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CORRECTIVE ACTION AND STORM WATER CONTROL PLAN VOLUME 1
FINAL COVER CORRECTIVE MEASURES WORKPLAN

SUNRISE MOUNTAIN LANDFILL

CLARK COUNTY, NEVADA

TASK 4.1

REVISION 3, JULY 2011

Prepared for:

Republic Services of Southern Nevada
770 East Sahara Avenue
Las Vegas, Nevada 89104

Prepared by:

July 1, 2011 093-9743611

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ACRONYMS AND ABBREVIATIONS

Apex	Republic Services Apex Regional Landfill
ASTM	ASTM International
CQAP	Construction Quality Assurance Plan
CQC	Contractor Quality Control
EPA	United States Environmental Protection Agency
FCCMW	Final Cover Corrective Measures Workplan
QA	Quality Assurance
RSSN	Republic Dumpco, Inc. and Republic Silver State Disposal, Inc., d/b/a - Republic Services of Southern Nevada
Site	Sunrise Mountain Landfill
SOW	Appendix A, "Scope of Work," to the Consent Decree and Settlement Agreement, United States v. Republic Dumpco, Inc., Civ Action No. 2:08-CV-01024-PMP-PAC (D. Nev. entered September 26, 2008).

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1.0 INTRODUCTION

1.1 Purpose

The purpose of this document is to present this Final Cover Corrective Measures Workplan (FCCMW) for the Sunrise Mountain Landfill ("Site") as stipulated in Appendix A, "Scope of Work," (SOW) to the Consent Decree and Settlement Agreement, United States v. Republic Dumpco, Inc., Civ Action No. 2:08-CV-01024-PMP-PAC (D. Nev. entered September 26, 2008). Republic Dumpco, Inc. and Republic Silver State Disposal, Inc., d/b/a - Republic Services of Southern Nevada (collectively "RSSN"), with its consultants, has prepared this FCCMW.

This FCCMW includes work required by Tasks 4.1.1 through 4.1.10 of the SOW. This FCCMW includes design criteria and is being submitted with plans and specifications that will be used during the final cover construction process.

This FCCMW also includes a discussion of the data and results of the compaction test pad that was used to develop the performance specification for the in-place compaction for the slope greater than 10 percent erosion layer material as required in Task 4.1.6.1. A minimum acceptable operating procedure has been developed for compacting the erosion layer material and is included in the construction specifications.

1.2 Site Location

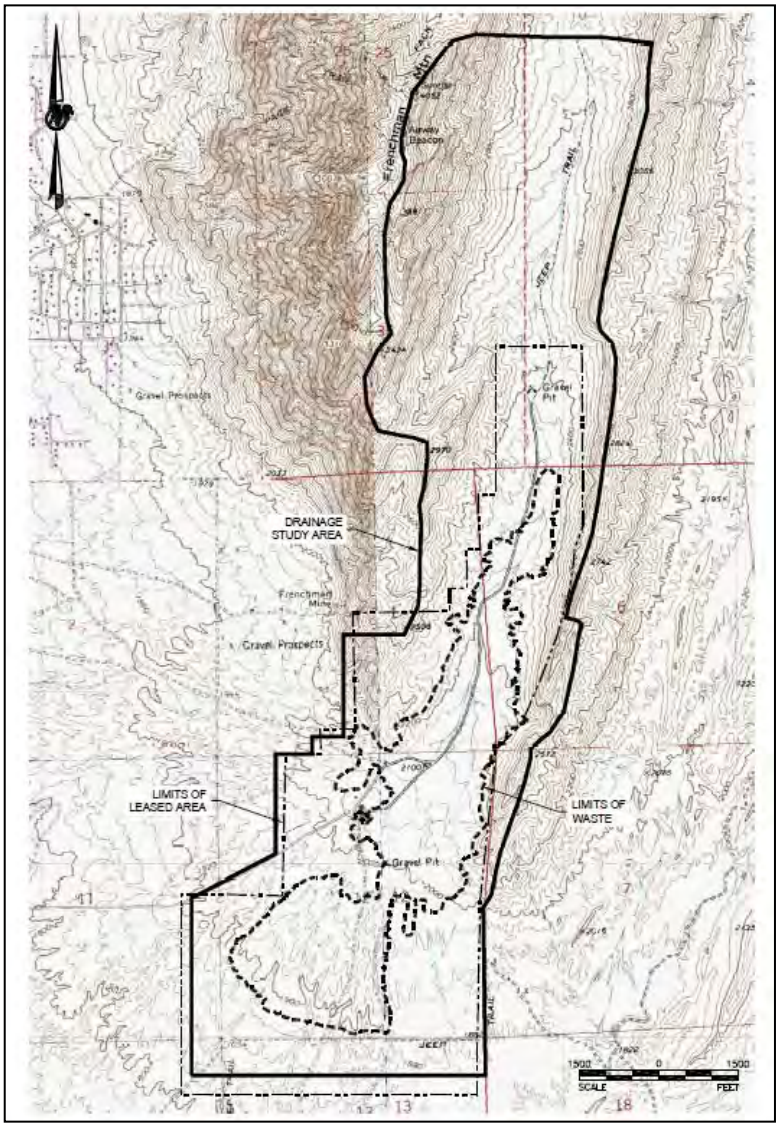
The Site is located approximately 3 miles east of Las Vegas, in Clark County, Nevada on the eastern edge of Las Vegas Valley, immediately southeast of Frenchman Mountain (Figure 1, "Site Location"). The Site includes the closed Sunrise Mountain Landfill, which lies on a 720-acre parcel of land that is leased to Clark County by the Bureau of Land Management; and three adjacent areas known as the Northeast Canyon Area (an 80-acre parcel), the Eastern Perimeter Area (a 240-acre parcel), and the Western Burn Pit Area (a 20-acre parcel). The uppermost portion of the landfill area is located within the canyon directly east of Frenchman Mountain. However, the majority of the landfill is located on a large alluvial fan that originates at the mouth of the canyon and spreads out into the adjacent valley. Elevation on the Site ranges from 1,900 to 2,275 feet above mean sea level.

1.3 Task 4.1.1 – Final Cover Design Criteria

The final cover has been designed as a non-vegetated soil cover consisting of a soil barrier layer and an armored surface element (erosion layer) to enhance evapotranspiration and minimize erosion. The final cover will be constructed with a total cover thickness of at least 3.5 feet, comprised of a soil barrier layer and an erosion layer meeting the requirements specified in Tasks 4.1.3 and 4.1.4 of the SOW. The 2.5 feet thick soil barrier layer requirement is for total depth above waste, and the existing cover will be used to meet all or part of this 2.5 feet requirement. On-site borrow sources will be used to generate construction materials used in the cover layers.

The design criteria are generally summarized in Tables 5.1 and 5.2 and Task 4.1 of the SOW. Tables 5.1 and 5.2 are included in Appendix A, "Scope of Work Tables 5.1 and 5.2." Design criteria were compared to the Clark County Regional Flood Control District Hydrologic Criteria and Drainage Design Manual (the Manual) minimum criteria (1999). Surface water control features were designed in accordance with the Manual if those design standards were more stringent.

Figure 1
Site Location



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2.0 TASK 4.1.2 – FINAL COVER DESIGN REQUIREMENTS

The final cover design summarized in the following sections is presented in detail in the Construction Drawings and Specifications submitted as separate documents. References to both the Construction Drawings and Specifications are made throughout the following sections.

2.1 Task 4.1.3 – Soil Barrier Layer

2.1.1 Grading of Existing Barrier Layer Surface

2.1.1.1 Existing Berms, Roads, and Drainage Channels

Existing berms, roads, and drainage ditches will be graded according to the requirements of Part 3.04, Section 02220 of the Construction Specifications to provide a smooth surface prior to placement of barrier layer soils. The filling of existing drainage channels, where necessary, will be treated in the same manner as other areas where supplemental soil barrier layer soils are placed. Placement will meet the requirements of Part 2.02 (A-G) and Part 3.03 (A), Section 02224 of the Construction Specifications. Existing landfill conditions are shown on Sheet A-1, "Existing Conditions and Site Plan," of the Construction Drawings.

2.1.1.2 Task 4.1.5 – Existing Cracks

Prior to placement of soil barrier or erosion layer soils, the existing landfill surface will be inspected for significant cracks. If observed, significant cracks will be repaired by over excavating the cover soil until the crack is removed. The excavations will be filled in 6 inch lifts with soil meeting the specifications of Section 02224 of the Construction Specifications.

2.1.1.3 Task 4.1.8.1 – Landfill Gas System

The piping for the landfill gas collection and control system will be buried in the soil barrier layer prior to placement of the erosion layer. The piping will be buried in accordance with the requirements of Section 02233 of the Construction Specifications. The gas lines will be marked with buried marker tape along the length of the pipe and vertical surface markers spaced at 100 feet on centers for the duration of construction activities associated with final cover material placement. The

landfill gas system is shown on Sheet LFG-1, "Proposed LFG Collection System Modification," of the Construction Drawings.

2.1.2 Minimum Thickness

The Final Cover is designed with a soil barrier layer, which is a minimum of 2.5 feet thick, above all waste. Cover soil thickness measurements documented in the "Shallow Boring and Geotechnical Sampling Report" (SCS, 2001) were used to determine where the existing cover is less than 2.5 feet thick. Supplemental barrier layer soils will be placed over existing cover soils so that the total combined thickness is a minimum of 2.5 feet in these areas. Areas that need additional soil barrier layer soils are shown on Sheet-SB-1, "Soil Barrier Layer Grading Overall Site Plan," of the Construction Drawings. Additional details of the grading plan can be seen on the area enlargements included as Sheets SB-2 through SB-7 of the Construction Drawings.

2.1.3 Soil Properties

Supplemental soil barrier layer material characteristics will meet the requirements of Part 2.02 (A- F), Section 02224 of the Construction Specifications.

The existing in-place soil barrier soils will be considered an acceptable final soil barrier provided that the soils meet the requirements of Part 2.02 (G), Section 02224 of the Construction Specifications.

2.2 Task 4.1.4 – Erosion Layer Thicknesses and Soil Properties

The method used to determine the proposed erosion layer thicknesses and gradations is set forth in Task 4.1.4 of the SOW. As stated in the SOW, the method is based on modifications to the method described by Steve Abt and Terry Johnson in "Riprap Design for Overtopping Flow" (American Society of Civil Engineers, 1991). A 200-year event runoff rate of 245 millimeters per hour is prescribed for the cover design. The modified gravel-soil erosion layer calculation method was prepared specifically for this project by Cliff Anderson of Anderson-Hydro, a consultant to the EPA. This calculation method is used to devise a single gravel-soil erosion layer thickness instead of a riprap layer underlain by a granular filter layer.

Based on the method set forth in Task 4.1.4.1 of the SOW, slopes greater than or equal to 10 percent will have a minimum erosion layer thickness of 14 inches. Based on the method set forth in Task

4.1.4.2 of the SOW, the areas with slopes less than10 percent will have a minimum erosion layer thickness of 13 inches.

2.2.1 Task 4.1.4.1 – Minimum Thicknesses and Soil Properties for Slopes Greater than or Equal to 10 Percent

For areas with slopes greater than or equal to 10 percent, the erosion layer has been designed in accordance with the layer thicknesses shown in Attachment 7 of the SOW. Attachment 7 is included as Appendix B, "Scope of Work Attachment 7." A 14-inch erosion layer will be placed on slopes greater than or equal to 10 percent. The erosion layer thickness is based on the slope versus drainage length provided in Attachment 7g. The erosion layer material will be generated on site to the specifications included in Part 2.02 (F), Section 02222 of the Construction Specifications.

2.2.2 Task 4.1.4.2 – Minimum Thicknesses and Soil Properties for Slopes Less than 10 Percent

For areas with slopes less than 10 percent, the erosion layer has been designed in accordance with the layer thicknesses shown on Golder Table 3 and 4 included in Appendix B. A 13-inch erosion layer will be placed on slopes less than 10 percent. The proposed erosion layer thickness is based on the slope versus drainage length provided in Golder Table 3. The erosion layer material will be generated on site to the specifications included in Part 2.02 (G), Section 02222 of the Construction Specifications.

2.3 Task 4.1.4.4 – Soil Sampling and Analysis

2.3.1 Task 4.1.4.4.1 – Borrow Study

A borrow study was conducted to determine if on-site soils are suitable for use as materials for the soil barrier layer. The borrow study methods and results, and resulting volume calculations are included in Appendix C, "Borrow Study Report." Proposed borrow area soils were evaluated using test method ASTM International (ASTM) Standard D422 to determine the particle size distributions; the Atterberg Limits test, ASTM Standard D4318 to determine the plasticity indexes and liquid limits; and the Standard Test Method for Dispersive Characteristics of Clay Soil by Double Hydrometer, ASTM Standard D4221-99 (2005) to determine the dispersive characteristics of the clay within the soils.

Geotechnical samples were collected from excavated test pit material from three on-site borrow areas and one imported material stockpile. The three natural locations are shown on Figures 1 and 2 within Appendix C. The Terrace Borrow Source and Colluvium Borrow Source are located in and along the north/northeastern area of the Site and borrow materials are designated for dam construction. The third area, the T-Wash Borrow Source, is located in the southern portion of the property and will be used to supply barrier soil material. The imported material consists of approximately 275,000 cubic yards of soils that the landfill accepted as clean fill from a housing development construction project in North Las Vegas. This material, staged adjacent to the site trailer, is known as the Beazer Soils.

Based on the results of the borrow study, approximately 350,000 cubic yards of material are available from the Terrace Borrow Source and Colluvium Borrow Source for construction of the detention dam and approximately 770,000 cubic yards of material are available from the T-Wash Borrow Source for construction of the soil barrier layer. The Beazer Soils may be incorporated into the soil barrier layer material as appropriate to adjust the material characteristics.

2.3.2 Task 4.1.4.4 – Soil Sampling and Analysis

Compliance with plans and specifications will be determined through the use of the Construction Quality Assurance Plan (CQAP) which was submitted as required by Task 3.3 of the SOW. The CQAP presents the measures to be taken to determine compliance with the construction plans and specifications through tests and systems of inspection during construction of the final cover and storm water controls. Material testing and characteristics requirements are included in the CQAP.

As required in the SOW, RSSN will retain a third party to monitor construction and to serve as a Quality Assurance (QA) Consultant. The QA Consultant will work as an independent party to ensure project conformance by the Contractor to the Contractor Quality Control (CQC) standards established in the CQAP. Following the Contractor's acceptable completion of work, the QA Consultant will certify that the installation of the final cover system and storm water features were constructed in accordance with the approved construction plans and specifications.

2.4 Task 4.1.7 – Top Deck Surface

2.4.1 Task 4.1.7.1 – Grades

The proposed design includes regrading of the surface of the Top Deck area to a minimum 3 percent slope consistent with Attachment 6 of the SOW (Appendix B). Proposed final Top Deck grades are shown on Sheet A-2, "Overall Channel Layout," of the Constructions Drawings.

2.4.2 Task 4.1.7.2 –Waste

Landfill waste material, if encountered during construction, will be removed from the footprint of the detention dam in the Northeast Canyon and from footprints of the channels, and will be placed, in accordance with Task 4.1.7.2 of the SOW (Appendix B), on the Top Deck. The relocated waste will be covered by the required 2.5-foot thick soil barrier layer and the 13-inch erosion layer. Standard landfill practices will be followed during the excavation, transportation, placement, and covering of the relocated waste. Daily cover will be used in areas of exposed waste during the relocation operations. Relocation operations will be conducted in accordance with Section 02228 of the Construction Specifications.

2.5 Task 4.1.6 – Final Cover Construction and Compaction Methods

2.5.1 Soil Barrier Layer

Soil barrier layer soils will be placed and compacted in accordance with Part 3.03, Section 02224 of the Construction Specifications. This compaction requirement applies to all new soil barrier layer soils and any replacement of excavated existing cover soils.

2.5.2 Erosion Layer

Erosion layer soils will be placed and compacted in accordance with Part 3.04, Section 02224 of the Construction Specifications. There is no ASTM standard for in-place compaction testing for large diameter crushed aggregate; therefore, a site-specific performance specification was developed for the soil erosion layer on slopes greater than or equal to 10 percent. RSSN and their consultants constructed a test pad to develop the erosion layer compaction performance specification. The test pad methods and results, and the proposed performance specification are summarized in the letter

report included in Appendix D, "In-Place Compaction Testing for Large Diameter Crushed Aggregate."

To adequately develop the performance specification, a test pad was constructed on a slope of approximately 30 percent (as determined from a site topographic map) at the Republic Services Apex Regional Landfill (Apex), located in Las Vegas, Nevada. The test pad was constructed at Apex due to its similar geographical and climate disposition and soil characteristics. In addition, material and equipment to build the pad was readily available, and there was a sufficient area with a slope greater than 10 percent on which to construct it.

The test pad was constructed from material that meets the gradation requirements set forth in Attachment 7a of the SOW (Appendix B). Attachment 7a was chosen as the governing gradation for this test pad because it represented the material needed to construct an 18-inch-thick erosion layer on a slope greater than 10 percent (worst case scenario). Material meeting the gradation was taken from a stockpile of crushed aggregate resulting from the excavation activities associated with active cell construction at Apex. In order to confirm that the material met the gradation requirements of Attachment 7a, a bulk sample of the material (approximately 830 pounds) was taken and analyzed in accordance with ASTM D5519, Test Procedure A.

Based on the compaction test results, the 14-inch thick erosion layer material will be placed on slopes of greater than or equal to 10 percent and will be compacted in accordance with Part 3.04 (A,B,C,D and E), Section 02224 of the Construction Specifications.

Thirteen-inch thick erosion layer material will be placed on slopes less than 10 percent and will be compacted in accordance with the requirements of Part 3.04 (A,B,C,D and F), Section 02224 of the Construction Specifications.

2.6 Task 4.1.8 – Requirements Specific to All Areas

Design requirements and final design features associated with the surface water control features, perimeter drainage berms, diversion berms, pipe and channel inlet structures, and down drains are included in the companion *Volume 4, Task 4.4—Storm Water Control Workplan / Technical Drainage Study*, and in the Construction Drawings and Specifications.

2.7 Task 4.1.9 – Requirements Specific to Settling Basins, Road Surfaces, and Black Lagoons

Design requirements and final design features associated with the settling basins, road surfaces, and the black lagoons are included in the companion *Volume 4, Task 4.4—Storm Water Control Workplan / Technical Drainage Study*, and in the Construction Drawings and Specifications.

2.8 Task 4.1.8.7 – Construction Drawings and Specifications

Construction drawings, including grading plans that illustrate the layout and details of all cover materials and surface water control features to be placed at the Site are included in the Construction Drawings and Specifications being submitted under separate cover. The design drawing package provides plan view drawings of the surface water conveyance structures, erosion layer construction, modified surfaces, modified side slope areas, and the Northeast Canyon Area with landfill waste removal areas. The construction drawings also include details of the various cover design features including the soil barrier layer and soil erosion layer components; surface water control features including diversion berms, perimeter channels, perimeter drainage conveyances, inlet structures, terrace drains, hardened surfaces, and down drains; and landfill gas collection and control system pipe alignments. Site areas with slopes less than 10 percent, existing surface grades, and proposed surface grades are described by 1 foot contour interval mapping. Site areas with slopes equal to or greater than 10 percent are described by a 5 foot (maximum) contour interval. Final plans for the surface control features are of sufficient detail to allow their construction by an independent construction company. The design computations for storm water conveyances include the area and topography of the contributing watershed, land surface features, and methodology for determining precipitation losses and runoff rates and volumes.

2.9 Implementation

Following EPA approval of this FCCMW, the Construction Drawings and Specifications, and the companion *Volume 4, Task 4.4—Storm Water Control Workplan / Technical Drainage Study*, this FCCMW will be implemented in accordance with the approved Overall Project Schedule.

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3.0 CERTIFICATION

I certify under penalty of law that I have examined and am familiar with the information submitted in this document and all attachments and that this document and its attachments were prepared either by me personally or under my direction or supervision in a manner designed to ensure that qualified and knowledgeable personnel properly gather and present the information contained therein. I further certify, based on my personal knowledge or on my inquiry of those individuals immediately responsible for obtaining the information, that the information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowingly and willfully submitting a materially false statement.

RSSN Representative

Date

Title

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4.0 REFERENCES

American Society of Civil Engineers, 1991, "Riprap Design for Overtopping Flow," *Journal of Hydraulic Engineering*, Vol. 117, No. 8, pp. 959-972, August.

ASTM International, *C127 Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate*, formerly American Society for Testing and Materials, West Conshohocken, Pennsylvania.

ASTM International, *C535* or *C131 Standard Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine*, formerly American Society for Testing and Materials, West Conshohocken, Pennsylvania.

ASTM International, *D422-63(2002) Standard Test Method for Particle-Size Analysis of Soils*, formerly American Society for Testing and Materials, West Conshohocken, Pennsylvania.

ASTM International, *D4221-99 (2005) Standard Test Method for Dispersive Characters of Clay Soil by Double Hydrometer*, formerly American Society for Testing and Materials, West Conshohocken, Pennsylvania.

ASTM International, *D4318-00 Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils*, formerly American Society for Testing and Materials, West Conshohocken, Pennsylvania.

ASTM International, *D5519 Standard Test Methods for Particle Size Analysis of Natural and Man-Made Riprap Materials*, formerly American Society for Testing and Materials, West Conshohocken, Pennsylvania.

ASTM International, *D698 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort*, formerly American Society for Testing and Materials, West Conshohocken, Pennsylvania.

ASTM International, *D6913 Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis*, formerly American Society for Testing and Materials, West Conshohocken, Pennsylvania.

Clark County Regional Flood Control District, 1999, *Clark County Regional Flood Control District, Hydrologic Criteria and Drainage Design Manual*, Las Vegas, Nevada, August 12.

SCS Engineers, 2001, *Shallow Boring and Geotechnical Sampling Report*, prepared on behalf of Republic DUMPCo, Inc., November 13.

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APPENDIX A

SCOPE OF WORK TABLES 5.1 AND 5.2

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Table 5.1 Final Cover - Design Criteria

Design Requirements	**Design Specifications**
Cover Repair Methods:	
- Fill local depressions	Use same soil and construction specifications as for barrier layer soil.
- Repair significant cracks in existing cover soil prior to placement of erosion layer.	The excavation shall be replaced in six-inch lifts with soil meeting the specifications detailed in Tasks 4.1.3 and 4.1.6.
Cover Grades:	
- Top deck, Area D Slope	3% minimum slope
- All other areas	No required changes to existing grades
Cover Thickness: [for all areas including side slopes and Northeast Canyon]	
- Total thickness	3 feet minimum
- Soil barrier layer	2.5 feet minimum thickness
- Erosion layer - slopes less than 10%	6 inches minimum thickness (varies with slope, slope length, and soil gradation). See Attachments 7, 7d, 7e, and 7f.
- Erosion layer – slopes greater than or equal to 10%	Varies based on drainage area slope, slope length, and soil gradation applied. See Attachments 7, 7a, 7b, and 7c.
Cover Soil Properties:	
- Soil added to soil barrier layers	Supplemental soil as described in Section 4.1.3.
- Erosion layer - slopes less than 10%	Gravel-soil layer meeting gradations specified in Attachments 7d, 7e, and 7f.
- Erosion layer – slopes greater than or equal to 10%	Gravel-soil layer meeting gradations specified in Attachments 7a, 7b, and 7c.

Cover Construction Methods: Greater Than or Equal to 10% Erosion Layer	
- Acceptable compaction range	Performance Specification - I.E number of passes with specified equipment to achieve desired compaction. A test fill/erosion layer which will be constructed to establish the ≥ 10% erosion layer compaction performance specification.
- Lift thickness	Lift thicknesses for each drainage area will match erosion layer thicknesses detailed on Attachment 7 and subsequent construction drawings.
Cover Construction Methods: Barrier Layer Soils, less than 10% Erosion Layers, and Replacement of Excavated Cover Soils	
- Acceptable compaction range	At Least 90% of Standard Proctor
- Lift thickness	Lifts up to 1 ft thick as described in Section 4.1.6.
- Moisture content	Drier than optimum moisture conditions.

Table 5.2 Final Cover Surface Water Control Features - Design Criteria

Surface Water Control Requirements	Design Specifications
Perimeter drainage diversions/berms	Locations: all top slope areas that drain to slopes greater than or equal to 10% Capacity: runoff from Design Storm Event plus freeboard
Diversion berms	Capacity: runoff from Design Storm Event plus freeboard Spacing: according to appropriate sections of Appendix A and Attachments.
Pipe and channel inlet structures	Capacity: runoff from Design Storm Event plus freeboard
Down drains	Capacity: runoff from Design Storm Event
Road surfaces used to transport flow	Minimum 3inch thick gravel surfacing. Ditches lined with riprap or paved. Capacity: runoff from Design Storm Event
Management of gas collection pipes	Cover LF gas pipe with soil that complies with specifications in this SOW
Settling basins	Capacity: - runoff from Design Storm Event

APPENDIX B

SCOPE OF WORK ATTACHMENTS 7G AND 7A

GOLDER TABLES 3 AND 4

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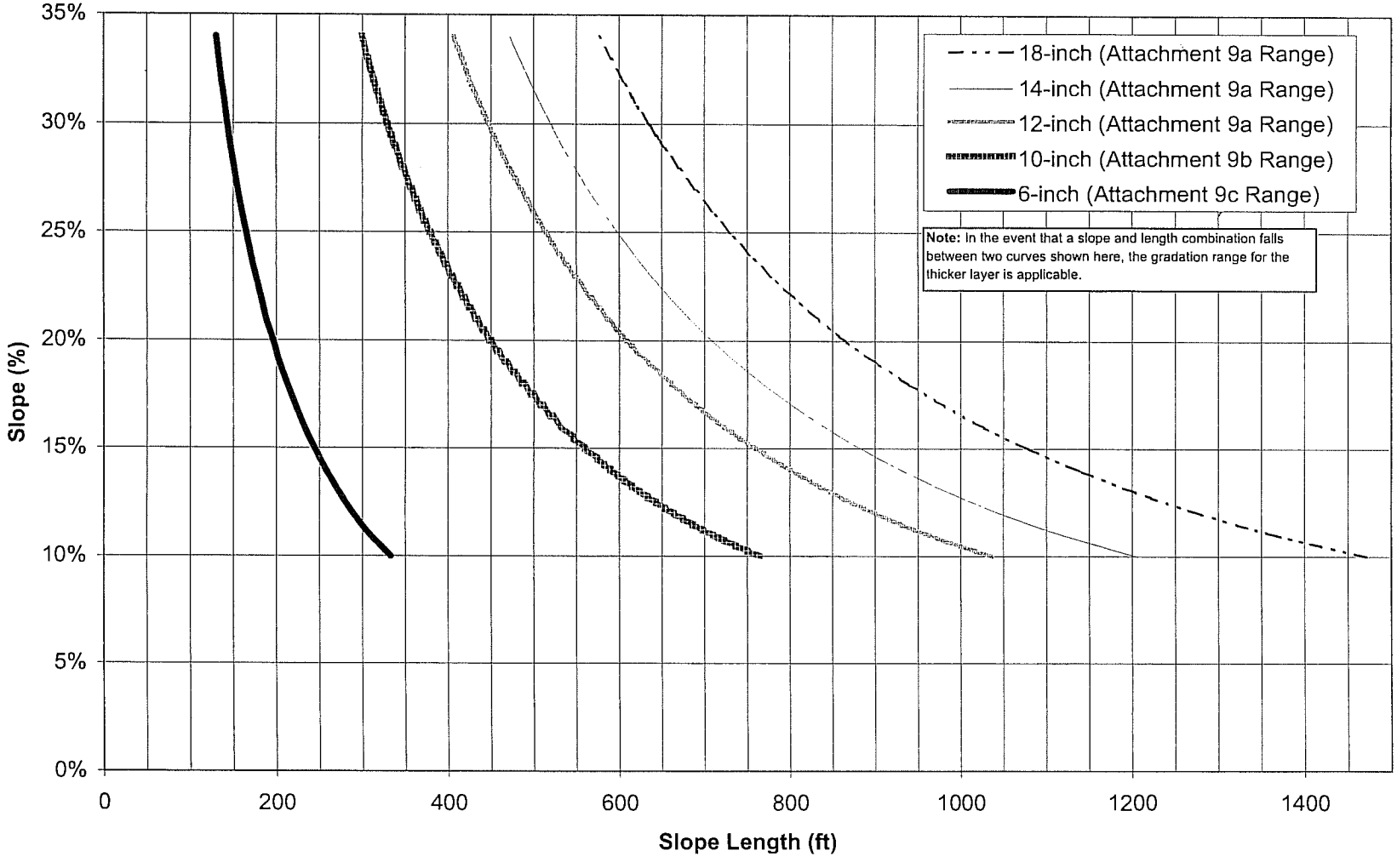
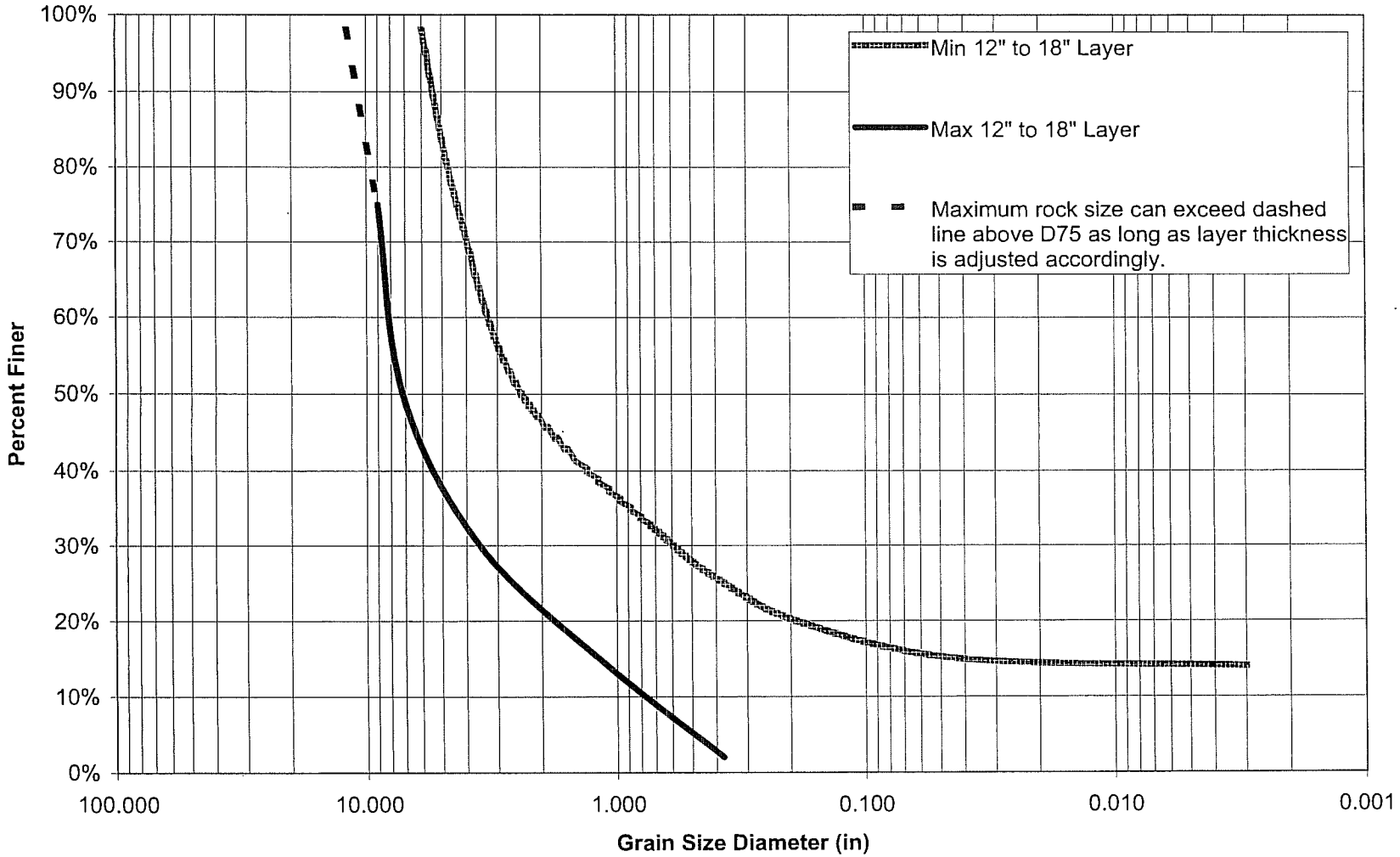
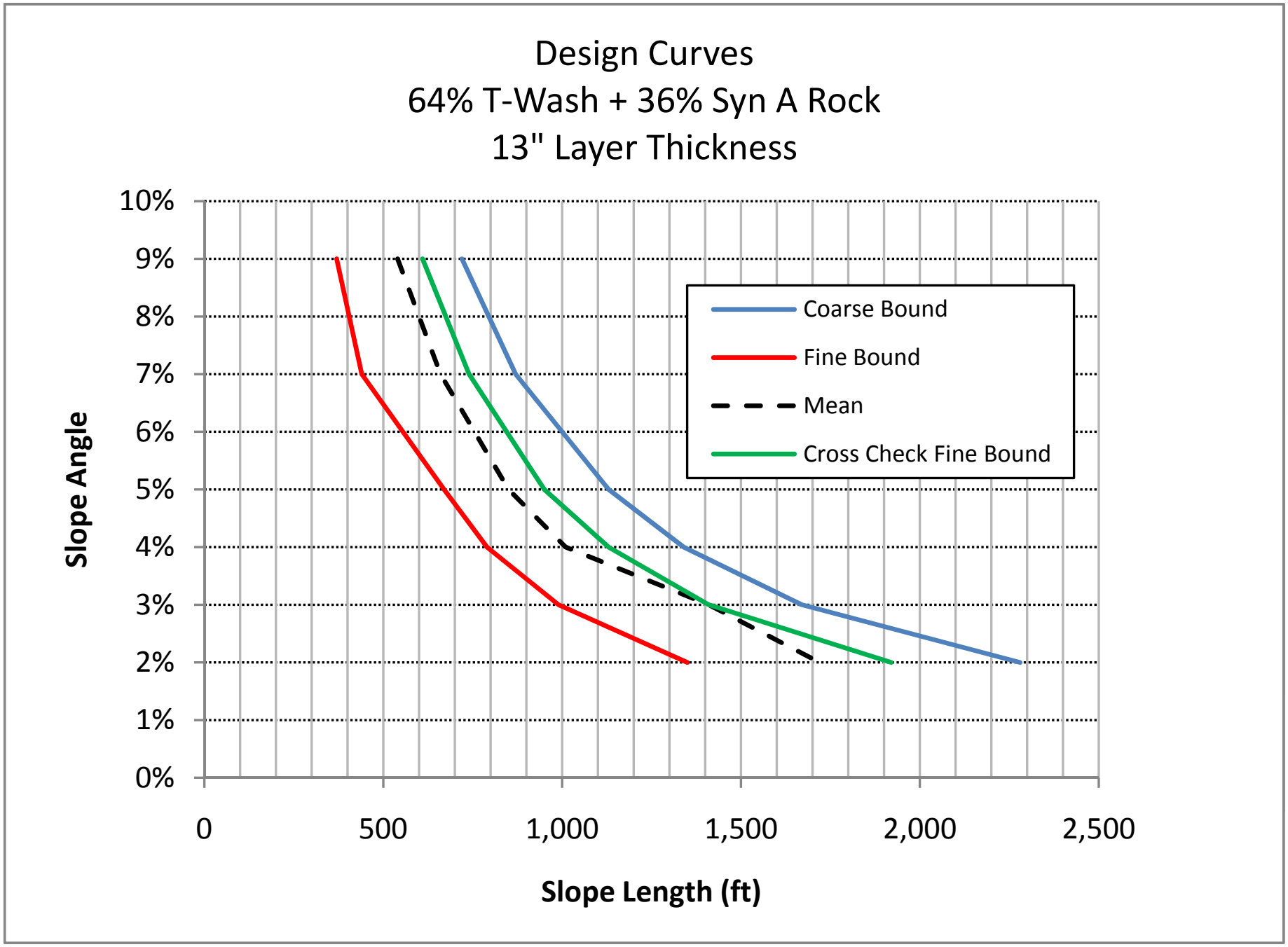
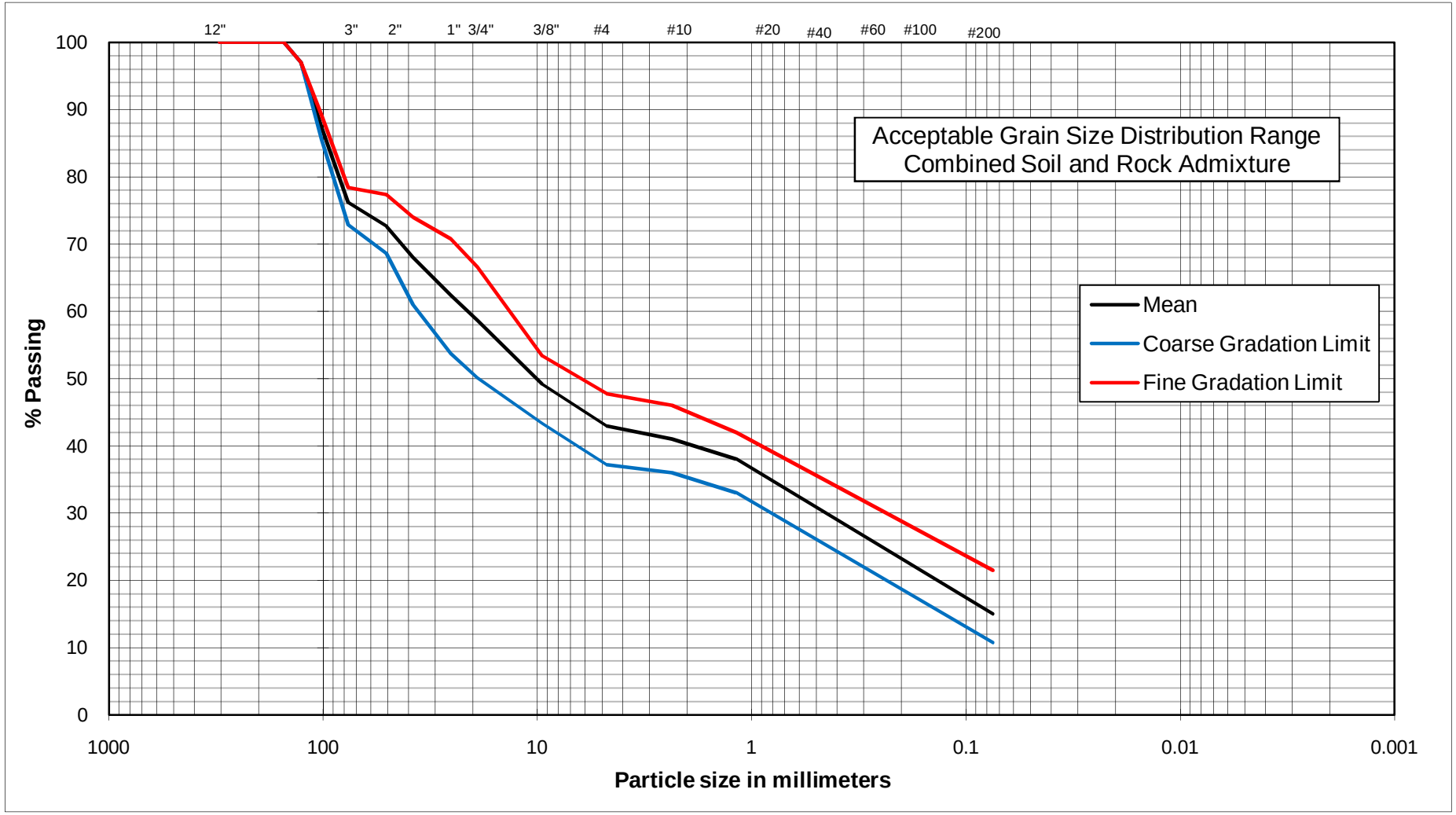
Attachment 7g
Slope and Length Combinations for Gradation Ranges for Slopes Greater than or Equal to 10%



Attachment 7a
Gradation Range for 12-, 14-, and 18-inch Layer Thickness and Slopes Greater than or Equal to 10%




Design Curves
64% T-Wash + 36% Syn A Rock
13" Layer Thickness
10%
9%
8%
7%
6%
5%
4%
3%
2%
1%
0%
Slope Angle
0
500
1,000
1,500
2,000
2,500
Slope Length (ft)
Coarse Bound
Fine Bound
Mean
Cross Check Fine Bound



Golder Associates

Acceptable Grain Size Distribution Range
Combined Soil and Rock Admixture

FIGURE 4

APPENDIX C

BORROW STUDY REPORT

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BORROW STUDY REPORT
Sunrise Mountain Landfill
Clark County, Nevada

January 2009

Prepared for:

REPUBLIC SERVICES, INC.

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Las Vegas, Nevada 89104

Submitted by:

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Table 3-1 CBS Geotechnical Properties

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Acronyms and Abbreviations

bgs	below ground surface
CBS	Colluvium Borrow Source
cm/sec	centimeters per second
CY	cubic yards
GM	silty gravel with sand
lb/cf	pound(s) per cubic feet
Shaw	The Shaw Group Inc.'s Environmental & Infrastructure Group
SM	silty sand
TBS	Terrace Borrow Source
TWBS	T-Wash Borrow Source

1.0 Introduction

The Shaw Group Inc.'s Environmental & Infrastructure Group (Shaw) collected geotechnical samples of excavated test pit material from several on-site borrow areas in support of ongoing work at Sunrise Mountain Landfill located in Las Vegas, Nevada. The purpose of the investigation was to classify and quantify existing on-site soils in three natural borrow areas and one stockpile of imported material located within the property boundary of the landfill. The three natural locations are shown in on Figures 1 and 2 within **Appendix A**. The Terrace Borrow Source (TBS) and Colluvium Borrow Source (CBS) are located in and along the north/northeastern area of the property and are designated for dam construction. The third area, the T-Wash Borrow Source (TWBS) is located in the southern portion of the property and will be used to supply barrier soil material. The imported material consists of approximately 275,000 CY of soils that the landfill accepted as clean fill from a housing development construction project in North Las Vegas. This material is located adjacent to the site trailer and is known as the Beazer Soils.

The investigation began on October 17, 2008 and was finished October 22, 2008. This investigation was preceded by a preliminary investigation of the TWBS, which occurred during spring of 2008.

During this investigation, 29 test pits were excavated to bedrock or to refusal of the construction equipment. There were a total of 13 samples taken for geotechnical analysis. Based on site and material conditions, samples were composited producing a total of five samples to be analyzed. The following information summarizes the results of the test pit investigation and soil analyses for the three areas.

2.0 Terrace Borrow Source Area

The TBS is located in the northern portion of the site and encompasses an area of approximately 8.3 acres. A site map showing the TBS area and the location of the excavated test pits is included as Figure 1 in Appendix A. Exact coordinates of the test pits are shown in Table 1 of Appendix B.

Test pits were excavated using a 330 B Caterpillar tracked excavator and each test pit was excavated to bedrock or to refusal. Field test pit logs giving a general description of the site conditions, characteristics and trench pit cross sections for all TBS trench pits are located in Appendix B. Test pit depths ranged from 5.5 to 15 feet below ground surface (bgs).

The volume of material was calculated based on the estimated area of the TBS and test pit excavation depths. Each test pit was assigned an area based on a polygon method using midpoint distances to the next test pit. The surfaces of the test pit area were assumed to be flat at both the existing ground surface and at the depth to bedrock or caliche. Each area was assumed to have straight cut walls from existing ground surface to the depth of bedrock or caliche. The total available borrow material from the TBS area is estimated to be approximately 171,700 cubic yards (CY). Volume calculations are shown in Appendix C.

Geotechnical lab data for all TBS samples are shown in Appendix D. . Samples analyzed from the TBS area included TBS-01, TBS-02, TBS-04, TBS-07, TBS-08 and TBS-11. Tests on samples included, grain size analysis/hydrometer, modified proctor, permeability, direct shear, Atterberg limits and soil classification. The soils in this area were determined to be Silty Sand (SM) to a Silty Gravel with Sand (GM) (see

Table 2-1, "TBS Geotechnical Properties"). Permeability of the soil was analyzed using the Constant Head Method (ASTM D 2434) and values ranged from 2.96 E^{-5} centimeters/second (cm/sec) to 5.94 E^{-3} cm/sec. See Appendix D for all other geotechnical test results.

Table 2-1
TBS Geotechnical Properties

Sample ID	Classification	Modified Proctor (Dry Density)(lb/cf)	Permeability k (cm/sec)
TBS-1 & 2	SM	113	2.96 E^{-05}
TBS-4 & 7	GM	133	5.94 E^{-03}
TBS- 8 & 11	GM	131	6.71 E^{-05}

lb/cf denotes pound(s) per cubic feet

3.0 Colluvium Borrow Source Area

The CBS is located in the northern portion of the site and encompasses an area of approximately 7.8 acres. A site map showing the CBS area and the location of the excavated test pits is included as Figure 1 of Appendix A. Exact coordinates of the test pits are shown in Table 1 of Appendix B.

Test pits were excavated using a 330 B Caterpillar tracked excavator and each test pit was excavated to bedrock or to refusal Field test pit logs giving a general description of the site conditions, characteristics and trench pit cross sections for all TBS trench pits are located in Appendix B. Tests pit depths ranged from 9 to 18 feet bgs.

The total amount of available volume was calculated based on the method described in Section 2.0. The total available borrow material available from the CBS area is estimated to be approximately 179,500 CY. Volume calculations are shown in Appendix C.

Geotechnical lab data for all CBS samples are shown in Appendix D. Samples analyzed from the CBS area included, CBS-01, CBS-03, CBS-04, CBS-06 and CSB-08. Tests on samples included grain size analysis/hydrometer, modified proctor, permeability, direct shear, Atterberg limits and soil classification. Soils from the area were determined to be GM (see Table 3-1, "CBS Geotechnical Properties"). Permeability of the soil was analyzed using the Constant Head Method (ASTM D 2434) and values ranged from 3.80 E^{-3} cm/sec to 2.70 E^{-3} cm/sec. See Appendix D for all other geotechnical test results.

Table 3-1
CBS Geotechnical Properties

Sample ID	Classification	Modified Proctor (Dry Density)(lb/cf)	Permeability k (cm/sec)
CBS- 1, 03 & 04	GM	134	2.71 E^{-03}
CBS- 06 & 08	GM	140	3.80 E^{-03}

4.0 T-Wash Borrow Source Area

The TWBS is located in the southern portion of the site and encompasses an area of approximately 46 acres. A site map showing the location of the TWBS area and the location of the excavated test pits is included as Figure 2 in Appendix A. Exact coordinates of the (TW) test pits are shown in Table 1 of Appendix B.

The preliminary investigation was conducted on March 3, 2008 using a Case 550 backhoe. Eight test pits were excavated to a depth of 8 feet bgs and samples taken for gradation analysis. During the excavation, approximately 6080 CY of red bagged waste was discovered from 4 to 8 feet below ground surface. Geotechnical analyses of the eight test pits are summarized in Appendix D. In October of 2008, eight additional test pits were excavated to bedrock or refusal using a 330 B Caterpillar tracked excavator. Tests pit depths ranged from 8 to 22 feet bgs. No additional geotechnical samples were taken during this investigation. More red bag waste was located at the base of test Pit TW-1 at a depth of 12 feet. Because of the depth of waste, it was not delineated further.

