# FINAL GEOTECHNICAL INVESTIGATION

# U. S. HIGHWAY 95 PROJECT 1A WIDENING RAINBOW BOULEVARD TO CHEYENNE AVENUE

LAS VEGAS, NEVADA

**JUNE 2000** 

prepared for

Sverdrup Civil Inc. Las Vegas, Nevada



June 16, 2000

Project No.: 0215-01-1

Mr. David Potter Sverdrup Civil, Inc. 5450 West Sahara Avenue, Suite 150 Las Vegas, NV 89146

Black Eagle Consulting, Inc.

U.S. 95 Widening Geotechnical Investigation Re:

Dear Mr. Potter:

The following report presents the final results of our geotechnical investigation for widening of U.S. 95 between Rainbow Boulevard and Cheyenne Avenue. This report incorporates review comments from Sverdrup Civil and the Nevada Department of Transportation.

Soils encountered along the alignment are almost exclusively cemented granular materials exhibiting high standard penetration testing blowcounts, low plasticity, and a low percentage of fines. Subgrade strength along the mainline alignment was found to be high with R-Values ranging from 47 to 74. Localized lenses of weak caliche are present at depth, generally in the range of 300 to 450 millimeters in thickness. Very stiff clay soils were encountered along the northern segment of the proposed southbound sound walls at depths below one to two meters. All areas explored were suitable for standard spread footings or drilled shaft foundations for support of sound walls and/or retaining walls. Trench footings, if desired, will require aggressive excavation techniques.

We wish to thank you for the opportunity to provide our services and will be available to answer related questions.

Sincerely,

Black Eagle Consulting, Inc.

Dal Hunter, Ph.D., P.E.

Vice President R.E. 9343

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President

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#### FINAL GEOTECHNICAL INVESTIGATION

# U. S. HIGHWAY 95 PROJECT 1A WIDENING RAINBOW BOULEVARD TO CHEYENNE AVENUE

LAS VEGAS, NEVADA

#### **SUMMARY OF RECOMMENDATIONS**

#### General Information

Soils encountered along the alignment are almost exclusively cemented granular materials exhibiting high standard penetration testing blowcounts, low plasticity, and a low percentage of fines. Subgrade strength along the mainline alignment was found to be high with R-values ranging from 47 to 74. Localized lenses of weak caliche are present at depth, generally in the range of 300 to 450 millimeters in thickness. Very stiff clay soils were encountered along the northern segment of the proposed southbound noise barriers at depths below one to two meters. All areas explored were suitable for standard spread footings or drilled shaft foundations for support of noise barriers and/or retaining walls. Trench footings may be possible, but will require aggressive excavation techniques. The vast majority of the materials encountered will be suitable for *Borrow* or backfill.

# Site Preparation

All vegetation should be stripped and grubbed from structural areas and removed from the site. A stripping depth of 25 mm is anticipated. Clearing and grubbing should be performed in accordance with section 201 of the Nevada Department of Transportation Standard Specifications for Road And Bridge Construction (SSRBC).

All areas to receive structural fill or structural loading should be densified to, at least, 90 percent relative compaction in accordance with SSRBC section 203.03.15. Where cemented soils are present, compaction is not practical or necessary. The surface of cemented soils should be cleaned of loose material prior to placement of fill, aggregate base or footing loads. In all cases, the final surface should be smooth, firm, and exhibit no signs of deflection.

If wet weather construction is anticipated, surface soils may be well above optimum moisture and impossible to compact. In most situations, stabilization should be possible by scarifying the top 300 mm of subgrade and allowing it to air dry to near-optimum moisture, prior to compaction. Where this procedure is ineffective or where construction schedules preclude delays, it will be necessary to remove the saturated soils. Areas of overexcavation for embankment fill should be backfilled with borrow, as per section 203 of the State of Nevada Standard Specifications for Road and Bridge Construction (SSRBC). Areas of overexcavation for foundation fill should be backfilled with granular backfill as per Section 207 of SSRBC. All Borrow or Granular Backfill should be densified to at least 90 percent relative compaction.

# Trenching and Excavation

Trenching on this site will be difficult due to the weak to moderate soil cementation, including zones of weak caliche. All of our exploration was performed with hollow-stem auger drilling techniques (refer to section on **Exploration**), indicating that no extremely hard caliche was encountered. Localized zones of harder caliche may be present between boring locations. Temporary trenches with near vertical side walls should be stable to a depth of approximately 1.5 meters. Excavations to greater depths will require shoring or laying back of sidewalls to maintain adequate stability. Regulations amended in Part 1926, Volume 54, Number 209 of the Federal Register (Table B-1, October 31, 1989) require that the temporary sidewall slopes be no greater than those presented in Table 1.

	TABLE 1 - MAXIMUM ALLOWABLE TEMPORARY SLOPES				
	Soil or Rock Type	Maximum Allowable Slopes <sup>1</sup> for Deep Excavations less than 6 Meters Deep <sup>2</sup>			
Stable Rock Vertical (90 degrees)					
	Type A <sup>3</sup>	4V:3H (53 degrees)			
	Type B 1V:1H (45 degrees)				
	Type C	2V:3H (34 degrees)			
		Notes:			
1.	Numbers shown in parentheses next to maximum allowable slopes are angles expressed in degrees from the horizontal. Angles have been rounded off.				
2.	Sloping or benching for excavations great than 6 meters deep shall be designed by a registered professional engineer.				
3.	A short-term (open 24 hours or less) maximum allowable slope of 2V:1H (63 degrees) is allowed in excavation in type A soil that are 3.7 meters or less in depth. Short-term maximum allowable slopes for excavations greater than 3.7 meters in depth shall be 4V:3H (53 degrees).				

On the basis of our exploration, the U.S. 95 soils are predominately Type A. Any area in question should be specifically examined by the geological engineer during construction. All trenching should be performed and stabilized in accordance with local, state, and OSHA standards.

The majority of the materials encountered during our exploration were granular and would be suitable for backfill, except where *Granular Backfill* is required in accordance with section 207.02.02 of *SSRBC*. Backfill placement and compaction shall be in accordance with *SSRBC* sections 207.03.01, 207.03.02, and 207.03.03.

# **Directional Borings**

It is our understanding that directional borings may be required for storm drains at mainline station 120+50 (0.91-meter diameter) and 129+50 (1.22-meter diameter). In both cases our borings indicate the presence of weakly to moderately cemented sands and gravels with localized zones of weak caliche. Since all of our exploration drilling was performed with a hollow stem auger (152-mm diameter), we anticipate that directional borings should be possible on this site. The drilling contractor needs to be familiar with the Las Vegas area and recognize that, while we drilled the borings with a hollow-stem auger, most of our sampling efforts either met with refusal or had very high standard penetration tests ("blowcounts").

# **Grading and Filling**

Borrow and Select Borrow on this project should conform to the requirements of sections 203.02.04 and 203.02.05 of the SSRBC, respectively. The material should all pass a 75 mm sieve and must have a minimum R-value of 45. Native granular soils meeting these requirements will be suitable for use as Borrow, where available.

Fill materials in structural areas should be placed and compacted to at least 90 percent in accordance with *SSRBC* sections 203.03.12, 203.03.13, 203.03.14, and 203.03.15.

### Subsidence and Shrinkage

Any granular cemented soils excavated and recompacted in structural fills should experience quantity shrinkage of approximately 5 to 10 percent. In other words, one cubic meter of excavated granular material will generate about 0.9 to 0.95 cubic meters of structural fill at 90 percent relative compaction.

### **Foundation Design**

#### **Spread Footings**

Noise barriers and/or retaining walls on this project can readily be supported on cemented granular soils, compacted granular native soil or *Borrow*. Bearing capacity and settlement calculations were performed using AASHTO (1996) methodologies and are included as Appendix A. Continuous wall footings underlain by compacted, granular native soil or structural fill can be designed for a net maximum allowable bearing pressure of 192 kPa. The net allowable bearing pressure is that pressure at the base of the footing in excess of the adjacent overburden pressure. This allowable bearing value should be used for dead plus ordinary live loads. Ordinary live loads are defined as being that portion of the design live load which will be present during the majority of the life of the structure. Design live loads are those loads which are produced by the use and occupancy of the building, such as by moveable objects, including people or equipment, as well as snow loads. The bearing value of 192 kPa may be increased by one-third for total loads. Total loads are defined as the maximum load imposed by the required combinations of dead load, design live loads, snow loads, and wind or seismic loads.

Allowable bearing capacity for sound wall and retaining wall spread footings is limited by settlement. With the above allowable bearing pressure, total settlements of approximately 13 mm or less should be anticipated. Differential settlements along footings with similar loads, dimensions, and base elevations should not exceed two-thirds of the values provided above for total settlements. The majority of the anticipated settlement will occur during the construction period as the loads are applied.

Lateral loads, such as wind or seismic, may be resisted by passive soil pressure and friction on the bottom of the footing. The recommended coefficient of base friction is 0.45 and has been reduced by a factor of 1.5 on the ultimate soil strength. Design values for active and passive equivalent fluid pressures are 5.3 and 66.7 kN/m³, respectively. Foundation fill should be backfilled with *granular backfill* as per Section 207, SSRBC. All exterior footings should be placed a minimum 300 mm below adjacent finish grade for frost protection.

If loose, soft, wet, or disturbed soils are encountered at the foundation subgrade, these soils should be removed to expose undisturbed material, and the resulting overexcavation backfilled with compacted *Granular Backfill*. The maximum depth of overexcavation required would be one meter. The base of all excavations should be dry and free of loose soils at the time of concrete placement.

#### **Drilled Shafts**

It is our understanding that drilled shaft foundations are not necessary for this project, as currently designed. The following design criteria were developed for granular materials during an earlier draft of this report and are included for use in the event of a design change. Drilled shafts for noise barriers between borings WR-9 and WR-14 would require another design due to the presence of clay soils below a depth of 2 meters. Cemented soils and interbedded caliche layers will slow drilling operations but should be easily penetrated with a rock bit.

Numerous combinations of shaft diameter, length, and capacity are possible for sound and retaining wall foundations. Based on the preliminary loads provided, we have calculated the compressive uplift and axial capacity for a variety of drilled shaft configurations, presented in Tables 2A and 2B.

TABLE 2A -	TABLE 2A - CAPACITY OF DRILLED SHAFT FOUNDATIONS IN kN - GRANULAR SOILS								
Length in Millimeters									
2,500 3,000 3,500									
Diameter in Millimeters	Com- pression	Uplift	Lateral*	Com- pression	Uplift	Lateral*	Com- pression	Uplift	Lateral*
305	93	26		103	37	_	114	49	
460	192	41	_	206	58	_	224	77	_
610	325	58	400	345	81	_	368	108	_
	* Shear Load at Ground Line								

	Length in Millimeters  3,500			
Diameters in Millimeters				
	Compression	Up Lift	Lateral**	
305	265	171	_	
460	318	233	-	
610	423	367	400	

The axial capacities were calculated using the method provided by AASHTO (1996) for cohesionless soils. Since the soils are both granular and cohesive (weakly cemented), the calculation is conservative. Lateral capacity was calculated only for a 610-mm-diameter shaft, 2,500 mm in length. Because of the granular, cemented nature of the materials, the lateral capacity is quite high. The lateral capacity was determined for a 3 mm ground line deflection using the finite element method of Bowles (1996). If drilled shafts are selected, we will provide specific analysis for the actual shaft configuration(s) and lateral and moment loading. Design calculations for drilled shaft foundations are included as Appendix B.

#### **High Mast Lighting**

Foundations for this type of structure are dominated by lateral loads and best supported on a drilled shaft foundation. It is our understanding that the base plate configuration requires a minimum shaft diameter of 91 mm. The Brohms method (AASHTO, 1996; Brohms, 1966) was used to determine

the minimum shaft length. The length was increased by 20 percent as a factor of safety with the following results:

Table 3 – Design Parameters for High Mast Lighting Drilled Shaft Foundations				
Minimum Diameter	Minimum Length of Embedment	Depth to Maximum  Moment	Maximum Moment	
91 mm	4,400 mm	610 mm	455 kN - m @ 610 mm	

Design calculations are presented in Appendix B.

#### **Trench Footings**

Trench footings could also provide adequate support for noise barriers. We are not aware of AASHTO design methods for trench footings so that the methodology of the California Department of Transportation (1990) was used (Appendix C). This method uses a simplified sheet pile analysis to calculate the allowable net horizontal lateral soil pressure. Our design values for the various noise barriers are presented below:

TABLE 2 - TRENCH FOOTING DESIGN PARAMETERS				
Noise Barrier Number  Allowable Net Horizontal Lateral Soil Pressure in kN/m³				
2, 3, 4, and 5 (level ground condition)	230			
5 (1:6 downward slope to the east) 148				
* Includes "R" factor of 0.753 and wall friction. No additional factor of safety has been applied.				

The bottom of trench footings should be cleaned of loose materials, to the extent practical, prior to pouring of concrete.

#### **RETAINING STRUCTURES**

# **Conventional Retaining Walls**

The following recommendations are for backfill of conventional retaining walls with vertical back faces and various backfill slopes. Surcharge loads, including construction and traffic loads, should be added to the following values. Design calculations, in accordance with AASHTO (1996) methodology are included in Appendix D.

STATIC CONDITIONS				
Top Slope Coefficient				
(vert:horiz)	Active	At Rest	Passive	Friction**
Flat	0.288	0.441	7.4	0.68
1:3	0.352	0.441	14.4	0.68
1:2	0.417	0.441	19.2	0.68

EARTHQUAKE CONDITIONS**				
Top Slope (vert:horiz) Coefficient				
	Active	Passive		
Flat	0.33	4.9		
1:3	0.45	14		
1:2	0.65	26		
* Recommend use of unit weight of 20.4 kN/m³ in calculation of lateral earth pressures.				
** Based on ground acceleration o	of 0.15 g with a 10 percent pro (AASHTO, 1996).	bability of exceedence in 50 years		

Backfill behind retaining walls should be placed and compacted in accordance with sections 207.03.01 and 207.03.02 of SSRBC. The walls should be sufficiently drained with NDOT Type 2 Drain Backfill and weepholes to prevent build-up of hydrostatic pressure. Note that passive pressure in front of the wall should be neglected, unless the wall extends below the frost depth and/or utility trench excavation.

#### Soil Nail Wall, Lake Mead Boulevard

We understand that there is insufficient room for a cantilever retaining wall to widen the southbound outside lanes of U.S. 95 beneath Lake Mead Boulevard. A soil nail wall has been selected for this application, pending additional field exploration. Since this was not part of our original scope, no exploration was performed with the initial field work. We will use backhoe trenching to explore the existing 1:2 (vertical:horizontal) embankment slope at the wall location. The exploration will verify the constructability of soil nails and, following laboratory testing, provide final geotechnical design parameters.

For preliminary design purposes, the existing embankment can reasonably be assumed to be either *Borrow* or *Select Borrow* (*SSRBC*) with the following properties:

	TABLE 5 - DESIGN CRITERIA FOR SOIL	NAIL WALL		
Top Slope: 1:2 (vertical:horizontal)				
Surcharge:	Existing Structure Footing at 192 kPa, 3.35 meter from Front Face of Wall			
	SOIL PARAMETERS			
Embankment Fill Native				
φ 34 degrees 40 degrees				
Cohesion	0.0 kPa	4.8 kPa		
Unit Weight	Unit Weight 20.4 kN/m <sup>3</sup> 20.4 kN/m <sup>3</sup>			

Based on these parameters the following design requirements were determined:

TABLE 6 - DESIGN REQUIREMENTS FOR SOIL NAIL WALL				
Nail Spacing: 910 mm horz.; 1,220 mm vert.	Nail Diameter: 25.4 mm			
Nail Length: 3,050 mm	Boring Diameter: 100 mm			
Nail Angle: 20 degrees below horz.	Thickness of Structural Facing: 125 mm			
Depth of Embedment: 610 mm (min)	Slope of Wall Face: Vertical			
Minimum Distance of Bottom Nail Row Above Toe of Wall: 457 mm	Maximum distance of Bottom Nail Row Above Toe Nail of Wall: 686 mm			

TABLE 6 - DESIGN REQUIREMENTS FOR SOIL NAIL WALL					
Maximum Distance of Top Nail Row Below Top of Wall: 915 mm  Minimum Distance of Top Nail Row Below Top of Wall: 457 mm					
Ultimate Bond Stress - Backfill: 70 kN/m <sup>2</sup> Ultimate Bond Stress - native: 115 kN/m <sup>2</sup>					

The design was performed using the FHWA (1996) method, aided by the computer program SNAILZ, developed by the California Department of Transportation (1999). The design has included seismic loading of 0.08 based on a ground acceleration with a 10 percent probability of being exceeded in 50 years (AASHTO, 1996). Since this is a critical structure and aggressive (corrosive) soils can be expected, the nails should be encapsulated.

# **Slope Stability and Erosion Control**

The exploration and testing program conducted during this investigation demonstrates that fill slopes up to 1:2 (vert:horiz) and cut slopes in native materials will be stable. Slope stability was verified using the program XSTABL (Appendix E). Slopes steeper than 1:3 will be subject to erosion unless drainage is prevented from washing over the slope or erosion protection is provided.

Dust potential at this site will be moderate during dry periods. Temporary (during construction) and permanent (after construction) erosion control will be required for all disturbed areas. The contractor shall prevent dust from being generated during construction in compliance with all applicable city, county, state, and federal regulations.

# Site Drainage

Excellent surface drainage should be provided away from all improvements, including pavement edges and foundations. Subgrade on this project is moderately to highly moisture sensitive.

# Curbs, Gutters, and Sidewalks

Any concrete slabs, such as curbs, gutters, or sidewalks, should be directly underlain by Type 2, Class B, aggregate base. The thickness of base material shall be 150 mm beneath curb and gutters and 100 mm beneath sidewalks. Aggregate base courses should be densified to at least 95 percent relative compaction.

#### **Concrete**

Type V cement should be used for all concrete work. Sulfate levels were found to vary with localized areas having very high concentrations. For the high levels of sulfate encountered, we recommend a minimum of 6.5 sacks of cement per cubic yard and a maximum water to cement ratio of 0.45. All concrete should be proportioned, mixed, placed, and cured in accordance with sections 501, 502, 508.03.01, .02, 0.3, and .04, 701, and 702 of SSRBC.

#### **Corrosion Potential**

The results of our corrosion testing program for native soils are presented in Appendix F.

#### INTRODUCTION

Presented herein are the results of the Black Eagle Consulting, Inc. geotechnical investigation, laboratory testing, and associated geotechnical design recommendations for the proposed widening of U. S. Highway 95, Project 1A in Las Vegas, Nevada. The improvements will extend between Rainbow Boulevard on the south and Cheyenne Avenue on the north. The preceding recommendations are based on surface and subsurface conditions encountered in our explorations, review of previous geotechnical reports, and on details of the proposed project as described in this report. The objectives of this study were to:

- 1. Determine general soil and caliche conditions pertaining to design and construction of the proposed highway improvements.
- 2. Provide recommendations for design and construction of the project, as related to these geotechnical conditions.

The area covered by this report is shown on Plate 1 - Plot Plan. Our investigation included field exploration, laboratory testing, and engineering analysis to determine the physical and mechanical properties of the various on-site materials. Results of our field exploration and testing programs are included in this report and form the basis for all conclusions and recommendations.

The services described above were conducted in accordance with the Black Eagle Consulting, Inc. Professional Geotechnical Agreement and the Sverdrup Subconsultant Agreement dated December 29, 1999.

#### PROJECT DESCRIPTION

The segment of U. S. 95 between Rainbow Boulevard and Cheyenne Avenue and Craig Road is to be widened to improve traffic flow and ease ingress and egress from the Rainbow Boulevard, Lake Mead Boulevard, and Cheyenne Avenue Interchanges. The following improvements are planned:

- Addition of northbound exit lane for Rainbow Boulevard (mainline station 88+40 to 93+80±).
- Addition of northbound entrance lane from westbound Rainbow Boulevard (mainline station 97+50 to 99+97).
- North and southbound mainline widening (mainline stations 100+14.630 to 138+10±).
- Addition of 1 to 2 southbound on-ramp lanes from westbound Lake Mead Boulevard (mainline stations 102+65 to 113+40±).
- Addition of 1 to 2 southbound on-ramp lanes from the eastbound Lake Mead Boulevard (mainline stations 102+60± to 113+20±).
- Addition of 1 to 2 southbound on-ramp lanes from eastbound Cheyenne Avenue (mainline stations 129+17± to 137+70±).
- Noise barrier walls along ramps on west side of U. S. 95 from Rainbow Boulevard to Smoke Ranch Road (minor interruptions).
- Noise barrier walls along ramps on east side of U. S. 95 from Washington (mainline station 96+80) to mainline station 102+50.

- Noise barrier walls along ramps on east side of U. S. 95 from Smoke Ranch Road (mainline station 121+60) to mainline station 133+70±.
- Utility relocation, as required.

#### SITE CONDITIONS

The areas proposed for widening and other improvements are all undeveloped and adjacent to existing ramps and freeway mainline. The mainline widening will be to the center, where the center median lies below the adjacent pavement and is drained by a small v-ditch. The areas of ramp widening and noise barriers traverse a variety of conditions, ranging from nearly level to steeply sloping. Vegetation throughout most of the alignment is very sparse, although landscaping is present in localized areas next to residential developments.

#### **EXPLORATION**

U. S. Highway 95, Project 1 A was explored in January 2000 by drilling a series of 60 test borings and two test pits. The borings along proposed wall alignments generally alternated between depths of 8.1 meters and 10.7 meters but ranged from 1.68 to 11.13 meters. Borings along the mainline were advanced to a depth of 3.5 meters. The borings were drilled using 152-mm-outside-diameter (O.D.), 83-mm-inside-diameter (I.D.), augers and a truck-mounted Foremost B 4500 or B90 soils sampling drill rig. The locations of the test borings are shown on Plate 1 - Plot Plan. Boring WR-5 the 61<sup>st</sup> boring was inaccessible to the drill rig, due to a steep slope, and was not drilled.

In the borings, the native soils were sampled in-place every 0.6 to 1.5 meters by use of a standard, 51-mm O.D., split-spoon sampler driven by a standard 63.6 kg drive hammer with a 762 mm stroke. The number of blows to drive the sampler the final 300 mm of a 450 mm penetration (Standard Penetration Test - AASHTO T 206-87) into undisturbed soil is an indication of the density and consistency of the material. Pocket penetrometer testing was performed on various samples of fine grained soils in order to evaluate unconfined compressive strength.

An 89-mm O.D., split-spoon sampler (ASTM D 3550) was also used to sample soils where approximate in-place densities of subsurface materials were required. Sampling methods used were

similar to the SPT but also included the use of 64-mm-diameter, 150-mm- and 25-mm-long, brass sampling rings placed inside the split-spoon sampler. Because of the larger diameter of the sampler, blow counts are typically higher than those obtained with the SPT and should not be directly equated to SPT blow counts. The logs indicate the type of sampler used for each sample.

Due to the relatively small diameter of the samplers, the maximum particle size that could be obtained was approximately 90 mm. The final logs may not, therefore, adequately represent the actual quantity or presence of cobble or caliche fragments.

Exploration was performed with backhoe test pits on the existing west embankment slope at the Lake Mead Boulevard structure. Test Pits were used to observe and sample existing embankment fill materials for design of the soil nail wall. The site is inaccessible to a conventional soils sampling drill rig because of the existing 1:2 (Vertical:Horizontal) slope.

#### **Material Classification**

A geologist examined and classified all soils in the field in accordance with ASTM D 2488. During drilling, representative bulk samples were placed in sealed plastic bags and returned to our Sparks, Nevada, laboratory for testing. Additional soil classification was subsequently performed in accordance with ASTM 2487 (Unified Soil Classification System [USCS]) upon completion of laboratory testing as described below in the **Laboratory Testing** section. Logs of the test borings are presented as Plate 2 - Exploration Logs, and a USCS chart has been included as Plate 3 - Graphic Soils Classification Chart.

#### **LABORATORY TESTING**

All soils testing performed in the Black Eagle Consulting, Inc. soils laboratory for this project was conducted in accordance with the standards and methodologies described in AASHTO (1998) and NDOT (1999) standards.

# **Index Testing**

Samples of each significant soil type were analyzed to determine their in situ moisture content (NDOT T 206 F), grain size distribution, and plasticity index (NDOT 210 E, 211 E, and 212 E). The results

of these tests are shown on Plate 4 - Index Test Results. Results of these tests were used to classify the soils according to ASTM D 2487 and to verify the field logs, which were then updated as appropriate. Classification in this manner provides an indication of the soil's mechanical properties and can be correlated with standard penetration testing and published charts (Bowles, 1996; NAVFAC, 1982) to evaluate bearing capacity, lateral earth pressures, and settlement potential.

#### **Direct Shear Tests**

Two direct shear tests (ASTM D 3080) were performed on representative samples of clayey sand obtained from 64-mm-diameter ring samples. Since these samples were driven and the split spoon sampler has a relatively thick wall, the samples are not entirely undisturbed. They do, however, represent in-place conditions better than a remolded sample would. Sampling by thin wall shelby tube was not possible anywhere on this project due to the very dense/hard, weakly cemented and, generally, gravelly nature of the soils. A third sample was remolded from existing fill in the area to be supported by the soil nail wall. The sample was scalped on a No. 4 sieve and remolded to 90 percent relative compaction, representing in-place conditions. Tests were run on saturated samples at various lateral pressures so as to plot the Mohr's Circle Envelope. Results of these tests are shown on Plate 5 - Direct Shear Test Results and aid in calculation of bearing capacities, friction factors, and lateral soil pressures.

#### **R-Value Tests**

Resistance value testing (NDOT T 115 C) was performed on seven representative samples of subgrade soil along the mainline. R-Value testing is a measure of subgrade strength and expansion potential and is used in design of flexible pavements. Results of the R-Value tests are shown on Plate 6.

# **Moisture-Density Curve**

A moisture-density curve was determined for a sample of embankment fill collected at the site of the Lake Mead Soil Wall. A direct shear sample was remolded at 90 percent of the maximum dry density and optimum moisture content to evaluate soil strengths for the nails. The moisture-density curve is included as Plate 7.

#### **Corrosion Potential Tests**

Corrosion index property testing was performed on representative samples of site foundation soils. This included testing for pH, soil resistivity, soluble chloride and soluble sulfate, and redox potential. The results of the corrosion index property tests are shown in Appendix F. Corrosion testing was performed by Col•Tech Laboratories of Reno, Nevada.

#### GEOLOGIC AND GENERAL SOIL CONDITIONS

The alignment traverses the distal end of an alluvial fan sloping into Las Vegas Valley from mountains to the west. The materials are mapped by the Nevada Bureau of Mines and Geology (Matti, et al., 1987) as predominantly older alluvium of the Red Rock fan. The alignment crosses numerous narrow bands of younger, inactive, and intermittently active alluvial deposits between Rainbow Boulevard and Smoke Ranch Road. Between Cheyenne Avenue and Smoke Ranch Road, U.S. 95 lies primarily in intermittently active alluvial deposits and active alluvial zones.

The materials encountered in our borings were very uniform along most of the alignment. In general, these materials consist of a moderately cemented mixture of silts, sands, and gravels exhibiting low plasticity and SPT blowcounts in excess of 50. Grain size analysis generally showed between 10 and 30 percent fines (material passing the 0.074 mm sieve), with soils in the upper 3 to 4 meters generally coarser than deeper materials. Interbedded, weakly cemented, caliche layers, 0.3 to 0.5 meters thick, are common in the upper 4 meters. To the north, in the younger alluvium, the materials are slightly less cemented and, therefore, have slightly lower blowcounts in some areas. Borings WR-11 through WR-14 include interbedded hard clay layers, up to 3 meters thick, below a depth of about 2 meters. Some of the thinner layers of clay are expected to be moderately expansive, based on the measured index properties.

Ground water was not encountered to the depths explored and lies well below a depth which would affect construction.

#### **GEOLOGIC HAZARDS**

The project lies within Seismic Zone 2B, an area with some potential for earthquakes. There are no known faults or fissures crossing the alignment. A series of well-developed faults parallel the alignment 1.6 to 2.4 kilometers to the east. These faults are though to be of tectonic origin but may have additional movement associated with subsidence within the Las Vegas Valley (Bell and Price, 1991). This fault system appears to cut Holocene age deposits and are considered active (Bell and Price, 1999).

Liquefaction potential is negligible due to the types of materials present. Mapping by the U. S. Survey (1996) indicates that there is a 10 percent probability that a ground acceleration of 0.10 g to 0.15 g will be exceeded in 50 years at the  $S_B/S_C$  soils profile boundary. Materials encountered in our borings indicate that those boundary conditions are appropriate. For design purposes we recommend that an AASHTO Type II soil profile be used.

## Other Geologic Hazards

A moderate potential for dust generation is present if grading is performed in dry weather. No other geologic hazards were identified.

#### ANTICIPATED CONSTRUCTION PROBLEMS

Some difficulty will be encountered in trenching due to the presence of moderately cemented sands and gravels.

#### STANDARD LIMITATION CLAUSE

This report has been prepared in accordance with generally accepted geotechnical practices. The analyses and recommendations submitted are based upon field exploration performed at the locations shown on Plate 1 - Plot Plan of this report. This report does not reflect soils variations that may become evident during the construction period, at which time re-evaluation of the recommendations may be necessary.

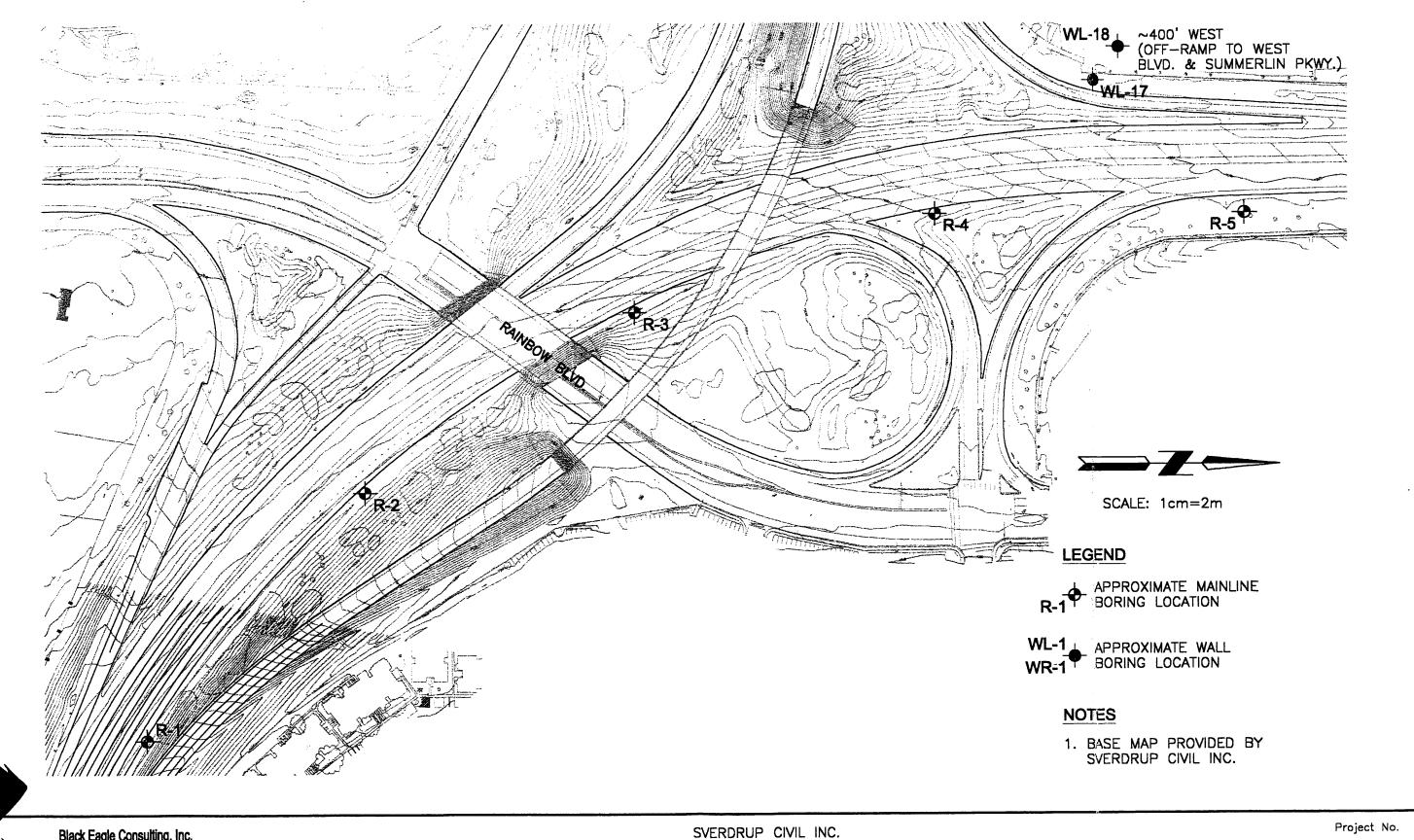
This report has been prepared to provide information allowing the engineer to design the project. In the event of changes in the design, or location of the project from the time of this report, recommendations should be reviewed and possibly modified by the geotechnical engineer. If the geotechnical engineer is not accorded the privilege of making this recommended review, he can assume no responsibility for misinterpretation or misapplication of his recommendations or their validity in the event changes have been made in the original design concept without his prior review. The geotechnical engineer makes no other warranties, either expressed or implied, as to the professional advice provided under the terms of this agreement and included in this report.

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# **PLATES**



Black Eagle Consulting, Inc.
Geotechnical & Construction Services 1380 Greg Street, Suite 218 Sparks, Nevada 89431 Telephone: 775/359-6600 Facsimile: 775/359-7766

# PLOT PLAN

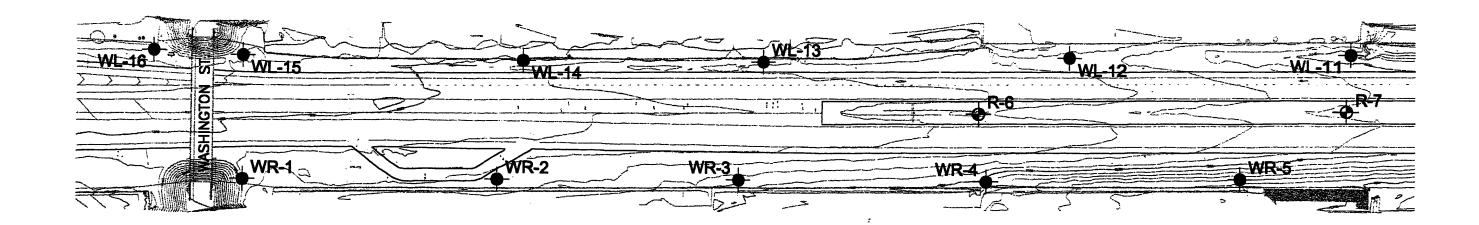
U.S. 95 IMPROVEMENTS — PHASE 1 RAINBOW BLVD. TO CHEYENE AVE. LAS VEGAS, NEVADA

0215-01-1

Plate 1a



SCALE: 1cm=2m



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SVERDRUP CIVIL INC.

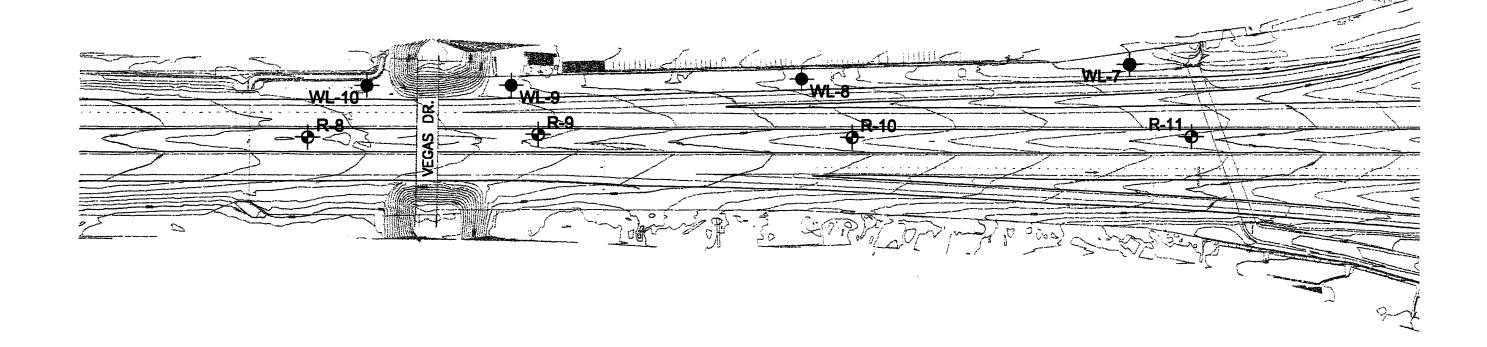
PLOT PLAN

U.S. 95 IMPROVEMENTS — PHASE 1 RAINBOW BLVD. TO CHEYENE AVE. LAS VEGAS, NEVADA Project No. 0215-01-1

Plate 1b



SCALE: 1cm=2m



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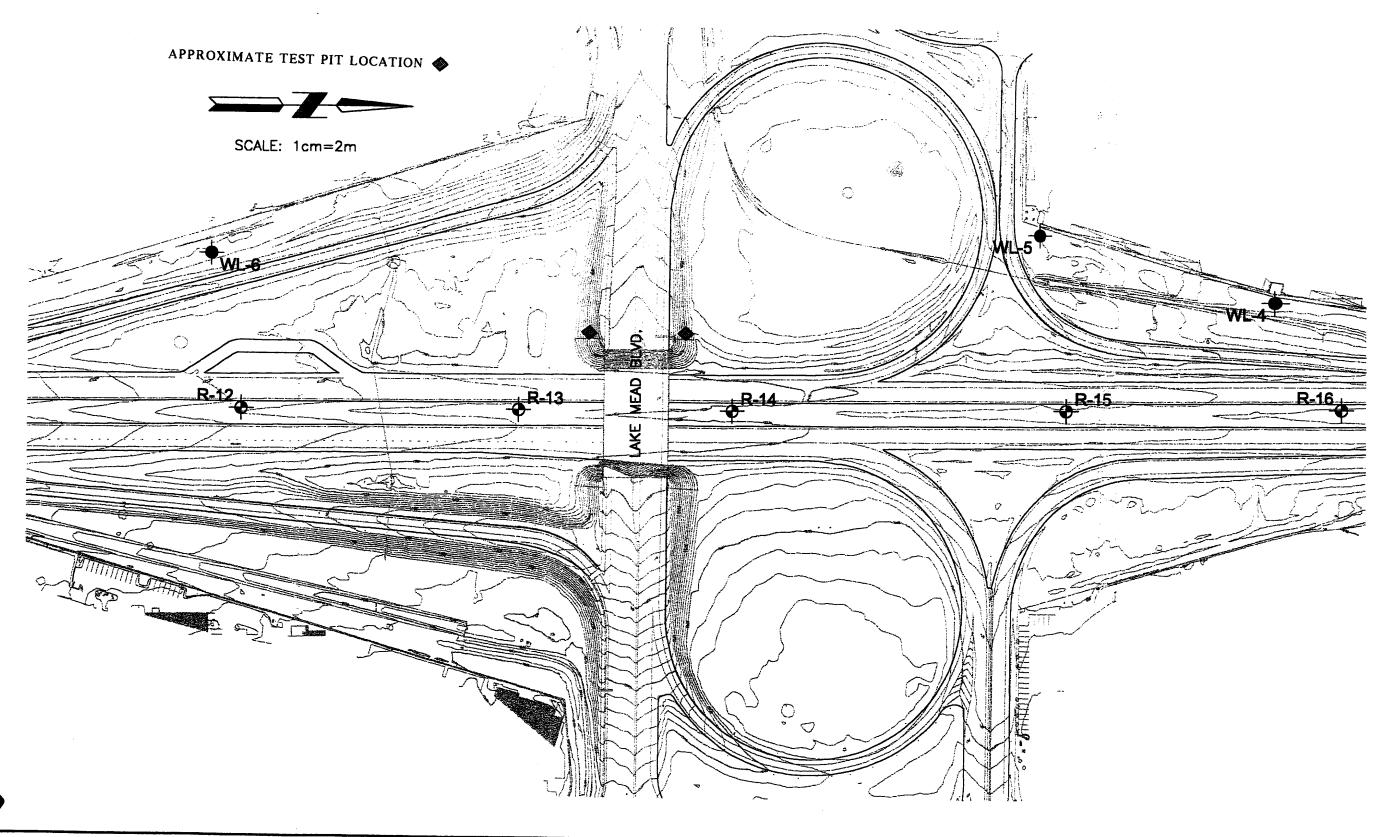
Telephone: 775/359-6600 Facsimile: 775/359-7766

SVERDRUP CIVIL INC.

PLOT PLAN
U.S. 95 IMPROVEMENTS - PHASE 1
RAINBOW BLVD. TO CHEYENE AVE. LAS VEGAS, NEVADA

Project No. 0215-01-1

Plate 1c



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SVERDRUP CIVIL INC.

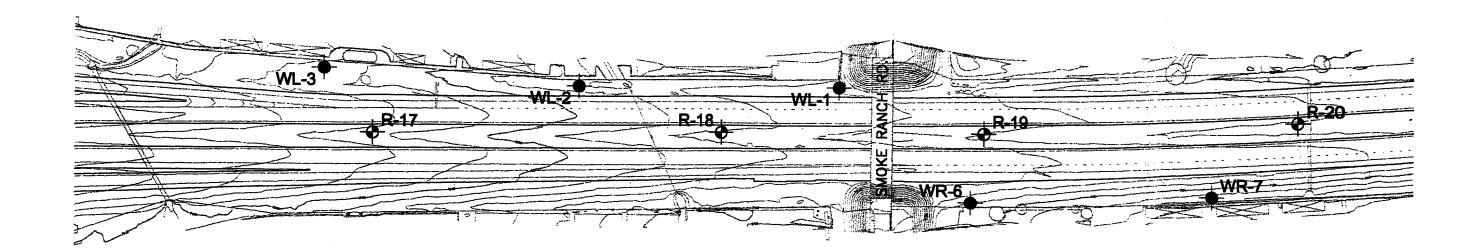
PLOT PLAN

U.S. 95 IMPROVEMENTS — PHASE 1 RAINBOW BLVD. TO CHEYENE AVE. LAS VEGAS, NEVADA Project No. 0215-01-1

Plate 1d



SCALE: 1cm=2m



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PLOT PLAN
U.S. 95 IMPROVEMENTS - PHASE 1

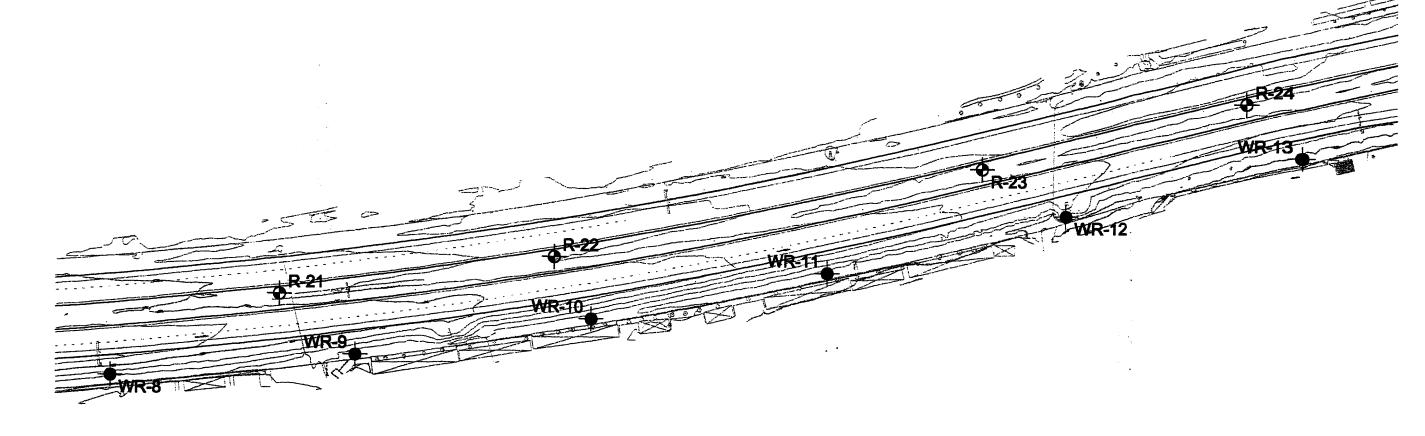
LAS VEGAS, NEVADA

Project No. 0215-01-1

Plate 1e



SCALE: 1cm=2m



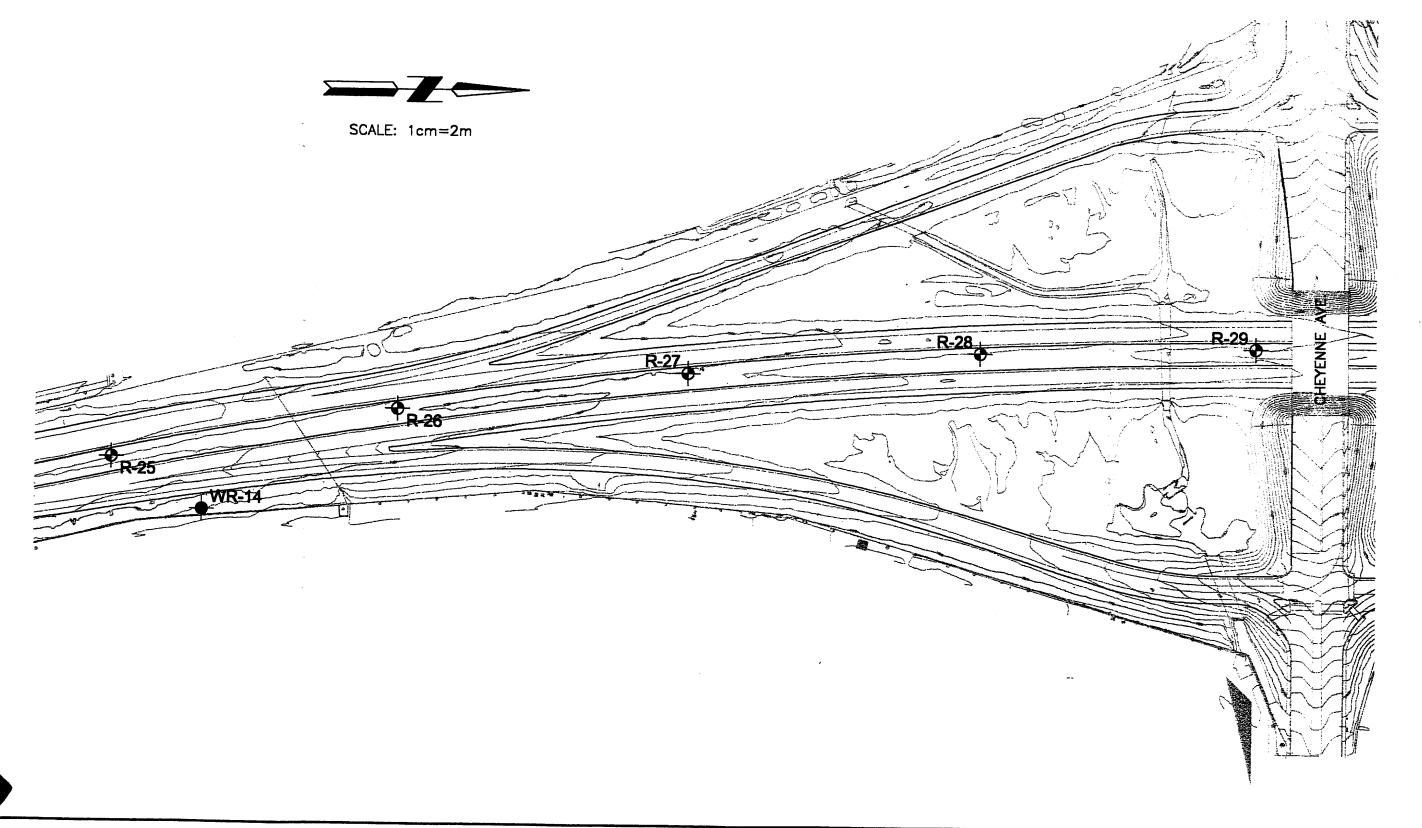
Black Eagle Consulting, Inc.
Geotechnical & Construction Services 1380 Greg Street, Suite 218 Sparks, Nevada 89431 Telephone: 775/359-6600 Facsimile: 775/359-7768

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PLOT PLAN
U.S. 95 IMPROVEMENTS — PHASE 1
RAINBOW BLVD. TO CHEYENE AVE. LAS VEGAS, NEVADA

Project No. 0215-01-1

Plate 1f



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Facsimile: 775/359-7766

SVERDRUP CIVIL INC.

PLOT PLAN

U.S. 95 IMPROVEMENTS — PHASE 1 RAINBOW BLVD. TO CHEYENE AVE. LAS VEGAS, NEVADA Project No. 0215-01-1

Plate 1g

	START DATE	1/29/00			EXPL	ORATIO	N LOG			SHEET 1 OF
	END DATE  JOB DESCRIPT	1/29/00 ION U.S.	 95 Widenin	STATION						
	LOCATION	Las Vega	ENGINEER	JRO						
	BORING	R-01			EQUIPMEN				Foremost B4500	
	E.A. #	0215-01-1			GROU	INDWATER	LEVEL	OPERATOR	W. Dugas	
20	GROUND ELEV.		<del></del>			DEPTH m	ELEV. m	DRILLING METHOD	152 mm HS Auger	
	HAMMER DROP	SYSTEM_H	lydraulic					BACKFILLED	Yes	DATE 1/29/00
I ELEV. I DEPTH	TYPE   BLOW COUN	ast Percent	LAB TESTS	USCS		MATE	ERIAL DI	ESCRIPTION		REMARKS

		1	H	AMMER DI	ROP SYS	STEM	iydraulic	[	BACKFILLED Yes DATE 1/29/0
ELEV. (m)	DEPTH (m)		MPLE TYPE	BLOW 0 150 mm Increments	Last	Percent Recovid	LAB TESTS	USCS Group	MATERIAL DESCRIPTION REMARKS
	0.30	1A	SPT	44 50/50	50/50	75	MC, SA, PI	SM	SILTY SAND with GRAVEL light brown, dry to slightly moist, moderately to well cemented, with 14% very low plastic fines, 48% fine to coarse sand, 38% fine, subangular gravel to +12.5mm in diameter.
719.57 -	1					•			POORLY GRADED SAND with SILT and GRAVEL light grey to brown, dry to slightly moist, well cemented, with estimated 10-15% non-plastic to low plastic fines, 45-60% fine to coarse sand, 30-40% fine to coarse, angular to subangular gravel to +19mm in diameter.
	1.52 - 1.64	18	SPT	50/113	50/113	89		SP SM	
718.57	-								2.44  CLAYEY SAND with GRAVEL brown, slightly moist, well cemented, with estimated 25% low
717.57	2.74 - 2.90 3	1C	SPT	50/150	50/150	100		SC	plastic fines, 45-55% fine to coarse sand, 20-30% fine, subangular gravel to +12.5mm in diameter. 2.90
716.57	-4								

	START DATE END DATE JOB DESCRIPT	1/29/00 1/29/00 TION U.S.	 95 Widenin	g Proje		ORATION	N LOG	STATION OFFSET		SHEET 1 OF		
	LOCATION BORING	Las Vega R-02	s, Nevada					ENGINEER EQUIPMENT	JRO Foremost B4500			
	E.A. #	0215-01-1			GROUNDWATER LEVEL			OPERATOR	W. Dugas	W. Dugas		
2	GROUND ELEV	720.94 (m	1)	DATE	DEPTH m	ELEV. m	DRILLING METHOD	152 mm HS Auger				
	HAMMER DRO							BACKFILLED	Yes C	ATE 1/29/00		
ELEV. I DEPTH (***	O. TYPE   BLOW COL	INT Last Percent 00 mm Recov'd	LAB TESTS	USCS Group		MATE	RIAL DI	ESCRIPTION		REMARKS		
- 0.30												

		CAI	HA APLE	MMER DR		TEM	yuraulic	L	BACKFILLED Yes DATI	E 1/29/00
ELEV. (m)	DEPTH (m)		TYPE	150 mm Increments	Last	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	- 0.30 0.36	2A	GRAB	50/50	50/50	.50		GP	POORLY GRADED GRAVEL with SAND brown, dry to slightly moist, moderately to well cemented, with estimated 10% non-plastic to low plastic fines, 30% fine to coarse sand, 60% fine to coarse, subangular to subround gravel to 25mm in diameter.	
719.94 -	1 1.22 1.33	2B	SPT	50/113	50/113	89		SP SM	POORLY GRADED SAND with SILT and GRAVEL light brown, dry to slightly moist, well cemented with estimated 10-15% low plastic fines, 55-65% fine to coarse sand, 25-30% fine to coarse, angular to subangular gravel to +19mm in diameter.	
718.94 -	2								Caliche at 5 feet.	
717.94 -	3									
716.94 -	<b>-4</b>									
	-									

