the Buckeye Road bridge (see Figure 1). Refuse is deposited over about 10 acres to reported depths of 15 to 20 ft below prevailing grade adjacent to the west. Although no detailed volumetric records were kept, the County estimates that about 250,000 cu yd of solid waste, consisting primarily of municipal refuse with some local agriculture wastes, were deposited at the site. No liquid or hazardous wastes were allowed into the landfill. The landfill was constructed using a combination of area and trench methods; hence, the bottom contours of the fill are irregular. Daily soil cover was applied, and the site is overlain by varied thicknesses of final cover.

During a series of heavy storms in February 1980, the site was subject to inundation of short duration. A portion of the refuse deposited at the site was washed out, and substantial scouring of the cover and waste fill occurred. In response to this situation, SCS Engineers was assigned in 1981 to perform a study for Maricopa County (funded by the EPA) of potential remedial actions at the Avondale site. The study identified two alternative approaches: (1) isolation of the refuse in place via sheet piling, erosion control, and final cover; and (2) removal

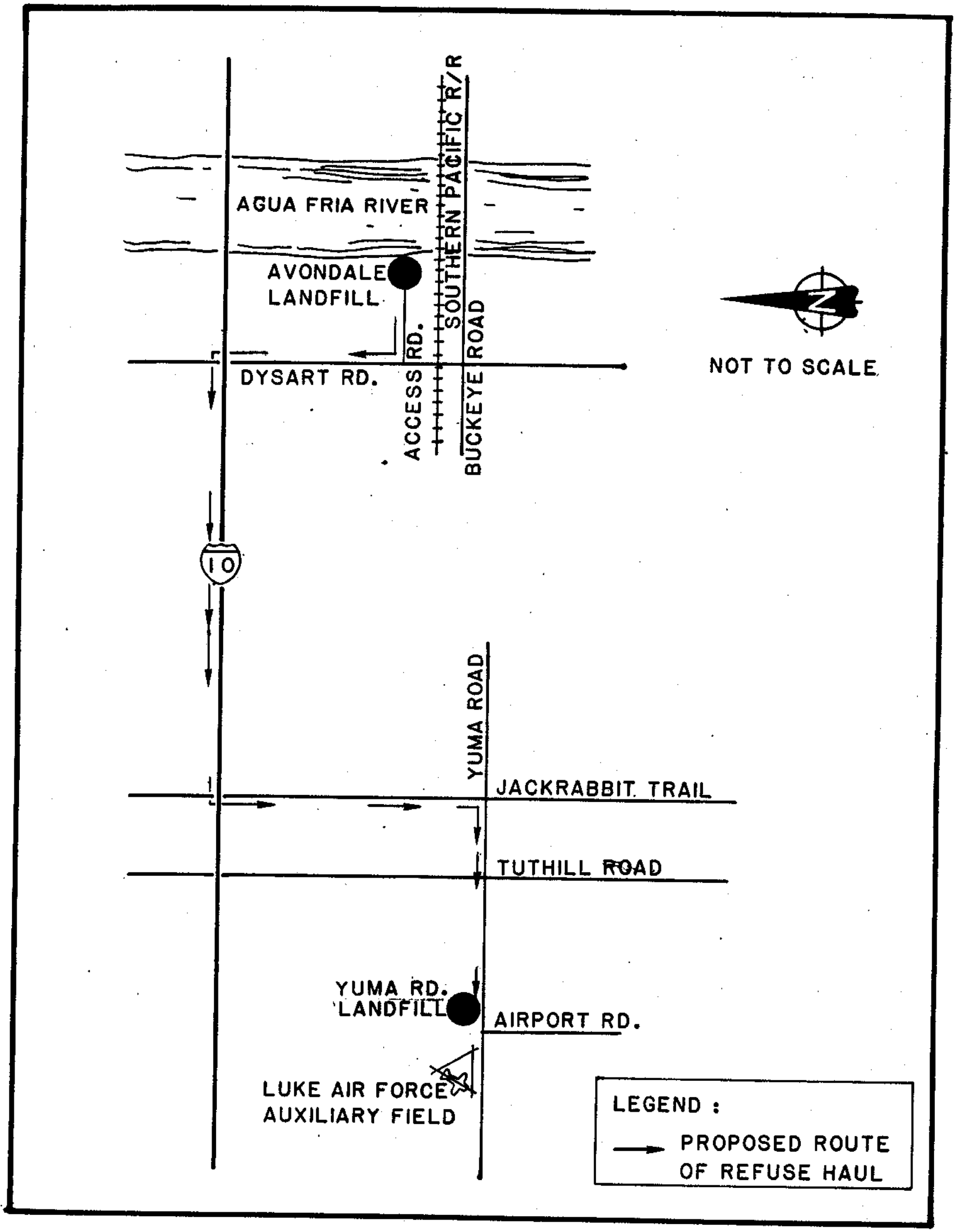

FIGURE – 1. PROJECT LOCATION PLAN.

of the refuse. Due to funding constraints, no immediate action was taken.

The Flood Control District of Maricopa County is currently implementing plans to channelize the Agua Fria River. This project will necessitate removal of the refuse within the landfill, as much of it lies within the proposed levee.

Maricopa County has designated its proposed Yuma Road Landfill to be the recipient site for redeposition of the buried refuse. The site is leased by the County from the State Land Department. *A development report for the new landfill site was* prepared by the SP Group of Phoenix in August 1982 prior to any decision to move Avondale wastes to the site. It details a trench-type operation, and includes landfill appurtenances such as access roads, gatehouse and scale, water quality, and landfill gas monitoring wells, etc.

The excavation of deposited refuse at a landfill can be a sensitive environmental undertaking, and poses issues of safety to workers and the adjacent community. Further, as with any landfill site, there is uncertainty as to the nature of buried waste at Avondale *and the characteristics of decomposition* gases. In consideration of these issues, SCS was retained by the District to prepare this preliminary engineering report to (1) more clearly define the excavation/haul/placement operation; (2) present results of field and laboratory testing of soil, refuse, and gas from the site; (3) address job site and community safety; and (4) refine previous cost estimates and schedules for waste excavation and removal.

SECTION 2

SITE INVESTIGATION

In order to more firmly define physical parameters at the Avondale site, SCS subcontracted with the Phoenix firm of Sergent, Hauskins, and Beckwith, Consulting Geotechnical Engineers (SHB), to conduct a subsurface drilling program. SCS personnel then installed gas monitoring wells in the boreholes. SHB tested soil samples for various physical parameters; SCS retrieved soil and, subsequently, gas samples for chemical (pollutant) analyses. Appendix 1 presents SHB's Geotechnical Report; Appendix 2 contains the report of the SCS Laboratory.

EXPLORATORY BORINGS

A total of 11 borings were made at the Avondale site on November 12 and 13, 1984. Nine borings were drilled within the suspected limits of refuse deposition, and two were installed outside of the site area where landfill operations have not affected the soil to provide background data. At five of the borings located within the landfill, landfill gas (LFG) monitoring probes were installed for subsequent monitoring and sample collection. The exploratory borings were made to assess approximate limits of the landfill, depth of refuse fill, thickness of cover material, as well as sample retrieval.

The Geotechnical Investigation Report presented in Appendix 1 provides details of the location of borings, method of drilling, boring logs, method of soil sampling, and cross sections along borings. The soil cover over the refuse fill varies from 6 in to 7.5 ft in depth, and consists of sand and silty sand. The bottom of the refuse deposition varies from 10 to 35 ft below existing grade. The refuse is heterogeneous throughout the fill, including solid waste and construction debris, scrap wood, concrete blocks, etc.

The refuse is relatively loose in consistency, and varies from dry to moist in nature. Free ground water was not encountered in any of the borings. However, very wet to saturated conditions were encountered in Boring No. 6 at a depth of 45 ft. Moisture content in the soil underlying the refuse typically varies from 2 to 5 percent, or approximately the same range as the sands and gravel in the two background borings.

Recommendations from the geotechnical report include:

- Both soil and refuse fill can be excavated with conventional earth-moving equipment. Larger blocks of concrete or other construction debris will be encountered in the landfill, requiring special equipment for hoisting, loading, and perhaps transportation.

- A temporary slope angle of 2 to 1 (horizontal to vertical) is recommended for the refuse during excavation.

- Temporary slopes in soils adjacent to and underlying the site can be cut to 1.5 to 1 (horizontal to vertical).

INVESTIGATION OF SOIL CONTAMINATION

Normally, leachate would not be expected to be produced at the Avondale site due to the dry climate (i.e., negative moisture balance -- excess of evapotranspiration over precipitation). However, the inundation of 1980 may have caused a leaching of organics and/or metals into the upper soil layers under the site. In order to determine if the Avondale refuse had caused any contamination of underlying soils, soil samples were collected during this investigation. Nine soil samples (seven from soil underlying the landfill and two from background borings) were analyzed at the SCS Laboratory for the following parameters:

- Electroconductivity.
- Organic carbon.
- pH.
- Chlorides.
- Selected heavy metals (Cd, Ni, Pb, Zn, and Cu).
- Hexavalent chromium.

Laboratory findings for the above parameters from the soil underlying the landfill were compared with the results from background samples to evaluate the impact of landfill operations on the underlying soils. SCS Laboratory's findings and conclusions are provided in Appendix 2 of this report. The highlights of this investigation are summarized below:

- Heavy metals are within the ranges typically reported for natural soils.

- Electroconductivity, pH, organic carbon, and chlorides from samples underlying the landfill did not exhibit sufficient differences from control borings to conclude that leachate has been produced.

Hence, it is concluded that soil underlying the landfill has not been significantly affected by landfill operations, and extensive overexcavation of soil below the refuse deposit is not warranted.

LANDFILL GAS

Decomposition of organic material within the refuse under anaerobic conditions will generate LFG, predominantly methane and carbon dioxide. Neither gas is toxic, but methane is flammable at concentrations exceeding 5 percent in air. Protection of workers from this explosion and fire risk is discussed later in this report.

Municipal waste can also contain trace amounts of volatile organic compounds (VOCs), some of which are toxic if found in sufficient concentration. However, toxic levels are not commonly found in municipal landfills, i.e., in the absence of significant deposition of hazardous wastes.

In order to assess potential worker exposure to these hazards during the excavation, gases at the site were monitored in situ and samples collected for laboratory analysis. LFG monitoring probes were installed into five borings drilled within the landfill. These consist of 1/2-in-diameter PVC pipe with the bottom 1 ft perforated in a gravel pack. The tops of the probes contained a cock valve for LFG sampling and pressure recording.

On November 26, 1984, SCS personnel measured the pressures and methane concentrations at these probes using portable instruments. Table 1 presents the results of field measurements.

Based on these monitoring data and our experience with similar landfills, the Avondale Landfill appears to be in an early but active state of decomposition. The methane flammability hazard does exist, but it is unlikely that confined, high-pressure volumes of methane will be encountered during the excavation. Routine fire suppression precautions should be sufficient for worker protection.

Four LFG samples, two from each of the two probes (Boring Nos. 1 and 9) were also collected for laboratory analysis of organic gases of potential concern. The samples were analyzed for major constituents by the SCS Laboratory in Long Beach, California; samples were then sent to West Coast Analytical Services,

TABLE 1. RESULTS OF METHANE AND PRESSURE MONITORING

Boring No.	Probe Depth (ft)	Methane Concentration (%)	Pressure (Inches of Water)
1	10	23	ND
4	10	<1.0	0.03
7	10	20	0.02
8	10	34	ND
9	9	50	ND

Inc., Santa Fe Springs, California, for trace constituent analysis. Their report is provided in Appendix 2 of this report. Results of gas analyses are shown in Table 2.

The analysis for trace volatile organics did not indicate the presence of any gas in concentrations exceeding OSHA workplace standards, with the exception of 1.4 ppm vinyl chloride. The Threshold Limit Value (TLV) of vinyl chloride is 1.0 ppm, based on 8-hour time-weighted average exposure. In light of extensive dilution that would take place as the LFG is vented to atmosphere during excavation activity, the vinyl chloride reading is not considered a hazard to workers in well ventilated areas.

TABLE 2. ANALYSIS OF LANDFILL GAS SAMPLES FROM AVONDALE LANDFILL, ARIZONA

	(% v/v)[1]	
Major Components[2]	Sample BH-1	Sample BH-9
Carbon dioxide	28.9	22.3
Oxygen	4.0	8.1
Nitrogen	43.6	49.0
Methane	23.5	20.6
Minor Components[3]	(ppm)[4]	
Vinyl chloride	1.4	0.5
1,1,1-trichloroethane	0.3	ND[5] < 0.3
Benzene	0.6	0.2
Trichloroethene	0.4	0.8
Tetrachloroethene	0.6	ND < 0.3
Toluene	9.8	2.9
Dichlorofluoromethane	5	0.5
Trichlorofluoromethane	2	ND < 0.3
Dimethyl sulfide	5	ND < 0.5
Freon TF	0.5	0.5
Methylene chloride	2	0.2
Carbon disulfide	0.5	0.5
Ethylbenzene	2	1
C4-C7 hydrocarbon	20	5
Xylenes	5	3

[1] Percent volume.
[2] Analyzed at SCS Laboratory.
[3] Analyzed at West Coast Analytical Services (see Appendix 2).
[4] Parts per million.
[5] None detected.

SECTION 3

PRELIMINARY ENGINEERING

This section presents a preliminary outline and basis of design of the Avondale excavation project which will serve to guide development of plans and specifications.

REFUSE QUANTITIES

The volume of material in place at the Avondale site is estimated at 305,000 cu yd. This is based on an average depth to the base of refuse of 17 ft per the log of borings, and includes an allowance for an average of 2 ft overexcavation to ensure that all refuse is retrieved. A swelling factor of 15 percent is assumed, which would project to a truck volume of approximately 350,000 cu yd.