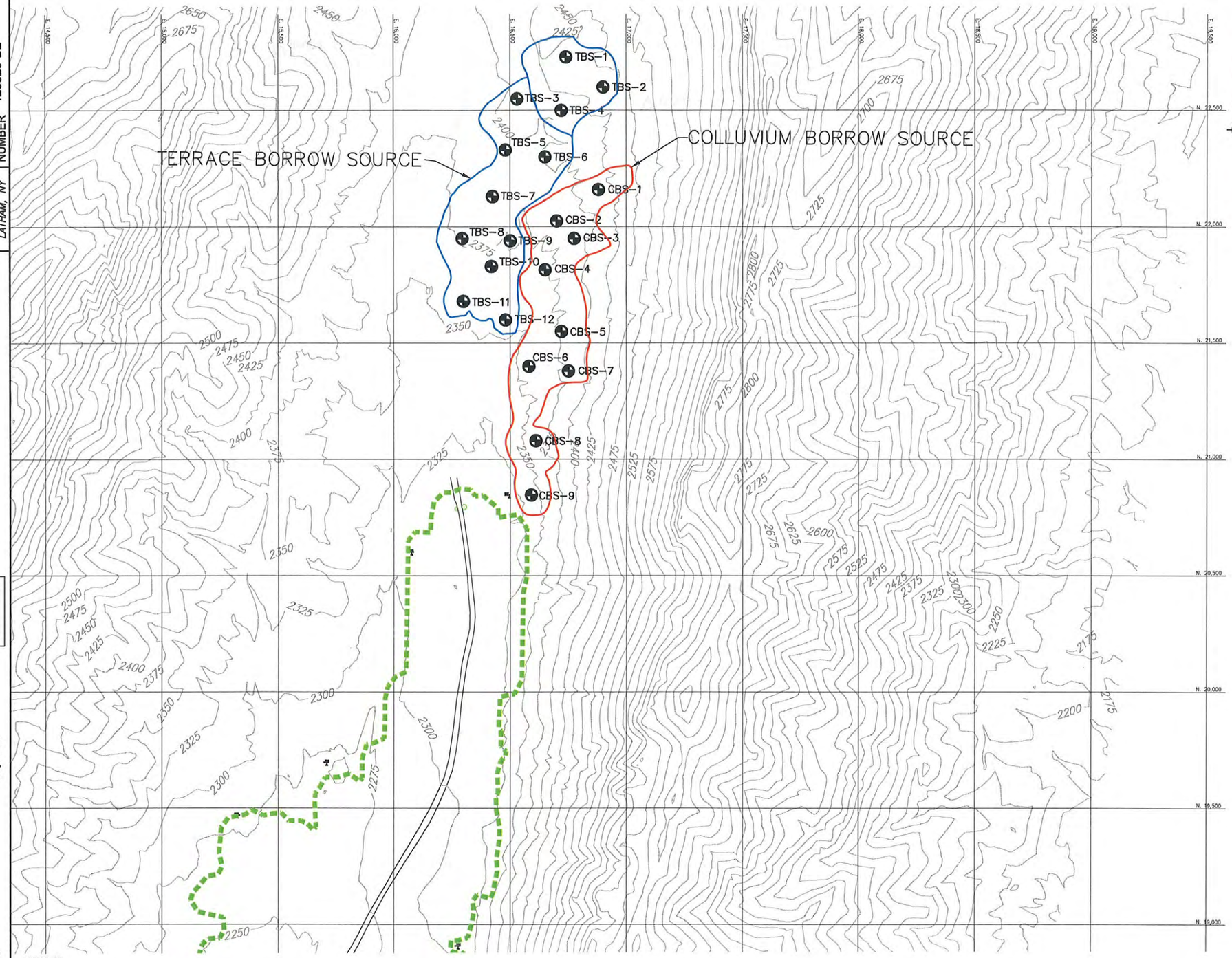
Field test pit logs giving a general description of the site conditions, characteristics and trench pit cross sections for all TWBS trench pits completed in October 2008 are located in Appendix B

The total amount of available volume was calculated based on the method described in Section 2.0 The total available borrow material available from the TWBS area is estimated to be approximately 766,800 cubic yards (CY). Volume calculations are shown in Appendix C.

5.0 Beazer Soils

Approximately 275,000 CY of soils are stockpiled for use as soil barrier layer material during the closure activities. Three samples were taken and analyzed for grain size analysis/hydrometer and Atterberg Limits. The soils were classified as clayey gravel (GC) with sand. Geotechnical analyses of the Beazer soils are summarized in **Appendix D.**

Appendix A
Figures



LEGEND:

- TBS-4 TEST PIT LOCATION
- CBS-3 TEST PIT LOCATION
- LIMITS OF WASTE
- LIMITS OF TERRACE
- LIMITS OF COLLUVIUM

DRAFT

SCALE
0 200 400 600 FEET

REV	DESCRIPTION / ISSUE	DATE	APPROVED
--	----	-/-/-	----

Shaw Environmental, Inc.

REPUBLIC SERVICES, INC.

DESIGNED BY: --
DRAWN BY: --
CHECKED BY: --
APPROVED BY: --

TEST PIT LOCATIONS
FIGURE 1
SUNRISE MOUNTAIN LANDFILL
LAS VEGAS, NEVADA

DATE:	SCALE:	DRAWING NO.	SHEET NO.
12/18/08	AS SHOWN	128526-D2	1 OF 2

OFFICE LATHAM, NY
DRAWING NUMBER 128526-D2

VERIFY SCALE 0 1"

Xref: .
Image: GLAC1

Z:\project\Sunrise\12852602.dwg
Plot Date/Time: 01/09/09 01:59pm
Plotted by: matt.sausville

REFERENCE:

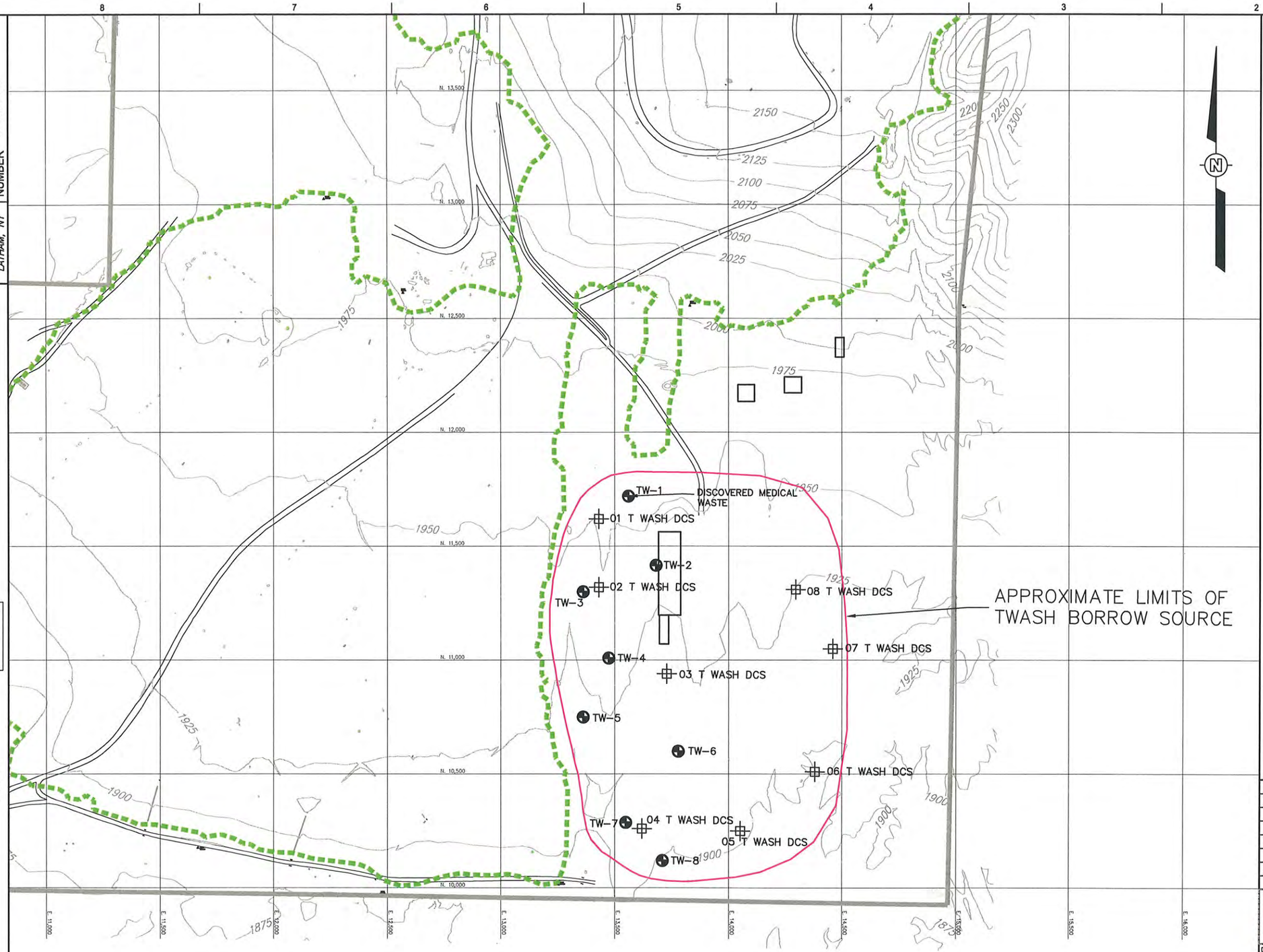
TOPOGRAPHY PREPARED BY KENNEY AERIAL MAPPING, INC.
FLIGHT DATE: NORTH HALF 03/24/99 SOUTH HALF 08/03/99.

N.E. CANYON UPDATED: FLIGHT DATE: MAY 22, 2002.

LANDFILL TOPOGRAPHY UPDATED BY KENNEY AERIAL MAPPING, INC.
FLIGHT DATE: 06/25/07, KAM# 070536-N-SUNRISE LANDFILL.

OFFICE LATHAM, NY

DRAWING NUMBER 128526-D3



LEGEND:

- TEST PIT LOCATION (MAR 08)
- TEST PIT LOCATION (OCT 08)
- LIMITS OF WASTE
- APPROXIMATE LIMITS OF T-WASH BORROW SOURCE
- LIMITS OF MEDICAL WASTE DISCOVERED MARCH OF 2008 4 – 8 FEET BGS

NOTES:

1) MEDICAL WASTE WAS DISCOVERED APPROXIMATELY 12 FEET BELOW GROUND SURFACE WITHIN TEST PIT TW-1.

2) NO MEDICAL WASTED WAS DISCOVERED IN TEST PIT TW-2.

DRAFT

SCALE
0 200 400 600 FEET

REV	DESCRIPTION / ISSUE	DATE	APPROVED
--	---	-/-/-	---

Shaw Environmental, Inc.

REPUBLIC SERVICES, INC.

DESIGNED BY: --
DRAWN BY: --
CHECKED BY: --
APPROVED BY: --

TEST PIT LOCATIONS
FIGURE 2
SUNRISE MOUNTAIN LANDFILL
LAS VEGAS, NEVADA

DATE:	SCALE:	DRAWING NO.	SHEET NO.
12/18/08	AS SHOWN	128526-D3	2 OF 2

REFERENCE:

TOPOGRAPHY PREPARED BY KENNEY AERIAL MAPPING, INC.
FLIGHT DATE: NORTH HALF 03/24/99 SOUTH HALF 08/03/99.

N.E. CANYON UPDATED: FLIGHT DATE: MAY 22, 2002.

LANDFILL TOPOGRAPHY UPDATED BY KENNEY AERIAL MAPPING, INC.
FLIGHT DATE: 06/25/07, KAM# 070536-N-SUNRISE LANDFILL.

VERIFY SCALE 0 1"

Xref: Image: GLAC1

Z:\project\Sunrise\12852603.dwg
Plot Date/Time: 01/09/09 02:00pm
Plotted by: matt.sausville

Appendix B
Test Pit Logs

TABLE 1-TEST PIT COORDINATES			
ID	Point 1	Point 2	Comment
TERRACE BORROW SOURCE			
	Northing	Easting	
TBS-1	22730	16740	
TBS-2	22600	16900	
TBS-3	22550	16530	
TBS-4	22500	16720	
TBS-5	22330	16480	
TBS-6	22300	16650	
TBS-7	22130	16425	
TBS-8	21950	16295	
TBS-9	21940	16500	
TBS-10	21830	16420	
TBS-11	21680	16300	
TBS-12	21600	16480	
COLLUVIUM BORROW SOURCE			
	Northing	Easting	
CBS-1	22160	16880	
CBS-2	22025	16700	
CBS-3	21950	16775	
CBS-4	21815	16650	
CBS-5	21550	16720	
CBS-6	21400	16580	
CBS-7	21380	16750	
CBS-8	21080	16610	
CBS-9	20847	16590	
T-WASH BORROW SOURCE			
	Northing	Easting	
TW-1	11720	13560	
TW-2	11416	13682	
TW-3	11300	13360	
TW-4	11009	13473	
TW-5	10750	13360	
TW-6	10600	13780	
TW-7	10287	13548	
TW-8	10120	13710	

Sunrise Mtn Landfill
Terrace Borrow Area
Trench Excavation Log

Shaw Project Number 128526

Trench Number	TBS-1	Date of Excavation	Friday October 17th 2008	*By:* MJS

General Description:

Soil consisted of a homogeneous sandy gravel with significant fines. The only difference that was distinguished between a sandy gravel vs gravelly sand was the amount and size of the rocks/stones in the material.

Stratigraphic Description:

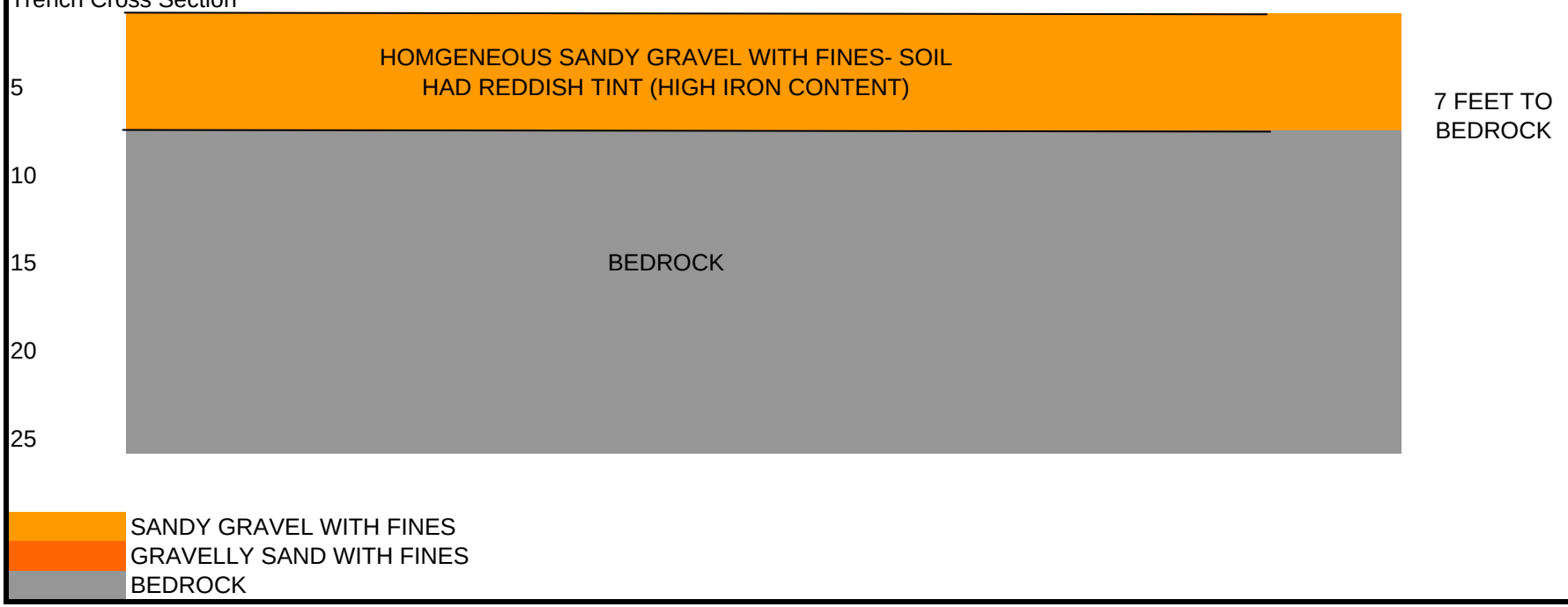
SCS	Lithic Description
USCS	Colluvium Borrow Source area

Note: Due to laboratory volume requirements samples TBS-1 and TBS-2 were combined.

Sample:

Yes/No	Analyses	
Yes	Atterberg Limits	D4318
	Gradation	D422
	Hydromenter	D4221
	Direct Shear	D3080
	Modified Proctor	D1557
	Permeability	D2434

Trench Cross Section



Sunrise Mtn Landfill
Terrace Borrow Area
Trench Excavation Log

Shaw Project Number 128526

Trench Number	TBS-2	Date of Excavation	Friday October 17th 2008	*By:* MJS

General Description:

Soil consisted of a homogeneous sandy gravel with significant fines. The only difference that was distinguished between a sandy gravel vs gravelly sand was the amount and size of the rocks/stones in the material.

Stratigraphic Description:

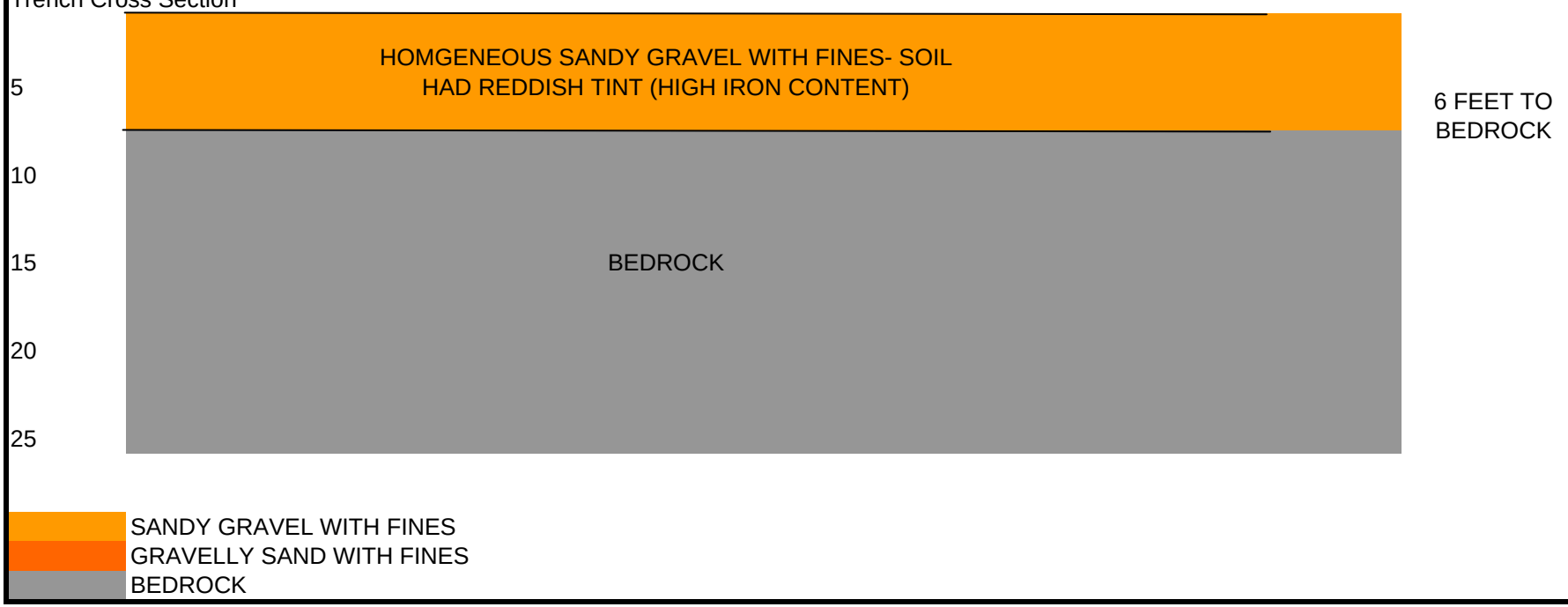
SCS	Lithic Description
USCS	Colluvium Borrow Source area

Note: Due to laboratory volume requirements samples TBS-1 and TBS-2 were combined.

Sample:

Yes/No	Analyses	
Yes	Atterberg Limits	D4318
	Gradation	D422
	Hydromenter	D4221
	Direct Shear	D3080
	Modified Proctor	D1557
	Permeability	D2434

Trench Cross Section



Sunrise Mtn Landfill
Terrace Borrow Area
Trench Excavation Log

Shaw Project Number 128526

Trench Number	TBS-3	Date of Excavation	Friday October 17th 2008	*By:* MJS

General Description:

Soil consisted of a homogeneous gravelly sand with significant fines. The only difference that was distinguished between a sandy gravel vs gravelly sand was the amount and size of the rocks/stones in the material.

Stratigraphic Description:

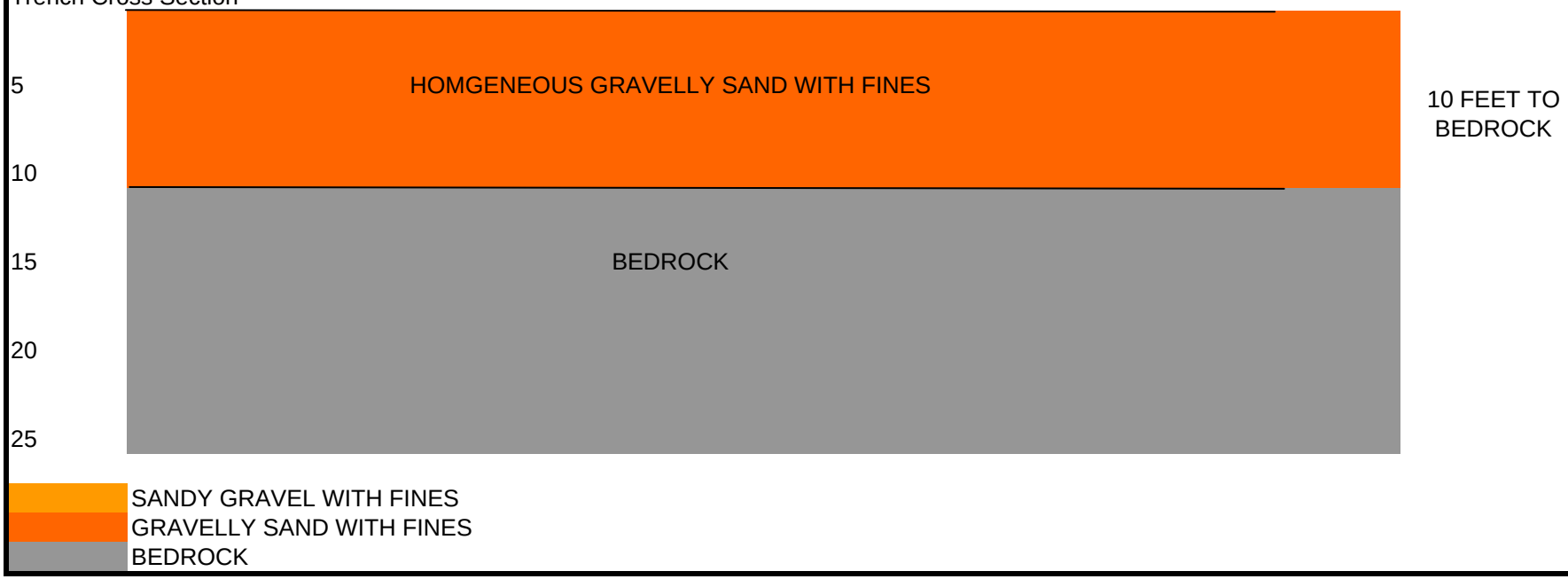
SCS	Lithic Description
USCS	Colluvium Borrow Source area

Note: Due to laboratory volume requirements samples TBS-4 and TBS-7 were combined.

Sample:

Yes/No	Analyses	
Yes	Atterberg Limits	D4318
	Gradation	D422
	Hydromenter	D4221
	Direct Shear	D3080
	Modified Proctor	D1557
	Permeability	D2434

Trench Cross Section



Sunrise Mtn Landfill
Terrace Borrow Area
Trench Excavation Log

Shaw Project Number 128526

Trench Number	TBS-4	Date of Excavation	Friday October 17th 2008	*By:* MJS

General Description:

Soil consisted of a homogeneous gravelly sand with significant fines. The only difference that was distinguished between a sandy gravel vs gravelly sand was the amount and size of the rocks/stones in the material.

Stratigraphic Description:

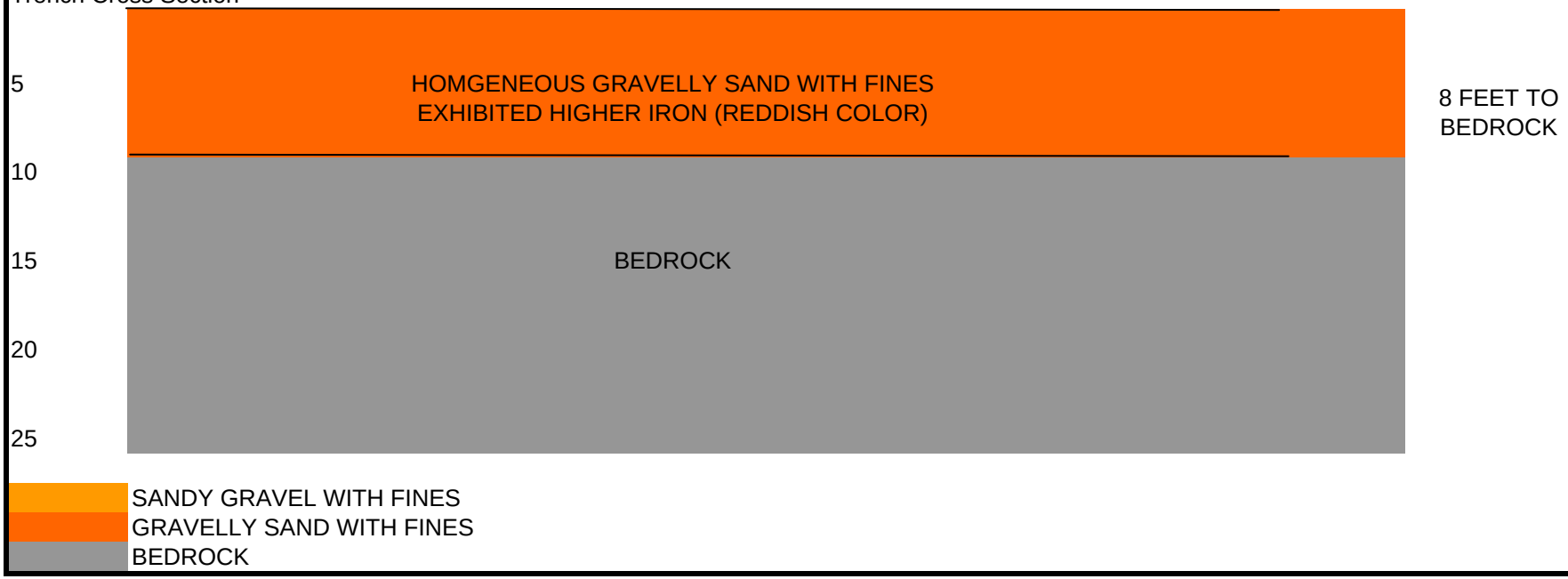
SCS	Lithic Description
USCS	Colluvium Borrow Source area

Note: Due to laboratory volume requirements samples TBS-4 and TBS-7 were combined.

Sample:

Yes/No	Analyses	
Yes	Atterberg Limits	D4318
	Gradation	D422
	Hydromenter	D4221
	Direct Shear	D3080
	Modified Proctor	D1557
	Permeability	D2434

Trench Cross Section



Sunrise Mtn Landfill
Terrace Borrow Area
Trench Excavation Log

Shaw Project Number 128526

Trench Number TBS-5	Date of Excavation Friday October 17th 2008	*By:* MJS

General Description:

Soil consisted of a homogeneous sandy gravel with significant fines. The only difference that was distinguished between a sandy gravel vs gravelly sand was the amount and size of the rocks/stones in the material.

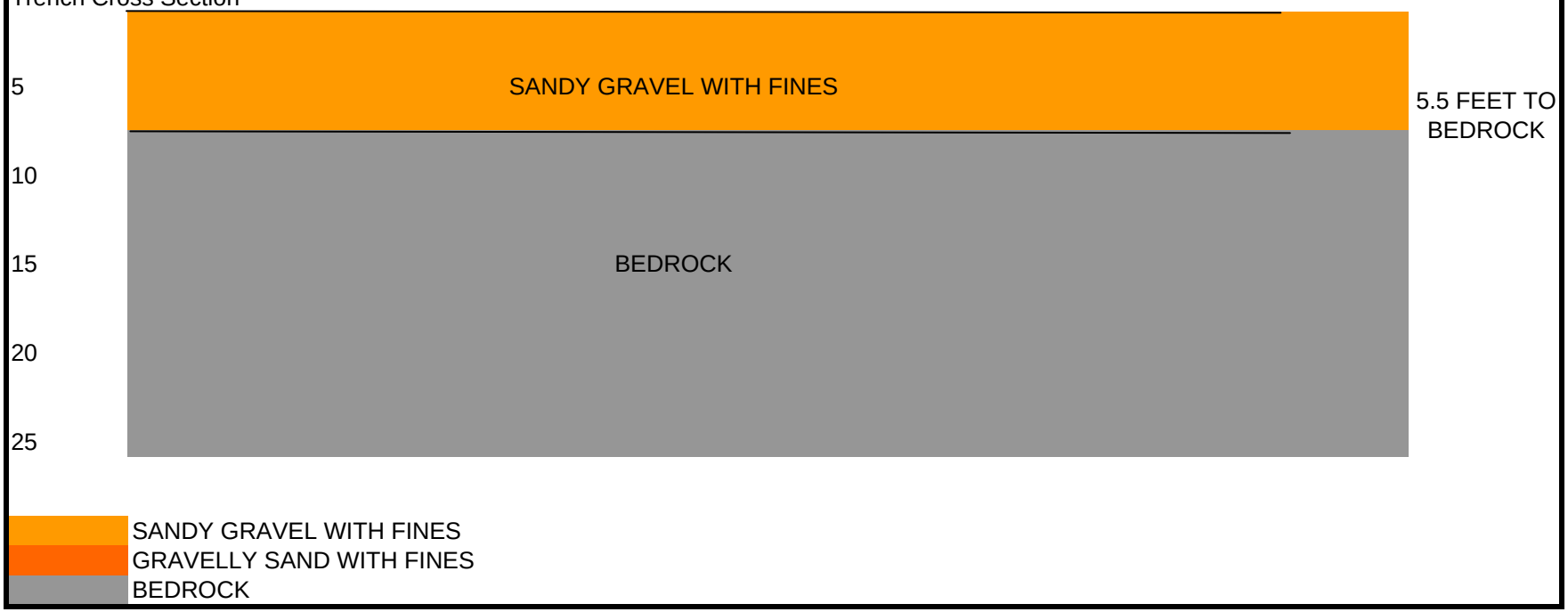
Stratigraphic Description:

SCS	Lithic Description
USCS	Terrace Borrow Source area

Sample:

Yes/No	Analyses	
No	Atterberg Limits	D4318
	Gradation	D422
	Hydromenter	D4221
	Direct Shear	D3080
	Modified Proctor	D1557
	Permeability	D2434

Trench Cross Section



Sunrise Mtn Landfill
Terrace Borrow Area
Trench Excavation Log

Shaw Project Number 128526

Trench Number TBS-6	Date of Excavation Friday October 17th 2008	*By:* MJS

General Description:

Soil consisted of a homogeneous sandy gravel with significant fines. The only difference that was distinguished between a sandy gravel vs gravelly sand was the amount and size of the rocks/stones in the material.

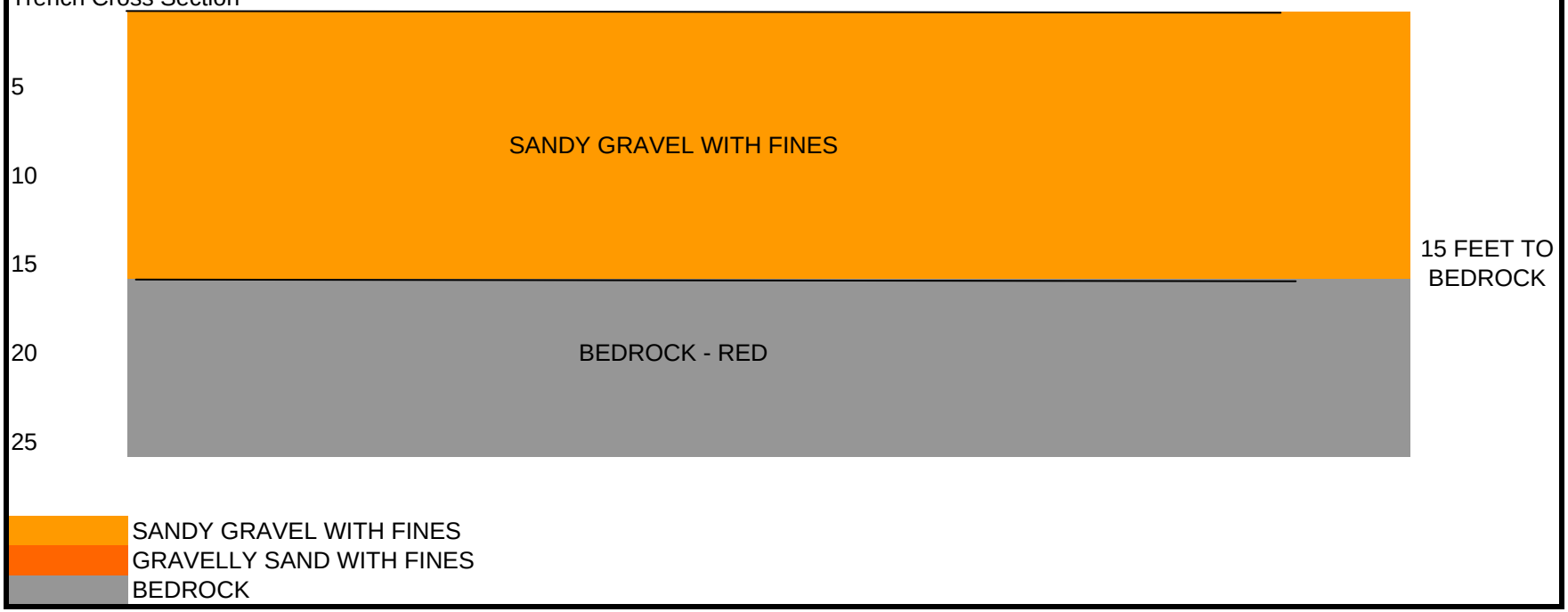
Stratigraphic Description:

SCS	Lithic Description
USCS	Terrace Borrow Source area

Sample:

Yes/No	Analyses	
No	Atterberg Limits	D4318
	Gradation	D422
	Hydromenter	D4221
	Direct Shear	D3080
	Modified Proctor	D1557
	Permeability	D2434

Trench Cross Section



Sunrise Mtn Landfill
Terrace Borrow Area
Trench Excavation Log

Shaw Project Number 128526

Trench Number	TBS-7	Date of Excavation	Friday October 17th 2008	*By:* MJS

General Description: Soil consisted of a non-homogeneous soil with a mix of sandy gravels and gravelly sands with significant fines. The only difference that was distinguished between a sandy gravel vs gravelly sand was the amount and size of the rocks/stones in the material.

Stratigraphic Description:

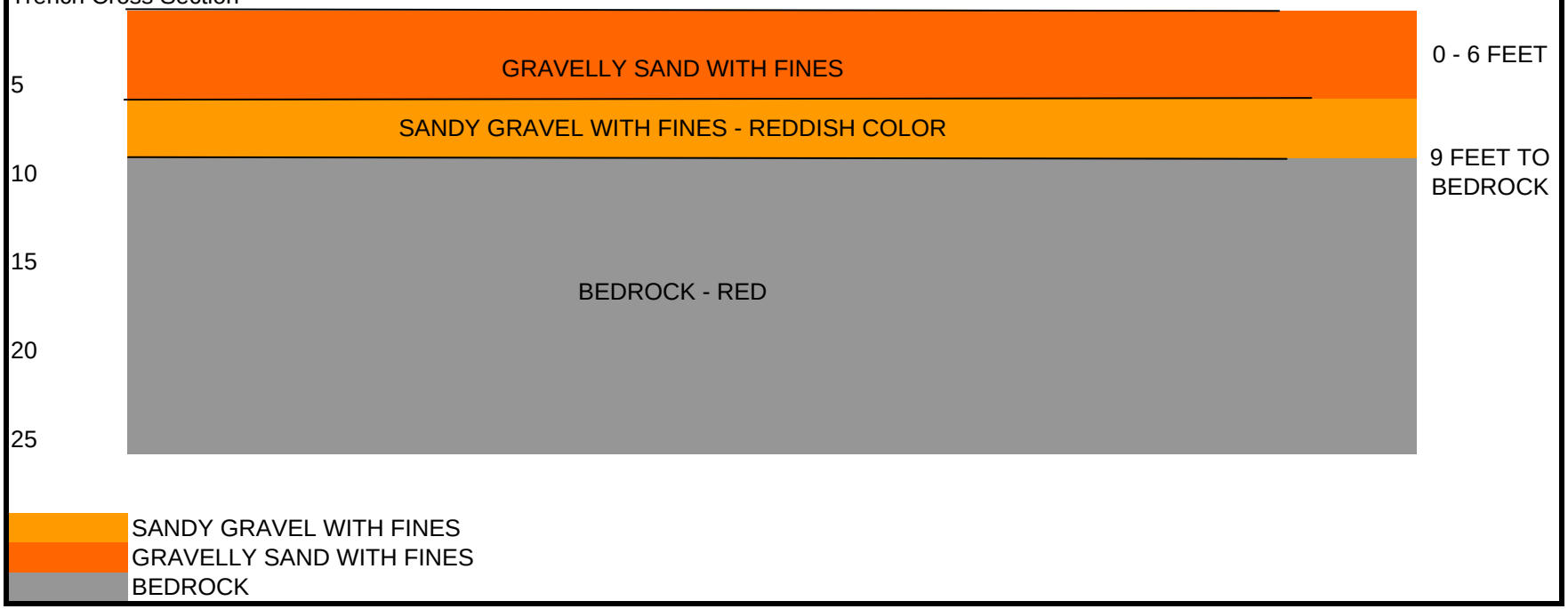
SCS	Lithic Description
USCS	Terrace Borrow Source area

Sample:

Yes/No	Analyses	
Yes	Atterberg Limits	D4318
	Gradation	D422
	Hydromenter	D4221
	Direct Shear	D3080
	Modified Proctor	D1557
	Permeability	D2434

Note: Due to laboratory volume requirements samples TBS-4 and TBS-7 were combined.

Trench Cross Section



Sunrise Mtn Landfill
Terrace Borrow Area
Trench Excavation Log

Shaw Project Number 128526

Trench Number	TBS-8	Date of Excavation	Monday October 20th 2008	*By:* MJS

General Description: Soil consisted of a non-homogeneous gravelly sand/sandy gravel with significant fines. The only difference that was distinguished between a sandy gravel vs gravelly sand was the amount and size of the rocks/stones in the material.

Stratigraphic Description:

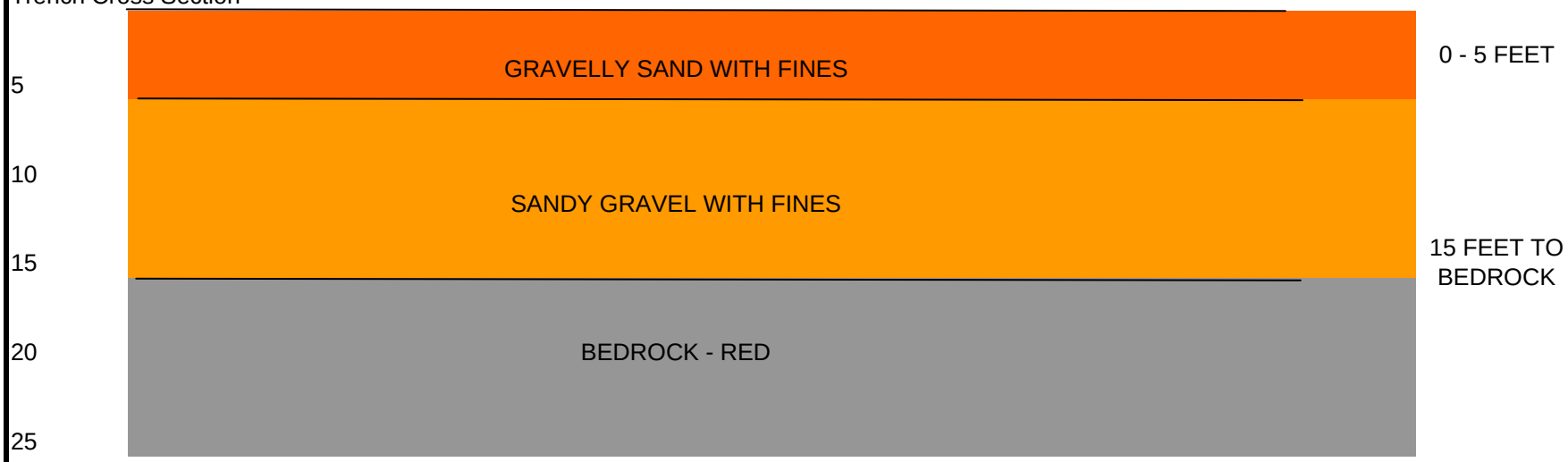
SCS	Lithic Description
USCS	Terrace Borrow Source area

Note: Due to laboratory volume requirements samples TBS-8 and TBS-11 were combined.

Sample:

Yes/No	Analyses	
Yes	Atterberg Limits	D4318
	Gradation	D422
	Hydromenter	D4221
	Direct Shear	D3080
	Modified Proctor	D1557
	Permeability	D2434

Trench Cross Section



SANDY GRAVEL WITH FINES
GRAVELLY SAND WITH FINES
BEDROCK

Sunrise Mtn Landfill
Terrace Borrow Area
Trench Excavation Log

Shaw Project Number 128526

Trench Number	TBS-9	Date of Excavation	Monday October 20th 2008	*By:* MJS

General Description:

Soil consisted of a homogeneous gravelly sand with significant fines. The only difference that was distinguished between a sandy gravel vs gravelly sand was the amount and size of the rocks/stones in the material.

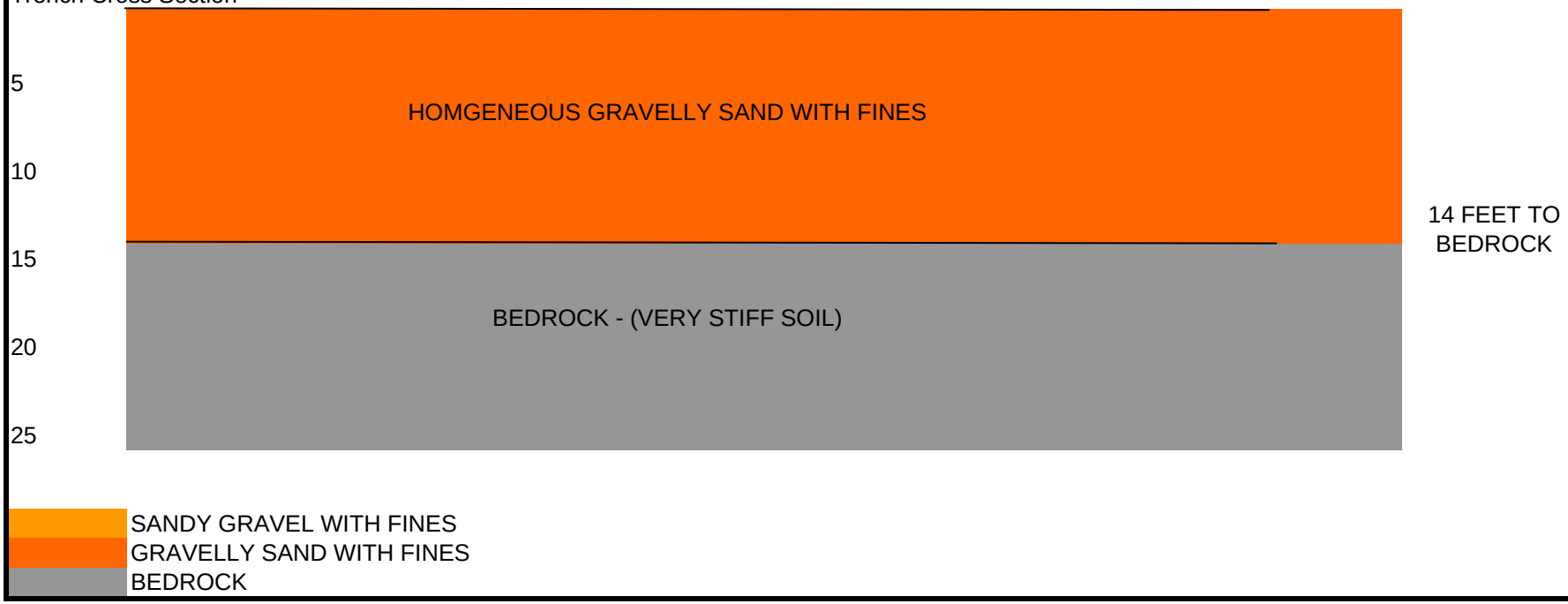
Stratigraphic Description:

SCS	Lithic Description
USCS	Terrace Borrow Source area

Sample:

Yes/No	Analyses	
No	Atterberg Limits	D4318
	Gradation	D422
	Hydromenter	D4221
	Direct Shear	D3080
	Modified Proctor	D1557
	Permeability	D2434

Trench Cross Section



Sunrise Mtn Landfill
Terrace Borrow Area
Trench Excavation Log

Shaw Project Number 128526

Trench Number	TBS-10	Date of Excavation	Monday October 20th 2008	*By:* MJS

General Description:

Soil consisted of a homogeneous gravelly sand with significant fines. The only difference that was distinguished between a sandy gravel vs gravelly sand was the amount and size of the rocks/stones in the material.

