GEOTECHNICAL REPORT

WARM SPRINGS GRADE SEPARATION AT I-15

CLARK COUNTY, NEVADA

JULY 2006

NEVADA DOT
GEOTECHNICAL ENGINEERING

MATERIALS DIVISION

STATE OF NEVADA

DEPARTMENT OF TRANSPORTATION

MATERIALS DIVISION

GEOTECHNICAL SECTION

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WARM SPRINGS GRADE SEPARATION AT I-15

E.A. 72495

July 2006

CLARK COUNTY, NEVADA

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INTRODUCTION

General

This report has been prepared for the proposed bridge structure at the Warm Springs Grade Separation (Structure H-788) over I-15 in Las Vegas. The photograph on the cover shows the existing bridge structure. The project scope includes replacing the existing structure with a wider and longer structure. The proposed structure is a grade separation, which is expected to convey the future increase in traffic more efficiently. For more details, see the contract documents for this project. The following sections summarize the results of our investigation work and present our recommendations.

Purpose and Scope

The purpose of the investigation was to (1) evaluate geologic conditions and determine if any hazards are in the area of the site, (2) characterize the general subsurface conditions in the area of the site and delineate or determine the presence of any features that might impact the locations of the proposed new structure and (3) provide geotechnical design and construction recommendations for the proposed structure, roadways, approach ramps and retaining walls.

The scope of this report consists primarily of geotechnical investigation, testing, analysis, and design. The investigation included gathering data from past field exploration and reports, in addition to information obtained from recent subsurface explorations, soil sampling, and analysis of the data from field and laboratory test results of the obtained soil samples. This report describes the subsurface soil conditions, provides recommendations regarding geotechnical properties of the soil strata, and includes boring logs and summaries of test results from the field investigation.

PROJECT DESCRIPTION

Site Description

The site location for the Warm Springs Road grade separation project is at milepost 34.4 on I-15, from Station “Le”412+00 to Station “Le” 413+00, approximately six miles south of the strip portion of Las Vegas Boulevard, SR 604, and one-half mile north of Blue Diamond Road, SR 160, interchange at I-15. A site map for the project is presented in Figure A1 in Appendix A. The

existing Warm Springs Road grade separation, shown in Photo 1, is a two-lane road, one-lane in each direction, and is oriented in the west and east directions. The existing structure was constructed under NDOT Contract No. 1096 in 1961. Business complexes are located to the south and north of the west approach embankment, just outside of the project site. The southern business complex is shown in Photo 2.

Project

The project consists of replacing the existing structure with a larger structure. The proposed larger structure will be wider than the existing structure and consist of six lanes, three in each direction, a bike lane, and a sidewalk. The proposed structure is a closed abutment, two span, steel girder bridge, 343.3 feet long and 115.5 feet wide. Four Mechanically Stabilized Earth walls (MSE walls) are planned for construction along the north and south sides of each of the two approach embankments to maintain clearance from the business complexes and provide maintenance access.

The new bridge will be constructed at the same location as the existing bridge. At present, the construction sequence for the new bridge is to remove and replace the north half (west bound lanes) prior to the south half (east bound lanes).

Drainage improvements expected at the site include, but are not limited to, Reinforced Concrete Box (RCB) culverts, rectangular concrete lined channels, and several small channels. Some specific drainage features and locations at the site are shown in Figure A3 of Appendix A and include the following:

- West side of I-15: A rectangular concrete lined channel (30' wide and 2.3' deep) oriented parallel to I-15 and immediately in front of the abutment;
- West side of I-15: A 5' by 4' reinforced concrete box culvert that crosses under the Warm Springs Road embankment west of the MSE walls and then runs parallel to and in front of the north wall, MSE Wall No. 1, (with approximately 3' of offset from the edge of box to face of wall) until it intersects the channel on the west side of I-15 (mentioned in the first

bullet); a 7 feet tall, 150 feet long cantilever retaining wall is planned near the west end of the north wall, MSE Wall No. 1, to facilitate grading and allow space for a maintenance road;

- West side of I-15: A small v-ditch oriented parallel to the embankment starting from Industrial Road and tying in to the box culvert at the west end of the south MSE wall, MSE Wall No. 2; the finished grade in front of the south wall will be sloped away from the wall so that a ditch will not be needed in front of the wall, MSE Wall No. 2; a barrier will be placed in front of the south wall, MSE Wall No. 2, to protect the MSE wall facing panels;
- East side of I-15 (not shown in Figure A3 of Appendix A): Small v-channels will be placed in front of both the north and south walls, MSE Walls No. 3 and 4 respectively, and a small v-channel will be constructed in front of the abutment oriented parallel to I-15.

GEOLOGY AND SEISMICITY

Local Geology

The project site is located in the eastern portion of the Las Vegas Valley. The valley is characteristic of the Basin and Range province and is a structural basin formed by block faulting. Valley deposits are comprised of sediments derived from surrounding mountains consisting of gravels, sand and clays, and are up to several thousand feet thick in some parts of the valley. Generally, coarser grained deposits are located near the base of the mountains which transition to finer grained deposits near the middle of the valley. A general geology map is provided in Figure B1 in Appendix B.

The site is founded in alluvium (Q_{oa})[1] deposited on the Blue Diamond and Red Rock alluvial fans originating from the Spring Mountains. The Spring Mountains are located within the limestone and dolostone belt of southern and eastern Nevada as shown in Figure B2 in Appendix B. The alluvial fan deposits are pink to brown sand, gravel, and cobble size material, and are unconsolidated to locally cemented due to petrocalcic carbonate deposits (caliche). Clasts are predominately limestone and dolostone with subordinate quartzite. Sand size sediment is mainly limestone and dolomite with subordinate quartz and feldspar. Detrital gypsum occurs locally, and is an important component in these deposits. There are also active wash alluvium deposits (typically veneers) throughout the area,

which is subject to flooding.

Faulting and Seismicity

Faults of tectonic origin through bedrock are not known to transect the alluvium in the area of the proposed grade separation. Subsidence and subsidence related faulting occurs approximately 3 miles north of the site, however none of these features are known to occur at the project site. The nearest fault of tectonic origin with evidence of possible geologically recent displacement is 15 miles northeast of the project site at the base of Frenchman Mountain. A study[6] concludes that faults in the Las Vegas area are caused primarily by tectonic activity related to the major regional faults, with subordinate compaction on some of the faults. At least eight major faults capable of generating earthquakes of magnitude (M_w) 6.5-7.0 are located in the Las Vegas Basin.

The project site is located approximately 15 miles east of the La Madre fault and 6 miles east of the Keystone Thrust[3]. These faults are not considered to be active. Other local faults including the Frenchman Mountain Fault, the Whitney Mesa Fault, the Cashman Fault, the Valley View Fault, the Decatur Fault, the Eglington Fault, and the West Charleston Fault[4], shown in Figure B3 of Appendix B, are considered to be active. The most prominent fault in the Las Vegas Valley is the Frenchman Mountain Fault, which is capable of producing a magnitude 7 earthquake every 10,000 to 50,000 years[4]. The Las Vegas Valley Shear Zone, shown in Figures B4 and B5 of Appendix B, lies approximately 6 miles northeast of the site and is considered to be active[3]. Other faults capable of causing earthquakes could occur outside the Las Vegas Valley with strong enough ground shaking to cause damage within the valley, such as the Furnace Creek Fault in Death Valley, some 90 miles northwest of Las Vegas.

The area north of the site has subsided up to greater than five feet between 1963 and 1987, probably due to lowering groundwater[2]. See Figures B6 and B7 in Appendix B for various soil types and contours of subsidence for this area.

Based on the regional map published by Algermissen and Perkins (1976), the expected peak

horizontal ground acceleration for the Las Vegas valley is approximately 0.1g. This value has a 10 percent chance of being exceeded in a 50 year period. See Figure B8 in Appendix B for a map of peak acceleration contours for Nevada and California. For design purposes, the NDOT Structural Division recommends using a peak horizontal ground acceleration of 0.15g for the Las Vegas valley. The recommended horizontal and vertical Acceleration Coefficients are A_h=0.15g and A_v=0. The AASHTO response spectra, Soil Profile Type II, and Site Coefficient S = 1.2 are recommended for the site. A graph with three Response Spectra curves, are shown in Figure B9 of Appendix B including the recommended AASHTO curve using 0.15g Peak Ground Acceleration. The other two curves, to be used for comparison only, are the UBC for Zone 2B and USGS based on the USGS National Seismic Hazard Mapping Project.

FIELD INVESTIGATION

The NDOT Geotechnical Section conducted a subsurface investigation at the site of the proposed structure. The subsurface soils at the structure were explored by drilling three boreholes, one next to the pier and one next to each of the east and west abutments of the existing structure. Groundwater was not encountered in any of the three boreholes.

At the west abutment location (Borehole WS1), below 6.5 feet depth beneath the ground surface, the soil layers consist of medium dense to very dense silt, sand, and gravel; medium dense to very dense clayey sand, some with gravel; and very stiff to hard sandy lean clay. Borehole WS1 was drilled to a depth of 72.5 feet below the existing ground surface.

At the east abutment location (Borehole WS2), below 5.0 feet depth beneath the ground surface, the soil layers consist of medium dense to very dense silt, sand, and gravel; medium dense to very dense clayey sand, some with gravel; and hard sandy lean clay. A layer of hard sandy fat clay exists from a depth of 76 to 80 feet. Borehole WS2 was drilled to a depth of 109.5 feet below the existing ground surface.

At the pier location (Borehole WS3), the upper 10 feet of soil is very loose to medium dense silty

sand and medium stiff sandy silty clay. The soils below this layer consist of dense to very dense silt, sand, and gravel; very dense clayey sand, some with gravel; and very stiff to hard sandy lean clay. A layer of hard sandy fat clay exists from 55 to 60 feet. Borehole WS3 was drilled to a depth of 113.5 feet below the existing ground surface.

The approximate locations of the boreholes are shown on Map A2 in Appendix A. Surface elevations were obtained for each borehole by surveying using a benchmark with known elevation. Drilling was accomplished using a Mobile B-80 drill rig with bentonite drilling slurry for wet drilling. Disturbed soil samples were obtained with a Split Spoon Sampler and a California Modified Split Spoon Sampler (CMS). Modified standard penetration resistance values were obtained using the CMS Sampler, based on the Standard Penetration Test (SPT) procedure (ASTM T 206-87). Uncorrected (for overburden, hammer drop system, and sampler type) blowcounts were recorded and are shown in the boring logs in Appendix C. All samples were transported to the NDOT Materials Division laboratory in Carson City for testing. All soil samples were classified using the Unified Soil Classification System (USCS). More detailed information for the soil samples is included in the boring logs in Appendix C, and in the test result summary sheets in Appendix D.

Line Sampling and soil testing was conducted at various locations at the project site. Testing included R-value, particle size gradation, liquid limit, plasticity index, sand equivalent, resistivity, and pH. Line sampling data sheets with results of the tests are shown in Appendix E. Existing embankment fill material has R-values ranging between 54 and 76, greater than the requirement for Borrow material (R-value of 45). Test results of native materials showed R-values ranging from 22 to 77, with the low values to the east of I-15.

LABORATORY ANALYSIS

Laboratory tests were conducted on samples collected from the three boreholes for the structure. The testing program consisted of particle size analysis, hydrometer, specific gravity, Atterberg limits, moisture content, and direct shear. Plasticity indices (PI) obtained from testing ranged from 2

to 38, and moisture contents varied from 0.9% to 25.7%. Percent fines (particle size less than the Number 200 sieve size) ranged from 5.0% to 76.5%. Unit weight and consolidation tests were not conducted due to the amount of sample disturbance, the inability of samples to retain their shape for placement into the testing molds, and the amount of coarse material in the samples. Further information is presented in the summaries of test results in Appendix D.

DISCUSSION

Subsurface Conditions

Samples from the subsurface investigation identified the soils to be primarily silt and silty sand, both with gravel in some layers. Broken pieces of rock in the samples indicate the possible occurrence of cobbles in the soil. In addition, several layers contained silt with lean clay, and a few layers contained fat clay. The upper six feet of soil at both abutment boring locations (WS1 and WS2) is a looser material and may partially consist of fill. The boring (WS3) next to the pier was loose for the upper 10 feet and was either fill or highly disturbed native soil, from visual observation. The native soil became considerably denser once the upper loose soils were penetrated. Since groundwater was not encountered in any of the borings, the water table is expected to be deeper than the depth of the borings. See the boring logs included in Appendix C for more detail.

Due to the high blow counts and deep water table (greater that 100') recorded during the subsurface investigation in the native soil, liquefaction and seismic induced settlement will be negligible. High blow counts generally indicate medium to very dense granular soils, or stiff to hard cohesive soils.

General Site Evaluation

Based on the results of the geotechnical investigation, the project site is suitable for the proposed grade separation. We did not identify any geotechnical or geologic hazards that would restrict development of the proposed grade separation.

RECOMMENDATIONS

Abutments and Pier Foundations

Spread footing foundations are recommended to support the pier and the abutments of the bridge. The soil bearing capacities and settlements for the elevations at the bottom of the spread footings were analyzed assuming continuous ($L/B \geq 9$, L = length, B = width of footing) footings for the abutments and square footings for the pier. At the time of preparation of this report, the loads given by HDR, the Structural Consulting Engineer for this project, are; Abutment Loadings: DL = 41 kips/foot, LL = 23 kips/foot; Pier Loadings: DL = 1141 kips, LL = 324 kips for a footing size of 16' x 16' supporting each column.

The recommended allowable soil bearing capacities, using a factor of safety equal to 3, for the current proposed design footing sizes on native soils are as follows:

Footing Location	Allowable Soil Bearing Capacity ($kips/ft^2$)
Pier (16' x 16' Square Footings)	6
West Abutment (21' Wide Continuous Footing)	6
East Abutment (21' Wide Continuous Footing)	6

The bearing capacity values were calculated using the recommended embedment depth of 8 feet below existing natural grade to the bottom of the spread footing. The soil below the footing must be moisture conditioned to approximately 2 to 4 percent above optimum moisture, properly compacted in accordance with Standard Specifications due to loose surficial soil at some locations on the project site.

A calculated total settlement of less than 1 inch for both abutments and the pier, and a differential settlement of less than ½ inch are expected by applying the given structure loads to the native soil

(not including embankment and MSE wall settlement).

Weep holes will need to be constructed near the bottom of all walls to prevent the potential buildup of hydrostatic water pressure. See the current NDOT Road and Bridge Construction Standard Plans for proper weep hole construction and specifications.

Mechanically Stabilized Earth (MSE) Walls

Mechanically Stabilized Earth (MSE) retaining walls are planned for retaining the sides of the approach embankments to both abutments. The recommended minimum vertical separation from the bottom invert of the drainage feature to the top of the leveling pad, with the leveling pad being at the lower elevation, is 3.0 feet where there is a channel, box culvert, or other drainage feature nearby (within 10 horizontal feet of) the retaining wall. Otherwise, if there are no drainage features, the recommended minimum embedment depth is 2.0 feet from the adjoining finish grade down to the top of the leveling pad.

Based on the external stability analysis, the needed reinforcement length for MSE walls is equal to or greater than 0.70 times the wall height, but not less than 8 feet. The provided reinforcement lengths in the following table can be used for the given wall heights:

WALL HEIGHT (H)	STRAP LENGTH (L)
$H \leq 11.4'$	8’
$11.4' < H \leq 14.2'$	10’
$14.2' < H \leq 17.1'$	12’
$17.1' < H \leq 20.0'$	14’
$20.0' < H \leq 22.8'$	16’
$22.8' < H \leq 25.7'$	18’
$25.7' < H \leq 28.5'$	20’

MSE backfill has been assumed to have a design friction angle of 34 degrees, cohesion of 0, and soil unit weight of 120 pcf. Borrow and retained earth have been assumed to have a design friction angle of 32 degrees, cohesion of 0, and an effective soil unit weight of 120 pcf.

Cast-in-Place Concrete Retaining Walls

A cast-in-place, concrete cantilever retaining wall is planned for the project. Active and at-rest lateral earth pressures should be used for design of yielding and restrained walls, respectively. Appropriate lateral earth pressure coefficients are provided in the following table for Granular Backfill for walls that are allowed to displace:

K_v	K_h	K_o	K_a	K_p	K_{ae}	K_{pe}
0.0	0.075	0.441	0.255	7.961	0.404	2.881

The at-rest and active coefficients are based on an angle of internal friction of 34 degrees, a soil unit weight of 120 pcf, and an interface friction angle between Granular Backfill and concrete of 20.4 degrees. If walls are considered to be restrained and cannot displace, then the above K_{ae} and K_{pe} are not applicable and will change. A vertical wall backface and horizontal top of backfill was assumed in calculating the above parameters. These values can also be used for the abutment wall with Granular Backfill behind the wall. If native soil is used in front of a yielding wall, the passive coefficients of $K_p = 8.768$ and $K_{pe} = 2.996$ should be used. Native soil has been assumed to have a design angle of internal friction of 35 degrees, a soil unit weight of 130 pcf, and an interface friction angle with concrete of 21.0 degrees.

Spread footings for cast-in-place, concrete cantilever retaining walls, with footing bottoms placed a minimum of 2 feet below adjacent finished grade, and minimum of 4 feet wide, which bear entirely on native soils, can be designed for a maximum allowable bearing pressure of 4 ksf. Total settlement of less than one inch is expected for this recommended bearing pressure. A differential settlement of less than ½ inch is estimated. This settlement is expected to occur during construction due to the granular nature of the native soil. A coefficient of sliding of 0.4 is recommended for design. The planned retaining wall is appropriately a standard wall taken from the NDOT Standard Plans for Road and Bridge Construction.

Embankment Settlement

Proposed approach embankments for the overpass will be approximately 26 feet in maximum height and retained on both sides with MSE walls. Estimated total settlement of the embankment with

MSE walls is approximately 1 inch. The majority of the settlement is expected to be immediate and occur as the loads are applied due to the granular nature of the native soils. Loads from the proposed steel superstructure will be applied directly to the pier and abutments as girders are placed and the deck is poured. Falsework should not be needed during construction for this structure type. It should be expected that the bridge deck would settle up to approximately two inches (one inch due to bridge loads and one inch due to embankment fill and MSE wall loads) depending on the construction sequence.

We recommend settlement plates be installed to measure the amount of settlement at each abutment and pier. The plates should be installed on the two outside pier footings, and one on each corner of both abutments. The pier plates should be installed directly on the top of the two pier footings to obtain actual measurements of the pier foundation movement. The abutment plates should be installed within three feet of each corner of the abutment wall and MSE wall intersection with the plates at the top of the abutment footings.

Elevation at the top of each settlement plate should be recorded prior to placement of the fill material to establish a baseline reading. Plate elevations should be monitored by use of riser pipes every other day during construction of the MSE walls, approach embankments, and pier backfill; then weekly until the settlement rate reduces to less than 1/16 of an inch for three successive weeks. Plate elevations should be monitored after the deck girders are set and again after the deck is poured.

Construction Specifications

Properties of materials and construction procedures should meet and conform to appropriate sections in the Standard Specifications for Road and Bridge Construction and drawings in the Standard Plans for Road and Bridge Construction. For earthwork requirements, use Section 201 (Clearing and Grubbing), Section 206 (Structure Excavation) and Section 207 (Backfill) and for MSE wall requirements, use Section 640 (Retaining Walls).

Subsection 206.03.01 (Structure Excavation), should be modified to make the contractor and

inspector aware that possible loose or low-density soils may be encountered at the bottom of footing excavations which could require additional overexcavation, moisture conditioning and recompaction.

Excavation and Earthwork

Perform all excavations in accordance with the current version of NDOT "Standard Specifications for Road and Bridge Construction"[6] (SSRBC). The contractor shall be responsible for all necessary shoring for any excavation and/or construction. We recommend using a maximum steepness of 2H:1V (horizontal to vertical inclination) for permanent slopes. The contractor is responsible for meeting all OSHA requirements for temporary excavations. Estimates for construction excavation quantities should be made based on using temporary slopes inclined at 1H:1V (horizontal to vertical inclination).

Scarify the subgrade in all areas to receive the placement of Borrow, Selected Borrow and MSE Backfill as specified in the Nevada Standard Specifications for Road and Bridge Construction, and include the following in the project Special Provisions: moisture condition these materials to approximately 2 to 4 percent above optimum moisture prior to compacting to the required minimum specified relative compaction. Also include in the Special Provisions, variable site conditions including encountering very dense soil deposits with gravel and cobbles may cause excavation to be difficult. For use in shoring design, a design angle of internal friction of 35 degrees and cohesion of 0 can be assumed for native soil and existing embankment fill can be assumed to have a design friction angle of 32 degrees and cohesion of 0.

Closure

The above recommendations and evaluations are based on our understanding of the project and the information provided to us at the time of writing this report. In the event that changes are made (other than what is presented in this report) in the overpass location, structural loads, drainage features, or other project features, we should be contacted to review and evaluate our analyses and recommendations.

REFERENCES

1. United States Geological Survey **"NW Las Vegas"**, 7½ Minute (1:24,000) Quadrangle Geologic Map (Map 3Dg, 1987), Nevada Bureau of Mines and Geology (Matti, Bachhuber, Morton, Bell).

2. **"Subsidence in Las Vegas Valley: Nevada Bureau of Mines and Geology"** Bulletin 95, Bell, J. W., 1981.

3. **"Subsidence-related and Fissures of the Las Vegas Valley Map"** Nevada Bureau of Mines and Geology, Subsidence in Las Vegas Valley 1980-91 Final Project report, John W. Bell and Jonathan G. Price, 1991.

4. United States Geological Survey **"Tectonic Map of Clark County, Nevada"** Bulletin 62 Plate 5, Nevada Bureau of Mines and Geology.

5. Las Vegas Review Journal article, **"Valley Faults Capable of Healthy Jolt"**, Keith Rogers interview with Craig dePolo, research geologist with the Nevada Bureau of Mines and Geology, and Geologist Burt Slemmons, a member of the Nevada Earthquake Safety Council and professor emeritus at the University of Nevada, Reno, April 11, 1999.

6. **"Earthquake Hazard in Las Vegas, Nevada"** D. Burton Slemmons, John W. Bell, Craig M, dePolo, Alan R. Ramelli, Gary S. Rasmussen, Victoria3 E. Langenheim, R.C. Jachens, Kenneth Smith, and Jim O'Donnell, 2001.

7. **"Standard Specifications for Road and Bridge Construction"** State of Nevada, Department of Transportation, 2001.

8. AASHTO **"Standard Specification for Highway Bridges"** Seventeenth Edition, 2002.

9. **"2005 Standard Plans for Road and Bridge Construction"** State of Nevada, Department of Transportation, 2001.

10. **"Earth Retaining Structures" Reference Manual (Draft)"**, May 1998, NHI Course No. 13236 - Module 6, FHWA Training Course In Geotechnical And Foundation Engineering.

Photo 1. Original structure, looking to the west.

Photo 2. Buildings to the south west of the current structure.

APPENDIX A

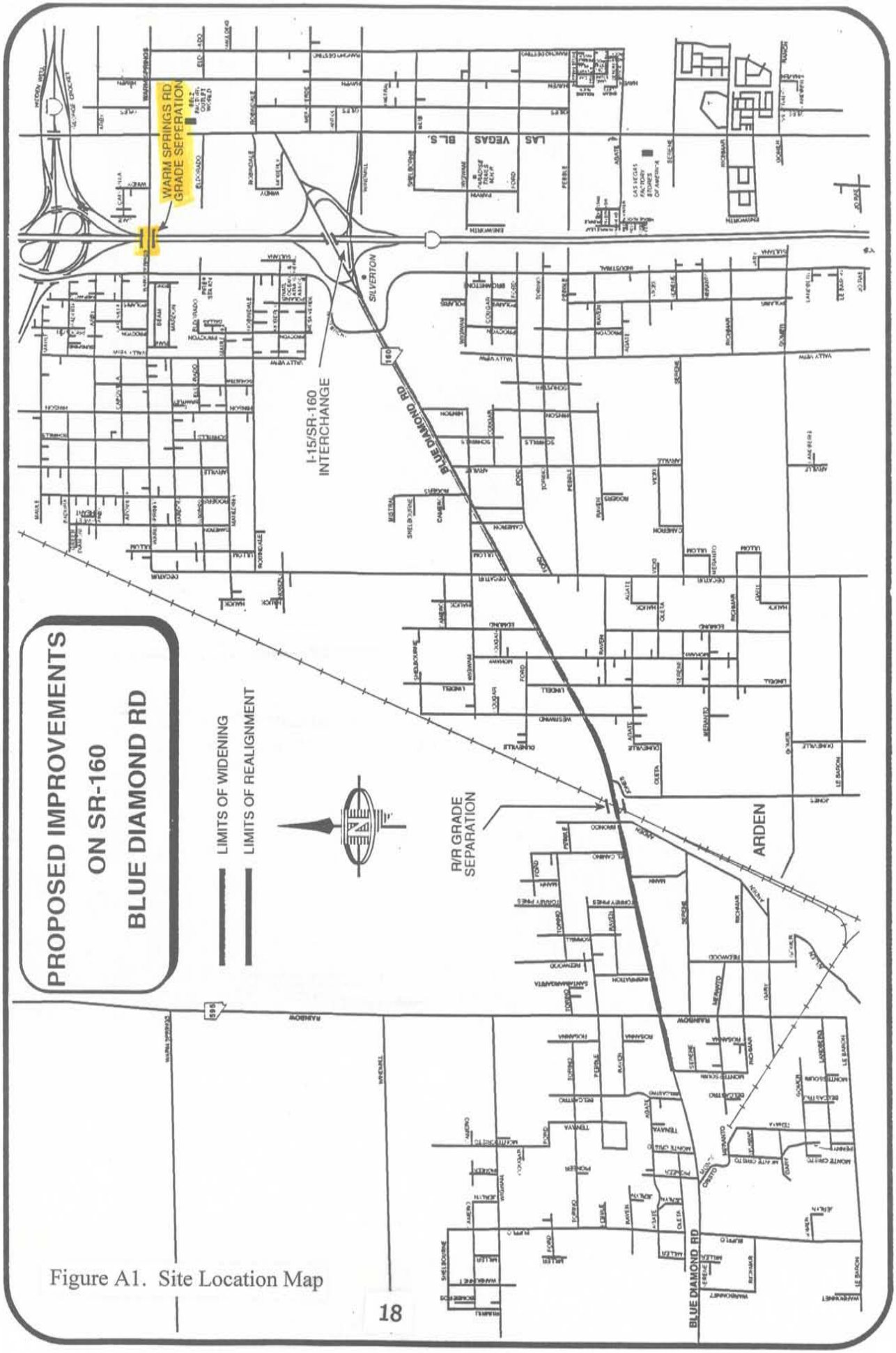


Figure A1. Site Location Map

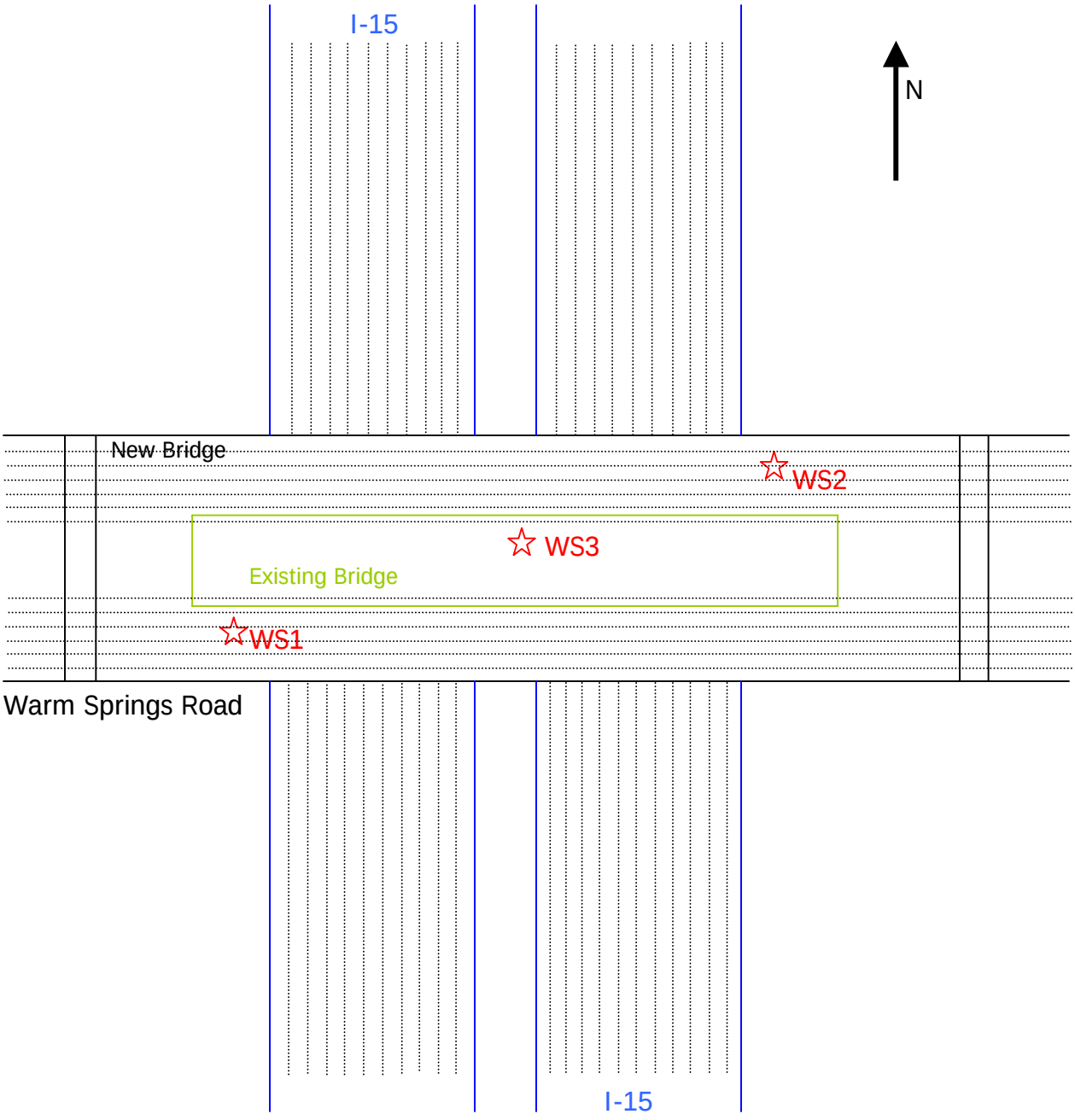


Figure A2. Borehole Location Map.

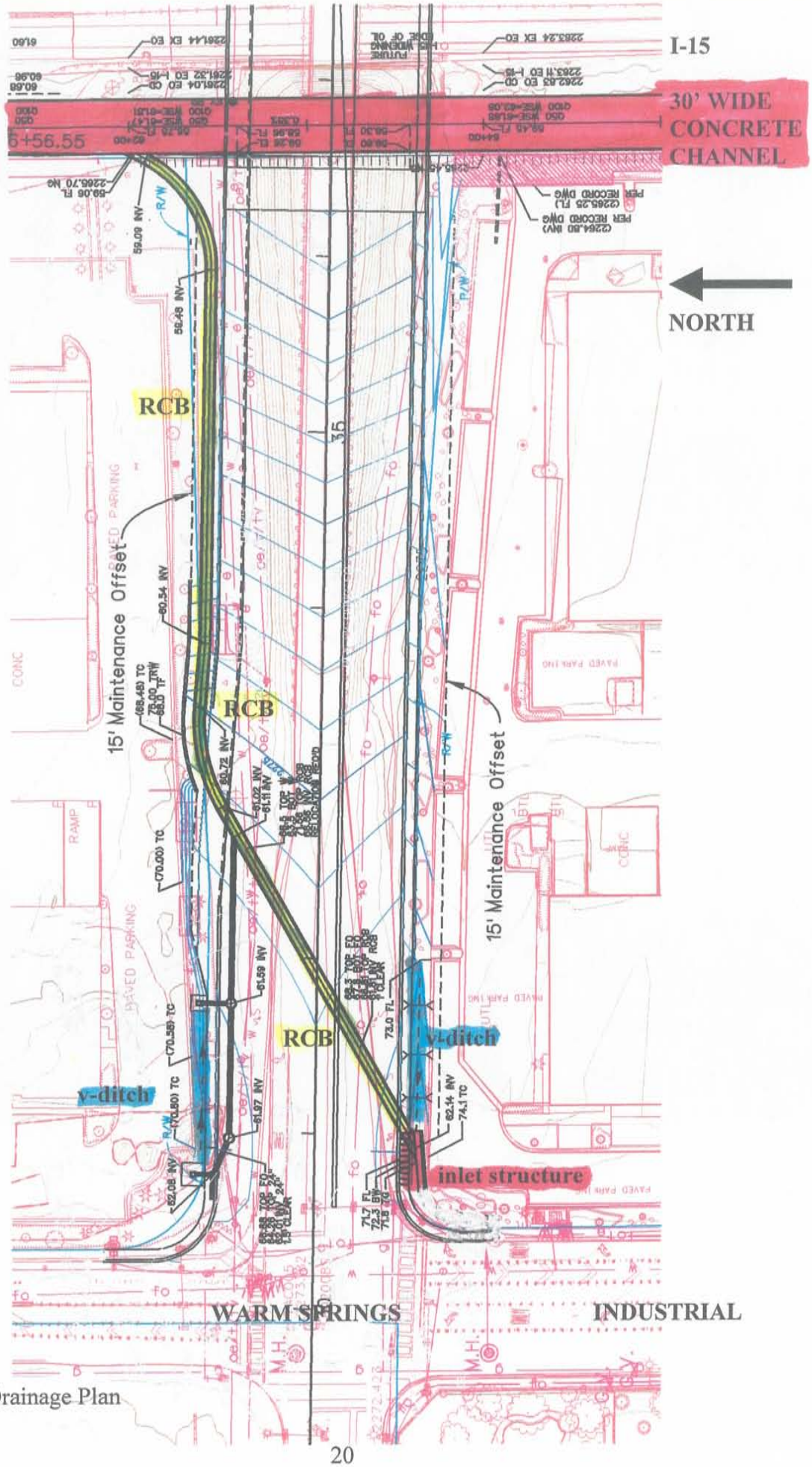


Figure A3. Drainage Plan

APPENDIX B

Terry Katzer, James R. Harrill, Gregg Berggren, and Russell W. Plume, 1985

Water Resources Division
U.S. Geological Survey
Carson City, Nevada

Lithologic units from Matti and Bachhuber (1982) Preliminary geologic map of Las Vegas SW quadrangle, Nevada Bureau of Mines and Geology, Open-file Map 82-6; and modified from Bingler (1977) Geologic map, Las Vegas SE quadrangle, Nevada Bureau of Mines and Geology Map 3Ag; and from Plume (1984) Ground-water conditions in Las Vegas Valley, Clark County, Nevada—Part I, hydrogeologic framework, U.S. Geological Survey Open-file Report 84-130.

LITHOLOGIC UNITS

Alluvial and fanglomerate deposits. Associated interbedded alluvial deposits consisting of fine to coarse sand and pebble to cobble gravel as mapped by Matti and Bachhuber (1982). Lithologies similar to the surficial units mapped by Bingler (1977) and described by Plume (1984). Deposits also include a minor amount of small boulders.

Scale 1:24,000
CONTOUR INTERVAL 10 FEET

0 0.5 1 kilometer
0 0.5 1 mile
0 1000 2000 3000 4000 5000 feet

GENERAL GEOLOGY

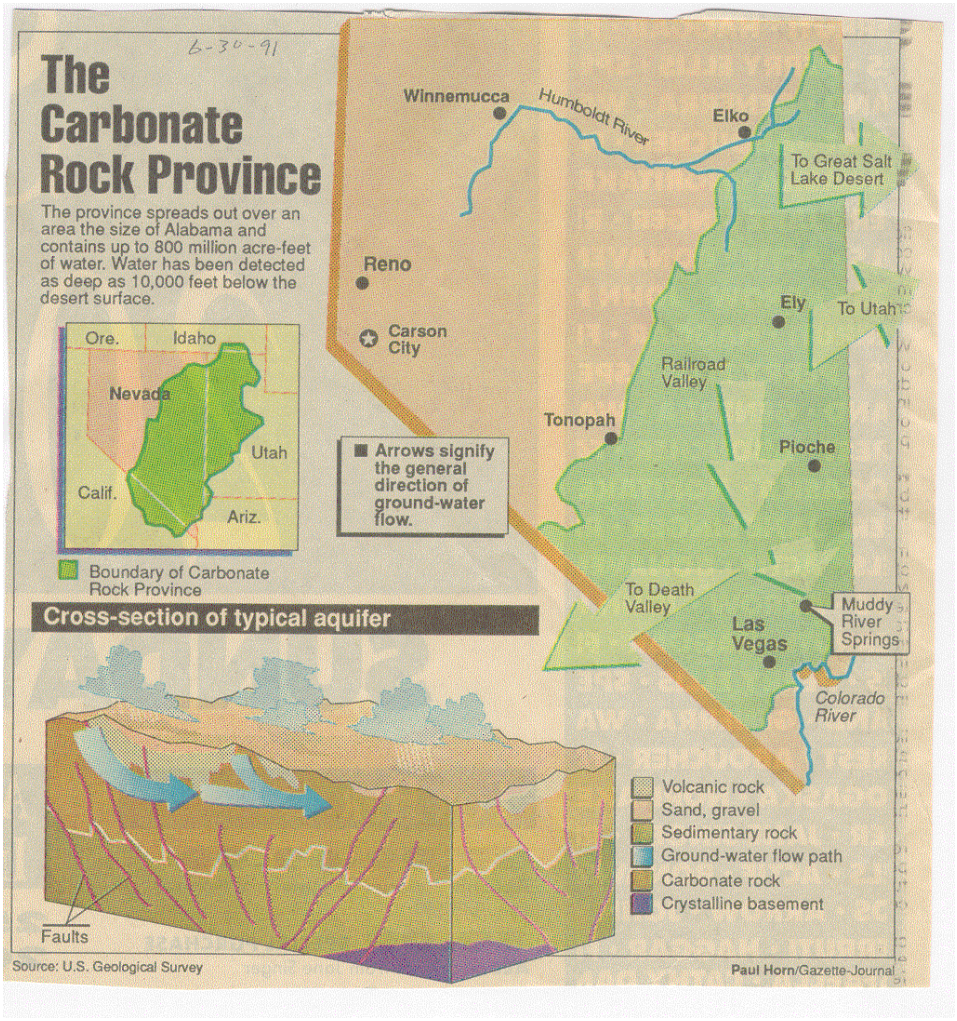


Figure B2. Map of limestone belt through Nevada.