Boring No. 6 indicated refuse deposition to a depth of 34 ft. It is believed that this resulted from filling in of a temporary pit at the site, and is not indicative of substantially larger refuse quantities. (The actual quantity will be determined in the field as the excavation proceeds.)

The average density of excavated material (both soil and refuse combined), which will affect maximum truck size for material transport, is estimated at 1,200 lb per cu yd, based on the following assumptions:

- In-place refuse - 900 lb per cu yd (considered average for a shallow site).
- In-place soil - 3,000 lb per cu yd.

- Refuse-to-soil ratio within landfill volume - 3:1.

- Swelling factor upon excavation - 15 percent.

It is recommended that, for contractor's payment, total quantities of earthwork at each site be based on aerial topography, i.e., the change in volumes between the beginning and completion of excavations at both the Avondale and Yuma Road sites. Truck volumes would not be utilized. Since the precise bottom contours at Avondale are unknown, the final depth of the excavation, and therefore total quantities to be removed, will be determined in the field as excavation proceeds. Similarly, at Yuma Road, the actual amount of trench to be excavated will be refined as waste is received at the site. Operational procedures for recompaction of the refuse (i.e., number of passes with dozer/compactor) will be specified, but the actual density achieved cannot be predicted and would not be measured. If lower densities are achieved, additional trench excavation will be required, and provisions for negotiating the extra cost will be specified.

EXCAVATION AND HAUL

Based on discussions with earth-moving contractors both in the Phoenix area and Los Angeles, a scenario for the excavation/haul/redisposal project was defined. It should be noted that the exact methodology will be left to the contractor who will presumably organize the effort and select equipment which maximizes efficiency and therefore profit. The specifications will influence his choice only in that items such as job site safety, working hours, covering of exposed refuse, etc., will be written to protect the County's interests.

The following method of operation was postulated to develop the cost and schedule estimates included herein.

Excavation and Transport of Refuse

- Excavation of refuse will be by front loaders with 7-cu-yd capacity buckets.
- Hauling of excavated material will be by high side trailers or end dump trucks.
- Average capacity of hauling vehicle will be 30 cu yd per load.
- For odor control purposes, exposed refuse will be covered nightly with soil and/or sprayed with foam or odor maskants.
- The maximum area of exposed refuse will be limited in the specifications.
- Health and safety procedures for excavation and hauling are discussed later in this report.

The final excavated surface will be 10 to 36 ft below the existing grades. The side slopes of the excavation will be a maximum of 1.5 to 1 (horizontal to vertical). Backfill of the excavated area will be coordinated to conform with the levee design by the Flood Control District, and is not considered part of this project.

The excavated material will be hauled to the Yuma Road Landfill using 30-cu-yd capacity end dump trucks or high side trailers. The hauling vehicle will have a cover tarp for odor and nuisance control. The haul route is from the landfill site to Dysart Road; north on Dysart Road to I-10; west on I-10 to Jackrabbit Trail; south on Jackrabbit Trail to Yuma Road; and west on Yuma Road to the new landfill site. One-way haul distance is approximately 10 miles. Except for Dysart Road, hauling is along an unpopulated, low-traffic volume route. The contractor will be required to control dust along Dysart Road during hauling operations.

Preparation of Yuma Road Landfill

As mentioned previously, excavated material from the Avondale Landfill will be placed at the site designated by the County, located off Yuma Road adjacent to Luke Air Force Base Auxiliary Airfield No. 6. Development of the Yuma Road Landfill is based on the following assumptions:

- In general, "Yuma Road Landfill Master Plan" prepared by the SP Group of Phoenix will be used as a guide for site preparation and refuse placement.

- The filling operation will be by the trench method as recommended in the Master Plan. Each trench will be about 156 ft wide at the top and 96 ft wide at the bottom. The depth of the trench will be about 30 ft. Side slopes will be 1:1 (horizontal to vertical). The top of the fill will in general be at the existing grade, and a 2-ft-thick, low-permeability cover will be placed over the refuse. It will be graded for surface drainage.

- Site improvements recommended in the Master Plan to be incorporated into the project plans will be limited to temporary roadways, perimeter fencing, and sight reduction berms.

- Additional improvements called for in the Master Plan may be included at the discretion of the Flood Control District and the County. These include permanent roadways, gate house, scale, landscaping, utilities, and ground water monitoring wells.

- We suggest a modification to the previously recommended LFG monitoring system. Monitoring wells should be installed in adjacent soils only when nearby land is developed.

- According to the Master Plan, soils to be excavated at the Yuma Road site are of sufficient quality to meet standards for final cover.

Per the Master Plan, each 1,200-ft trench would have disposal space for 168,000 cu yd. To receive the Avondale refuse, just under two complete trenches would have to be prepared. Excavated soil would be stockpiled on site; a portion would be reserved for the sight reduction berms, intermediate and final cover.

It should be noted that this filling methodology, since it does not allow for mounding of refuse above grade, will result in approximately 250,000 cu yd of excess soil to be stockpiled. An alternative approach to eliminate stockpiling would call for area filling with an initial excavation of about 10 ft, and the bulk of the refuse mounded to a height of about 30 ft above prevailing grade. Reduced excavation costs would yield a savings of approximately $200,000. Further, this would result in increased separation between refuse and the ground water table, estimated to be at a depth of 90 ft in the Master Plan. The mounding concept would also reduce the potential for subsurface LFG migration. However, for aesthetic reasons, the mounding concept may not be acceptable.

If the County wishes to explore this alternative further, it can be performed during the preparation of plans and specifications.

HEALTH AND SAFETY

This discussion provides an overview of the guidelines, procedures, and practices necessary to protect worker and community health during the refuse excavation. The potential hazards to be addressed are:

- Explosion and fires.
- Toxic gases, liquids, or solids.
- Infectious wastes.
- Physical hazards.

In addition, minimization of odors will be addressed to prevent unnecessary stress and aggravation of people in the community.

Job Site Safety

Explosive Hazards--

The control of explosion or fire hazards will involve monitoring of the working face to detect possible buildup of methane gas in voids or pockets in the waste mass. Frequent monitoring of newly opened areas will be conducted with combustible gas meters to identify areas of possible danger. No smoking or open flames will be allowed in the areas of waste excavation, handling, or storage activities. Unless exposed to open flames or extremely hot surfaces, it is unlikely that explosions of released methane gas will occur. However, the potential for spontaneous combustion of wastes, underground fires, and highly flammable wastes should be evaluated based on available monitoring/sampling data and regular visual inspections of the working areas. Stockpiles of cover soil and fire-suppressing foams should be available to extinguish any fires which may occur. These materials may also be useful if odors become a problem and a temporary cover of exposed wastes is desirable.

Toxic Wastes--

Hazards from exposures to potentially toxic gases, liquids, and solids can be minimized by limiting access to active areas, providing workers with personal protective clothing (i.e., boots, gloves, coveralls, etc.), control of waste dispersion (i.e., run-off diversion berms, wind screens, covering or closing containers, etc.), and use of bulk handling equipment to limit direct contact with wastes. There is no indication of hazardous waste disposal during the operation of the landfill. However, household chemical products and hazardous wastes from small-quantity generators may be encountered. As a precaution, a standby holding area for suspect wastes should be constructed. This area should provide a relatively impermeable surface (i.e., compacted clay or concrete) with runoff/run-on containment/diversion berms or curbing. Containers suitable for storage and/or transport of hazardous wastes that may be encountered should be available (i.e., overpack drums, covered dumpsters, roll-off boxes, etc.).

Based on preliminary information and limited sample analysis, it is not anticipated that workers will be exposed to hazardous constituents at any levels approaching applicable worker exposure levels set by the U.S. Occupational Safety and Health Administration (OSHA) or the State of Arizona. However, routine monitoring, sampling, and analysis of air and wastes will be conducted during excavations to identify possible hazardous contaminants. Century OVA Organic Vapor Analyzers, HNU photoionization detectors, and/or vapor detector tubes will be used to monitor relative levels of contamination by direct field readings. If indicated by field readings, air and waste samples will be collected and analyzed in the laboratory for possible hazardous compounds present in trace quantities. Evaluation of the results will determine if any additional monitoring and/or worker protection will be required. Suspicion or detection of hazardous conditions will result in temporary evacuation of workers from the active areas until the potential risks can be evaluated and any necessary modifications, control, and/or protective measures are instituted. Materials contaminated with hazardous wastes shall be transferred to the holding area for storage and/or evaluation. Containers provided for this purpose (i.e., overpack drums, covered dumpsters) will be used as appropriate.

Infectious/Radioactive Wastes--

Potential exposures to possibly infectious wastes can be minimized in a manner similar to procedures indicated for toxic gases, solids, and liquids. Infectious wastes may include hospital wastes, wastes from medical research facilities, and dead animals which may have been diseased (e.g., laboratory animals). Wastes which are suspect should not be directly handled, and equipment used should be cleaned after suspect wastes are removed to the holding area. (This also applies to handling/processing of potentially hazardous wastes). Samples of wastes and/or swab samples should be sent to a biological testing laboratory for evaluation and identification. Any dead animals found should not be directly handled, but need not be processed as infectious wastes unless found in large numbers or in conjunction with obvious hospital or laboratory wastes.

Physical hazards will be identified by the excavation inspector based on regular visual inspections of the working areas. Those hazards found will be pointed out to personnel in the area and removed as soon as possible. Protective gloves, boots, hard hats, eye wear, and coveralls will be used to minimize injuries from physical hazards.

Although there is no indication of possible radioactive wastes, a Geiger counter will be available to check for possible radiation, particularly if hospital or laboratory wastes are found. As a general precaution, it is advisable to check questionable areas of waste and/or drums. This activity should be very low key to prevent unwarranted public and worker concern.

Community Safety

To address community safety and health concerns and the issue of potential nuisance odors, a routine series of monitoring and sampling activities will be conducted in conjunction with on-site monitoring and sampling activities. Each day, at least two neighborhood odor checks will be made by driving and/or walking through the community around the excavation project. A record of odor problems will be made, and, when necessary, corrective actions will be taken. At the same time, visual inspections will be made to insure that excessive blowing of waste paper, dust, and possible runoff are not occurring. A record of these observations will also be kept, and corrective actions will be taken when needed. A record will also be kept of all community complaints to evaluate the overall impact of operations and to serve as a cross check of monitoring efforts. Response to community complaints shall be made by the appropriate local government agencies. Air samples will be collected using air sampling pumps connected to stainless steel cylinders. The samples shall be analyzed for potential hazardous and malodorous constituents. Total hydrocarbon measurements shall also be made during neighborhood checks each day. Finally, at least once per day, the route designated for waste haulers to follow will be visually inspected to insure that wastes are appropriately contained during transport. Daily records of all neighborhood inspections and sampling shall be maintained and available for review. If requested, summary reports of neighborhood findings shall be provided to the client to assist in maintaining community relations.

Standard operating procedures shall be implemented to minimize releases of vapors, blowing paper, dust, and runoff from active areas. These procedures may include covering excavated wastes during storage and transport, minimizing the distances involved in dumping wastes into and out of containers, the use of wind screens (if needed), and surface water diversion structures to prevent run-on and runoff. Daily operations will be continually inspected and evaluated to identify additional methods and procedures which may be used to minimize releases.

PERMIT REQUIREMENTS

Based on discussions with the Arizona Department of Health Services (ADHS) and County staff, it is our understanding that no specific permit is required for the removal of refuse from the Avondale Landfill.

The Yuma Road Landfill site is owned by the State of Arizona Land Department, and has been leased to Maricopa County for landfill purposes. We have been advised by the Maricopa County Landfill Department that no additional permission and/or permit is required from the State Land Department for its designated use.

ADHS requires that a permit to operate the landfill be obtained by submitting a completed "Notice of Disposal." A copy of the Notice of Disposal form has been provided in Appendix 3 of this report. The Master Plan describes the site as suitable for landfill purposes for the following reasons:

- The site is not in an existing floodplain, and is protected from the 100-year flood from the north.
- The existing ground water elevations are 90 to 150 ft below ground surface.
- There are many layers of "impervious" material located between the proposed sanitary landfill area and existing ground waters.

The above-mentioned characteristics of the site will facilitate permit acquisition. It is recommended that the County submit a Notice of Disposal to ADHS as soon as practical.

ESTIMATED COST AND DURATION

Based on the concepts outlined in this report, Table 3 contains the cost for removal and redisposal of the Avondale Landfill including initial developments at the Yuma Road disposal site as recommended in the Master Plan. Note that some items are not essential to this project, but will be required either prior to gaining a disposal permit for ADHS (e.g., ground water monitoring wells) or prior to implementing active landfilling (e.g., permanent access road). It is expected that identification of the precise list of elements to be included in the Yuma Road site work will be developed early in the process of preparing plans and specifications.

Estimates given are for the total cost, and include both construction and non-construction costs. Construction cost estimates are based on the best available data for the work of a similar nature at the present time. Cost estimates for non-construction items include engineering for preparation of construction documents; full-time inspection of work during construction; and legal and general administration items associated with the project during planning and construction periods.

It should be pointed out that the estimates assume that the Maricopa County Flood Control District moves ahead with the recommended program without undue delay. Estimates are not to be considered final, since more detailed estimates and quantity take-offs for the bid schedule will be prepared upon completion of final construction plans and specifications.