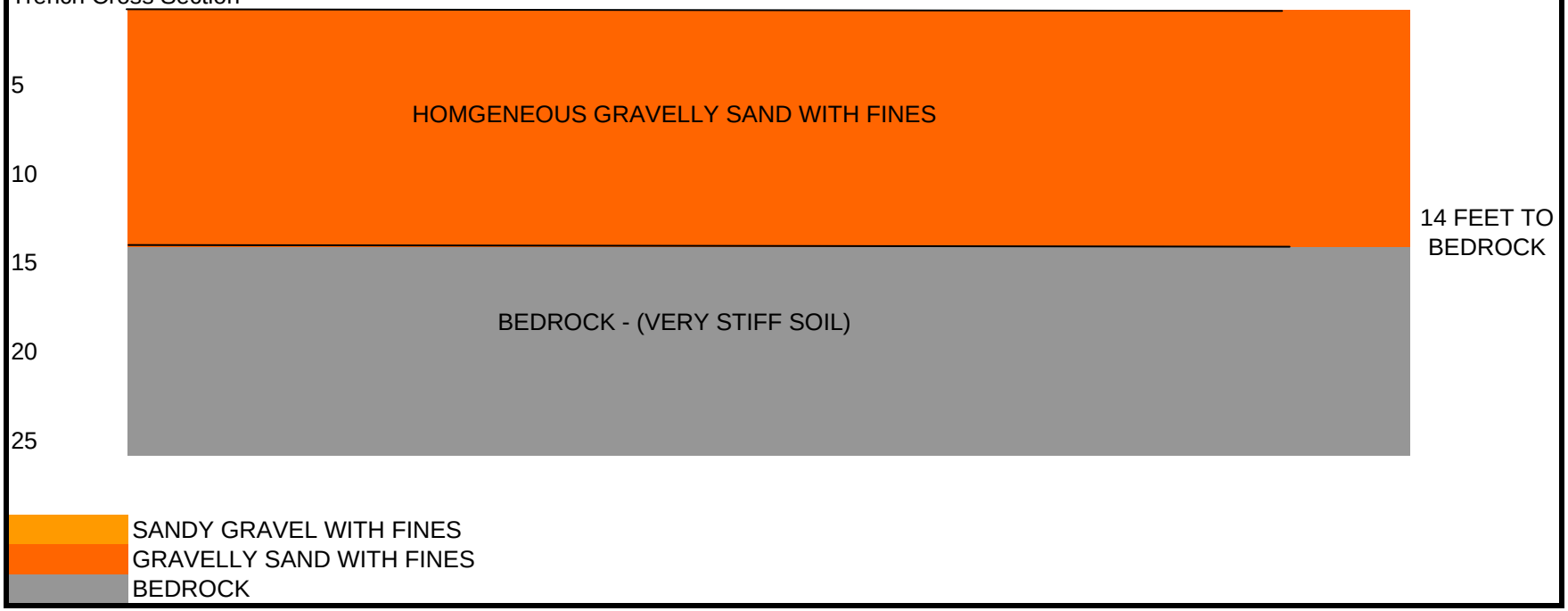
Stratigraphic Description:

SCS	Lithic Description
USCS	Terrace Borrow Source area

Sample:

Yes/No	Analyses	
No	Atterberg Limits	D4318
	Gradation	D422
	Hydromenter	D4221
	Direct Shear	D3080
	Modified Proctor	D1557
	Permeability	D2434

Trench Cross Section



Sunrise Mtn Landfill
Terrace Borrow Area
Trench Excavation Log

Shaw Project Number 128526

Trench Number	TBS-11	Date of Excavation	Monday October 20th 2008	*By:* MJS

General Description:

Soil consisted of a homogeneous sandy gravel with significant fines. The only difference that was distinguished between a sandy gravel vs gravelly sand was the amount and size of the rocks/stones in the material.

Stratigraphic Description:

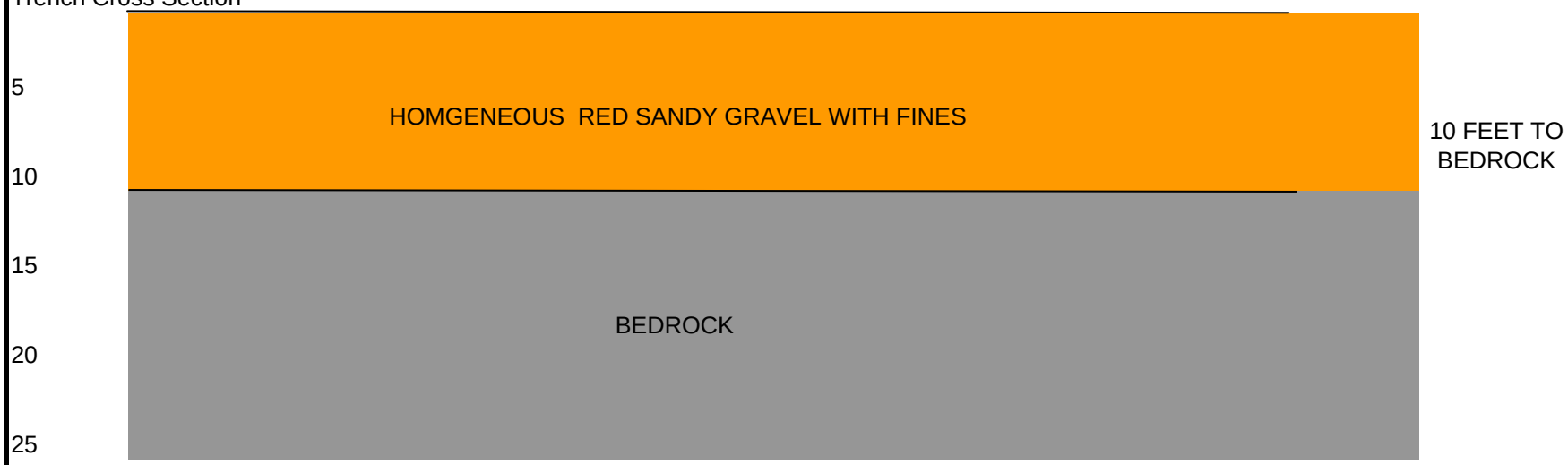
SCS	Lithic Description
USCS	Terrace Borrow Source area

Note: Due to laboratory volume requirements samples TBS-8 and TBS-11 were combined.

Sample:

Yes/No	Analyses	
Yes	Atterberg Limits	D4318
	Gradation	D422
	Hydromenter	D4221
	Direct Shear	D3080
	Modified Proctor	D1557
	Permeability	D2434

Trench Cross Section



SANDY GRAVEL WITH FINES
GRAVELLY SAND WITH FINES
BEDROCK

Sunrise Mtn Landfill
Terrace Borrow Area
Trench Excavation Log

Shaw Project Number 128526

Trench Number	TBS-12	Date of Excavation	Monday October 20th 2008	*By:* MJS

General Description: Soil consisted of a non-homogeneous sandy gravel with significant fines. The only difference that was distinguished between a sandy gravel vs gravelly sand was the amount and size of the rocks/stones in the material.

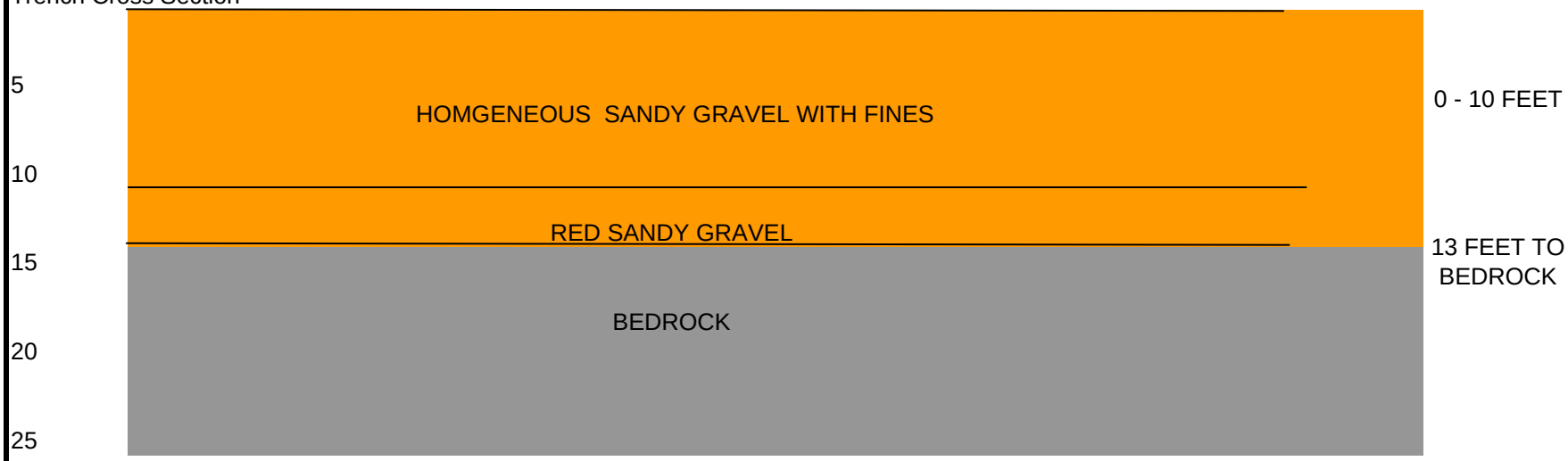
Stratigraphic Description:

SCS	Lithic Description
USCS	Terrace Borrow Source area

Sample:

Yes/No	Analyses	
No	Atterberg Limits	D4318
	Gradation	D422
	Hydromenter	D4221
	Direct Shear	D3080
	Modified Proctor	D1557
	Permeability	D2434

Trench Cross Section



SANDY GRAVEL WITH FINES
GRAVELLY SAND WITH FINES
BEDROCK

Sunrise Mtn Landfill
Colluvium Borrow Area
Trench Excavation Log

Shaw Project Number 128526

Trench Number	CBS-1	Date of Excavation	Friday October 17th 2008	*By:* MJS

General Description:

Soil consisted of a homogeneous sandy gravel with significant fines. The only difference that was distinguished between a sandy gravel vs gravelly sand was the amount and size of the rocks/stones in the material.

Stratigraphic Description:

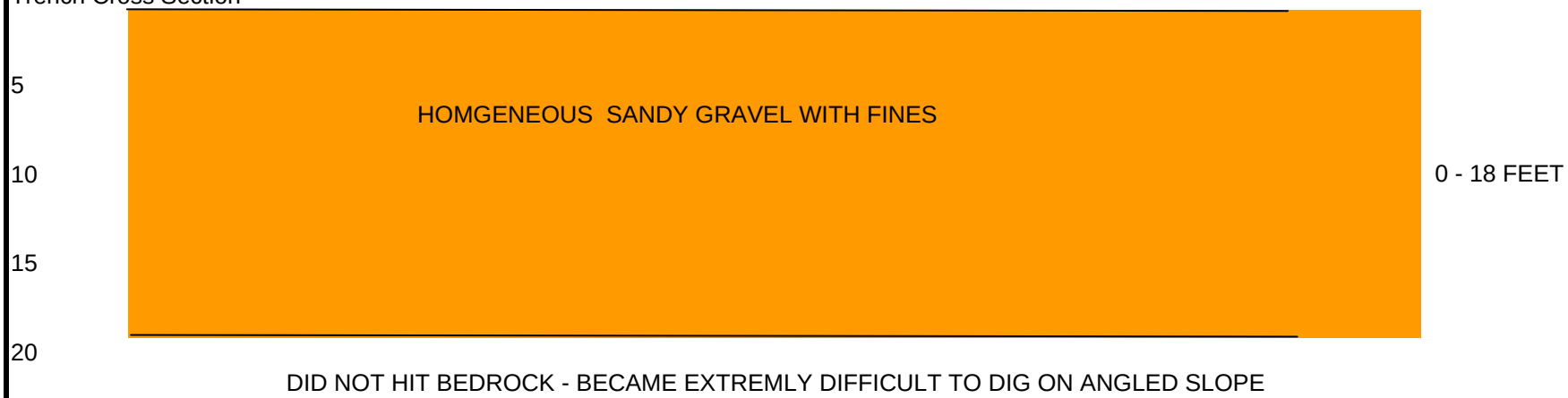
SCS	Lithic Description
USCS	Colluvium Borrow Source area

Note: Due to laboratory volume requirements samples CBS-1 and CBS-3/CBS-4 were combined.

Sample:

Yes/No	Analyses	
Yes	Atterberg Limits	D4318
	Gradation	D422
	Hydromenter	D4221
	Direct Shear	D3080
	Modified Proctor	D1557
	Permeability	D2434

Trench Cross Section



SANDY GRAVEL WITH FINES
GRAVELLY SAND WITH FINES
BEDROCK

Sunrise Mtn Landfill
Colluvium Borrow Area
Trench Excavation Log

Shaw Project Number 128526

Trench Number	CBS-2	Date of Excavation	Monday October 20th 2008	*By:* MJS

General Description:

Soil consisted of a homogeneous sandy gravel with significant fines. The only difference that was distinguished between a sandy gravel vs gravelly sand was the amount and size of the rocks/stones in the material.

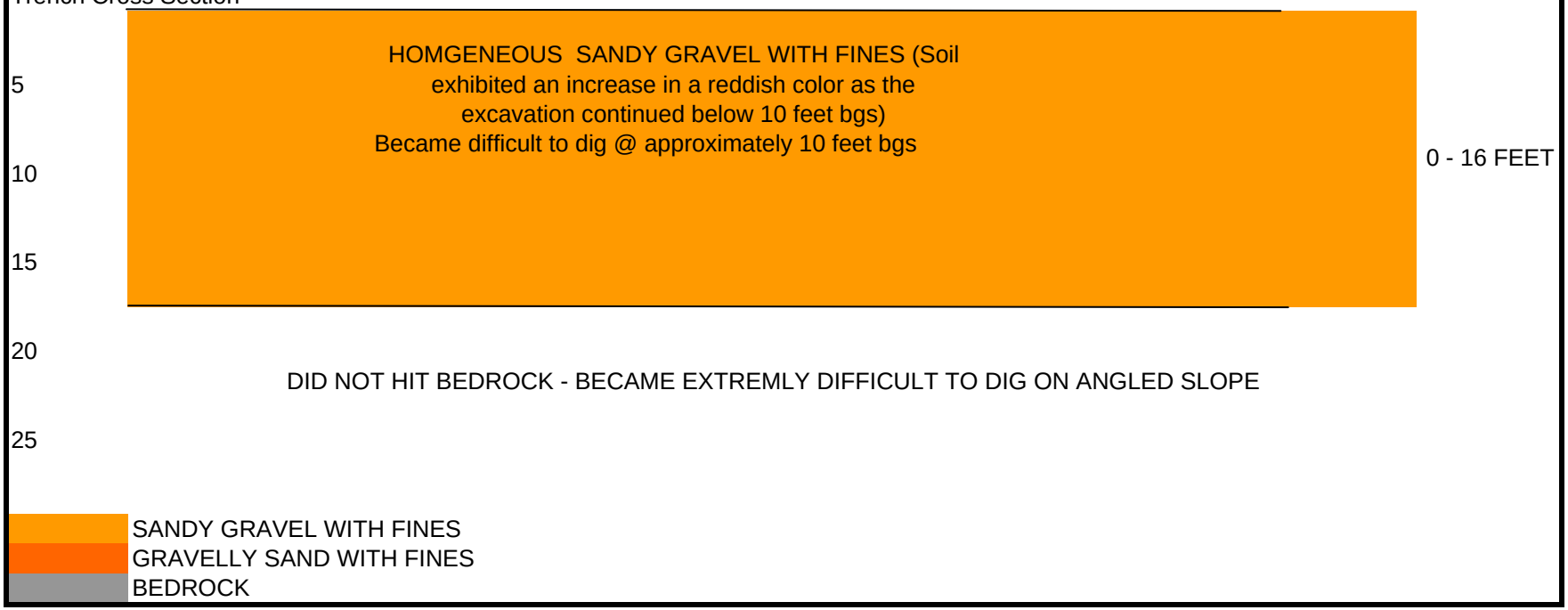
Stratigraphic Description:

SCS	Lithic Description
USCS	Colluvium Borrow Source area

Sample:

Yes/No	Analyses	
No	Atterberg Limits	D4318
	Gradation	D422
	Hydromenter	D4221
	Direct Shear	D3080
	Modified Proctor	D1557
	Permeability	D2434

Trench Cross Section



Sunrise Mtn Landfill
Colluvium Borrow Area
Trench Excavation Log

Shaw Project Number 128526

Trench Number	CBS-3	Date of Excavation	Monday October 20th 2008	*By:* MJS

General Description:

Soil consisted of a homogeneous sandy gravel with significant fines. The only difference that was distinguished between a sandy gravel vs gravelly sand was the amount and size of the rocks/stones in the material.

Stratigraphic Description:

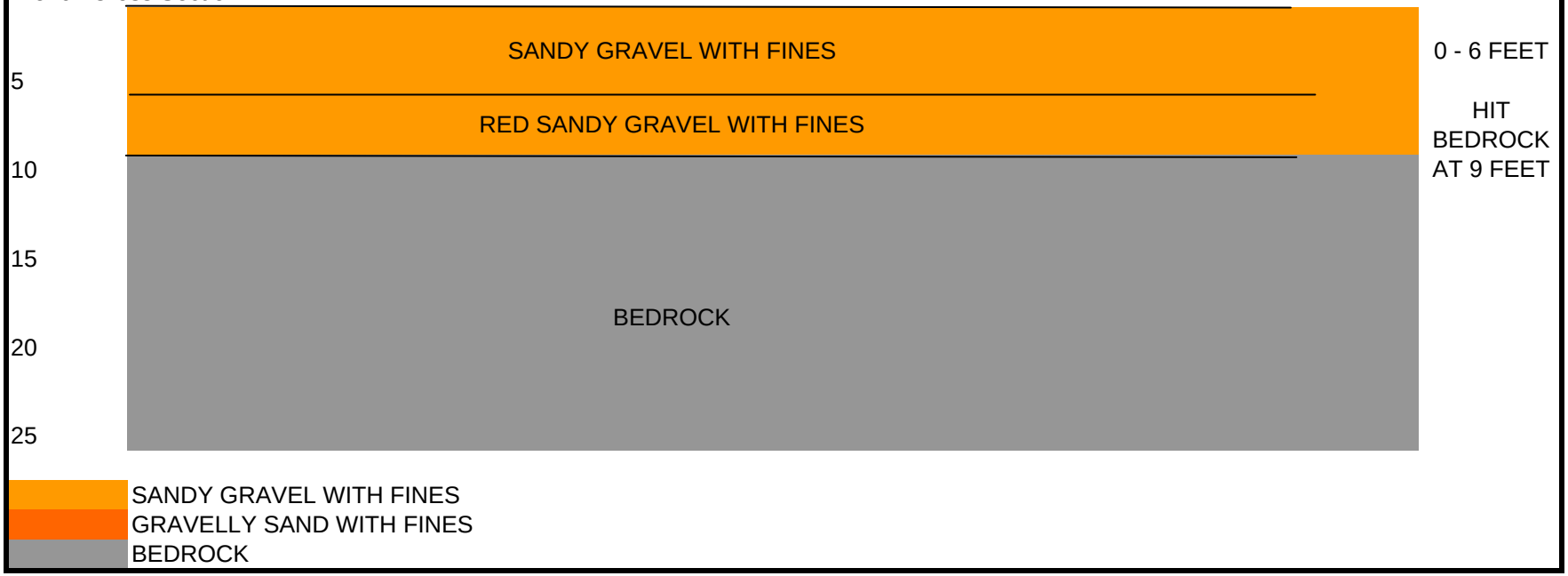
SCS	Lithic Description
USCS	Colluvium Borrow Source area

Note: 1) A composite sample was taken between test pits CBS-3 and CBS-4
2) Due to laboratory volume requirements samples CBS-1 and CBS-3/CBS-4 were combined.

Sample:

Yes/No	Analyses	
Yes	Atterberg Limits	D4318
	Gradation	D422
	Hydromenter	D4221
	Direct Shear	D3080
	Modified Proctor	D1557
	Permeability	D2434

Trench Cross Section



Sunrise Mtn Landfill
Colluvium Borrow Area
Trench Excavation Log

Shaw Project Number 128526

Trench Number	CBS-4	Date of Excavation	Monday October 20th 2008	*By:* MJS

General Description:

Soil consisted of a homogeneous sandy gravel with significant fines. The only difference that was distinguished between a sandy gravel vs gravelly sand was the amount and size of the rocks/stones in the material.

Stratigraphic Description:

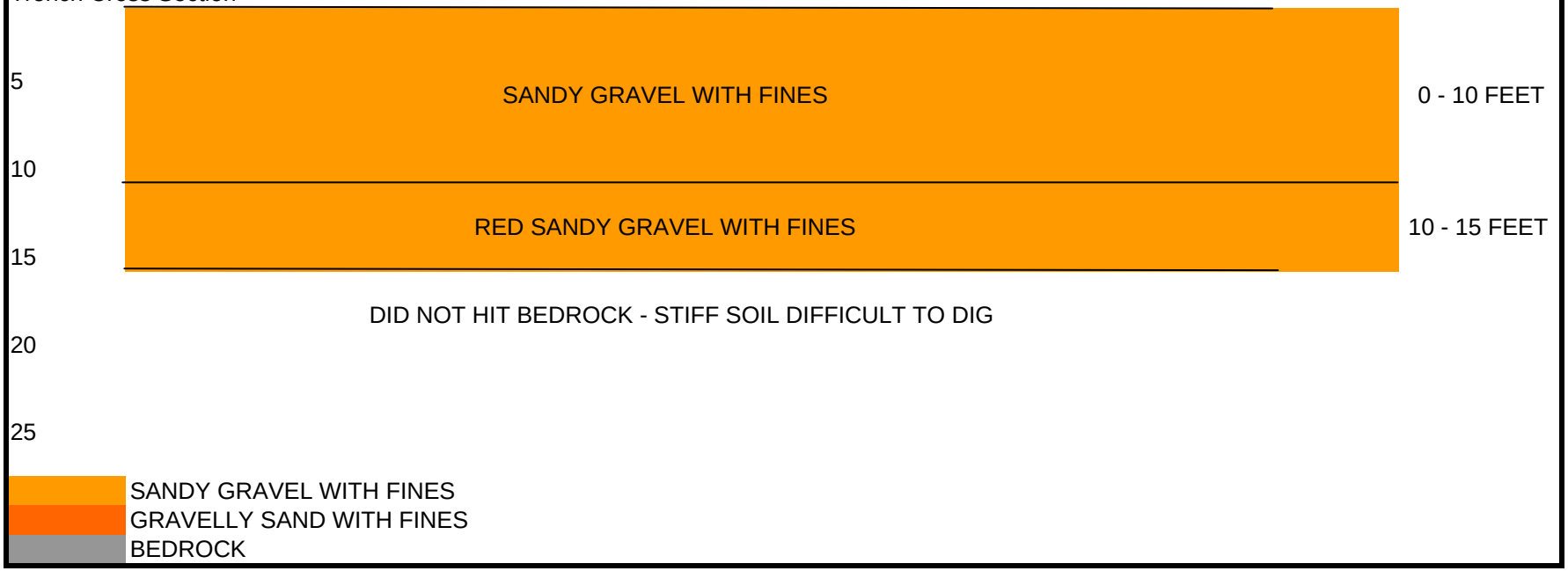
SCS	Lithic Description
USCS	Colluvium Borrow Source area

Sample:

Yes/No	Analyses	
YES	Atterberg Limits	D4318
	Gradation	D422
	Hydromenter	D4221
	Direct Shear	D3080
	Modified Proctor	D1557
	Permeability	D2434

Note: 1) A composite sample was taken between test pits CBS-3 and CBS-4
2) Due to laboratory volume requirements samples CBS-1 and CBS-3/CBS-4 were combined.

Trench Cross Section



Sunrise Mtn Landfill
Colluvium Borrow Area
Trench Excavation Log

Shaw Project Number 128526

Trench Number	CBS-5	Date of Excavation	Monday October 20th 2008	*By:* MJS

General Description: Soil consisted of a homogeneous gravelly sand with significant fines. The only difference that was distinguished between a sandy gravel vs gravelly sand was the amount and size of the rocks/stones in the material.

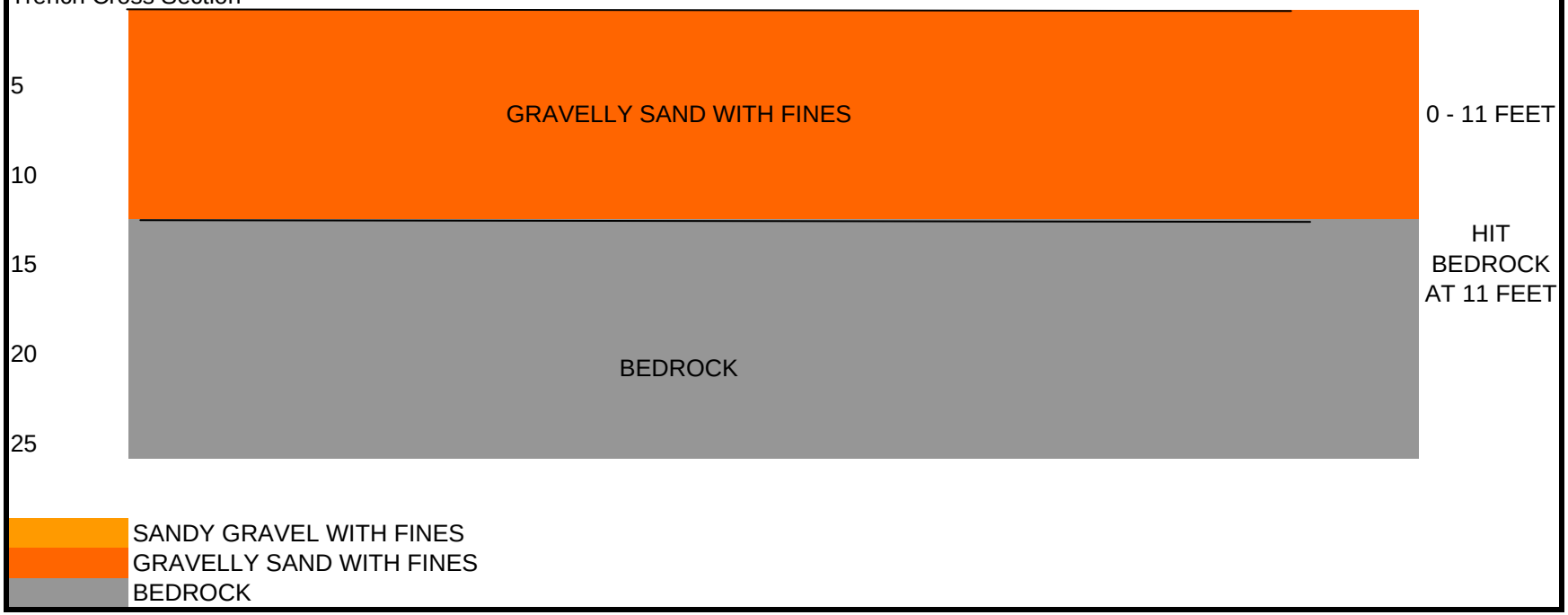
Stratigraphic Description:

SCS	Lithic Description
USCS	Colluvium Borrow Source area

Sample:

Yes/No	Analyses	
No	Atterberg Limits	D4318
	Gradation	D422
	Hydromenter	D4221
	Direct Shear	D3080
	Modified Proctor	D1557
	Permeability	D2434

Trench Cross Section



Sunrise Mtn Landfill
Colluvium Borrow Area
Trench Excavation Log

Shaw Project Number 128526

Trench Number	CBS-6	Date of Excavation	Monday October 20th 2008	*By:* MJS

General Description:

Soil consisted of a homogeneous sandy gravel with significant fines. The only difference that was distinguished between a sandy gravel vs gravelly sand was the amount and size of the rocks/stones in the material.

Stratigraphic Description:

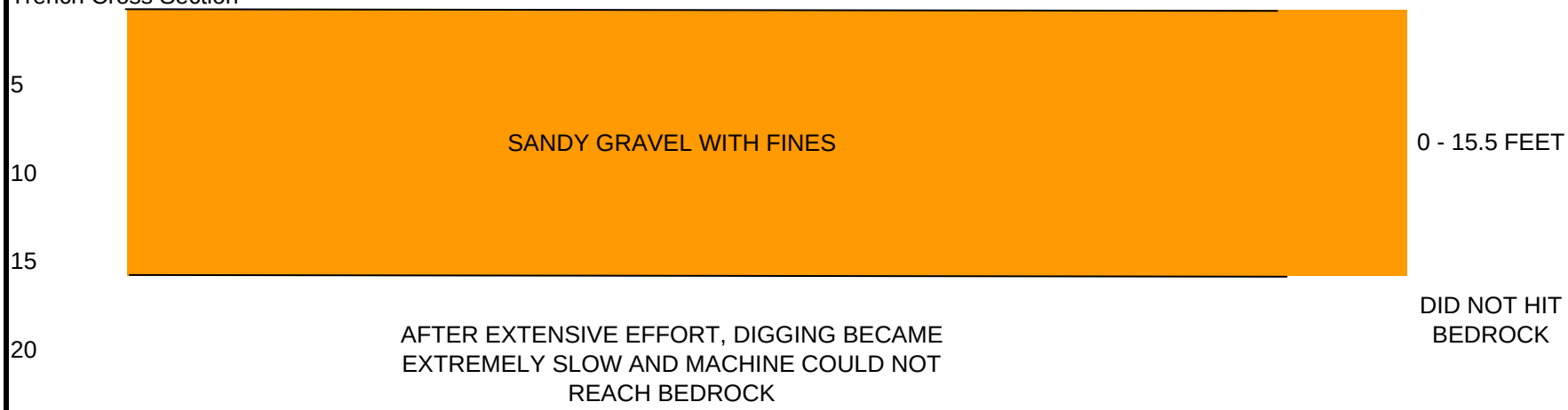
SCS	Lithic Description
USCS	Colluvium Borrow Source area

Note: Due to laboratory volume requirements samples CBS-6 and CBS-8 were combined.

Sample:

Yes/No	Analyses	
Yes	Atterberg Limits	D4318
	Gradation	D422
	Hydromenter	D4221
	Direct Shear	D3080
	Modified Proctor	D1557
	Permeability	D2434

Trench Cross Section



SANDY GRAVEL WITH FINES
GRAVELLY SAND WITH FINES
BEDROCK

Sunrise Mtn Landfill
Colluvium Borrow Area
Trench Excavation Log

Shaw Project Number 128526

Trench Number	CBS-7	Date of Excavation	Tuesday October 21st 2008	*By:* MJS

General Description: Soil consisted of a non-homogeneous sandy gravel with significant fines. The only difference that was distinguished between a sandy gravel vs gravelly sand was the amount and size of the rocks/stones in the material.

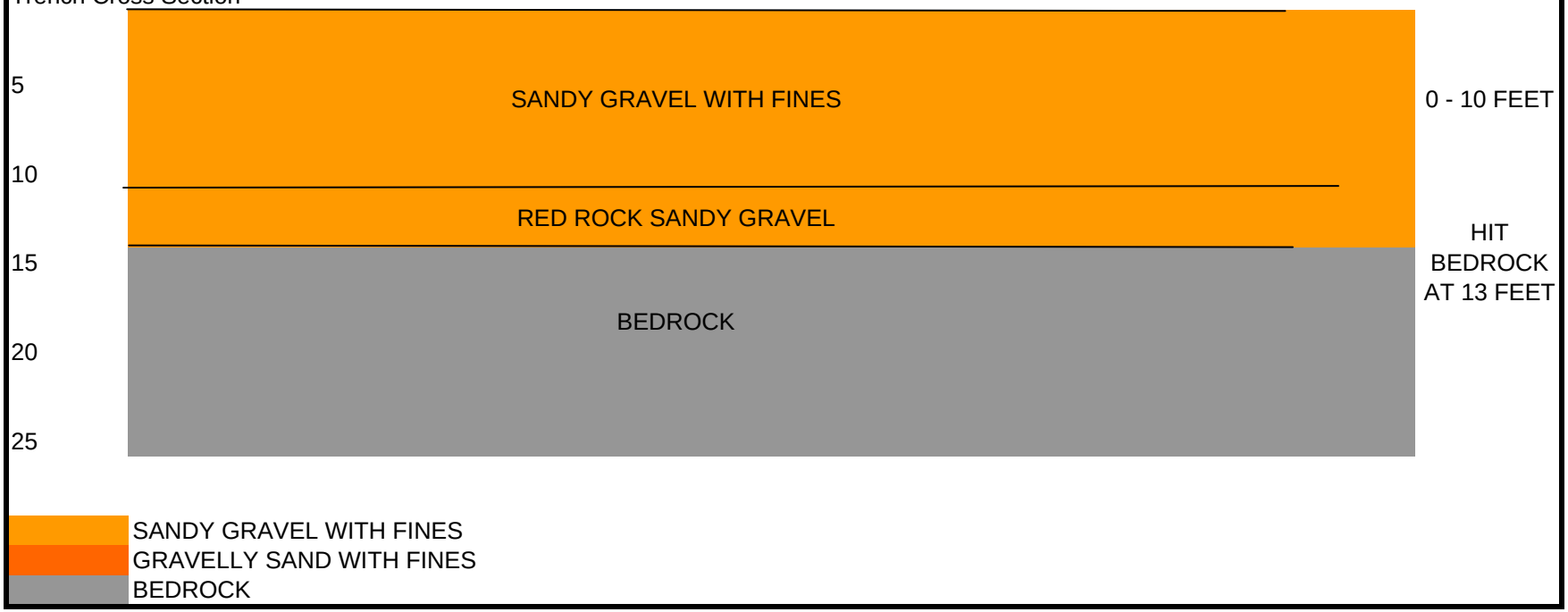
Stratigraphic Description:

SCS	Lithic Description
USCS	Colluvium Borrow Source area

Sample:

Yes/No	Analyses	
No	Atterberg Limits	D4318
	Gradation	D422
	Hydromenter	D4221
	Direct Shear	D3080
	Modified Proctor	D1557
	Permeability	D2434

Trench Cross Section



Sunrise Mtn Landfill
Colluvium Borrow Area
Trench Excavation Log

Shaw Project Number 128526

Trench Number	CBS-8	Date of Excavation	Tuesday October 21st 2008	*By:* MJS

General Description:

Soil consisted of a homogeneous sandy gravel with significant fines. The only difference that was distinguished between a sandy gravel vs gravelly sand was the amount and size of the rocks/stones in the material.

Stratigraphic Description:

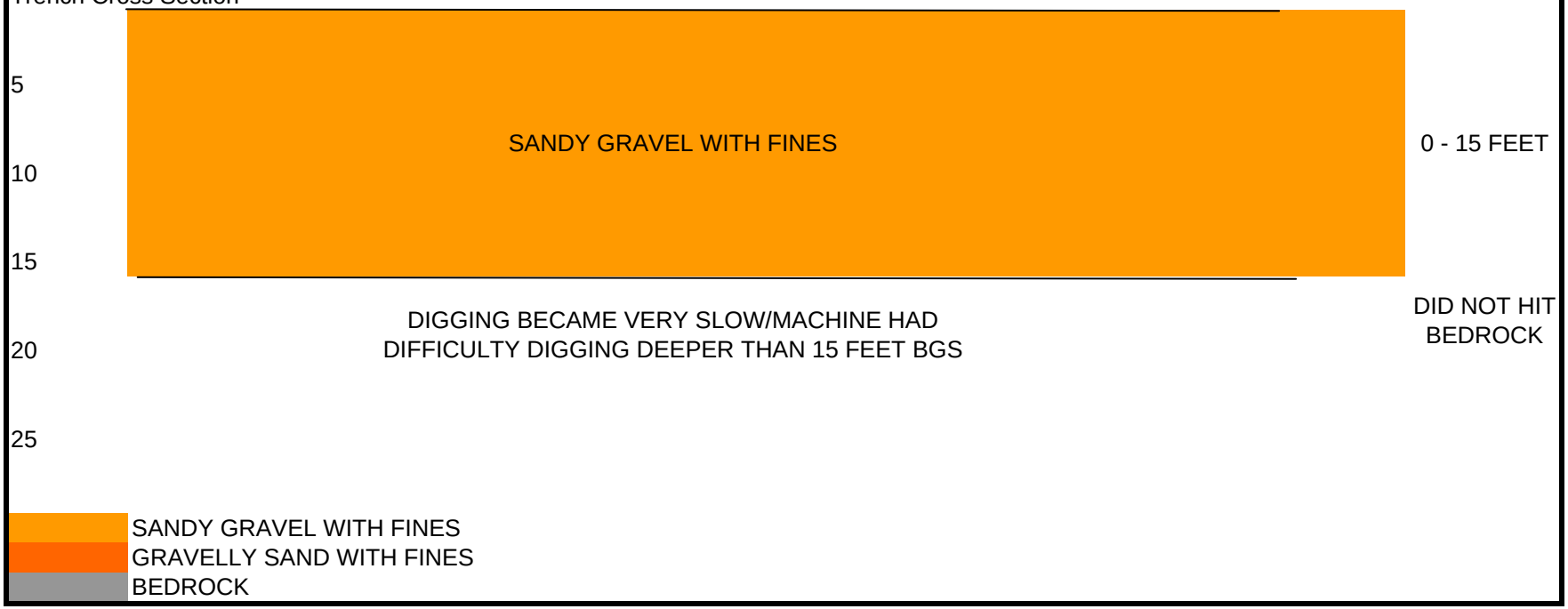
SCS	Lithic Description
USCS	Colluvium Borrow Source area

Note: Due to laboratory volume requirements samples CBS-6 and CBS-8 were combined.

Sample:

Yes/No	Analyses	
Yes	Atterberg Limits	D4318
	Gradation	D422
	Hydromenter	D4221
	Direct Shear	D3080
	Modified Proctor	D1557
	Permeability	D2434

Trench Cross Section



SANDY GRAVEL WITH FINES
GRAVELLY SAND WITH FINES
BEDROCK

Sunrise Mtn Landfill
Colluvium Borrow Area
Trench Excavation Log

Shaw Project Number 128526

Trench Number	CBS-9	Date of Excavation	Tuesday October 21st 2008	*By:* MJS

General Description:

Soil consisted of a homogeneous gravelly sand with significant fines. The only difference that was distinguished between a sandy gravel vs gravelly sand was the amount and size of the rocks/stones in the material.

Stratigraphic Description:

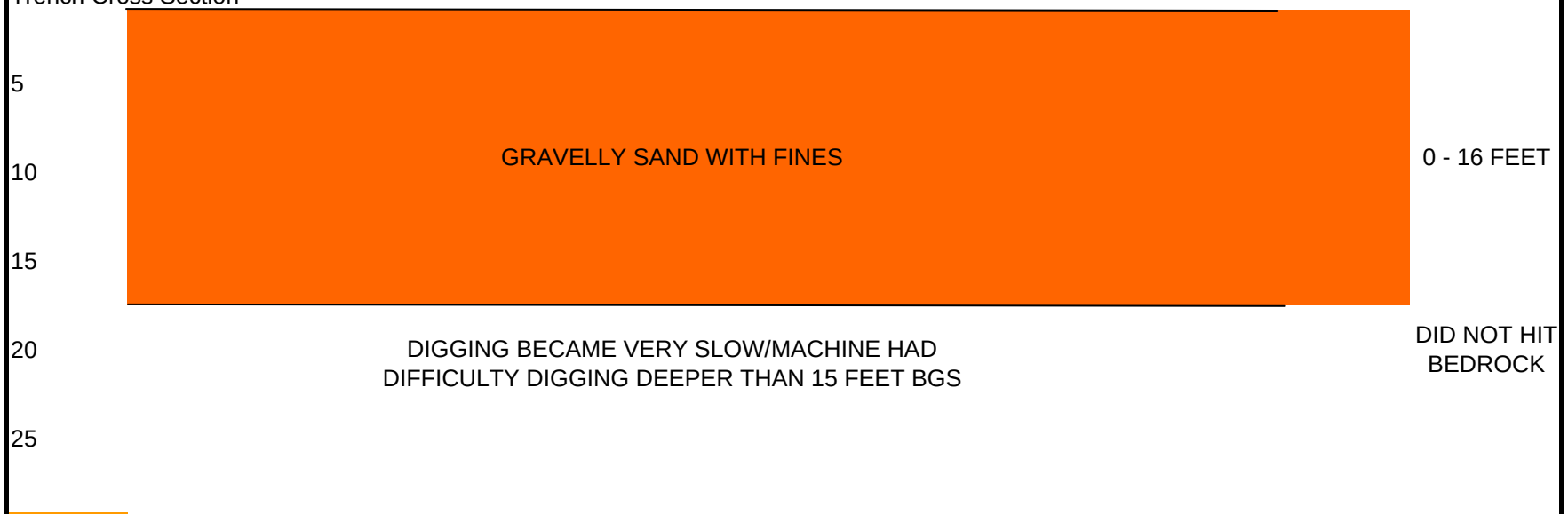
SCS	Lithic Description
USCS	Colluvium Borrow Source area

Note: Due to laboratory volume requirements sample CBS-9 shall not conduct a permeability test.

Sample:

Yes/No	Analyses	
Yes	Atterberg Limits	D4318
	Gradation	D422
	Hydromenter	D4221
	Direct Shear	D3080
	Modified Proctor	D1557

Trench Cross Section



SANDY GRAVEL WITH FINES
GRAVELLY SAND WITH FINES
BEDROCK

Sunrise Mtn Landfill
T-Wash Borrow Area
Trench Excavation Log

Shaw Project Number 128526

Trench Number	TW-1	Date of Excavation	Tuesday October 22nd 2008	*By:* MJS

General Description:

Soil consisted of a homogeneous sandy gravel with significant fines. The only difference that was distinguished between a sandy gravel vs gravelly sand was the amount and size of the rocks/stones in the material.

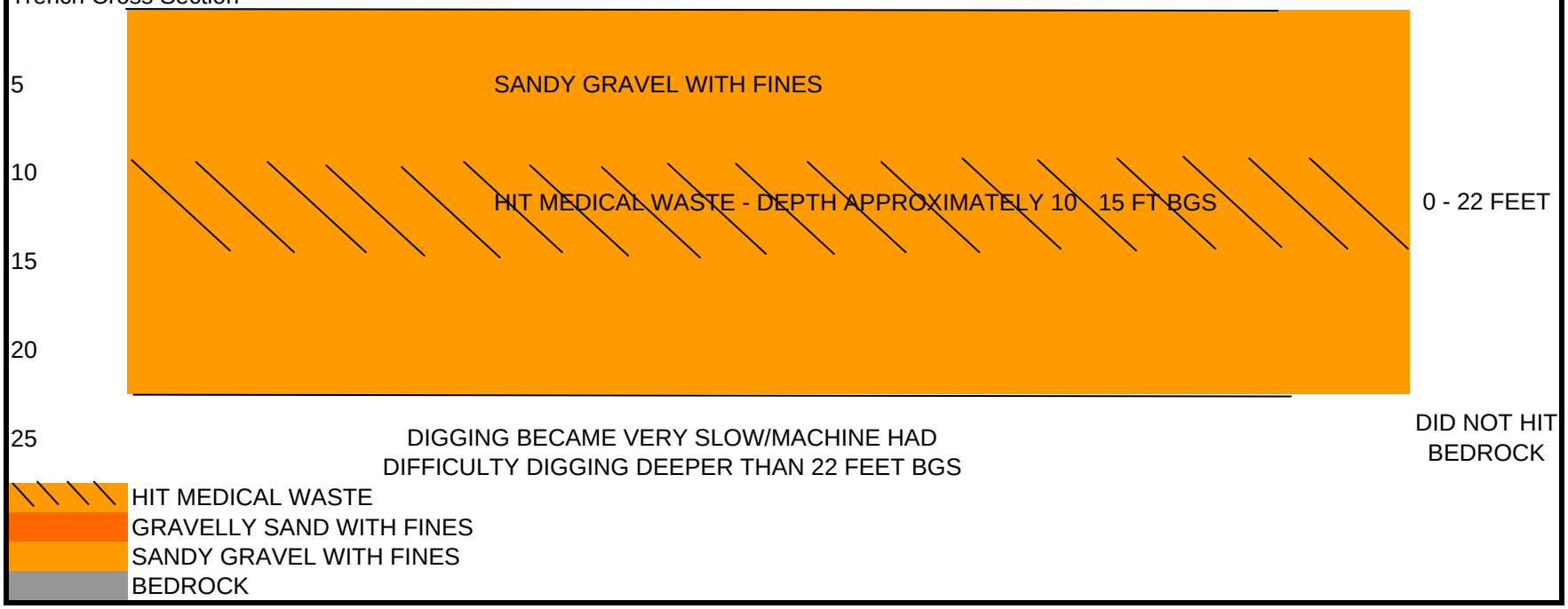
Stratigraphic Description:

SCS	Lithic Description
USCS	T-Wash Borrow Source area

Sample:

Yes/No	Analyses
NO	None

Trench Cross Section



Sunrise Mtn Landfill
T-Wash Borrow Area
Trench Excavation Log

Shaw Project Number 128526

Trench Number	TW-2	Date of Excavation	Tuesday October 22nd 2008	*By:* MJS

General Description:

Soil consisted of a homogeneous sandy gravel with significant fines. The only difference that was distinguished between a sandy gravel vs gravelly sand was the amount and size of the rocks/stones in the material.

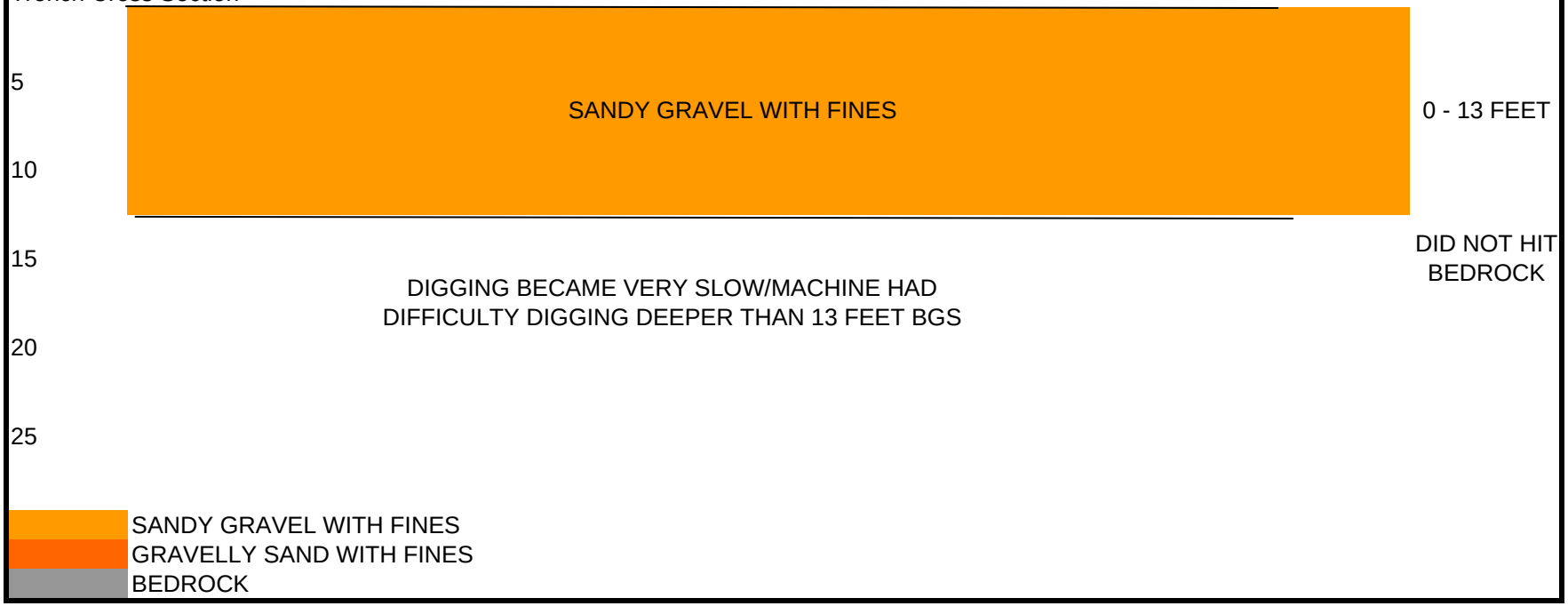
Stratigraphic Description:

SCS	Lithic Description
USCS	T-Wash Borrow Source area

Sample:

Yes/No	Analyses
NO	None

Trench Cross Section



Sunrise Mtn Landfill
T-Wash Borrow Area
Trench Excavation Log

Shaw Project Number 128526

Trench Number	TW-3	Date of Excavation	Tuesday October 22nd 2008	*By:* MJS

General Description:

Soil consisted of a homogeneous sandy gravel with significant fines. The only difference that was distinguished between a sandy gravel vs gravelly sand was the amount and size of the rocks/stones in the material.