JOB DESCRIPTION U.S. 95 Widening Project  LOCATION Las Vegas, Nevada  BORING R-03  E.A. # 0215-01-1 GROUNDWATER LEVEL  GROUND ELEV. 722.48 (m)  HAMMER DROP SYSTEM Hydraulic  BLEV. DEPTH SAMPLE BLOW COUNT  STATION  OFFSET  ENGINEER EQUIPMENT  FOR MOST DEPTH M ELEV. m  DATE DEPTH M ELEV. m  DRILLING METHOD  BACKFILLED Yes DATE 1/2	3				TART DAT		/29/00 /29/00			EXPLORATION LOG			SHEET 1 OF
Location   Las Vegas, Nevada   Shiften   Shiften   Las Vegas, Nevada   Shiften   Shi								95 Widenir	na Proi	ect			
BORING   C215-01-1   GROUNDWATER LEVEL   DEPTH   BLEV m   Foremost B4500   Material Depth   DATE   DEPTH   BLEV m   DATE   DEPTH   BLEV m   Material Depth									<u> </u>			JRO	
CROUNDWATER LEVEL   CROWN													st B4500
DATE   DEPTH   ELEV.   DEPTH   SAMPLE   SLOW COUNT   Last Percent   Last ESTS   Coop   County   Coun	Ä					0:	215-01-	1		GROUNDWATER LEVEL			
HAMMER DROP SYSTEM											DRILLING		
Signature   Sign		1.1	1										
Company   Comp			SA								BACKFILLED	168	DATE
Osb   Osb			_		150 mm	Last	Percent Recovid	LAB TESTS	USCS Group	MATERIAL DE	SCRIPTION		REMARKS
0.30  0.43 3A GRAE 50/125 50/126 0 MC_SA_PI.  R  1.37  1.47 3B SPT 50/100 50/100 50  720.48 2  2.74  719.48 3  718.48 4							1,000,0		<del>                                     </del>	POORLY GRADED G	RAVEL with SA	ND	
0.43 3A GRAB 50/125 50/125 0 MC, SA, PI,  R	1 }	-			İ				<u> </u>	grey, dry, loose, with	estimated <5%	non-plastic	4
721.48 —1  721.48 —1  721.48 —2  719.48 —3  718.48 —4			-	CDAE	E0/105	50/405		MC. SA. PI.	-	\coarse, subangular to	subround grave	el to	
721.48 — 1  1.37  1.47 38 SPT 50/100 50/100 50  GC  720.48 — 2  2.74  2.83 3C GRAB 50/88 50/88 40  719.48 — 4		- 0.43	J JA	GRAD	50/125	50/125	0		-	CLAYEY GRAVEL wit	th SAND light be	rown dry	
720.48 — 2  720.48 — 2  719.48 — 3  718.48 — 4	-	• ,								to slightly moist, well approximately 15% lo	cemented, with working the plant of the comments of the commen	35% fine	
720.48 — 2  720.48 — 2  719.48 — 3  718.48 — 4  718.48 — 4	721.48	-1											
720.48 — 2  720.48 — 2  719.48 — 3  718.48 — 4  718.48 — 4		1 37						i					
720.48 — 2  2.74  - 2.83 3C GRAE 50/88 50/88 40  719.48 — 3  718.48 — 4	<u> </u>		3B	SPT	50/100	50/100	50		66				
719.48 — 4									GC				
719.48 — 4		·											
719.48 — 4	-												
719.48 — 4													
719.48 — 3  718.48 — 4	720.48	-2											
719.48 — 3  718.48 — 4		1											
719.48 — 3  718.48 — 4													
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718.48 —4			3C	GRAE	50/88	50/88	40			2.74			
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				END DATE		/29/00					STATION		SMEEL I OF
				JOB DESCR			95 Widenir	ng Proj	ect		OFFSET		
				LOCATION			as, Nevada				ENGINEER	JRO	
.44.				BORING	_R	-04					EQUIPMENT		st B4500
	(3)			E.A. #	_02	215-01-	1		GROL	JNDWATER LEVEL	OPERATOR	W. Dug	as
				GROUND E	LEV72	25.91 (n	n)		DATE	DEPTH m ELEV. m	DRILLING	152 mm	n HS Auger
	1	1		HAMMER D							METHOD	Yes	
	T		AMPLI				1				BACKFILLED	163	DATE 1/29/00
ELEV. (m)	DEPTI (m)	н —	D. TYP		Last	Percent Recovid	LAB TESTS	USCS Group		MATERIAL DE	ESCRIPTION		REMARKS
İ										SILTY GRAVEL with	SAND brown, d		
	}									cemented, with estim 35% fine to coarse s	rated 5% non-ni	astic fines	
	0.3	30 38 4/	N SP	T 50/75	50/75	67	ļ	-		angular to subangula	r gravel to +37.5	imm in	
]	-		1	1 55	301.3	01		1		diameter.	•		
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724.91	<del> </del> 1												
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	1.3	7							_1.37_				Ì
1	1.4	7 4B	SPT	50/100	50/100	100	MC, SA, PI	<del> </del>		SILTY SAND with GR	AVEL brown, dr		-
				T	Γ			1		slightly moist, well ce	mented with		
	Γ									approximately 16% verifine to coarse sand, 3	2% fine angular	r to	
i	-									subangular gravel to	12.5mm in dian	neter.	
								SM					
723.91 -	-2							3111					
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							j						
	ļ ,								_2.44				_
	Ĺ								1	POORLY GRADED SA brown, slightly moist,	ND with GRAVI	EL light	
ı	2.74		İ					SP	•	estimated <5% non-pi	astic fines, 55-6:	5% fine to	
	2.84	_	SPT	50/100	50/100	75			(	coarse sand, 30-40% subangular gravel to +	fine to coarse ar	noular to	
į						·			2.00	subangular graver to .	19mm in diame	ter.	-{
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								EXPLORATION LOG			SHEET 1 OF
		j	OB DESCR	RIPTION	U.S.	95 Widenir	ng Proj	ect	STATION		
		L	OCATION	L						JRO	
		В	ORING	R	2-05						B4500
		Ε	.A. #	0	215-01-	1		GROUNDWATER LEVEL			
		G	ROUND E	LEV. 7	31.05 (n	1)		DATE DEPTH m ELEV. m	DRILLING		
	1										
	LSA					<u> </u>			BACKFILLED		ATE 1/29/00
DEPTH (m)			150 mm	Last	Percent Recovid	LAB TESTS	USCS Group	MATERIAL DE	SCRIPTION		REMARKS
8:39 -	5A	GRAE	50/25	50/25	0		GP	brown, dry, moderate estimated 5% non-pla 30-45% fine to coarse coarse, angular to su	ly to well cemer astic to low plast e sand, 50-60% bangular gravel	nted, with tic fines, fine to	
- - 1:38	58	GRAB	50/25	50/25	0			GRAVEL light brown, cemented with estimation low plasses fires 50-5 40% fine to boarse, at	dry to slightly mated 5-10% non 5% fine to coars	oist, well plastic to	
2			*				SP SM				
- 2.74 - 2.84 3	5C	SPT	50/100	50/100	100	MC, SA, PI	GM	slightly moist, well cen	ented, with 27% to coarse sand	6 very low	į
-4											
	- 1 - 1:36 2 - 2.74 - 2.84	1:37 SB 2 2.74 - 2.84 5C - 3	DEPTH NO. TYPE  8.39 5A GRAE  1.36 5B GRAE  2.74  2.74  2.84 5C SPT	END DATE JOB DESCR LOCATION BORING E.A. # GROUND EI HAMMER DI  DEPTH (m) NO. TYPE 150 mm Increments  8.39 5A GRAE 50/25	END DATE  JOB DESCRIPTION  LOCATION  BORING  E.A. #  GROUND ELEV. 7  HAMMER DROP SY  DEPTH NO. TYPE 150 mm Last Increments 300 mm  8:38 5A GRAB 50/25 50/25	END DATE 1/29/00  JOB DESCRIPTION U.S. LOCATION Las Vega BORING R-05  E.A. # 0215-01- GROUND ELEV. 731.05 (n.) HAMMER DROP SYSTEM L.  DEPTH NO. TYPE 150 mm Last Percent Increments 300 mm Recovid  8.39 5A GRAB 50/25 50/25 0  1 1 2.36 5B GRAB 50/25 50/25 0	END DATE 1/29/00  JOB DESCRIPTION U.S. 95 Widenin LOCATION Las Vegas, Nevada BORING R-05  E.A. # 0215-01-1  GROUND ELEV. 731.05 (m)  HAMMER DROP SYSTEM Hydraulic  DEPTH NO. TYPE 1050 mm Last Percent Increments 300 mm Recovd LAB TESTS  8:39 5A GRAE 50/25 50/25 0	END DATE	END DATE 1/29/00  JOB DESCRIPTION U.S. 95 Widening Project  LOCATION Las Vegas, Nevada  BORING R-05  EA. # 0215-01-1  GROUND ELEV. 731.05 (m)  HAMMER DROP SYSTEM Hydraulic  DEPTH NO TYPE 150 mm Last Percent Increments 300 mm Resovd  B 33 SA GRAE S0/25 50/25 0 GP  1.36 SB GRAF S0/25 50/25 0 GRAVEL light brown, camented with a similar low plagar, finish 510-5 40% fine to coarse, angular to suit +37.5mm in diameter simple similar	END DATE 1/29/00  JOB DESCRIPTION U.S. 95 Widening Project  LOCATION Las Vegas, Nevada  BORING R-05  EA # 0215-01-1  GROUNDWATER LEVEL  DATE DEPTH ELEV. III  MNO TYPE 150 OWN DATE 100 WORLD III  BORLY GRADED GRAVEL with SAMD light brown, dry to slightly more menter. with estimated 5-10% non low place and 5-55% fine to coarse sand, 50-55% fine to coarse sand, 95-95% fine to coarse sand, 95-95% fine to coarse sand, 95-95% fine to coarse sand, 95-95% fine to coarse sand, 95-95% fine to coarse sand, 95-95% fine to coarse sand, 95-95% fine to coarse sand, 95-95% fine to coarse sand, 95-95% fine to coarse sand, 95-95% fine to coarse sand, 95-95% fine to coarse sand, 95-95	END DATE 1/29/00  JOS DESCRIPTION U.S. 95 Widening Project  COCATION Las Vegas, Nevada  BORING R.05  EA.# 0215-01-1  GROUNDWATER LEVEL DATE DEPTH BLEV.m HAMMER DROP SYSTEM Hydraulic  DEPTH NO TYPE Increments 300 mm Recover CP ISON MR. 150 mm Last Percent CP ISON MR. 150 mm Last Percent CP ISON MR. 150 mm Last Percent CP ISON MR. 150 mm Last Percent CP ISON MR. 150 mm Last Percent CP ISON MR. 150 mm Last Percent CP ISON MR. 150 mm Last Percent CP ISON MR. 150 mm Last Percent CP ISON MR. 150 mm Last Percent CP ISON MR. 150 mm Last CP ISON MR. 150 mm Last CP ISON MR. 150 mm Ison MR. 150

		4.00	EXPLORATION LOG		
	START DATE	1/27/00	=XI EOIATION EOG		SHEET 1 OF
	END DATE	1/27/00			SHEET T OF
	JOB DESCRIPT	ION U.S. 95 Widening Pro	oject	STATION OFFSET	
	LOCATION	Las Vegas, Nevada		ENGINEER	JRO
S. Constitution of the con	BORING	R-06		EQUIPMENT	Foremost B4500
1 2	E.A. #	0215-01-1	GROUNDWATER LEVEL	OPERATOR	W. Dugas
1	GROUND ELEV		DATE DEPTH m ELEV. m	DRILLING METHOD	152 mm HS Auger
		SYSTEM Hydraulic		BACKFILLED	Yes DATE 1/27/00
ELEV. DEPTH SAM	150	NT	S MATERIAL DI	CODIDTION	

									METHOD152 mm HS Auger
			H.	AMMER DE	ROP SYS	STEM	Tyuraulic		BACKFILLED Yes DATE 1/27/00
ELEV.	DEPTH (m)	SAI NO.	MPLE TYPE	BLOW C	Last	Percent	LAB TESTS	USCS Group	
	0.30		SPT	20 50/50	50/50	75		Gloup	CLAYEY SAND with GRAVEL brown, dry to slightly moist, moderately to well cemented, with estimated 15-20% low plastic fines, 40-45% fine to coarse sand, 40% fine to coarse, subangular to subround gravel to +25mm in diameter.
726.18 -	1 52							sc	
	1.52	6B	SPT	50/75	50/75	67			
725.18 -	-							GC GM	SILTY, CLAYEY GRAVEL with SAND brown, slightly moist, well cemented, with estimated 15% non-plastic to low plastic fines, 35% fine to coarse sand, 50% fine to coarse, subangular gravel to +19mm in diameter.
724.18	2.74 - -3 3.20	6C	SPT	28 32 29	61	83	MC, SA, PI	SM	SILTY SAND with GRAVEL brown, slightly moist, very dense/moderately cemented, with 12% non-plastic fines, 52% fine to coarse sand, 36% fine to coarse, subangular to subround gravel to +19mm in diameter.  3.20
723.18	-4								

11.GP. ...\_.OT.GL. ....30

0<u>0</u> ≥

END DATE 1/2//00  JOB DESCRIPTION U.S. 95 Widening Project OFFSET LOCATION Las Vegas, Nevada ENGINEER JRO  BORING R-07 EQUIPMENT Foremost B4500  E.A. # 0215-01-1 GROUNDWATER LEVEL OPERATOR W. Dugas  OPERATOR DEPTH OF ELEVA DEPTH OF	START DATE	1/27/00	EXPL	ORATIO	N LOG		OUEET 4
LOCATION Las Vegas, Nevada  BORING R-07  E.A. # 0215-01-1 GROUNDWATER LEVEL OPERATOR W. Dugas  DATE DEPTH of ELEVA DEBUTIONS  DATE DEBUTIONS  DATE DEPTH of ELEVA DEBUTIONS  DATE DEBUTIONS			pject				SHEET 1 (
E.A. # 0215-01-1 GROUNDWATER LEVEL OPERATOR W. Dugas	LOCATION	Las Vegas, Nevada				ENGINEER	
GROUND ELEV 726.17 (m) DATE DEPTH m ELEV m DRILLING	E.A. #	0215-01-1	GROL	JNDWATER	R LEVEL	1	
METHOD _152 mm HS Auger	GROUND ELEV.		DATE	DEPTH m	ELEV. m	DRILLING METHOD	152 mm HS Auger
HAMMER DROP SYSTEM Hydraulic BACKFILLED Yes DATE 1/27/00						BACKFILLED	Yes DATE 1/27/00

	/	11	H	AMMER DE	ROP SYS	STEM _	lydraulic		BACKFILLED Yes DA	TE 1/27/00
ELEV.	DEPTH		MPLE	BLOW C	OUNT	Percent	LAB TESTS	uscs		, _
(m)		-	TYPE	Increments	300 mm	Recov'd	MC, SA, PI,	USCS Group	MATERIAL DESCRIPTION	REMARKS
725.17			GRAE	30/100	50/100	0	R R	GP GC	grey, dry, loose, with estimated <5% non-plastic   fines, 35% fine to coarse sand, 60% fine to   coarse, subangular gravel to +25mm in   diameter.  POORLY GRADED GRAVEL with SAND and SILTY CLAY brown, dry to slightly moist, moderately to well cemented, with approximately 10% low plastic fines, 35% fine to coarse sand, 50% fine to coarse, subangular gravel to +25mm in diameter.	
	-								1.22 CLAYEY SAND with GRAVEL red brown,	
}	1.52	<del>                                     </del>							slightly moist, moderately cemented, with estimated 15% low to medium plastic fines, 45% fine to coarse sand, 40% fine to coarse	
-	1.68	7B	SPT	50/150	50/150	50		sc	subangular to subround gravel to +38mm in diameter.	
724.17	-2								2.12	
-	2.74							SP SC	POORLY GRADED SAND with CLAY and GRAVEL light brown to brown, slightly moist, moderately cemented, with estimated 5-10% low plastic fines, 60-65% fine to coarse sand, 30% fine to coarse gravel to +25mm in diameter.	
723.17	2.92	7C	SPT	39 50/25	50/25	100			2.93	
-										
722.17	4									
-										

	START DATE	1/27/00	EXPL	ORATIO	N LOG		SHEET 1 OF
	END DATE JOB DESCRIPT		ect			STATION	
	LOCATION	Las Vegas, Nevada				ENGINEER	JRO
	BORING	R-08				EQUIPMENT	Foremost B4500
7 3	E.A. #	0215-01-1	GROU	JNDWATER	RLEVEL	OPERATOR	W. Dugas
	GROUND ELEV		DATE	DEPTH m	ELEV. m	DRILLING METHOD	152 mm HS Auger
		SYSTEM Hydraulic				BACKFILLED	Yes DATE 1/27/00
ELEV.   DEPTH	IPLE BLOW COUL	NT LAR TESTS USCS		BAATI	EDIAL DE	CODIDTION	

ELEV. (m)	DEPTH (m)	NO.	TYPE	150 mm Increments	Last	Percent	LAB TESTS	USCS Group	MATERIAL DESCRIPTION REMARK
723.97 -	0.61	8A	GRAE	20	50/100	0		GP	POORLY GRADED GRAVEL with SAND grey to brown, dry to slightly moist, weakly to moderately cemented, with estimated 5% non-plastic fines, 30-40% fine to coarse sand, 55-65% fine to coarse, subangular to subround gravel to +75mm in diameter. Unit contains approximately 5-10% cobbles at 0 to 0.61 meters.
	- 1.52 - 1.70	8B	SPT	43 50/25	50/25	86	MC, SA, PI		1.52  SILTY, CLAYEY SAND with GRAVEL brown, slightly moist, well cemented, with 16% low plastic fines, 43% fine to coarse sand. 41% fine
722.97 -	-2							SC SM	to coarse, subangular gravel to +19mm in diameter.
	2.74	8C (	GRAB	50/75	50/75	0		SP SM	POORLY GRADED SAND with SILT and GRAVEL brown, slightly moist, well cemented, with estimated 5-10% non-plastic to low plastic fines, 60-65% fine to coarse sand, 30% fine to 2.83 coarse, angular to subangular gravel to +19mm in diameter.
721.97	-3								
720.97	-4								

			S	TART DAT	E _1/	/27/00			EXPL	ORATIO	N LOG			SHEET 1 OF
			E	ND DATE	_1/	27/00						OT471011		SHEET I OF
			JC	OB DESCR	IPTION	U.S.	95 Widenin	g Proje	ect			STATION OFFSET		
7			LC	OCATION	_La	as Vega	s, Nevada					ENGINEER	JRO	
11.1			В	ORING	_R·	-09						EQUIPMENT		st B4500
7	<b>(3)</b>		E.	.A. #	_02	215-01-1	l		GROL	NDWATER	LEVEL	OPERATOR	W. Dug	as
in			G	ROUND EL	EV. 72	23.80 (m	1)		DATE	DEPTH m	ELEV. m	DRILLING	152 mm	n HS Auger
	4	1		AMMER DE								METHOD BACKFILLED	Yes	DATE 1/27/00
EV.	DEPTH	SA	MPLE	BLOW C	COUNT				T			DACKFILLED		DATE
n)	(m)	NO.	TYPE	150 mm Increments	Last 300 mm	Percent Recovid	LAB TESTS	USCS Group		MATE	RIAL DE	SCRIPTION		REMARKS
								}		POORLY (	GRADED G	RAVEL with SA	ND grey	
	0.30									estimated	5% non-pla	ell cemented, wi astic fines, 35%	fine to	
i	0.41	-	GRAB	50/100	50/100	25				coarse sar	1d, 60% fin	e to coarse, sub 75mm in diamet	angular to	
										cobbles at	surface.	onin in diamet	er. wimor	
	_													
				ĺ				GP						
:	-							Í						
80 -	_1							ļ						
	-													
									1.37					
	-			I		1	1		7 — — -	BOOR V		AND with SII Ta		-

POORLY GRADED SAND with SILT and GRAVEL light brown, dry to slightly moist, moderately to well cemented, with estimated 5-10% non-plastic to low plastic fines, 60-65% fine to coarse sand, 30% fine to coarse, angular to subangular gravel to +12.5mm in diameter. 25 50/25 9B SPT 50/25 57 1.70 SP SM 721.80 +2 2.44 SILTY, CLAYEY SAND with GRAVEL light brown, slightly moist, moderately to well cemented, with 13% low plastic fines, 45% fine to coarse sand, 42% fine, subangular gravel to +12.5mm in diameter. 2.74 SC SM 42 50/150 9C SPT 50/150 83 MC, SA, PI 720.80 -3 3.05 3.05 ... DOT ......1.GPJ inv\_noT.GD; or invol 719.80

END DATE	3	_		;	START DAT		/27/00			EXPLO	ORATIO	N LOG			SHEET 1 C
JOS DESCRIPTION Las Vegas, Nevada  BORING R.10  EA. # C215-01-1  GROUND ELEV_ 722.05 (m)  HAMMER DROP SYSTEM_ Hydraulic  ELEV_ 0p7 In m) No 1779E 19 mm Last Percent (n) 19 mm Last Per				E	END DATE	_1							STATION		ONEE! 1 C
LoCATION   LaS Vegas, Nevada   Security   Las Vegas, Nevada   Security   Se					IOB DESCF				ng Proje	ect					J
BORING				ı	OCATION	_L	as Vega	is, Nevada						JRO	
ELEY. GROUND ELEV. T22.05 (m) HAMMER DROP SYSTEM Hydraulic  DATE DEPTH ELEV. M BACKFILLED Yes DATE 1/27/00  SAMPLE BLOW COUNT NO TYPE DEPTH NO	· it			E	BORING	_R	-10								st B4500
GROUND ELEV. 722.05 (m)  HAMMER DROP SYSTEM Hydraulic  ELEV. (m)  SOUTH NO. TYPE SOUTH Recover (m)  NO. TYPE SOUTH RECOVER SOUTH RECOVER (m)  O 38 10A GRAE 50/75 50/75 0  O 38 10A GRAE 50/75 50/75 0  1.52  1.70  1.52  1.70  O BETHM RECOVER HYDRAULIC SOUTH RECOVER (M)  REMARKS  O STORY OF THE SOUTH RECOVER (M)  REMARKS  O STORY OF THE SOUTH RECOVER (M)  REMARKS  O STORY OF THE SOUTH RECOVER (M)  REMARKS  O STORY OF THE SOUTH RECOVER (M)  REMARKS  O SAMPLE SOUTH RECOVER (M)  REMARKS  O SAMPLE SOUTH RECOVER (M)  REMARKS  O STORY OF THE SOUTH RECOVER (M)  REMARKS  O STORY OF THE SOUTH RECOVER (M)  REMARKS  O STORY OF THE SOUTH RECOVER (M)  POORLY GRADED GRAVEL with SAID grey to end to ensure south of the salt mated 5% non-classic fines, 30/8 fine to coarse and, 60/8 fine to coarse south of the salt mated 5% non-classic fines, 30/8 fine to coarse and, 60/8 fine to coarse south of the salt mated (M) in approximately 10% non-plastic fines, 30/8 fine to coarse and, 60/8 fine to coarse and,	Ä			Е	E.A. #	0	215-01-	1		GROUI	NDWATER	LEVEL	l e		
HAMMER DROP SYSTEM   Hydraulic	1/2					EV 7	22.05 (n	n)							
SAMPLE   SLOW COUNT   NO   Type   No   Type   No   No   No   No   No   No   No   N			A										METHOD		
No   Type			11				STEM	iyuraunc					BACKFILLED	_Yes	DATE 1/27/00
0.30   0.38   10A GRAB   50/75   50/75   0					150 mm	Last	Percent Recovid	LAB TESTS	USCS Group		MATE	RIAL D	ESCRIPTION		REMARKS
0.38 10A GRAE 50/75 50/75 0  0.38 10A GRAE 50/75 50/75 0  0.39 10A GRAE 50/75 50/75 0  0.30 10A GRAE 50/75 50/75 0  0.30 10A GRAE 50/75 50/75 0  0.30 359 fine to coarse and, 60% fine to coarse, subangular gravel to 1-50mm in diameter.  SILTY GRAVEL with SIAD light brown, dry, well cemented, with estimated 10-15% low plasts fines, 35-40% fine to coarse, angular to subangular gravel to +25mm in diameter.  1.52  1.70 108 GRAE 50/25 50/25 0 MC, SA, PI  POORLY GRADED GRAVEL with SILT and SAND brown, slightly moist, well cemented, with approximately 10% non-plastic fines, 30% fine to coarse, angular to subangular gravel to +25mm in diameter.  POORLY GRADED GRAVEL with SILT and SAND brown, slightly moist, well cemented, with approximately 10% non-plastic fines, 30% fine to coarse, subangular to subround gravel to +25mm in diameter.  Caliche at 2.77 meters.				-					0.7		POORLY	GRADED C	GRAVEL with SA	ND grey	
0.38   10A   GRAE   50/75   50/75   0		0.30	اه						GP	1 (	cemented	. with estim	rated 5% non-ni	actic finac	
721.05 — 1  1.52  1.70  108 GRAE  25 50/25 50/25 0 MC, SA, PI  3ND STAND Light brown, dry, well cemented, with estimated 10-15% low plastic fines, 35-40% fine to coarse sand, 50% fine to coarse, angular gravel to +25mm in diameter.  POORLY GRADED GRAVEL with SILT and SAND brown, slightly moist, well cemented, with approximately 10% non-plastic fines, 30% fine to coarse sand, 60% fine to coarse sand, 60% fine to coarse sand, 60% fine to coarse sand, 60% fine to coarse sand, 60% fine to coarse sand, 60% fine to coarse sand, 60% fine to coarse, subangular to subround gravel to +25mm in diameter.  2.74  19.05 — 3  Caliche at 2.7 meters.				GRA	50/75	50/75	0		<del> </del>	<u></u>	35% fine t	o coarse s	and, 60% fine to	COarse	
1.52							1		1		Subangula SILTY GR	r grave to AVEL with	+50mm in diame	eter	1
T21.05 — 1  GM  1.52  1.52  1.52  1.52  1.52  1.52  1.52  POORLY GRADED GRAVEL with SILT and SAND brown, slightly moist, well cemented, with approximately 10% non-plastic fines, 30% fine to coarse, subangular to subround gravel to +25mm in diameter.  GP GM  2.74  Caliche at 2.7 meters.		ĺ			İ				1	1	well ceme	nted, with e	estimated 10-159	% low	
721.05 — 1  1.52  1.70 108 GRAE 25 50/25 50/25 0 MC, SA, PI SOURCE SAND brown, slightly moist, well camented, with approximately 10% non-plastic fines, 30% fine to coarse, subangular to subround gravel to +25mm in diameter.  2.74 186 GRAE 0 0 Calliche at 2.7 meters.		Γ		1						1 1	plastic fine	s. 35-40%	fine to coarse s	and 50%	
721.05 — 1  1.52  1.70  108 GRAE  25  50/25  50/25  0 MC, SA, PI  POORLY GRADED GRAVEL with SILT and SAND brown, slightly moist, well camented, with approximately 10% non-plastic fines, 30% fine to coarse, subangular to subround gravel to +25mm in diameter.  GP GM  2.74  19.05 — 3  Calliche at 2.7 meters.										'	+25mm in	rse, angula diameter	ar to subangular	gravel to	
1.52  1.70 108 GRAB 25 50/25 50/25 0 MC, SA, PI  1.70 108 GRAB 25 50/25 50/25 0 MC, SA, PI  2.70 108 GRAB 25 50/25 50/25 0 MC, SA, PI  GP GM  2.74 100 GRAB 2												didiffictor.			
1.52  1.70  108 GRAB 25 50/25 50/25 0 MC, SA, PI  SAND brown, slightly moist, well camented, with approximately 10% non-plastic fines, 30% fine to care and, 60% fine to coarse, subangular to subround gravel to +25mm in diameter.  GP GM  2.74  Caliche at 2.7 meters.	724.05								GM						
1.70 10B GRAB 25 50/25 50/25 0 MC, SA, PI POORLY GRADED GRAVEL with SILT and SAND brown, slightly moist, well cemented, with approximately 10% non-plastic fines, 30% fine to coarse sand, 60% fine to coarse, subangular to subround gravel to +25mm in diameter.  2.74 100 GRAD 0 Caliche at 2.7 meters.	721.05 -	1				1									
1.70 10B GRAB 25 50/25 50/25 0 MC, SA, PI POORLY GRADED GRAVEL with SILT and SAND brown, slightly moist, well cemented, with approximately 10% non-plastic fines, 30% fine to coarse sand, 60% fine to coarse, subangular to subround gravel to +25mm in diameter.  2.74 100 GRAD 0 Caliche at 2.7 meters.															
1.70 10B GRAB 25 50/25 50/25 0 MC, SA, PI POORLY GRADED GRAVEL with SILT and SAND brown, slightly moist, well cemented, with approximately 10% non-plastic fines, 30% fine to coarse sand, 60% fine to coarse, subangular to subround gravel to +25mm in diameter.  2.74 100 GRAD 0 Caliche at 2.7 meters.															
1.70 10B GRAB 25 50/25 50/25 0 MC, SA, PI POORLY GRADED GRAVEL with SILT and SAND brown, slightly moist, well cemented, with approximately 10% non-plastic fines, 30% fine to coarse sand, 60% fine to coarse, subangular to subround gravel to +25mm in diameter.  2.74 100 GRAD 0 Caliche at 2.7 meters.															
1.70 10B GRAB 25 50/25 50/25 0 MC, SA, PI POORLY GRADED GRAVEL with SILT and SAND brown, slightly moist, well cemented, with approximately 10% non-plastic fines, 30% fine to coarse sand, 60% fine to coarse, subangular to subround gravel to +25mm in diameter.  2.74 100 GRAD 0 Caliche at 2.7 meters.		1 52													
27.4 100 GRAE  1.70 INS GRAE  1.70 I		1.52	$\vdash$	+	25			· · · · · · · · · · · · · · · · · · ·			.=.=. = :				_
with approximately 10% non-plastic fines, 30% fine to coarse sand, 60% fine to coarse, subangular to subround gravel to +25mm in diameter.  2.74 106 GRAE  2.74  Caliche at 2.7 meters.		1.70	10B	GRAE		50/25	0	MC, SA, PI		F	OORLY G	RADED G	RAVEL with SIL	T and	
The to coarse sand, 60% fine to coarse, subangular to subround gravel to +25mm in diameter.  2.74  19.05  3  Caliche at 2.7 meters.	ĺ									l v	vith approx	kimately 10	% non-plastic fir	nes 30%	
Subangular to subround gravel to +25mm in diameter.  2.74 100 GRAE  2.74  Caliche at 2.7 meters.		_								1 1	ne to coar	se sand. 6	0% fine to coars	<b>.</b>	
19.05 — 3 Caliche at 2.7 meters.		_							:	S	ubangular	to subrou	nd gravel to +25	mm in	
2.74 10C CRAE 2.74  19.05 -3  Caliche at 2.7 meters.	720.05	-2								u	iameter.				
19.05 — 3 Caliche at 2.7 meters.															
19.05 — 3 Caliche at 2.7 meters.		-							GM						
19.05 — 3 Caliche at 2.7 meters.	1					!		İ							
19.05 — 3 Caliche at 2.7 meters.	Ī	-				ŀ									
19.05 — 3 Caliche at 2.7 meters.	İ								İ						
19.05 — 3 Caliche at 2.7 meters.	F				i			1	İ						
Caliche at 2.7 meters.	-	2.74	10C	GRAD			_o_			2.74					
Caliche at 2.7 meters.	ľ		į			1	-								1
Caliche at 2.7 meters.						1	[	İ							
	719.05	-3		ŀ	ĺ				J						
18.05 — 4						-			Ī	С	aliche at 2	2.7 meters.			
18.05 — 4	ľ	-				-			ļ						
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			Ε	START DAT END DATE JOB DESCR		/27/00 /27/00 U.S.	. 95 Widenin	na Proj		ORATIO	N LOG	STATION		SHEET 1 OF
				OCATION	1 .		as, Nevada	9				- OFFSET	JRO	
						R-11	10, 1101444				<del></del>	ENGINEER	Foremost	PASOO
ż				BORING		215-01-	1		CDOL			EQUIPMENT	W. Dugas	
1				E.A. #					DATE	DEPTH m	ELEVEL	OPERATOR		
				SROUND EL		20.45 (m	<del></del>	!	DATE	DC: 111111	ELEV. III	DRILLING METHOD	_152 mm H	
		1	Н	HAMMER DE	ROP SYS	STEM	lydraulic	'				BACKFILLED	Yes D	DATE1/27/00
ELEV. (m)	DEPTH (m)	SA NO.	TYPE	150 mm	Last	Percent n Recovid		USCS Group		MAT	ERIAL DI	ESCRIPTION	· · · · · · · · · · · · · · · · · · ·	REMARKS
	0.30	111A	GRAE	<del>B 50/0</del>	50/0	0	MC, SA, PI,	GP GC		grey, dry, fines, 30% coarse, su diameter. POORLY SAND bro with appro- fine to coa	loose, with fine to co- ubangular of Minor surfa GRADED Co- own, slightly oximately 10 parse sand, 6	GRAVEL with SA n estimated <5% n erse sand, 60% gravel to +75mm ace cobbles are GRAVEL with CL y moist, well cem 0% low plastic fi 60% fine to coar +19mm in diam	non-plastic   fine to   n in   present.   AY and   nented, ines, 30%	
719.45 -	1								1	moist, mo	derately ce	GRAVEL brown,	timated	
	1.52	<u>.</u>			'	'	_'			15% low p	plastic fines	s, 45% fine to coa subangular grave	arse sand.	
	-			30						+12.5mm	in diameter	subangulai yiavi r.	el to	į
	100	1	SPT	50/150	50/150	92	1							ı
-	- 1.83	<del>                                     </del>						1		•				
718.45 -	_2							sc						
							1		2.59					
	2.74			1			ı	Γ – –		CALICHE				
	-			32					_2.74_	CLAYEY S	AND with	GRAVEL brown,	slightly -	
717.45			SPT	32 50/113	50/113	95		sc	3.02	moist, mod 25% low pl sand, 20-2	derately cer lastic fines, 25% fine to	mented, with esti , 50-55% fine to coarse, subangu	timated coarse	
אל DOI עבו שון GP, מע טען GD. פון און 1992 אל 199. 42	-4							-	Į	<u>to +19mm</u>	in diamete	<u>r.                                    </u>		

				START DATE		/27/00 /27/00			EXPLORATION LOG			SHEET 1 OF
				OB DESCR		U.S.	95 Wideni	ng Proj	ect	STATION		
			L	OCATION	_ <u>L</u>		as, Nevada			OFFSET ENGINEER	JRO	
			В	ORING	_R	-12				EQUIPMENT	Foremos	st B4500
7	<b>E</b> (1)		E	.A.#	_0:	215-01-	1		GROUNDWATER LEVEL	OPERATOR	W. Duga	as
2.4			G	ROUND E	LEV7	18.81 (r	n)		DATE DEPTH m ELEV. m	DRILLING METHOD	152 mm	HS Auger
		1	Н	AMMER D	ROP SY	STEM_	Hydraulic			BACKFILLED		DATE 1/27/00
ELEV.	DEPTH		MPLE	BLOW				T.,,,,,,				DATE
(m)	(m)	NO	TYPE	150 mm Increment		Percent Recovid	LAB TESTS	USCS Group	MATERIAL DE	SCRIPTION		REMARKS
	0.30							GP	POORLY GRADED G to light brown, dry, we cemented, with estim 0.30 40% fine to coarse sa	eakly to modera ated 5% non-pland and 55% fine to	tely astic fines,	
	0.59	1	SPT	22 50/125	50/125	72			POORLY GRADED Some brown, dry, moderate estimated 5% non-ola	19mm in diame AND with GRAV y to well cemen stic fines 55-66	eter. /EL light ited, with	
								SP	coarse sand, 30-40% subangular gravel to	fine to coarse	angular to	
717.81	<del>-</del> 1											
	_								_1.52			
716.81 -	- - -2							SP SC	POORLY GRADED SA GRAVEL brown, dry to cemented, with estima fines, 60-65% fine to c subangular gravel to +	slightly moist, ted 5-10% low parse sand 300	well plastic	
	_							30	2.44			
	2.74							sc	CLAYEY SAND with G moist, moderately to w medium plastic fines, 5 28% fine, subround gra	ell cemented, w 1% fine to coar	rith 21%	
715.81	2.97 -3	12C	SPT	15 50/75	50/75	89	MC, SA, PI		diameter.			
				·								
								-				
714.81	-4											
714.81												

	_		\$	START DA		/27/00	<del></del>		EXP	LORATION LOG			SUEET 1.0
			E	END DATE	1	/27/00					CTATION		SHEET 1 O
			j	OB DESC	RIPTION	U.S	. 95 Widenir	ng Proj	ect		STATION OFFSET		
			L	OCATION		as Veg	as, Nevada				ENGINEER	JRO	
1			E	BORING		R-13					EQUIPMENT	Foremos	t B4500
4			E	.A. #	_0	215-01-	-1		GRO	UNDWATER LEVEL	OPERATOR	W. Dugas	
2			G	ROUND E	LEV7	17.32 (ı	n)		DATE		DRILLING METHOD	152 mm l	JC Augor
		1	H	IAMMER D	ROP SY	STEM	Hydraulic						
		S/	MPLE		COUNT	T =			·		BACKFILLED	Yes	DATE
ELEV. (m)	DEPTH (m)		. TYPE	150 mm	Last	Percent Recovid		USCS Group		MATERIAL DE			REMARKS
								GP	0.15	POORLY GRADED G SAND grey, dry, weak	RAVEL with SIL	LT and	
I	0.30	0	1					Γ	7	estimated 5-10% non	-plastic to low n	lastic	
	0.38	13/	GRA	50/75	50/75	0		+		fines, 40-45% fine to coarse, angular to sul	coarse sand 50	% fine to	
	1			İ				7		in diameter		1 :	
	-			-		İ				SILTY GRAVEL with	SAND brown, dr	y to	
						ŀ				slightly moist, well cer 15% non-plastic to lov	v nlastic fines 3	IO% fine to	
	-	İ	ŀ							coarse sand, 55% fine	to coarse and	ular to	
								GM		subangular gravel to	-37.5mm in diar	neter.	
716.32 -	<u> </u>												
ì	_							ł					
		İ			1	1						İ	
	-												
1	1.52 1.58	13B	GRAB	50/50	50/50	50			_1.52				
Ī	•				00,00					CLAYEY SAND with G	RAVEL light bro	own to	
		]								brown, slightly moist, vestimated 15-20% low	vell cemented, v	with	
Ī	-									to coarse sand, 30% fi	ne to coarse su	bangular	
745.00	_									gravel to +25mm in dia	meter.	Jangalai	
715.32	-2												
								sc					
ſ													
Ĺ													
						ĺ							
L													
1	2.74					J							
F	2.87	13C	SPT	50/125	50/125	100	MC, SA, PI		2.74_	CLAYEY SAND with Gi	PAVEL brown a	limbth.	
F			$\neg \neg$					-		moist, moderately to we	ell cemented wi	th 26%	
714.32 +	-3	1				1			1	medium plastic fines, 5	2% fine to coars	se sand	
									1	22% fine, subround gra diameter	vel to +12.5mm	in //	
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Γ	-					1							
713.32					-	1	Ĭ						
13.32	4					1	-						
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3				START DA		/28/00			EXPLORATION LOG			SHEET 1 OF
				END DATE		/28/00				STATION		<b>U</b> ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
			J	IOB DESC			95 Widenin	ig Proj	ect	OFFSET		
	<b>.</b>		Ĺ	OCATION			s, Nevada			ENGINEER	JRO	
F.			8	BORING		R-14				EQUIPMENT	Foremost	B4500
4			E	E.A. #		215-01-			GROUNDWATER LEVEL	OPERATOR	W. Dugas	3
7			G	ROUND E	LEV7	16.69 (n	n)		DATE DEPTH m ELEV. m	DRILLING METHOD	152 mm F	HS Auger
		1	Н	AMMER D	ROP SY	STEM_	Hydraulic			BACKFILLED		ATE _1/28/00
ELEV.	DEPTH	SA	MPLE		COUNT			1		BACKFILLED		ATE
(m)	(m)	NO	. TYPE	150 mm Increment	Last ts 300 mr	Percent n Recov'd	LAB TESTS	USCS Group				REMARKS
						Ì		GP	POORLY GRADED C	RAVEL with SA	ND	
	0.30	اد							<5% non-plastic fines	s 35-40% fine to	COarea	
	0.36	14/	GRAI	50/50	50/50	0			sand, 60% fine to co.	arse, subangulai	gravel to	
									POORLY GRADED G	RAVEL with SIL	T and — —	
İ	-								SAND light brown to moist, well cemented	brown dry to slig	ththy	
								GP	non-plastic to low pla	stic fines 30-45	% fine to	
	F			l		ĺ		GM	coarse sand, 50-60%	fine to coarse	angular to	
i			l						subangular gravel to	+37.5mm in diar	neter.	
715.69 -	<del> </del> 1											
	[		ĺ				i		1.22	55.75.T		
	L								CLAYEY SAND with ( slightly moist, well ce	mented with	1	
	1.52								approximately 20% lo	w plastic fines 5	0% fine	
	_ 1.62	14B	SPT	50/100	50/100	100	MC, SA, PI		to coarse sand, 30% gravel to +19mm in di	rine to coarse, si ameter	ubangular	
1												
	-											
714.69	-2							SC				
	_											
	-					1						
	-					ĺ						
	2.74											
<b>l</b>	2.82	14C	GRAB	50/75	50/75	0			2.82			
712.00		l	]									
713.69	-3		l					ĺ				
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3			;	START DA	-	/28/00			EXPLORATION LOG			SHEET 1
			E	END DATE	1	/28/00				CTATION		SHEET
				OB DESC			95 Widenir	ng Proj	ect	STATION OFFSET		
			ı	OCATION			as, Nevada			ENGINEER	JRO	
1.0			E	BORING		₹-15				EQUIPMENT	Foremos	t B4500
7			E	.A. #	_	215-01-			GROUNDWATER LEVEL	OPERATOR	W. Duga	s
7	, '		C	ROUND E	LEV7	16.24 (n	n)		DATE DEPTH m ELEV. m	DRILLING METHOD	152 mm l	HS Auger
		11-	F	AMMER C	ROP SY	STEM_	Hydraulic			BACKFILLED		
ELEV.	DEPTH	S	AMPLE		COUNT		T			BACKFILLED		DATE 1/28/0
(m)	(m)	NO	. TYPE	150 mm	Last s 300 mn	Percent Recovid	LAB TESTS	USCS Group	MATERIAL DE	SCRIPTION		REMARK
								GP	POORLY GRADED G	RAVEL with SA	ND light	<u> </u>
	-							<del>-</del>	_0.15 brown to grey, dry, lo non-plastic fines, 35%	ose with estima	tod -50/	
	0.3		GRA	50/75	50/75	33	MC, SA, PI,	-	inne to coarse, suban	gular to subroup	id aroual to !	
	0.4	1.0,	10.00	30773	30//3	33	R	1	+75mm in diameter. I SILTY, CLAYEY GRA	Minor cobblee at	t curfo oo	
	Ĺ	ļ							i Siigntiv moist, well ce	mented with		
									approximately 20% to	w plastic fines 1	35% fine	
	L		1	1				GC	to coarse sand, 45% gravel to +19mm in di	nne to coarse, s ameter	ubangular	
					1			GM				
715.24	1											
	-											
									_1.37			
	- 1 52								CLAYEY SAND with C	RAVEL light bro		
į	1.58	15B	GRAB	50/50	50/50	0			prown, slightly moist	veli cemented v	with	
l					] .				estimated 15% low pla coarse sand, 30% fine	istic fines, 55%	fine to	
-									gravel +19mm in diam	eter.	angulai	
								sc				
714.24	-2							30				
1												
t												
ſ	j						-		_2.44			
F									CLAYEY SAND with G brown, slightly moist, n	RAVEL light bro	wn to	
- 1	2.74					]		sc	with estimated 15% lov	v plastic fines 6	i0% fine i	
F		15C	SPT	34	50/25	00			to coarse sand, 25% fil +12.5mm in diameter.	ne, subangular g	gravel to	
-	2.92		<u> </u>	50/25	50/25	86			2.93			
13.24	-3		- 1									
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				9	START DAT	E _1	/28/00			EXPLORATION LOG			
				E	ND DATE	_1	/28/00						SHEET 1 OF
				J	OB DESCR	RIPTION	U.S.	95 Widenir	ıg Proj	ect	STATION		
				L	OCATION	_ <u>L</u>	as Vega	s, Nevada			OFFSET ENGINEER	JRO	
	1			Е	ORING	R	R-16				EQUIPMENT	Foremos	st B4500
		( <del>**</del> )		E	.A.#	0	215-01-	1		GROUNDWATER LEVEL	OPERATOR	W. Duga	
		4.1			ROUND E	 LEV. 7	15.69 (n	n)		DATE DEPTH m ELEV. m	DRILLING		
			1				STEM F	- Hydraulic			METHOD		HS Auger
			1 54	MPLE	BLOW		J - LW		<del></del> -		BACKFILLED	res	DATE
	ELEV.	DEPTH (m)	NO		150 mm	Last	Percent Recov'd		USCS Group	<del></del>			REMARKS
		8:39	16/	GRAI	50/25	50/25	0		GP	pOORLY GRADED G 0.15 to brown, dry, weakly with estimated 5% no fines, 35% fine to coa coarse, subangular gliameter. 5-10% cobb SILTY SAND with GR brown, dry to slightly	to moderately on-plastic to low rse sand, 60% ravel to +75mm ples at surface.  AVEL brown to moist, with esting the sattle street with esting the sattle str	remented, plastic fine to in	
	714.69	1.22							SM	20-25% low plastic fin sand, 35-40% fine to subround gravel to +1	es, 40% fine to	coarse	
		- 1.22	160	SPT	43	50/25			<del> </del>	SILTY SAND with GR	AVEL light beau		
		1.40		G. ,	50/25	30/23	86	MC, SA, PI		slightly moist, modera with approximately 20 fine to coarse sand, 3 subangular to subrour diameter.	tely to well cem % low plastic fin 0% fine to coars	ented, les, 50%	
	713.69	-							SM				
		2.74	16C	GRAE	50/75	50/75	0			2.82			
	712.69 -									2.02			
NV_DOT_0215011.GPJ_NV_DOT.GDT_6/14/00	711.69 -	-4											

				START DAT	<u> </u>	/28/00 /28/00			EXPL	ORATIO	N LOG	STATION		SHEET 1
			J	OB DESCR	RIPTION	U.S.	95 Widenin	ig Proje	ect			OFFSET		
			L	OCATION	_ <u>L</u>	as Vega	is, Nevada					ENGINEER	JRO	
11.			В	BORING	_R	-17						EQUIPMENT	Foremo	st B4500
4			Ε	.A. #	_0:	215-01-	1			JNDWATER		OPERATOR	W. Dug	as
' سر				ROUND E		14.50 (n	<del></del>		DATE	DEPTH m	ELEV. m	DRILLING METHOD	_152 mm	1 HS Auger
		1	Н	IAMMER DI	ROP SY	STEM_	lydraulic					BACKFILLED	Yes	DATE 1/28/0
LEV.	DEPTH		MPLE	BLOW 0	OUNT	Percent	LAB TESTS	uscs	T					
(m)	(m)	NO.	TYPE			Recov'd	LAB TESTS	Group	ļ			SCRIPTION		REMARK
	- 0.30							GP	1	to brown, o	dry, weakly astic fines	RAVEL with SA cemented, with 25-35% fine to	estimated	. I I
<u> </u>	0.71	17A	SPT	19 36 50/100	50/100	69	MC, SA, PI	SM		SILTY SAI slightly mo with 18% v coarse sar	m in diame ND with GR pist, modera very low pla	AVEL brown, di stely to well cerr stic fines, 45% to coarse, sub	ry to ented,	<u>i</u>
3.50	-1								4.82	graver to +	1917IM IN Q	ameter.		
-	1.52									GRAVEL li cemented, low plastic	ght brown, with estima fines, 50-6	AND with SILT a slightly moist, w ated 5-10% non- 0% fine to coars	ell -plastic to	_
	1.66	17B	SPT	50/138	50/138	95		SP SM		30-40% fin diameter.	e, subangu	lar gravel to +12	2.5mm in	
2.50	·2													
-						į			_2 <u>.1</u> 3_	CALICHE				-
							-		_2 <u>.4</u> 4		==			
-	ĺ						1			SILTY SAN	D with GD	VEL light brown	n to	l
-	2.74							SM	į	brown, sligh estimated 1	ntly moist, v 5% non-pla	vell cemented, vastic to low plas	vith tic fines	

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710.50

711.50

	3					START DA		/28/00			EXPL	ORATIO	N LOG			SHEET 1 OF
						ND DATE		/28/00						STATION		
						OB DESC			95 Widenin	ig Proj	ect			OFFSET		
						OCATION			s, Nevada					ENGINEER	_JRO_	
	12.5	· .	<b>A</b>			ORING		245.04						EQUIPMENT		st B4500
		4 /				.A.#		215-01-				NDWATER		OPERATOR	W. Duga	as
		1				ROUND E		12.00 (n			DATE	DEPTH m	ELEV. m	DRILLING METHOD	152 mm	HS Auger
		,	127	1	Н	IAMMER D	ROP SY	STEM_	lydraulic					BACKFILLED	Yes	DATE 1/28/00
	ELEV.				MPLE	BLOW 150 mm	COUNT	Percent	140 75070	uscs	T					
	(m)	<u>(n</u>	n)	NO.	TYPE	Increment	s 300 mn	Recov'd	LAB TESTS	Group				ESCRIPTION		REMARKS
			0.30									to brown, well ceme	ary to sligh	GRAVEL with SA tly moist, moder estimated 5% no	ately to	
				_	GRAE	50/100	50/100	0	<u> </u>	-	į	Tines, 35%	o fine to co	arse sand 60% :	fine to	
										1	1	in diamete	er. Approxir	bangular gravel nately 5% cobble	to +/5mm es at	
		-								GP		surface.		·		
	711.00	-1									_1.22					
		-										orown, slia	intly moist.	GRAVEL brown well cemented,	with 17%	
			.52 .58	188	GRAB	50/50	50/50	_ 0	MC SA PI	SC		low plastic	fines, 46%	fine to coarse s gular gravel to +	and 37%	
				100		50/50	30/30		MC, SA, PI		1.68	diameter.	-,	garar graver to v	· 51/1111 111	
-		_									7.00					1
		İ														
1	710.00	<del> </del> 2						1	Ì							
1								ĺ								Auger Refusal
		t		ĺ	Í			ľ								at 1.68 meters (very hard
l																caliche).
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				END DATE		/28/00							SHEET 1
				IOB DESC			95 Wideni	na Droi	oot		STATION		
				OCATION			as, Nevada		<del>c</del> ci		- OFFSET		
1 35						23 Vega R-19	as, Ivevaua				ENGINEER	<u>JRO</u>	
7				BORING		215-01-					EQUIPMENT	Foremos	
				E.A. #					GROL	NDWATER LEVEL	OPERATOR	W. Duga	IS
				ROUND E					DATE	DEPTH m ELEV. m	DRILLING METHOD	152 mm	HS Auger
	///	14	Η	IAMMER D	ROP SY	STEM	lydraulic				BACKFILLED	Yes	DATE 1/28/00
ELEV. (m)	DEPTH (m0).00	NO	TYPE	150 mm Increment	Last	Percent Recovid		USCS Group		MATERIAL DI	ESCRIPTION		REMARKS
	0.14	19/	GRA	50/138	50/138	55	MC, SA, PI, R	GP	0.15	POORLY GRADED	GRAVEL with SA	AND	<del> </del>
710.82 -	1							SC SM		grey, dry, loose, with fines, 20% fine to co- coarse, subangular of diameter.  SILTY, CLAYEY SAN to light brown, dry to to well cemented, with plastic fines, 40% fine to coarse, subangula diameter.	estimated 10% arse sand, 70% gravel to +50mm  ID with GRAVEL slightly moist, much approximately eto coarse sand	non-plastic fine to in brown loderately 20% low	
									_1.22_	CALICHE			JACAL.
										- XE. 511E			With approximately
	1.52 1.60		GRAB	50/75	50/75	0							25% fine to coarse.
		100	0.0.0	30//3	30/73		· · · · · · · · · · · · · · · · · · ·						subangular
	_												gravel to +19mm.
								<u> </u>	_1.83_	CLAYEY SAND with (	CEAVEL STATE		. 13/11/1
709.82	-2							sc	t t	prown, slightly moist, stimated 15-20% low o coarse, 25-30% find subangular gravel to	well cemented, well cemented, well cemented, well control of the coarse and the c	with 0-60% fine	
	2.74												
F	2.82	19C	GRAB	50/75	50/75	0			2.82				
708.82	-3	ĺ											
700.02	J		1			İ		İ					
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END DATE   1/28/00   J.S. 95 Widening Project   STATION   JOB DESCRIPTION   U.S. 95 Widening Project   Continue   Location   Locat	OUEET 4
U.S. 95 Widehing Project   U.S. 95 Widehing Pr	SHEET 1
LOCATION   BORING   R-20	
BORING   E.A. #   0215-01-1   GROUNDWATER LEVEL   DATE   DEPTH   ELEV.   DEPTH   ELEV.   MAMER RDROP SYSTEM   Hydraulic   DATE   DEPTH   ELEV.   DEPTH   BLEV.   MATERIAL DESCRIPTION   BACKFILLED   Yes   DATE   DEPTH   ELEV.   METHOD   BACKFILLED   Yes   DATE   DEPTH   ELEV.   DEPTH   NO.   TYPE   150 mm   Last   Percent   LAB TESTS   USCS   Group   MATERIAL DESCRIPTION   DATE   DEPTH   SAMPLE   BLOW COUNT   ELEV.   BLOW COUNT   Increments   300 mm   Recovid   AB TESTS   USCS   MATERIAL DESCRIPTION   DATE   DEPTH   METHOD   MET	
EA.#   0215-01-1   GROUNDWATER LEVEL   DATE   DEPTH   ELEV. m   HAMMER DROP SYSTEM   Hydraulic   DATE   DEPTH   ELEV. m   METHOD   BACKFILLED   Yes   DATE	B4500
Company   Comp	
HAMMER DROP SYSTEM Hydraulic  ELEV. (m) SAMPLE BLOW COUNT Last Percent (m) NO. TYPE Increments 200 mm Recovd LAB TESTS USCS Group  O.30 SPT 31 81 72 MC, SA, PI SO MC, SA,	
ELEV.   DEPTH   SAMPLE   SLOW COUNT   NO   TYPE   150 mm   Last   Percent   LAB TESTS   USCS   Stroup   POORLY GRADED GRAVEL with SAND grey   to light brown, dry, weakly cemented, with estimated <5% non-plastic fines, 20-25% fine to coarse sand, 75% fine to coarse sand, 50% fine to coarse sand, 50% fine to coarse sand, 50% fine to coarse sand, 50% fine to coarse sand, 25% fine to coarse, subangular gravel to +25mm in diameter.	
Lab Tests   Lab	ATE
0.30	REMARKS
0.30    0.30   0	NEWARKS
0.30	
20A SPT 31 81 72 MC, SA, PI  20A SPT 31 81 72 MC, SA, PI  0.76  31 81 72 MC, SA, PI  0.76  31 81 72 MC, SA, PI  0.76  4	
20A   SPT   31   81   72   MC, SA, PI	
1.52	
0.76	
710.17 — 1  1.52  1.60 208 GRAE 50/75 50/75 0  1.68 CALICHE  709.17 — 2  SILTY SAND with GRAVEL light brown to brown, slightly moist, well cemented, with estimated 15% low plastic fines, 60% fine to coarse sand, 25% fine to coarse, subangular gravel to +25mm in diameter.  2.74  2.82 20C SPT 50/75 50/75 98  2.82	
710.17 —1 GP GC  1.52 1.60 20B GRAE 50/75 50/75 0 1.68 CALICHE  709.17 —2 SILTY SAND with GRAVEL light brown to brown, slightly moist, well cemented, with estimated 15% low plastic fines, 60% fine to coarse sand, 25% fine to coarse, subangular gravel to +25mm in diameter.  2.82 20C SPT 50/75 50/75 98 2.82	
1.52 1.60 208 GRAE 50/75 50/75 0	
1.60   20B   GRAB   50/75   50/75   0	
1.60   20B   GRAB   50/75   50/75   0	
1.60   20B   GRAB   50/75   50/75   0	
1.60   20B   GRAB   50/75   50/75   0	
709.17 —2  SILTY SAND with GRAVEL light brown to brown, slightly moist, well cemented, with estimated 15% low plastic fines, 60% fine to coarse sand, 25% fine to coarse, subangular gravel to +25mm in diameter.  2.82 20C SPT 50/75 50/75 98  2.82	
CALICHE  2.29  SILTY SAND with GRAVEL light brown to brown, slightly moist, well cemented, with estimated 15% low plastic fines, 60% fine to coarse sand, 25% fine to coarse, subangular gravel to +25mm in diameter.  2.82 20C SPT 50/75 50/75 98  2.82	
2.29  SILTY SAND with GRAVEL light brown to brown, slightly moist, well cemented, with estimated 15% low plastic fines, 60% fine to coarse sand, 25% fine to coarse, subangular gravel to +25mm in diameter.  2.82 20C SPT 50/75 50/75 98  2.82	
SILTY SAND with GRAVEL light brown to brown, slightly moist, well cemented, with estimated 15% low plastic fines, 60% fine to coarse sand, 25% fine to coarse, subangular gravel to +25mm in diameter.  2.74  2.82 20C SPT 50/75 50/75 98  2.82	
SILTY SAND with GRAVEL light brown to brown, slightly moist, well cemented, with estimated 15% low plastic fines, 60% fine to coarse sand, 25% fine to coarse, subangular gravel to +25mm in diameter.  2.74  2.82 20C SPT 50/75 50/75 98  2.82	
SILTY SAND with GRAVEL light brown to brown, slightly moist, well cemented, with estimated 15% low plastic fines, 60% fine to coarse sand, 25% fine to coarse, subangular gravel to +25mm in diameter.  2.74  2.82 20C SPT 50/75 50/75 98  2.82	
SILTY SAND with GRAVEL light brown to brown, slightly moist, well cemented, with estimated 15% low plastic fines, 60% fine to coarse sand, 25% fine to coarse, subangular gravel to +25mm in diameter.  2.82 20C SPT 50/75 50/75 98 2.82	
brown, slightly moist, well cemented, with estimated 15% low plastic fines, 60% fine to coarse sand, 25% fine to coarse, subangular gravel to +25mm in diameter.  2.74  2.82 20C SPT 50/75 50/75 98  2.82	
SM estimated 15% low plastic fines, 60% fine to coarse sand, 25% fine to coarse, subangular gravel to +25mm in diameter.  2.82 20C SPT 50/75 98 2.82	
2.74   Coarse sand, 25% fine to coarse, subangular gravel to +25mm in diameter.  2.82 20C SPT 50/75 50/75 98   2.82	
_ 2.82 20C SPT 50/75 50/75 98 2.82	
08.17 — 3	
07.17 +4	
07.17 —4	

	START DATE	1/28/00		EXPL	ORATIO	N LOG			0.1557
	END DATE JOB DESCRIPT		g Proje	ect			STATION OFFSET		SHEET 1 OF
	LOCATION	Las Vegas, Nevada					ENGINEER	JRO	
	BORING	R-21					EQUIPMENT	Foremost	B4500
4	E.A. #	0215-01-1		GROL	INDWATER	RLEVEL	OPERATOR	W. Dugas	5
	GROUND ELEV			DATE	DEPTH m	ELEV. m	DRILLING METHOD	152 mm ł	HS Auger
	HAMMER DROP						BACKFILLED	Yes	ATE 1/28/00
ELEV.   DEP   H	TYPE   BLOW COUR	ast Percent LAB TESTS	USCS Group		MAT	ERIAL DE	SCRIPTION		REMARKS

ELEV.	DEPTH		MPLE	BLOW C	OUNT			HECC	
(m)	(m)	NO.	TYPE	150 mm Increments	Last 300 mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION REMARK
								GP	POORLY GRADED GRAVEL with SAND grey
	0.30	L							estimated <5% non-plastic fines, 35% fine to coarse sand, 60% fine to coarse, subangular
	}	21 4	CDT	30				1	
	0.60	1	SPT	50/138	50/138	96			SILTY SAND with GRAVEL light brown to
									brown, dry to slightly moist, moderately to well cemented, with approximately 15% low plastic
	-								tines, 50% fine to coarse sand, 35% fine to
700 70									caorse, subangular gravel to +19mm in diameter.
709.75 -	_1								
	-							SM	
								SIVI	
	1.52								
	-	21B	SPT	43	50/75	89	MC, SA, PI		
	1.75			50/75	30773	- 09	IVIC, SA, PI		
			İ				-		
708.75	-2								
	_	i							2.29
	-					-			CALICHE
	_								SILTY SAND with GRAVEL brown to light
l	2.74		ļ	į				SM	brown, slightly moist, well cemented, with estimated 15-20% low plastic fines, 40-50% fine
	2.82	21C (	SRAB	50/75	50/75	66			to coarse sand, 30-40% fine to coarse, 2.82 subangular gravel to +25mm in diameter.
707.75	-3								
				Í					
-	.			ł		ĺ			
-							+		
		-							
f									
-					l				
									·
706.75	-4								
-									
Ţ									
+									
r	1		- 1		- 1		1		