Anticipated Duration of Construction Period

As computed previously the truck volume of excavated material (mixture of refuse and soil) to be hauled from Avondale

TABLE 3. PRELIMINARY COST ESTIMATE FOR REMOVAL AND DISPOSAL OF AVONDALE LANDFILL INCLUDING INITIAL IMPROVEMENTS AT YUMA ROAD LANDFILL

Item	Quantity	Unit Cost ($)	Cost ($)
Excavation, hauling, and placing excavated material at Yuma Road Landfill	305,000 cu yd	6	1,830,000
Improvements at Yuma Road:			
Trench excavation and stockpiling on site	425,000 cu yd	1	~~305,000~~ 425,000
Construction of sight reduction berm	26,000 cu yd	3	78,000
Chain link fence and gates	1,000 lf	7	7,000
Five-strand barbed wire fence	2,700 lf	2	5,400
Gatehouse and weigh station	550 sq ft	50	27,500
Truck scale	Lump sum		50,000
Permanent roads	1,000 sq yd	10	10,000
Landscaping	8,000 sq ft	1	8,000
Water lines including storage tank	Lump sum		15,000
Ground water monitoring wells	3 each	5,000	15,000
Diesel fuel tank	1 each	5,000	5,000
Subtotal			2,355,900
Construction Contingencies @ ±10%			235,000
Subtotal, Construction Cost			2,590,000
Non-Construction Cost @ ±12%			310,000
TOTAL PROJECT COST			2,900,000

Landfill is about 350,000 cu yd. Assuming that the hauling vehicle has a capacity of 30 cu yd and that it can be loaded by a front loader in about 5 minutes:

- No. of hauling vehicles per hour = 60/5 = 12
- Volume of excavated material hauled per hour = 12 x 30 = 360 cu yd

Two scenarios are contemplated for the project: normal timing, utilizing an 8-hour work day; and an accelerated schedule, assuming 16-hour days (double shift, probably 6 a.m. to 10 p.m.), accelerated mobilization, oversize equipment, etc. The construction durations projected are as follows:

	Duration (Calendar Days)	
	Normal	Accelerated
Mobilization	30	15
Initial preparation (one trench) at Yuma Road	60	30
Excavation and redisposal	168	80
Subtotal	258	125
Contingency allowance for delays at ±10%	30	15
Total	288 (9.5 months)	140 (4.5 months)

A decision to adopt the accelerated schedule should consider the following:

- It would reduce the total length of exposure of the community to the potential nuisances (noise, odor, dust) associated with the excavation, particularly odors.

- Double shifts would require night work, with lighting, etc. It would expose the community to the noise of the excavation and truck traffic on Dysart Road.

- No net additional costs are anticipated. Lighting would be offset by savings in more efficient use of equipment (less startups, etc.). Overtime rates are not contemplated, as different employees would work each shift.

- Single shifts would be more likely to require covering the exposed refuse (working face) each night. Double shifts might allow cover only for weekends. (Nightly cover is assumed for cost purposes.)

ADHS and community representatives should be consulted prior to a decision on an accelerated schedule.

APPENDIX 1

SERGENT, HAUSKINS, AND BECKWITH
GEOTECHNICAL INVESTIGATION REPORT

1. INTRODUCTION

This report is submitted pursuant to a geotechnical investigation made by this firm of the Avondale landfill. The landfill is located near the intersection of Yuma Road and Dysart Road in Avondale, Arizona, adjacent to the Agua Fria River. The objectives of this investigation were to identify the depth of refuse at the existing landfill site, to evaluate the physical properties of the soils underlying the refuse, and to provide recommendations for the excavation and earthwork elements of the project.

2. PROJECT DESCRIPTION

Details of the project were provided by Mark B. Beizer, P.E. and Krishan Saigal, P.E. of SCS Engineers. The landfill is owned and was operated from April, 1979 to October, 1980 by the Maricopa County Highway Department. During its 18 months of operation, the landfill received approximately 250,000 cubic yards of uncompacted municipal solid waste. Apparently no hazardous wastes were deposited at the site. It is understood that the existing landfill will be removed and disposed of at a selected site. The purpose of this study is to provide information required to develop a preliminary for the removal and disposal operations.

Prior to initiation of the field investigations, the site area was inspected by the above named representatives of SCS Engineers and James R. Fahy, E.I.T. and

Lawrence A. Hansen, P.E. of this firm. Boring and gas monitoring well locations were selected, based on observations made at the site. It is our understanding that a detailed description of the landfill operation is not available, however, it has been assumed that the refuse was placed in trenches averaging 15 to 20 feet in depth, then backfilled with soils excavated from on-site. The landfill has been impacted by one or more flood events of the Agua Fria and Gila Rivers.

3. INVESTIGATION

3.1 Review of Site Hydrogeology

As part of our investigation, we reviewed a closure study for the landfill prepared by SCS Engineers, which detailed hydrogeologic conditions at the disposal site. We also reviewed available governmental reports of water levels, well locations, and effects of flooding in the region of the landfill.

3.2 Subsurface Exploration

Eleven exploratory borings were drilled on November 12 and 13, 1984. Nine of the borings were advanced to depths of 10 to 48 feet below existing grade within the suspected boundaries of the landfill. Two borings (numbers 10 and 11) were advanced to depths of 20 and 24 feet at locations approximately 400 and 600 feet from the approximate northern boundary of the landfill to provide soil samples for analysis that had not been impacted by the landfill operation.

The borings were drilled with a truck-mounted CME-55 drill rig advancing 6 5/8-inch O.D. hollow stem auger. Standard penetration testing and open-end drive sampling were performed at selected intervals in the soils underlying the refuse and in the two background borings. Standard penetration was also performed at selected intervals in the refuse. The field investigation was supervised by James R. Fahy, E.I.T., staff engineer of this firm.

Gas monitoring wells were installed in Borings 1, 4, 7, 8 and 9 under the supervision of SCS Engineers personnel. As indicated on the boring logs, samples of the soils underlying the landfill were provided to SCS Engineers for geotechnical analysis.

The results of the field investigation are presented in Appendix A, which includes a brief description of drilling and sampling equipment and procedures, a site plan showing the boring locations, and logs of the test borings. Elevations of the ground surface at the boring locations were determined by leveling, referenced to an assumed elevation of 100 feet at Boring 7.

3.3 Laboratory Analysis

Moisture contents of selected samples were determined. These are shown on the boring logs. Grain-size analysis, Atterberg Limits and a direct shear test were performed on selected samples. The results of these tests are presented in Appendix B, along with a brief description of laboratory testing procedures.

4. SITE CONDITIONS & GEOTECHNICAL PROFILE

4.1 Site Conditions

The landfill site is relatively level, exhibiting an elevation difference of about 4 feet, except at its western boundary. At this location, a trench with approximate maximum depth of 10 feet has been excavated, and subsequently partially backfilled with construction debris. The debris includes blocks of concrete, asphalt and several truck loads of earth materials.

The eastern edge of the landfill apparently coincides with a gentle slope having a maximum height of approximately 10 feet. Borings 2 and 3, which are located on the relatively level ground adjacent to and east of the sloped section, did not encounter refuse. However, evidence of refuse is apparent on the ground surface in this area, as well as on the higher plateau. The extent to which this boundary was affected by flood events following closure are unknown. The approximate eastern edge of the landfill is shown on the site plan in Appendix A.

4.2 Geotechnical Profile

As indicated by the boring logs, the soils overlying the refuse comprising the landfill consist of sands and silty sands. The thickness of this material, apparently placed as a cover, varies from zero to as much as 10 feet. The soil appears to have been borrowed from the lower plateau adjacent to the landfill, or other adjacent areas. The soils underlying the refuse include sands, silty sands and sandy gravels. The more sandy soils typically overlie the gravels, however, the thickness of the sandy soils is inconsistent. The soils do not appear stratified, and the elevation of the boundary between the refuse and the underlying soil varies from 63 to 86.

Five cross-sections through the landfill and adjacent areas are shown in Figures 1 through 5. Two of these are oriented in a northerly direction, and three are oriented in a predominantly easterly direction. The boundaries between the different materials identified in the figures are approximate, based on assumptions regarding the operation of the landfill and the continuity of the material layers between borings spaced at distances of 180 to 400 feet.

As indicated by the profiles, the thickness of the refuse apparently varies from 10 to 26 feet. A thicker zone of refuse appears to be located near the eastern boundary of the landfill, as indicated by Figure 5. It appears likely that the refuse was placed in trench excavations oriented in a northerly direction. This observation is consistent with the trench located along the apparent western edge of the landfill.

The refuse is heterogeneous, including such solid waste as construction debris, pipe sections and other metal parts, scrap wood and concrete blocks. In all but one

FIGURE 1
CROSS-SECTION A-A'

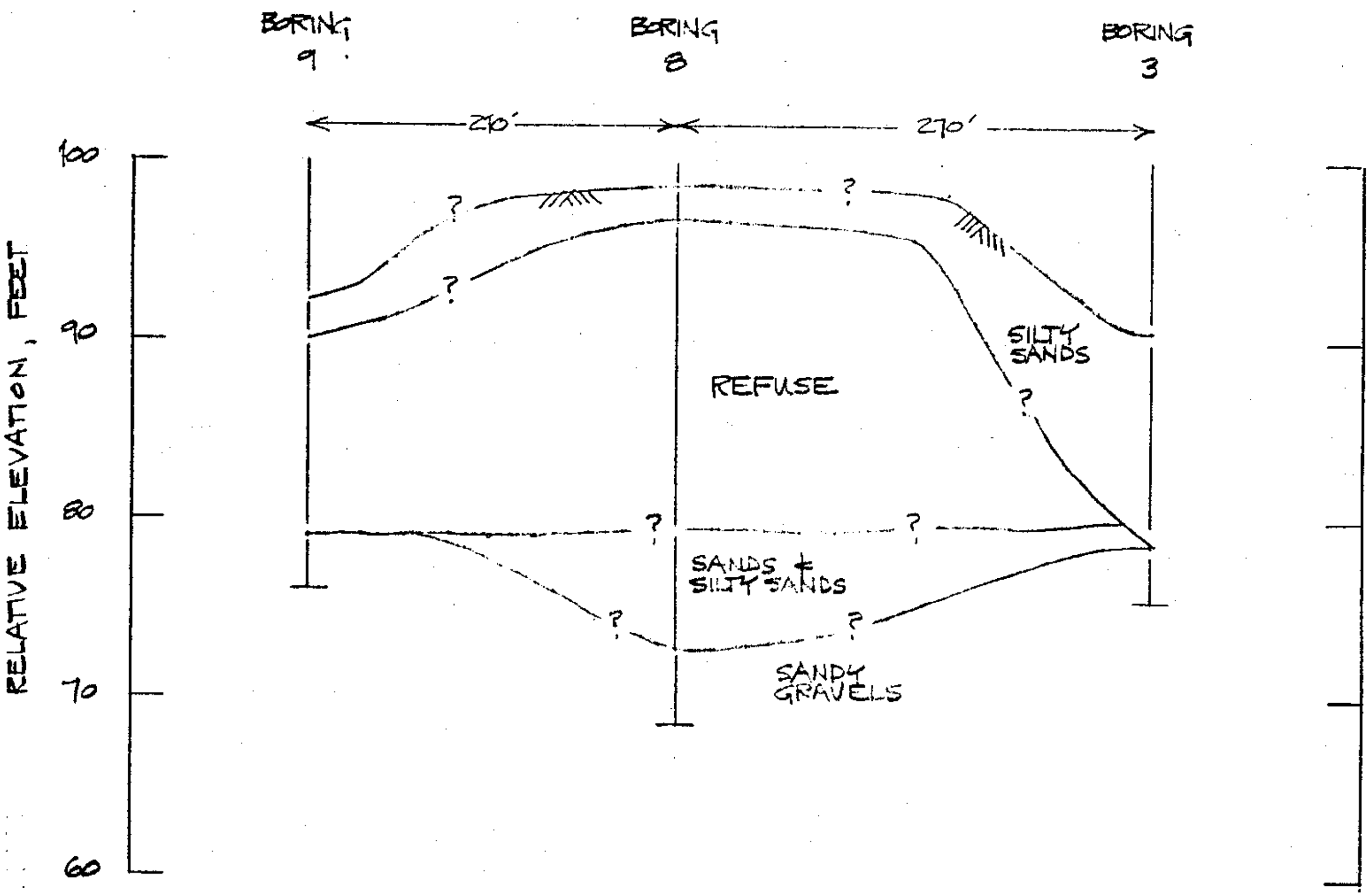

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FIGURE 2
CROSS-SECTION B-B'