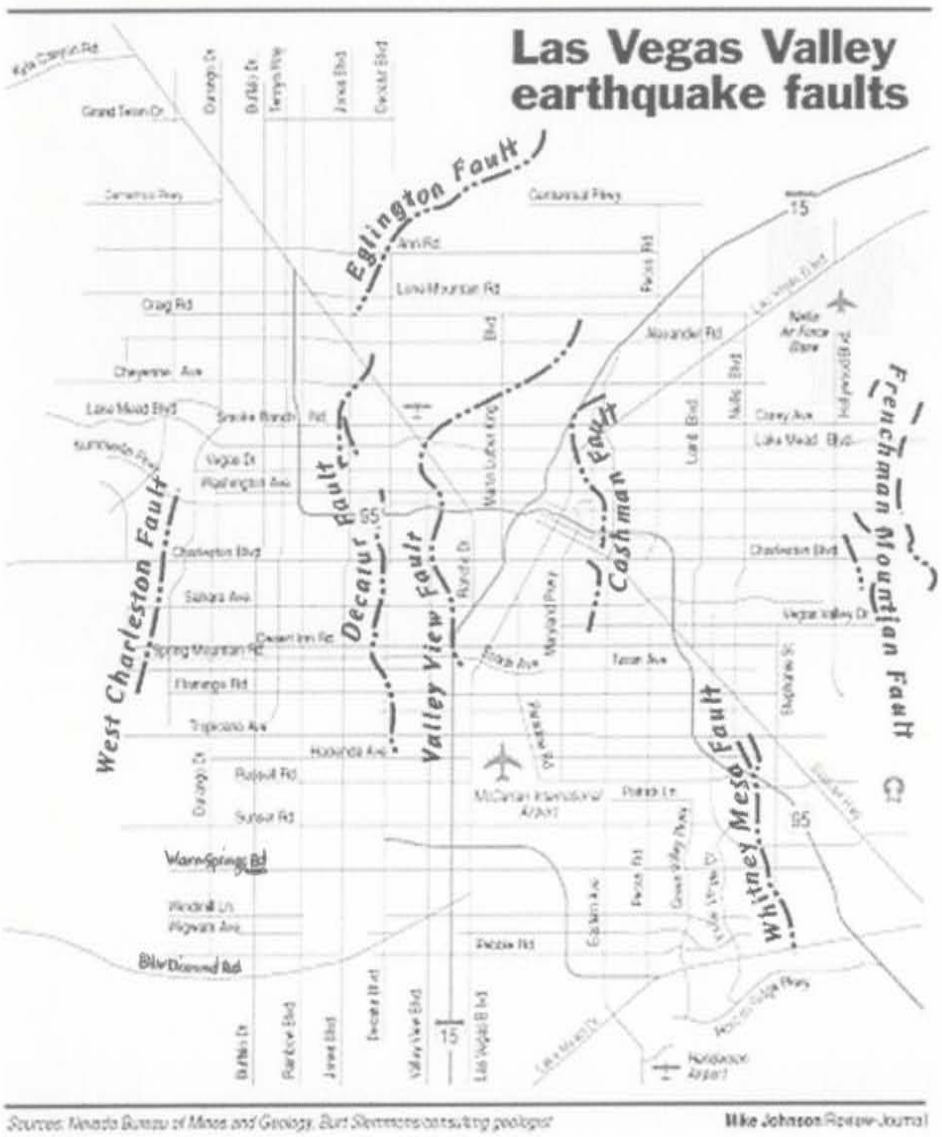


Figure B3. Significant local earthquake fault of Las Vegas Valley (printed in Las Vegas Review Journal, April 11, 1999).

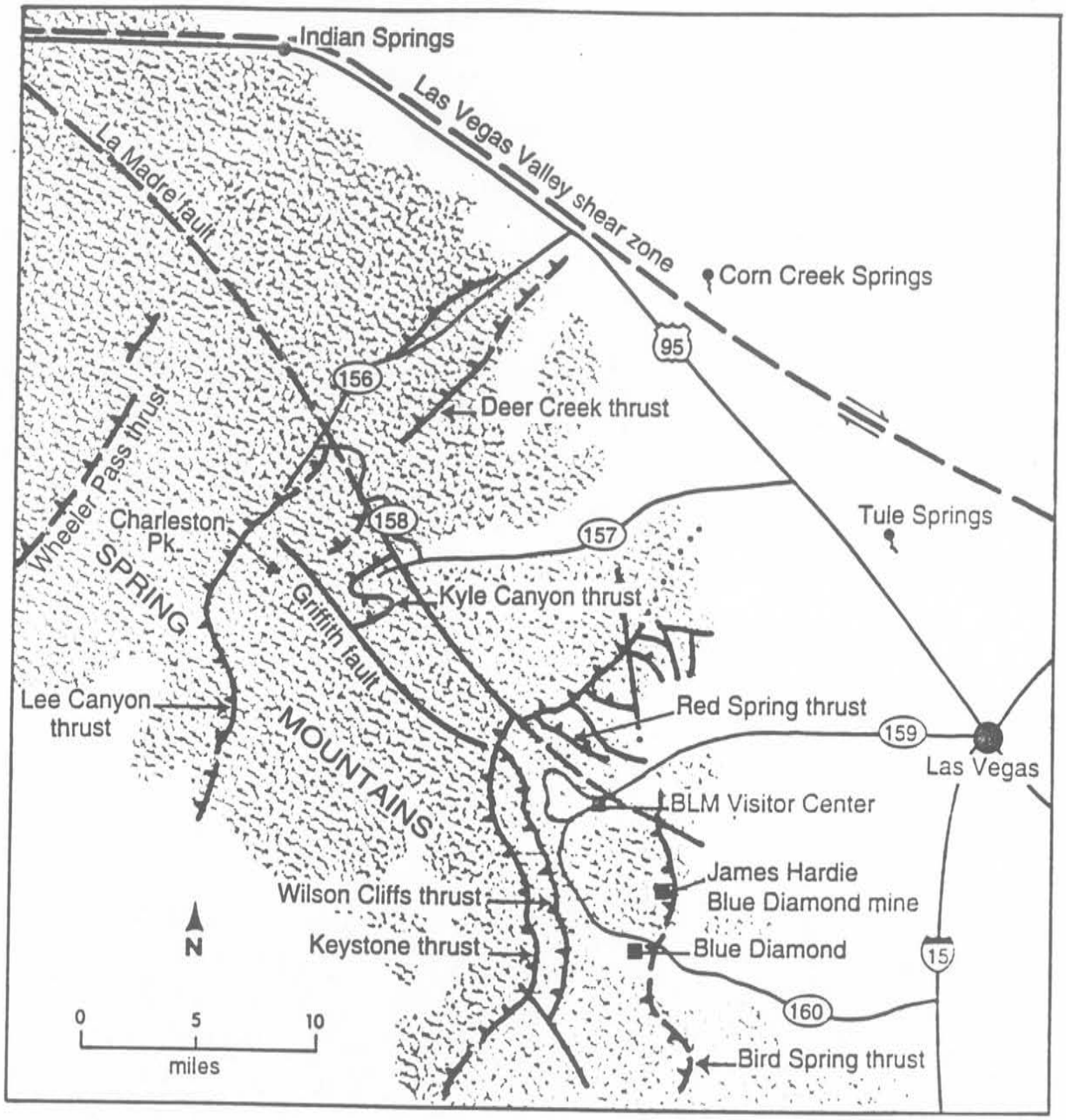


Figure B4. Las Vegas and Spring Mountains Fault Map.

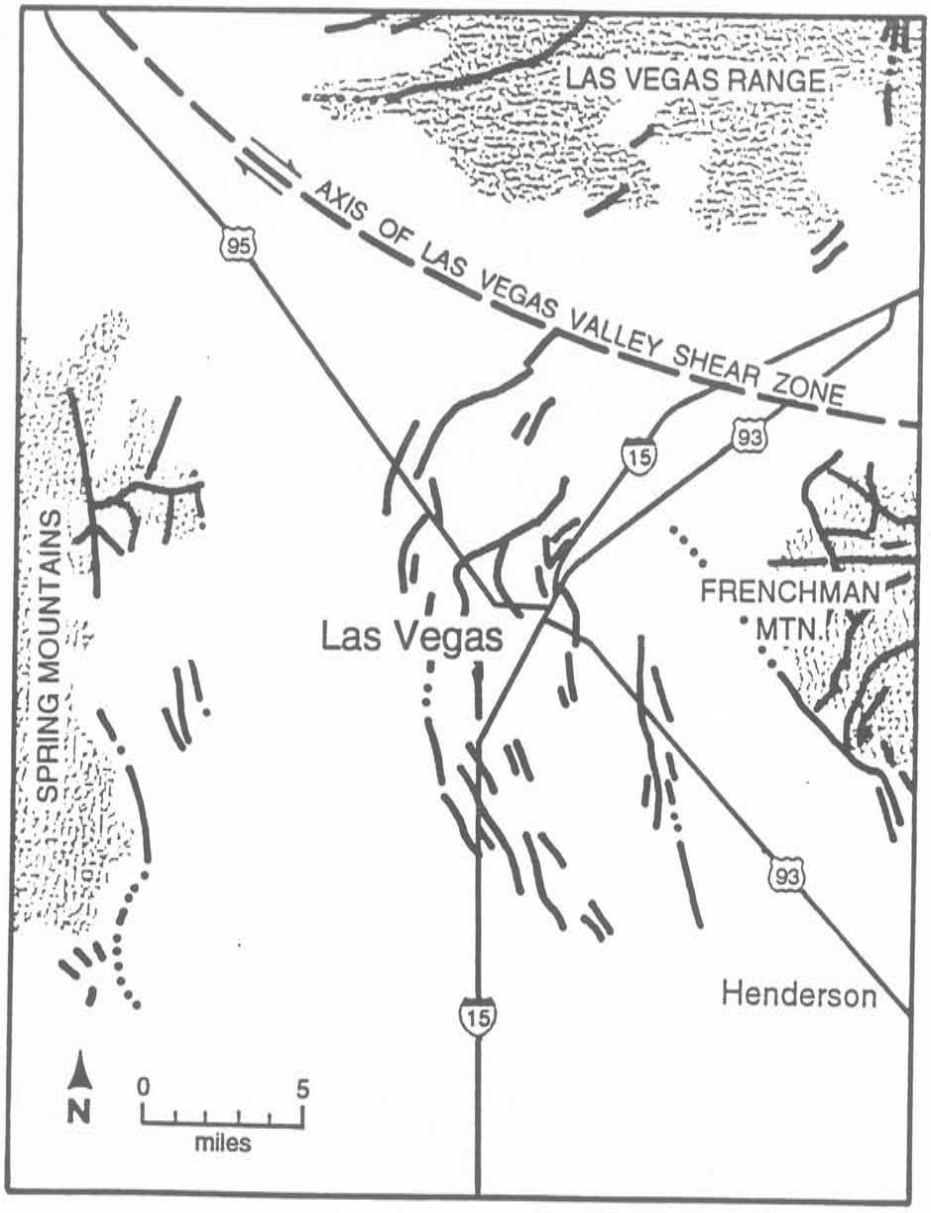
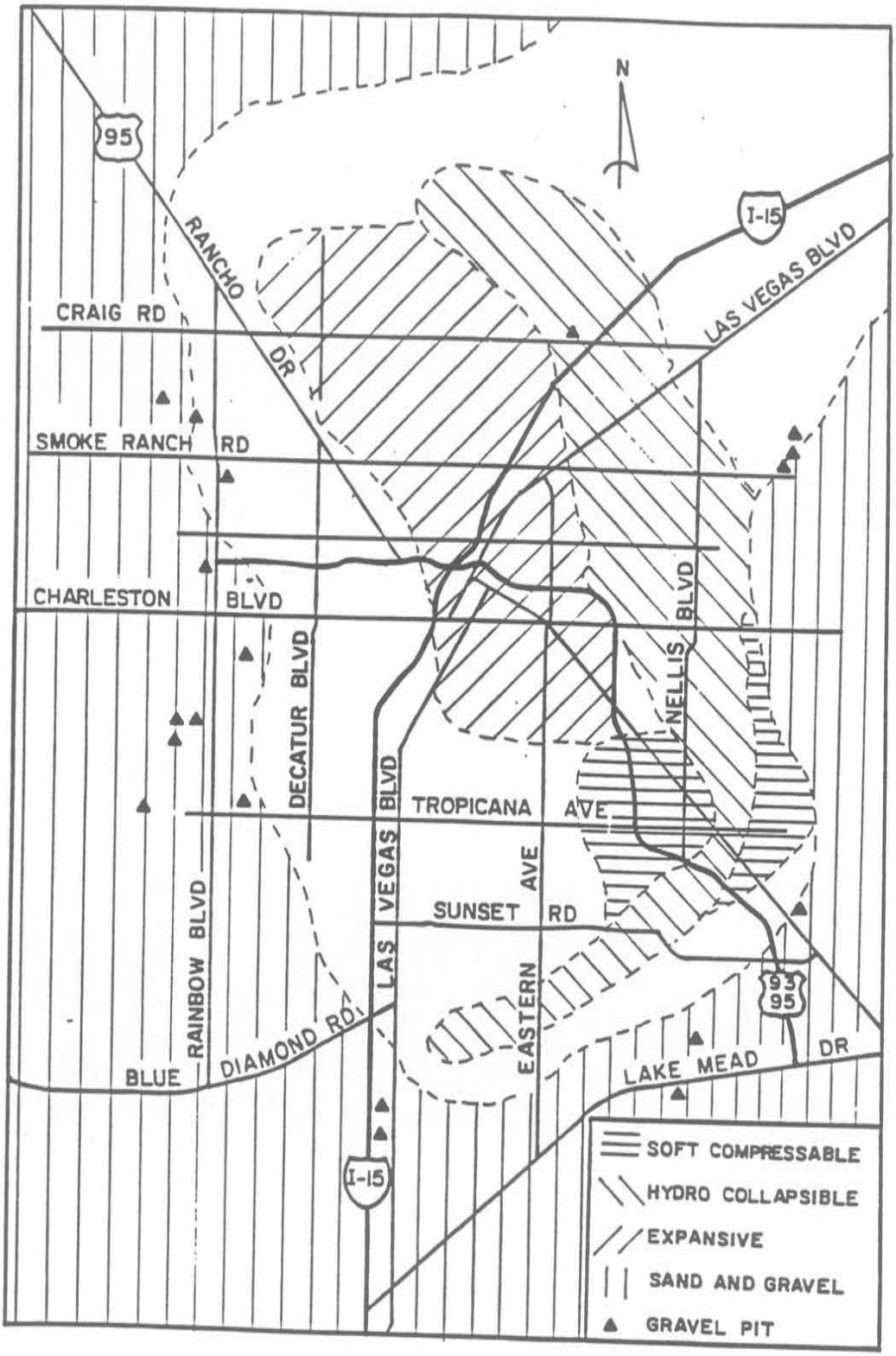


Figure B5. Las Vegas Valley Fault Map.



Soil types and gravel pits of the Las Vegas Valley

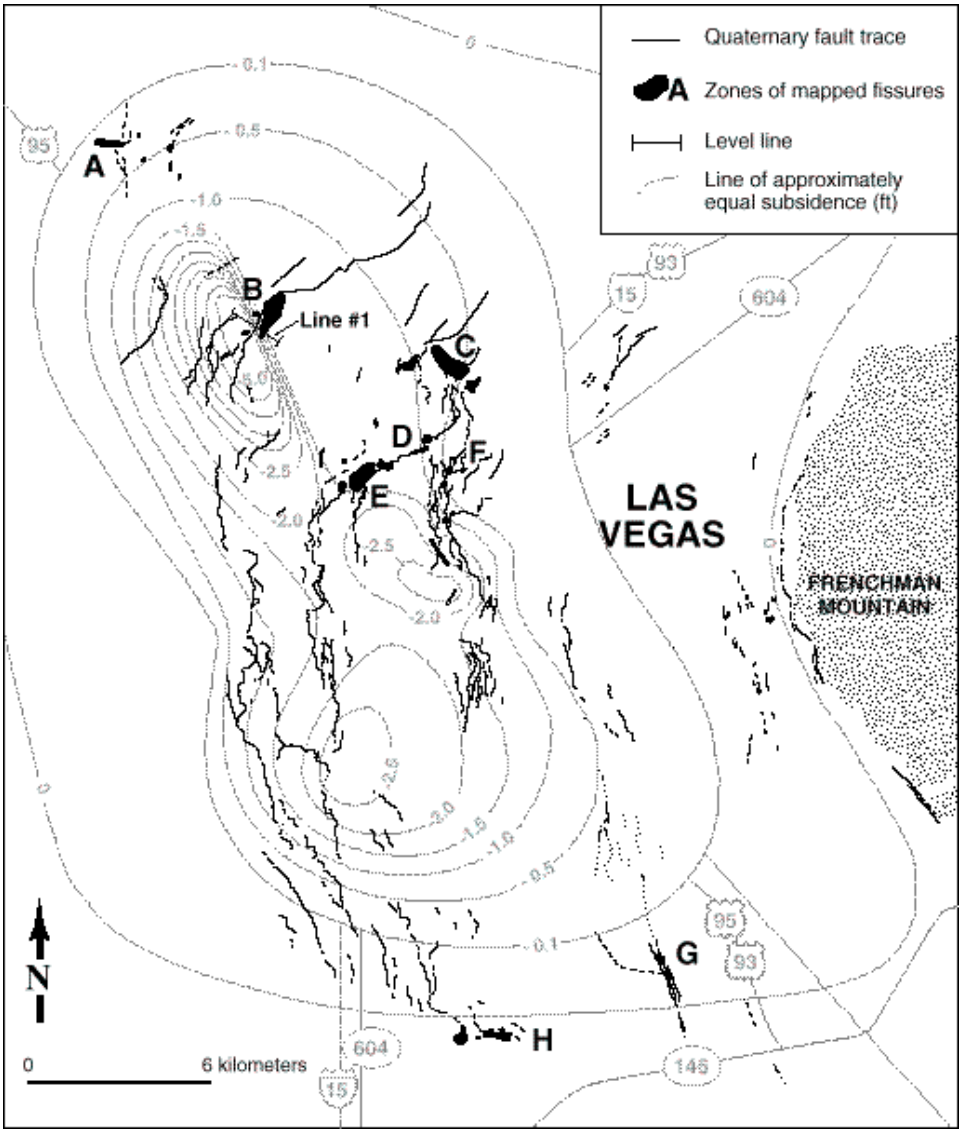


Figure B7. Land surface subsidence (feet) in Las Vegas between 1963 and 1987.

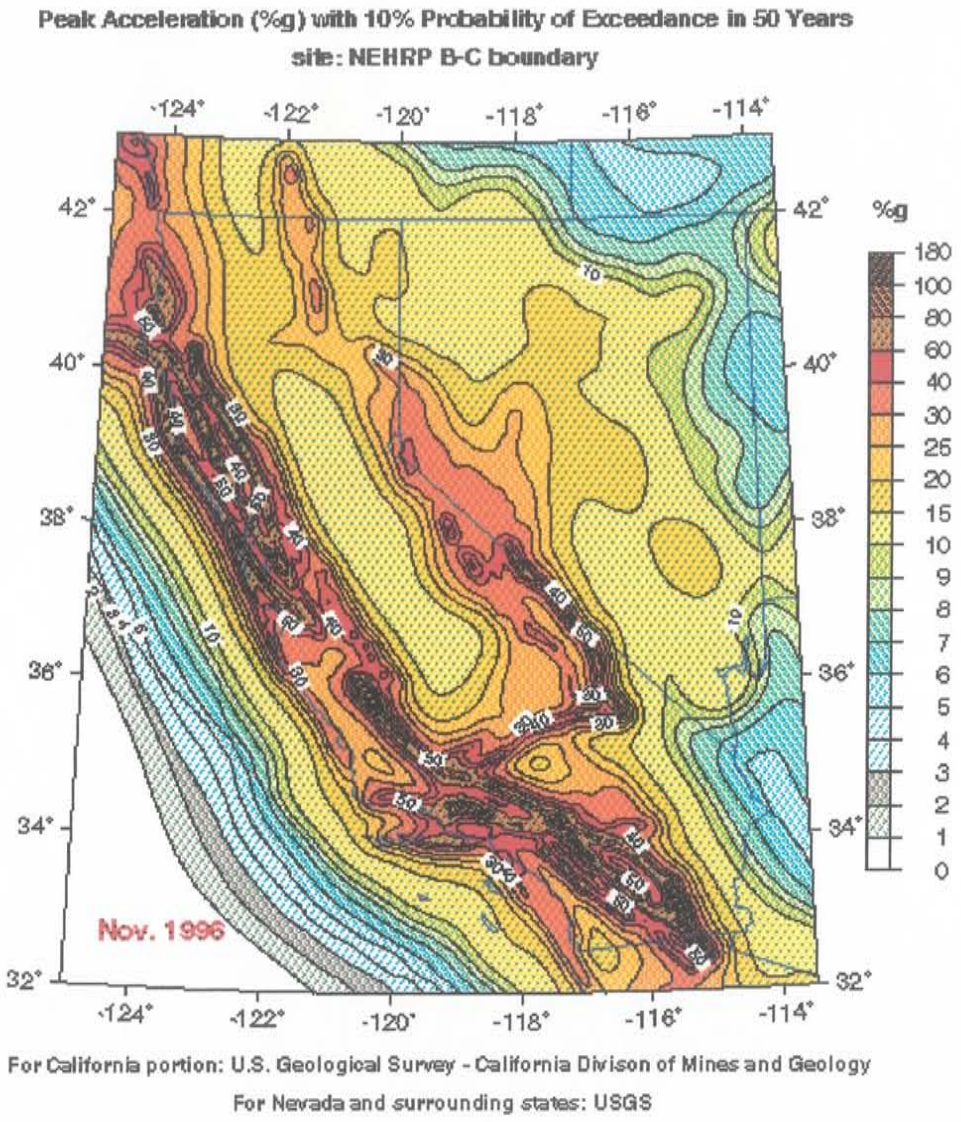


Figure B8. Seismic acceleration coefficients for Nevada and California.

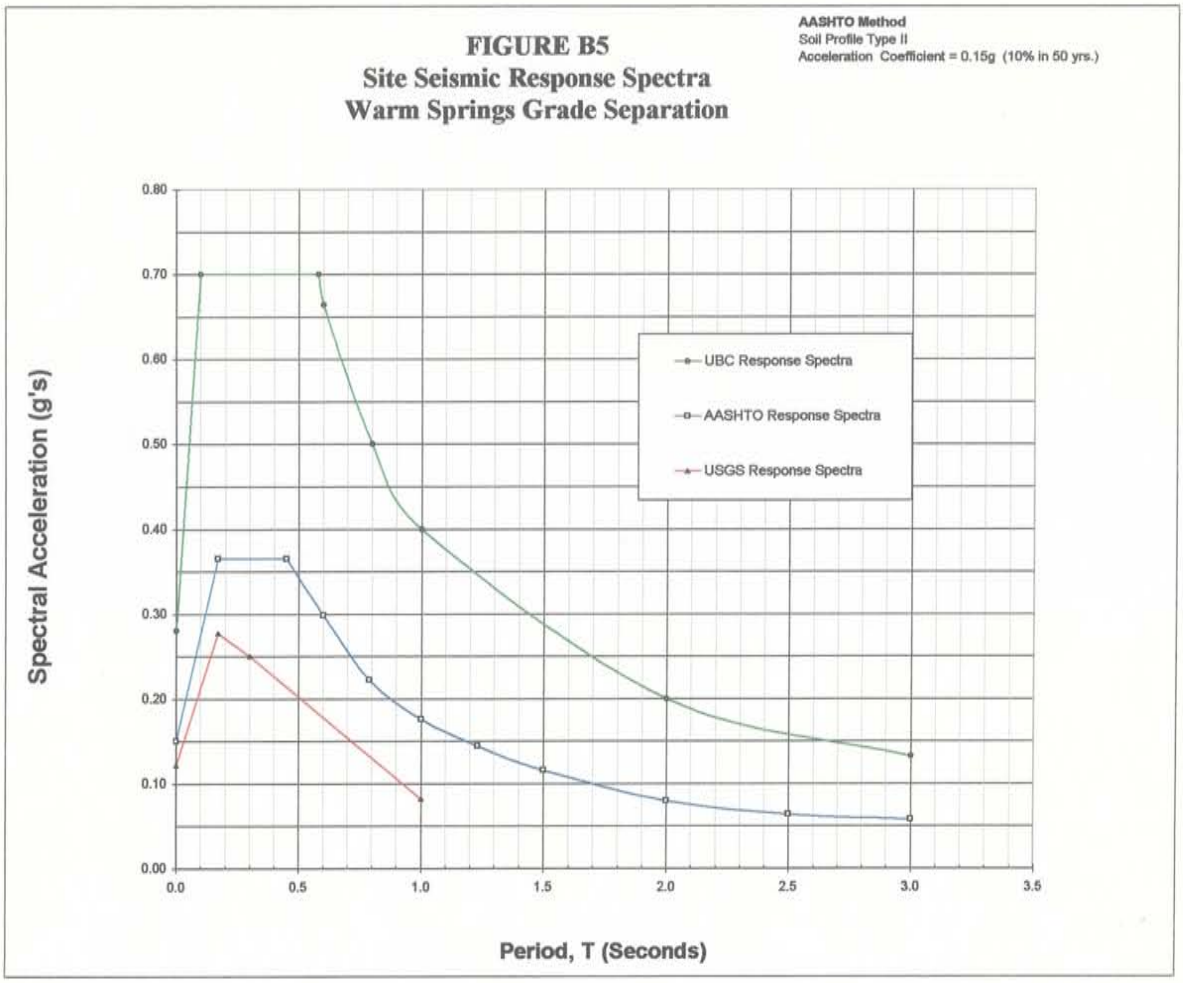


Figure B9. Response Spectra for the Warm Springs Grade Separation.

APPENDIX C

KEY TO BORING LOGS

PARTICLE SIZE LIMITS								
CLAY	SILT	SAND			GRAVEL		COBBLES	BOULDERS
		FINE	MEDIUM	COARSE	FINE	COARSE		
.002 mm		#200	#40	#10	#4	¾ inch	3 inch	12 inch

USCS GROUP	TYPICAL SOIL DESCRIPTION
GW	Well graded gravels, gravel-sand mixtures, little or no fines
GP	Poorly graded gravels, gravel-sand mixtures, little or no fines
GC	Clayey gravels, poorly graded gravel-sand-clay mixtures
SW	Well graded sands, gravelly sands, little or no fines
SP	Poorly graded sands, gravelly sands, little or no fines
SM	Silty sands, poorly graded sand-silt mixtures
SC	Clayey sands, poorly graded sand-clay mixtures
ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands with slight plasticity
CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
OL	Organic silts and organic silt-clays of low plasticity
MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
CH	Inorganic clays of high plasticity, fat clays
OH	Organic clays of medium to high plasticity
CS	Claystone/Siltstone
PT	Peat and other highly organic soils

MOISTURE CONDITION CRITERIA

Description	Criteria
Dry	Absence of moisture, dusty, dry to touch.
Moist	Damp, no visible free water.
Wet	Visible free water, usually below groundwater table.

▽ ▼ Groundwater Elevation Symbols

SOIL CEMENTATION CRITERIA

Description	Criteria
Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Won't break or crumble w/finger pressure

STANDARD PENETRATION CLASSIFICATION*			
GRANULAR SOIL		CLAYEY SOIL	
BLOWS/FT	DENSITY	BLOWS/FT	CONSISTENCY
0 - 4	VERY LOOSE	0 - 1	VERY SOFT
5 – 10	LOOSE	2 - 4	SOFT
11 - 30	MEDIUM DENSE	5 - 8	MEDIUM STIFF
31 - 50	DENSE	9 - 15	STIFF
OVER 50	VERY DENSE	16 - 30	VERY STIFF
		31 - 60	HARD
		OVER 60	VERY HARD

*Standard Penetration Test (N) 140 lb hammer 30 inch free fall on 2 inch O.D. x 1.4 inch I.D. sampler.

Blow counts on Calif. Modified Sampler (N_{CMS}) can be converted to N_{SPT} by:

$(N_{CMS})(0.62) = N_{SPT}$

Blow counts from Automatic or Safety Hammer can be converte to Standard SPT N_{60} by:

$(N_{AUTOMATIC})(1.25) = N_{60}$

$(N_{SAFETY})(1.17) = N_{60}$

TEST ABBREVIATIONS

CD	CONSOLIDATED DRAINED	O	ORGANIC CONTENT
CH	CHEMICAL (CORROSIVENESS)	OC	CONSOLIDATION
CM	COMPACTION	PI	PLASTICITY INDEX
CU	CONSOLIDATED UNDRAINED	RQD	ROCK QUALITY DESIGNATION
D	DISPERSIVE SOILS	RV	R-VALUE
DS	DIRECT SHEAR	S	SIEVE ANALYSIS
E	EXPANSIVE SOIL	SL	SHRINKAGE LIMIT
G	SPECIFIC GRAVITY	U	UNCONFINED COMPRESSION
H	HYDROMETER	UU	UNCONSOLIDATED UNDRAINED
HC	HYDRO-COLLAPSE	UW	UNIT WEIGHT
K	PERMEABILITY	W	MOISTURE CONTENT

SOIL COLOR DESIGNATIONS ARE FROM THE MUNSELL SOIL COLOR CHART.

EXAMPLE: (7.5 YR 5/3) BROWN

SAMPLER NOTATION

CMS	CALIF. MODIFIED SAMPLER①
CPT	CONE PENETRATION TEST
CS	CONTINUOUS SAMPLER②
CSS	CALIFORNIA SPLIT SPOON
P	PUSHED (NOT DRIVEN)
PB	PITCHER BARREL
RC	ROCK CORE③
SH	SHELBY TUBE④
SPT	STANDARD PENETRATION TEST
TP	TEST PIT

①- I.D.= 2.421 inch

②- I.D.=3.228 inch with tube; 3.50 inch w/o tube

③- NXB I.D.= 1.875 inch

④- I.D.= 2.875 inch

LAST MODIFIED: October 11, 2004

NEVADA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL ENGINEERING

EXPLORATION LOG

START DATE 3/28/00
END DATE 3/29/00
JOB DESCRIPTION I-15 At Warm Springs Grade Separation
LOCATION I-15 At Warm Springs
BORING WS1
E.A. # 72495
GROUND ELEV. 2265.24 (ft)
HAMMER DROP SYSTEM SAFETY

GROUNDWATER LEVEL		
DATE	DEPTH ft	ELEV. ft

STATION "L"411+46.5
OFFSET 191 ft Lt.
ENGINEER PALMER
EQUIPMENT MOBILE B-57
OPERATOR ALTAMIRANO
DRILLING METHOD wet w/bentonite slurry
BACKFILLED Yes DATE 6/15/00

ELEV. (ft)	DEPTH (ft)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 6 inch Increments	BLOW COUNT Last 1 foot	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
									SILTY CLAY moist, brown, medium stiff	
	2.00							CL		
		A	SPT	10 4 4	8	50	H, W, PI, G			
	3.50								3.50	
		B	SPT	2 2 4	6	72	H, W, PI, G		SILTY SAND moist, brown, loose to medium dense	
2260.2	5.00 5									
		C	SPT	2 3 5	8	61	H, W, PI, G			
	6.50									
		D	CMS	10 8 11	19	83	UW, W, DS	SM		
	8.00									
		E	SPT	5 6 10	16	89	H, W, PI, G, CH			
	9.50									
2255.2	10	F	SPT	10 13 11	24	94	H, W, PI, G			
	11.00								11.00	
		G	SPT	11 9 9	18	78	H, W, PI, G	SP SM	POORLY-GRADED SAND with SILT and GRAVEL damp, brown, medium dense	
	12.50								12.50	
		H	SPT	10 9 9	18	78	H, W, PI, G	GP GM	POORLY-GRADED GRAVEL with SILT and SAND damp, brown, medium dense	
	14.00								14.00	
		I	CMS	24 32 24	56	78	S, W	GW GM	WELL-GRADED GRAVEL with SILT and SAND damp, brown, very dense	
2250.2	15 15.50								15.50	
		J	SPT	10 6 5	11	56	H, W, PI, G	SC	CLAYEY SAND with GRAVEL moist, brown, medium dense to dense	
	17.00									
		K	SPT	8 20 21	41	72	H, W, PI, G			
	18.50								18.50	
		L	SPT	14 15 22	37	89	H, W, PI, G	SC	CLAYEY SAND moist, brown, dense	
2245.2	20.00 20									
		M	SPT	10 13 13	26	83	H, W, PI, G, CH			
	21.50								21.50	
		N	SPT	8 12 15	27	83	H, W, PI, G		SANDY LEAN CLAY moist, reddish brown, very stiff	
	23.00							CL		
2240.2	25								25.00	
	27.00								SILTY SAND with GRAVEL damp, pinkish brown, very dense	
		O	SPT	37 49 70	119	83	H, W, PI, G	SM		
	28.50									
									30.00	

NV_DOT WARM SPRINGS.GPJ NV_DOT.GDT 10/5/06

EXPLORATION LOG

NEVADA DEPARTMENT OF TRANSPORTATION — GEOTECHNICAL ENGINEERING

START DATE 3/28/00
END DATE 3/29/00
JOB DESCRIPTION I-15 At Warm Springs Grade Separation
LOCATION I-15 At Warm Springs
BORING WS1
E.A. # 72495
GROUND ELEV. 2265.24 (ft)
HAMMER DROP SYSTEM SAFETY

GROUNDWATER LEVEL		
DATE	DEPTH ft	ELEV. ft

STATION "L"411+46.5
OFFSET 191 ft Lt.
ENGINEER PALMER
EQUIPMENT MOBILE B-57
OPERATOR ALTAMIRANO
DRILLING METHOD wet w/bentonite slurry
BACKFILLED Yes DATE 6/15/00

ELEV. (ft)	DEPTH (ft)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 6 inch Increments	BLOW COUNT Last 1 foot	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	32.00								CLAYEY SAND with GRAVEL moist, pinkish brown, very dense	
	33.50	P	SPT	20 28 23	51	83	H, W, PI, G	SP		
2230.2	35								35.00	
	37.00								SILTY SAND with GRAVEL moist, pinkish brown, dense	
	38.50	Q	SPT	33 21 19	40	83	H, W, PI, G, CH	SM		
2225.2	40								40.00	
	42.00								CLAYEY SAND with GRAVEL moist, brown, very dense, thin layers of white clay	
	43.50	R	SPT	20 28 37	65	89	H, W, PI, G			
2220.2	45									
	47.00							SC		
	48.50	S	SPT	8 15 38	53	83	H, W, PI, G			
2215.2	50									
	52.00									
	53.42	T	SPT	30 46 65/5"	65/5"	83	H, W, PI, G			(T) Refusal
									54.00	
2210.2	55								SANDY LEAN CLAY moist, grayish white, hard	
	57.00									
	58.50	U	SPT	30 23 28	51	83	H, W, PI, G	CL		

NV_DOT WARM SPRINGS.GPJ NV_DOT.GDT 10/5/06

EXPLORATION LOG

NEVADA DEPARTMENT OF TRANSPORTATION — GEOTECHNICAL ENGINEERING

START DATE 3/28/00
END DATE 3/29/00
JOB DESCRIPTION I-15 At Warm Springs Grade Separation
LOCATION I-15 At Warm Springs
BORING WS1
E.A. # 72495
GROUND ELEV. 2265.24 (ft)
HAMMER DROP SYSTEM SAFETY

GROUNDWATER LEVEL		
DATE	DEPTH ft	ELEV. ft

STATION "L"411+46.5
OFFSET 191 ft Lt.
ENGINEER PALMER
EQUIPMENT MOBILE B-57
OPERATOR ALTAMIRANO
DRILLING METHOD wet w/bentonite slurry
BACKFILLED Yes DATE 6/15/00

ELEV. (ft)	DEPTH (ft)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 6 inch Increments	BLOW COUNT Last 1 foot	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
									61.00	
	62.00								CLAYEY SAND with GRAVEL moist, reddish brown with black limestone gravel, very dense	
	63.50	V	SPT	16 25 50	75	83	H, W, PI, G			
2200.2	65							SC		
	67.00									
	68.50	W	SPT	14 25 24	49	78	H, W, PI, G, CH			
2195.2	70								70.00	
	72.00							GM	SILTY GRAVEL with SAND damp, brown, very dense	
	72.50	X	SPT	90 R	R	100	H, W, G		72.50	
									B.O.H.	(X) Refusal, gravel stuck in retainer
2190.2	75									
2185.2	80									
2180.2	85									

NV_DOT WARM SPRINGS.GPJ NV_DOT.GDT 10/5/06

EXPLORATION LOG

NEVADA DEPARTMENT OF TRANSPORTATION — GEOTECHNICAL ENGINEERING

SHEET 1 OF 4

START DATE 4/24/00
END DATE 4/26/00
JOB DESCRIPTION I-15 At Warm Springs Grade Separation
LOCATION I-15 At Warm Springs
BORING WS2
E.A. # 72495
GROUND ELEV. 2261.70 (ft)
HAMMER DROP SYSTEM SAFETY

GROUNDWATER LEVEL		
DATE	DEPTH ft	ELEV. ft

STATION "L"413+14.5
OFFSET 111 ft Rt.
ENGINEER PALMER
EQUIPMENT MOBILE B-80
OPERATOR ALTAMIRANO
DRILLING METHOD wet w/bentonite slurry
BACKFILLED Yes DATE 5/4/00