•			s	START DAT	E _1/	28/00			EXPLORATION LOG			CUEET 1
			E	ND DATE		28/00						SHEET 1
			J	OB DESCF	RIPTION	U.S.	95 Widenin	g Proj	ect	STATION		
				OCATION		as Vega	s, Nevada			OFFSET ENGINEER	JRO	
11, 11				BORING	R	-22				EQUIPMENT	Foremos	t B4500
Ż	(\$			.A. #	02	215-01-1	1		GROUNDWATER LEVEL	OPERATOR	W. Duga	
1						10.12 (m			DATE DEPTH m ELEV. m	DRILLING		
				ROUND E	•		·			METHOD		HS Auger
	11 L	1	Н	IAMMER D	ROP SYS	STEM	iyuraulic	——		BACKFILLED	Yes	DATE
ELEV.	DEPTH		MPLE	BLOW 0	COUNT	Percent	LAB TESTS	uscs	MATERIAL DE	CODIDEION		
(m)	(m)	NO	TYPE	Increments			0.0.20.0	USCS Group	MATERIAL DE			REMARKS
								GP	POORLY GRADED G 0.15 to light brown, dry, we	RAVEL with SA	ND grey	
	0.30								cemented, with estim	ated <5% non-r	plastic	
			GRA	50/75	50/75	0		-	fines, 35% fine to coa	rse sand, 60%	fine to 1	
									coarse, subangular g	les at surface	1	
								SP	POORLY GRADED S	AND with SILT	and	
	Γ							3111	GRAVEL light brown moist, well cemented	o brown, dry to with estimated	slightly 5-10%	
	L								low plastic fines, 30-3	5% fine to coars	se sand	
									60% fine to coarse, si 0.91 gravel to +37.5mm in	ubangular to sul	bround	
709.12 -	1								SILTY, CLAYEY SAN	D brown to red b	orown,	
									slightly moist, well cer	mented, with es	timated	
	- 1								20-25% low plastic fin sand, 30-40% fine to	es, 35-45% fine coarse subandi	to coarse	
I									to +19mm in diameter	·	ulai giatoi	
ļ	<u> </u>											
	1.52 1.58	22H	GRAE	50/50	50/50	0		sc				
	F	441	LICO.	50/50 <u>.</u>	50/5v	<u> </u>		SM	·			
	r											
						1						
708.12	-2											
									_2.13			
	Ī								POORLY GRADED SA GRAVEL light brown,	ND with CLAY	and	
	_		1						cemented, with approx	cimately 10% lo	w to	
-	-							SP	medium plastic fines,	50% fine to coa	rse sand.	
	_		]					SC	40% fine, subangular diameter.	gravel to +12.5n	nm in	
1	2.74								<u> </u>			
-		32C	SPT	50/145	F0/4.45	00	OA DI					
}	2.89	220	Sr I	50/145	50/145	86	MC, SA, PI		2.90			
07.12	-3						1					
}	-						1					
											1	
F	.					1	†					
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	]			1		İ						
t	.			1								
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06.12 +	-4		1		- 1						1	
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	1	- 1										
Γ						1	-					
			İ	1				1			1	

	START DATE	1/28/00			EXPL	ORATIO	N LOG			
	END DATE	1/28/00								SHEET 1 OF
	JOB DESCRIPT	ION U.S.	95 Widenin	ıg Proje	ect			STATION		
	LOCATION	Las Vegas	s, Nevada					OFFSET ENGINEER	JRO	
	BORING	R-23						EQUIPMENT	Foremo	est B4500
	E.A. #	0215-01-1			GROL	INDWATER	LEVEL	OPERATOR	W. Dug	as
	GROUND ELEV.	709.53 (m	)		DATE	DEPTH m	ELEV. m	DRILLING METHOD	152 mm	n HS Auger
	HAMMER DROP	SYSTEM H	ydraulic					BACKFILLED	Yes	DATE 1/28/00
I ELEV.   DEPTH	MPLE BLOW COUNTYPE 150 mm L. Increments 300	ast Percent	LAB TESTS	USCS Group		MATE	RIAL DE	SCRIPTION		REMARKS

		//	11	}-	IAMMER C	ROP SYS	STEM_	lydraulic		BACKFILLED Yes DATE 1/28/00
	ELEV.	DEPTH		AMPLE	BLOW					
	(m)	(m)	NO	. TYPE	150 mm Increment	Last s 300 mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION REMARKS
									GP	POORLY GRADED GRAVEL with SAND  0.15 grey, dry, loose, with estimated <5% nonplastic
		0.30	0							lilles, 30% fine to coarse sand 70% fine to
		-							1	coarse, subangular gravel to +25mm in
			23A	GRAE	33 46	86	44	MC, SA, PI,		POORLY GRADED GRAVEL with SILTY CLAY and SAND brown, slightly moist,
		<u> </u>			40			R	GP	moderately cemented, with approximately 10% low plastic fines, 30% fine to coarse sand, 60%
		0.76	-	+					GC	nne to coarse, subangular gravel to +25mm in
										diameter.
	708.53	<b>T</b> 1								
	İ	-	ĺ							_1.22_
										CLAYEY GRAVEL with SAND brown slightly
		1.52					į			moist, moderately to well cemented, with estimated 25-30% low to medium plastic fines,
					4.4			•		30-35% fine to coarse sand, 40% fine to coarse, angular to subangular gravel to +25mm in
			23B	SPT	44 31	50/100	81		GC	diameter.
		1.93			50/100				GC	
	707.53	-2								
										2.29
		-								CLAYEY SAND light brown, slightly moist, weakly cemented, with estimated 30% medium
										plastic fines, 60% fine to coarse sand 10% fine
		2.74		j						subangular gravel to +9.5mm in diameter.
									sc	
	706.53 -	_3	23C	SPT	20 16	29	56			
	7 00.00				13					
		3.20	$\dashv$	+						3.20
								1		
		-								
		_								
94/00		ļ			ĺ					
167	705.53	-4								
9		.						-	ŀ	
20 >										
NV_DUI UZISO11.GPJ NV_DOT.GDT 6/14/00	F	.								
011.6										
6170										
ā	r									

	START DATE	1/28/00		EXPL	ORATIO	N LOG			SHEET 1 OF
	END DATE	1/28/00					CTATIO:		3,122, 1 3
	JOB DESCRIPTI	ON U.S. 95 Widening	Proje	ect			STATION OFFSET		
	LOCATION	Las Vegas, Nevada					ENGINEER	JRO	
	BORING	R-24					EQUIPMENT	Foremo	st B4500
7 (3)	E.A. #	0215-01-1		GROU	INDWATER	LEVEL	OPERATOR	W. Dug	as
21	GROUND ELEV.		_	DATE	DEPTH m	ELEV. m	DRILLING METHOD	152 mm	HS Auger
	HAMMER DROP	SYSTEM Hydraulic	_ [				BACKFILLED	Yes	DATE 1/28/00
ELEV. DEPTH SAM	IPLE BLOW COUN		JSCS	T					

		1	H	AMMER DR	ROP SYS	STEM_	lydraulic		BACKFILLED Yes DATE 1/28/00
ELEV.	DERTH	SA	MPLE	BLOW C					
(m)	DEPTH (m)	NO.	TYPE	150 mm Increments	Last 300 mm	Percent Recovid	LAB TESTS	USCS Group	MATERIAL DESCRIPTION REMARKS
								GP	POORLY GRADED GRAVEL with SAND grey
	0.30								0.15 to brown, dry, moderately cemented, with estimated 5% non-plastic fines, 30% fine to
			GRAE	50/25	50/25	0			coarse sand, 65% fine to coarse, subangular gravel to +50mm in diameter. Minor cobbles at
									Surface.
	-								SILTY, CLAYEY SAND with GRAVEL brown to red brown, dry to slightly moist, well
									cemented, with estimated 15-25% low plastic
	<u> </u>							00	fines, 40-50% fine to coarse sand, 30-40% fine to coarse, angular to subround gravel to +25mm
707.92 -	1							SC SM	in diameter.
	-				į				
	1.52								
	_ 1.62	24B	SPT	50/100	50/100	75			
	-		ŀ						_1.83
706.92	_2		ŀ						CLAYEY SAND with GRAVEL brown, moist, weakly cemented, with 30% low to medium
	_								plastic fines, 45% fine to coarse sand 25% fine
-	-					ĺ			subangular gravel to +12.5mm in diameter.
ļ		j	ŀ				Ī		
1	-							sc	
	2.74								
-	-								
05.92	_з	24C	SPT	9 7	16	61	MC, SA, PI		
03.52			-	9	.	ŭ.	INIC, OA, FI		
}	3.20								3.20
1							1		
r	•								
-									
					,				
ŀ									
4.92	-4								
-									
F									
ſ									
}									

IV\_DO\_\_\_\_\_11.GP\_\_\_\_\_OT.GL, \_\_\_\_30

	START DATE	1/28/00	EXPL	ORATIO	N LOG		SHEET 1 OF 1
	JOB DESCRIPTI LOCATION BORING	ON U.S. 95 Widening P Las Vegas, Nevada R-25	oject	-		STATION OFFSET ENGINEER EQUIPMENT	JRO Foremost B4500
	E.A. #	0215-01-1	- ——	JNDWATER		OPERATOR	W. Dugas
SAMI	GROUND ELEV.	SYSTEM Hydraulic	DATE	DEPTH m	ELEV. m	DRILLING METHOD BACKFILLED	152 mm HS Auger  Yes

		1	HA	AMMER DF	OP SYS	STEM	yuraulic	L	BACKFILLED Yes DATE 1/28/00
ELEV. (m)	DEPTH (m)		MPLE TYPE	BLOW C 150 mm Increments	Last	Percent Recovid	LAB TESTS	USCS Group	MATERIAL DESCRIPTION REMARKS
	0.30			THO STITES IN	, , , , , , , , , , , , , , , , , , ,	Necov d		GP	POORLY GRADED GRAVEL with SILT and SAND grey to light brown, dry to slightly moist, weakly to moderately cemented, with estimated 0.30 5-10% non-plastic to low plastic fines, 30-35%
	- 0.76		SPT	44 26 20	46	83	MC, SA, PI		fine to coarse sand, 60% fine to coarse,   subangular gravel to +50mm in diameter.     SILTY SAND with GRAVEL brown to red brown, slightly moist, moderately to well cemented, with approximately 20% non-plastic to low plastic fines, 50% fine to coarse sand
707.44 -	_1							SM	30% fine, subangular gravel to +12.5mm in diameter.
	-								
	1.52								
ŀ	- 1.64	25B	SPT	50/113	50/113	67			
	-								_1.83
706.44	_ 2					ĺ			CALICHE
706.44	<b>-</b> 2								2.13
	-								CLAYEY SAND with GRAVEL brown, slightly moist, moderately cemented, with estimated 30-40% medium plastic fines, 40-50% fine to coarse sand, 20% fine to coarse, subangular gravel to +25mm in diameter.
	2.74							sc	
705.44		25C	SPT	24 26 19	45	89			
ŀ	3.20								3.20
-	.	İ			l	İ	+		
		-							
}									
04.44	-4								
ŀ									
-									
<u></u>									
}									
					1	-			

3				START DAT		/28/00			EXPLORATION LOG			SHEET 1
				ND DATE	-	/28/00				STATION		
				OB DESCF			95 Widenir	ng Proje	ect	OFFSET		
	<b></b>		L	OCATION			is, Nevada			ENGINEER	JRO	
13.			В	ORING		-26				EQUIPMENT	Foremost	B4500
4			E	.A. #		215-01-			GROUNDWATER LEVEL	OPERATOR	W. Dugas	3
سترة.			G	ROUND E	LEV70	07.95 (n	n)		DATE DEPTH m ELEV. m	DRILLING METHOD	152 mm F	lS Auger
	_7//	T SA	MPLE	AMMER DI		STEM_	lydraulic			BACKFILLED .		ATE 1/28/0
ELEV. (m)	DEPTH (m)	NO			Last	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DE			REMARK
								GP	POORLY GRADED 0	eakly to moderat	elv .	
	0.30	+	ļ					į	cemented, with estim 35-40% fine to coars	iated 5% non-pla	etic fines	
	- 0.43	26/	GRAE	50/125	50/125	0		]	Subangular gravel to	+37 5mm in dian	neter //	
	-							GC GM	SILTY, CLAYEY GRA brown, dry to slightly cemented, with estim fines, 35-40% fine to coarse, angular to su in diameter.	moist, moderate ated 10-15% low coarse sand 500	ly to well / plastic	
706.95	— 1 - 							SC SM	SILTY, CLAYEY SAN slightly moist, moders approximately 20% lo to coarse sand, 30% +12.5mm in diameter	itely cemented, v w plastic fines, 5 fine, subangular	with	
05.95	1.98 -2	26B	SPT	28 31 31	62	78	MC, SA, PI		2.13			
	2.74							sc	CLAYEY SAND with C moist to moist, moder with estimated 25% lo 50% fine to coarse san gravel to +12.5mm in o	ately to well cem- w to medium pla- nd, 25% fine, sub	ented,	
F		26C	SPT	22	50/00							
04.95	2.98	200	SPI	50/88	50/88	84			2.99			
3.95	4											
-												

	START DATE	_1/28/00	EXPL	ORATIO	N LOG			
	END DATE	1/28/00 ON _U.S. 95 Widening Pr	rojout			STATION		SHEET 1 OF
	JOB DESCRIPTI LOCATION	Las Vegas, Nevada	ојест			OFFSET ENGINEER	JRO	
	BORING	R-27				EQUIPMENT	Foremo	ost B4500
4	E.A. #	0215-01-1	GRO	UNDWATER	RLEVEL	OPERATOR	W. Dug	jas
7.	GROUND ELEV.		DATE	DEPTH m	ELEV. m	DRILLING METHOD	152 mn	n HS Auger
	HAMMER DROP	SYSTEM Hydraulic				BACKFILLED	_Yes	DATE _ 1/28/00

	1.1	1	Н	AMMER DI	ROP SY	STEM H	lydraulic		METHOD 152 mm HS Auger
ELC:	0500	_SA	MPLE	BLOW	_			<sup> </sup>	BACKFILLED Yes DATE 1/28/00
ELEV. (m)	DEPTH (m0.00		TYPE		Last	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION REMARKS
	0.10	27 <i>A</i>	GRAE		50/100		MC, SA, PI,	GP	POORLY GRADED GRAVEL with SAND
06.56 -	-							GC GM	0.15 brown to grey, dry, loose, with estimated 10% low plastic fines, 30% fine to coarse sand, 60% fine to coarse, subangular gravel to +25mm in diameter.  SILTY, CLAYEY GRAVEL with SAND light brown, moist, well cemented, with approximately 12% low plastic fines, 40% fine to coarse sand, 48% fine to coarse, subangular gravel to +19mm in diameter.
J <b>o.36</b> -	1.52			15					CLAYEY SAND brown. moist, weakly to moderately cemented, with estimated 20% low plastic fines, 75% fine to medium sand, 5% fine, subangular gravel to +4.8mm in diameter.
05.56 <del>-</del>	1.98	27B	SPT	20 23	43	78		sc	2.13CLAYEY SAND with GRAVEL brown to light
-	2.74	770	ODT.					sc	brown, slightly moist, well cemented, with estimated 15% low to medium plastic fines, 65% fine to coarse sand, 20% fine to coarse, subangular gravel to +25mm in diameter.
	2.90	:/C	SPI	50/150	50/150	83			2.90
4.56	-3								
3.56	-4								
-									

NV\_DCI UZ13011.GPJ NV\_DOT.GDT 6/14/00

7			s <sup>.</sup>	TART DAT	E _1/	28/00			EXPL	ORATIO	N LOG			CHEET 4 OF
			E	ND DATE	_1/	28/00								SHEET 1 OF
			JC	OB DESCR	IPTION	U.S.	95 Widenin	g Proj	ect			STATION OFFSET		
			LC	CATION	La	as Vega	s, Nevada					ENGINEER	JRO	
1,4			В	ORING	_R-	-28						EQUIPMENT	Foremos	B4500
71	<b>(3)</b>		E.	A. #	_02	215-01-	1		GROL	INDWATER	LEVEL	OPERATOR	_W. Duga:	5
12			G	ROUND EL	.EV70	)7.13 (m	1)		DATE	DEPTH m	ELEV. m	DRILLING METHOD	152 mm ł	HS Auger
		1	H	AMMER DE	ROP SYS	STEM_	lydraulic					BACKFILLED	Yes [	OATE 1/28/00
ELEV.	DEPTH	SAI	MPLE	BLOW C				uscs	T					
(m)	(m)	NO.	TYPE	Increments	Last 300 mm	Percent Recov'd	LAB TESTS	Group		MATI	ERIAL DE	SCRIPTION		REMARKS
	0.30							GP GM	0.30	SAND gre cemented	y to brown, , with estim	RAVEL with SIL dry, moderately lated 5-10% non 15% fine to coars	-plastic to	
	0.46	28A	GRAB	50/150	50/150	17				∖,50% fine t	o coarse, a	ingular to suband	gular /	
	-									to light bro to well cer plastic fine 40-50% fir	own, dry to a mented, with es, 35-40% ne to coarse	diameter.  VEL with SAND  slightly moist, m  h estimated 10-2  fine to coarse si  e, angular to sub	oderately 20% low and	

GC GM 706.13 1.52 \_1<u>.5</u>8\_ CLAYEY SAND with GRAVEL brown to light brown, slightly moist, moderately cemented, with estimated 25-30% low plastic fines, 50-55% fine to coarse sand, 20% fine, angular 27 15 28B SPT 32 89 SC 1.98 to subangular gravel to +9.5mm in diameter. 705.13 2.13 CLAYEY SAND with GRAVEL light brown, slightly moist, moderately cemented, with approximately 35% medium plastic fines, 50% fine to coarse sand, 15% fine, subangular gravel to +12.5mm in diameter. SC 2.74 19 28C SPT 34 12 22 89 MC, SA, PI 704.13 3.20 3.20 NV\_DOT\_0215011.GPJ\_NV\_DOT.GDT\_6/14/00 703.13 +4

	<b>~</b> \		5	START DA	re _1	1/28/00			EXPL	ORATIO	N LOG		· · · · · · · · · · · · · · · · · · ·	
				END DATE		/28/00								SHEET 1 O
			J	IOB DESC	RIPTION	U.S	. 95 Widenir	ng Proj	ect		<u></u>	STATION OFFSET		
			L	OCATION			as, Nevada					ENGINEER	JRO	
**			Ε	BORING		R-29						EQUIPMENT	Foremost	
1	C	_		E.A. #		215-01-				INDWATER		OPERATOR	W. Dugas	3
				ROUND E					DATE	DEPTH m	ELEV. m	DRILLING METHOD	152 mm l	HS Auger
		77	· +	IAMMER D	ROP SY	STEM_	Hydraulic					BACKFILLED	Yes c	ATE 1/28/00
ELEV. (m)	DEPT (m)	н [	AMPLE D. TYPE	150 mm	Last	Percent		USCS Group		MATE	PIAI DI	SCRIPTION		
(111)	("")	+	+-	Increment	s  300 mn	n Recovid	1	Group	-			VEL with SANI		REMARKS
	-									brown, dry	to slightly	moist well cem	ented with	
	0.:	<del></del>	A GRAI	50/100	50/100	50	-			to coarse s	sand. 50%	w plastic fines, 3	35-40% fine subangular	
	0.4	41 20	A Grai	30/100	50/100	50		GC		gravel to +	37.5mm in	diameter.	J	
								GM						
	F													
705.57 -	_1							<u> </u>	_0.91_	CI AVEV C	A A I Dith			
703.37	<u> </u>								Į.	moist to m	oist, weakl	GRAVEL brown y to moderately	cemented	
	}									with approx 50% fine to	kimately 30 coarse sa	)% medium plas and, 20% fine to	tic fines,	
										subangulai	gravel to	+ 19mm in diam	eter.	
	1.5	2												
	-				<del>                                     </del>									
		298	SPT	22 16	30	67	140 CA DI							
	_	23.	3 3 1	16	30	67	MC, SA, PI						1	
704.57	1.9	8												
	-							sc						
ŀ	-													
	-													
}	-													
1	2.74	•												
F	=			-										
703.57	-3	29C	SPT	7 16	38	83								
				22										
t	3.20	-	+ +						3.20					
1				ĺ		1	+							
				1										
F														
T														
02.57	-4				1									
ŀ						1								
_														
}														
Ţ						- 1								
	- 1	- 1	1	}										

1			S	START DAT	F 1.	/21/00			EXPLORATION LOG			
				ND DATE	_	/21/00	<del></del>					SHEET 1 O
				OB DESCR			95 Widenir	na Proi	ect	STATION		
				OCATION			as, Nevada	<u>J</u>		OFFSET	JRO	
				ORING		/L-01				ENGINEER		ost B4500
7,				.A. #		215-01-	1		GROUNDWATER LEVEL	EQUIPMENT OPERATOR	W. Dug	
				.A. # ROUND EL					DATE DEPTH m ELEV. m	DRILLING		
										METHOD		n HS Auger
				AMMER DE		STEM	Tyuraunc			BACKFILLED	_Yes	DATE1/21/00
ELEV.	DEPTH		MPLE TYPE	BLOW C	Last	Percent	LAB TESTS	uscs	MATERIAL DE	SCRIPTION		
(m)	(m)	$^{\dagger}$	-	increments	300 mm	Recov'd	ļ	Group				REMARKS
	- 0.30		GRAE	50/50	50/50	ļ	110 21 21	4	CLAYEY GRAVEL wit slightly moist, well cer	mented with	-	
	0.61	1	GIVAL	30/30	50/50	-	MC, SA, PI	4	approximately 15% lo	w plastic fines	30% fine	
711.54	<u> </u>							GC	to coarse sand, 55% gravel to +19mm in di	ine to coarse, s ameter.	ubround	
	- '			Ì		ĺ						
	1.52		ļ						_1.52			
	1.83	В	GRAE	50/13	50/13				CALICHE			-
710.54 -	-2							1				
	Ė											
	[											
	3.05								SILTY, CLAYEY SAND		<del></del>	_
709.54 -	3.05 3.18		SPT	50/125	50/125	80	MC. SA. PI	SC	brown, slightly moist, i	noderately to w	ell	
	-							JIVI	3.35 cemented, with approx fines, 45% fine to coar	rimately 15% lo	w plactic	
	-								coarse, subangular gra	se sand, 40% t avel to +25mm	ine to in	/
708.54 <i>-</i>	_4							GP	diameter.			<u> </u>
	-							GM	POORLY GRADED GR SAND light brown, slig	htly moist well		
	4.57								cemented, with estima	ted 10% non-ni	lastic to	
	- 4.88	D	GRAB	51/50	51/50				4.63 slightly plastic fines, 30 60% fine to coarse, an	gular to subano	e sand,	4
707.54 -	-5								gravel to +37.5mm in o	liameter.		/
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	-											
706.54	<del>-</del> 6											
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705.54	-7	Ì				İ						
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704.54	-8		Ì				1					
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703.54	-9					1						
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702.54	-10	1						1				
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701.54	-11											
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	START DATE		EXPL	ORATIO	N LOG			0.1555
	END DATE	1/21/00						SHEET 1 OF
	JOB DESCRIPTI	ON U.S. 95 Widening Pr	oject			STATION OFFSET		
3.00	LOCATION	Las Vegas, Nevada				ENGINEER	JRO	
	BORING	WL-02				EQUIPMENT	Forem	ost B4500
7 3	E.A. #	0215-01-1	GRO	JNDWATER	RLEVEL	OPERATOR	W. Du	gas
	GROUND ELEV.		DATE	DEPTH m	ELEV. m	DRILLING METHOD	152 m	m HS Auger
	HAMMER DROP	SYSTEM Hydraulic				BACKFILLED	Yes	_ DATE1/21/00
ELEV. DEPTH SAM		AST Percent LAB TECTO USO	28					

	\ \	1		AMMED DE		075:	Hydraulic		METHOD 152 mm HS Auger
		1.7		AMMER DE		STEM_	riyuraunc		BACKFILLED Yes DATE 1/21/0
ELEV. (m)	DEPTH (m)	NO.	TYPE	150 mm	Last	Percen	LAB TESTS	USCS	MATERIAL DESCRIPTION REMARK
	- 0.30		1	Increments	300 mm	Recovid	+	_ GP	
	0.61	_	GRAE	50/75	50/75			GM	to brown, dry, moderately to well cemented, with estimated 5% non-plastic fines 35% fine to
712.30	<u>_</u> 1								coarse sand, 60% fine to coarse, subangular to  0.91   subround gravel to +50mm in diameter.  SILTY GRAVEL with SAND brown, slightly
	1:58	В	SPT	50/50	50/50	100	MC, SA, PI	sc	moist, well cemented, with estimated 15% non-plastic fines, 35% fine to coarse sand, 40%   1.68   fine to coarse, subround gravel to +25mm in
711.30	-2								CLAYEY SAND with GRAVEL light brown,   slightly moist, well cemented, with
	Ė							<u> </u>	2 44 approximately 25% low to medium plastic fines
	-							CL	145% fine to coarse sand. 30% fine, subangular
710.30	3 3.05	-						L	3.05 SANDY/GRAVELLY LEAN CLAY light brown,
	3.35	С	GRAB	50/25	50/25				Signity moist, moderately cemented with
	-  -								estimated 60% medium plastic fines, 20% fine to coarse sand, 20% fine. subangular to subround gravel to +12.5mm in diameter.
709.30 -	<del>  4</del>								CALICHE
	4.57				l			⊢ <i>-</i>	4.27 CLAYEY SAND with GRAVEL light brown,
	4.69	D	SPT	50/125	50/125	100		sc 	A 72 slightly moist, moderately cemented with
08.30 -	-5			j					nestimated 25% low plastic fines, 60% fine to coarse sand, 15% fine subangular to subround /
	- I								gravel to +9.5mm in diameter
	[							GC	CLAYEY GRAVEL with SAND light brown, slightly moist, moderately cemented, with
	- 1		İ						estimated 15% low plastic fines 35% fine to
07.30 -	6 6.10			26					5.94_ coarse sand, 60% fine to coarse, subangular gravel to +37.5mm in diameter. /
	6.55	E	SPT	24	49	66	MC, SA, PI		CLAYEY SAND/SANDY LEAN CLAY brown
	0.55		-	25		-			moist, moderately cemented, with approximately 40% low plastic fines, 60% fine
06.30	-7				}				to medium sand, and trace fine to coarse
00.30	-								subangular gravel to +19mm in diameter. (Unit contains numerous interbeds of <u>Sandy Lean</u>
	7.62								Clay and Sandy Lean Clay with Gravel with
				28					estimated 45-50% low to medium plastic fines, 35-50% fine to coarse sand, and 0-20% fine to
05.30	-8 8.08	F	MC	30 50	80	100			coarse, subangular gravel to +25mm in
ŀ	- ]								diameter.)
ļ	_							sc	
ŀ	-								
04.30	-9								
	-					İ			
}	-								
3.30	-10							-	
-							į		
+	10.67	-							
F		+		18					10.82
2.30	-1111.13	Н	SPT	15 20	35	66	MC, SA, PI		
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F									
1				1	İ	1			

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				S	START DAT		/21/00			EXPL	ORATIO	N LOG			SUFET 4 OF
				E	ND DATE		/21/00								SHEET 1 OF
				j	OŖ DESCF	RIPTION	U.S.	95 Widenir	ng Proj	ect			STATION - OFFSET		
				L	OCATION	_La	as Vega	as, Nevada					ENGINEER	JRO	
	1,5			В	ORING		/L-03						EQUIPMENT		ost B4500
				Ε	.A.#	02	215-01-	1		GROL	INDWATER	LEVEL	OPERATOR	W. Dug	
				G	ROUND E	LEV7	14.82 (r	n)		DATE	DEPTH m		DRILLING METHOD		n HS Auger
			1	Н	AMMER D	ROP SYS	STEM H	Hydraulic						Yes	
	ELEV.	DEST	L SA	MPLE	BLOW		T	T					BACKFILLED	103	_ DATE
	(m)	DEPTH (m)	NO	. TYPE	450	Last	Percent Recovid	LAB TESTS	USCS Group		MATE	ERIAL DI	ESCRIPTION		REMARKS
		- 0.30				İ			<del>                                     </del>		POORLY (	GRADED C	RAVEL with SII	Tand	
		0.43	A	SPT	50/125	50/125	60	MC, SA, PL	‡	1	SAND brow	wn to light	brown, dry to slid	ahtiv	
		F								1	approxima	telv 10% s	well cemented, lightly plastic fin	es 30%	
	713.82	<del> </del> 1									fine to coa	rse sand. (	60% fine to coars +25mm in diame	Se	
	1	1.52									Jubangula	i graver to	+25mm in diame	eter.	
		1.83		GRAE	50/0	50/0			1						
	712.82			1		30/0			-						
	, 12.02	-							GP GM						
	j	Ė							Givi						
		-													
	711.82			0000											
		3.35	С	GRAB	50/0	50/0									
		F													
	710.82	<u>_</u> 4													
		+								_4 <u>.2</u> 7					
		4.57			30				 _ sc		CLAYEY S	AND with (	GRAVEL brown,	slightly	-
		4.74	D	SPT	50/12.5	50/12.5	77	MC, SA, PI		4.72	noist, mod approximat	erately to v elv 15% m	well cemented, well cemented, well cemented, well community and the community well and the	ith	
	709.82	<del>_</del> 5			į					\1	ine to coar	se sand. 4	0% fine to coars	_	//
		F								B	subangular	gravel to 4	19mm in diame	ter.	/
		<b> </b>													
	708.82 -	<u> </u>					ĺ								
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**EXPLORATION LOG** 1/21/00 START DATE SHEET 1 OF 1 1/21/00 END DATE STATION U.S. 95 Widening Project JOB DESCRIPTION OFFSET Las Vegas, Nevada LOCATION **JRO ENGINEER** WL-04 BORING Foremost B4500 **EQUIPMENT** 0215-01-1 GROUNDWATER LEVEL W. Dugas E.A. # **OPERATOR** GROUND ELEV. 715.48 (m) DATE | DEPTH m | ELEV. m **DRILLING** 152 mm HS Auger **METHOD** HAMMER DROP SYSTEM Hydraulic Yes DATE \_\_1/21/00 **BACKFILLED** ELEV. DEPTH Last 150 mm Percent LAB TESTS NO. TYPE MATERIAL DESCRIPTION (m) (m) REMARKS Increments 300 mm Recov'd GP. -0.15, POORLY GRADED GRAVEL with SAND grey 0.30 0.48 A SPT to brown, dry, non to weakly cemented, with 50/25 MC, SA, PI 57 <del>50/25</del> estimated 0-5% non-plastic fines, 35-40% fine to coarse sand, 60% fine to coarse, subangular gravel to +25mm in diameter. 714.48 WELL GRADED GRAVEL with SILT and SAND light brown, slightly moist, moderately 1.52 GP to well cemented, with approximately 10% GM

GRAB slightly plastic fines, 35% fine to coarse sand. В 50/13 50/13 1.83 55% fine to coarse, subangular to subround 713.48 gravel to +37.5mm in diameter. 2.74 CLAYEY GRAVEL with SAND light brown, 3.05 712.48 slightly moist, with approximately 15% low 40 SPT С 50/125 55 MC, SA, PI plastic fines, 35% fine to coarse sand, 50% fine 50/125 to coarse, subangular to subrounded gravel to GC +19mm in diameter. 711.48 4.27 CLAYEY SAND olive to brown, moist, with 4.57 approximately 40%-60% low to medium plastic D MC 27 50 fines, 40%-60% fine to medium sand, 5% fine. 100 MC, SA, PI 5.03 SC 710.48 subrounded gravel to +9.5mm in diameter. 5.49 SANDY FAT CLAY olive to brown, moist, with approximately 55% high plastic fines, 45% fine 709.48 -6 6.10 to medium sand, trace of fine gravel to +4.75mm in diameter. SPT Ε 10 27 MC, SA, PI CH 6.55 708.48 7.16 SANDY LEAN CLAY brown, moist, with 7.62 approximately 60%-70% low to medium plastic CL fines and 30%-40% fine to medium sand. SPT 25 57 100 MC, SA, PI 7.92 707.48 -8 8.08 CLAYEY SAND with GRAVEL grey, moist, SC 8.23 with approximately 30% low plastic fines, 55% GC fine to coarse sand, 15% fine to coarse, subangular gravel to +25mm in diameter CLAYEY GRAVEL with SAND brown, slightly 706.48 moist, with approximately 30% low to medium 9.14 -37 plastic fines, 30% fine to coarse sand, 40% fine, G SPT 9.35 50/50 75 50/50 subangular gravel to +9.5mm in diameter. CLAYEY SAND with GRAVEL brown to olive, moist, with approximately 20% low plastic fines, SC 60% fine to coarse sand, 20% fine, subangular 705.48 gravel to +12.5mm in diameter. 10.67 SPT н 20 40 100 MC, SA, PI 704.48 11/11.13 11.13

DOT 0215011.GPJ NV\_DOT.GDT 6/14/00

START DATE 1/21/00 EXPI	LORATION LOG
END DATE 1/21/00	SHEET 1 0
JOB DESCRIPTION U.S. 95 Widening Project	STATION
LOCATION Las Vegas, Nevada	OFFSET
BORING WL-05	ENGINEER JRO
	EQUIPMENT Foremost B4500  UNDWATER LEVEL OPERATOR W. Dugas
GROUND ELEV. 718.02 (m) DATE	DEPTH m ELEV m DRILLING
	METHOD 152 mm HS Auger
HAMMER DROP SYSTEM Hydraulic	BACKFILLED Yes DATE 1/21/00
ELEV. DEPTH (m) NO. TYPE ISOME	MATERIAL DECORPTION
133313	MATERIAL DESCRIPTION REMARKS
- 0.30   0.30	¬graver to +25mm in diameter
50/50 30/30 75 MC, SA, PI	POORLY GRADED SAND with SILT and
717.02 +1	GRAVEL light brown, dry to slightly moist, with approximately 10% slightly low plastic fines,
717.02	50% fine to coarse sand, 40% fine to coarse
1.58 B SPT 50/25 50/25 0 SP	subangular gravel to +25mm in diameter.
8 SPT 50/25 50/25 0 SP SM	
716.02 —2	
745.00 0 3.05	
715.02 3 3.05 C GRAB 50/0 50/0 0 MC, SA, PI	CLAYEY GRAVEL with SAND light brown
	slightly moist, well cemented with
- GC	approximately 15% low plastic fines, 35% fine to coarse sand, 50% fine to coarse, subangular
714.02 +4	gravel to +19mm in diameter.
4.27	
4.57 SP	POORLY GRADED SAND with CLAY and
4.65 D GRAB 50/75 50/75 0 SC 4.65	GRAVEL light brown slightly moist well
713.02 +5	cemented, with approximately 10% low plastic fines, 65%-70% fine to coarse sand, 20%-25%
	fine, subangular gravel to +12.5mm diameter.
712.02 —6	
744 00   7	
711.02 +7	
710.02 -8	
709.02 +9	
08.02 +10	
07.02	
07.02 + 11	
	1

3			S	START DA	TE _1	/22/00			EXPLORATION LOG			
			E	ND DATE	1	/22/00						SHEET 1
			J	OB DESC	RIPTION	U.S.	95 Wider	ning Proj	ect	STATION		
				OCATION			as, Nevada			OFFSET	100	
				ORING		VL-06	.,			ENGINEER	JRO	D.555
7							1			EQUIPMENT	Foremost	
1				.A.#		215-01-			GROUNDWATER LEVEL	OPERATOR	W. Dugas	3
			G	ROUND	ELEV. <u>7</u>	19.28 (r	n)		DATE DEPTH m ELEV. m	DRILLING METHOD	152 mm l	HS Auger
		1	Н	AMMER (	OROP SY	STEM_	lydraulic					
ELEV.	DEPTH	SA	MPLE	BLOW	COUNT					BACKFILLED		ATE1/22/0
(m)	(m)	NO.	TYPE	150 mm Incremen		Percent Recovid	LAB TEST	S USCS Group	MATERIAL DE	SCRIPTION		REMARK
	0.30 0.42	A	SPT	50/112	50/112	44	MC, SA, P	GC GP	0.30 CLAYEY GRAVEL wit			
718.28 -	1 1.52	В	GRAB	50/13	50/13		MC, SA, P	GM	9.43 POORLY GRADED G SAND light brown, slig cemented, with appro- plastic fines, 30% fine to coarse, subangular diameter.	phtly moist, well ximately 10% sl to coarse sand gravel to +25m	ightly low , 60% fine m in	
717.28 -	2	_		00,10	30/13			GC	gravel to +19mm in dia CLAYEY GRAVEL wit  2.13 slightly moist, well cen	ameter. h SAND light bro nented, with est	own,	
716.28 -	33.05	- <del>C</del>	GRAB	<del>- 50/25</del>	50/25	0	MC, SA, PI	sc	50% fine to coarse, sus +19mm in diameter.  CLAYEY SAND with G slightly moist, well cem approximately 15% low	35% fine to coa bangular gravel RAVEL light bronented, with v plastic fines 4	own,	
715.28	- 4 4 57							sc	to coarse sand, 40% fi +12.5mm in diameter. CLAYEY SAND with 6 slightly moist, well cem approximately 30% low 4.27 4.27 40%-45% fine to coars	RAVEL light bromented, with to medium plase e sand 25%-30	gravel to  own,  stic fines,	
714.28	- 1.57 - - 5 -	D	SRAB	50/75	50/75	0		sc	coarse, subangular to s +19mm in diameter. CLAYEY SAND with Gi slightly moist, well cem approximately 15% nor 5 49 55% fine to coarse san	RAVEL light bro ented, with to low plastic fide, 30% fine, sub	vel to	
713.28	-6 6.10 - 6.24	E	SPT	50/137	50/137	100	MC, SA, PI	sc	gravel to +9.5mm in dia CLAYEY SAND light brocemented, with approxiplastic fines, 60% fine to subangular to subround diameter.	meter. own, moist, well mately 30% me o coarse sand	dium	
12.28	7.98							GC	7.01  CLAYEY GRAVEL with slightly moist, well ceme	ented, with		
11.28	-8	F	SPT	50/75	50/75	100	-	sc	7.62 approximately 30% med fine to coarse sand, 40% subangular to subround diameter. CLAYEY SAND with GR moist, well cemented, w	6 fine to coarse ed gravel to +37 AVEL brown, slith approximate	7.5mm in	
10.28	9 8:34	3 5	SPT	50/75	50/75	100		80	low plastic fines, 45%-5: 30%-40% fine to coarse subrounded gravel to +1 CLAYEY SAND brown, scemented, with approximation of the component of	5% fine to coars, subangular to 9mm in diamete slightly moist, we nately 30% low	er.	
09.28	10							sc	medium plastic fines, 60 10% fine to coarse, suba +25mm in diameter. 10.36	% fine to coarse	bnese	
[_	10.67							80	CLAYEY SAND with GR.	AVEL light brow	ın I	
08.28	10.80	S	PT	50/125	50/125	100 M	C. SA. PI		10.79 slightly moist, well ceme approximately 15% medi fine to coarse sand, 40% gravel to +12.5mm in dia	nted, with ium plastic fines ifine, subangula	45%	

										EXPLORATION LOG			
					START DAT		/22/00			EXPLORATION LOG			SHEET 1 OF
					ND DATE		/22/00				STATION		0/1227 7 0/
					OB DESCR			95 Widenir	ng Proje	ect	OFFSET		
				L	OCATION			is, Nevada			ENGINEER	JRO	
				В	ORING		/L-07				EQUIPMENT	Foremos	t B4500
	4				.A. #		215-01-			GROUNDWATER LEVEL	OPERATOR	W. Duga	s
	3	GROUND ELEV. 720.04 (m)								DATE DEPTH m ELEV. m DRILLING METHOD 152 mm HS A			HS Auger
		1/	1	Н	AMMER DE	ROP SYS	STEM_	lydraulic			BACKFILLED		OATE1/22/00
	ELEV.	DEPTH		MPLE	BLOW C				T			L	ATE
	(m)	(m)	NO.	TYPE	150 mm Increments	Last 300 mm	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DE	SCRIPTION		REMARKS
		8:39	_	CDAE	50/75					POORLY GRADED G	RAVEL with SIL	T and	
				GRAC	50//5	507/5	0		GP GM	SAND light brown to be cemented, with appro	prown, dry, well	on to law	Minor surface
	İ	-							GIVI	DIASTIC TIMES, 4(1% time	to coarse sand	EOO/ fina	cobbles.
	719.04	<del> </del> 1							<u> </u>	0.91 to coarse, subangular	gravel to +75m	m in	
		1:53		l					GP GM	POORLY GRADED G	RAVEL with SIL	T and	
		1.60	В	GRAE	50/75	50/75	0	MC, SA, PL		1.60 SAND light brown, dry	otto low plactic	fines	
	718.04	_2								130% line to coarse sa	nd 60% fine to	coarco [	
	1	-								subangular gravel to +	19mm in diame	eter.	
		<u> </u>								with gravel to +19mm	in diameter.	ny maru,	
		[											
	717.04 -	-3											
	1						1						
	1	-					1						
	745.04	t. 1											
	716.04 -	-4		l		1							
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	715.04	-5											
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	714.04	-6					]						
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	711.04	-9				-	1						ĺ
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		START DATE 1/25/00 EXPLORATION LOG  END DATE 1/25/00										
	JOB DESCR	PTION U.S.	95 Widenin	ıg Proje	ect			STATION OFFSET				
	LOCATION	_Las Veg	as, Nevada					ENGINEER	JRO			
7	BORING	_WL-08						EQUIPMENT	Foremost B90			
7 3	E.A. #	0215-01-	1		GROU	JNDWATER	RLEVEL	OPERATOR	J. Sorrells	S		
		<sub>EV</sub> 722.33 (r			DATE	DEPTH m	ELEV. m	DRILLING METHOD	152 mm l	HS Auger		
	HAMMER DR	OP SYSTEM _	Hydraulic					BACKFILLED	Yes	OATE 1/25/00		
ELEV.   DEPIH	MPLE BLOW CO	OUNT Last Percent 300 mm Recovid	LAB TESTS	USCS Group		MATI	ERIAL DE	SCRIPTION		REMARKS		
- 0.30	SDT FO	50 400			RAVEL brown to	light	+					

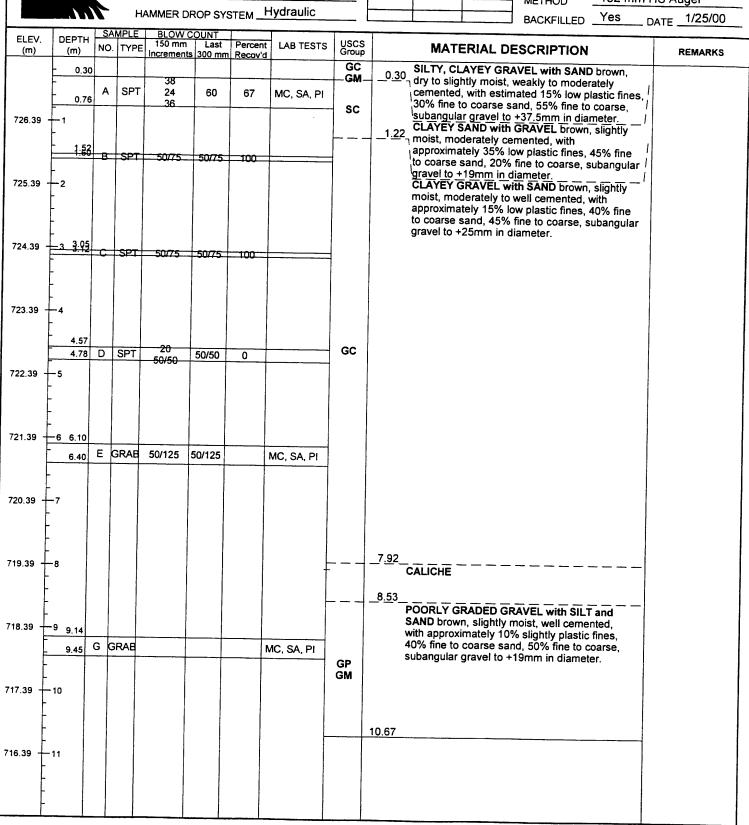
721.33	DEPTH (m) - 0.30 - 0.46	NO.	MPLE TYPE	BLOW C	OUNT			T	_					
- -	- 0.30					Percent		USCS	l	MATE	RIAL DE	SCRIPTION	.	DEMARK
-	<b>-</b> 1	Α	SPT	Increments 50	50 mm	100	MC, SA, PI	SM	1.22	SILTY SAN brown, dry, fines, 50%	D with GR with appro-	AVEL brown to eximately 15% arse sand, 35% +12.5mm in di	o light non plastic	REMARK
720.33	1:56	В	GRAB	50/75	50/75	- 66		GP GC		SAND light approximate 40%-45% fi	brown, dry ely 5%-109 ne to coar	RAVEL with C	ed with nes, 50% fine to	
719.33	-3 3.05 3.28	С	SPT	21 	50/75	56		GC		to medium p coarse sand	st, with app plastic fine I, 40%-50%	th SAND light to proximately 15 s, 30%-40% fi % fine to coars aded gravel to	%-20% low ne to	
718.33	-4 -4:53 -5	D	SPT	50/75	50/75	100	MC, SA, PL	GM	3	slightly mois approximate 40% fine to (	it, well cen ily 15% no coarse sar	SAND light brownented, with no low plastic od, 45% fine to ded gravel to	c fines,	
716.33	6 6.10 6.25	E	SPT	50	50	100		GC	s F t	slightly moisi plastic fines,	t, with app 35% fine	n SAND light b roximately 20% to coarse sand gravel to +25m	% medium	
715.33							-		7.01 7.16 c	CALICHE ligi	ht brown to	grey, very ha	rd, with	
714.33 -8		F	SPI	50/100	50/100	100	MC, SA, PI	SC SM	s b a to	SILTY, CLAY prown, slightl approximatel	<b>EY SAND</b> ly moist, w y 15% low nd. 35% fir	with GRAVEL rell cemented, plastic fines, ne subangular	with 50% fine	
713.33 -9	9 9.14	6 G	RAB	50/0	50/0	0		GC	C m lo fi	CLAYEY GRA noist, well ce ow plastic fin	AVEL with emented, vies, 40% fi	SAND light br vith approxima ne to coarse s lar gravel to +	tely 15%	
712.33 — 10								sc	m fir	noist, with ap nes, 50% fin	proximate e to coars	RAVEL light brilly 25% medius e sand, 25% fi 2.5mm in dian	m plastic	
		H S	PT	-38 -50/25	50/25	100 N	MC, SA, PI		10.82	-sangular gi	AVEI (U T )	e.Jiiiii in qian	ieter.	

	5						/22/00			EXPLORATION LOG			
					START DA		/22/00	<del></del>					SHEET 1 OF
					END DATE			OE \A(;-t:			STATION		
					JOB DESC			95 Wideni		ect	OFFSET		
					LOCATION			as, Nevada			ENGINEER	JRO	
				1	BORING		VL-09				EQUIPMENT	Foremos	st B4500
		4		I	E.A. #	_0	215-01-	1		GROUNDWATER LEVEL	OPERATOR	_W. Duga	as
				(	GROUND E	LEV7	23.65 (r	n)		DATE DEPTH m ELEV. m	DRILLING METHOD	152 mm	HS Auger
			1	٠,	HAMMER D	ROP SY	STEM	Hydraulic					
	-			AMPLE		COUNT					BACKFILLED	163	DATE 1/22/00
	(m)	DEPTI	1	O. TYP	_ 150 mm	Last	Percent n Recov'd	LAB TESTS	Group	MATERIAL DE	SCRIPTION		REMARKS
		- 0.3		CD3	5040=	56445			GC GM	0.30 SILTY, CLAYEY GRA	VEL with SAND	light	
		- 4.5	5 д	SP	Γ 50/137	50/137	91	MC, SA, PI	-	brown, dry, with appr low plastic fines, 35%	6-40% fine to co:	area eand	Д
		ŀ				ļ			GC	1 \50% tine to coarse, s	ubangular grave	el to	
	722.65	5 +1								+75mm in diameter.	th SAND light by	COMP	
	ı	1.5	2							slightly moist, well ce	mented with		d
		- 1.6	6 B	GRA	B 50/137	50/137	0		-	approximately 15% to coarse sand, 50%	w plastic fines, t	35% fine	
	721 66	. L.				Ì				gravel to +37.5mm in	diameter	- 1	
	721.65	5 <del> </del> 2							00	SILTY, CLAYEY SAN brown, slightly moist,	D with GRAVEL	light	
	i	-							SC	slightly low plastic fine	es. 45% fine to d	narse	
		-				1				sand, 40% fine to coa subrounded gravel to	irse subanquiar	to	
	720.65	£3 3.0	5						ļ	Subjourned graver to	+ iamm in diam	eter.	
		3.1	C	SPT	50/125	50/125	80	MC, SA, PI					
		-				l				3.35	15 O A M D 17 1 1 1 1	·	
	1									CLAYEY GRAVEL wit slightly moist, well cer	mented with		
	719.65	<u>+4</u>		1						approximately 25% to	w to medium pla	stic fines,	
		<b>-</b>							1	25% fine to coarse sa subangular gravel to	nd, 50% fine to	coarse,	
	l	4.63								oubungulai giavei to	rannin in diame	ter.	
	1			SPT	50/50	50/50	100		GC				
	718.65	<del> </del> 5											
		ŀ		1	ł								
	ĺ	Į.					]						
	1	F	}		ļ		ĺ						
	717.65	6 6.10	E	GRAB	50/0	50/0				6.10			
	1	Ĺ	] _		33.5	30/0-				CALICHE light brown,	extremely hard.		Auger Refusal
		F									•		at 6.10 meters.
		F											
	716.65	<del></del>					1						
	ŀ	-											
		-				1							
	715.65	上 <b>。</b>				-						j	
	/ 13.65	<del>  8</del>			ĺ	-		+				1	
		-											
		<b>†</b>										į	
	714.65	Ļ,											
ا		F				j	İ		Ī				
6/14/00		<b> </b>		İ					- 1				
		t 1							}				
9	713.65					ĺ			ĺ				
3		-						1					
⋛		<b>h</b>						İ					
릷		[											
影	712.65 -	11					]						
77.13		<u> </u>											
NV_DO1 UZIDUTI.GPJ NV_DUT.GDT													
ڄ		<u> </u>	-		1								
źL				L									

HAMMER DROP SYSTEM Hydraulic  ELEV. (m)  DEPTH (m)  NO. TYPE 150 mm Last Percent Increments 300 mm Recovd  B.34 A SPT 50/26 50/26 100  T723.67 -1  SM  SM  SM  SM  SPT 50/50 50/50 50/50 MC, SA, PI  T722.67 -2  Hydraulic  BACKFILLED Yes (Soup MATERIAL DESCRIPTION)  MATERIAL DESCRIPTION  MATERIAL DESCRIPTION  SM  SILTY GRAVEL with SAND grey to light brown, dry, moderately cemented, with estimated 15% non-plastic to slightly plastic lines, 35% fine to coarse, subangular gravel to +25mm in diameter.  SILTY SAND with GRAVEL light brown, dry to slightly moist, well cemented, with approximately 15% slightly plastic fines, 45% fine to coarse sand, 40% fine, subround gravel to +12.5mm in diameter.  2.44 CALICHE	
JOB DESCRIPTION U.S. 95 Widening Project  LOCATION Las Vegas, Nevada  BORING WL-10  EA. # 0215-01-1 GROUNDWATER LEVEL  GROUND ELEV. 724.67 (m)  HAMMER DROP SYSTEM Hydraulic  ELEV. DEPTH NO. TYPE 150 mm Recov'd  GROUND Last Percent LAB TESTS Group  GROUND LAST Percent LAB TESTS Group  MATERIAL DESCRIPTION  MATERIAL DESCRIPTION  MATERIAL DESCRIPTION  FORM 1.58 B GRAB 50/50 50/50 MC, SA, PI  T22.67 -2  T22.67 -2  SM STATION OFFSET  SRGINEER JRO  EQUIPMENT FORMOS  GROUNDWATER LEVEL  OPERATOR J. SOPRILING  METHOD 152 mm MATERIAL DESCRIPTION  MATERIAL DESCRIPTION  SM SILTY GRAVEL with SAND grey to light brown, dry, moderately cemented, with estimated 15% non-plastic to slightly plastic lines, 35% fine to coarse sand, 50% fine to plastic or slightly plastic lines, 35% fine to coarse sand, 50% fine to coarse sand, 40% fine, subround gravel to +12.5mm in diameter.  722.67 -2  CALICHE	ls HS Auger
LOCATION Las Vegas, Nevada  BORING  WL-10  EA. # 0215-01-1  GROUNDWATER LEVEL  OPERATOR  DATE DEPTH   ELEV. m   DATE DEPTH   ELEV. m   DATE DEPTH   ELEV. m   DATE DEPTH   ELEV. m   DATE DEPTH   ELEV. m   DATE DEPTH   DATE DEPT	ls HS Auger
BORING WL-10  E.A. # 0215-01-1  GROUNDWATER LEVEL OPERH ELEV. METHOD 152 mm METHOD 152	ls HS Auger
ELEV. DEPTH (m) PORT SAMPLE BLOW COUNT (m) PORT Increments 300 mm Recovid (m) PORT INCREMENT (M) PORT INCREM	ls HS Auger
GROUND ELEV. 724.67 (m)  HAMMER DROP SYSTEM Hydraulic  ELEV. (m)  DEPTH (m)	HS Auger
HAMMER DROP SYSTEM Hydraulic  ELEV. (m) DEPTH (m) NO. TYPE ISO mm Last Percent Increments 300 mm Recovd ISO Group	
ELEV. (m) DEPTH (m) NO. TYPE 150 mm   Last   Percent   Recov'd   LAB TESTS   USCS   Group   MATERIAL DESCRIPTION    - 8.34	DATE 1/25/00
ELEV. (m) DEPTH (m) SAMPLE BLOW COUNT   LAB TESTS   USCS Group   LAB TESTS   USCS GROUP   LAB TE	
(m) (m) NO. TYPE Increments 300 mm Recovid  8.34	
brown, dry, moderately cemented, with estimated 15% non-plastic to slightly plastic fines, 35% fine to coarse sand, 50% fine to coarse, subangular gravel to +25mm in diameter.    SILTY SAND with GRAVEL light brown, dry to slightly moist, well cemented, with approximately 15% slightly plastic fines, 45% fine to coarse sand, 40% fine, subround gravel to +12.5mm in diameter.    CALICHE	REMARKS
restimated 15% non-plastic to slightly plastic fines, 35% fine to coarse sand, 50% fine to coarse, subangular gravel to +25mm in diameter.  SILTY SAND with GRAVEL light brown, dry to slightly moist, well cemented, with approximately 15% slightly plastic fines, 45% fine to coarse sand, 40% fine, subround gravel to +12.5mm in diameter.  2.44 CALICHE	1
723.67 — 1  SM  SM  SM  SILTY SAND with GRAVEL light brown, dry to slightly moist, well cemented, with approximately 15% slightly plastic fines, 45% fine to coarse sand, 40% fine, subround gravel to +12.5mm in diameter.  2.13  CALICHE	
SM SILTY SAND with GRAVEL light brown, dry to slightly moist, well cemented, with approximately 15% slightly plastic fines, 45% fine to coarse sand, 40% fine, subround gravel to +12.5mm in diameter.  2.13 CALICHE	
1.53 B GRAB 50/50 50/50 MC, SA, PI  T22.67 -2 SICTY SAND With GRAVEL light brown, dry to slightly moist, well cemented, with approximately 15% slightly plastic fines, 45% fine to coarse sand, 40% fine, subround gravel to +12.5mm in diameter.  2.13 CALICHE	
approximately 15% slightly plastic fines, 45% fine to coarse sand, 40% fine, subround gravel to +12.5mm in diameter.	
722.67 +2	
POORLY GRADED GRAVEL with CLAY and	
SAND light brown, slightly moist, well	
721.67 3 3.95 C SPT 50775 100 GC cemented, with approximately 10% low plastic fines, 35% fine to coarse sand, 55% fine to	
L J 3.35 coarse, subangular gravel to +19mm in	
CALICHE CALICHE	
720 67 -4	
CLAYEY SAND with GRAVEL light brown, slightly moist, well cemented, with	
4-57 approximately 20% medium plastic fines 55%	
fine to coarse sand, 25% fine to coarse, subangular to subround gravel to +19mm in	
719.67 —5 diameter.	
718.67 + 6 6.10	
718.67 6 6.18 E GRAB 50/50 50/50 MC, SA, PL	
717.67 +7 SC	
- 7.62 F GRAB 50/75 50/75	
716.67 +8	
715.67 — 9 9.14 — 9.24 G SPI 50/300 F//300 F	,
75	
5 74.67 10 CALICHE	
CLAYEY GRAVEL with SAND light brown,	
GC slightly moist, well cemented, with estimated	
10.70 15-20% low plastic fines, 35% fine to coarse sand, 45-50% fine to coarse, subangular gravel	
714.67 10 9.75  CLAYEY GRAVEL with SAND light brown, slightly moist, well cemented, with estimated 15-20% low plastic fines, 35% fine to coarse sand, 45-50% fine to coarse, subangular gravel to +25mm in diameter.	
[	
<u> </u>	

1			S	TART DAT	F 1	/24/00			EXPL	ORATION LOG			
				ND DATE		/24/00							SHEET 1 C
			J	OB DESCR	RIPTION	U.S.	95 Widenir	ng Proje	ect		STATION		
			L	OCATION	_ <u>L</u>	as Vega	as, Nevada				OFFSET ENGINEER	JRO	
1.5			В	ORING		/L-11					EQUIPMENT	Foremos	t B4500
1 4			Ε	.A. #	_0:	215-01-	1		GROU	INDWATER LEVEL	OPERATOR	W. Duga	
1.7			G	ROUND EI	_EV7	25.77 (n	n)		DATE	DEPTH m ELEV. m	DRILLING	152 mm	HS Auger
		1	н	AMMER DI	ROP SY	STEM_	Hydraulic				METHOD		DATE 1/24/00
ELEV.	DEPTH	SA	MPLE	BLOW C			T				BACKFILLED		DATE
(m)	(m)	NO	. TYPE	150 mm Increments	Last 300 mm	Percent Recovid	LAB TESTS	USCS Group		MATERIAL DE	SCRIPTION		REMARKS
	- 0.30	)		28				_GP_	-0.15	POORLY GRADED G	RAVEL with SI	LT and	<u> </u>
!	0.69	A	SPT	38	50/75	80	MC, SA, PI	sc	١	SAND grey to brown, to weakly cemented,	dry to slightly m	noist, non	
	F		†	50/75	<u> </u>			00	į l	non-plastic fines, 35%	6 fine to coarse	sand	
724.77	<del> </del> 1								_0. <u>3</u> 17	55-60% fine to coarse gravel to +50mm in d	e, subangular to iameter, Minor (	subround   cobbles at	
	1.52								,	surface. CLAYEY SAND with			
	1.83	В	GRAB	50/25	50/25			GC	1 1	moist, moderately cei	mented with		
723.77 -	-2									approximately 30% lo to coarse sand, 25%	w plastic fines, fine_subangular	45% fine	
	Ė				j		i	<u> </u>	—— <u>—</u> —¬	Subround gravel to +1	2.5mm in diame	eter i	
	-							<u> </u>	į (	CLAYEY GRAVEL wi moist, well cemented	with estimated	30% low 1	
722.77 -	3 3.05								1	to medium plastic fine sand, 40% fine to coa	s 30% fine to c	coarea /	
122.11	3.35	С	GRAE	50/0	50/0		MC, SA, PI		ì	subround gravel to +3	7.5mm in diame	eter	
	0.00							GC		CALICHE CLAYEY GRAVEL wit	th SAND light br	own —	
	F -							GC		slightly moist, well cer	mented with est	hatemit	
721.77	-4									30% low plastic fines, 40% fine to coarse, su	ibangular to sub	arse sand, pround	
	- 4.27	D	GRAB	50/25	50/25				9	gravel to +25mm in di	ameter.		
	4.57		GRAD	50/25	50/25				4.60				
720.77	- -5												
	-			1		i							
<u> </u>	_												
}	-		ł	}									
719.77	-6	ļ	- 1	Ì									
	.							1					
-													
718.77	-7												
}	.	j	1										
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717.77	-8					1	+						
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716.77	-9												
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714.77	11							f					
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	START DATE	1/25/00 1/25/00			EXPL	ORATIO	N LOG	STATION		SHEET 1 OF
	JOB DESCRIPT	Las Vegas,	5 Widening , Nevada	g Proj	ect			STATION OFFSET ENGINEER	JRO	
	BORING E.A. #	WL-12 0215-01-1			GROL	JNDWATER	LEVEL	EQUIPMENT OPERATOR	Foremos J. Sorrell	
	GROUND ELEV. HAMMER DROP				DATE	DEPTH m	ELEV. m	DRILLING METHOD BACKFILLED		HS Auger DATE 1/25/00
ELEV. DEPTH SAME	450	ast Percent	LAB TESTS	USCS		MATE	ERIAL DE	SCRIPTION		DEMARKS



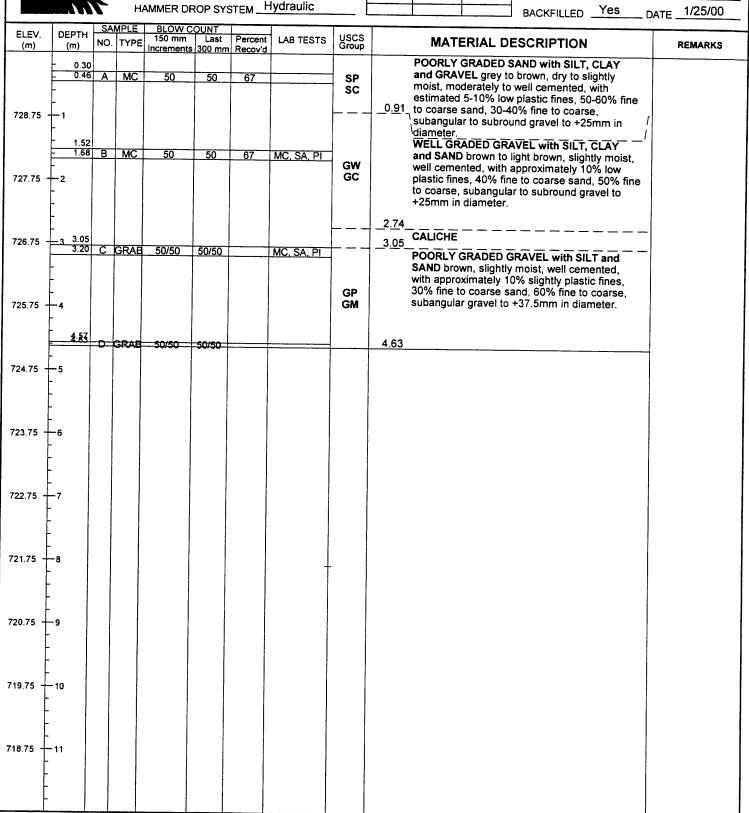
\_\_\_\_11.GP. ...\_JJT.GE.