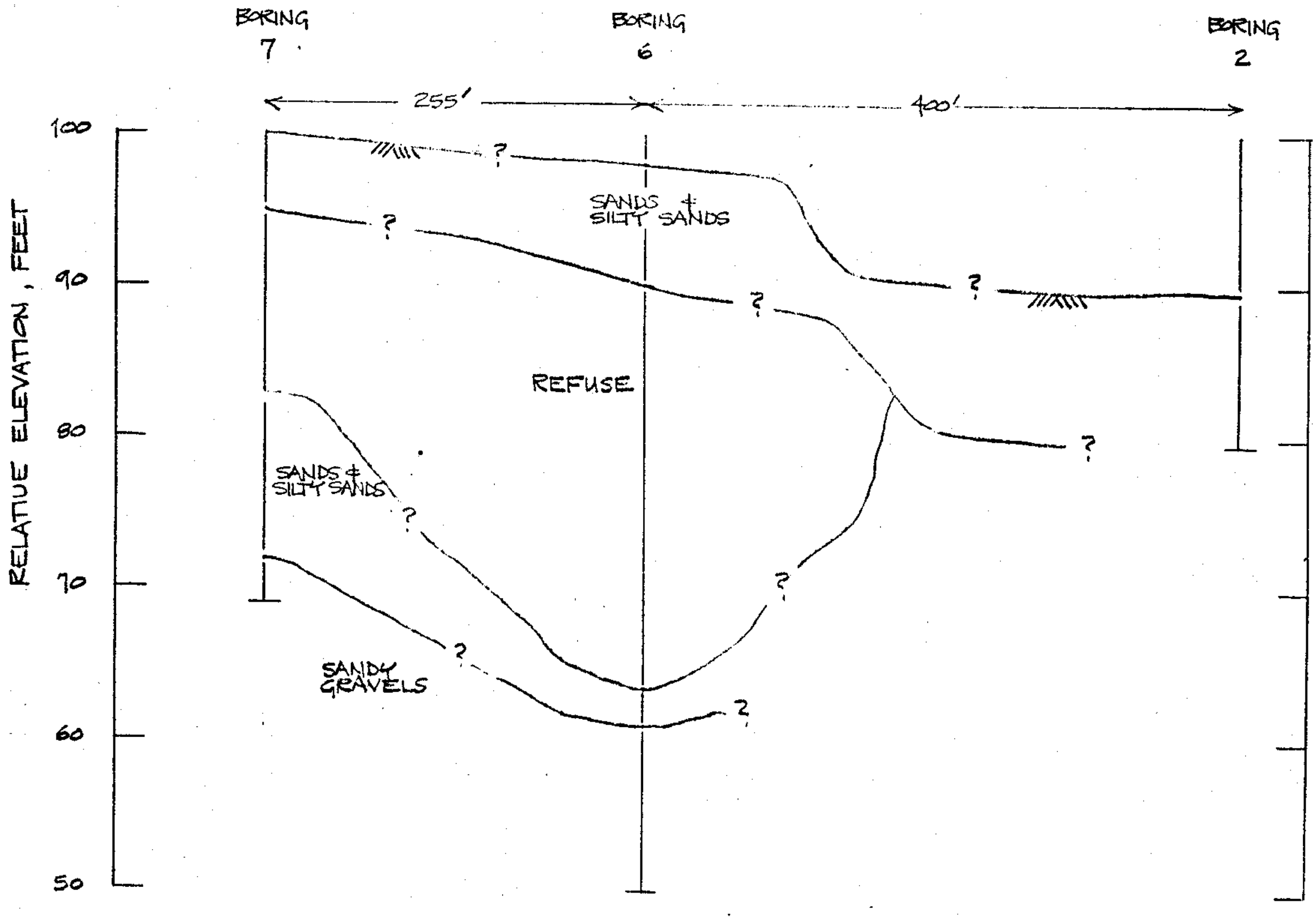

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FIGURE 3
CROSS-SECTION C-C'

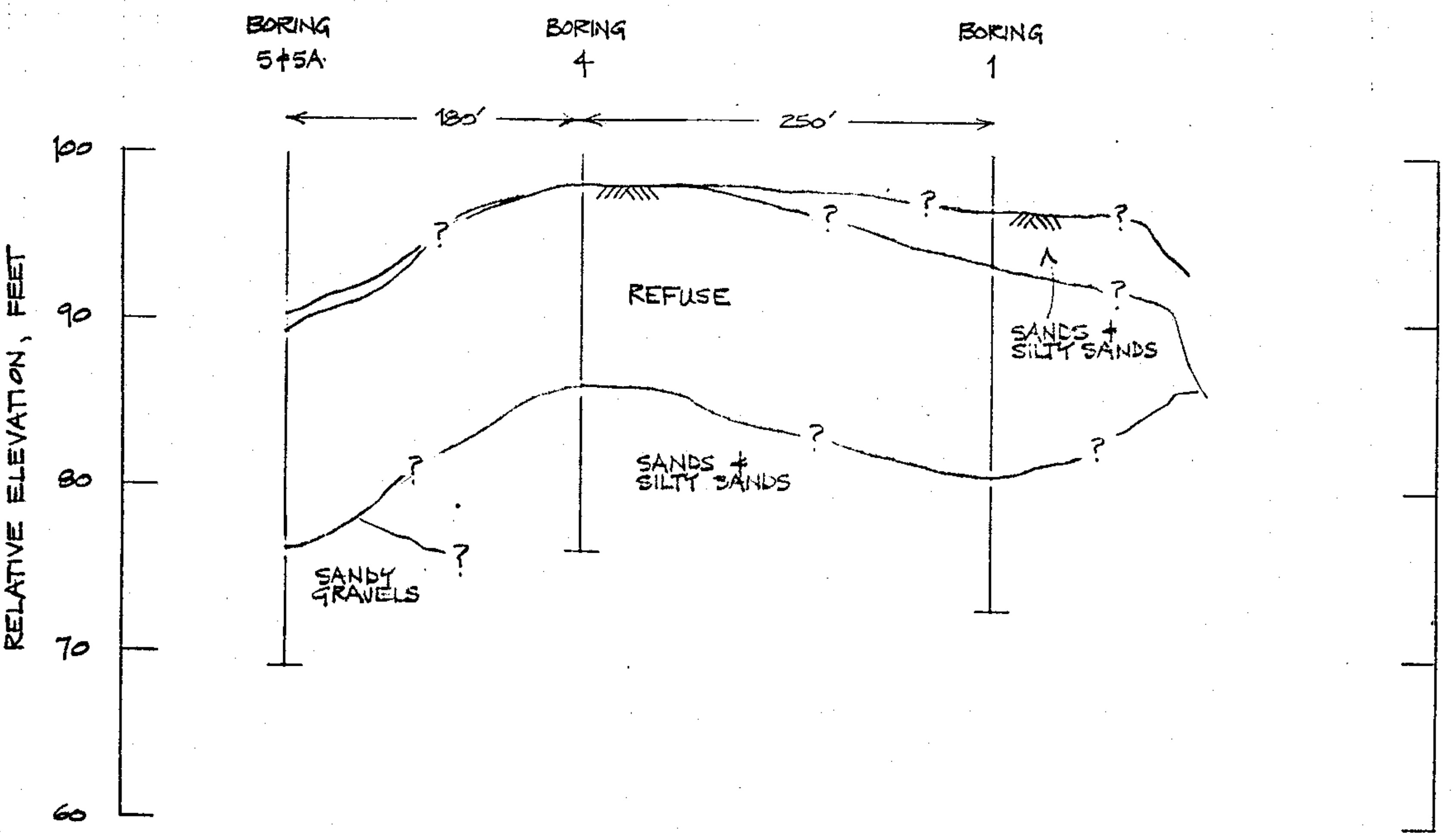

FIGURE 4
CROSS-SECTION D-D'

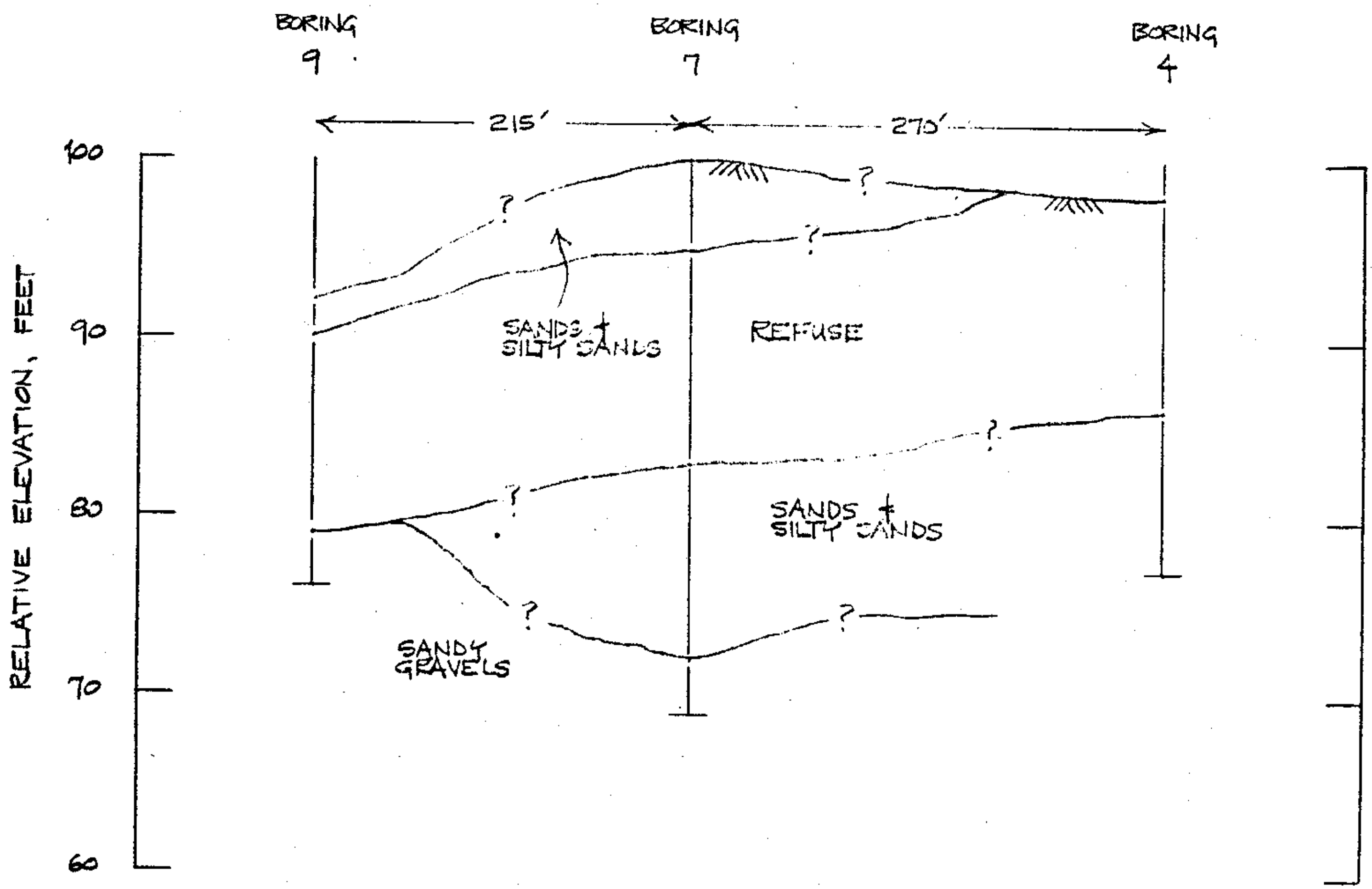

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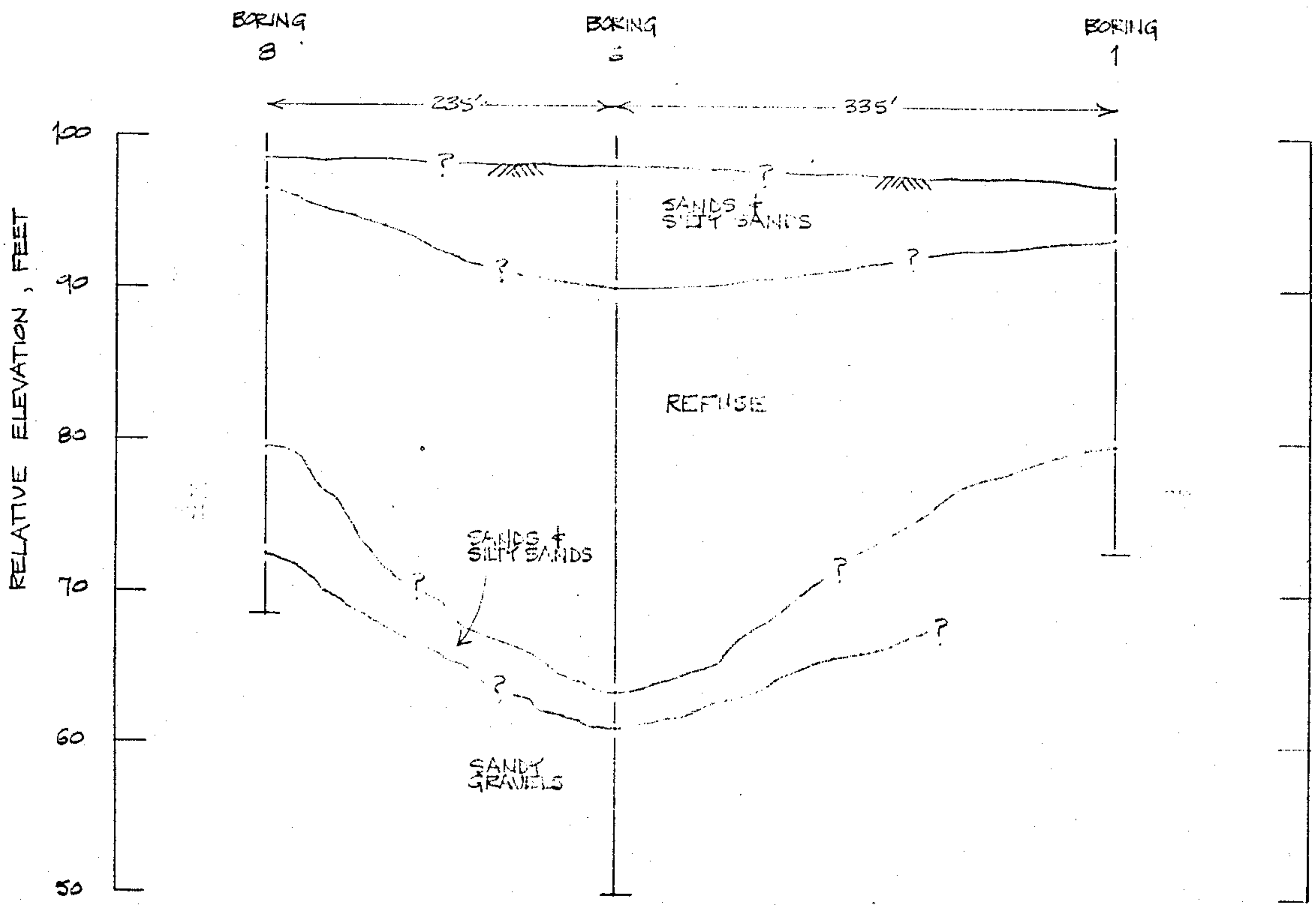
FIGURE 5
CROSS-SECTION E-E'



boring, the auger was advanced with no difficulty. However, Boring 5 apparently encountered a block of concrete or other such obstacle and was terminated at a depth of 13 feet. Boring 5a was located 3 feet from Boring 5 and advanced to 7 feet below the refuse without difficulty. The refuse is relatively loose in consistency, as evidenced by several of the borings caving to depths of 8 to 30 feet after removal of the hollow stem auger.