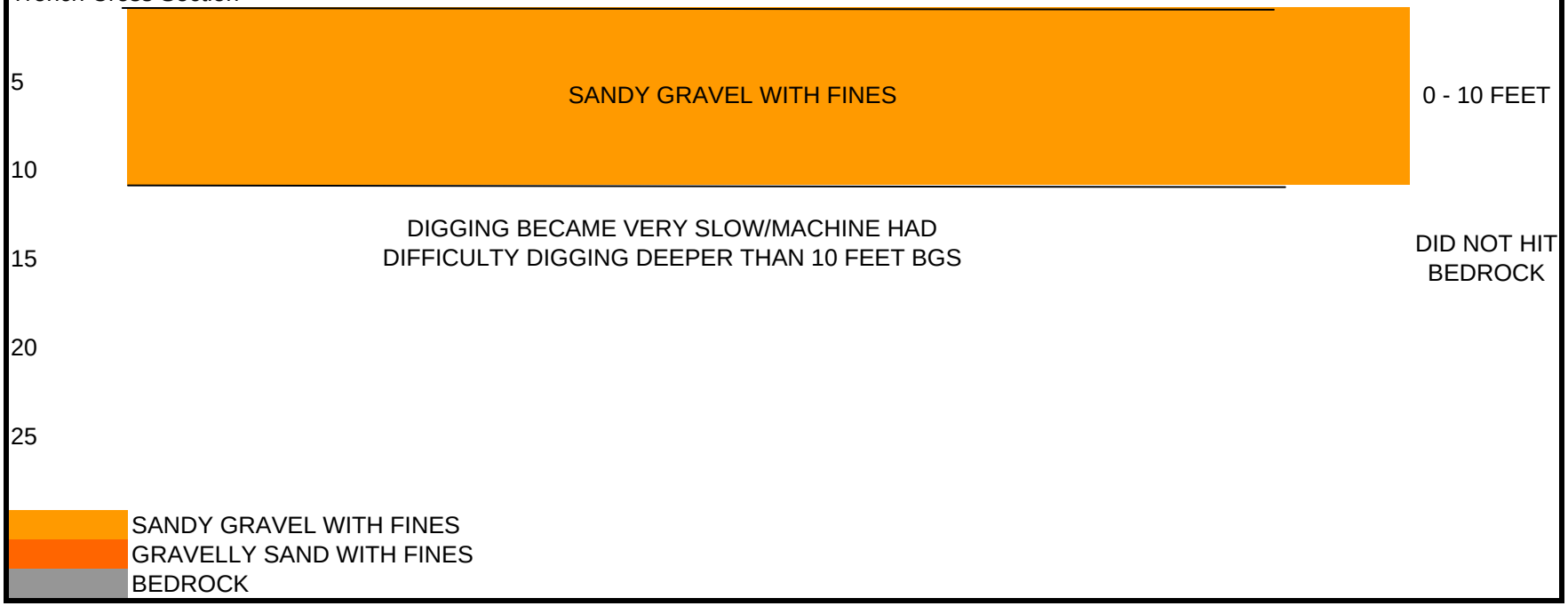
Stratigraphic Description:

SCS	Lithic Description
USCS	T-Wash Borrow Source area

Sample:

Yes/No	Analyses
NO	None

Trench Cross Section



Sunrise Mtn Landfill
T-Wash Borrow Area
Trench Excavation Log

Shaw Project Number 128526

Trench Number	TW-4	Date of Excavation	Tuesday October 22nd 2008	*By:* MJS

General Description:

Soil consisted of a homogeneous sandy gravel with significant fines. The only difference that was distinguished between a sandy gravel vs gravelly sand was the amount and size of the rocks/stones in the material.

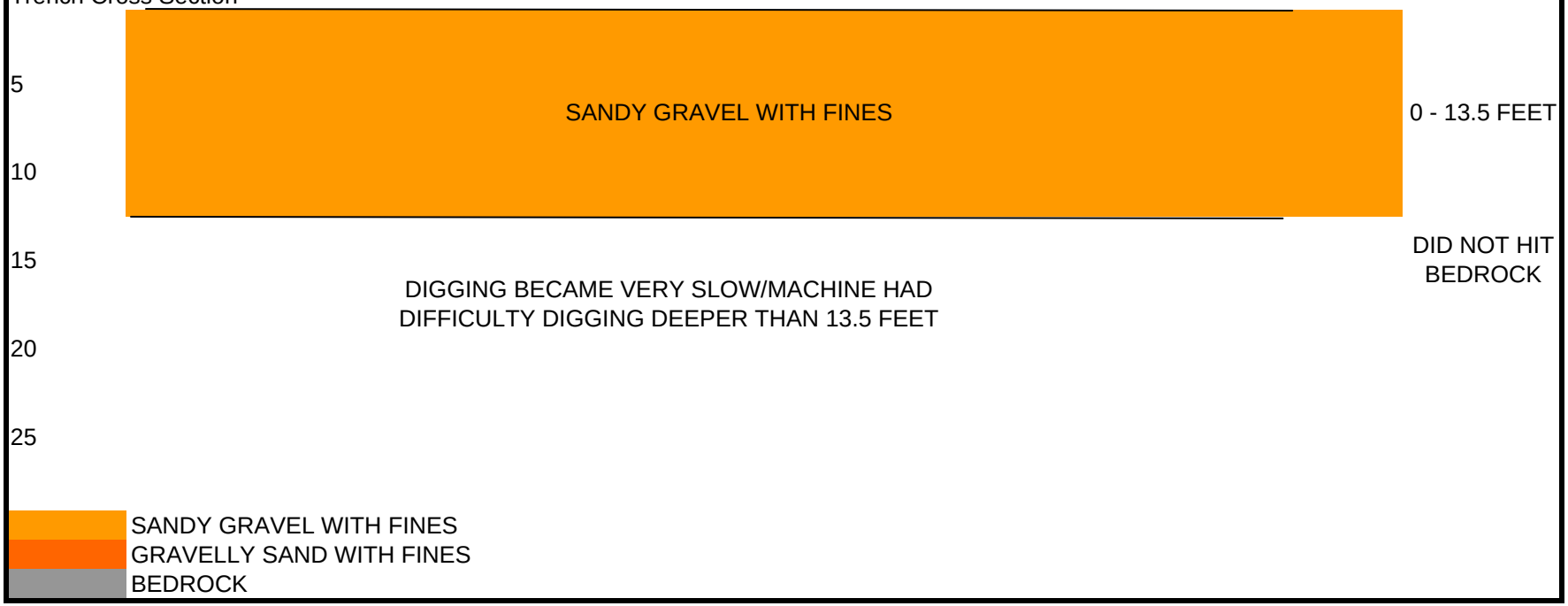
Stratigraphic Description:

SCS	Lithic Description
USCS	T-Wash Borrow Source area

Sample:

Yes/No	Analyses	
YES	Permeability	D2434

Trench Cross Section



Sunrise Mtn Landfill
T-Wash Borrow Area
Trench Excavation Log

Shaw Project Number 128526

Trench Number	TW-5	Date of Excavation	Tuesday October 22nd 2008	*By:* MJS

General Description:

Soil consisted of a homogeneous sandy gravel with significant fines. The only difference that was distinguished between a sandy gravel vs gravelly sand was the amount and size of the rocks/stones in the material.

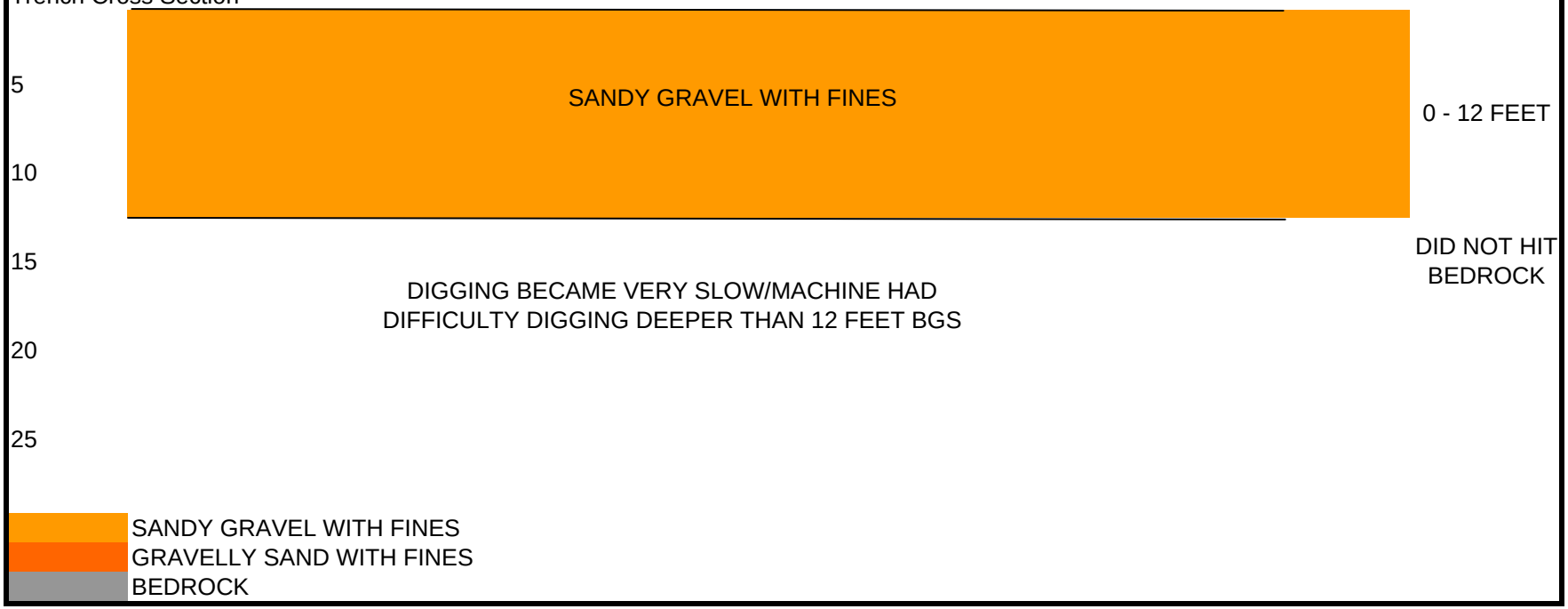
Stratigraphic Description:

SCS	Lithic Description
USCS	T-Wash Borrow Source area

Sample:

Yes/No	Analyses
NO	None

Trench Cross Section



Sunrise Mtn Landfill
T-Wash Borrow Area
Trench Excavation Log

Shaw Project Number 128526

Trench Number	TW-6	Date of Excavation	Tuesday October 22nd 2008	*By:* MJS

General Description:

Soil consisted of a homogeneous sandy gravel with significant fines. The only difference that was distinguished between a sandy gravel vs gravelly sand was the amount and size of the rocks/stones in the material.

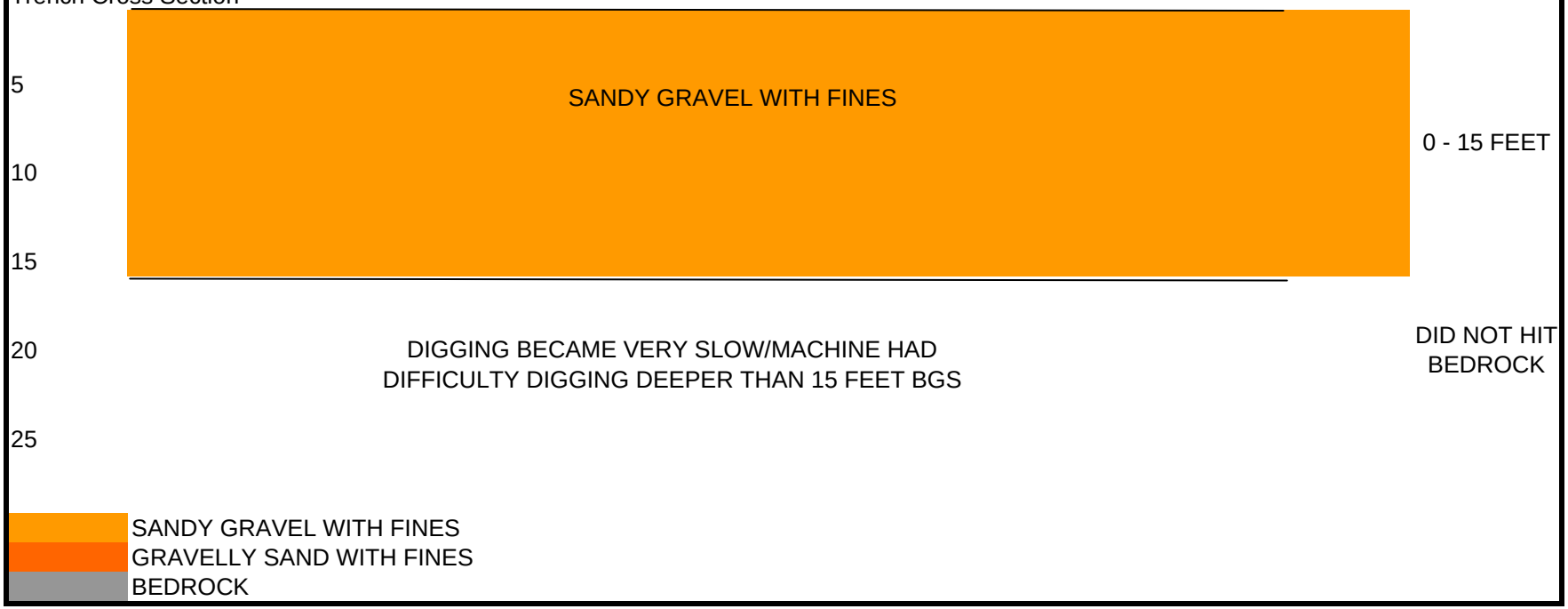
Stratigraphic Description:

SCS	Lithic Description
USCS	T-Wash Borrow Source area

Sample:

Yes/No	Analyses
NO	None

Trench Cross Section



Sunrise Mtn Landfill
T-Wash Borrow Area
Trench Excavation Log

Shaw Project Number 128526

Trench Number	TW-7	Date of Excavation	Tuesday October 22nd 2008	*By:* MJS

General Description:

Soil consisted of a homogeneous sandy gravel with significant fines. The only difference that was distinguished between a sandy gravel vs gravelly sand was the amount and size of the rocks/stones in the material.

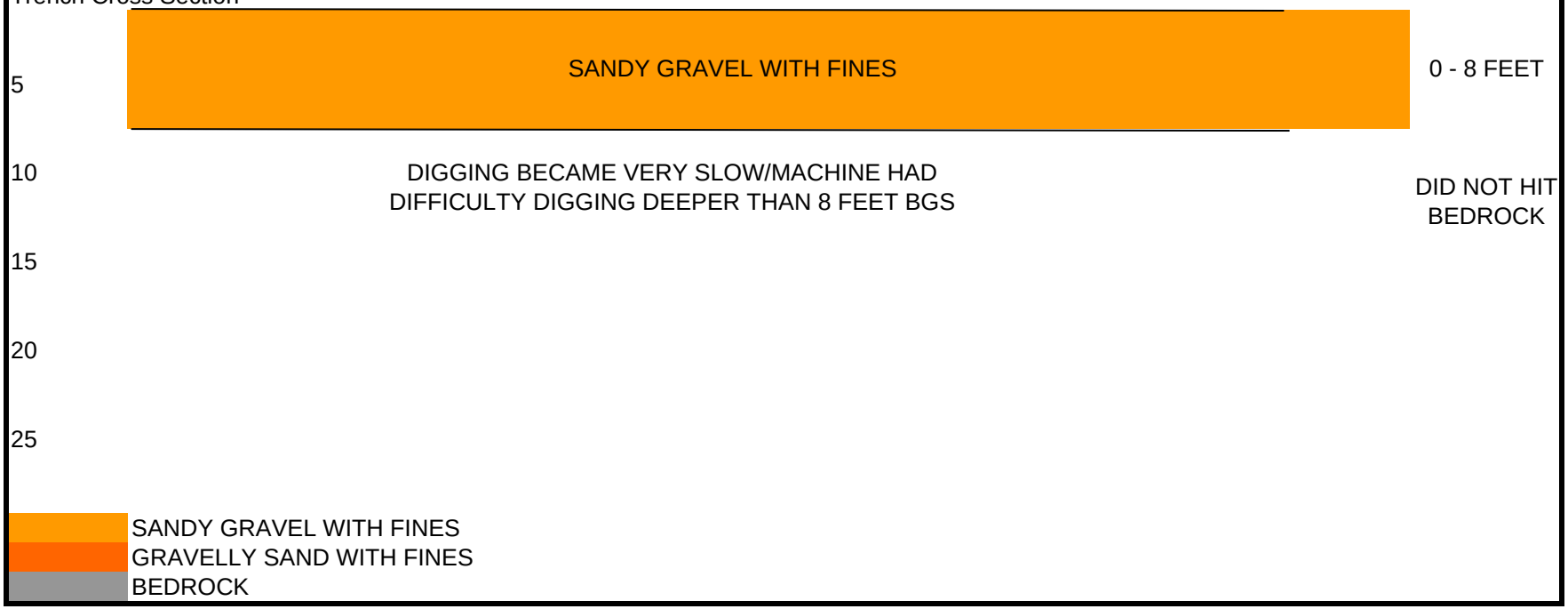
Stratigraphic Description:

SCS	Lithic Description
USCS	T-Wash Borrow Source area

Sample:

Yes/No	Analyses
NO	None

Trench Cross Section



Sunrise Mtn Landfill
T-Wash Borrow Area
Trench Excavation Log

Shaw Project Number 128526

Trench Number	TW-8	Date of Excavation	Tuesday October 22nd 2008	*By:* MJS

General Description:

Soil consisted of a homogeneous sandy gravel with significant fines. The only difference that was distinguished between a sandy gravel vs gravelly sand was the amount and size of the rocks/stones in the material.

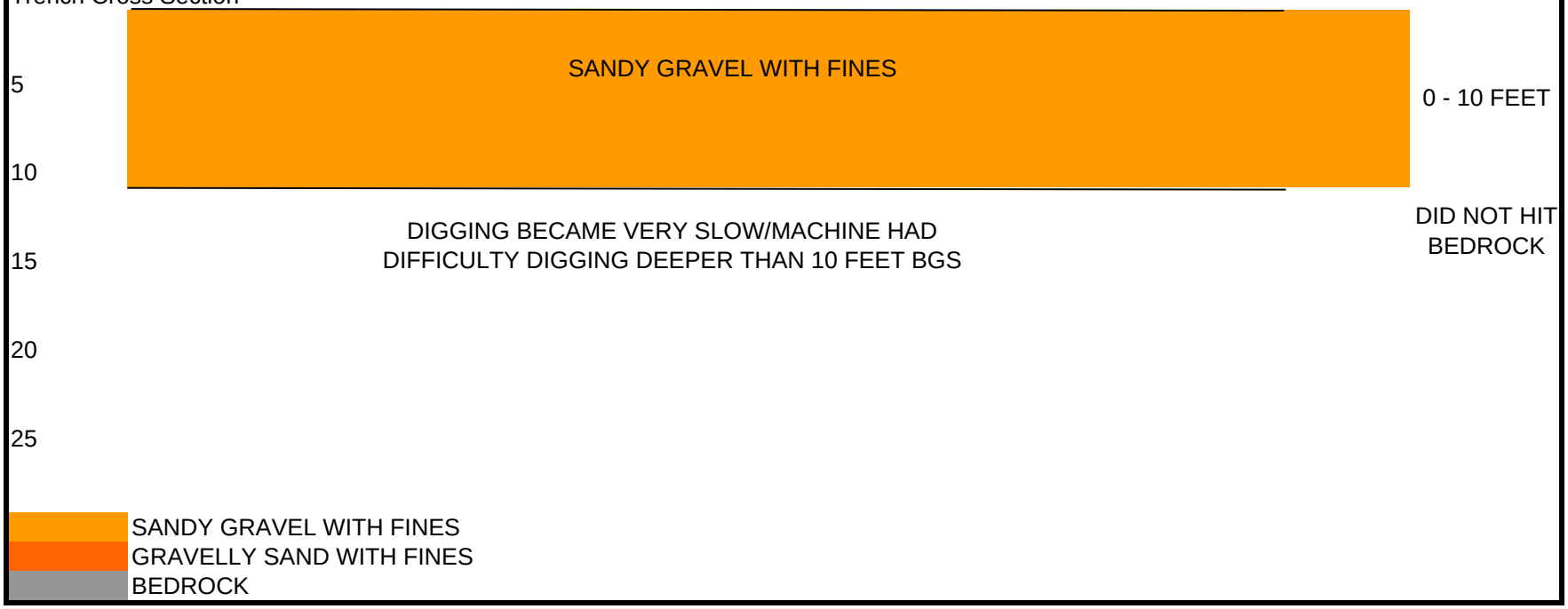
Stratigraphic Description:

SCS	Lithic Description
USCS	T-Wash Borrow Source area

Sample:

Yes/No	Analyses
NO	None

Trench Cross Section



Appendix C
Soil Volumes

Republic Services
Sunrise Landfill
Colluvium and Terrace Borrow Source Volumes
(12/19/2008)

Boring ID	Borrow Source	Area (sf)	Depth to Bedrock (ft)	Volume (CY)
TBS-1	Terrace	48299	7	12522
TBS-2	Terrace	31066	6	6904
TBS-3	Terrace	33496	10	12406
TBS-4	Terrace	40542	8	12013
TBS-5	Terrace	29711	5.5	6052
TBS-6	Terrace	52700	15	29278
TBS-7	Terrace	53986	9	17995
TBS-8	Terrace	39992	15	22218
TBS-9	Terrace	22551	14	11693
TBS-10	Terrace	37619	14	19506
TBS-11	Terrace	26685	10	9883
TBS-12	Terrace	23296	13	11217
CBS-1	Colluvium	35142	18	23428
CBS-2	Colluvium	36132	16	21411
CBS-3	Colluvium	30882	9	10294
CBS-4	Colluvium	48090	15	26717
CBS-5	Colluvium	54019	11	22008
CBS-6	Colluvium	36501	15.5	20954
CBS-7	Colluvium	27037	13	13018
CBS-8	Colluvium	45910	15	25506
CBS-9	Colluvium	27202	16	16120
				351142
Volume Colluvium (CY) 179455	Volume Terrace (CY) 171687			
179500	**171700**			**351000**

Volume Assumptions:
1) Flat square footage area was determined per test pit using polygon method
2) Calculated based on straight cut walls from surface to depth

Republic Services
Sunrise Landfill
T-WASH Borrow Source Volumes
(12/31/2008)

Boring ID	Borrow Source	Area (sf)	Area (acre)	Depth to Bedrock (ft)	Volume (CY)	Comment
TW-1	T-WASH	130192	3	10	48219	Hit medical waste @ approximately 10-15' bgs (Actual Depth fo Bedrock=22'bgs)
TW-2	T-WASH	113606	3	13	54699	Subtracted out Volume of Discovered Med Waste from March 2008
TW-3	T-WASH	115069	3	10	42618	
TW-4	T-WASH	188229	4	13.5	94114	Subtracted out Volume of Discovered Med Waste from March 2008
TW-5	T-WASH	97521	2	12	43343	
TW-6	T-WASH	147974	3	15	82208	
TW-7	T-WASH	103859	2	8	30773	
TW-8	T-WASH	104441	2	10	38682	
01 T WASH DCS	T-WASH	NA	NA	9	NA	Included in TW-1
02 T WASH DCS	T-WASH	NA	NA	9	NA	Included in TW-3
03 T WASH DCS	T-WASH	NA	NA	9	NA	Included in TW-4
04 T WASH DCS	T-WASH	NA	NA	9	NA	Included in TW-7
05 T WASH DCS	T-WASH	142313	3	9	47438	
06 T WASH DCS	T-WASH	194241	4	9	64747	
07 T WASH DCS	T-WASH	247526	6	9	82509	
08 T WASH DCS	T-WASH	412218	9	9	137406	
Volume T-WASH (CY)	Area-T-WASH (acre)					
766756	46					
					766800	

Volume Assumptions:
1) Flat square footage area was determined per test pit using polygon method
2) Calculated based on straight cut walls from surface to depth

Appendix D
Geotechnical Laboratory Data

GEOTEK

6835 South Escondido Street
Las Vegas, NV 89119
(702) 897-1424
(702) 897-2213 fax

SIEVE ANALYSIS & HYDROMETER
ASTM D 422

Project No.	8787
Client:	Republic Services
Project Name:	Sunrise Landfill
Date:	10/24/2008
Sample Desc:	TBS-1 & 2
GeoTek Lab No:	97393

Size		% passing
(mm)	(inch - #)	
75	3 in	100.0
50	2 in	94.7
37.5	1.5 in	94.7
25	1 in	93.7
19	3/4 in	93.2
9.5	3/8 in	92.6
4.75	No. 4	91.5
2.38	No. 8	87.4
2	No. 10	86.4
1.19	No. 16	83.7
0.595	No. 30	80.9
0.42	No. 40	79.5
0.297	No. 50	77.7
0.149	No. 100	71.5
0.074	No. 200	35.4
0.0358	-	12.4
0.0228	-	11.5
0.0134	-	8.9
0.0095	-	8.0
0.0078	-	7.1
0.0068	-	6.7
0.0055	-	6.7
0.0034	-	6.2
0.0014	-	4.4

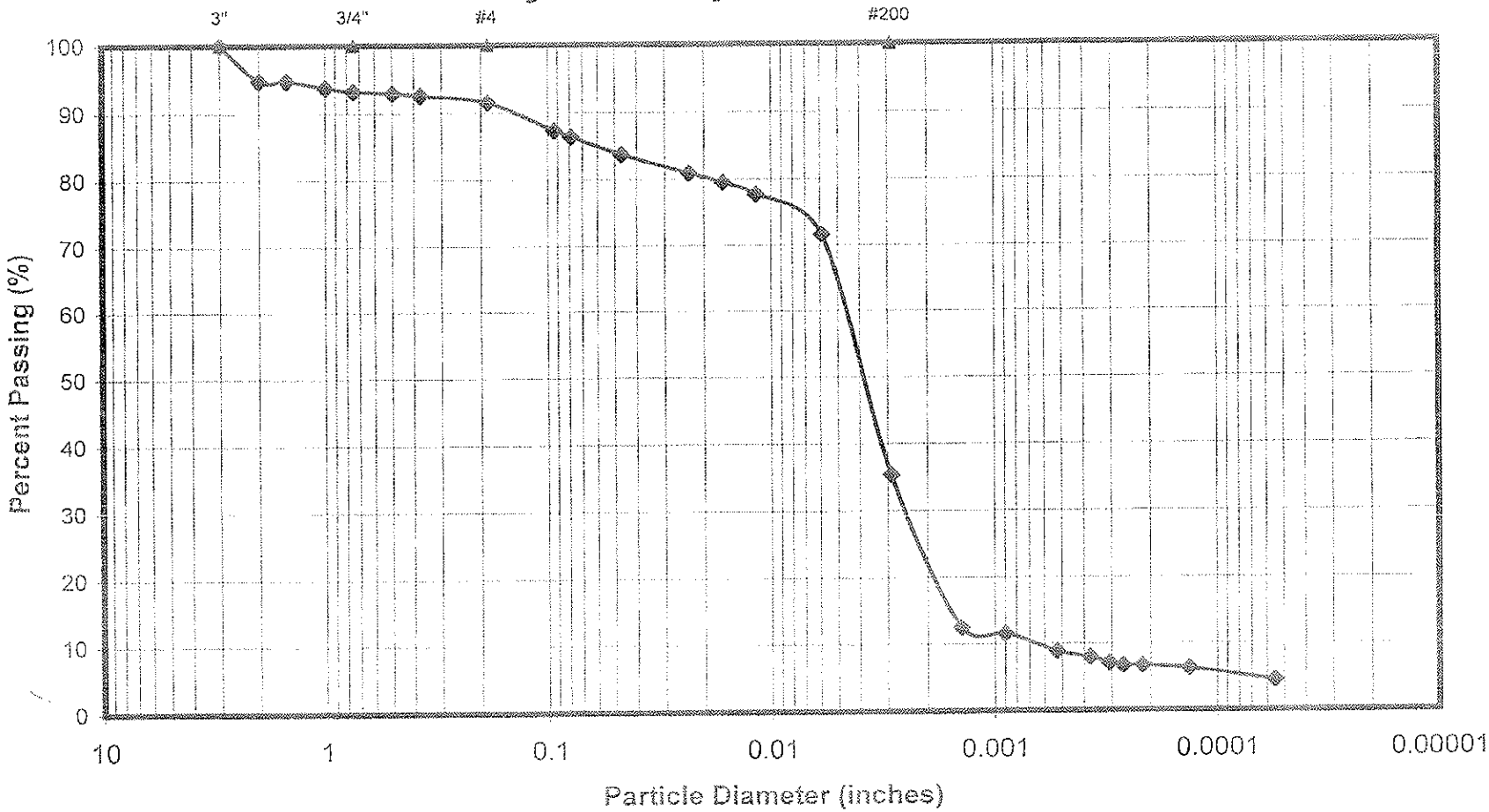
Reviewed By: _____ Date: 11-28-08

GEOTEK

6835 South Escondido Street
Las Vegas, NV 89119
(702) 897-1424
(702) 897-2213 fax

Project No.	8787
Client:	Republic Services
Project Name:	Sunrise Landfill
Date:	10/24/2008
Sample Desc:	TBS-1 & 2
GeoTek Lab No:	97393

Sieve Analysis w/Hydrometer ASTM D422



Reviewed By: _____ Date: 11-21-08

Geo Tek, Inc.
6825 S. Escondido Street, Suite A
Las Vegas, Nevada 89119-3826

Telephone (702) 897 1424

SampleID: LNS08/97393
Report No: MAT:LNS08/97393
Issue No: 1
This report replaces all previous issues of report no 'MAT:LNS08/97393'

Aggregate/Soil Test Report

Client: REPUBLIC SERVICES OF SOUTHERN NEVADA

Project: 8787-LV1
SUNRISE LANDFILL

This laboratory is accredited by AASHTO
The test(s) reported have been performed in accordance with its terms of accreditation

Date Issued: 11/14/2008 Signed: 11/14/2008

Sample Details

Sample ID: LNS08/97393
Field Sample ID:
Date Sampled: 10/24/2008
Source:
Material:
Specification: Hyrometer Sieve
Sampling Method:
Location: TBS-1 & 2

Other Test Results

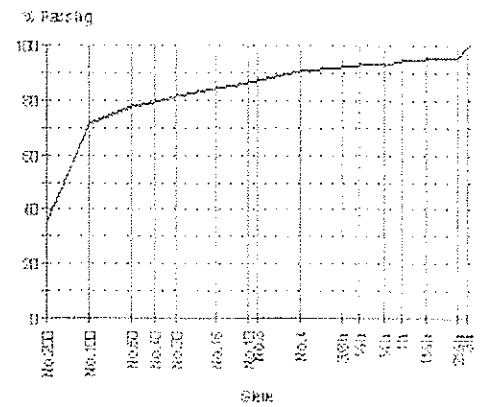
Description	Method	Result	Limits
Maximum Dry Density (lb/ft³)	AASHTO T 180	113.0	
Optimum Moisture Content (%)		10.0	
Oversize Sieve		No.4 (4.75mm)	
Oversize Material (%)			
Oversize Sieve 2		¾in (19mm)	
Oversize Material (%)		5	
Liquid Limit (%)	AASHTO T89/T90	NO	
Method			
Plastic Limit (%)		NO	
Plasticity Index (%)		NP	
Sample History			
Preparation			
Bulk Specific Gravity	AASHTO T 85	2.44	
Bulk Specific Gravity SSD		2.53	
Apparent Specific Gravity		2.68	
Absorption (%)		3.7	
Additional Notes			
Group Symbol	ASTM D 2487	SM	
Group Name		Silty sand	

Particle Size Distribution

Method: AASHTO T 27, AASHTO T 11
Drying by:

Sieve Size	% Passing	Limits
3in (75.0mm)	100	
2½in (63.0mm)	95	
1½in (37.5mm)	95	
1in (25.0mm)	94	
¾in (19.0mm)	93	
½in (12.5mm)	93	
3/8in (9.5mm)	92	
No.4 (4.75mm)	91	
No.8 (2.36mm)	87	
No.10 (2.0mm)	86	
No.16 (1.18mm)	84	
No.30 (600µm)	81	
No.40 (425µm)	79	
No.50 (300µm)	78	
No.100 (150µm)	71	
No.200 (75µm)	35	

Chart



Comments

NO = Not Obtainable
NP = Non Plastic

Geo Tek, Inc.
6835 S. Escondido Street, Suite A
Las Vegas, Nevada 89119-3628

Telephone: (702) 897 1424

SampleID: LNS08/97393
Report No: MDD:LNS08/97393
Issue No: 1
This report replaces all previous issues of report no MDD:LNS08/97393

Proctor - Modified [AASHTO T 180]Test Report

Client: REPUBLIC SERVICES OF SOUTHERN NEVADA

Project: 8787-LV1
SUNRISE LANDFILL

This laboratory is accredited by AASHTO The test(s) reported have been performed in accordance with its terms of accreditation.

AASHTO R18

Date Issued: 11/14/2008 Signed: 11/14/2008

Sample Details

Sample ID: LNS08/97393
Field Sample:
Date Sampled: 10/24/2008
Source:
Material:
Specification: Hyrometer Sieve
Location: TBS-1 & 2
Sampled From:

Maximum Dry Density

Method: AASHTO T 180
Description: Determination of the dry density/moisture content relation of a soil using modified compactive effort.

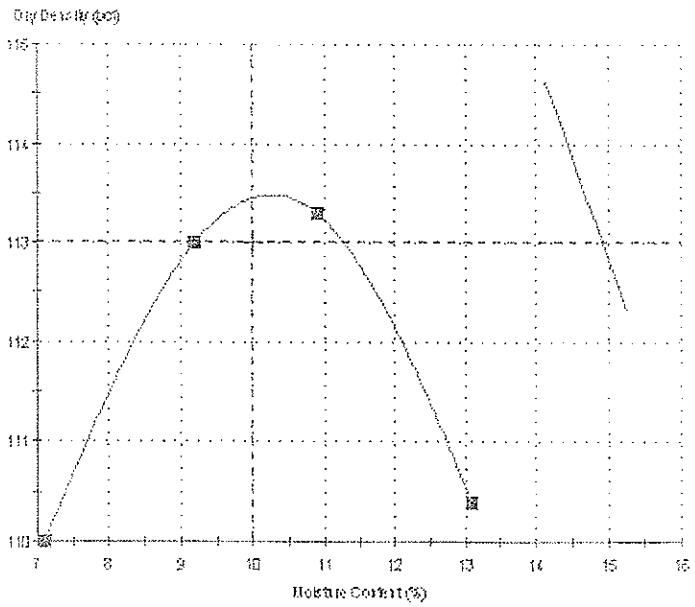
Test Results

Description	Result
Maximum Dry Density (lb/ft³)	113
Optimum Moisture Content (%)	10
Oversize Sieve 1 (mm)	4.8
Oversize Material (%)	
Method Used	D
Bulk Specific Gravity	2.440
Oversize Sieve 2 (mm)	19.0
Oversize Material 2 (%)	5.1

Soil Classification

Symbol
Name
Method ASTM D 2487

Chart



Comments
N/A

GeoTek, Inc.
6835 South Escondido Street Suite A
Las Vegas, Nevada 89119-3832
(702) 897-1424 (702) 897-2213
www.geotekusa.com

Constant Head Permeability

Project No	8787 -LV1
Client:	Republic Services
Project:	Sunrise Landfill
Date:	10/24/2008
Sample:	TBS-1&2
GTI Lab#:	97393

Q= Quantity of Flow, taken as an average of Inflow and Outflow, ft^3
L= Length of Specimen along Path of Flow, ft
A= Cross-Sectional area of Specimen, ft^2
t= Interval of Time, over which the Flow Q occurs, min
h= Difference in Hydraulic Head across the Specimen, ft of water
k= Hyraulic Conductivity, ft/min

Input

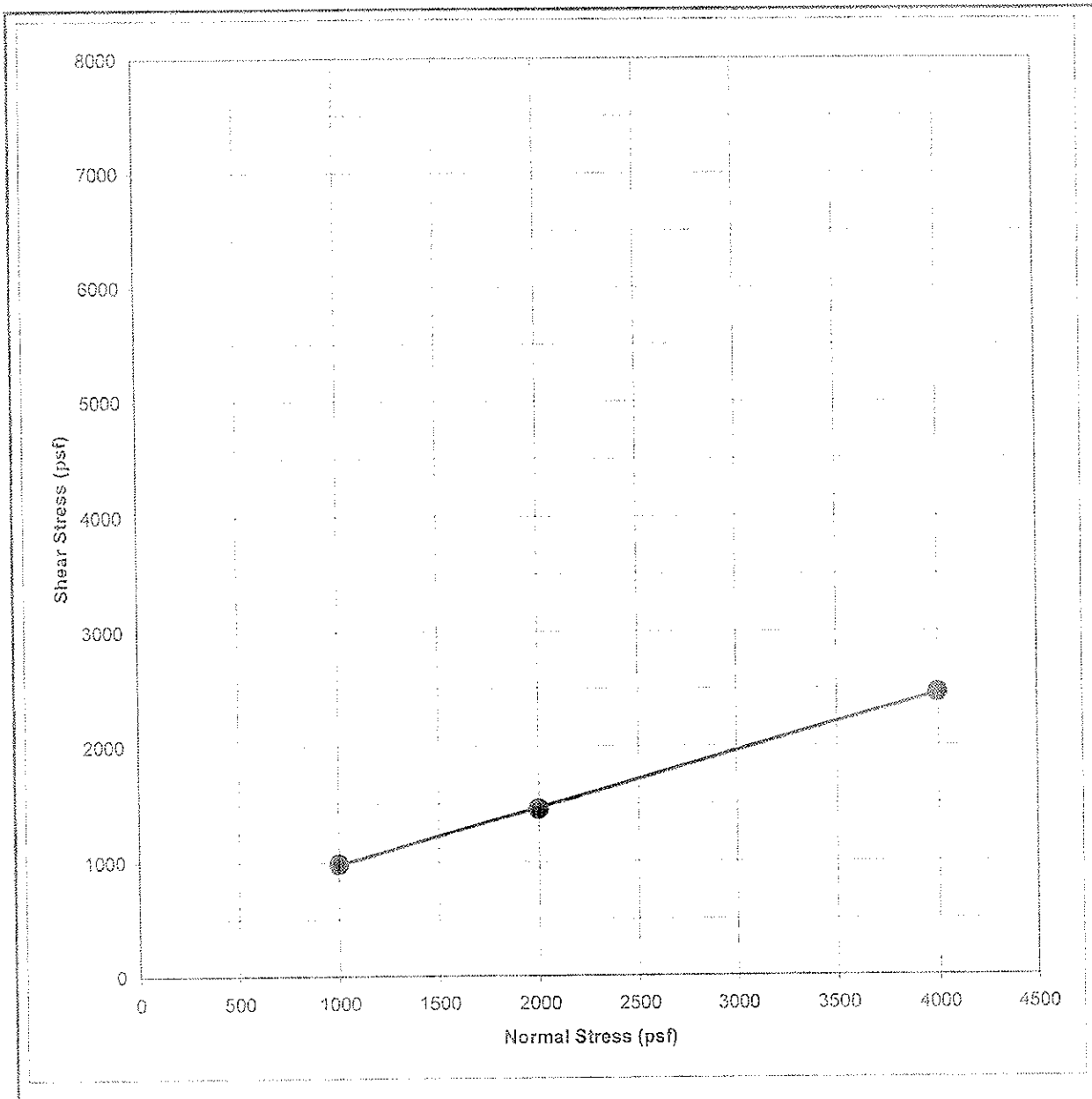
	Hours	Minutes	Seconds
Start Time	11	6	0
End Time	12	53	0

Water Output during test	1000 cc = ml
Height of specimen	4.63 in
Diameter of mold	6.00 in
H = top of water to output tube	133.50 in

Output k=QL/(Ath)

Q=	1000	cm3	3.53E-02 ft^3
L=	11.75	cm	0.39 ft
A=	182.4147	cm2	0.1963 ft^2
t=	6420	sec	107.00 min
h=	339.09	cm	11.13 ft

k (ft/min)=	5.82E-05 ft/min
k (cm/s)=	2.96E-05 cm/sec



Symbol	Lab #	Location	Depth	Classification	DD (pcf)	MC %	Frc. Angle	Cohesion
●	97393	TBS 1&2	0	Silty Sand	101.7	10	26	471
■								
▲								

GeoTek, Inc.
6835 South Escondido Street Suite A
Las Vegas, Nevada 89119-3832
(702) 897-1424 (702) 897-2213
www.geotekusa.com

GEOTECHNICAL ENVIRONMENTAL MATERIALS

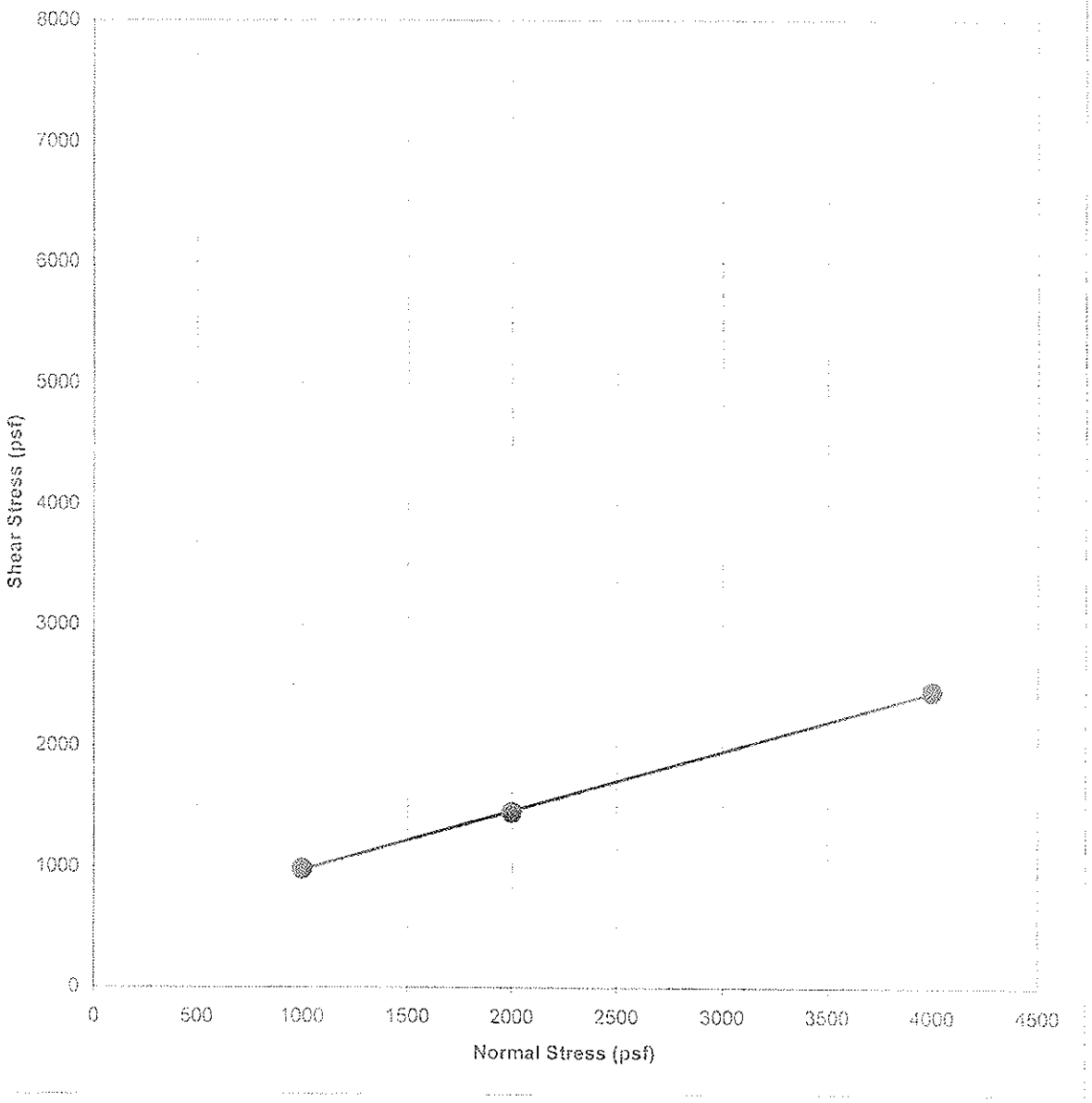
DIRECT SHEAR TEST RESULTS

Sunrise Landfill

Clark County, Nevada

Prepared For: Republic Services

Work Order: 8787 -LYI Date: Nov. 2008



Symbol	Lab #	Location	Depth	Classification	DD (pcf)	MC %	Frc. Angle	Cohesion
●	97393	TBS 1&2	0	0	0	0	26	471
■								
▲								

GeoTek, Inc.
6835 South Escondido Street Suite A
Las Vegas, Nevada 89119-3832
(702) 897-1424 (702) 897-2213
www.geotekusa.com

GEOTEK

APPLIED GEOTECHNICAL ENVIRONMENTAL MATERIALS

DIRECT SHEAR TEST RESULTS

Sunrise Landfill

Clark County, Nevada

Prepared For: Republic Services

Work Order: 8787 -LV1 Date: Nov. 2008

GEOTEK

6835 South Escondido Street
Las Vegas, NV 89119
(702) 897-1424
(702) 897-2213 fax

SIEVE ANALYSIS & HYDROMETER
ASTM D 422

Project No.	8787
Client:	Republic Services
Project Name:	Sunrise Landfill
Date:	10/24/2008
Sample Desc:	TBS - 4 & 7
GeoTek Lab No:	97394

Size		% passing
(mm)	(inch - #)	
75	3 in	100.0
50	2 in	91.2
37.5	1.5 in	87.9
25	1 in	77.2
19	3/4 in	70.3
9.5	3/8 in	53.7
4.75	No. 4	44.6
2.38	No. 8	40.2
2	No. 10	39.4
1.19	No. 16	37.4
0.595	No. 30	35.6
0.42	No. 40	34.8
0.297	No. 50	33.8
0.149	No. 100	30.5
0.074	No. 200	21.9
0.0307	-	11.2
0.0203	-	8.5
0.0120	-	7.3
0.0086	-	6.2
0.0071	-	5.8
0.0062	-	5.4
0.0051	-	5.0
0.0031	-	4.2
0.0013	-	3.5

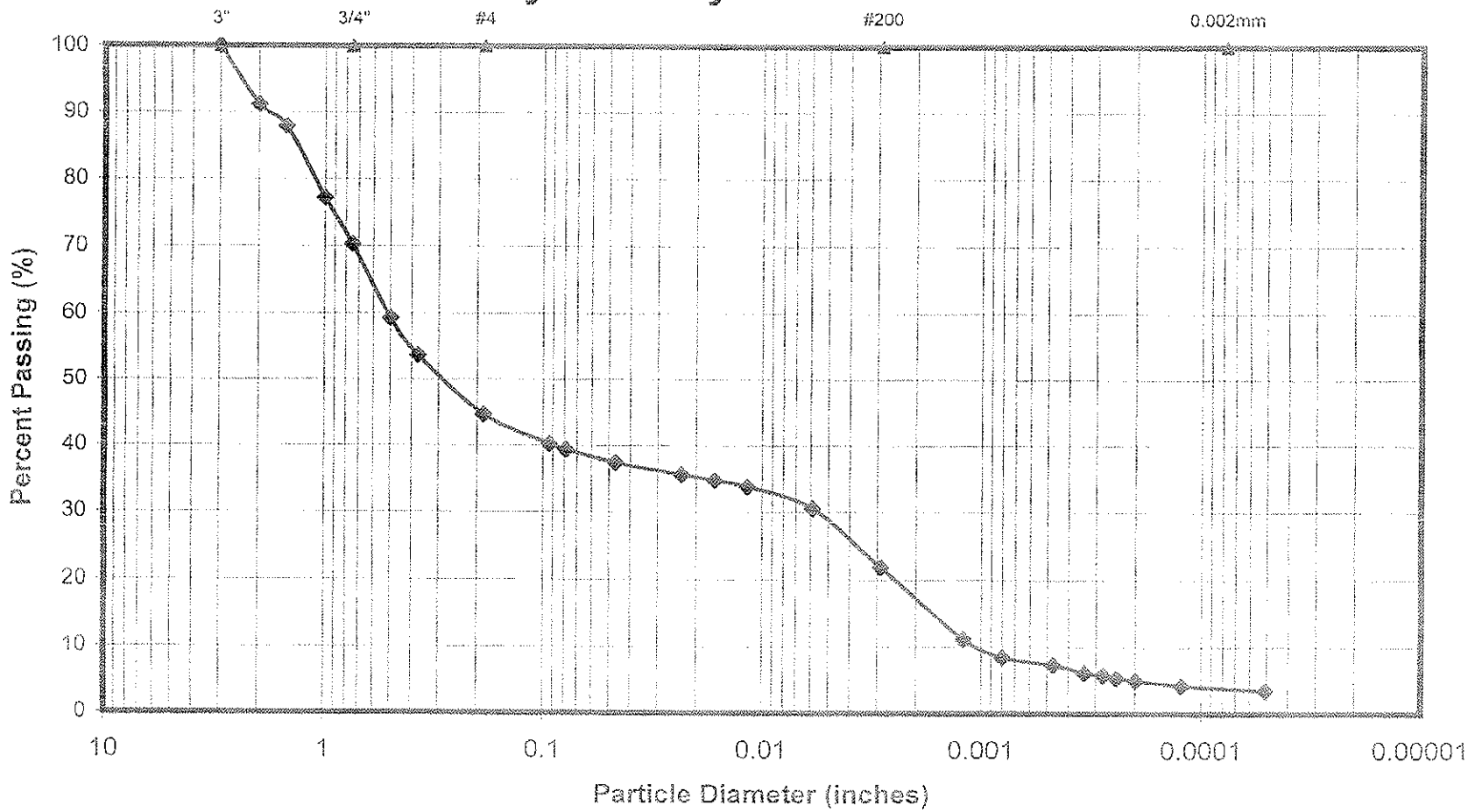
Reviewed By: _____ Date: 11-21-08

GEOTEK

6835 South Escondido Street
Las Vegas, NV 89119
(702) 897-1424
(702) 897-2213 fax

Project No.	8787
Client:	Republic Services
Project Name:	Sunrise Landfill
Date:	10/24/2008
Sample Desc:	TBS - 4 & 7
GeoTek Lab No:	97394

Sieve Analysis w/Hydrometer ASTM D422



Reviewed By: _____ Date: _____

Geo Tek, inc.
6835 S. Escondido Street, Suite A
Las Vegas, Nevada 89119-3628

Telephone: (702) 897-1424

SampleID: LNS08/97394
Report No: MAT:LNS08/97394
Issue No: 1
This report replaces all previous issues of report no MAT:LNS08/97394

Aggregate/Soil Test Report

Client: REPUBLIC SERVICES OF SOUTHERN NEVADA

Project: 8787-LV1
SUNRISE LANDFILL

This laboratory is accredited by AASHTO
The test(s) reported have been performed in accordance with its terms of accreditation

Date Issued: 11/14/2008 Signed: 11/14/2008

Sample Details

Sample ID: LNS08/97394
Field Sample ID:
Date Sampled: 10/24/2008
Source:
Material:
Specification: Hyrometer Sieve
Sampling Method:
Location: TBS -4 & 7

Other Test Results

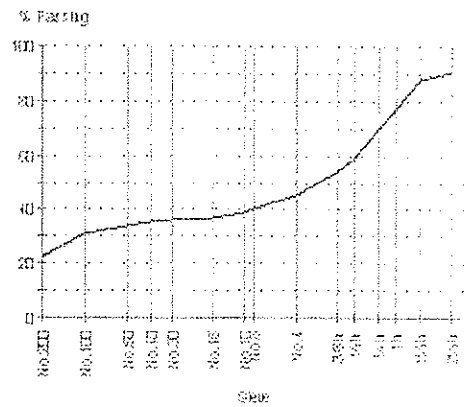
Description	Method	Result	Limits
Maximum Dry Density (lb/ft³)	AASHTO T 180	133.0	
Optimum Moisture Content (%)		7.0	
Oversize Sieve		No.4 (4.75mm)	
Oversize Material (%)			
Oversize Sieve 2		¾in (19mm)	
Oversize Material (%)		27	
Liquid Limit (%)	AASHTO T89/T90	NO	
Method			
Plastic Limit (%)		NO	
Plasticity Index (%)		NP	
Sample History			
Preparation			
Bulk Specific Gravity	AASHTO T 85	2.60	
Bulk Specific Gravity SSD		2.63	
Apparent Specific Gravity		2.69	
Absorption (%)		1.2	
Additional Notes			
Group Symbol	ASTM D 2487	GM	
Group Name		Silty gravel with sand	

Particle Size Distribution

Method: AASHTO T 27, AASHTO T 11
Drying by:

Sieve Size	% Passing	Limits
2½in (63.0mm)	91	
1½in (37.5mm)	88	
1in (25.0mm)	77	
¾in (19.0mm)	70	
½in (12.5mm)	59	
3/8in (9.5mm)	54	
No.4 (4.75mm)	45	
No.8 (2.36mm)	40	
No.10 (2.0mm)	39	
No.16 (1.18mm)	37	
No.30 (600µm)	36	
No.40 (425µm)	35	
No.50 (300µm)	34	
No.100 (150µm)	31	
No.200 (75µm)	22	

Chart



Comments
NO = Not Obtainable
NP = Non Plastic

Geo Tek, Inc.
5835 S. Escondido Street, Suite A
Las Vegas, Nevada 89119-3828

Telephone: (702) 897 1424

SampleID: LNS08/97394
Report No: MDD:LNS08/97394
Issue No: 1
This report replaces all previous issues of report no 'MDD:LNS08/97394'

Proctor - Modified [AASHTO T 180]Test Report

Client: REPUBLIC SERVICES OF SOUTHERN NEVADA

Project: 8787-LV1
SUNRISE LANDFILL

This laboratory is accredited by AASHTO
The test(s) reported have been performed in accordance with its terms of accreditation

Date Issued: 11/14/2008 Signed: 11/14/2008

Sample Details

Sample ID: LNS08/97394
Field Sample:
Date Sampled: 10/24/2008
Source:
Material:
Specification: Hyrometer Sieve
Location: TBS -4 & 7
Sampled From:

Maximum Dry Density

Method: AASHTO T 180
Description: Determination of the dry density/moisture content relation of a soil using modified compactive effort.