3			s	TART DAT	1	/25/00			EXPLORATION LOG			
				ND DATE		/25/00	<del></del>					SHEET 1 OF
				OB DESCR			95 Widenii	na Proi	ect	STATION		
				OCATION			as, Nevada	3 ,		OFFSET	JRO	
1				ORING		VL-13				ENGINEER	Foremo	et Ron
7.				.A. #		215-01-	1		GROUNDWATER LEVEL	EQUIPMENT OPERATOR	J. Sorre	
1						27.74 (r			DATE DEPTH m ELEV. m	DRILLING		
				ROUND E						METHOD		HS Auger
				AMMER D	ROP SY	STEM	Hydraulic			BACKFILLED	<u>Yes</u>	DATE 1/25/00
ELEV. (m)	DEPTH (m)		MPLE TYPE	450	Last	Percent n Recovid		USCS Group	MATERIAL DE	SCRIPTION		REMARKS
1	9:30							1	WELL GRADED GRA	VEL with SILT,	CLAY	<del> </del>
1	0.41	A	MC	50/100	50/100	100	MC SA PL	7	and SAND grey to light 0.61 moist, moderately to	nt brown, dry to	slightly	
	ļ.							<b></b>	□ □ □ □ approximately10% lov	v plastic fines :	35% fine to	4
726.74	<del> </del> 1								coarse sand, 55% fine subround gravel to +3	e to coarse, sub	angular to	!
1	<u> </u>		İ					GW	CALICHE	msib ni mmc.vo	eter.	
1	1.58	В	MC	50/50	50/50	<u> </u>		GC				
	}											
725.74 -	-2											
l	<u> </u>											
	-							<u> </u>	2.74			-
724.74 -	3.05					<del> </del>			WELL GRADED GRAY SAND light brown, slig	thtly moist well		
	3.35	C	GRAB	50/75	50/75		MC, SA, PI		cemented, with approx	ximately 10% sl	iahtly	
	- 1							GW	plastic fines, 45% fine to coarse, subangular	to coarse sand	, 45% fine	
	-							GM	diameter.	graver to + 19m	m in	
723.74 -	-4											
	4:50	<del>-D-</del>	MC	50/25	50/25	0			4.60			
700.74	- !											,
722.74 -	-5											
	-											
	-											
721.74	-6											
721.74	-											
	-											
f	-											
720.74	-7					İ						i
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-	-		l			į						
			- 1		-							
719.74	-8	ł	İ				ĺ					
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}												
		l										
718.74	-9											
-		İ				1						
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717.74	-10		ļ	1	1							
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716.74	-11			-								
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	START DATE	1/25/00 1/25/00	EXPL	ORATIO	N LOG		SHEET 1 OF
	END DATE	11.0.051171	niect			STATION	
	JOB DESCRIPTI	Las Vegas, Nevada	Jeci		····	OFFSET	IPO
	BORING	WL-14	·			ENGINEER EQUIPMENT	JRO Foremost B90
3	E.A. #	0215-01-1	GROU	JNDWATER	RLEVEL	OPERATOR	J. Sorrells
2	GROUND ELEV.	728.64 (m)	DATE	DEPTH m	ELEV. m	DRILLING METHOD	152 mm HS Auger
	HAMMER DROP	sysтем Hydraulic				BACKFILLED	Yes DATE 1/25/00
ELEV. DEPTH SAM	IPLE BLOW COUN	NT   LAB TESTS   USG					

51 53 <i>i</i>	DEST	_S/	MPLE	BLOW C	OUNT		1	T	BACKFILLED Yes DATE 1/25/00
ELEV. (m)	DEPTH (m)	NO	TYPE	150 mm Increments	Last	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DESCRIPTION REMARK
	0.30								POORLY GRADED GRAVEL with SILT and
	0.61	Α	GRAB	50/100	50/100		MC, SA, PI	1	SAND grey to brown, dry to slightly moist, moderately to well cemented, with
	- 5.61		<b> </b>					1	approximately 10% non-plastic fines 40% fine
727.64	<del> </del> 1								to coarse sand, 50% fine to coarse, subangular gravel to +37.5mm in diameter.
	-							GP GM	graver to +57.5mm in diameter.
	1.52	<del> </del>			<u> </u>			Givi	
	1.83	В	GRAB	50	50				
726.64	-2								
	[								_2.44
	-								POORLY GRADED GRAVEL with SILT and
725.64 -	3.05							CD	SAND light brown, slightly moist, well cemented, with estimated 10% non-plastic
725.64 -	3.35	С	GRAE	50/25	50/25			GP GM	fines, 30% fine to coarse sand, 60% fine to
	3.33				55725				coarse, subangular gravel to +19mm in
724.64 -	4					;		<u> </u>	3.96 CALICHE
	- 1								SILTY, CLAYEY SAND with GRAVEL light brown, slightly moist, well cemented, with
	4.57								approximately 15% low plastic fines, 50% fine
	- 4.88	D	GRAB	50	50		MC, SA, PI	sc	to coarse sand, 35% fine to coarse, subangular gravel to +19mm in diameter.
723.64 -	-5							SM	graver to + remini in diameter.
						ĺ			
	-				1	ŀ			
									5.79
722.64	<u>6 6.10</u>	_	CDAG	50.05					SILTY GRAVEL with SAND light brown, slightly moist, well cemented, with
}	6.40		GRAB	50/25	50/25				approximately 15% slightly plastic fines, 40%
	-								fine to coarse sand, 45% fine to coarse, subangular gravel to +19mm in diameter.
721.64				ĺ					
}	-			1					
	7.62				1	1			
	7.92	F	GRAB	50/50	50/50		MC, SA, PI	GM	
720.64	-8								
]	_			ļ					
}	-	Ì					Ì		
719.64				ļ					
19.04	-9 <sub>9.14</sub>	$\overline{}$	-						
F	9.45	G	GRAB	50/100	50/100				
Į									_9.75
18.64	-10			1					SILTY, CLAYEY SAND with GRAVEL brown.
}	10.36			- 1	İ			SC SM	slightly moist, well cemented, with approximately 15% low plastic fines, 60% fine
Ī	10.67	н	SRAB	50/0	50/0	1	MC, SA, PI	311	to coarse sand, 25% fine, subangular gravel to
F	-								10.67 +12.5mm in diameter.
17.64	-11								
1									
L					1			1	

	START DATE	1/25/00 1/25/00			EXPL	ORATIO	N LOG	STATION		SHEET 1 OF
	JOB DESCRIPTI	Las Vegas	95 Widenin s, Nevada	g Proje	ect			OFFSET ENGINEER	JRO	
3	BORING E.A. #	WL-15 0215-01-1	<del></del>		GROL	INDWATER	LEVEL	EQUIPMENT OPERATOR	Foremost J. Sorrells	
	GROUND ELEV.				DATE	DEPTH m		DRILLING METHOD	152 mm l	lS Auger
ELEV. DEPTH SAME		IT			T			BACKFILLED	Yes D	ATE
	YPE 150 mm La	ast Percent mm Recovid	LAB TESTS	USCS Group		MAT	ERIAL DE	SCRIPTION		REMARKS



DOT 0215011.GPJ NV\_DOT.GDT 6/14/00

				TART DAT	- 1	/26/00			EXPLORATION LOG			
				TART DAT ND DATE		26/00						SHEET 1 OF
							 . 95 Widenii	aa Proj	art	STATION		
				OB DESCR OCATION			as, Nevada		<u> </u>	OFFSET	100	
	_					/L-16	as, 1101aaa			ENGINEER	JRO Foremost	DOO
* 7				ORING		215-01-	1		22211211122212	EQUIPMENT	Foremost J. Sorrells	
1				A. #					DATE DEPTH m ELEV. m	OPERATOR DRILLING		
./*				ROUND E		29.19 (1		<del></del>	DATE DEPTH III ELEV. III	METHOD	152 mm l	
		11_	H	AMMER D	ROP SYS	STEM	Hydraulic			BACKFILLED	Yes D	ATE 1/26/00
ELEV.	DEPTH		MPLE	BLOW 0	OUNT	Percent	LAB TESTS	uscs	**ATEDIAL DE			
(m)	(m)	NO.	TYPE	Increments				USCS Group				REMARKS
	0.30	1	<u> </u>		<u> </u>	ļ	ļ		POORLY GRADED GI SAND light brown, dry	RAVEL with SIL	T and	
	0.61	A	GRAB	50/50	50/50		MC, SA, PI	GP GM	cemented, with approx	ximately 10% s	liahtly	
700 40	-							L	plastic fines, 30% fine 0.91 to coarse, subangular	to coarse sand gravel to +25m	l, 60% fine m in	
728.19 -	<del>-</del> 1							L				
	1.52								POORLY GRADED GR	AVEL with SIL	Tand	
	- 1.68	В	MC	50	50	100		7	SAND light brown, slig	htly moist, mod	lerately	
727.19 -	-2								to well cemented, with to slightly plastic fines	. 40% fine to co	arse sand	
	t							GP GM	55% fine to coarse, an gravel to +37.5mm in	iquiar to suban	gular	
	[							0	graver to +37.3mm m	diameter.		
700.10	<b>-</b>											
726.19 -	-3							1	3.20			
	-								CALICHE			
								<u></u>	3.66			
725.19	-4								POORLY GRADED SA GRAVEL brown, slight	ND with SILT a v moist, well ca	nd emented	
	-							SP	with approximately 10°	% non-plastic fir	nes. 50%	
	4.57							SM	fine to coarse sand, 40 subangular gravel to +	1% fine to coars	e, ter.	
	- 4.88	D	GRAB	50/100	50/100		MC, SA, PI					
724.19	<del></del> 5 -								5.18			
}	-							Γ	CALICHE			
	-							ĺ	5.79			
723.19	<b>-6</b> 6.10								POORLY GRADED GR	AVEL with SIL	T and	
F	6.40	Ε	GRAB	50/50	50/50			GP	SAND light brown, slight cemented, with estimate	ntly moist, well	plantia to	
1	-							GM	slightly plastic fines, 40	-45% fine to co	arse	
-	-		' i						sand, 50% fine, suband	gular gravel to -	-12.5mm	
722.19	-7		}	1				<u> </u>	POORLY GRADED SA	ND with SILTs		
Ĺ									GRAVEL brown, slight!	v moist, well ce	mented.	
-	7.62	_	GRAB	50				SP	with estimated 5-10% r plastic fines, 50-60% fi	non-plastic to sl	ightly	
721.19	7.92 -8	F	GRAB	50	50			sc	30-40% fine to coarse,	subangular gra	vel to	
}	.						-	-	+19mm in diameter.			
		l	l						_8.53			
-					1				POORLY GRADED GR	AVEL with CLA	Yand	
720.19	-9 <sub>9.14</sub>								SAND brown, slightly m with approximately 10%	loist, well ceme	nted, es, 40%	
[	9.45	G	GRAB	50	50		MC, SA, PI	GP GC	fine to coarse sand, 50 subangular gravel to +1	% fine to coars	e. l	
-								00	Subangular graver to + r	Silili ili diamei	er.	
719.19	-10			i					10.06			
-									10.06 CLAYEY SAND with G	RAVEL light bro		
r	10.67			[				sc	slightly moist, well ceme	ented, with esti	mated	
-	18:56	H	GRAB	50/100	50/100				15% low plastic fines, 5 10.76 gravel to +12.5mm in di	5% fine, suban iameter.	gular	
718.19	-11		1									
Į												
+												

			s	TART DAT	E _1.	/26/00	-		<b>EXPLORATION LOG</b>				
				ND DATE		/26/00						SHEET	1 0
			J	OB DESCR	RIPTION	U.S.	95 Widenir	ig Proje	ct	STATION			
			Ł	OCATION	_ <u>L</u> ;	as Vega	s, Nevada			OFFSET ENGINEER	JRO		
*			86	ORING		/L-17				EQUIPMENT	Foremo	st B90	
1				A.#		215-01-			GROUNDWATER LEVEL	OPERATOR	J. Sorre	ls	
ju.			G	ROUND EL	.EV72	29.91 (n	1)		DATE DEPTH m ELEV. m	DRILLING METHOD	152 mm	HS Auger	
<u> </u>	77	1	H	AMMER DA	ROP SYS	STEM_	lydraulic			BACKFILLED		DATE1/26/	/00
ELEV. (m)	DEPTH (m)		TYPE	BLOW C 150 mm Increments	Last	Percent	LAB TESTS	USCS Group	MATERIAL DE			REMAR	
	- 0.30			merements	300 11111	Recov a			POORLY GRADED O	RAVEL with SII	Tand	, ALMAN	<del></del>
	0.61	Α	GRAB	50/100	50/100		MC, SA, PI	1	SAND grey to brown, cemented, with appro	dry to slightly m	nict wall		
728.91 -	- -1 -							GP GM	plastic fines, 30% fin- to coarse, subangula diameter.	e to coarse sand	1 60% fine		
	1.52												
	1.83	В	GRAB	50/100	50/100				_1.83				
727.91 -	-2								2.13 CALICHE			-	
	-			i				GP	POORLY GRADED G SAND brown, slightly with approximately 10	moist, well cem	ented,		
726.91	_3_3.05							GM	40% fine to coarse sa subangular gravel to	nd 50% fine to	COSTCO		
	3.35	С	GRAB	50/50	50/50		MC, SA, PI		_3.35				
725.91	- - -4							SP SM	POORLY GRADED S. GRAVEL brown, sligh with estimated 5-10% plastic fines. 50-55%	tly moist, well ce non-plastic to si fine to coarse sa	emented, lightly		
	4:86	D	GRAB	50/100	50/100				fine to coarse, subang diameter. 4.66	jular gravel to +	19mm in		
724.91	-5												
23.91	-6												
-													
22.91	-7												
21.91	-8												
ļ							†						
20.91	9												
Ł													
}						İ					ļ		
19.91	10												
ŀ													
F													
8.91	11												
L							ı						
-											1		

3			S	START DA	TE _1	/26/00			EXPLORATION LOG			SUEET 1
			E	ND DATE	1	/26/00				<b></b>		SHEET 1
			J	OB DESC	RIPTION	U.S	. 95 Wideni	ng Proj	ect	STATION OFFSET		
			L	OCATION	<u>_</u>	as Veg	as, Nevada			ENGINEER	JRO	
12			В	ORING		VL-18				EQUIPMENT	Foremos	st B90
Ä			Ε	.A.#	0:	215-01-	-1		GROUNDWATER LEVEL	OPERATOR	J. Sorrel	
يا المالية				ROUND E	1 EV 7	29.50 (r	m)		DATE   DEPTH m   ELEV. m	DRILLING		
	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	1					Hydraulic			METHOD		HS Auger
						21FM	Tydradic			BACKFILLED	Yes	DATE
ELEV.	DEPTH	NO	TYPE	150 mm	COUNT	Percent	LAB TESTS	USCS Group	MATERIAL DE	SCRIPTION	<del></del>	
(m)	(m)	$\vdash$		Increment	ts 300 mm	Recov'd	-	Group				REMARKS
	- 0.30	_				<del> </del>	-	_	POORLY GRADED G SAND grey to light bro	RAVEL with SIL	T and	
	0.61	A	GRAE	50/100	50/100	ļ	MC, SA, PI	GP	well cemented, with a	oproximately 10	10/4 love	
700.50	<b>-</b>							GM	plastic fines, 30% fine to coarse, subangular	to coarse sand	l, 60% fine	
728.50 -	Γ'								1.22 diameter.	graver to + 1911	irii in	
	1.52								POORLY GRADED GR	RAVEL with SIL		
	1.83	В	GRAB	50	50		†	1	SAND light brown, dry moderately to well cen	to slightly mois	t,	
727.50 -	-2				<b>†</b>	<b>†</b>		1	approximately 10% no	n-plastic to slig	htly plastic	
	_								lines, 40% fine to coar	se sand, 50% f	ine to	
į	-								coarse, subangular gra diameter.	avei to +25mm	ın	
	-											
726.50	_3 3.05	_			<del>- </del>			_				
	3.35	С	GRAB	50	50			GP				
}	-							GM				
725 50	-											
725.50	-4											
}	4.57											
F	4.88	D	GRAB	50	50		MC, SA, PI	-				
724.50	-5	_			30		IVIC, SA, FI					
-												
t					l i			L	_5.49			
-									POORLY GRADED GR	AVEL with SAN	īD — —	
723.50	-6 6.10								brown to light brown, si to well cemented with	approximately (	L5%	
Ė	6.40	Ε	GRAB	50/125	50/125				non-plastic fines, 40% f	fine to coarse s	and	
}									55-60% fine to coarse, gravel to +25mm in dia	angular to suba meter.	ingular	
<b>-</b>	_	ļ							•			
722.50	-7											
-			1									
<u> </u> -	7.62	F (	GRAB	50/405	50405						İ	
<sup>7</sup> 21.50	7.92		JRAB	50/125	50/125		MC, SA, PI	GP				
			İ			- 1	†	-				
}												
1				1		1	1	ļ				
720.50	9 9.14		1				İ	1				
F	9.45	G d	RAE	50/50	50/50							
F		$\dashv$	_		-	-		ĺ				
-	1			Ì		}						
19.50	10	- 1	1		ĺ	ĺ	_		10.06			
F								sc	CLAYEY SAND with GR well cemented, with app	AVEL brown, m	noist,	
<u></u>	18.63		RAB	50/50	50/50		AC	30	10.72 plastic fines, 50% fine to	coarse sand 3	30% fine	
18.50	11			JU/JU	<del></del>		VIC, SA, PI		to coarse, subangular gr	avel to +19mm	in /	
.3.30	''		İ	1			1		Mannoter.			
<b> </b>							ļ					
Ė				1			1					
		- 1						1				

							<del></del>						
3	_			START DA	re <u>1</u>	/26/00			EXP	LORATION LOG			SHEET 1 OF
				END DATE	_1	/26/00					CTATION		SHEET 1 OF
				JOB DESCI	RIPTION	_U.S.	95 Wideni	ng Proj	ect		STATION OFFSET		
				LOCATION	L	as Vega	as, Nevada				ENGINEER	JRO	
`\$				BORING	N	/R-01					EQUIPMENT	Foremos	t B90
			J	E.A. #	_0:	215-01-	.1		GRO	UNDWATER LEVEL	OPERATOR	J. Sorrell:	S
				GROUND E	LEV. 72	28.50 (r	n)		DATE	DEPTH m ELEV. m	DRILLING	152 mm l	JS Augos
		1		HAMMER D		STEM I	Hydraulic				METHOD		
		S	AMPLE				<del></del>				BACKFILLED		DATE 1/26/00
ELEV. (m)	DEPTH (m)	NC		450	Last	Percent		USCS Group		MATERIAL DE	SCRIPTION		REMARKS
		,		increment	5 300 11111	Recov o		+	<del>                                     </del>	SILTY, CLAYEY GRA		light	112111111111111111111111111111111111111
	8.30	A	GRA	B 50/100	50/100	0	MC, SA, PI	=		brown to brown, dry t	o slightly moist	well	
1	Ė									cemented, with appro- fines, 25% fine to coa	eximately 15% lo	w plastic	
727.50	<del>1</del> 1									coarse, angular to su	bround gravel to	+25mm in	
ł	F				1			GC		diameter.			
	1.56	В	SPT	50/50	50/50	0		GM					
	-												
726.50	-2											,	
1	[					İ			2.44				
	-		ĺ					GP	<del></del>	POORLY GRADED G	RAVEL with CL	AY light	
725.50	3 3.95				İ			GC	0.05	brown, slightly moist.	well cemented	with -	
723.30	3.310	C	GRA	E 50/50	50/50	0	MC, SA. PI	+	_3.05	approximately 10% lo to coarse sand, 60% i	ine to coarse, a	ngular to	
	-									subround gravel to +3	7.5mm in diame	eter.	
	L							<u> </u>	_3.66				
724.50	<b>-</b> 4							00		POORLY GRADED GI SAND light brown, slig	RAVEL with CLA	AY and	
	-							GP GC	İ	cemented with approx	imately 10% low	plastic	
	4.60	<u> </u>	SPT	50/25	50/25				4.60	fines, 30% fine to coa coarse, angular to sub	rse sand, 60% fi	ne to	
	-		011	30/25	30/25				4.00	\in diameter.	mound graver to	+37.5mm  \	
723.50 -	-5												
								İ					
	<u> </u>		İ										
700 50	1											İ	
722.50 -	-6		ĺ	}									
	- 1												
721.50 -	7					1							
	-					1							
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	-											1	
720.50	-8							_					
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-	-												
710.50	-	ł										İ	
719.50	-9 -							1					
}	-	ĺ											
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718.50	-10	- 1											
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717.50	-11			ľ									
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UDDI LELLE INTERNATION OF THE PROPERTY OF THE

			s	TART DAT	E _1/	/26/00			EXPLOR	RATION LOG		<del></del>	
			Ε	ND DATE	1/	/26/00	<del></del>						SHEET 1 C
				OB DESCR	IPTION	U.S.	95 Widenir	ng Proje	ect		STATION		
				OCATION			as, Nevada	<u> </u>			OFFSET	JRO	
				ORING		/R-02	<del></del>				ENGINEER EQUIPMENT	Foremo	et R90
7,				.A. #		215-01-	1	<del></del>	GROUND	WATER LEVEL	OPERATOR	J. Sorre	
ير:						28.00 (n				PTH m ELEV. m	DRILLING		
				ROUND EL							METHOD		HS Auger
			Н.	AMMER DE	ROP SYS	STEM	Tydraulic				BACKFILLED	Yes	DATE1/26/00
ELEV. (m)	DEPTH (m)		TYPE	BLOW C 150 mm Increments	Last	Percent Recov'd		USCS Group		MATERIAL DE	SCRIPTION		REMARKS
	8.30							_GP_	_0.15 <sub>7</sub> PC	ORLY GRADED	RAVEL with SA	ND grey	
727.00 -	- 1 - 1.52 - 1.68		MC	50/100	50/100	50	MC, SA, PI	GP GC	cer slig 60° +3 PO SA to v	light brown, dry, we mented, with estimy plastic fines, which fine to coarse, so the fine fine fine fine fine fine fine fin	lated 5% non-pla 35% fine to coar ubangular grave :: RAVEL with CL slightly moist, mo h approximately e to coarse sand	astic to se sand, el to AY and oderately 10% low	1
726.00 - 725.00 -	-2 - - - - 3 3.05 - 3.20	С	MC	50	50	0			to 6 +37	coarse, subangula 7.5mm in diameter	r to subround gra	avel to	
724.00	- -4 - - 4.57 - 4.72	D	GRAB	50	50	0	MC, SA, PI		cen 35% ang	ORLY GRADED G AY and SAND brownented, with estim 6 fine to coarse satular to subangular meter.	vn. slightly moist ated 10% low pla ind. 55% fine to a	t. well astic fines, coarse	-
723.00	-5 - - -							GP GC					
722.00	-6 6.10	-	МС	50/100	50/300								
721.00	-7			50/100	30/100				CLA	DRLY GRADED GI	n, slightly moist	well	
720.00	<del>7.62</del>	F	GRAB	50/50	50/50	0	MC, SA, PI	GP GC	cem fines coar	ented, with approse, 40% fine to coal se, angular to sub ameter.	timately 10% low se sand, 50% fir	v plastic ne to	
}			}			-			8.53				
<b> </b>							Ì			ICHE light brown,	erv hard		
719.00	-9 0 14							}		g 3.0mii,			
	9 9.36	G	MC	50/50	50/50	-0-			_9.14				1
718.00	-10							GC GM	CLA ceme fines angu	PRLY GRADED GR Y and SAND brow ented, with approx s, 45% fine to coar ular to subangular leter.	n. slightly moist, imately 10% low se sand. 45% fin	well plastic	
E	18.93	н ¢	RAB	50/50	50/50	- <del>0  </del> 1	VIC, SA, PI		10.73				
717.00	-11												

		<del></del>								EVDI	ODATIO	N 1 00			
				S	TART DAT		/26/00			EAPL	ORATIO	N LOG			SHEET 1 OF
				Е	ND DATE		/26/00						STATION		3.1221 1 3,
				J	OB DESCF			95 Widenir	ng Proj	ect			- OFFSET		
				Ļ	OCATION			as, Nevada					ENGINEER	JRO	
	1.5			В	ORING		/R-03						EQUIPMENT	Foremos	
	1				.A. #		215-01-			GROL	INDWATER		OPERATOR	J. Sorrell	s
		2.		G	ROUND E	LEV72	26.75 (r	n)		DATE	DEPTH m	ELEV. m	DRILLING METHOD	152 mm	HS Auger
			1	Н	AMMER D	ROP SYS	STEM_	Hydraulic					BACKFILLED		DATE1/26/00
	ELEV.	DEPTH	SA	MPLE	BLOW (				T	7					DATE
	(m)	(m)	NO.	TYPE	150 mm Increments	Last 300 mm	Percent Recov'd	LAB TESTS	USCS Group		MAT	ERIAL DI	ESCRIPTION		REMARKS
		- 8:38		GRAF		1					POORLY	GRADED (	GRAVEL with SIL	_T and	
		_	^	GRAE	50//5	50/75	0	MC, SA, PL	GP		cemented	wn, dry to : I. with appr	slightly moist, we oximately 10% lo	ell Ny plastic	
		-							GM		tines, 40%	6 fine to co	arse sand 50%	fine to	
	725.75	<del>_</del> 1							L	_1.07_	un diamete	er.	brounded grave		
	]	1:52								1	SILTY, CL	.AYEY GRA	AVEL with SAND emented, with	brown,	1
		1.62	В	GRAB	50/100	50/100	0	<u> </u>	-	1	approxima	ately 10% i	ow plastic fines.	40% fine	
	724.75	_2									to coarse	sand. 50%	fine to coarse, a +25mm in diame	ngular to	
	]	-										g.uvc. to	· Zomm in diame	tei.	
		3.05							GC						
	723.75	3 3:95	C	GRAB	50/75	50/75	-0	MC, SA, PI	GM						
		-													
	722.75	+4													
		<b> </b>													
		4.53		GRAE	50/50	50/50				4.57					
		<b>-</b>				00.00									
	721.75	-5													
		-													
ı	720.75 -	-6	l												
				]			ŀ							j	
		-	ĺ	ł											
	740.75	<b>-</b>													
	719.75 -	7													
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-	718.75 -	-8													
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-	747.75														
	717.75	9		-											
14/Q	}	-						1							
9		-		ĺ											
	716.75	-10			1		ĺ							1	
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립	745 75	-													ļ
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2	}	-				İ		,							
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3				START DA		1/26/00 1/26/00			EXPLORATION LOG			SHEET 1 O
				END DATE JOB DESC			. 95 Widen	ina Pro	ect	STATION		
							as, Nevada		eci	OFFSET		
				LOCATION	-	NR-04	as, Nevaus	1		ENGINEER	_JRO	
7				BORING	_	0215-01	1	<del></del>		EQUIPMENT	Foremo	
41.45				E.A. #					GROUNDWATER LEVEL DATE DEPTH m ELEV. m	OPERATOR	J. Sorre	IIS
				GROUND		726.42 (	<del></del>		DATE DEPTH III ELEV. III	DRILLING METHOD	_152 mm	HS Auger
4	///	1/		HAMMER I	DROP SY	YSTEM_	Hydraulic			BACKFILLED	_Yes	DATE1/26/00
ELEV.	DEPTH		AMPLE	150	COUNT	Percen	LAB TESTS	USCS				
(m)	(m)	NO	TYP			m Recovid	1 200 12313	Group				REMARKS
	9.36	R A	GRA	B 50/50	50/50	<u> </u>	MC SA PI	GP	0.23 POORLY GRADED G	RAVEL with SA	ND grey	]
725.42	1 53						WO, 3A, F	SC SM	With estimated <5% r   fine to coarse sand, 6   subangular gravel to   CLAYEY, SILTY SAN   dry to slightly moist v	ion-plastic fines 60% fine to coan +37.5 mm in dia D with GRAVEL vell cemented w	, 35-40% se, <u>Imeter.</u> _ brown,	
724.42	1.58 - 2 -	8	NR	50/50	50/50	0		GC	approximately 10% not coarse sand, 50% subangular gravel to SILTY, CLAYEY GRA slightly moist, well certain approximately 10%-15 fines, 35%-40% fine to	on-plastic fines, fine to coarse, a +19mm in diame VEL with SAND mented, with 5% non to low processing to coarse sand	40% fine ingular to eter.  brown, lastic	     
723.42 -	3 3.95	С	GRAI	50/50	50/50	0		GM	to coarse, angular to +12.5mm in diameter	subangular grav	el to	
722.42 -	-4 - 4:57		COAL	50/100					3.96	to grey, hard, wi ameter.	<del>_</del>	
721.42 -	- -5 -		ISRAF	50/100	50/100	0	MC, SA, PI		SILTY, CLAYEY GRAY slightly moist, well cen approximately 10% lov to coarse sand, 55% fi subangular gravel to +	nented, with v plastic fines, 3 ne to coarse, ar	55% fine	
720.42	- -6 6.10 -	Е-	GRAE	<del>- 50/0</del> -	50/0	0		GC GM				
719.42	- -7								_7.01_ POORLY GRADED GR	AVEL with CLA	 Y and	
718.42	7.62 -8	F	GRAB	50/100	50/100	0	MC, SA, PI	GP _ GC	SAND brown, slightly n with approximately 10% fine to coarse sand, 50 to subangular gravel to	6 low plastic fine % fine to coarse	es, 40%	
717.42	-9 <sub>9.14</sub>								8.84_ SILTY, CLAYEY GRAV	EL with SAND		
716.42	9.30	G	GRAB	50	50	0		GC GM	slightly moist, well cem approximately 10% low to coarse sand, 50% fir subangular gravel to +1 10.06	ented, with plastic fines, 40 te to coarse, and	% fine	
715.42	10.67 10.80	НС	SRAB	50/125	50/125	0	MC, SA, PI	GC	CLAYEY GRAVEL with moist, well cemented, v medium plastic fines, 5 35% fine, angular to su +12.5mm in diameter.	vith approximate  0% fine to coars	ely 15%	
-									audinotal.	-		

				START DA	re <u>1</u>	/19/00		·	EXPLORATION LOG			
			Ε	END DATE	_1	/19/00						SHEET 1 OF
			J	IOB DESC	RIPTION	U.S.	. 95 Widenir	ng Proi	ect	STATION		
				OCATION			as, Nevada			OFFSET	JRO	
				BORING		VR-06				ENGINEER		ost B4500
7				E.A. #		215-01-	.1		GROUNDWATER LEVEL	EQUIPMENT OPERATOR	W. Dug	
1				ROUND E		11.50 (r			DATE DEPTH m ELEV. m	DRILLING		
									STATE SELFTANIA ELEVANIA	METHOD		n HS Auger
		T SA	AMPLE	IAMMER D		STEM'	Tyuraunc			BACKFILLED	Yes	DATE 1/19/00
ELEV. (m)	DEPTH (m)	NO	. TYPE	450	Last	Percent Recovid		USCS Group	MATERIAL DE	SCRIPTION		REMARKS
	0.30	3	SPT	50/25	50/25	ļ.,	MC, SA, PI		CLAYEY GRAVEL wi slightly moist, well ce	th SAND light b	rown,	
	[				00,20		10, 07,11		approximately 20% m	edium plastic fi	nes. 40%	
	- 0.91	_							fine to coarse sand, 4 subangular to subrou	0% fine to coar:	se	
710.50	<b>1</b>	Δ2	GRA					GC	diameter.	nded graver to +	·25mm In	
	1.52	1	GIVA									
	1.65	В	MC	50/125	50/125	0		1				
709.50	<u>2</u>											
	-							L	_2.29			
	ļ.								CALICHE light brown	to grey, hard, w	 ith	_
	}								gravel to +19mm in di	ameter.		
708.50	3.05 3.20		SPT	50	50	33						
	-							<u> </u>	_3.35			
	<b>-</b>								CLAYEY GRAVEL will slightly moist, well cer	h SAND light br	own,	
707.50									approximately 25% lo	v to medium pla	stic fines,	
707.00	<b> </b>						·		40% fine to coarse sa	nd, 35% fine to	coarse	
	4.50								subangular to subrour diameter. At approxim	ately a depth of	13.5'	
		0	GRAB	<del>50/125</del>	50/125	0		GC	there is a transition wi	th approximately	,	
706.50 -	-5								15%-20% low plastic to coarse sand, 50% fine	to coarse suba	ngular to	
	-								subrounded gravel to	+25mm in diar	neter.	
	- 1								_5.79			
705.50 -	6 6.10			30					CLAYEY SAND with C slightly moist to moist,	RAVEL light browing	own,	
	6.40	E	SPT	50	50	83	MC, SA, PI		high plastic fines, 40%	fine to medium	sand.	
	-								20% fine, subangular t +12.5mm in diameter.	o subrounded a	ravel to	
704.50 -	7					ĺ	i		of 6.7m there is a trans	sition to a higher	r percent	
704.30	F'					l	}	sc	sand, with approximate plastic fines, 65% fine	elv 15% low to n	nedium	
	7.62							••	to coarse, subangular	to coarse sand, gravel to +19mn	20% fine n in	
	- 7.02	_	CDT	23					diameter.	_		
703.50 -	<b>-8 8.08</b>	F	SPT	40 40	80	66						
}	-						ļ		_8.53_			
	-	ĺ					ľ		CALICHE light brown to	grey, extremel	 v well	·
02.50	-9 <b>9</b> .1#			İ					cemented, with gravel	to +19mm in dia	meter.	
	- "	0	GRAB	50/125	50/125	-0-						
[	-											
}	-					ļ						
01.50	- 10 <sup>10.06</sup>	нк	GRAB						10.06			
	-		J. V.U									] . [
-	.	-	-									
00.50	-											
00.50	-11		1									
-							İ	ĺ				
Ŀ	:											

3				START DAT	re 1	/18/00			EXPLORATION LOG	
				END DATE		/18/00				SHEET 1 OF
				JOB DESCR			95 Widenir	na Proi	station	
				LOCATION			as, Nevada	<u>.g . 10</u>	OFFSET	
1,5				BORING		√R-07	20, 1101444		ENGINEER JRO	
		1		E.A. #		215-01-	1			ost B4500
				GROUND E					GROUNDWATER LEVEL OPERATOR W. DU DATE DEPTH m ELEV. m DRILLING 153	
		A							METHOD 152 m	m HS Auger
				HAMMER D		STEM'	Tydraulic		BACKFILLED Yes	_ DATE1/18/00
ELEV. (m)	DEPT (m)	н —	O. TYI	450	Last	Percent Recovid	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	- 0.:	30						<u> </u>	CLAYEY SAND with GRAVEL brown slightly	
	- o.:	76 /	A SP		60	100	MC, SA, PI	sc	moist, with approximately 20% non-plastic fine	s,
700 50		/6	+	- 50	ļ			1	angular to subangular gravel to +19mm in 0.91 diameter.	
709.53	<b>T</b> 1								CALICHE light brown to grey hard with	
	1.5			45				<u> </u>	1.37 gravel to +19mm in diameter.	
	1.7	73 B	3 MC	C 15 50	50	44		1	CLAYEY GRAVEL with SAND light brown, moist, with approximately 30% low plastic fine	
708.53	<del>-</del> 2								30% fine to coarse sand 40% fine to coarse	
ľ	F								subangular to subrounded gravel to +75mm in diameter.	
	-									
707.53	3 3.9	<b>6</b>								
1	F		SP	50/50	50/50	0		GC		
	3.5	1	-	+						
700.50	<b>.</b>									
706.53	-4	C2	gra	.B						
	4.57	7				į				
	4.70	D	SPI	50/125	50/125	0			4.70	
705.53 -	-5									
	-									
	-									
704.53 -	-6				l					
	-									
	-									
703.53 -	<b>−</b> 7									
	-		ļ				į			
	_					İ				
702.53	-8					İ				
İ	- -						†			
}	-									
701.53	-9									
-										
	.									
F				ļ						
700.53	-10									
F										
<b> </b>										
699.53	-11									
<u> </u>										
F										
L	1	- 1	- 1	1	1		1	1		1

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	3				START DA		1/18/00			EXPL	ORATIO	N LOG			SHEET 1 OF
					END DAT		1/18/00		D				STATION		31.221 / 3/
					JOB DESC			95 Wideni		ject			OFFSET		
					LOCATION			as, Nevada		-			ENGINEER	_JRO_	
		4	)		BORING		NR-08						EQUIPMENT		st B4500
					E.A. #		0215-01-				JNDWATER		OPERATOR	W. Dug	as
		7	A.		GROUND		'09.61 (r	<del></del>		DATE	DEPIHM	ELEV. m	DRILLING METHOD	_152 mm	HS Auger
		//	<u> </u>		HAMMER	DROP SY	/STEM	Hydraulic					BACKFILLED	Yes	DATE 1/18/00
	ELEV	. DEPT	H	SAMPL O. TY	nc 150 mr	COUNT n Last	Percent	LAB TESTS	USCS	6	MATE	EDIAL DI			
	(11)		_		incremer	nts   300 mi	m Recov'd		Group	· · · · · · ·			ESCRIPTION		REMARKS
		F	.30	A SF	oT 16	54/13	7 64	MC 64 61			moist, with	n approxim	GRAVELbrown, ately 20% low pl	actic finas	
	l	0.	.00		54/137	, 34/13	04	MC, SA, PI	sc		30% fine t	o coarse s:	and 50% fine to	COarea	
	708.61	<u> </u>			j					0 <u>.8</u> 4_	\diameter.		inded gravel to +		4
		-							GC	1 27	CLAYEY C	RAVEL W	ith SAND / CLAY	EY -	
			52 66 E	3 M	C 50/137	50/137	30		<u></u>	7 <b></b> 7	moist, with	approxim:	ately 20% low to	medium	.}
	707.61	+							1		lio coarse,	s, 40% fine subrounde	e to coarse sand d gravel to +25m	, 40% fine	1
	707.61	<del>  2</del>									glameter		GRAVEL light br		
		-									slightly mo	ist, well ce	mented with		
		-									fine to coal	tely 15% m rse sand. 4	edium plastic fir	nes, 45%	
	706.61	3 3.0	75 C	SP	T 50/50	50/50	11	MC SA PI		1	subangular diameter.	r to subrou	nded gravel to +	19mm in	
		-				00.00		141 <del>0, 671, 1-1</del> -	sc		diameter.				
		}													
	705.61	-4							}						
		+													
		4.5	7 2 D												
ļ			4 0	SP	50	50	33								
	704.61	<del>+</del> 5			İ					5.18					
		}								1	CLAYEY GI	RAVEL wit	h SAND light bro		
									GC	1	slightly moi:	St. with apr	proximately 25% to coarse sand,	low	
	703.61	6 6.10	0							1 , 1	∞ coarse, s	ubrounded	gravel to +19mi	40% fine m in	
			E	SPT	17	30	83				diameter. CLAYEY SA	ND with G	RAVEL light bro	wn /	
		6.5	5	┼	15					8	siigntiy mois	st, with app	roximately 25%	low	
	702.61	<del> -</del> 7		į					SC	Į t	o coarse, a	ngular to s	to coarse sand, ubangular grave	35% fine	
ı	702.01	F'								+	19mm in d	iameter.			
		7.62	2					Í							
		-	F	SPT	20 22	54	-			_7 <u>.6</u> 2	LAYEYSA	ND with C	RAVEL / LEAN (	5, -,	
	701.61 -	8 8.08	ļ ·		32	34	83		CL	W	vith SAND	iaht brown	to brown moist	with	
		ļ.								TI	nes. 35%-5	5% fine to	% low to medium coarse sand, 10	0/ 150/	
		L						-		0.55_ 1	ne, angular i diameter.	to subang	ular gravel to +1	2.5mm	
	700.61 -	9 9.14						-		L	EAN CLAY	with SAN	light brown, we	t, with	
8		9.30	G	SPT	50	50	33		l	a	pproximate	lv 50%-609	% medium plastice sands, 5% fine	c fines	
4179		-				İ				a	ngular to su	ıbangular ç	ravel to +4.75m	m in	
ā									CL	ui	iameter.				
ğ	699.61	─10 -													
N	}	-													
쥥	ļ	- 10.67 - 10.84	Н	SPT	12	50/25	39								
11	98.61	-11			50/25		-			11 12					1
77	ļ	.			1			<u> </u>		11.13					1
JV_DC, uzisulliGF, NV_UOT.GDI 6/14/00	}	-			į										
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	START DATE	1/18/00			EXPL	ORATIO	N LOG			
	END DATE	1/18/00								SHEET 1 OF
	JOB DESCRIPT		95 Widenin	g Proje	ect	···		STATION OFFSET		
	LOCATION		s, Nevada		ENGINEER	JRO				
	BORING	WR-09						EQUIPMENT	Foremo	ost B4500
	E.A. #	0215-01-1	1		GROL	NDWATER	LEVEL	OPERATOR	W. Dug	jas
	GROUND ELEV.	-			DATE	DEPTH m	ELEV. m	DRILLING METHOD	152 mn	n HS Auger
	HAMMER DROP		lydraulic					BACKFILLED	Yes	DATE1/18/00
ELEV. DEPTH SAM (m) (m) NO. 1	150	ast Percent	LAB TESTS	USCS Group		MATE	ERIAL DE	SCRIPTION	·· <del>·</del>	REMARKS

	1.3	1	щ	AMMER DE	000 eve	TEAL F	lydraulic		METHOD 152 mm HS Auger
		I CA				SIEM	Tydraunc	\	BACKFILLED Yes DATE 1/18/00
ELEV. (m)	DEPTH (m)	NO.	TYPE	BLOW C 150 mm increments	Last	Percent	LAB TESTS	USCS Group	MATERIAL DESCRIPTION REMARKS
	0.30			morements	300 11111	Recov a		-	CLAYEY SAND with GRAVEL light brown,
		А	SPT	19	00			1	Slightly moist, with approximately 20% medium
	0.76		3F1	12 20	32	100			plastic fines, 50% fine to coarse sand, 30% fine, angular to subangular gravel to +12.5mm in
08.50	<del> </del> 1								diameter.
	-							sc	
	1.52		SPT	28	50/00			30	
	1.74	U	JF I	50/63	50/63	47	MC, SA, PI	-	
7.50 -	-2								
	-								
	<u> </u>				į				2.59
6.50 -	3 3.05							_GC_	2.90 CLAYEY GRAVEL with SAND light brown, slightly moist, with approximately 20% low
	h	С	SPT	17 22	44	100	MC, SA, PI		plastic fines, 30% fine to coarse sand 50% fine
	3.51			22		100	IVIC, SA, PI	CL	diameter
	-					1			SANDY LEAN CLAY light brown to brown
5.50	-4		1						plastic fines, 40% fine to coarse sand 5%
			1						fine, subangular to subrounded gravel to 44.75mm in diameter.
ŀ	4.57	-	-+	16				sc	CLAYEY SAND with GRAVEL brown slightly
1.50	5.03	D	SPT	33 25	58	83			moist, with approximately 25% low to medium
	-			- 23					to coarse, subangular to subrounded gravel to
ŀ	-		ļ	İ					+25mm in diameter.
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	*				START DATE		1/20/00			EXPLORATION LOG			SHEET 1 OF
				J	OB DESC	RIPTION	U.S.	95 Wideni	ng Proj	ect	STATION		
				L	OCATION	_L	as Vega	as, Nevada			OFFSET ENGINEER	JRO	
	1			В	ORING		VR-10				EQUIPMENT		st B4500
				E	.A. #	_0	215-01-	1		GROUNDWATER LEVEL	OPERATOR	W. Dug	
		in the second		G	ROUND E	LEV7	'08.33 (n	n)		DATE DEPTH m ELEV. m	DRILLING METHOD	152 mm	HS Auger
			1	н	AMMER D	ROP SY	STEM_	Hydraulic			BACKFILLED		DATE 1/20/00
	ELEV.	DEPTH		MPLE	BLOW C			1	ucco				DATE
	(m)	(m)	NO.	TYPE	150 mm increments	Last 300 mr	Percent n Recov'd	LAB TESTS	USCS Group	MATERIAL DE			REMARKS
		8:39	A	GRAE	50/75	50/75	1	MC SA PL	GM	0.30 SILTY GRAVEL with	SAND brown, di	y, with	
		F				3073		MC, SA, PI	SM	approximately 20% no to coarse sand, 50% i	ine to coarse s	uhangular	il .
	707.33	<u>L</u> .							SIVI	to subrounded gravel 0.91 SILTY SAND with GR	to +75mm in dia	amotor.	<i>i</i>
	707.33	<del>+</del> 1								approximately 20% no	n-plastic fines	40% fina	1
		1.58	R	SPT	50/50	50/50			sc	to coarse sand, 40% f			il
	1	-	-		30,00	00/00			<b>T</b>	1.60 CLAYEY SAND with C	RAVEL / CLAY	EY -	4
	706.33	-2	ĺ							moist, with approximate	tely 30% low to	medium	11
		+								subrounded gravel to	to coarse sand	, 30% fine,	
										CALICHE light brown to with gravel to +12.5mr	a arev extreme	ly hard,	
-	705.33	<del>+</del> 3								g. 200 ( to 12.011)	m m diameter.		
		-											
	704.33	<u></u>											
		F		1									
		<b> </b>											
	703.33	-5											
		- 1					}						
		-											
	702.33 -	-6	İ										
		[		- 1			· .						
		<u> </u>											
	701.33 -	7											
		-											
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	700.00	- 1		l	1				j				
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		-			į	1	İ						
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	699.33	-9											{
8	ļ	-											
64	ŀ	-			}	İ							
9	698.33	-10			İ								
3	-	-											
Ž													
9	607.55												
1001	697.33	-11											
NV DOI UZISUTLGPJ NV DOT GDT 6/14/00	-												
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					START DAT	E 1	/20/00			EXP	LORATIO	N LOG			
					END DATE		/20/00								SHEET 1 OF
					JOB DESCR	 RIPTION	U.S	. 95 Widenir	na Proi	ect			STATION		
					OCATION			as, Nevada					OFFSET	JRO	
					BORING		/R-11						ENGINEER EQUIPMENT	Foremost	R4500
		•			E.A. #	02	215-01	-1		GRO	UNDWATER	DIEVE!	OPERATOR	W. Dugas	
	1				GROUND EI	FV 70	08.25 (	m)		DATE			DRILLING		
			1					Hydraulic					METHOD	152 mm F	
			SA	MPLE			3   EIVI _			<u> </u>			BACKFILLED	Yes D	ATE 1/20/00
ELEV. (m)	DEP (m		NO.		460	Last	Percen Recovid	LAB TESTS	USCS		MATE	ERIAL DE	SCRIPTION		REMARKS
	- 0	0.30							GM	0.23	SILTY GR	AVEL with	SAND grey to b	rown,	
		0.59	Α	SPT	15 50/125	50/125	82	MC, SA, PI	7		SILTY SAI	obbles to + ND with GF	200mm in diame CAVEL brown, si	eter /	
	+										moist, with	n approxima	ately 20% non-ni	astic fines	
707.25	<b>†</b> 1								SM		gravel to +	o coarse sa ·12.5mm in	and, 20% fine, si diameter.	ubrounded	
		.52													
	= 1	.68	В	SPT	50	50	50		<del> </del>	1 <u>.6</u> 8					
706.25	<u></u> 2								L	2.04	CALICHE   subrounde	light brown	to light grey, had +25mm in diam	rd, with	
	t										SANDY LE	AN CLAY	prown slightly m	oist to	
	F										plastic fine	s. 45% fine	tely 50% low to	5% fine	
705.05	- 3	.05									subangula	r gravel to	9.5mm in diam	eter.	
705.25		.35	С	GRAE	<u></u>		0		CL						
	-	.66							-						
		$\neg \uparrow$	D	MC	21	50	100	MC CA DI	-						
704.25	4 3.	96	_		50	30	100	MC, SA, PI	-						
									CL -	4.19	FAT CLAY	with SAND	olive to light gre		
		57 72	E	SPT	50	50	100		- CL	_4 <u>.5</u> 0_	moist with	annrovima	halv 900/ 000/	أ مقسسيناست	
703.25 -	-5						100			4.72	ligatiu.		10%-20% fine to	1) [	
700.20	-										SANDY LE	AN CLAY b	rown, moist, wit	h	
	L										145% fine to	coarse sai	v to medium pland, 5% fine, sub	stic fines,     rounded	
	F										gravel to +1	2.5mm in (	diameter.		
702.25 -	-6					ĺ									
	[														
	-													İ	
701.25 -	7		İ												
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700.25	<del>-</del> 8							1							
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697.25	-11														
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NV DOI UZISUTT.GPJ NV UOT.GDI 6/14/00

**EXPLORATION LOG** 1/20/00 START DATE 1/20/00 END DATE STATION JOB DESCRIPTION U.S. 95 Widening Project OFFSET Las Vegas, Nevada LOCATION JRO **ENGINEER** WR-12 BORING Foremost B4500 EQUIPMENT . 0215-01-1 E.A. # GROUNDWATER LEVEL W. Dugas **OPERATOR** DATE DEPTH m ELEV. m DRILLING GROUND ELEV.\_\_708.75 (m)

SHEET 1 OF 1

				GROUND E					DATE DEPTH m ELEV. m DRILLING METHOD 152 mm HS Auger
		11				STEM_	Hydraulic		BACKFILLED Yes DATE 1/20/00
ELEV.	DEPTI	NC	AMPLE D. TYPI	150	Last	Percent	LAB TESTS	USCS	MATERIAL DESCRIPTION REMARKS
	- 8:3	30						_GM	-0.15 SILTY GRAVEL with SAND light brown to
707.75	-	' A	GRA	50/100	50/100	0		sc	grey, dry  CLAYEY SAND with GRAVEL brown, slightly moist, well cemented, with approximately 20% low plastic fines, 50% fine to coarse sand, 30% fine to coarse, subrounded gravel to +19mm in
706.75	1:5	В	GRA	50/75	50/75	0		GC	CLAYEY GRAVEL with SAND light brown, slightly moist, well cemented, with approximately 30% low to medium plastic fines,
	-							CL	GALICHE light brown to grey, hard, with gravel to +9.5mm in diameter.
705.75	3 3.0	5		19					2.90 brown, slightly moist, with approximately 40% low to medium plastic fines, 30% fine to coarse
	3.5	C	MC	24 27	51	66		CL	sand, 30% fine, subrounded gravel to +9.5mm in diameter.  LEAN CLAY with GRAVEL olive to brown, moist, with approximately 70% low to medium
704.75	4.57	,							angular to subangular gravel to +9.5mm in diameter.
703.75	5 5.03	D	SPT	13 33 27	60	66			SANDY LEAN CLAY light brown, moist, with approximately 60% low to medium plastic fines and 40% fine sands.
	E							sc 	CLAYEY SAND light brown, moist, with  5.33 approximately 40% low to medium plastic fines and 60% fine sands.
702.75	6 6.10			15				GC	CLAYEY GRAVEL with SAND light brown, moist, with approximately 30% low to medium 6.10 plastic fines, 25% fine to coarse sand, 45% fine
	6.55	E	SPT	14	19	66		SC _	to coarse, subangular to subrounded gravel to  6.40 \+19mm in diameter.  CLAYEY SAND with GRAVEL brown, moist.
701.75	7.62							CL	with approximately 35% low to medium plastic fines, 45% fine to coarse sand, 20% fine to coarse, subangular gravel to +19mm in diameter.  SANDY LEAN CLAY reddish brown, moist,
00.75 -	8 8.08	F	SPT	29 24 50	74	56	MC, SA, PI		with approximately 70% medium plastic fines 7.92 and 30% fine sand.  SANDY LEAN CLAY with GRAVEL brown
699.75 -	9 9.14							CL	moist, with approximately 60% medium plastic, / 20% fine to medium sand, 20% fine, subangular/ to subrounded gravel to +9.5mm in diameter. SANDY LEAN CLAY brown, moist, with approximately 50%-60% low to medium plastic.
	9.60	G	SPT	10 28 32	60	83			fines, 35%-45% fine to medium sand, 5%-10% fine, subangular gravel to +9.5mm in diameter. At approximately 28' in depth the material is olive to brown, moist, with approximately 80%
98.75 -	— 10 —								medium plastic fines, 15% fine to coarse sand,  10.06 5% fine, subangular to +4.75mm in diameter.  CLAYEY SAND light brown to glive moist
97.75	- 10.67 - - 1111.13	н	SPT	12 7	14	100		sc	with approximately 45% high plastic fines, 50% fine to coarse sand, 5% fine, subangular gravel to +4.75mm in diameter.
	- 11,13			7					11.13
	-								

NV\_DCI UZIDUTI.GPJ NV\_UOT.GDT 6/14/00

	START DATE	_1/20/00			EXPL	ORATIO	N LOG			
	END DATE	1/20/00								SHEET 1 OF
	JOB DESCRI		6. 95 Widenir	ng Proje	ect			STATION OFFSET		
	LOCATION		jas, Nevada					ENGINEER	JRO	
	BORING	WR-13						EQUIPMENT	Foremost	B4500
	E.A. #	0215-01	-1		GROL	INDWATER	RLEVEL	OPERATOR	W. Dugas	
	GROUND ELE					DEPTH m		DRILLING METHOD	152 mm l	dS Auger
	HAMMER DRO		Hydraulic			L		BACKFILLED	Yes D	ATE1/20/00
ELEV. DEPTH NO.	MPLE BLOW CO TYPE 150 mm Increments 3	UNT Last Percen 300 mm Recov	LAB TESTS	USCS Group		MATE	ERIAL DE	SCRIPTION		REMARKS
L 0.20	1 1 1			GM	0.45	<u> </u>				