The soil profile north of the landfill, as indicated by Borings 10 and 11, includes a surficial layer of sandy clay 5 to 7 feet in thickness. This stratum is underlain by sequential layers of gravelly sand and sandy gravel and cobbles. The gravelly sand had a thickness of 6 feet in Boring 10, and 12 feet in boring 11.

4.3 Soil Moisture & Groundwater Conditions

Free groundwater was not encountered in any of the borings. Moisture contents in the soils underlying the refuse typically vary from 2 to 5 percent, or approximately the same range as the sands and gravels in the two background borings. However, in Boring 6 very wet to saturated conditions were encountered at a depth of 45 feet. The refuse is slightly moist to moist, and no pockets of wet to saturated materials were encountered.

A groundwater contour map prepared by SCS Engineers using 1973* depth to water data indicates that, at that time, the depth to water beneath the landfill was about 60 feet, and groundwater movement was to the northwest. Declines of the water table are caused by pumping of water primarily for irrigation. Recharge and water level rises are by flooding adjacent to the Agua Fria and Gila Rivers. During a flood, groundwater moves downward forming a mound on the water table, and if the flood is sufficiently long, the mound extends upward to the river. Mann and Rohne (1983) for the floods during the period February 1978 to June 1980 indicate that one well 4 miles west of the landfill had a rise in the water table of 19 feet, a second 3 miles to the south-east had a rise of 10 feet, and a third of 3½ miles to the northeast a rise of 34 feet. As these three are some distance from the Agua Fria, the water table mound under the landfill was likely much higher than the pre-flood water table.

Data from borings beneath the landfill indicate that the material is very permeable. This indicates that the mound would form rapidly, and also after the flow has stopped, that the mound would dissipate rapidly. The amount of rise of the water table away from the mound is dependent on the length of time that the river flows. This rise would take longer to dissipate because of lower permeabilities and because of the groundwater flow

*References are listed at the end of this report.

that is dependent on the water table gradient.

5. DISCUSSIONS & RECOMMENDATIONS

Based on the soil and refuse conditions encountered in the borings, it appears that both the waste material and soil can be excavated with conventional earth moving equipment. It is likely, however, that larger blocks of concrete or other construction debris will be encountered in the refuse, requiring special handling.

Temporary slopes in the in situ soils adjacent to and underlying the site, if above the water table, can be cut to grades of 1.5 to 1 (horizontal to vertical). Steeper slopes may be possible, particularly along the western boundary of the landfill, however, sloughing of the native materials would result. A temporary slope angle of 2 to 1 is recommended for the refuse during excavation.

REFERENCES

Mann, L.J. and Rohne, P.B., Jr., 1983, Streamflow Losses and Changes in Groundwater Levels along the Salt and Gila Rivers Near Phoenix, Arizona - February 1978 to June 1980, U.S. Geological Survey Water Resources Investigations 83-4043.

SCS Engineers, 1981, Closure Study for the Avondale Landfill, Avondale, Arizona, Report prepared for the U.S. Environmental Protection Agency, July.

TEST DRILLING EQUIPMENT & PROCEDURES

Drilling Equipment Truck-mounted CME-55 drill rigs powered with 4 or 6 cylinder Ford industrial engines are used in advancing test borings. The 4 cylinder and 6 cylinder engines are capable of delivering about 4,350 and 6,500 foot/pounds torque to the drill spindle, respectively. The spindle is advanced with twin hydraulic rams capable of exerting 12,000 pounds downward force. Drilling through soil or softer rock is performed with 6 1/2 O.D., 3 1/4 I.D. hollow stem auger or 4 1/2 inch continuous flight auger. Carbide insert teeth are normally used on the auger bits so they can often penetrate rock or very strongly cemented soils which require blasting or very heavy equipment for excavation. Where refusal is experienced in auger drilling, the holes are sometimes advanced with tricone gear bits and NX rods using water or air as a drilling fluid. Where auger and tricone gear bits cannot be used to advance the hole due to cobbles or caving conditions, the ODEX (overburden drilling with the eccentric method) is used. A percussion down-the-hole hammer underreams the hole and 5 inch steel casing is introduced into the hole during drilling. The drill bit is eccentric and can be removed from the center of the casing to allow sampling of the material below the bit penetration depth.

Sampling Procedures Dynamically driven tube samples are usually obtained at selected intervals in the borings by the ASTM D1586 procedure. In many cases, 2" O.D., 1 3/8" I.D. samplers are used to obtain the standard penetration resistance. "Undisturbed" samples of firmer soils are often obtained with 3" O.D. samplers lined with 2.42" I.D. brass rings. The driving energy is generally recorded as the number of blows of a 140 pound 30 inch free fall drop hammer required to advance the samplers in 6 inch increments. However, in stratified soils, driving resistance is sometimes recorded in 2 or 3 inch increments so that soil changes and the presence of scattered gravel or cemented layers can be readily detected and the realistic penetration values obtained for consideration in design. These values are expressed in blows per foot on the logs. "Undisturbed" sampling of softer soils is sometimes performed with thin walled Shelby tubes (ASTM D1587). Where samples of rock are required, they are obtained by NX diamond core drilling (ASTM D2113). Tube samples are labeled and placed in watertight containers to maintain field moisture contents for testing. When necessary for testing, larger bulk samples are taken from auger cuttings.

Continuous Penetration Tests Continuous penetration tests are performed by driving a 2" O.D. blunt nosed penetrometer adjacent to or in the bottom of borings. The penetrometer is attached to 1 5/8" O.D. drill rods to provide clearance to minimize side friction so that penetration values are as nearly as possible a measure of end resistance. Penetration values are recorded as the number of blows of a 140 pound 30 inch free fall drop hammer required to advance the penetrometer in one foot increments or less.

Boring Records Drilling operations are directed by our field engineer or geologist who examines soil recovery and prepares boring logs. Soils are visually classified in accordance with the Unified Soil Classification System (ASTM D2487) with appropriate group symbols being shown on the logs.

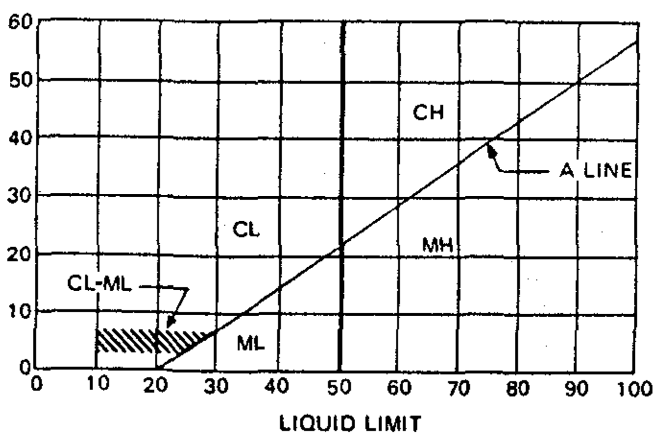
UNIFIED SOIL CLASSIFICATION SYSTEM

Soils are visually classified by the Unified Soil Classification system on the boring logs presented in this report. Grain-size analysis and Atterberg Limits Tests are often performed on selected samples to aid in classification. The classification system is briefly outlined on this chart. For a more detailed description of the system, see "The Unified Soil Classification System" Corp of Engineers, US Army Technical Memorandum No. 3-357 (Revised April 1960) or ASTM Designation: D2487-66T.

MAJOR DIVISIONS				GRAPHIC SYMBOL	GROUP SYMBOL	TYPICAL NAMES
COARSE-GRAINED SOILS (Less than 50% passes No. 200 sieve)	GRAVELS (50% or less of coarse fraction passes No. 4 sieve)	CLEAN GRAVELS (Less than 5% passes No. 200 sieve)			GW	Well graded gravels, gravel-sand mixtures, or sand-gravel-cobble mixtures.
					GP	Poorly graded gravels, gravel-sand mixtures, or sand-gravel-cobble mixtures.
		GRAVELS WITH FINES (More than 12% passes No. 200 sieve)	Limits plot below "A" line & hatched zone on plasticity chart		GM	Silty gravels, gravel-sand-silt mixtures.
			Limits plot above "A" line & hatched zone on plasticity chart		GC	Clayey gravels, gravel-sand-clay mixtures.
	SANDS (More than 50% of coarse fraction passes No. 4 sieve)	CLEAN SANDS (Less than 5% passes No. 200 seive)			SW	Well graded sands, gravelly sands.
					SP	Poorly graded sands, gravelly sands.
		SANDS WITH FINES (More than 12% passes No. 200 sieve)	Limits plot below "A" line & hatched zone on plasticity chart		SM	Silty sands, sand-silt mixtures.
			Limits plot above "A" line & hatched zone on plasticity chart		SC	Clayey sands, sand-clay mixtures.
FINE-GRAINED SOILS (50% or more passes No. 200 sieve)	SILTS (Limits plot below "A" line & hatched zone on plasticity chart)	SILTS OF LOW PLASTICITY (Liquid Limit Less Than 50)			ML	Inorganic silts, clayey silts with slight plasticity.
		SILTS OF HIGH PLASTICITY (Liquid Limit More Than 50)			MH	Inorganic silts, micaceous or diatomaceous silty soils, elastic silts.
	CLAYS (Limits plot above "A" line & hatched zone on plasticity chart)	CLAYS OF LOW PLASTICITY (Liquid Limit Less Than 50)			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
		CLAYS OF HIGH PLASTICITY (Liquid Limit More Than 50)			CH	Inorganic clays of high plasticity, fat clays, sandy clays of high plasticity.

NOTE: Coarse grained soils with between 5% & 12% passing the No. 200 sieve and fine grained soils with limits plotting in the hatched zone on the plasticity chart to have double symbol.

PLASTICITY CHART



DEFINITIONS OF SOIL FRACTIONS

SOIL COMPONENT	PARTICLE SIZE RANGE
Cobbles	Above 3 in.
Gravel	3 in. to No. 4 sieve
Coarse gravel	3 in. to ¾ in.
Fine gravel	¾ in. to No. 4 sieve
Sand	No. 4 to No. 200
Coarse	No. 4 to No. 10
Medium	No. 10 to No. 40
Fine	No. 40 to No. 200
Fines (silt or clay)	Below No. 200 sieve

TERMINOLOGY USED TO DESCRIBE THE RELATIVE DENSITY, CONSISTENCY OR FIRMNESS OF SOILS

The terminology used on the boring logs to describe the relative density, consistency or firmness of soils relative to the standard penetration resistance is presented below. The standard penetration resistance (N) in blows per foot is obtained by the ASTM D1586 procedure using 2" O.D., 1 3/8" I.D. samplers.

1. Relative Density. Terms for description of relative density of cohesionless, uncemented sands and sand-gravel mixtures.

N	Relative Density
0-4	Very loose
5-10	Loose
11-30	Medium dense
31-50	Dense
50+	Very dense

2. Relative Consistency. Terms for description of clays which are saturated or near saturation.

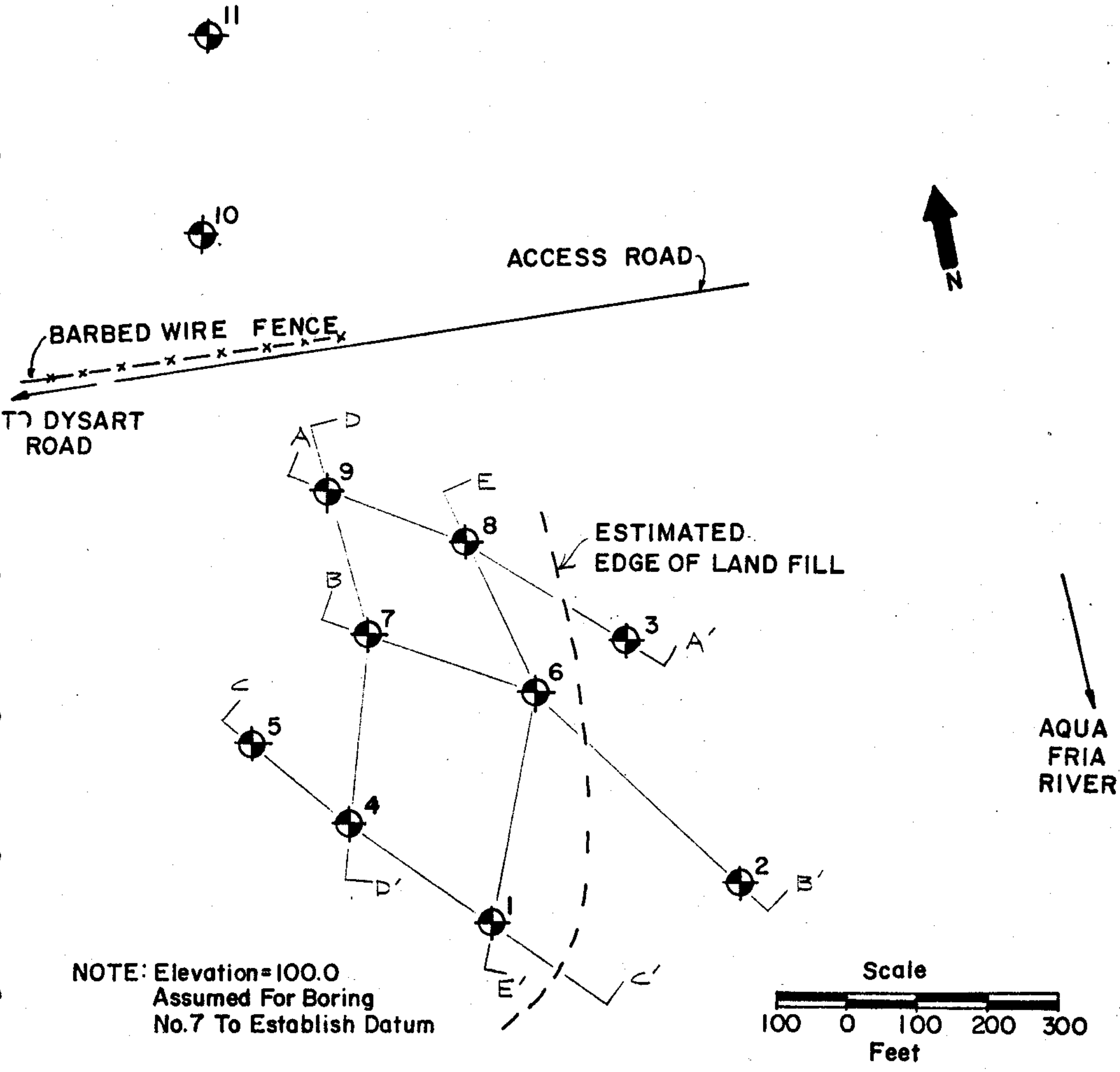
N	Relative Consistency	Remarks
0-2	Very soft	Easily penetrated several inches with fist.
3-4	Soft	Easily penetrated several inches with thumb.
5-8	Medium stiff	Can be penetrated several inches with thumb with moderate effort.
9-15	Stiff	Readily indented with thumb, but penetrated only with great effort.
16-30	Very stiff	Readily indented with thumbnail.
30+	Hard	Indented only with difficulty by thumbnail.