ELEV. (ft)	DEPTH (ft)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 6 inch Increments	BLOW COUNT Last 1 foot	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	2.00							SM	SILTY SAND moist, brown, medium dense	
	3.50	A	SPT	4 5 6	11	78	H, W, PI, G		3.50	
	5.00	B	SPT	7 8 7	15	67	S, W, PI, CH	SP SM	POORLY-GRADED SAND with SILT moist, brown, medium dense 5.00	
2256.7	5									
	6.50	C	SPT	9 15 23	38	78	S, W, PI	SM	SILTY SAND moist, brown, dense 6.50	(C) Refusal; No recovery.
	8.00	D	SPT	6 8 16	24	78	H, W, PI, G	SC SM	SILTY, CLAYEY SAND with GRAVEL moist, brown with black limestone gravel, medium dense 8.00	
	9.50	E	SPT	8 8 36	44	72	S, W, PI, CH	SP SM	POORLY-GRADED SAND with SILT and GRAVEL moist, brown with black limestone gravel, dense 9.50	
2251.7	10									
	11.00	F	SPT	32 36 54	90	67	S, W, PI	SC SM	SILTY, CLAYEY SAND with GRAVEL damp, brown with black limestone gravel, very dense 11.00	(E) No recovery.
	12.50	G	SPT	48 64 85	149	89	H, W, PI, G	SM	SILTY SAND with GRAVEL damp, brown with black limestone gravel, very dense 12.50	
	14.00	H	SPT	30 38 36	74	67	S, W, PI	SC SM	SILTY CLAYEY SAND damp, brown to brick red, very dense 14.00	
2246.7	15									
	15.50	I	SPT	34 50 54	104	89	S, W, PI, CH	SM	SILTY SAND with GRAVEL moist, brown with black limestone gravel, very dense 15.50	(G) No recovery.
	16.42	J	SPT	38 85/5"	85/5"	91	H, W, PI, G	SP SM	POORLY-GRADED SAND with SILT and GRAVEL moist, brown with brick red colored spots, very dense	
	17.00									
	17.92	K	SPT	34 90/5"	90/5"	73	S, W, PI			
	18.50									
	19.29	L	SPT	56 70/3.5"	70/3.5"	95	S, W			
	20.00									
2241.7	20									
	20.92	M	SPT	63 80/5"	80/5"	100	S, W, PI			
	21.50								21.50	
	23.00	N	SPT	36 46 45	91	100	H, W, PI, G, CH	SM	SILTY SAND with GRAVEL moist, white with black limestone gravel, very dense	
2236.7	25									
	27.00									
	27.92	O	SPT	50 80/5"	80/5"	91	S, W			
									30.00	

NV_DOT WARM SPRINGS.GPJ NV_DOT.GDT 10/5/06

EXPLORATION LOG

NEVADA DEPARTMENT OF TRANSPORTATION — GEOTECHNICAL ENGINEERING

START DATE 4/24/00
END DATE 4/26/00
JOB DESCRIPTION I-15 At Warm Springs Grade Separation
LOCATION I-15 At Warm Springs
BORING WS2
E.A. # 72495
GROUND ELEV. 2261.70 (ft)
HAMMER DROP SYSTEM SAFETY

GROUNDWATER LEVEL		
DATE	DEPTH ft	ELEV. ft

STATION "L"413+14.5
OFFSET 111 ft Rt.
ENGINEER PALMER
EQUIPMENT MOBILE B-80
OPERATOR ALTAMIRANO
DRILLING METHOD wet w/bentonite slurry
BACKFILLED Yes DATE 5/4/00

ELEV. (ft)	DEPTH (ft)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 6 inch Increments	BLOW COUNT Last 1 foot	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
									POORLY-GRADED SAND with SILT and GRAVEL moist, brown, very dense	
	32.00									
		P	SPT	30 56 105	161	83	S, W, PI			
	33.50									
2226.7	35							SP SM		
	38.00									
		Q	SPT	32 48 64	112	83	S, W, PI			
	39.50									
2221.7	40									
									41.00	
									CLAYEY SAND with GRAVEL moist, brown with pockets of white clay, very dense	
	43.00									
		R	SPT	13 31 36	67	78	H, W, PI, G, CH			
	44.50									
2216.7	45							SC		
	48.00									
	48.75	S	SPT	58 80/3"	80/3"	100	S, W, PI			
2211.7	50									
									52.00	
									SILTY GRAVEL with SAND moist, tan, very dense	
	53.00									
	53.42	T	SPT	100/5"	100/5"	100	S, W			
								GM		
2206.7	55									
									56.00	
									SANDY LEAN CLAY moist, pinkish brown, hard	
	58.00									
	58.75	U	SPT	78 75/3"	75/3"	89	H, W, PI, G	CL		
									60.00	

NV_DOT WARM SPRINGS.GPJ NV_DOT.GDT 10/5/06

EXPLORATION LOG

NEVADA DEPARTMENT OF TRANSPORTATION — GEOTECHNICAL ENGINEERING

START DATE 4/24/00
END DATE 4/26/00
JOB DESCRIPTION I-15 At Warm Springs Grade Separation
LOCATION I-15 At Warm Springs
BORING WS2
E.A. # 72495
GROUND ELEV. 2261.70 (ft)
HAMMER DROP SYSTEM SAFETY

GROUNDWATER LEVEL		
DATE	DEPTH ft	ELEV. ft

STATION "L"413+14.5
OFFSET 111 ft Rt.
ENGINEER PALMER
EQUIPMENT MOBILE B-80
OPERATOR ALTAMIRANO
DRILLING METHOD wet w/bentonite slurry
BACKFILLED Yes DATE 5/4/00

ELEV. (ft)	DEPTH (ft)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 6 inch Increments	BLOW COUNT Last 1 foot	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
									SILTY SAND with GRAVEL moist, brown with black limestone gravel, very dense	
	63.00							SM		
		V	SPT	24 62 106	168	78	S, W, PI			
	64.50									
2196.7	65									
									66.00	
									SILTY GRAVEL with SAND moist, brown with black limestone gravel, very dense	
	68.00									
		W	SPT	58 108	50/1"	92	S, W	GM		
	69.10									
				50/1"						
2191.7	70									
									70.50	
								CL	71.00 SANDY LEAN CLAY moist, pinkish brown, hard	
								SM	SILTY SAND with GRAVEL moist, brown with black limestone gravel, very dense	
	73.00								72.50	
									SILTY SAND moist, reddish brown, very dense	
		X	SPT	16 29 28	57	94	S, W, PI	SM		
	74.50									
2186.7	75									
									76.00	
									SANDY FAT CLAY moist, reddish brown, hard	
	78.00							CH		
		Y	SPT	11 22 32	54	94	H, W, PI, G, CH			
	79.50									
2181.7	80								80.00	
									SANDY LEAN CLAY moist, reddish brown, dense	
	83.00							CL		
		Z	SPT	14 15 19	34	89	H, W, PI, G			
	84.50									
2176.7	85									
									86.00	
									CLAYEY SAND with GRAVEL wet, reddish brown with black gravel, dense	
	88.00							SC		
		AA	SPT	9 11 19	30	89	H, W, PI, G			
	89.50									
									90.00	

NV_DOT WARM SPRINGS.GPJ NV_DOT.GDT 10/5/06

EXPLORATION LOG

NEVADA DEPARTMENT OF TRANSPORTATION — GEOTECHNICAL ENGINEERING

START DATE 4/24/00
END DATE 4/26/00
JOB DESCRIPTION I-15 At Warm Springs Grade Separation
LOCATION I-15 At Warm Springs
BORING WS2
E.A. # 72495
GROUND ELEV. 2261.70 (ft)
HAMMER DROP SYSTEM SAFETY

GROUNDWATER LEVEL		
DATE	DEPTH ft	ELEV. ft

STATION "L"413+14.5
OFFSET 111 ft Rt.
ENGINEER PALMER
EQUIPMENT MOBILE B-80
OPERATOR ALTAMIRANO
DRILLING METHOD wet w/bentonite slurry
BACKFILLED Yes DATE 5/4/00

ELEV. (ft)	DEPTH (ft)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 6 inch Increments	BLOW COUNT Last 1 foot	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
									SILTY CLAYEY SAND with GRAVEL wet, reddish brown with black gravel, very dense	
	93.00									
		AB	SPT	6 19 32	51	89	S, W, PI	SC SM		
	94.50									
2166.7	95									
									97.00	
	98.00								CLAYEY SAND with GRAVEL moist, reddish brown with black gravel, contains many rock fragments and crystals (gypsum), very dense	
		AC	SPT	24 32 32	64	89	H, W, PI, G			
	99.50							SM		
2161.7	100									
									102.00	
	103.00								SANDY LEAN CLAY moist, reddish brown, hard	
		AD	SPT	40 80 80/3"	80/3"	67	S, W, PI			
	104.25									
2156.7	105							CL		
	108.00									
		AE	SPT	29 100	100	75	S, W			
	109.00									
									109.50	
2151.7	110								B.O.H.	
2146.7	115									

NV_DOT WARM SPRINGS.GPJ NV_DOT.GDT 10/5/06

EXPLORATION LOG

NEVADA DEPARTMENT OF TRANSPORTATION — GEOTECHNICAL ENGINEERING

SHEET 1 OF 4

START DATE 6/12/00
END DATE 6/14/00
JOB DESCRIPTION I-15 At Warm Springs Grade Separation
LOCATION I-15 At Warm Springs
BORING WS3
E.A. # 72495
GROUND ELEV. 2262.97 (ft)
HAMMER DROP SYSTEM SAFETY

GROUNDWATER LEVEL		
DATE	DEPTH ft	ELEV. ft

STATION "L"412+51.5
OFFSET 41 ft Lt.
ENGINEER PALMER
EQUIPMENT MOBILE B-80
OPERATOR ALTAMIRANO
DRILLING METHOD wet w/bentonite slurry
BACKFILLED Yes DATE 6/26/00

ELEV. (ft)	DEPTH (ft)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 6 inch Increments	BLOW COUNT Last 1 foot	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
									SILTY SAND moist, brown, medium dense	
	2.00							SM		
		A	SPT	6 8 11	19	39	S, W, PI			
	3.50								3.50	
		B	SPT	3 3 3	6	94	S, W, PI	CL ML	SANDY SILTY CLAY moist, brown, medium stiff	
	5.00								5.00	
2258.0	5	C	SPT	1 1 2	3	94	S, W		SILTY SAND moist, brown, very loose	
	6.50							SM		
2253.0	10								10.00	
								GW GM	POORLY-GRADED GRAVEL with SILT and SAND damp, brown sand and silt with black limestone gravel, very dense	
	12.00									
	13.21	D	SPT	16 66 50/2.5"	50/2.5"	90	S, W, PI			
	13.50								13.50	(D) Refusal
		E	SPT	24 42 56	98	100	H, W, PI, G		SILTY CLAYEY SAND with GRAVEL damp to moist, brown to dark reddish brown, very dense	
2248.0	15.00 15									
		F	SPT	34 66 65	131	94	S, W, PI	SC SM		
	16.50									
	17.00									
		G	SPT	31 37 30	67	83	S, W, PI			
	18.50								18.50	
		H	SPT	20 62 96	158	94	S, W, PI	SC	CLAYEY SAND with GRAVEL moist, dark reddish brown, very dense	
2243.0	20.00 20								20.00	
	20.50								SANDY SILT moist, brown, dense	
		I	SPT	12 14 22	36	94	S, W, PI	ML		
	22.00								22.00	
	22.71	J	SPT	38 75/2.5"	75/2.5"	71	S, W		CLAYEY SAND moist, dark reddish brown, very dense	
								SC		(J) Refusal
	24.50								24.50	
2238.0	25	K	SPT	19 30 32	62	94	S, W, PI, CH	ML	SANDY SILT moist, brown, very dense	
	26.00									
	27.00								27.00	
		L	SPT	11 19 21	40	83	S, W, PI	CL	SANDY LEAN CLAY moist, brown, hard	
	28.50									
	29.50								29.00	
				38					SILTY CLAYEY SAND with GRAVEL moist, brown, very dense	

NV_DOT WARM SPRINGS.GPJ NV_DOT.GDT 10/5/06

EXPLORATION LOG

NEVADA DEPARTMENT OF TRANSPORTATION — GEOTECHNICAL ENGINEERING

START DATE 6/12/00
END DATE 6/14/00
JOB DESCRIPTION I-15 At Warm Springs Grade Separation
LOCATION I-15 At Warm Springs
BORING WS3
E.A. # 72495
GROUND ELEV. 2262.97 (ft)
HAMMER DROP SYSTEM SAFETY

GROUNDWATER LEVEL		
DATE	DEPTH ft	ELEV. ft

STATION "L"412+51.5
OFFSET 41 ft Lt.
ENGINEER PALMER
EQUIPMENT MOBILE B-80
OPERATOR ALTAMIRANO
DRILLING METHOD wet w/bentonite slurry
BACKFILLED Yes DATE 6/26/00

ELEV. (ft)	DEPTH (ft)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 6 inch Increments	BLOW COUNT Last 1 foot	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	31.00	M	SPT	83 85	168	94	S, W, PI	SC SM		
	32.00								32.00	
	32.75	N	SPT	60 50/3"	50/3"	89	S, W		SILTY SAND damp, brown, very dense	
								SM		(N) Refusal
2228.0	35								35.00	
	37.00								CLAYEY SAND with GRAVEL moist, brown with yellow minerals, very dense	
	38.50	O	SPT	22 40 60	100	72	S, W, PI	SC		
2223.0	40								40.00	
	42.00								SANDY LEAN CLAY moist, brown and gray, very stiff	
	43.50	P	SPT	10 12 10	22	94	S, W, PI	CL		
2218.0	45								45.00	
	47.00								CLAYEY SAND moist, brown, gray and green, very dense	
	48.50	Q	SPT	12 12 15	27	83	H, W, PI, G	SC		
2213.0	50								50.00	
	52.00								CLAYEY GRAVEL with SAND moist, black and green, very dense	
	53.38	R	SPT	32 52 75/4.5"	75/4.5"	91	S, W, PI	GC		(R) Refusal
2208.0	55								55.00	
	57.00								SANDY FAT CLAY moist, brown, hard	
	58.50	S	SPT	11 25 36	61	94	S, W, PI, CH	CH		
									60.00	

NV_DOT WARM SPRINGS.GPJ NV_DOT.GDT 10/5/06

NEVADA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL ENGINEERING

EXPLORATION LOG

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END DATE 6/14/00
JOB DESCRIPTION I-15 At Warm Springs Grade Separation
LOCATION I-15 At Warm Springs
BORING WS3
E.A. # 72495
GROUND ELEV. 2262.97 (ft)
HAMMER DROP SYSTEM SAFETY

GROUNDWATER LEVEL		
DATE	DEPTH ft	ELEV. ft

STATION "L"412+51.5
OFFSET 41 ft Lt.
ENGINEER PALMER
EQUIPMENT MOBILE B-80
OPERATOR ALTAMIRANO
DRILLING METHOD wet w/bentonite slurry
BACKFILLED Yes DATE 6/26/00

ELEV. (ft)	DEPTH (ft)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 6 inch Increments	BLOW COUNT Last 1 foot	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	62.00								CLAYEY SAND with GRAVEL moist, brown with black and white gravel, very dense	
	63.50	T	SPT	15 28 32	60	89	S, W, PI			
2198.0	65 67.00									
	68.50	U	SPT	27 44 82	126	83	S, W, PI	SC		
2193.0	70 72.00									
	73.50	V	SPT	18 58 24	82	44	S, W, PI			
2188.0	75 77.00								75.00 SANDY LEAN CLAY OR LEAN SANDY CLAY wet, brown to greenish brown, layered, very stiff to hard	
	78.50	W	SPT	12 20 21	41	89	S, W, PI			
2183.0	80 82.00									
	83.50	X	SPT	4 7 17	24	100	H, W, G			
2178.0	85 87.00							CL		
	88.50	Y	SPT	14 16 17	33	100	S, W, PI, CH			

NV_DOT WARM SPRINGS.GPJ NV_DOT.GDT 10/5/06

EXPLORATION LOG

NEVADA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL ENGINEERING

START DATE 6/12/00
END DATE 6/14/00
JOB DESCRIPTION I-15 At Warm Springs Grade Separation
LOCATION I-15 At Warm Springs
BORING WS3
E.A. # 72495
GROUND ELEV. 2262.97 (ft)
HAMMER DROP SYSTEM SAFETY

GROUNDWATER LEVEL		
DATE	DEPTH ft	ELEV. ft

STATION "L"412+51.5
OFFSET 41 ft Lt.
ENGINEER PALMER
EQUIPMENT MOBILE B-80
OPERATOR ALTAMIRANO
DRILLING METHOD wet w/bentonite slurry
BACKFILLED Yes DATE 6/26/00

ELEV. (ft)	DEPTH (ft)	SAMPLE NO.	SAMPLE TYPE	BLOW COUNT 6 inch Increments	BLOW COUNT Last 1 foot	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	92.00									
	93.50	Z	SPT	7 15 26	41	100	H, W, PI, G			
2168.0	95								95.00 CLAYEY SAND with GRAVEL moist, brown with black, red and white gravel, very dense	
	97.00									
	98.50	AA	SPT	17 53 62	115	89	S, W, PI, CH	SC		
2163.0	100								100.00 SILTY CLAYEY SAND with GRAVEL moist, brown with black, red and white gravel, very dense	
	102.00									
	103.42	AB	SPT	70 75/5"	75/5"	59	S, W, PI	SC SM		(AB) Refusal
2158.0	105								105.00	
	107.00									
	107.96	AC	SPT	75/5.5"	75/5.5"	43	S, W			(AC) Refusal
2153.0	110								SANDY LEAN CLAY moist, brown, hard	
	112.00							CL		
	113.50	AD	SPT	22 25 42	67	94	S, W, PI		113.50	
									B.O.H.	
2148.0	115									

NV_DOT WARM SPRINGS.GPJ NV_DOT.GDT 10/5/06

APPENDIX D

SUMMARY OF TEST RESULTS
N.D.O.T. GEOTECHNICAL SECTION

Boring No. WS1
I-15 @ Warm Springs Interchange, SR 160 Project, Phase 3
E.A. No. 72495

SAMPLE NO.	SAMPLE DEPTH (feet)	SAMPLER TYPE	SOIL GROUP	W%	G	% PASS #200	LL %	PL %	PI %	OTHER TESTS CONDUCTED
A	2.0 - 3.5	SPT	CL	15.9	2.727	57.9	23	15	8	
B	3.5 - 5.0	SPT	SM	14.9	2.678	31.6	17	NP	NP	
C	5.0 - 6.5	SPT	SM	14.4	2.681	29.6	16	NP	NP	
D	6.5 -8.0	CMS								Direct Shear
E	8.0 -9.5	SPT	SM	17.5		26.9	17	NP	NP	Ch
F	9.5 - 11.0	SPT	SM	8.4	2.716	14.0	19	16	3	
G	11.0 - 12.5	SPT	SP-SM	8.2	2.755	11.1	16	NP	NP	
H	12.5 - 14.0	SPT	GP-GM	8.4	2.705	11.9	18	16	2	
I	14.0 - 15.5	CMS	GW-GM	0.9		7.3				
J	15.5 - 17.0	SPT	SC	12.1	2.699	12.7	30	18	12	
K	17.0 - 18.5	SPT	SC	11.2	2.679	20.6	31	18	13	

CMS = California Modified Sampler 2.4 inch I.D.
SPT = Standard Penetration Test using 1.38 inch I.D. Split Spoon Sampler
CS = Continuous Sample 3.2 inch I.D.
RC = Rock Core
PB = Pitcher Barrel
CPT = Cone Penetration Test
TP = Test Pit
P = Pushed, not driven
R = Refusal
Sh = Shelby Tube 2.87 inch I.D.

U = Unconfined Compressive
UU = Unconsolidated Undrained
CD = Consolidated Drained
CU = Consolidated Undrained
DS = Direct Shear
φ = Friction Angle
C = Cohesion
N = Number of blows to drive a 1.38 inch I.D. split spoon sampler a distance of 1 foot with a 140 lb hammer dropped 2.5 feet
N = Field SPT N = Ncms x 0.62

H = Hydrometer
S = Sieve
G = Specific Gravity
PI = Plasticity Index
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OC = Consolidation
Ch = Chemical
RV = R - Value

CM = Compaction
E = Swell/Pressure on Expansive Soils
SL = Shrinkage Limit
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RQD = Rock Quality Designation
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SUMMARY OF TEST RESULTS
N.D.O.T. GEOTECHNICAL SECTION

Boring No. WS1
I-15 @ Warm Springs Interchange, SR 160 Project, Phase 3
E.A. No. 72495

SAMPLE NO.	SAMPLE DEPTH (feet)	SAMPLER TYPE	SOIL GROUP	W%	G	% PASS #200	LL %	PL %	PI %	OTHER TESTS CONDUCTED
L	18.5 - 20.0	SPT	SC	12.7	2.673	42.3	28	15	13	
M	20.0 - 21.5	SPT	SC	13.0	2.698	39.0	23	13	10	Ch
N	21.5 - 23.0	SPT	CL	15.8	2.687	63.2	32	12	20	
O	27.0 - 28.5	SPT	SM	8.4	2.724	12.2	19	NP	NP	
P	32.0 - 33.5	SPT	SC	10.6	2.713	13.7	24	15	9	
Q	37.0 - 38.5	SPT	SM	13.3	2.685	13.5	18	NP	NP	Ch
R	42.0 - 43.5	SPT	SC	16.0	2.672	22.7	27	17	10	
S	47.0 - 48.5	SPT	SC	22.6	2.694	34.7	64	31	33	
T	52.0 - 53.42	SPT	SC	17.8	2.658	27.7	53	27	26	
U	57.0 - 58.5	SPT	CL	19.1	2.698	56.5	44	21	23	
V	62.0 - 63.5	SPT	SC	20.5	2.684	31.9	44	20	24	

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SUMMARY OF TEST RESULTS
N.D.O.T. GEOTECHNICAL SECTION

Boring No. WS1
I-15 @ Warm Springs Interchange, SR 160 Project, Phase 3
E.A. No. 72495

SAMPLE NO.	SAMPLE DEPTH (feet)	SAMPLER TYPE	SOIL GROUP	W%	G	% PASS #200	LL %	PL %	PI %	OTHER TESTS CONDUCTED
W	67.0 - 68.5	SPT	SC	17.4	2.681	28.5	40	21	19	Ch
X	72.0 - 72.5	SPT	GM	9.1	2.707	17.8				

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SUMMARY OF TEST RESULTS
N.D.O.T. GEOTECHNICAL SECTION

Boring No. WS2
I-15 @ Warm Springs Interchange, SR 160 Project, Phase 3
E.A. No. 72495

SAMPLE NO.	SAMPLE DEPTH (feet)	SAMPLER TYPE	SOIL GROUP	W%	G	% PASS #200	LL %	PL %	PI %	OTHER TESTS CONDUCTED
A	2.0 - 3.5	SPT	SM	14.3	2.701	27.7	16	NP	NP	
B	3.5 - 5.0	SPT	SP-SM	10.8		5.0				Ch
C	5.0 - 6.5	SPT	SM	10.9		33.0	16	NP	NP	
D	6.5 - 8.0	SPT	SC-SM	15.9	2.686	31.9	21	16	5	
E	8.0 - 9.5	SPT	SP-SM	14.2		10.1		0		Ch
F	9.5 - 11.0	SPT	SC-SM	9.4		26.3	19	14	5	
G	11.0 - 12.5	SPT	SM	9.7	2.694	17.2	16	NP	NP	
H	12.5 - 14.0	SPT	SC-SM	8.2		27.9	19	15	4	
I	14.0 - 15.5	SPT	SM	10.5		14.3	19	NP	NP	Ch
J	15.5 - 16.42	SPT	SP-SM	10.3	2.69	11.4	21	NP	NP	
K	17.0 - 17.92	SPT	SP-SM	9.8		6.5				

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φ = Friction Angle
C = Cohesion
N = Number of blows to drive a 1.38 inch I.D. split spoon sampler a distance of 1 foot with a 140 lb hammer dropped 2.5 feet
N = Field SPT N = Ncms x 0.62

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SUMMARY OF TEST RESULTS
N.D.O.T. GEOTECHNICAL SECTION

Boring No. WS2
I-15 @ Warm Springs Interchange, SR 160 Project, Phase 3
E.A. No. 72495

SAMPLE NO.	SAMPLE DEPTH (feet)	SAMPLER TYPE	SOIL GROUP	W%	G	% PASS #200	LL %	PL %	PI %	OTHER TESTS CONDUCTED
L	18.5 - 19.29	SPT	SP-SM	11.0		6.8	19	NP	NP	
M	20.0 - 20.92	SPT	SP-SM	11.0		8.0	19	NP	NP	
N	21.5 - 23.0	SPT	SM	13.2	2.724	14.6	17	NP	NP	Ch
O	27.0 - 27.92	SPT	SM	11.7		12.3				
P	32.0 - 33.5	SPT	SP-SM	12.6		10.4	20	NP	NP	
Q	38.0 - 39.5	SPT	SP-SM	11.2		11.8	18	NP	NP	
R	43.0 - 44.5	SPT	SC	14.8	2.694	21.7	28	17	11	Ch
S	48.0 - 48.75	SPT	SC	14.4		26.6	42	21	21	
T	53.0 - 53.42	SPT	GM	11.9		14.4				
U	58.0 - 58.75	SPT	CL	18.4	2.702	53.8	28	17	11	
V	63.0 - 64.5	SPT	SM	16.2		23.0	52	29	23	

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SUMMARY OF TEST RESULTS
N.D.O.T. GEOTECHNICAL SECTION

Boring No. WS2
I-15 @ Warm Springs Interchange, SR 160 Project, Phase 3
E.A. No. 72495

SAMPLE NO.	SAMPLE DEPTH (feet)	SAMPLER TYPE	SOIL GROUP	W%	G	% PASS #200	LL %	PL %	PI %	OTHER TESTS CONDUCTED
W	68.0 - 69.1	SPT	GM	10.9		14.5				
X	73.0 - 74.5	SPT	SM	21.0		40.0	55	31	24	
Y	78.0 - 79.5	SPT	CH	19.4	2.715	63.5	50	22	28	Ch
Z	83.0 - 84.5	SPT	CL	16.8	2.712	60.9	34	16	18	
AA	88.0 - 89.5	SPT	CL	23.5	2.742	75.2	47	18	29	
AB	93.0 - 94.5	SPT	CL	23.0		55.2	31	17	14	
AC	98.0 - 99.5	SPT	SC	12.6	2.742	22.2	50	26	24	
AD	103.0 - 104.25	SPT	SC	10.7		15.7	30	20	10	
AE	108.0 - 109.0	SPT	SM	10.3		19.1				Ch

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SUMMARY OF TEST RESULTS
N.D.O.T. GEOTECHNICAL SECTION

Boring No. WS3
I-15 @ Warm Springs Interchange, SR 160 Project, Phase 3
E.A. No. 72495

SAMPLE NO.	SAMPLE DEPTH (feet)	SAMPLER TYPE	SOIL GROUP	W%	G	% PASS #200	LL %	PL %	PI %	OTHER TESTS CONDUCTED
A	2.0 - 3.5	SPT	SM	10.1		31.0	15	NP	NP	
B	3.5 - 5.0	SPT	ML	18.9		54.9	18	14	4	
C	5.0 - 6.5	SPT	SM	18.4		30.9	15	NP	NP	
D	12.0 - 13.21	SPT	GP-GM	5.0		10.5	16	NP	NP	
E	13.5 - 15.0	SPT	SC-SM	9.3	2.685	21.4	20	14	6	
F	15.0 - 16.5	SPT	SC-SM	7.8		12.2	18	14	4	
G	17.0 - 18.5	SPT	SC-SM	11.0		19.7	23	16	7	
H	18.5 - 20.0	SPT	SC	11.1		21.7	32	16	16	
I	20.5 - 22.0	SPT	ML	16.0		69.4				
J	22.0 - 22.71	SPT	SC	19.3		32.9	28	18	10	
K	24.5 - 26.0	SPT	ML	14.1		58.2	21	NP	NP	Ch

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SUMMARY OF TEST RESULTS
N.D.O.T. GEOTECHNICAL SECTION

Boring No. WS3
I-15 @ Warm Springs Interchange, SR 160 Project, Phase 3
E.A. No. 72495

SAMPLE NO.	SAMPLE DEPTH (feet)	SAMPLER TYPE	SOIL GROUP	W%	G	% PASS #200	LL %	PL %	PI %	OTHER TESTS CONDUCTED
L	27.0 - 28.5	SPT	CL	12.6		53.2	31	14	17	
M	30.0 - 31.0	SPT	SC-SM	12.3		17.9	20	16	4	
N	32.0 - 32.75	SPT	SM	9.4		14.8				
O	37.0 - 38.5	SPT	SC	16.6		30.2	29	20	9	
P	42.0 - 43.5	SPT	CL	20.6		67.2	46	16	30	
Q	47.0 - 48.5	SPT	SC	22.9	2.67	38.6	63	25	38	
R	52.0 - 53.38	SPT	GC	13.1		23.8	51	25	26	
S	57.0 - 58.5	SPT	CH	18.7		57.1	54	22	32	Ch
T	62.0 - 63.5	SPT	SC	18.4		29.0	57	27	30	
U	67.0 - 68.5	SPT	SC	13.9		19.9	42	24	18	
V	72.0 - 73.5	SPT	SC	16.2		30.3	63	29	34	

CMS = California Modified Sampler 2.4 inch I.D.
SPT = Standard Penetration Test using 1.38 inch I.D. Split Spoon Sampler
CS = Continuous Sample 3.2 inch I.D.
RC = Rock Core
PB = Pitcher Barrel
CPT = Cone Penetration Test
TP = Test Pit
P = Pushed, not driven
R = Refusal
Sh = Shelby Tube 2.87 inch I.D.

U = Unconfined Compressive
UU = Unconsolidated Undrained
CD = Consolidated Drained
CU = Consolidated Undrained
DS = Direct Shear
φ = Friction Angle
C = Cohesion
N = Number of blows to drive a 1.38 inch I.D. split spoon sampler a distance of 1 foot with a 140 lb hammer dropped 2.5 feet
N = Field SPT N = Ncms x 0.62

H = Hydrometer
S = Sieve
G = Specific Gravity
PI = Plasticity Index
LL = Liquid Limit
PL = Plastic Limit
NP = Non-Plastic
OC = Consolidation
Ch = Chemical
RV = R - Value

CM = Compaction
E = Swell/Pressure on Expansive Soils
SL = Shrinkage Limit
UW= Unit Weight
W = Moisture Content
K = Permeability
O = Organic Content
D = Dispersive
RQD = Rock Quality Designation
X = X-Ray Defraction

SUMMARY OF TEST RESULTS
N.D.O.T. GEOTECHNICAL SECTION

Boring No. WS3
I-15 @ Warm Springs Interchange, SR 160 Project, Phase 3
E.A. No. 72495

SAMPLE NO.	SAMPLE DEPTH (feet)	SAMPLER TYPE	SOIL GROUP	W%	G	% PASS #200	LL %	PL %	PI %	OTHER TESTS CONDUCTED
W	77.0 -78.5	SPT	CL	18.0		50.4	49	23	26	
X	82.0 - 83.5	SPT	CL	25.7	2.768	73.6	40	19	21	
Y	87.0 - 88.5	SPT	CL	22.4		76.5	37	16	21	Ch
Z	92.0 - 93.5	SPT	CL	25.1	2.673	65.6	38	18	20	
AA	97.0 - 98.5	SPT	SC	15.3		22.9	60	28	32	Ch
AB	102.0 - 103.42	SPT	SC-SM	10.3		15.9	22	17	5	
AC	107.0 - 107.96	SPT	SM	12.4		18.2				
AD	112.0 - 113.5	SPT	CL	18.8		62.4	30	14	16	

CMS = California Modified Sampler 2.4 inch I.D.
SPT = Standard Penetration Test using 1.38 inch I.D. Split Spoon Sampler
CS = Continuous Sample 3.2 inch I.D.
RC = Rock Core
PB = Pitcher Barrel
CPT = Cone Penetration Test
TP = Test Pit
P = Pushed, not driven
R = Refusal
Sh = Shelby Tube 2.87 inch I.D.

U = Unconfined Compressive
UU = Unconsolidated Undrained
CD = Consolidated Drained
CU = Consolidated Undrained
DS = Direct Shear
φ = Friction Angle
C = Cohesion
N = Number of blows to drive a 1.38 inch I.D. split spoon sampler a distance of 1 foot with a 140 lb hammer dropped 2.5 feet
N = Field SPT N = Ncms x 0.62

H = Hydrometer
S = Sieve
G = Specific Gravity
PI = Plasticity Index
LL = Liquid Limit
PL = Plastic Limit
NP = Non-Plastic
OC = Consolidation
Ch = Chemical
RV = R - Value

CM = Compaction
E = Swell/Pressure on Expansive Soils
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UW= Unit Weight
W = Moisture Content
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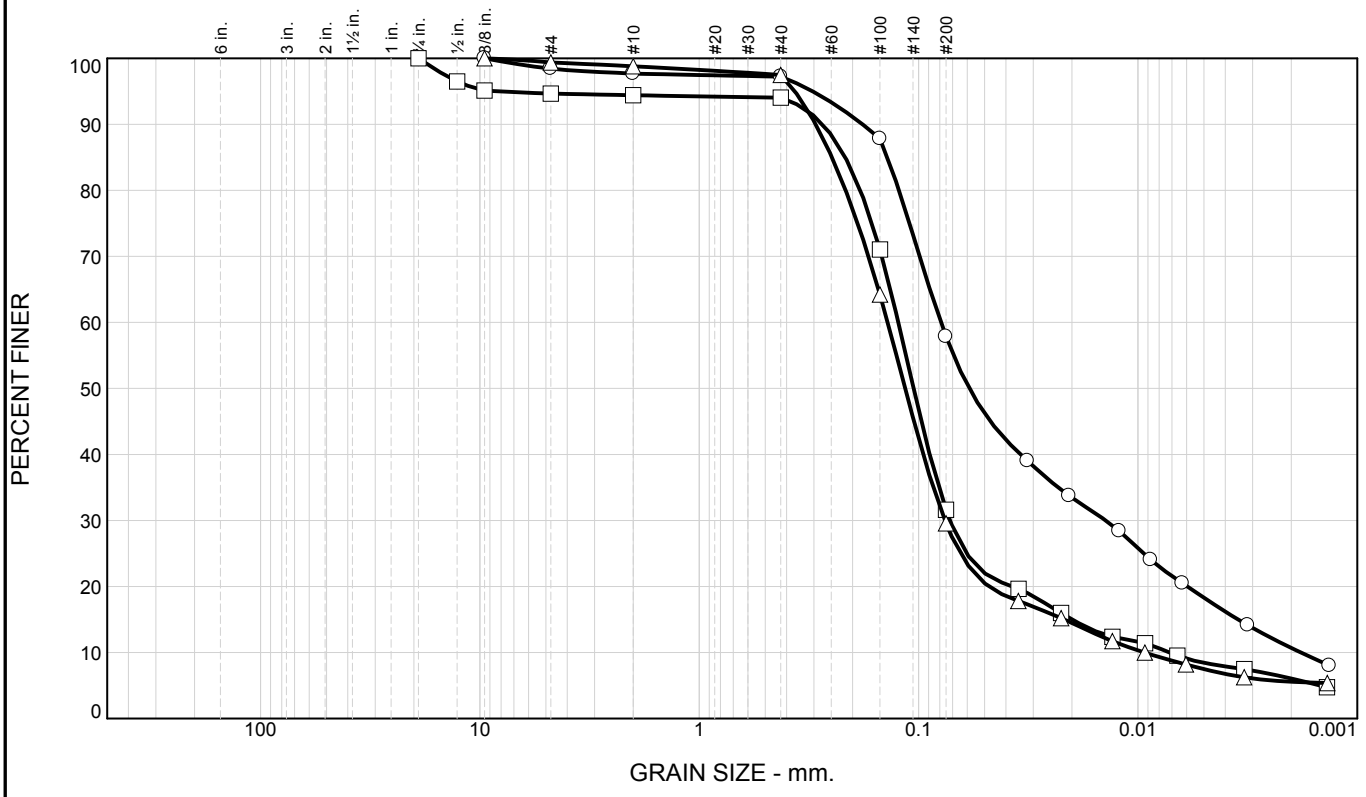
Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	1.6	40.5	39.6	18.3	CL	A-4(2)	15	23
□	0.0	5.3	63.1	23.2	8.4	SM		NP	
△	0.0	0.6	69.8	22.1	7.5	SM		NP	

SIEVE inches size	PERCENT FINER ○	□	△
3/4"		100.0	
1/2"		96.5	
3/8"	100.0	95.1	100.0
	GRAIN SIZE		
D_{60}	0.0791	0.1236	0.1383
D_{30}	0.0140	0.0719	0.0759
D_{10}	0.0018	0.0072	0.0093
	COEFFICIENTS		
C_c	1.38	5.82	4.46
C_u	43.73	17.19	14.80

SIEVE number size	PERCENT FINER ○	□	△
#4	98.4	94.7	99.4
#10	97.7	94.4	98.8
#40	97.2	94.0	97.5
#100	87.8	71.0	64.2
#200	57.9	31.6	29.6