		77	•	НА	MMER DE	ROP SYS	STEM_	lydraulic		METHOD 152 mm HS Auger  BACKFILLED Yes DATE 1/20/00
LEV.	DEPTH	1	SAMP	_	BLOW C					BACKFILLED Yes DATE 1/20/00
m)	(m)	N	0. TY	/PE	150 mm Increments	Last 300 mm	Percent Recovid	LAB TESTS	USCS Group	MATERIAL DESCRIPTION REMARKS
Ė	0.3	1		PT	32				_GM_	-0.15 SILTY GRAVEL brown to grey, dry. SILTY SAND with GRAVEL brown to light
E	0.6	0 4	1 3	-	50/138	50/138	50	MC, SA, PI	SM	Drown, dry to slightly moist, with approximately
6.75	-1									0.76 20% non-plastic fines, 50% fine to coarse sand, 25% fine to coarse, subrounded gravel to
ļ	1.52	2							SM	+19mm in diameter. SILTY SAND / CLAYEY SAND light brown,
E	1.80	_	SF	PT	27 50/125	50/125	55			plastic fines, 65% fine to coarse sand, 10% fine
5.75	-2								GC 	1.98 +19mm in diameter
										CLAYEY GRAVEL with SAND light brown, slightly moist, with approximately 30% low
Ł							ĺ		CL	plastic lines, 30% fine to coarse sand 40% fine
.75	3.05	$\tau$		$\bot$	20					subangular to subangular gravel to +9.5mm in
-	3.35	C	SP	Υ	22 50	50	66	MC, SA, PI	sc	GRAVELLY LEAN CLAY with SAND light brown, slightly moist, with approximately 45%
E										30% fine, subrounded gravel to +9 5mm in
.75 🕂	4									3.96 diameter. CLAYEY SAND with GRAVEL light brown
-										slightly moist, with approximately 40% medium plastic fines, 40% fine to coarse sand, 20% fine,
L						1				angular to subangular gravel to +12.5mm in diameter.
75 +5	5									CALICHE light brown to grey hard with
F										gravel to +12.5mm in diameter.
Ė										
75 +6	5									
F										
ţ			l							
75 +7	.			į						
F	1									
						İ				
5 +8										
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DOT

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	START DATE 1/20/00	EXPLORATION LOG		OUSET 4 00
	END DATE 1/20/00  JOB DESCRIPTION U.S.	95 Widening Project	STATION	SHEET 1 OF
		s, Nevada	OFFSET ENGINEER EQUIPMENT	JRO Foremost B4500
4 2	E.A. # 0215-01-1	CROSINDIVALEREEVEL	OPERATOR	W. Dugas
	GROUND ELEV. 707.24 (m HAMMER DROP SYSTEM H	<del></del>	DRILLING METHOD BACKFILLED	152 mm HS Auger Yes DATE 1/20/00

		ISA	MPLE	BLOW		) EM	lydraulic		BACKFILLED Yes DATE	1/20/00
(m)	DEPTH (m)		TYPE	150 mm Increments	Last	Percent Recovid	LAB TESTS	USCS Group	MATERIAL DESCRIPTION	REMARKS
	8:38	A	SPT	50/75	50/75	0		GM	_0.30_ SILTY GRAVEL grey, dry	
	-							sc	CLAYEY SAND with GRAVEL brown to light brown, slightly moist, with approximately 20% 0.91 low plastic fines, 60% fine to coarse sand, 20%	
6.24	<b>F</b> '							GC	1 30 CLAYEY GRAVEL light brown slightly moist	
	1.52		007	15		-		CL	fine to coarse sand, 60% fine to coarse	
5.24 -	1.98	В	SPT	17 	46	66	MC, SA, PI	OL	subangular to subrounded gravel to +9.5mm in   1.98 diameter.	
1.24 -	3 3.05							sc	SANDY LEAN CLAY with GRAVEL brown, slightly moist, with approximately 35% low to medium plastic fines, 40% fine to medium sand, 25% fine to coarse, subangular gravel to +19mm in diameter.	
	3.51	С	SPT	41 38 27	65	83	MC, SA, PI		CLAYEY SAND with GRAVEL light brown, moist, with approximately 35% medium plastic fines, 40% fine to coarse sand, 25% fine to	
3.24 -	-4								3.66 coarse, subangular gravel to +19mm in diameter.  CALICHE light brown to grey, hard, with gravel to +19mm in diameter.	
	4.57			23					SANDY LEAN CLAY light brown, moist, with	
.24	5 5.03	D	SPT	25 12	37	83		CL 	4.88 approximately 60%-70% medium plastic fines, 20%-30% fine to coarse sand, 10% fine	
	-							GC	\subangular gravel to +4.75mm in diameter. CLAYEY GRAVEL with SAND light brown, moist, moderately cemented, with estimated 5.79 30% low to medium plastic fines, 30% fine to	
.24	6.55	E	SPT	13 19 20	39	56	MC, SA, PI	CL	coarse sand, 40% fine to coarse, subangular to subround gravel to +25mm in diameter.  SANDY LEAN CLAY light brown, moist, with approximately 65% medium to high plastic	
.24	- -7 -								subangular to subrounded gravel to +12.5mm in diameter.	
24	-8						+			
24	-9									
24	-10									
24 +	-11									
r										

NV\_DV. 1213011.GFJ NV\_DOT.GDT 6/14/00

	1			E	START DATE	4	1/13/00 1/13/00 U.S.	 . 95 Widenir	na Proie		ORATIO	N LOG	STATION		SHEET 1 OF
					OCATION			as, Nevada	<u> </u>				- OFFSET - ENGINEER	CCM	
	14.				BORING		P-01						EQUIPMENT		30 Super L
					.A.#	0	215-01-	·1		GROL	JNDWATE	R LEVEL	OPERATOR	UKN	
					ROUND E	LEV. 7	15.06 (r	n)				ELEV. m	DRILLING METHOD		
			1		AMMER D								BACKFILLED	Yes	DATE 4/13/2000
	ELEV.	DEPTH (m)	I S	AMPLE	150 mm	Last			USCS		MAT	ERIAL D	ESCRIPTION		REMARKS
	714.06	-1			increment	<u>s 300 mn</u>	n Recov'd				0-10 (Into GRAVEL light brow fines, 40% coarse gr	Embankm with SILT a yn, with esti % fine to co ravel to +3" 1 30% by yo	ent): POORLY ( and SAND Moist mated 10% non- arse sand, and ! in diameter. Uni olume cobbles 3'	RADED, dense, plastic 50% fine to	
	713.06	1.53	1	GRAE				Sv, PI, W, Sh, P	GC GM						
	712.06	3								3.05					
	711.06 -	4							-						
NV_DOI 0213011.6PJ NV_DOI.6D1 6/16/00	710.06 -	5													
NV For uz		_													

		-				_ 1	/13/00			EXPLORATION LOG		···-	
					TART DAT		/13/00						SHEET 1 OF
					ND DATE			 95 Widenin	a Proi	act	STATION		·
					OB DESCR			s, Nevada	<u>19 1 10</u>		OFFSET	ССМ	
					OCATION ORING		P-02	10, 1101000			ENGINEER EQUIPMENT		0 Super L
	ż				.A.#	-	215-01-	1	<del></del>	GROUNDWATER LEVEL	OPERATOR	UKN	o ouper E
	1				A. # ROUND EL		15.06 (n			DATE DEPTH m ELEV. m	DRILLING METHOD		
		\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \			AMMER DE			-/				Yes	4/13/2000
			8/	MPLE	BLOW		31 EM	T			BACKFILLED		DATE 4/13/2000
	ELEV. (m)	DEPTH (m)		TYPE		Last	Percent Recov'd	LAB TESTS	USCS Group	MATERIAL DE			REMARKS
	714.06 ·	1								0-10 (Into Embankme GRAVEL with SILT ar light brown, with estim fines, 40% fine to coar coarse gravel to +3" in estimated 30% by voli diameter.	nd SAND Moist, lated 10% non- rse sand, and 5 n diameter. Unit	dense, plastic 50% fine to t contains	
		1.52							GP				
		-							GM				
		-	2A	GRAE				Sv, PI, W,					
	713.06 -	_2						Sh, P					
	7 10.55	2.13											
		-		İ									
		-											
	712.06 -	-3						i		3.05	· · · · · · · · · · · · · · · · · · ·	·	
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#### SOIL CLASSIFICATION CHART

MA.	JOR DIVIS	SIONS	SYMI	BOLS	TYPICAL
	JOIN DIVIS	J10N3		LETTER	DESCRIPTIONS
	GRAVEL AND	CLEAN GRAVELS		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
	GRAVELLY SOILS	(LITTLE OR NO FINES)		GP	POOPLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
COARSE GRAINED SOILS	MORE THAN 50% OF COARSE	GRAVELS WITH FINES		GM	SILTY GRAVELS GRAVEL - SAND - SILT MIXTURES
	FRACTION RETAINED ON NO. 4 SIEVE	(APPRECIABLE AMOUNT OF FINES;		GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
MORE THAN 50%	SAND	CLEAN SANDS		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
OF MATERIAL IS LARGER THAN NO 200 SIEVE SIZE	AND SANDY SOILS	(LITTLE OR NO FINES)		SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION	SANDS WITH FINES		SM	SILTY SANDS, SAND - SILT MIXTURES
	PASSING ON NO. 4 SIEVE			sc	CLAYEY SANDS, SAND - CLAY MIXTURES
				ML	INORGANIC SILTS AND VERY FINE SANDS. ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
FINE GRAINED	SILTS AND CLAYS	LIQUIO LIMIT LESS THAN 50		CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
SOILS				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
MORE THAN 50% OF MATERIAL IS SMALLER THAN				МН	INORGANIC SILTS, MICACEOUS OR DIATCMACEOUS FINE SAND OR SILTY SOILS
NO 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		СН	INORGANIC CLAYS OF HIGH PLASTICITY
				ОН	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
н	GHLY ORGANIC SC	,,,,,	77 77 77 77 3 77 77 77 7 37 75 75 77	PT	PEAT HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

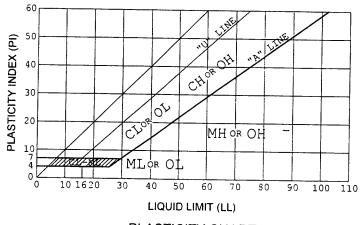
#### **GRAIN SIZE TERMINOLOGY**

Major Component of Sample	Size Range
Boulders	Over 12 in. (300mm)
Cobbles	12 in. to 3 in. (300mm to 75mm)
Gravel	3 in. to #4 sieve (75mm to 2mm)
Sand	# 4 to #200 sieve (2mm to 0.074mm)
Silt or Clay	Passing #200 sieve (0.074mm)

# RELATIVE DENSITY OF GRANULAR SOILS:

N-Blows/ft.	Relative Density
0-4	Very Loose
5-10	Loose
11-30	Medium Dense
31-50	Dense
greater than 50	Very Dense

## NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS



# CONSISTENCY OF OF COHESIVE SOILS:

Unconfined Compressive Strength, psi	N-Blows/ft	Consistency
less than 500	0-1	Very Soft
500-1,000	2-4	Soft
1,000-2,000	5-8	Firm
2,000-4,000	9-15	Stiff
4,000-8,000	16-30	Very Stiff
8,000-16.000	31-60	Hard
greater than 16,000	greater than 60	Very Hard

#### PLASTICITY CHART

FOR CLASSIFICATION OF FINE-GRAINED SOILS AND FINE-GRAINED FRACTION OF COARSE-GRAINED SOILS

Black Eagle Consulting, Inc. 1380 Greg Street, Suite 218 Sparks, Nevada 89431 Telephone: (775) 359-6600 Fax: (775) 359-7766

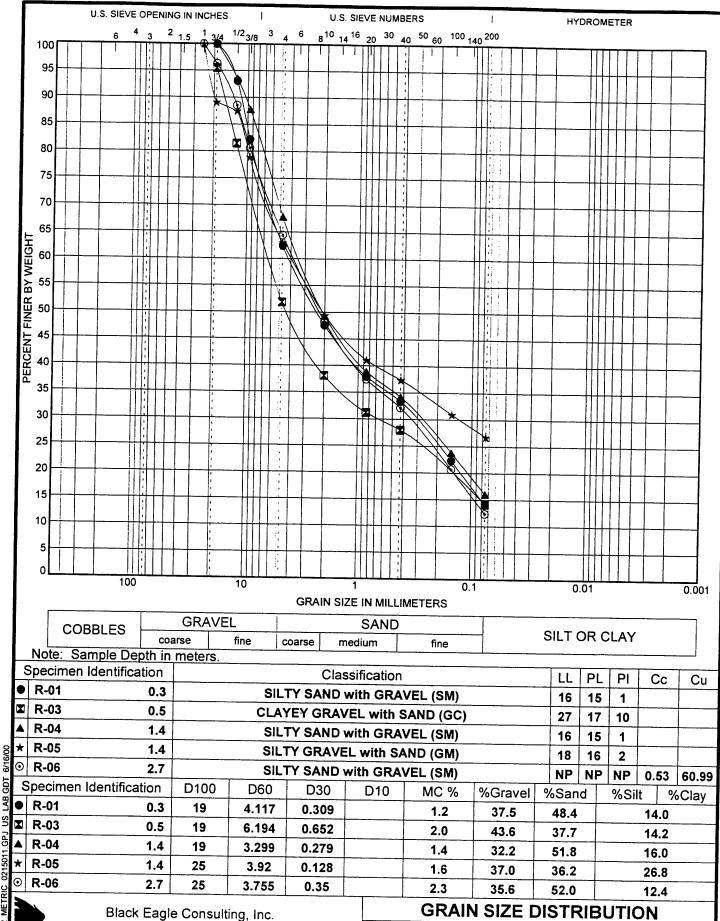
## **USCS Soil Classification**

Project: U.S. 95 Widening Project Location: Las Vegas, Nevada

Project Number: 0215-01-1

Plate Number: 3

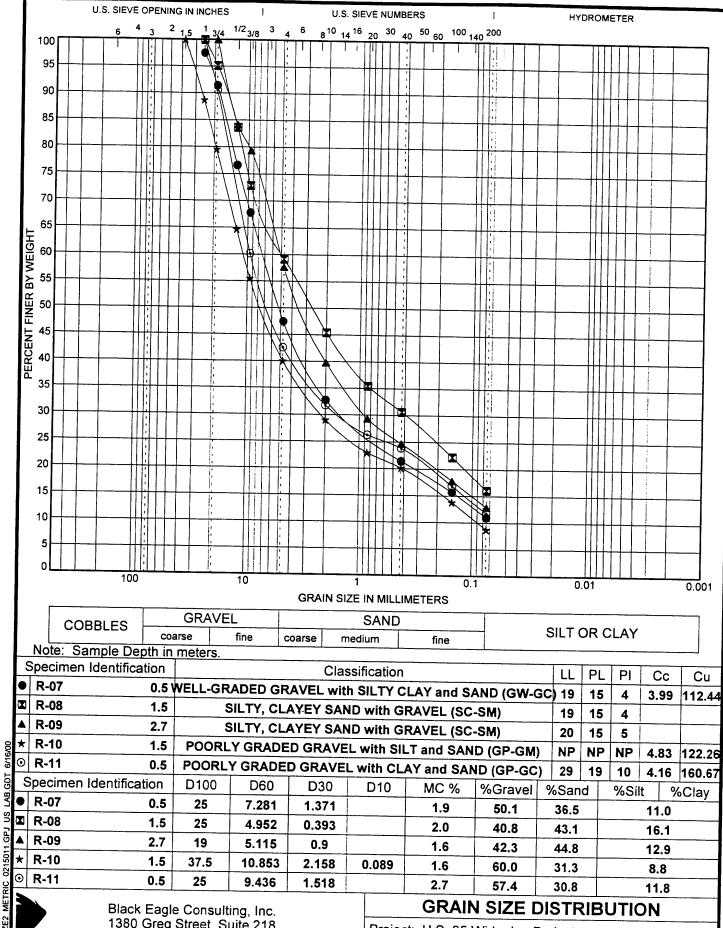
USCS CHART 0215011.GPJ US LAB.GDT 2/28/00



Project: U.S. 95 Widening Project

Location: Las Vegas, Nevada

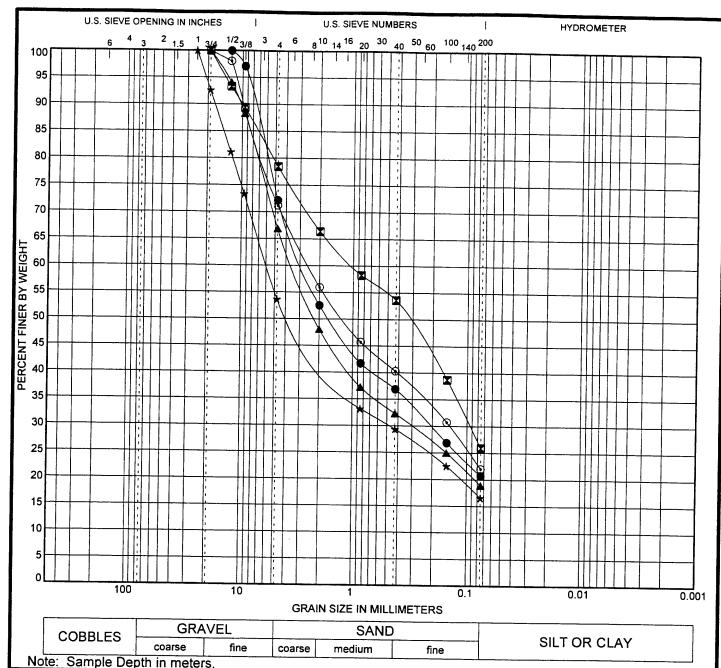
Project Number: 0215-01-1 Plate Number: 4a



Project: U.S. 95 Widening Project

Location: Las Vegas, Nevada

Project Number: 0215-01-1 Plate Number: 4b



_		J D OP CO. III	11101010.										
Ľ	Specimen Ider	ntification			Clas	sification			LL	PL	PI	Сс	Cu
•	R-12	2.7		CLA	YEY SAND	with GR	AVEL (SC)		30	17	13		
X	R-13	2.7					AVEL (SC)		32	19	13		
A	R-14	1.5	S				RAVEL (SC	-SM)	25	18	7		-
*	R-15	0.5		SILTY, CLAYEY GRAVEL with SAND (GC-GM)							6		+
<b>★</b>	R-16	1.2								15 14	3		
S	Specimen Ider	ntification	D100	D60	D30	D10	MC %	%Gravel	17 %San	ь.,	%Sil	+   (	⊥ %Clay
	R-12	2.7	12.5	2.775	0.207		3.2	27.8	51.5		70011	20.7	70 Olay
X	R-13	2.7	19	1.019	0.093		4.6	21.6	52.5			25.9	<del></del>
<b>A</b>	R-14	1.5	19	3.46	0.306		3.3	33.1	48.0			18.9	· · · · ·
*	R-15	0.5	25	5.937	0.475		2.1	46.3	37.1			16.6	
0	R-16	12	10	2.540	0.444			1 3.0				- 3.0	

19

2.516

0.141

1.2

⊚ R-16

METRIC

## **GRAIN SIZE DISTRIBUTION**

49.2

28.8

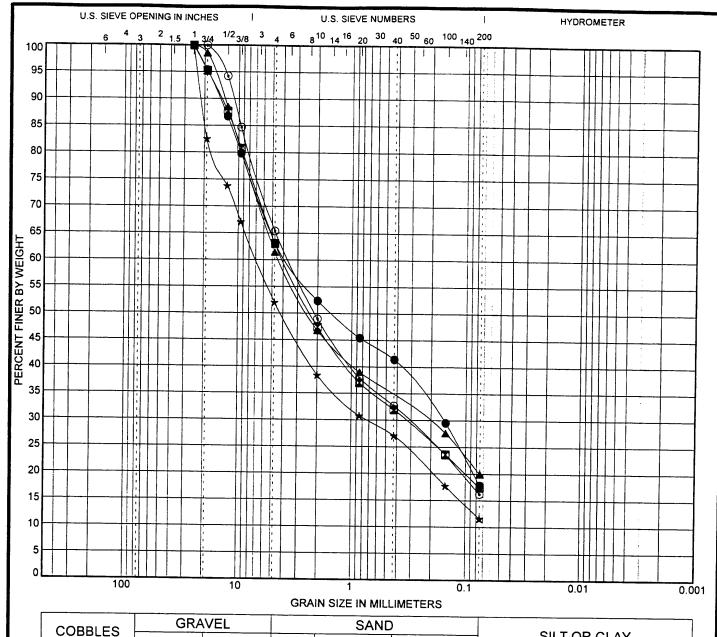
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Project: U.S. 95 Widening Project

Location: Las Vegas, Nevada

2.2

Project Number: 0215-01-1 Plate Number: 4c



	GRA	VEL		SAND	)	
coarse		fine	coarse	medium	fine	SILT OR CLAY

N	loto:	Samo	1	Da	ath		meters
ľ	IUIE.	Sallio		: Del	JUL	и	meters

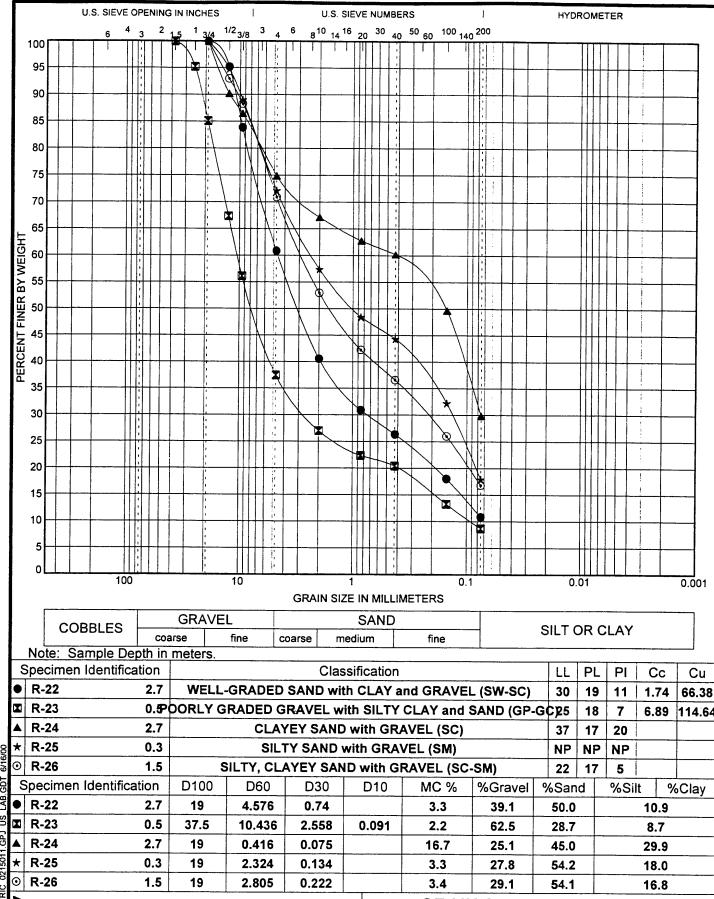
LS	Specimen Identification			Clas	sification			LL	PL	PI	Сс	Cu
•	R-17 0.3		SIL'	TY SAND	17	16	1		"			
X	R-18 1.5		SIL.	TY-SAND	17	14	3	<del>                                     </del>				
Δ	R-19 0.5	S	SILTY, CLAYEY SAND with GRAVEL (SC-SM)								<u>-</u> 	<del> </del>
*	R-20 0.3		GC) 24	14	7	1.25	110.07					
★ R-200.3 WELL-GRADED GRAVEL with SILTY CLAY and SAND (GW-GOOD)⊙ R-211.5SILTY SAND with GRAVEL (SM)									17	3		1.0.0.
	Specimen Identification	D100	D60	D30	D10	MC %	%Gravel	%Sar	nd	%Sil	t 9	6Clay
•	R-17 0.3	25	3.686	0.156		3.9	36.8	45.3			17.8	00.4
K	R-18 1.5	25	4.009	0.332	-	2.6	36.9	45.6			17.4	
Δ	R-19 0.5	25	4.359	0.215	-	2.8	38.5	41.5			20.0	
<b>★</b>	R-20 0.3	25	6.848	0.73		2.5	48.0	40.4		· · · · · · · · · · · · · · · · · · ·	11.6	
⊙	R-21 1.5	19	3.576	0.313		2.4	34.6	49.2	<del></del>		16.2	
) //	Black Eag	le Consult	ina. Inc.	·		GRAII	N SIZE			JTIC		

#### **GRAIN SIZE DISTRIBUTION**

Project: U.S. 95 Widening Project

Location: Las Vegas, Nevada

Project Number: 0215-01-1 Plate Number: 4d



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SIZE2

Black Eagle Consulting, Inc. 1380 Greg Street, Suite 218 Sparks, Nevada 89431 Telephone: (775) 359-6600

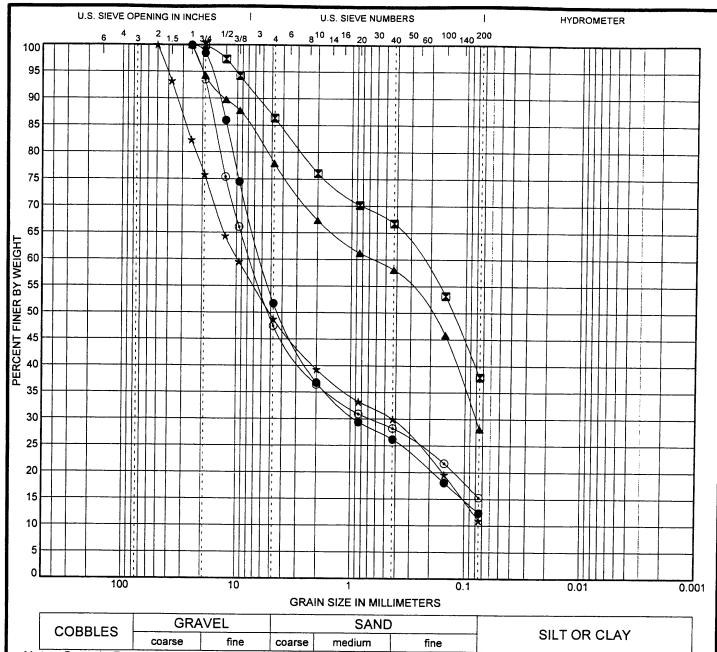
Fax: (775) 359-7766

#### GRAIN SIZE DISTRIBUTION

Project: U.S. 95 Widening Project

Location: Las Vegas, Nevada

Project Number: 0215-01-1 Plate Number: 4e



COBBLES	GRA	VEL		SAND	)	CIL T OR OLAY
OODDELEG	coarse	fine	coarse	medium	fine	SILT OR CLAY

Note: Sample Depth in meters. Specimen Identification Classification LL PL Ы Cc Cu ● R-27 0.5 SILTY, CLAYEY GRAVEL with SAND (GC-GM) 22 16 6 2.41 108.74 X R-28 2.7 -CLAYEY SAND (SC) 37 17 20 R-29 1.5 **CLAYEY SAND with GRAVEL (SC)** 22 13 9 **TP-01** 1.5 POORLY GRADED GRAVEL with SILT and SAND (GP-GM) NP NP NP 0.27 140.87 0 WL-01 0.3 **CLAYEY GRAVEL with SAND (GC)** 24 16 8 Specimen Identification D100 D60 D30 D10 MC % %Gravel %Sand %Silt %Clay R-27 0.5 25 6.107 0.909 2.6 48.3 39.4 12.4 W R-28 2.7 19 0.252 8.7 13.6 48.5 37.9 0215011.GPJ R-29 1.5 25 0.646 0.081 5.2 22.1 49.8 28.2 **TP-01** 1.5 50 9.74 0.428 3.5 51.2 37.8 11.0 0 **WL-01** 0.3 25 7.574 0.668 2.9 52.5 32.2 15.3



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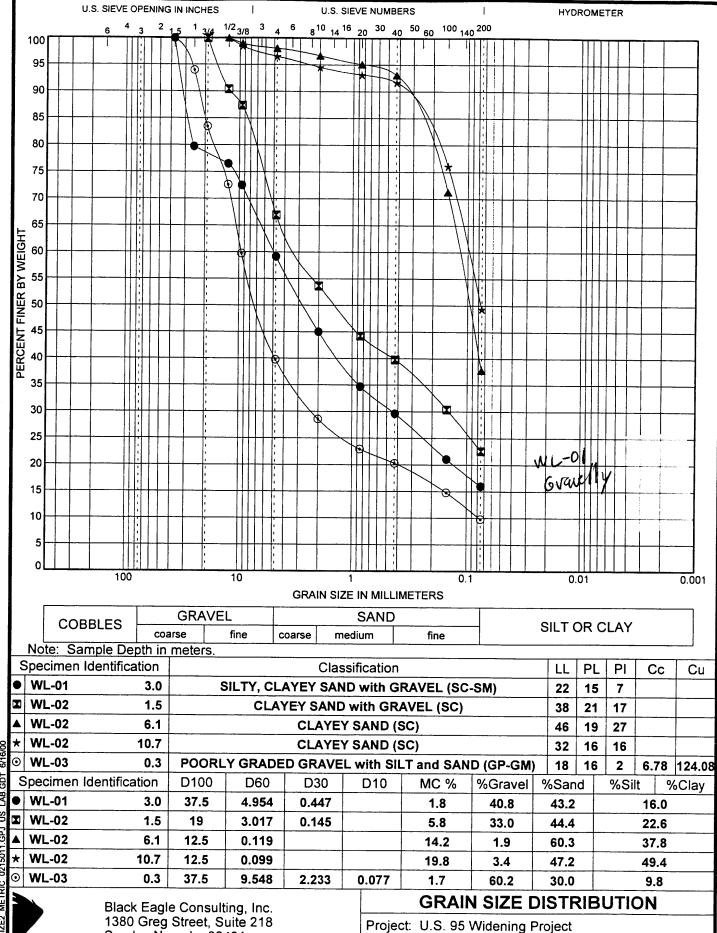
#### **GRAIN SIZE DISTRIBUTION**

Project: U.S. 95 Widening Project

Location: Las Vegas, Nevada

Project Number: 0215-01-1

Plate Number: 4f

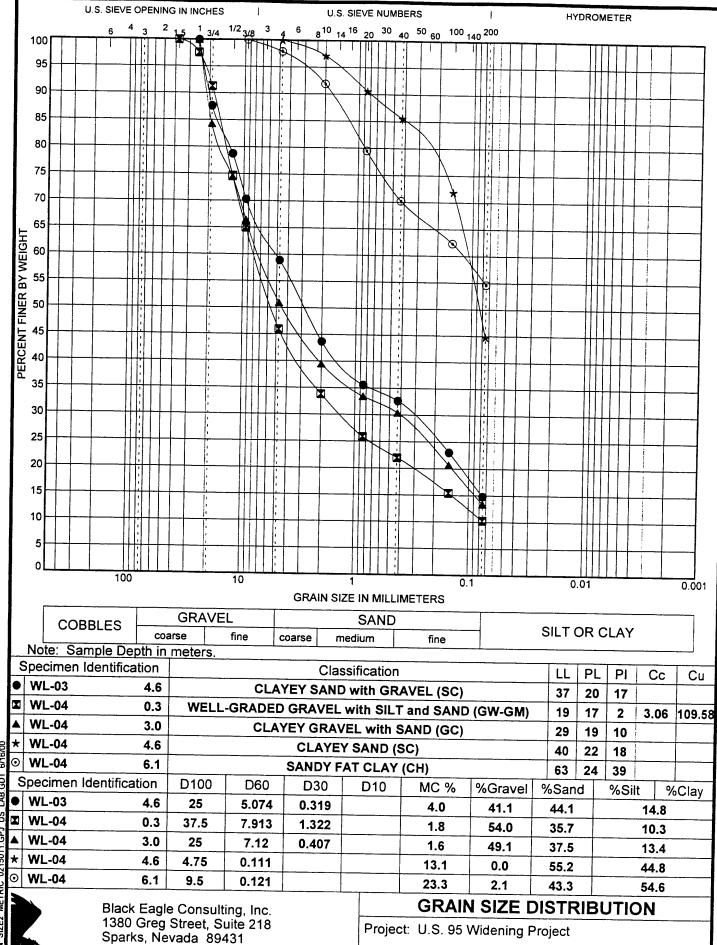


Sparks, Nevada 89431 Telephone: (775) 359-6600

Fax: (775) 359-7766

Location: Las Vegas, Nevada

Project Number: 0215-01-1 Plate Number: 4g



Location: Las Vegas, Nevada

Plate Number:

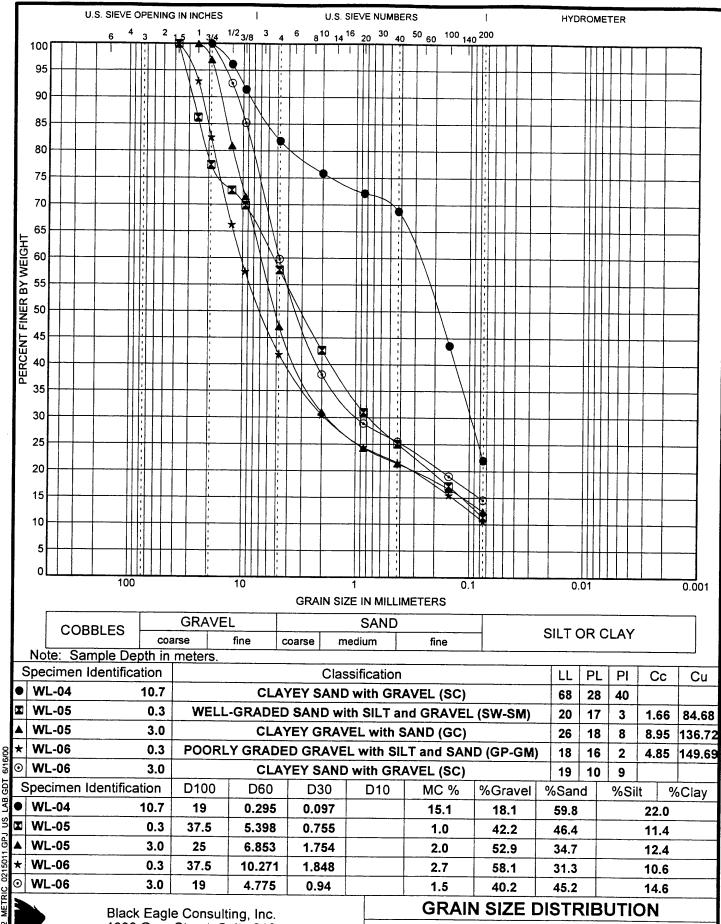
4h

Project Number: 0215-01-1

US GRAIN SIZE2 METRIC 0215

Telephone: (775) 359-6600

Fax: (775) 359-7766

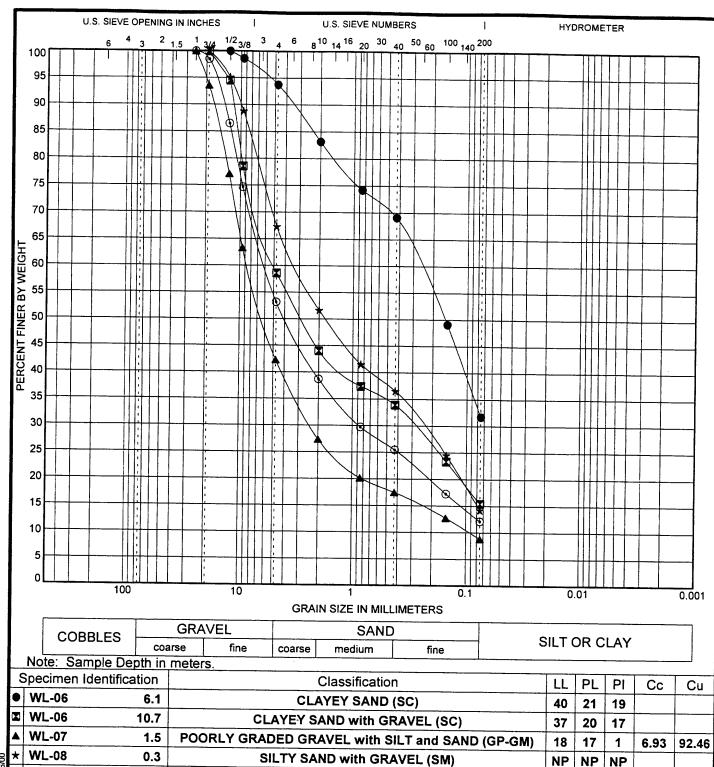


Fax: (775) 359-7766

Project: U.S. 95 Widening Project Location: Las Vegas, Nevada

Project Number: 0215-01-1 Plate Number:

4i



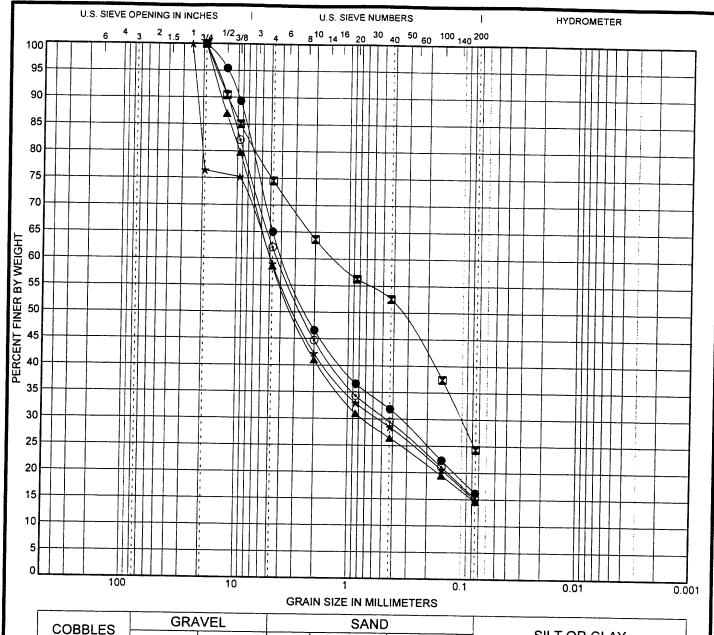
1		Ampic Deput in	meters.										
		Identification			Clas	ssification			LL	PL	PI	Cc	Cu
•	WL-06	6.1			CLAYE	Y SAND (S	40	21	19				
	WL-06	10.7		CLA	YEY SAND		37	20	17		<del> </del>		
A	WL-07	1.5	POORL		ID (GP-GM)	18	17	1	6.93	92.46			
<b>★</b>	WL-08	0.3		SIL	NP	NP	NP	0.00	02.40				
0	WL-08	4.6		SILT	TY GRAVE	L with SA	ND (GM)		19	17	2	2.27	105.09
		Identification	D100	D60	D30	D10	MC %	%Gravel	%San	d	%Si		6Clay
•		6.1	12.5	0.264			11.0	6.2	62.0			31.8	
×	WL-06	10.7	19	4.984	0.289		3.6	41.4	43.2			15.4	
Δ	WL-07	1.5	25	8.513	2.33	0.092	1.0	57.7	33.4	<del></del>		8.9	
*	WL-08	0.3	19	3.165	0.241		0.6	32.6	53.1			14.3	
0	WL-08	4.6	25	5.922	0.871		2.1	46.8	41.0	_		12.1	
3	_	Black Eagl	e Consult	ina. Inc.	· · · · · · · · · · · · · · · · · · ·		GRAII	N SIZE			JTI		

# GRAIN SIZE DISTRIBUTION Project: U.S. 95 Widening Project

Location: Las Vegas, Nevada

Project Number: 0215-01-1 Plate Number:

4j



COBBLES	GRA	VEL		SAND		
	coarse	fine	coarse	medium	fine	SILT OR CLAY
te. Sample Do	oth in motor	-				

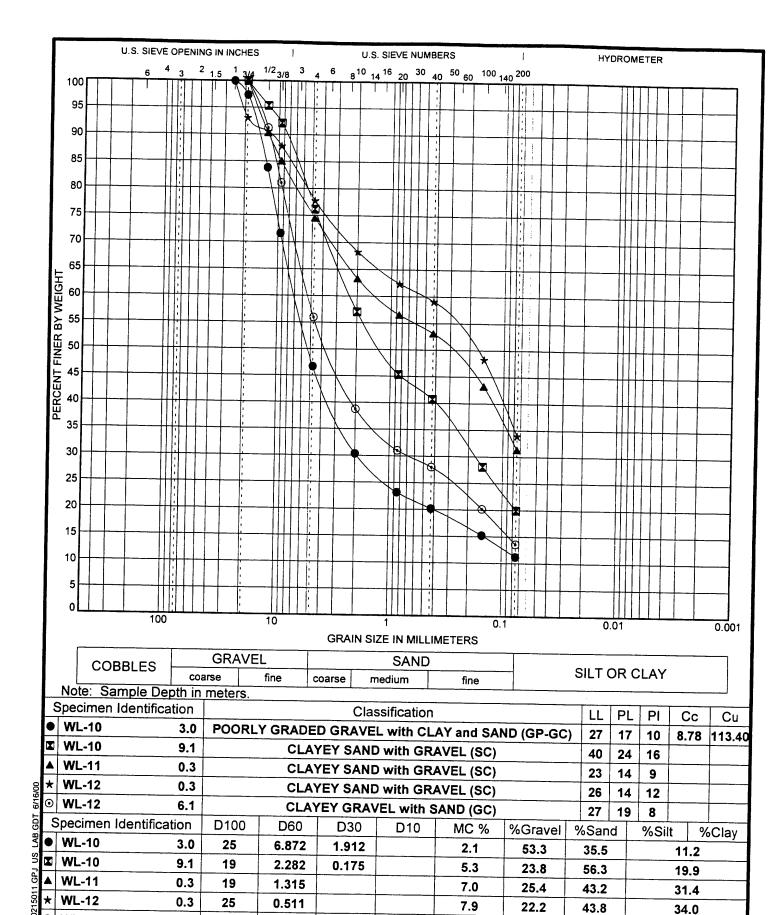
<u> </u>	Tiole. Gai	ubie pebui ili	meters.										
Specimen Identification			Classification						LL	PL	PI	Сс	Cu
•	WL-08	7.6	SILTY, CLAYEY SAND with GRAVEL (SC-SM)						25	18	7		Ou
X	WL-08	10.7	CLAYEY SAND with GRAVEL (SC)						45	21	24		
•	WL-09	1.5	SILTY, CLAYEY SAND with GRAVEL (SC-SM)						19	15	4		
*	WL-09	3.0	SILTY SAND with GRAVEL (SM) SILTY SAND with GRAVEL (SM)						21	18	3		
<b>★</b>	WL-10	1.5							17	16	1		
	Specimen I	dentification	D100	D60	D30	D10	MC %	%Gravel	%San		%Silt	0/	Clay
•	WL-08	7.6	19	3.75	0.347		3.9	35.0	48.8	<u> </u>	16.2		Clay
X	WL-08	10.7	19	1.306	0.101	-	9.4	25.5	50.2				
▲	WL-09	1.5	19	4.969	0.73		1.8	41.4	44.0		14.6		
*	WL-09	3.0	25	4.949	0.538		1.9	41.0	44.2		14.9		
0	WL-10	1.5	19	4.273	0.458		1.7	37.9	46.9	_	15.2		
		Black Eagle	e Consult	ing, Inc.		GRAIN SIZE DISTRIBUTION							

## **GRAIN SIZE DISTRIBUTION**

4k

Project: U.S. 95 Widening Project Location: Las Vegas, Nevada

Project Number: 0215-01-1 Plate Number:



19

5.311

0.672

Fax: (775) 359-7766

6.1

⊙

WL-12

#### GRAIN SIZE DISTRIBUTION

42.4

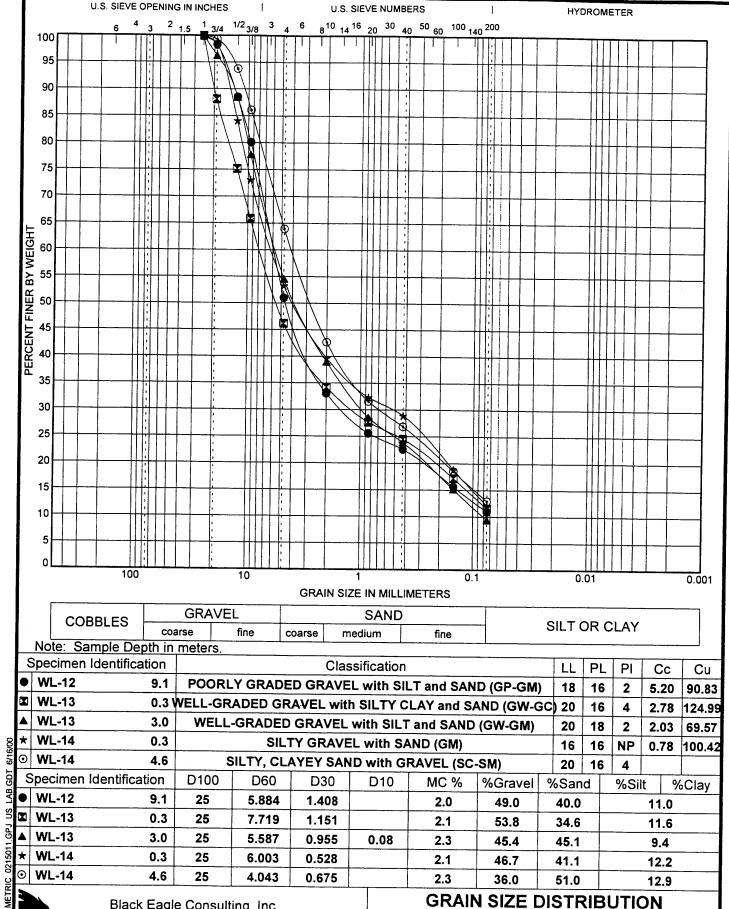
13.6

Project: U.S. 95 Widening Project Location: Las Vegas, Nevada

44.0

3.0

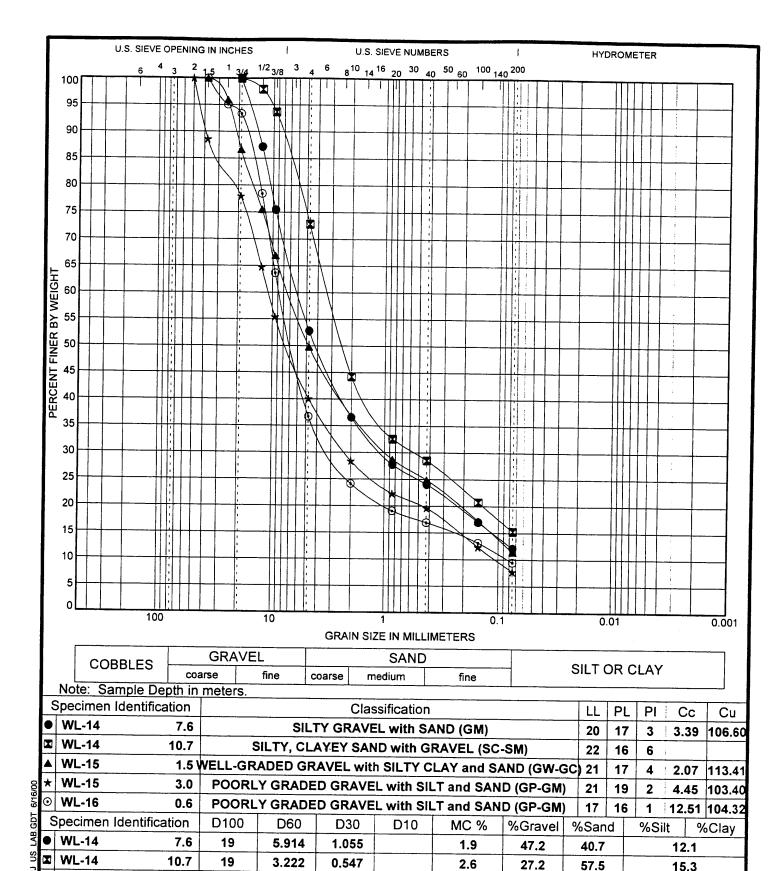
Project Number: 0215-01-1 Plate Number: 4



Project: U.S. 95 Widening Project Location: Las Vegas, Nevada

Project Number: 0215-01-1

Plate Number: 4m



37.5

50

37.5

7.178

10.853

8.644

0.971

2.252

2.994

0.105

0.083

1.5

3.0

0.6

**WL-15** 

WL-15

WL-16

\*

0

#### **GRAIN SIZE DISTRIBUTION**

38.4

32.3

27.2

11.4

7.8

9.5

4n

Project: U.S. 95 Widening Project

Location: Las Vegas, Nevada

2.4

2.4

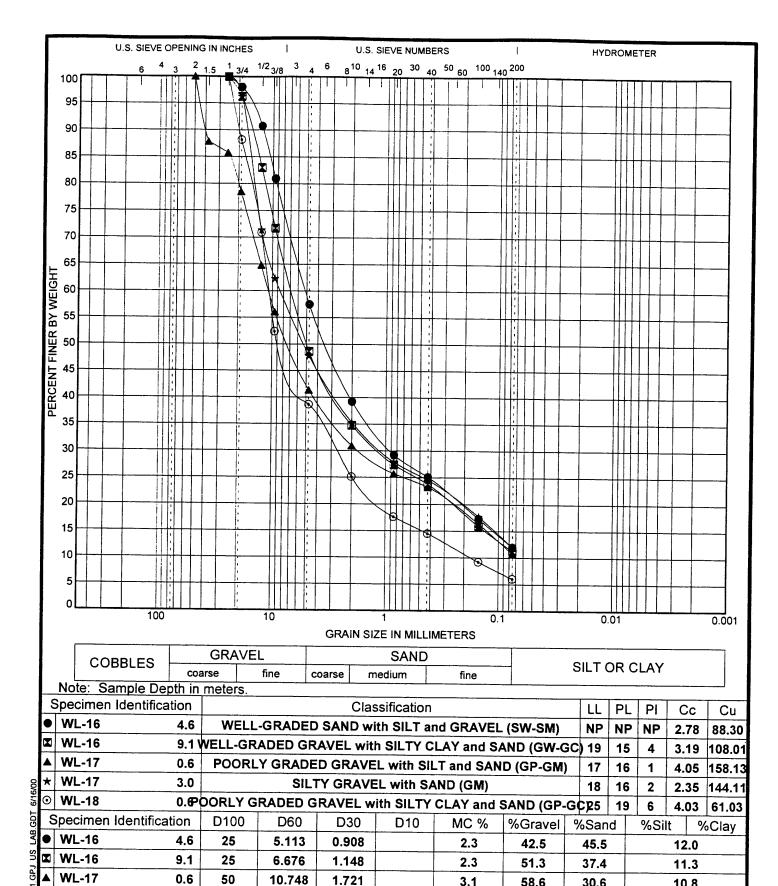
1.7

Project Number: 0215-01-1 Plate Number:

50.2

59.9

63.3



25

25

8.48

10.632

1.082

2.734

0.174

3.0

0.6

WL-17

WL-18

0

METRIC

### **GRAIN SIZE DISTRIBUTION**

30.6

35.8

32.6

58.6

52.2

61.3

Project: U.S. 95 Widening Project

Location: Las Vegas, Nevada Project Number: 0215-01-1

3.1

2.5

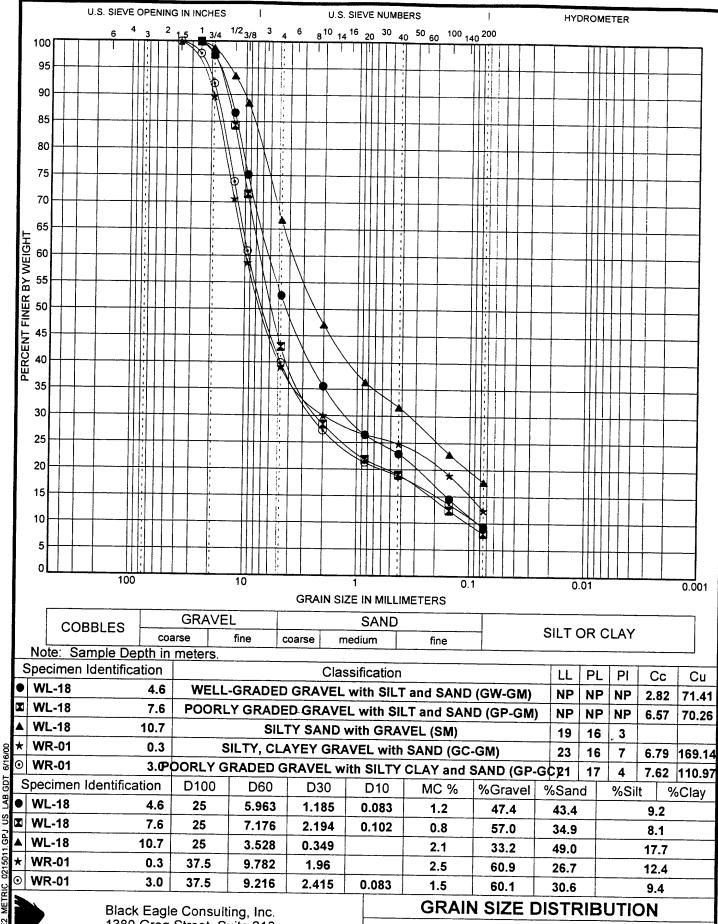
0.9

Plate Number: 40

10.8

12.0

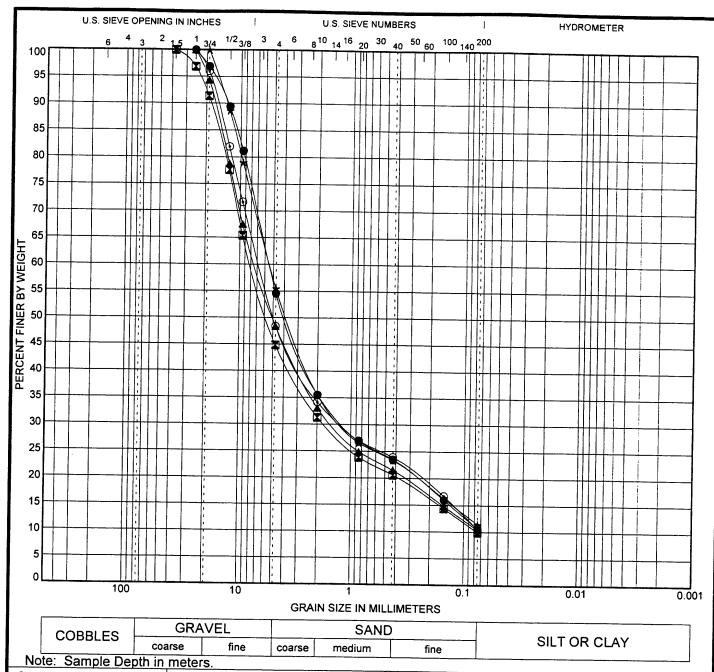
6.1



Project: U.S. 95 Widening Project

Location: Las Vegas, Nevada

Project Number: 0215-01-1 Plate Number: 4p



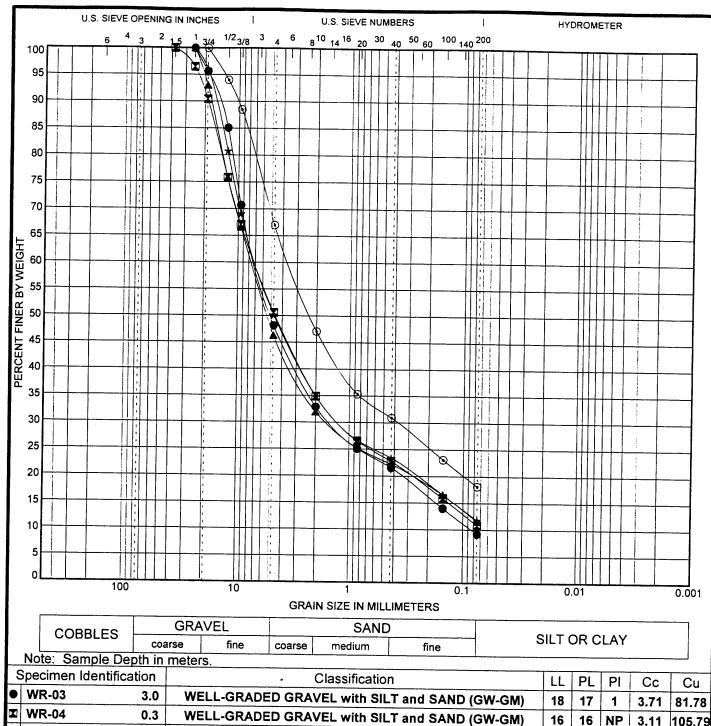
_			,,,, <u>o.co.o.</u>	<del></del>									
Ŀ	Specimen I	dentification			Clas	ssification			LL	PL	PI	Сс	Cu
•	WR-02	1.5	WELL-GF	RADED GR	RAVEL wit	h SILTY C	LAY and SA	AND (GW-G	C) 23	17	6	3.54	78.89
X	WR-02	4.6P	OORLY C	RADED G	RAVEL w	ith SILTY	CLAY and	SAND (GP-	GCP4	17	7	4.96	104.58
A	WR-02						CLAY and			16	7		<del></del>
*	WR-02						CLAY and			17	-		103.44
<b>★</b>	WR-03	0.3					and SAND				5		89.09
	<del></del>							·	18	16	2	3.13	94.90
	Specimen id	dentification	D100	D60	D30	D10	MC %	%Gravel	%San	d	%Sil	t %	Clay
•	WR-02	1.5	25	5.473	1.159		2.2	45.4	44.0			10.6	
X	WR-02	4.6	37.5	7.913	1.724	0.076	2.1	55.1	34.9	+		9.9	
<b>A</b>	WR-02	7.6	25	7.236	1.451		2.1	51.6	37.9	-		10.4	
<b>★</b>	WR-02	10.7	19	5.426	1.183		2.5	44.5		-			
	M/D 02							44.5	44.0			11.4	
	WR-03	0.3	25	6.712	1.219		2.0	51.6	37.9			10.5	
3		Black Eagl	e Consul	ting, Inc.			GRAIN	SIZE	ISTF	RIBL	JTIC	ON.	