3. Relative Firmness. Terms for description of partially saturated and/or cemented soils which commonly occur in the Southwest including clays, cemented granular materials, silts and silty and clayey granular soils.

N	Relative Firmness
0-4	Very soft
5-8	Soft
9-15	Moderately firm
16-30	Firm
31-50	Very firm
50+	Hard

SITE PLAN

SHOWING LOCATIONS OF TEST BORINGS



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PROJECT Avondale Landfill

JOB NO. E84-220 DATE 11-12-84

LOG OF TEST BORING NO. 1

RIG TYPE CME-55

BORING TYPE 6½" Hollow Stem Auger

SURFACE ELEV. 96.8'

DATUM Assumed - See Site Plan

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0								SM	slightly moist	FILL SILTY SAND, some medium & coarse sand, non-plastic, light brown
5										REFUSE
10										
15										
20			X	* S	58			SP	slightly moist	SAND, some medium sand, trace of silt & coarse sand, nonplastic, brown note: thin lenses of sandy gravel
25										Stopped auger at 22'6" Stopped sampler at 24' Hole caved to 15' * Sample to SCS Engineers

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A – Auger cuttings. B – Block sample

S – 2" O.D. 1.38" I.D. tube sample.

U – 3" O.D. 2.42" I.D. tube sample.

T – 3" O.D. thin-walled Shelby tube.

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LOG OF TEST BORING NO. 2

JOB NO. E84-220 DATE 11-12-84

RIG TYPE CME-55
BORING TYPE 6½" Hollow Stem Auger
SURFACE ELEV. 89.7'
DATUM Assumed - See Site Plan

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0–10		o o o						SW	slightly moist	SAND, trace to some gravel, trace of silt, well graded, nonplastic, brown note: cobbles at 6' note: some to considerable gravel below 6'
10										Stopped auger at 10'

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A – Auger cuttings. B – Block sample
S – 2" O.D. 1.38" I.D. tube sample.
U – 3" O.D. 2.42" I.D. tube sample.
T – 3" O.D. thin-walled Shelby tube.

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JOB NO. E84-220 DATE 11-12-84

LOG OF TEST BORING NO. 3

RIG TYPE CME-55

BORING TYPE 6½" Hollow Stem Auger

SURFACE ELEV. 90.4'

DATUM Assumed - See Site Plan

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0–12								SW	slightly moist to moist	SAND, trace to some gravel, trace of silt, subrounded to rounded, nonplastic, brown note: cobbles at 6'
12–15								GP	moist	SANDY GRAVEL, some cobbles, subrounded to rounded, nonplastic, brown
										Stopped auger at 15'

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A – Auger cuttings. B – Block sample

S – 2" O.D. 1.38" I.D. tube sample.

U – 3" O.D. 2.42" I.D. tube sample.

T – 3" O.D. thin-walled Shelby tube.

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JOB NO. E84-220 DATE 11-12-84

LOG OF TEST BORING NO. 4

RIG TYPE CME-55

BORING TYPE 6½" Hollow Stem Auger

SURFACE ELEV. 98.1'

DATUM Assumed - See Site Plan

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0–12										REFUSE
12–21		o o o						SW	moist	SAND, some gravel, well graded, nonplastic, brown note: occasional grades to GP
20		o o o	X	S*	47					
										Stopped auger at 19'6" Stopped sampler at 21' Hole caved to 9' * Sample to SCS Engineers

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A – Auger cuttings. B – Block sample

S – 2" O.D. 1.38" I.D. tube sample.

U – 3" O.D. 2.42" I.D. tube sample.

T – 3" O.D. thin-walled Shelby tube.

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PROJECT Avondale Landfill

JOB NO. E84-220 DATE 11-12-84

LOG OF TEST BORING NO. 5

RIG TYPE CME-55

BORING TYPE 6½" Hollow Stem Auger

SURFACE ELEV. 90.2'

DATUM Assumed - See Site Plan

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0		o o o o o						SW		FILL
									slightly moist	SILTY SAND, some medium to coarse sand, non-plastic, brown
5										REFUSE
10										
15										Auger refused at 13' Sampler refused at 13'8"
										note: drill rig moved 3' north and resumed drilling

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A – Auger cuttings. B – Block sample

S – 2" O.D. 1.38" I.D. tube sample.

U – 3" O.D. 2.42" I.D. tube sample.

T – 3" O.D. thin-walled Shelby tube.

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JOB NO. E84-220 DATE 11-12-84

LOG OF TEST BORING NO. 5A

RIG TYPE CME-55

BORING TYPE 6½" Hollow Stem Auger

SURFACE ELEV. 90.2'±

DATUM Assumed - See Site Plan

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0										REFUSE
5										
10										
15			☒	U	48		4	GP	slightly moist to moist	SANDY GRAVEL, well graded, subrounded to rounded, nonplastic, brown
20			☒ *	S	44					note: grades to gravelly sand
25										Stopped auger at 19'6" Stopped sampler at 21' Hole caved to 10' * Sample to SCS Engineers

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A – Auger cuttings. B – Block sample

S – 2" O.D. 1.38" I.D. tube sample.

U – 3" O.D. 2.42" I.D. tube sample.

T – 3" O.D. thin-walled Shelby tube.

SERGENT, HAUSKINS & BECKWITH

CONSULTING GEOTECHNICAL ENGINEERS

PHOENIX · ALBUQUERQUE · SANTA FE · SALT LAKE CITY · EL PASO

PROJECT Avondale Landfill

JOB NO. E84-220 DATE 11-13-84

LOG OF TEST BORING NO. 6

RIG TYPE CME-75

BORING TYPE 6½" Hollow Stem Auger

SURFACE ELEV. 98.0'

DATUM Assumed - See Site Plan

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0–8								SM	slightly moist to moist	FILL SILTY SAND, some medium to coarse sand, non-plastic, brown note: grades to sandy gravel
8–34										REFUSE
20			▭	S	50/5 3/4"					
25			☒	S	86					
30			☒	S	63					
34–37								SP	moist	SAND, poorly graded, subrounded, nonplastic, brown
35			☒	S	50		5			
37–48								GP	moist very moist to saturated at 45'	SANDY GRAVEL, trace to some cobbles, subrounded, nonplastic, dark brown
39.5			*							
40			☒	S	50/5 3/4"					
48										Auger refused at 48' Hole caved to 30' * Sample to SCS Engineers

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A – Auger cuttings. B – Block sample

S – 2" O.D. 1.38" I.D. tube sample.

U – 3" O.D. 2.42" I.D. tube sample.

T – 3" O.D. thin-walled Shelby tube.

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PROJECT Avondale Landfill

JOB NO. E84-220 **DATE** 11-13-84

LOG OF TEST BORING NO. 7

RIG TYPE: CME-75
BORING TYPE: 6½" Hollow Stem Auger
SURFACE ELEV.: 100.0'
DATUM: Assumed - See Site Plan

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0–5								SM	slightly moist	FILL SILTY SAND, some medium to coarse sand, trace to some gravel, subrounded, nonplastic, brown
5–17										REFUSE note: thin sandy cover at 13'
15			☒	S	9					
17–23			☒	S	32		3	SM	slightly moist to moist	SILTY SAND, subrounded, nonplastic, brown
23–28			☒	S	23		4	SW	slightly moist to moist	GRAVELLY SAND, subrounded, nonplastic, brown note: considerable gravel at 18' - 19'
28–31			☒	*S	59			GP	moist	SANDY GRAVEL, some to considerable cobbles, subrounded to rounded, nonplastic, brown

Auger refused at 29'6"
Stopped sampler at 31'

* Sample to SCS Engineers

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A – Auger cuttings. B – Block sample
S – 2" O.D. 1.38" I.D. tube sample.
U – 3" O.D. 2.42" I.D. tube sample.
T – 3" O.D. thin-walled Shelby tube.

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JOB NO. E84-220 DATE 11-13-84

LOG OF TEST BORING NO. 8

RIG TYPE CME-75

BORING TYPE 6½" Hollow Stem Auger

SURFACE ELEV. 98.6'

DATUM Assumed - See Site Plan

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0–1								SM		FILL
1–5									slightly moist	SILTY SAND, some to considerable gravel, subrounded, nonplastic, brown
5–19										REFUSE
20			☒	S	18		5	SW-SM	slightly moist	SAND, trace to some gravel, subrounded, nonplastic, brown. note: occasional grades to sandy gravel
25			☒	S	50		4			
26.5–30			☒	* S	80			GP	slightly moist	SANDY GRAVEL, trace to some cobbles, subrounded to rounded, nonplastic, brown

Auger refused at 28'6"
Stopped sampler at 30'

* Sample to SCS Engineers

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A – Auger cuttings. B – Block sample
S – 2" O.D. 1.38" I.D. tube sample.
U – 3" O.D. 2.42" I.D. tube sample.
T – 3" O.D. thin-walled Shelby tube.

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PROJECT Avondale Landfill

JOB NO. E84-220 DATE 11-13-84

LOG OF TEST BORING NO. 9

RIG TYPE CME-75

BORING TYPE 6½" Hollow Stem Auger

SURFACE ELEV. 92.1'

DATUM Assumed - See Site Plan

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0								SM	slightly moist	SILTY SAND, some gravel, nonplastic, brown
										REFUSE
5										
10			☒	S	55					
15			☒	S	45		2	GP-GM	slightly moist	SANDY GRAVEL, subrounded, nonplastic, brown
										Stopped auger at 14'6" Stopped sampler at 16'
20										

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A – Auger cuttings. B – Block sample

S – 2" O.D. 1.38" I.D. tube sample.

U – 3" O.D. 2.42" I.D. tube sample.

T – 3" O.D. thin-walled Shelby tube.

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PROJECT Avondale Landfill

JOB NO. E84-220 DATE 11-13-84

LOG OF TEST BORING NO. 10

RIG TYPE CME-75

BORING TYPE 6½" Hollow Stem Auger

SURFACE ELEV. 89.8'

DATUM Assumed - See Site Plan

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0–5								CL	slightly moist	SANDY CLAY, considerable fine sand, low plasticity, brown
10								SW	slightly moist to moist	GRAVELLY SAND, well graded, subrounded, nonplastic, brown
15			☒	S	53		2	GP	slightly moist	SANDY GRAVEL, well graded sand, subrounded to rounded, nonplastic, brown note: cobbles below 18'
20			☒	A						
24				S	50/0" (no recovery)					
25										Auger refused at 24' Sampler refused at 24' Hole caved to 8'6"

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A – Auger cuttings. B – Block sample

S – 2" O.D. 1.38" I.D. tube sample.

U – 3" O.D. 2.42" I.D. tube sample.

T – 3" O.D. thin-walled Shelby tube.

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PROJECT Avondale Landfill

JOB NO. E84-220 DATE 11-13-84

LOG OF TEST BORING NO. 11

RIG TYPE CME-75

BORING TYPE 6½" Hollow Stem Auger

SURFACE ELEV. 90.7'

DATUM Assumed - See Site Plan

Depth in Feet	Continuous Penetration Resistance	Graphical Log	Sample	Sample Type	Blows per foot 140 lb. 30" free-fall drop hammer	Dry Density Lbs. per cu. ft.	Moisture Content Per Cent of Dry Wt.	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0			X	A				CL	slightly moist to moist	SANDY CLAY, low plasticity, brown note: grades to sandy clay, medium plasticity at 3'
5			X	A				SW	moist	GRAVELLY SAND, well graded, subrounded, nonplastic, brown note: occasional grades to sandy gravel cobbles at 13'
15			X	S	23		4			
20			X	S	63 (no recovery)			GP	moist	SANDY GRAVEL & COBBLES, subrounded to rounded, nonplastic, brown
25										Auger refused at 19' Stopped sampler at 20'6" Hole caved to 11'6"

GROUND WATER

DEPTH	HOUR	DATE
	none	

SAMPLE TYPE

A – Auger cuttings. B – Block sample

S – 2" O.D. 1.38" I.D. tube sample.

U – 3" O.D. 2.42" I.D. tube sample.

T – 3" O.D. thin-walled Shelby tube.