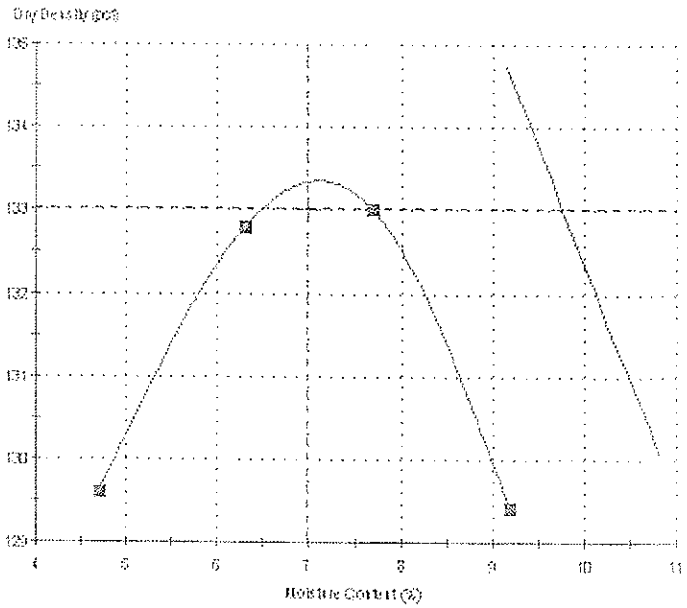
Test Results

Description	Result
Maximum Dry Density (lb/ft³)	133
Optimum Moisture Content (%)	7
Oversize Sieve 1 (mm)	4.8
Oversize Material (%)	
Method Used	D
Bulk Specific Gravity	2.600
Oversize Sieve 2 (mm)	19.0
Oversize Material 2 (%)	26.9

Soil Classification

Symbol GM
Name Silty gravel with sand
Method ASTM D 2487

Chart



Comments
N/A

GeoTek, Inc.
6835 South Escondido Street Suite A
Las Vegas, Nevada 89119-3832
(702) 897-1424 (702) 897-2213
www.geotekusa.com

Project No	8787 -LV1
Client:	Republic Services
Project:	Sunrise Landfill
Date:	10/24/2008
Sample:	TBS - 4 & 7
GTI Lab#:	97394

Constant Head Permeability

Q= Quantity of Flow, taken as an average of Inflow and Outflow, ft^3
L= Length of Specimen along Path of Flow, ft
A= Cross-Sectional area of Specimen, ft^2
t= Interval of Time, over which the Flow Q occurs, min
h= Difference in Hydraulic Head across the Specimen, ft of water
k= Hyraulic Conductivity, ft/min

Input

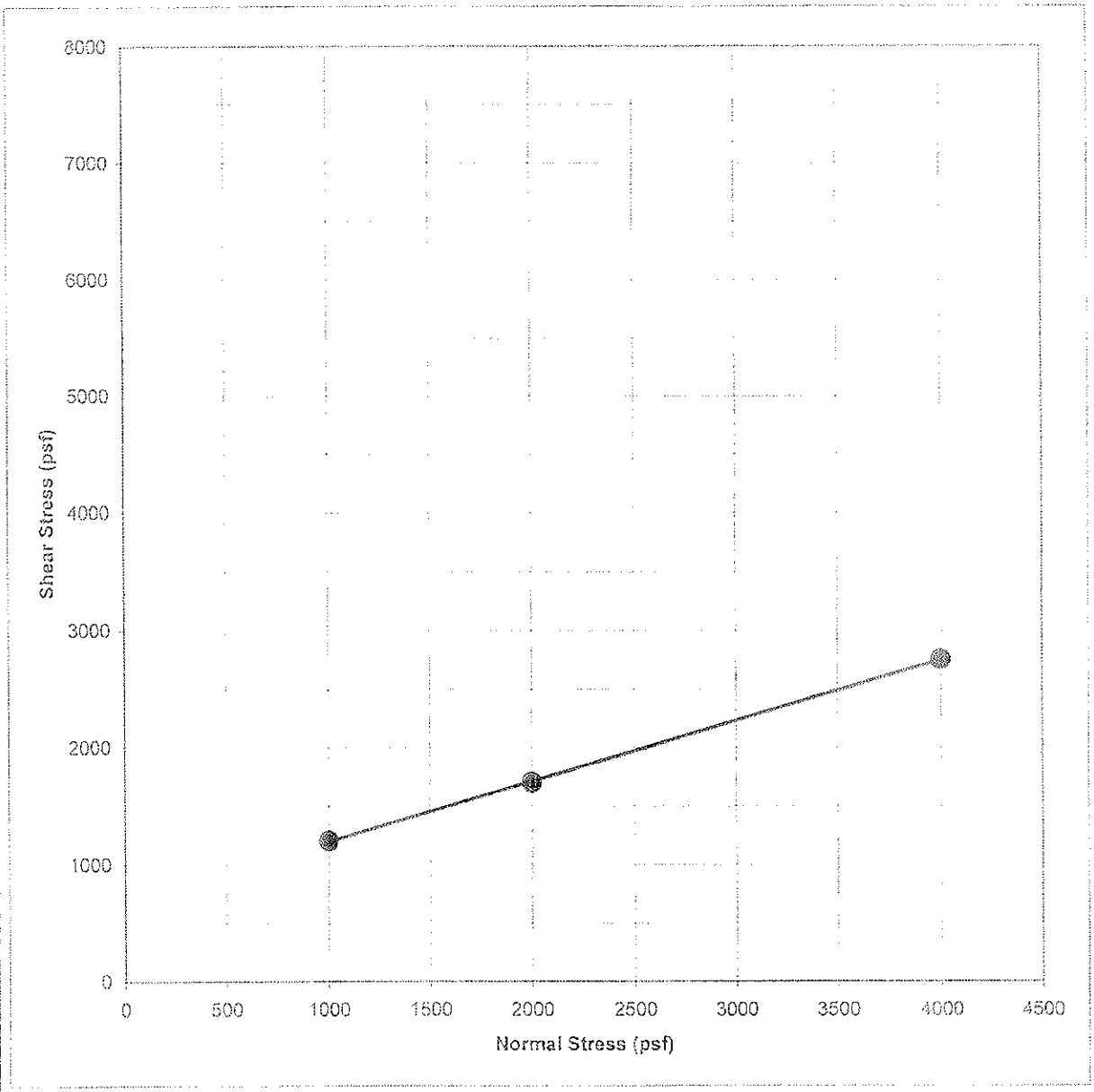
	Hours	Minutes	Seconds
Start Time	0	0	0
End Time	0	1	4

Water Output during test	2000 cc = ml
Height of specimen	4.63 in
Diameter of mold	6.00 in
H = top of water to output tube	133.50 in

Output k=QL/(Ath)

Q=	2000	cm3	7.06E-02 ft^3
L=	11.75	cm	0.39 ft
A=	182.4147	cm2	0.1963 ft^2
t=	64	sec	1.07 min
h=	339.09	cm	11.13 ft

k (ft/min)=	1.17E-02 ft/min
k (cm/s)=	5.94E-03 cm/sec



Symbol	Lab #	Location	Depth	Classification	DD (pcf)	MC %	Frc. Angle	Cohesion
●	97394	TBS 4&7	0	Silty Gravel w/sand	119.7	7	27	713
■								
▲								

GeoTek, Inc.
6835 South Escondido Street Suite A
Las Vegas, Nevada 89119-3832
(702) 897-1424 (702) 897-2213
www.geotekusa.com

GEOTECHNICAL ENVIRONMENTAL MATERIALS

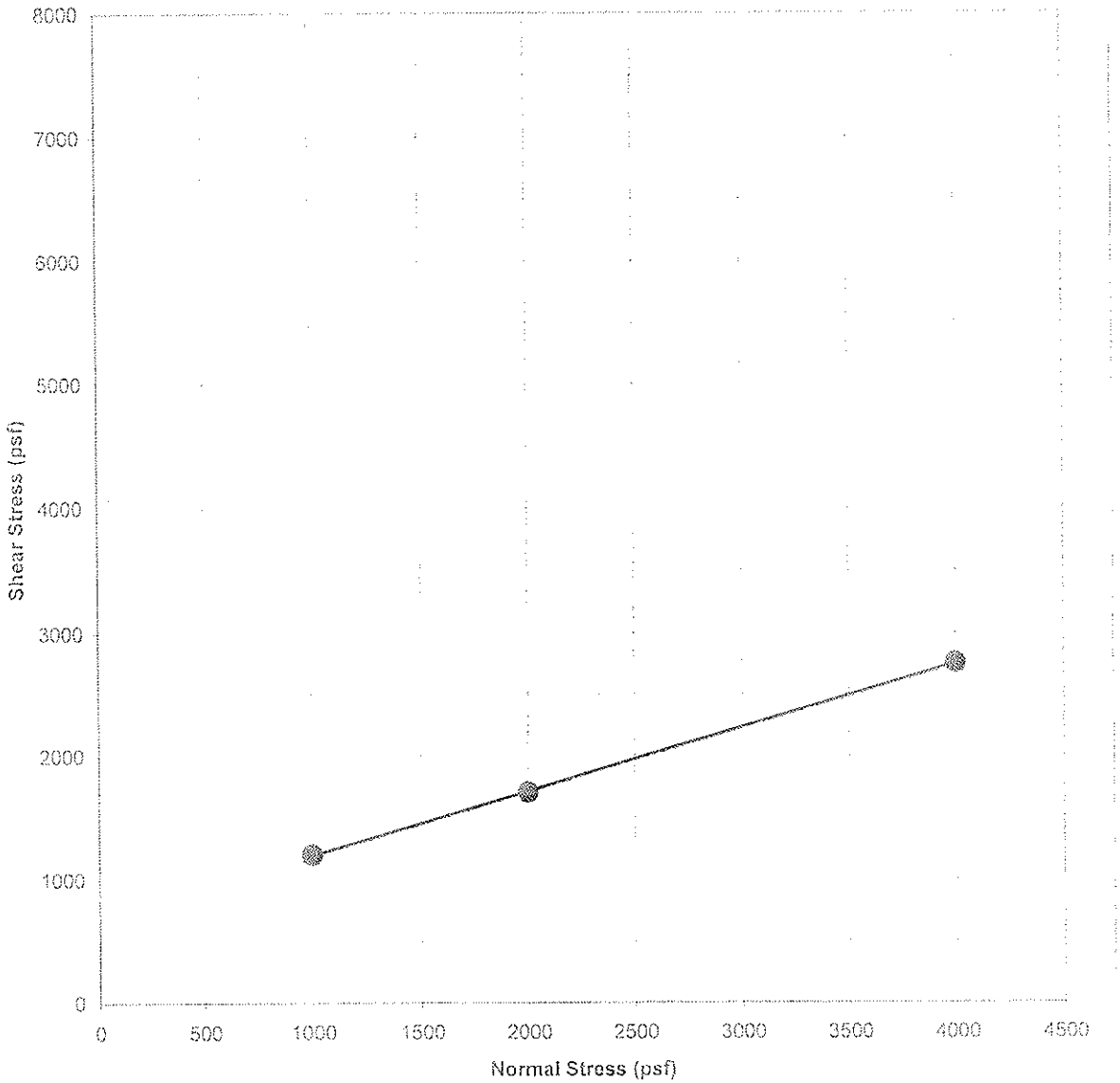
DIRECT SHEAR TEST RESULTS

Sunrise Landfill

Clark County, Nevada

Prepared For: Republic Services

Work Order: 8787 -LVI Date: Nov. 2008



Symbol	Lab #	Location	Depth	Classification	DD (pcf)	MC %	Frc. Angle	Cohesion
●	97394	TBS 4&7	0	Silty Sand	0	0	27	713
■								
▲								

GeoTek, Inc.
6835 South Escondido Street Suite A
Las Vegas, Nevada 89119-3832
(702) 897-1424 (702) 897-2213
www.geotekusa.com

GEOTECHNICAL ENVIRONMENTAL MATERIALS

DIRECT SHEAR TEST RESULTS

Sunrise Landfill

Clark County, Nevada

Prepared For: Republic Services

Work Order: 8787 -LV1 Date: Nov. 2008

GEOTEK

6835 South Escondido Street
Las Vegas, NV 89119
(702) 897-1424
(702) 897-2213 fax

SIEVE ANALYSIS & HYDROMETER
ASTM D 422

Project No.	8787-LV1
Client:	Republic Services
Project Name:	Sunrise Landfill
Date:	10/24/2008
Sample Desc:	TBS - 8 & 11
GeoTek Lab No:	97397

Size		% passing
(mm)	(inch - #)	
75	3 in	100.0
50	2 in	94.3
37.5	1.5 in	93.0
25	1 in	88.7
19	3/4 in	82.6
9.5	3/8 in	71.5
4.75	No. 4	63.4
2.38	No. 8	59.6
2	No. 10	59.6
1.19	No. 16	55.8
0.595	No. 30	52.0
0.42	No. 40	50.1
0.297	No. 50	50.1
0.149	No. 100	44.4
0.074	No. 200	28.6
0.0335	-	15.6
0.0219	-	12.6
0.0129	-	10.8
0.0092	-	10.2
0.0076	-	9.0
0.0066	-	9.0
0.0054	-	7.8
0.0034	-	6.6
0.0014	-	5.4

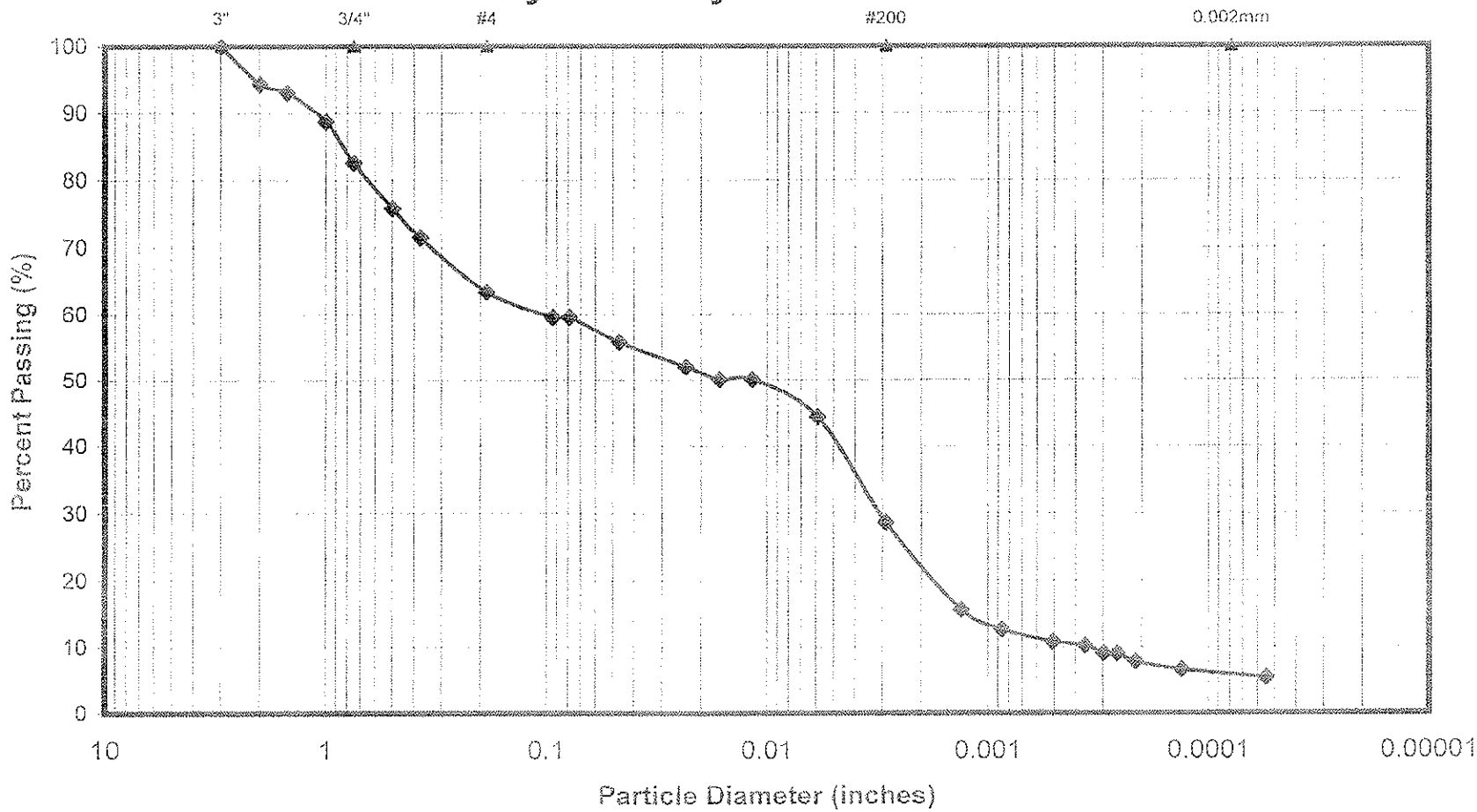
Reviewed By: _____ Date: 11-4-08

GEOTEK

6835 South Escondido Street
Las Vegas, NV 89119
(702) 897-1424
(702) 897-2213 fax

Project No.	8787-LV1
Client:	Republic Services
Project Name:	Sunrise Landfill
Date:	10/24/2008
Sample Desc:	TBS - 8 & 11
GeoTek Lab No:	97397

Sieve Analysis w/Hydrometer ASTM D422



Reviewed By: _____ Date: 11-21-08

Geo Tek, Inc.
6936 S. Pecos Road, Suite A
Las Vegas, Nevada 89119-3626

Telephone (702) 897-1424

SampleID: LNS08/97397
Report No: MAT:LNS08/97397
Issue No: 1
This report replaces all previous issues of report no MAT:LNS08/97397

Aggregate/Soil Test Report

Client: REPUBLIC SERVICES OF SOUTHERN NEVADA

Project: 8787-LV1
SUNRISE LANDFILL

The laboratory is accredited by AASHTO. The test(s) reported have been performed in accordance with its terms of accreditation.

Date Issued: 11/14/2008 Signed: 11/14/2008

Sample Details

Sample ID: LNS08/97397
Field Sample ID:
Date Sampled: 10/24/2008
Source:
Material:
Specification: Hyrometer Sieve
Sampling Method:
Location: TBS - 8 & 11

Other Test Results

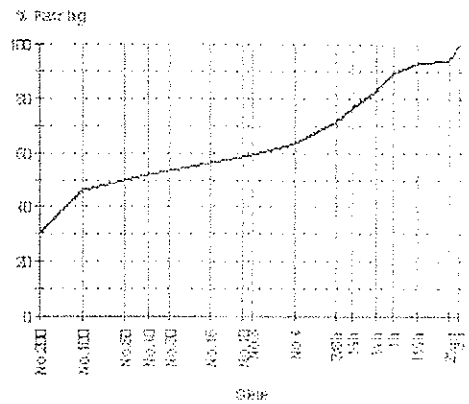
Description	Method	Result	Limits
Maximum Dry Density (lb/ft³)	AASHTO T 180	131.0	
Optimum Moisture Content (%)		8.0	
Oversize Sieve		No.4 (4.75mm)	
Oversize Material (%)			
Oversize Sieve 2		¾in (19mm)	
Oversize Material (%)		17	
Liquid Limit (%)	AASHTO T89/T90	NO	
Method		One Point	
Plastic Limit (%)		NO	
Plasticity Index (%)		NP	
Sample History			
Preparation			
Bulk Specific Gravity	AASHTO T 85	2.61	
Bulk Specific Gravity SSD		2.65	
Apparent Specific Gravity		2.71	
Absorption (%)		1.4	
Additional Notes			
Group Symbol	ASTM D 2487	GM	
Group Name		Silty gravel with sand	

Particle Size Distribution

Method: AASHTO T 27, AASHTO T 11
Drying by:

Sieve Size	% Passing	Limits
3in (75.0mm)	100	
2½in (63.0mm)	94	
1½in (37.5mm)	93	
1in (25.0mm)	89	
¾in (19.0mm)	83	
½in (12.5mm)	76	
3/8in (9.5mm)	71	
No.4 (4.75mm)	63	
No.8 (2.36mm)	59	
No.10 (2.0mm)	58	
No.16 (1.18mm)	56	
No.30 (600µm)	53	
No.40 (425µm)	52	
No.50 (300µm)	50	
No.100 (150µm)	46	
No.200 (75µm)	30	

Chart



Comments
NO = Not Obtainable
NP = Non Plastic

Geo Tek, Inc.
8835 S. Escondido Street, Suite A
Las Vegas, Nevada 89119-3828

Telephone: (702) 897-1424

SampleID: LNS08/97397
Report No: MDD:LNS08/97397
Issue No: 1
This report replaces all previous issues of report no 'MDD:LNS08/97397'

Proctor - Modified [AASHTO T 180]Test Report

This laboratory is accredited by AASHTO
The test(s) reported have been performed in accordance with its terms of accreditation

Date Issued: 11/14/2008 Signed: 11/6/2008

Client: REPUBLIC SERVICES OF SOUTHERN NEVADA

Project: 8787-LV1
SUNRISE LANDFILL

Sample Details

Sample ID:	LNS08/97397
Field Sample:	
Date Sampled:	10/24/2008
Source:	
Material:	
Specification:	Hyrometer Sieve
Location:	TBS - 8 & 11
Sampled From:	

Maximum Dry Density

Method:	AASHTO T 180
Description:	Determination of the dry density/moisture content relation of a soil using modified compactive effort.

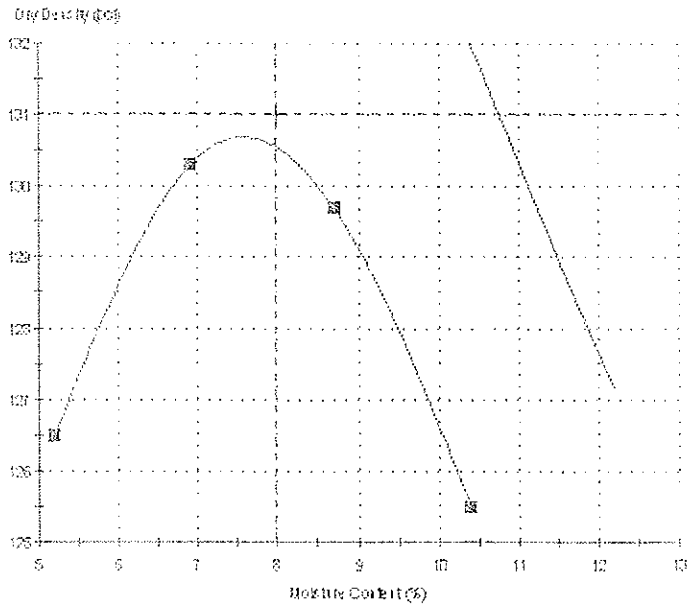
Test Results

Description	Result
Maximum Dry Density (lb/ft³)	131
Optimum Moisture Content (%)	8
Oversize Sieve 1 (mm)	4.8
Oversize Material (%)	
Method Used	D
Bulk Specific Gravity	2.610
Oversize Sieve 2 (mm)	19.0
Oversize Material 2 (%)	16.9

Soil Classification

Symbol
Name
Method ASTM D 2487

Chart



Comments
N/A

GeoTek, Inc.
6835 South Escondido Street Suite A
Las Vegas, Nevada 89119-3832
(702) 897-1424 (702) 897-2213
www.geotekusa.com

Project No	8787 -LV1
Client:	Republic Services
Project:	Sunrise Landfill
Date:	10/25/2008
Sample:	TBS 8 & 11
GTI Lab#:	97397

Constant Head Permeability

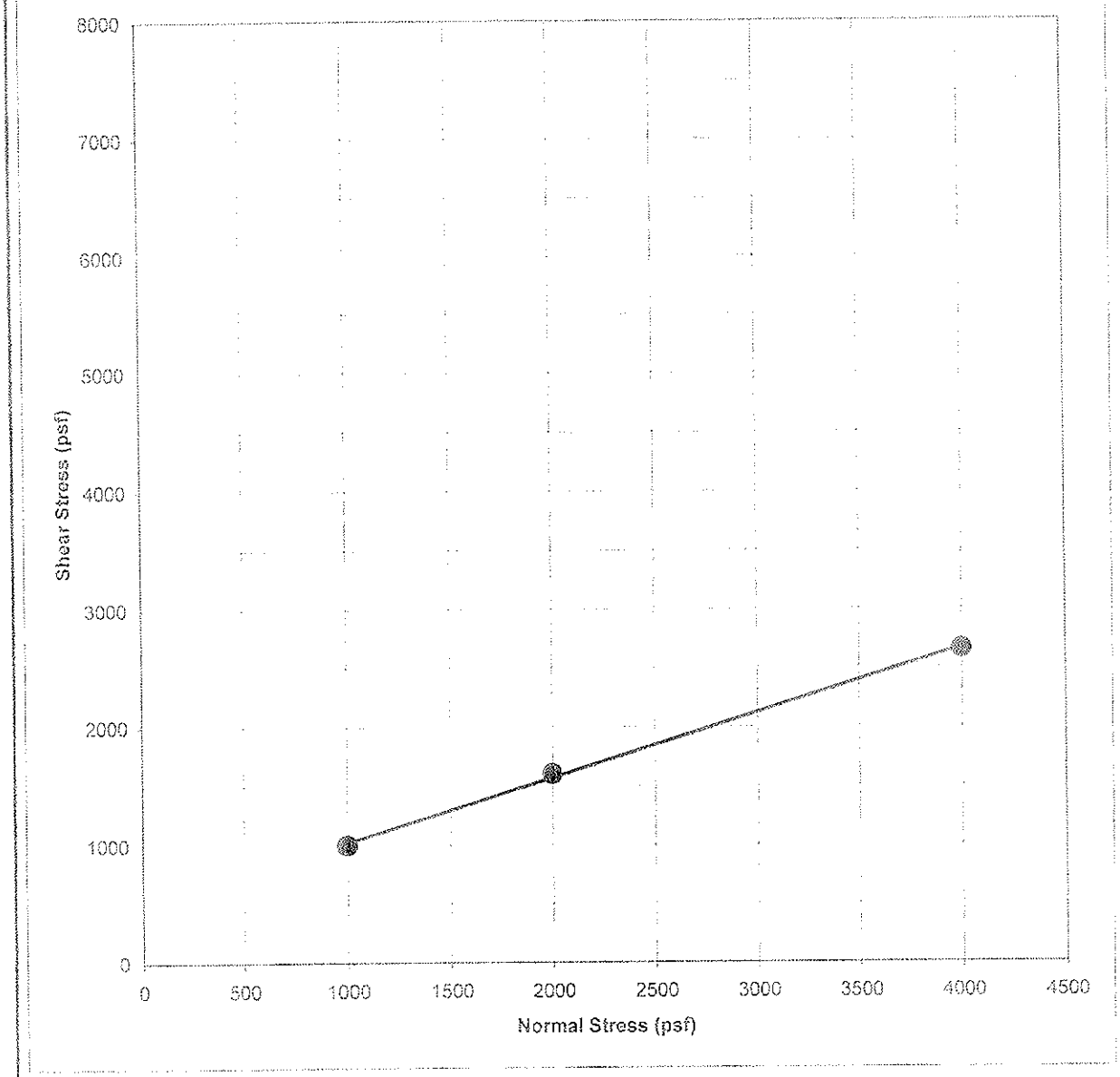
Q= Quantity of Flow, taken as an average of Inflow and Outflow, ft^3
L= Length of Specimen along Path of Flow, ft
A= Cross-Sectional area of Specimen, ft^2
t= Interval of Time, over which the Flow Q occurs, min
h= Difference in Hydraulic Head across the Specimen, ft of water
k= Hyraulic Conductivity, ft/min

Input

	Hours	Minutes	Seconds	
Start Time	7	57	0	
End Time	9	8	40	
Water Output during test			1520	cc = ml
Height of specimen			4.63	in
Diameter of mold			6.00	in
H = top of water to output tube			133.50	in

Output k=QL/(Ath)

Q=	1520	cm3	5.37E-02 ft^3
L=	11.75	cm	0.39 ft
A=	182.4147	cm2	0.1963 ft^2
t=	4300	sec	71.67 min
h=	339.09	cm	11.13 ft
k (ft/min)=			1.32E-04 ft/min
k (cm/s)=			6.71E-05 cm/sec



Symbol	Lab #	Location	Depth	Classification	DD (pcf)	MC %	Frc. Angle	Cohesion
●	97397	TBS-B&11	0	Silty Gravel w/sand	117.9	8	28	485
■								
▲								

GeoTek, Inc.
6835 South Escondido Street Suite A
Las Vegas, Nevada 89119-3832
(702) 897-1424 (702) 897-2213
www.geotekusa.com

GEOTECHNICAL ENVIRONMENTAL MATERIALS

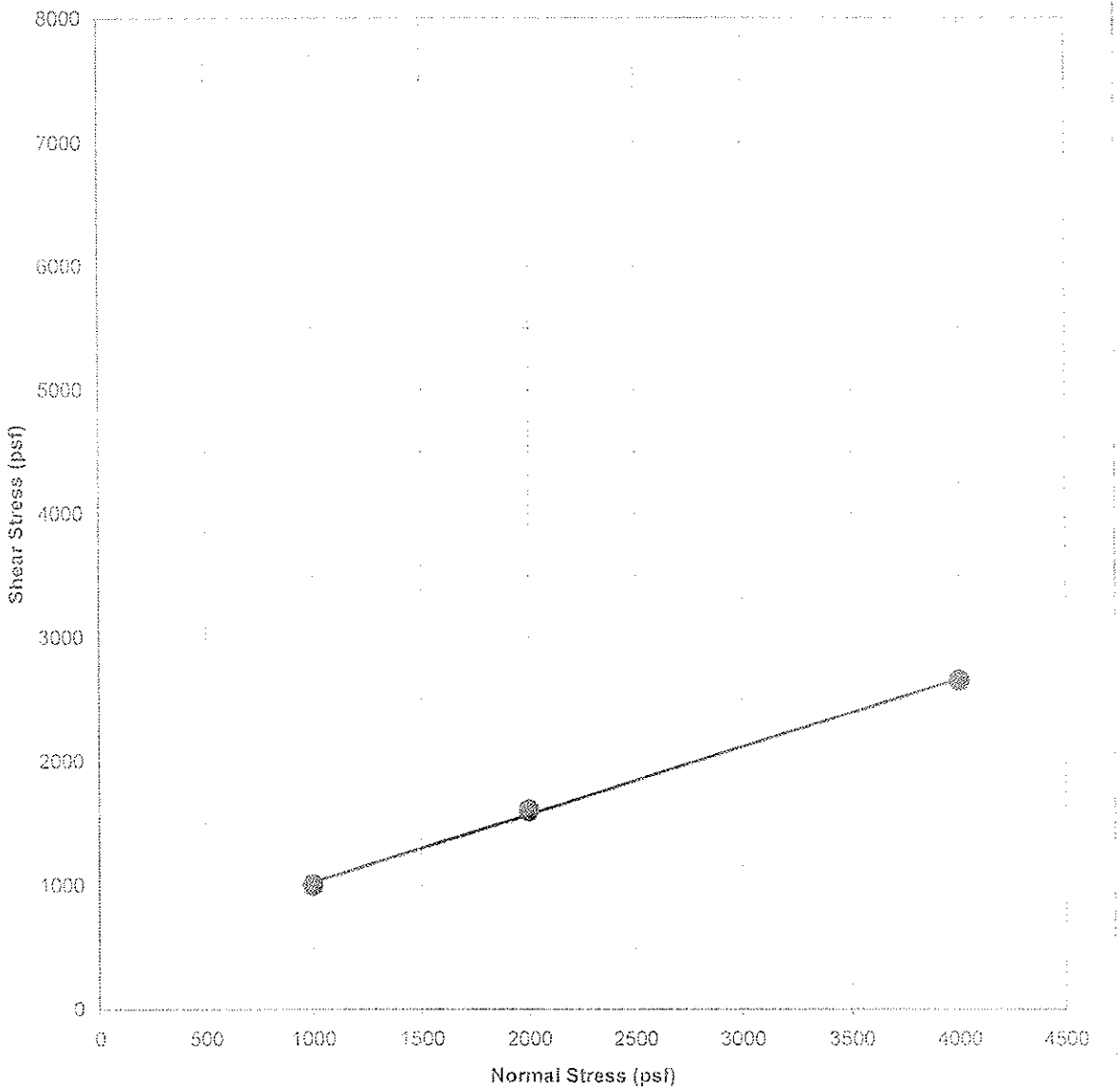
DIRECT SHEAR TEST RESULTS

Sunrise Landfill

Clark County, Nevada

Prepared For: Republic Services

Work Order: 8787 -LVI Date: Nov. 2008



Symbol	Lab #	Location	Depth	Classification	DD (pcf)	MC %	Frc. Angle	Cohesion
●	97397	TBS-8&11	0	Silty Sand	0	0	28	485
■								
▲								

GeoTek, Inc.
6835 South Escondido Street Suite A
Las Vegas, Nevada 89119-3832
(702) 897-1424 (702) 897-2213
www.geotekusa.com

GEOTECHNICAL ENVIRONMENTAL MATERIALS

DIRECT SHEAR TEST RESULTS

Sunrise Landfill

Clark County, Nevada

Prepared For: Republic Services

Work Order: 8787 -LVI Date: Nov. 2008

GEOTEK

6835 South Escondido Street
Las Vegas, NV 89119
(702) 897-1424
(702) 897-2213 fax

SIEVE ANALYSIS & HYDROMETER
ASTM D 422

Project No.	8787
Client:	Republic Services
Project Name:	Sunrise Landfill
Date:	10/24/2008
Sample Desc:	CBS - 1 -03 & 04
GeoTek Lab No:	97395

Size		% passing
(mm)	(inch - #)	
75	3 in	94.8
50	2 in	94.8
37.5	1.5 in	92.7
25	1 in	84.8
19	3/4 in	76.5
9.5	3/8 in	59.3
4.75	No. 4	49.8
2.38	No. 8	45.9
2	No. 10	45.0
1.19	No. 16	42.8
0.595	No. 30	40.5
0.42	No. 40	39.4
0.297	No. 50	38.2
0.149	No. 100	34.7
0.074	No. 200	24.4
0.0328	-	13.4
0.0217	-	10.2
0.0128	-	8.8
0.0092	-	7.8
0.0075	-	7.4
0.0066	-	6.9
0.0054	-	5.5
0.0034	-	3.7
0.0014	-	2.3

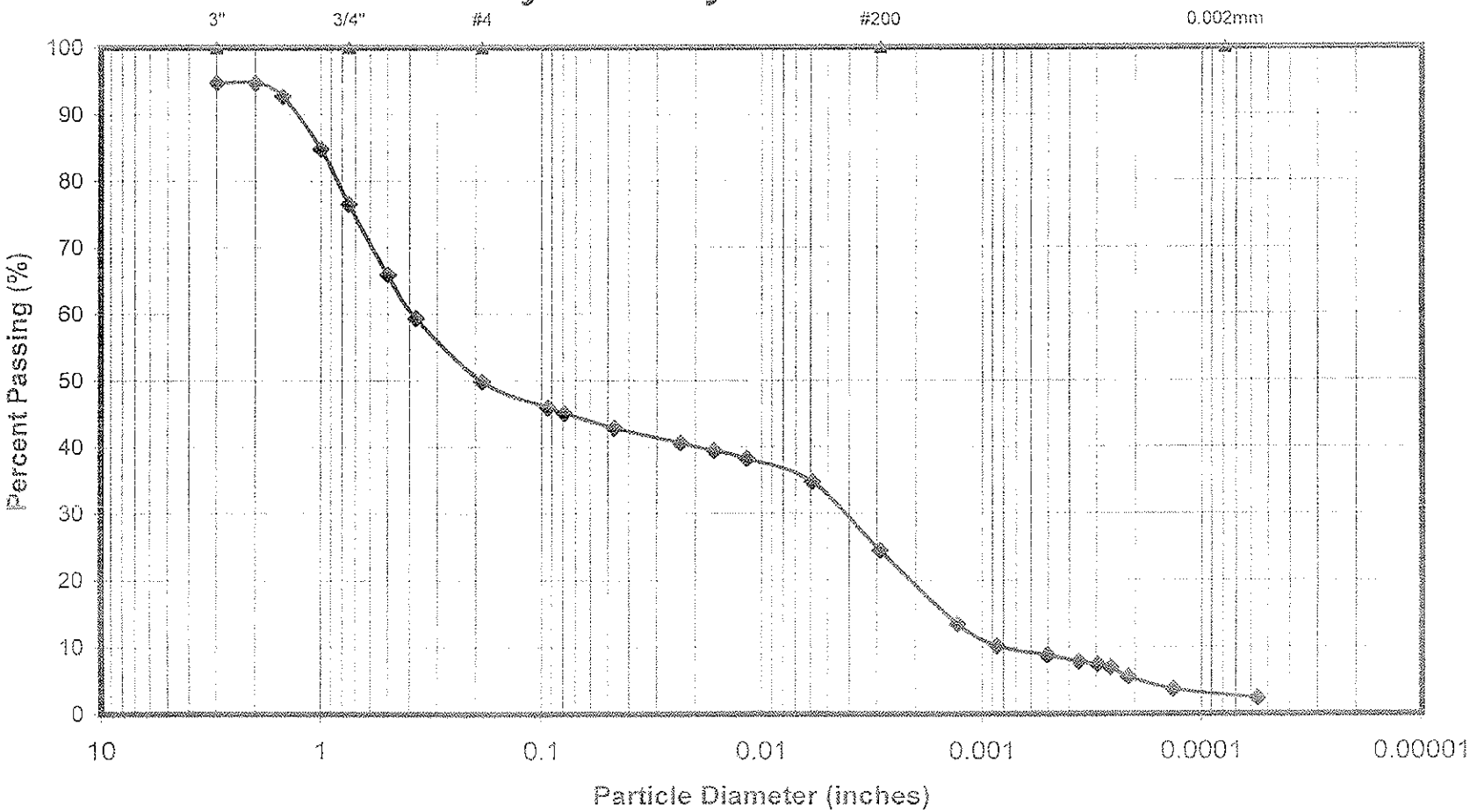
Reviewed By: _____ Date: 11-21-08

GEOTEK

6835 South Escondido Street
Las Vegas, NV 89119
(702) 897-1424
(702) 897-2213 fax

Project No.	8787
Client:	Republic Services
Project Name:	Sunrise Landfill
Date:	10/24/2008
Sample Desc:	CBS - 1 -03 & 04
GeoTek Lab No:	97395

Sieve Analysis w/Hydrometer ASTM D422



Reviewed By: _____ Date: 11-21-08

Geo Tek, Inc.
6835 S. Escondido Street, Suite A
Las Vegas, Nevada 89119-3926

Telephone: (702) 897-1424

SampleID: LNS08/97395
Report No: MAT:LNS08/97395
Issue No: 1
This report replaces all previous issues of report no 'MAT:LNS08/97395'

Aggregate/Soil Test Report

Client: REPUBLIC SERVICES OF SOUTHERN NEVADA

Project: 8787-LV1
SUNRISE LANDFILL

This laboratory is accredited by AASHTO
The tests reported have been performed in accordance with its terms of accreditation

Date Issued: 11/14/2008 Signed: 11/14/2008

Sample Details

Sample ID: LNS08/97395
Field Sample ID:
Date Sampled: 10/24/2008
Source:
Material:
Specification: Hyrometer Sieve
Sampling Method:
Location: CBS -1 -03 & 04

Other Test Results

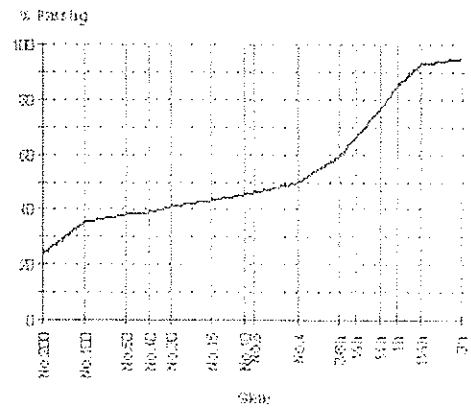
Description	Method	Result	Limits
Maximum Dry Density (lb/ft³)	AASHTO T 180	134.0	
Optimum Moisture Content (%)		7.0	
Oversize Sieve		No.4 (4.75mm)	
Oversize Material (%)			
Oversize Sieve 2		¾in (19mm)	
Oversize Material (%)		20	
Liquid Limit (%)	AASHTO T89/T90	NO	
Method		One Point	
Plastic Limit (%)		NO	
Plasticity Index (%)		NP	
Sample History			
Preparation			
Bulk Specific Gravity	AASHTO T 85	2.55	
Bulk Specific Gravity SSD		2.60	
Apparent Specific Gravity		2.68	
Absorption (%)		1.9	
Additional Notes			
Group Symbol	ASTM D 2487	GM	
Group Name		Silty gravel with sand	

Particle Size Distribution

Method: AASHTO T 27, AASHTO T 11
Drying by:

Sieve Size	% Passing	Limits
3in (75.0mm)	95	
1½in (37.5mm)	93	
1in (25.0mm)	85	
¾in (19.0mm)	76	
½in (12.5mm)	66	
3/8in (9.5mm)	59	
No.4 (4.75mm)	50	
No.8 (2.36mm)	46	
No.10 (2.0mm)	45	
No.16 (1.18mm)	43	
No.30 (600µm)	41	
No.40 (425µm)	39	
No.50 (300µm)	38	
No.100 (150µm)	35	
No.200 (75µm)	24	

Chart



Comments

NO = Not Obtainable
NP = Non Plastic

Geo Tek, Inc.
6835 S. Escondido Street, Suite A
Las Vegas, Nevada 89119-3828

Telephone: (702) 897-1424

SampleID: LNS08/97395
Report No: MDD:LNS08/97395
Issue No: 1
This report replaces all previous issues of report no MDD:LNS08/97395

Proctor - Modified [AASHTO T 180]Test Report

This laboratory is accredited by AASHTO. The test(s) reported have been performed in accordance with its terms of accreditation.