### **GRAIN SIZE DISTRIBUTION**

Project: U.S. 95 Widening Project

Location: Las Vegas, Nevada

Project Number: 0215-01-1 Plate Number: 4q



┡	INOIE. 5	sample Depth in	meters.										
L	Specimer	n Identification			· Clas	ssification			LL	PL	PI	Сс	Cu
ŀ	● WR-03	3.0	WELL	-GRADED	) GRAVEL	with SILT	T and SAND	(GW-GM)		17	1	3.71	81.78
C	<b>▼</b> WR-04	0.3					T and SAND			16	NP	3.11	105.79
1	▲ WR-04	4.6					AY and SA			18	14	5.37	126.84
g,	<b>★ WR-04</b>	7.6 \					LAY and SA			17	6	1	118.15
6/16/00	⊙ WR-04	10.7					AVEL (SC)		45	22	23	5.03	1 10.15
		n Identification	D100	D60	D30	D10	MC %	%Gravel	%San	1 = 7 1	%Sil	t 0/	⊥ 6Clay
YBB.	● WR-03	3.0	25	6.836	1.457	0.084	1.8	51.8	38.9	-+	7001	9.3	Clay
SD D	<b>▼</b> WR-04	0.3	37.5	7.056	1.211		1.7	49.4	39.7			10.9	
do do la	▲ WR-04	4.6	25	7.582	1.56		2.4	53.7	34.7			11.6	
¥ 50	<b>★</b> WR-04	7.6	25	6.812	1.203		2.2	49.9	38.3			11.8	
0 021	⊙ WR-04	10.7	19	3.506	0.377		4.5	33.0	48.9			10.0	

# **GRAIN SIZE DISTRIBUTION**

48.9

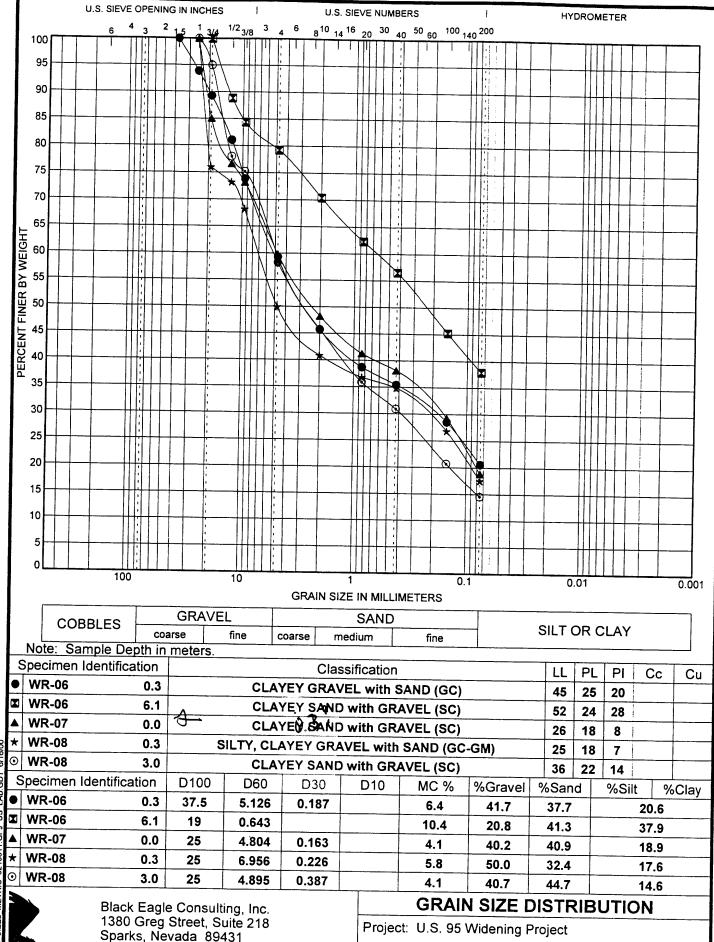
18.1

Project: U.S. 95 Widening Project Location: Las Vegas, Nevada

33.0

4.5

Project Number: 0215-01-1 Plate Number: 4г



Location: Las Vegas, Nevada

Plate Number:

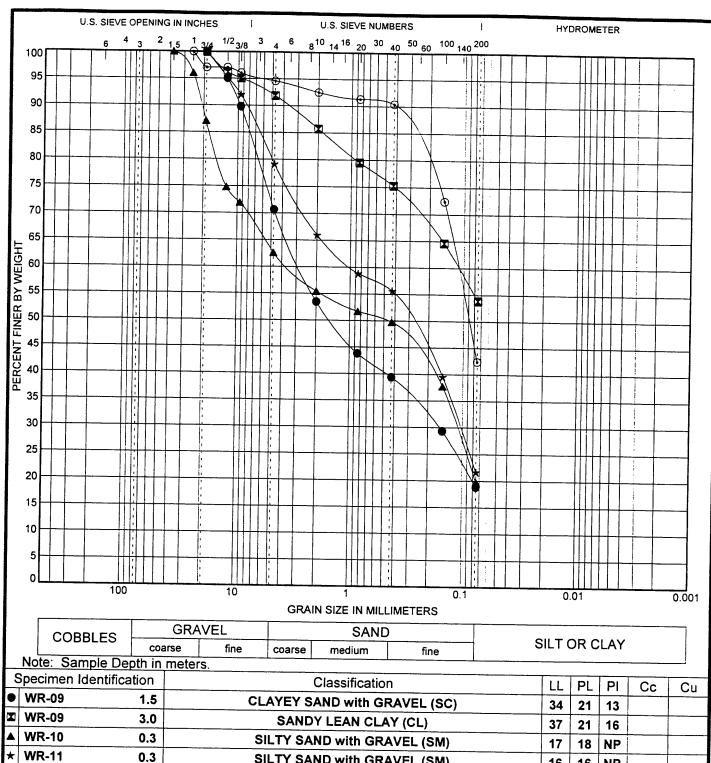
4s

Project Number: 0215-01-1

US GRAIN SIZE2 METRI

Telephone: (775) 359-6600

Fax: (775) 359-7766



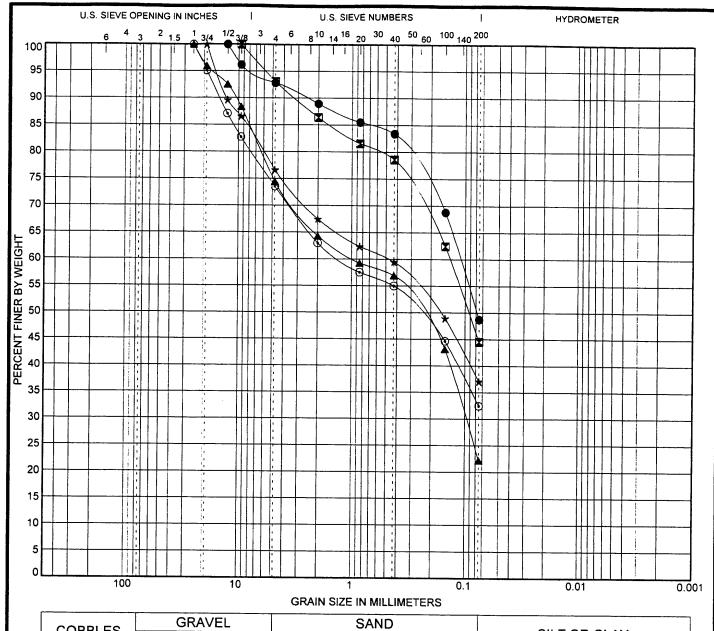
$\vdash$	Hote. Camp		meters.										
	Specimen Ide	ntification			Clas	sification	**	***************************************	LL	PL	Ы	Cc	Cu
•	WR-09	1.5		CLAY	YEY SAND	with GR	AVEL (SC)		34	21	13	-	<u> </u>
X	WR-09	3.0			SANDY LE				37	21	16		
<b>A</b>	WR-10	0.3			TY SAND				17	18	NP		
*	WR-11	0.3			TY SAND			····	16	16	NP		
<b>*</b>	WR-11	3.7				SAND (S			34	12	22		
	Specimen Ide	ntification	D100	D60	D30	D10	MC %	%Gravel	%San		%Sil	t 0/	6Clay
•	WR-09	1.5	19	2.774	0.16		3.7	29.3	51.8		70011	18.9	ociay
X	WR-09	3.0	19	0.111			11.9	8.1	38.0			53.9	
Δ	WR-10	0.3	37.5	3.46	0.111		3.2	37.4	42.9	+		19.8	
*	WR-11	0.3	19	0.975	0.103		4.6	20.8	57.5	_		21.7	
0	WR-11	3.7	25	0.113			11.1	5.4	52.2			42.4	
3		Black Eagle	e Consult	ina, Inc.	<u>-</u>			N SIZE		RIBI	JTIC		

# **GRAIN SIZE DISTRIBUTION**

4t

Project: U.S. 95 Widening Project Location: Las Vegas, Nevada

Project Number: 0215-01-1 Plate Number:



	COBBLES	GRA	VEL		SAND		SILT OR CLAY					
		coarse	fine	coarse	medium	fine	SILI					
Not	e: Sample De	oth in meter	S.			<del></del>						
Spec	cimen Identifica	ition			Classification		LL	PL	PI	Сс		
● WF	₹-12	7.6		CLA	YEY SAND (	SC)	25	15	10		T	

1	Ŀ	Specimen identification			Clas	LL	PL	PI	Cc	Cu			
ļ	•	WR-12 7.6			CLAYE	25	15	10					
1	M	WR-12 10.7			CLAYE	56	26	30					
ı	A	WR-13 0.3		SIL	TY SAND	16	16	NP					
8	*	WR-13 3.0		CLA	YEY SAND	with GR	AVEL (SC)		39	21	18		
	<b>★</b> ⊙	WR-14 1.5		CLA	YEY SAND	with GR	AVEL (SC)	· · · · · · · · · · · · · · · · · · ·	26	15	11		*****
GDT	ű	Specimen Identification	D100	D60	D30	D10	MC %	%Gravel	%Sar	nd	%Silt	<b>\</b> %	Clay
ന													•

*	WR-13	3.0		CLAY	YEY SAND	with GRA	AVEL (SC)		39	21	18	
⊙	WR-14	1.5		CLAY	EY SAND	with GRA	AVEL (SC)		26	15	11	
	Specimen Ide	entification	D100	D60	D30	D10	MC %	%Gravel	%Sar	d	%Silt	%Clay
•	WR-12	7.6	12.5	0.111			9.5	7.1	44.1		4	8.7
X	WR-12	10.7	9.5	0.136			16.0	6.9	48.6			4.5
<b>A</b>	WR-13	0.3	25	0.961	0.097		2.7	25.5	52.3			2.2
*	WR-13	3.0	19	0.476			9.0	23.4	39.5			7.1
0	WR-14	1.5	25	1.251			7.0	26.4	41.1			2.5
	* <b>F B</b> • 0	<ul> <li>WR-14</li> <li>Specimen Ide</li> <li>WR-12</li> <li>WR-12</li> <li>WR-13</li> <li>★ WR-13</li> </ul>	<ul> <li>WR-14 1.5</li> <li>Specimen Identification</li> <li>WR-12 7.6</li> <li>WR-12 10.7</li> <li>WR-13 0.3</li> <li>WR-13 3.0</li> </ul>	WR-14       1.5         Specimen Identification       D100         WR-12       7.6       12.5         WR-12       10.7       9.5         WR-13       0.3       25         WR-13       3.0       19	WR-14       1.5       CLAY         Specimen Identification       D100       D60         ● WR-12       7.6       12.5       0.111         WR-12       10.7       9.5       0.136         ▲ WR-13       0.3       25       0.961         ★ WR-13       3.0       19       0.476	WR-14       1.5       CLAYEY SAND         Specimen Identification       D100       D60       D30         ● WR-12       7.6       12.5       0.111         WR-12       10.7       9.5       0.136         ▲ WR-13       0.3       25       0.961       0.097         ★ WR-13       3.0       19       0.476	WR-14       1.5       CLAYEY SAND with GRAMS         Specimen Identification       D100       D60       D30       D10         ● WR-12       7.6       12.5       0.111       0.136 <t< td=""><td>WR-14       1.5       CLAYEY SAND with GRAVEL (SC)         Specimen Identification       D100       D60       D30       D10       MC %         ● WR-12       7.6       12.5       0.111       9.5         WR-12       10.7       9.5       0.136       16.0         ▲ WR-13       0.3       25       0.961       0.097       2.7         ★ WR-13       3.0       19       0.476       9.0</td><td>WR-14       1.5       CLAYEY SAND with GRAVEL (SC)         Specimen Identification       D100       D60       D30       D10       MC %       %Gravel         WR-12       7.6       12.5       0.111       9.5       7.1         WR-12       10.7       9.5       0.136       16.0       6.9         WR-13       0.3       25       0.961       0.097       2.7       25.5         WR-13       3.0       19       0.476       9.0       23.4</td><td>WR-14       1.5       CLAYEY SAND with GRAVEL (SC)       26         Specimen Identification       D100       D60       D30       D10       MC % %Gravel %San         ● WR-12       7.6       12.5       0.111       9.5       7.1       44.1         ▼ WR-12       10.7       9.5       0.136       16.0       6.9       48.6         ▲ WR-13       0.3       25       0.961       0.097       2.7       25.5       52.3         ★ WR-13       3.0       19       0.476       9.0       23.4       39.5</td><td>WR-14       1.5       CLAYEY SAND with GRAVEL (SC)       26       15         Specimen Identification       D100       D60       D30       D10       MC % %Gravel %Sand         ● WR-12       7.6       12.5       0.111       9.5       7.1       44.1         WR-12       10.7       9.5       0.136       16.0       6.9       48.6         WR-13       0.3       25       0.961       0.097       2.7       25.5       52.3         ★ WR-13       3.0       19       0.476       9.0       23.4       39.5</td><td>WR-14       1.5       CLAYEY SAND with GRAVEL (SC)       26       15       11         Specimen Identification       D100       D60       D30       D10       MC %       %Gravel       %Sand       %Silt         WR-12       7.6       12.5       0.111       9.5       7.1       44.1       44.1         WR-12       10.7       9.5       0.136       16.0       6.9       48.6       4.4         WR-13       0.3       25       0.961       0.097       2.7       25.5       52.3       2.7         WR-13       3.0       19       0.476       9.0       23.4       39.5       3</td></t<>	WR-14       1.5       CLAYEY SAND with GRAVEL (SC)         Specimen Identification       D100       D60       D30       D10       MC %         ● WR-12       7.6       12.5       0.111       9.5         WR-12       10.7       9.5       0.136       16.0         ▲ WR-13       0.3       25       0.961       0.097       2.7         ★ WR-13       3.0       19       0.476       9.0	WR-14       1.5       CLAYEY SAND with GRAVEL (SC)         Specimen Identification       D100       D60       D30       D10       MC %       %Gravel         WR-12       7.6       12.5       0.111       9.5       7.1         WR-12       10.7       9.5       0.136       16.0       6.9         WR-13       0.3       25       0.961       0.097       2.7       25.5         WR-13       3.0       19       0.476       9.0       23.4	WR-14       1.5       CLAYEY SAND with GRAVEL (SC)       26         Specimen Identification       D100       D60       D30       D10       MC % %Gravel %San         ● WR-12       7.6       12.5       0.111       9.5       7.1       44.1         ▼ WR-12       10.7       9.5       0.136       16.0       6.9       48.6         ▲ WR-13       0.3       25       0.961       0.097       2.7       25.5       52.3         ★ WR-13       3.0       19       0.476       9.0       23.4       39.5	WR-14       1.5       CLAYEY SAND with GRAVEL (SC)       26       15         Specimen Identification       D100       D60       D30       D10       MC % %Gravel %Sand         ● WR-12       7.6       12.5       0.111       9.5       7.1       44.1         WR-12       10.7       9.5       0.136       16.0       6.9       48.6         WR-13       0.3       25       0.961       0.097       2.7       25.5       52.3         ★ WR-13       3.0       19       0.476       9.0       23.4       39.5	WR-14       1.5       CLAYEY SAND with GRAVEL (SC)       26       15       11         Specimen Identification       D100       D60       D30       D10       MC %       %Gravel       %Sand       %Silt         WR-12       7.6       12.5       0.111       9.5       7.1       44.1       44.1         WR-12       10.7       9.5       0.136       16.0       6.9       48.6       4.4         WR-13       0.3       25       0.961       0.097       2.7       25.5       52.3       2.7         WR-13       3.0       19       0.476       9.0       23.4       39.5       3



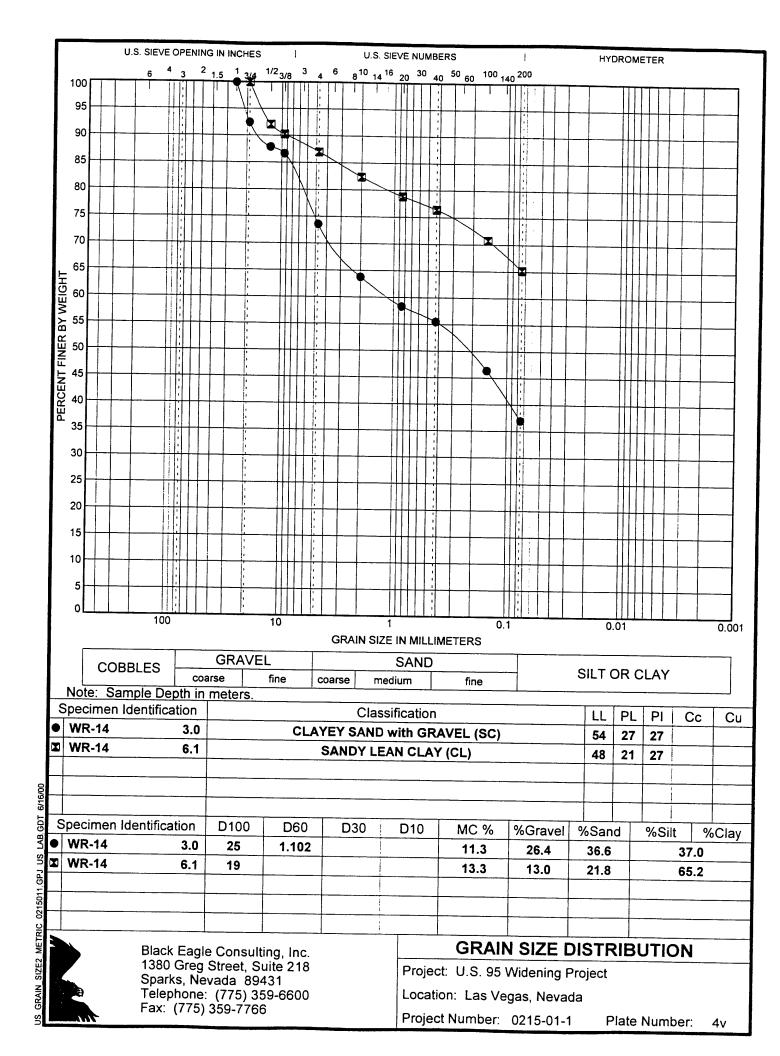
### **GRAIN SIZE DISTRIBUTION**

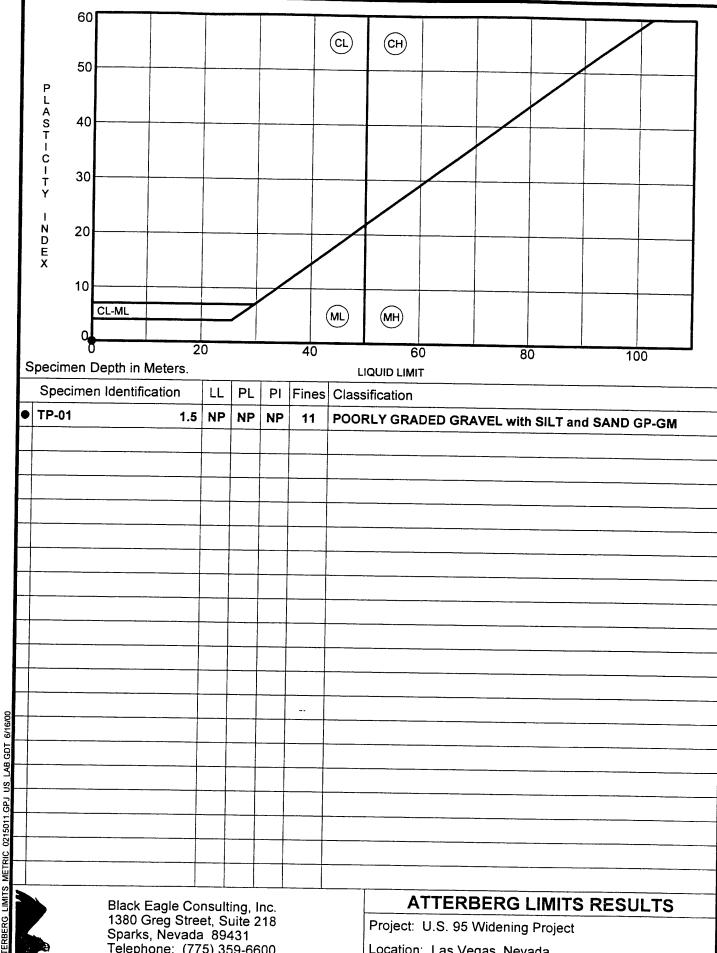
Project: U.S. 95 Widening Project Location: Las Vegas, Nevada

Project Number: 0215-01-1

Plate Number:

4u





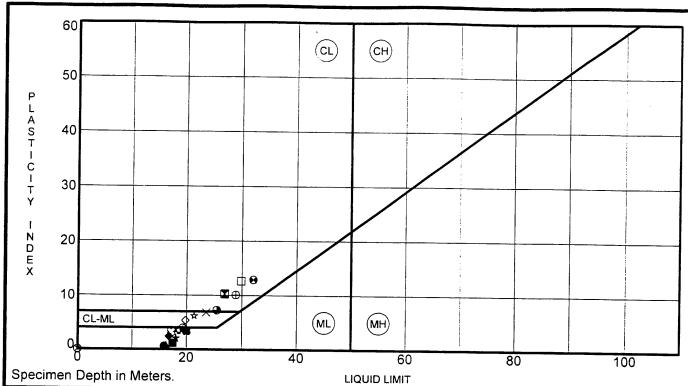
IMITS METRIC

Telephone: (775) 359-6600 Fax: (775) 359-7766

Location: Las Vegas, Nevada

Project Number: 0215-01-1

Plate Number:



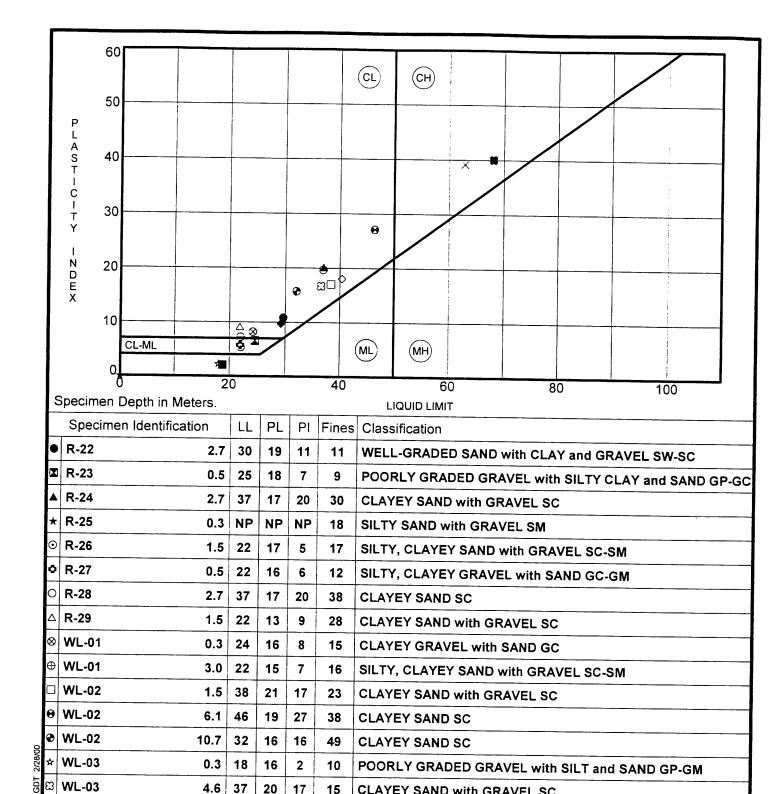
L		Dopul III Motors.		· · · · · ·			LIQUID LIMIT
L	Specime	en Identification	LL	PL	PI	Fines	Classification
•	R-01	0.3	16	15	1	14	SILTY SAND with GRAVEL SM
(X)	R-03	0.5	27	17	10	14	CLAYEY GRAVEL with SAND GC
<b>A</b>	R-04	1.4	16	15	1	16	SILTY SAND with GRAVEL SM
*	R-05	1.4	18	16	2	27	SILTY GRAVEL with SAND GM
<b>⊙</b>	R-06	2.7	NP	NP	NP	12	SILTY SAND with GRAVEL SM
•	R-07	0.5	19	15	4	11	WELL-GRADED GRAVEL with SILTY CLAY and SAND GW-GO
0	R-08	1.5	19	15	4	16	SILTY, CLAYEY SAND with GRAVEL SC-SM
Δ	R-09	2.7	20	15	5	13	SILTY, CLAYEY SAND with GRAVEL SC-SM
8	R-10	1.5	NP	NP	NP	9	POORLY GRADED GRAVEL with SILT and SAND GP-GM
Φ	R-11	0.5	29	19	10	12	POORLY GRADED GRAVEL with CLAY and SAND GP-GC
	R-12	2.7	30	17	13	21	CLAYEY SAND with GRAVEL SC
8	R-13	2.7	32	19	13	26	CLAYEY SAND with GRAVEL SC
3	R-14	1.5	25	18	7	19	SILTY, CLAYEY SAND with GRAVEL SC-SM
-1	R-15	0.5	21	15	6	17	SILTY, CLAYEY GRAVEL with SAND GC-GM
3	R-16	1.2	17	14	3	22	SILTY SAND with GRAVEL SM
-	R-17	0.3	17	16	1	18	SILTY SAND with GRAVEL SM
•	R-18	1.5	17	14	3	17	SILTY SAND with GRAVEL SM
>	R-19	0.5	20	14	6	20	SILTY, CLAYEY SAND with GRAVEL SC-SM
<	R-20	0.3	24	17	7	12	WELL-GRADED GRAVEL with SILTY CLAY and SAND GW-GO
8	R-21	1.5	20	17	3	16	SILTY SAND with GRAVEL SM
		Black Eagle Co 1380 Greg Stro Sparks, Nevad Telephone: (7 Fax: (775) 359	eet, S la 89 75) 3	Suite : 431 59-66	218		ATTERBERG LIMITS RESULTS  Project: U.S. 95 Widening Project  Location: Las Vegas, Nevada
		(	0	_			Desired No. 1 0045 04 4 By

### ATTERBERG LIMITS RESULTS

Project Number: 0215-01-1

Plate Number:

4x



4.6

0.3 19

3.0 29

4.6

6.1

WL-04

WL-04

WL-04

WL-04

WL-04

**\rightarrow** 

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22

### ATTERBERG LIMITS RESULTS

Project: U.S. 95 Widening Project Location: Las Vegas, Nevada

WELL-GRADED GRAVEL with SILT and SAND GW-GM

Project Number: 0215-01-1

**CLAYEY SAND with GRAVEL SC** 

CLAYEY GRAVEL with SAND GC

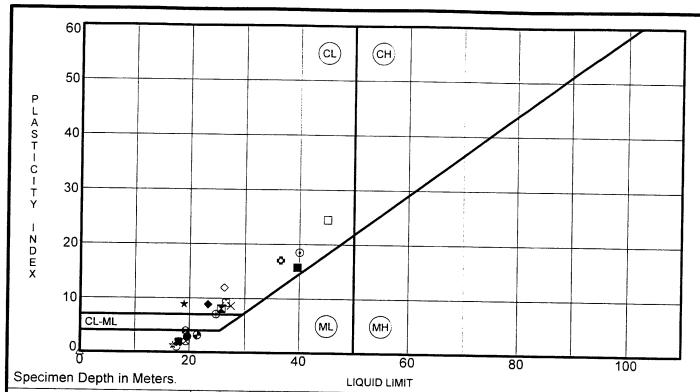
**CLAYEY SAND with GRAVEL SC** 

**CLAYEY SAND SC** 

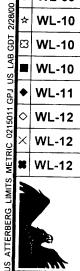
SANDY FAT CLAY CH

Plate Number:

4γ



Г	0 11 11	Т.	Τ –	T	Т	
L	Specimen Identification	LL	PL	PI	Fines	Classification
1	WL-05 0.3	20	17	3	11	WELL-GRADED SAND with SILT and GRAVEL SW-SM
13	WL-05 3.0	26	18	8	12	CLAYEY GRAVEL with SAND GC
1	WL-06 0.3	18	16	2	11	POORLY GRADED GRAVEL with SILT and SAND GP-GM
*	WL-06 3.0	19	10	9	15	CLAYEY SAND with GRAVEL SC
0	WL-06 6.1	40	21	19	32	CLAYEY SAND SC
٥	WL-06 10.7	37	20	17	15	CLAYEY SAND with GRAVEL SC
С	WL-07 1.5	18	17	1	9	POORLY GRADED GRAVEL with SILT and SAND GP-GM
Δ	WL-08 0.3	NP	NP	NP	14	SILTY SAND with GRAVEL SM
8	WL-08 4.6	19	17	2	12	SILTY GRAVEL with SAND GM
0	WL-08 7.6	25	18	7	16	SILTY, CLAYEY SAND with GRAVEL SC-SM
	WL-08 10.7	45	21	24	24	CLAYEY SAND with GRAVEL SC
8	WL-09 1.5	19	15	4	15	SILTY, CLAYEY SAND with GRAVEL SC-SM
<b>æ</b>	WL-09 3.0	21	18	3	15	SILTY SAND with GRAVEL SM
☆	WL-10 1.5	17	16	1	15	SILTY SAND with GRAVEL SM
ಐ	WL-10 3.0	27	17	10	11	POORLY GRADED GRAVEL with CLAY and SAND GP-GC
-	WL-10 9.1	40	24	16	20	CLAYEY SAND with GRAVEL SC
•	WL-11 0.3	23	14	9	31	CLAYEY SAND with GRAVEL SC
<b>\rightarrow</b>	WL-12 0.3	26	14	12	34	CLAYEY SAND with GRAVEL SC
×	WL-12 6.1	27	19	8	14	CLAYEY GRAVEL with SAND GC
×	WL-12 9.1	18	16	2	11	POORLY GRADED GRAVEL with SILT and SAND GP-GM

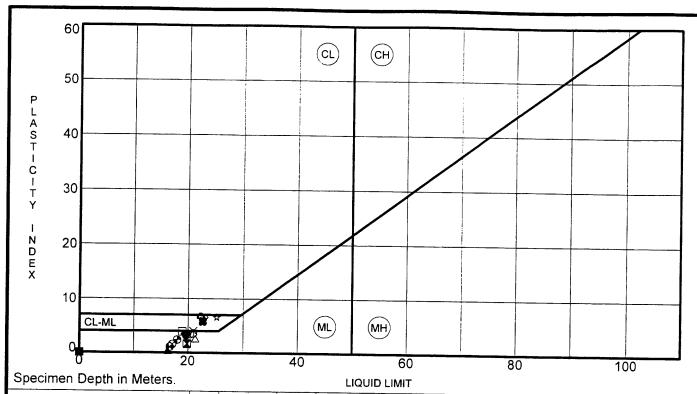


# ATTERBERG LIMITS RESULTS

Project: U.S. 95 Widening Project

Location: Las Vegas, Nevada

Project Number: 0215-01-1 Plate Number:



Specimen Identification LL PL PI Fine					Di	Cin a -						
			<del> </del>		-	Fines						
•	1112 10	0.3	20	16	4	12	WELL-GRADED GRAVEL with SILTY CLAY and SAND GW-GC					
X	WL-13	3.0	20	18	2	9	WELL-GRADED GRAVEL with SILT and SAND GW-GM					
▲	WL-14	0.3	16	16	NP	12	SILTY GRAVEL with SAND GM					
*	WL-14	4.6	20	16	4	13	SILTY, CLAYEY SAND with GRAVEL SC-SM					
<u></u>	WL-14	7.6	20	17	3	12	SILTY GRAVEL with SAND GM					
0	WL-14	10.7	22	16	6	15	SILTY, CLAYEY SAND with GRAVEL SC-SM					
0	WL-15	1.5	21	17	4	11	WELL-GRADED GRAVEL with SILTY CLAY and SAND GW-GC					
Δ	WL-15	3.0	21	19	2	8	POORLY GRADED GRAVEL with SILT and SAND GP-GM					
8	WL-16	0.6	17	16	1	9	POORLY GRADED GRAVEL with SILT and SAND GP-GM					
Φ	WL-16	4.6	NP	NP	NP	12						
	WL-16	9.1	19	15	4	11	WELL-GRADED GRAVEL with SILTY CLAY and SAND GW-GC					
8	WL-17	0.6	17	16	1	11	POORLY GRADED GRAVEL with SILT and SAND GP-GM					
•	WL-17	3.0	18	16	2	12	SILTY GRAVEL with SAND GM					
☆	WL-18	0.6	25	19	6	6	POORLY GRADED GRAVEL with SILTY CLAY and SAND GP-GC					
3	WL-18	4.6	NP	NP	NP	9	WELL-GRADED GRAVEL with SILT and SAND GW-GM					
	WL-18	7.6	NP	NP	NP	8	POORLY GRADED GRAVEL with SILT and SAND GP-GM					
•	WL-18	10.7	19	16	3	18	SILTY SAND with GRAVEL SM					
>	WR-01	0.3	23	16	7	12	2 SILTY, CLAYEY GRAVEL with SAND GC-GM					
<	WR-01	3.0	21	17	4	9	POORLY GRADED GRAVEL with SILTY CLAY and SAND GP-GC					
8	WR-02	1.5	23	17	6	11 WELL-GRADED GRAVEL with SILTY CLAY and SAND GW-GC						
	Black	Eagle Co	nsuli	tina	Inc		ATTERBERG LIMITS RESULTS					
	1000			,9,								

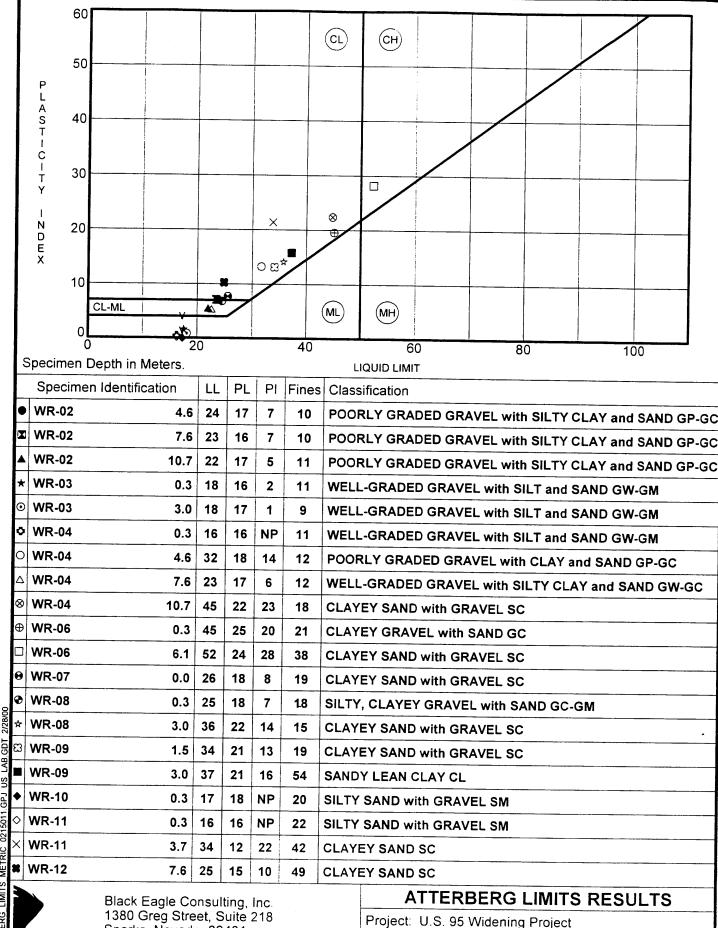
# ATTERBERG LIMITS RESULTS

Project: U.S. 95 Widening Project Location: Las Vegas, Nevada

Project Number: 0215-01-1

Plate Number:

4aa



ΥB

GP.

21

Sparks, Nevada 89431 Telephone: (775) 359-6600

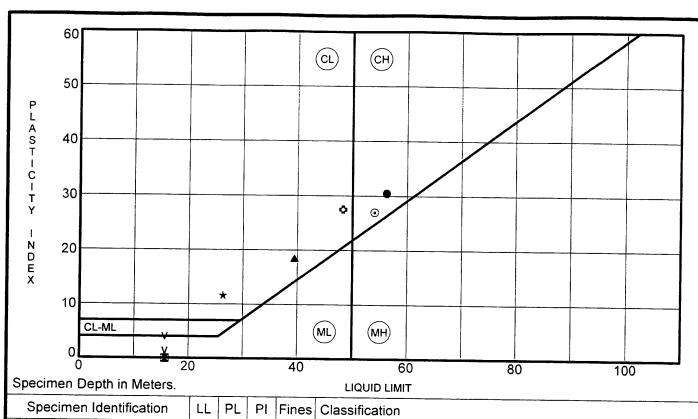
Fax: (775) 359-7766

Project: U.S. 95 Widening Project Location: Las Vegas, Nevada

Project Number: 0215-01-1

Plate Number:

4ab



	Specimen Ide	entification	LL	PL	PI	Fines	Classification
•	WR-12	10.7	56	26	30	45	CLAYEY SAND SC
X	WR-13	0.3	16	16	NP	22	SILTY SAND with GRAVEL SM
•	WR-13	3.0	39	21	18	37	CLAYEY SAND with GRAVEL SC
*	WR-14	1.5	26	15	11	32	CLAYEY SAND with GRAVEL SC
ગ	WR-14	3.0	54	27	27	37	CLAYEY SAND with GRAVEL SC
9	WR-14	6.1	48	21	27	65	SANDY LEAN CLAY CL
4							
1							
1							
4							
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	Bi	lack Eagle Co	nsult	ing, l	nc.		ATTERBERG LIMITS RESULTS

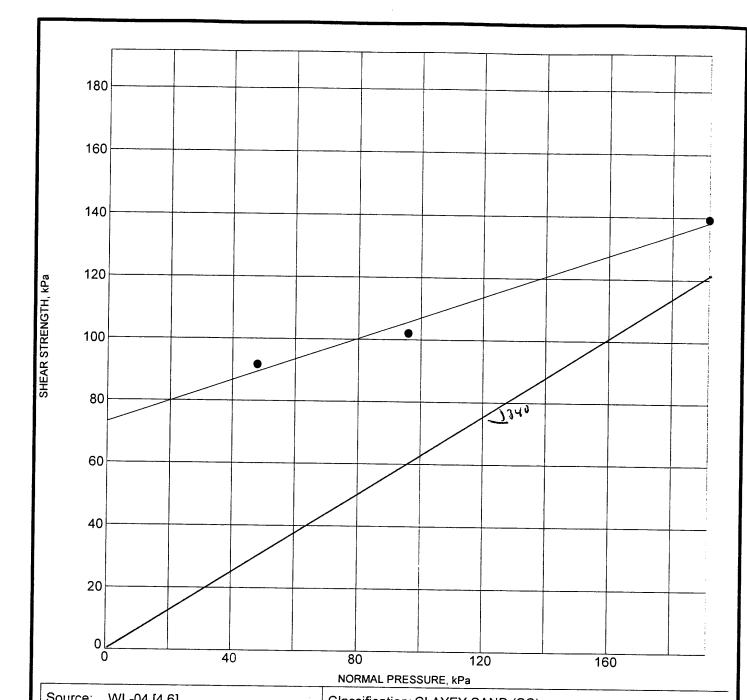
### ATTERBERG LIMITS RESULTS

Project: U.S. 95 Widening Project Location: Las Vegas, Nevada

Project Number: 0215-01-1

Plate Number:

4ac



Source.	VVL-04 [4.0	o]		Classification: CLAYEY SAND (SC)							
LL = 40	PL =22	PI =18	Gs = NT	Test Unit: Carol-Warner	2001D, 2.41" Round						
Specime	n Type: Und	disturbed		Condition: Inundated	Before Test	After Test					
Diameter	r (mm): 61.4	17 Height	(mm): 25.40	Water Content, w(%)	Water Content, w(%) 13.1						
Rate of S	Shearing (mi	m/min)	0.76	Dry Density (kg/m^3)	Dry Density (kg/m^3) 1586.7						
Cohesior	n, c (kPa)		73.2	Wet Density (kg/m^3) 1794.2							
Friction A	Angle, phi (d	eg)	19	Test Method: AASHTO T236							

Remarks:

SHEAR METRIC 0215011 GPJ US LAB GDT 2/28/00



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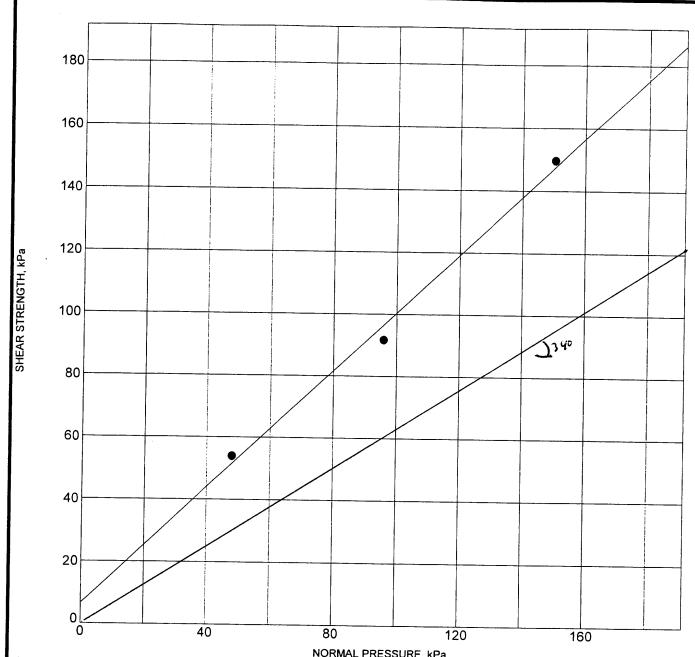
### **DIRECT SHEAR TEST**

Project: U.S. 95 Widening Project Location: Las Vegas, Nevada

Project Number: 0215-01-1

Plate Number:

5а



NOTHING ET REGOOKE, KFa
Classification: CLAYEY SAND (SC)

LL = 34	PL =12	PI =21	Gs = NT	Test Unit: Carol-Warner 2001D, 2.41" Round				
Specime	n Type: Un	disturbed		Condition: Inundated	Before Test	After Test		
Diameter	(mm): 61.4	17 Heigh	t (mm): 25.40	Water Content, w(%)	11.1			
Rate of S	Shearing (m	m/min)	0.51	Dry Density (kg/m^3)	1766.1			
Cohesion	ı, c (kPa)		6.6	Wet Density (kg/m^3)	1962.2			
Friction Angle, phi (deg) 43				Test Method: AASHTO T	236			

Remarks:

Source:

WR-11 [3.7]



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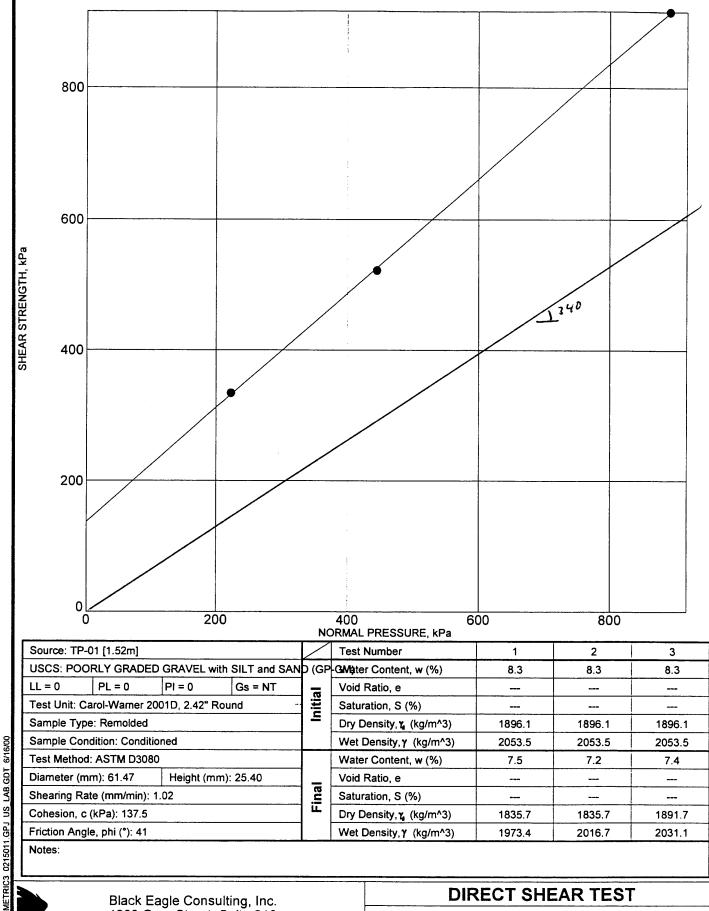
# DIRECT SHEAR TEST

Project: U.S. 95 Widening Project Location: Las Vegas, Nevada

Project Number: 0215-01-1

Plate Number:

5b



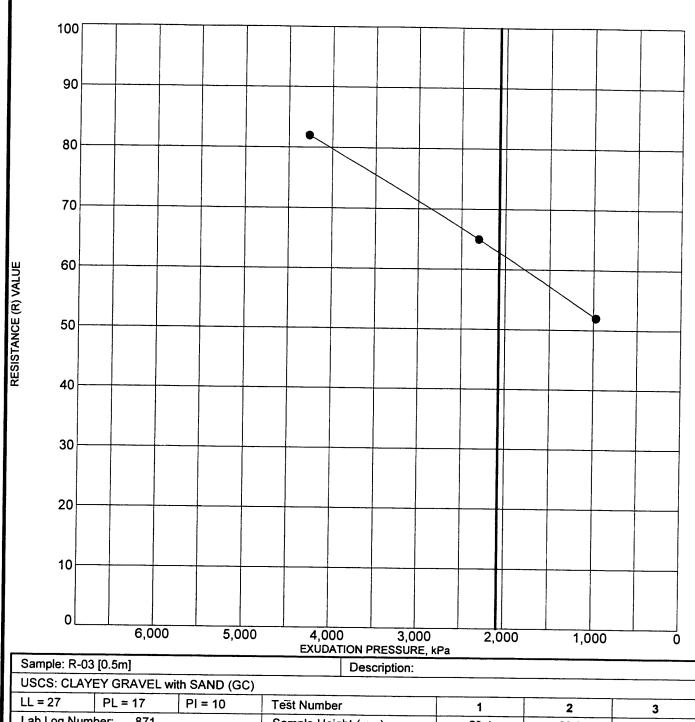


### DIRECT SHEAR TEST

Project: U.S. 95 Widening Project Location: Las Vegas, Nevada

Project Number: 0215-01-1

Plate Number: 5c



Sample: R-0	03 [0.5m]		Description:			
USCS: CLA	YEY GRAVEL	with SAND (GC)				
LL = 27	PL = 17	PI = 10	Test Number	1	2	3
Lab Log Number: 871		Sample Height (mm)	58.4	59.2	59.9	
Date Tested: 2/7/2000		Water Content, w (%)	6.3	6.5	6.8	
Compactor Unit: Cox & Sons CS-1000		Dry Density, (kg/m^3)	2273.0	2269.8	2234.5	
Stabilometer Unit: ELE AP-490A		Wet Density, (kg/m^3)	2417.1	2417.1	2386.7	
Test Method	: AASH	TO T190	Exudation Pressure (kPa)	4267.4	2302.6	972.1
			Expansion Pressure (kPa)	0.0	0.0	0.0
Sample R Value: 63			Corrected R Value, R	82	65	52
Notes:						

## **RESISTANCE (R) VALUE TEST**

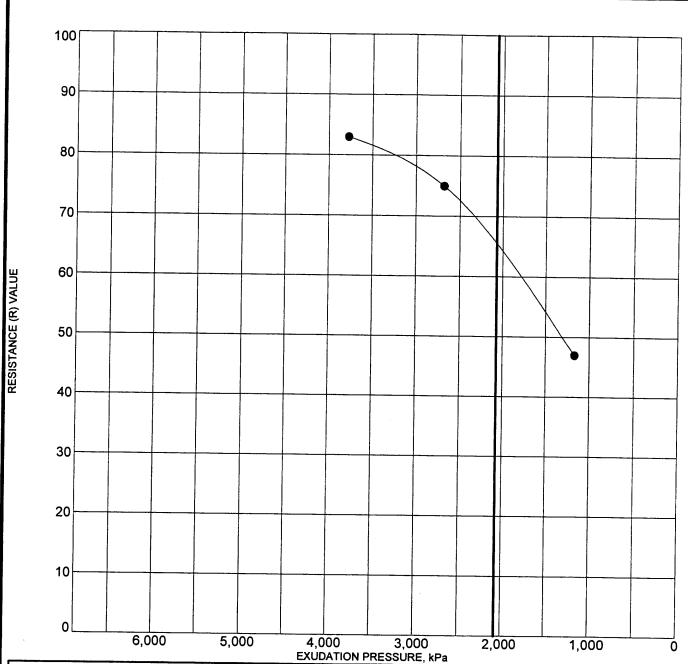
Project: U.S. 95 Widening Project

Location: Las Vegas, Nevada

Project Number: 0215-01-1

Plate Number: 6a

ALUE METRIC 0215011.GPJ US LAB.GDT 2/28/00



Sample: R-07	[0.5m]		Description:			
USCS: WELL-	GRADED GF	RAVEL with SILT	Y CLAY and SAND (GW-GC)			
LL = 19 PL = 15 PI = 4			Test Number	1	2	3
Lab Log Number: 871			Sample Height (mm)	61.7	60.7	62.0
Date Tested: 2/8/2000			Water Content, w (%)	7.0	6.5	6.1
Compactor Unit: Cox & Sons CS-1000		Dry Density, (kg/m^3)	2295.4	2316.2	2325.8	
Stabilometer Unit: ELE AP-490A		P-490A	Wet Density, (kg/m^3)	2455.6	2466.8	2466.8
Test Method:	Test Method: AASHTO T190		Exudation Pressure (kPa)	1165.1	2681.8	3771.0
			Expansion Pressure (kPa)	0.0	0.0	0.0
Sample R Value: 64		Corrected R Value, R	47	75	83	
Notes:						



0215011.GPJ US LAB.GDT 2/28/00

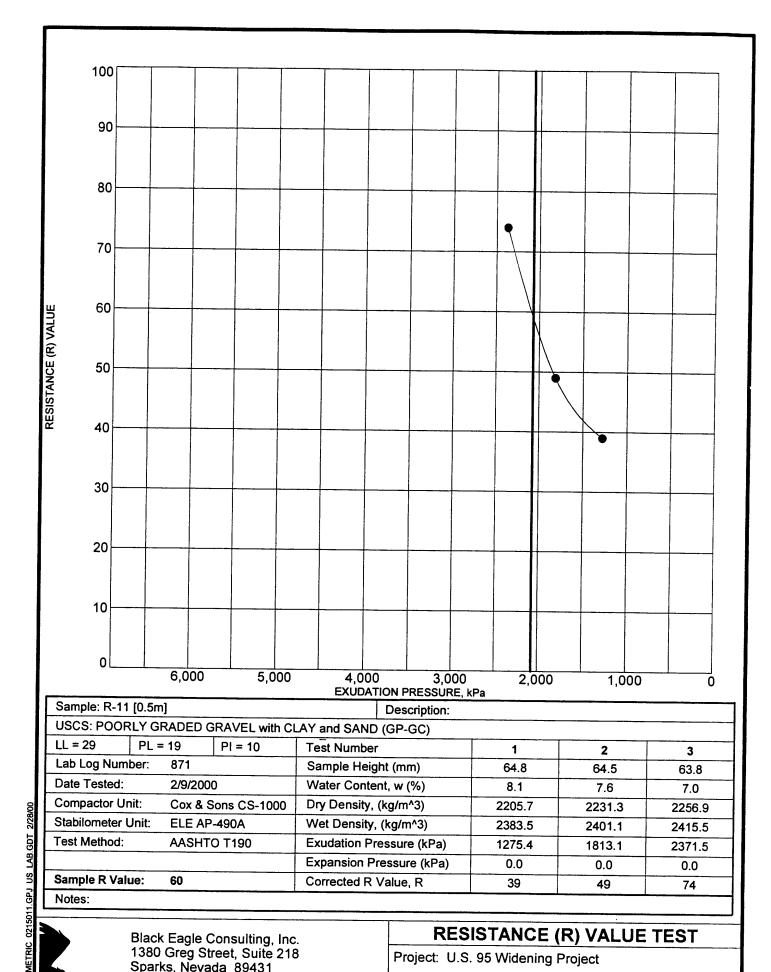
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## **RESISTANCE (R) VALUE TEST**

Project: U.S. 95 Widening Project Location: Las Vegas, Nevada

Project Number: 0215-01-1

Plate Number: 6b

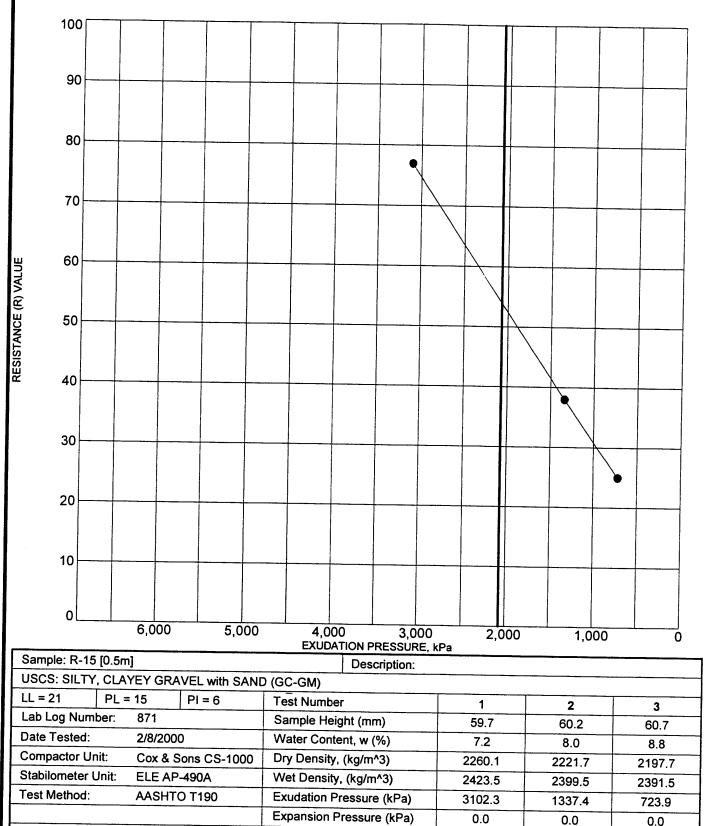


## **RESISTANCE (R) VALUE TEST**

Project: U.S. 95 Widening Project Location: Las Vegas, Nevada

Project Number: 0215-01-1

Plate Number: 6c



Corrected R Value, R

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54

RESISTANCE (R) VALUE TEST
Project: U.S. 95 Widening Project

Location: Las Vegas, Nevada

77

Project Number: 0215-01-1

Plate Number: 6d

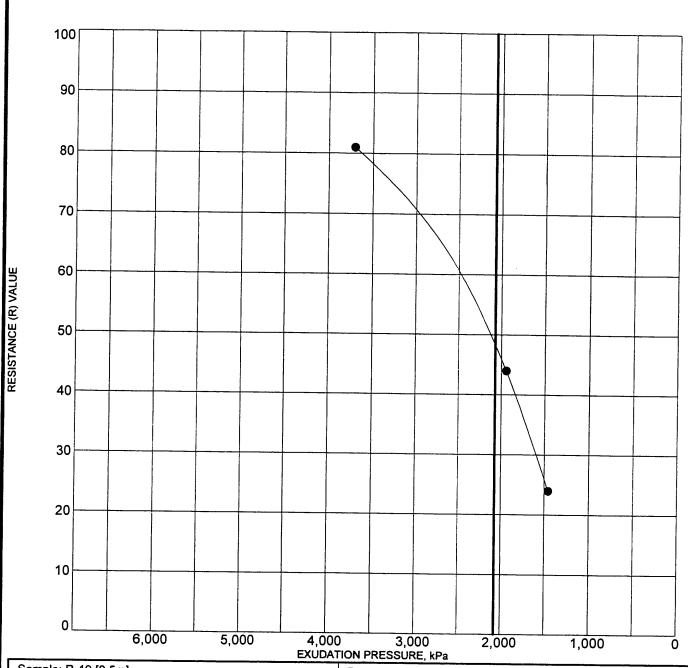
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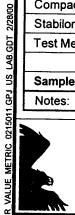
TETRIC 0215011.GPJ US LAB.GDT 2/28/0

Sample R Value:

Notes:



Sample: R-19 [0	.5m]		Description:			
USCS: SILTY, C	LAYEY SA	ND with GRAVE	L (SC-SM)			
LL = 20 F	L = 14	PI = 6	Test Number	1	2	3
Lab Log Number: 871			Sample Height (mm)	64.5	64.5	64.0
Date Tested: 2/13/2000		Water Content, w (%)	8.1	7.4	7.2	
Compactor Unit: Cox & Sons CS-1000		Dry Density, (kg/m^3)	2212.1	2220.1	2232.9	
Stabilometer Uni	t: ELE A	P-490A	Wet Density, (kg/m^3)	2391.5	2385.1	2393.1
Test Method:	AASH <sup>*</sup>	TO T190	Exudation Pressure (kPa)	1454.6	1944.1	3702.1
			Expansion Pressure (kPa)	0.0	0.0	0.0
Sample R Value: 47		Corrected R Value, R	24	44	81	
Notes:						