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LABORATORY TESTING PROCEDURES

Consolidation Tests Soiltest or Clockhouse apparatus of the "floating-ring" type are employed for the one-dimensional consolidation tests. They are designed to receive one inch high 2.5 inch O.D. brass liner rings with soil specimens as secured in the field. Procedures for the tests generally are those outlined in ASTM D2435. Loads are applied in several increments to the upper surface of the test specimen and the resulting deformations are recorded at selected time intervals for each increment. For soils which are essentially saturated, each increment of load is maintained until the deformation versus log of time curve indicates completion of primary consolidation. For partially saturated soils, each increment of load is maintained until the rate of deformation is equal or less than 1/10,000 inch per hour. Applied loads are such that each new increment is equal to the total previously applied loading. Porous stones are placed in contact with the top and bottom of the specimens to permit free addition or expulsion of water. For partially saturated soils, the tests are normally performed at in situ moisture conditions until consolidation is complete under stresses approximately equal to those which will be imposed by the combined overburden and foundation loads. The samples are then submerged to show the effect of moisture increase and the tests continued under higher loadings. Generally, the tests are continued to about twice the anticipated curve due to overburden and structural loads with a rebound curve then being established by releasing loads.

Expansion Tests The same type of consolidometer apparatus described above is used in expansion testing. Undisturbed samples contained in brass liner rings are placed in the consolidometers, subjected to appropriate surcharge loads and submerged. The loads are maintained until the expansion versus log of time curve indicates the completion of "primary swell".

Direct Shear Tests Direct shear tests are run using a Clockhouse or Soiltest apparatus of the strain-control of approximately 0.05 inches per minute. The machine is designed to receive one of the one inch high 2.42 inch diameter specimens obtained by tube sampling. Generally, each sample is sheared under a normal load equivalent to the effective overburden pressure at the point of sampling. In some instances, samples are sheared at several normal loads to obtain the cohesion and angle of internal friction. When necessary, samples are saturated and/or consolidated before shearing in order to approximate the anticipated controlling field loading conditions.

TABULATION OF TEST RESULTS

Job No. E84-220
W/O 1

HOLE NO	DEPTH	UNIFIED CLASS	L.L.	P.I.	#200 .75"	#100 1"	#50 1.5"	#40 2"	#30 2.5"	#16 3"	#10 3.5"	#8 4"	#4 6"	.25" 8"	.375" 10"	.5" 12"	LAB NO
5A	14.5′-16′	GP	-	NP	4.9	8	15	19	25	38	44	45	50	52	57	59	
					63	70	100										4-220-1
6	34.5′-36′	SP	-	NP	4.8	8	19	36	64	96	99	99	100				4-220-2
7	19.5′-21′	SM	-	NP	29.5	30	34	39	45	64	76	78	85	87	91	93	
					93	100											4-220-3
7	24.5′-26′	SW-SM	-	NP	7.7	11	19	31	50	76	82	84	85	85	87	87	
					100												4-220-4
8	19.5′-21′	SP-SM	-	NP	6.9	11	24	40	60	86	94	95	98	100			4-220-5
8	24.5′-26′	SW-SM	-	NP	7.6	11	19	28	40	61	68	71	75	77	77	78	
					84	84	100										4-220-6
9	14.5′-16′	GP-GM	-	NP	8.3	11	17	20	25	34	39	40	45	48	55	63	
					88	100											4-220-7
10	14.5′-16′	GP	-	NP	3.9	6	9	12	14	21	26	32	33	36	41	48	
					69	80	100										4-220-8
11	14.5′-16′	SW-SM	-	NP	9.4	13	21	34	50	74	80	80	83	83	85	87	
					87	100											4-220-12

REPORT ON LABORATORY TESTS

DATE ____________

PROJECT Avondale Landfill JOB NO. E84-220

LOCATION Yuma & Dysart Roads; Avondale, Arizona LAB NO. 4-220-1

SAMPLE Boring 5A @ 14½'-16'

DIRECT SHEAR TESTS

In Situ - Point No. 1 (= ± .995 KSF) SAMPLE UNOBTAINABLE

Initial Moisture Content	____ %
Dry Density (PCF)	____
Submerged	
Final Moisture Content	____ %
Maximum Vertical Deformation @ T Max.	____ Inches
Shearing Stress, T Max.	____ KSF

In Situ - Point No. 2 (= ± 2.998 KSF)

Initial Moisture Content	8.2 %
Dry Density (PCF)	102.2
Submerged	
Final Moisture Content	24.6 %
Maximum Vertical Deformation @ T Max.	(-) 0.014 Inches
Shearing Stress, T Max.	3.02 KSF

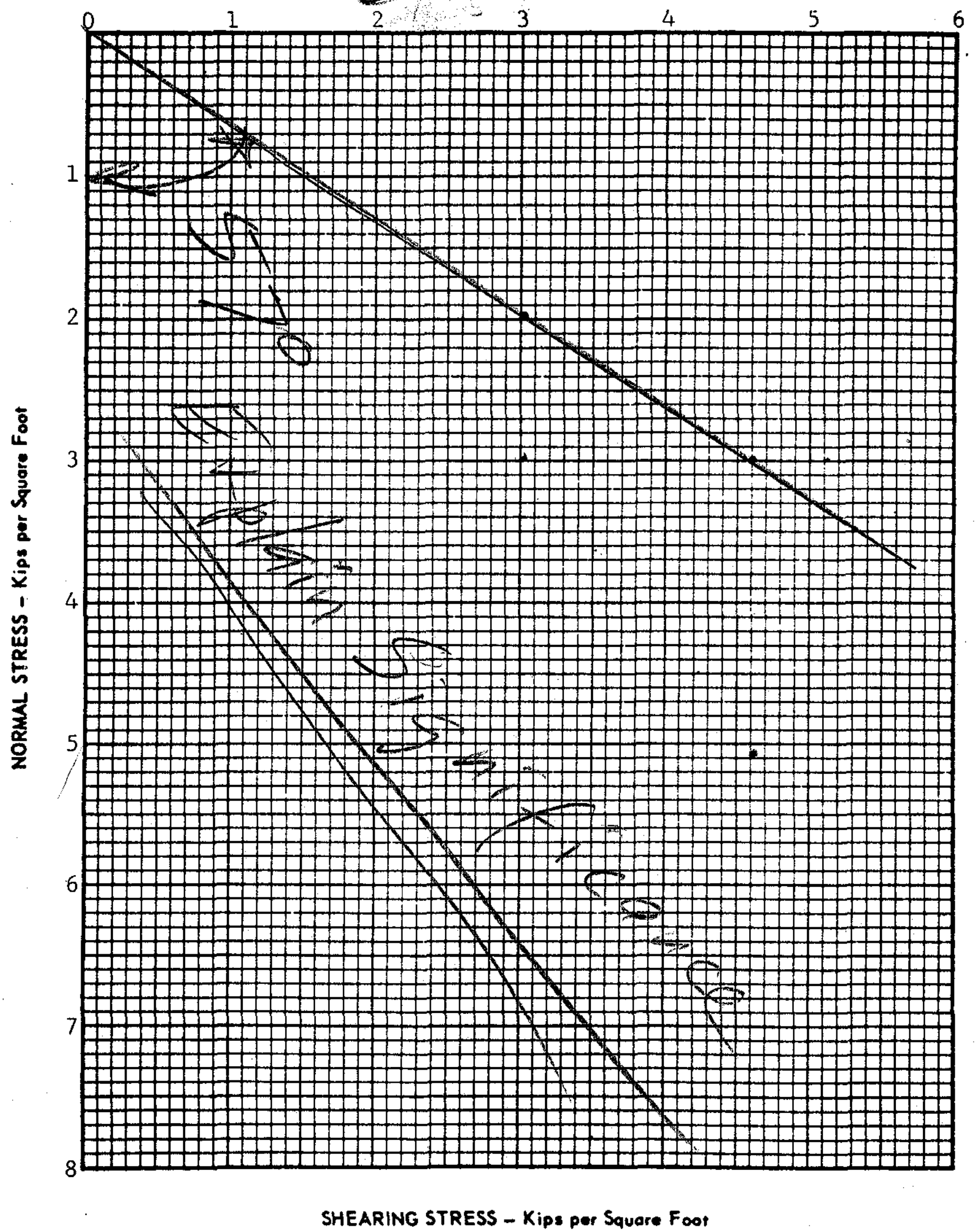
In Situ - Point No. 3 (= ± 5.08 KSF)

Initial Moisture Content	5.2 %
Dry Density (PCF)	107.3
Submerged	
Final Moisture Content	17.3 %
Maximum Vertical Deformation @ T Max.	(-) 0.009 Inches
Shearing Stress, T Max.	4.60 KSF

SUMMARY OF DIRECT SHEAR TESTS

PROJECT Avondale Landfill **JOB NO.** E84-220

Boring 5A @ 14½'-16' Lab No. 4-220-1



SOIL MOISTURE CONDITION

O – INSITU
● – SUBMERGED

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APPENDIX 2

LABORATORY REPORTS
(SCS AND WCAS)

WEST COAST ANALYTICAL SERVICE, INC
9840 Alburtis Ave.
Santa Fe Springs, CA 90670

SCS Engineers
4014 Long Beach Blvd.
Long Beach, CA 90807

ATTN: Ken LaConde

Job Number 1272 December 6, 1984

LABORATORY REPORT

Samples: Two (2) landfill gas samples
Date Received: 11-27-84
Purchase Order No.: 18422

The samples were analyzed for trace volatile organic components by GCMS. The results are as follows:

	Parts Per Million	
	1A	9B
vinyl chloride	1.4	0.5
1,1,1-trichloroethane	.3	ND<.3
benzene	.6	.2
trichloroethene	.4	.8
tetrachloroethene	.6	ND<.3
toluene	9.8	2.9
dichlorofluoromethane*	5	.5
trichlorofluoromethane*	2	ND<.3
dimethyl sulfide*	5	ND<.5
Freon TF*	.5	0.5
methlene chloride*	2	0.2
carbon disulfide*	.5	0.5
ethylbenzene	2	1
C4-C7 hydrocarbon*	20	5
xylenes*	5	3

*Approximate

Joe Bramblett
Laboratory Manager

D. J. Northington, Ph.D.
Technical Director

We would appreciate a telephone call if you have any questions about this report. (213)948-2225

SCS ENGINEERS
ANALYTICAL LABORATORY

December 17, 1984
File No. 18422

TO: K. Saigal

FROM: K. LaConde

SUBJECT: Analysis of Soil and Gas Samples from Avondale

The SCS laboratory has completed their phase of the analytical investigation on both soil and gas samples. Nine (9) soil samples were analyzed for a variety of parameters to determine whether leachate has migrated through the soil profile beneath the landfill. Analytical results are presented in Table 1.

In addition, four landfill gas samples, 2 each from probes installed at BH-1 amd BH-9, were obtained and analyzed for the presence of volatile priority pollutants. This data is presented in Table 2.

For location of boreholes and method of collecting the soil samples, refer to "Geotechnical Investigation Report, Avondale Landfill," provided for in the Appendix of this report.

<u>Discussion of Results</u>

A. Soils

Soil samples labeled BH-1, -4, -5, -6, -7, and -8 were taken from boreholes 1, 4, 5, 6, 7, and 8. Samples marked B-10 (flight), B-10 (bit), and BH-11 were taken as controls from a field adjacent to the site. A summary of results follows:

<u>pH</u> - No significant differences.

<u>EC (electro conductivity)</u> - BH-4 significantly higher than others. This may be a highly localized condition or could be the result of excessive dissolved salts migration.

<u>Organic Carbon</u> - BH-1 and -4 are higher than other samples, but not sufficiently high to indicate leachate contamination.

<u>Chlorides</u> - BH-1 about twice as high as others, indicating possible higher salt concentrations.

4014 LONG BEACH BOULEVARD LONG BEACH, CALIFORNIA 90807-2687 (213) 494-2828

Heavy Metals - All results within ranges typically reported for soils. High Zn concentration for B-10 (Bit) may be contamination from sampling equipment.

Based on the data in Table 1, the data suggest that samples BH-1 and -4 have enhanced levels of some parameters. This may be the result of leachate migration or from other unknown causes.

B. Landfill Gas

Data from GC and GC/MS landfill gas analysis appear to be typical of landfills that we have seen over the years. The one element of concern, vinyl chloride, is slightly in excess of 1 ppm in Sample 1.

TABLE 1. CHEMICAL ANALYSIS OF SOILS SAMPLES FROM AVONDALE LANDFILL, ARIZONA

Sample No.	pH	Moisture (%)	EC (umhos/cm)	Chlorides*	Organic* Carbon	Cd*	Cr(+6)*	Cu*	Pb*	Zn*
BH-1	8.3	4.8	462	130	0.27	<0.1	<0.2	16.6	2.2	54.3
BH-4	8.4	17.5	1,780	24.2	0.06	<0.1	<0.2	7.1	2.2	109
BH-5	8.1	Dry	368	44.9	0.29	<0.1	<0.2	<0.1	<0.5	86.2
BH-6	8.2	9.4	306	79.6	0.04	0.21	<0.2	21	1.7	65.8
BH-7	7.7	0.7	299	16.8	0.04	<0.1	<0.2	15.2	1.1	66.0
BH-8	8.2	1.4	295	84.9	0.03	0.16	<0.2	17.6	5.7	54.4
BH-10 Flight†	8.4	2.5	340	75.0	0.15	0.1	<0.2	21.3	3.7	56.0
BH-10 Bit†	8.4	1.9	333	78.3	0.03	0.06	<0.2	22.9	4.5	2,028
BH-11†	8.7	3.2	336	62.1	0.08	0.24	<0.2	19.0	8.2	96

* All data reported in terms of mg/kg air-dried soil.

† Control samples.

SCS ENGINEERS
ANALYTICAL LABORATORY

MEMO

December 3, 1984
File No. 18422

TO: Galen Petoyan

FROM: Ken LaConde

SAMPLES: Landfill Gas Samples From Avondale Landfill, Arizona

RESULTS

Four (4) landfill gas samples were received - there were 2 sets of duplicates. One set was analyzed by the SCS Lab. The other set was taken to WCAS for GC/MS analysis. SCS lab results were as follows:

	% v/v				
Sample	CO_2	O_2	N_2	CH_4	Pressure
BH-1	28.9	4.0	43.6	23.5	Yes
BH-9	22.3	8.1	49.0	20.6	Low

APPENDIX 3

ARIZONA DEPARTMENT OF HEALTH SERVICES
"NOTICE OF DISPOSAL" FORM AND INSTRUCTIONS

INSTRUCTIONS FOR COMPLETING THE NOTICE OF DISPOSAL FORM

Comment: If additional space is required to provide the requested information in any line number attach additional sheets/documents.