Material Description
○ Sandy lean clay

□ Silty sand

△ Silty sand

REMARKS:
○

□

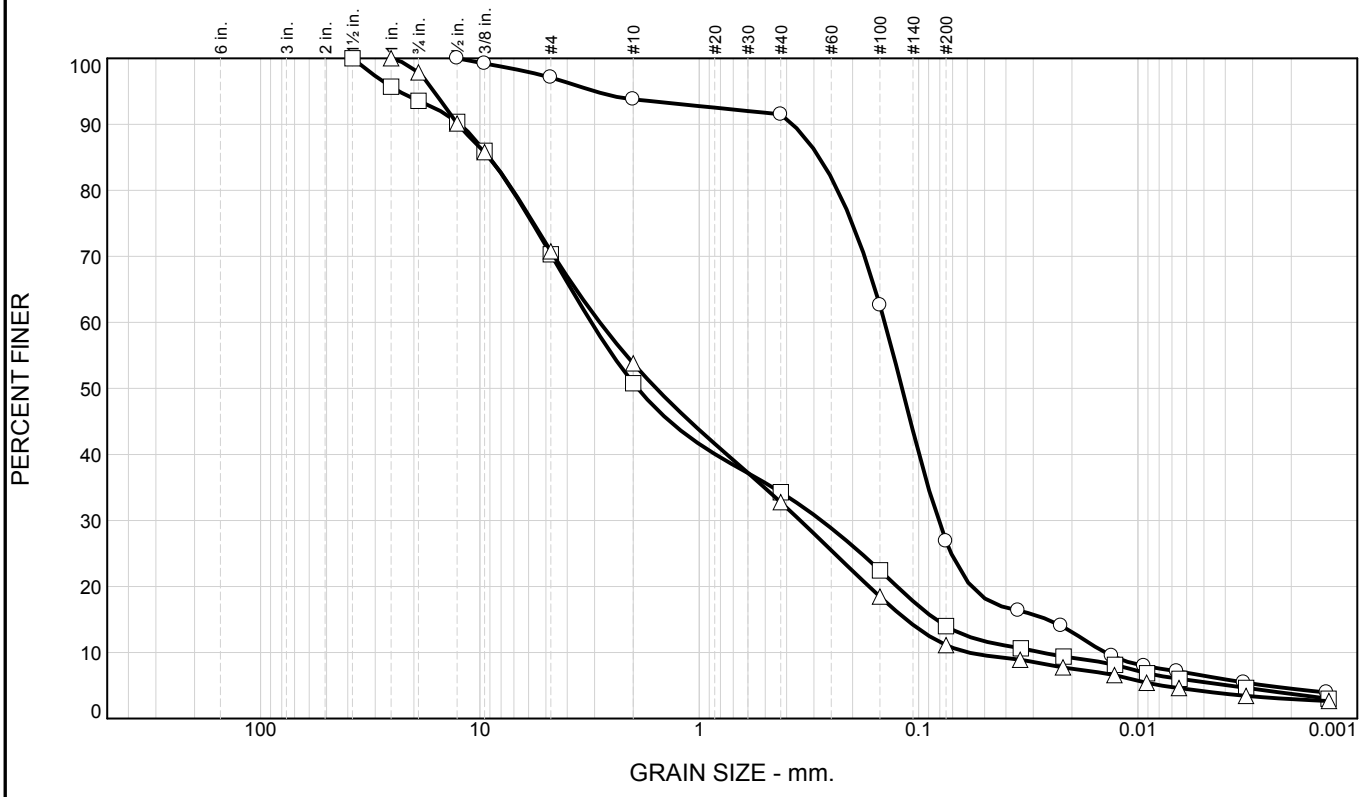
△

○ Location: Boring WS1, sample: a Depth: 0.61 - 1.07m Sample Number: WS1 - a
□ Location: Boring WS1, sample: b Depth: 1.07 - 1.52m Sample Number: WS1 - b
△ Location: Boring WS1, sample: c Depth: 1.52 - 1.98m Sample Number: WS1 - c

NEVADA DEPARTMENT OF TRANSPORTATION

Client:
Project: I-15 @ Warm Springs Interchange
Project No.: 72495 Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	2.9	70.2	20.4	6.5	SM		NP	
□	0.0	29.7	56.3	8.5	5.5	SM	A-1-b	16	19
△	0.0	29.2	59.7	7.0	4.1	SP-SM		NP	

SIEVE inches size	PERCENT FINER ○	□	△
1.5"		100.0	
1"		95.7	100.0
3/4"		93.6	97.9
1/2"	100.0	90.4	90.1
3/8"	99.2	86.0	85.8
	GRAIN SIZE		
D_{60}	0.1425	3.1064	2.8410
D_{30}	0.0811	0.2777	0.3463
D_{10}	0.0141	0.0274	0.0592
	COEFFICIENTS		
C_c	3.27	0.90	0.71
C_u	10.10	113.21	48.00

SIEVE number size	PERCENT FINER ○	□	△
#4	97.1	70.3	70.8
#10	93.8	50.8	53.8
#40	91.5	34.3	32.8
#100	62.6	22.4	18.5
#200	26.9	14.0	11.1

Material Description

○ Silty sand

□ Silty sand with gravel

△ Poorly graded sand with silt and gravel

REMARKS:

○

□

△

○ Location: Boring WS1, sample: e Depth: 2.44 - 2.90m Sample Number: WS1 - e

□ Location: Boring WS1, sample: f Depth: 2.90 - 3.35m Sample Number: WS1 - f

△ Location: Boring WS1, sample: g Depth: 3.35 - 3.81m Sample Number: WS1 - g

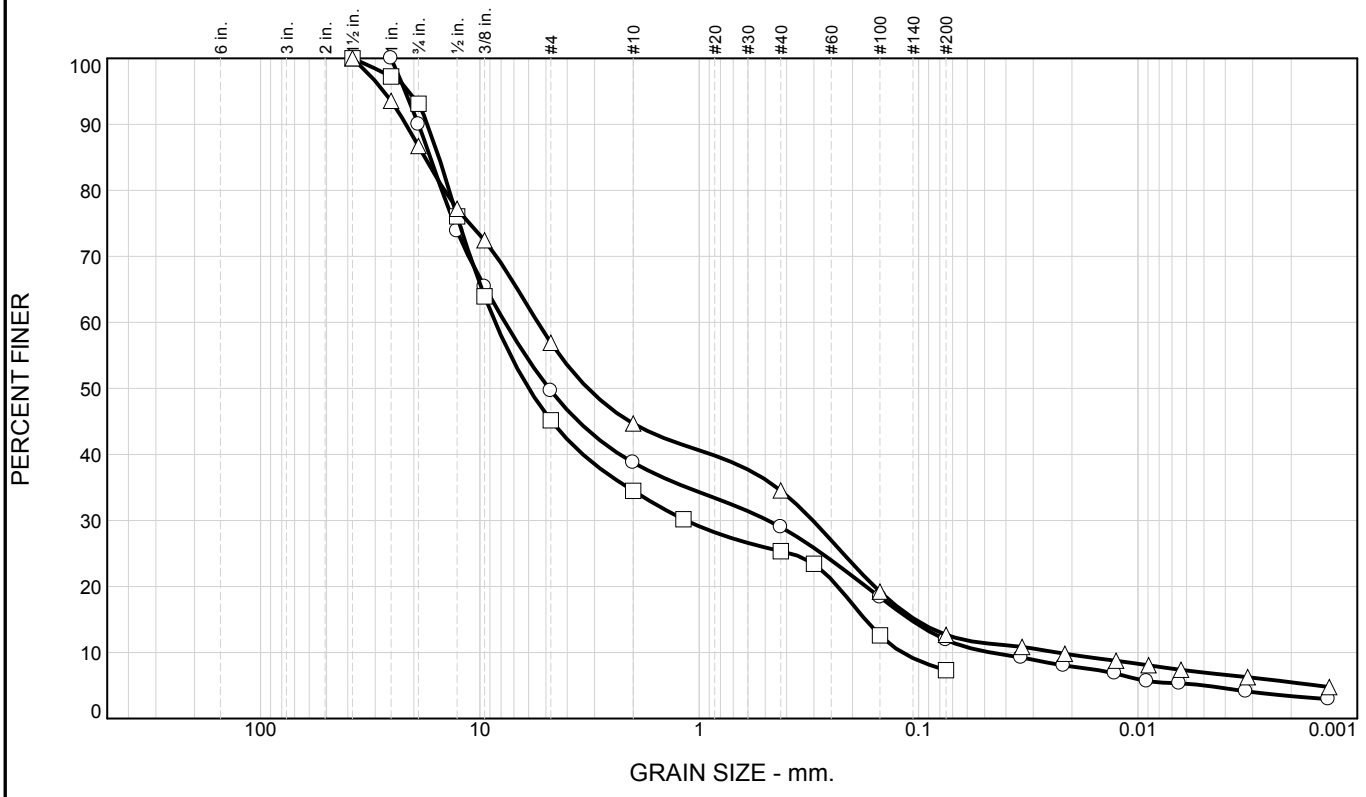
NEVADA DEPARTMENT OF TRANSPORTATION

Client:

Project: I-15 @ Warm Springs Interchange

Project No.: 72495 Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	50.4	37.7	6.9	5.0	GP-GM	A-1-a	16	18
□	0.0	54.8	37.9	7.3		GW-GM			
△	0.0	43.1	44.2	5.7	7.0	SC	A-2-6(0)	18	30

SIEVE inches size	PERCENT FINER ○	□	△
1-1/2"		100.0	100.0
1"	100.0	97.2	93.6
3/4"	90.0	93.1	86.7
1/2"	73.8	76.0	77.2
3/8"	65.4	63.9	72.4
	GRAIN SIZE		
D_{60}	7.6836	8.5215	5.4528
D_{30}	0.4850	1.1497	0.3036
D_{10}	0.0469	0.1187	0.0234
	COEFFICIENTS		
C_c	0.65	1.31	0.72
C_u	163.96	71.80	233.21

SIEVE number size	PERCENT FINER ○	□	△
#4	49.6	45.2	56.9
#10	38.8	34.5	44.7
#16		30.2	
#40	29.0	25.3	34.5
#50		23.4	
#100	18.4	12.6	19.2
#200	11.9	7.3	12.7

Material Description

○ Poorly graded gravel with silt and sand

□ Well-graded gravel with silt and sand

△ Clayey sand with gravel

REMARKS:

○

□

△

○ Location: Boring WS1, sample: h Depth: 3.81 - 4.27m Sample Number: WS1 - h

□ Location: Boring WS1, sample: i Depth: 4.27 - 4.72m Sample Number: WS1 - i

△ Location: Boring WS1, sample:j Depth: 4.72 - 5.18m Sample Number: WS1 - j

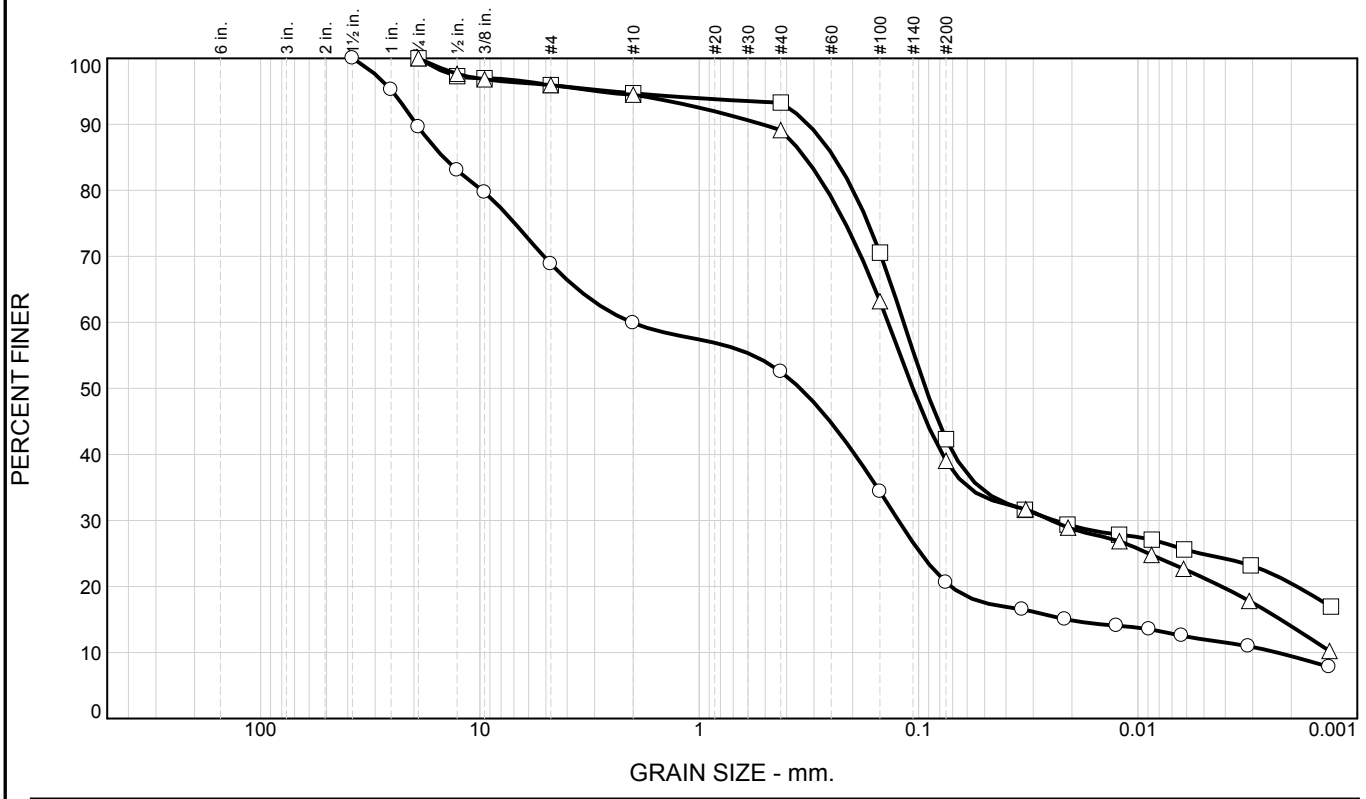
NEVADA DEPARTMENT OF TRANSPORTATION

Client:

Project: I-15 @ Warm Springs Interchange

Project No.: 72495 Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	31.1	48.3	8.6	12.0	SC	A-2-6(0)	18	31
□	0.0	4.1	53.6	17.4	24.9	SC	A-6(2)	15	28
△	0.0	4.1	56.9	17.7	21.3	SC	A-4(0)	13	23

SIEVE inches size	PERCENT FINER ○	□	△
1.5"	100.0		
1"	95.2		
3/4"	89.6	100.0	100.0
1/2"	83.0	97.3	97.6
3/8"	79.7	97.0	96.8
GRAIN SIZE			
D_{60}	2.0322	0.1169	0.1377
D_{30}	0.1236	0.0240	0.0248
D_{10}	0.0023		
COEFFICIENTS			
C_c	3.24		
C_u	875.62		

SIEVE number size	PERCENT FINER ○	□	△
#4	68.9	95.9	95.9
#10	59.9	94.7	94.5
#40	52.5	93.3	89.1
#100	34.4	70.6	63.2
#200	20.6	42.3	39.0

Material Description
○ Clayey sand with gravel
□ Clayey sand
△ Clayey sand

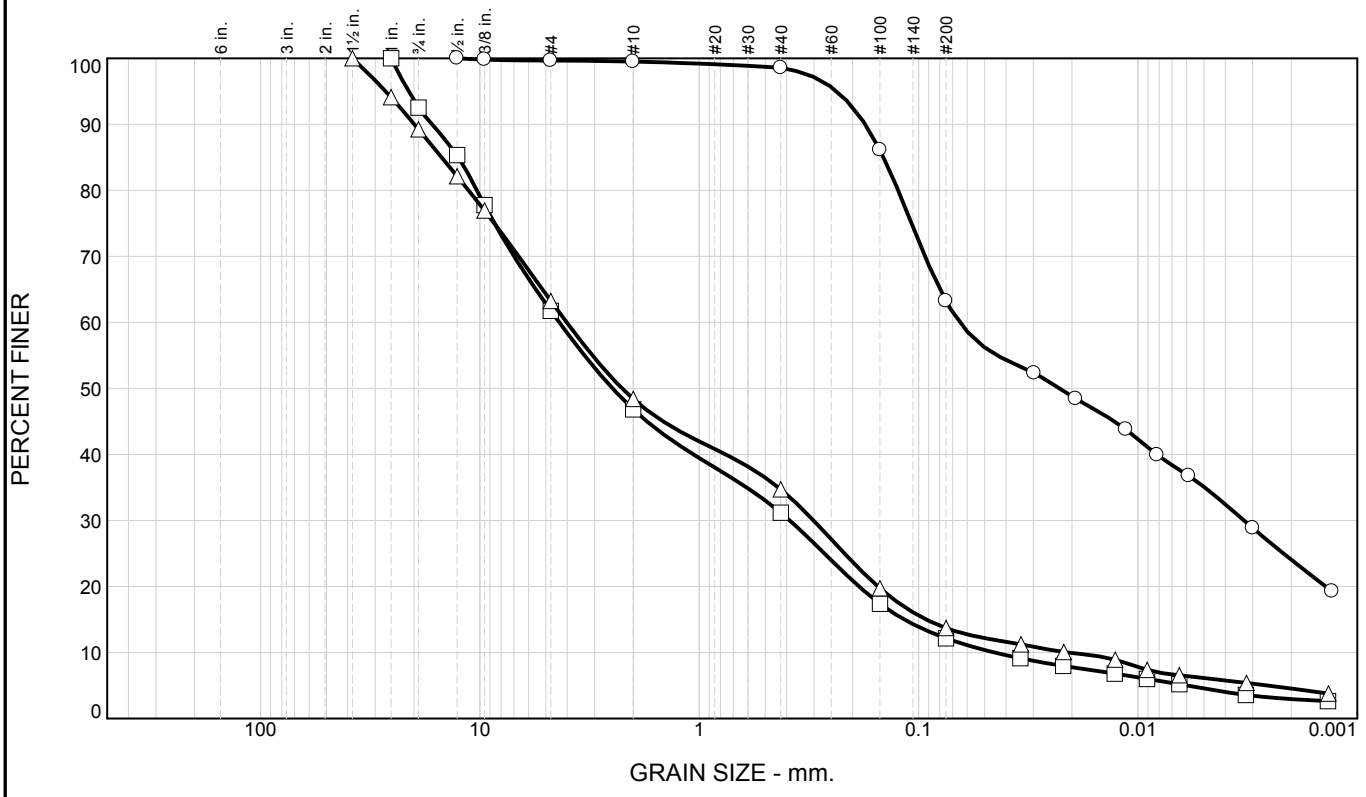
REMARKS:
○
□
△

○ Location: Boring WS1, sample: k Depth: 5.18 - 5.64m Sample Number: WS1 - k
□ Location: Boring WS1, sample: l Depth: 5.64 - 6.10m Sample Number: WS1 - l
△ Location: Boring WS1, sample: m Depth: 6.10 - 6.55m Sample Number: WS1 - m

NEVADA DEPARTMENT OF TRANSPORTATION

Client:
Project: I-15 @ Warm Springs Interchange
Project No.: 72495 Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	0.3	36.5	28.1	35.1	CL	A-6(9)	12	32
□	0.0	38.2	49.6	7.6	4.6	SM		NP	
△	0.0	36.8	49.5	7.6	6.1	SC	A-2-4(0)	15	24

SIEVE inches size	PERCENT FINER ○	□	△
1.5"			100.0
1"		100.0	94.1
3/4"		92.5	89.2
1/2"	100.0	85.3	82.1
3/8"	99.8	77.8	76.9
	GRAIN SIZE		
D_{60}	0.0650	4.3475	4.0239
D_{30}	0.0033	0.3867	0.3012
D_{10}		0.0451	0.0210
	COEFFICIENTS		
C_c		0.76	1.07
C_u		96.42	191.66

SIEVE number size	PERCENT FINER ○	□	△
#4	99.7	61.8	63.2
#10	99.5	46.8	48.4
#40	98.6	31.2	34.7
#100	86.1	17.4	19.7
#200	63.2	12.2	13.7

Material Description
○ Sandy lean clay
□ Silty sand with gravel
△ Clayey sand with gravel

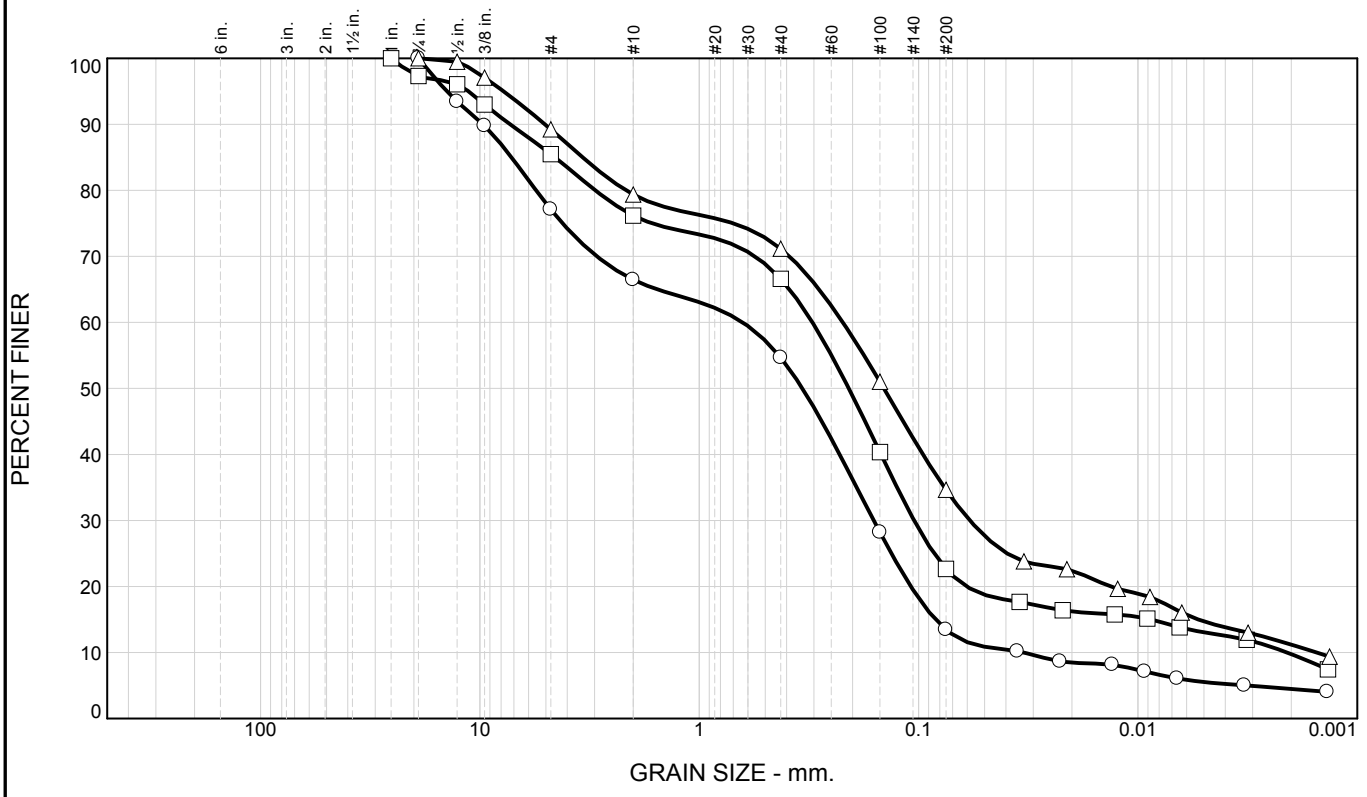
REMARKS:
○
□
△

○ Location: Boring WS1, sample: n Depth: 6.55 - 7.01m Sample Number: WS1 - n
□ Location: Boring WS1, sample: o Depth: 8.23 - 8.69m Sample Number: WS1 - o
△ Location: Boring WS1, sample: p Depth: 9.75 - 10.21m Sample Number: WS1 - p

NEVADA DEPARTMENT OF TRANSPORTATION

Client:
Project: I-15 @ Warm Springs Interchange
Project No.: 72495 Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	22.9	63.6	8.0	5.5	SM		NP	
□	0.0	14.5	62.8	9.6	13.1	SC	A-2-4(0)	17	27
△	0.0	10.8	54.6	19.9	14.7	SC	A-2-7(5)	31	64

SIEVE inches size	PERCENT FINER ○	□	△
1"		100.0	
3/4"	100.0	97.3	100.0
1/2"	93.4	96.1	99.5
3/8"	89.8	93.0	97.1
	GRAIN SIZE		
D_{60}	0.6334	0.3047	0.2213
D_{30}	0.1601	0.1048	0.0584
D_{10}	0.0333	0.0021	0.0015
	COEFFICIENTS		
C_c	1.22	17.26	10.06
C_u	19.04	145.88	144.37

SIEVE number size	PERCENT FINER ○	□	△
#4	77.1	85.5	89.2
#10	66.5	76.2	79.4
#40	54.7	66.6	71.2
#100	28.2	40.4	51.0
#200	13.5	22.7	34.6

Material Description

○ Silty sand with gravel

□ Clayey sand

△ Clayey sand

REMARKS:

○

□

△

○ Location: Boring WS1, sample: q Depth: 11.28 - 11.73m Sample Number: WS1 - q

□ Location: Boring WS1, sample: r Depth: 12.80 - 13.26m Sample Number: WS1 - r

△ Location: Boring WS1, sample: s Depth: 14.33 - 14.78m Sample Number: WS1 - s

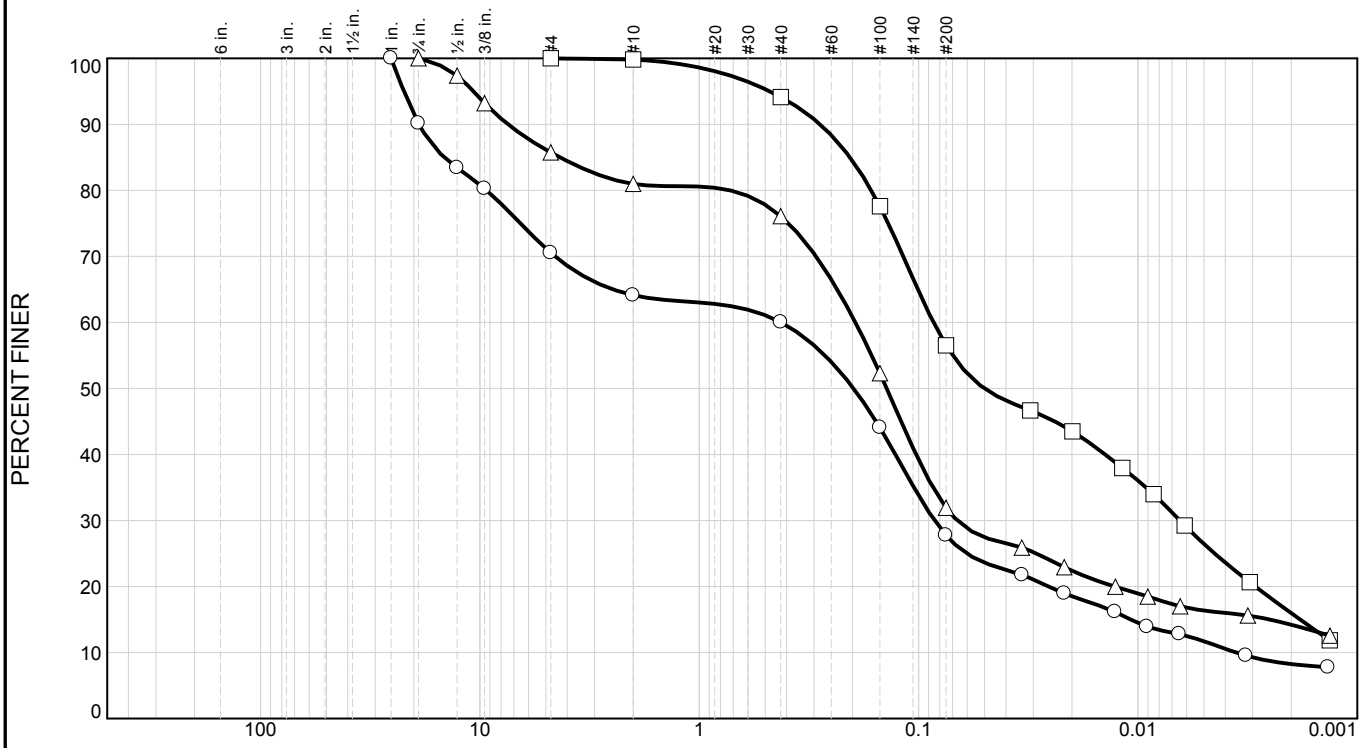
NEVADA DEPARTMENT OF TRANSPORTATION

Client:

Project: I-15 @ Warm Springs Interchange

Project No.: 72495 Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	29.5	42.7	16.1	11.7	SC	A-2-7(2)	27	53
□	0.0	0.0	43.5	30.1	26.4	CL	A-7-6(10)	21	44
△	0.0	14.3	53.8	15.5	16.4	SC	A-2-7(2)	20	44

SIEVE inches size	PERCENT FINER ○	□	△
1"	100.0		
3/4"	90.1		100.0
1/2"	83.4		97.4
3/8"	80.3		93.2
	GRAIN SIZE		
D_{60}	0.4238	0.0856	0.1940
D_{30}	0.0846	0.0064	0.0667
D_{10}	0.0036		
	COEFFICIENTS		
C_c	4.73		
C_u	118.67		

SIEVE number size	PERCENT FINER ○	□	△
#4	70.5	100.0	85.7
#10	64.1	99.8	81.0
#40	60.0	94.1	76.1
#100	44.1	77.6	52.3
#200	27.8	56.5	31.9

Material Description
○ Clayey sand with gravel
□ Sandy lean clay
△ Clayey sand

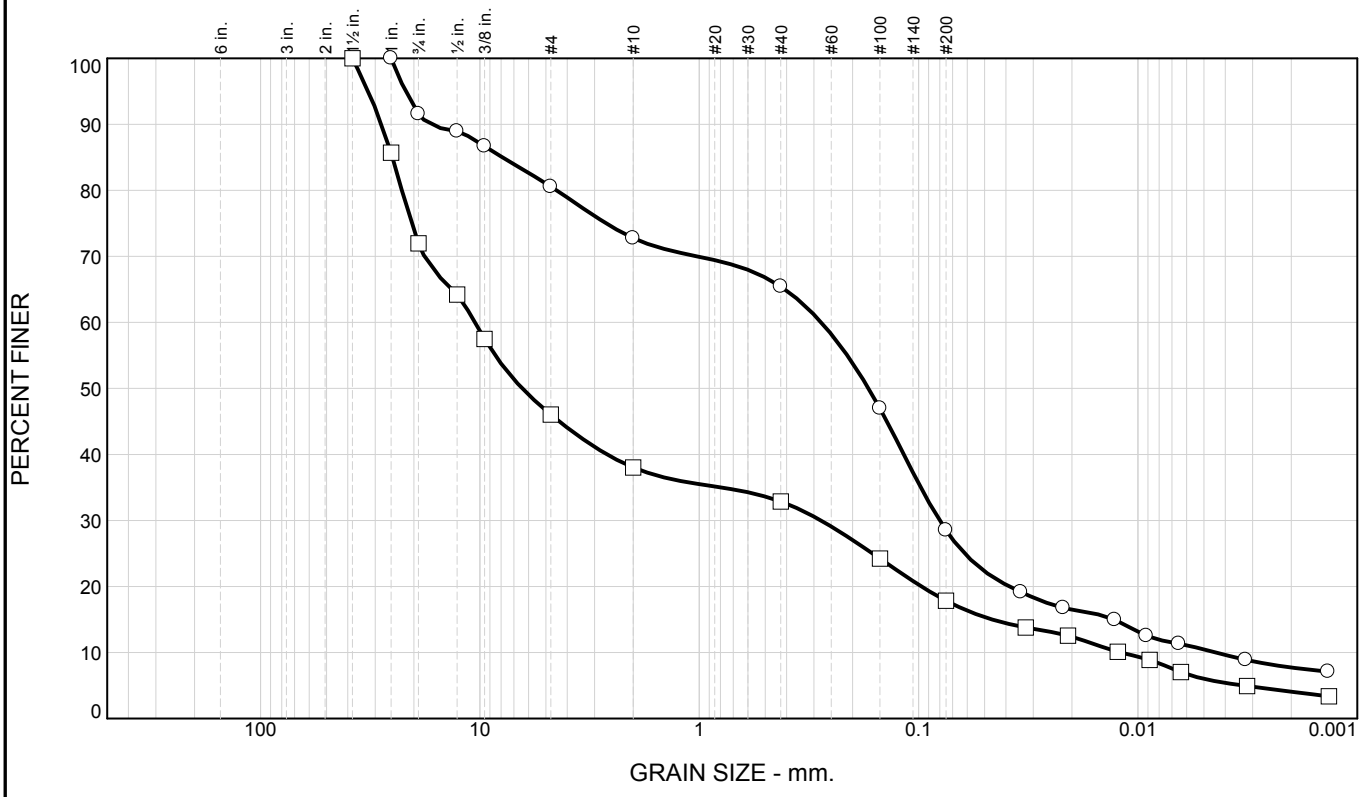
REMARKS:
○
□
△

○ Location: Boring WS1, sample: t Depth: 15.85 - 16.21m Sample Number: WS1 - t
□ Location: Boring WS1, sample: u Depth: 17.37 - 17.83m Sample Number: WS1 - u
△ Location: Boring WS1, sample: v Depth: 18.90 - 19.35m Sample Number: WS1 - v

NEVADA DEPARTMENT OF TRANSPORTATION

Client:
Project: I-15 @ Warm Springs Interchange
Project No.: 72495 Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	19.4	52.1	18.0	10.5	SC		21	40
□	0.0	54.0	28.2	11.8	6.0	GM			

SIEVE inches size	○	□
1.5"		100.0
1"	100.0	85.7
3/4"	91.6	72.0
1/2"	88.9	64.2
3/8"	86.7	57.5
GRAIN SIZE		
D_{60}	0.2777	10.5334
D_{30}	0.0802	0.2790
D_{10}	0.0044	0.0120
COEFFICIENTS		
C_c	5.26	0.61
C_u	63.04	876.65

SIEVE number size	○	□
#4	80.6	46.0
#10	72.8	38.0
#40	65.4	32.9
#100	47.0	24.2
#200	28.5	17.8

Material Description
○ Clayey sand with gravel

□ Silty gravel with sand

REMARKS:
○

□

○ Location: Boring WS1, sample: w Depth: 20.42 - 20.88m Sample Number: WS1 - w

□ Location: Boring WS1, sample: x Depth: 21.95 - 22.40m Sample Number: WS1 - x

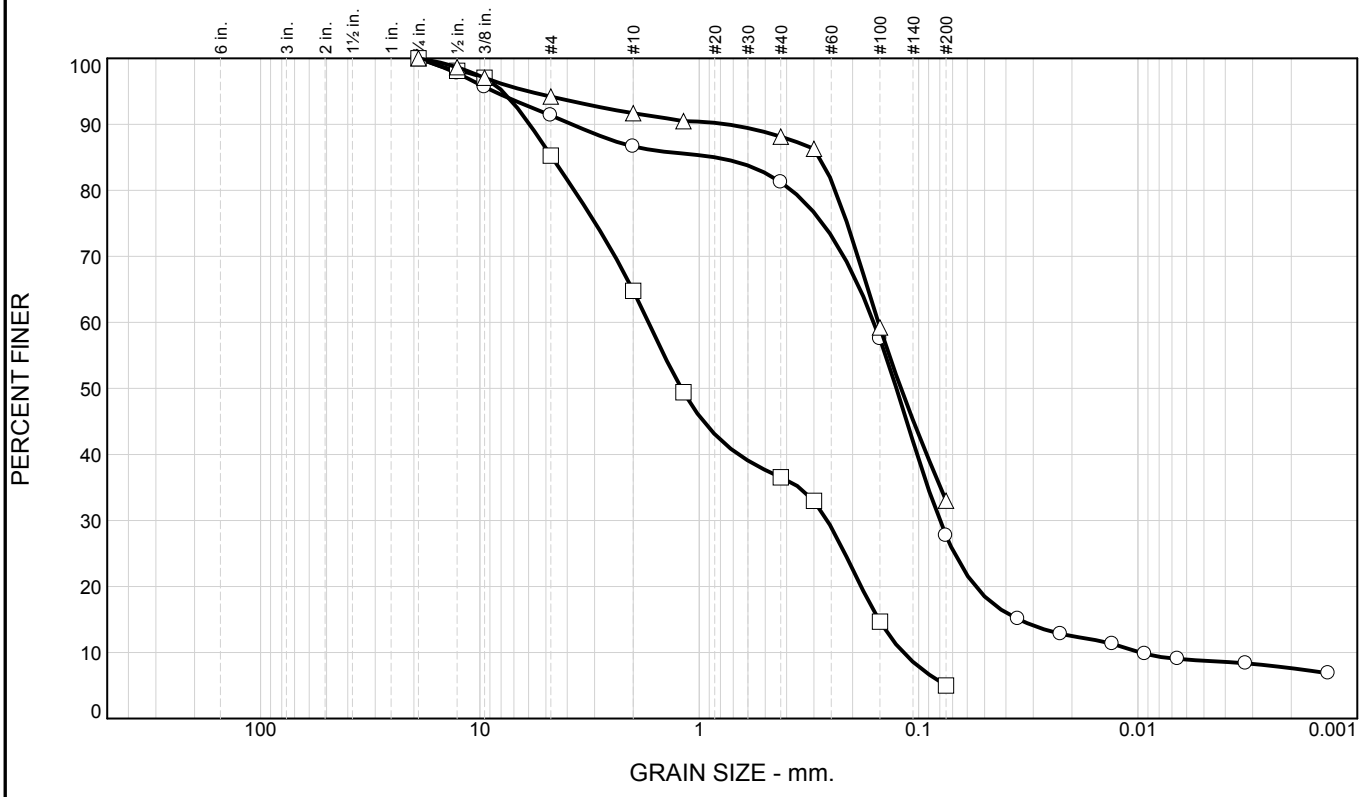
NEVADA DEPARTMENT OF TRANSPORTATION

Client:

Project: I-15 @ Warm Springs Interchange

Project No.: 72495 Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	8.6	63.7	18.9	8.8	SM		NP	
□	0.0	14.7	80.3	5.0		SP-SM			
△	0.0	5.8	61.2	33.0		SM		NP	

SIEVE inches size	PERCENT FINER ○	□	△
3/4"	100.0	100.0	100.0
1/2"	97.7	98.1	98.7
3/8"	95.6	97.1	97.1
	GRAIN SIZE		
D_{60}	0.1598	1.7046	0.1526
D_{30}	0.0800	0.2605	
D_{10}	0.0098	0.1175	
	COEFFICIENTS		
C_c	4.09	0.34	
C_u	16.32	14.51	