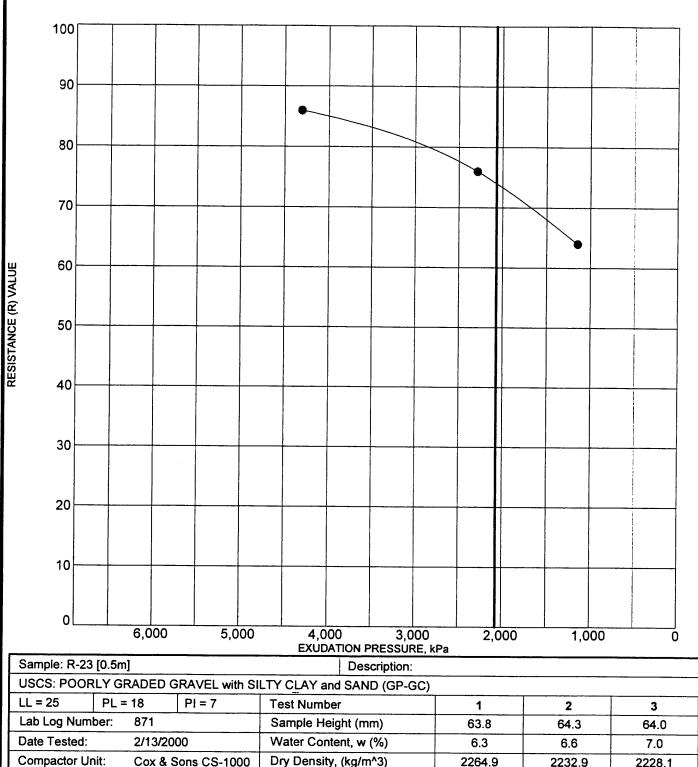


## **RESISTANCE (R) VALUE TEST**

Project: U.S. 95 Widening Project Location: Las Vegas, Nevada

Project Number: 0215-01-1

Plate Number: 6e



Sample: R-	23 [0.5m]		Description:			
USCS: POO	RLY GRADE	D GRAVEL with SI	LTY CLAY and SAND (GP-GC)			
LL = 25	PL = 18	PI = 7	Test Number	1	2	3
Lab Log Nu	mber: 871		Sample Height (mm)	63.8	64.3	64.0
Date Tested: 2/13/2000		Water Content, w (%)	6.3	6.6	7.0	
Compactor Unit: Cox & Sons CS-1000		Dry Density, (kg/m^3)	2264.9	2232.9	2228.1	
Stabilometer Unit: ELE AP-490A		Wet Density, (kg/m^3)	2407.5	2380.3	2383.5	
Test Method	Test Method: AASHTO T190		Exudation Pressure (kPa)	4308.8	2288.8	1144.4
			Expansion Pressure (kPa)	0.0	0.0	0.0
Sample R Value: 74		Corrected R Value, R	86	76	64	
Notes:						



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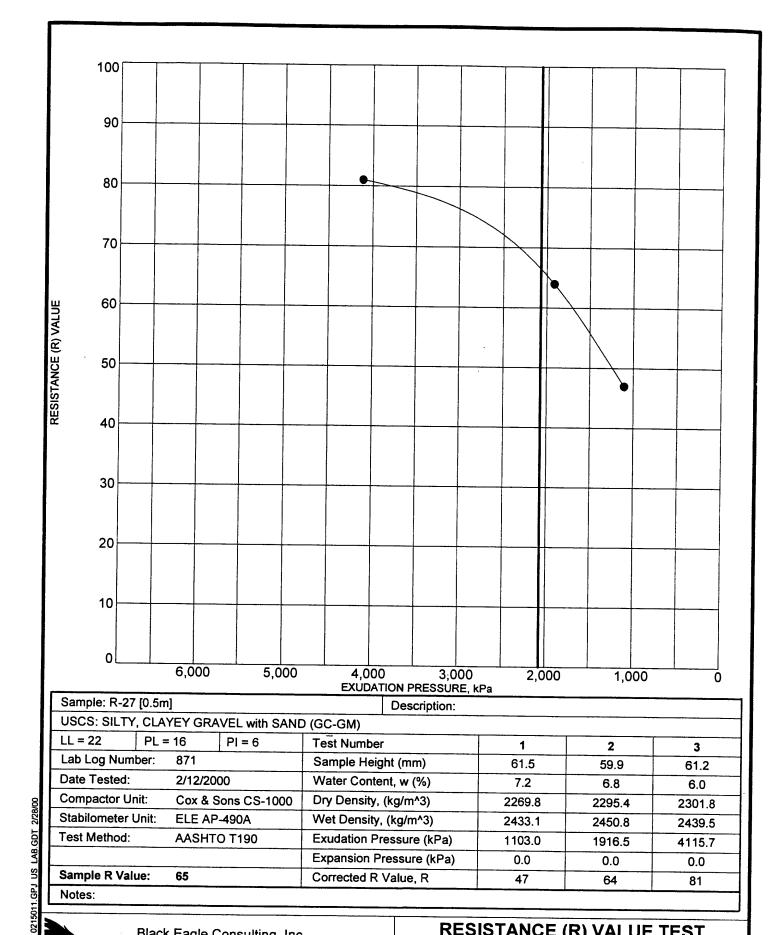
# **RESISTANCE (R) VALUE TEST**

Project: U.S. 95 Widening Project Location: Las Vegas, Nevada

Project Number: 0215-01-1

Plate Number: 6f

R VALUE METRIC 0215011.GPJ US LAB.GDT 2/28/00



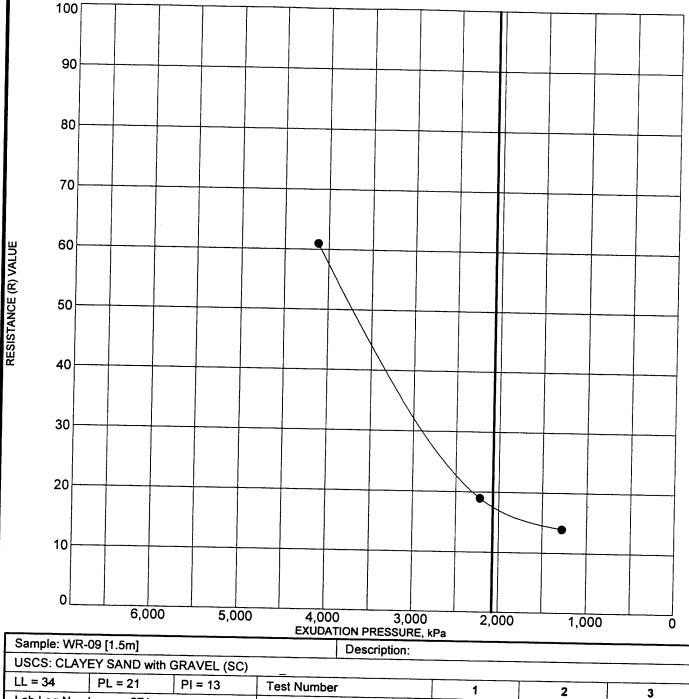


# RESISTANCE (R) VALUE TEST

Project: U.S. 95 Widening Project Location: Las Vegas, Nevada

Project Number: 0215-01-1

Plate Number: 6g



Sample: WF	R-09 [1.5m]		Description:			
USCS: CLA	YEY SAND	with GRAVEL (SC)				
LL = 34	PL = 21	PI = 13	Test Number	1	2	3
Lab Log Number: 871			Sample Height (mm)	60.2	60.7	60.7
Date Tested: 2/13/2000		13/2000	Water Content, w (%)	10.6	9.6	9.0
Compactor Unit:		x & Sons CS-1000	Dry Density, (kg/m^3)	2032.7	2069.5	2074.3
Stabilometer Unit: EL		E AP-490A	Wet Density, (kg/m^3)	2248.9	2269.8	2261.7
Test Method	. AA	SHTO T190	Exudation Pressure (kPa)	1275.4	2219.9	4122.6
			Expansion Pressure (kPa)	0.0	0.0	0.0
Sample R Va	lue: 18		Corrected R Value, R	14	19	61
Notes:		· · · · · · · · · · · · · · · · · · ·				



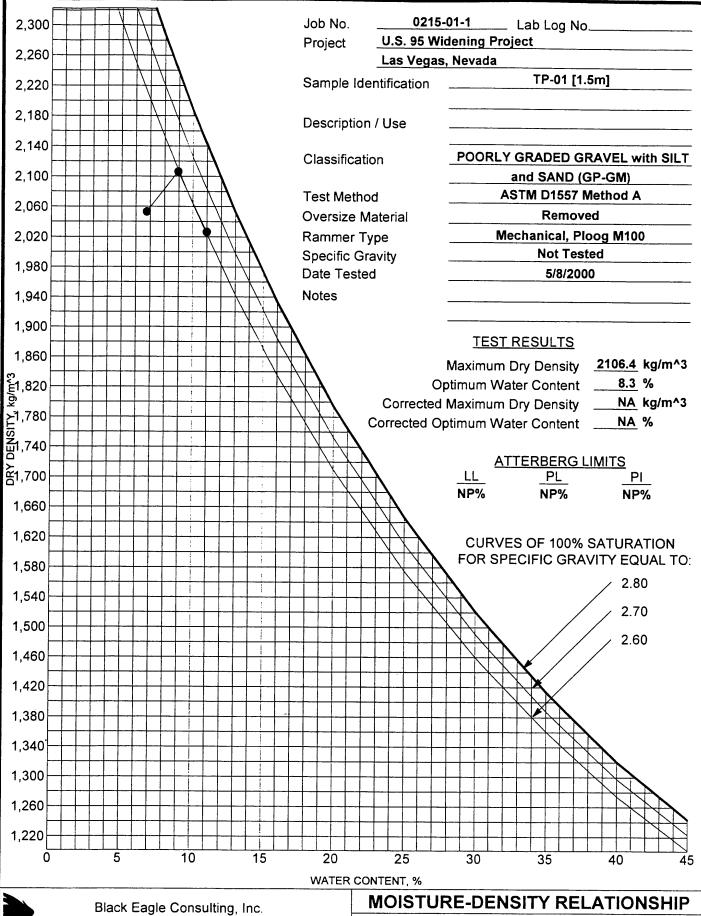
# **RESISTANCE (R) VALUE TEST**

Project: U.S. 95 Widening Project

Location: Las Vegas, Nevada Project Number: 0215-01-1

Plate Number: 6h

VALUE METRIC 0215011.GPJ US LAB.GDT 2/28/00



METRIC 0215011.GPJ US LAB.GDT

Project: U.S. 95 Widening Project Location: Las Vegas, Nevada

Project Number: 0215-01-1

Plate Number: 7

# APPENDIX A -

# DESIGN CALCULATIONS FOR SPREAD FOOTING FOUNDATIONS

### BLACK EAGLE CONSULTING

Geotechnical and Construction Services

Date: 2-21-00

Project Name: US 95 SOUND and/or RETAINING WALL FOUNDATIONS Page: 1 of 1

Project Number: 215-01-1

# CALCULATION OF BEARING CAPACITY USING THE VESIC METHOD

### Depth to Groundwater >B

- 1.) References:
  - a.) AASHTO, 1996: Standard Specifications for Highway Bridges, 16th ed.
  - b.) Bowles, J.E., 1996: Foundation Analysis and Design, 5th ed.
- 2.) Variables: Note that additional factors can be added for inclined loads and/or inclined base.

$$c := 0.0 \cdot \frac{lb}{ft^2}$$
  $\phi := 34 \cdot deg$   $\gamma_{eff} := 130 \cdot \frac{lb}{ft^3}$   $L := 40 \cdot ft$   $B := 7.25 \cdot ft$   $D := 1.0 \cdot ft$ 

3.) Calculate Bearing Capacity Factors: 
$$N_q := e^{\pi \cdot tan(\phi)} \cdot tan \left( 45 \cdot deg + \frac{\phi}{2} \right)^2$$

$$N_c := (N_q - 1) \cdot \cot(\phi) \qquad \qquad N_\gamma := 2 \cdot (N_q + 1) \cdot \tan(\phi)$$

$$N_c = 42.164$$
  $N_q = 29.44$   $N_v = 41.064$ 

4.) Calcuate Shape Factors:

$$S_c := 1 + \left(\frac{B}{L}\right) \cdot \left(\frac{N_q}{N_c}\right)$$
 
$$S_q := 1 + \left(\frac{B}{L}\right) \cdot \tan(\phi)$$
 
$$S_{\gamma} := 1 - 0.4 \cdot \left(\frac{B}{L}\right) \cdot \tan(\phi)$$
 
$$S_{\gamma} := 1 - 0.4 \cdot \left(\frac{B}{L}\right) \cdot \tan(\phi)$$
 
$$S_{\gamma} := 0.928$$

5.) Calculate Ultimate Bearing Capacity, qult:

$$kip := 1000 \cdot lb$$

$$q_{ult} := (c \cdot N_c \cdot S_c) + (0.5 \cdot \gamma_{eff} \cdot B \cdot N_{\gamma} \cdot S_{\gamma}) + \gamma_{eff} \cdot D \cdot N_q \cdot S_q$$
 
$$kPa := 47.88026 \cdot \frac{kip}{ft^2}$$

6.) Calculate Allowable Bearing Pressure, q<sub>allow</sub>, at Appropriate Safety Factor, SF

$$SF := 3.0$$

$$q_{allow} := \frac{q_{ult}}{SF}$$

$$q_{allow} = 7.414 \, ft^{-2} \, kip$$

$$q_{allow} = 0.155 \, kPa$$

# BLACK EAGLE CONSULTING Geotechnical and Construction Services

Date: 2-24-00 Page: 1 of 1

Project Name: US 95 SOUND and/or RETAINING WALL FOUNDATIONS

Project Number: 215-01-1 Cohesive Soil (sample WL-4 @ 4.75 m

# CALCULATION OF BEARING CAPACITY USING THE VESIC METHOD Depth to Groundwater >B

- 1.) References:
  - a.) AASHTO, 1996: Standard Specifications for Highway Bridges, 16th ed.
  - b.) Bowles, J.E., 1996: Foundation Analysis and Design, 5th ed.
- 2.) Variables: Note that additional factors can be added for inclined loads and/or inclined base.

$$c:=3546\cdot\frac{lb}{ft^2} \qquad \varphi:=19\cdot deg \qquad \qquad \gamma_{eff}:=114\cdot\frac{lb}{ft^3} \qquad \qquad L:=40\cdot ft \qquad B:=7.25\cdot ft \quad D:=1.0\cdot ft$$

3.) Calculate Bearing Capacity Factors: 
$$N_q := e^{\pi \cdot tan(\phi)} \cdot tan \left(45 \cdot deg + \frac{\phi}{2}\right)^2$$

$$N_c := (N_q - 1) \cdot \cot(\phi) \qquad \qquad N_{\gamma} := 2 \cdot (N_q + 1) \cdot \tan(\phi)$$

$$N_c = 13.934$$
  $N_q = 5.798$   $N_y = 4.681$ 

4.) Calcuate Shape Factors:

$$S_{c} := 1 + \left(\frac{B}{L}\right) \cdot \left(\frac{N_{q}}{N_{c}}\right)$$

$$S_{q} := 1 + \left(\frac{B}{L}\right) \cdot \tan(\phi)$$

$$S_{\gamma} := 1 - 0.4 \cdot \left(\frac{B}{L}\right)$$

$$S_{c} = 1.075$$

$$S_{q} = 1.062$$

$$S_{\gamma} = 0.928$$

5.) Calculate Ultimate Bearing Capacity, quit:

$$kip := 1000 \cdot lb$$

$$q_{ult} := \left(c \cdot N_c \cdot S_c\right) + \left(0.5 \cdot \gamma_{eff} \cdot B \cdot N_{\gamma} \cdot S_{\gamma}\right) + \gamma_{eff} \cdot D \cdot N_q \cdot S_q$$
 
$$kPa := 47.88026 \cdot \frac{kip}{ft^2}$$

6.) Calculate Allowable Bearing Pressure,  $q_{\text{allow}}$ , at Appropriate Safety Factor, SF

$$SF := 3.0$$

$$q_{allow} := \frac{q_{ult}}{SF}$$

$$q_{allow} = 18.544 \text{ ft}^{-2} \text{kip}$$

$$q_{allow} = 0.387 \text{ kPa}$$

Sheet 1 of 1 Date: 2-21-00

Project Name: US 95 SOUND and/or RETAINING WALL FOUNDATIONS

Project Number: 215-01-1

Calculated By: DH Checked By: mcd

### CALCULATION OF IMMEDIATE SETTLEMENT ON GRANULAR SOILS

REFERENCE: Bowles, J.E., 1996, Foundation Analysis and Design, 5th edition

Calculation of Immediate Settlement on sandy soils beneath soil cement embankment

Variables:

$$B := 5.4 \cdot \text{ft} \quad L := 54 \cdot \text{ft} \qquad N_{\text{stp}} := 57 \qquad \quad H := 30 \cdot \text{ft} \quad \cdot \ \ \, \mu := .35 \qquad I_F := .85 \qquad kip := 1000 \cdot lb = 10000 \cdot lb = 1000 \cdot lb = 10000 \cdot lb = 10000 \cdot lb = 10000 \cdot lb = 100$$

$$L' := \frac{L}{2}$$
  $B' := \frac{B}{2}$   $M := \frac{L'}{B'}$   $N := \frac{H}{B'}$   $q_o := 4.25 \cdot \frac{kip}{ft^2}$ 

$$E_s := 10 \cdot \left( N_{stp} + 15 \right) \cdot \frac{kip}{ft^2} \qquad E_s \cdot \frac{ft^2}{kip} = 720$$

Calculations:

Results:

$$I_{1} := \frac{1}{\pi} \cdot \left[ M \cdot \ln \left[ \frac{\left(1 + \sqrt{M^{2} + 1}\right) \cdot \sqrt{M^{2} + N^{2}}}{M \cdot \left(1 + \sqrt{M^{2} + N^{2} + 1}\right)} \right] + \ln \left[ \frac{\left(M + \sqrt{M^{2} + 1}\right) \cdot \sqrt{1 + N^{2}}}{M + \sqrt{M^{2} + N^{2} + 1}} \right] \right] \quad I_{1} = 0.803$$

$$I_2 := \frac{N}{2 \cdot \pi} \cdot atan \left( \frac{M}{N \cdot \sqrt{M^2 + N^2 + 1}} \right)$$
 $I_2 = 0.106$ 

$$I_s := I_1 + \left(\frac{1 - 2 \cdot \mu}{1 - \mu}\right) \cdot I_2$$
 —  $I_s = 0.852$ 

$$\Delta H := q_o \cdot B' \cdot \left(\frac{1 - \mu^2}{E_s}\right) \cdot \left[I_1 + \left[\left(\frac{1 - 2 \cdot \mu}{1 - \mu}\right) \cdot I_2\right]\right] \cdot I_F \cdot 4$$

$$\Delta H = 0.486 \text{ in}$$

 $\Delta H = 12.344 \, \text{mm}$ 

### **BLACK EAGLE CONSULTING** Geotechnical and Construction Services

Sheet 1 of 1 Date: 6-14-00

Project Name: US 95 1A Soundwall and/or Retaining Wall Footings

Project Number: 215-01-1

Calculated By: DH Checked By: mcd

### LATERAL PRESSURES for FOOTINGS or SMALL RETAINING WALLS

VARIABLES:

$$\gamma := 18.86 \cdot \frac{\text{kg}}{\text{m}^3}$$

At-Rest Condition:

$$A_r := (1 - \sin(\phi)) \cdot \gamma$$

$$A_r = 8.314 \,\mathrm{kg} \,\mathrm{m}^{-3}$$

Active Condition:

$$A := \frac{1 - \sin(\phi)}{1 + \sin(\phi)} \cdot \gamma$$

$$A = 5.332 \,\mathrm{kg} \,\mathrm{m}^{-3}$$

Passive Condition:

$$P := \frac{1 + \sin(\phi)}{1 - \sin(\phi)} \cdot \gamma$$

$$P = 66.71 \text{ kg m}^{-3}$$

Coefficient of Friction:

$$\mu := tan(\phi) \qquad \mu = 0.675$$

$$\mu = 0.675$$

$$\mu_{sf} := .67 \cdot \mu$$

$$\mu_{sf} = 0.452$$

# **APPENDIX B -**

# DESIGN CALCULATIONS FOR DRILLED SHAFT FOUNDATIONS

### BLACK EAGLE CONSULTING Geotechnical and Construction Services

Sheet 1 of 2 Date: 2-20-00

Project Name: US 95 SOUND and/or RETAINING WALL FOUNDATIONS

Project Number: 215-01-1

Calculated By: DH Checked By: mcd

# CALCULATION of DRILLED SHAFT AXIAL LOAD in COHESIONLESS SOILS

References:

- 1.) AASHTO, 1996: Standard Specifications for Highway Bridges, 16th edition
- 2.) Federal Highway Administration: Drilled Shafts, Construction Procedures and Design Methods: Pub. No. FWHA-HI-88-042

**Design Conditions:** 

- 1.) Length = 8.2 ft
- 2.) Diameter = 1.0 ft

### **Design Calcuations-Compression**

#### Side Resistance

z = depth below ground surface

$$kip := 1000 \cdot lbf$$

$$z := \left(\frac{2 + 8.2}{2}\right)$$

$$\gamma := 130 \cdot \frac{lbf}{ft^3}$$

$$z := \left(\frac{2 + 8.2}{2}\right)$$
 ft  $\gamma := 130 \cdot \frac{lbf}{63}$   $kN := \frac{kip}{4.448222}$ 

Eq.11.13 
$$\beta := 1.5 - 0.135 \cdot z^{.5}$$
 diameter  $D := 1.0 \cdot ft$ 

$$\sigma'_{Z} := z \cdot \gamma \cdot ft$$

length of embedment  $L := (8.2 - 2) \cdot ft$ 

$$L := (8.2 - 2) \cdot ft$$

eq. 11.11 
$$f_{SZ} := \beta \cdot \sigma'_Z$$
 Ref. 2

but 
$$f_{SZ} := if \left( f_{SZ} \ge 4 \cdot \frac{kip}{ft^2}, 4 \cdot \frac{kip}{ft^2}, f_{SZ} \right)$$

$$f_{SZ} = 0.792 \frac{kip}{ft^2}$$

$$\underline{Shaft \ side \ friction =} \qquad Q_S := f_{SZ^*\pi^*}D_*L$$

$$Q_S := f_{SZ} \cdot \pi \cdot D \cdot I$$

$$Q_S = 15.434 \, \text{kip}$$

$$Q_{S} = 68.652 \, \text{kN}$$

### **End Bearing**

**Uncorrected SPT Values** 

 $N_{SDt} := 50$ 

from Table 4.6.5.1.4A page 83; Ref. 1

$$q_b := 1.20 \cdot N_{spt} \cdot \frac{kip}{ft^2}$$

End Bearing eq 11.14, Ref.2 Cb = correction factor for D > 50"

$$C_d := \frac{4.17f}{D}$$

$$C_d := \frac{4.17ft}{D}$$
  $C_d := if(C_d \ge 1.00, 1.00, C_d)$ 

$$C_d = 1$$

$$Q_b := \left(\frac{\pi}{4} \cdot D^2 \cdot q_b\right) \cdot C_d$$

$$Q_b = 47.124 \text{kip}$$

$$Q_b = 209.618 \, kN$$

$$Q_{ult} := Q_{s} + Q_{b}$$

$$Q_{ult} = 62.558 \, kip$$

with safety factor

$$Q_a := \frac{Q_{ult}}{SF}$$
 Qult = 278.27 kN

$$Q_{ult} = 278.27 \, kN$$

and to have low settlement  $Q_a \leq Q_s$ 

$$Q_a = 20.853 \, \text{kip}$$

$$Q_a = 92.757 \, kN$$

### **Design Calculations-Uplift**

$$W_{shaft} := \pi \left(\frac{D}{2}\right)^2 \cdot L \cdot \left(0.140 \cdot \frac{kip}{ft^3}\right)$$

$$Q_{au} := \frac{Q_S}{3} + W_{Shaft}$$

$$Q_{au} = 5.826 \, kip$$

$$Q_{au} = 25.917 \, kN$$

### BLACK EAGLE CONSULTING Geotechnical and Construction Services

Sheet 1 of 2 Date: 2-20-00

Project Name: US 95 SOUND and/or RETAINING WALL FOUNDATIONS

Project Number: 215-01-1

Calculated By: DH Checked By: mcd

### CALCULATION of DRILLED SHAFT AXIAL LOAD in COHESIONLESS SOILS

References:

- 1.) AASHTO, 1996: Standard Specifications for Highway Bridges. 16th edition
- 2.) Federal Highway Administration: Drilled Shafts, Construction Procedures and Design Methods: Pub. No. FWHA-HI-88-042

**Design Conditions:** 

- 1.) Length = 9.84 ft
- 2.) Diameter = 1.0 ft

### **Design Calcuations-Compression**

#### Side Resistance

z = depth below ground surface

$$kip := 1000 \cdot lbf$$

$$z:=\left(\frac{2+9.84}{2}\right)$$

$$\gamma := 130 \cdot \frac{lbf}{ft^3}$$

$$z := \left(\frac{2 + 9.84}{2}\right)$$
 ft  $\gamma := 130 \cdot \frac{lbf}{63}$   $kN := \frac{kip}{4.448222}$ 

Eq.11.13 
$$\beta := 1.5 - 0.135 \cdot z^{.5}$$
 Ref. 2

$$\sigma'_{7} := z \cdot \gamma \cdot ft$$

 $\sigma'_Z := z \cdot \gamma \cdot \text{ft} \hspace{1cm} \text{length of embedment} \hspace{1cm} L := (9.84-2) \cdot \text{ft}$ 

$$L := (9.84 - 2) \cdot ft$$

eq. 11.11 
$$f_{SZ} := \beta \cdot \sigma'_{Z}$$
 Ref. 2

but 
$$f_{SZ} := if \left( f_{SZ} \ge 4 \cdot \frac{kip}{ft^2}, 4 \cdot \frac{kip}{ft^2}, f_{SZ} \right)$$

$$f_{SZ} = 0.902 \frac{kip}{ft^2}$$

 $\underline{Shaft \ side \ friction =} \qquad Q_S := f_{SZ^{\cdot}} \pi \cdot D \cdot L$ 

$$Q_S := f_{SZ^*} \pi \!\cdot\! D \!\cdot\! L$$

$$Q_S = 22.207 \, kip$$

$$Q_{S} = 98.78 \, kN$$

Uncorrected SPT Values

$$N_{\text{Spt}} := 50$$

from Table 4.6.5.1.4A page 83; Ref. 1

$$q_b := 1.20 \cdot N_{spt} \cdot \frac{kip}{ft^2}$$

End Bearing eq 11.14, Ref.2 Cb = correction factor for D > 50"

$$C_d := \frac{4.17ft}{D}$$

$$C_d := \frac{4.17ft}{D}$$
  $C_d := if(C_d \ge 1.00, 1.00, C_d)$ 

$$C_d = 1$$

$$Q_b := \left(\frac{\pi}{4} \cdot D^2 \cdot q_b\right) \cdot C_d$$

$$Q_b = 47.124 \, kip$$

$$Q_b = 209.618 \, kN$$

$$Qult := Q_S + Q_b$$

$$Quit = 69.331 kip$$

with safety factor

$$Q_a := \frac{Q_{ult}}{SF}$$
 Qult = 308.398 kN

$$Q_{ult} = 308.398 \, kN$$

and to have low settlement  $Q_a \leq Q_s$ 

$$Q_a = 23.11 \, \text{kip}$$

$$Q_a = 102.799 \, kN$$

$$W_{shaft} := \pi \left(\frac{D}{2}\right)^2 \cdot L \cdot \left(0.140 \cdot \frac{kip}{ft^3}\right) \qquad \qquad Q_{au} := \frac{Q_s}{3} + W_{shaft}$$

$$Q_{au} := \frac{Q_s}{3} + W_{shaft}$$

$$Q_{au} = 8.264 \text{kip}$$

$$Q_{au} = 36.761 \, kN$$

Sheet 1 of 2 Date: 2-20-00

Project Name: US 95 SOUND and/or RETAINING WALL FOUNDATIONS

Project Number: 215-01-1

Calculated By: DH Checked By: mcd

#### CALCULATION of DRILLED SHAFT AXIAL LOAD in COHESIONLESS SOILS

#### References:

- 1.) AASHTO, 1996: Standard Specifications for Highway Bridges. 16th edition
- 2.) Federal Highway Administration: Drilled Shafts, Construction Procedures and Design Methods: Pub. No. FWHA-HI-88-042

#### **Design Conditions:**

- 1.) Length = 11.48 ft
- 2.) Diameter = 1.0 ft

# **Design Calcuations-Compression**

#### Side Resistance

z = depth below ground surface

$$z := \left(\frac{2+11.48}{2}\right)$$

$$\gamma := 1$$

$$z := \left(\frac{2 + 11.48}{2}\right) \qquad \text{ft} \qquad \qquad \gamma := 130 \cdot \frac{\text{lbf}}{\text{ft}^3} \qquad \text{kN} := \frac{\text{kip}}{4.448222}$$

Eq.11.13 
$$\beta := 1.5 - 0.135 \cdot z^{.5}$$
 Ref. 2

$$\sigma'_{Z} := z \cdot \gamma \cdot ft$$

length of embedment 
$$L := (11.48 - 2) \cdot ft$$

eq. 11.11 
$$f_{SZ} := \beta \cdot \sigma'_Z$$
 Ref. 2

but 
$$f_{SZ} := if \left( f_{SZ} \ge 4 \cdot \frac{kip}{ft^2}, 4 \cdot \frac{kip}{ft^2}, f_{SZ} \right)$$

$$f_{SZ} = 1.007 \frac{\text{kip}}{\text{ft}^2}$$

 $\underline{Shaft \ side \ friction =} \qquad Q_S := f_{SZ^{\cdot}\pi \cdot} D \cdot L$ 

$$O_{S} = 29.997 \, \text{kip}$$

$$Q_S = 133.433 \, kN$$

# **End Bearing**

**Uncorrected SPT Values** 

$$N_{spt} := 50$$

from Table 4.6.5.1.4A page 83; Ref. 1

$$q_b := 1.20 \cdot N_{spt} \cdot \frac{kip}{ft^2}$$

End Bearing eq 11.14, Ref.2 Cb = correction factor for D > 50"

$$C_d := \frac{4.17f1}{D}$$

$$C_d := \frac{4.17ft}{D}$$
  $C_d := if(C_d \ge 1.00, 1.00, C_d)$ 

$$C_d = 1$$

$$Q_b := \left(\frac{\pi}{4} \cdot D^2 \cdot q_b\right) \cdot C_d$$

$$Q_b = 47.124 \text{ kip}$$

$$Q_b = 209.618 \, kN$$

$$Quit := Q_S + Q_b$$

$$Q_{ult} = 77.121 \, kip$$

with safety factor

$$SF := 3$$

$$Q_a := \frac{Q_{ult}}{SF}$$
 
$$Q_{ult} = 343.051 \, kN$$

$$Q_{IJIt} = 343.051 \, kN$$

and to have low settlement  $Q_a \leq Q_s$ 

$$Q_a = 25.707 \, kip$$

$$Q_{a}=\,114.35\,kN$$

$$W_{shaft} := \pi \left(\frac{D}{2}\right)^{2} \cdot L \cdot \left(0.140 \cdot \frac{kip}{ft^{3}}\right)^{-1}$$

$$Q_{au} := \frac{Q_S}{3} + W_{shaft}$$

$$Q_{au} = 11.041 \text{ kip}$$

$$Q_{au} = 49.115 kN$$

Sheet 1 of 2

Date: 2-20-00

Project Name: US 95 SOUND and/or RETAINING WALL FOUNDATIONS

Project Number: 215-01-1

Calculated By: DH Checked By: mcd

# CALCULATION of DRILLED SHAFT AXIAL LOAD in COHESIONLESS SOILS

#### References:

- 1.) AASHTO, 1996: Standard Specifications for Highway Bridges, 16th edition
- 2.) Federal Highway Administration: Drilled Shafts, Construction Procedures and Design Methods: Pub. No. FWHA-HI-88-042

### **Design Conditions:**

- 1.) Length = 8.2 ft
- 2.) Diameter = 1.5 ft

# **Design Calcuations-Compression**

#### Side Resistance

z = depth below ground surface

$$kip := 1000 \text{-} lbf$$

$$z := \left(\frac{2 + 8.2}{2}\right)$$

$$\gamma := 130 \cdot \frac{lbf}{ft^3}$$

ft 
$$\gamma := 130 \cdot \frac{lbf}{f^3} \qquad kN := \frac{kip}{4.448222}$$

Eq.11.13 
$$\beta := 1.5 - 0.135 \cdot z^{.5}$$
 Ref. 2

$$\sigma'_{Z} := z \cdot \gamma \cdot ft$$

 $\sigma'_Z := z \cdot \gamma \cdot \text{ft} \hspace{1cm} \text{length of embedment} \hspace{1cm} L := (8.2-2) \cdot \text{ft}$ 

$$L := (8.2 - 2) \cdot ft$$

eq. 11.11 
$$f_{SZ} := \beta \cdot \sigma'_{Z}$$
 Ref. 2

but 
$$f_{SZ} := if \left( f_{SZ} \ge 4 \cdot \frac{kip}{ft^2}, 4 \cdot \frac{kip}{ft^2}, f_{SZ} \right)$$

$$f_{SZ} = 0.792 \frac{kip}{ft^2}$$

 $\underline{Shaft \ side \ friction =} \qquad Q_S := f_{SZ^{\cdot}\pi \cdot} D \cdot L$ 

$$Q_S = 23.151 \, \text{kip}$$

$$Q_S = 102.979 \, kN$$

# **End Bearing**

Uncorrected SPT Values

$$N_{spt} := 50$$

from Table 4.6.5.1.4A page 83; Ref. 1

$$q_b := 1.20 \cdot N_{spt} \cdot \frac{kip}{ft^2}$$

End Bearing eq 11.14, Ref.2 Cb = correction factor for D > 50"

$$C_d := \frac{4.17ft}{D}$$

$$C_d := \frac{4.17ft}{D}$$
  $C_d := if(C_d \ge 1.00, 1.00, C_d)$ 

$$C_d = 1$$

$$Q_b := \left(\frac{\pi}{4} \cdot D^2 \cdot q_b\right) \cdot C_d$$

$$Q_b = 106.029 \, kip$$

$$Q_b = 471.639 \, kN$$

$$Q_{ult} := Q_{s} + Q_{b}$$

$$Q_{ult} = 129.179 \, kip$$

with safety factor

$$SF := 3$$

$$Q_a := \frac{Q_{ult}}{SF}$$

$$Q_a := \frac{Q_{ult}}{SF}$$
 Qult = 574.618 kN

and to have low settlement  $Q_a \leq Q_s$ 

$$Q_a = 43.06 \, \text{kip}$$

$$Q_a = 191.539 \, kN$$

$$W_{shaft} := \pi \left(\frac{D}{2}\right)^{2} \cdot L \cdot \left(0.140 \cdot \frac{kip}{ft^{3}}\right)$$

$$Q_{au} := \frac{Q_s}{3} + W_{shaft}$$

$$Q_{au} = 9.251 \, \text{kip}$$

$$Q_{au} = 41.149 \, kN$$

Sheet 1 of 2 Date: 2-20-00

Project Name: US 95 SOUND and/or RETAINING WALL FOUNDATIONS

Project Number: 215-01-1

Calculated By: DH Checked By: mcd

#### CALCULATION of DRILLED SHAFT AXIAL LOAD in COHESIONLESS SOILS

#### References:

- 1.) AASHTO, 1996: Standard Specifications for Highway Bridges, 16th edition
- 2.) Federal Highway Administration: Drilled Shafts, Construction Procedures and Design Methods: Pub. No. FWHA-HI-88-042

#### **Design Conditions:**

- 1.) Length = 9.84 ft
- 2.) Diameter = 1.5 ft

# **Design Calcuations-Compression**

#### Side Resistance

z = depth below ground surface

$$kip := 1000 \cdot lbf$$

$$z:=\left(\frac{2+9.84}{2}\right) \hspace{1cm} \text{ft} \hspace{1cm} \gamma:=130\cdot\frac{lbf}{ft^3} \hspace{1cm} kN:=\frac{kip}{4.448222}$$

$$\gamma := 130 \cdot \frac{lbf}{ft^3}$$

$$kN := \frac{kip}{4.448222}$$

Eq.11.13 
$$\beta := 1.5 - 0.135 \cdot z^{.5}$$
 Ref. 2

$$\sigma'_Z := z \cdot \gamma \cdot ft$$

 $\sigma'_Z := z \cdot \gamma \cdot \text{ft} \hspace{1cm} \text{length of embedment} \hspace{1cm} L := (9.84-2) \cdot \text{ft}$ 

$$L := (9.84 - 2) \cdot ft$$

eq. 11.11 
$$f_{SZ} := \beta \cdot \sigma'_{Z}$$
 Ref. 2

but 
$$f_{SZ} := if \left( f_{SZ} \ge 4 \cdot \frac{kip}{ft^2}, 4 \cdot \frac{kip}{ft^2}, f_{SZ} \right)$$

$$f_{SZ} = 0.902 \frac{kip}{ft^2}$$

Shaft side friction =  $Q_S := f_{SZ} \cdot \pi \cdot D \cdot L$ 

$$Q_S := f_{SZ} \cdot \pi \cdot D \cdot I$$

$$Q_{S} = 33.31 \, \text{kip}$$

$$Q_S = 148.171 \, kN$$

**Uncorrected SPT Values** 

$$N_{spt} := 50$$

from Table 4.6.5.1.4A page 83; Ref. 1

$$q_b := 1.20 \cdot N_{spt} \cdot \frac{kip}{ft^2}$$

End Bearing eq 11.14, Ref.2 Cb = correction factor for D > 50"

$$C_d := \frac{4.17f}{D}$$

$$C_d := \frac{4.17ft}{D}$$
  $C_d := if(C_d \ge 1.00, 1.00, C_d)$ 

$$C_d = 1$$

$$Q_b := \left(\frac{\pi}{4} \cdot D^2 \cdot q_b\right) \cdot C_d$$

$$Q_b = 106.029 \, kip$$

$$Q_b = 471.639 \, kN$$

$$Q_{ult} := Q_{s} + Q_{b}$$

$$Q_{ult} = 139.339 \, kip$$

with safety factor

$$Q_a := \frac{Q_{ult}}{SF} \qquad \qquad Q_{ult} = 619.81 \, kN$$

$$Q_{ult} = 619.81 \, kN$$

and to have low settlement  $Q_a \leq Q_s$ 

$$Q_a = 46.446 \, \text{kip}$$

$$Q_a = 206.603 \, kN$$

$$W_{shaft} := \pi \left(\frac{D}{2}\right)^2 \cdot L \cdot \left(0.140 \cdot \frac{kip}{ft^3}\right)$$

$$Q_{au} := \frac{Q_s}{3} + W_{shaft}$$

$$Q_{au} = 13.043 \, kip$$

$$Q_{au} = 58.018 \, kN$$

Project Name: US 95 SOUND and/or RETAINING WALL FOUNDATIONS

Project Number: 215-01-1

Calculated By: DH Checked By: mcd

#### CALCULATION of DRILLED SHAFT AXIAL LOAD in COHESIONLESS SOILS

References:

- 1.) AASHTO, 1996: Standard Specifications for Highway Bridges. 16th edition
- 2.) Federal Highway Administration: Drilled Shafts, Construction Procedures and Design Methods: Pub. No. FWHA-HI-88-042

**Design Conditions:** 

- 1.) Length = 11.48 ft
- 2.) Diameter = 1.5 ft

# **Design Calcuations-Compression**

#### Side Resistance

z = depth below ground surface

$$kip := 1000 \cdot lbf$$

$$z:=\left(\frac{2+11.48}{2}\right) \hspace{1cm} \text{ft} \hspace{1cm} \gamma:=130\cdot\frac{lbf}{ft^3} \hspace{1cm} kN:=\frac{kip}{4.448222}$$

$$\gamma := 130 \cdot \frac{\mathsf{lbf}}{\mathsf{ft}^3}$$

$$kN := \frac{kip}{4.448222}$$

Sheet 1 of 2

Date: 2-20-00

Eq.11.13 
$$\beta := 1.5 - 0.135 \cdot z^{.5}$$
 Ref. 2

$$\sigma'_Z:=z{\cdot}\gamma{\cdot}ft$$

length of embedment  $L := (11.48 - 2) \cdot ft$ 

$$L := (11.48 - 2) \cdot ft$$

eq. 11.11 
$$f_{SZ} := \beta \cdot \sigma'_Z$$
 Ref. 2

but 
$$f_{SZ} := if \left( f_{SZ} \ge 4 \cdot \frac{kip}{ft^2}, 4 \cdot \frac{kip}{ft^2}, f_{SZ} \right)$$

$$f_{SZ} = 1.007 \frac{kip}{ft^2}$$

Shaft side friction =  $Q_S := f_{SZ} \cdot \pi \cdot D \cdot L$ 

$$Q_S := f_{SZ} \cdot \pi \cdot D \cdot L$$

$$Q_S = 44.996 \, \text{kip}$$

$$Q_S = 200.15 \, kN$$

**Uncorrected SPT Values** 

$$N_{spt} := 50$$

from Table 4.6.5.1.4A page 83; Ref. 1

$$q_b := 1.20 \cdot N_{spt} \cdot \frac{kip}{ft^2}$$

End Bearing eq 11.14, Ref.2 Cb = correction factor for D > 50"

$$C_d := \frac{4.17ft}{D}$$

$$C_d := \frac{4.17ft}{D}$$
  $C_d := if(C_d \ge 1.00, 1.00, C_d)$ 

$$C_d = 1$$

$$Q_b := \left(\frac{\pi}{4} \cdot D^2 \cdot q_b\right) \cdot C_d$$

$$Q_b = 106.029 \, kip$$

$$Q_b = 471.639 \, kN$$

$$Qult := Q_S + Q_b$$

$$Qult = 151.024 kip$$

with safety factor

$$Q_a := \frac{Q_{ult}}{S_E}$$

$$Q_a := \frac{Q_{ult}}{SF}$$
 Qult = 671.789 kN

and to have low settlement  $Q_a \leq Q_s$ 

$$Q_a = 50.341 \, \text{kip}$$

$$Q_a = 223.93 \, kN$$

$$W_{shaft} := \pi \left(\frac{D}{2}\right)^{2} \cdot L \cdot \left(0.140 \cdot \frac{kip}{ft^{3}}\right)$$

$$Q_{au} := \frac{Q_s}{3} + W_{shaft}$$

$$Q_{au} = 17.344 \, kip$$

$$Q_{au} = 77.149 \, kN$$

Sheet 1 of 2 Date: 2-20-00

Project Name: US 95 SOUND and/or RETAINING WALL FOUNDATIONS

Project Number: 215-01-1

Calculated By: DH Checked By: mcd

## CALCULATION of DRILLED SHAFT AXIAL LOAD in COHESIONLESS SOILS

#### References:

- 1.) AASHTO, 1996: Standard Specifications for Highway Bridges, 16th edition
- 2.) Federal Highway Administration: Drilled Shafts, Construction Procedures and Design Methods: Pub. No. FWHA-HI-88-042

#### **Design Conditions:**

- 1.) Length = 8.2 ft
- 2.) Diameter = 2.0 ft

# **Design Calcuations-Compression**

#### Side Resistance

z = depth below ground surface

$$kip := 1000 \cdot lbf$$

$$z := \left(\frac{2 + 8.2}{2}\right)$$

$$\gamma := 130 \cdot \frac{lbf}{ft^3}$$

$$z := \left(\frac{2+8.2}{2}\right) \qquad \qquad \text{ft} \qquad \qquad \gamma := 130 \cdot \frac{\text{lbf}}{\text{ft}^3} \qquad \text{kN} := \frac{\text{kip}}{4.448222}$$

Eq.11.13 
$$\beta := 1.5 - 0.135 \cdot z^{.5}$$
 Ref. 2

$$\sigma'_{Z} := z \cdot \gamma \cdot ft$$

length of embedment  $L := (8.2 - 2) \cdot ft$ 

$$L := (8.2 - 2) \cdot ft$$

eq. 11.11 
$$f_{SZ} := \beta \cdot \sigma'_{Z}$$
 Ref. 2

but 
$$f_{SZ} := if \left( f_{SZ} \ge 4 \cdot \frac{kip}{ft^2}, 4 \cdot \frac{kip}{ft^2}, f_{SZ} \right)$$

$$f_{SZ} = 0.792 \frac{\text{kip}}{\text{ft}^2}$$

Shaft side friction =  $Q_S := f_{SZ} \cdot \pi \cdot D \cdot L$ 

$$Q_S := f_{SZ} \cdot \pi \cdot D \cdot L$$

$$Q_S=\,30.867\,kip$$

$$Q_S = 137.305 \, kN$$

**Uncorrected SPT Values** 

$$N_{spt} := 50$$

from Table 4.6.5.1.4A page 83; Ref. 1

$$q_b := 1.20 \cdot N_{spt} \cdot \frac{kip}{ft^2}$$

End Bearing eq 11.14, Ref.2 Cb = correction factor for D > 50"

$$C_d := \frac{4.17f}{D}$$

$$C_d := \frac{4.17ft}{D}$$
  $C_d := if(C_d \ge 1.00, 1.00, C_d)$ 

$$C_d = 1$$

$$Q_b := \left(\frac{\pi}{4} \cdot D^2 \cdot q_b\right) \cdot C_d$$

$$Q_b = 188.496 \, \text{kip}$$

$$Q_b = 838.47 \, kN$$

$$Qult := Q_S + Q_b$$

$$Q_{ult} = 219.363 \, kip$$

with safety factor

$$Q_a := \frac{Q_{ult}}{S_{E}}$$

$$Q_a := \frac{Q_{ult}}{SF}$$
 Qult = 975.775 kN

and to have low settlement  $Q_a \leq Q_s$ 

$$Q_a = 73.121 \, kip$$

$$Q_a = 325.258 \, kN$$

$$W_{shaft} := \pi \left(\frac{D}{2}\right)^{2} \cdot L \cdot \left(0.140 \cdot \frac{kip}{ft^{3}}\right)$$

$$Q_{au} := \frac{Q_s}{3} + W_{shaft}$$

$$W_{shaft} = 2.727 kip$$

$$Q_{au} = 13.016 \, kip$$

$$Q_{au} = 57.898 \, kN$$

Sheet 1 of 2 Date: 2-20-00

Project Name: US 95 SOUND and/or RETAINING WALL FOUNDATIONS

Project Number: 215-01-1

Calculated By: DH Checked By: mcd

#### CALCULATION of DRILLED SHAFT AXIAL LOAD in COHESIONLESS SOILS

#### References:

- 1.) AASHTO, 1996: Standard Specifications for Highway Bridges. 16th edition
- 2.) Federal Highway Administration: Drilled Shafts, Construction Procedures and Design Methods: Pub. No. FWHA-HI-88-042

#### **Design Conditions:**

- 1.) Length = 9.84 ft
- 2.) Diameter = 2.0 ft

# **Design Calcuations-Compression**

#### Side Resistance

z = depth below ground surface

$$\gamma := 130 \cdot \frac{lbf}{r}$$
 kN :=

$$z:=\left(\frac{2+9.84}{2}\right) \hspace{1cm} \text{ft} \hspace{1cm} \gamma:=130\cdot\frac{lbf}{ft^3} \hspace{1cm} kN:=\frac{kip}{4.448222}$$

$$\gamma := 130 \cdot \frac{lbf}{ft^3}$$

$$kN := \frac{kip}{4.448222}$$

 $kip := 1000 \cdot lbf$ 

Eq.11.13 
$$\beta := 1.5 - 0.135 \cdot z^{.5}$$
 Ref. 2

diameter 
$$D := 2.0 \cdot ft$$

$$\sigma'_{Z} := z \cdot \gamma \cdot ft$$

length of embedment L := (9.84 - 2) ft

$$L := (9.84 - 2) \cdot ft$$

eq. 11.11 
$$f_{SZ} := \beta \cdot \sigma'_{Z}$$
 Ref. 2

but 
$$f_{SZ} := if \left( f_{SZ} \ge 4 \cdot \frac{kip}{ft^2}, 4 \cdot \frac{kip}{ft^2}, f_{SZ} \right)$$

$$f_{SZ} = 0.902 \frac{\text{kip}}{\text{ft}^2}$$

 $\underline{Shaft \ side \ friction =} \qquad Q_S := f_{SZ^{\cdot}} \pi \cdot D \cdot L$ 

$$Q_S := f_{SZ} \cdot \pi \cdot D \cdot L$$

$$Q_S = 44.413 \, \text{kip}$$

$$Q_S = 197.561 \, kN$$

**Uncorrected SPT Values** 

$$N_{spt} := 50$$

from Table 4.6.5.1.4A page 83; Ref. 1

$$q_b := 1.20 \cdot N_{spt} \cdot \frac{kip}{ft^2}$$

End Bearing eq 11.14, Ref.2 Cb = correction factor for D > 50"

$$C_d := \frac{4.17ft}{D}$$

$$C_d := \frac{4.17ft}{D}$$
  $C_d := if(C_d \ge 1.00, 1.00, C_d)$ 

$$C_d = 1$$

$$Q_b := \left(\frac{\pi}{4} \cdot D^2 \cdot q_b\right) \cdot C_d$$

$$Q_b = 188.496 \, \text{kip}$$

$$Q_b = 838.47 \, kN$$

$$Qult := Q_S + Q_b$$

$$Q_{ult} = 232.909 \, kip$$

with safety factor

$$Q_a := \frac{Q_{ult}}{SF}$$

$$Q_a := \frac{Q_{ult}}{SF} \qquad \qquad Q_{ult} = 1.036 \times 10^3 \, kN$$

and to have low settlement  $Q_a \leq Q_s$ 

$$Q_a = 77.636 \, \text{kip}$$

$$Q_a = 345.344 \, kN$$

$$W_{shaft} := \pi \left(\frac{D}{2}\right)^{2} \cdot L \cdot \left(0.140 \cdot \frac{kip}{ft^{3}}\right)$$

$$Q_{au} := \frac{Q_s}{3} + W_{shaft}$$

$$Q_{au} = 18.253 \, \text{kip}$$

$$Q_{au} = 81.192 \, kN$$

Sheet 1 of 2 Date: 2-20-00

Project Name: US 95 SOUND and/or RETAINING WALL FOUNDATIONS

Project Number: 215-01-1

Calculated By: DH Checked By: mcd

# CALCULATION of DRILLED SHAFT AXIAL LOAD in COHESIONLESS SOILS

#### References:

- 1.) AASHTO, 1996: Standard Specifications for Highway Bridges. 16th edition
- 2.) Federal Highway Administration: Drilled Shafts, Construction Procedures and Design Methods: Pub. No. FWHA-HI-88-042

#### **Design Conditions:**

- 1.) Length = 11.48 ft
- 2.) Diameter = 2.0 ft

# **Design Calcuations-Compression**

#### Side Resistance

z = depth below ground surface

$$kip := 1000 \cdot lbf$$

$$z:=\left(\frac{2+11.48}{2}\right) \hspace{1cm} \text{ft} \hspace{1cm} \gamma:=130\cdot\frac{lbf}{ft^3} \hspace{1cm} kN:=\frac{kip}{4.448222}$$

$$\gamma := 130 \cdot \frac{lbf}{ft^3}$$

$$kN := \frac{kip}{4.448222}$$

Eq.11.13 
$$\beta := 1.5 - 0.135 \cdot z^{.5}$$
 Ref. 2

$$\sigma'_Z:=z{\cdot}\gamma{\cdot}ft$$

length of embedment  $L := (11.48 - 2) \cdot ft$ 

$$L := (11.48 - 2) \cdot ft$$

eq. 11.11 
$$f_{SZ} := \beta \cdot \sigma'_{Z}$$
 Ref. 2

but 
$$f_{SZ} := if \left( f_{SZ} \ge 4 \cdot \frac{kip}{ft^2}, 4 \cdot \frac{kip}{ft^2}, f_{SZ} \right)$$

$$f_{SZ} = 1.007 \frac{kip}{ft^2}$$

 $f_{SZ} = 1.007 \frac{\text{kip}}{\epsilon^2}$  Shaft side friction =  $Q_S := f_{SZ} \cdot \pi \cdot D \cdot L$ 

$$Q_S = 59.994 \, \text{kip}$$

$$Q_S = 266.867 \, kN$$

**Uncorrected SPT Values** 

$$N_{spt} := 50$$

from Table 4.6.5.1.4A page 83; Ref. 1

$$q_b := 1.20 \cdot N_{spt} \cdot \frac{kip}{ft^2}$$

End Bearing eq 11.14, Ref.2 Cb = correction factor for D > 50"

$$C_d := \frac{4.17ft}{D}$$

$$C_d := \frac{4.17ft}{D}$$
  $C_d := if(C_d \ge 1.00, 1.00, C_d)$ 

$$C_d = 1$$

$$Q_b := \left(\frac{\pi}{4} \cdot D^2 \cdot q_b\right) \cdot C_d$$

$$Q_b = 188.496 \, kip$$

$$Q_b = 838.47 \, kN$$

$$Qult := Q_S + Q_b$$

$$Qult = 248.49 kip$$

with safety factor

$$Q_a := \frac{Q_{ult}}{SF}$$

$$Q_a := \frac{Q_{ult}}{\text{SF}} \qquad \qquad Q_{ult} = 1.105 \times 10^3 \, \text{kN}$$

and to have low settlement  $Q_a \leq Q_s$ 

$$Q_a = 82.83 \, kip$$

$$Q_a = 368.446 \, kN$$

$$W_{shaft} := \pi \left(\frac{D}{2}\right)^2 \cdot L \cdot \left(0.140 \cdot \frac{kip}{ft^3}\right)$$

$$Q_{au} := \frac{Q_S}{3} + W_{shaft}$$

$$W_{shaft} = 4.17 kip$$

$$Q_{au} = 24.168 \, \text{kip}$$

$$Q_{au} = 107.503 \, kN$$

#### BLACK EAGLE CONSULTING Inc.

Geotechnical and Construction Services

Project Name: US 95 Project 1B WR-9 to WR-14

Project Number: 0215-01-1

Calculated By: pap Checked By: mcd

## CALCULATION of DRILLED SHAFT AXIAL LOAD in MIXED SOILS

#### References:

1.) AASHTO, 1996: Standard Specifications for Highway Bridges, 16th edition

Sheet 1 of 8

Date: 6-13-00

- 2.) Federal Highway Administration: Drilled Shafts, Construction Procedures and Design Methods: Pub. No. FWHA-HI-88-042
- 3. Geotechnical Investigation, Black Eagle Consulting, Inc.

#### Design Conditions for 2 Strata:

- 1.) Exclude top 5 feet due to disturbance and lateral loads
- 2.) Shaft Diameter = 1.5 ft; Shaft Length= 11.5 ft
- 3.) Based on Black Eagle Consulting Boring No. WR-11 (worst case)
- 4.) GWT = > 35 feet

5.) Layer 1: 0-6.7' granular Layer 2: 6.7-15.5' cohesive

Calculation of Overburden Pressure for Correction of SPT N Values to Aid in Selection of Undrained Strength of Cohesive Soil Layers

$$L_{01} := 6.7 \cdot \text{ft}$$
  $L_{02} := 15.5 \cdot \text{ft}^{-1}$ 

$$\gamma_{01} := 130 \cdot \frac{lb}{ft^3} \qquad \gamma_{02} := 110 \cdot \frac{lb}{ft^3}$$

$$D_i := 13 \cdot ft$$
 (Depth of Interest)

$$\sigma'_{i} := \left(\mathsf{L}_{01} \cdot \gamma_{01} + \mathsf{L}_{02} \cdot \gamma_{02}\right)$$

$$\sigma'_{i} = 2.576 \times 10^{3} \, lb \, ft^{-2}$$

$$N_C := \left(\frac{2000 \cdot lb \cdot ft^{-2}}{\sigma'i}\right)^{.5} \cdot N_{stp}$$
  $N_C =$ 

# DESIGN CALCULATIONS Shaft Resistance in Compression

**Note**: Set  $c_u = 0$  for Granular (g) soils; L = 0 for Cohesive Soils

# **Shaft Resistance for Granular Condition**

Layer No. 1 Silty Sand with Gravel; Caliche

z = mid point of strata

Midpoint of Interval: 
$$z_1 := \left(\frac{6.7+5}{2}\right)$$
 
$$\begin{aligned} \gamma_1 &:= 130 \cdot \frac{lb}{ft^3} \\ \text{Eq.11.13} \quad \beta &:= 1.5-0.135 \cdot z_1^{-.5} \\ \text{Ref. 2} \end{aligned}$$
 
$$\begin{aligned} \beta &= 1.173 \\ \sigma'_{Z1} &:= z_1 \cdot \gamma_1 \end{aligned} \qquad \begin{aligned} \text{Length of embedment:} \quad L_1 := (6.7-5) \cdot \text{ft} \\ \text{Eq. 11.11} \quad f_{sz1} := \beta \cdot \sigma'_{z1} \cdot \text{ft} \end{aligned}$$
 
$$\begin{aligned} \text{but} \quad f_{sz1} &:= \text{if} \left(f_{sz1} \geq 4000 \cdot \frac{lb}{ft^2}, 4000 \cdot \frac{lb}{ft^2}, f_{sz1}\right) \end{aligned}$$

fef. 2 
$$f_{SZ1} = 892.43 \frac{lb}{ft^2}$$
 Shaft Resistance Layer 1 
$$G_{TA} = \frac{1}{2} + \frac{$$

#### **Shaft Resistance for Cohesive Condition**

Layer No. 2 Sandy Lean Clay

$$c_{u2} := 8000 \cdot \frac{lb}{ft^2} \hspace{1cm} \text{Interval:} \hspace{0.2cm} 6.7 \text{ to } 11.5 \text{ feet} \\ L_{2c} := 11.5 \cdot ft - 6.7 \cdot ft$$

 $A := D \cdot \pi \cdot L_{2C}$ 

Area of Interval

$$L_{2C} = 4.8 ft$$

 $A = 22.619 \, \text{ft}^2$ 

From Table 11.1, Ref. 2,  $\alpha := 0.55$ 

$$\begin{split} \alpha_{Cu2} &:= \alpha \cdot c_{u2} &\qquad \alpha_{Cu2} := if \left( \alpha_{Cu2} \geq 5500 \cdot lb \cdot ft^{-2}, 5500 \cdot lb \cdot ft^{-2}, \alpha_{Cu2} \right) \\ &\qquad \alpha_{Cu2} = 4.4 \times 10^3 \, lb \, ft^{-2} \end{split}$$

Shaft Resistance, layer 2 Cohesive Condition:  $S_{2C} := A \cdot c_{u2} \cdot \alpha$ 

$$S_{2c} = 9.953 \times 10^4 \text{ lb}$$

Total Shaft Resistance:  $Q_S := (S_{1g} + S_{2c})$ 

 $kip := 1000 \cdot lb$ 

$$Q_S = 1.067 \times 10^5 \, lb$$

$$kN := \frac{kip}{4.448222}$$

 $Q_S = 106.675 \, \text{kip}$ 

 $Q_S = 474.514 \, kN$ 

## **DESIGN CALCULATIONS** End Bearing

#### **Cohesive Soil**

Equation 11.4, Ref. 2:

Length of Shaft:

 $L_{S} := 11.5 \cdot ft$ 

 $C_{ub'} := 8000 \cdot lb$ 

$$N_C := 6.0 \cdot \left[ 1 + \left( 0.2 \cdot \frac{L_S}{D} \right) \right]$$

$$N_C := if(N_C \ge 9.00, 9.00, N_C)$$

$$Q_{bc} := N_{c} \cdot C_{ub}$$

$$Q_{bc} = 7.2 \times 10^4 lb$$

$$Q_{bc} := if(Q_{bc} \ge 80000 \cdot lb, 80000 \cdot lb, Q_{bc})$$

$$Quit := Q_S + Q_{bC}$$

$$Q_{Ult} = 178.675 \, \text{kip}$$

$$Q_{ult} = 178.675 \, kip$$
  $Q_{ult} = 794.786 \, kN$ 

with safety factor 
$$SF := 3$$
  $Q_a := \frac{Q_{ult}}{SF}$ 

and to have low settlement  $Q_a \leq Q_s$   $Q_a = 59.558 \text{ kip}$ 

 $Q_a = 264.929 \, kN$ 

# DESIGN CALCULATIONS Uplift

 $L := 11.5 \cdot ft$ 

$$W_{shaft} := \pi \left(\frac{D}{2}\right)^2 \cdot L \cdot \left(0.140 \cdot \frac{kip}{ft^3}\right)$$

$$Q_{au} := \frac{Q_s}{3} + W_{shaft}$$

$$Q_{au} = 38.403 \, \text{kip}$$

$$Q_{au} = 38.403 \, \text{kip}$$
  $Q_{au} = 170.827 \, \text{kN}$ 

#### BLACK EAGLE CONSULTING Inc.

Geotechnical and Construction Services

Project Name: US 95 Project 1B WR-9 to WR-14

Project Number: 0215-01-1

Calculated By: pap Checked By: mcd

#### CALCULATION of DRILLED SHAFT AXIAL LOAD in MIXED SOILS

References:

1.) AASHTO, 1996: Standard Specifications for Highway Bridges, 16th edition

Sheet 1 of 8

Date: 6-13-00

- 2.) Federal Highway Administration: Drilled Shafts, Construction Procedures and Design Methods: Pub. No. FWHA-HI-88-042
- 3. Geotechnical Investigation, Black Eagle Consulting, Inc.