Client: REPUBLIC SERVICES OF SOUTHERN NEVADA

Project: 8787-LV1
SUNRISE LANDFILL

Date Issued: 11/14/2008 Signed: 11/14/2008

Sample Details

Sample ID:	LNS08/97395
Field Sample:	
Date Sampled:	10/24/2008
Source:	
Material:	
Specification:	Hyrometer Sieve
Location:	CDS -1 -03 & 04
Sampled From:	

Maximum Dry Density

Method:	AASHTO T 180
Description:	Determination of the dry density/moisture content relation of a soil using modified compactive effort.

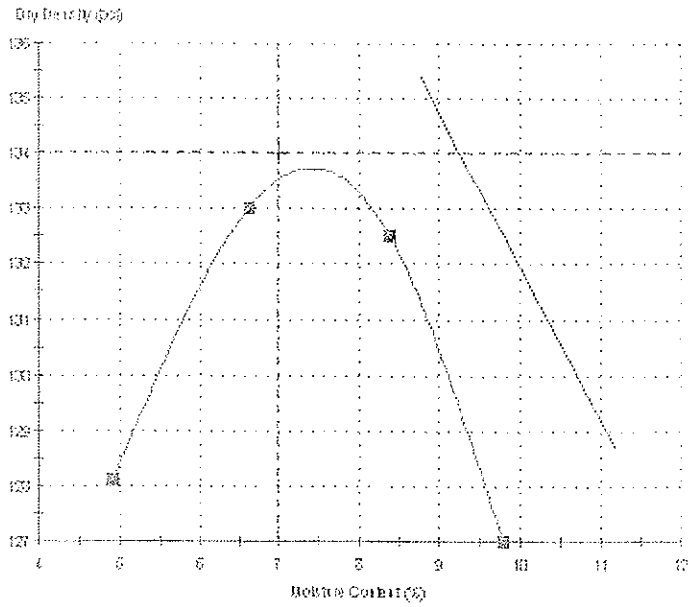
Test Results

Description	Result
Maximum Dry Density (lb/ft³)	134
Optimum Moisture Content (%)	7
Oversize Sieve 1 (mm)	4.8
Oversize Material (%)	
Method Used	D
Bulk Specific Gravity	2.550
Oversize Sieve 2 (mm)	19.0
Oversize Material 2 (%)	20.2

Soil Classification

Symbol	GM
Name	Silty gravel with sand
Method	ASTM D 2487

Chart



Comments
N/A

GeoTek, Inc.
6835 South Escondido Street Suite A
Las Vegas, Nevada 89119-3832
(702) 897-1424 (702) 897-2213
www.geotekusa.com

Constant Head Permeability

Project No	8787 -LV1
Client:	Republic Services
Project:	Sunrise Landfill
Date:	10/24/2008
Sample:	CBS - 1 - 03 & 04
GTI Lab#:	97395

Q= Quantity of Flow, taken as an average of Inflow and Outflow, ft^3
L= Length of Specimen along Path of Flow, ft
A= Cross-Sectional area of Specimen, ft^2
t= Interval of Time, over which the Flow Q occurs, min
h= Difference in Hydraulic Head across the Specimen, ft of water
k= Hyraulic Conductivity, ft/min

Input

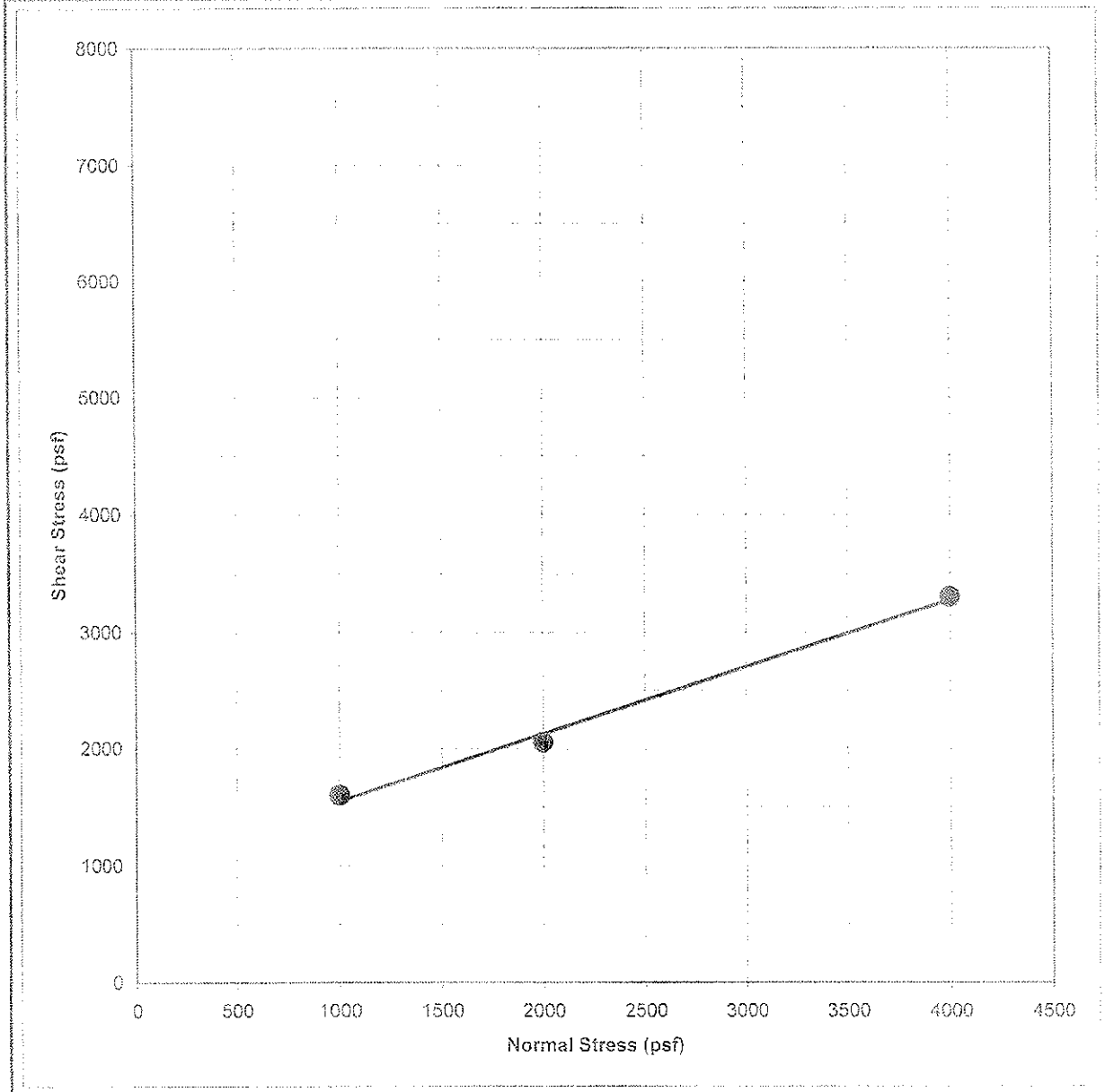
	Hours	Minutes	Seconds
Start Time	0	0	0
End Time	0	2	20

Water Output during test	2000 cc = ml
Height of specimen	4.63 in
Diameter of mold	6.00 in
H = top of water to output tube	133.50 in

Output k=QL/(Ath)

Q=	2000	cm3	7.06E-02 ft^3
L=	11.75	cm	0.39 ft
A=	182.4147	cm2	0.1963 ft^2
t=	140	sec	2.33 min
h=	339.09	cm	11.13 ft

k (ft/min)=	5.34E-03 ft/min
k (cm/s)=	2.71E-03 cm/sec



Symbol	Lab #	Location	Depth	Classification	DD (pcf)	MC %	Frc. Angle	Cohesion
●	97395	CBS-1-03-04	0	Silty Gravel w/sand	120.6	7	31	884
■								
▲								

GeoTek, Inc.
6835 South Escondido Street Suite A
Las Vegas, Nevada 89119-3832
(702) 897-1424 (702) 897-2213
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GEOTECHNICAL ENVIRONMENTAL MATERIALS

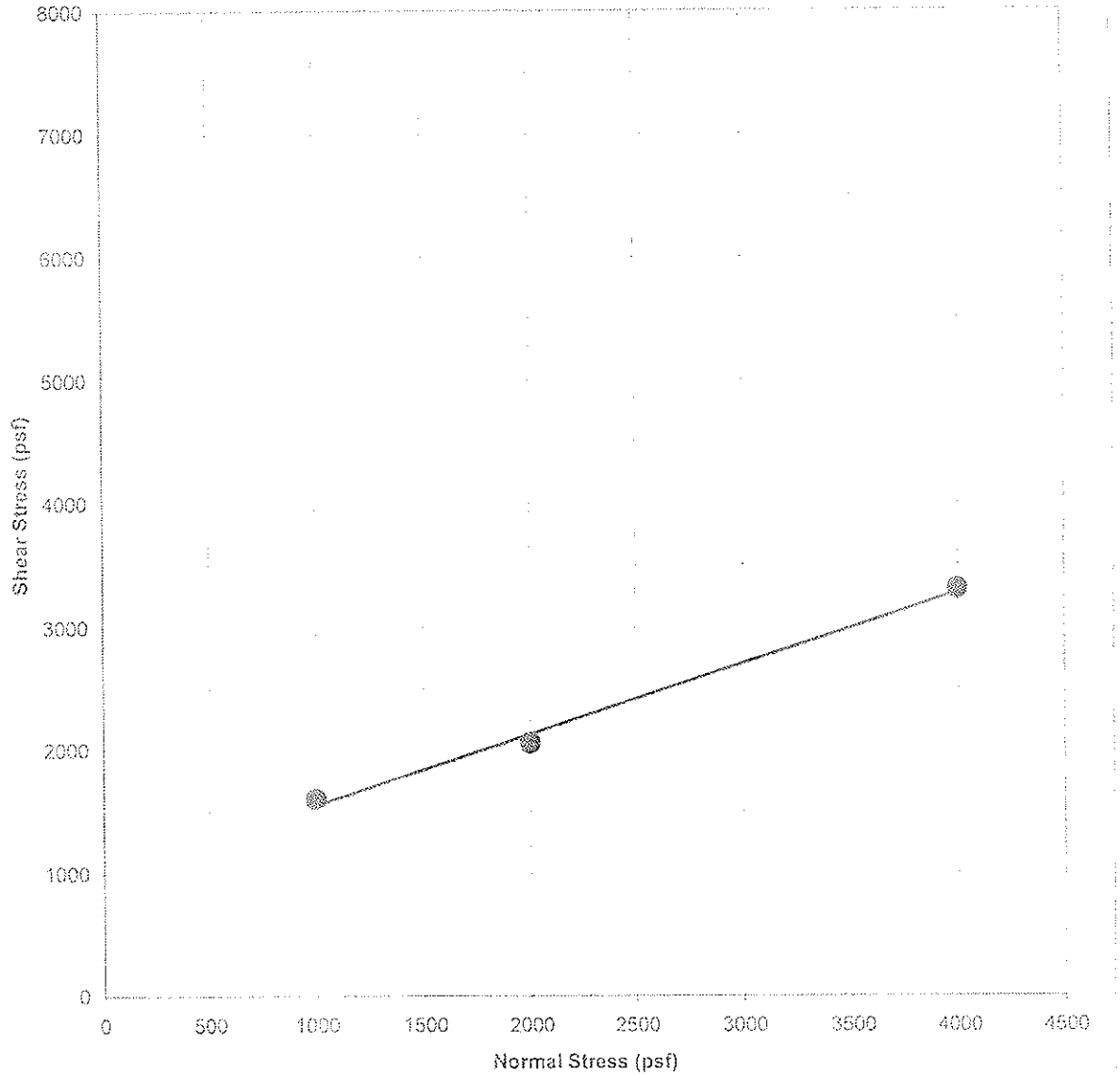
DIRECT SHEAR TEST RESULTS

Sunrise Landfill

Clark County, Nevada

Prepared For: Republic Services

Work Order: 8787 -LV1 Date: Nov. 2008



Symbol	Lab #	Location	Depth	Classification	DD (pcf)	MC %	Frc. Angle	Cohesion
●	97395	CBS-1-03-04	0	Silty Sand	0	0	31	884
■								
▲								

GeoTek, Inc.
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www.geotekusa.com

GEOTECHNICAL ENVIRONMENTAL MATERIALS

DIRECT SHEAR TEST RESULTS

Sunrise Landfill

Clark County, Nevada

Prepared For: Republic Services

Work Order: 8787-LVI Date: Nov. 2008

GEOTEK

6835 South Escondido Street
Las Vegas, NV 89119
(702) 897-1424
(702) 897-2213 fax

SIEVE ANALYSIS & HYDROMETER
ASTM D 422

Project No.	8787
Client:	Republic Services
Project Name:	Sunrise Landfill
Date:	10/24/2008
Sample Desc:	CBS - 06 & 08
GeoTek Lab No:	97396

Size		% passing
(mm)	(inch - #)	
75	3 in	100.0
50	2 in	92.1
37.5	1.5 in	87.5
25	1 in	74.8
19	3/4 in	65.8
9.5	3/8 in	49.2
4.75	No. 4	39.2
2.38	No. 8	34.1
2	No. 10	33.2
1.19	No. 16	31.0
0.595	No. 30	29.1
0.42	No. 40	28.2
0.297	No. 50	27.3
0.149	No. 100	21.9
0.074	No. 200	13.4
0.0342	-	7.6
0.0217	-	7.3
0.0128	-	6.3
0.0092	-	5.6
0.0076	-	5.0
0.0066	-	4.3
0.0054	-	4.0
0.0034	-	2.0
0.0014	-	1.7

Reviewed By: _____ Date: 11-21-08

GEOTEK

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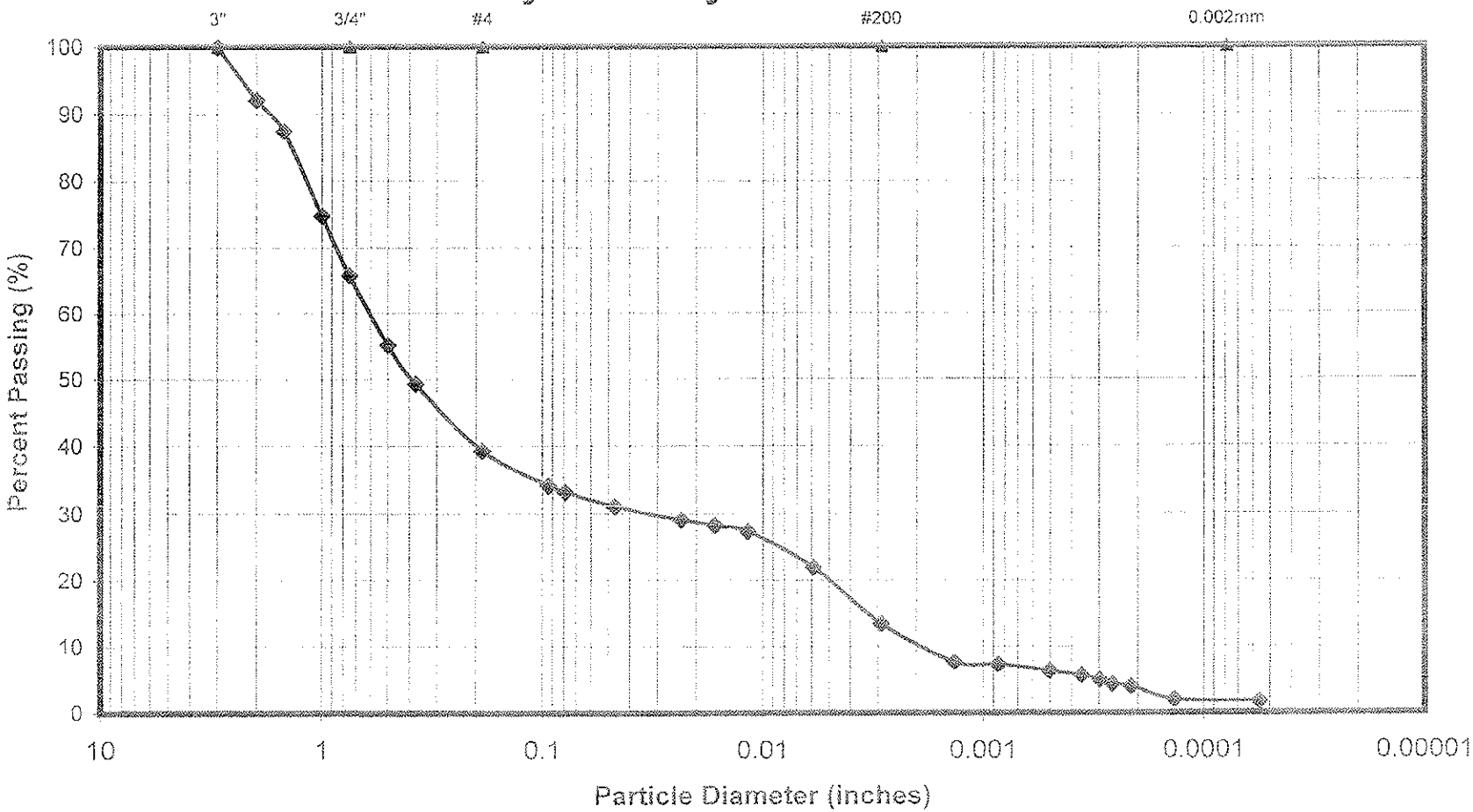
Las Vegas, NV 89119
(702) 897-1424
(702) 897-2213 fax

Project No.	8787
Client:	Republic Services
Project Name:	Sunrise Landfill
Date:	10/24/2008
Sample Desc:	CBS - 06 & 08
GeoTek Lab No:	97396

Sieve Analysis w/Hydrometer ASTM D422



Reviewed By: _____ Date: 11-24-08

Geo Tek, Inc.
6635 S. Escondido Street, Suite A
Las Vegas, Nevada 89119-3828

Telephone: (702) 807 1424

SampleID: LNS08/97396
Report No: MAT:LNS08/97396
Issue No: 1
This report replaces all previous issues of report no 'MAT:LNS08/97396'

Aggregate/Soil Test Report

Client: REPUBLIC SERVICES OF SOUTHERN NEVADA

Project: 3797-LV1
SUNRISE LANDFILL

This laboratory is accredited by AASHTO
The test(s) reported have been performed in accordance with its terms of accreditation

Date Issued: 11/14/2008 Signed: 11/14/2008

Sample Details

Sample ID: LNS08/97396
Field Sample ID:
Date Sampled: 10/24/2008
Source:
Material:
Specification: Hyrometer Sieve
Sampling Method:
Location: CBS - 06 & 08

Other Test Results

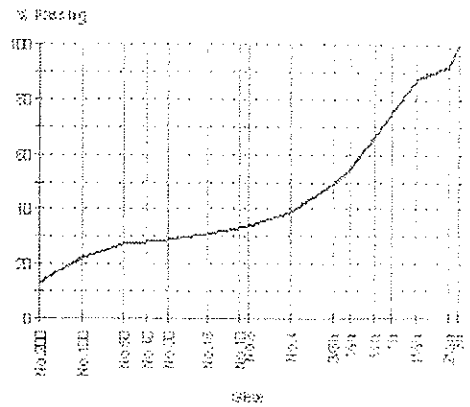
Description	Method	Result	Limits
Maximum Dry Density (lb/ft³)	AASHTO T 180	140.0	
Optimum Moisture Content (%)		5.0	
Oversize Sieve		No.4 (4.75mm)	
Oversize Material (%)			
Oversize Sieve 2		¾in (19mm)	
Oversize Material (%)		27	
Liquid Limit (%)	AASHTO T89/T90	NO	
Method		One Point	
Plastic Limit (%)		NO	
Plasticity Index (%)		NP	
Sample History			
Preparation			
Bulk Specific Gravity	AASHTO T 85	2.60	
Bulk Specific Gravity SSD		2.64	
Apparent Specific Gravity		2.70	
Absorption (%)		1.4	
Additional Notes			
Group Symbol	ASTM D 2487	GM	
Group Name		Silty gravel with sand	

Particle Size Distribution

Method: AASHTO T 27, AASHTO T 11
Drying by:

Sieve Size	% Passing	Limits
3in (75.0mm)	100	
2½in (63.0mm)	92	
1½in (37.5mm)	87	
1in (25.0mm)	75	
¾in (19.0mm)	66	
½in (12.5mm)	55	
3/8in (9.5mm)	49	
No.4 (4.75mm)	39	
No.8 (2.36mm)	34	
No.10 (2.0mm)	33	
No.16 (1.18mm)	31	
No.30 (600µm)	29	
No.40 (425µm)	28	
No.50 (300µm)	27	
No.100 (150µm)	22	
No.200 (75µm)	13	

Chart



Comments

NO = Not Obtainable
NP = Non Plastic

Geo Tek, Inc.
6835 S. Escondido Street, Suite A
Las Vegas, Nevada 89119-3628

Telephone (702) 897-1424

SampleID: LNS08/97396
Report No: MDD:LNS08/97396
Issue No: 1
This report replaces all previous issues of report no 'MDD:LNS08/396'

Proctor - Modified [AASHTO T 180]Test Report

This laboratory is accredited by AASHTO. The test(s) reported have been performed in accordance with its terms of accreditation.

Client: REPUBLIC SERVICES OF SOUTHERN NEVADA

Project: 8787-I V1
SUNRISE LANDFILL

Date Issued: 11/14/2008 Signed: 11/14/2008

Sample Details

Sample ID:	LNS08/97396
Field Sample:	
Date Sampled:	10/24/2008
Source:	
Material:	
Specification:	Hyrometer Sieve
Location:	CBS - 06 & 08
Sampled From:	

Maximum Dry Density

Method:	AASHTO T 180
Description:	Determination of the dry density/moisture content relation of a soil using modified compactive effort.

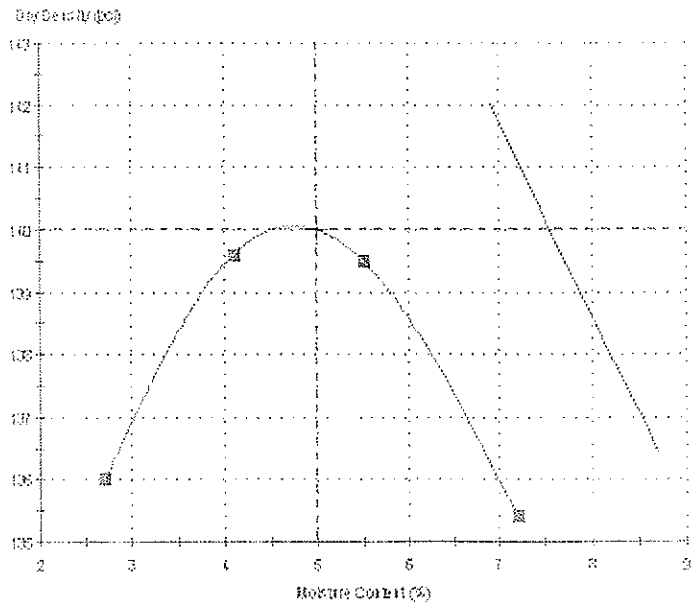
Test Results

Description	Result
Maximum Dry Density (lb/ft³)	140
Optimum Moisture Content (%)	5
Oversize Sieve 1 (mm)	4.8
Oversize Material (%)	
Method Used	D
Bulk Specific Gravity	2.600
Oversize Sieve 2 (mm)	19.0
Oversize Material 2 (%)	26.6

Soil Classification

Symbol	GM
Name	Silty gravel with sand
Method	ASTM D 2487

Chart



Comments
N/A

GeoTek, Inc.
6835 South Escondido Street Suite A
Las Vegas, Nevada 89119-3832
(702) 897-1424 (702) 897-2213
www.geotekusa.com

Project No	8787 -LV1
Client:	Republic Services
Project:	Sunrise Landfill
Date:	10/25/2008
Sample:	CBS - 06 & 08
GTI Lab#:	97396

Constant Head Permeability

Q= Quantity of Flow, taken as an average of Inflow and Outflow, ft^3
L= Length of Specimen along Path of Flow, ft
A= Cross-Sectional area of Specimen, ft^2
t= Interval of Time, over which the Flow Q occurs, min
h= Difference in Hydraulic Head across the Specimen, ft of water
k= Hyraulic Conductivity, ft/min

Input

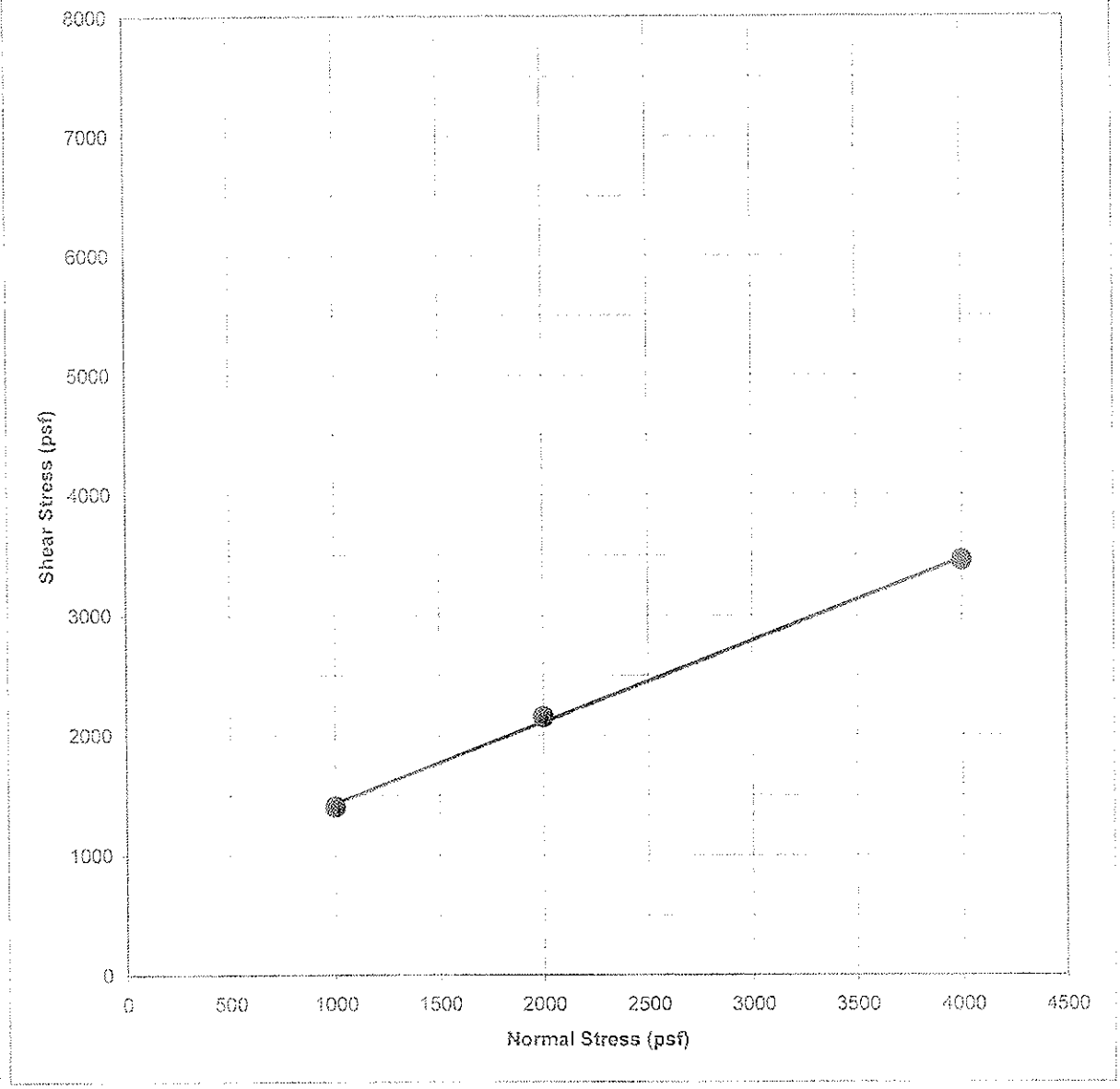
	Hours	Minutes	Seconds
Start Time	13	8	0
End Time	13	9	40

Water Output during test	2000	cc = ml
Height of specimen	4.63	in
Diameter of mold	6.00	in
H = top of water to output tube	133.50	in

Output k=QL/(Ath)

Q=	2000	cm3	7.06E-02 ft^3
L=	11.75	cm	0.39 ft
A=	182.4147	cm2	0.1963 ft^2
t=	100	sec	1.67 min
h=	339.09	cm	11.13 ft

k (ft/min)=	7.48E-03 ft/min
k (cm/s)=	3.80E-03 cm/sec



Symbol	Lab #	Location	Depth	Classification	DD (pcf)	MC %	Frc. Angle	Cohesion
●	97396	CBS-06&08	0	Silty Gravel w/sand	126	5	34	742
■								
▲								

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6835 South Escondido Street Suite A
Las Vegas, Nevada 89119-3832
(702) 897-1424 (702) 897-2213
www.geotekusa.com

GEOTECHNICAL ENVIRONMENTAL MATERIALS

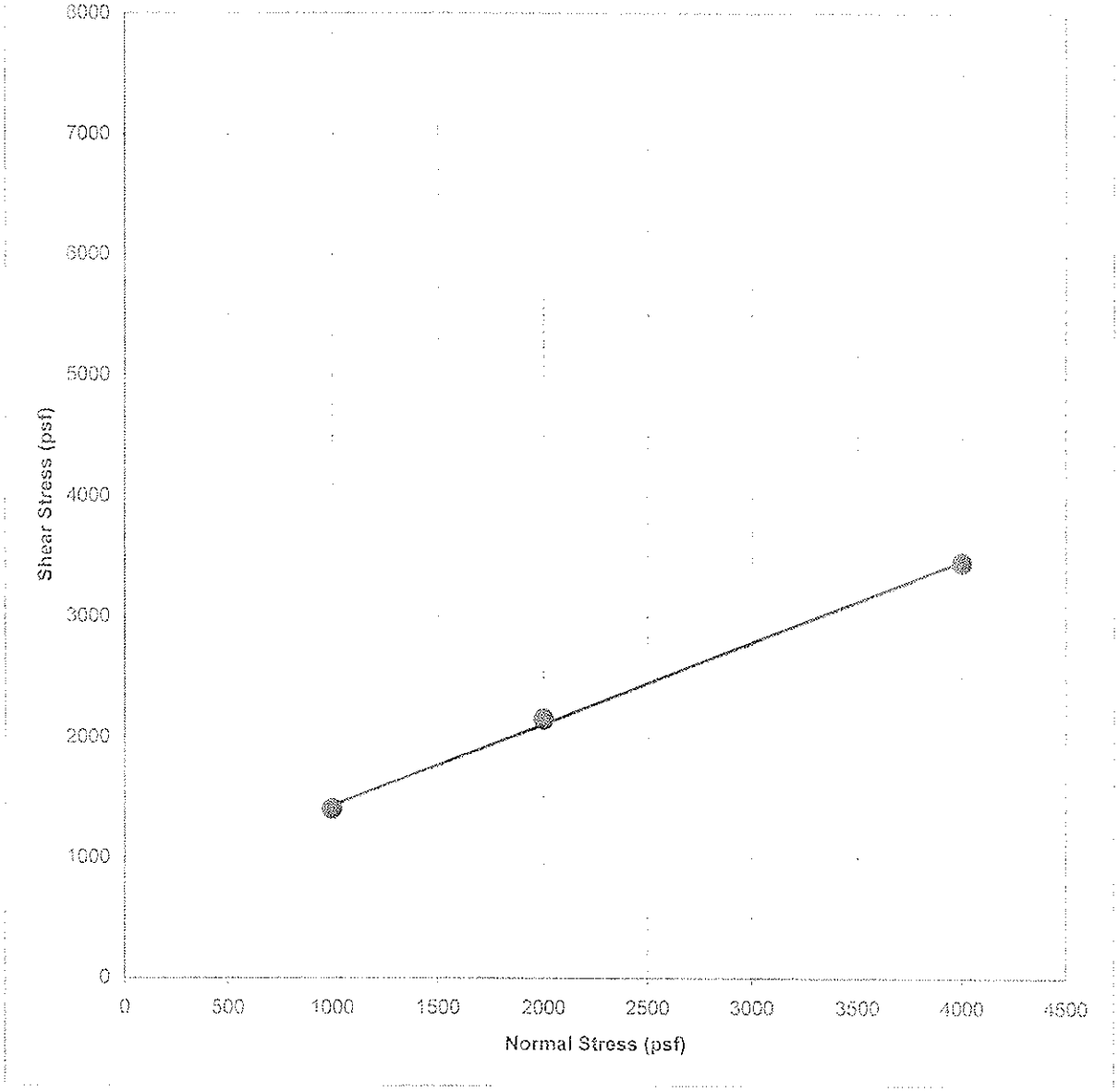
DIRECT SHEAR TEST RESULTS

Sunrise Landfill

Clark County, Nevada

Prepared For: Republic Services

Work Order: 8787 -LVI Date: Nov. 2008



Symbol	Lab #	Location	Depth	Classification	DD (pcf)	MC %	Frc. Angle	Cohesion
●	97396	CBS-06&08	0	0	0	0	34	742
⊠								
▲								

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Las Vegas, Nevada 89119-3832
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GEOTECHNICAL ENVIRONMENTAL MATERIALS

DIRECT SHEAR TEST RESULTS

Sunrise Landfill

Clark County, Nevada

Prepared For: Republic Services

Work Order: 8787 -LVI Date: Nov. 2008

GeoTek Laboratory Testing Request Form

SOIL

Date Sampled: 3-4-08
Sampled By: Client
Project Manager: J.S.
Report Results By:

WO #: 8787-LV1
Client: Republic Services of Nev
Project: Sunrise Landfill

Location: LV ☐ NV ☐ CC ☐ HEN ☐ OTHER ☐

Activity Codes

Laboratory ID#	Sample ID & Location Lot/Boring/Test Pit #	Location: Sample Depth	Sample Type: (LB - SB - RG)	SOILS	S1 Moisture Content	S2 Atterburg Limits	S4 Sieve w/ 200 Wash	S5 Hydrometer	S6 Consolidation (in-situ)	S6R Consolidation - Remold	S7 Solubility	S8 Direct Shear (in-situ)	S8R Direct Shear - Remold	S9 Proctor Curve	S10 Check Pt. (Proctor)	S11 Specific Gravity	S12 Chem. Sodium Sulfate	S13 Ph	S14 Resistivity	S15 Permeability-Falling Head	S16 R-Value	S18 Swell (in-situ)	S18R Swell Remold	S21 Expansion Index	S24 Organic Impurities	S25 Moist./Dens. (in-situ)	S26 Unconfined Compression	S28 Particle Size Analysis	S29 Freeze/Thaw	S30 Chlorides	S31 Corrosivity	L.A. w/ & R. Note Bag 14 Rock	Durability Test	
95470	01 Twash DCS					X	X	X																										
95471	02 Twash DCS					X	X	X								X																X	X	
95472	03 Twash DCS					X	X	X																										
95473	04 Twash DCS					X	X	X																										
95474	05 Twash DCS					X	X	X								X																X	X	
95475	06 Twash DCS					X	X	X																										
95476	07 Twash DCS					X	X	X																										
95477	08 Twash DCS					X	X	X																										

RECEIVED MAR 6 2008

Comments/Special Instructions:

White - Lab Yellow - Billing Pink - Project Manager Goldenrod - Technician

Geo Tek, Inc.
6835 S. Escondido Street, Suite A
Las Vegas, Nevada 89119-3828

Telephone: (702) 897-1424

SampleID: LNS08/95470
Report No: MAT:LNS08/95470
Issue No: 2
This report replaces all previous issues of report no 'MAT:LNS08/95470'

Aggregate/Soil Test Report

Client: REPUBLIC SERVICES OF SOUTHERN NEVADA

Project: 8787-LV1
SUNRISE LANDFILL

This laboratory is accredited by AASHTO
The test(s) reported have been performed in accordance with its terms of accreditation

Date Issued: 4/10/2008 Signed: 4/10/2008

Sample Details

Sample ID: LNS08/95470
Field Sample ID:
Date Sampled: 03/04/2008
Source:
Material:
Specification: Hyrometer Sieve -1
Sampling Method:
Location: 01 T Wash DCS

Other Test Results

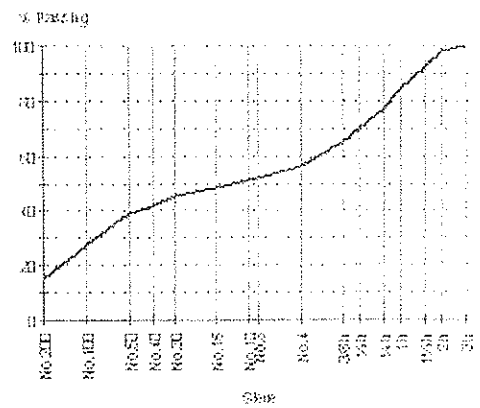
Description	Method	Result	Limits
Liquid Limit (%)	ASTM D 4318	NO	
Method		One Point	
Plastic Limit (%)		NO	
Plasticity Index (%)		NP	
Sample History			
Preparation			
Group Symbol	ASTM D 2487	GM	
Group Name		Silty gravel with sand	

Particle Size Distribution

Method: ASTM C 136, ASTM C 117
Drying by:

Sieve Size	% Passing	Limits
3in (75.0mm)	100	
2in (50.0mm)	98	
1½in (37.5mm)	92	
1in (25.0mm)	84	
¾in (19.0mm)	77	
½in (12.5mm)	70	
3/8in (9.5mm)	65	
No.4 (4.75mm)	56	
No.8 (2.36mm)	52	
No.10 (2.0mm)	51	
No.16 (1.18mm)	48	
No.30 (600µm)	45	
No.40 (425µm)	42	
No.50 (300µm)	39	
No.100 (150µm)	27	
No.200 (75µm)	15	

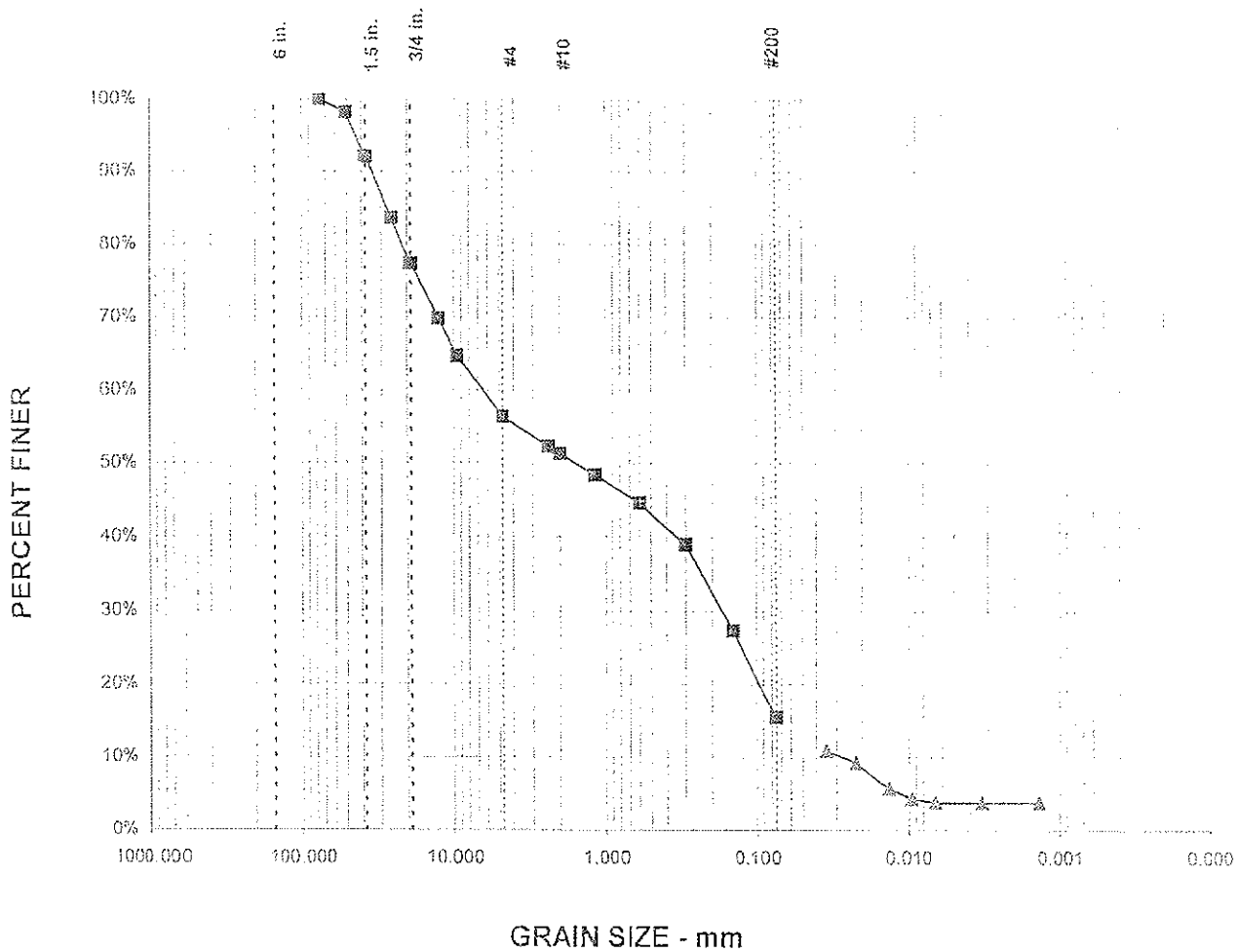
Chart



Comments

NO = Not Obtainable
NP = Non Plastic

GRAIN SIZE DISTRIBUTION GRAPH



HYDROMETER TEST SUMMARY

% GRAVEL =	44%	D_{85} = 27.3	D_{15} =
% SAND =	41%	D_{60} = 6.5	D_{10} =
% SILT & CLAY =	15%	D_{50} = 1.6	C_U =
		D_{30} = 0.2	C_C =

Project No.: Republic Service of Nevada
Project Name: Sunrise Landfill
Date: 04-Mar-08
Boring No.: 01 T Wash DCS
Sample No.: 95470
Material Description: Silty Gravel with Sand

GEOTEK

GRAIN SIZE DISTRIBUTION TEST REPORT with HYDROMETER

GEOTEK - NEVADA, INC

Geo Tek, Inc.
6835 S. Escondido Street, Suite A
Las Vegas, Nevada 89119-3828

Telephone (702) 897 1424

SampleID: LNS08/95471
Report No: MAT:LNS08/95471
Issue No: 1
This report replaces all previous issues of report no MAT:LNS08/95471.