SIEVE number size	PERCENT FINER ○	□	△
#4	91.4	85.3	94.2
#10	86.6	64.8	91.7
#16		49.4	90.5
#40	81.2	36.5	88.1
#50		33.0	86.3
#100	57.5	14.7	59.2
#200	27.7	5.0	33.0

Material Description
○ Silty sand
□ Poorly graded sand with silt
△ Silty sand

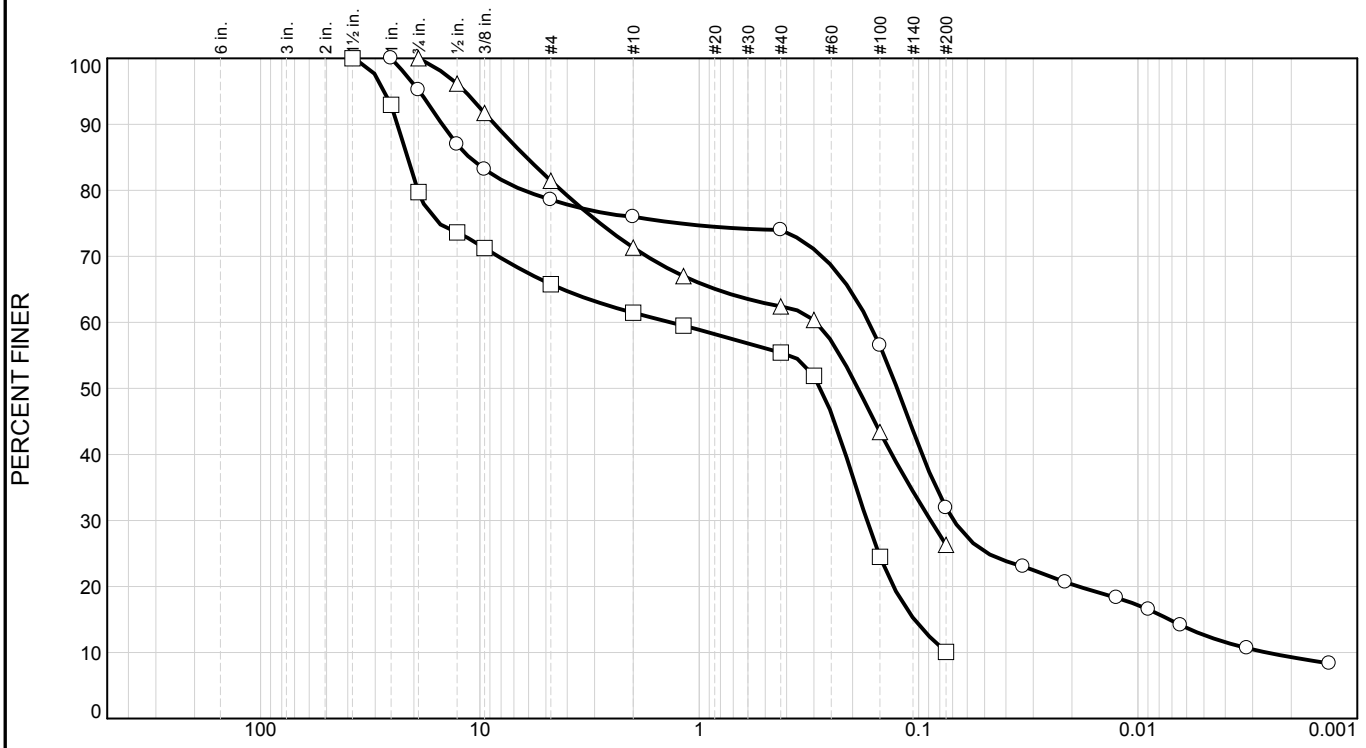
REMARKS:
○
□
△

○ Location: Boring WS2, sample: a Depth: 0.61 - 1.07m Sample Number: WS2 - a
□ Location: Boring WS2, sample: b Depth: 1.07 - 1.52m Sample Number: WS2 - b
△ Location: Boring WS2, sample: c Depth: 1.52 - 1.98m Sample Number: WS2 - c

NEVADA DEPARTMENT OF TRANSPORTATION

Client:
Project: I-15 @ Warm Springs Interchange
Project No.: 72495 Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	21.4	46.7	19.3	12.6	SC-SM	A-2-4(0)	16	21
□	0.0	34.2	55.7	10.1		SP-SM			
△	0.0	18.5	55.2	26.3		SC-SM	A-2-4(0)	14	19

SIEVE inches size	PERCENT FINER ○	□	△
1-1/2"		100.0	
1"	100.0	93.0	
3/4"	95.2	79.7	100.0
1/2"	87.0	73.6	96.2
3/8"	83.2	71.3	91.7
	GRAIN SIZE		
D_{60}	0.1682	1.3478	0.2918
D_{30}	0.0692	0.1720	0.0880
D_{10}	0.0026		
	COEFFICIENTS		
C_c	11.00		
C_u	64.93		

SIEVE number size	PERCENT FINER ○	□	△
#4	78.6	65.8	81.5
#10	76.0	61.5	71.3
#16		59.5	67.0
#40	74.0	55.4	62.4
#50		51.9	60.4
#100	56.5	24.5	43.4
#200	31.9	10.1	26.3

Material Description

○ Silty, clayey sand with gravel

□ Poorly graded sand with silt and gravel

△ Silty, clayey sand with gravel

REMARKS:

○

□

△

○ Location: Boring WS2, sample: d Depth: 1.98 - 2.44m Sample Number: WS2 - d

□ Location: Boring WS2, sample: e Depth: 2.44 - 2.90m Sample Number: WS2 - e

△ Location: Boring WS2, sample: f Depth: 2.90 - 3.35m Sample Number: WS2 - f

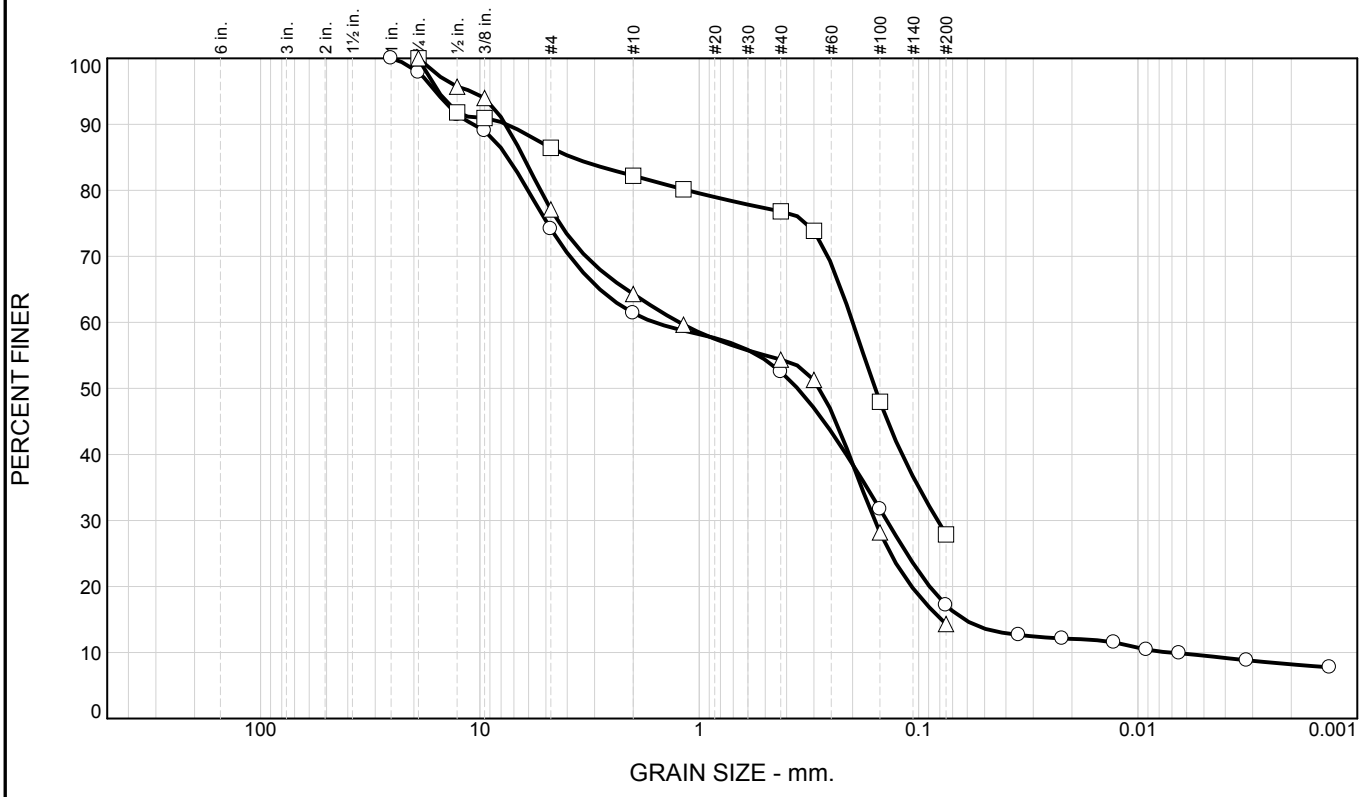
NEVADA DEPARTMENT OF TRANSPORTATION

Client:

Project: I-15 @ Warm Springs Interchange

Project No.: 72495 Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	25.9	56.9	7.7	9.5	SM		NP	
□	0.0	13.6	58.5	27.9		SC-SM		15	19
△	0.0	22.9	62.8	14.3		SM		NP	19

SIEVE inches size	PERCENT FINER ○	□	△
1"	100.0		
3/4"	97.9	100.0	100.0
1/2"	91.4	91.8	95.7
3/8"	89.0	91.0	94.0
	GRAIN SIZE		
D_{60}	1.5972	0.1995	1.2338
D_{30}	0.1397	0.0819	0.1585
D_{10}	0.0071		
	COEFFICIENTS		
C_c	1.71		
C_u	223.67		

SIEVE number size	PERCENT FINER ○	□	△
#4	74.1	86.4	77.1
#10	61.4	82.2	64.3
#16		80.2	59.7
#40	52.5	76.8	54.4
#50		73.9	51.3
#100	31.7	48.0	28.2
#200	17.2	27.9	14.3

Material Description
○ Silty sand with gravel
□ Silty, clayey sand
△ Silty sand with gravel

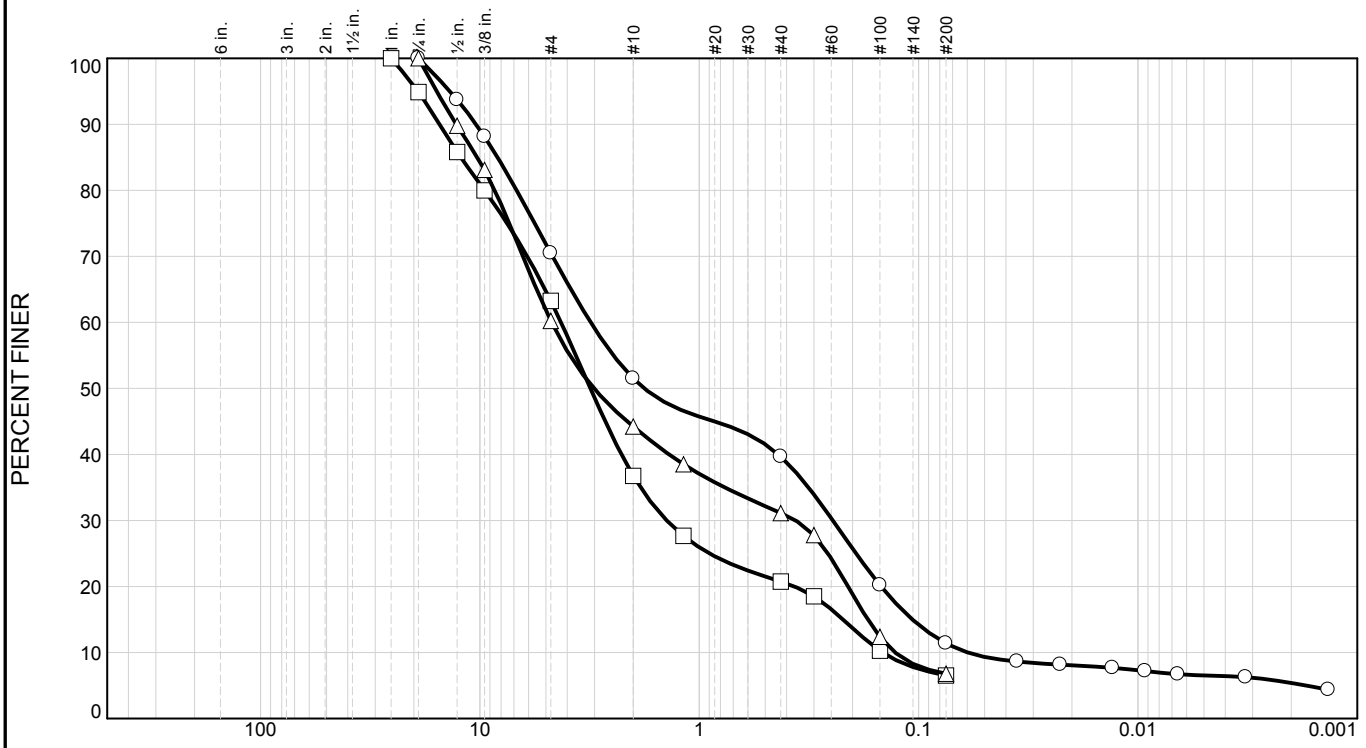
REMARKS:
○
□
△

○ Location: Boring WS2, sample: g Depth: 3.35 - 3.81m Sample Number: WS2 - g
□ Location: Boring WS2, sample: h Depth: 3.81 - 4.27m Sample Number: WS2 - h
△ Location: Boring WS2, sample: i Depth: 4.27 - 4.72m Sample Number: WS2 - i

NEVADA DEPARTMENT OF TRANSPORTATION

Client:
Project: I-15 @ Warm Springs Interchange
Project No.: 72495 Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	29.5	59.1	4.9	6.5	SP-SM		NP	
□	0.0	36.7	56.8	6.5		SP-SM			
△	0.0	39.8	53.4	6.8		SP-SM		NP	19

SIEVE inches size	PERCENT FINER ○	□	△
1"		100.0	
3/4"	100.0	94.9	100.0
1/2"	93.7	85.8	89.8
3/8"	88.1	80.0	83.1
	GRAIN SIZE		
D_{60}	3.1275	4.2688	4.7135
D_{30}	0.2461	1.4082	0.3638
D_{10}	0.0596	0.1459	0.1280
	COEFFICIENTS		
C_c	0.33	3.18	0.22
C_u	52.50	29.26	36.84

SIEVE number size	PERCENT FINER ○	□	△
#4	70.5	63.3	60.2
#10	51.5	36.7	44.2
#16		27.7	38.5
#40	39.7	20.7	31.1
#50		18.5	27.8
#100	20.2	10.3	12.4
#200	11.4	6.5	6.8

Material Description

○ Poorly graded sand with silt and gravel

□ Poorly graded sand with silt and gravel

△ Poorly graded sand with silt and gravel

REMARKS:

○

□

△

○ Location: Boring WS2, sample: j Depth: 4.72 - 5.18m Sample Number: WS2 - j

□ Location: Boring WS2, sample: k Depth: 5.18 - 5.64m Sample Number: WS2 - k

△ Location: Boring WS2, sample: l Depth: 5.64 - 6.1m Sample Number: WS2 - l

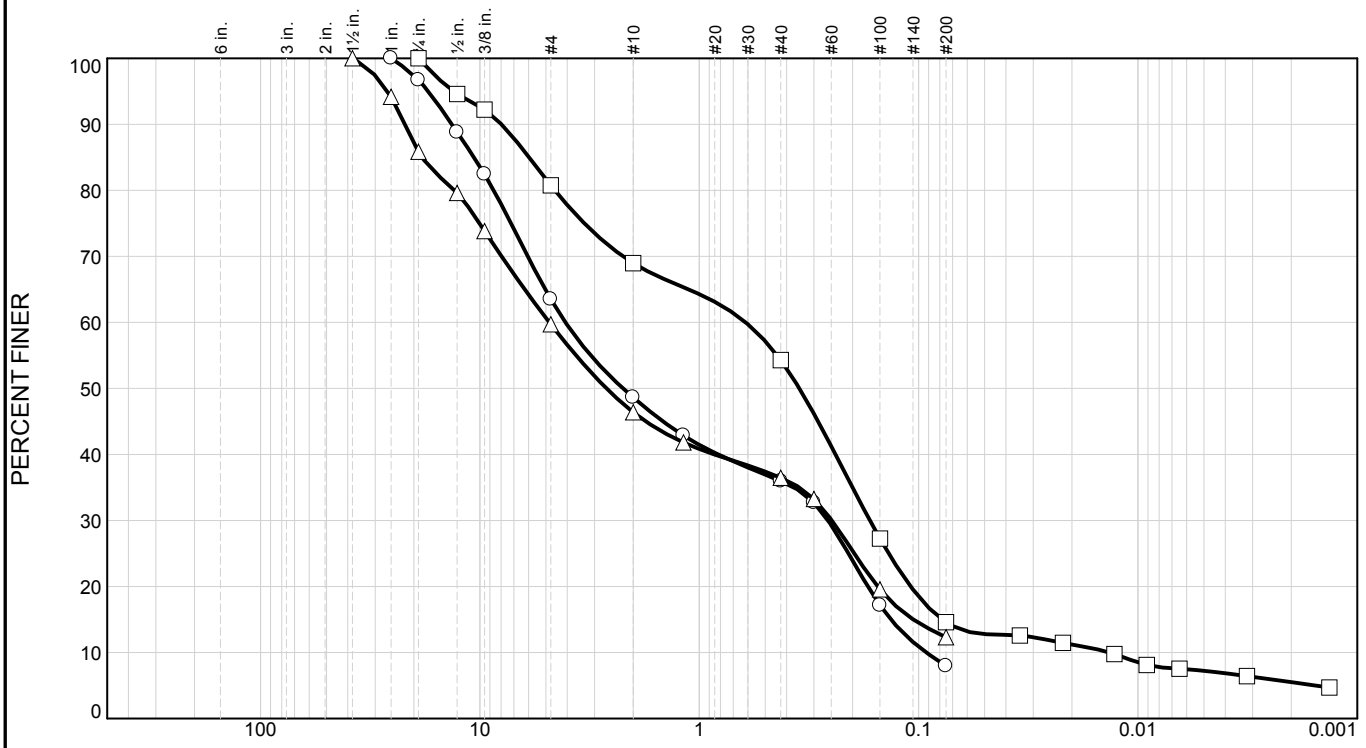
NEVADA DEPARTMENT OF TRANSPORTATION

Client:

Project: I-15 @ Warm Springs Interchange

Project No.: 72495 Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	36.5	55.5	8.0		SP-SM		NP	
□	0.0	19.2	66.2	7.4	7.2	SM		NP	
△	0.0	40.3	47.4	12.3		SM			

SIEVE inches size	PERCENT FINER ○	□	△
1-1/2"			100.0
1"	100.0		94.2
3/4"	96.7	100.0	85.9
1/2"	88.8	94.6	79.6
3/8"	82.4	92.2	73.8
	GRAIN SIZE		
D_{60}	4.0775	0.6142	4.8250
D_{30}	0.2586	0.1667	0.2485
D_{10}	0.0922	0.0135	
	COEFFICIENTS		
C_c	0.18	3.35	
C_u	44.21	45.52	

SIEVE number size	PERCENT FINER ○	□	△
#4	63.5	80.8	59.7
#10	48.6	69.0	46.4
#16	42.9		41.8
#40	35.9	54.3	36.5
#50	32.7		33.2
#100	17.1	27.3	19.6
#200	8.0	14.6	12.3

Material Description

○ Poorly graded sand with silt and gravel

□ Silty sand with gravel

△ Silty sand with gravel

REMARKS:

○

□

△

○ Location: Boring WS2, sample: m Depth: 6.10 - 6.55m Sample Number: WS2 - m

□ Location: Boring WS2, sample: n Depth: 6.55 - 7.01m Sample Number: WS2 - n

△ Location: Boring WS2, sample: o Depth: 8.23 - 8.69m Sample Number: WS2 - o

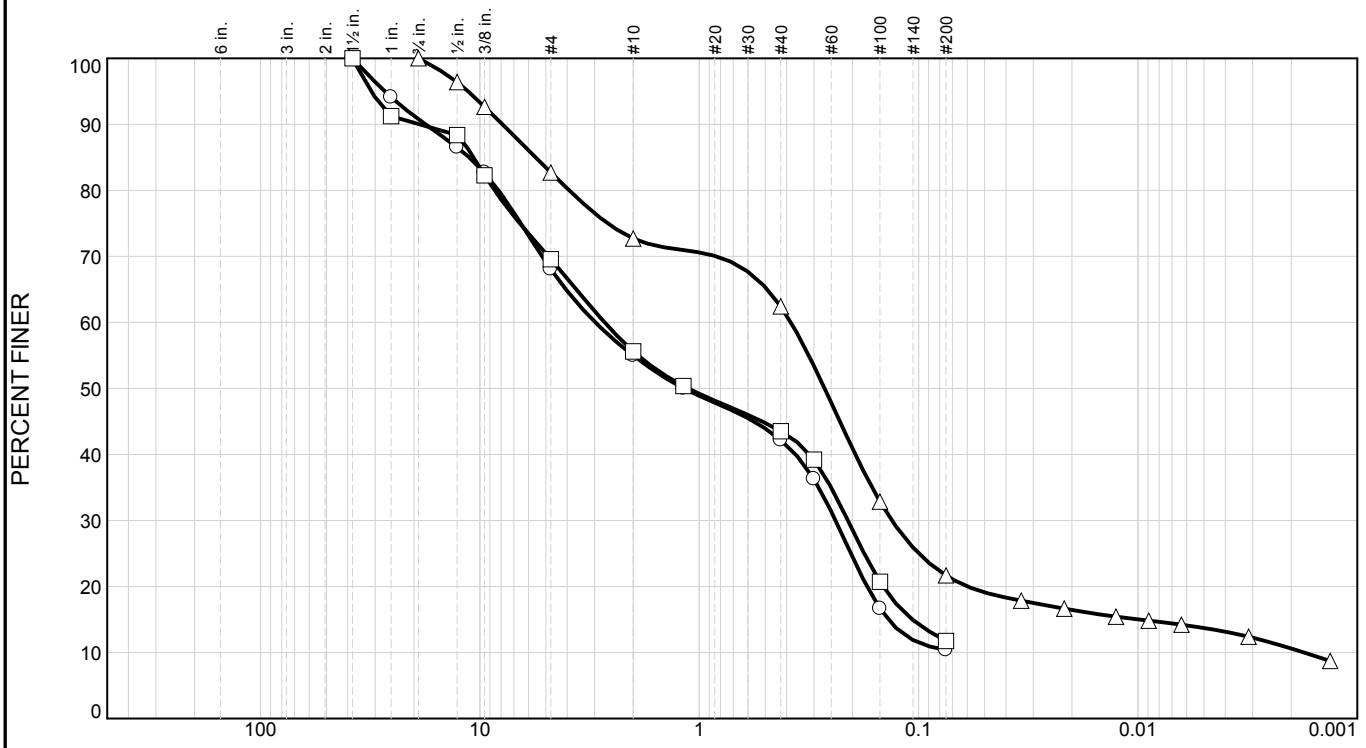
NEVADA DEPARTMENT OF TRANSPORTATION

Client:

Project: I-15 @ Warm Springs Interchange

Project No.: 72495 Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	31.9	57.7	10.4		SP-SM		NP	
□	0.0	30.4	57.9	11.7		SP-SM		NP	
△	0.0	17.3	61.0	8.0	13.7	SC	A-2-6(0)	17	28

SIEVE inches size	PERCENT FINER ○	□	△
1-1/2"	100.0	100.0	
1"	94.1	91.2	
3/4"			100.0
1/2"	86.5	88.4	96.4
3/8"	82.7	82.3	92.7
GRAIN SIZE			
D_{60}	2.9792	2.7018	0.3818
D_{30}	0.2391	0.2100	0.1325
D_{10}			0.0018
COEFFICIENTS			
C_c			26.25
C_u			218.09

SIEVE number size	PERCENT FINER ○	□	△
#4	68.1	69.6	82.7
#10	55.0	55.6	72.7
#16	50.0	50.4	
#40	42.2	43.5	62.4
#50	36.3	39.2	
#100	16.6	20.7	32.8
#200	10.4	11.7	21.7

Material Description

○ Poorly graded sand with silt and gravel

□ Poorly graded sand with silt and gravel

△ Clayey sand with gravel

REMARKS:

○

□

△

○ Location: Boring WS2, sample: p Depth: 9.75 - 10.21m Sample Number: WS2 - p

□ Location: Boring WS2, sample: q Depth: 11.58 - 12.04m Sample Number: WS2 - q

△ Location: Boring WS2, sample: r Depth: 13.11 - 13.56m Sample Number: WS2 - r

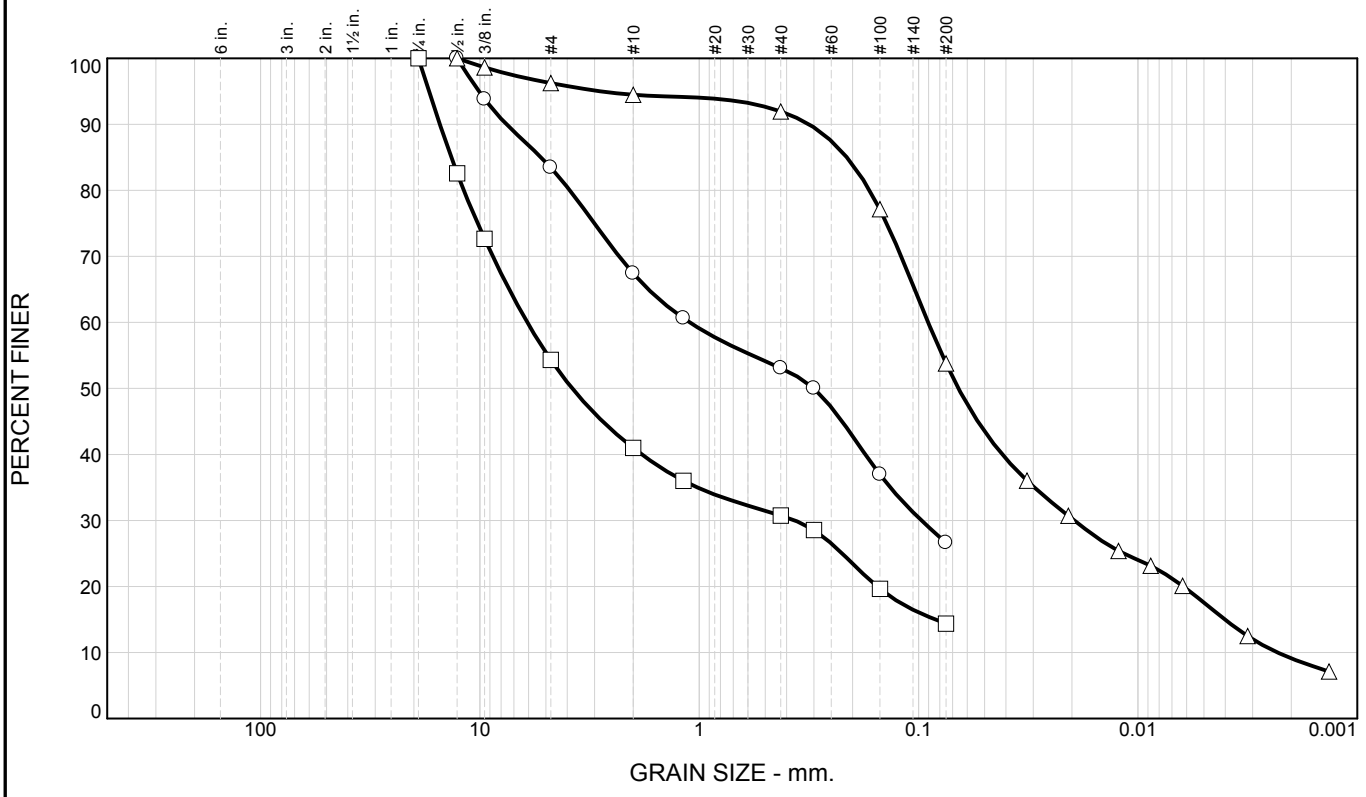
NEVADA DEPARTMENT OF TRANSPORTATION

Client:

Project: I-15 @ Warm Springs Interchange

Project No.: 72495 Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	16.5	56.9	26.6		SC	A-2-7(1)	21	42
□	0.0	45.7	39.9	14.4		GM			
△	0.0	3.8	42.4	36.2	17.6	CL	A-6(3)	17	28

SIEVE inches size	PERCENT FINER ○	□	△
3/4"		100.0	
1/2"	100.0	82.6	100.0
3/8"	93.8	72.7	98.6
	GRAIN SIZE		
D_{60}	1.1059	6.0854	0.0904
D_{30}	0.0970	0.3664	0.0195
D_{10}			0.0023
	COEFFICIENTS		
C_c			1.82
C_u			39.17

SIEVE number size	PERCENT FINER ○	□	△
#4	83.5	54.3	96.2
#10	67.4	41.0	94.5
#16	60.6	36.0	
#40	53.1	30.7	92.0
#50	50.0	28.6	
#100	36.9	19.6	77.1
#200	26.6	14.4	53.8

Material Description

○ Clayey sand with gravel

□ Silty gravel with sand

△ Sandy lean clay

REMARKS:

○

□

△

○ Location: Boring WS2, sample: s Depth: 14.63 - 15.09m Sample Number: WS2 - s

□ Location: Boring WS2, sample: t Depth: 16.15 - 16.61m Sample Number: WS2 - t

△ Location: Boring WS2, sample: u Depth: 17.68 - 18.14m Sample Number: WS2 - u

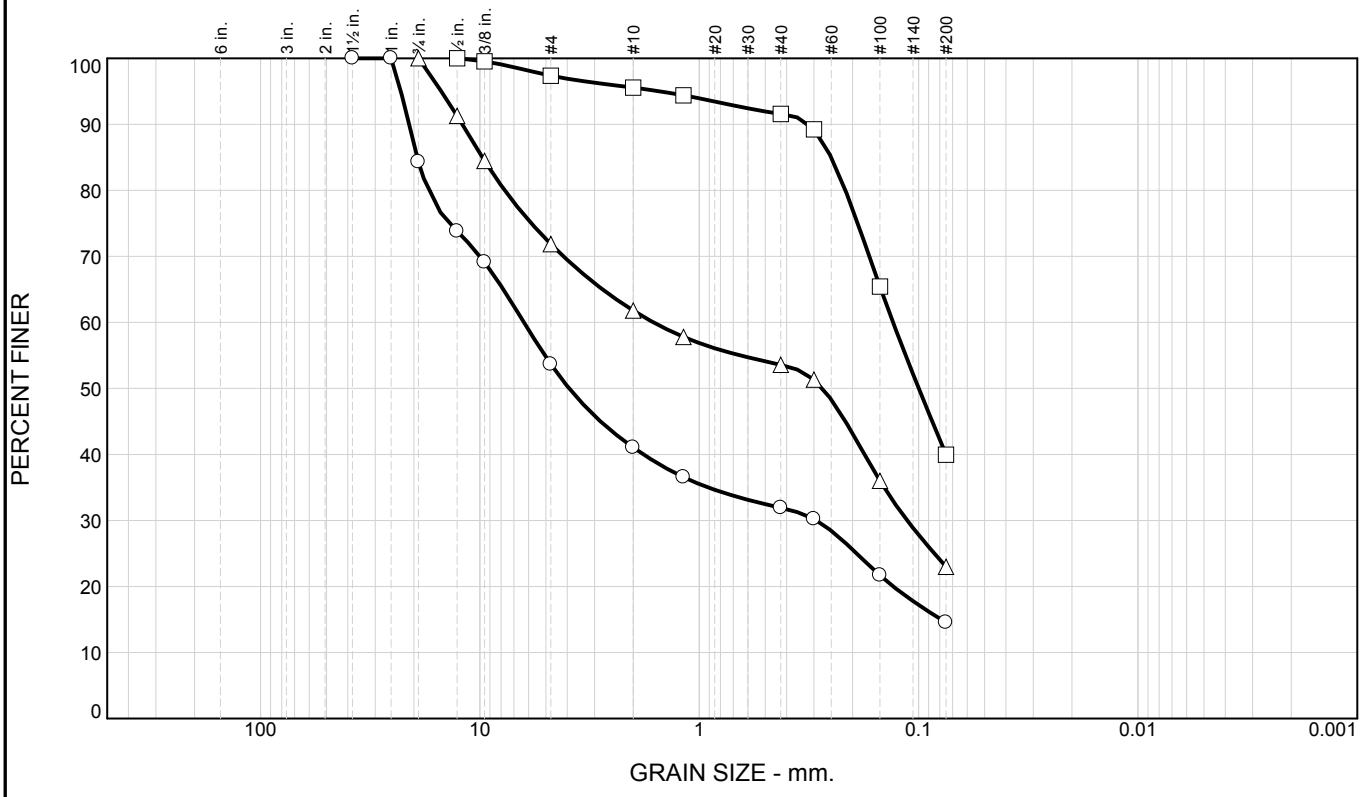
NEVADA DEPARTMENT OF TRANSPORTATION

Client:

Project: I-15 @ Warm Springs Interchange

Project No.: 72495 Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	46.3	39.2	14.5		GM			
□	0.0	2.6	57.4	40.0		SM	A-7-5(5)	31	55
△	0.0	28.1	48.9	23.0		SC	A-2-7(1)	29	52

SIEVE inches size	PERCENT FINER ○	□	△
1-1/2"	100.0		
1"	100.0		
3/4"	84.3		100.0
1/2"	73.8	100.0	91.3
3/8"	69.1	99.5	84.5
	GRAIN SIZE		
D_{60}	6.3000	0.1307	1.6175
D_{30}	0.2917		0.1127
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#4	53.7	97.4	71.9
#10	41.0	95.6	61.8
#16	36.6	94.4	57.8
#40	31.9	91.6	53.6
#50	30.2	89.3	51.3
#100	21.7	65.4	36.0
#200	14.5	40.0	23.0

Material Description
○ Silty gravel with sand
□ Silty sand
△ Silty sand with gravel

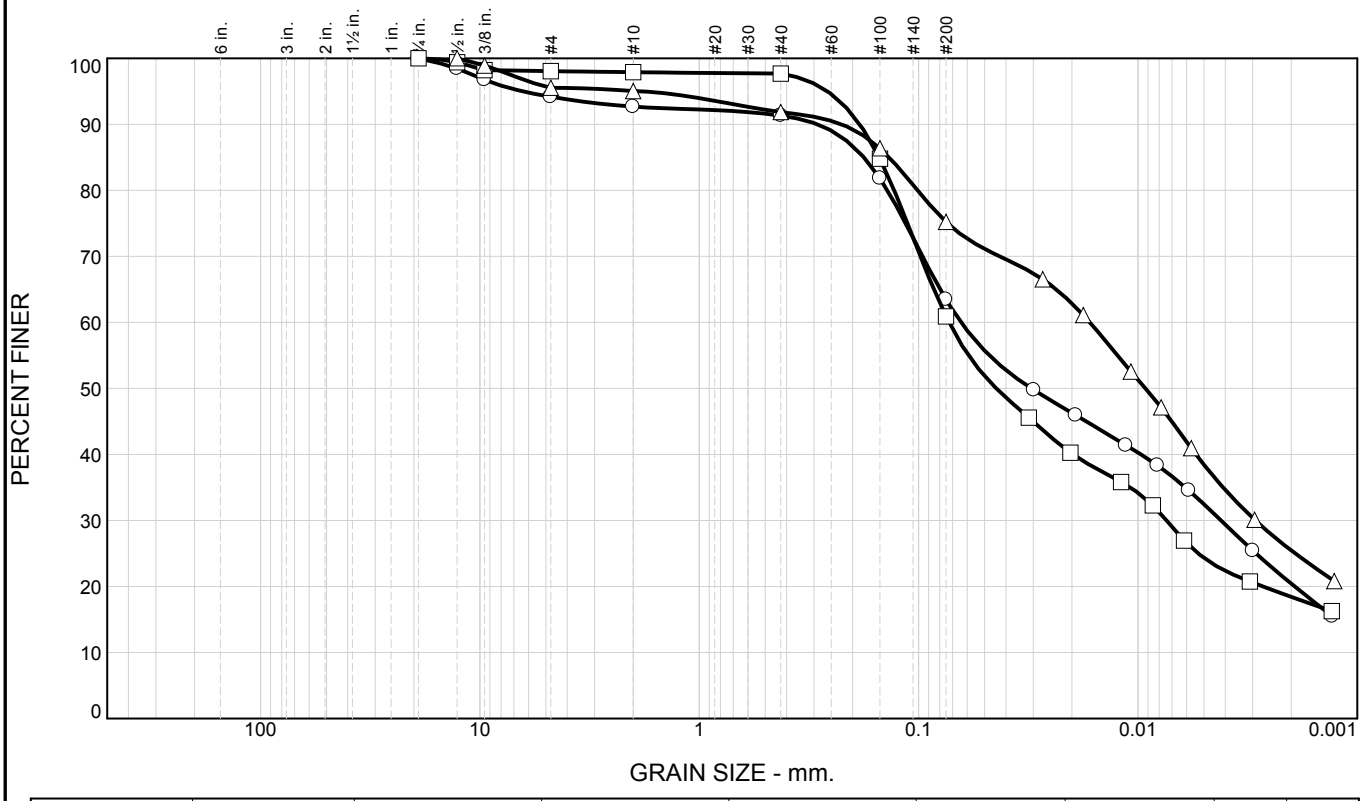
REMARKS:
○
□
△

○ Location: Boring WS2, sample: w Depth: 20.73 - 21.18m Sample Number: WS2 - w
□ Location: Boring WS2, sample: x Depth: 22.25 - 22.71m Sample Number: WS2 - x
△ Location: Boring WS2, sample: v Depth: 19.2 - 19.66m Sample Number: WS2 - v