Design Conditions for 2 Strata:

- 1.) Exclude top 5 feet due to disturbance and lateral loads
- 2.) Shaft Diameter = 2.0 ft; Shaft Length= 11.5 ft
- 3.) Based on Black Eagle Consulting Boring No. WR-11 (worst case)
- 4.) GWT = > 35 feet
- 5.) Layer 1: 0-6.7' granular

Layer 2: 6.7-15.5' cohesive

Calculation of Overburden Pressure for Correction of SPT N Values to Aid in Selection of Undrained Strength of Cohesive Soil Layers

$$L_{01} := 6.7 \cdot \text{ft}$$
  $L_{02} := 15.5 \cdot \text{ft}$ 

$$\gamma_{O1} := 130 \cdot \frac{lb}{ft^3}$$
  $\gamma_{O2} := 110 \cdot \frac{lb}{ft^3}$ 

$$D_i := 13 \cdot ft$$
 (Depth of Interest)

$$\sigma'_i := \left(\mathsf{L}_{01} \cdot \gamma_{01} + \mathsf{L}_{02} \cdot \gamma_{02}\right)$$

$$\sigma'_{i} = 2.576 \times 10^{3} \text{ lbft}^{-2}$$

$$N_{C} := \left(\frac{2000 \cdot lb \cdot ft^{-2}}{\sigma'_{i}}\right)^{.5} \cdot N_{stp}$$
  $N_{C}$ 

#### **DESIGN CALCULATIONS** Shaft Resistance in Compression

**Note**: Set  $c_u = 0$  for Granular (g) soils; L= 0 for Cohesive Soils

# Shaft Resistance for Granular Condition

Layer No. 1 Silty Sand with Gravel; Caliche

z = mid point of strata

Midpoint of Interval: 
$$z_1 := \left(\frac{6.7 + 5}{2}\right)$$

$$\gamma_1 := 130 \cdot \frac{lb}{ft^3}$$

Eq.11.13 
$$\beta := 1.5 - 0.135 \cdot z_1^{.5}$$
 Ref. 2

$$\beta = 1.173$$

$$\sigma'_{71} := Z_1 \cdot \gamma_1$$

 $\sigma'_{Z1} := z_1 \cdot \gamma_1$  Length of embedment:  $L_1 := (6.7 - 5) \cdot ft$ 

Eq. 11.11 
$$f_{SZ1} := \beta \cdot \sigma'_{Z1} \cdot ft$$

$$\begin{array}{ll} \text{Eq. 11.11} & f_{SZ1} := \beta \cdot \sigma'_{Z1} \cdot \text{ft} \\ \text{Ref. 2} & \\ \end{array} \quad \text{but} \quad f_{SZ1} := \text{if} \left( f_{SZ1} \geq 4000 \cdot \frac{\text{lb}}{\text{ft}^2} \,, 4000 \cdot \frac{\text{lb}}{\text{ft}^2} \,, 4000 \cdot \frac{\text{lb}}{\text{ft}^2} \,, f_{SZ1} \right)$$

$$f_{SZ1} = 892.43 \frac{lb}{ft^2}$$

Shaft Resistance Layer 1

 $S_{1q} := f_{SZ1} \cdot \pi \cdot D \cdot L_1$ Granular Condition

$$S_{1g} = 9.532 \times 10^3 \text{ lb}$$

#### **Shaft Resistance for Cohesive Condition**

Layer No. 2 Sandy Lean Clay

$$c_{u2} := 8000 \cdot \frac{lb}{ft^2} \hspace{1cm} \begin{array}{c} \text{Interval:} \quad 6.7 \text{ to } 11.5 \text{ feet} \\ \\ L_{2c} := 11.5 \cdot ft - 6.7 \cdot ft \end{array}$$

 $A := D \cdot \pi \cdot L_{2C}$ 

Area of Interval

$$L_{2C} = 4.8 ft$$

From Table 11.1, Ref. 2,  $\alpha := 0.55$ 

 $A = 30.159 \, ft^2$ 

$$\alpha_{Cu2} := \alpha \cdot c_{u2}$$

 $\alpha_{\text{Cu2}} := \alpha \cdot \text{Cu2}$   $\alpha_{\text{Cu2}} := \text{if}\left(\alpha_{\text{Cu2}} \ge 5500 \cdot \text{lb} \cdot \text{ft}^{-2}, 5500 \cdot \text{lb} \cdot \text{ft}^{-2}, \alpha_{\text{Cu2}}\right)$ 

$$\alpha_{CU2} = 4.4 \times 10^3 \, lb \, ft^{-2}$$

Shaft Resistance, layer 2 Cohesive Condition:  $S_{2C} := A \cdot c_{U2} \cdot \alpha$ 

$$S_{2c} = 1.327 \times 10^5 \, lb$$

Total Shaft Resistance:  $Q_S := (S_{1g} + S_{2c})$ 

kip := 1000·lb

$$Q_S = 1.422 \times 10^5 lb$$

$$kN := \frac{kip}{4.448222}$$

$$Q_S = 142.233 \, \text{kip}$$

$$Q_S = 632.685 \, kN$$

#### **DESIGN CALCULATIONS End Bearing**

#### **Cohesive Soil**

Equation 11.4, Ref. 2:

Length of Shaft:

$$L_S := 11.5 \cdot ft$$

$$C_{ub'} := 8000 \cdot lb$$

$$N_C := 6.0 \cdot \left[1 + \left(0.2 \cdot \frac{L_S}{D}\right)\right]$$

$$N_C := if(N_C \ge 9.00, 9.00, N_C)$$

$$Q_{bc} := N_{c \cdot} C_{ub} \text{'}$$

$$Q_{bc} = 7.2 \times 10^4 lb$$

$$Q_{bc} := if \left( Q_{bc} \geq 80000 \cdot lb \,, 80000 \cdot lb \,, Q_{bc} \right)$$

$$Qult := Qs + Qbc$$

$$Q_{ult} = 214.233 \, kip$$
  $Q_{ult} = 952.957 \, kN$ 

$$Q_{tilt} = 952.957 \, kN$$

with safety factor 
$$SF := 3$$
  $Q_a := \frac{Q_{ult}}{SF}$ 

and to have low settlement  $Q_a \leq Q_s$ 

$$Q_a = 71.411 \, kip$$

$$Q_a = 317.652 \, kN$$

## **DESIGN CALCULATIONS** Uplift

 $L := 11.5 \cdot ft$ 

$$W_{shaft} := \pi \left(\frac{D}{2}\right)^{2} \cdot L \cdot \left(0.140 \cdot \frac{kip}{ft^{3}}\right)$$

$$Q_{au} := \frac{Q_S}{3} + W_{Shaft}$$

$$Q_{AH} = 52.469 \, \text{kip}$$

$$Q_{au} = 52.469 \, \text{kip}$$
  $Q_{au} = 233.394 \, \text{kN}$ 

#### BLACK EAGLE CONSULTING Inc.

Geotechnical and Construction Services

Project Name: US 95 Project 1B WR-9 to WR-14

Project Number: 0215-01-1

Calculated By: pap Checked By: mcd

#### CALCULATION of DRILLED SHAFT AXIAL LOAD in MIXED SOILS

References:

- 1.) AASHTO, 1996: Standard Specifications for Highway Bridges. 16th edition
- 2.) Federal Highway Administration: Drilled Shafts, Construction Procedures and Design Methods: Pub. No. FWHA-HI-88-042
- 3. Geotechnical Investigation, Black Eagle Consulting, Inc.

Design Conditions for 2 Strata:

- 1.) Exclude top 5 feet due to disturbance and lateral loads
- 2.) Shaft Diameter = 3.0 ft; Shaft Length= 11.5 ft
- 3.) Based on Black Eagle Consulting Boring No. WR-11 (worst case)
- 4.) GWT = > 35 feet

5.) Layer 1: 0-6.7' granular Layer 2: 6.7-15.5' cohesive

Calculation of Overburden Pressure for Correction of SPT N Values to Aid in Selection of Undrained Strength of Cohesive Soil Layers

$$L_{01} := 6.7 \cdot \text{ft}$$
  $L_{02} := 15.5 \cdot \text{ft}$ 

$$\gamma_{01} := 130 \cdot \frac{lb}{ft^3}$$
  $\gamma_{02} := 110 \cdot \frac{lb}{ft^3}$ 

$$\gamma_W := 62.4 \cdot \frac{lb}{ft^3}$$

$$N_{stp} := 50$$

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Date: 6-13-00

$$D_i := 13 \cdot ft$$
 (Depth of Interest)

$$\sigma'_i := \left(\mathsf{L}_{01} \cdot \gamma_{01} + \mathsf{L}_{02} \cdot \gamma_{02}\right)$$

$$\sigma'_{i} = 2.576 \times 10^{3} lbft^{-2}$$

$$N_C := \left(\frac{2000 \cdot lb \cdot ft^{-2}}{\sigma'_i}\right)^{.5} \cdot N_{stp} \qquad \qquad N_C = 44.057$$

# DESIGN CALCULATIONS Shaft Resistance in Compression

**Note**: Set  $c_u = 0$  for Granular (g) soils; L= 0 for Cohesive Soils

# Shaft Resistance for Granular Condition

Layer No. 1 Silty Sand with Gravel; Caliche

z = mid point of strata

Midpoint of Interval: 
$$z_1:=\left(\frac{6.7+5}{2}\right)$$
 
$$\begin{aligned} \gamma_1:=130\cdot\frac{lb}{t^3} \\ \text{Eq.11.13} \quad \beta:=1.5-0.135\cdot z_1^{-.5} \\ \text{Ref. 2} \end{aligned}$$
 diameter  $D:=3.0\text{ft}$  Ref. 2 
$$\beta=1.173$$
 
$$\sigma'z_1:=z_1\cdot \gamma_1 \qquad \text{Length of embedment:} \quad L_1:=(6.7-5)\cdot \text{ft}$$

$$\begin{array}{ll} \text{Eq. 11.11} & f_{SZ1} := \beta \cdot \sigma'_{Z1} \cdot \text{ft} & \quad \text{but} \quad f_{SZ1} := \text{if} \left( f_{SZ1} \geq 4000 \cdot \frac{\text{lb}}{\text{ft}^2} \,, 4000 \cdot \frac{\text{lb}}{\text{ft}^2} \,, f_{SZ1} \right) \\ \text{Ref. 2} & \end{array}$$

$$f_{SZ1} = 892.43 \frac{lb}{ft^2} \qquad \qquad \begin{array}{l} Shaft \ Resistance \\ Layer \ 1 \\ Granular \ Condition \end{array} \qquad S_{1g} := f_{SZ1} \cdot \pi \cdot D \cdot L_1 \\ S_{1g} = 1.43 \times 10^4 \, lb \end{array}$$

#### **Shaft Resistance for Cohesive Condition**

Layer No. 2 Sandy Lean Clay

$$c_{u2} := 8000 \cdot \frac{lb}{ft^2} \hspace{1cm} \text{Interval:} \hspace{0.2cm} 6.7 \text{ to } 11.5 \text{ feet} \\ L_{2c} := 11.5 \cdot ft - 6.7 \cdot ft$$

$$2c := 11.5 \cdot \text{ft} - 6.7 \cdot \text{ft}$$

 $A := D \cdot \pi \cdot L_{2C}$ 

Area of Interval

$$L_{2c} = 4.8 ft$$

 $A = 45.239 \, ft^2$ 

From Table 11.1, Ref. 2,  $\alpha := 0.55$ 

$$\begin{aligned} \alpha_{Cu2} &:= \alpha \cdot c_{u2} & \qquad \alpha_{Cu2} := if \left( \alpha_{Cu2} \geq 5500 \cdot lb \cdot ft^{-2}, 5500 \cdot lb \cdot ft^{-2}, \alpha_{Cu2} \right) \\ & \qquad \qquad \alpha_{Cu2} = 4.4 \times 10^3 \, lb \, ft^{-2} \end{aligned}$$

Shaft Resistance, layer 2 Cohesive Condition:  $S_{2C} := A \cdot c_{U2} \cdot \alpha$ 

$$S_{2c} = 1.991 \times 10^5 lb$$

Total Shaft Resistance:  $Q_S := (S_{1g} + S_{2c})$ 

 $kip := 1000 \cdot lb$ 

$$Q_S = 2.133 \times 10^5 lb$$

$$kN := \frac{kip}{4.448222}$$

$$Q_S = 213.35 \, kip$$

$$Q_S = 949.028 \, kN$$

## DESIGN CALCULATIONS **End Bearing**

#### **Cohesive Soil**

Equation 11.4, Ref. 2:

Length of Shaft:

$$L_{S} := 11.5 \cdot ft$$

$$C_{ub'} := 8000 {\cdot} \text{lb}$$

$$N_C := 6.0 \cdot \left[ 1 + \left( 0.2 \cdot \frac{L_S}{D} \right) \right]$$

$$N_C := if(N_C \ge 9.00, 9.00, N_C)$$

$$Q_{bc} := N_{c^{\star}}C_{ub^{\prime}}$$

$$Q_{bC} = 7.2 \times 10^4 \text{ lb}$$

$$Q_{bc} := if(Q_{bc} \ge 80000 \cdot lb, 80000 \cdot lb, Q_{bc})$$

$$Q_{ult} := Q_{s} + Q_{bc}$$

$$Q_{ult} = 285.35 \, kip$$

$$Q_{ult} = 285.35 \text{ kip}$$
  $Q_{ult} = 1.269 \times 10^3 \text{ kN}$ 

with safety factor 
$$SF := 3$$
  $Q_a := \frac{Q_ult}{SF}$ 

and to have low settlement  $Q_a \leq Q_s$ 

$$Q_a = 95.117 \, kip$$

$$Q_a = 423.1 \, kN$$

# **DESIGN CALCULATIONS** Uplift

 $L := 11.5 \cdot ft$ 

$$W_{shaft} := \pi \left(\frac{D}{2}\right)^2 \cdot L \cdot \left(0.140 \cdot \frac{kip}{ft^3}\right)$$

$$Q_{au} := \frac{Q_S}{3} + W_{shaft}$$

$$Q_{au} = 82.497 \, \text{kip}$$

$$Q_{au} = 366.965 \, kN$$

1

```
SOLUTION FOR LATERALLY LOADED PILE--ITYPE = 1 ++++++++
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```
NO OF NP = 20 NO OF ELEMENTS, NM = 9 NO OF NON-ZERO P, NNZP = 1 NO OF LOAD CASES, NLC = 4 NO OF CYCLES NCYC = 3 NODE SOIL STARTS JTSOIL = 2 NONLINEAR (IF > 0) = 1 NO OF BOUNDARY CONDIT NZX = 0 LIST BAND IF > 0 = 0 IMET (SI > 0) = 0
```

MEMNO	NP1	NP2	NP3	NP4	LENGTH	WIDTH	INERTIA, FT**4
1	1	2	3	4	2.000	2.000	.78500E+00
2	3	4	5	6	2.000	2.000	.78500E+00
3	5	6	7	8	2.000	2.000	.78500E+00
4	7	8	9	10	2.000	2.000	.78500E+00
5	9	10	11	12	2.000	2.000	.78500E+00
6	11	12	13	14	2.000	2.000	.78500E+00
7	13	14	15	16	2,000	2.000	.78500E+00
8	15	16	17	18	2.000	2.000	.78500E+00
9	17	18	19	20	2.000	2.000	.78500E+00

THE INITIAL INPUT P-MATRIX ENTRIES

IΡ	LC	P(NP,LC)
2	1	70.000
2	2	80.000
2	3	90.000
2	4	95.000

THE ORIGINAL P-MATRIX WHEN NONLIN > 0 ++++++

1	.00	70.00
2	.00	.00
3	.00	.00
4	.00	.00
5	.00	.00
6	.00	.00
7	.00	.00
8	.00	.00
9	.00	.00
10	.00	.00
OD OF	CLACTICITY C -	///000

MOD OF ELASTICITY E = 466900. KSF

GROUND NODE REDUCTION FACTORS FOR PILES, FAC1, FAC2 = -1.00 1.00

THE NOD	E SOIL MODULUS,	SPRINGS AND MA	AX DEFL:
NODE	SOIL MODULUS	SPRING,K/FT	MAX DEFL,FT
1	.0	.0	.0500
2	1545.0	4691.3	.0400
3	3947.0	14850.0	.0300
4	4942.0	19614.0	.0200
5	5706.0	22743.3	.0100
6	6349.0	25345.3	.0100
7	6916.0	27628.0	.0100
8	7429.0	29688.0	.0100
9	7900.0	31578.7	.0100
10	8339.0	16385.3	.0100

BASE SUM OF NODE SPRINGS = 192524.0 K/FT NO ADJUSTMENTS \* = NODE SPRINGS HAND COMPUTED AND INPUT

MEMB	ER MOMENTS, NOD	E REACTIONS,	DEFLECTION	S, SOIL PRESSURE,	AND LAST USED	P-MATRIX	FOR LC = 1		
MEMNO	MOMENTS NEAR	END 1ST, K-FT		SPG FORCE, KIPS	ROT, RADS	DEFL. FT	SOIL Q. KSF	P-, K-FT	P KIPS
1	.000	140.000	1	.00	00322	.01455	.00	.00	70.00
2	-140.000	201.580	2	39.21	00284	.00836	12.91	.00	.00
3	-201.580	157 <b>.68</b> 0	3	52.74	00191	.00355	14.02	-00	-00
4	-157.680	84.232	4	14.77	00093	.00075	3.72	.00	-00
5	-84.232	27.975	5	-8.60	00027	00038	2.16	.00	-00
6	-27.975	.031	6	-14.16	.00004	00056	<b>3.</b> 55	.00	.00
7	031	-6.784	7	-10.56	.00011	00038	2.64	.00	-00
8	6.784	-3.658	8	-4.97	.00010	00017	1.24	.00	.00

9	3.658	.000	9	27	.00007	00001	.07	.00	.00
			10	1.83	.00006	.00011	.93	.00	.00
SUM SPR	ING FORCES =	70.00 V	S SUM APPLI	ED FORCES =	70.00 KIPS				

(\*) = SOIL DISPLACEMENT > XMAX SO SPRING FORCE AND Q = XMAX\*VALUE ++++++++++
NOTE THAT P-MATRIX ABOVE INCLUDES ANY EFFECTS FROM X > XMAX ON LAST CYCLE +++++++++

MEMB	ER MOMENTS, NOD	E REACTIONS,	DEFLECTIONS,	, SOIL PRESSURE,	AND LAST USE	P-MATRIX	FOR LC = 2		
MEMNO	MOMENTSNEAR			SPG FORCE, KIPS	ROT, RADS	DEFL, FT		P-, K-FT	P-, KIPS
1	.000	160.000	1	.00	00368	.01663	.00	.00	80.00
2	-160.000	230.377	2	44.81	00325	.00955	14.76	.00	.00
3	-230.377	180.206	3	60.27	00218	.00406	16.02	.00	.00
4	-180.206	96.265	4	16.88	00106	.00086	4.25	.00	.00
5	-96.265	31.971	5	-9.82	00031	00043	2.46	.00	.00
6	-31.971	.036	6	-16.18	.00004	00064	4.05	.00	.00
7	036	-7.753	7	-12.07	.00013	00044	3.02	.00	.00
8	7.753	-4.180	8	-5.68	.00011	00019	1.42	.00	.00
9	4.180	.000	9	30	.00008	00001	.08	.00	.00
			10	2.09	.00006	.00013	1.06	.00	.00
SUM	SPRING FORCES =	80.00 V	S SUM APPLIE	D FORCES =	80.00 KIPS				

MEMB	BER MOMENTS, NOD	DE REACTIONS,	DEFLECTIONS,	SOIL PRESSURE,	AND LAST USED	P-MATRIX	FOR LC = 3		
MEMNO	MOMENTSNEAR			G FORCE, KIPS	ROT, RADS	DEFL, FT	SOIL Q. KSF	P-, K-FT	P-, KIPS
1	.000	180.000	1	.00	00414	.01871	.00	.00	90.00
2	-180.000	259.174	2	50.41	00365	.01075	16.60	.00	.00
3	-259.174	202.732	3	67.81	00245	.00457	18.02	.00	.00
4	-202 <b>.7</b> 32	108.299	4	19.00	00119	.00097	4.79	.00	.00
5	-108.299	35.968	5	-11.05	00035	00049	2.77	.00	.00
6	-35.968	.040	6	-18.20	.00005	00072	4.56	.00	.00
7	040	-8.722	7	-13.58	.00015	00049	3.40	.00	.00
8	8.722	-4.703	8	-6.39	.00012	00022	1.60	.00	.00
9	4.703	.000	9	34	.00009	00001	.09	.00	.00
			10	2.35	.00007	.00014	1.20	.00	.00
SUM	SPRING FORCES =	= 90.00 V	S SUM APPLIED	FORCES =	90.00 KIPS			*	

(\*) = SOIL DISPLACEMENT > XMAX SO SPRING FORCE AND Q = XMAX\*VALUE ++++++++++
NOTE THAT P-MATRIX ABOVE INCLUDES ANY EFFECTS FROM X > XMAX ON LAST CYCLE +++++++++

MEMB	ER MOMENTS, NOD	E REACTIONS,	DEFLECTIONS	, SOIL PRESSURE	, AND LAST USE	P-MATRIX	FOR LC = 4		
MEMNO	MOMENTS NEAR	END 1ST, K-FI	NODE	SPG FORCE, KIPS	ROT, RADS	DEFL, FT	SOIL Q, KSF	P-, K-FT	P-, KIPS
1	.000	190.000	1	.00	00437	.01975	.00	.00	95.00
2	-190.000	273.573	2	53.21	00386	.01134	17.52	.00	.00
3	-273.573	213.995	3	71.58	00259	.00482	19.02	.00	.00
4	-213.995	114.315	4	20.05	00126	.00102	5.05	.00	.00
5	-114.315	37.966	5	-11.67	00037	00051	2.93	.00	.00
6	-37.966	.042	6	-19.21	.00005	00076	4.81	.00	.00
7	042	-9.207	7	-14.34	.00015	00052	3.59	.00	.00
8	9.207	-4.964	8	-6.75	.00013	00023	1.69	.00	.00
9	4.964	.000	9	36	.00009	00001	.09	.00	.00
			10	2.48	.00008	.00015	1.26	.00	.00
SUM	SPRING FORCES =	95.00 V	'S SUM APPLI	ED FORCES =	95.00 KIPS				

Sheet 1 of 2 Date: 5-1-00

Project Name: US 95 High Mast Lighting Foundations

Project Number: 215-01-1

Calculated By: DH Checked By: mcd

## CALCULATION of DRILLED SHAFT AXIAL LOAD in COHESIONLESS SOILS

#### References:

- 1.) AASHTO, 1996: Standard Specifications for Highway Bridges, 16th edition
- 2.) Federal Highway Administration: Drilled Shafts, Construction Procedures and Design Methods: Pub. No. FWHA-HI-88-042

#### **Design Conditions:**

- 1.) Length = 14.3 ft
- 2.) Diameter = 3.0 ft

# **Design Calcuations-Compression**

#### Side Resistance

z = depth below ground surface

$$kip := 1000 {\cdot} lbf$$

$$z := \left(\frac{2+14.3}{2}\right)$$

$$\gamma := 130 \cdot \frac{lbf}{ft^3}$$

$$z := \left(\frac{2+14.3}{2}\right) \qquad \text{ft} \qquad \qquad \gamma := 130 \cdot \frac{\text{lbf}}{\text{ft}^3} \qquad \text{kN} := \frac{\text{kip}}{4.448222}$$

Eq.11.13 
$$\beta := 1.5 - 0.135 \cdot z^{.5}$$
 Ref. 2

$$\sigma'_{Z} := Z \cdot \gamma \cdot fl$$

 $\sigma'_Z := z \cdot \gamma \cdot \text{ft} \qquad \qquad \text{length of embedment} \qquad L := (14.3 - 2) \cdot \text{ft}$ 

$$L := (14.3 - 2) \cdot ft$$

eq. 11.11 
$$f_{SZ} := \beta \cdot \sigma'_Z$$
 Ref. 2

but 
$$f_{SZ} := if \left( f_{SZ} \ge 4 \cdot \frac{kip}{ft^2}, 4 \cdot \frac{kip}{ft^2}, f_{SZ} \right)$$

$$f_{SZ} = 1.181 \frac{kip}{ft^2}$$

 $\underline{Shaft \ side \ friction =} \qquad Q_S := f_{SZ^{\cdot}\pi^{\cdot}}D \cdot L$ 

$$Q_S = 136.898 \, kip$$

$$Q_S = 608.951 \, kN$$

**Uncorrected SPT Values** 

$$N_{spt} := 50$$

from Table 4.6.5.1.4A page 83; Ref. 1

$$q_b := 1.20 \cdot N_{spt} \cdot \frac{kip}{ft^2}$$

End Bearing eq 11.14, Ref.2 Cb = correction factor for D > 50"

$$C_d := \frac{4.17 ft}{D} \qquad C_d := if \left(C_d \geq 1.00, 1.00, C_d\right)$$

$$C_d = 1$$

$$Q_b := \left(\frac{\pi}{4} \cdot D^2 \cdot q_b\right) \cdot C_d$$

$$Q_b = 424.115 \, kip$$

$$Q_b = 1.887 \times 10^3 \text{kN}$$

$$Qult := Qs + Qb$$

$$Q_{ult} = 561.013 \, kip$$

with safety factor

$$Q_a := \frac{Q_{ult}}{SF}$$

$$Q_a := \frac{Q_{ult}}{SF}$$
  $Q_{ult} = 2.496 \times 10^3 \text{ kN}$ 

and to have low settlement  $Q_a \leq Q_s$ 

$$Q_a = 187.004 \, \text{kip}$$

$$Q_a = 831.836 \, kN$$

Wshaft := 
$$\pi \left(\frac{D}{2}\right)^2 \cdot L \cdot \left(0.140 \cdot \frac{\text{kip}}{\text{ft}^3}\right)$$

$$Q_{au} := \frac{Q_S}{3} + W_{shaft}$$

$$W_{shaft} = 12.172 kip$$

$$Q_{au} = 57.805 \, \text{kip}$$

$$Q_{au} = 257.128 \, kN$$

BLACK EAGLE CONSULTING

Project Name: U.S 95 High Mast Lighting

Project Number: 215-01-1

Calculated By: DH; Checked By: mcd

Sheet: 1 of 2 Date: 5-1-00

# DESIGN OF LATERALLY LOADED DRILLED SHAFT USING THE BROMS METHOD

# References:

- 1.) AASHTO, 1996: Standard Specifications for Highway Bridges, 16th edition
- 2.) Broms, B.B., 1964: Design of Laterally Loaded Piles, Proceedings of the American Society of Civil Engineers, Journal of the Soil Mechanics and Foundation Division, Vol. 91, No. SM-3

#### Variables:

Q = Horizontal Load at Top of Shaft in kips: Q := 0.0

Moment at Top of Shaft in kip-ft:

a = Depth of Unsuitable Soil, 2' min: M := 335.0

 $\gamma$  = Effective Unit Weight of Soil in kcf: a := 2.0

 $\gamma := .130$ 

 $\phi$  = Angle of Internal Friction:

L = Depth of Embedment in feet:  $\phi := 38 \deg$ 

D = Diameter of Shaft in feet: find

Kp = Coefficient of Rankine passive earth pressure: D := 3.0

 $K_p := \frac{1 + \sin(\phi \cdot \deg)}{1 - \sin(\phi \cdot \deg)}$ 

 $K_{\rm p} = 1.023$ 

For Granular Soils:

Initial estimate of L to start iteration: L := 10

 $L := root \left[ L^3 - 2 \cdot Q \cdot \frac{(a+L)}{\gamma \cdot K_p \cdot D} - \frac{2M}{\gamma \cdot K_p \cdot D}, L \right]$  L = 11.885 feet

Add 20% safety factor to length:

$$L_D := L \cdot 1.2$$

$$L_D = 14.262$$
 feet

Location of Maximum Moment-below top of shaft in feet:

$$Y_{m} := \left[\frac{2 \cdot Q}{\left(3 \cdot \gamma \cdot K_{p} \cdot D\right)}\right]^{.5} + a$$

$$Y_m = 2$$
 feet

Maximum Moment:

$$M_{max} := M + Q \cdot a + Q \cdot Y_m - \frac{Q \cdot Y_m}{3}$$

$$M_{\text{max}} = 335$$
 kip – ft

# **APPENDIX C** -

# DESIGN CALCULATIONS FOR TRENCH FOOTINGS

Project Name: SVERDRUP-US 95

Project Number: 215-01-1

#### Date: 3-20-00 Sheet 1 of 2

#### Lateral Soil Pressure for Trench Footings by The Sheet Pile Procedure

#### References:

- 1.) California Department of Transportation, 1990, Lateral Soil Pressure by the Sheet Pile Procedure: Bridge Design Aids, p. 16-2 to 16-8
- 2.) NAVFAC (Naval Facilities Engineering Command), 1982, Foundations and Earth Structures; Design Manual 7.2.

Surface Slope Condition: Level (Noise walls 2,3,4 and east side of 5)

#### Variables:

 $\phi := 40 deg$  angle of shearing resistance

 $\delta := -\frac{2}{3} \cdot \phi$  wall friction angle  $\cos(\delta) = 0.894$ 

 $\beta := 0.0 deg$  slope angle

 $\gamma := 130 \cdot \frac{lbf}{ft^3}$  effective unit weight of soil

#### Find:

 $P_p$  = passive soil pressure

P<sub>a</sub> = active soil pressure

 $K_p$  = coefficient of passive pressure

K<sub>a</sub> = coefficient of active pressure

R = reduction factor for K<sub>p</sub>

Q = allowable net horizontal ultimate lateral soil pressure

$$\frac{\beta}{\phi}=0$$

$$\frac{\delta}{\phi} = -0.667$$

- (Interpolated From Figure 1 of Reference 1 or Figure 6 of Reference 2) R := .753
- $K_a := .22$ (From Figure 1 of Reference 1 or Figure 6 of Reference 2)
- $K_p := 17$ (From Figure 1 of Reference 1 or Figure 6 of Reference 2)
  - 1.) Find Passive Pressure, Corrected to the Horizontal:

$$P_p := R \cdot K_p \cdot \gamma \cdot cos(\delta)$$

$$P_p = 1487 \frac{lbf}{ft^3}$$

2.) Find Active Pressure, Corrected to the Horizontal:

$$P_a := K_a \cdot \gamma \cdot \cos(\delta)$$

$$P_a = 25.6 \frac{lbf}{ft^3}$$

3.) Determine Allowable Net Horizontal Ultimate Lateral Soil Pressure:

$$Q := P_p - P_s$$

$$Q := P_p - P_a \qquad \qquad Q = 1462 \frac{lbf}{ft^3}$$

$$Q = 230 \frac{kN}{m^3}$$

# BLACK EAGLE CONSULTING Geotechnical and Construction Services

Project Name: SVERDRUP-US 95

Project Number: 215-01-1

#### Date: 3-20-00 Sheet 1 of 2

#### Lateral Soil Pressure for Trench Footings by The Sheet Pile Procedure

#### References:

- 1.) California Department of Transportation, 1990, *Lateral Soil Pressure* by the Sheet Pile Procedure: Bridge Design Aids, p. 16-2 to 16-8
- 2.) NAVFAC (Naval Facilities Engineering Command), 1982, Foundations and Earth Structures; Design Manual 7.2.

Surface Slope Condition: 6:1 (west side of noise wall 5)

#### Variables:

 $\phi := 40 deg$  angle of shearing resistance

 $\delta := -\frac{2}{3} \cdot \phi$  wall friction angle  $\cos(\delta) = 0.894$ 

 $\beta := -9.5 deg$  slope angle ( 6:1 H:V downward slope on the west side)

 $\gamma := 130 \cdot \frac{lbf}{e^3}$  effective unit weight of soil

#### Find:

 $P_p$  = passive soil pressure

P<sub>a</sub> = active soil pressure

 $K_p$  = coefficient of passive pressure

K<sub>a</sub> = coefficient of active pressure

R = reduction factor for K<sub>p</sub>

Q = allowable net horizontal ultimate lateral soil pressure

$$\frac{\beta}{\phi} = -0.238$$

$$\frac{\beta}{\phi} = -0.238 \qquad \qquad \frac{\delta}{\phi} = -0.667$$

R := .753(Interpolated From Figure 1 of Reference 1 or Figure 6 of Reference 2)

 $K_a := .16$ (From Figure 1 of Reference 1 or Figure 6 of Reference 2)

 $K_p := 11$ (From Figure 1 of Reference 1 or Figure 6 of Reference 2)

1.) Find Passive Pressure, Corrected to the Horizontal:

$$P_p := R \cdot K_p \cdot \gamma \cdot \cos(\delta)$$

$$P_p = 962 \frac{lbf}{ft^3}$$

2.) Find Active Pressure, Corrected to the Horizontal:

$$P_a := K_a \cdot \gamma \cdot \cos(\delta)$$
  $P_a = 18.6 \frac{lbf}{ft^3}$ 

$$P_a = 18.6 \frac{lbf}{ft^3}$$

3.) Determine Allowable Net Horizontal Ultimate Lateral Soil Pressure:

$$Q := P_p - P_a$$

$$Q := P_p - P_a \qquad \qquad Q = 944 \frac{lbf}{ft^3}$$

$$kN := 1000N$$

$$Q = 148 \frac{kN}{m^3}$$

# **APPENDIX D -**

# LATERAL EARTH PRESSURES FOR RETAINING WALLS

Geotechnical and Construction Services

Project Name: US 95: Retaining Walls

Project Number: 0215-01-1

Calculated By: DH Checked By: mcd

#### CALCLUATION OF COEFFICIENT FOR PASSIVE PRESSURE

1.) References:

a.) AASHTO, 1996: Standard Specifications for Highway Bridges, 16th ed

2.) Design Parameters:

$$\beta_0 := 0.0 \deg$$

$$\beta := 22 \deg$$

$$\beta_3 := 18.4 \deg$$

$$\delta := -22 deg$$

$$\beta_2 := 26.6 \deg$$

$$\frac{\delta}{\phi} = -0.647$$

Interpolate Rf from Fig. 5.5.2E of reference:

For Flat Slope:

$$\frac{\beta_0}{\phi} = 0$$

$$R_1 := .752 + (.836 - .752) \cdot .7$$

$$R_1 = 0.811$$

Sheet 1 of 1

Date: 2-21-2000

$$R_2 := .682 + (.783 - .682) \cdot .7$$
  $R_2 = 0.753$ 

$$R_2 = 0.753$$

$$R_f := (R_1 - R_2) \cdot .8 + .753$$

For 3:1 Slope:  $\frac{\beta_3}{\phi} = 0.541$ 

$$R_{\rm f} = 0.799$$

For 2:1 Slope: 
$$\frac{\beta_2}{\phi} = 0.782$$

From Fig. 5.5.2E of reference:

$$K_{pflat} := 9.2 \cdot R_f$$

$$K_{pflat} = 7.355$$

$$K_{p3} := 18 \cdot R_f$$

$$K_{p3} = 14.391$$

$$K_{p2} := 24 \cdot R_f$$

$$K_{p2} = 19.188$$

Geotechnical and Construction Services

Sheet 1 of 2 Date: 2-21-2000

Project Name: US 95: Retaining Walls - 3:1 Backfill slope, i.

Project Number: 0215-01-1

Calculated By: DH Checked By: mcd

#### COULOMB ANALYSIS ACTIVE COEFFICIENT for SLOPING BACKFILL

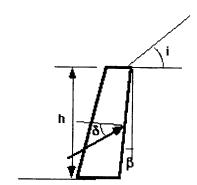
#### References:

 AASHTO- 1996STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES sec 5.5

$$\phi := 34 \cdot deg$$

 $\beta := \mathbf{0} \cdot \mathbf{deg}$ 

i := 18.4deg



Calculate Ka for static conditions (Assumes  $\delta = 0$ ; i.e, does not include wall friction ):

$$K_{a}(\phi, i, \beta) = \frac{\cos(\phi - \beta)^{2}}{\left(\cos(\beta)^{2}\cos(\beta)\right) \cdot \left[\left(1 + \sqrt{\frac{\sin(\phi) \cdot \sin(\phi - i)}{\cos(\beta) \cdot \cos(i - \beta)}}\right)^{2}\right]}$$

$$K_a := K_a(\phi, i, \beta)$$

 $K_a = 0.352$ 

AT REST CONDITION:

$$K_0 := 1 - \sin(\phi)$$

$$K_0 = 0.441$$

#### COEFFICIENT OF FRICTION, µ:

Static Conditions:

$$\mu := tan(\phi) \quad \mu = 0.675$$

With Safety Factor:

$$\mu_{\text{Sf}} := .667 \cdot \mu$$

$$\mu_{Sf} = 0.45$$

Geotechnical and Construction Services

Sheet 1 of 2 Date: 2-21-2000

Project Name: US 95: Retaining Walls - 2:1 Backfill slope, i.

Project Number: 0215-01-1

Calculated By: DH Checked By: mcd

#### COULOMB ANALYSIS ACTIVE COEFFICIENT for SLOPING BACKFILL

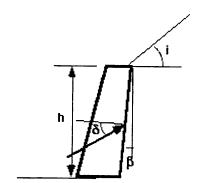
#### References:

 AASHTO- 1996STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES sec 5.5

$$\phi := 34 \cdot deg$$

 $\beta := \mathbf{0} \cdot \mathbf{deg}$ 

i := 26.6deg



Calculate Ka for static conditions (Assumes  $\delta$  = 0; i.e, does not include wall friction ):

$$K_{a}(\phi, i, \beta) \equiv \frac{\cos(\phi - \beta)^{2}}{\left(\cos(\beta)^{2} \cdot \cos(\beta)\right) \cdot \left[\left(1 + \sqrt{\frac{\sin(\phi) \cdot \sin(\phi - i)}{\cos(\beta) \cdot \cos(i - \beta)}}\right)^{2}\right]}$$

$$K_a := K_a(\phi, i, \beta)$$

 $K_a = 0.417$ 

AT REST CONDITION:

$$K_0 := 1 - \sin(\phi)$$

$$K_0 = 0.441$$

#### COEFFICIENT OF FRICTION, µ:

Static Conditions:

$$\mu := tan(\phi) \quad \mu = 0.675$$

With Safety Factor:

$$\mu_{\text{Sf}} := .667 \cdot \mu$$

$$\mu_{\text{Sf}} = 0.45$$

Geotechnical and Construction Services

Project Name: US 95: Retaining Walls - Flat Backfill.

Project Number: 0215-01-1

Calculated By: DH Checked By: mcd

COULOMB ANALYSIS ACTIVE COEFFICIENT for SLOPING BACKFILL

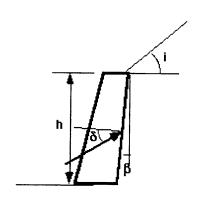
Sheet 1 of 2

Date: 2-21-2000

References:

AASHTO- 1996STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES sec 5.5

$$\beta := 0 \cdot deg$$
  $i := 0.0deg$ 



Calculate Ka for static conditions (Assumes  $\delta$  = 0; i.e, does not include wall friction ):

$$K_{a}(\phi, i, \beta) = \frac{\cos(\phi - \beta)^{2}}{\left(\cos(\beta)^{2} \cdot \cos(\beta)\right) \cdot \left[\left(1 + \sqrt{\frac{\sin(\phi) \cdot \sin(\phi - i)}{\cos(\beta) \cdot \cos(i - \beta)}}\right)^{2}\right]}$$

$$K_a := K_a(\phi, i, \beta)$$
  $K_a = 0.283$ 

AT REST CONDITION:

$$K_0 := 1 - \sin(\phi)$$

$$K_0 = 0.441$$

COEFFICIENT OF FRICTION, µ:

Static Conditions:

$$\mu := tan(\phi) \quad \mu = 0.675$$

With Safety Factor:

$$\mu_{\text{Sf}} := .667 \cdot \mu$$

$$\mu_{\mathbf{Sf}} = \mathbf{0.45}$$

Geotechnical and Construction Services

Project Name: U.S.95: Retaining Walls - Flat Backfill.

Project Number: 0215-01-1

Calculated By: DH Checked By: mcd

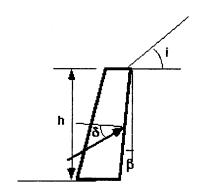
#### MONONOBE- OKABE ANALYSIS

#### References:

Federal Highway Administration, 1981: Seismic Design Guidelines for Highway Bridges, Final Report No. FHWAIRD-81/081.

AASHTO- 1997 Interim Revisions to the STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES sec 5.8.9

Federal Highway Administration, 1998: Geotechnical Earthquake Engineering, Publication No. FHWA HI-99-012.



Sheet 1 of 2

Date: 4-5-2000

From AASHTO seismic map  $k_h = 0.08 g$  for 10% probability in 50 years.

$$A := 0.08$$
  $A_m := [(1.45 - A) \cdot A]$   $A_m = 0.11$ 

$$k_h := A_m$$
  $k_v := 0$ 

 $\phi := 34 \cdot deg$ 

$$\delta := \frac{\phi}{3}$$
  $\delta = 11.333 \, deg$  (may approach 0 during earthquake;  $\phi/3$  is conservative))

$$\beta := \textbf{0.deg}$$
 
$$\textbf{i} := \textbf{0.0deg}$$

$$\theta := atan \left( \frac{k_h}{1 - k_V} \right) \qquad \qquad \theta = 6.255 deg$$

$$\begin{aligned} \textbf{K}_{ae} := \frac{\cos(\phi - \theta - \beta)^2}{\cos(\theta) \cdot \cos(\beta)^2 \cdot \cos(\delta + \beta + \theta) \cdot \left(1 + \sqrt{\frac{\sin(\phi + \delta) \cdot \sin(\phi - \theta - i)}{\cos(\delta + \beta + \theta) \cdot \cos(i - \beta)}}\right)^2} \end{aligned}$$

$$\begin{aligned} \textbf{K}_{\textbf{pe}} := \frac{\cos(\phi - \theta + \beta)^{2}}{\cos(\theta) \cdot \cos(\beta)^{2} \cdot \cos(\delta - \beta + \theta) \cdot \left(1 - \sqrt{\frac{\sin(\phi + \delta) \cdot \sin(\phi - \theta + i)}{\cos(\delta - \beta + \theta) \cdot \cos(i - \beta)}}\right)^{2}} \end{aligned}$$

$$K_{ae} = 0.327$$

$$K_{pe} = 4.902$$

Geotechnical and Construction Services

Project Name: U.S.95: Retaining Walls - 3:1 Sloped Backfill.

Project Number: 0215-01-1

Calculated By: DH Checked By: mcd

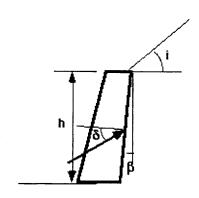
#### MONONOBE- OKABE ANALYSIS

#### References:

Federal Highway Administration,1981: Seismic Design Guidelines for Highway Bridges, Final Report No. FHWAIRD-81/081.

AASHTO- 1997 Interim Revisions to the STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES sec 5.8.9

Federal Highway Administration, 1998: Geotechnical Earthquake Engineering, Publication No. FHWA HI-99-012.



Sheet 1 of 2

Date: 4-5-2000

From AASHTO seismic map  $k_h = 0.08 g$  for 10% probability in 50 years.

$$A := 0.08$$
  $A_m := [(1.45 - A) A]$   $A_m = 0.11$ 

$$k_h := A_m$$
  $k_v := 0$ 

 $\phi := 34 \cdot deg$ 

$$\delta := \frac{\phi}{3} \qquad \delta = \textbf{11.333 deg} \text{ (may approach 0 during earthquake; } \phi/3 \\ \text{is conservative))}$$

$$\beta := 0 \cdot deg \qquad \qquad i := 18.4 deg$$

$$\theta := atan \left( \frac{k_h}{1 - k_v} \right) \qquad \qquad \theta = 6.255 deg$$

$$\begin{aligned} \textbf{K}_{ae} \coloneqq \frac{\cos(\phi - \theta - \beta)^{2}}{\cos(\theta) \cdot \cos(\beta)^{2} \cdot \cos(\delta + \beta + \theta) \cdot \left(1 + \sqrt{\frac{\sin(\phi + \delta) \cdot \sin(\phi - \theta - i)}{\cos(\delta + \beta + \theta) \cdot \cos(i - \beta)}}\right)^{2}} \end{aligned}$$

$$\begin{split} \textbf{K}_{\textbf{pe}} := \frac{\cos(\phi - \theta + \beta)^{2}}{\cos(\theta) \cdot \cos(\beta)^{2} \cdot \cos(\delta - \beta + \theta) \cdot \left(1 - \sqrt{\frac{\sin(\phi + \delta) \cdot \sin(\phi - \theta + i)}{\cos(\delta - \beta + \theta) \cdot \cos(i - \beta)}}\right)^{2}} \end{split}$$

$$K_{ae} = 0.449$$

$$K_{pe} = 13.547$$

Geotechnical and Construction Services

Project Name: U.S.95: Retaining Walls - 2:1 Sloped Backfill.

Project Number: 0215-01-1

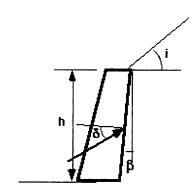
#### MONONOBE- OKABE ANALYSIS

#### References:

Federal Highway Administration, 1981: Seismic Design Guidelines for Highway Bridges, Final Report No. FHWAIRD-81/081.

AASHTO- 1997 Interim Revisions to the STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES sec 5.8.9

Federal Highway Administration, 1998: Geotechnical Earthquake Engineering, Publication No. FHWA HI-99-012.



Sheet 1 of 2

Date: 4-5-2000

From AASHTO seismic map  $k_h = 0.08 g$  for 10% probability in 50 years.

$$A := 0.08$$
  $A_m := [(1.45 - A) \cdot A]$   $A_m = 0.11$ 

$$k_h := A_m$$
  $k_v := 0$ 

 $\phi := 34 \cdot deg$ 

$$\delta := \frac{\phi}{3}$$
  $\delta = 11.333 \, deg \, (may \, approach \, 0 \, during \, earthquake; \, \phi/3 \, is \, conservative))$ 

$$\beta := 0 \cdot deg \qquad \qquad i := 26.6 deg$$

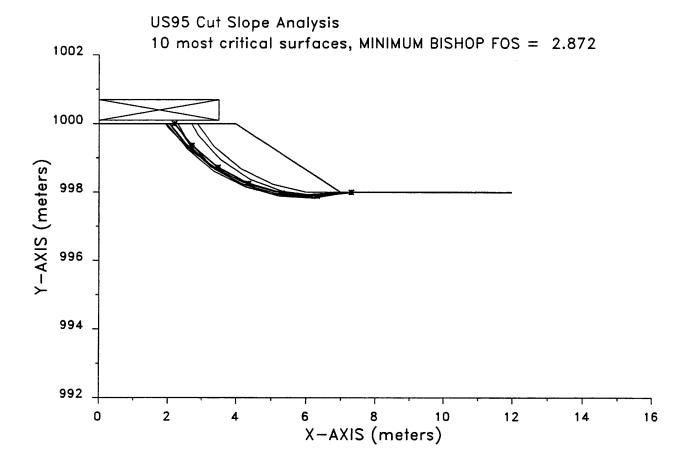
$$\theta := atan \left( \frac{k_h}{1 - k_v} \right) \qquad \qquad \theta = 6.255 deg$$

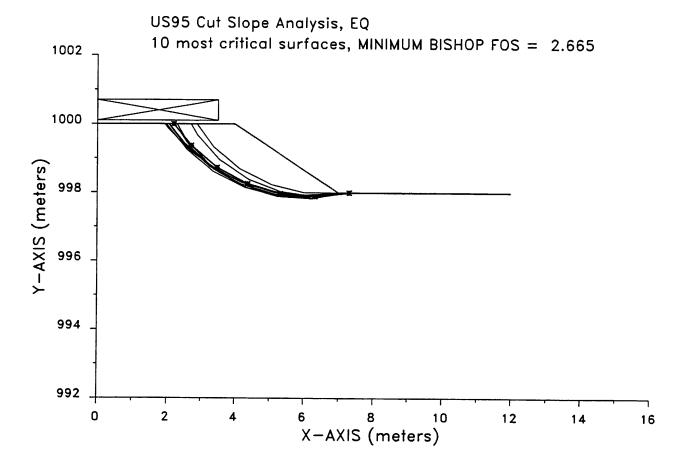
$$\begin{aligned} \textbf{K}_{\textbf{ae}} := \frac{\cos(\phi - \theta - \beta)^{2}}{\cos(\theta) \cdot \cos(\beta)^{2} \cdot \cos(\delta + \beta + \theta) \cdot \left(\mathbf{1} + \sqrt{\frac{\sin(\phi + \delta) \cdot \sin(\phi - \theta - i)}{\cos(\delta + \beta + \theta) \cdot \cos(i - \beta)}}\right)^{2}} \end{aligned}$$

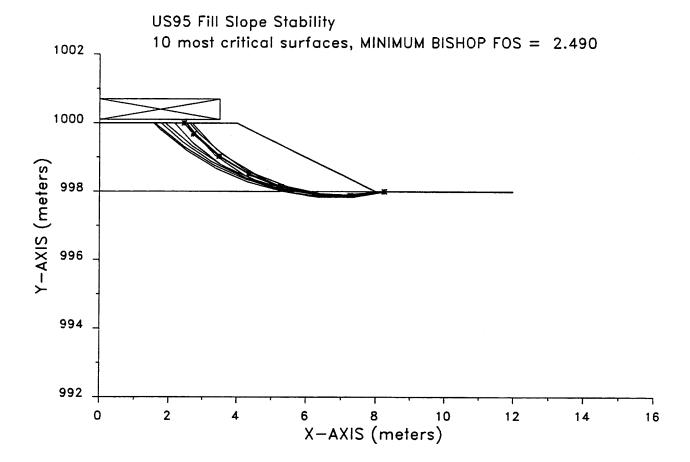
$$\begin{split} \textbf{K}_{\text{pe}} \coloneqq \frac{\cos(\phi - \theta + \beta)^{2}}{\cos(\theta) \cdot \cos(\beta)^{2} \cdot \cos(\delta - \beta + \theta) \cdot \left(1 - \sqrt{\frac{\sin(\phi + \delta) \cdot \sin(\phi - \theta + i)}{\cos(\delta - \beta + \theta) \cdot \cos(i - \beta)}}\right)^{2}} \end{split}$$

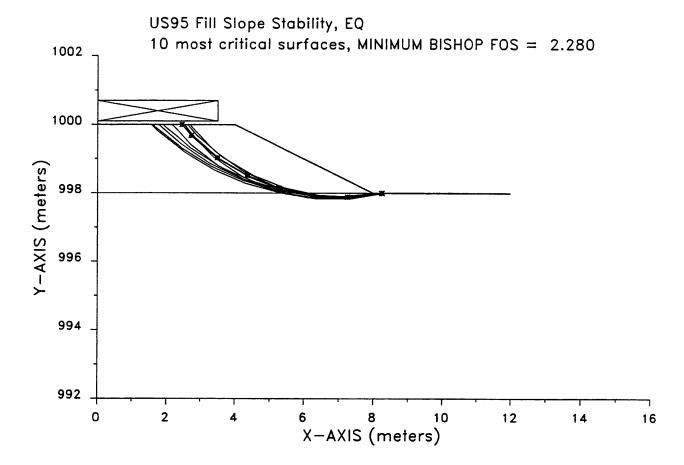
$$K_{ae} = 0.648$$
  $K_{pe} = 26.505$ 

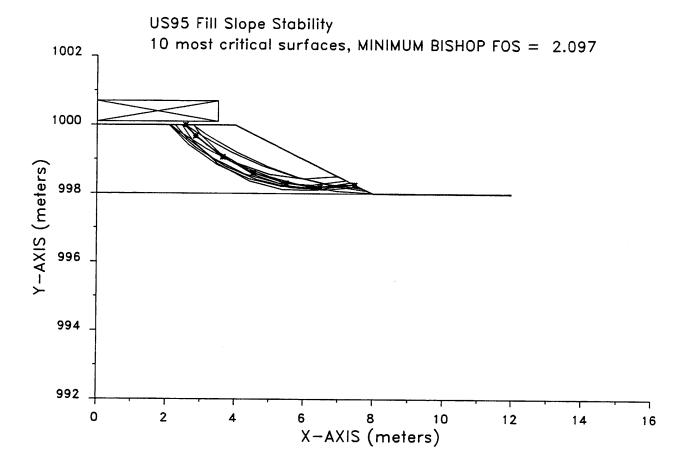
# APPENDIX E SLOPE STABILITY CALCULATIONS

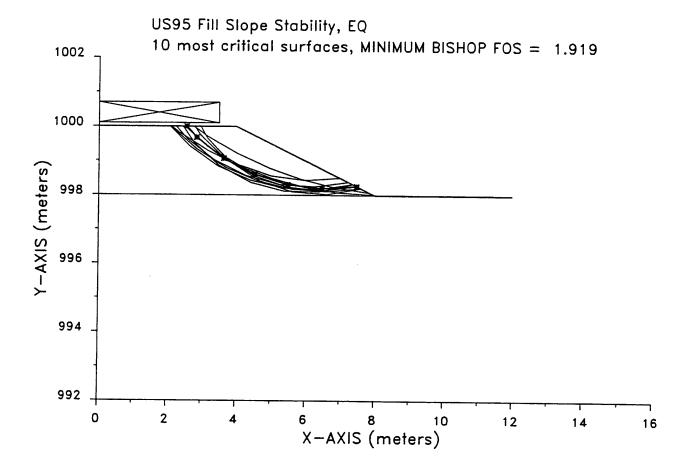












# APPENDIX F CORROSION TESTING PROGRAM RESULTS



**PAGE:** 1 of 1

**CLIENT:** Mr. Dal Hunter

BLA001 Black Eagle Consulting, Inc.

1380 Greg Street Suite 218

Sparks NV 89431

DATE: February 25, 2000

INVOICE NUMBER:

P0085

PROJECT NUMBER:

215-01-1

LABORATORY NUMBER:

P045-05

## REPORT OF ANALYSIS

SAMPLE ID:	Chloride ( mg/Kg )	pH (SI)	Resistivity ( ohm-cm )	Redox Potential ( m√ )	Sulfate ( mg/Kg )
WR - 1B	4.70	7.71	20300	195	22.1
WR - 12A	7.96	7.87	19500	180	16.9
WL - 2A	8.67	7.54	14000	205	141
WL - 6B	45.0	7.57	5100	210	258
WL - 12B	7.60	7.87	10500	200	53.2
WL - 16B	5.54	8.28	14400	205	12.6
DATE OF ANALYSIS & ANALYTICAL METHODS					
DATES:	2-18-00	2-16-00	2-23-00	2-23-00	2-18-00
METHODS:	SM 4500 CI <sup>-</sup> F	 SM 4500 - H <sup>+</sup> - B	DOT		SM 4500 - SO <sub>4</sub> <sup>-2</sup> B

Wayne M, Colwell

Director of Laboratory Services

COL•TECH EnviroLabs

855 Mill Street, Suite 1 B Reno, Nevada 89502 PH 800 774 3636, 775 331 3600, FAX 775 323 8253