Aggregate/Soil Test Report

Client: REPUBLIC SERVICES OF SOUTHERN NEVADA

Project: 6787-LV1
SUNRISE LANDFILL

This laboratory is accredited by AASHTO The test(s) reported have been performed in accordance with its terms of accreditation

Date Issued: 4/10/2008 Signed: 4/10/2008

Sample Details

Sample ID: LNS08/95471
Field Sample ID:
Date Sampled: 03/04/2008
Source:
Material:
Specification: Hyrometer Sieve -1
Sampling Method:
Location: 02 T Wash DCS

Other Test Results

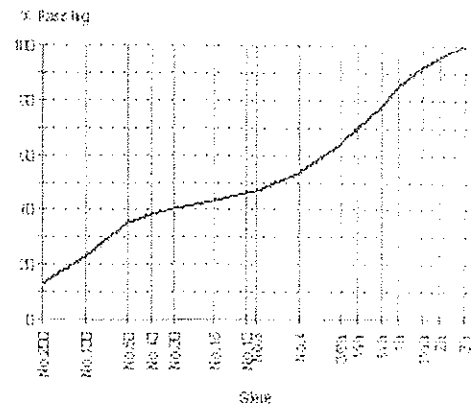
Description	Method	Result	Limits
Liquid Limit (%)	ASTM D 4318	NO	
Method		One Point	
Plastic Limit (%)		NO	
Plasticity Index (%)		NP	
Sample History			
Preparation			
Bulk Specific Gravity	ASTM C 127	2.64	
Bulk Specific Gravity SSD		2.66	
Apparent Specific Gravity		2.68	
Absorption (%)		0.6	
Additional Notes			
Group Symbol	ASTM D 2487	GM	
Group Name		Silty gravel with sand	
Los Angeles Value (%)	ASTM C 131	27	
Test Grading		3	

Particle Size Distribution

Method: ASTM C 136, ASTM C 117
Drying by:

Sieve Size	% Passing	Limits
3in (75.0mm)	100	
2in (50.0mm)	96	
1½in (37.5mm)	92	
1in (25.0mm)	85	
¾in (19.0mm)	78	
½in (12.5mm)	70	
3/8in (9.5mm)	64	
No.4 (4.75mm)	53	
No.8 (2.36mm)	47	
No.10 (2.0mm)	46	
No.16 (1.18mm)	43	
No.30 (600µm)	40	
No.40 (425µm)	38	
No.50 (300µm)	35	
No.100 (150µm)	23	
No.200 (75µm)	13	

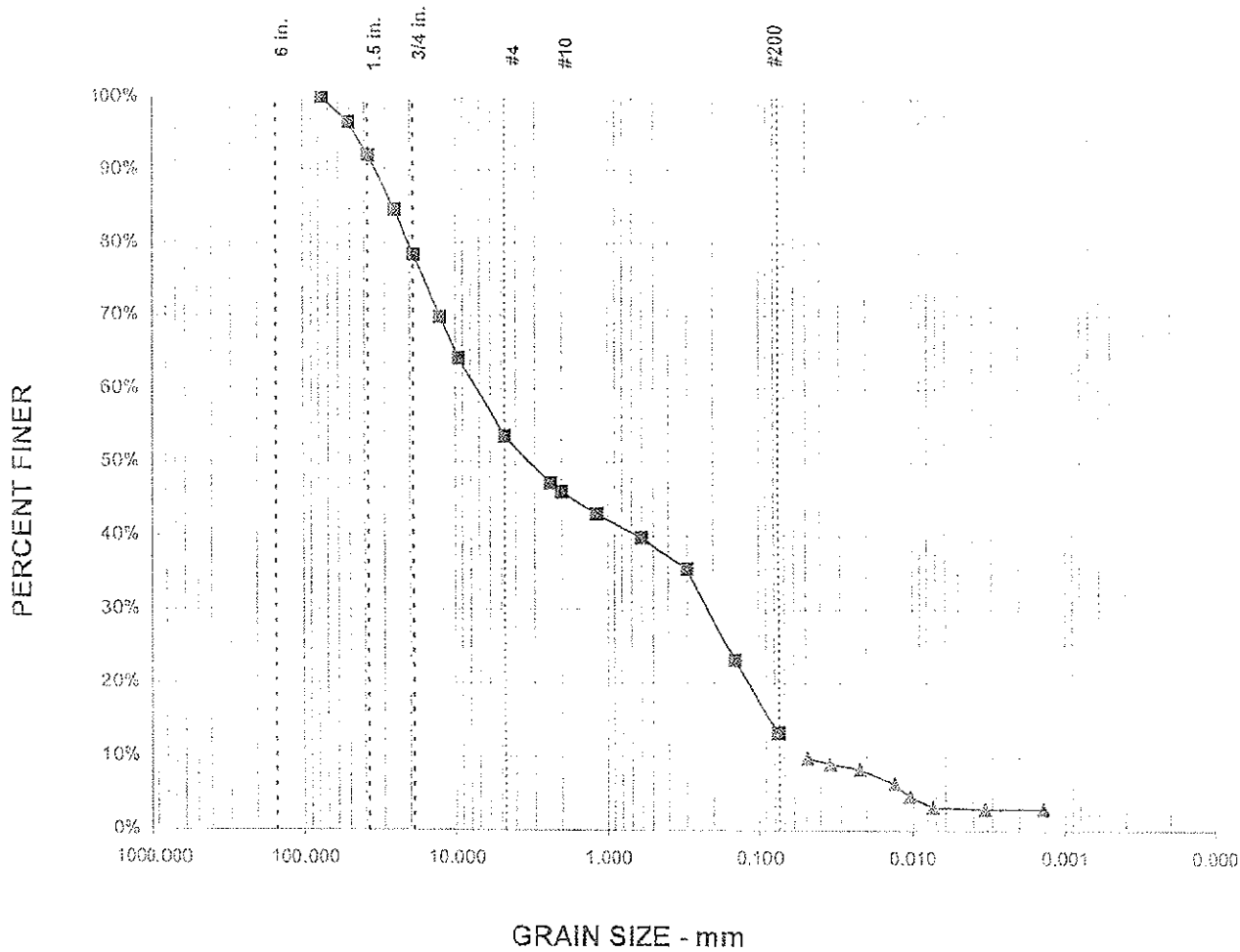
Chart



Comments

NO = Not Obtainable
NP = Non Plastic

GRAIN SIZE DISTRIBUTION GRAPH



HYDROMETER TEST SUMMARY

% GRAVEL =	47%	D_{85} = 26.1	D_{15} = 0.1
% SAND =	40%	D_{60} = 7.3	D_{10} =
% SILT & CLAY =	13%	D_{50} = 3.2	C_U =
		D_{30} = 0.2	C_C =

Project No.: Republic Service of Nevada
Project Name: Sunrise Landfill
Date: 04-Mar-08
Boring No.: 02 T Wash DCS
Sample No.: 95471
Material Description: Silty gravel with sand

GEOTEK

GRAIN SIZE DISTRIBUTION TEST REPORT with HYDROMETER

GEOTEK - NEVADA, INC

Geo Tek, Inc.
6825 S. Escondido Street, Suite A
Las Vegas, Nevada 89119-3628

Telephone (702) 897-1424

SampleID: LNS08/95472
Report No: MAT:LNS08/95472
Issue No: 2
This report replaces all previous issues of report no 'MAT:LNS08/95472'

Aggregate/Soil Test Report

Client: REPUBLIC SERVICES OF SOUTHERN NEVADA

Project: 8787-LV1
SUNRISE LANDFILL

This laboratory is accredited by AASHTO
The test(s) reported have been performed in accordance with its terms of accreditation

Date Issued: 4/10/2008 Signed: 4/10/2008

Sample Details

Sample ID: LNS08/95472
Field Sample ID:
Date Sampled: 03/04/2008
Source:
Material:
Specification: Hyrometer Sieve -1
Sampling Method:
Location: 03 T Wash DCS

Other Test Results

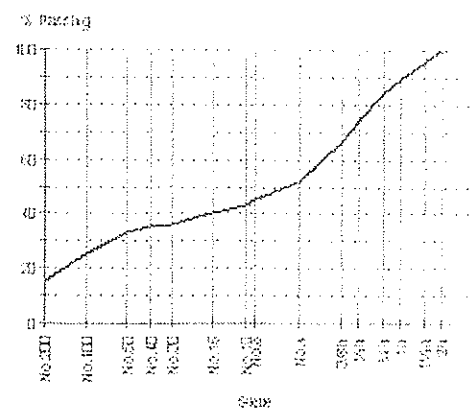
Description	Method	Result	Limits
Liquid Limit (%)	ASTM D 4318	NO	
Method		One Point	
Plastic Limit (%)		NO	
Plasticity Index (%)		NP	
Sample History			
Preparation			
Group Symbol	ASTM D 2487	GM	
Group Name		Silty gravel with sand	

Particle Size Distribution

Method: ASTM C 136, ASTM C 117
Drying by:

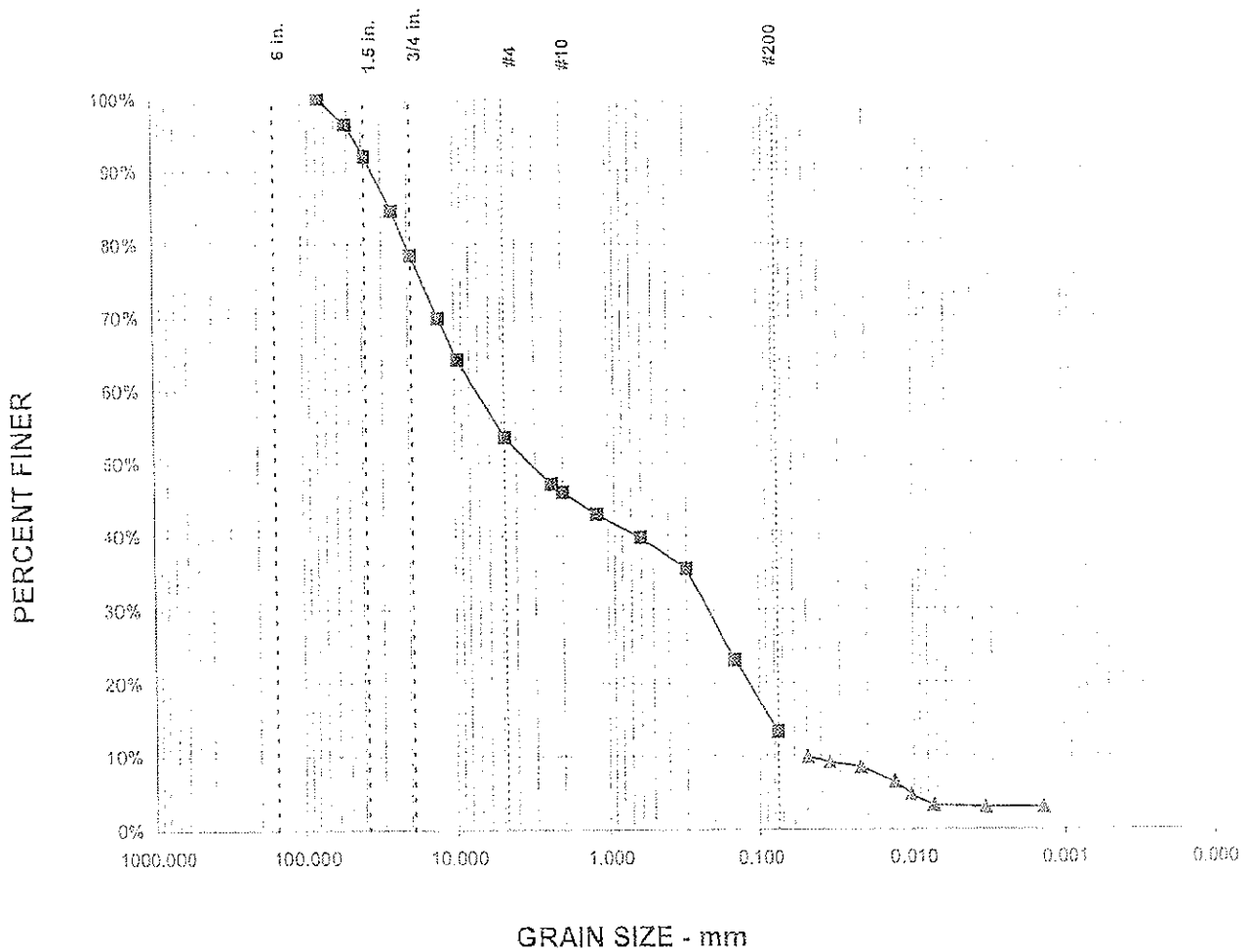
Sieve Size	% Passing	Limits
2in (50.0mm)	100	
1½in (37.5mm)	96	
1in (25.0mm)	89	
¾in (19.0mm)	84	
½in (12.5mm)	74	
3/8in (9.5mm)	66	
No.4 (4.75mm)	52	
No.8 (2.36mm)	45	
No.10 (2.0mm)	43	
No.16 (1.18mm)	40	
No.30 (600µm)	36	
No.40 (425µm)	35	
No.50 (300µm)	33	
No.100 (150µm)	25	
No.200 (75µm)	15	

Chart



Comments
NO = Not Obtainable
NP = Non Plastic

GRAIN SIZE DISTRIBUTION GRAPH



HYDROMETER TEST SUMMARY

% GRAVEL =	47%	D_{85} = 26.1	D_{15} = 0.1
% SAND =	40%	D_{60} = 7.3	D_{10} =
% SILT & CLAY =	13%	D_{50} = 3.2	C_U =
		D_{30} = 0.2	C_C =

Project No.: Republic Service of Nevada
Project Name: Sunrise Landfill
Date: 04-Mar-08
Boring No.: 03 T Wash DCS
Sample No.: 95472
Material Description: Silty gravel with sand

GEOTEK

GRAIN SIZE DISTRIBUTION TEST REPORT with HYDROMETER

GEOTEK - NEVADA, INC

Geo Tek, Inc.
6835 S. Escondido Street, Suite A
Las Vegas, Nevada 89119-3828

Telephone: (702) 897-1424

SampleID: LNS08/95473
Report No: MAT:LNS08/95473
Issue No: 2
This report replaces all previous issues of report no MAT:LNS08/95473

Aggregate/Soil Test Report

This laboratory is accredited by AASHTO
The test(s) reported have been performed in accordance with its terms of accreditation

Date Issued: 4/10/2008 Signed: 4/10/2008

Client: REPUBLIC SERVICES OF SOUTHERN NEVADA

Project: 8787-LV1
SUNRISE LANDFILL

Sample Details

Sample ID: LNS08/95473
Field Sample ID:
Date Sampled: 03/04/2008
Source:
Material:
Specification: Hydrometer Sieve -1
Sampling Method:
Location: 04 T Wash DCS

Other Test Results

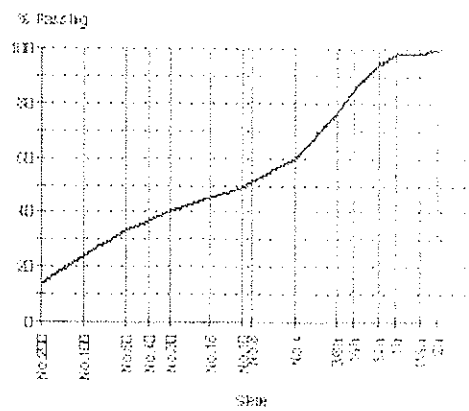
Description	Method	Result	Limits
Liquid Limit (%)	ASTM D 4318	NO	
Method		One Point	
Plastic Limit (%)		NO	
Plasticity Index (%)		NP	
Sample History			
Preparation			
Group Symbol	ASTM D 2487	SM	
Group Name		Silty sand with gravel	

Particle Size Distribution

Method: ASTM C 136, ASTM C 117
Drying by:

Sieve Size	% Passing	Limits
2in (50.0mm)	100	
1½in (37.5mm)	98	
1in (25.0mm)	98	
¾in (19.0mm)	94	
½in (12.5mm)	85	
3/8in (9.5mm)	76	
No.4 (4.75mm)	60	
No.8 (2.36mm)	51	
No.10 (2.0mm)	49	
No.16 (1.18mm)	45	
No.30 (600µm)	40	
No.40 (425µm)	37	
No.50 (300µm)	33	
No.100 (150µm)	24	
No.200 (75µm)	14	

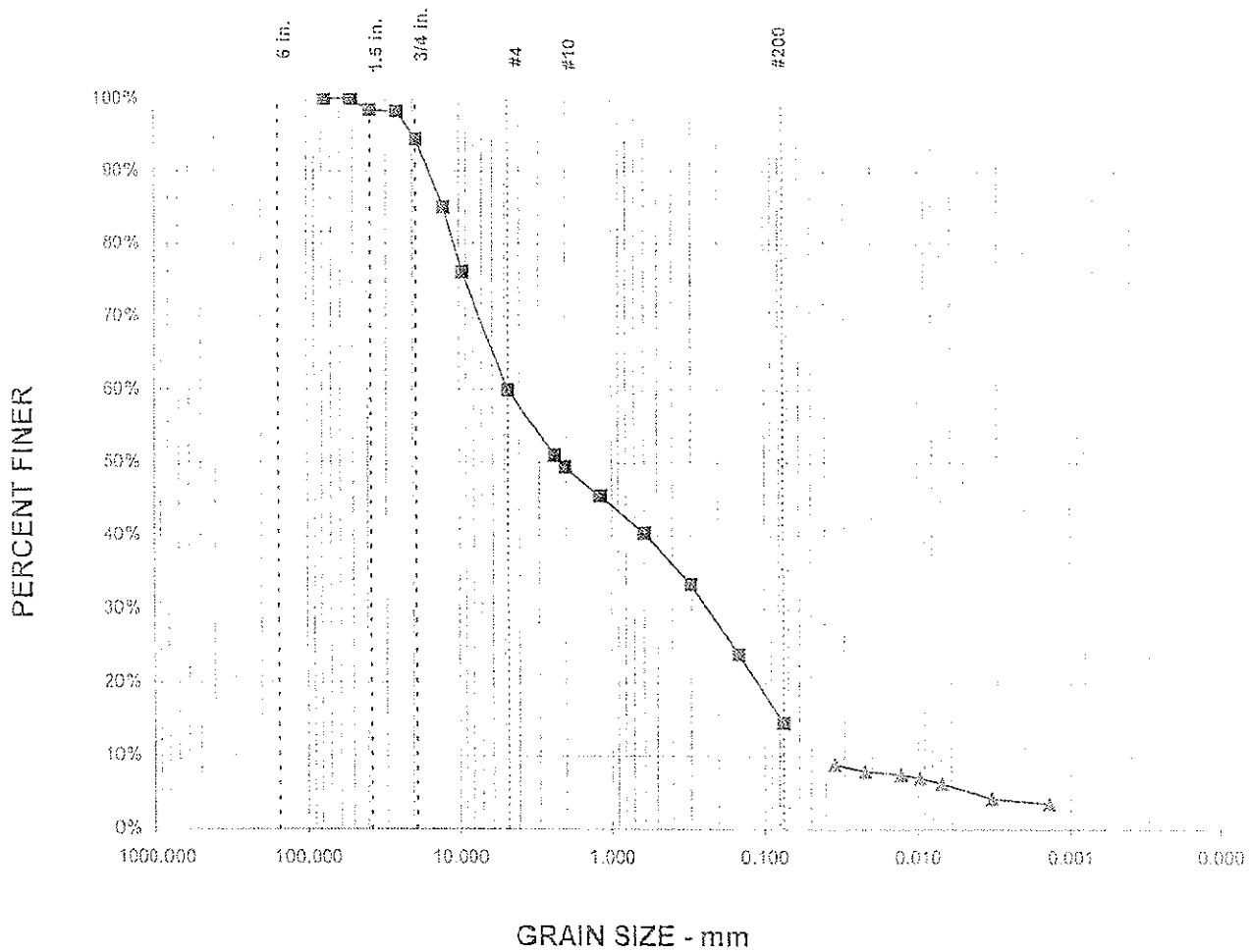
Chart



Comments

NO = Not Obtainable
NP = Non Plastic

GRAIN SIZE DISTRIBUTION GRAPH



HYDROMETER TEST SUMMARY

% GRAVEL =	40%	D_{85} = 12.7	D_{15} = 0.1
% SAND =	45%	D_{60} = 4.8	D_{10} =
% SILT & CLAY =	14%	D_{50} = 2.1	C_U =
		D_{30} = 0.2	C_C =

Project No.: Republic Service of Nevada
Project Name: Sunrise Landfill
Date: 04-Mar-08
Boring No.: 04 T Wash DCS
Sample No.: 95473
Material Description: Silty sand with gravel

GEOTEK

GRAIN SIZE DISTRIBUTION TEST REPORT with HYDROMETER

GEOTEK - NEVADA, INC

Geo Tek, Inc.
6835 S. Escondido Street Suite A
Las Vegas, Nevada 89119-3828

Telephone (702) 897-1424

SampleID: LNS08/95474
Report No: MAT:LNS08/95474
Issue No: 2
This report replaces all previous issues of report no 'MAT:LNS08/95474'

Aggregate/Soil Test Report

This laboratory is accredited by AASHTO. The test(s) reported have been performed in accordance with its terms of accreditation.

Date Issued: 4/10/2008 Signed: 4/10/2008

Client: REPUBLIC SERVICES OF SOUTHERN NEVADA

Project: 8787-LV1
SUNRISE LANDFILL

Sample Details

Sample ID: LNS08/95474
Field Sample ID:
Date Sampled: 03/04/2008
Source:
Material:
Specification: Hyrometer Sieve -1
Sampling Method:
Location: 05 T Wash DCS

Other Test Results

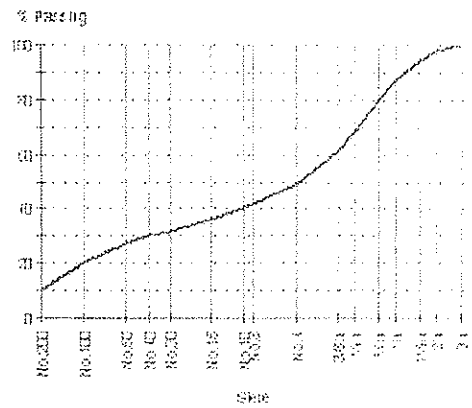
Description	Method	Result	Limits
Liquid Limit (%)	ASTM D 4318	NO	
Method		One Point	
Plastic Limit (%)		NO	
Plasticity Index (%)		NP	
Sample History			
Preparation			
Bulk Specific Gravity	ASTM C 127	2.58	
Bulk Specific Gravity SSD		2.61	
Apparent Specific Gravity		2.67	
Absorption (%)		1.3	
Additional Notes			
Group Symbol	ASTM D 2487	GP-GM	
Group Name	Poorly graded gravel with silt and sand		
Los Angeles Value (%)	ASTM C 131	24	
Test Grading		3	

Particle Size Distribution

Method: ASTM C 136, ASTM C 117
Drying by:

Sieve Size	% Passing	Limits
3in (75.0mm)	100	
2in (50.0mm)	98	
1½in (37.5mm)	94	
1in (25.0mm)	87	
¾in (19.0mm)	80	
½in (12.5mm)	68	
3/8in (9.5mm)	61	
No.4 (4.75mm)	49	
No.8 (2.36mm)	42	
No.10 (2.0mm)	40	
No.16 (1.18mm)	36	
No.30 (600µm)	32	
No.40 (425µm)	30	
No.50 (300µm)	27	
No.100 (150µm)	20	
No.200 (75µm)	10	

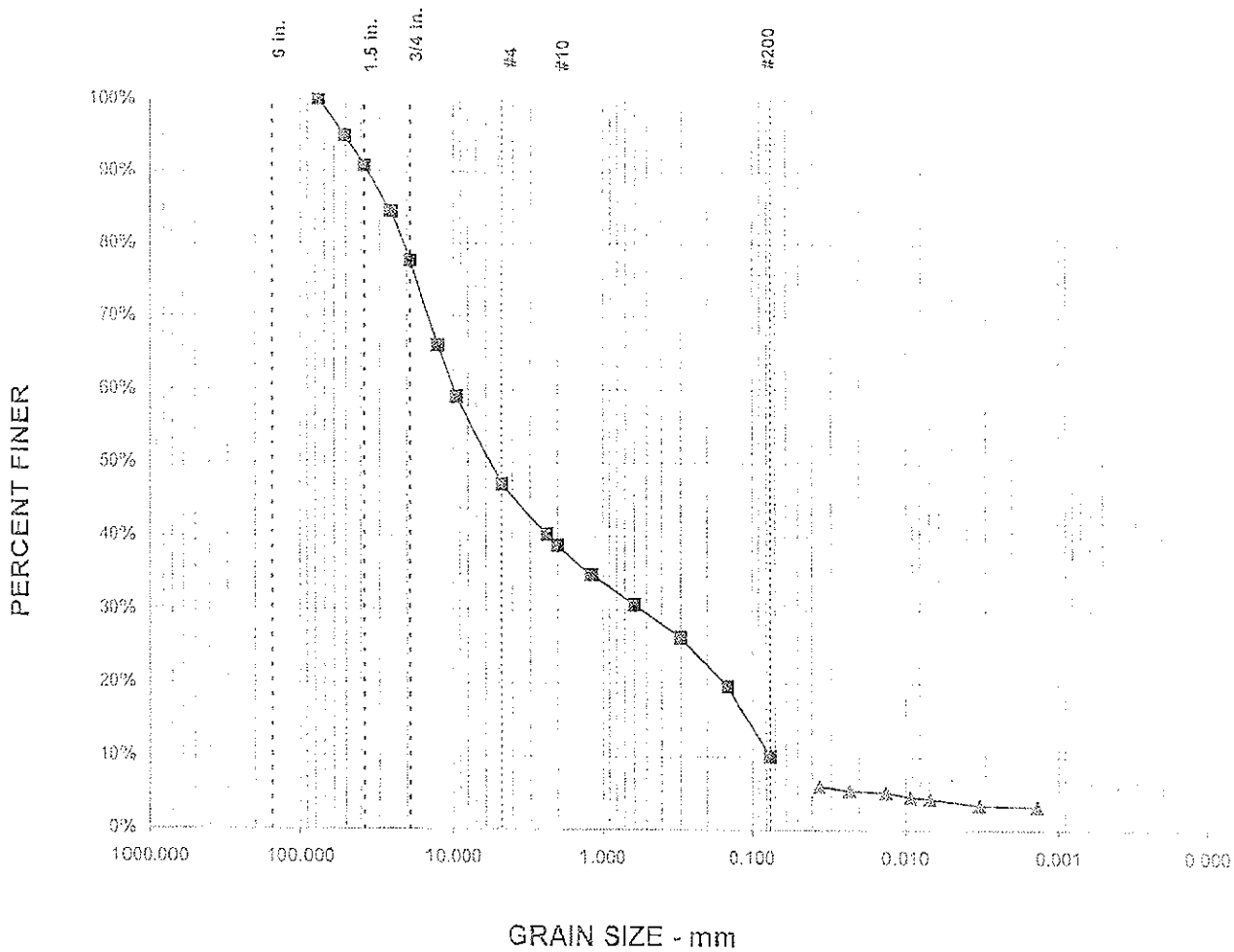
Chart



Comments

NO = Not Obtainable
NP = Non Plastic

GRAIN SIZE DISTRIBUTION GRAPH



HYDROMETER TEST SUMMARY

% GRAVEL =	53%	D_{85} = 26.4	D_{15} = 0.1
% SAND =	37%	D_{60} = 9.9	D_{10} =
% SILT & CLAY =	10%	D_{50} = 5.7	C_U =
		D_{30} = 0.5	C_C =

Project No.: Republic Service of Nevada
Project Name: Sunrise Landfill
Date: 04-Mar-08
Boring No.: 05 T Wash DCS
Sample No.: 95474
Material Description: Poorly graded gravel with silt and sand

GRAIN SIZE DISTRIBUTION TEST REPORT with HYDROMETER

GEOTEK - NEVADA, INC

GEOTEK

Geo Tek, Inc.
6835 S. Escondido Street, Suite A
Las Vegas, Nevada 89119-3828

Telephone (702) 897 1424

SampleID: LNS08/95475
Report No: MAT:LNS08/95475
Issue No: 2
This report replaces all previous issues of report no MAT:LNS08/95475

Aggregate/Soil Test Report

This laboratory is accredited by AASHTO
The test(s) reported have been performed in accordance with its terms of accreditation

Date Issued: 4/10/2008 Signed: 4/10/2008

Client: REPUBLIC SERVICES OF SOUTHERN NEVADA

Project: 8787-LV1
SUNRISE LANDFILL

Sample Details

Sample ID: LNS08/95475
Field Sample ID:
Date Sampled: 03/04/2008
Source:
Material:
Specification: Hyrometer Sieve -1
Sampling Method:
Location: 06 T Wash DCS

Other Test Results

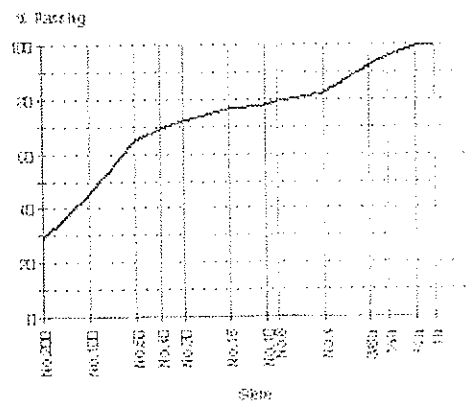
Description	Method	Result	Limits
Liquid Limit (%)	ASTM D 4318	NO	
Method		One Point	
Plastic Limit (%)		NO	
Plasticity Index (%)		NP	
Sample History			
Preparation			
Moisture Content (%)	ASTM D 2216	7.3	
Group Symbol	ASTM D 2487	SM	
Group Name	Silty sand with gravel		

Particle Size Distribution

Method: ASTM C 136, ASTM C 117
Drying by:

Sieve Size	% Passing	Limits
1in (25.0mm)	100	
¾in (19.0mm)	99	
½in (12.5mm)	96	
3/8in (9.5mm)	92	
No.4 (4.75mm)	82	
No.8 (2.36mm)	79	
No.10 (2.0mm)	76	
No.16 (1.18mm)	76	
No.30 (600µm)	72	
No.40 (425µm)	69	
No.50 (300µm)	65	
No.100 (150µm)	45	
No.200 (75µm)	29	

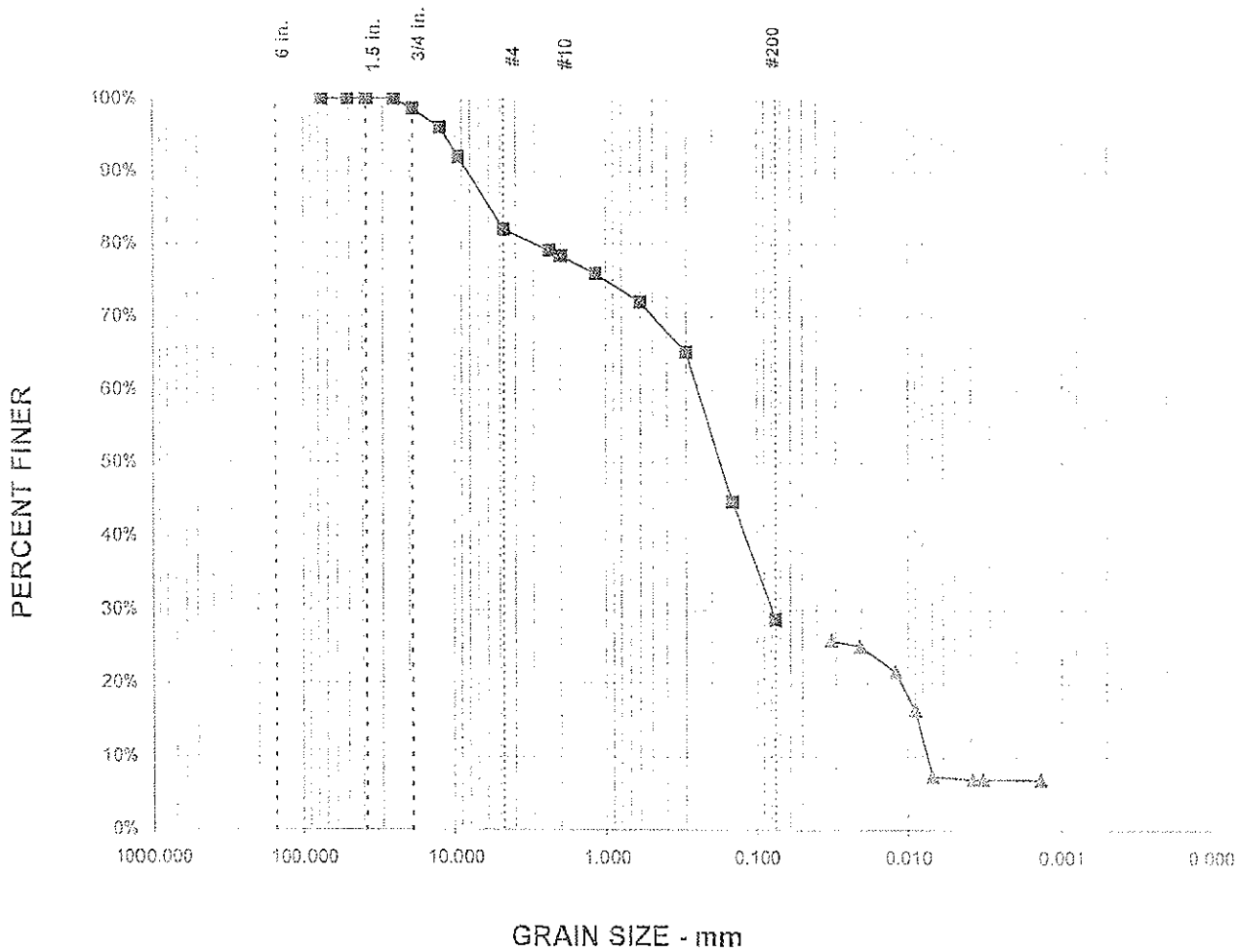
Chart



Comments

NO = Not Obtainable
NP = Non Plastic

GRAIN SIZE DISTRIBUTION GRAPH



HYDROMETER TEST SUMMARY

% GRAVEL =	18%	D_{85} = 5.9	D_{15} =
% SAND =	53%	D_{60} = 0.3	D_{10} =
% SILT & CLAY =	29%	D_{50} = 0.2	C_U =
		D_{30} = 0.1	C_C =

Project No.: Republic Service of Nevada
Project Name: Sunrise Landfill
Date: 04-Mar-08
Boring No.: 06 T Wash DCS
Sample No.: 95475
Material Description: Silty sand with gravel

GEOTEK

GRAIN SIZE DISTRIBUTION TEST REPORT with HYDROMETER

GEOTEK - NEVADA, INC

Geo Tek, Inc.
6835 S. Escondido Street, Suite A
Las Vegas, Nevada 89119-3828

Telephone: (702) 897-1424

SampleID: LNS08/95476
Report No: MAT:LNS08/95476
Issue No: 2
This report replaces all previous issues of report no: MAT:LNS08/95476

Aggregate/Soil Test Report

This laboratory is accredited by AASHTO. The test(s) reported have been performed in accordance with its terms of accreditation.

Date Issued: 4/10/2008 Signed: 4/10/2008

Client: REPUBLIC SERVICES OF SOUTHERN NEVADA

Project: 8787 LV1
SUNRISE LANDFILL

Sample Details

Sample ID:	LNS08/95476
Field Sample ID:	
Date Sampled:	03/04/2008
Source:	
Material:	
Specification:	Hyrometer Sieve -1
Sampling Method:	
Location:	07 T Wash DCS

Other Test Results

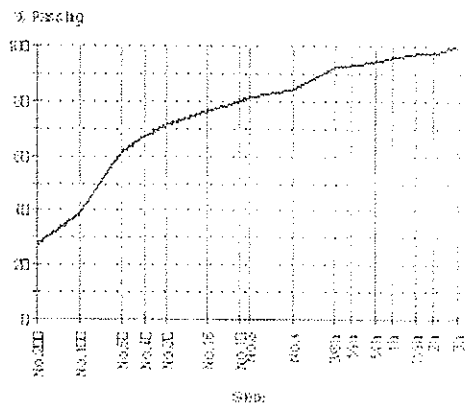
Description	Method	Result	Limits
Liquid Limit (%)	ASTM D 4318	NO	
Method		One Point	
Plastic Limit (%)		NO	
Plasticity Index (%)		NP	
Sample History			
Preparation			
Group Symbol	ASTM D 2487	SM	
Group Name		Silty sand with gravel	

Particle Size Distribution

Method: ASTM C 136, ASTM C 117
Drying by:

Sieve Size	% Passing	Limits
3in (75.0mm)	100	
2in (50.0mm)	97	
1½in (37.5mm)	97	
1in (25.0mm)	96	
¾in (19.0mm)	94	
½in (12.5mm)	93	
3/8in (9.5mm)	92	
No.4 (4.75mm)	84	
No.8 (2.36mm)	81	
No.10 (2.0mm)	80	
No.16 (1.18mm)	76	
No.30 (600µm)	71	
No.40 (425µm)	67	
No.50 (300µm)	61	
No.100 (150µm)	39	
No.200 (75µm)	27	

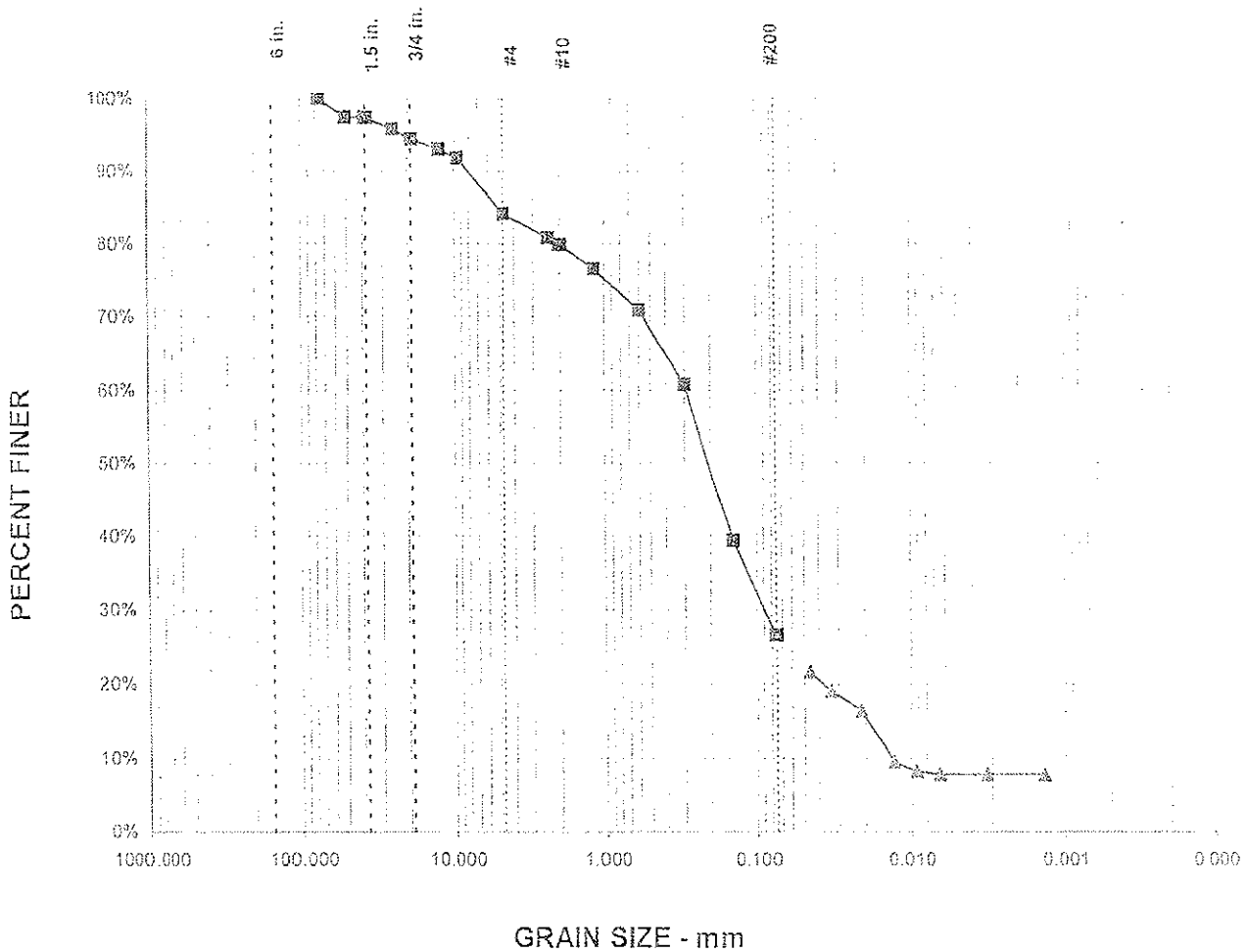
Chart



Comments

NO = Not Obtainable
NP = Non Plastic

GRAIN SIZE DISTRIBUTION GRAPH



HYDROMETER TEST SUMMARY

% GRAVEL =	16%	D_{85} = 5.2	D_{15} =
% SAND =	57%	D_{60} = 0.3	D_{10} =
% SILT & CLAY =	27%	D_{50} = 0.2	C_U =
		D_{30} = 0.1	C_C =

Project No.: Republic Service of Nevada
Project Name: Sunrise Landfill
Date: 04-Mar-08
Boring No.: 07 T Wash DCS
Sample No.: 95476
Material Description: Silty sand with gravel

GEOTEK

GRAIN SIZE DISTRIBUTION TEST REPORT with HYDROMETER

GEOTEK - NEVADA, INC

Geo Tek, Inc.
6835 S. Escondido Street, Suite A
Las Vegas, Nevada 89119-3828

Telephone (702) 897-1424

SampleID: LNS08/95477
Report No: MAT:LNS08/95477
Issue No: 2
This report replaces all previous issues of report no 'MAT:LNS08/95477'

Aggregate/Soil Test Report

This laboratory is accredited by AASHTO. The test(s) reported have been performed in accordance with its terms of accreditation.

Date Issued: 4/10/2008 Signed: 4/10/2008

Client: REPUBLIC SERVICES OF SOUTHERN NEVADA

Project: 8787-LV1
SUNRISE LANDFILL

Sample Details

Sample ID: LNS08/95477
Field Sample ID:
Date Sampled: 03/04/2008
Source:
Material:
Specification: Hyrometer Sieve - 1
Sampling Method:
Location: 08 T Wash DCS

Other Test Results

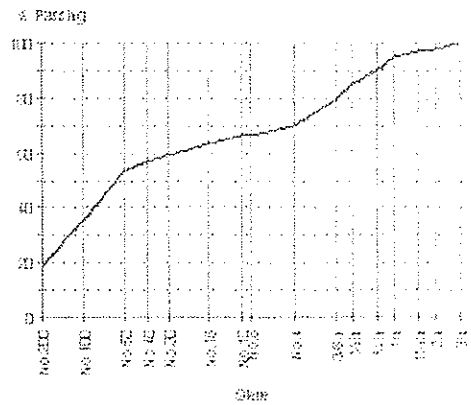
Description	Method	Result	Limits
Liquid Limit (%)	ASTM D 4318	NO	
Method		One Point	
Plastic Limit (%)		NO	
Plasticity Index (%)		NP	
Sample History			
Preparation			
Group Symbol	ASTM D 2487	SM	
Group Name		Silty sand with gravel	

Particle Size Distribution

Method: ASTM C 136, ASTM C 117
Drying by:

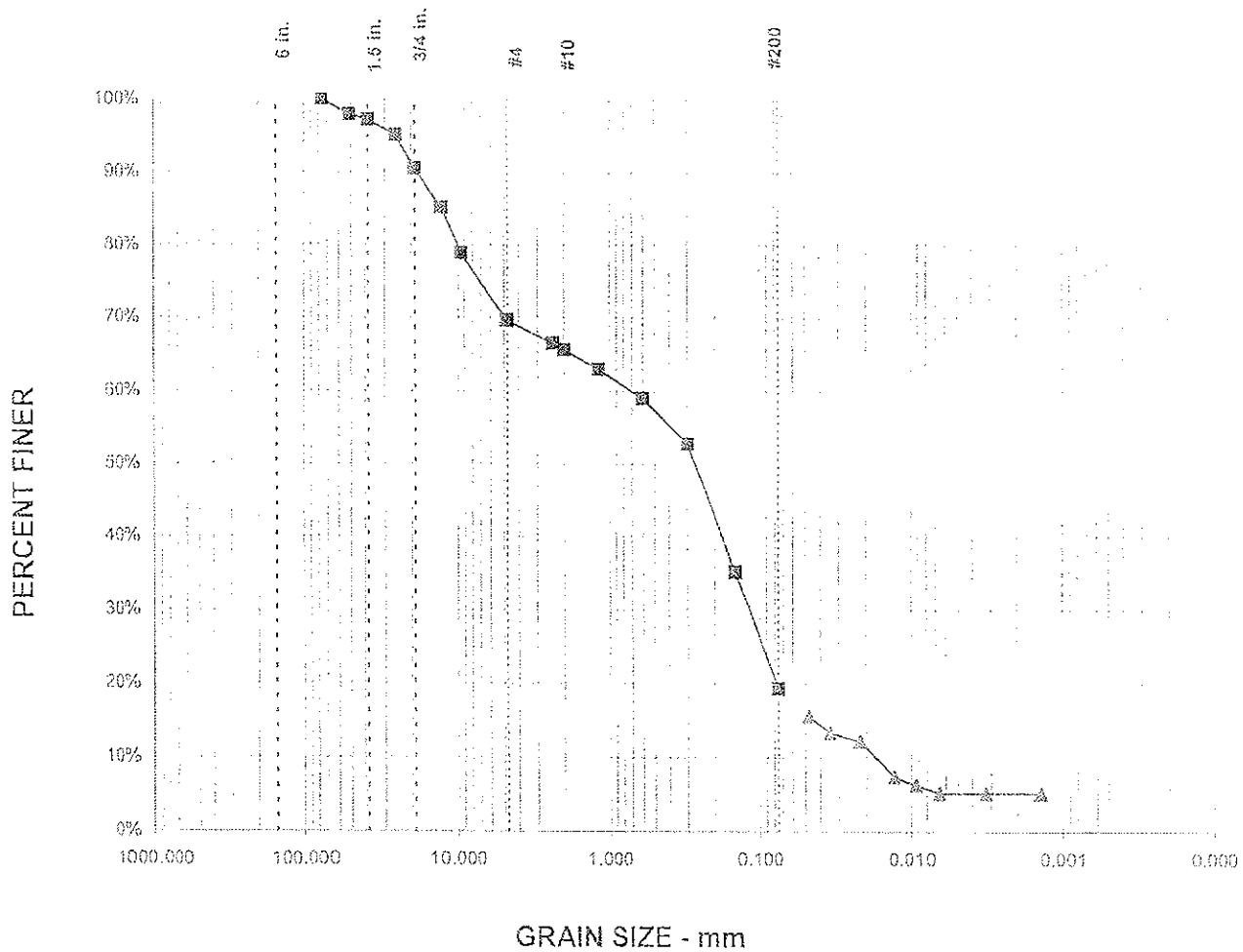
Sieve Size	% Passing	Limits
3in (75.0mm)	100	
2in (50.0mm)	98	
1½in (37.5mm)	97	
1in (25.0mm)	95	
¾in (19.0mm)	90	
½in (12.5mm)	85	
3/8in (9.5mm)	79	
No.4 (4.75mm)	70	
No.8 (2.36mm)	66	
No.10 (2.0mm)	66	
No.16 (1.18mm)	63	
No.30 (600µm)	59	
No.40 (425µm)	57	
No.50 (300µm)	53	
No.100 (150µm)	35	
No.200 (75µm)	19	

Chart



Comments
NO = Not Obtainable
NP = Non Plastic

GRAIN SIZE DISTRIBUTION GRAPH



HYDROMETER TEST SUMMARY

% GRAVEL =	30%	D_{85} = 12.6	D_{15} =
% SAND =	50%	D_{60} = 0.7	D_{10} =
% SILT & CLAY =	19%	D_{50} = 0.3	C_U =
		D_{30} = 0.1	C_C =

Project No.: Republic Service of Nevada
Project Name: Sunrise Landfill
Date: 04-Mar-08
Boring No.: 08 T Wash DCS
Sample No.: 95477
Material Description: Silty sand with gravel

GEOTEK

GRAIN SIZE DISTRIBUTION TEST REPORT with HYDROMETER

GEOTEK - NEVADA, INC

GEOTEK

CRUMB TEST FOR DISPERSIBILITY OF CLAYEY SOILS

ASTM D6572

Sample No. 95471 & 95474 WO # 8787 Location

Drill hole no. Depth ☐ m ☐ ft ☒ Disturbed ☐ Undisturbed

Color Natural Moisture Content(as received) %

Specimen Type: ☐ Natural irregularly shaped crumb ☒ Remolded crumb cube

Moisture Content: ☒ Natural Moisture ☐ Air dried ☐ Distilled water added to remold specimen

Curing time 0 min Water used ☒ Distilled ☐ Distilled and demineralized

Initial water temperature 21.9 °C Time at beginning of test 7:00 ☒ am ☐ pm

Tested by: Fred Gillett Date tested: 4/9/2008

Specimen Number	Dish Number	2 minutes		1 hour		6 hours	
		Grade	°C	Grade	°C	Grade	°C
95471		1	21.9	1	20.4	1	19.1
95474		1	21.9	1	20.4	1	19.1

WO # 8787

Sample # 95471

T. Wash-2

WO.# 8787
Sample # 95474

GeoTek Laboratory Testing Request Form

SOIL

Date Sampled: 3-5-08
Sampled By: CLIENT
Project Manager: JUSTIN S.
Report Results By:

WO #: 8787-LV1
Client: REPUBLIC SERVICES
Project: SUNRISE LANDFILL

Location: LV [ ] NV [ ] CC [X] HEN [ ] OTHER [ ]

Activity Codes

Laboratory ID#	Sample ID & Location Lot/Boring/Test Pit #	Location: Sample Depth	Sample Type: (LB - SB - RG)	SOILS	S1 Moisture Content	S2 Atterburg Limits	S4 Sieve w/ 200 Wash	S5 Hydrometer 422Z	S6 Consolidation (in-situ)	S6R Consolidation - Remold	S7 Solubility	S8 Direct Shear (in-situ)	S8R Direct Shear - Remold	S9 Proctor Curve	S10 Check Pt. (Proctor)	S11 Specific Gravity	S12 Chem. Sodium Sulfate	S13 Ph	S14 Resistivity	S15 Permeability-Falling Head	S16 R-Value	S18 Swell (in-situ)	S18R Swell Remold	S21 Expansion Index	S24 Organic Impurities	S25 Moist./Dens. (in-situ)	S26 Unconfined Compression	S28 Particle Size Analysis	S29 Freeze/Thaw	S30 Chlorides	S31 Corosivity	Crush Dest 2
95489	BEAZER-1		LB			X	X	X	Done																							
95490	BEAZER-2		LB			X	X	X																							X	
95491	BEAZER-3		LB			X	X	X	-P	Done																						
95492	BEAZER-4		LB			X	X	X	-P	Done																						

Comments/Special Instructions:

White - Lab Yellow - Billing Pink - Project Manager Goldenrod - Technician

USE #10 & #40 Sieve

Geo Tek, Inc.
6635 S. Escondido Street, Suite A
Las Vegas, Nevada 89119-3828

Telephone (702) 897 1424

SampleID: LNS08/95489
Report No: MAT:LNS08/95489
Issue No: 1
This report replaces all previous issues of report no 'MAT:LNS08/95489'

Aggregate/Soil Test Report

Client: REPUBLIC SERVICES OF SOUTHERN NEVADA

Project: 8787-LV1
SUNRISE LANDFILL

This laboratory is accredited by AASHTO. The test(s) reported have been performed in accordance with its terms of accreditation