NEVADA DEPARTMENT OF TRANSPORTATION

Client:
Project: I-15 @ Warm Springs Interchange
Project No.: 72495 Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	5.8	30.7	31.0	32.5	CH	A-7-6(16)	22	50
□	0.0	1.9	37.2	36.6	24.3	CL		16	34
△	0.0	4.5	20.3	36.8	38.4	CL	A-7-6(21)	18	47

SIEVE inches size	PERCENT FINER ○	□	△
3/4"	100.0	100.0	
1/2"	98.4	99.4	100.0
3/8"	96.7	98.2	98.9
	GRAIN SIZE		
D_{60}	0.0641	0.0727	0.0166
D_{30}	0.0042	0.0074	0.0029
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#4	94.2	98.1	95.5
#10	92.7	97.9	95.0
#40	91.3	97.7	91.9
#100	81.8	84.8	86.4
#200	63.5	60.9	75.2

Material Description
○ Sandy fat clay
□ Sandy lean clay
△ Lean clay with sand

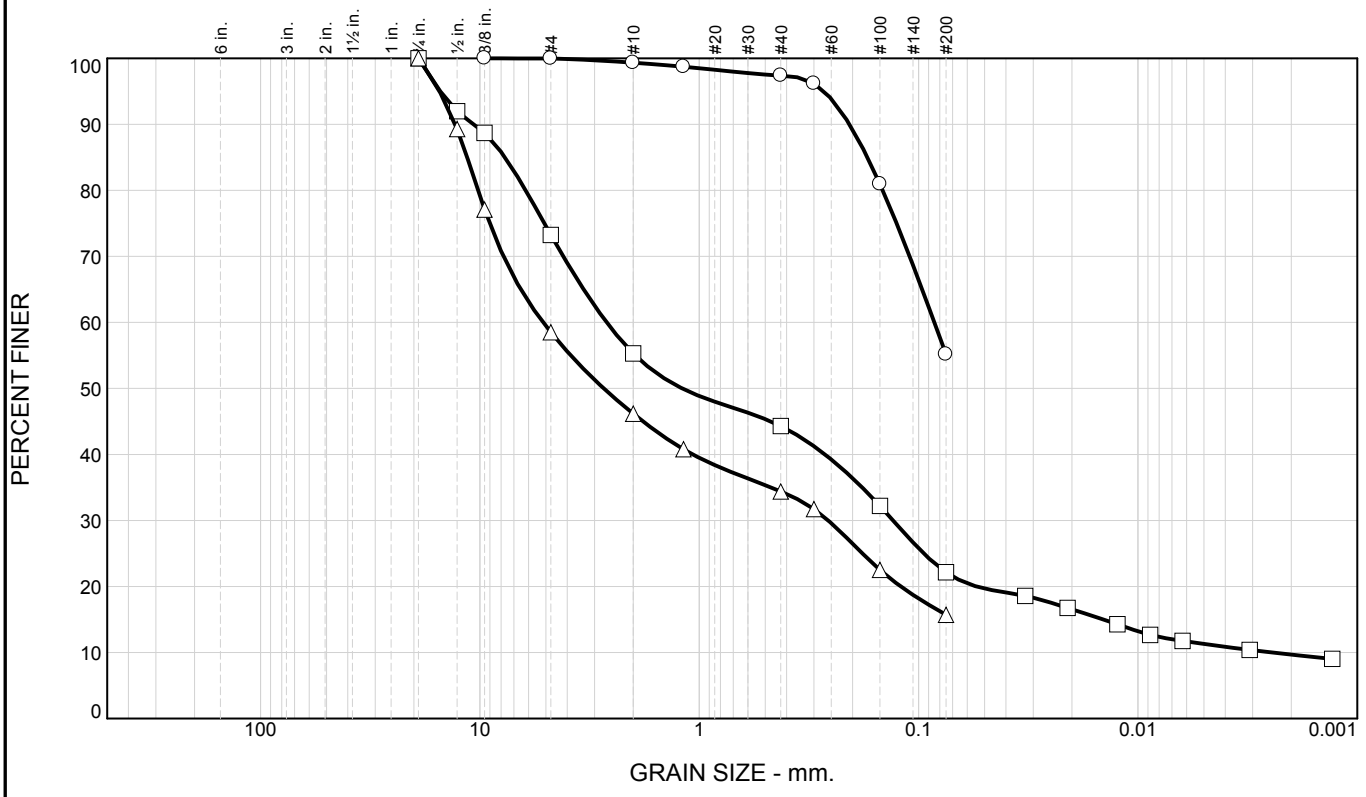
REMARKS:
○
□
△

○ Location: Boring WS2, sample: y Depth: 23.77 - 24.23m Sample Number: WS2 - y
□ Location: Boring WS2, sample: z Depth: 25.30 - 25.76m Sample Number: WS2 - z
△ Location: Boring WS2, sample: aa Depth: 26.82 - 27.28m Sample Number: WS2 - aa

NEVADA DEPARTMENT OF TRANSPORTATION

Client:
Project: I-15 @ Warm Springs Interchange
Project No.: 72495 Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	0.0	44.8	55.2		CL		17	31
□	0.0	26.7	51.1	10.9	11.3	SC		26	50
△	0.0	41.5	42.8	15.7		SC		20	30

SIEVE inches size	PERCENT FINER ○	□	△
3/4"		100.0	100.0
1/2"		92.0	89.3
3/8"	100.0	88.7	77.1
	GRAIN SIZE		
D_{60}	0.0847	2.6460	5.1527
D_{30}		0.1306	0.2582
D_{10}		0.0024	
	COEFFICIENTS		
C_c		2.63	
C_u		1080.26	

SIEVE number size	PERCENT FINER ○	□	△
#4	100.0	73.3	58.5
#10	99.3	55.3	46.2
#16	98.7		40.8
#40	97.4	44.3	34.4
#50	96.2		31.7
#100	81.0	32.2	22.5
#200	55.2	22.2	15.7

Material Description
○ Sandy lean clay

□ Clayey sand with gravel

△ Clayey sand with gravel

REMARKS:
○

□

△

○ Location: Boring WS2, sample: ab Depth: 28.35 - 28.80m Sample Number: WS2 - ab
□ Location: Boring WS2, sample: ac Depth: 29.87 - 30.33m Sample Number: WS2 - ac
△ Location: Boring WS2, sample: ad Depth: 31.39 - 31.85m Sample Number: WS2 - ad

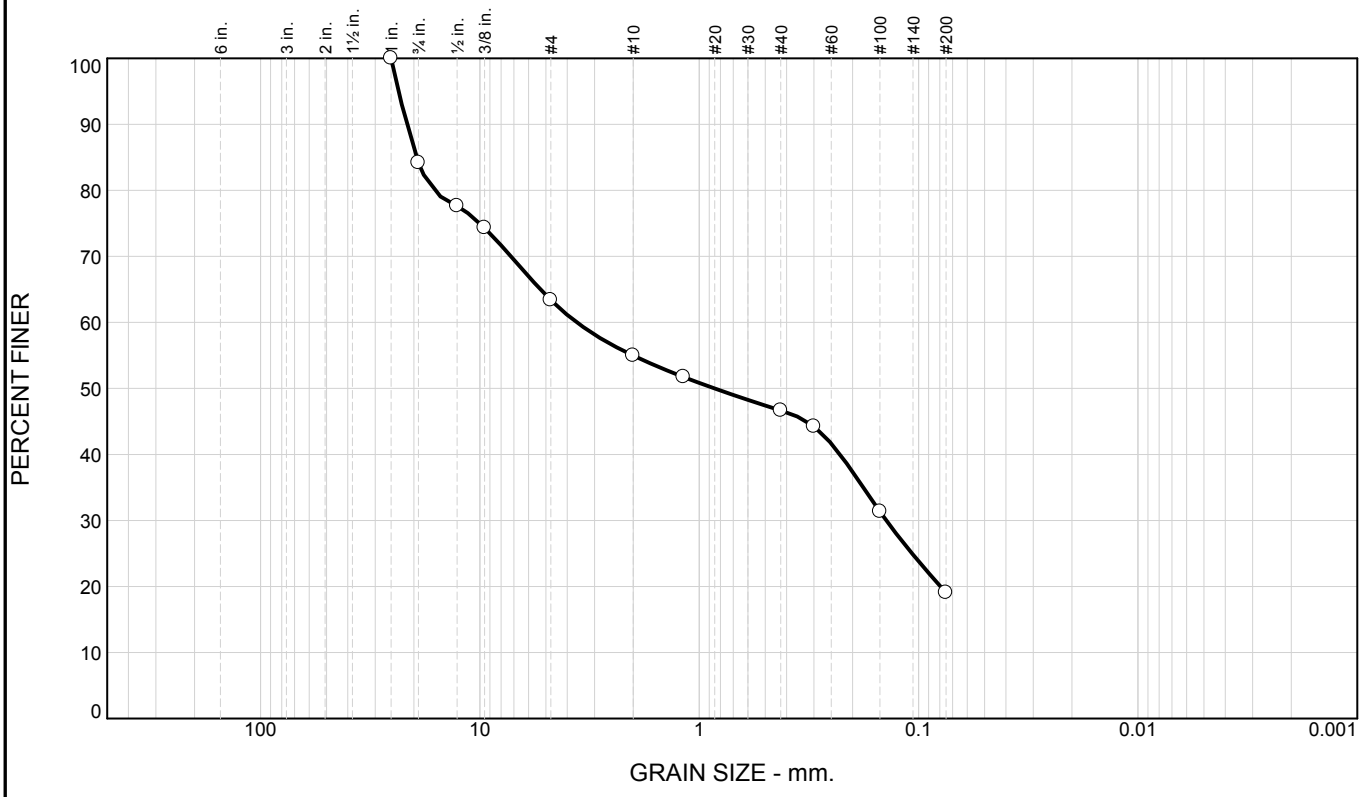
NEVADA DEPARTMENT OF TRANSPORTATION

Client:

Project: I-15 @ Warm Springs Interchange

Project No.: 72495 Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	36.6	44.3	19.1		SM			

SIEVE inches size	PERCENT FINER ○		
1"	100.0		
3/4"	84.2		
1/2"	77.6		
3/8"	74.3		
	GRAIN SIZE		
D_{60}	3.6178		
D_{30}	0.1403		
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○		
#4	63.4		
#10	55.0		
#16	51.7		
#40	46.6		
#50	44.2		
#100	31.3		
#200	19.1		

Material Description
○ Silty sand with gravel

REMARKS:
○

○ Location: Boring WS2, sample: ae Depth: 32.92 - 33.22m Sample Number: WS2 - ae

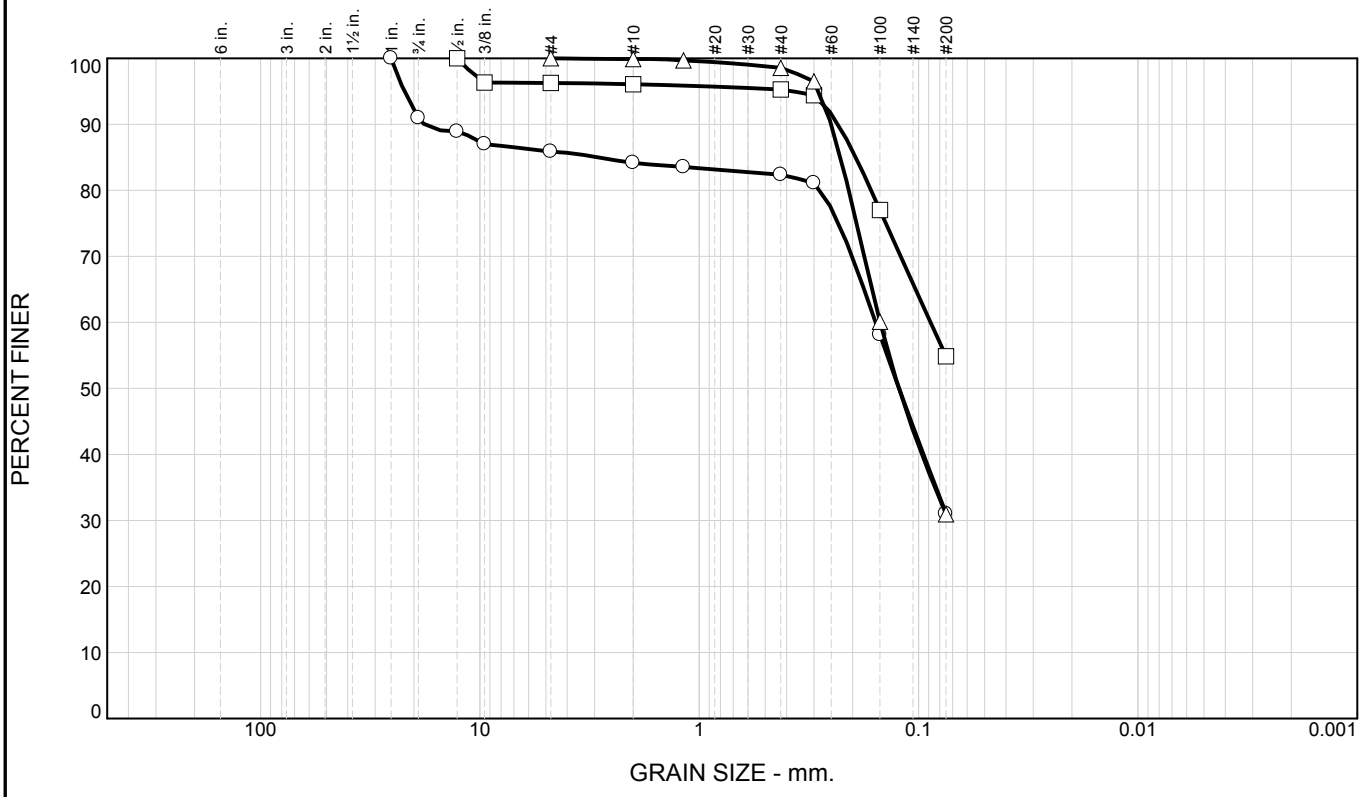
NEVADA DEPARTMENT OF TRANSPORTATION

Client:

Project: I-15 @ Warm Springs Interchange

Project No.: 72495 Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	14.1	54.9	31.0		SM		NP	
□	0.0	3.7	41.4	54.9		CL-ML	A-4(0)	14	18
△	0.0	0.0	69.1	30.9		SM		NP	

SIEVE inches size	PERCENT FINER ○	□	△
1"	100.0		
3/4"	91.0		
1/2"	88.9	100.0	
3/8"	87.0	96.3	
	GRAIN SIZE		
D_{60}	0.1570	0.0881	0.1497
D_{30}			
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#4	85.9	96.3	100.0
#10	84.2	96.1	99.9
#16	83.6		99.7
#40	82.4	95.3	98.6
#50	81.1	94.4	96.5
#100	58.1	77.0	60.1
#200	31.0	54.9	30.9

Material Description
○ Silty sand
□ Sandy silty clay
△ Silty sand

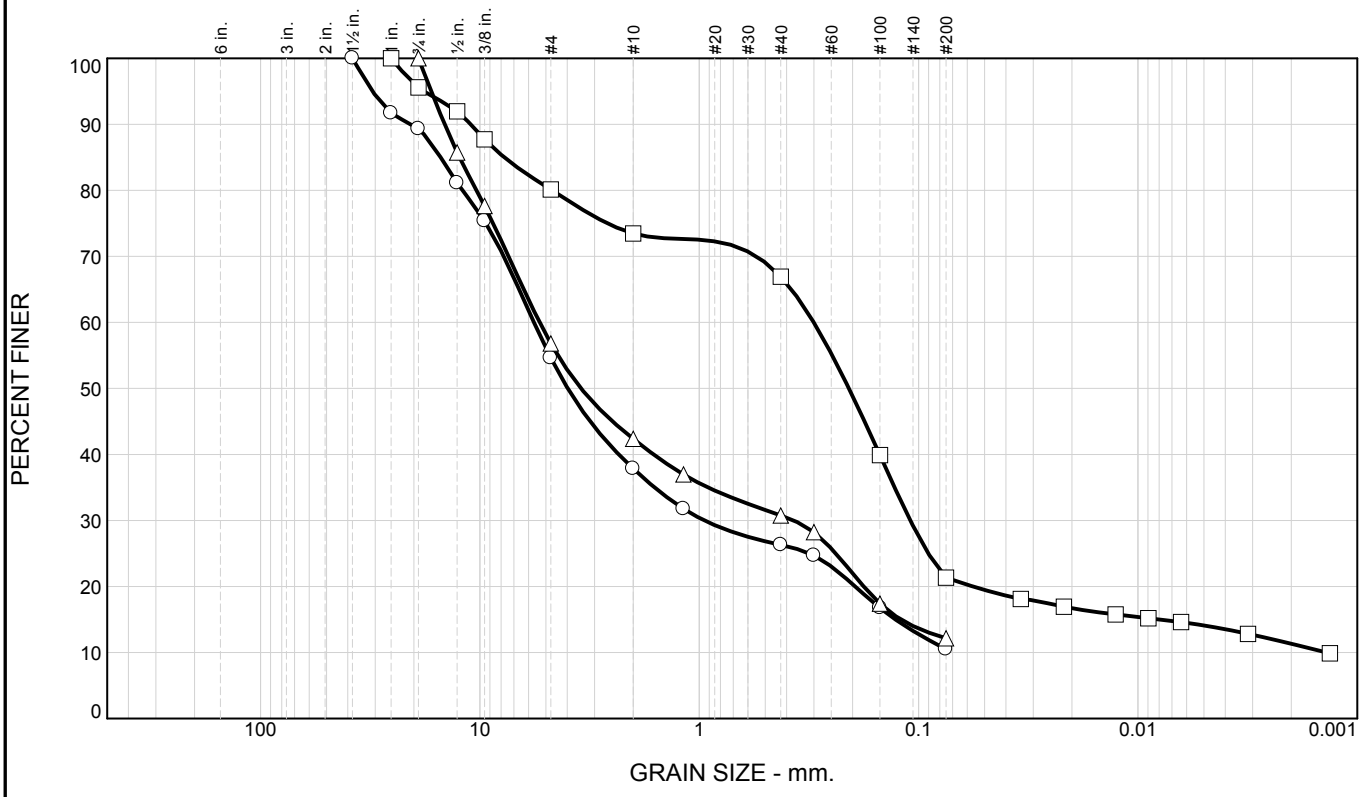
REMARKS:
○
□
△

○ Location: Boring WS3, sample: a Sample Number: WS3 - a
□ Location: Boring WS3, sample: b Sample Number: WS3 - b
△ Location: Boring WS3, sample: c Sample Number: WS3 - c

NEVADA DEPARTMENT OF TRANSPORTATION

Client:
Project: I-15 @ Warm Springs Interchange
Project No.: 72495 Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	45.4	44.1	10.5		GP-GM		NP	16
□	0.0	19.9	58.8	7.2	14.1	SC-SM		14	20
△	0.0	43.2	44.6	12.2		SC-SM	A-1-b	14	18

SIEVE inches size	PERCENT FINER ○	□	△
1-1/2"	100.0		
1"	91.7	100.0	
3/4"	89.3	95.6	100.0
1/2"	81.1	92.0	85.7
3/8"	75.4	87.7	77.6
	GRAIN SIZE		
D_{60}	5.6725	0.3005	5.3443
D_{30}	0.9468	0.1091	0.3712
D_{10}		0.0014	
	COEFFICIENTS		
C_c		28.69	
C_u		217.83	

SIEVE number size	PERCENT FINER ○	□	△
#4	54.6	80.1	56.8
#10	37.9	73.5	42.4
#16	31.8		37.0
#40	26.3	66.9	30.8
#50	24.7		28.2
#100	16.8	39.9	17.4
#200	10.5	21.3	12.2

Material Description

○ Poorly graded gravel with silt and sand

□ Silty, clayey sand with gravel

△ Silty, clayey sand with gravel

REMARKS:

○

□

△

○ Location: Boring WS3, sample: d Sample Number: WS3 - d

□ Location: Boring WS3, sample: e Sample Number: WS3 - e

△ Location: Boring WS3, sample: f Sample Number: WS3 - f

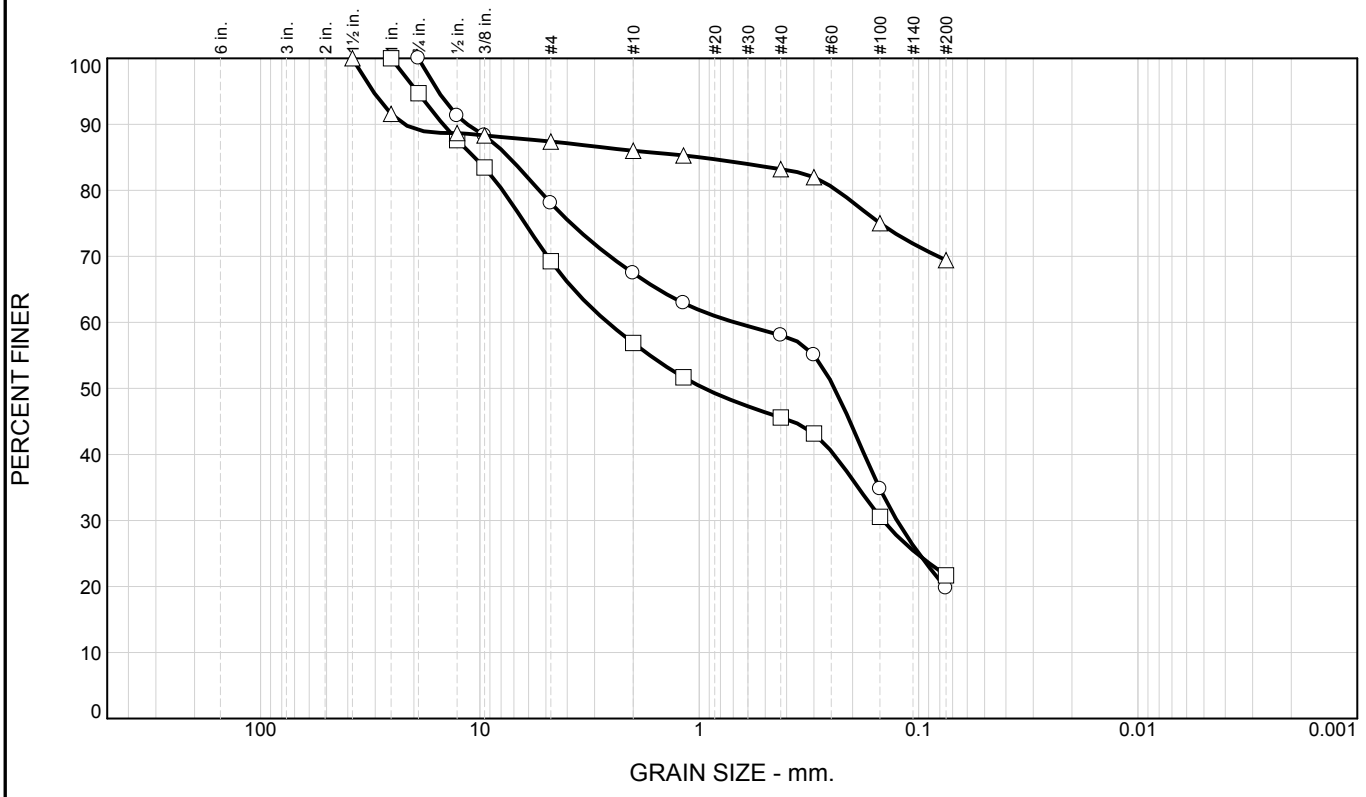
NEVADA DEPARTMENT OF TRANSPORTATION

Client:

Project: I-15 @ Warm Springs Interchange

Project No.: 72495 Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	21.9	58.4	19.7		SC-SM	A-2-4(0)	16	23
□	0.0	30.7	47.6	21.7		SC	A-2-6(0)	16	32
△	0.0	12.6	18.0	69.4		ML			

SIEVE inches size	PERCENT FINER ○	□	△
1-1/2"			100.0
1"		100.0	91.6
3/4"	100.0	94.7	
1/2"	91.3	87.6	88.7
3/8"	88.3	83.5	88.3
	GRAIN SIZE		
D_{60}	0.6877	2.6168	
D_{30}	0.1254	0.1454	
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#4	78.1	69.3	87.4
#10	67.5	56.9	86.0
#16	62.9	51.7	85.3
#40	58.0	45.6	83.2
#50	55.1	43.2	82.0
#100	34.8	30.5	75.0
#200	19.7	21.7	69.4

Material Description

○ Silty, clayey sand with gravel

□ Clayey sand with gravel

△

REMARKS:

○

□

△

○ Location: Boring WS3, sample: g Sample Number: WS3 - g

□ Location: Boring WS3, sample: h Sample Number: WS3 - h

△ Location: Boring WS3, sample: i Sample Number: WS3 - i

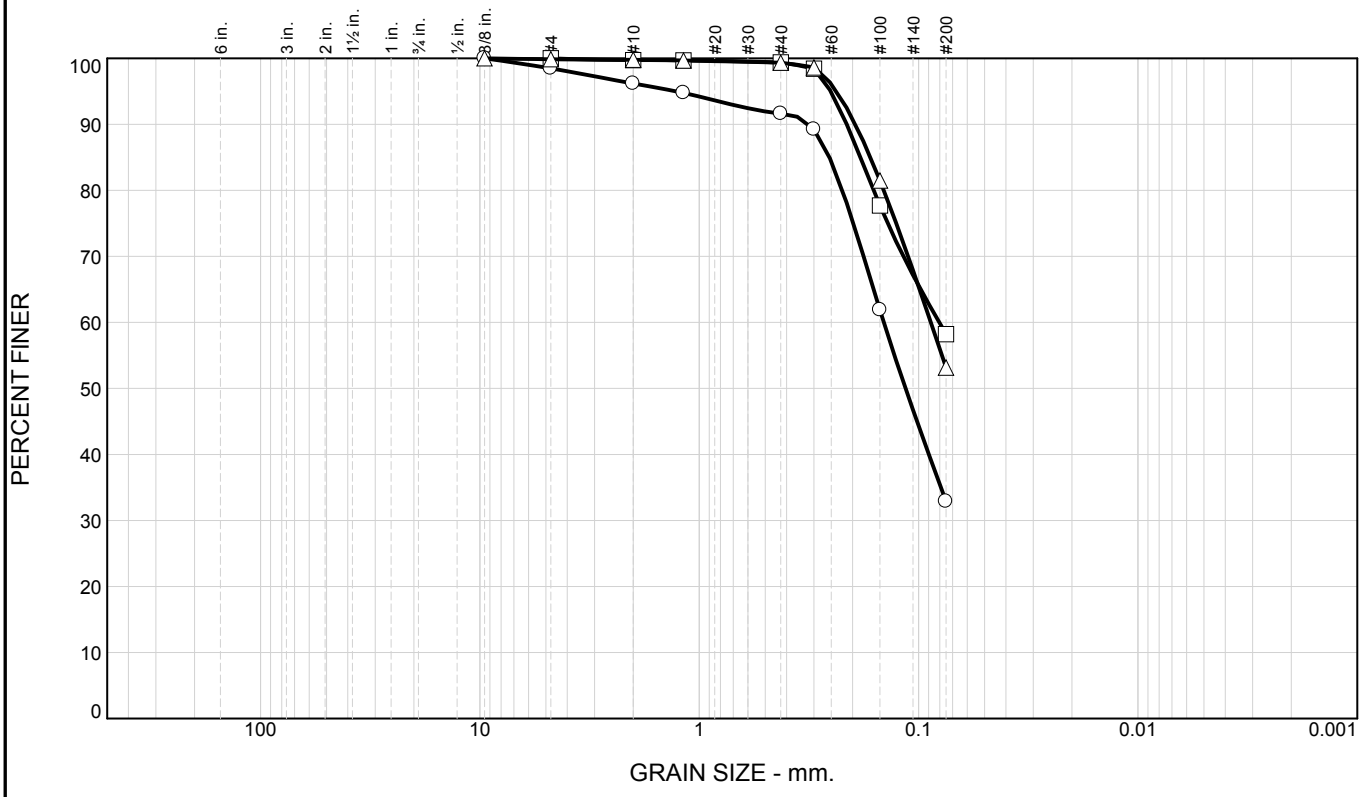
NEVADA DEPARTMENT OF TRANSPORTATION

Client:

Project: I-15 @ Warm Springs Interchange

Project No.: 72495 Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	1.5	65.6	32.9		SC		18	28
□	0.0	0.0	41.8	58.2		ML		NP	21
△	0.0	0.1	46.7	53.2		CL	A-6(5)	14	31

SIEVE inches size	PERCENT FINER ○	□	△
3/8"	100.0		100.0
GRAIN SIZE			
D_{60}	0.1440	0.0805	0.0879
D_{30}			
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#4	98.5	100.0	99.9
#10	96.2	99.7	99.8
#16	94.8	99.7	99.7
#40	91.6	99.4	99.3
#50	89.2	98.4	98.6
#100	61.9	77.7	81.5
#200	32.9	58.2	53.2

Material Description
○ Clayey sand
□ Sandy silt
△ Sandy lean clay

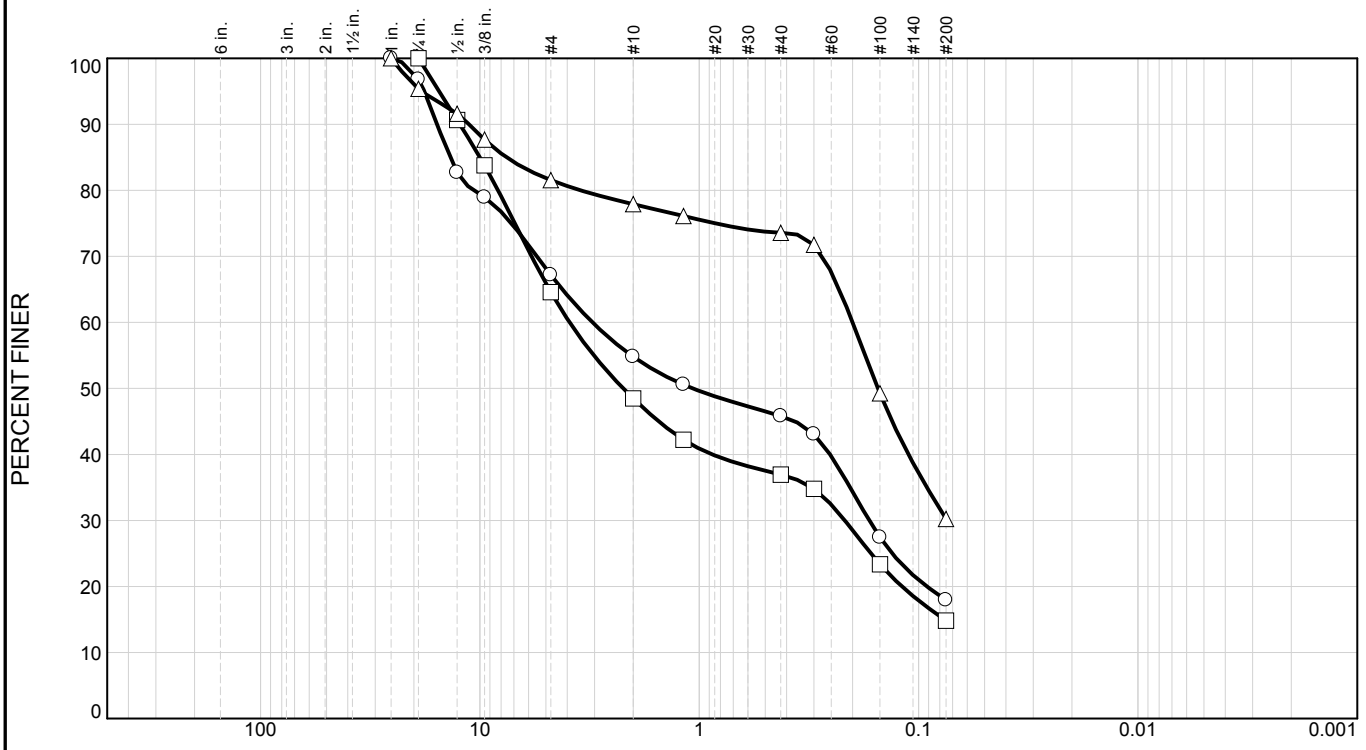
REMARKS:
○
□
△

○ Location: Boring WS3, sample: j Sample Number: WS3 - j
□ Location: Boring WS3, sample: k Sample Number: WS3 - k
△ Location: Boring WS3, sample: l Sample Number: WS3 - l

NEVADA DEPARTMENT OF TRANSPORTATION

Client:
Project: I-15 @ Warm Springs Interchange
Project No.: 72495 Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	32.8	49.3	17.9		SC-SM	A-1-b	16	20
□	0.0	35.4	49.8	14.8		SM			
△	0.0	18.4	51.4	30.2		SC	A-2-4(0)	20	29

SIEVE inches size	PERCENT FINER ○	□	△
1"	100.0		100.0
3/4"	96.8	100.0	95.4
1/2"	82.7	90.6	91.6
3/8"	78.9	83.8	87.7
	GRAIN SIZE		
D_{60}	3.0695	3.9033	0.1998
D_{30}	0.1679	0.2169	
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#4	67.2	64.6	81.6
#10	54.8	48.5	77.9
#16	50.6	42.2	76.1
#40	45.8	36.9	73.6
#50	43.0	34.8	71.7
#100	27.4	23.4	49.2
#200	17.9	14.8	30.2

Material Description

○ Silty, clayey sand with gravel

□

△ Clayey sand with gravel

REMARKS:

○

□

△

○ Location: Boring WS3, sample: m Sample Number: WS3 - m

□ Location: Boring WS3, sample: n Sample Number: WS3 - n

△ Location: Boring WS3, sample: o Sample Number: WS3 - o

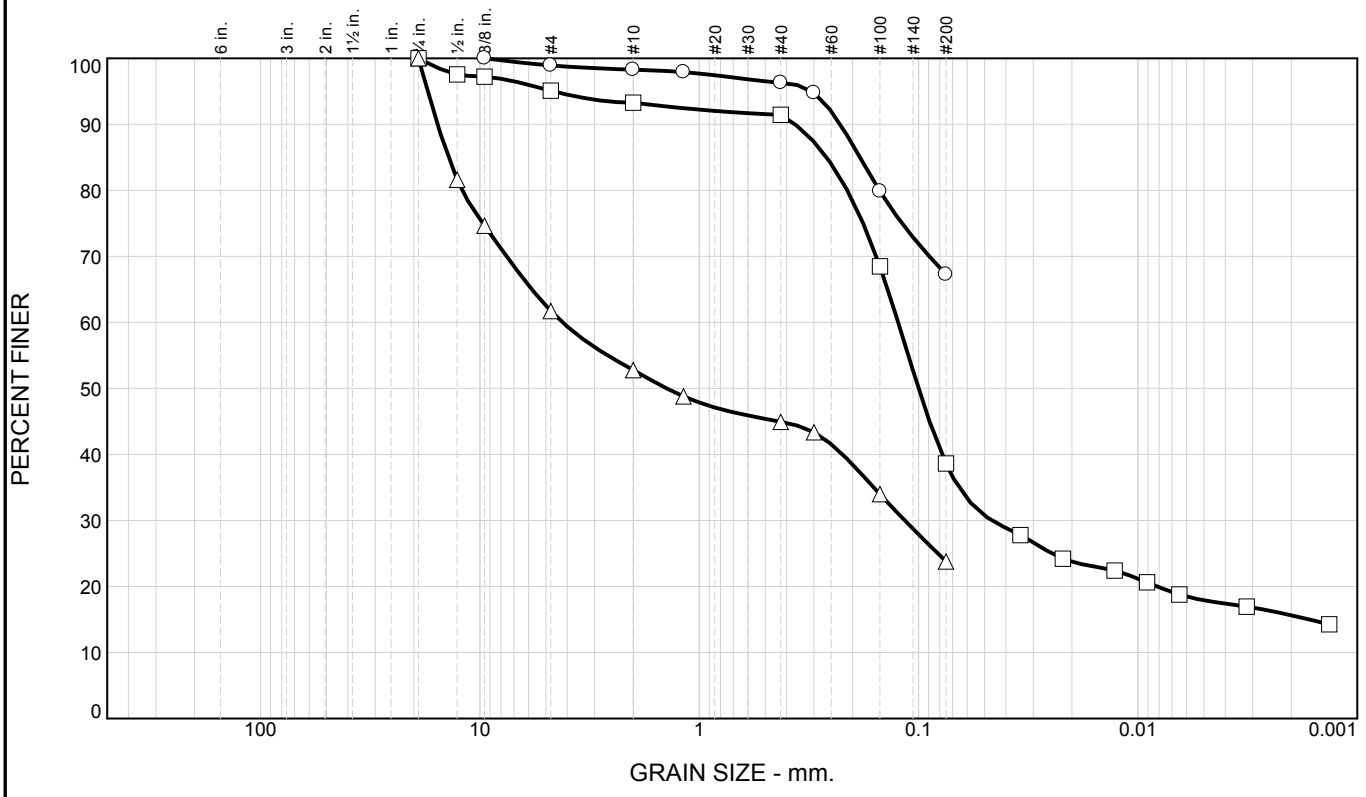
NEVADA DEPARTMENT OF TRANSPORTATION

Client:

Project: I-15 @ Warm Springs Interchange

Project No.: 72495 Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	1.1	31.7	67.2		CL	A-7-6(18)	16	46
□	0.0	4.9	56.5	20.7	17.9	SC	A-7-6(8)	25	63
△	0.0	38.3	37.9	23.8		GC	A-2-7(1)	25	51

SIEVE inches size	PERCENT FINER ○	□	△
3/4"		100.0	100.0
1/2"		97.6	81.6
3/8"	100.0	97.2	74.6
GRAIN SIZE			
D_{60}		0.1238	4.2029
D_{30}		0.0464	0.1155
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#4	98.9	95.1	61.7
#10	98.3	93.3	52.8
#16	97.9		48.8
#40	96.3	91.4	44.9
#50	94.8		43.4
#100	79.9	68.5	34.0
#200	67.2	38.6	23.8