Line Number

1a. Enter the name of the facility.

b. Enter the name of facility owner.

c. Enter the name, title, mailing address, and telephone number of contact person for the facility. This person should be thoroughly familiar with the facts reported on this form in the event that contact regarding the NOD must be made.

d. Enter the mailing address and telephone number of the facility. This address may include a P.O. Box number or an address different from the physical location of the facility.

e. Enter the physical location of the facility by street, city and county and by Township, Range and Section designations.

f. Give narrative directions to the facility site; this will facilitate any site visits by ADHS inspectors.

g. List the landowner of the facility site.

h. Check the appropriate type of permit you are applying for.

i. Check the appropriate facility type: new or existing. Facility types are defined in R9-20-203.

2a. Include the described map attachment with the required information. Include latitude, longitude, and U.S.G.S. numbers for all wells (of the form: A-19-29 36 abc). Approximate vicinity means that area within a one-quarter mile radius of the facility boundary and of the disposal area if disposal is off-site.

b. List Latitude/Longitude of all disposal locations (to the nearest 5 seconds).

3a. Enter the type of facility. Examples: electroplating shop, dry cleaners, car wash, etc.

b. Enter a description of the activities conducted at the facility. Examples would be: describing the industrial processing occurring within the facility; the major product(s) produced the service provided.

c. List the Standard Industrial Classification Code(s) from the Standard Industrial Classification Manual 1972 (OMB) applicable to the activities described in 3b. Enter the code number(s) that best describe the major product(s) or service(s) produced or provided.

4. Enter the date the facility began or will begin operations.

5. Enter the expected operational lifetime of the facility.

6. Enter other environmental permits issued to the facility. Examples would be: air quality, NPDES, wastewater reuse, and hazardous waste permits.

7a. Enter the process or method of disposal activity conducted by the facility. Examples would be: burial of wastes; discharge to percolation ponds; leaks; spills; surface applications; etc. Be sure to describe the disposal process or method for all disposal locations identified on the attached map required by line 2, and to identify the source of all disposals.

b. List any control measures and treatment processes designed and operated to protect groundwater quality from any adverse disposal affects. Examples would be: lined ponds; controlled release schedules; drain field collection systems; controlled application rates; physical, chemical, biological treatment systems.

c. Enter those uses of groundwater of the receiving aquifer(s). Examples would be: industrial wells; drinking water supply wells; irrigation wells. Be sure to list and identify the use of all groundwater withdrawal wells shown on the map required by line 2.

d. Note depth to groundwater, source of data, and date of measurement.

e. Enter in Appendix A-Part I the ambient groundwater concentrations of the receiving aquifer(s) for those constituents listed that are contained in the disposal. Indicate source of data and date of sampling for all values listed.

8a. Identify the type(s) of waste(s) generated by each process within the facility. Be as descriptive as possible without listing specific constituents. Examples would be: leachate from tailings dams, spent solutions from solvent extraction tanks, secondary effluent from aerobic stabilization tanks, sludge from digesters, etc.

b. Self explanatory.

c. Self explanatory.

d. Indicate the yearly average disposal schedule in hours per day and days per year and the disposal periods if the disposal is seasonal.

e. Indicate flow rate(s) of disposals using the appropriate units. Examples would be: minimum, average, and maximum daily, seasonal and annual flow rates in gallons/day; application rates inches/day; percolation rates in inches/day; or total quantity (gallons) spilled or leaked; etc.

9. If a groundwater quality monitoring program has been initiated describe in detail the scope of the program. Include such information as; the number of monitoring wells and their location; well construction information and geologic log; depth to groundwater in each well; parameters analyzed; perforated intervals in which samples are collected; frequency of sample collection; analytical results; etc.

10. Include any other data or information which you feel demonstrates that your facility qualifies for a groundwater quality protection permit based upon compliance with criteria listed in R9-20-208.A. Examples would be: depth to groundwater; amount of groundwater produced from wells in the vicinity; geology at the site; design and construction plans which further exemplify control measures described in line 7b; hydrogeologic data which exemplify that no aquifers exist in the discharge impact area; data from effluent analyses indicating that disposal constituent concentrations are less than or equal to ambient groundwater concentrations of those constituents; groundwater monitoring program data and hydrogeologic data which support that groundwater contamination is not and will not occur or that no wastes or pollutants will enter an aquifer in sufficient quantities to violate adopted groundwater quality standards.

11. Notice of Disposal Forms shall be signed as follows pursuant to R9-20-207:

    1.) For a corporation: by a responsible corporate executive at the level of at least vice president of the firm, or the manager of its Arizona operation if a multistate corporation;

    2.) For a partnership or sole proprietorship: by a general partner or the proprietor, respectively;

    3.) For a municipality, State, Federal or other public agency: by either a principal executive officer or ranking elected official.

Table I

Allowable limits and monitoring requirements are established for these parameters pursuant to R9-8-221 and R9-8-222.

Microbiological

- Fecal Coliforms

Inorganic Chemicals

- Arsenic
- Barium
- Cadmium
- Chromium
- Lead
- Mercury
- Nitrate (as N)
- Selenium
- Silver
- Fluoride

Organic Chemicals

- Chlorinated hydrocarbons
  - endrin
  - lindane
  - methoxychlor
  - toxaphene
- Chlorophenoxys
  - 2, 4-D
  - 2, 4, 5-TP Silvex
- Total Trihalomethanes (TTHM)

Radiochemicals

- radium-226
- radium-228
- gross alpha particle activity
- beta particles

Radionuclides

- Tritium
- Strontium-90/89
- Cesium-134
- Uranium
- Iodine-131

Secondary Contaminants

- Alkalinity
- Calcium
- Chloride
- Copper
- Hardness
- Iron
- Magnesium
- Maganese
- pH
- Sodium
- Sulfate
- Total Dissolved Solids (TDS)
- Zinc

ADDENDUM TO THE NOTICE OF DISPOSAL FORM INSTRUCTIONS

Facilities with no leakage or discharge to groundwater

Facilities which are designed or constructed such that there will be no migration of wastes or pollutants into the vadose zone or groundwater, will be issued a permit by the Director of ADHS pursuant to R9-20-208.A.1., after receipt and review of a completed Notice of Disposal (NOD). Such facilities are not required to submit the constituent concentration data requested in lines 7e and 8c. However, they are required to list or identify the constituents in their waste effluent under question 8b.

Facilities discharging to groundwater

Facilities which are not designed to prevent migration of wastes or pollutants into the vadose zone or groundwater, must submit all of the information requested in line items 1-11 of the NOD, including lines 7e, 8b, and 8c. To receive a groundwater permit, such facilities must meet requirements outlined in R9-20-208.A.2.

- Question 7e - Enter the ambient groundwater concentrations on the line provided in Appendix A - Part I for only those constituents which were identified in question 8b. This data may be available from a variety of sources such as: your own facility well data, adjacent property well data, or from the Basic Data Unit of the Department of Water Resources, at 255-1543.

- Question 8b - Check off, circle, or identify those constituents listed in Appendix A - Part II, which are contained or are expected to be contained in your facilities disposal waste stream. If a constituent in your disposal waste stream is not listed, please write the constituent in the lines provided on the last page of Appendix A.

- Question 8c - Enter the maximum disposal concentrations on the line provided in Appendix A - Part II for only those constituents identified in question 8b. Actual concentrations from a laboratory analysis is preferred. However, typical values for your industry may be substituted if necessary. If you are submitting test results, please indicate the name of the laboratory and the date of the results. If you are submitting typical or characteristic values, the information source or development document must be indicated.

NOTICE OF DISPOSAL FORM

1.) a. Facility name ______________________________

b. Facility Owner ______________________________

c. Name, title, address, and telephone number of contact person for facility.

Name: ______________________________

Title: ______________________________

Mailing address: ______________________________

____

______________ Zip Code ______________

Telephone number: ______________________________
(Area Code)

d. Address and telephone number of facility:

Mailing address: ______________________________

____

______________ Zip Code ______________

Telephone number: ______________________________
(Area Code)

e. Facility location information:

____

____

______________ Zip Code ______________

______________ County, Arizona

Township ______________________________

Range ______________________________

Section ______________________________

__________ ¼ __________ ¼ __________

f. Describe access to facility ____________________

____

____

g. Landowner of facility site ____________________

h. Type of Permit you are applying for:

area permit ______ individual facility permit __________

i. Type of facility requesting permit:

new _________ existing __________

2.) a. Attach a topographic map (preferably a 7.5 minute quadrangle base), showing the geographic location of the facility(s) and all disposal locations. In addition, show the location of any existing groundwater withdrawal wells within the approximate vicinity (¼ mile radius) of the disposal area and identify the use of each well (i.e. industrial wells, drinking water supply wells, etc.). (If applying for an area permit as described in R9-20-211, indicate on the map the location of each facility and disposal location in the proposed permitted area).

b. List Latitude/Longitude of all disposal locations indicated on the attached map ____________________

____

____

3.) a. Type of Facility(s) ____________________

b. Nature of Activity conducted at facility(s) __________

____

____

____

c. List applicable U.S. Department of Commerce Standard Industrial Classification (SIC) Codes for above activities

____

____

4.) Date Facility began/will begin operating ____________

5.) Expected Facility(s) Operational Lifetime ____________

6.) List any other environmental permits issued to the facility(s) (i.e. air quality permit, NPDES permit, hazardous waste permit)

7.) a. Describe disposal acitivites at the facility(s) ____________

b. Describe any control measures and treatment processes designed and operated to protect groundwater quality from effects of the disposal ____________

c. Describe existing groundwater use(s) of the receiving aquifer(s) ____________

d. Note of depth to groundwater ____________________

Source of data ____________________

Date of measurement ____________________

e. Enter in Appendix A - Part I the ambient groundwater concentrations of the receiving aquifer(s) for those constituents listed that are contained in the disposal. Indicate source of data and date of sampling for all values listed.

8.) a. Identify the type(s) of waste(s) generated by each process within the facility. Be as descriptive as possible without listing specific constituents.

____

____

____

____

____

b. Check of list in Appendix A - Part II of the specific pollutants disposed by the facility. Include those disposed materials that are listed in Tables I and II of this document, in Title 40 Code of Federal Regulations Part 261, or any other constituent contained in the disposed waste stream.

c. Enter in Appendix A - Part II the maximum disposal concentration of those constituents you checked or listed, as required by 8b. Indicate the date of sampling in parenthesis next to the sample value and the source of the data at the bottom of page three in Appendix A.

d. Estimate the disposal schedule including the annual average in hours per day, days per year, and the disposal periods if the disposal is seasonal.

Hours/day ____________________

Days/year ____________________

Seasonal Distribution of Disposal ____________________

e. Estimate the flow rate(s) of the disposal (i.e. minimum, average, and maximum daily flow; mean annual flow; or mean, minimum, and maximum flow by season if disposal is periodic; or by whatever other units appropriate to the type of disposal.

____

____

____

____

9.) Describe any existing groundwater quality monitoring program(s) (attach supporting technical reports if available)_________

____

____

____

____

10.) Include any other data or information which, in the judgement of the owner/operator, demonstrates that the facility qualifies for a groundwater quality protection permit based on compliance with the criteria listed in R9-20-208.A. Use attachments if applicable (i.e. depth to groundwater, geology at the site).

____

____

____

____

11.) Certification:

"I certify that under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment."

Printed Name of Applicant

Title

Date Application Signed

Signature of Applicant

Appendix A - NOTICE OF DISPOSAL FORM

Ambient Groundwater and Maximum Disposal Waste Stream Constituent Concentrations

	PART I Ambient Groundwater	Units	PART II Disposal Waste Stream
Microbiological			
Fecal Coliform Bacteria	______	#/100 ml	______
Inorganic Chemicals			
Arsenic	______	mg/l	______
Barium	______	mg/l	______
Cadmium	______	mg/l	______
Chromium (Total)	______	mg/l	______
Lead	______	mg/l	______
Mercury	______	mg/l	______
Nitrate (as N)	______	mg/l	______
Selenium	______	mg/l	______
Silver	______	mg/l	______
Fluoride	______	mg/l	______
Organic Chemicals			
Chlorinated Hydrocarbons			
Endrin	______	mg/l	______
Lindane	______	mg/l	______
Methoxychlor	______	mg/l	______
Toxaphene	______	mg/l	
Chlorophenoxys			
2, 4-D	______	mg/l	______
2, 4, 5TP Silvex	______	mg/l	______
Total Trihalomethanes	______	mg/l	______

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	PART I Ambient Groundwater	Units	PART II Disposal Waste Stream
Radiochemicals			
Combined radium-226 and radium-228	________	pCi/l	________
Gross alpha particle activity (including radium-226 but excluding radon and Uranium)	________	pCi/l	________
Beta particle and photon emitters from man-made radionuclides	________	pCi/l	________
Secondary Contaminants			
Alkalinity	________	mg/l	________
Calcium	________	mg/l	________
Chloride	________	mg/l	________
Copper	________	mg/l	________
Hardness	________	mg/l	________
Iron	________	mg/l	________
Magnesium	________	mg/l	________
Manganese	________	mg/l	________
pH	________	mg/l	________
Sodium	________	mg/l	________
Sulfate	________	mg/l	________
Total Dissolved Solids (TDS)	________	mg/l	________
Zinc	________	mg/l	________

	PART I Ambient Groundwater	Units	PART II Disposal Waste Stream
Priority Pollutants			

Others: (list all other constituents contained in the disposal waste stream)

Source of data: ______________________________

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