Date Issued: 3/11/2009 Signed: 3/11/2009

Sample Details

Sample ID: LNS08/95489
Field Sample ID:
Date Sampled: 03/05/2008
Source:
Material:
Specification: Hyrometer Sieve -1
Sampling Method:
Location: Beazer - 1

Other Test Results

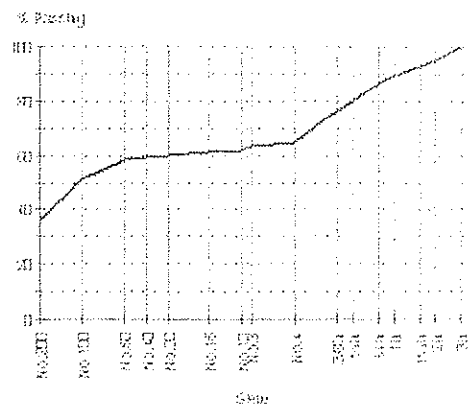
Description	Method	Result	Limits
Liquid Limit (%)	ASTM D 4318	34	
Method		One Point	
Plastic Limit (%)		19	
Plasticity Index (%)		15	
Sample History			
Preparation			
Group Symbol	ASTM D 2487	GC	
Group Name		Clayey gravel with sand	

Particle Size Distribution

Method: ASTM C 136, ASTM C 117
Drying by:

Sieve Size	% Passing	Limits
3in (75.0mm)	100	
2in (50.0mm)	95	
1½in (37.5mm)	93	
1in (25.0mm)	89	
¾in (19.0mm)	86	
½in (12.5mm)	80	
3/8in (9.5mm)	76	
No.4 (4.75mm)	65	
No.8 (2.36mm)	63	
No.10 (2.0mm)	62	
No.16 (1.18mm)	61	
No.30 (600µm)	60	
No.40 (425µm)	59	
No.50 (300µm)	58	
No.100 (150µm)	51	
No.200 (75µm)	36	

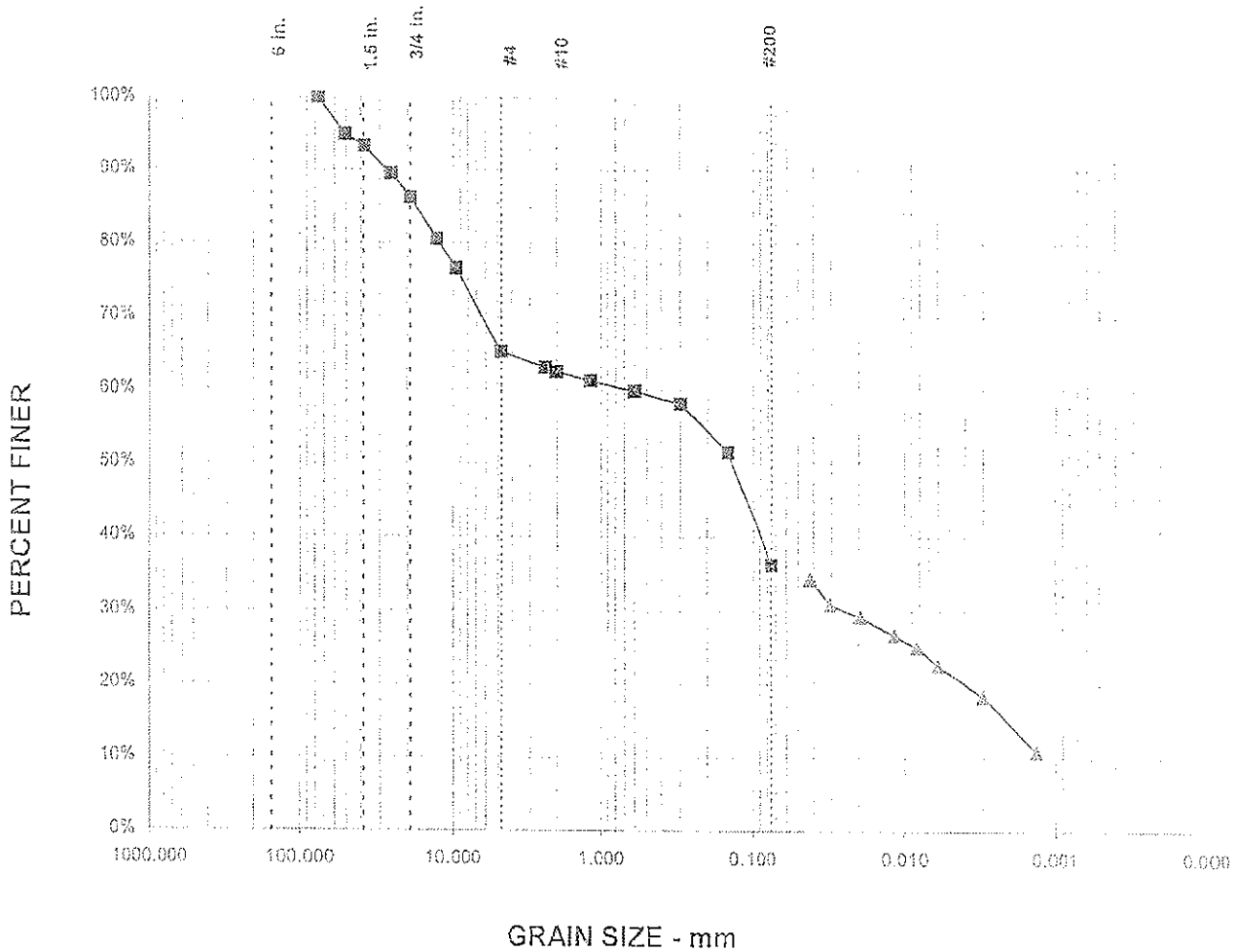
Chart



Comments

N/A

GRAIN SIZE DISTRIBUTION GRAPH



HYDROMETER TEST SUMMARY

% GRAVEL =	35%	D_{85} = 17.5	D_{15} =
% SAND =	29%	D_{60} = 0.7	D_{10} =
% SILT & CLAY =	36%	D_{50} = 0.1	C_U =
		D_{30} =	C_C =

Project No.: Republic Service of Nevada
Project Name: Sunrise Landfill
Date: 05-Mar-08
Boring No.: Beazer 1
Sample No.: 95489
Material Description: Clayey gravel with sand

GRAIN SIZE DISTRIBUTION TEST REPORT with HYDROMETER

GEOTEK - NEVADA, INC

GEOTEK

Geo Tek, Inc.
6635 S. Escondido Street, Suite A
Las Vegas, Nevada 89119-3828

Telephone: (702) 897-1424

SampleID: LNS08/95490
Report No: MAT:LNS08/95490
Issue No: 1
This report replaces all previous issues of report no MAT:LNS08/95490

Aggregate/Soil Test Report

Client: REPUBLIC SERVICES OF SOUTHERN NEVADA

Project: 8787-LV1
SUNRISE LANDFILL

This laboratory is accredited by AASHTO
The test(s) reported have been performed in accordance with its terms of accreditation

Date Issued: 3/11/2008 Signed: 3/11/2008

Sample Details

Sample ID: LNS08/95490
Field Sample ID:
Date Sampled: 03/05/2008
Source:
Material: Boazer - 2
Specification: Hyrometer Sieve -1
Sampling Method:
Location:

Other Test Results

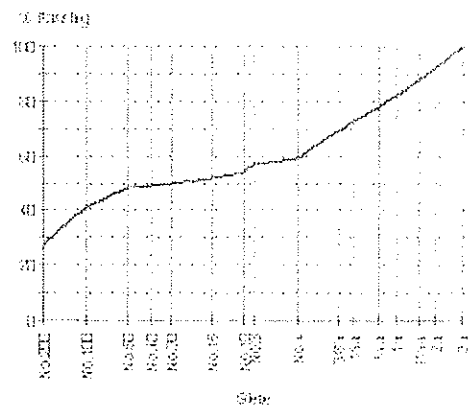
Description	Method	Result	Limits
Liquid Limit (%)	ASTM D 4318	33	
Method		One Point	
Plastic Limit (%)		18	
Plasticity Index (%)		15	
Sample History			
Preparation			
Group Symbol	ASTM D 2487	GC	
Group Name		Clayey gravel with sand	

Particle Size Distribution

Method: ASTM C 136, ASTM C 117
Drying by:

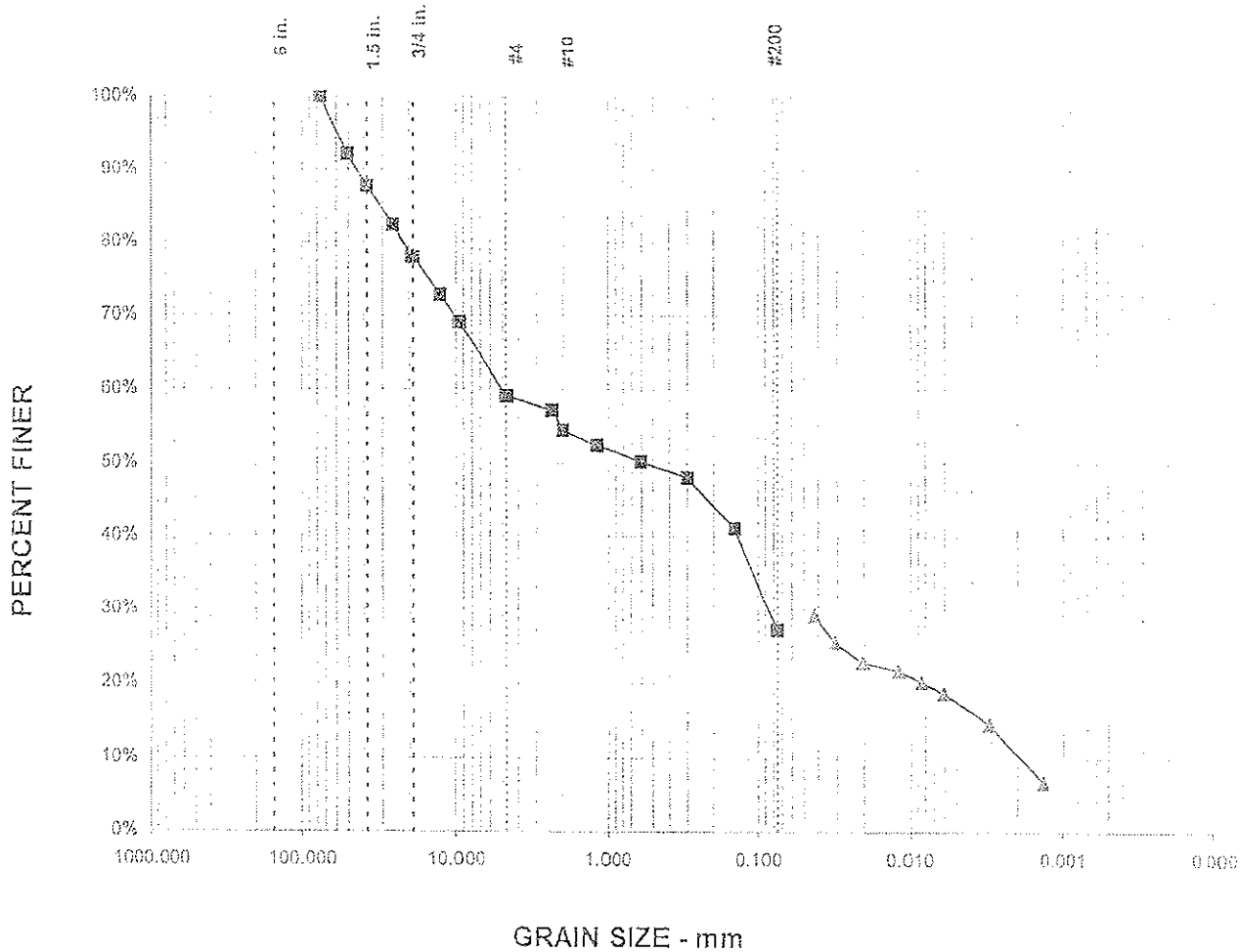
Sieve Size	% Passing	Limits
3in (75.0mm)	100	
2in (50.0mm)	92	
1½in (37.5mm)	88	
1in (25.0mm)	82	
¾in (19.0mm)	78	
½in (12.5mm)	73	
3/8in (9.5mm)	69	
No.4 (4.75mm)	59	
No.8 (2.36mm)	57	
No.10 (2.0mm)	54	
No.16 (1.18mm)	52	
No.30 (600µm)	50	
No.40 (425µm)	49	
No.50 (300µm)	48	
No.100 (150µm)	41	
No.200 (75µm)	27	

Chart



Comments
N/A

GRAIN SIZE DISTRIBUTION GRAPH



HYDROMETER TEST SUMMARY

% GRAVEL =	41%	D_{85} = 31.0	D_{15} =
% SAND =	32%	D_{60} = 5.1	D_{10} =
% SILT & CLAY =	27%	D_{50} = 0.6	C_U =
		D_{30} = 0.1	C_C =

Project No.: Republic Service of Nevada
Project Name: Sunrise Landfill
Date: 05-Mar-08
Boring No.: Beazer 2
Sample No.: 95490
Material Description: Clayey gravel with sand

GEOTEK

GRAIN SIZE DISTRIBUTION TEST REPORT with HYDROMETER

GEOTEK - NEVADA, INC

Geo Tek, Inc.
6835 S. Escondido Street, Suite A
Las Vegas, Nevada 89119-3878

Telephone: (702) 897-1424

SampleID: LNS08/95491
Report No: MAT:LNS08/95491
Issue No: 1
This report replaces all previous issues of report no MAT:LNS08/95491

Aggregate/Soil Test Report

This laboratory is accredited by AASHTO. The test(s) reported have been performed in accordance with its terms of accreditation.

Date Issued: 3/11/2008 Signed: 3/11/2008

Client: REPUBLIC SERVICES OF SOUTHERN NEVADA

Project: 8787-LV1
SUNRISE LANDFILL

Sample Details

Sample ID: LNS08/95491
Field Sample ID:
Date Sampled: 03/05/2008
Source:
Material:
Specification: Hyrometer Sieve - 1
Sampling Method:
Location: Beazer - 3

Other Test Results

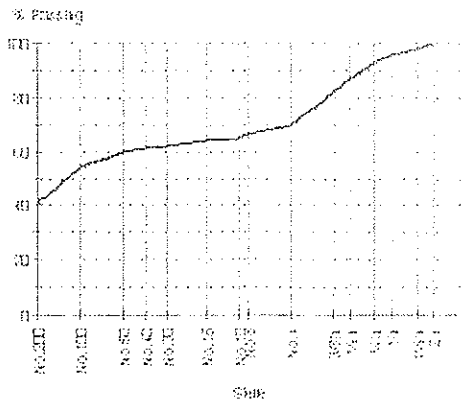
Description	Method	Result	Limits
Liquid Limit (%)	ASTM D 4318	35	
Method		One Point	
Plastic Limit (%)		20	
Plasticity Index (%)		15	
Sample History			
Preparation			
Group Symbol	ASTM D 2487	GC	
Group Name		Clayey gravel with sand	

Particle Size Distribution

Method: ASTM C 136, ASTM C 117
Drying by:

Sieve Size	% Passing	Limits
2in (50.0mm)	100	
1½in (37.5mm)	98	
1in (25.0mm)	96	
¾in (19.0mm)	93	
½in (12.5mm)	87	
3/8in (9.5mm)	82	
No.4 (4.75mm)	70	
No.8 (2.36mm)	66	
No.10 (2.0mm)	65	
No.16 (1.18mm)	64	
No.30 (600µm)	62	
No.40 (425µm)	61	
No.50 (300µm)	60	
No.100 (150µm)	54	
No.200 (75µm)	41	

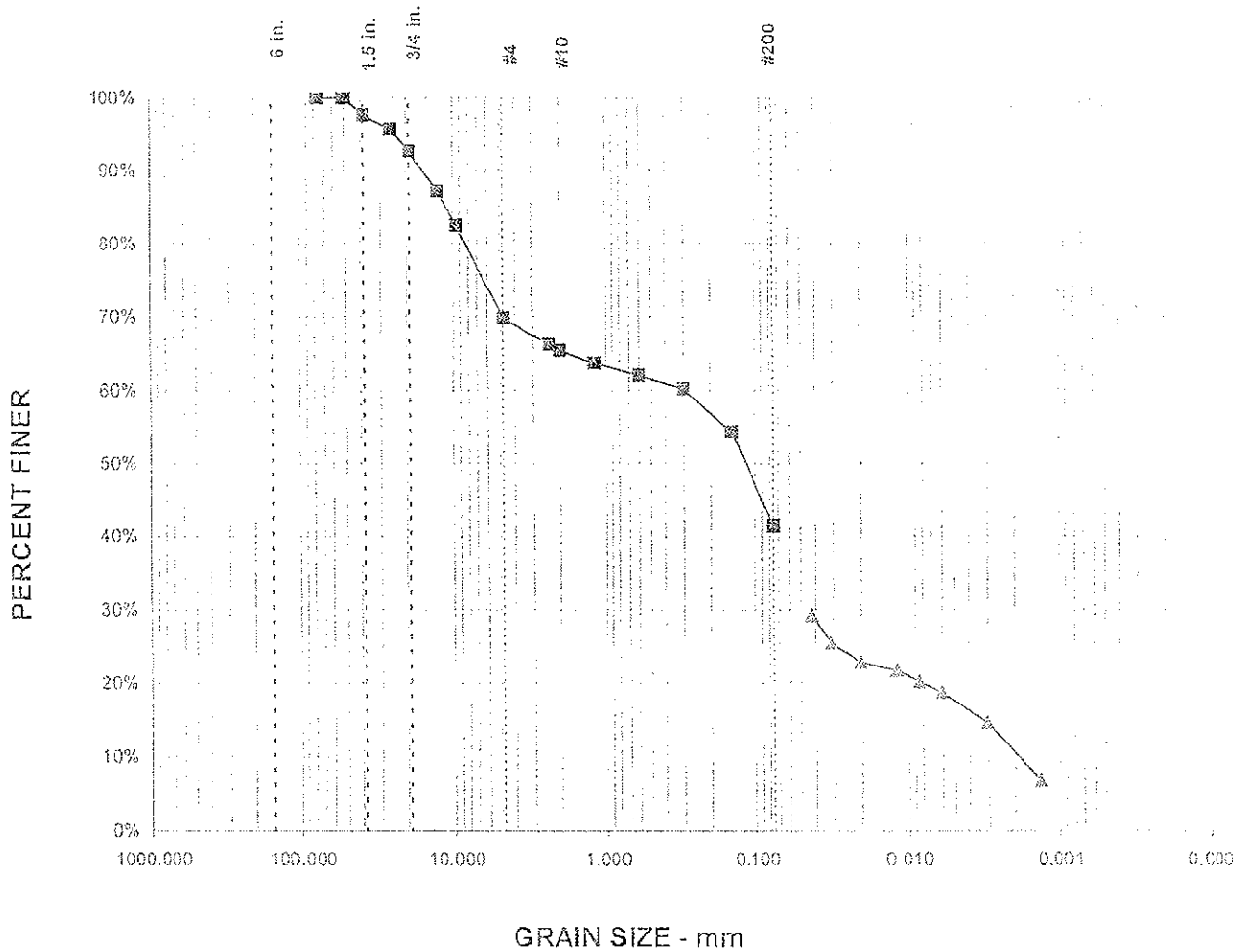
Chart



Comments

N/A

GRAIN SIZE DISTRIBUTION GRAPH



HYDROMETER TEST SUMMARY

% GRAVEL =	30%	D_{85} = 11.1	D_{15} =
% SAND =	28%	D_{60} = 0.3	D_{10} =
% SILT & CLAY =	41%	D_{50} = 0.1	C_U =
		D_{30} =	C_C =

Project No.: Republic Service of Nevada
Project Name: Sunrise Landfill
Date: 05-Mar-08
Boring No.: Beazer 3
Sample No.: 95490
Material Description: Clayey gravel with sand

GEOTEK

GRAIN SIZE DISTRIBUTION TEST REPORT with HYDROMETER

GEOTEK - NEVADA, INC

Geo Tek, Inc.
6835 S. Escondido Street, Suite A
Las Vegas, Nevada 89119-3828

Telephone (702) 897-1424

SampleID: LNS08/95492
Report No: MAT:LNS08/95492
Issue No: 1
This report replaces all previous issues of report no "MAT:LNS08/95492"

Aggregate/Soil Test Report

This laboratory is accredited by AASHTO
The test(s) reported have been performed in accordance with its terms of accreditation

Client: REPUBLIC SERVICES OF SOUTHERN NEVADA

Project: 8787-LV1
SUNRISE LANDFILL

Date Issued: 3/11/2008 Signed: 3/11/2008

Sample Details

Sample ID: LNS08/95492
Field Sample ID:
Date Sampled: 03/05/2008
Source:
Material:
Specification: Hyrometer Sieve -1
Sampling Method:
Location: Beazer - 4

Other Test Results

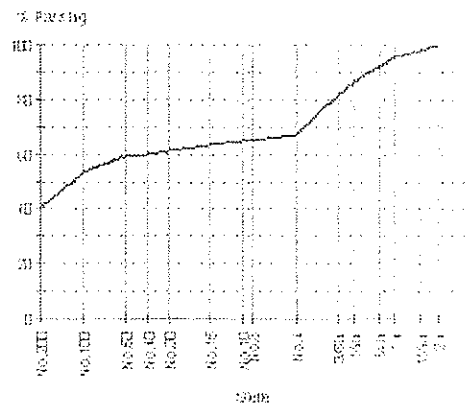
Description	Method	Result	Limits
Liquid Limit (%)	ASTM D 4318	39	
Method		One Point	
Plastic Limit (%)		19	
Plasticity Index (%)		20	
Sample History			
Preparation			
Group Symbol	ASTM D 2487	GC	
Group Name		Clayey gravel with sand	

Particle Size Distribution

Method: ASTM C 136, ASTM C 117
Drying by:

Sieve Size	% Passing	Limits
2in (50.0mm)	100	
1½in (37.5mm)	98	
1in (25.0mm)	96	
¾in (19.0mm)	92	
½in (12.5mm)	86	
3/8in (9.5mm)	81	
No.4 (4.75mm)	67	
No.8 (2.36mm)	65	
No.10 (2.0mm)	65	
No.16 (1.18mm)	63	
No.30 (600µm)	61	
No.40 (425µm)	60	
No.50 (300µm)	59	
No.100 (150µm)	53	
No.200 (75µm)	40	

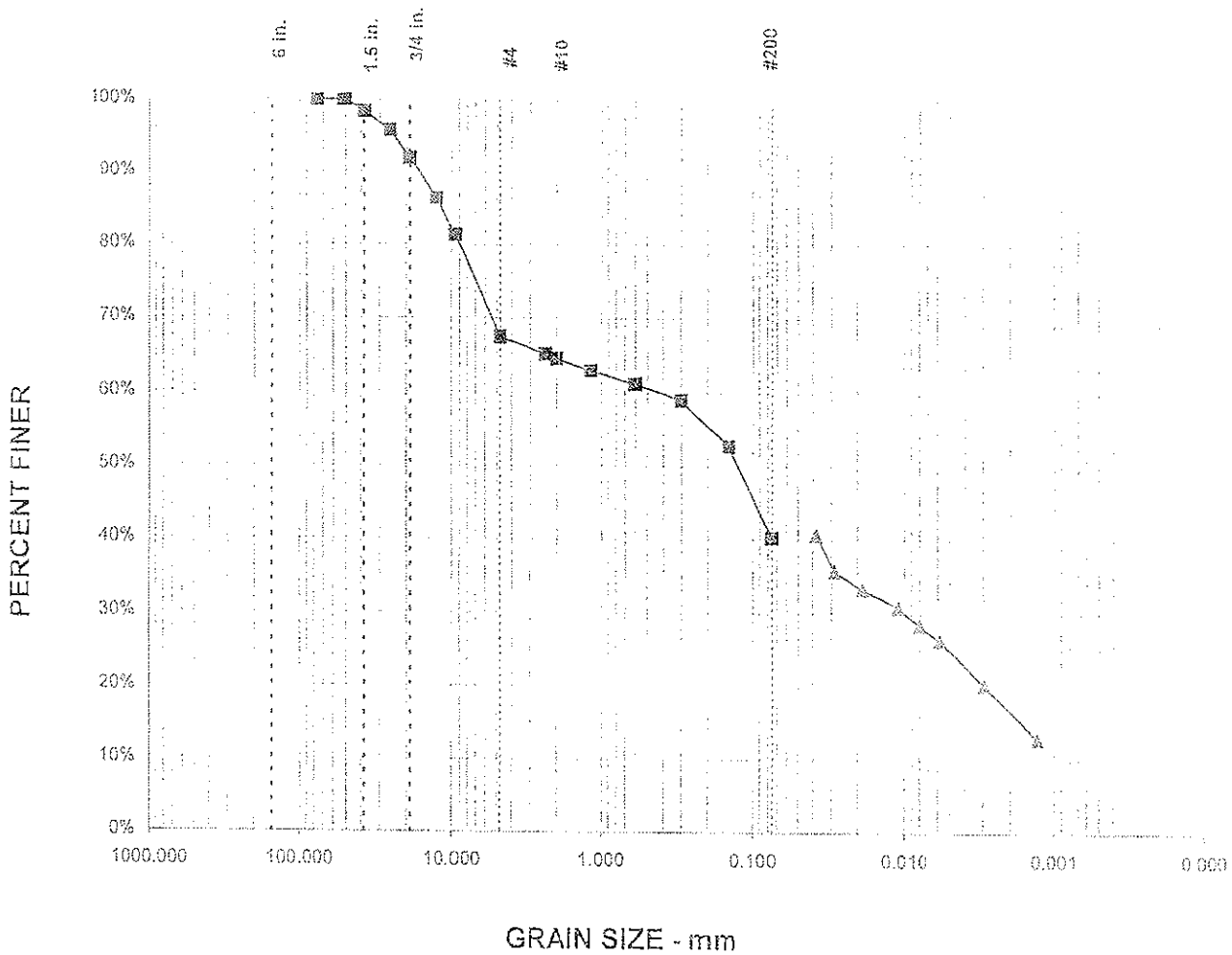
Chart



Comments

N/A

GRAIN SIZE DISTRIBUTION GRAPH



HYDROMETER TEST SUMMARY

% GRAVEL =	33%	D_{85} = 11.8	D_{15} =
% SAND =	27%	D_{60} = 0.4	D_{10} =
% SILT & CLAY =	40%	D_{50} = 0.1	C_U =
		D_{30} =	C_C =

Project No.: Republic Service of Nevada
Project Name: Sunrise Landfill
Date: 05-Mar-08
Boring No.: Beazer 4
Sample No.: 95491
Material Description: Clayey gravel with sand

GRAIN SIZE DISTRIBUTION TEST REPORT with HYDROMETER

GEOTEK - NEVADA, INC

GEOTEK

GEOTEK

CRUMB TEST FOR DISPERSIBILITY OF CLAYEY SOILS

ASTM D6572

Sample No. 95490 WO # 8787 Location

Drill hole no. Depth ☐ m ☐ ft ☐ Disturbed ☐ Undisturbed

Color Natural Moisture Content(as received) %

Specimen Type: ☐ Natural irregularly shaped crumb ☐ Remolded crumb cube

Moisture Content: ☐ Natural Moisture ☐ Air dried ☐ Distilled water added to remold specimen

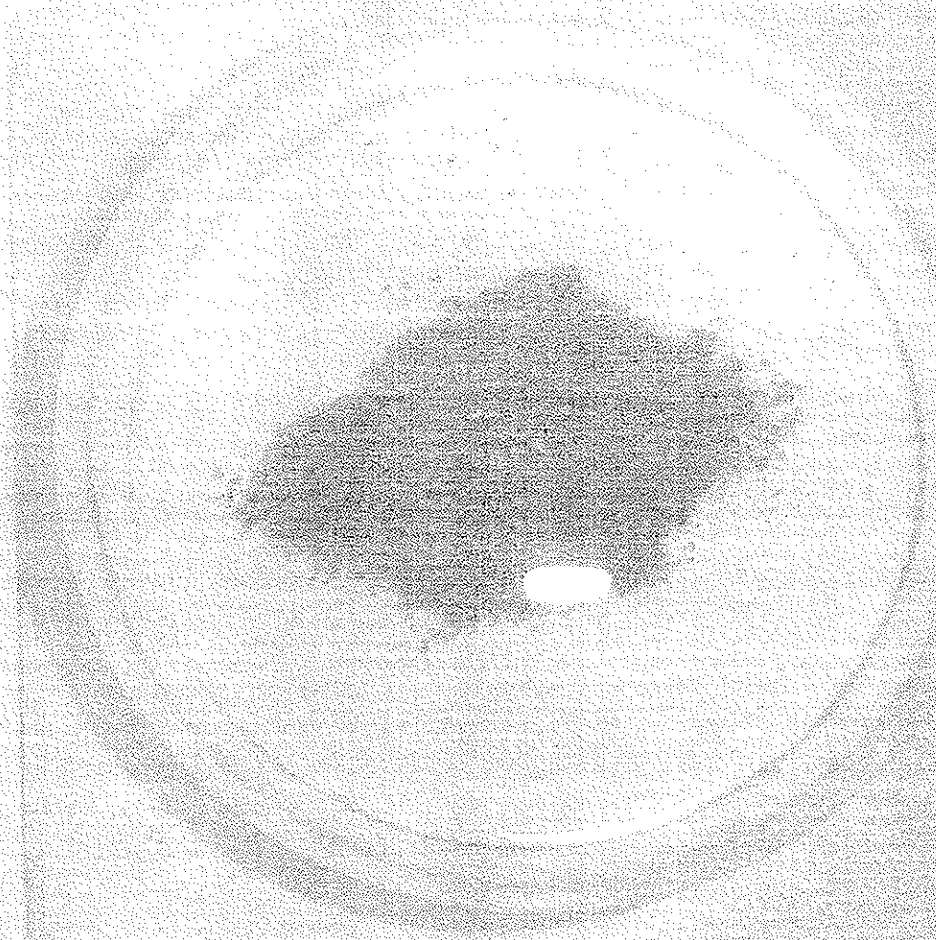
Curing time 0 min Water used ☐ Distilled ☐ Distilled and demineralized

Initial water temperature 21.9 °C Time at beginning of test 7:00 ☐ am ☐ pm

Tested by: Fred Gillett Date tested: 4/9/2008

Specimen Number	Dish Number	2 minutes		1 hour		6 hours	
		Grade	°C	Grade	°C	Grade	°C
95490		1	21.9	1	20.4	1	19.1

WO. # 8787
Sample # 95490



APPENDIX D

IN-PLACE COMPACTION TESTING FOR LARGE DIAMETER CRUSHED AGGREGATE

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Appendix D
In-Place Compaction Testing for Large Diameter Crushed Aggregate

Shaw Environmental, Inc.
13 British American Boulevard
Latham, NY 12110-1405
PHONE: 518-783-1996
FAX: 518-783-8397

January 24, 2009

To: Mr. Steve Wall
Sunrise project Coordinator
U.S. Environmental Protection Agency, Region 9
75 Hawthorne Street (WST-7)
San Francisco, CA 94105-3901

Via: e-mail

cc: Ann Murphy
Sandra Doty
Cliff Anderson
Mike Moran
Ed Glick
Alan Pinkerton

Subject: In-Place Compaction Testing for Large Diameter Crushed Aggregate
Task 4.1.6.1, Appendix A, Scope of Work for Sunrise Mountain Landfill
Sunrise Landfill Consent Decree
Las Vegas, Nevada

Dear Mr. Wall:

This letter report summarizes the in-place compaction testing that occurred on September 15, 2008, at Republic Dumpco, Inc. and Republic Silver State Disposal, Inc., d/b/a - Republic Services of Southern Nevada (RSSN) Service's Apex Regional Landfill in Las Vegas, Nevada. RSSN personnel, along with several members of RSSN's Sunrise Landfill Team, performed a field test to develop a performance specification for the erosion layer material (large diameter crushed aggregate) as required in Task 4.1.6.1 of the Scope of Work (SOW) for Sunrise Landfill. The following sections detail those activities.

Test Pad Construction

To adequately develop the performance specification, a test pad was constructed at the RSSN Services Apex Regional Landfill (Apex), located in Las Vegas, Nevada. The test pad was constructed at Apex because material and equipment to build the pad was readily available, and there was a sufficient area with a slope greater than 10 percent on which to construct it.

The test pad was constructed from material that meets the gradation requirements set forth in Attachment 7a of the U.S. Environmental Protection Agency's (EPA) SOW (Attachment 1 to this report). Attachment 7a was chosen as the governing gradation for this test pad because it represented the material needed to construct an 18-inch-thick erosion layer on a slope greater than 10 percent (worse case scenario). Material meeting the gradation was taken from a stockpile of crushed aggregate resulting from the excavation activities associated with active cell construction at Apex. In order to confirm that the material met the gradation requirements of Attachment 7a, a bulk sample of the material (approximately 830 pounds) was taken and analyzed in accordance with ASTM D5519 Test Procedure A. The results are presented in Attachment 2. The gradation

of the aggregate was compared to the required gradation range and it was determined that the material met the requirements (Attachment 3).

Approximately 120 tons of material were transferred via 6-wheeled articulated dump trucks and deposited on a slope of approximately 25 percent in Apex Cell MA 10. Photographs of the test pad are included in Attachment 4. Photographs 1 and 2 show the deposited material. Using a D8 Bulldozer, RSSN personnel constructed a test pad, approximately 18 inches thick by 40 feet wide by 80 feet long (Photograph 3). Grade stakes were placed along the perimeter of the pad to verify that the final thickness was 18 inches.

Compaction

Once the erosion layer was spread to the required thickness, the D8 bulldozer, which generates approximately 15.3 pounds per square inch (psi) of ground pressure, travelled back and forth over the material "tracking it in" (Photograph 4). After the first pass of the bulldozer, the material did not exhibit any additional consolidation as the machine passed over it successive times. After four passes of the bulldozer, several trenches were excavated through the erosion layer to inspect the matrix of the aggregate (Photographs 5 and 6). Upon inspection, the smaller particles were evenly distributed and the resulting aggregate matrix did not appear to have appreciable size separation. The matrix appeared uniform and stable, with no appreciable voids.

Issues Observed & Reported

Based on the results of the compactive effort of the D8 bulldozer, the erosion layer will be adequately compacted by a minimum of four passes of a tracked vehicle that generates a minimum ground pressure of 15.3 psi.

We propose including this performance specification in the plans and specifications for the construction of the Sunrise final cover. If you require additional information or would like to discuss the in-place testing, please contact us.

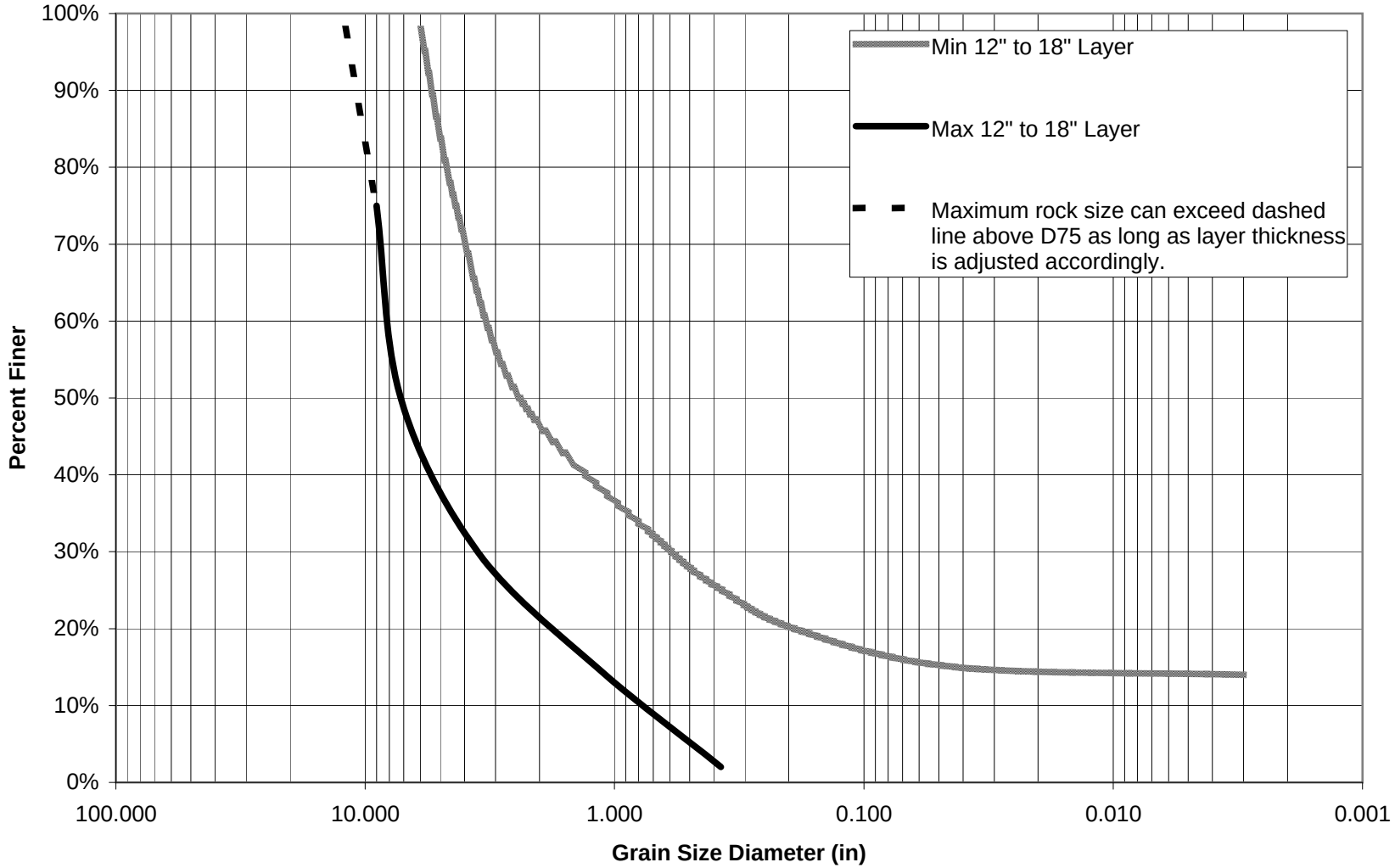
SHAW ENVIRONMENTAL, INC.

Mark A. Bergeon
Sunrise Project Coordinator

Attachments: Attachment 1 – SOW Attachment 7a
Attachment 2 – Large Diameter Aggregate Gradation Curve
Attachment 3 – Aggregate Gradation Data Plotted on Attachment 7a
Attachment 4 – Photographic Log

Attachment 1
SOW Attachment 7a

Attachment 7a
Gradation Range for 12-, 14-, and 18-inch Layer Thickness and Slopes Greater than or Equal to 10%



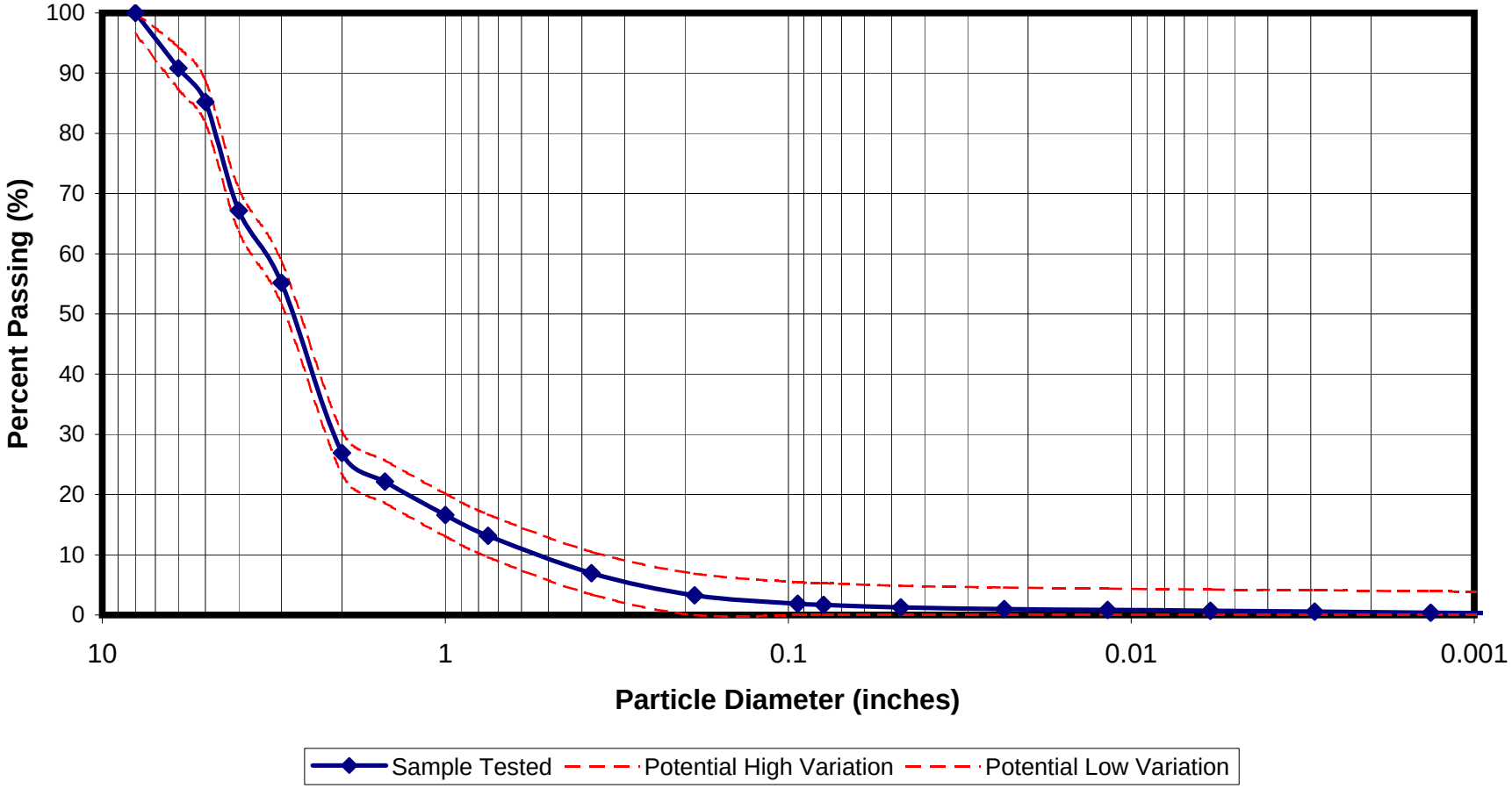
Attachment 2
Large Diameter Aggregate Gradation Curve

GEOTEK

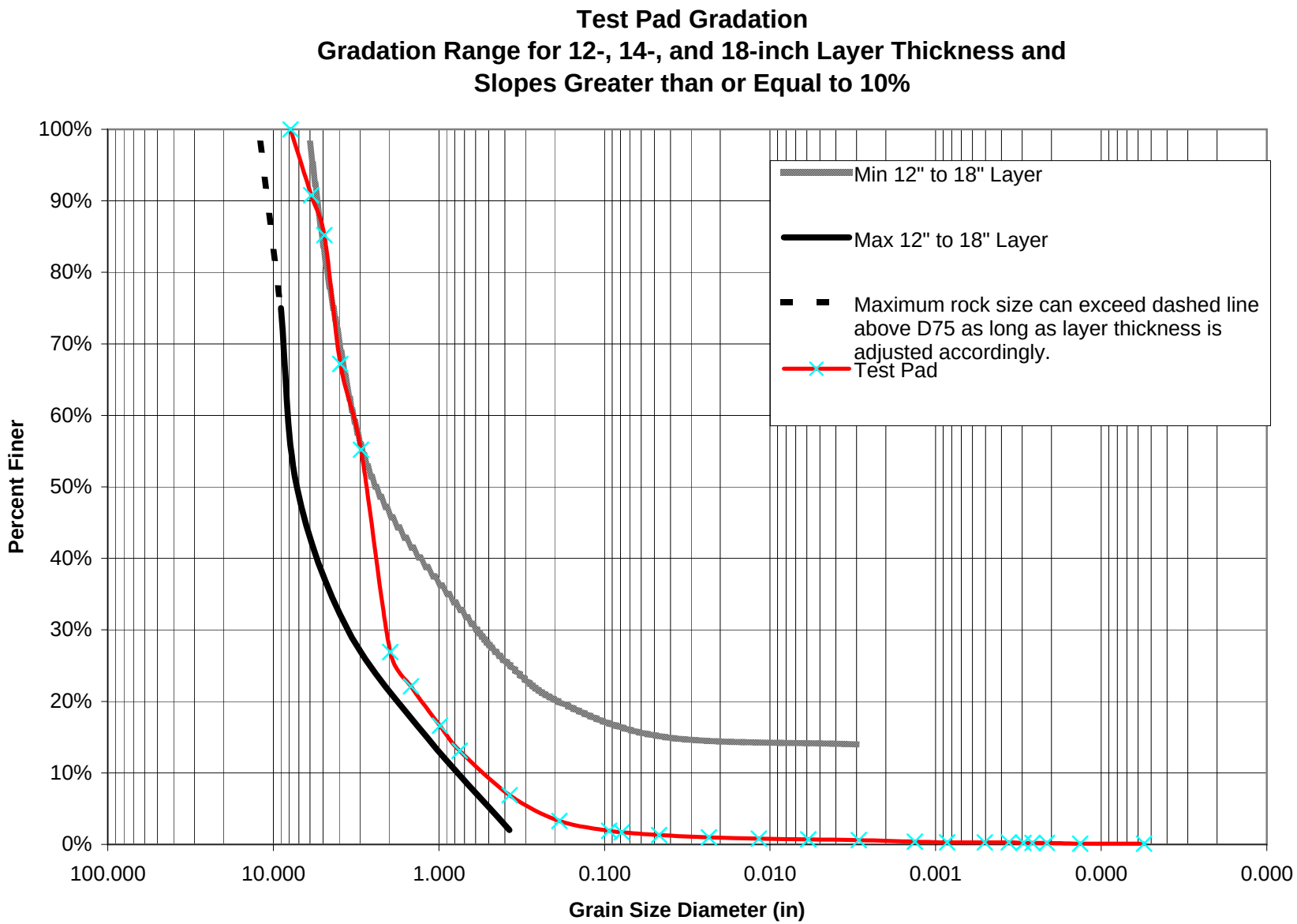
6835 South Escondido Street
Las Vegas, NV 89119
(702) 897-1424
(702) 897-2213 fax

Project No.	8787-LV1
Client:	Republic Services
Project Name:	Sunrise Landfill
Date:	10/24/2008
Sample Desc:	Stock Pile
GeoTek Lab No:	97290

Sieve Analysis w/Hydrometer ASTM D422



Attachment 3
Aggregate Gradation Data Plotted on Attachment 7a


Test Pad Gradation
Gradation Range for 12-, 14-, and 18-inch Layer Thickness and
Slopes Greater than or Equal to 10%
Percent Finer
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
100.000
10.000
1.000
0.100
0.010
0.001
0.000
0.000
Grain Size Diameter (in)
Min 12" to 18" Layer
Max 12" to 18" Layer
Maximum rock size can exceed dashed line above D75 as long as layer thickness is adjusted accordingly.
Test Pad

Attachment 4
Photographic Log

Photo 1
Erosion Layer Material Prior to Placement

Photo 2
Erosion Layer Material

Photo 3
Spreading Erosion Layer Material to 18” thickness

Photo 4
Compacting with Tracked Bulldozer

Photo 5
Sidewall of Trench Cut through Erosion Layer.
Note the Well Graded Matrix

Photo 6
Sidewall of Trench Cut through Erosion Layer

Photo 7
Finished Test Pad
18” Compacted Thickness