Material Description
○ Sandy lean clay
□ Clayey sand
△ Clayey gravel with sand

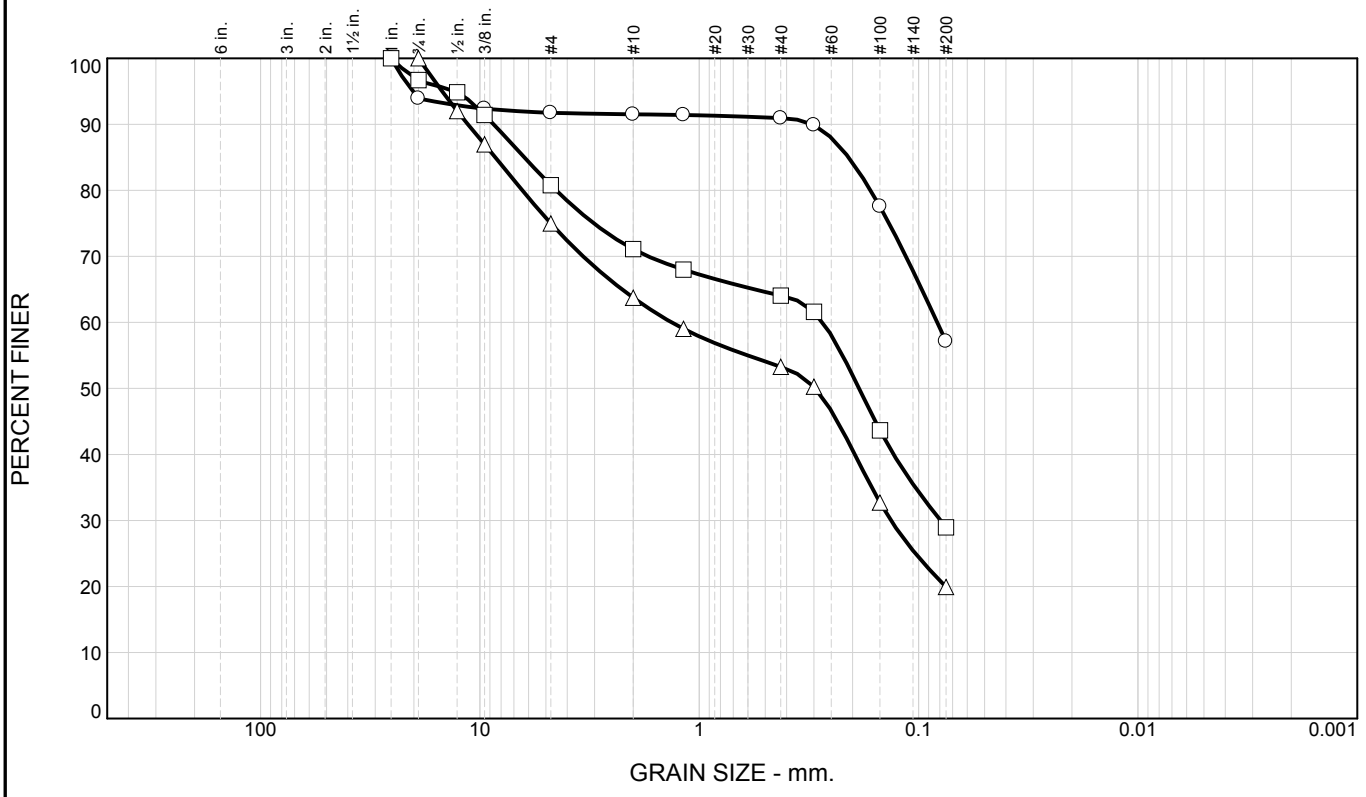
REMARKS:
○
□
△

○ Location: Boring WS3, sample: p Sample Number: WS3 - p
□ Location: Boring WS3, sample: q Sample Number: WS3 - q
△ Location: Boring WS3, sample: r Sample Number: WS3 - r

NEVADA DEPARTMENT OF TRANSPORTATION

Client:
Project: I-15 @ Warm Springs Interchange
Project No.: 72495 Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	8.3	34.6	57.1		CH	A-7-6(15)	22	54
□	0.0	19.2	51.8	29.0		SC	A-2-7(3)	27	57
△	0.0	25.0	55.1	19.9		SC	A-2-7(0)	24	42

SIEVE inches size	PERCENT FINER ○	□	△
1"	100.0	100.0	
3/4"	93.9	96.7	100.0
1/2"		94.9	92.0
3/8"	92.4	91.4	87.0
GRAIN SIZE			
D_{60}	0.0822	0.2732	1.3364
D_{30}		0.0794	0.1337
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#4	91.7	80.8	75.0
#10	91.5	71.1	63.7
#16	91.4	68.0	59.0
#40	90.9	64.1	53.3
#50	89.9	61.6	50.3
#100	77.6	43.6	32.7
#200	57.1	29.0	19.9

Material Description
○ Sandy fat clay

□ Clayey sand with gravel

△ Clayey sand with gravel

REMARKS:
○

□

△

○ Location: Boring WS3, sample: s Sample Number: WS3 - s
□ Location: Boring WS3, sample: t Sample Number: WS3 - t
△ Location: Boring WS3, sample: u Sample Number: WS3 - u

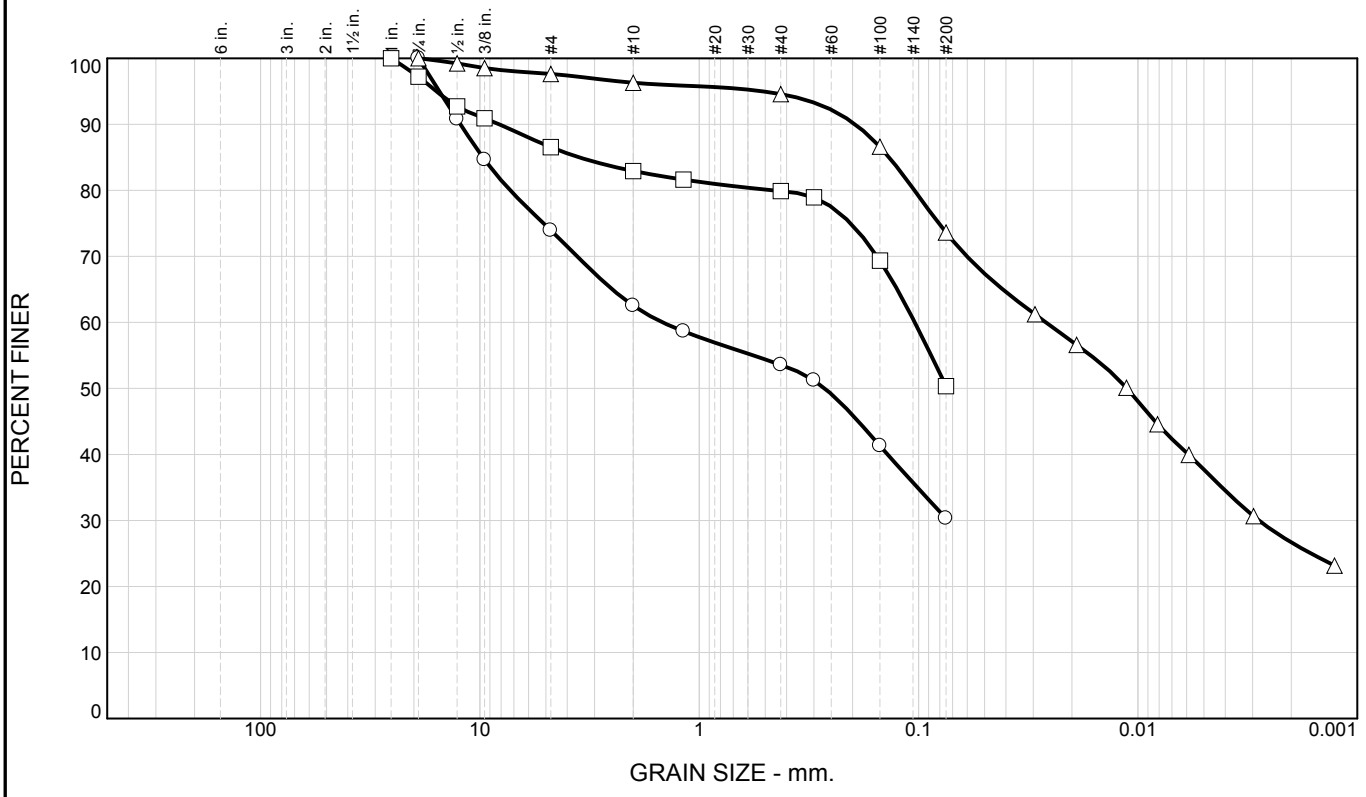
NEVADA DEPARTMENT OF TRANSPORTATION

Client:

Project: I-15 @ Warm Springs Interchange

Project No.: 72495 Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	26.1	43.6	30.3		SC	A-2-7(4)	29	63
□	0.0	13.5	36.2	50.3		CL		23	49
△	0.0	2.4	24.0	35.9	37.7	CL		19	40

SIEVE inches size	PERCENT FINER ○	□	△
1"		100.0	
3/4"	100.0	97.2	100.0
1/2"	90.8	92.7	99.2
3/8"	84.6	90.9	98.5
GRAIN SIZE			
D_{60}	1.4689	0.1040	0.0263
D_{30}			0.0028
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#4	73.9	86.5	97.6
#10	62.5	82.9	96.3
#16	58.7	81.6	
#40	53.6	79.9	94.6
#50	51.2	78.9	
#100	41.3	69.4	86.6
#200	30.3	50.3	73.6

Material Description
○ Clayey sand with gravel
□ Sandy lean clay
△ Lean clay with sand

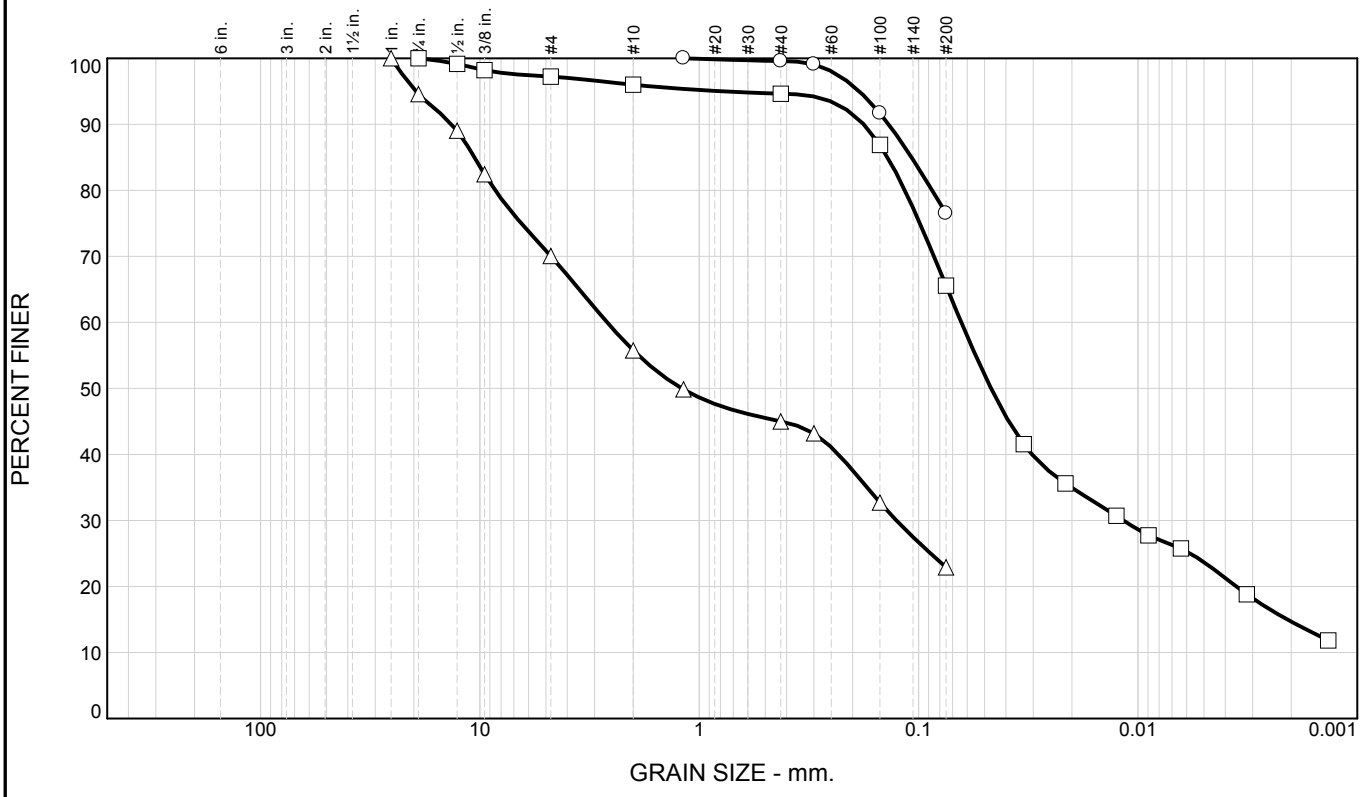
REMARKS:
○
□
△

○ Location: Boring WS3, sample: v Sample Number: WS3 - v
□ Location: Boring WS3, sample: w Sample Number: WS3 - w
△ Location: Boring WS3, sample: x Sample Number: WS3 - x

NEVADA DEPARTMENT OF TRANSPORTATION

Client:
Project: I-15 @ Warm Springs Interchange
Project No.: 72495 Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	0.0	23.5	76.5		CL	A-6(14)	16	37
□	0.0	2.8	31.6	41.9	23.7	CL	A-6(11)	18	38
△	0.0	30.0	47.1	22.9		SC	A-2-7(2)	28	60

SIEVE inches size	PERCENT FINER ○	□	△
1"			100.0
3/4"		100.0	94.6
1/2"		99.2	89.0
3/8"		98.2	82.4
GRAIN SIZE			
D_{60}		0.0638	2.6301
D_{30}		0.0116	0.1261
D_{10}			
COEFFICIENTS			
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#4		97.2	70.0
#10		96.0	55.8
#16	100.0		49.9
#40	99.6	94.6	45.0
#50	99.1		43.2
#100	91.7	86.9	32.7
#200	76.5	65.6	22.9

Material Description
○ Lean clay with sand
□ Sandy lean clay
△ Clayey sand with gravel

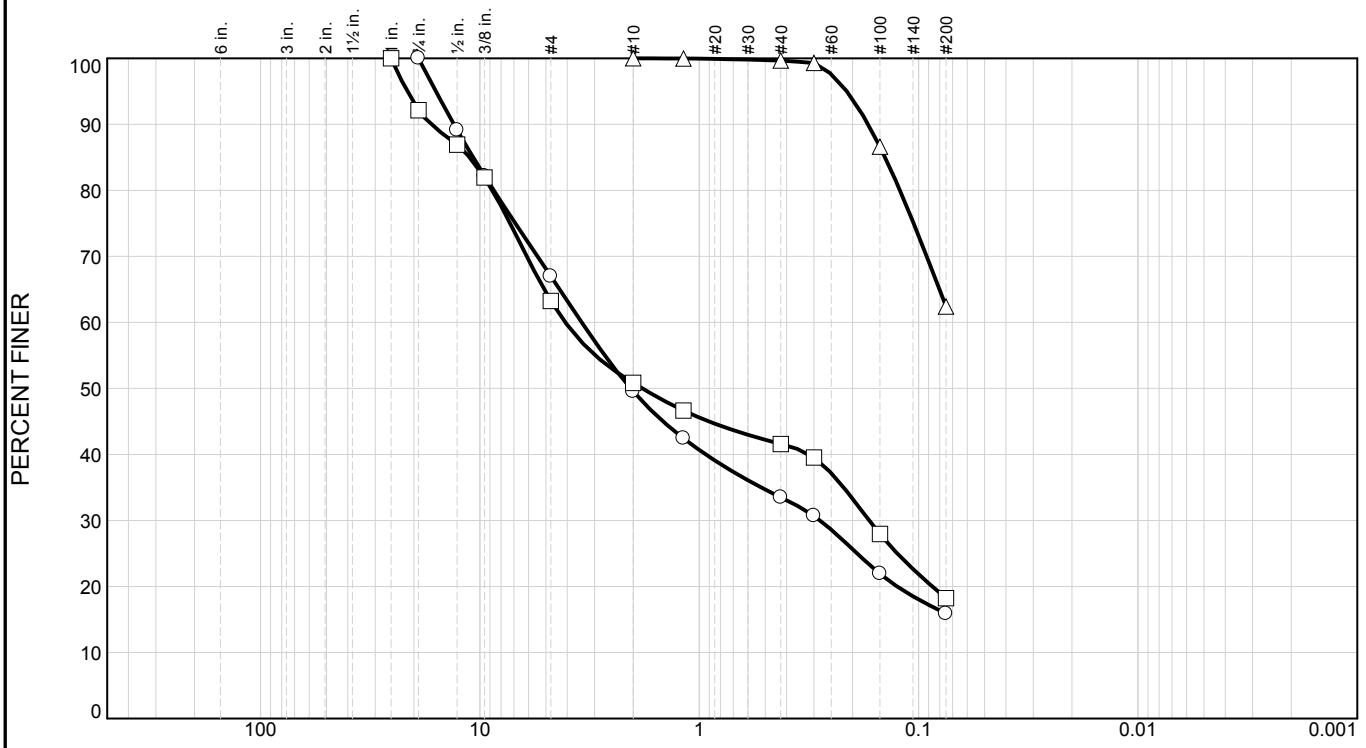
REMARKS:
○
□
△

○ Location: Boring WS3, sample: y Sample Number: WS3 - y
□ Location: Boring WS3, sample: z Sample Number: WS3 - z
△ Location: Boring WS3, sample: aa Sample Number: WS3 - aa

NEVADA DEPARTMENT OF TRANSPORTATION

Client:
Project: I-15 @ Warm Springs Interchange
Project No.: 72495 Figure

Particle Size Distribution Report



	+3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○	0.0	33.0	51.1	15.9		SC-SM	A-1-b	17	22
□	0.0	36.7	45.1	18.2		SM			
△	0.0	0.0	37.6	62.4		CL		14	30

SIEVE inches size	○	□	△
1"		100.0	
3/4"	100.0	92.1	
1/2"	89.1	86.9	
3/8"	82.2	82.0	
	GRAIN SIZE		
D_{60}	3.4362	4.0840	
D_{30}	0.2809	0.1679	
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	○	□	△
#4	67.0	63.3	
#10	49.5	50.8	100.0
#16	42.4	46.7	100.0
#40	33.5	41.6	99.7
#50	30.7	39.5	99.3
#100	21.9	28.0	86.6
#200	15.9	18.2	62.4

Material Description
○ Silty, clayey sand with gravel
□ Silty sand with gravel
△ Sandy lean clay

REMARKS:
○
□
△

○ Location: Boring WS3, sample: ab Sample Number: WS3 - ab
□ Location: Boring WS3, sample: ac Sample Number: WS3 - ac
△ Location: Boring WS3, sample: ad Sample Number: WS3 - ad

NEVADA DEPARTMENT OF TRANSPORTATION

Client:
Project: I-15 @ Warm Springs Interchange
Project No.: 72495 Figure

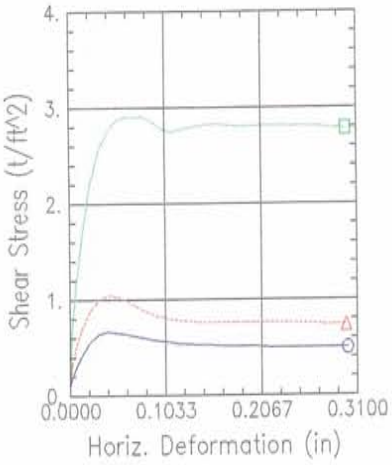
SUMMARY OF DIRECT SHEAR TEST RESULTS
N.D.O.T. GEOTECHNICAL SECTION

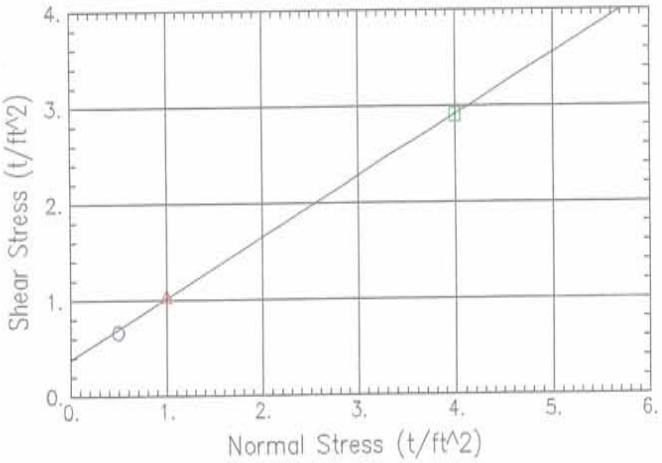
Boring Number WS1

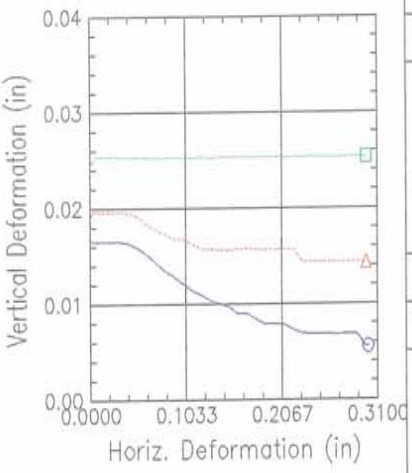
I-15 @ Warm Springs Interchange, SR 160 Project, Phase 3

SAMPLE NO.	SAMPLE DEPTH (feet)	SAMPLER TYPE	SOIL CLASSIFICATION (USCS)	φ FRICTION (degrees)	C COHESION (psf)
DMa	6.6 - 6.8	CMS	SM	32.4	764
DMb	7.0 - 7.2	CMS	SM	32.5	822
DMc	7.4 - 7.6	CMS	SM	31.5	968
DMd	7.8 - 8.0	CMS	SM	36.6	606

DS = Direct Shear
CMS = California Modified Sampler 2.4 inch I.D.







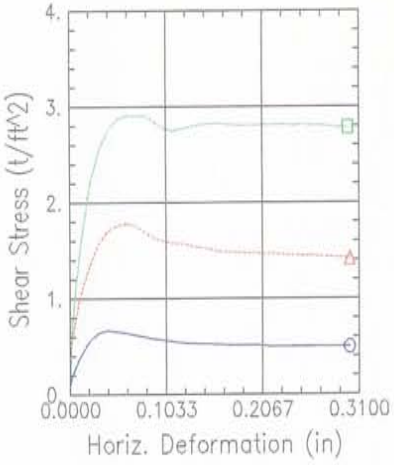
Graph Symbol			○	△	□	
Test No.			b	c	e	
Initial	Water content (%)	w_o				
	Void ratio	e_o				
	Saturation (%)	S_o				
	Dry density (lb/ft^3)	γ_d				
Void ratio after consolidation		e_c				
Time for 50 percent consolidation		t_{50}				
Final	Water content (%)	w_f				
	Void Ratio	e_f				
	Saturation (%)	S_f				
Normal stress (t/ft^2)		σ	0.50	1.00	4.00	
Maximum shear stress (t/ft^2)		τ_{max}	0.67	1.05	2.91	
Actual time to failure (min)		t_f	12	13	20	
Rate of strain						
Ultimate shear stress (t/ft^2)		τ_{ult}	0.50	0.74	2.78	

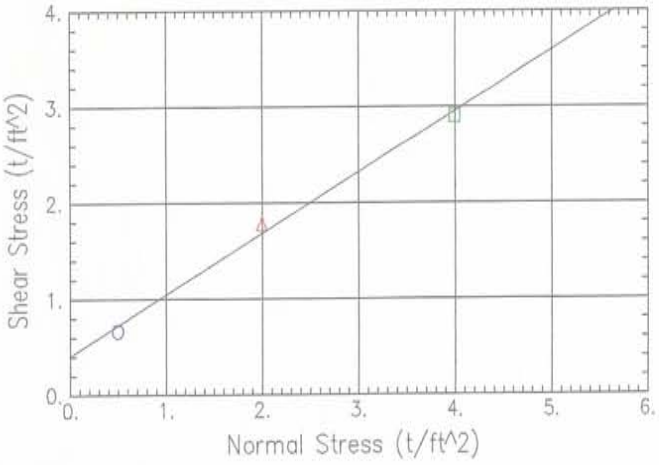
Strength Parameters

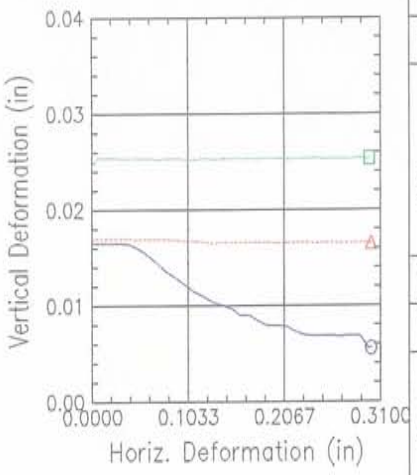
c = 0.382 tons/ft^2

ϕ = 32.4 degrees

Type of Specimen	CMS			
Description	---			
LL	PL	PI		G_s
Remarks	--	Project	I-15 @ Warm Springs	
		Area	4.60 (in^2)	Boring No. WS1
		Depth	6.6 - 6.8 ft	Sample No. DM a
		Elevation		Date 04/28/00
		DIRECT SHEAR TEST REPORT		







Graph Symbol			○	△	□	
Test No.			b	d	e	
Initial	Water content (%)	w_o				
	Void ratio	e_o				
	Saturation (%)	S_o				
	Dry density (lb/ft^3)	γ_d				
Void ratio after consolidation		e_c				
Time for 50 percent consolidation		t_{50}				
Final	Water content (%)	w_f				
	Void Ratio	e_f				
	Saturation (%)	S_f				
Normal stress (t/ft^2)		σ	0.50	2.00	4.00	
Maximum shear stress (t/ft^2)		τ_{max}	0.67	1.78	2.91	
Actual time to failure (min)		t_f	12	18	20	
Rate of strain						
Ultimate shear stress (t/ft^2)		τ_{ult}	0.50	1.42	2.78	

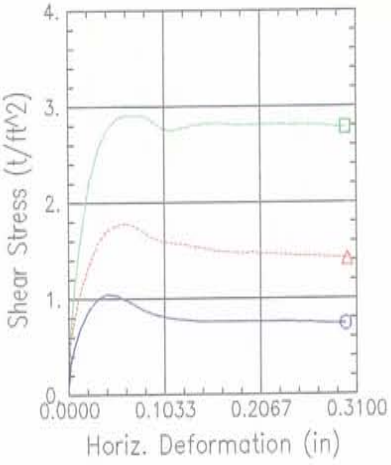
Strength Parameters

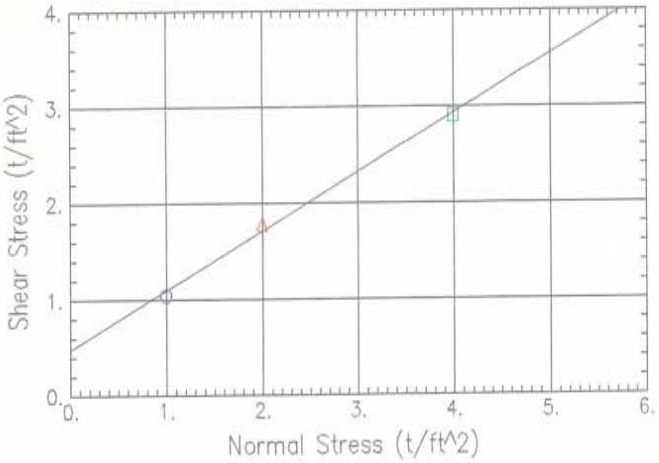
c = 0.411 tons / ft²

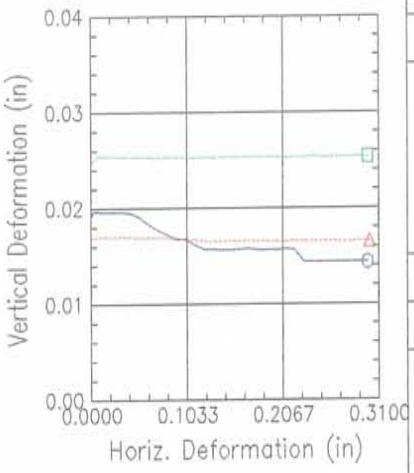
ϕ = 32.5 degrees

Type of Specimen	CMS			
Description	---			
LL	PL	PI		G_s
Remarks	--	Project	I-15 @ Warm Springs	
		Area	4.60 (in^2)	Boring No. WS1
		Depth	7.0 - 7.2 ft	Sample No. DM b
		Elevation		Date 04/28/00

DIRECT SHEAR TEST REPORT







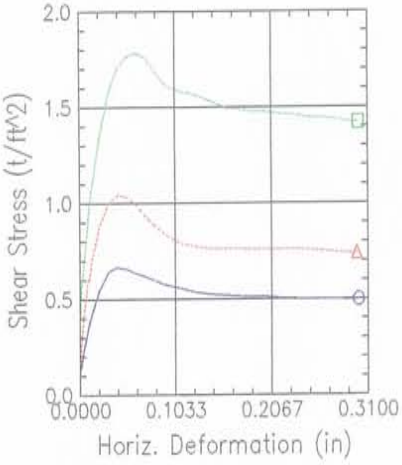
Graph Symbol			○	△	□	
Test No.			c	d	e	
Initial	Water content (%)	w_o				
	Void ratio	e_o				
	Saturation (%)	S_o				
	Dry density (lb/ft^3)	γ_d				
Void ratio after consolidation		e_c				
Time for 50 percent consolidation		t_{50}				
Final	Water content (%)	w_f				
	Void Ratio	e_f				
	Saturation (%)	S_f				
Normal stress (t/ft^2)		σ	1.00	2.00	4.00	
Maximum shear stress (t/ft^2)		τ_{max}	1.05	1.78	2.91	
Actual time to failure (min)		t_f	13	18	20	
Rate of strain						
Ultimate shear stress (t/ft^2)		τ_{ult}	0.74	1.42	2.78	

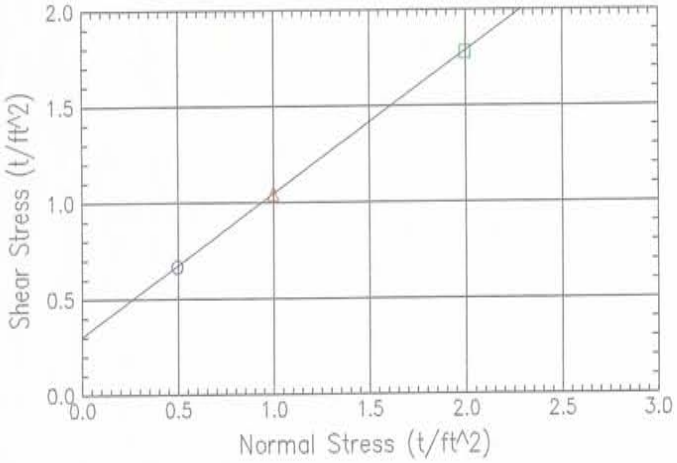
Strength Parameters

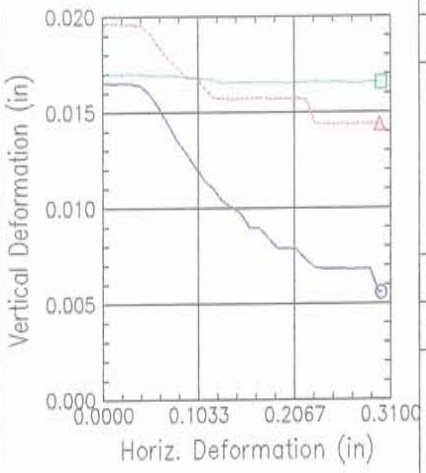
$c = 0.484$ tons/ft²

$\phi = 31.5$ degrees

Type of Specimen	CMS			
Description	---			
LL	PL	PI		G_s
Remarks	--	Project	I-15 @ Warm Springs	
		Area	4.60 (in^2)	Boring No. WS1
		Depth 7.4-7.6 ft		Sample No. DM c
		Elevation		Date 04/28/00
		DIRECT SHEAR TEST REPORT		







Graph Symbol			○	△	□	
Test No.			b	c	d	
Initial	Water content (%)	w_o				
	Void ratio	e_o				
	Saturation (%)	S_o				
	Dry density (lb/ft^3)	γ_d				
Void ratio after consolidation		e_c				
Time for 50 percent consolidation		t_{50}				
Final	Water content (%)	w_f				
	Void Ratio	e_f				
	Saturation (%)	S_f				
Normal stress (t/ft^2)		σ	0.50	1.00	2.00	
Maximum shear stress (t/ft^2)		τ_{max}	0.67	1.05	1.78	
Actual time to failure (min)		t_f	12	13	18	
Rate of strain						
Ultimate shear stress (t/ft^2)		τ_{ult}	0.50	0.74	1.42	

Strength Parameters

c = 0.303 tons / ft^2

ϕ = 36.6 degrees

Type of Specimen	CMS				
Description	---				
LL 0.0	PL 0.0	PI 0.0		G_s 0	
Remarks	--	Project	I-15 @ Warm Springs		
		Area	4.60 (in^2)	Boring No.	WS1
		Depth	7.8 - 8.0 ft	Sample No.	DM d
		Elevation		Date	04/28/00
		DIRECT SHEAR TEST REPORT			

NEVADA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL SECTION

CHEMICAL ANALYSIS

E.A. No. 72495

PROJECT I-15 @ Warm Springs Interchange

BORING # WS1

Sample No.	Chlorides ppm	Sulfates ppm	Ph	Resistivity Ohm-cm
e	60	1,000	7.9	1,166
m	50	800	8.1	2,160
q	50	700	8.3	2,123
w	60	400	8.0	3,831

NEVADA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL SECTION

CHEMICAL ANALYSIS

E.A. No. 72495

PROJECT I-15 @ Warm Springs Interchange

BORING # WS2

Sample No.	Chlorides ppm	Sulfates ppm	Ph	Resistivity Ohm-cm
b	120	0	8.3	2,611
e	110	400	8.4	1,637
i	120	800	8.1	618
n	70	1,000	8.1	858
r	60	trace	8.1	2,809
y	50	400	8.1	2,833
ae	160	trace	7.9	4,202

NEVADA DEPARTMENT OF TRANSPORTATION
GEOTECHNICAL SECTION

CHEMICAL ANALYSIS

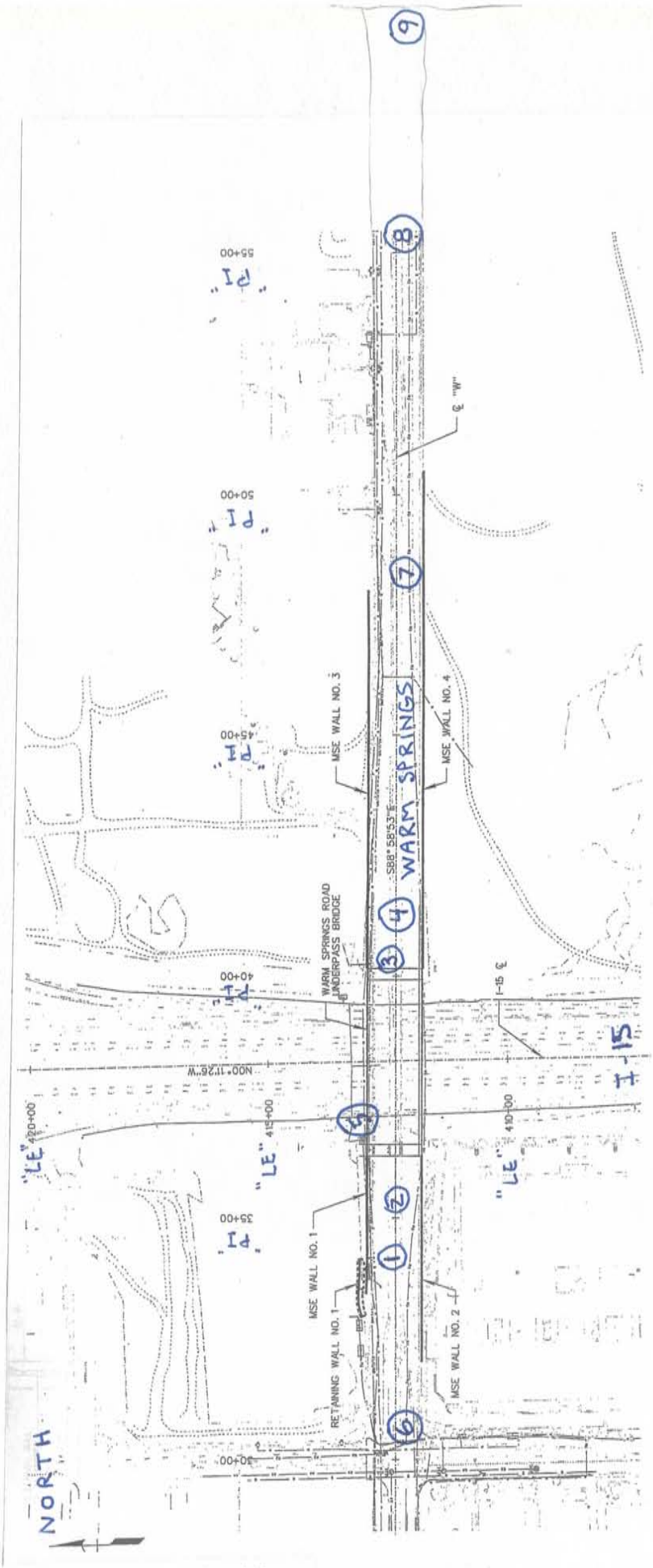
E.A. No. 72495

PROJECT I-15 @ Warm Springs Interchange

BORING # WS3

Sample No.	Chlorides ppm	Sulfates ppm	Ph	Resistivity Ohm-cm
k	60	400	8.2	2,770
s	50	0	8.1	4,425
y	60	0	8.0	4,831
aa	50	0	8.1	5,208

APPENDIX E



Line Sampling Location Map.

LINE SAMPLING DATA

Date Reported: 09/23/05
Lab No.: Soils 09-05, RV-417-05, C-561-05
E.A.: 72495 Job Description: I-15, WARM SPRINGS OVERPASS
Date Rec'd 09/15/05
Samplers: Marshall, Hinton Station PI 34+00 Route
Location from C/L (ft) Lt. 6 Rt.
Sample No.: 1A County: CLARK

Sample Type:
RV ■ Sub ☐ Chem ☐ DC ☐ Other ☐

Vegetation: None ■ Trees ☐ Shrubs ☐
Brushy ☐ Grassy ☐

Cut Section ☐ Fill Section ■
Taken Through Oil ■ Taken on Shoulder ☐
Gravel Depth (in) 3 Oil Depth (in) 3
Remarks:

Submitted By: HINTON
Title: ET III

Depth (ft)	Boring Description	PSI
0--	Oil/Base	0--
2--		2--
4--	Sandy Silt	4--
6--		6--
8--		8--
10--		10--
12--		12--
14--		14--
16--		16--
18--		18--
20--		20--

Sieve Size	% Passing
3"	
2"	
1.5"	
1"	
3/4"	
1/2"	100
3/8"	99
No. 4	94
No. 10	90
No. 16	89
No. 40	87
No. 50	85
No. 100	65
No. 200	40

Liquid Limit 16
Plastic Index 2
Specific Gravity
Resistance Value 54
Cover Stabilometer Expansion Pressure
Thickness

Sand Equivalent 8
Natural Moisture, %
Resistivity 1,279
pH Factor 7.6
HRB Classification

Remarks:

NDOT 027, Rev. 05-01

LINE SAMPLING DATA

Date Reported: 09/23/05
Lab No.: Soils 09-05, RV-418-05, C-562-05
E.A.: 72495 Job Description: I-15, WARM SPRINGS OVERPASS
Date Rec'd 09/13/05
Samplers: Marshall, Hinton Station PI 34+00 Route
Location from C/L (ft) Lt. 6 Rt.
Sample No.: 1B County: CLARK

Sample Type:
RV ■ Sub ☐ Chem ☐ DC ☐ Other ☐

Vegetation: None ■ Trees ☐ Shrubs ☐
Brushy ☐ Grassy ☐

Cut Section ☐ Fill Section ■
Taken Through Oil ■ Taken on Shoulder ☐
Gravel Depth (in) Oil Depth (in)
Remarks:

Submitted By: HINTON
Title: ET II

Depth (ft)	Boring Description	PSI
0--		0--
2--		2--
4--		4--
6--	Sandy Silt	6--
8--		8-- 300
10--		10--
12--		12--
14--		14--
16--		16--
18--		18--
20--		20--

Sieve Size	% Passing
3"	
2"	
1.5"	
1"	
3/4"	100
1/2"	98
3/8"	95
No. 4	90
No. 10	86
No. 16	84
No. 40	82
No. 50	81
No. 100	58
No. 200	32

Liquid Limit 15
Plastic Index NP
Specific Gravity
Resistance Value 75
Cover Stabilometer Expansion Pressure
Thickness

Sand Equivalent 11
Natural Moisture, %
Resistivity 941
pH Factor 7.8
HRB Classification

Remarks:

NDOT 027, Rev. 05-01

LINE SAMPLING DATA

Date Reported: 09/23/05
Lab No.: Soils 09-05, RV-419-05, C-563-05
E.A.: 72495 Job Description: I-15, WARM SPRINGS OVERPASS
Date Rec'd 09/13/05
Samplers: Marshall, Hinton Station PI 34+00 Route
Location from C/L (ft) Lt. 6 Rt.
Sample No.: 1C County: CLARK

Sample Type:
RV ■ Sub ☐ Chem ☐ DC ☐ Other ☐

Vegetation: None ■ Trees ☐ Shrubs ☐
Brushy ☐ Grassy ☐

Cut Section ☐ Fill Section ■
Taken Through Oil ■ Taken on Shoulder ☐
Gravel Depth (in) Oil Depth (in)
Remarks:

Submitted By: HINTON
Title: ET II

Depth (ft)	Boring Description	PSI
0--		0--
2--		2--
4--		4--
6--		6--
8--		8--
10--		10--
12--	Sandy Silt	12-- 300
14--	Gravel	14--
16--		16--
18--		18--
20--		20--

Sieve Size	% Passing
3"	
2"	
1.5"	
1"	100
3/4"	97
1/2"	95
3/8"	91
No. 4	80
No. 10	73
No. 16	70
No. 40	67
No. 50	66
No. 100	48
No. 200	27

Liquid Limit 15
Plastic Index NP
Specific Gravity
Resistance Value 76
Cover Stabilometer Expansion Pressure
Thickness

Sand Equivalent 12
Natural Moisture, %
Resistivity 1,044
pH Factor 8.1
HRB Classification

Remarks:

NDOT 027, Rev. 05-01

LINE SAMPLING DATA

Date Reported: 09/23/05
Lab No.: Soils 09-05, RV-420-05, C-564-05
E.A.: 72495 Job Description: I-15, WARM SPRINGS OVERPASS
Date Rec'd 09/15/05
Samplers: Marshall, Hinton Station PI 35+56 Route
Location from C/L (ft) Lt. Rt. 6
Sample No.: 2A County: CLARK

Sample Type:
RV ■ Sub ☐ Chem ☐ DC ☐ Other ☐

Vegetation: None ■ Trees ☐ Shrubs ☐
Brushy ☐ Grassy ☐

Cut Section ☐ Fill Section ■
Taken Through Oil ■ Taken on Shoulder ☐
Gravel Depth (in) 2 Oil Depth (in) 3
Remarks:

Submitted By: HINTON
Title: ET III

Depth (ft)	Boring Description	PSI
0--	Oil/Base	0--
2--		2--
4--	Sandy Silt	4--
6--		6--
8--		8--
10--		10--
12--		12--
14--		14--
16--		16--
18--		18--
20--		20--

Sieve Size	% Passing
3"	
2"	
1.5"	
1"	
3/4"	100
1/2"	97
3/8"	93
No. 4	88
No. 10	84
No. 16	83
No. 40	81
No. 50	79
No. 100	60
No. 200	35

Liquid Limit 16
Plastic Index 1
Specific Gravity
Resistance Value 70
Cover Stabilometer Expansion Pressure
Thickness

Sand Equivalent 8
Natural Moisture, %
Resistivity 978
pH Factor 8.1
HRB Classification

Remarks:

NDOT 027, Rev. 05-01

LINE SAMPLING DATA

Date Reported: 09/23/05
Lab No.: Soils 09-05, RV-421-05, C-565-05
E.A.: 72495 Job Description: I-15, WARM SPRINGS OVERPASS
Date Rec'd 09/13/05
Samplers: Marshall, Hinton Station PI 35+56 Route
Location from C/L (ft) Lt. Rt. 6
Sample No.: 2B County: CLARK

Sample Type:
RV ■ Sub ☐ Chem ☐ DC ☐ Other ☐

Vegetation: None ■ Trees ☐ Shrubs ☐
Brushy ☐ Grassy ☐

Cut Section ☐ Fill Section ■
Taken Through Oil ■ Taken on Shoulder ☐
Gravel Depth (in) Oil Depth (in)
Remarks:

Submitted By: HINTON
Title: ET II

Depth (ft)	Boring Description	PSI
0--		0--
2--		2--
4--		4--
6--	Sandy Silt	6--
8--		8-- 300
10--		10--
12--		12--
14--		14--
16--		16--
18--		18--
20--		20--

Sieve Size	% Passing
3"	
2"	
1.5"	
1"	
3/4"	100
1/2"	98
3/8"	96
No. 4	87
No. 10	83
No. 16	82
No. 40	80
No. 50	78
No. 100	57
No. 200	32

Liquid Limit 15
Plastic Index NP
Specific Gravity
Resistance Value 73
Cover Stabilometer Expansion Pressure
Thickness

Sand Equivalent 12
Natural Moisture, %
Resistivity 1,126
pH Factor 8.2
HRB Classification

Remarks:

NDOT 027, Rev. 05-01

LINE SAMPLING DATA

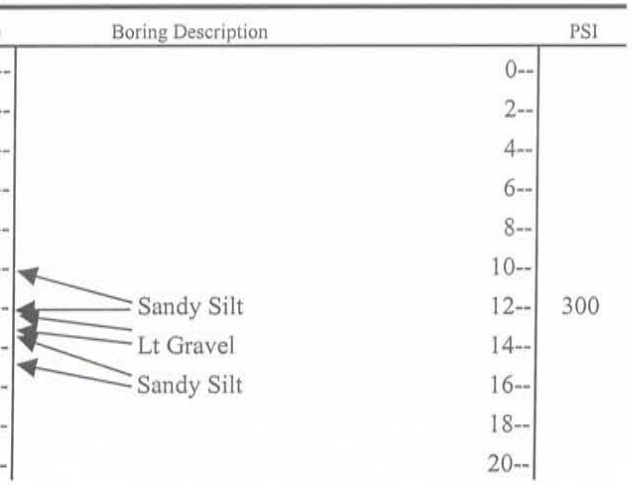
Date Reported: 09/23/05
Lab No.: Soils 09-05, RV-422-05, C-566-05
E.A.: 72495 Job Description: I-15, WARM SPRINGS OVERPASS
Date Rec'd 09/13/05
Samplers: Marshall, Hinton Station PI 35+56 Route
Location from C/L (ft) Lt. Rt. 6
Sample No.: 2C County: CLARK

Sample Type:
RV ■ Sub ☐ Chem ☐ DC ☐ Other ☐

Vegetation: None ■ Trees ☐ Shrubs ☐
Brushy ☐ Grassy ☐

Cut Section ☐ Fill Section ■
Taken Through Oil ■ Taken on Shoulder ☐
Gravel Depth (in) Oil Depth (in)
Remarks:

Submitted By: HINTON
Title: ET II



Sieve Size	% Passing
3"	
2"	
1.5"	
1"	
3/4"	100
1/2"	99
3/8"	97
No. 4	92
No. 10	87
No. 16	85
No. 40	83
No. 50	82
No. 100	61
No. 200	35

Liquid Limit 15
Plastic Index 1
Specific Gravity
Resistance Value 74
Cover Stabilometer Expansion Pressure
Thickness

Sand Equivalent 11
Natural Moisture, %
Resistivity 1,250
pH Factor 8.2
HRB Classification

Remarks:

NDOT 027, Rev. 05-01

LINE SAMPLING DATA

Date Reported: 09/23/05
Lab No.: Soils 09-05, RV-423-05, C-567-05
E.A.: 72495 Job Description: I-15, WARM SPRINGS OVERPASS
Date Rec'd 09/13/05
Samplers: Marshall, Hinton Station PI 35+56 Route
Location from C/L (ft) Lt. Rt. 6
Sample No.: 2D County: CLARK

Sample Type:
RV ■ Sub ☐ Chem ☐ DC ☐ Other ☐

Vegetation: None ■ Trees ☐ Shrubs ☐
Brushy ☐ Grassy ☐

Cut Section ☐ Fill Section ■
Taken Through Oil ■ Taken on Shoulder ☐
Gravel Depth (in) Oil Depth (in)
Remarks:

Submitted By: HINTON
Title: ET II

Depth (ft)	Boring Description	PSI
0--		
2--		
4--		
6--		
8--		
10--		
12--		
14--		
16--		
18--	Sandy Silt	300
20--		

Sieve Size	% Passing
3"	
2"	
1.5"	
1"	
3/4"	
1/2"	
3/8"	100
No. 4	99
No. 10	97
No. 16	95
No. 40	93
No. 50	91
No. 100	70
No. 200	46

Liquid Limit 18
Plastic Index 4
Specific Gravity
Resistance Value 55
Cover Stabilometer Expansion Pressure
Thickness

Sand Equivalent 8
Natural Moisture, %
Resistivity 659
pH Factor 8.1
HRB Classification

Remarks:

NDOT 027, Rev. 05-01

LINE SAMPLING DATA

Date Reported: 09/23/05
Lab No.: Soils 09-05, RV-424-05, C-568-05
E.A.: 72495 Job Description: I-15, WARM SPRINGS OVERPASS
Date Rec'd 09/15/05
Samplers: Marshall, Hinton Station PI 40+52 Route
Location from C/L (ft) Lt. 6 Rt.
Sample No.: 3A County: CLARK

Sample Type:
RV ■ Sub ☐ Chem ☐ DC ☐ Other ☐

Vegetation: None ■ Trees ☐ Shrubs ☐
Brushy ☐ Grassy ☐

Cut Section ☐ Fill Section ■
Taken Through Oil ■ Taken on Shoulder ☐
Gravel Depth (in) 2 Oil Depth (in) 3
Remarks:

Submitted By: HINTON
Title: ET III

Depth (ft)	Boring Description	PSI
0--	Oil/Base	0--
2--		2--
4--	Sandy Silt, Lt Gravel	4--
6--		6--
8--		8--
10--		10--
12--		12--
14--		14--
16--		16--
18--		18--
20--		20--

Sieve Size	% Passing
3"	
2"	
1.5"	
1"	
3/4"	100
1/2"	97
3/8"	97
No. 4	94
No. 10	91
No. 16	90
No. 40	89
No. 50	87
No. 100	65
No. 200	38

Liquid Limit 16
Plastic Index 2
Specific Gravity
Resistance Value 64
Cover Stabilometer Expansion Pressure
Thickness

Sand Equivalent 10
Natural Moisture, %
Resistivity 861
pH Factor 8.1
HRB Classification

Remarks:

NDOT 027, Rev. 05-01

LINE SAMPLING DATA

Date Reported: 09/23/05
Lab No.: Soils 09-05, RV-425-05, C-569-05
E.A.: 72495 Job Description: I-15, WARM SPRINGS OVERPASS
Date Rec'd 09/13/05
Samplers: Marshall, Hinton Station PI 40+52 Route
Location from C/L (ft) Lt. 6 Rt.
Sample No.: 3B County: CLARK

Sample Type:
RV ■ Sub ☐ Chem ☐ DC ☐ Other ☐

Vegetation: None ■ Trees ☐ Shrubs ☐
Brushy ☐ Grassy ☐

Cut Section ☐ Fill Section ■
Taken Through Oil ■ Taken on Shoulder ☐
Gravel Depth (in) Oil Depth (in)
Remarks:

Submitted By: HINTON
Title: ET II

Depth (ft)	Boring Description	PSI
0--		0--
2--		2--
4--		4--
6--		6--
8--	Sandy Silt	8-- 300
10--	Gravel	10--
12--		12--
14--		14--
16--		16--
18--		18--
20--		20--

Sieve Size	% Passing
3"	
2"	
1.5"	
1"	
3/4"	100
1/2"	99
3/8"	95
No. 4	90
No. 10	86
No. 16	84
No. 40	82
No. 50	81
No. 100	59
No. 200	34

Liquid Limit 16
Plastic Index 1
Specific Gravity
Resistance Value 75
Cover Stabilometer Expansion Pressure
Thickness

Sand Equivalent 11
Natural Moisture, %
Resistivity 1,021
pH Factor 8.2
HRB Classification

Remarks:

NDOT 027, Rev. 05-01

LINE SAMPLING DATA

Date Reported: 09/23/05
Lab No.: Soils 09-05, RV-426-05, C-571-05
E.A.: 72495 Job Description: I-15, WARM SPRINGS OVERPASS
Date Rec'd 09/13/05
Samplers: Marshall, Hinton Station PI 40+52 Route
Location from C/L (ft) Lt. 6 Rt.
Sample No.: 3C County: CLARK

Sample Type:
RV ■ Sub ☐ Chem ☐ DC ☐ Other ☐

Vegetation: None ■ Trees ☐ Shrubs ☐
Brushy ☐ Grassy ☐

Cut Section ☐ Fill Section ■
Taken Through Oil ■ Taken on Shoulder ☐
Gravel Depth (in) Oil Depth (in)
Remarks:

Submitted By: HINTON
Title: ET II

Depth (ft)	Boring Description	PSI
0--		0--
2--		2--
4--		4--
6--		6--
8--		8--
10--		10--
12--	Sandy Silt	12-- 300
14--		14--
16--		16--
18--		18--
20--		20--

Sieve Size	% Passing
3"	
2"	
1.5"	
1"	
3/4"	
1/2"	100
3/8"	97
No. 4	93
No. 10	88
No. 16	87
No. 40	84
No. 50	83
No. 100	62
No. 200	37

Liquid Limit 17
Plastic Index 1
Specific Gravity
Resistance Value 70
Cover Stabilometer Expansion Pressure
Thickness

Sand Equivalent 9
Natural Moisture, %
Resistivity 763
pH Factor 8.2
HRB Classification

Remarks:

NDOT 027, Rev. 05-01

LINE SAMPLING DATA

Date Reported: 09/23/05
Lab No.: Soils 09-05, RV-427-05, C-572-05
E.A.: 72495 Job Description: I-15, WARM SPRINGS OVERPASS
Date Rec'd 09/13/05
Samplers: Marshall, Hinton Station PI 40+52 Route
Location from C/L (ft) Lt. 6 Rt.
Sample No.: 3D County: CLARK

Sample Type:
RV ■ Sub ☐ Chem ☐ DC ☐ Other ☐

Vegetation: None ■ Trees ☐ Shrubs ☐
Brushy ☐ Grassy ☐

Cut Section ☐ Fill Section ■
Taken Through Oil ■ Taken on Shoulder ☐
Gravel Depth (in) Oil Depth (in)
Remarks:

Submitted By: HINTON
Title: ET II

Depth (ft)	Boring Description	PSI
0--		0--
2--		2--
4--		4--
6--		6--
8--		8--
10--		10--
12--		12--
14--		14--
16--		16--
18--	Sandy Silt	18-- 300
20--		20--

Sieve Size	% Passing
3"	
2"	
1.5"	
1"	
3/4"	100
1/2"	99
3/8"	98
No. 4	93
No. 10	89
No. 16	88
No. 40	86
No. 50	84
No. 100	59
No. 200	35

Liquid Limit 16
Plastic Index 1
Specific Gravity
Resistance Value 68
Cover Stabilometer Expansion Pressure
Thickness

Sand Equivalent 12
Natural Moisture, %
Resistivity 662
pH Factor 8.1
HRB Classification

Remarks:

NDOT 027, Rev. 05-01

LINE SAMPLING DATA

Date Reported: 09/23/05
Lab No.: Soils 09-05, RV-428-05, C-573-05
E.A.: 72495 Job Description: I-15, WARM SPRINGS OVERPASS
Date Rec'd 09/15/05
Samplers: Marshall, Hinton Station PI 42+00 Route
Location from C/L (ft) Lt. Rt. 6
Sample No.: 4A County: CLARK

Sample Type:
RV ■ Sub ☐ Chem ☐ DC ☐ Other ☐

Vegetation: None ■ Trees ☐ Shrubs ☐
Brushy ☐ Grassy ☐

Cut Section ☐ Fill Section ■
Taken Through Oil ■ Taken on Shoulder ☐
Gravel Depth (in) 2 Oil Depth (in) 3
Remarks:

Submitted By: HINTON
Title: ET III

Depth (ft)	Boring Description	PSI
0--	Oil/Base	
2--		300
4--	Sandy Silt, Lt Gravel	
6--		
8--		
10--		
12--		
14--		
16--		
18--		
20--		

Sieve Size	% Passing
3"	
2"	
1.5"	
1"	
3/4"	100
1/2"	96
3/8"	92
No. 4	86
No. 10	81
No. 16	80
No. 40	78
No. 50	77
No. 100	56
No. 200	33

Liquid Limit 15
Plastic Index NP
Specific Gravity
Resistance Value 69
Cover Stabilometer Expansion Pressure
Thickness

Sand Equivalent 11
Natural Moisture, %
Resistivity 1,203
pH Factor 8.3
HRB Classification

Remarks:

NDOT 027, Rev. 05-01

LINE SAMPLING DATA

Date Reported: 09/23/05
Lab No.: Soils 09-05, RV-429-05, C-574-05
E.A.: 72495 Job Description: I-15, WARM SPRINGS OVERPASS
Date Rec'd 09/13/05
Samplers: Marshall, Hinton Station PI 42+00 Route
Location from C/L (ft) Lt. Rt. 6
Sample No.: 4B County: CLARK

Sample Type:
RV ■ Sub ☐ Chem ☐ DC ☐ Other ☐

Vegetation: None ■ Trees ☐ Shrubs ☐
Brushy ☐ Grassy ☐

Cut Section ☐ Fill Section ■
Taken Through Oil ■ Taken on Shoulder ☐
Gravel Depth (in) Oil Depth (in)
Remarks:

Submitted By: HINTON
Title: ET II

Depth (ft)	Boring Description	PSI
0--		0--
2--		2--
4--		4--
6--	Sandy Silt	6--
8--		8-- 300
10--		10--
12--		12--
14--		14--
16--		16--
18--		18--
20--		20--

Sieve Size	% Passing
3"	
2"	
1.5"	
1"	
3/4"	
1/2"	100
3/8"	99
No. 4	95
No. 10	91
No. 16	90
No. 40	88
No. 50	86
No. 100	61
No. 200	35

Liquid Limit 16
Plastic Index 1
Specific Gravity
Resistance Value 73
Cover Stabilometer Expansion Pressure
Thickness

Sand Equivalent 13
Natural Moisture, %
Resistivity 713
pH Factor 8.1
HRB Classification

Remarks:

NDOT 027, Rev. 05-01

LINE SAMPLING DATA

Date Reported: 09/23/05
Lab No.: Soils 09-05, RV-430-05, C-575-05
E.A.: 72495 Job Description: I-15, WARM SPRINGS OVERPASS
Date Rec'd 09/13/05
Samplers: Marshall, Hinton Station PI 42+00 Route
Location from C/L (ft) Lt. Rt. 6
Sample No.: 4C County: CLARK

Sample Type:
RV ■ Sub ☐ Chem ☐ DC ☐ Other ☐

Vegetation: None ■ Trees ☐ Shrubs ☐
Brushy ☐ Grassy ☐

Cut Section ☐ Fill Section ■
Taken Through Oil ■ Taken on Shoulder ☐
Gravel Depth (in) Oil Depth (in)
Remarks:

Submitted By: HINTON
Title: ET II

Depth (ft)	Boring Description	PSI
0--		0--
2--		2--
4--		4--
6--		6--
8--		8--
10--		10--
12--	Sandy Silt	12-- 300
14--		14--
16--		16--
18--		18--
20--		20--

Sieve Size	% Passing
3"	
2"	
1.5"	
1"	
3/4"	
1/2"	
3/8"	100
No. 4	97
No. 10	93
No. 16	91
No. 40	89
No. 50	87
No. 100	64
No. 200	42

Liquid Limit 17
Plastic Index 4
Specific Gravity
Resistance Value 55
Cover Stabilometer Expansion Pressure
Thickness

Sand Equivalent 9
Natural Moisture, %
Resistivity 606
pH Factor 8.1
HRB Classification

Remarks:

NDOT 027, Rev. 05-01

LINE SAMPLING DATA

Date Reported: 09/23/05
Lab No.: Soils 09-05, RV-431-05, C-576-05
E.A.: 72495 Job Description: I-15, WARM SPRINGS OVERPASS
Date Rec'd 09/15/05
Samplers: Marshall, Hinton Station LE 413+10 Route
Location from C/L (ft) Lt. 60 Rt.
Sample No.: 5A County: CLARK

Sample Type:
RV ■ Sub ☐ Chem ☐ DC ☐ Other ☐

Vegetation: None ■ Trees ☐ Shrubs ☐
Brushy ☐ Grassy ☐

Cut Section ■ Fill Section ☐
Taken Through Oil ■ Taken on Shoulder ☐
Gravel Depth (in) 6 Oil Depth (in) 12
Remarks:

Submitted By: HINTON
Title: ET III

Depth (ft)	Boring Description	PSI
0--	Oil/Base	
2--		400
4--	Sandy Silt	
6--		
8--		
10--		
12--		
14--		
16--		
18--		
20--		

Sieve Size	% Passing
3"	
2"	
1.5"	
1"	
3/4"	100
1/2"	98
3/8"	97
No. 4	93
No. 10	90
No. 16	88
No. 40	84
No. 50	82
No. 100	58
No. 200	37

Liquid Limit 16
Plastic Index 1
Specific Gravity
Resistance Value 68
Cover Stabilometer Expansion Pressure
Thickness

Sand Equivalent 10
Natural Moisture, %
Resistivity 535
pH Factor 8.2
HRB Classification

Remarks:

NDOT 027, Rev. 05-01

LINE SAMPLING DATA

Date Reported: 09/23/05
Lab No.: Soils 09-05, RV-432-05, C-577-05
E.A.: 72495 Job Description: I-15, WARM SPRINGS OVERPASS
Date Rec'd 09/15/05
Samplers: Marshall, Hinton Station LE 413+10 Route
Location from C/L (ft) Lt. 60 Rt.
Sample No.: 5B County: CLARK

Sample Type:
RV ■ Sub ☐ Chem ☐ DC ☐ Other ☐

Vegetation: None ■ Trees ☐ Shrubs ☐
Brushy ☐ Grassy ☐

Cut Section ■ Fill Section ☐
Taken Through Oil ■ Taken on Shoulder ☐
Gravel Depth (in) Oil Depth (in)
Remarks:

Submitted By: HINTON
Title: ET III

Depth (ft)	Boring Description	PSI
0--		0--
2--		2--
4--		4--
6--	Sandy Silt	6--
8--		8-- 300
10--		10--
12--		12--
14--		14--
16--		16--
18--		18--
20--		20--

Sieve Size	% Passing
3"	
2"	
1.5"	
1"	
3/4"	
1/2"	100
3/8"	99
No. 4	96
No. 10	94
No. 16	93
No. 40	91
No. 50	89
No. 100	60
No. 200	31

Liquid Limit 15
Plastic Index NP
Specific Gravity
Resistance Value 77
Cover Stabilometer Expansion Pressure
Thickness

Sand Equivalent 11
Natural Moisture, %
Resistivity 1,034
pH Factor 8.3
HRB Classification

Remarks:

NDOT 027, Rev. 05-01

LINE SAMPLING DATA

Date Reported: 09/23/05
Lab No.: Soils 09-05, RV-433-05, C-578-05
E.A.: 72495 Job Description: I-15, WARM SPRINGS OVERPASS
Date Rec'd 09/13/05
Samplers: Marshall, Hinton Station LE 413+10 Route
Location from C/L (ft) Lt. 60 Rt.
Sample No.: 5C County: CLARK

Sample Type:
RV ■ Sub ☐ Chem ☐ DC ☐ Other ☐

Vegetation: None ■ Trees ☐ Shrubs ☐
Brushy ☐ Grassy ☐

Cut Section ■ Fill Section ☐
Taken Through Oil ■ Taken on Shoulder ☐
Gravel Depth (in) Oil Depth (in)
Remarks:

Submitted By: HINTON
Title: ET II

Depth (ft)	Boring Description	PSI
0--		0--
2--		2--
4--		4--
6--		6--
8--		8--
10--	Sandy Silt, Lt Gravel	10--
12--		12-- 300
14--		14--
16--		16--
18--		18--
20--		20--

Sieve Size	% Passing
3"	
2"	
1.5"	
1"	100
3/4"	97
1/2"	97
3/8"	94
No. 4	88
No. 10	82
No. 16	81
No. 40	78
No. 50	76
No. 100	50
No. 200	28

Liquid Limit 20
Plastic Index 5
Specific Gravity
Resistance Value 65
Cover Stabilometer Expansion Pressure
Thickness

Sand Equivalent 3
Natural Moisture, %
Resistivity 918
pH Factor 8.2
HRB Classification

Remarks:

NDOT 027, Rev. 05-01

LINE SAMPLING DATA

Date Reported: 09/23/05
Lab No.: Soils 09-05, RV-434-05, C-579-05
E.A.: 72495 Job Description: I-15, WARM SPRINGS OVERPASS
Date Rec'd 09/13/05
Samplers: Marshall, Hinton Station LE 413+10 Route
Location from C/L (ft) Lt. 60 Rt.
Sample No.: 5D County: CLARK

Sample Type:
RV ■ Sub ☐ Chem ☐ DC ☐ Other ☐

Vegetation: None ■ Trees ☐ Shrubs ☐
Brushy ☐ Grassy ☐

Cut Section ■ Fill Section ☐
Taken Through Oil ■ Taken on Shoulder ☐
Gravel Depth (in) Oil Depth (in)
Remarks:

Submitted By: HINTON
Title: ET II

Depth (ft)	Boring Description	PSI
0--		0--
2--		2--
4--		4--
6--		6--
8--		8--
10--		10--
12--		12--
14--		14--
16--		16--
18--	Sandy Silt	18-- 300
20--		20--

Sieve Size	% Passing
3"	
2"	
1.5"	
1"	
3/4"	100
1/2"	99
3/8"	93
No. 4	83
No. 10	77
No. 16	75
No. 40	73
No. 50	71
No. 100	49
No. 200	27

Liquid Limit 25
Plastic Index 9
Specific Gravity
Resistance Value 75
Cover Stabilometer Expansion Pressure
Thickness

Sand Equivalent 3
Natural Moisture, %
Resistivity 881
pH Factor 8.2
HRB Classification

Remarks:

NDOT 027, Rev. 05-01

LINE SAMPLING DATA

Date Reported: 05/31/02
Lab No.: Soils-06-02, RV-172-02, C-194-02
E.A.: 72495 Job Description: WARM SPRINGS ROAD
Date Sampled: 05/22/02
Samplers: K. MARSHALL Station: "P1" 32+00 Route
P. ARGALL Location from C/L (ft) Lt. Rt. 31
Sample No.: 6 County: CLARK

Sample Type:
RV ■ Sub ☐ Chem ☐ DC ☐ Other ☐

Vegetation: None ■ Trees ☐ Shrubs ☐
Brushy ☐ Grassy ☐

Cut Section ■ Fill Section ☐
Taken Through Oil ☐ Taken on Shoulder ■
Gravel Depth (cm) Oil Depth (cm)
Remarks:
again.

Submitted By: KEVIN MARSHALL
Title: ENGR. TECH. III

Depth (m)	Boring Description	PSI
0--		0--
1--	0 to 1.5 m	1-- 300
2--	Silty Sand & Lt. Gravel	2--
3--		3--
4--		4--
5--		5--
6--		6--
7--		7--
8--		8--
9--		9--
10--		10--

Sieve Size	% Passing
3"	
2"	
1.5"	
1"	100
3/4"	94
1/2"	88
3/8"	86
No. 4	76
No. 10	69
No. 16	66
No. 40	61
No. 50	59
No. 100	38
No. 200	17

Liquid Limit 14
Plastic Index NP
Specific Gravity
Resistance Value 66
Cover Stabilometer Expansion Pressure
Thickness 8" 0

Sand Equivalent 20
Natural Moisture, %
Resistivity 2,294
pH Factor 8.0
HRB Classification A-2-4 (0)

Remarks:

NDOT 027, Rev. 05-01

LINE SAMPLING DATA

Date Reported: 05/31/02
Lab No.: Soils-06-02, RV-173-02, C-195-02
E.A.: 72495 Job Description: WARM SPRINGS ROAD
Date Sampled: 05/22/02
Samplers: K. MARSHALL Station: "P1" 48+00 Route
P. ARGALL Location from C/L (ft) Lt. Rt. 22
Sample No.: 7 County: CLARK

Sample Type:
RV ■ Sub ☐ Chem ☐ DC ☐ Other ☐

Vegetation: None ■ Trees ☐ Shrubs ☐
Brushy ☐ Grassy ☐

Cut Section ■ Fill Section ☐
Taken Through Oil ☐ Taken on Shoulder ■
Gravel Depth (cm) Oil Depth (cm)
Remarks:
again.

Submitted By: KEVIN MARSHALL
Title: ENGR. TECH. III

Depth (m)	Boring Description	PSI
0--		0--
1--	0 to 1.5 m	1-- 300
2--	Silty Sand & Lt. Gravel	2--
3--		3--
4--		4--
5--		5--
6--		6--
7--		7--
8--		8--
9--		9--
10--		10--

Sieve Size	% Passing
3"	
2"	
1.5"	100
1"	96
3/4"	96
1/2"	92
3/8"	89
No. 4	83
No. 10	80
No. 16	79
No. 40	76
No. 50	73
No. 100	43
No. 200	28

Liquid Limit 14
Plastic Index NP
Specific Gravity
Resistance Value 65
Cover Stabilometer Expansion Pressure
Thickness 8" 0

Sand Equivalent 18
Natural Moisture, %
Resistivity 1,017
pH Factor 7.9
HRB Classification A-2-4 (0)

Remarks:

NDOT 027, Rev. 05-01

LINE SAMPLING DATA

Date Reported: 05/31/02
Lab No.: Soils-06-02, RV-174-02, C-196-02
E.A.: 72495 Job Description: WARM SPRINGS ROAD
Date Sampled: 05/22/02
Samplers: K. MARSHALL Station: "P1" 55+50 Route
P. ARGALL Location from C/L (ft) Lt. Rt. 31
Sample No.: 8A County: CLARK

Sample Type:
RV ■ Sub ☐ Chem ☐ DC ☐ Other ☐

Vegetation: None ■ Trees ☐ Shrubs ☐
Brushy ☐ Grassy ☐

Cut Section ■ Fill Section ☐
Taken Through Oil ☐ Taken on Shoulder ■
Gravel Depth (cm) Oil Depth (cm)
Remarks:
again.

Submitted By: KEVIN MARSHALL
Title: ENGR. TECH. III

Depth (m)	Boring Description	PSI
0--		0--
1--	0 to 1.5 m	1-- 300
2--	Silty Sand	2--
3--		3--
4--		4--
5--		5--
6--		6--
7--		7--
8--		8--
9--		9--
10--		10--

Sieve Size	% Passing
3"	
2"	
1.5"	
1"	
3/4"	
1/2"	
3/8"	100
No. 4	98
No. 10	97
No. 16	96
No. 40	94
No. 50	92
No. 100	70
No. 200	48

Liquid Limit 18
Plastic Index 6
Specific Gravity
Resistance Value 44
Cover Stabilometer Expansion Pressure
Thickness 15" 0

Sand Equivalent 4
Natural Moisture, %
Resistivity 478
pH Factor 7.9
HRB Classification A-4 (3)

Remarks:

NDOT 027, Rev. 05-01

LINE SAMPLING DATA

Date Reported: 05/31/02
Lab No.: Soils-06-02, RV-175-02, C-197-02
E.A.: 72495 Job Description: WARM SPRINGS ROAD
Date Sampled: 05/22/02
Samplers: K. MARSHALL Station: "P1" 55+50 Route
P. ARGALL Location from C/L (ft) Lt. Rt. 31
Sample No.: - 8B County: CLARK

Sample Type:
RV ■ Sub ☐ Chem ☐ DC ☐ Other ☐
Vegetation: None ■ Trees ☐ Shrubs ☐
Brushy ☐ Grassy ☐
Cut Section ■ Fill Section ☐
Taken Through Oil ☐ Taken on Shoulder ■
Gravel Depth (cm) Oil Depth (cm)
Remarks:
again.

Submitted By: KEVIN MARSHALL
Title: ENGR. TECH. III

Depth (m)	Boring Description	PSI
0--		0--
1--		1--
2--	1.5 to 3 m	2-- 300
3--	Silty Sand	3--
4--	Very Lt Gravel	4--
5--		5--
6--		6--
7--		7--
8--		8--
9--		9--
10--		10--

Sieve Size	% Passing
3"	
2"	
1.5"	
1"	
3/4"	
1/2"	
3/8"	100
No. 4	99
No. 10	97
No. 16	96
No. 40	93
No. 50	92
No. 100	71
No. 200	50

Liquid Limit 18
Plastic Index 6
Specific Gravity
Resistance Value 43
Cover Stabilometer Expansion Pressure
Thickness 15.5" 0

Sand Equivalent 5
Natural Moisture, %
Resistivity 465
pH Factor 7.9
HRB Classification A-4 (3)

Remarks:

NDOT 027, Rev. 05-01

LINE SAMPLING DATA

Date Reported: 05/31/02
Lab No.: Soils-06-02, RV-176-02, C-198-02
E.A.: 72495 Job Description: WARM SPRINGS ROAD
Date Sampled: 05/22/02
Samplers: K. MARSHALL Station: "P1" 59+25 Route
P. ARGALL Location from C/L (ft) Lt. Rt. 45
Sample No.: 9 County: CLARK

Sample Type:
RV ■ Sub ☐ Chem ☐ DC ☐ Other ☐

Vegetation: None ■ Trees ☐ Shrubs ☐
Brushy ☐ Grassy ☐

Cut Section ■ Fill Section ☐
Taken Through Oil ☐ Taken on Shoulder ■
Gravel Depth (cm) Oil Depth (cm)
Remarks:
again.

Submitted By: KEVIN MARSHALL
Title: ENGR. TECH. III

Depth (m)	Boring Description	PSI
0--	Base Matl. to 8"	0--
1--	0 to 1.5 m	1-- 300
2--	Silty Sand	2--
3--		3--
4--		4--
5--		5--
6--		6--
7--		7--
8--		8--
9--		9--
10--		10--

Sieve Size	% Passing
3"	
2"	
1.5"	
1"	
3/4"	100
1/2"	98
3/8"	98
No. 4	94
No. 10	91
No. 16	88
No. 40	85
No. 50	84
No. 100	70
No. 200	53

Liquid Limit 20
Plastic Index 8
Specific Gravity
Resistance Value 22
Cover Stabilometer Expansion Pressure
Thickness 22.5" 6.5"

Sand Equivalent 6
Natural Moisture, %
Resistivity 427
pH Factor 7.8
HRB Classification A-4 (4)

Remarks:

NDOT 027, Rev. 05-01